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Non-listed, Non-Commercially Active Stone or Material Source; G-ECD.

If after award of a contract, the Contractor proposes to furnish stone, or granular materials from non-listed, or non-commercially active sources, the following information and data for each non-listed or non-commercially active source of stone, or granular material shall be furnished forty-five (45) or more calendar days prior to the date the Contractor is scheduled to obtain materials from such source(s).

- a. Name and address (Property Owner).
- b. Location, site map, and legal description (or appropriate substitute) of the area.
- c. Previous land use information.
- d. A topographic map of the area.
- e. Photographs showing the area proposed for use.
- f. Written permission of the owners of the proposed non-listed or non-commercially active sources(s).
- g. Written permission of the owners of the access properties involved.
- h. All data required to assess potential environmental impacts. This information is required in order to determine the necessity for environmental documentation for any non-commercially active, non-listed source(s).
- i. Documentation of coordination of the use of proposed non-commercially active, non-listed source(s) with Federal, State and local agencies having an interest and furnish written approval of these agencies for use of such source(s).
 - (1) Field Supervisor, U.S. Fish and Wildlife Service, Ecological Services, 2651 Coolidge Road, East Lansing, Michigan 48823. Phone: 517-351-2555.
 - (2) Chief, Office of Strategic Environmental Analysis, B 19J,, U.S. Environmental Protection Agency, 77 West Jackson Blvd., Chicago, Illinois 60604-3590.
 - (3) Chief, Land and Water Mgmt. Division, Michigan Department of Environmental Quality, P. O. Box 30458, Lansing, Michigan 48909.
 - (4) State Historic Preservation Officer, Michigan Bureau of History, 717 W. Allegan, Lansing, Michigan 48918-1800.
- j. The proposed reduction, if any, in the applicable unit or lump-sum prices the BIDDING SCHEDULE if the request were to be approved by the Government.

Survey Note Format; G-AOF.

Submit the proposed survey note format prior to performing any survey work at the work site.

Video Cassettes; G-AOF.

Prior to the start of work, video recordings shall be delivered within seven (7) calendar days.

SD-07 Certificates

As-Built Technician's Qualifications

Submit the identity and qualifications of the persons assigned to prepare the as-built information at least 10 calendar days in advance of preparing the drawings.

As-built Drawings; G-AOF.

Within ten (10) calendar days after the substantial completion date as established by the Contracting Officer, submit the as-built details of the work performed under this contract on a set of blue-line prints of the contract drawings marked in red. Following review and approval by the Government, the Contractor shall prepare electronic and mylar copies of as-built drawings for submittal within 15 calendar days following receipt of comments from the Government. Electronic files shall be submitted in Microstation 95 (.dgn) CADD file format, suitable for plotting with Intergraph Iplot Software. The electronic medium for file transfers shall be agreed to prior to the time of submittal and shall be compatible with current industry standards and hardware configurations.

Survey Information

Upon completion of the contract work, the originals of all field notes, sketches, recordings and computations made by the Contractor in performing the layout work shall be submitted in ring binders.

1.3 REGULATORY REQUIREMENTS

1.3.1 Additional Work Proposed and Not Authorized

1.3.1.1 Work Subject to 33 CFR 320-330

Any additional work (not specifically shown on the plans or delineated in the specifications) proposed by the Contractor in or affecting navigable waters, including wetlands (as defined in 33 CFR 320-330, published in the Federal Register Vol.51, No. 219, Thursday, November 13, 1986) shall not be performed without a Department of the Army Permit. This requirement shall be applicable to all work, permanent or temporary, and/or fill(s). The Department of the Army Permit shall be approved by the District Engineer or Deputy District Engineer in accordance with the laws of the United States and the regulations promulgated thereunder, including, but not limited to, the River and Harbor Act of 1899, the Clean Water Act and the National Environmental Policy Act of 1969, as amended. Corps employees (Contracting Officer's Representatives (COR) or inspectors) are not delegated authority to authorize such work. Information on making application for such permit(s) may be obtained by contacting one of the offices as listed hereinafter. When applying for information or a permit, a copy of any correspondence should be directed to the Contracting Officer of this contract. If a permit is not obtained, the additional work cannot

be accomplished. Any delay in processing the permit will not constitute the basis of a claim under this contract. The fact that the Contractor is performing work under a Department of the Army Contract will give the Contractor no greater rights than any other applicant for a Department of the Army Permit.

MICHIGAN-INDIANA

Regulatory Branch
Engineering and Technical Services Division
U.S. Army Engineer District, Detroit
P. O. Box 1027
Detroit, MI 48231
Telephone: 313-226-6813

1.4 PROJECT/SITE CONDITIONS

1.4.1 Condition and Use of Project Site

The drawings indicate soundings and elevations at the project site as found in condition surveys made as stated on the contract drawings. A notification of at least five (5) calendar days shall be given to the Contracting Officer prior to bringing any construction equipment or material upon the work site. The Contractor shall be responsible for damages that may be suffered due to its operations. The Contractor shall note CLAUSE titled "PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS."

1.4.1.1 Physical Conditions

The physical conditions shown on the drawings are indicative of those that prevailed at the time of the site investigations and may be different than those at the time of construction. Significant variations that would require changes to the plans or specification shall be reported to the Contracting Officer immediately. The information shown on the logs of soil borings on the contract drawings is from borings located within or near the work areas. While the borings are representative of subsurface conditions at their respective locations and for their respective vertical reaches, localized variations of characteristics of the subsurface materials of this region are anticipated. Field logs of borings taken in the project area, soil samples, and other subsurface information obtained or prepared for this contract are available for examination upon request at the Engineering & Construction Division, Design Branch, U.S. Army Corps of Engineers, Detroit District, 477 Michigan Avenue, Detroit, MI 48226.

1.4.1.2 Work and Storage Areas

Work and storage areas will be provided at the site and will be as designated and/or approved by the Contracting Officer. Areas made available to the Contractor will be selected to minimize interference with Government operations and other contractors.

1.4.2 Existing Vegetation, Structures, Equipment, Utilities & Improvements

General locations of applicable existing utilities, vegetation, structures, equipment and improvements, based upon latest information available to the Government have been shown on the drawings. However, it is the Contractor's obligation to establish the exact horizontal and vertical location and size of all existing utility lines which are located within

the required work area. The Contractor shall submit a utility locating plan for locating existing utilities and a copy of its utility location findings prior to commencing work on the site. Any utility lines which are not found by the Contractor, but which are known to exist at the project site, shall be reported to the Contracting Officer immediately. The Contracting Officer will have the option of directing commencement of work at the site or requiring the Contractor to submit further plans for locating the utility lines. Once the utilities have been located and marked, the Contractor shall be deemed to have the location made known to it pursuant to CLAUSE titled "PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS." If the Contractor damages any existing utility line, vegetation, structure, equipment or improvement, a report thereof shall be made immediately to the Contracting Officer. In any event, existing utility lines, vegetation, structures, equipment or improvements shall be protected from damage, and if damaged, shall be repaired by the Contractor at its own expense.

1.4.3 Vehicular Access

Throughout the period of work on this contract, the Contractor shall maintain an all-weather roadway through or around its work area when work therein would otherwise block an existing roadway. Such permanent or temporary roadways shall be kept open for use by emergency vehicles, as well as residential and commercial traffic at all times.

1.4.4 Utility Services

1.4.4.1 Contractor-Furnished Utility Services

The Contractor shall furnish, all water, electric current and other utilities required for its use.

1.4.5 Protection and Maintenance of Traffic

1.4.5.1 Haul Roads

The Contractor shall, at its own expense, construct access and haul roads necessary for proper prosecution of the work under this contract. Haul roads shall be constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided. The Contractor shall provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic. The method of dust control shall be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and hauling roads shall be subject to approval by the Contracting Officer. Lighting shall be adequate to assure full and clear visibility for full width of haul road and work areas during any night work operations. Upon completion of the work, haul roads shall be removed unless otherwise approved by the Contracting Officer. Any dirt or mud which is tracked onto paved or surfaced roadways shall be promptly cleaned away.

1.4.5.2 Barricades

The Contractor shall erect and maintain temporary barricades to limit public access to hazardous areas. Such barricades shall be required whenever safe and public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Barricades shall be securely placed, clearly visible with adequate

illumination to provide sufficient visual warning of the hazard during both day and night.

1.4.6 Contract Supervision and Representation

The Contractor's local representative shall be available to Government representatives during duty hours, 8 a.m. to 4:30 p.m., on normal working days and shall be available by telephone at other times. The name of the Contractor's representative and the contact telephone number shall be furnished to the Government.

1.4.7 Quantity Surveys

The CLAUSE titled "QUANTITY SURVEYS" is applicable other than for measurement of quantities of work performed for stone construction utilizing new stone. Measurement and payment for stone construction is as specified in SECTION 01270A, "MEASUREMENT AND PAYMENT".

1.4.8 Layout of Work and Surveys

1.4.8.1 Layout of Work

The following requirements are in addition to the requirements of CLAUSE titled "LAYOUT OF WORK." The Government has established bench marks and horizontal control points at the site of the work. Horizontal and Vertical control points are shown on the drawings. The elevations of bench marks are referred to mean water level (IGLD 1955).

1.4.8.2 Surveyor Requirements

From these control points and bench marks, the Contractor shall lay out the work by establishing all lines, grades, range markers and gauges at the site as necessary to control the work. All survey information shall be recorded in accordance with standard and approved methods and in the survey note format approved by the Contracting Officer. All field notes, sketches, recordings and computations made by the Contractor in performing the layout work shall be available at all times during the progress of the work for ready examination by the Contracting Officer or his or her duly authorized representative and upon completion of the contract work the originals shall be turned over to the Contracting Officer in ring binders.

1.4.8.3 Suspension

The Contracting Officer may require that work be suspended at any time when location and limit marks established by the Contractor are not reasonably adequate to permit checking the work. Such suspension will be withdrawn upon satisfactory replacement of location and limit marks. Such suspension shall be at no additional cost to the Government and shall not entitle the Contractor to an extension of time for completing the work.

1.4.8.4 Verification

The Government may make checks as the work progresses to verify lines and grades established by the Contractor and to determine the conformance of the completed work as it progresses with the requirements of contract specifications and drawings. Such checking by the Contracting Officer or his or her representative shall not relieve the Contractor of its responsibility to perform all work in accordance with the contract drawings and specifications and the lines and grades given therein.

1.5 SEQUENCING AND SCHEDULING

1.5.1 Construction Period and Other Restrictions

a. Unless otherwise approved by the Contracting Officer's Representative, all work including final paving; in either the US-2 or M-28 MDOT right of ways, as well as all other streets disturbed, shall be completed in a single construction season.

b. Unless otherwise approved by the Contracting Officer's Representative, sewer and lateral installation shall be completed on a block-by-block basis. All work on a block, up to placement of the gravel base shall be completed before proceeding to the next block. If more than one crew is used for sewer installation this restriction shall apply to each crew.

c. Access to a driveway, side street or alley shall not be obstructed for more than 24 hours, unless prior arrangements are made.

d. Unless otherwise approved by the Contracting Officer's Representative, street restoration (except paving), including curb and gutter, sidewalks and driveways shall be completed within the 30 working days of the completion of the work on each street.

e. Base course paving shall be completed at intervals such that no streets in the city are unpaved for more than 60 days.

1.5.2 Sunday, Holiday' Night and Extended Hours of Operations

When the Contractor elects to work more than 8 hours per day, Monday through Friday or on Saturdays, Sundays, holidays or nights when not prohibited herein, notice of its intention to do so shall be given to the Contracting Officer not less than forty-eight (48) hours in advance thereof. Adequate lighting for thorough inspection of night operations shall be provided by the Contractor at its expense.

1.5.3 Work Period Restrictions

No work is allowed at the project sites during the following periods:

c. Holiday periods as follows:

- (1) 6 p.m. 28 May to 6 a.m. 1 June 2004
- (2) 6 p.m. 2 July to 6 a.m. 6 July 2004
- (3) 6 p.m. 3 September to 6 a.m. 7 September 2004
- (4) 6 p.m. 24 November to 6 a.m. 29 November 2004
- (5) 6 p.m. 23 December to 6 a.m. 3 January 2005
- (6) 6 p.m. 27 May to 6 a.m. 31 May 2005
- (7) 6 p.m. 1 July to 6 a.m. 5 July 2005
- (8) 6 p.m. 2 September to 6 a.m. 6 September 2005

(9) 6 p.m. 23 November to 6 a.m. 28 November 2005

The above-stated no-work periods, as applicable, are included in the number of calendar days within which the Contractor is required to complete the work as established in CLAUSE titled "COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK" and therefore the above-stated no-work periods will not entitle the Contractor to additional time for completing the work.

1.5.4 Start Work

Evidence that the Contractor has started procurement of materials, preparation and submission of shop drawings, preparation of subcontracts, and other preparatory work will satisfy the requirement that work commence within ten (10) calendar days after receipt of Notice to Proceed. (See Clause titled COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK, FAR 52.212-0003.)

1.6 ACCOMMODATIONS FOR INSPECTORS

The Contractor shall, prior to the start of work, furnish a temporary field office for Government personnel, physically and acoustically separated from the Contractor's offices, located near the site of the work, as approved by the Contracting Officer. The Contractor shall have the option of providing the field office facility in an existing or new building, or a trailer. All utilities as specified or required shall be hooked up and in working order prior to the start of work and shall be maintained during the entire contract period. The entire cost to the Contractor for furnishing, equipping and maintaining the accommodations shall be included in the contract price. If the Contractor fails to meet these requirements, the facilities will be secured by the Contracting Officer and the cost thereof will be deducted from payments to the Contractor. All facilities provided for the use of Government personnel under this Paragraph shall remain the property of the Contractor.

1.6.1 Field Office

The temporary field office shall have approximately 200 square feet of floor space and a minimum of seven (7) feet of headroom. An eight (8) foot by thirty (30) foot office trailer may be made available in lieu of the building. The field office or trailer shall be provided with a work table, two (2) lockable desks, and five (5) chairs. It shall be weatherproof and be supplied with heat in season, a minimum of one (1) door, electric lights, a telephone answering device with handset, a facsimile machine, a medium production rate plain paper copier with sorter and paper supplies, a sufficient number of adjustable windows for adequate light and ventilation, toilet facilities with a wash basin with unheated water, and water cooler with approved drinking water. Telephone service to the Government's field office will be provided by the Contractor. Exterior portable toilet facilities without wash basin may be provided in lieu of interior toilet facilities. The windows shall be screened and provided with locking devices, arranged to open and be securely fastened from the inside. In warm weather, air conditioning shall be furnished which will maintain the office at 50 percent relative humidity and a room temperature of 75 degrees F, or 20 degrees below the outside temperature when the outside temperature is 95 degrees F or higher. In addition to the above requirements, the Government field office or trailer shall be provided with the following:

1.6.1.1 Door Locks

Each exterior door shall be provided with an approved deadbolt lock in the door, key operated from both sides and tamperproof heavy duty hasp bolted to the door. Each lock shall be provided with two (2) keys.

1.6.1.2 Security Window Guards

All exterior window openings and glazed panels of exterior doors shall be provided with security window guards. As a minimum, they shall be round frame stationary window guards consisting of 1-1/2 inch diamond mesh No. 10 W & M gage wire, clinched to 3/8 inch round rod frames, secured to the building or trailer with tamperproof fastenings and shall cover the entire glazed opening.

1.6.1.3 Lighting

A light shall be installed over each exterior door and shall be kept lighted at night, including Saturdays, Sundays and holidays.

1.6.1.4 Storage Closet

The field office building or trailer shall have a closet for storage of pilferable equipment. The closet shall be at least three (3) foot by three (3) foot, floor to ceiling height, and have one (1) upper shelf. The door to the closet shall have an approved deadbolt lock or a hasp with an approved padlock. The hasp shall be installed with tamperproof type fastenings. Two (2) keys shall be provided for the deadbolt lock or padlock. Leaves of door hinges shall be unexposed.

1.6.1.5 Cleaning

The Contractor shall clean the office facility once each work week, or as directed. Cleaning shall include, but not be limited to, sweeping the floor, dusting furniture, collecting trash, floor scrubbing, window washing and toilet facility cleaning.

1.6.1.6 Computer Equipment

a. Hardware

Hardware

- (1) IBM-compatible PC with 500 MHz Pentium or higher processor
- (2) 128+ MB RAM for workstation / 256+ MB RAM for server
- (3) 1 GB hard drive disk space for sole use by the QCS system
- (4) 3 1/2 inch high-density floppy drive
- (5) Compact disk (CD) Reader 8x speed or higher
- (6) SVGA or higher resolution monitor (1024 x 768, 256 colors)
- (7) Mouse or other pointing device
- (8) Windows compatible printer (Laser printer compatible must have 4 MB+ of RAM)

- (9) Connection to the Internet, minimum 56k BPS

Software

- (1) MS Windows 98, ME, NT, or 2000
- (2) Word Processing software compatible with MS Word 97 or newer
- (3) Latest version of: Netscape Navigator, Microsoft Internet Explorer, or other browser that supports HTML 4.0 or higher
- (4) Electronic mail (E-mail) MAPI compatible
- (5) The Contractor's computer system shall be protected by virus protection software that is regularly upgraded with all issued manufacturer's updates throughout the life of the contract.

1.7 REPORT REQUIREMENTS

1.7.1 Accident Prevention Plan

Contractor shall provide an accident prevention plan including an activity hazard analysis to the Contracting Officer within 15 calendar days after receipt of award. Plan shall be in accordance with Contract Clause entitled "ACCIDENT PREVENTION (NOV 1991) - ALTERNATE 1.

1.7.2 Payrolls and Basic Records

Contractor shall submit payrolls and basic records in accordance with the CLAUSE entitled "PAYROLLS AND BASIC RECORDS (FEB 1988)".

1.7.3 Progress Chart

Contractor shall submit progress chart in accordance with the Contract clause entitled "SCHEDULE FOR CONSTRUCTION CONTRACTS (APR 1984)".

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Use of Materials from Non-Listed, Non-Commercially Active Sources

If after award of the contract, the Contractor proposes to use soil, granular or aggregate materials for fill from a non-commercially active source or sources, the Contractor shall submit data as required in the Paragraph entitled "SUBMITTALS". The data shall be accompanied by a request for approval. Non-listed, non-commercially active stone or material sources shall not be used unless the proposal and use of the source(s) are approved by the Contracting Officer in accordance with applicable provisions of the contract. All expenses incurred by the Government and the Contractor in connection with the Contractor's request for approval for the use of materials from non-listed, non-commercially active sources shall be borne by the Contractor and all use of such materials and all operations in connection therewith shall be at the Contractor's risk. No extension of the time for completion of the work will be granted as the result of disapproval or approval of the Contractor's request to use a non-listed, non-commercially active source or sources. If not approved, the Contractor shall use materials from the

applicable listed or commercially active source(s).

2.2 AS-BUILT DRAWINGS

The as-built drawing details shall be accurate and of professional quality prepared those with adequate as-built technician's qualifications.

PART 3 EXECUTION

3.1 VIDEO RECORDS

Prior to commencing any work at the project site, the Contractor shall produce video tape recordings of the conditions which exist at the project site. After the required work has been completed, a tape of the conditions at the project site shall also be produced. The physical features to be video taped shall be as indicated by the Contracting Officer's Representative at the site. Such physical features shall also include, but are not limited to, the exterior condition of all private property within 100 feet of the boundary of the required work area. The Contractor shall make every effort to obtain permission from each adjacent property owner, whose property may be affected by the construction, to enter upon the premises to make close-up video tape recordings of the exterior and interior of all structures, and upon receiving such permission shall proceed with video taping in accordance therewith. Video tape for the recording shall be of the standard full-size VHS type and shall be run at the standard or normal speed. Image recording shall be clear and provide sharp details. Every segment of tape footage shall be completely identified with either markers or title cards in the scenes, voice-over on the tape or written notes to be submitted with the tape to the Contracting Officer. Video cassettes, G shall be marked with the project name, number, date and general description of the footage.

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SECTION 01101

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PART 3 EXECUTION (NOT APPLICABLE)

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SECTION 01101

REAL ESTATE

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Additional Property Agreements; G-RED.

Copies of any agreements for Contractor-acquired real estate rights for this project shall be furnished before entering thereon.

1.2 REGULATORY REQUIREMENTS

1.2.1 Real Estate Rights

Rights for the use of the Government-furnished work and storage areas have been obtained and the general limits of the areas are shown on the drawings. Copies of instruments conveying rights for use of the work and storage areas shown on the drawings and specified herein are available for inspection in the Engineering & Construction Division, Design Branch, U.S. Army Corps of Engineers, Detroit District, 477 Michigan Avenue, McNamara Building, Detroit, Michigan. Conformance to all applicable requirements of the instruments conveying rights is required. Two (2) copies of each instrument will be furnished to the Contractor. All real estate lakeward of the Ordinary High Water Mark is under Federal jurisdiction and no real estate permit or agreements are necessary for work therein.

1.2.2 Additional Real Estate Rights

Any additional property agreements and/or real estate rights desired by the Contractor shall be obtained by the Contractor at its own expense. Such agreements shall clearly relieve the Government of any responsibility for damages or liability resulting from the Contractor's use of such grounds.

1.3 PROJECT/SITE CONDITIONS

1.3.1 Location and Verification

It shall be the Contractor's responsibility to accurately locate the limits of all lands utilized under the contract. The corner and angle points of each area for which rights have been obtained shall be marked with semipermanent markers except where there is an approved existing property marker. Temporary markers shall be placed at points on alignment. The points on alignment shall be marked at stations so that intervals between points do not exceed 200 feet.

1.3.2 Survey Markers

All markers shall be installed in an area prior to its use and they shall be available for reference during and upon completion of use of the area. Where approved existing property markers are found, a witness stake, as specified in Subparagraph, "Semipermanent Markers" below, shall be provided. If the types of markers specified hereinafter cannot be used, other types, as approved by the Contracting Officer, shall be provided.

1.3.2.1 Semipermanent Markers

The markers shall be a steel rod one-half inch in diameter and four (4) feet long. The steel rod shall be driven vertically into the ground so that the top is flush with the finished ground surface. Each marker shall be witnessed by a 2" x 2" yellow stake extending two (2) feet above the ground surface and driven into the ground until stable, with not less than one (1) foot penetration.

1.3.2.2 Temporary Markers

Markers shall be 2" x 2", red-colored, wood hub stakes driven into the ground until stable (not less than one (1) foot penetration) with two (2) feet projecting above the ground surface. If the period in which temporary markers are to be in place exceeds one (1) construction season, a more permanent type of marker, as approved, shall be provided.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

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SECTION 01130

ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

CODE OF FEDERAL REGULATIONS (CFR)

40 CFR 261 Identification and listing of Hazardous Waste

ENGINEERING MANUALS (EM)

EM 385-1-1 (3 Sept. 1996) U.S. Army Corps of Engineers Safety and Health Requirements Manual

MICHIGAN DEPARTMENT OF TRANSPORTATION (MDOT)

MDOT 1996 (1996) Standard Specifications for Construction

1.2 DEFINITIONS

Environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents that adversely affect human health or welfare; unfavorably alter ecological balances of plant or animal communities; or degrade the environment from an aesthetic, cultural or historic perspective. Environmental protection is the prevention/control of pollution and habitat disruption that may occur during construction. The control of environmental pollution and damage requires consideration of air, water, land, biological and cultural resources (archaeological and historic resources); and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive materials; and other pollutants.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01130 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Environmental Protection Plan; G-AOF.

Submit in writing an Environmental Protection Plan within ten (10) calendar days after receipt of Notice to Proceed. See Article titled ENVIRONMENTAL

PROTECTION PLAN for details.

1.4 ENVIRONMENTAL PROTECTION REQUIREMENTS

The Contractor shall be knowledgeable of and comply with all applicable Federal, State, and local laws, regulations, permits and licenses concerning environmental protection, pollution control and abatement that are applicable to the Contractor's proposed operations. Note any unique requirements for this contract in the environmental pollution control plan. Also see Clauses titled "CLEAN AIR AND WATER" and "PERMITS AND RESPONSIBILITIES." The Contractor shall provide environmental protective measures and procedures to prevent and control pollution, limit habitat disruption, and correct environmental damage that occurs during construction.

1.4.1 Protection of Features

This section supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS. The Contractor shall prepare a list of features requiring protection under the provisions of the contract clause which are not specially identified on the drawings as environmental features requiring protection. The Contractor shall confine its activities to areas defined by the drawings and specifications. The Contractor shall protect those environmental features, indicated specially on the drawings or in the specifications, in spite of interference which their preservation may cause to the Contractor's work under the contract.

1.4.2 Permits

The Contractor shall obtain any necessary permits and licenses that have not been obtained by the Government. This section supplements the Contractor's responsibility under the contract clause PERMITS AND RESPONSIBILITIES to the extent that the Government has already obtained environmental permits.

1.4.3 Environmental Assessment of Contract Deviations

The Contract specifications have been prepared to comply with the special conditions and mitigation measures of an environmental nature which were established during the planning and development of this project. The Contractor is advised that deviations from the drawings or specifications (e.g., proposed alternate borrow areas, disposal areas, staging areas, alternate access routes, etc.) could result in the requirement for the Government to reanalyze the project from an environmental standpoint. Deviations from the construction methods and procedures indicated by the plans and specifications which may have an environmental impact will require an extended review, processing, and approval time by the Government. The Contracting Officer reserves the right to disapprove alternate methods, even if they are more cost effective, if the Contracting Officer determines that the proposed alternate method will have an adverse environmental impact.

1.5 ENVIRONMENTAL PROTECTION PLAN

The Contractor shall submit an Environmental Protection Plan for review and acceptance by the Contracting Officer. The Government will consider an interim plan for the first 30 days of operations. However, the Contractor shall furnish an acceptable final plan not later than 30 calendar days

after receipt of the Notice to Proceed. Acceptance is conditional and is predicated upon satisfactory performance during construction. The Government reserves the right to require the Contractor to make changes in the Environmental Protection Plan or operations if the Contracting Officer determines that environmental protection requirements are not being met. The plan shall detail the actions which the Contractor shall take to comply with all applicable Federal, State, and local laws and regulations concerning environmental protection and pollution control and abatement, as well as the additional specific requirements of this contract. The Contractor shall refer to the applicable existing environmental documentation to ensure that the natural, historic, and cultural resources specific or unique to this project are protected. Any necessary coordination with and/or notices to all interested agencies and the public have been made by the Government for environmental documentation prepared by the Government. Copies of the documents are available for review at the offices of the Detroit District, Engineering & Construction Division, Environmental Analysis Branch, 7th Floor, 477 Michigan Avenue, Detroit, MI 48226. No physical work at the site shall begin prior to acceptance of the Contractor's plan or an interim plan covering the work to be performed. The environmental protection plan shall include, but not be limited to, the following:

1.5.1 Federal, State and Local Laws and Regulations

The Contractor shall be knowledgeable of all Federal, State and local environmental laws and regulations which apply to the construction operations under the Contract and shall list any unique requirements applicable to this contract as part of the Environmental Protection Plan.

1.5.2 Spill Control Plan

The Contractor shall include as part of the Environmental Protection Plan, a Spill Control Plan. The plan shall include the procedures, instructions, and reports to be used in the event of an unforeseen spill of a substance regulated by the Emergency Response and Community Right-to-Know Act or regulated under State or local laws or regulations. The Spill Control Plan supplements the requirements of EM 385-1-1. This plan shall include as a minimum:

- a. The name of the individual who will be responsible for implementing and supervising the containment and cleanup.
- b. Training requirements for Contractor's personnel and methods of accomplishing the training.
- c. A list of materials and equipment to be immediately available at the job site, tailored to cleanup work of the potential hazard(s) identified.
- d. The names and locations of suppliers of containment materials and locations of additional fuel oil recovery, cleanup, restoration, and material-placement equipment available in case of an unforeseen spill emergency.
- e. The methods and procedures to be used for expeditious contaminant cleanup.
- f. The name of the individual who will report any spills or hazardous substance releases and who will follow up with complete documentation.

This individual shall immediately notify the Contracting Officer in addition to the legally required Federal, State, and local reporting channels (including the National Response Center 1-800-424-8802) if a reportable quantity spill occurs. The plan shall contain a list of the required reporting channels and telephone numbers.

1.5.3 Recycling and Waste Minimization Plan

The Contractor shall submit a Recycling and Waste Minimization Plan as a part of the Environmental Protection Plan. The plan shall detail the Contractor's actions to comply with the following recycling and waste minimization requirements:

- a. The Contractor shall participate in State and local government sponsored recycling programs to reduce the volume of solid waste materials at the source.

1.5.4 Contaminant Prevention Plan

As a part of the Environmental Protection Plan, the Contractor shall prepare a contaminant prevention statement identifying potentially hazardous substances to be used on the job site and intended actions to prevent accidental or intentional introduction of such materials into the air, water, or ground. The Contractor shall detail provisions to be taken to meet Federal, State, and local laws and regulations regarding the storage and handling of these materials.

1.5.5 Environmental Monitoring

The Contractor shall include in the plan the details of environmental monitoring requirements under the laws and regulations and a description of how this monitoring will be accomplished, including, but not limited to, monitoring of land, air, and water resources, including noise, odors and vibrations.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 SPECIAL ENVIRONMENTAL PROTECTION REQUIREMENTS

3.1.1 Work Area Limits

Prior to any construction, the Contractor shall mark the areas where the work is to be performed under this contract. Isolated areas within the general work area which are to be saved and protected shall also be marked or fenced. Monuments and markers shall be protected before construction operations commence. Where construction operations are to be conducted during darkness, the markers shall be visible during darkness. The Contractor shall convey to its personnel the purpose of marking and/or protection of all necessary objects.

3.1.2 Protection of Landscape

Trees, shrubs, vines, grasses, land forms and other landscape features to be preserved, indicated and defined on the drawings submitted by the Contractor as a part of the Environmental Protection Plan shall be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques. Vegetated soil surfaces disturbed by construction

activities shall be re-vegetated as soon as practicable after completing operations in the disturbed area.

3.1.2.1 Tree Protection

No ropes, cables, or guys shall be fastened to or attached to any tree(s) for anchorage unless specifically authorized by the Contracting Officer. Where such special use is permitted, the Contractor shall provide effective protection to prevent damage to the tree and other land and vegetative resources. Unless specifically authorized by the Contracting Officer, no construction equipment or materials shall be placed or used within the drip line of trees shown on the drawings to be saved. No excavation or fill shall be permitted within the drip line of trees to be saved except as shown on the drawings.

3.1.3 U.S. Department of Agriculture (USDA) Quarantined Considerations

The Contractor shall thoroughly clean all construction equipment at the prior job site in a manner that ensures all residual soil is removed and that egg deposits from plant pests are not present to prevent the spread of non-indigenous and/or pest species. The Contractor shall consult with the USDA Plant Protection and Quarantine (USDA - PPQ) jurisdictional office for additional cleaning requirements that may be necessary.

3.1.3.1 Control of Non-Indigenous Aquatic Nuisance Species

The Contractor shall conduct diligent watercraft operating practices to prevent the spread of Non-Indigent Aquatic Nuisance Species (ANS). Such practices shall include, but not be limited to, cleaning equipment on-site to prevent the spread of seeds, eggs, larvae, or other dispersal vectors (e.g. do not transport soil and plant matter from one location to another); and discharging or exchanging ballast water or other water from a vessel of any type only at a location where the chances for survival of ANS are minimal, such as at cold, deep regions of Lake Superior which are far from shore.

3.1.4 Disposal of Waste Materials

Disposal of any materials, waste, effluents, trash, garbage, oil, grease, chemicals, etc., in areas adjacent to streams, rivers, or lakes and in areas not authorized for waste disposal shall not be permitted. If any waste material is dumped or placed in unauthorized areas, the Contractor shall remove the material and restore the area to the condition of the adjacent undisturbed area. If necessary, ground which has become contaminated through the fault or negligence of the Contractor shall be excavated, disposed of as directed by the Contracting Officer, and replaced with suitable fill material compacted and finished with topsoil and planted as required to re-establish vegetation, all at the expense of the Contractor. Disposal of waste, trash and other materials off the project site shall be in accordance with all applicable Federal, State, and local laws, rules and regulations. Removed vegetation, including trees, shall be put to beneficial reuse and not placed into landfills.

3.1.4.1 Disposal of Solid Wastes

Solid waste is rubbish, debris, waste materials, garbage, and other discarded solid materials (excluding clearing debris and hazardous waste as defined in following paragraphs). Solid waste shall be placed in containers and disposed of on a regular schedule. All handling and

disposal shall be conducted in such a way as to prevent spillage and contamination. The Contractor shall transport all solid waste off Government property and dispose in compliance with Federal, State, and local requirements. The Contractor shall comply with Federal, State, and local laws and regulations pertaining to the use of the landfill area.

3.1.4.2 Disposal of Chemical Waste

Chemical waste shall be stored in corrosion resistant containers, removed from the work area and disposed of in accordance with Federal, State, and local laws, rules and regulations.

3.1.4.3 Spillages

Special measures shall be taken to prevent chemicals, fuels, oils, greases, bituminous materials, ashes, sawdust, waste washings, herbicides and insecticides, rubbish or sewage, and other pollutants from entering public waters.

3.1.5 Clearing Debris

Clearing debris is trees, tree stumps, tree trimmings, and shrubs, and leaves, vegetative matter, excavated natural materials (e.g., dirt, sand, and rock), and demolition products (e.g., brick, concrete, glass, and metals).

a. The Contractor shall collect trees, tree stumps, tree trimmings, shrubs, leaves, and other vegetative matter; and shall transport from Government property for proper disposal in compliance with Federal, State, and local requirements. The Contractor shall segregate the matter where appropriate for proper disposal. Untreated and unpainted scrap lumber may be disposed of with this debris where appropriate.

b. Demolition products shall be transported from Government property for proper disposal in compliance with Federal, State, and local requirements.

3.1.6 Disposal of Contractor Generated Hazardous Wastes

Hazardous wastes are hazardous substances as defined in 40 CFR 261, or as defined by applicable State and local regulations. Hazardous waste generated by construction activities shall be removed from the work area and be disposed in compliance with Federal, State, and local requirements. The Contractor shall segregate hazardous waste from other materials and wastes, and shall protect it from the weather by placing it in a safe covered location; precautionary measures against accidental spillage such as berming or other appropriate measures shall be taken. Hazardous waste shall be removed from Government property within 60 days. Hazardous waste shall not be dumped onto the ground, into storm sewers or open water courses, or into the sanitary sewer system. A copy of the manifest shall be provided to the Contracting Officer for any hazardous waste disposed of under this contract.

3.1.7 Fuels and Lubricants

Fueling and lubrication of equipment and motor vehicles shall be conducted in a manner that affords the maximum protection against spills and evaporation. Lubricants and waste oil to be discarded shall be stored in marked corrosion-resistant containers and recycled or disposed in

accordance with Federal, State, and local laws and regulations.

3.1.8 Hydrocarbons, Carbon Monoxide, and Oxides of Nitrogen and Sulfur

Vapor/gaseous emissions of hydrocarbons, carbon monoxide, oxides of nitrogen and sulfur oxides from equipment shall be controlled to Federal and State limits at all times.

3.1.9 Odors

Odors from all construction activities, processing and preparation of shall be controlled at all times.

3.1.10 Ground Vibrations

Ground vibrations from construction activities shall be controlled at all times.

3.1.11 Protection from Sound Intrusions

The Contractor shall keep construction activities under surveillance and control to minimize damage to the environment by noise. Construction equipment shall be fitted with noise control devices.

3.2 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

3.2.1 Discovered Historic, Archaeological, and Cultural Resources

If, during construction activities, items are observed that may have historic or archaeological value (e.g., human remains or associated objects, or artifacts are discovered), such items shall be protected in place and the observations shall be reported immediately to the Contracting Officer so that the District Archaeologist may be notified and a determination made as to their significance and what, if any, special disposition of the finds should be made. The Contractor shall cease all activities that may result in impact to, or the destruction of, these resources. The Contractor shall prevent its employees from trespassing on, removing, or otherwise disturbing such resources.

3.3 PROTECTION OF WATER RESOURCES

The Contractor shall keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters.

3.4 PROTECTION OF FISH AND WILDLIFE RESOURCES

3.4.1 Protection of Fish, Wildlife and Flora

The Contractor shall keep construction activities under surveillance, management and control to minimize interference with, disturbance to and damage of fish, wildlife and flora. Species that require specific attention along with measures for their protection shall be listed by the Contractor prior to beginning construction operations. See Subparagraph titled "Environmental Protection Plan."

3.5 PROTECTION OF AIR RESOURCES

Special management techniques as set out below shall be implemented to control air pollution by the construction activities. These techniques

supplement the requirements of Federal, State, and local laws and regulations; and the safety requirements under this Contract. If any of the following techniques conflict with the requirements of Federal, State, or local laws or regulations, or safety requirements under this contract, then those requirements shall be followed in lieu of the following.

3.5.1 Particulates

Airborne particulates, including dust particles, aerosols, and gaseous by-products from construction activities and processing and preparation of materials, shall be controlled at all times, including weekends, holidays, and hours when work is not in progress. The Contractor shall maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, disposal sites, borrow areas, and all other work areas free from airborne dust which would cause a hazard or nuisance.

3.6 INSPECTION

If the Contracting Officer notifies the Contractor in writing of any observed noncompliance with contract requirements or Federal, State, or local laws, regulations, or permits, the Contractor shall inform the Contracting Officer of proposed corrective action and take such action to correct the noncompliance. If the Contractor fails to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action is taken. No time extensions will be granted or costs or damages allowed to the Contractor for any such suspension.

3.7 MAINTENANCE OF POLLUTION CONTROL FACILITIES

The Contractor shall maintain all constructed pollution control facilities and portable pollution control devices for the duration of the Contract or for the length of time construction activities create the particular pollutant.

3.8 TRAINING OF CONTRACTOR PERSONNEL

Contractor personnel shall be trained in environmental protection and pollution control. The Contractor shall conduct environmental protection/pollution control meetings for all Contractor personnel monthly. The training and meeting agenda shall include methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual, installation and care of facilities (vegetative covers, etc.), and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control. Anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants, shall also be discussed. Other items required to be discussed shall include recognition and protection of archaeological sites, artifacts, and historic structures.

3.9 POST CONSTRUCTION CLEANUP OR OBLITERATION

The Contractor shall obliterate all signs of temporary facilities such as haul roads, work area, structures, stock piles of excess or waste materials, fencing, buoys, stakes, or other vestiges of construction within the work, storage and access areas or as directed by the Contracting Officer. Except for surfaced areas, the areas shall be restored to near natural conditions which will permit the growth of vegetation thereon. In areas where restoration to near natural conditions is not required,

surfaces shall be evenly and smoothly dressed, sloped to drain, and the edges of the restored area graded to be flush with the surrounding existing grade even if original contours are not restored. All damaged non-surfaced areas shall be restored by topsoiling, fertilizing, seeding and mulching, unless otherwise specified or directed. The topsoiling, fertilizing, seeding, and mulching shall be in accordance with the applicable provisions of MDOT 1996, DIVISION 8, Section 816 "Turf Establishment." Dune grass planting shall be in accordance with MDOT 1996, Section 818, Dune Grass Planting.

3.10 RESTORATION OF LANDSCAPE

The Contractor shall restore all landscape features damaged or destroyed during construction operations outside the limits of the approved work areas. Such restoration shall be in accordance with the Contractor's submitted plan, as approved by the Contracting Officer. The work shall be accomplished at the Contractor's expense.

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SECTION 01270A

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PART 2 PRODUCTS (Not Applicable)

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SECTION 01270A

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 LUMP SUM PAYMENT ITEMS

1.1.1 General

Payment items for the work of this contract for which contract lump sum payments will be made are listed in the BIDDING SCHEDULE and described below. All costs for items of work, which are not specifically mentioned to be included in a particular lump sum or unit price payment item, shall be included in the listed lump sum item most closely associated with the work involved. The lump sum price and payment made for each item listed shall constitute full compensation for furnishing all plant, labor, materials, and equipment, and performing any associated Contractor quality control, environmental protection, meeting safety requirements, tests and reports, and for performing all work required for which separate payment is not otherwise provided.

1.1.2 Mobilization and Demobilization

1.1.2.1 Payment

Payment will be made for costs associated with mobilization and demobilization, as defined in Special Clause PAYMENT FOR MOBILIZATION AND DEMOBILIZATION.

1.1.2.2 Unit of Measure

Unit of measure: lump sum.

1.2 UNIT PRICE PAYMENT ITEMS

1.2.1 General

Payment items for the work of this contract on which the contract unit price payments will be made are listed in the BIDDING SCHEDULE and described below. The unit price and payment made for each item listed shall constitute full compensation for furnishing all plant, labor, materials, and equipment, and performing any associated Contractor quality control, environmental protection, meeting safety requirements, tests and reports, and for performing all work required for each of the unit price items.

1.2.2 Unit Price Items

a. "Abandon Drainage Structures" [Item No. 0002]

(1) Payment will be made for costs associated with demolition and excavation of existing structure to a depth of two (2) feet below the surface elevation which includes plugging all pipes entering the manhole in accordance with the detail sheets and filling the

manhole with compacted sand. All work shall be in accordance with Sections 02220a, DEMOLITION, 2302, EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES.

(2) Unit of measure: Each

b. "Reconstruct 48-inch Cast-in-Place Manhole" [Item No. 0003]

(1) Payment will be made for costs associated with the reconstruction of the existing structure which includes sawcutting, removal of top section of manhole, constructing the new section of the manhole including the frame and cover, cleanout, backfilling. All work shall be in accordance with Sections 02220a, DEMOLITION, 02302, EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES, 02630a, STORM-DRAINAGE SYSTEM, AND CONTRACTION JOINTS, 03200a, CONCRETE REINFORCEMENT, and 03307a, CONCRETE FOR MINOR STRUCTURES.

(2) Unit of measure: Each

c. "24 inch Drainage Structures" [Item No. 0004]
"48 inch Drainage Structures" [Item No. 0005]
"60 inch Drainage Structures" [Item No. 0006]

(1) Payment will be made for costs associated with demolition and excavation of existing structure which includes flowable fill to abandon sewer pipe, constructing drainage structures including concrete footing and drainage structure cover, drainage structure taps, cleanout, backfilling. All work shall be in accordance with Sections 02220a, DEMOLITION, 02302, EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES, 02630a, STORM-DRAINAGE SYSTEM, AND CONTRACTION JOINTS, 03200a, CONCRETE REINFORCEMENT, and 03307a, CONCRETE FOR MINOR STRUCTURES.

(2) Unit of measure: Each

d. "Install 8 inch Sanitary Pipe" [Item No. 0007]
"Install 10 inch Sanitary Pipe" [Item No. 0008]

(1) Payment will be made for costs associated with excavation of pavement, curb and gutter, and sidewalk, placement of sanitary sewer, backfilling. All work shall be in accordance with Sections 002230a, SITEWORK, 02302, EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES, 02630a, STORM-DRAINAGE SYSTEM, AND CONTRACTION JOINTS, and 03200a, CONCRETE REINFORCEMENT.

e. "Install 12 inch Storm Pipe" [Item No. 0009]
"Install 15 inch Storm Pipe" [Item No. 0010]
"Install 18 inch Storm Pipe" [Item No. 0011]
"Install 24 inch Storm Pipe" [Item No. 0012]

(1) Payment will be made for costs associated with excavation of pavement, curb and gutter, and sidewalk, placement of storm sewer, backfilling. All work shall be in accordance with Sections 002230a, SITEWORK, 02302, EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES, 02630a, STORM-DRAINAGE SYSTEM, and 03200a, CONCRETE REINFORCEMENT.

(2) Unit of measure: Feet

- f. "Sanitary Sewer Service" [Item No. 0013]
- (1) Payment will be made for costs associated with removal of existing sewer service pipe and installation of new sewer service pipe connected to the sanitary sewer and the existing service lead at the property line. Payment shall include wye branch, lateral and riser pipes, coupling, all fittings and cleanout installed at grade. All work shall be in accordance with Sections 02302, EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES and 02531, SANITARY SEWERS.
- (2) Unit of measure: Feet
- g. "Rock Excavation: First 333 CYD and Over 333 CYD" [Item No. 0014]
- (1) Payment will be made for costs associated with removal of rock material from the excavation area, including loose and scattered rocks and boulders incidental to excavation activities. All work shall be in accordance with Section 02317a, ROCK REMOVAL.
- (2) Unit of measure: Cubic Yard
- h. "Bituminous Roadway Paving Driveway Repair" [Item No. 0015AA]
"Bituminous Roadway Over Concrete Repair" [Item No. 0015AB]
- (1) Payment will be made for costs associated with pavement replacement. All work shall be in accordance with Sections 02721a, SUBBASE COURSES, 02722a, AGGREGATE AND/OR GRADED-CRUSHED AGGREGATE BASE COURSE, 02741a, HOT-MIX ASPHALT (HMA) FOR ROADS, 02748A, BITUMINOUS TACKCOATS, 02761, PAVEMENT MARKINGS, 02980a PATCHING OF RIGID PAVEMENTS, 03150a, EXPANSION JOINTS AND CONTRACTION JOINTS, and 03200a, CONCRETE REINFORCEMENT.
- (2) Unit of measure: Square Yard
- i. "Sidewalk Replacement" [Item No. 0015AC]
"Curb & Gutter Replacement" [Item No. 0015AD]
- (1) Payment will be made for costs associated with curb and gutter replacement and sidewalk replacement. All work shall be in accordance with Sections 02721a, SUBBASE COURSES, 02722a, AGGREGATE AND/OR GRADED-CRUSHED AGGREGATE BASE COURSE, and 02770a, CONCRETE SIDEWALKS AND CURBS AND GUTTERS.
- (2) Unit of measure: Item No. 0015AC: Square Feet
Item No. 0015AD: Lineal Feet
- j. "Concrete Driveway Repair" [Item No. 0015AE]
- (1) Payment will be made for costs associated with concrete driveway repair. All work shall be in accordance with Sections 02721a, SUBBASE COURSES, 02722a, AGGREGATE AND/OR GRADED-CRUSHED AGGREGATE BASE COURSE, 02741a, HOT-MIX ASPHALT (HMA) FOR ROADS, 02748A, BITUMINOUS TACKCOATS, 02761, PAVEMENT MARKINGS, 02980a PATCHING OF RIGID PAVEMENTS, 03150a, EXPANSION JOINTS AND CONTRACTION JOINTS, and 03200a, CONCRETE REINFORCEMENT.
- (2) Unit of measure: Square Yard

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

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SECTION 01312A

QUALITY CONTROL SYSTEM (QCS)

1.1 GENERAL

The Government will use the Resident Management System for Windows (RMS) to assist in its monitoring and administration of this contract. The Contractor shall use the Government-furnished Construction Contractor Module of RMS, referred to as QCS, to record, maintain, and submit various information throughout the contract period. This joint Government-Contractor use of RMS and QCS will facilitate electronic exchange of information and overall management of the contract. QCS provides the means for the Contractor to input, track, and electronically share information with the Government in the following areas:

- Administration
- Finances
- Quality Control
- Submittal Monitoring
- Scheduling
- Import/Export of Data

1.1.1 Correspondence and Electronic Communications

For ease and speed of communications, both Government and Contractor will, to the maximum extent feasible, exchange correspondence and other documents in electronic format. Correspondence, pay requests and other documents comprising the official contract record shall also be provided in paper format, with signatures and dates where necessary. Paper documents will govern, in the event of discrepancy with the electronic version.

1.1.2 Other Factors

Particular attention is directed to Contract Clause, "Schedules for Construction Contracts", Contract Clause, "Payments", Section 01320A, PROJECT SCHEDULE, Section 01330, SUBMITTAL PROCEDURES, and Section 01451A, CONTRACTOR QUALITY CONTROL, which have a direct relationship to the reporting to be accomplished through QCS. Also, there is no separate payment for establishing and maintaining the QCS database; all costs associated therewith shall be included in the contract pricing for the work.

1.2 QCS SOFTWARE

QCS is a Windows-based program that can be run on a stand-alone personal computer or on a network. The Government will make available the QCS software to the Contractor after award of the construction contract. Prior to the Pre-Construction Conference, the Contractor shall be responsible to download, install and use the latest version of the QCS software from the Government's RMS Internet Website. Upon specific justification and request by the Contractor, the Government can provide QCS on 3-1/2 inch high-density diskettes or CD-ROM. Any program updates of QCS will be made available to the Contractor via the Government RMS Website as they become available.

1.3 SYSTEM REQUIREMENTS

The following listed hardware and software is the minimum system configuration that the Contractor shall have to run QCS:

Hardware

IBM-compatible PC with 500 MHz Pentium or higher processor
128+ MB RAM for work station/ 256+MB RAM for server.
4 GB hard drive disk space for sole use by the QCS system
3 1/2 inch high-density floppy drive
Compact disk (CD) Reader 8X speed or higher
SVGA or higher resolution monitor (1024X768, 256 colors)
Mouse or other pointing device.
Windows compatible printer. (Laser printer must have 4 MB+ of RAM)
Connection to the Internet, minimum 256k BPS

Software

MS Windows 98, ME, NT, or 2000
Word Processing software compatible with MS Word 97 or newer
Latest version of; Navigator, Microsoft Internet Explorer, or other browser that supports HTML 4.0 or higher
The Contractor's computer system shall be protected by virus protection software that is regularly upgraded with all issued manufacturer's updates throughout the life of the contract.
Electronic mail (E-mail) MAPI compatible.

1.4 RELATED INFORMATION

1.4.1 QCS User Guide

After contract award, the Contractor shall download instructions for the installation and use of QCS from the Government RMS Internet Website; the Contractor can obtain the current address from the Government. In case of justifiable difficulties, the Government will provide the Contractor with a CD-ROM containing these instructions.

1.4.2 Contractor Quality Control(CQC) Training

The use of QCS will be discussed with the Contractor's QC System Manager during the mandatory CQC Training class.

1.5 CONTRACT DATABASE

Prior to the pre-construction conference, the Government shall provide the Contractor with basic contract award data to use for QCS. The Government will provide data updates to the Contractor as needed, generally by files attached to E-mail. These updates will generally consist of submittal reviews, correspondence status, QA comments, and other administrative and QA data.

1.6 DATABASE MAINTENANCE

The Contractor shall establish, maintain, and update data for the contract in the QCS database throughout the duration of the contract. The Contractor shall establish and maintain the QCS database at the Contractor's site office. Data updates to the Government shall be submitted by E-mail with file attachments, e.g., daily reports, schedule updates, payment requests. If permitted by the Contracting Officer, a data diskette or CD-ROM may be used instead of E-mail (see Paragraph DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM). The QCS database typically shall include current data on the following items:

1.6.1 Administration

1.6.1.1 Contractor Information

The database shall contain the Contractor's name, address, telephone numbers, management staff, and other required items. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver Contractor administrative data in electronic format via E-mail.

1.6.1.2 Subcontractor Information

The database shall contain the name, trade, address, phone numbers, and other required information for all subcontractors. A subcontractor must be listed separately for each trade to be performed. Each subcontractor/trade shall be assigned a unique Responsibility Code, provided in QCS. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver subcontractor administrative data in electronic format via E-mail.

1.6.1.3 Correspondence

All Contractor correspondence to the Government shall be identified with a serial number. Correspondence initiated by the Contractor's site office shall be prefixed with "S". Letters initiated by the Contractor's home (main) office shall be prefixed with "H". Letters shall be numbered starting from 0001. (e.g., H-0001 or S-0001). The Government's letters to the Contractor will be prefixed with "C".

1.6.1.4 Equipment

The Contractor's QCS database shall contain a current list of equipment planned for use or being used on the jobsite, including the most recent and planned equipment inspection dates.

1.6.1.5 Management Reporting

QCS includes a number of reports that Contractor management can use to track the status of the project. The value of these reports is reflective

of the quality of the data input, and is maintained in the various sections of QCS. Among these reports are: Progress Payment Request worksheet, QA/QC comments, Submittal Register Status, Three-Phase Inspection checklists.

1.6.2 Finances

1.6.2.1 Pay Activity Data

The QCS database shall include a list of pay activities that the Contractor shall develop in conjunction with the construction schedule. The sum of all pay activities shall be equal to the total contract amount, including modifications. Pay activities shall be grouped by Contract Line Item Number (CLIN), and the sum of the activities shall equal the amount of each CLIN. The total of all CLINs equals the Contract Amount.

1.6.2.2 Payment Requests

All progress payment requests shall be prepared using QCS. The Contractor shall complete the payment request worksheet and include it with the payment request. The work completed under the contract, measured as percent or as specific quantities, shall be updated at least monthly. After the update, the Contractor shall generate a payment request report using QCS. The Contractor shall submit the payment requests with supporting data by E-mail with file attachment(s). If permitted by the Contracting Officer, a data diskette may be used instead of E-mail. A signed paper copy of the approved payment request is also required, which shall govern in the event of discrepancy with the electronic version.

1.6.3 Quality Control (QC)

QCS provides a means to track implementation of the 3-phase QC Control System, prepare daily reports, identify and track deficiencies, document progress of work, and support other contractor QC requirements. The Contractor shall maintain this data on a daily basis. Entered data will automatically output to the QCS generated daily report. The Contractor shall provide the Government a Contractor Quality Control (CQC) Plan within the time required in Section 01451A, CONTRACTOR QUALITY CONTROL. Within seven calendar days of Government acceptance, the Contractor shall submit a data diskette or CD-ROM reflecting the information contained in the accepted CQC Plan: schedule, pay activities, features of work, submittal register, QC requirements, and equipment list.

1.6.3.1 Daily Contractor Quality Control (CQC) Reports.

QCS includes the means to produce the Daily CQC Report. The Contractor may use other formats to record basic QC data. However, the Daily CQC Report generated by QCS shall be the Contractor's official report. Data from any supplemental reports by the Contractor shall be summarized and consolidated onto the QCS-generated Daily CQC Report. Daily CQC Reports shall be submitted as required by Section 01451A, CONTRACTOR QUALITY CONTROL. Reports shall be submitted electronically to the Government using E-mail or diskette within 24 hours after the date covered by the report. Use of either mode of submittal shall be coordinated with the Government representative. The Contractor shall also provide the Government a signed, printed copy of the daily CQC report.

1.6.3.2 Deficiency Tracking.

The Contractor shall use QCS to track deficiencies. Deficiencies

identified by the Contractor will be numerically tracked using QC punch list items. The Contractor shall maintain a current log of its QC punch list items in the QCS database. The Government will log the deficiencies it has identified using its QA punch list items. The Government's QA punch list items will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of both QC and QA punch list items.

1.6.3.3 Three-Phase Control Meetings

The Contractor shall maintain scheduled and actual dates and times of preparatory and initial control meetings in QCS.

1.6.3.4 Accident/Safety Tracking.

The Government will issue safety comments, directions, or guidance whenever safety deficiencies are observed. The Government's safety comments will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of the safety comments. In addition, the Contractor shall utilize QCS to advise the Government of any accidents occurring on the jobsite. This brief supplemental entry is not to be considered as a substitute for completion of mandatory reports, e.g., ENG Form 3394 and OSHA Form 200.

1.6.3.5 Features of Work

The Contractor shall include a complete list of the features of work in the QCS database. A feature of work may be associated with multiple pay activities. However, each pay activity (see subparagraph "Pay Activity Data" of paragraph "Finances") will only be linked to a single feature of work.

1.6.3.6 QC Requirements

The Contractor shall develop and maintain a complete list of QC testing, transferred and installed property, and user training requirements in QCS. The Contractor shall update all data on these QC requirements as work progresses, and shall promptly provide this information to the Government via QCS.

1.6.4 Submittal Management

The Government will provide the initial submittal register, ENG Form 4288, SUBMITTAL REGISTER, in electronic format. Thereafter, the Contractor shall maintain a complete list of all submittals, including completion of all data columns. Dates on which submittals are received and returned by the Government will be included in its export file to the Contractor. The Contractor shall use QCS to track and transmit all submittals. ENG Form 4025, submittal transmittal form, and the submittal register update, ENG Form 4288, shall be produced using QCS. RMS will be used to update, store and exchange submittal registers and transmittals, but will not be used for storage of actual submittals.

1.6.5 Schedule

The Contractor shall develop a construction schedule consisting of pay activities, in accordance with Contract Clause "Schedules for Construction Contracts", or Section 01320A, PROJECT SCHEDULE, as applicable. This schedule shall be input and maintained in the QCS database either manually

or by using the Standard Data Exchange Format (SDEF) (see Section 01320A PROJECT SCHEDULE). The updated schedule data shall be included with each pay request submitted by the Contractor.

1.6.6 Import/Export of Data

QCS includes the ability to export Contractor data to the Government and to import submittal register and other Government-provided data, and schedule data using SDEF.

1.7 IMPLEMENTATION

Contractor use of QCS as described in the preceding paragraphs is mandatory. The Contractor shall ensure that sufficient resources are available to maintain its QCS database, and to provide the Government with regular database updates. QCS shall be an integral part of the Contractor's management of quality control.

1.8 DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM

The Government-preferred method for Contractor's submission of updates, payment requests, correspondence and other data is by E-mail with file attachment(s). For locations where this is not feasible, the Contracting Officer may permit use of computer diskettes or CD-ROM for data transfer. Data on the disks or CDs shall be exported using the QCS built-in export function. If used, diskettes and CD-ROMs will be submitted in accordance with the following:

1.8.1 File Medium

The Contractor shall submit required data on 3-1/2 inch double-sided high-density diskettes formatted to hold 1.44 MB of data, capable of running under Microsoft Windows 95 or newer. Alternatively, CD-ROMs may be used. They shall conform to industry standards used in the United States. All data shall be provided in English.

1.8.2 Disk or CD-ROM Labels

The Contractor shall affix a permanent exterior label to each diskette and CD-ROM submitted. The label shall indicate in English, the QCS file name, full contract number, contract name, project location, data date, name and telephone number of person responsible for the data.

1.8.3 File Names

The Government will provide the file names to be used by the Contractor with the QCS software.

1.9 MONTHLY COORDINATION MEETING

The Contractor shall update the QCS database each workday. At least monthly, the Contractor shall generate and submit an export file to the Government with schedule update and progress payment request. As required in Contract Clause "Payments", at least one week prior to submittal, the Contractor shall meet with the Government representative to review the planned progress payment data submission for errors and omissions. The Contractor shall make all required corrections prior to Government acceptance of the export file and progress payment request. Payment requests accompanied by incomplete or incorrect data submittals will be

returned. The Government will not process progress payments until an acceptable QCS export file is received.

1.10 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the requirements of this specification. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification.

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SECTION 01330

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SECTION 01330

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

1.1.1 Government-Furnished Information

Submittal register will be delivered to the contractor, by contracting officer on 3 1/2 inch disk. Register will have the following fields completed, to the extent that will be required by the Government during subsequent usage.

Column (c): Lists specification section in which submittal is required.

Column (d): Lists each submittal description (SD No. and type, e.g. SD-04 Drawings) required in each specification section.

Column (e): Lists one principal paragraph in specification section where a material or product is specified. This listing is only to facilitate locating submitted requirements. Do not consider entries in column (e) as limiting project requirements.

Column (f): Indicate approving authority for each submittal. A "G" indicates approval by contracting officer; a blank indicates approval by QC manager.

1.2 DEFINITIONS

1.2 Submittal

Shop drawings, product data, samples, and administrative submittals presented for review and approval. Contract Clauses "FAR 52.236-5, Material and Workmanship," paragraph (b) and "FAR 52.236-21, Specifications and Drawings for Construction," paragraphs (d), (e), and (f) apply to all "submittals."

1.3 Types of Submittals

All submittals are classified as indicated in paragraph "Submittal Descriptions (SD)". Submittals also are grouped as follows:

- a. Shop drawings: As used in this section, drawings, schedules, diagrams, and other data prepared specifically for this contract, by contractor or through contractor by way of subcontractor, manufacturer, supplier, distributor, or other lower tier contractor, to illustrate portion of work.
- b. Product data: Preprinted material such as illustrations, standard schedules, performance charts, instructions, brochures, diagrams, manufacturer's descriptive literature, catalog data, and other data to illustrate portion of work, but not prepared exclusively for this contract.

- c. Samples: Physical examples of products, materials, equipment, assemblies, or workmanship that are physically identical to portion of work, illustrating portion of work or establishing standards for evaluating appearance of finished work or both.
- d. Administrative submittals: Data presented for reviews and approval to ensure that administrative requirements of project are adequately met but not to ensure directly that work is in accordance with design concept and in compliance with contract documents.

1.4 Submittal Descriptions (SD)

SD-01 Preconstruction Submittals

Certificates of insurance

Surety bonds

List of proposed subcontractors

List of proposed products

Construction Progress Schedule

Submittal schedule

Schedule of values

Health and safety plan

Work plan

Quality control plan

Environmental protection plan

SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the contractor for integrating the product or system into the project.

Drawings prepared by or for the contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

Physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies which are to be incorporated into the project and those which will be removed at conclusion of the work.

SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. (Testing must have been within three years of date of contract award for the project.)

Report which includes findings of a test required to be performed by the contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports

Daily checklists

Final acceptance test and operational test procedure

SD-07 Certificates

Statements signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a supplier, installer or subcontractor through Contractor, the purpose of which is to further quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications.

Confined space entry permits.

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and Material Safety Data sheets concerning impedances, hazards and safety precautions.

1.5 SUBMITTAL CLASSIFICATION

Submittals are identified with submittal description (SD) numbers and are classified as follows:

1.5.1 Government Approved

Governmental approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings."

1.5.2 Designated Reviewers

The organization designated to perform the review for approval for items requiring Government approval (G) is identified by acronym in the REVIEWER column on the SUBMITTAL REGISTER, ENG FORM 4288 or ENG FORM 4288 (RMS). Following is a list of the acronyms used and their full description:

AOF = The Resident U.S. Army Corps of Engineers Area Office

RED = Real Estate Division, Detroit District, U.S. Army Corps of Engineers

AEN = The Architect/Engineer firm that designed the project

ECD = Engineering and Construction Division, Detroit District, U.S. Army Corps of Engineers

1.6 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work. After submittals have been approved by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.7 DISAPPROVED SUBMITTALS

When a submittal is returned to the Contractor and marked "DISAPPROVED" or "APPROVED AS NOTED, REVISE AND RESUBMIT", the Contractor shall make all corrections required by the Contracting Officer and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, a notice in accordance with the Contract Clause "Changes" shall be given promptly to the Contracting Officer.

1.8 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION3.1 GENERAL

The Contractor shall make submittals as required by the specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Submittals shall be made in the required number of copies and to the applicable Area Office. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Prior to submittal, all items shall be checked and stamped in accordance with ARTICLE titled STAMPS, and approved by the CQC representative. Each respective transmittal form (ENG FORM 4025) shall be signed and dated by the CQC representative certifying that the accompanying submittal complies with the contract requirements. Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby. Samples remaining upon completion of the work shall be picked up and disposed of in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

3.2 SUBMITTAL REGISTER (ENG FORM 4288)

In Section 01999, is one set of ENG Form 4288 listing items of equipment and materials for which submittals are required by the specifications; this list may not be all inclusive and additional submittals may be required. The Contractor will also be given the submittal register as a diskette containing the computerized ENG Form 4288 and instructions on the use of the diskette. Columns "d" through "r" have been completed by the Government; the Contractor shall complete columns "a" and "s" through "u" and submit the forms (hard copy plus associated electronic file) to the Contracting Officer for approval within 10 calendar days after receipt of the Notice to Proceed. The Contractor shall keep this diskette up-to-date and shall submit it to the Government together with the monthly payment request. The approved submittal register will become the scheduling document and will be used to control submittals throughout the life of the contract. The submittal register and the progress schedules shall be coordinated.

3.3 SCHEDULING

Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently. Certifications to be submitted with the pertinent drawings shall be so scheduled. Adequate time (a minimum of 10 calendar days exclusive of mailing time) shall be allowed and shown on the register for review and approval. No delay damages or time extensions will be allowed for time lost in late submittals. An additional 5 calendar days shall be allowed and shown on the register for review and approval of submittals for refrigeration and HVAC control systems.

3.4 TRANSMITTAL FORM (ENG FORM 4025)

The sample transmittal form (ENG Form 4025) enclosed in SECTION 01999 shall

be used for submitting both Government approved and information only submittals in accordance with the instructions on the reverse side of the form. These forms will be furnished to the Contractor, or may be copied from the enclosed form. This form shall be properly completed by filling out all the heading blank spaces and identifying each item submitted. Special care shall be exercised to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

3.5 SUBMITTAL PROCEDURE

Submittals shall be made as follows:

3.5.1 Deviations

For submittals which include proposed deviations requested by the Contractor, the column "variation" of ENG Form 4025 shall be checked. The Contractor shall set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

3.6 CONTROL OF SUBMITTALS

The Contractor shall carefully control its procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

3.7 GOVERNMENT APPROVED SUBMITTALS

Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval by being so stamped and dated. The distribution of approved copies will be as specified in the Clause titled "SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION".

3.8 INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals.

3.9 RESERVATION OF RIGHTS

The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

3.10 STAMPS

Stamps, approximately 2 inches high by 3 inches wide, and similar to the following, shall be used by the Contractor on the submittal data to validate approval:

CONTRACTOR (Firm Name)
_____ Approved
_____ Approved with corrections as noted on submittal data and/or attached sheets(s).
SIGNATURE: _____
TITLE: _____
DATE: _____

3.11 ACCIDENT PREVENTION PLAN

The format of the Contractor's Accident Prevention Plan shall be in accordance with APPENDIX A, MINIMUM BASIC OUTLINE FOR ACCIDENT PREVENTION PLAN of the SAFETY AND HEALTH REQUIREMENTS MANUAL, EM 385 1-1, 3 Sept 1996. A copy of NCE FORM 129 is included in SECTION 01999 for use in preparing activity hazard analysis documentation.

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SECTION 01420

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SECTION 01420

SOURCES FOR REFERENCE PUBLICATIONS

PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization, (e.g. ASTM B 564 Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided. Documents listed in the specifications with numbers which were not assigned by the standards producing organization should be ordered from the source by title rather than by number.

ACI INTERNATIONAL (ACI)

P.O. Box 9094
Farmington Hills, MI 48333-9094
Ph: 248-848-3700
Fax: 248-848-3701
Internet: <http://www.concrete.org/BOOKSTORE/BKSTR.htm>

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

444 N. Capital St., NW, Suite 249
Washington, DC 20001
Ph: 202-624-5800
Fax: 202-624-5806
Internet: <http://www.aashto.org>

AMERICAN CONCRETE PIPE ASSOCIATION (ACPA)

222 West Las Colinas Blvd., Suite 641
Irving, TX 75039-5423
Ph: 972-506-7216 or 800-290-2272
Fax: 972-506-7682
Internet: <http://www.concrete-pipe.org>
e-mail: info@concrete-pipe.org

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

100 Barr Harbor Drive
W. Conshohocken, PA 19428-2959
Ph: 610-832-9585
FAX: 610-832-9555
Internet: <http://www.astm.org/cgi-bin/SoftCart.exe/index.shtml?E+mystore>

AMERICAN WELDING SOCIETY (AWS)

550 N.W. LeJeune Road
Miami, FL 33126
Ph: 800-443-9353 or 305-443-9353
Fax: 817-326-6306
Internet: <http://www.awpa.com>

ASPHALT INSTITUTE (AI)

Research Park Dr.
P.O. Box 14052
Lexington, KY 40512-4052
Ph: 859-288-4960
Fax: 859-288-4999
Internet: <http://www.asphaltinstitute.org>

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

933 N. Plum Grove Rd.
Schaumburg, IL 60173-4758
Ph: 847-517-1200
Fax: 847-517-1206
Internet: <http://www.crsi.org/>

MICHIGAN DEPARTMENT OF TRANSPORTATION (MDOT)

Cashier's Office
P.O. Box 30648
Lansing, MI 48909-8148
Ph: 517-322-1676
Internet: <http://www.michigan.gov/mdot/0,1607,7-151-9622---,00.html>

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

1 Batterymarch Park
P.O. Box 9101
Quincy, MA 02269-9101
Ph: 617-770-3000
Fax: 617-770-0700
Internet: <http://www.nfpa.org>

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

2655 Villa Creek Dr., Suite 155
Dallas, TX 75234
Ph: 214-243-3902

Fax: 214-243-3907
Internet: <http://www.uni-bell.org>
e-mail: info@uni-bell.org

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SECTION 01451

CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Quality Control Plan; G-AOF

At least ten (10) calendar days prior to commencing work submit a Quality Control Plan.

Preparatory Inspection Checklist

Within 48 hours after any preparatory phase meeting submit the original preparatory inspection checklist.

Initial Inspection Checklist

Within 48 hours after any preparatory phase meeting submit the original preparatory inspection checklist.

Daily Inspection Reports

Within 24 hours following any previous calendar day submit the original daily inspection report.

CQC System Manager; G-AOF

At least ten (10) calendar days prior to commencing work submit the qualification of the CQC manager.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 GENERAL

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with Clause titled "INSPECTION OF CONSTRUCTION." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all construction operations, both on-site and off-site, and shall be keyed to the proposed construction sequence. The project superintendent will be held responsible for the quality of work on the job and is subject to removal by the Contracting Officer for non-compliance with quality

requirements specified in the contract. The project superintendent in this context shall mean the individual with the responsibility for the overall management of the project including quality and production.

3.2 QUALITY CONTROL PLAN

3.2.1 General

The Contractor shall furnish for review by the Government, not later than 30 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of Clause titled "INSPECTION OF CONSTRUCTION." The plan shall identify personnel, procedures, control, instructions, records, and forms to be used. The Government will consider an interim plan for the first 30 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

3.2.2 Content of the CQC Plan

The CQC plan shall include, as a minimum, the following to cover all construction operations, both on-site and off-site, including work by subcontractors, fabricators, suppliers, and purchasing agents:

- a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC system manager who shall report to the project superintendent.
- b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.
- c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities and responsibilities. Copies of these letters shall also be furnished to the Government.
- d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators suppliers, and purchasing agents. These procedures shall be in accordance with SECTION 01330, "SUBMITTAL PROCEDURES".
- e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities will be approved by the Contracting Officer.)
- f. Procedures for tracking preparatory, initial, and follow-up control phases, including documentation.

- g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.
- h. Reporting procedures, including proposed reporting formats.
- i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may be generally considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list shall be as agreed upon during the coordination meeting.

3.2.3 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in its CQC plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.2.4 Notification of Changes

After acceptance of the CQC plan, the Contractor shall notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

3.3 COORDINATION MEETING

Immediately after adjournment of the required Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the Quality Control Plan, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. The CQC plan shall be submitted in draft form for a review a minimum of 3 working days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, administration of the system for both on-site and off-site work, and the interrelationship of the Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting will be prepared by the Government and are to be signed by both the Contractor and the Contracting Officer or the Contracting Officer's Representative. The minutes shall be separate from the Preconstruction Conference minutes and shall become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

3.3.1 Finalize CQC Plan

Immediately following the Preconstruction Conference, the Contractor shall finalize the CQC plan, taking into account comments made at the conference, and shall formally submit the CQC plan for acceptance. The Contractor shall allow up to 10 calendar days for review and acceptance of the

finalized submittal.

3.4 QUALITY CONTROL ORGANIZATION

3.4.1 General

The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel to ensure contract compliance. The Contractor shall provide a CQC organization which shall be at the site at all times during progress of the work and with complete authority to take any action necessary to ensure compliance with the contract. All CQC staff members shall be subject to acceptance by the Contracting Officer.

3.4.2 CQC System Manager

The Contractor shall identify as CQC System Manager an individual within the on site work organization who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. This CQC System Manager shall be a construction person with a minimum of 3 years in related work. This CQC system manager shall be on site at all times during construction and shall be employed by the prime Contractor. The CQC System Manager shall be assigned as System Manager but may have duties as project superintendent in addition to quality control. An alternate for the CQC System Manager shall be identified in the plan to serve in the event of the System Manager's absence. The requirements for the alternate shall be the same as for the designated CQC System Manager.

3.4.3 Additional Requirements

In addition to the above experience and education requirements the CQC System Manager shall have completed the course titled "Construction Quality Management For Contractors". This course is periodically offered at one or more of the Area Offices within the District.

3.4.4 Organizational Changes

The Contractor shall maintain the CQC staff at full strength at all times that the work related to the applicable skill is ongoing. When it is necessary to make changes to the CQC staff, the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

3.5 SUBMITTALS

Submittals shall be as specified in SECTION 01330, titled "SUBMITTAL PROCEDURES". The CQC organization shall be responsible for certifying that all submittals are in compliance with the contract requirements.

3.6 CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors, complies with the requirements of the contract. The controls shall be adequate to cover all construction operations and will be keyed to the proposed construction sequence. The controls shall include at least three phases of control to be conducted by the CQC system manager for all definable features of work, as follows:

3.6.1 Preparatory Phase

This phase shall be performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase shall include:

- a. A review of each paragraph of applicable specifications.
- b. A review of the contract drawings.
- c. A check to assure that all materials and/or equipment have been tested, submitted, and approved.
- d. Review of provisions have been made to provide required control inspection and testing.
- e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.
- f. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.
- g. A review of the appropriate activity hazard analysis to assure safety requirements are met.
- h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.
- i. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.
- j. Discussion of the initial control phase.
- k. The Government shall be notified at least 24 hours in advance of beginning any of the required action of the preparatory control phase. This phase shall include a meeting conducted by the CQC system manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase actions shall be documented by a completed Preparatory Inspection Checklist and by separate minutes prepared by the CQC system manager and attached to the daily QC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

3.6.2 Initial Phase

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

- a. A check of preliminary work to ensure that it is in compliance with contract requirements. Review minutes of the preparatory meeting.
- b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.

- c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
- d. Resolve all differences.
- e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
- f. The Government shall be notified at least 24 hours in advance of beginning the initial phase. A completed initial inspection checklist of this phase shall be prepared by the CQC system manager and attached to the daily QC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.
- g. The initial phase should be repeated for each new crew to work on-site, or any time acceptable specified quality standards are not being met.

3.6.3 Follow-up Phase

Daily checks shall be performed to assure continuing compliance with contract requirements until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The Contractor shall not build upon nor conceal non-conforming work.

3.6.4 Implementation of Government Resident Management System (RMS)

The Contractor shall utilize the Government-furnished CQC Management Report. (Copy enclosed in SECTION 01999). Other Contractor desired reporting forms may be used in addition to this form. The Contractor shall use a government-furnished RMS CQC computer module for managing the quality control for this project. On the Government-furnished Input Forms in SECTION 01999 for use with the RMS, the Contractor shall provide the following information:

- (1) Prime Contractor staffing
- (2) letter codes which the Contractor wishes to use in addition to those supplied with the program libraries. A list of current existing codes is provided in SECTION 01999.
- (3) subcontractor information showing trade, name, address, and insurance expiration dates
- (4) Definable features of work from a Government provided dictionary (may be expanded by the Contractor, as approved).
- (5) Pay activity and activity information, including minimum and maximum durations for each activity on a separate listing. The sum of all activity values shall equal the contract amount and, all Bid Items and Additives shall be separately identified, in accordance with the BIDDING SCHEDULE. Bid Items may include multiple activities, but activities may only be assigned to one such Bid Item. All of the data listed in this Subpart 6 shall be

provided and the RMS CQC module shall be completed to the satisfaction of the Contracting Officer prior to any contract payments (except payments for bonds, insurance and/or mobilization as approved by the Contracting Officer) and shall be updated as required.

(6) Required Quality Control tests (as applicable) tied to individual activities. The QC Reports/QC Requirements function of the RMS QC Module will be used to meet the requirements for tracking of verification and acceptance testing specified in the paragraph titled "Content of the CQC Plan".

(7) Submittal information relating to specification section, bid item number, description, activity number, review period and expected procurement period

(8) User schooling information (as applicable).

The above items shall be incorporated into the required submittal for the Contractor's Quality Control Plan required in the paragraph titled "QUALITY CONTROL PLAN" of this Section.

a. During the course of the contract, the Contractor will receive various Quality Assurance comments from the Government that will reflect corrections needed to Contractor activities or reflect outstanding or future items needing the attention of the Contractor. The Contractor shall acknowledge receipt of these comments by specific number reference on its Daily CQC Report, and will also reflect on his Daily CQC Report when these items are specifically completed or corrected to permit Government verification. The contractor will use the QC COMMENTS function of the RMS QC Module to meet the requirements for tracking construction deficiencies as specified in paragraph titled, "Content of the CQC Plan".

b. The Contractor's schedule system shall include, as specified and separate activities, all Preparatory Phase Meetings (inspections); all O&M Manuals (as applicable) and all Test Plans of Electrical and Mechanical Equipment or Systems that require validation testing or instructions to Contracting Officer Representatives (as applicable).

3.6.5 Additional Preparatory and Initial Phases

Additional preparatory and initial phases may be conducted on the same definable features of work as determined by the Government if the quality of on-going work is unacceptable; or if there are changes in the applicable QC staff or in the on-site production supervision or work crew; or if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

3.7 COMPLETION INSPECTION

3.7.1 Punch-Out Inspection

At the completion of all work the CQC system manager shall conduct an inspection of the work and develop a "punch list" of items which do not conform to the approved plans and specifications. Such a list of deficiencies shall be included in the CQC documentation, as required by paragraph "DOCUMENTATION" below, and shall include the estimated date by which the deficiencies will be corrected. The CQC system manager or staff

shall make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify the Government that the facility is ready for the Government Pre-Final Inspection.

3.7.2 Pre-Final Inspection

The Government will perform this inspection to verify that the facility is complete and ready to be occupied, A Government Pre-Final Punch List may be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected before notifying the Government so that a Final inspection with the customer can be scheduled. Any items noted on the Pre-Final inspection shall be corrected in a timely manner. These inspections and any deficiency corrections required by this paragraph shall be accomplished within the time slated for completion of the entire work or any particular increment thereof if the project is divided into increments by separate completion dates.

3.7.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative shall be in attendance at this inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups, and major commands may also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notice shall be given to the Contracting Officer at least 14 days prior to the final acceptance inspection and shall include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptable complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause titled "Inspection of Construction".

3.8 DOCUMENTATION

The Contractor shall maintain Daily Inspection Reports of quality control operations, activities, and tests performed, including the work of subcontractors. These records shall be on an acceptable form and shall include factual evidence that required quality control activities and/or tests have been performed, including but not limited to the following:

- a. Contractor/subcontractor and their area of responsibility.
- b. Operating plant/equipment with hours worked, idle, or down for repair.
- c. Work performed today, giving location, description, and by whom. For dredging projects, the report shall always include the character and types of materials removed. Whenever there is a significant change in the materials, the location of such change shall be included in the reports.
- d. Control activities performed with results and references to

specifications/plan requirements. The control phase should be identified (Preparatory, Initial, Follow-up). List deficiencies noted along with corrective action.

e. Quantity of materials received at the site, with statement as to acceptability, storage, and reference to specifications/drawings requirements.

f. Identify submittals reviewed, with contract reference, by whom, and action taken.

g. Off-site surveillance activities, including actions taken.

h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.

i. List instructions given/received and conflicts in plans and/or specifications.

j. Contractor's verification statement.

These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that the workmanship complies with the contract. The original and one copy of these records in report form shall be furnished to the Government daily within 24 hours after the date(s) covered by the report, except that reports need not be submitted for days on which no work is performed. All calendar days shall be accounted for throughout the life of the contract. The first report following a period of no work shall be for that day and all the no-work days since the last reported work day. Reports shall be sequentially numbered for this project, signed and dated by the CQC system manager. The report from the CQC system manager shall include copies of reports prepared by all subordinate quality control personnel.

3.9 SAMPLE FORMS

Sample forms for the CQC Management Report, Preparatory Inspection Checklist, Initial Inspection Checklist, and other required reports and plans are enclosed in SECTION 01999. The Contractor shall tailor the checklists to include all reporting and quality control requirements specific to this project.

3.10 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor at the site of the work, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor or subcontractor.

-- End of Section --

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DIVISION 01 - GENERAL REQUIREMENTS

SECTION 1999

LISTING OF ENCLOSED DOCUMENTS, EXHIBITS AND OTHER ATTACHEMENT

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PART 3 EXECUTION (NOT APPLICABLE)

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SECTION 1999

LISTING OF ENCLOSED DOCUMENTS, EXHIBITS AND OTHER ATTACHEMENT

PART 1 GENERAL

1.1 ENCLOSURES

This Section contains documents referenced in other Sections of the specifications. They are consolidated in this Section for the convenience of the Contractor and the Government. The Contractor may reproduce the enclosed forms for its use or obtain a supply of the forms from the Contracting Officer.

TITLE

CONSTRUCTION QUALITY MANAGEMENT REPORT - NCE FORM 63,
6 MAY 77. (2 Sides)

PREPARATORY INSPECTION CHECKLIST (3 SIDES)

INITIAL INSPECTION CHECKLIST (2 SIDES)

ACCIDENT PREVENTION PROGRAM ACTIVITY HAZARD ANALYSIS-
NCE FORM 129, 6 JUNE 1986.

RESIDENT MANAGEMENT SYSTEM FORMS (SAMPLES)

A. CURRENT ACTIVITY SUMMARY (SMPL)

B. INITIAL INSPECTION WORKSHEET

C. PREPARATORY INSPECTION WORKSHEET

D. CONTRACTOR QUALITY CONTROL REPORT (QCR)

E. TRANSMITTAL SHEET (4025-R)

RMS CORRESPONDENCE CODES

SUBMITTAL REGISTER - ENG FORM 4288, MAY 91

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA,
MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATIONS
OF COMPLIANCE ENG FORM 4025, MAY 91 (2 SIDES)

CHANGES TO MDOT STANDARD DETAILS

STADARD MDOT MANHOLE DETAILS

SOIL BORINGS

GENERAL DECISION NO. MI030064

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

-- End of Section --

CONSTRUCTION QUALITY CONTROL MANAGEMENT

DATE _____ REPORT _____
CONTRACTOR _____ CONTRACT NO. _____
PROJECT NAME _____ LOCATION _____
WEATHER TYPE _____ TEMP. MAX _____ MIN _____ RAINFALL _____ GAGE READING _____
EMPLOYEES: SUPV. _____ SKILLED _____ LABORERS _____ LENGTH OF SHIFT _____ HR _____

WORK RESPONSIBILITY: NAME (PRIME OR SUBCONTRACTOR) AND AREA OF RESPONSIBILITY .

- A. _____
- B. _____
- C. _____
- D. _____
- E. _____

WORK PERFORMED TODAY: (LOCATION, DESCRIPTION, QUANTITY AND RESPONSIBILITY BY LETTER REFERENCE
(Relate to Items on the Progress Chart or CPM)

INSPECTION: (DESCRIPTION OF INSPECTION AND LOCATION. INCLUDE OFF-SITE, MATERIALS AND EQUIPMENT INSPECTION.)

A. PREPARATORY PHASE:

B. INITIAL PHASE:

C. CONTINUOUS PHASE:

RESULTS OF INSPECTION: (INCLUDE FINDINGS, DEFICIENCIES OBSERVED & CORRECTIVE ACTION)

RESULTS OF SURVEILLANCE CONTINUED:

TEST PERFORMED: TYPE, LOCATION, RESULTS INCLUDING FAILURES & REMEDIAL ACTION,
(ATTACH COPY OF TEST REPORT OR NOTATION WHEN IT WILL BE FURNISHED.)

WORK ITEMS BEHIND SCHEDULE: REASON, EFFECT ON PROGRESS SCHEDULE AND ACTION TAKEN.

JOB SAFETY: (REPORT CONDITIONS, DEFICIENCIES, CORRECTIVE ACTION & RESULTS.)

REMARKS: LIST ATTACHMENT AND OTHER MANAGEMENT ACTIONS TAKEN TO ASSURE QUALITY
CONSTRUCTION

IF INSPECTION & RESULTS ARE NOT LISTED THEN IT IS ASSUMED THAT QUALITY CONTROL IS NOT BEING
IMPLEMENTED.
THE ABOVE REPORT IS COMPLETE AND CORRECT AND ALL MATERIALS & SUPPLIES INCORPORATED IN THE
WORK ARE IN COMPLIANCE WITH THE TERMS OF THE CONTRACT EXCEPT AS NOTED:

CONTRACTOR'S APPROVED REPRESENTATIVE SIGNATURE

ACCIDENT PREVENTION PROGRAM
ACTIVITY HAZARD ANALYSIS

Page of

1. Contract No.	2. Project	3. Facility
4. Date	5. Location	6. Estimated Start Date

7. Item	8. Phase of Work	9. Safety Hazard	10. Precautionary Action Taken

11. Contractor (Signature & Date)

12. Report discussed with contractor/ superintendent on	13. Contracting Officer (Signature & Date)
---	--



US Army Corps
of Engineers

Current Activity Summary

08 Jul 2002

Project Name: Repair of North & South Piers, Baloney Harbor, MI
Contract Number: DACW35-02-C-####

Location Name

Activity Number	Activity Description	QUANTITY	UNIT PRICE	AMOUNT
CLIN 0001	North and South Pier Repairs	1	\$3,437,787.18 / LS	\$3,437,787.18
1001	Bonds			\$49,136.00
1002A	Prepare & Mobilize Equipment			\$94,864.00
1002B	Prepare Site			\$72,500.00
1002C	Office Trailers & Utilities			\$22,500.00
1003A	Demobilize Equipment			\$5,000.00
1003B	Site Restoration			\$2,500.00
1003C	As-Built Drawings			\$2,500.00
1004A	Furnish SSP			\$750,000.00
1004B	Furnish Special Piles			\$50,000.00
1004C	Furnish SSP Pile Shoes			\$30,000.00
1004D	Fabricate Template			\$6,000.00
1004E	Excavate Driving Line			\$100,000.00
1004F	Set & Drive SSP			\$500,000.00
1004G	Backfill Driving Line			\$50,000.00
1004I	South Driving Line Obstruction Removal			\$117,787.18
1005A	Furnish Misc. Steel			\$193,000.00
1005B	Furnish Tie-Rods			\$20,000.00
1005C	Furnish Plate Washers			\$15,000.00
1005D	Furnish Fasteners			\$12,000.00
1005E	Place Misc. Steel			\$280,000.00
1006A	Demo Concrete & Remove (Rubblemound)			\$100,000.00
1006B	Excavate Existing Cribs (Rubblemound Area)			\$185,000.00
1006C	Disposal of Demo Materials (Rubblemound Area)			\$25,000.00
1007A	Furnish H-Pile Materials			\$22,800.00
1007B	Install H-Piles			\$27,200.00
1008A	Furnish Rebar			\$135,000.00
1008B	Place Concrete (2000 CY @ \$250.00/CY)			\$500,000.00
1009A	Furnish Handrails			\$60,000.00
1009B	Place Handrails			\$7,000.00
1009C	Paint Handrails			\$3,000.00
				<u>\$3,437,787.18</u>
CLIN 0002	Fill Stone:	0	\$0.00 / NA	\$0.00
	No Activities Assigned to this Bid Item.			
CLIN 0002AA	First 18,000 tons	18,000	\$22.50 / TN	\$405,000.00
2001	Furnish & Place Fill Stone - 1st 18,000 Tons			\$405,000.00
				<u>\$405,000.00</u>
CLIN 0002AB	Over 10,000 tons	2,000	\$22.50 / TN	\$45,000.00
2101	Furnish & Place Fill Stone - Over 18,000 Tons			\$45,000.00
				<u>\$45,000.00</u>
CLIN 0003	Underlayer Stone:	0	\$0.00 / NA	\$0.00
	No Activities Assigned to this Bid Item.			
CLIN 0003AA	First 4,500 Tons	4,500	\$31.50 / TN	\$141,750.00
3001	Furnish & Place Underlayer Stone - 1st 4,500 Tons			\$141,750.00
				<u>\$141,750.00</u>
CLIN 0003AB	Over 4,500 tons	450	\$31.50 / TN	\$14,175.00
3101	Furnish & Place Underlayer Stone - Over 4,500 Tons			\$14,175.00
				<u>\$14,175.00</u>
CLIN 0004	Scour Stone:	0	\$0.00 / NA	\$0.00



US Army Corps
of Engineers

Current Activity Summary

08 Jul 2002

Project Name: Repair of North & South Piers, Baloney Harbor, MI
Contract Number: DACW35-02-C-####

Location Name

Activity Number	Activity Description	QUANTITY	UNIT PRICE	AMOUNT
CLIN 0004	Scour Stone: (Continued)	0	\$0.00 / NA	\$0.00
No Activities Assigned to this Bid Item.				
CLIN 0004AA	First 3,500 tons	3,500	\$27.50 / TN	\$96,250.00
4001	Furnish & Place Scour Stone - 1st 3,500 Tons			\$96,250.00
				\$96,250.00
CLIN 0004AB	Over 3,500 tons	600	\$27.50 / TN	\$16,500.00
4101	Furnish & Place Scour Stone - Over 3,500 Tons			\$16,500.00
				\$16,500.00
CLIN 0005	Bedding Stone:	0	\$0.00 / NA	\$0.00
No Activities Assigned to this Bid Item.				
CLIN 0005AA	First 3,000 tons	3,000	\$28.00 / TN	\$84,000.00
5001	Furnish & Place Bedding Stone - 1st 3,000 Tons			\$84,000.00
				\$84,000.00
CLIN 0005AB	Over 3,000 tons	600	\$28.00 / TN	\$16,800.00
5101	Furnish & Place Bedding Stone - Over 3,000 Tons			\$16,800.00
				\$16,800.00
CLIN 0006	Armor Stone:	0	\$0.00 / NA	\$0.00
No Activities Assigned to this Bid Item.				
CLIN 0006AA	First 6,000 tons	6,000	\$34.00 / TN	\$204,000.00
6001	Furnish & Place Armor Stone - 1st 6,000 Tons			\$204,000.00
				\$204,000.00
CLIN 0006AB	Over 6,000 tons	825	\$34.00 / TN	\$28,050.00
6101	Furnish & Place Armor Stone - Over 6,000 Tons			\$28,050.00
				\$28,050.00
Sum of CLINs				\$4,489,312.18
Sum of Activities				\$4,489,312.18
Difference				\$0.00

INITIAL INSPECTION WORKSHEET

DEFINABLE FEATURE OF WORK : Site Cast Concrete

A. ACTIVITIES INCLUDED UNDER Site Cast Concrete -

ABC Company, Inc

1008A	Furnish Rebar	\$135,000.00
1008B	Place Concrete (2000 CY @ \$250.00/CY)	\$500,000.00
		\$635,000.00

B. QUALITY CONTROL REQUIREMENTS -

SUBMITTALS REQUIRED -

00700	1	SF 1413 for Subcontracts		Not submitted
03250	1	Expansion Joint Materials	A	Approved
03307	1	Batching and Mixing Equipment	F	Receipt
03307	2	Conveying and Placement Equipment	F	Receipt
03307	3	Reinforcing Steel (Mat Steel, Bar Steel)	A	Approved
03307	4	Concrete Mixture Proportions;	A	Approved
03307	5	Cementitious Material	A	Approved
03307	6	Aggregates	A	Approved
03307	7	Manufacturer's Literature	A	Approved
03307	8	Batching & Mixing Equipment - Redi-Mix	F	Receipt
03307	9	Conveying & Placing Equipment - Redi-Mix	F	Receipt
03307	10	Concrete Mix Proportions - Redi-Mix	A	Approved
03307	11	Cementitious Material - Redi-Mix	A	Approved
03307	12	Aggregates - Redi Mix	A	Approved
03307	13	Manufacturer's Data; AEA - Redi-Mix	A	Approved
03307	14	Manufacturer's Data; WRA - Redi-Mix	A	Approved
05500	2	Welders	F	Receipt
05552	4	Mill Certs - Ladder Grab Rails	A	Approved

QC TESTS -

CT # 00001	Obtain 1 Cylinder for strength testing at 7 days and 2 Cylinders for 28 days. Minimum of one set per day or 1 set per every 150 CY placed. (ASTM C-94) Required strength at 7 Days = 2,800 p.s.i.; 28 Days = 4,000 p.s.i.		Not Performed
CT # 00002	Check Batch slips for water/cement ratio not to exceed 0.40 by weight		Not Performed
CT # 00003	Check Slump at both mixer and discharge ends: Pumped = 3" - 7" at discharge Maximum of 5" at Mixer if no admixture used Maximum of 7" at mixer if admixture is used 2 checks per shift is minimum required		Not Performed
CT # 00004	2 Air Content tests required per shift. Check approved mix design for maximum and minimum values acceptable.		Not Performed

C. QA/QC PUNCH LIST ITEMS -

INITIAL INSPECTION WORKSHEET

DEFINABLE FEATURE OF WORK : Site Cast Concrete

C. QA/QC PUNCH LIST ITEMS - Cont.

INCLUDE ADDITIONAL COMMENTS ON DAILY REPORT

D. LABOR RATES -

LABOR CLASSIFICATIONS	BASIC RATE	FRINGE BENEFITS	PLUS %	TOTAL WAGE/HR
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

E. INSPECTION CHECKS -

	IN COMPLIANCE Yes/ No/ NA
1. Check rebar for proper bar sizes, per approved shop drawings.	___ ___ ___
2. Check for 3" clearance of rebar from form sides and top surface.	___ ___ ___
3. Check for proper use of concrete vibrators	___ ___ ___
4. Check for correct finish elevations.	___ ___ ___
5. Concrete finish shall meet approval of on-site Government Representative. Make sure all finishers are aware of approved finishing method and degree of brooming.	___ ___ ___
6. Ensure embedded items are not displaced during placement and finishing of the concrete.	___ ___ ___
7. _____	___ ___ ___
8. _____	___ ___ ___
9. _____	___ ___ ___
10. _____	___ ___ ___

F. JOB SITE SAFETY -

	IN COMPLIANCE Yes/ No/ NA
1. All employees working over water are required to wear workvests (PFDs)	___ ___ ___
2. All employees are to wear hard hats.	___ ___ ___
3. Concrete Pump must be shut down prior to cleaning.	___ ___ ___
4. Review Activity Hazard Analysis for Concrete Work prior to performing this work.	___ ___ ___
5. _____	___ ___ ___
6. _____	___ ___ ___
7. _____	___ ___ ___
8. _____	___ ___ ___

G. QA Evaluation Notes -

	DISCUSSED Yes/ No/ NA
1. _____	___ ___ ___
2. _____	___ ___ ___
3. _____	___ ___ ___
4. _____	___ ___ ___

PREPARATORY INSPECTION WORKSHEET

DEFINABLE FEATURE OF WORK : Site Cast Concrete

A. ACTIVITIES INCLUDED UNDER Site Cast Concrete -

ABC Company, Inc.

1008A	Furnish Rebar	\$135,000.00
1008B	Place Concrete (2000 CY @ \$250.00/CY)	\$500,000.00
		\$635,000.00

B. QUALITY CONTROL REQUIREMENTS -

SUBMITTALS REQUIRED -

00700	1	SF 1413 for Subcontracts		Not submitted
03250	1	Expansion Joint Materials	A	Approved
03307	1	Batching and Mixing Equipment	F	Receipt
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03307	11	Cementitious Material - Redi-Mix	A	Approved
03307	12	Aggregates - Redi Mix	A	Approved
03307	13	Manufacturer's Data; AEA - Redi-Mix	A	Approved
03307	14	Manufacturer's Data; WRA - Redi-Mix	A	Approved
05500	2	Welders	F	Receipt
05552	4	Mill Certs - Ladder Grab Rails	A	Approved

C. QA/QC PUNCH LIST ITEMS -

INCLUDE ADDITIONAL COMMENTS ON DAILY REPORT

D. LABOR RATES -

LABOR CLASSIFICATIONS	BASIC RATE	FRINGE BENEFITS	PLUS %	TOTAL WAGE/HR
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

PREPARATORY INSPECTION WORKSHEET

DEFINABLE FEATURE OF WORK : Site Cast Concrete

E. REVIEW CONTRACT DRAWINGS AND SPECIFICATIONS -

DRAWING / SPEC. NO

COMMENTS / CONFLICTS

DRAWING / SPEC. NO	COMMENTS / CONFLICTS
_____	_____
_____	_____
_____	_____

DISCUSSED

Yes/ No/ NA

- | | | | | |
|----|-------|-----|-----|-----|
| 1. | _____ | ___ | ___ | ___ |
| 2. | _____ | ___ | ___ | ___ |
| 3. | _____ | ___ | ___ | ___ |
| 4. | _____ | ___ | ___ | ___ |

F. REPETITIVE DEFICIENCIES FOUND ON PREVIOUS PROJECTS -

DISCUSSED

Yes/ No/ NA

- | | | | | |
|----|-------|-----|-----|-----|
| 1. | _____ | ___ | ___ | ___ |
| 2. | _____ | ___ | ___ | ___ |
| 3. | _____ | ___ | ___ | ___ |
| 4. | _____ | ___ | ___ | ___ |

G. INSPECTION CHECKS -

IN COMPLIANCE

Yes/ No/ NA

- | | | | | |
|----|-------|-----|-----|-----|
| 1. | _____ | ___ | ___ | ___ |
| 2. | _____ | ___ | ___ | ___ |
| 3. | _____ | ___ | ___ | ___ |
| 4. | _____ | ___ | ___ | ___ |

H. JOB SITE SAFETY -

IN COMPLIANCE

Yes/ No/ NA

- | | | | | |
|----|-------|-----|-----|-----|
| 1. | _____ | ___ | ___ | ___ |
| 2. | _____ | ___ | ___ | ___ |
| 3. | _____ | ___ | ___ | ___ |
| 4. | _____ | ___ | ___ | ___ |

I. QUALITY ASSURANCE EVALUATION NOTES -

DISCUSSED

Yes/ No/ NA

- | | | | | |
|----|-------|-----|-----|-----|
| 1. | _____ | ___ | ___ | ___ |
| 2. | _____ | ___ | ___ | ___ |
| 3. | _____ | ___ | ___ | ___ |
| 4. | _____ | ___ | ___ | ___ |

CONTRACTORS QUALITY CONTROL REPORT (QCR) DAILY LOG OF CONSTRUCTION - CIVIL		REPORT NUMBER 92	Page 1 of 2																				
		DATE 22 Jun 2001 - Friday																					
PROJECT North & South Pier Repair, Baloney Harbor, MI		CONTRACT NUMBER DACW35-02-C-#### NA																					
CONTRACTOR ABC Company, Inc. 555 Imagination Road, Fantasy, MI 49494		WEATHER Weather Caused No Delay Temperature Min 80 °F, Max 63 °F; 0.01 IN Precipitation; 10 MPH Wind																					
QC NARRATIVES																							
<p>Activities in Progress: Set and drove 24 sheets of SSP Installing Miscellaneous Steel Waler sections c/s 4+00W to 4+50W 123 Tons of Fill stone placed between existing structure and req'd SSP wall from c/s 6+25 W to 6+75W.</p> <p>Safety Inspection / Safety Meetings: Weekly Safety Meeting held today - Use of PPE - Hrad hats & Work Vests</p>																							
PREP/INITIAL DATES (Preparatory and initial dates held and advance notice)																							
<p>A preparatory inspection was held today for the following feature: Miscellaneous Steel & Handrail</p> <p>An initial inspection was held today for the following feature: Miscellaneous Steel & Handrail</p>																							
ACTIVITY START/FINISH																							
<p>The following activity was started today:</p> <table style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;">Activity No</th> <th style="text-align: left; border-bottom: 1px solid black;">Description</th> </tr> </thead> <tbody> <tr> <td>2001</td> <td>Furnish & Place Fill Stone - 1st 18,000 Tons</td> </tr> </tbody> </table> <p>No activities were finished today</p>				Activity No	Description	2001	Furnish & Place Fill Stone - 1st 18,000 Tons																
Activity No	Description																						
2001	Furnish & Place Fill Stone - 1st 18,000 Tons																						
QC REQUIREMENTS																							
<p>The following 4 QC requirements were completed today:</p> <table style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;">Requirement No</th> <th style="text-align: left; border-bottom: 1px solid black;">Type</th> <th style="text-align: left; border-bottom: 1px solid black;">Description</th> <th style="text-align: left; border-bottom: 1px solid black;">Results</th> </tr> </thead> <tbody> <tr> <td>CT-00001</td> <td>QC Testing</td> <td>Check Plumbness of piles during driving</td> <td>Completed</td> </tr> <tr> <td>CT-00002</td> <td>QC Testing</td> <td>Check horizontal placement of piling (Check for Pile-Walk)</td> <td>Completed</td> </tr> <tr> <td>CT-00003</td> <td>QC Testing</td> <td>Check vibratory hammer driving rate for SSP - 12"/minute is the minimum rate. If exceeded, switch to Impact hammer.</td> <td>Completed</td> </tr> <tr> <td>CT-00004</td> <td>QC Testing</td> <td>Video Tape Interlocks of piling after driving SSP</td> <td>Completed</td> </tr> </tbody> </table>				Requirement No	Type	Description	Results	CT-00001	QC Testing	Check Plumbness of piles during driving	Completed	CT-00002	QC Testing	Check horizontal placement of piling (Check for Pile-Walk)	Completed	CT-00003	QC Testing	Check vibratory hammer driving rate for SSP - 12"/minute is the minimum rate. If exceeded, switch to Impact hammer.	Completed	CT-00004	QC Testing	Video Tape Interlocks of piling after driving SSP	Completed
Requirement No	Type	Description	Results																				
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CT-00004	QC Testing	Video Tape Interlocks of piling after driving SSP	Completed																				
QA/QC PUNCH LIST (Describe QC Punch List items issued, Report QC and QA Punch List items corrected)																							
<p>The following QC Punch List item was issued today:</p> <table style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;">Item No</th> <th style="text-align: left; border-bottom: 1px solid black;">Location</th> <th style="text-align: left; border-bottom: 1px solid black;">Description</th> </tr> </thead> <tbody> <tr> <td>QC-00001</td> <td>4+25W</td> <td>Cut-off sheets to finish grade from 4+00W to 4+50W</td> </tr> </tbody> </table> <p>No Punch List items were corrected today</p>				Item No	Location	Description	QC-00001	4+25W	Cut-off sheets to finish grade from 4+00W to 4+50W														
Item No	Location	Description																					
QC-00001	4+25W	Cut-off sheets to finish grade from 4+00W to 4+50W																					
CONTRACTORS ON SITE (Report first and/or last day contractors were on site)																							
<p>No contractors had their first or last day on site today</p>																							
LABOR HOURS																							
<p>The following labor hours were Reported today:</p> <table style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;">Employer</th> <th style="text-align: left; border-bottom: 1px solid black;">Labor Classification</th> <th style="text-align: right; border-bottom: 1px solid black;">Number of Employees</th> <th style="text-align: right; border-bottom: 1px solid black;">Hours Worked</th> </tr> </thead> <tbody> <tr> <td></td> <td>IRONWORKER</td> <td style="text-align: right;">3.0</td> <td style="text-align: right;">10.0</td> </tr> <tr> <td></td> <td>PILE DRIVING SETTER</td> <td style="text-align: right;">2.0</td> <td style="text-align: right;">10.0</td> </tr> </tbody> </table>				Employer	Labor Classification	Number of Employees	Hours Worked		IRONWORKER	3.0	10.0		PILE DRIVING SETTER	2.0	10.0								
Employer	Labor Classification	Number of Employees	Hours Worked																				
	IRONWORKER	3.0	10.0																				
	PILE DRIVING SETTER	2.0	10.0																				

CONTRACTORS QUALITY CONTROL REPORT (QCR) DAILY LOG OF CONSTRUCTION - CIVIL		REPORT NUMBER 92	Page 2 of 2
		DATE 22 Jun 2001 - Friday	
PROJECT	North & South Pier Repair, Baloney Harbor, MI	CONTRACT NUMBER DACW35-02-C#####	
ABC Company, Inc.	PILE DRIVER OPERATOR	1.0	10.0
Total hours worked to date:	30.0	Total 6.0	30.0
EQUIPMENT HOURS			
The following equipment hours were Reported today:			
<u>Equipment ID</u>	<u>Description</u>	<u>Standby Hours</u>	<u>Operating Hours</u>
00000002	Vibratory Hammer	0.0	10.0
00000003	Arc Welder	0.0	8.0
00000004	Crane - 100' Boom	0.0	10.0
Total operating hours to date:	28.0	Total 0.0	28.0
ACCIDENT REPORTING (Describe accidents)			
No accidents reported today			
CONTRACTOR CERTIFICATION	On behalf of the contractor, I certify that this Report is complete and correct and all equipment and material used and work performed during this Reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as noted above.		
QC REPRESENTATIVE'S SIGNATURE	DATE	SUPERINTENDENT'S INITIALS	DATE

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE <small>(Read instructions on the reverse side prior to initiating this form)</small>	DATE 06/06/2002	TRANSMITTAL NO. 02486-37.2
---	--------------------	-------------------------------

SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS (This section will be initiated by the contractor)

TO: Grand Haven Area Office 307 South Harbor Street P. O. Box 629 Grand Haven, MI 49417	FROM: ABC Company, Inc 555 Imagination Park Road Fantasy, MI 49494	CONTRACT NO. DACW35-02-C-#### NA	CHECK ONE: <input type="checkbox"/> THIS IS A NEW TRANSMITTAL <input checked="" type="checkbox"/> THIS IS A RESUBMITTAL OF TRANSMITTAL 02486-37.1
--	--	-------------------------------------	--

SPECIFICATION SEC. NO. (Cover only one section with each transmittal) 02486	PROJECT TITLE AND LOCATION	CHECK ONE: THIS TRANSMITTAL IS FOR <input checked="" type="checkbox"/> FIO <input type="checkbox"/> GOV'T. APPROVAL
--	----------------------------	--

ITEM NO. <small>a.</small>	DESCRIPTION OF ITEM SUBMITTED <small>(Type size, model number/etc.)</small> <small>b.</small>	MFG OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. <small>(See instruction no. 8)</small> <small>c.</small>	NO. OF COPIES <small>d.</small>	CONTRACT REFERENCE DOCUMENT		FOR CONTRACTOR USE CODE <small>g.</small>	VARIATION <small>(See Instruction No. 6)</small> <small>h.</small>	FOR CE USE CODE <small>i.</small>
				SPEC. PARA. NO. <small>e.</small>	DRAWING SHEET NO. <small>f.</small>			
12	Production Test Results	DATA	3	3.2.3.4				F

REMARKS	<p>I certify that the above submitted items have been reviewed in detail and are correct and in the strict conformance with the contract drawings and specifications except as otherwise stated.</p> <p style="text-align: center;">_____ NAME AND SIGNATURE OF CONTRACTOR</p>
---------	--

SECTION II - APPROVAL ACTION

ENCLOSURES RETURNED (List by item No.)	NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY	DATE

RMS CORRESPONDENCE CODE

CODE	DESCRIPTION
A/E	ARCHITECT/ENGINEER
ASB	AS-BUILT INFORMATION
C	COE LETTER TO CONTRACTOR
EPA	U.S. ENVIRONMENTAL PROTECTION AGENCY
FAX	FACSIMILE TRANSMISSION
FIA	FREEDOM OF INFORMATION REQUEST
H	CONTRACTOR LETTER - FROM HOME OFFICE
LOC	LOCAL GOVERNMENT UNIT
LRE	DETROIT DISTRICT CORPS OF ENGINEERS
MDN	MICHIGAN DEPARTMENT OF NATURAL RESOURCES
MEM	COE IN-HOUSE MEMORANDUM
MFR	MEMORANDUM FOR RECORDS
MSC	MISCELLANEOUS CORRESPONDENCE
MTN	MINUTES OF MEETINGS
NTP	NOTICE TO PROCEED
PNM	PRICE NEGOTIATION MEMORANDUM
POC	POINTS OF CONTACT LIST
QAR	QUALITY ASSURANCE REPORT
QCR	QUALITY CONTROL REPORT
RFI	CONTRACTOR REQUEST FOR INFORMATION
RFP	COE REQUEST FOR PROPOSAL TO CONTRACTOR
S	CONTRACTOR LETTER - FROM SITE OFFICE
SEG	SNELL ENVIRONMENTAL GROUP
SUB	SUBCONTRACTOR LETTER
TEL	TELEPHONE CONVERSATION RECORDS
VM	VOICE-MAIL

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION WAKEFIELD SEWER REHAB, PHASE II						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEWER	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01100	SD-01 Preconstruction Submittals														
			Accident Prevention Plan	1.7.1													
			Payrolls and Basic Records	1.7.2													
			Progress Chart	1.7.3	G AOF												
			Non-listed, Non-Commercially Active Stone or Material Source	2.1.1	G ECD												
			Survey Note Format	1.4.8.2	G AOF												
			Video Cassettes	3.1	G												
			SD-07 Certificates														
			As-Built Technician's Qualifications	2.2													
			As-built Drawings	2.2	G AOF												
			Survey Information	1.4.8.2													
		01101	SD-01 Preconstruction Submittals														
			Additional Property Agreements	1.2.2	G RED												
		01130	SD-01 Preconstruction Submittals														
			Environmental Protection Plan		G AOF												
		01451	SD-01 Preconstruction Submittals														
			Quality Control Plan	3.2	G AOF												
			Preparatory Inspection Checklist	3.6.1													
			Initial Inspection Checklist	3.6.2													
			Daily Inspection Reports	3.8													
			CQC System Manager	3.4.2	G AOF												
			CQC System Manager	3.4.2	G AOF												
		02220a	SD-03 Product Data														
			Work Plan	1.2	G AOF												

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION WAKEFIELD SEWER REHAB, PHASE II						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEWER	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02230a	SD-01 Preconstruction Submittals														
			Construction Equipment	3.1													
			F, AOF														
			Work Plan	1.5	G AOF												
			Check Survey Reports	1.7													
			Utility Verification	1.5	G AOF												
			Erosion Control Plan	3.2													
			SD-03 Product Data														
			Materials Other Than Salable Timber	3.8	G AOF												
		02302	SD-06 Test Reports														
			Trench backfill material tests		G AOF												
			Pipe bedding	2.1.9	G AOF												
			Material tests	1.8.6	G AOF												
			Topsoil tests	1.8.4	G AOF												
			Test for moisture-density relation	1.8.3	G AOF												
			Density and moisture tests	1.8.5	G AOF												
			Subsurface drains granular fill tests		G AOF												
			Fill tests		G AOF												
			Backfill tests		G AOF												
			Granular fill tests		G AOF												
			SD-07 Certificates														
			Shoring and sheeting plan	1.8.1	G AOF												
			Dewatering plan	1.8.2	G AOF												
		02317a	SD-01 Preconstruction Submittals														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION WAKEFIELD SEWER REHAB, PHASE II						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVWNR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02317a	Permits	1.4	G AOF												
			SD-02 Shop Drawings														
			Shop Drawings	1.4													
			F, AOF														
			SD-03 Product Data														
			Blasting Plans	1.4	G AOF												
			SD-06 Test Reports														
			Survey Report	1.5	G AOF												
			Blasting Records	1.4	G AOF												
		02531	SD-02 Shop Drawings														
			Precast concrete manhole	2.3.1	G AOF												
			Frames, covers, and gratings	2.3.4.1	G AOF												
			SD-03 Product Data														
			Pipeline materials	2.1	G AOF												
			SD-07 Certificates														
			Portland Cement	2.2.2	G AOF												
			Joints	2.1.1.1	G AOF												
		02630a	SD-03 Product Data														
			Placing Pipe	3.3	G AOF												
			SD-04 Samples														
			Pipe for Culverts and Storm	2.1	G AOF												
			Drains														
			SD-07 Certificates														
			Resin Certification	1.4	G AOF												
			Pipeline Testing	1.4	G AOF												

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION WAKEFIELD SEWER REHAB, PHASE II						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	GOVT CLASSIFICATION REV DATE	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02630a	Hydrostatic Test on Watertight Joints	1.4	G AOF												
			Determination of Density	1.4	G AOF												
			Frame and Cover for Gratings	1.4	G AOF												
		02721a	SD-03 Product Data														
			Equipment	1.6	G AOF												
			Waybills and Delivery Tickets	1.4.4	G AOF												
			SD-06 Test Reports														
			Sampling and Testing	1.4	G AOF												
		02722a	SD-03 Product Data														
			Plant, Equipment, and Tools	1.6	G AOF												
			Waybills and Delivery Tickets	1.4.4	G AOF												
			SD-06 Test Reports														
			Sampling and testing	1.4	G AOF												
			Field Density Tests	1.4.2.4	G AOF												
		02731a	SD-03 Product Data														
			Equipment	1.4	G AOF												
			SD-06 Test Reports														
			Sampling and Testing	1.5	G AOF												
			Density Tests	3.11	G AOF												
		02741a	SD-03 Product Data														
			Mix Design	2.3	G AOF												
			Contractor Quality Control	3.9	G												
			AOF														
			Material Acceptance and Percent Payment		G												

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION WAKEFIELD SEWER REHAB, PHASE II						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
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		02741a	SD-04 Samples														
			Asphalt Cement Binder	2.2	G AOF												
			Aggregates	2.1	G AOF												
			SD-06 Test Reports														
			Aggregates	2.1	G AOF												
			QC Monitoring		G AOF												
			SD-07 Certificates														
			Asphalt Cement Binder	2.2	G AOF												
			Testing Laboratory		G AOF												
		02748A	SD-03 Product Data														
			Waybills and Delivery Tickets	1.3.1													
			SD-06 Test Reports														
			Sampling and Testing	3.7													
		02761	SD-03 Product Data														
			Reflective media for roads and streets; G, AOF.														
			Paints for roads and streets; G, AOF.														
			waterborne Marking Material														
			Thermoplastic compounds														
			Raised Pavement Markers														
			SD-06 Test Reports														
			Reflective media for roads and streets; G, AOF.														
			Paints for roads and streets; G, AOF.														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
WAKEFIELD SEWER REHAB, PHASE II

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEWER	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
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		02761	Waterborne Marking Material														
			Thermoplastic compounds														
			Raised Pavement Markers														
			SD-07 Certificates														
			Reflective media for roads and streets; G, AOF.														
			Paints for roads and streets; G, AOF.														
			Thermoplastic compounds														
			Construction equipment list; G, AOF.														
			SD-08 Manufacturer's Instructions														
			Paints for roads and streets; G, AOF.														
			Thermoplastic compounds														
		02770a	SD-03 Product Data														
			Concrete	2.1	G AOF												
			SD-06 Test Reports														
			Field Quality Control	3.8	G AOF												
		02921a	SD-03 Product Data														
			Equipment	1.4.6	G AOF												
			Surface Erosion Control Material	2.8	G AOF												
			Chemical Treatment Material	1.4.3	G AOF												
			Delivery	1.4.1	G AOF												
			Finished Grade and Topsoil	3.2.1	G AOF												
			Topsoil	1.4.1.1	G AOF												

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION WAKEFIELD SEWER REHAB, PHASE II						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEWER	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02921a	Topsoil	2.2	G AOF												
			Quantity Check	3.5	G AOF												
			Seed Establishment Period	3.9	G AOF												
			Maintenance Record	3.9.1	G AOF												
			Application of Pesticide	3.6	G AOF												
			SD-04 Samples														
			Delivered Topsoil	1.3	G AOF												
			Soil Amendments	1.4.1.2	G AOF												
			Mulch	2.4	G AOF												
			SD-06 Test Reports														
			Equipment Calibration	3.1.3	G AOF												
			Soil Test	1.4.1.1	G AOF												
			SD-07 Certificates														
			Seed	1.4.2	G AOF												
			Topsoil	1.4.1.1	G AOF												
			Topsoil	2.2	G AOF												
			pH Adjuster	2.3.1	G AOF												
			Fertilizer	2.3.2	G AOF												
			Organic Material	2.3	G AOF												
			Organic Material	2.3.3	G AOF												
			Soil Conditioner	2.3.4	G AOF												
			Mulch	2.4	G AOF												
			Asphalt Adhesive	2.5	G AOF												
			Pesticide	1.4.1.3	G AOF												
			delivery	1.4.1													
		02980a	SD-03 Product Data														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION WAKEFIELD SEWER REHAB, PHASE II						CONTRACTOR											
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		02980a	Patching System	Part 3	G AOF												
			SD-06 Test Reports														
			Patching System	Part 3	G AOF												
		03150a	SD-03 Product Data														
			Preformed Expansion Joint Filler	2.2	G AOF												
			Sealant	2.3	G AOF												
			SD-07 Certificates														
			Preformed Expansion Joint Filler	2.2	G AOF												
			Sealant	2.3	G AOF												
		03200a	SD-02 Shop Drawings														
			Reinforcement	2.3	G AOF												
			SD-03 Product Data														
			Welding	1.3	G AOF												
			SD-07 Certificates														
			Reinforcement	2.3	G AOF												
		03307a	SD-03 Product Data														
			Air-Entraining Admixture	2.1.3.1	G AOF												
			Accelerating Admixture	2.1.3.2	G AOF												
			Water-Reducing or Retarding Admixture	2.1.3.3	G AOF												
			Curing Materials	2.1.7	G AOF												
			Reinforcing Steel	2.1.5	G AOF												
			Batching and Mixing Equipment	3.1.4.3	G AOF												
			Conveying and Placing Concrete	3.2	G AOF												
			Formwork	2.1.6	G AOF												
			SD-06 Test Reports														

INSTRUCTIONS

1. Section I will be initiated by the Contractor in the required number of copies.
2. Each transmittal shall be numbered consecutively in the space provided for "Transmittal No.". This number, in addition to the contract number, will form a serial number for identifying each submittal. For new submittals or resubmittals mark the appropriate box; on resubmittals, insert transmittal number of last submission as well as the new submittal number.
3. The "Item No." will be the same "Item No." as indicated on ENG FORM 4288 for each entry on this form.
4. Submittals requiring expeditious handling will be submitted on a separate form.
5. Separate transmittal form will be used for submittals under separate sections of the specifications.
6. A check shall be placed in the "Variation" column when a submittal is not in accordance with the plans and specifications--also, a written statement to that effect shall be included in the space provided for "Remarks".
7. Form is self-transmittal, letter of transmittal is not required.
8. When a sample of material or Manufacturer's Certificate of Compliance is transmitted, indicate "Sample" or "Certificate" in column c, Section I.
9. U.S. Army Corps of Engineers approving authority will assign action codes as indicated below in space provided in Section I, column i to each item submitted. In addition they will ensure enclosures are indicated and attached to the form prior to return to the contractor. The Contractor will assign action codes as indicated below in Section I, column g, to each item submitted.

THE FOLLOWING ACTION CODES ARE GIVEN TO ITEMS SUBMITTED

- | | |
|---|--|
| A -- Approved as submitted | E -- Disapproved (See attached) |
| B -- Approved, except as noted on drawings. | F -- Receipt acknowledged |
| C -- Approved, except as noted on drawings.
Refer to attached sheet resubmission required. | FX -- Receipt acknowledged, does not comply
as noted with contract requirements |
| D -- Will be returned by separate correspondence. | G -- Other (Specify) |
10. Approval of items does not relieve the contractor from complying with all the requirements of the contract plans and specifications.

Reverse of ENG Form 4025

CHANGES TO
MICHIGAN DEPARTMENT OF TRANSPORTATION
STANDARD DETAILS

UTILITY TRENCHES, DETAIL R-83-B, Sheet 1 of 3:

In Detail A, "SEWER NOT UNDER ROADBED"

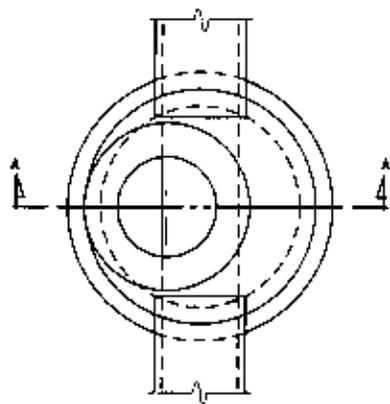
Delete: "GRANULAR MATERIAL CLASS III" and

Add: "GRANULAR MATERIAL CLASS IIIA"

In Detail B, "SEWER UNDER ROADBED OR WITHIN INFLUENCE OF ROADBED"

Delete: "GRANULAR MATERIAL CLASS III" and

Add: "GRANULAR MATERIAL CLASS IIIA"

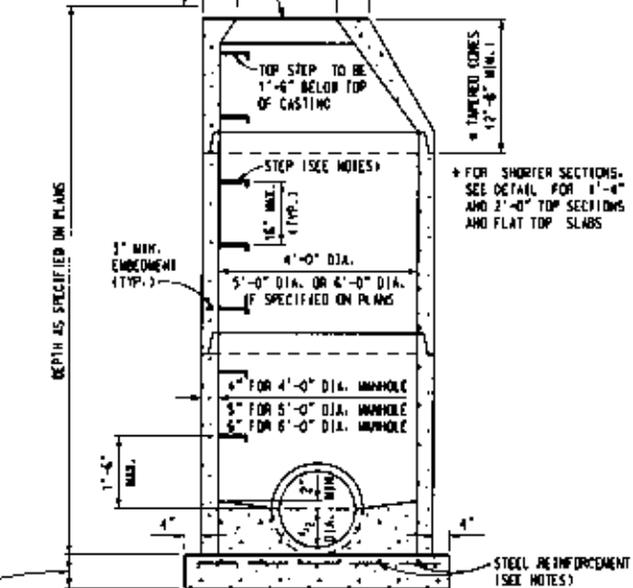


PLAN VIEW

PLACE COVER ON MANHOLE AS SPECIFIED ON PLANS

2'-0" DIA. MIN.
2'-3" DIA. MAX.

TOP OF MASONRY STRUCTURE OR BOTTOM OF CASTING



DEPTH AS SPECIFIED ON PLANS

3" MIN. EMBEDMENT (TYP.)

1'-4" MAX.

CONCRETE FOOTING SHALL BE 8" THICK FOR DEPTHS TO 25'-0" AND 1'-0" THICK FOR DEPTHS OVER 25'-0"

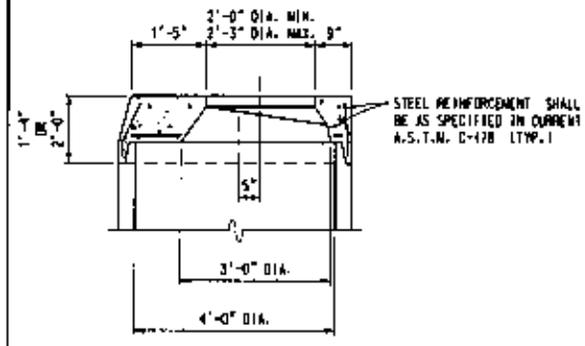
DIA. = 4'-0" + 12 x WALL THICKNESS FOR 4'-0" DIA. MANHOLE

DIA. = 5'-0" + 12 x WALL THICKNESS FOR 5'-0" DIA. MANHOLE

DIA. = 6'-0" + 12 x WALL THICKNESS FOR 6'-0" DIA. MANHOLE

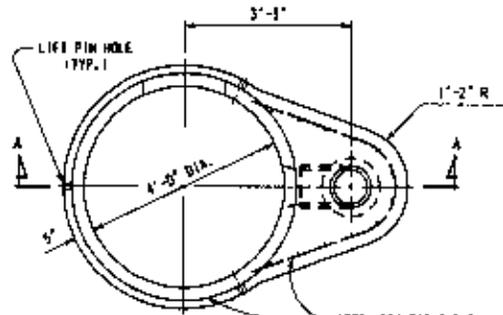
SECTION A - A
TYPICAL MANHOLE

PRECAST REINFORCED CONCRETE SHOWN
OTHER OPTIONS INCLUDE CONCRETE BLOCK, BRICK, OR CAST-IN-PLACE WALL SECTIONS
SEE TYPICAL WALL SECTIONS FOR WALL THICKNESS



DETAIL FOR
1'-4" & 2'-0" TOP SECTIONS

SHAPE MAY VARY FROM DETAIL SHOWN BUT MUST COMPLY WITH A.S.T.M. C-478 AND JOINTS SHALL BE COMPATIBLE WITH THE RISER



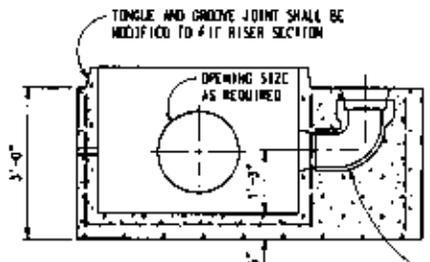
LIFT PIN HOLE (TYP.)

3'-3"

1'-2" R

4'-0" DIA.

STEEL REINFORCEMENT SHALL BE AS SPECIFIED IN CURRENT A.S.T.M. C-478

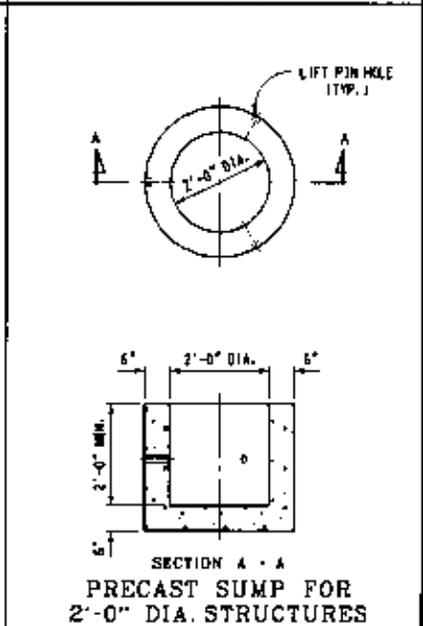
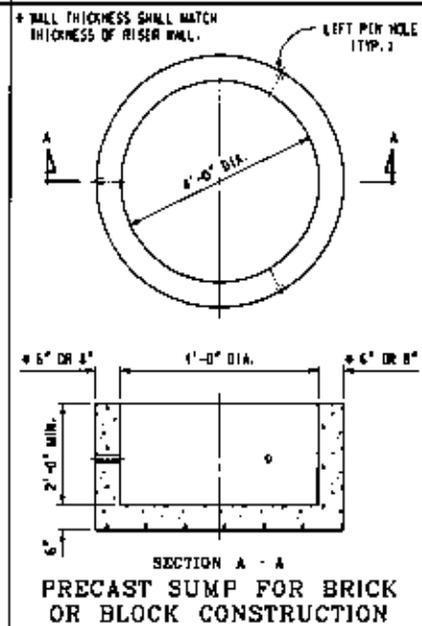
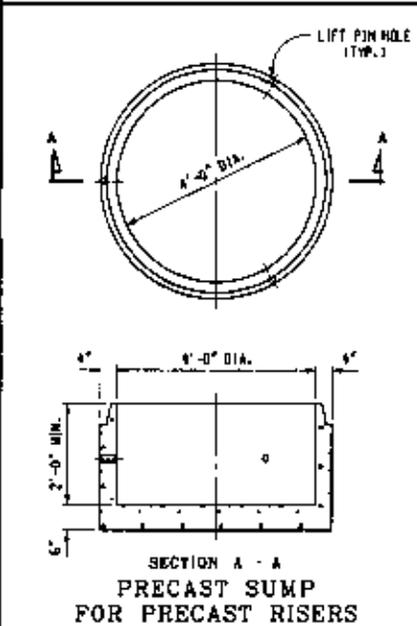
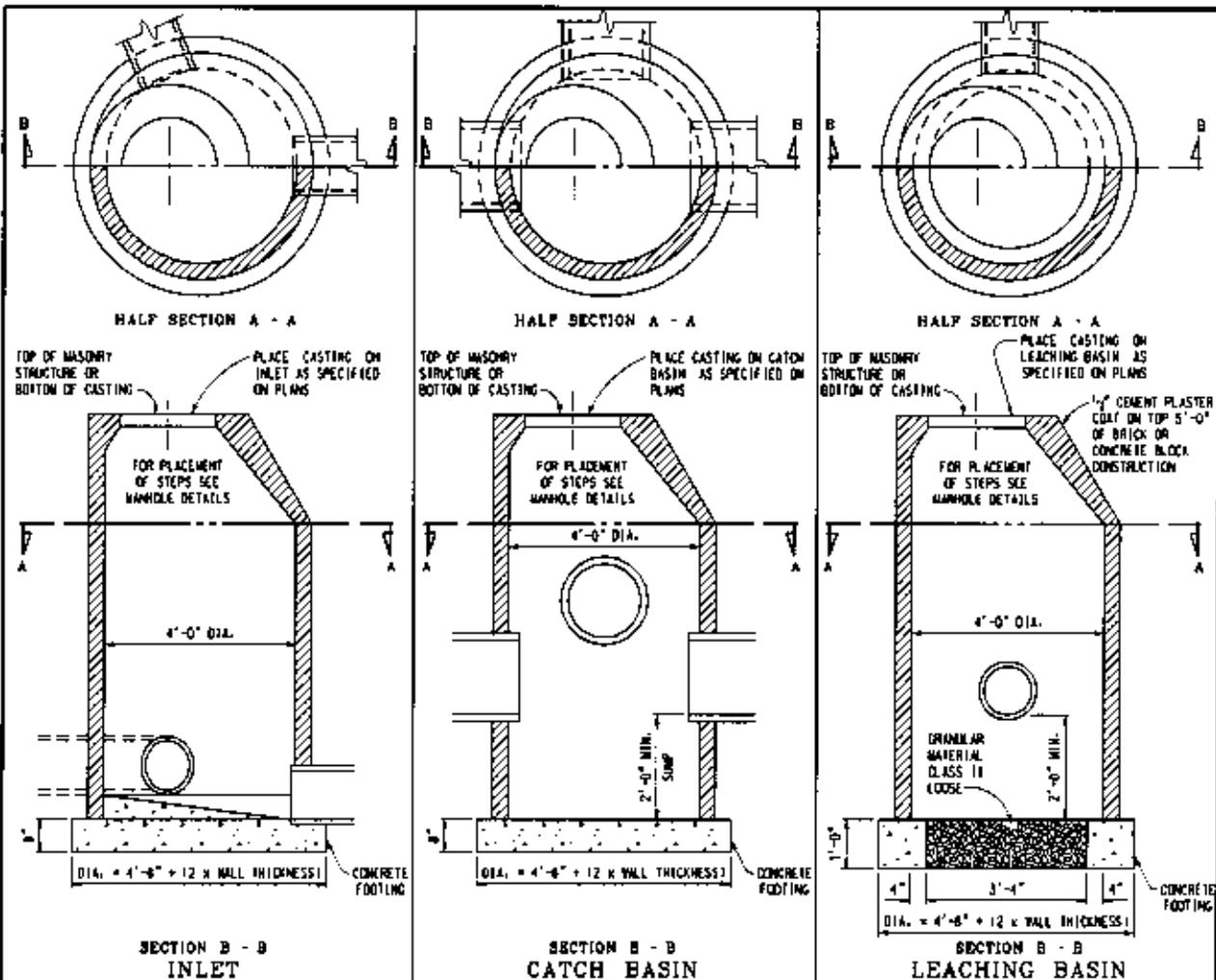


SECTION A - A
TYPICAL PRECAST REINFORCED
BOTTOM SECTION FOR DROP MANHOLE

	ENGINEER OF CONSTRUCTION & TECHNOLOGY	ENGINEER - ROAD DESIGN
	ENGINEER OF MAINTENANCE	ENGINEER OF DESIGN DEPARTMENT DIRECTOR Gregory J. Payne
PREPARED BY DESIGN DIVISION DRAWN BY: B.L.T. CHECKED BY: M.K.P.	ENGINEER OF TRAFFIC AND SAFETY	BY: CHIEF ENGINEER/DEPUTY DIRECTOR BUREAU OF HIGHWAY TECHNICAL SERVICES

MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR		
DRAINAGE STRUCTURES		
12-21-2001 F.H.W.A. APPROVAL	2-22-2001 PLAN DATE	R-1-D SHEET 1 OF 5

NOTE: THIS PLAN IS NOT A LEGAL ENGINEERING DOCUMENT BUT AN ELECTRONIC DUPLICATE. THE ORIGINAL SIGNED COPY APPROVED FOR PUBLICATION, IS KEPT ON FILE AT THE MICHIGAN DEPARTMENT OF TRANSPORTATION.



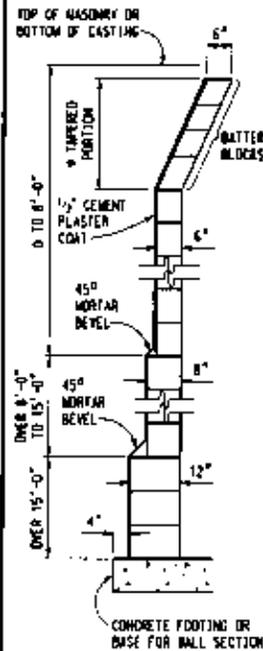
MICHIGAN DEPARTMENT OF TRANSPORTATION
 BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR

DRAINAGE STRUCTURES

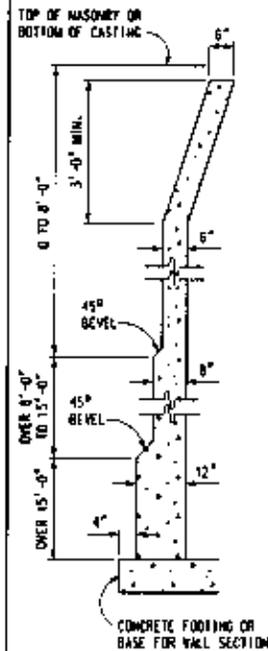
12-21-2001 F.H.S.A. APPROVAL	2-22-2001 PLAN DATE	R-1-D	SHEET 2 OF 3
---------------------------------	------------------------	--------------	-----------------

NOTE: THIS PLAN IS NOT A LEGAL ENGINEERING DOCUMENT BUT AN ELECTRONIC DUPLICATE. THE ORIGINAL SIGNED COPY APPROVED FOR PUBLICATION, IS KEPT ON FILE AT THE MICHIGAN DEPARTMENT OF TRANSPORTATION.

4 BLOCK MIN. FOR 4'-0" DIA. STRUCTURE
 6 BLOCK MIN. FOR 5'-0" DIA. STRUCTURE
 8 BLOCK MIN. FOR 6'-0" DIA. STRUCTURE

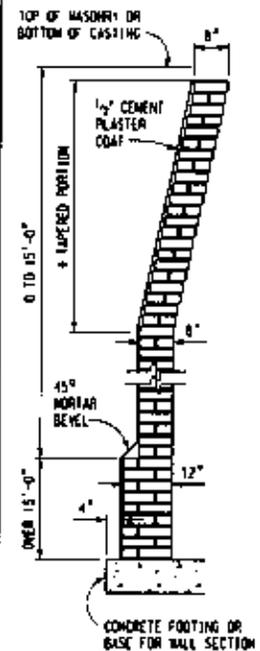


TYPICAL CONCRETE BLOCK WALL SECTION

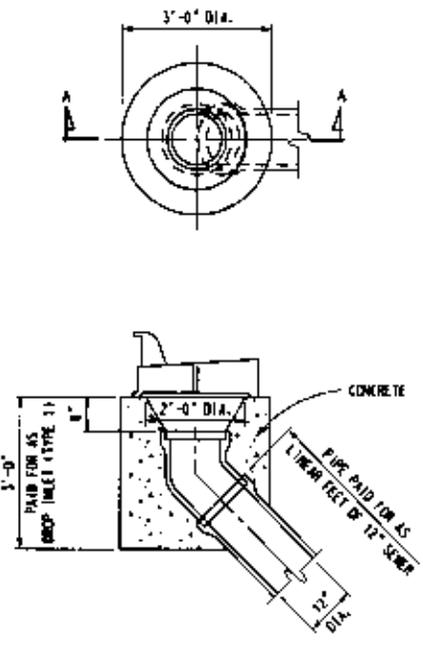


TYPICAL CAST-IN-PLACE CONCRETE WALL SECTION

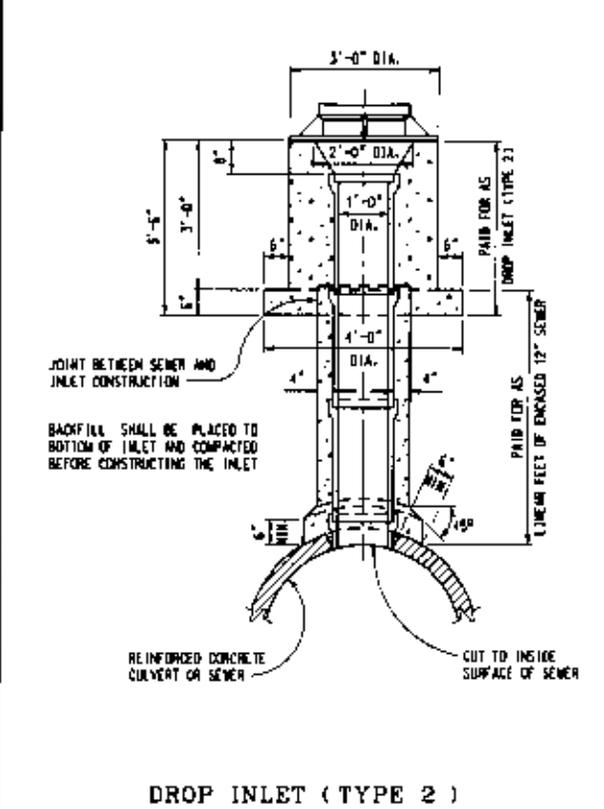
5'-0" MIN. FOR 4'-0" DIA. STRUCTURE
 6'-0" MIN. FOR 5'-0" DIA. STRUCTURE
 8'-0" MIN. FOR 6'-0" DIA. STRUCTURE



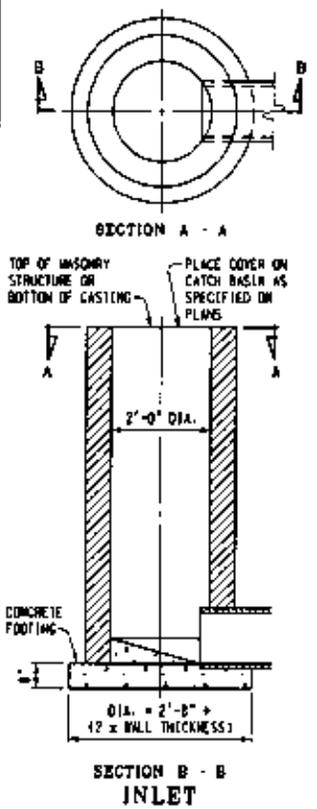
TYPICAL BRICK WALL SECTION



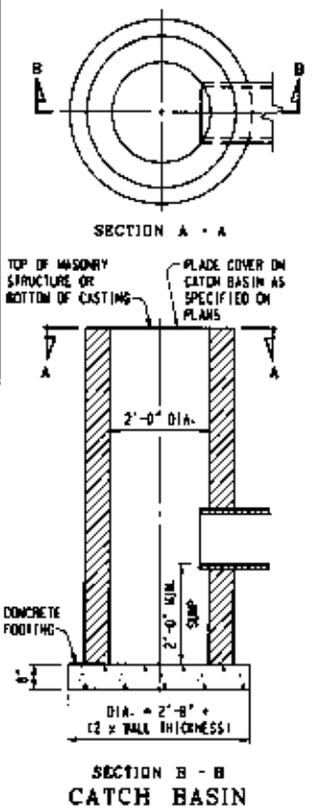
SECTION A - A
 DROP INLET (TYPE 1)



DROP INLET (TYPE 2)



SECTION B - B
 INLET



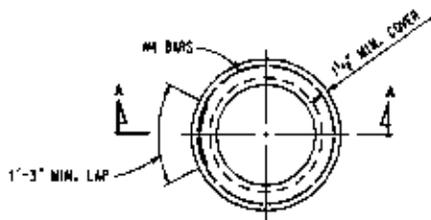
SECTION B - B
 CATCH BASIN

MICHIGAN DEPARTMENT OF TRANSPORTATION
 BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR

DRAINAGE STRUCTURES

12-21-2001	7-22-2001	R-1-D	SHEET 3 OF 5
F.H.S.A. APPROVAL	PLAN DATE		

NOTE: THIS PLAN IS NOT A LEGAL ENGINEERING DOCUMENT BUT AN ELECTRONIC DUPLICATE. THE ORIGINAL SIGNED COPY APPROVED FOR PUBLICATION, IS KEPT ON FILE AT THE MICHIGAN DEPARTMENT OF TRANSPORTATION.



SECTION A - A

• WHEN RISER TONGUE LENGTH IS GREATER THAN 3". USE 2 TIMES THE TONGUE LENGTH.

NOTE: PRECAST RISER SHALL FULLY ENGAGE THE TONGUE OF THE RISER PIPE.

PRECAST RISER RING (FOR 2'-0" DIAMETER STRUCTURE)

NOTES:

THE DRAINAGE STRUCTURE COVERS ALLOWED FOR USE ON THESE DRAINAGE STRUCTURES ARE SPECIFIED IN SUBSEQUENT STANDARD PLANS AND ARE INTERCHANGEABLE ON ANY STRUCTURE.

THE TOPS OF MANHOLE STRUCTURES SHALL BE SUFFICIENTLY LOW TO PERMIT PROPER ADJUSTMENT OF COVER TO GRADE USING MORTAR OR BRICK AS DIRECTED BY THE ENGINEER.

THE TOP PORTION OF 4'-0" DIAMETER AND LARGER PRECAST REINFORCED UNITS SHALL BE ECCENTRIC IN DESIGN.

PREMIUM JOINTS ARE REQUIRED ON ALL SANITARY MANHOLES. SEE A.S.T.M. DESIGNATION C-923.

GRANULAR MATERIAL CLASS III SHALL BE USED IN BACKFILLING AROUND ALL STRUCTURES THAT FALL WITHIN THE 111 INFLUENCE LINES FROM THE EDGE OF PAVEMENT OR BACK OF CURB.

A STRIP OF 500 3'-0" WIDE SHALL BE PLACED AROUND THE TOP OF EACH STRUCTURE LYING OUTSIDE THE SURFACED PORTIONS OF THE HIGHWAY.

STEPS FOR DRAINAGE STRUCTURES SHALL BE OF AN APPROVED DESIGN AND MADE FROM CAST IRON, ALUMINUM, OR PLASTIC COATED STEEL. RUNGS SHALL BE A MINIMUM OF 10" IN CLEAR LENGTH, DESIGNED TO PREVENT THE FOOT FROM SLIPPING OFF THE END. THE MINIMUM HORIZONTAL PULL OUT LOAD SHALL BE 400 LBS. THE MINIMUM VERTICAL LOAD SHALL BE 400 LBS.

THE BELL SHALL BE REMOVED FOR THE FIRST LENGTH OF DUAL PIPE PROJECTING THROUGH THE WALL OF THE MANHOLE.

PRECAST CONCRETE SECTIONS, SHIMS, AND FLAT TOP SLABS SHALL BE BUILT ACCORDING TO A.S.T.M. C-478 AND ACCORDING TO DETAILS SPECIFIED ON THIS PLAN. PRECAST REINFORCED CONCRETE FLAT TOP SLAB SHALL BE MARKED TO SHOW LOCATION OF REINFORCEMENT. THE WALLS OF THE PRECAST UNITS MAY HAVE A SLIGHT TAPER TO ALLOW FOR FORM REMOVAL. PRECAST CONCRETE 2'-0" DIAMETER DRAINAGE STRUCTURES SHALL HAVE A MINIMUM 3" WALL THICKNESS WITH A 6" MINIMUM BEARING SURFACE ON TOP. SEE PRECAST RISER RING FOR 2'-0" DIAMETER STRUCTURE.

PIPES ENTERING OR LEAVING PRECAST STRUCTURES SHALL NOT HAVE AN INSIDE DIAMETER GREATER THAN 2'-0" LESS THAN THE INSIDE DIAMETER OF THE STRUCTURE. EXCEPT THAT PIPES ENTERING OR LEAVING 2'-0" INSIDE DIAMETER STRUCTURES MAY HAVE PIPES WITH A 1'-0" INSIDE DIAMETER OR LESS.

THE NUMBER OF PIPE OPENINGS IN A RISER SHALL BE DETERMINED BY THE DESIGNER. SPACING BETWEEN OPENINGS SHALL BE 6" MINIMUM. OPENINGS MAY BE CONSTRUCTED BY CASTING, REMOVING THE GREEN CONCRETE, OR BY DRILLING THE OPENINGS IN CURED CONCRETE.

WHEN A SEWER TRAP IS CALLED FOR ON THE PLANS, IT SHALL BE PLACED IN THE OUTLET SEWER LINE OF CATCH BASINS AND CONSTRUCTED ACCORDING TO STANDARD PLAN R-19-SERIES. SEWER TRAPS SHALL BE PAID FOR SEPARATELY AT THE CONTRACT UNIT PRICE, EACH.

PRECAST CONCRETE FOOTINGS OR BASES SHALL BE REINFORCED WITH #4 BARS SPACED AT 1'-0" BOTH WAYS OR WITH TWO LAYERS OF WELDED WIRE FABRIC OF EQUIVALENT CROSS SECTIONAL AREA LAID AT RIGHT ANGLES AND WIRE TOGETHER. REINFORCEMENT SHALL BE PLACED IN TOP OF FOOTING AND SHALL BE MARKED. STEEL REINFORCEMENT MAY BE OMITTED IN CAST-IN-PLACE CONCRETE FOOTINGS.

PRECAST CONCRETE FOOTINGS SHALL BE SUPPORTED BY A COMPACTED 6" GRANULAR SUBBASE.

THE MINIMUM WALL THICKNESS FOR ALL 2'-0", 4'-0", 5'-0", AND 6'-0" DRAINAGE STRUCTURES USING CONCRETE BLOCK, BRICK, OR CAST-IN-PLACE CONCRETE SHALL BE AS SPECIFIED IN TYPICAL WALL SECTIONS.

THE CONICAL SECTION OF MANHOLES OR CATCH BASINS CONSTRUCTED OF BLOCK OR BRICK SHALL BE SHROUDED WITH GEOTEXTILE FABRIC TO A MINIMUM DEPTH OF 5'-0" OR THROUGH THE FROST ZONE. ENOUGH GEOTEXTILE MATERIAL SHALL BE LEFT ON THE TOP 18" OR MORE TO ROLL OVER THE TOP OF THE CONE.

PREFORMED HIGH DENSITY POLYSTYRENE FILLER PIECES MAY BE USED TO CHANNEL FLOW IN THE BOTTOM OF MANHOLES PROVIDED THEY HAVE AT LEAST 2" OF CONCRETE COVER. THE USE OF THIS MATERIAL FOR CHANNEL FLOW IS RESTRICTED TO MANHOLES WHERE THE BOTTOM SECTION IS NOT SUBJECT TO FREEZING. THE USE OF THIS MATERIAL MUST BE APPROVED BY THE ENGINEER.

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR

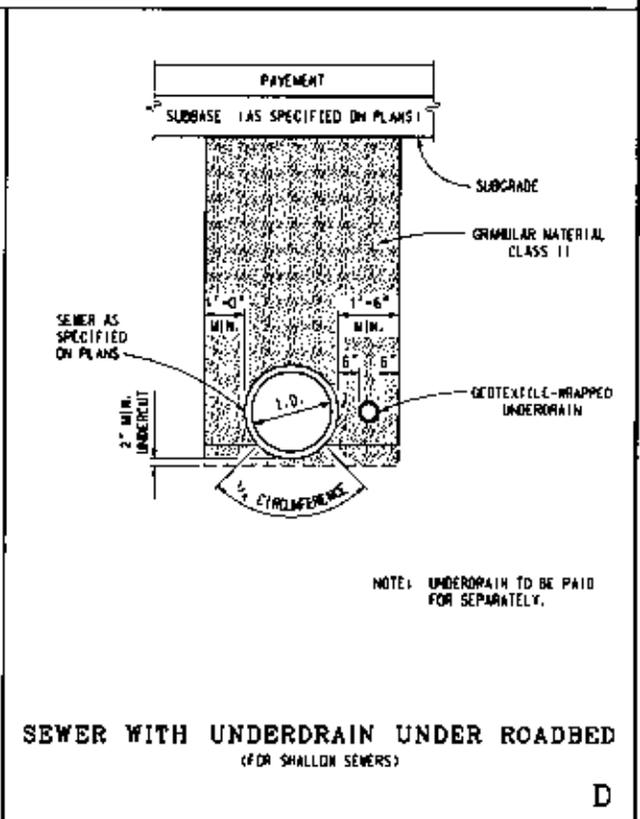
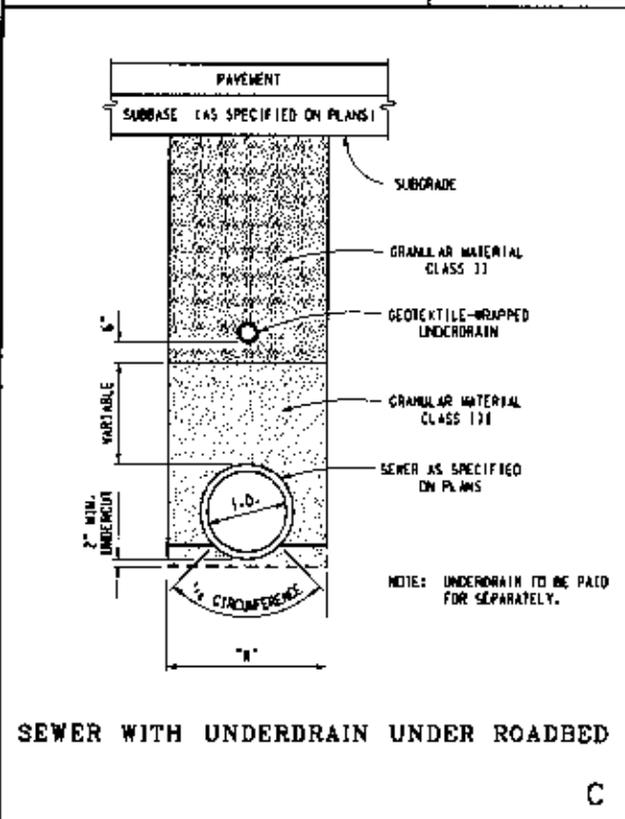
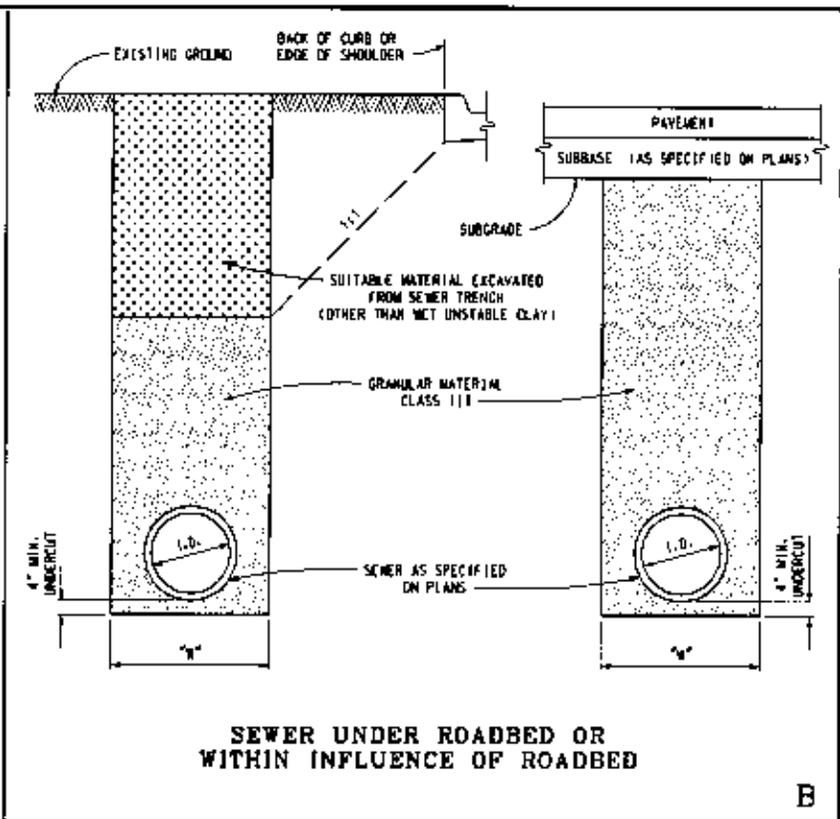
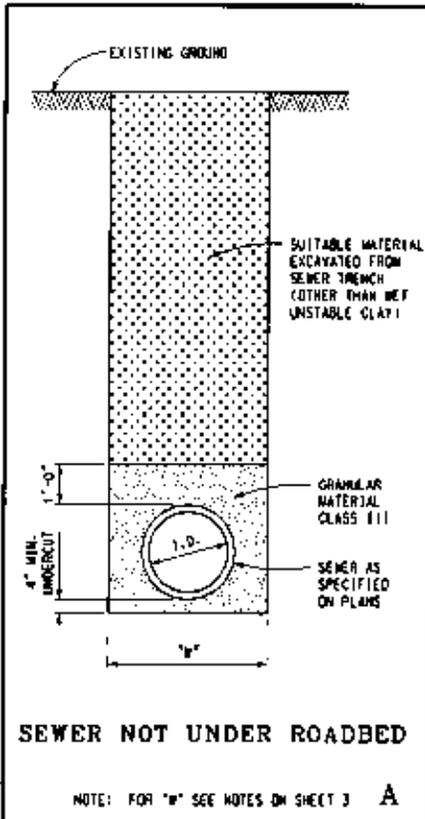
DRAINAGE STRUCTURES

12-21-2001
F.W.N.B. APPROVAL

2-22-2001
PLAN DATE

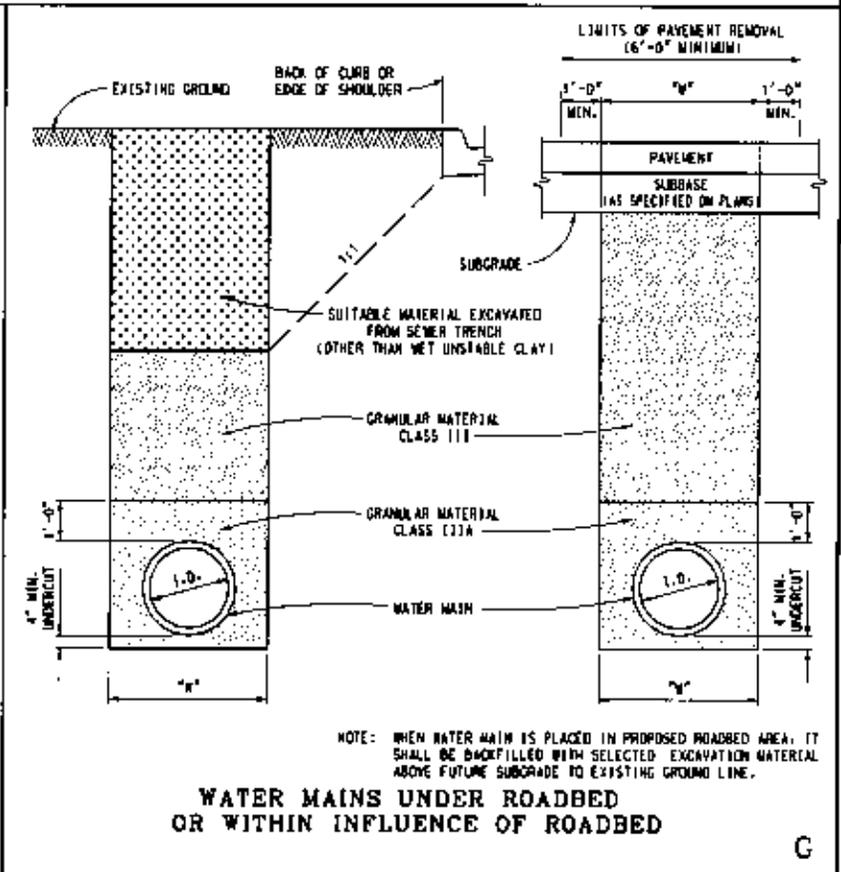
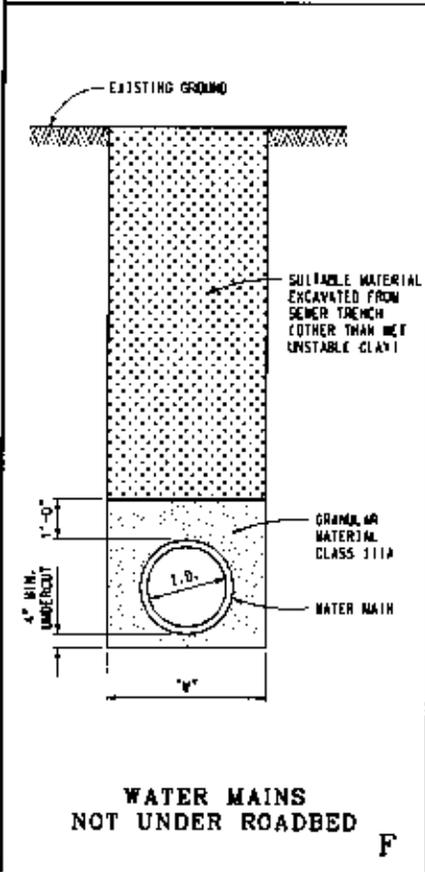
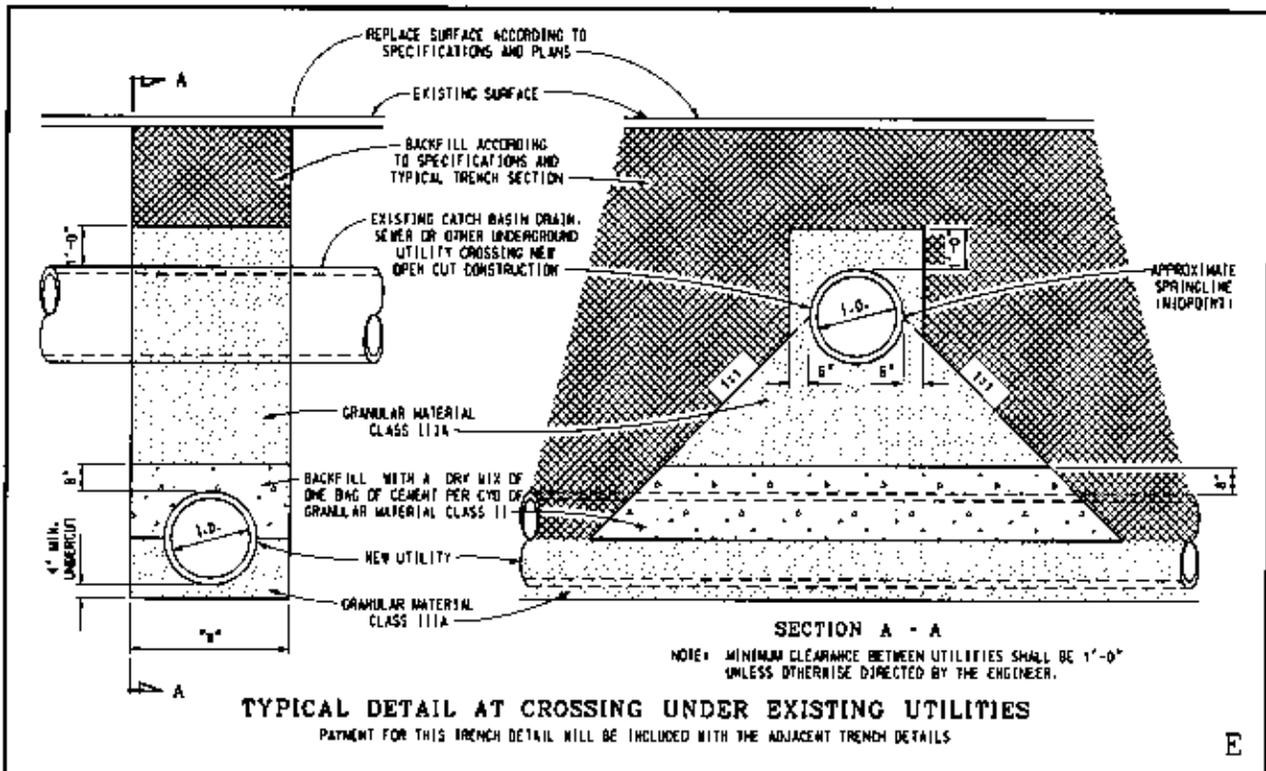
R-1-D

SHEET
5 OF 5



	ENGINEER OF CONSTRUCTION & TECHNOLOGY	ENGINEER - ROAD DESIGN	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR UTILITY TRENCHES	
	ENGINEER OF MAINTENANCE	ENGINEER OF DESIGN		
PREPARED BY DESIGN DIVISION	ENGINEER OF TRAFFIC AND SAFETY	DEPARTMENT DIRECTOR Gregory J. Robine	9-14-2001 F.H.B.A. APPROVAL	2-28-2001 PLAN DATE
DRAWN BY: B.L.T.		By: CHIEF ENGINEER/DEPUTY DIRECTOR BUREAU OF HIGHWAY TECHNICAL SERVICES	R-83-B	SHEET 1 OF 3
CHECKED BY: W.K.P.				

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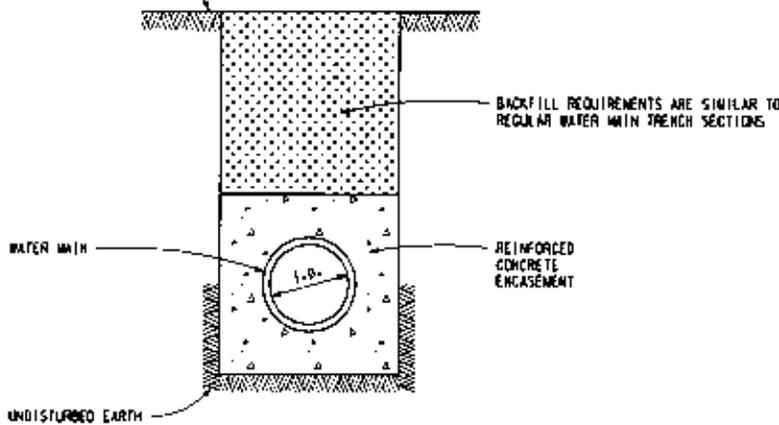
MICHIGAN DEPARTMENT OF TRANSPORTATION
 BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR

UTILITY TRENCHES

9-14-2001 F.M.B.A. APPROVAL	2-28-2001 PLAN DATE	R-83-B	SHEET 2 OF 3
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EXISTING GROUND
BOTTOM OF SUBBASE



**REQUIRED ENCASEMENT
SIZE FOR RESPECTIVE
PIPE SIZES**

DIAMETER OF PIPE	ENCASEMENT SIZE AND TRENCH WIDTH
6" - 12"	3'-0"
16"	3'-6"
24"	4'-6"
30"	5'-0"
36"	5'-6"
42"	6'-0"
48"	7'-0"
54"	7'-6"
60"	8'-0"
66"	8'-6"
72"	9'-0"

NOTE:
REINFORCEMENT SHALL BE AS SPECIFIED ON PLANS.

WATER MAINS IN REINFORCED CONCRETE ENCASEMENT

H

NOTES:

BEDDING UNDER THE UTILITY SHALL BE AS SPECIFIED AND THE UNDERCUT MATERIAL REPLACED WITH GRANULAR MATERIAL CLASS IIIA. BACKFILLING SHALL BE ACCORDING TO THE CURRENT STANDARD SPECIFICATION.

BACKFILL FOR UTILITY TRENCHES ABOVE GRANULAR MATERIAL CLASS IIIA SHALL BE PLACED AS FOLLOWS:

- (A) GRANULAR MATERIAL, OF THE CLASS SPECIFIED ON DETAILS, SHALL BE USED TO BACKFILL TRENCHES UNDER THE ROADBED AND SHALL BE COMPACTED TO NOT LESS THAN 95% OF ITS MAXIMUM UNIT WEIGHT.
- (B) GRANULAR MATERIAL, OF THE CLASS SPECIFIED ON DETAILS, SHALL BE USED TO BACKFILL UTILITY TRENCHES OUTSIDE THE ROADBED BUT WITHIN THE 1:1 ZONE OF INFLUENCE SHOWN. IT WILL ALSO BE USED AS BACKFILL UNDER SIDEWALKS, SURFACED AREAS, AND MISCELLANEOUS STRUCTURES, AND COMPACTED TO NOT LESS THAN 95% OF ITS MAXIMUM UNIT WEIGHT.
- (C) WHEN ACCEPTABLE, MATERIAL EXCAVATED FROM THE UTILITY TRENCHES SHALL BE USED TO BACKFILL UTILITY TRENCHES OUTSIDE THE LIMITS OF THE 1:1 ZONE OF INFLUENCE AND SHALL BE COMPACTED TO NOT LESS THAN 90% OF ITS MAXIMUM UNIT WEIGHT.

GRANULAR MATERIAL CLASS I, II, IIIA, OR IIIA MAY BE USED WHERE GRANULAR MATERIAL CLASS III IS SPECIFIED ON THE PLANS.

SUFFICIENT TRENCH WIDTH SHALL BE PROVIDED TO ALLOW FREE WORKING SPACE AND TO PERMIT COMPACTING THE BACKFILL AROUND THE PIPE.

THE FOLLOWING ARE MINIMUM TRENCH WIDTHS:

I.D. PIPE SIZE (INCHES)	LESS THAN 18	21	24	30	36	
TRENCH WIDTH (FEET)	3.0	3.5	4.0	5.0	6.0	
I.D. PIPE SIZE (INCHES)	42	48	54	60	66	72
TRENCH WIDTH (FEET)	7.0	8.0	9.5	10.0	10.5	11.0
I.D. PIPE SIZE (INCHES)	78	84	90	96	102	108
TRENCH WIDTH (FEET)	11.5	12.0	12.5	13.0	13.5	14.0

ESTIMATED PAVEMENT REMOVAL WIDTH IS TO BE TRENCH WIDTH "W" PLUS 1'-0" EACH SIDE OF THE TRENCH 16'-0" MINIMUM.

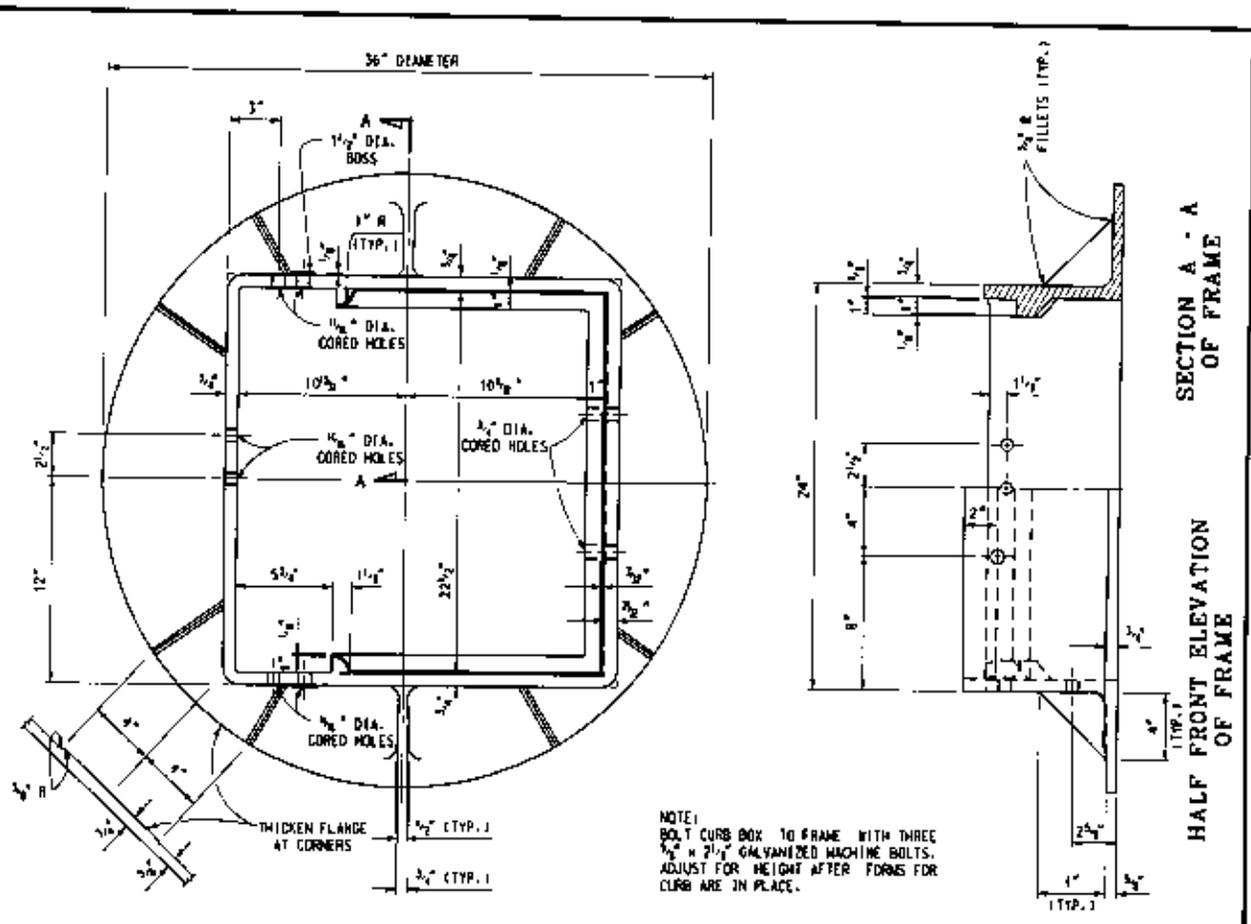
MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR

UTILITY TRENCHES

9-14-2001 F.W.L. APPROVAL	2-28-2001 PLAN DATE	R-83-B	SHEET 3 OF 3
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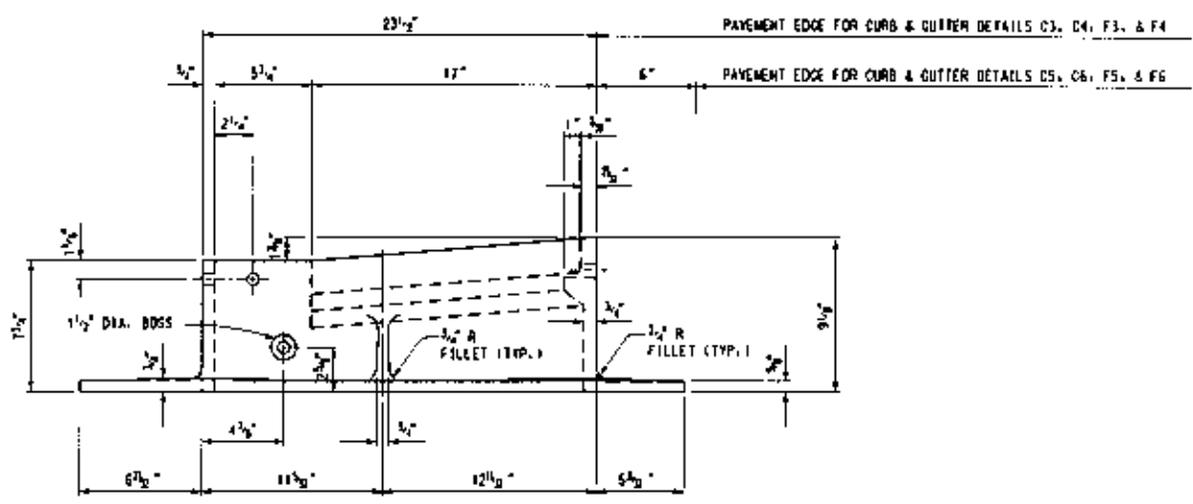
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PLAN VIEW OF FRAME

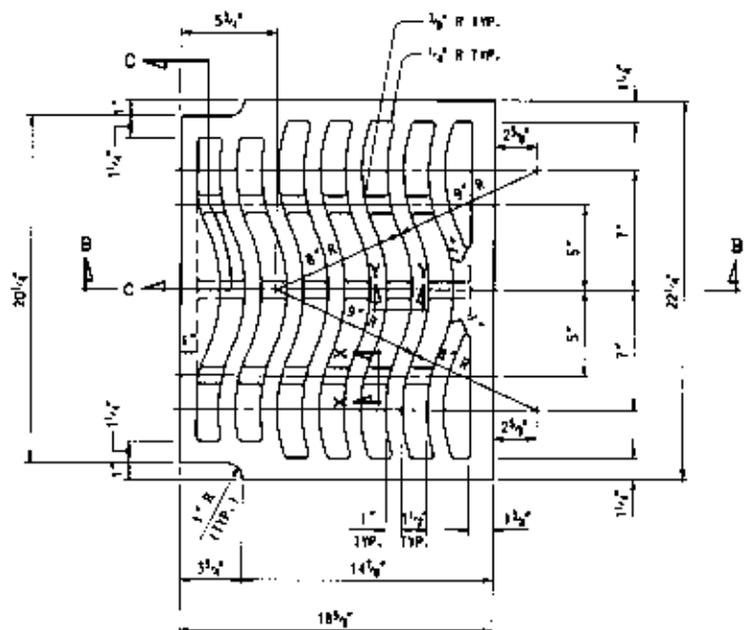
NOTE:
BOLT CURB BOX TO FRAME WITH THREE
1/2" x 2 1/2" GALVANIZED MACHINE BOLTS.
ADJUST FOR HEIGHT AFTER FORMS FOR
CURB ARE IN PLACE.



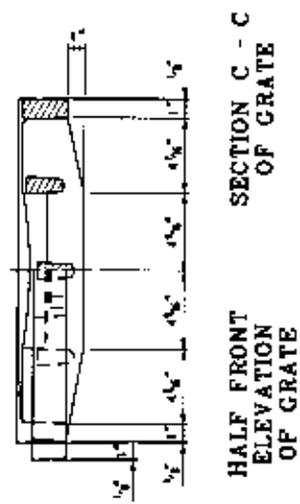
SIDE ELEVATION OF FRAME

	ENGINEER OF CONSTRUCTION & TECHNOLOGY _____	ENGINEER - ROAD DESIGN _____	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR	
	PREPARED BY DESIGN DIVISION DRAWN BY: <u>B.L.F.</u> CHECKED BY: <u>C.A.L.</u>	ENGINEER OF MAINTENANCE _____	ENGINEER OF DESIGN DEPARTMENT DIRECTOR Gregory J. Rasine	COVER K FOR USE WITH CONCRETE CURB & GUTTER DETAILS C3, C4, C5, C6, F3, F4, F5, & F6
	ENGINEER OF TRAFFIC AND SAFETY _____	By: CHIEF ENGINEER/DEPUTY DIRECTOR BUREAU OF HIGHWAY TECHNICAL SERVICES	9-14-2001 F.W.B.A. APPROVAL	2-26-2001 PLAN DATE
			R-15-C	SHEET 1 OF 3

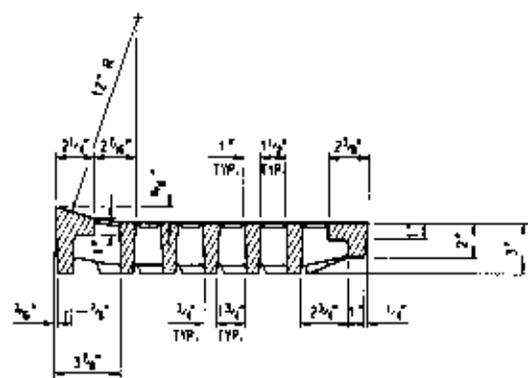
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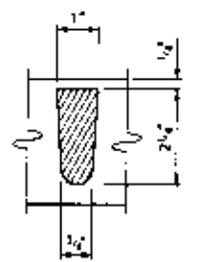
PLAN VIEW OF GRATE



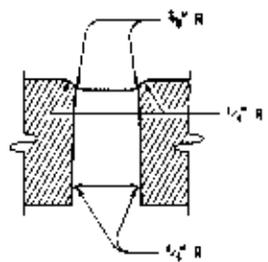
SECTION C - C
HALF FRONT ELEVATION OF GRATE



SECTION B - B



SECTION X - X



SECTION Y - Y

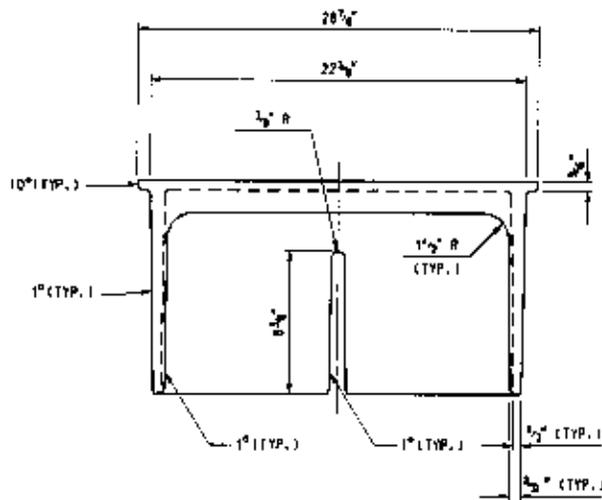
MICHIGAN DEPARTMENT OF TRANSPORTATION
 BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR

COVER K

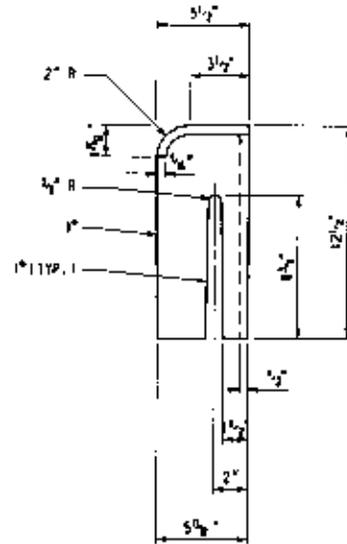
FOR USE WITH CONCRETE CURB & GUTTER
 DETAILS C3, C4, C5, C6, F3, F4, F5, & F6

9-14-2001 F.H.S.A. APPROVAL	2-26-2001 PLAN DATE	R-15-C	SHEET 2 OF 3
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FRONT VIEW OF CURB BOX



SIDE VIEW

NOTES:

THE CASTINGS SHALL MEET THE REQUIREMENTS OF THE CURRENT STANDARD SPECIFICATION FOR GRAY - IRON CASTINGS ASMTD M 105, AND SHALL HAVE A MINIMUM STRENGTH AS PROVIDED FOR CLASS NO. 30 GRAY - IRON CASTINGS.

ALL CASTINGS SHALL BE CLEANED BY CURRENT APPROVED BLASTING METHODS.

THE SEATING FACE OF THE GRATE AND THE SEAT FOR THE SAME ON THE FRAME SHALL BE GROUNDED OR MACHINED SO THAT THE GRATE WILL HAVE AN EVEN BEARING ON ITS SEAT TO PREVENT ROCKING OR FILTERING.

THE CASTINGS SHALL BE FREE OF POURING FALLS, BLOW HOLES, CRACKS AND OTHER IMPERFECTIONS. THEY SHALL BE SOUND, TRUE TO FORM AND THICKNESS, CLEAN AND NEATLY FINISHED, AND SHALL BE COATED WITH COAL TAR PITCH VARNISH.

THE CURB BOX AND FRAME SHALL BE SHIPPED ASSEMBLED.

THIS COVER IS DESIGNED TO FIT ON ANY INLET, CATCH BASIN OR ON ANY EXISTING SIMILAR STRUCTURE WHEN SO DESIGNATED ON THE PLANS.

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR

COVER K

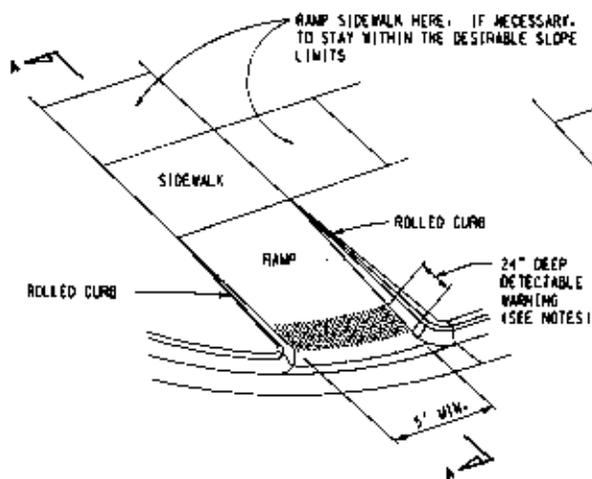
FOR USE WITH CONCRETE CURB & GUTTER
DETAILS C3, C4, C5, C6, F3, F4, F5, & F6

9-14-2001
F.H.R.S. APPROVAL

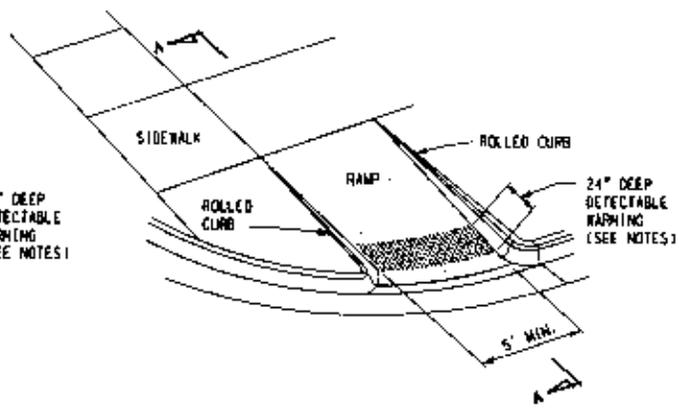
2-26-2001
PLAN DATE

R-15-C

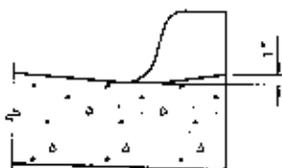
SHEET
3 OF 3



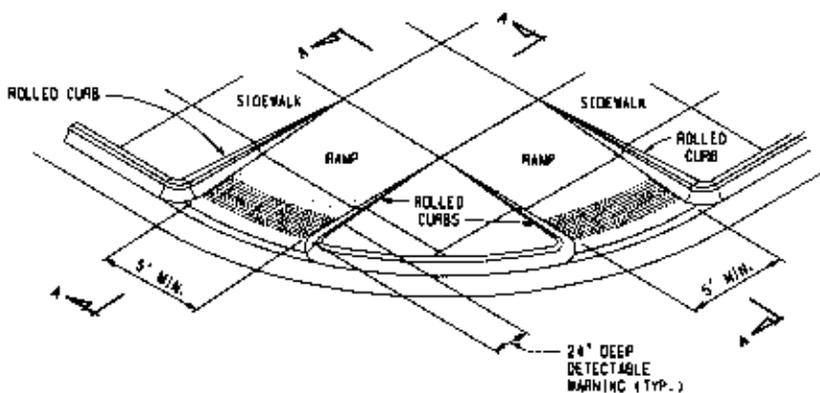
SIDEWALK RAMP TYPE 1



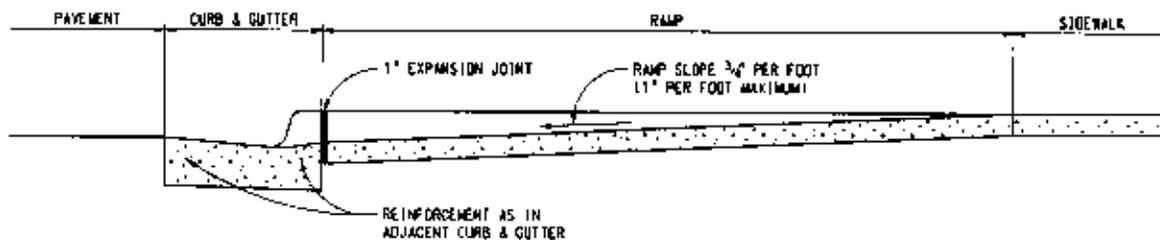
SIDEWALK RAMP TYPE 2



SECTION THROUGH CURB CUT
(TYPICAL ALL RAMP TYPES)



SIDEWALK RAMP TYPE 4
(TWO RAMPS ARE SHOWN)



SECTION A-A
(TYPICAL ALL RAMP DETAILS)

MDOT
Michigan Department of Transportation

ENGINEER OF CONSTRUCTION & TECHNOLOGY

ENGINEER - ROAD DESIGN

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR

PREPARED BY
DESIGN DIVISION

ENGINEER OF MAINTENANCE

ENGINEER OF DESIGN
DEPARTMENT DIRECTOR
Gregory J. Roalson

SIDEWALK RAMP DETAILS

DRAWN BY: B.L.T.

BY:
CHIEF ENGINEER/DEPUTY DIRECTOR
BUREAU OF HIGHWAY TECHNICAL SERVICES

F.R.V.A. APPROVAL

11-6-2002
PLAN DATE

R-28-D

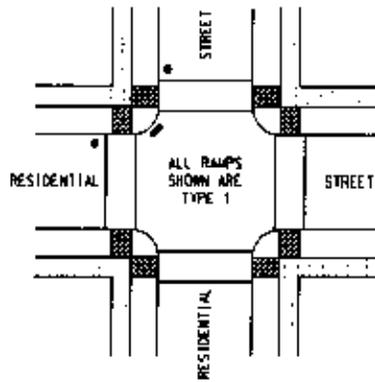
SHEET
1 OF 3

CHECKED BY: M.E.P.

ENGINEER OF TRAFFIC AND SAFETY

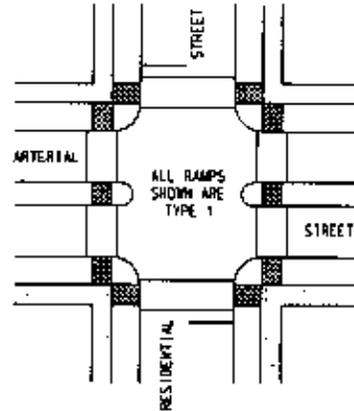
LEGEND

-  SIDEWALK
-  INDICATES PAY LIMITS OF SIDEWALK RAMPS TYPE 1, 2 AND 4
-  PREFERRED LOCATION OF DRAINAGE INLET (TYP.)
-  ALTERNATE LOCATION OF DRAINAGE INLET (TYP.)
-  CROSSWALK MARKING
-  STOP LINE MARKING



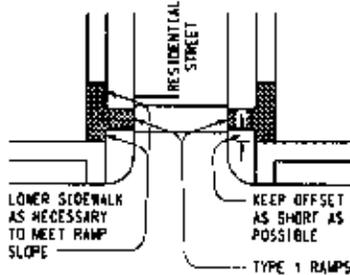
NORMAL TREATMENT IN RESIDENTIAL AREAS

A



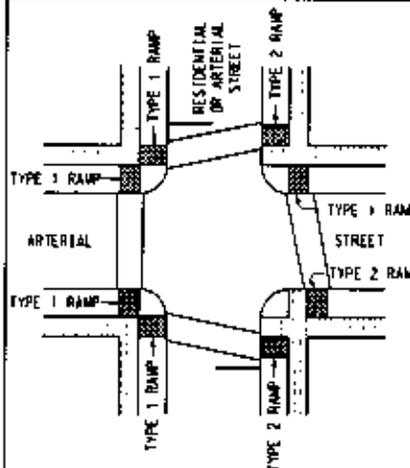
DIVIDED ARTERIAL STREET

B



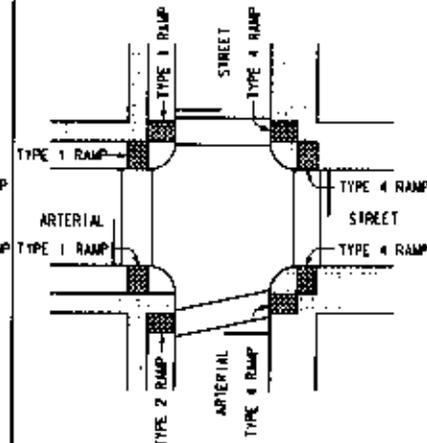
MAY BE USED ONLY WHERE TRAFFIC VOLUME IS LOW AND WHERE OTHER FEATURES MAKE DETAIL A IMPRACTICAL.

C



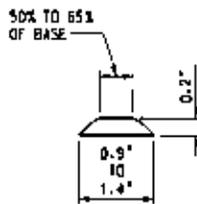
TYPICAL RAMP TREATMENTS SIGNALIZED INTERSECTIONS

D

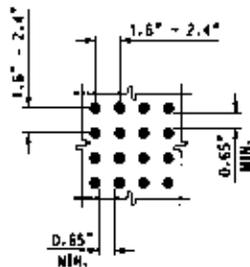


TYPICAL RAMP TREATMENTS TRAFFIC CONTROL ON BOTH STREETS

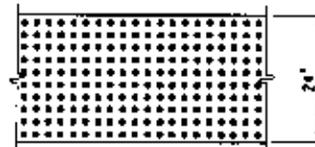
E



DOME SECTION



DOME SPACING



DOME ALIGNMENT

DETECTABLE WARNING DETAILS

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR

SIDEWALK RAMP DETAILS

F.H.W.S. APPROVAL	11-6-2002 PLAN DATE	R-28-D	SHEET 2 OF 3
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NOTES:

DETAILS SPECIFIED ON THIS PLAN APPLY TO ALL CONSTRUCTION OR RECONSTRUCTION OF STREETS, CURBS, OR SIDEWALKS BY ALL PUBLIC AGENCIES AND BY ALL PRIVATE ORGANIZATIONS CONSTRUCTING FACILITIES FOR PUBLIC USE.

SIDEWALK RAMPS ARE TO BE LOCATED AS SPECIFIED ON THE PLANS OR AS DIRECTED BY THE ENGINEER.

RAMPS SHALL BE PROVIDED AT ALL CORNERS OF AN INTERSECTION WHERE THERE IS EXISTING OR PROPOSED SIDEWALK AND CURB. RAMPS SHALL ALSO BE PROVIDED AT WALK LOCATIONS IN MID-BLOCK IN THE VICINITIES OF HOSPITALS, MEDICAL CENTERS, AND LARGE ATHLETIC FACILITIES.

SURFACE TEXTURE OF THE RAMP SHALL BE THAT OBTAINED BY A COARSE BROOMING, TRANSVERSE TO THE SLOPE OF RAMP.

SIDEWALK SHALL BE RAMPED WHERE THE DRIVEWAY CURB IS EXTENDED ACROSS THE WALK.

CARE SHALL BE TAKEN TO ASSURE A UNIFORM GRADE ON THE RAMP, FREE OF SAGS AND SHORT GRADE CHANGES. WHERE CONDITIONS PERMIT, IT IS DESIRABLE THAT THE SLOPE OF THE RAMP BE IN ONLY ONE DIRECTION, PARALLEL TO THE DIRECTION OF TRAVEL.

RAMP WIDTH SHALL BE INCREASED, IF NECESSARY, TO ACCOMMODATE SIDEWALK SNOW REMOVAL EQUIPMENT NORMALLY USED BY THE MUNICIPALITY.

IF POSSIBLE, DRAINAGE STRUCTURES SHOULD NOT BE PLACED IN LINE WITH RAMPS. EXCEPT WHERE EXISTING DRAINAGE STRUCTURES ARE BEING UTILIZED IN THE NEW CONSTRUCTION, LOCATION OF THE RAMP SHOULD TAKE PRECEDENCE OVER LOCATION OF DRAINAGE STRUCTURE.

THE NORMAL GUTTER LINE PROFILE SHALL BE MAINTAINED THROUGH THE AREA OF THE RAMP.

THE TOP OF THE JOINT FILLER FOR ALL RAMP TYPES SHALL BE FLUSH WITH THE ADJACENT CONCRETE.

CROSSWALK AND STOP LINE MARKINGS, IF USED, SHALL BE SO LOCATED AS TO STOP TRAFFIC SHORT OF RAMP CROSSINGS. SPECIFIC DETAILS FOR MARKING APPLICATIONS ARE GIVEN IN THE "MICHIGAN MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES".

DETECTABLE WARNINGS SHALL EXTEND THE FULL WIDTH OF THE CURB RAMP. THEY SHALL BE LOCATED SO THAT THE EDGE NEAREST THE CURB LINE IS 6" TO 8" FROM THE CURB LINE.

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR

SIDEWALK RAMP DETAILS

F.R.T.A. APPROVAL

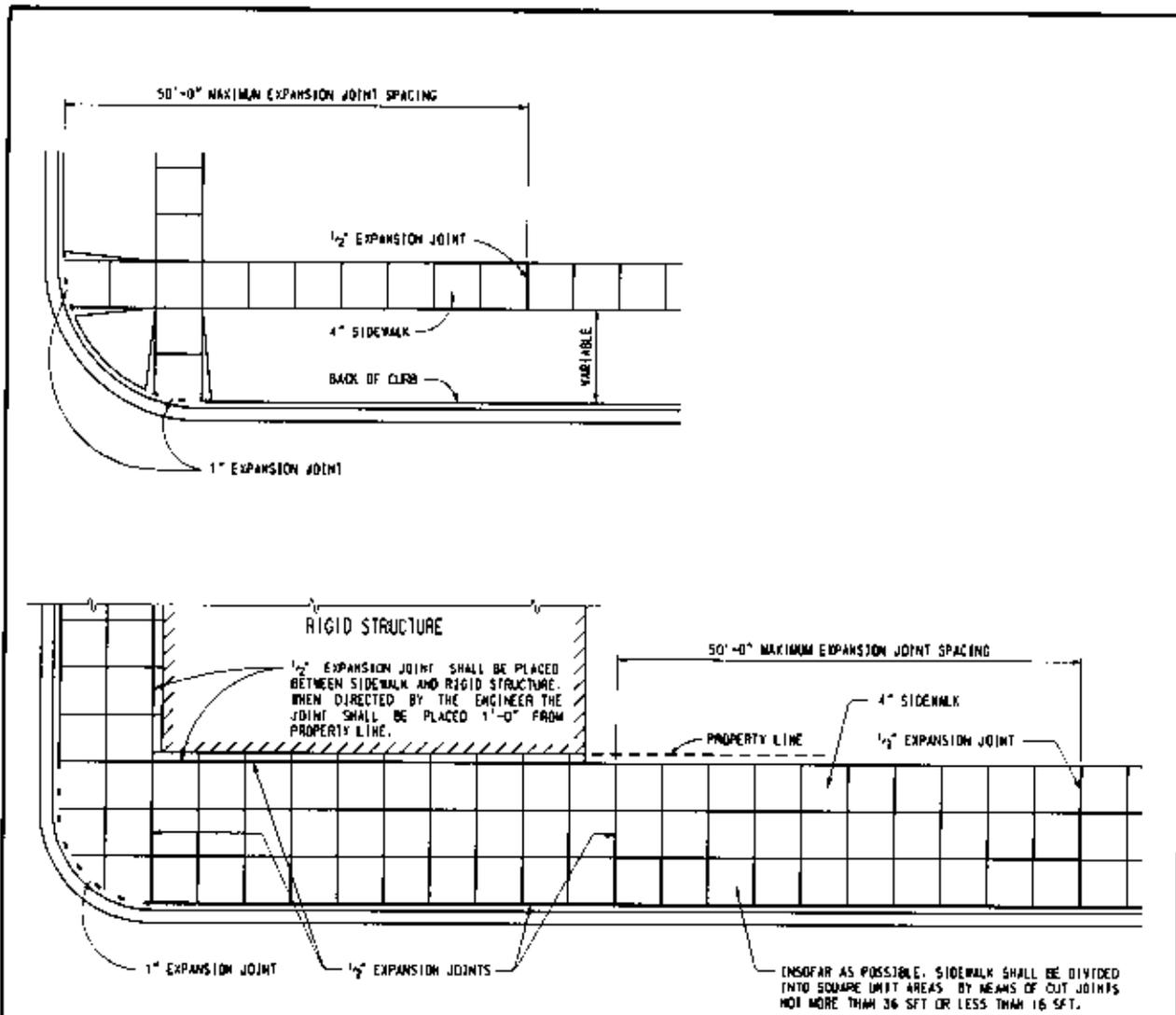
11-6-2002

PLAN DATE

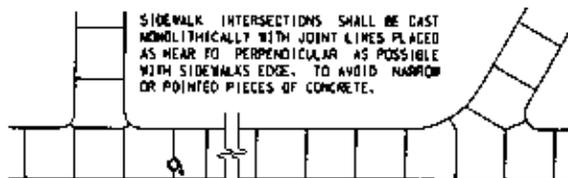
R-28-D

SHEET

3 OF 3

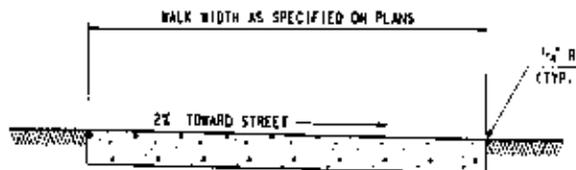


LOCATION OF JOINTS IN CONCRETE SIDEWALK



WHERE A PERMANENT STRUCTURE IS LOCATED IN SIDEWALK, PLACE EXPANSION MATERIAL AROUND STRUCTURE AND ADJUST JOINT PATTERN TO INTERSECT STRUCTURE AS ILLUSTRATED.

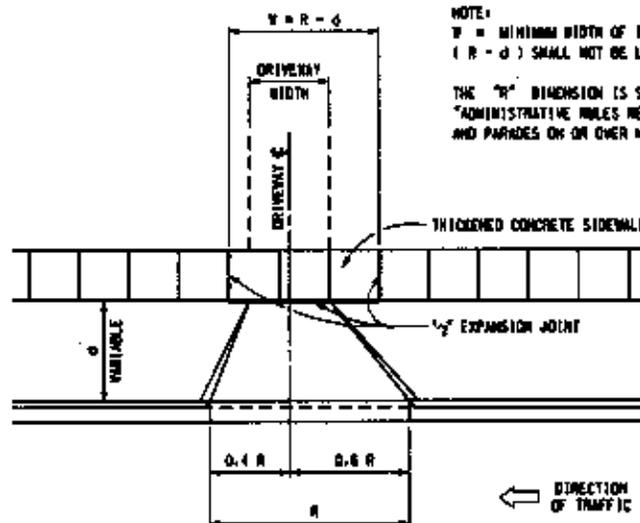
TYPICAL SIDEWALK JOINT LAYOUTS



4" CONCRETE SIDEWALK

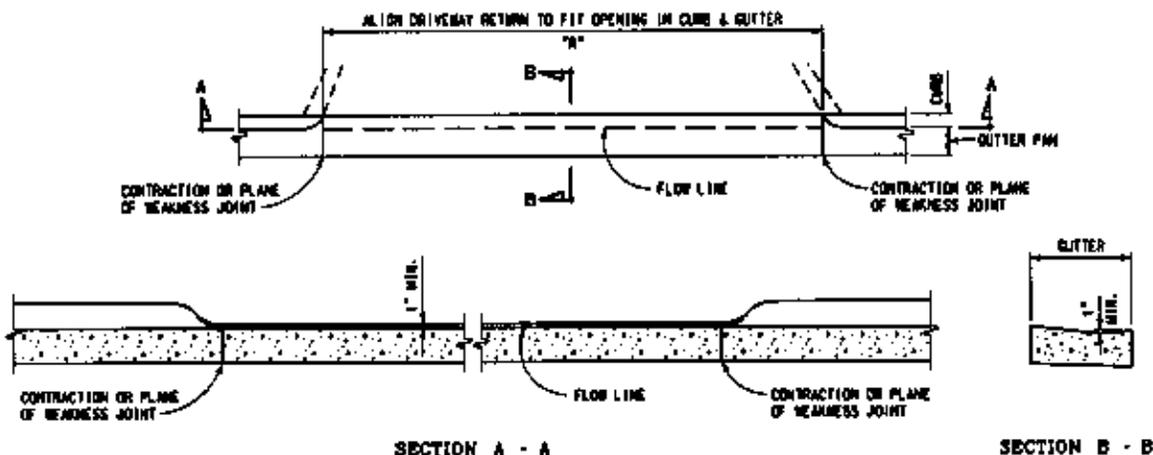
	ENGINEER OF CONSTRUCTION & TECHNOLOGY _____	ENGINEER - ROAD DESIGN _____	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR DRIVEWAY OPENINGS & APPROACHES, AND CONCRETE SIDEWALK		
	PREPARED BY DESIGN DIVISION _____	ENGINEER OF DESIGN DEPARTMENT DIRECTOR Gregory J. Rosine			
DRAWN BY: <u>B.L.T.</u>	ENGINEER OF MAINTENANCE _____	CHECKED BY: <u>W.K.P.</u>	ENGINEER OF TRAFFIC AND SAFETY _____	R-29-D	SHEET 6 OF 4

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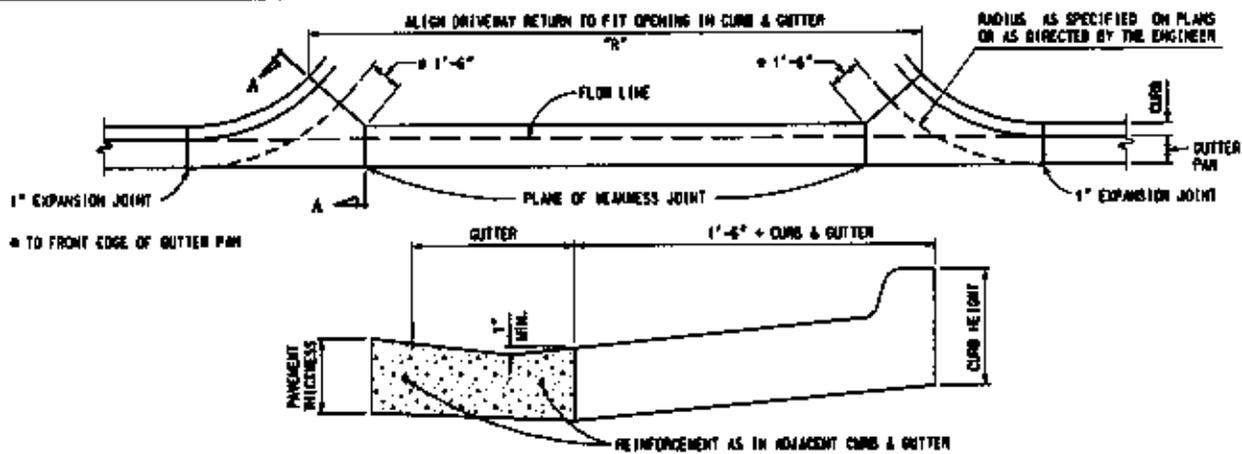


NOTE:
 W = MINIMUM WIDTH OF THICKENED CONCRETE SIDEWALK.
 $(R - d)$ SHALL NOT BE LESS THAN DRIVEWAY WIDTH.
 THE "R" DIMENSION IS SPECIFIED IN THE PUBLICATION
 "ADMINISTRATIVE RULES REGULATING DRIVEWAYS, BARRIERS
 AND PARADES ON OR OVER HIGHWAYS".

CONCRETE DRIVEWAY OPENING LAYOUT



CONCRETE DRIVEWAY OPENING, DETAIL L



CONCRETE DRIVEWAY OPENING, DETAIL M

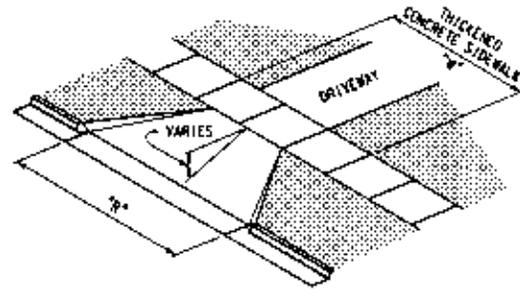
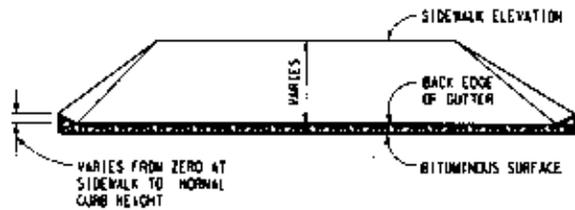
MICHIGAN DEPARTMENT OF TRANSPORTATION
 BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR
**DRIVEWAY OPENINGS
 & APPROACHES,
 AND CONCRETE SIDEWALK**

9-14-2001
 F.H.S.A. SYSTEM

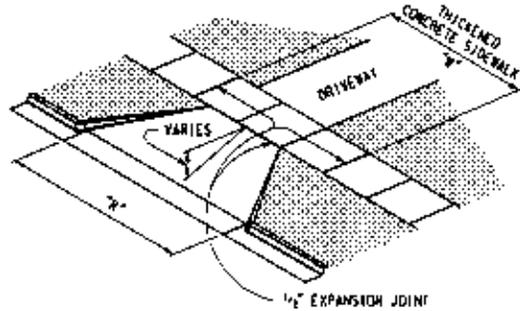
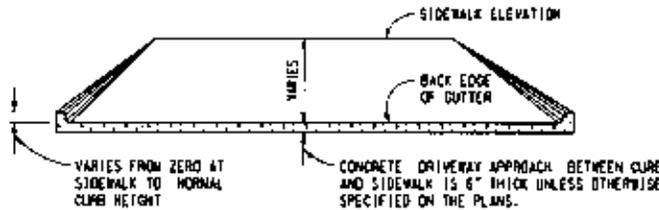
2-7-2001
 P.O. DATE

R-29-D

SHEET
 2 OF 4



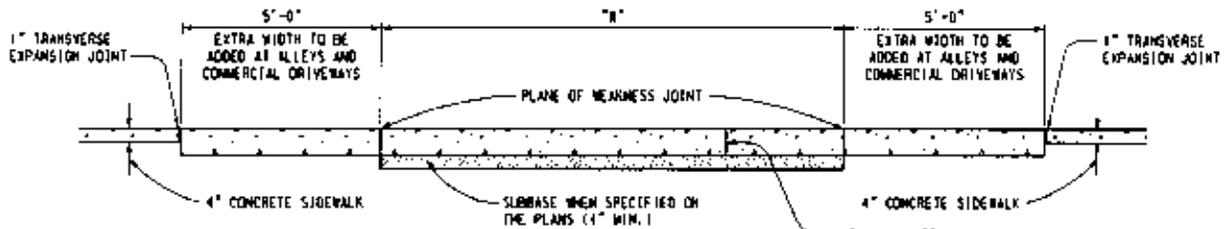
BITUMINOUS DRIVEWAY APPROACH
(TO BE USED WITH DETAIL L)



NOTES:

MONOLITHIC CURB IS INCLUDED IN THE CONCRETE DRIVEWAY APPROACH QUANTITY.
 REINFORCEMENT IS NOT REQUIRED UNLESS SPECIFIED ON THE PLANS. WHEN REINFORCEMENT IS SPECIFIED, SEE CHART ON THIS SHEET.
 WHEN AREA BETWEEN CURB & DUTTER AND SIDEWALK IS MORE THAN 300 SFT, PLACE A CONTRACTION JOINT IN LINE WITH CENTERLINE OF DRIVEWAY AND PERPENDICULAR TO ROADWAY.

CONCRETE DRIVEWAY APPROACH
(TO BE USED WITH DETAIL L OR W)



WHEN CONCRETE DRIVEWAY APPROACH IS SPECIFIED, THE THICKENED CONCRETE SIDEWALK THICKNESS IS EQUAL TO THE THICKNESS OF THE CONCRETE DRIVEWAY APPROACH. WHEN BITUMINOUS DRIVEWAY APPROACH IS SPECIFIED, THE THICKENED CONCRETE SIDEWALK THICKNESS IS 6\"/>

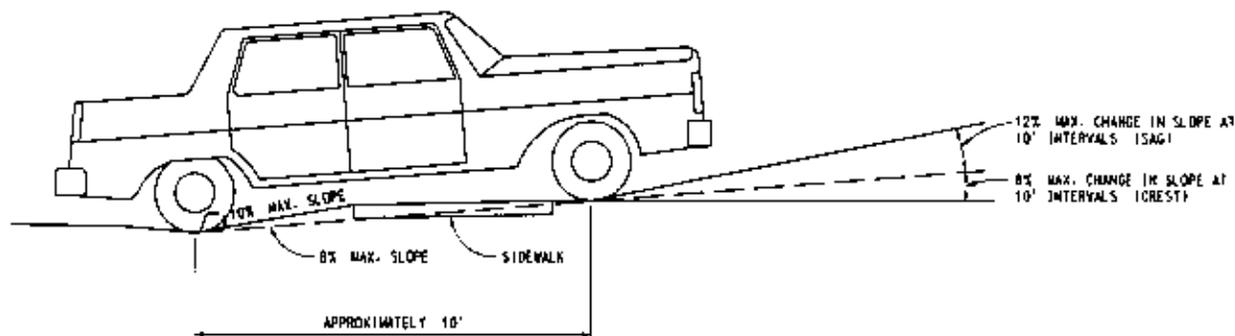
THICKENED CONCRETE SIDEWALK

REINFORCEMENT FOR CONCRETE DRIVEWAYS		
CONCRETE DRIVEWAY THICKNESS	WIRE SIZE (6" x 6" MESH)	AVERAGE WEIGHT (LBS/SFT)
LESS THAN 8"	#14	21
	#20	42
8" OR GREATER	USE WIRE FABRIC REINFORCEMENT SPECIFIED ON STANDARD PLAN R-45-SERIES	

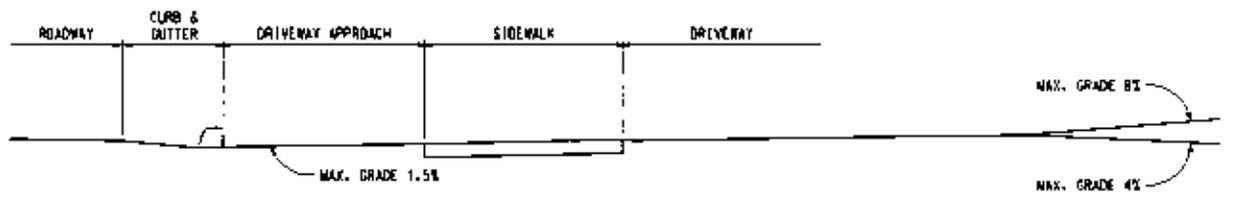
MICHIGAN DEPARTMENT OF TRANSPORTATION
 BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR
**DRIVEWAY OPENINGS
 & APPROACHES,
 AND CONCRETE SIDEWALK**

9-14-2001 F.H.W.A. APPROVAL	2-7-2001 PLAN DATE	R-29-D	SHEET 3 OF 4
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LOW VOLUME COMMERCIAL OR RESIDENTIAL DRIVEWAY SLOPES



COMMERCIAL DRIVEWAY PROFILE FOR MAJOR TRAFFIC GENERATORS

NOTES:

FOR DRIVEWAY DESIGN REFER ALSO TO "ADMINISTRATIVE RULES REGULATING DRIVEWAYS, BARRIERS, AND PARADES ON OR OVER HIGHWAYS" AND GEOMETRIC DESIGN G-600-SERIES, COMMERCIAL DRIVEWAYS.

FOR CURB AND GUTTER DETAILS, SEE STANDARD PLAN R-30-SERIES.

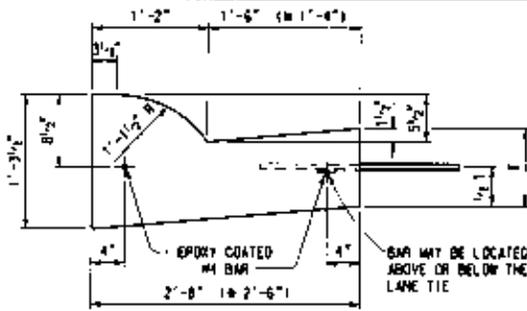
SIDEWALK TRANSVERSE SLOPE MAY VARY FROM 0% TO 4% TO MEET THE SITE CONDITIONS. WHEN TRANSVERSE SLOPE IS LESS THAN 2%, LONGITUDINAL DRAINAGE MUST BE PROVIDED.

WHEN SETTING GRADES FOR COMMERCIAL DRIVES, THE TYPES OF VEHICLES USING THE DRIVE SHOULD BE CONSIDERED.

MICHIGAN DEPARTMENT OF TRANSPORTATION
 BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR
**DRIVEWAY OPENINGS
 & APPROACHES,
 AND CONCRETE SIDEWALK**

9-14-2001 F.W.B. APPROVAL	7-7-2001 PLAN DATE	R-29-D	SHEET 4 OF 4
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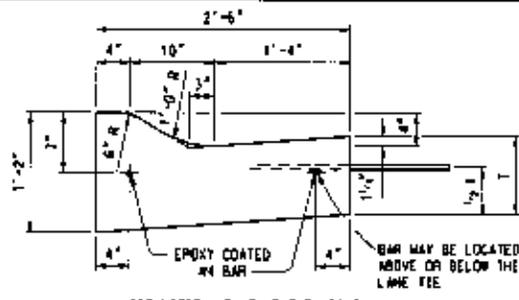
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↳ GUTTER PAN WIDTH MAY BE REDUCED WHEN APPROVED BY THE ENGINEER!

DETAIL	DIMENSION		LANE TIES	CONCRETE CYD / LFT	CONCRETE CYD / LFT
	T				
B1	9"	AS SHOWN	AS SHOWN	0.0900	(≠ 0.0855)
B2	9"	OMITTED	OMITTED	0.0900	(≠ 0.0855)
B3	10"	AS SHOWN	AS SHOWN	0.0941	(≠ 0.0894)

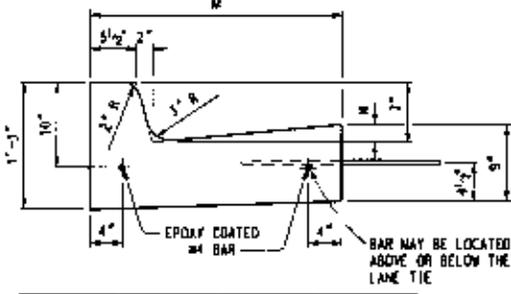
B



SEE NOTES WHEN PAVEMENT JOINT IS SEALED WITH MECPHENE

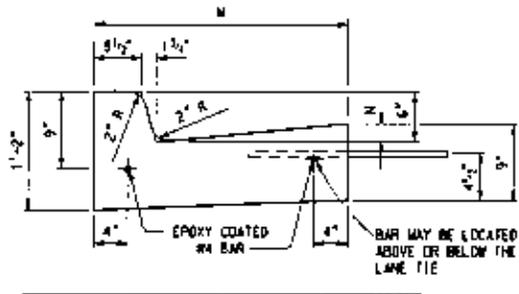
DETAIL	DIMENSION		LANE TIES	CONCRETE CYD / LFT
	T			
D1	9"	AS SHOWN	AS SHOWN	0.0788
D2	9"	OMITTED	OMITTED	0.0788
D3	10"	AS SHOWN	AS SHOWN	0.0826

D



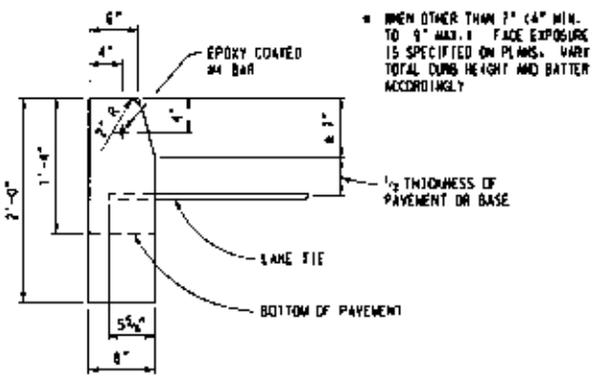
DETAIL	DIMENSION		LANE TIES	CONCRETE CYD / LFT
	M	N		
C1	1'-6"	1 1/2"	AS SHOWN	0.0506
C2	1'-6"	1 1/2"	OMITTED	0.0506
C3	2'-0"	1 1/2"	AS SHOWN	0.0632
C4	2'-0"	1 1/2"	OMITTED	0.0632
C5	2'-6"	1 1/2"	AS SHOWN	0.0757
C6	2'-6"	1 1/2"	OMITTED	0.0757

C



DETAIL	DIMENSION		LANE TIES	CONCRETE CYD / LFT
	M	N		
F1	1'-6"	1 1/2"	AS SHOWN	0.0484
F2	1'-6"	1 1/2"	OMITTED	0.0484
F3	2'-0"	1 1/2"	AS SHOWN	0.0610
F4	2'-0"	1 1/2"	OMITTED	0.0610
F5	2'-6"	1 1/2"	AS SHOWN	0.0737
F6	2'-6"	1 1/2"	OMITTED	0.0737

F

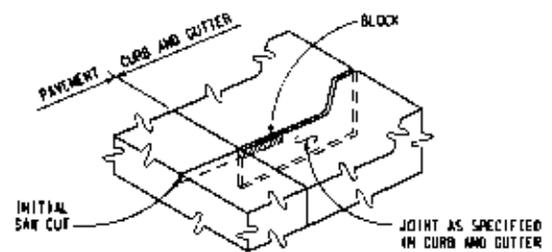


• WHEN OTHER THAN 7" (4" MIN. TO 9" MAX.) FACE EXPOSURE IS SPECIFIED ON PLANS, VARY TOTAL CURB HEIGHT AND BATTER ACCORDINGLY.

DETAIL	CURB HEIGHT	LANE TIES	CONCRETE CYD / LFT
E1	1'-4"	AS SHOWN	0.0310
E2	1'-4"	OMITTED	0.0310
E4	2'-0"	OMITTED	0.0477

E

NOTE:
PLACE BLOCK IN FRONT EDGE OF GUTTER PAN. BLOCK WIDTH AND DEPTH SHALL BE THE SAME WIDTH AND DEPTH AS PROPOSED JOINT IN PAVEMENT. THE LENGTH OF BLOCK SHALL BE SUCH THAT THE FULL DEPTH OF THE JOINT IN CONCRETE PAVEMENT CAN BE OBTAINED. BLOCKED OUT AREA SHALL BE SEALED WITH THE SAME SEALER AS USED IN CONCRETE PAVEMENT.



PROVISION FOR SAW CUT
↳ TO BE MADE WHEN FINAL SAW CUT IN PAVEMENT IS MADE AFTER CURB AND GUTTER IS PLACED

MDOT
Michigan Department of Transportation

ENGINEER OF CONSTRUCTION & TECHNOLOGY

ENGINEER - ROAD DESIGN

ENGINEER OF DESIGN
DEPARTMENT DIRECTOR
Gregory J. Roane

PREPARED BY
DESIGN DIVISION

ENGINEER OF MAINTENANCE

BY:
CHIEF ENGINEER/DEPUTY DIRECTOR
BUREAU OF HIGHWAY TECHNICAL SERVICES

DRAWN BY: B.L.T.

CHECKED BY: R.K.P.

ENGINEER OF TRAFFIC AND SAFETY

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR

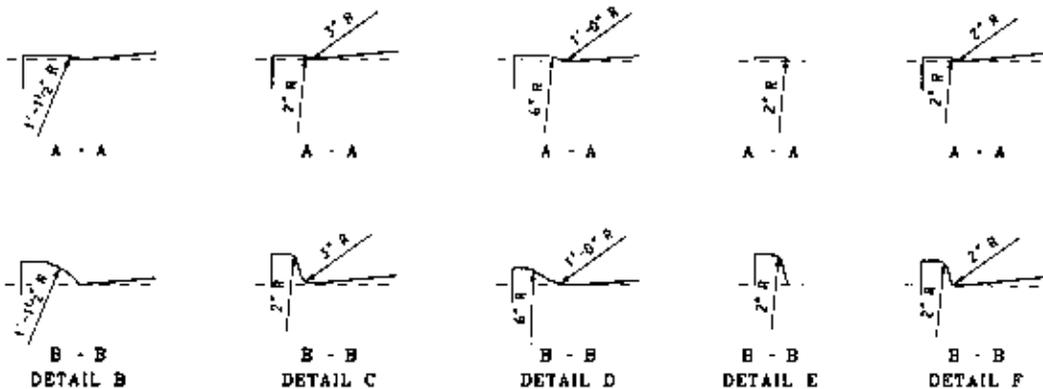
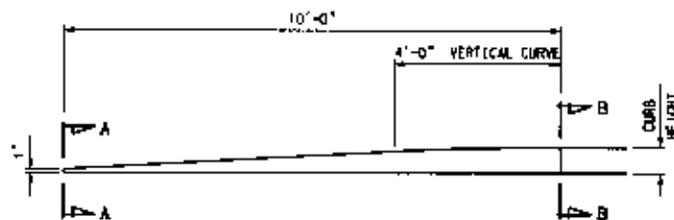
**CONCRETE CURB AND
CONCRETE CURB & GUTTER**

9-14-2001 2-22-2001
F.H.S.A. APPROVAL PLAN DATE

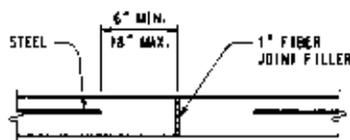
R-30-D

SHEET
1 OF 2

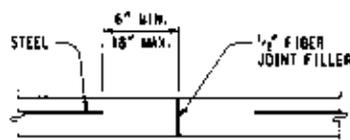
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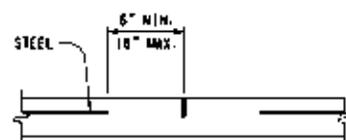
CONCRETE CURB, CURB AND GUTTER ENDINGS



1" FIBER JOINT FILLER



1/2" FIBER JOINT FILLER



CONTRACTION JOINT

NOTES:

CURB AND GUTTER RADIUS SHALL BE DIMENSIONED TO THE FRONT EDGE OF THE GUTTER PAN OR EDGE OF PAVEMENT.

CONCRETE CURB AND GUTTER ENDINGS WILL BE PAID FOR IN LINEAR FEET OF THE ADJACENT CURB DETAIL.

PAVEMENT REINFORCEMENT MAY BE SUBSTITUTED FOR THE EPOXY COATED #4 BARS SPECIFIED (TEMPERATURE STEEL), PROVIDED A MINIMUM OF 0.33 IN.² OF LONGITUDINAL STEEL AREA IS FURNISHED.

JOINTS SHALL BE PLACED AT RIGHT ANGLES TO THE EDGE OF CONCRETE CURB AND GUTTER.

JOINTS DETAILED ON THE PLANS SHALL SUPERSEDE THOSE SPECIFIED ON THIS STANDARD PLAN.

BOTTOM SLOPE OF CURB AND GUTTER STRUCTURE MAY BE THE SAME SLOPE AS BOTTOM OF PAVEMENT. BACK OF CURB AND VERTICAL EDGE OF GUTTER PAN MAY HAVE A MAXIMUM 1/2" BATTER TO FACILITATE FORMING.

WHEN CURB AND GUTTER IS CAST INTEGRALLY, SEE CURRENT STANDARD PLAN R-31-SERIES.

OMIT LONGITUDINAL REINFORCEMENT WHEN CURB AND GUTTER IS TIED TO A NON-REINFORCED CONCRETE BASE COURSE OR PAVEMENT.

JOINTS IN CURB OR CURB AND GUTTER NOT TIED TO CONCRETE PAVEMENT; ADJACENT TO CONCRETE BASE COURSE; OR ADJACENT TO BITUMINOUS PAVEMENT:

- A. PLACE 1" FIBER JOINT FILLER AT 400' MAXIMUM INTERVALS.
- B. PLACE 1" FIBER JOINT FILLER AT SPRING POINTS OF INTERSECTING STREETS.
- C. PLACE 1" FIBER JOINT FILLER IN ADJACENT CONTRACTION JOINTS EACH SIDE OF CATCH BASINS.
- D. PLACE CONTRACTION JOINTS AT 40' MAXIMUM INTERVALS.

JOINTS IN CURB OR CURB AND GUTTER TIED TO JOINTED PAVEMENT

- A. PLACE 1" FIBER JOINT FILLER OPPOSITE ALL TRANSVERSE EXPANSION JOINTS IN PAVEMENT.
- B. PLACE 1/2" FIBER JOINT FILLER IN ADJACENT CONTRACTION JOINTS EACH SIDE OF CATCH BASINS.
- C. PLACE CONTRACTION JOINTS OPPOSITE ALL TRANSVERSE CONTRACTION JOINTS IN PAVEMENT. WHEN THE PAVEMENT IS PLACED BETWEEN JUNE 1ST AND SEPTEMBER 15TH, AND THE CURB AND GUTTER IS PLACED AFTER OCTOBER 1ST, 1" FIBER JOINT FILLER SHALL BE PLACED IN ALL CURB OR CURB AND GUTTER CONTRACTION JOINTS.
- D. A SYMBOL (B) JOINT SHALL BE PLACED BETWEEN CURB OR CURB AND GUTTER AND ADJACENT CONCRETE PAVEMENT AS SPECIFIED ON STANDARD PLAN R-41-SERIES.
- E. WHEN CURB AND GUTTER DETAIL D ADJOINS PAVEMENT SEALED WITH NEOPRENE, THE NEOPRENE JOINT SEALER SHALL BE CONTINUED IN ONE PIECE ACROSS THE CONTRACTION OR 1/2" FIBER JOINT AND TURNED DOWN OUTSIDE EDGE OF CURB.

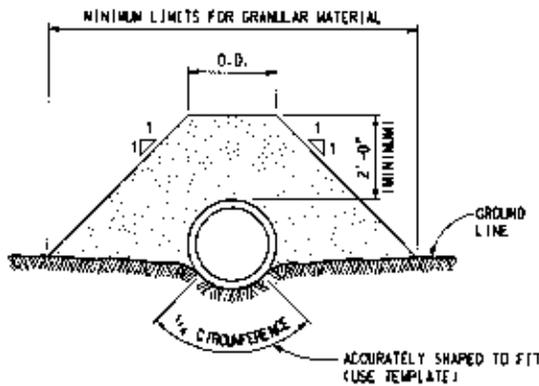
MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR

CONCRETE CURB AND CONCRETE CURB & GUTTER

9-14-2001	2-22-2001	R-30-D	SHEET 2 OF 2
F.H.S.A. APPROVAL	PLAN DATE		

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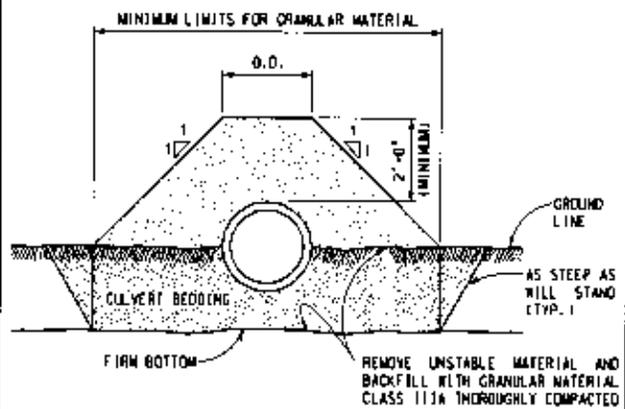
EMBANKMENT BETWEEN GROUND LINE AND 2'-0" MINIMUM ABOVE TOP OF PIPE CULVERT SHALL CONSIST OF GRANULAR MATERIAL CLASS 111A COMPACTED TO 95% OF ITS MAXIMUM UNIT WEIGHT. THE MATERIAL SHALL BE DEPOSITED AND COMPACTED IN LAYERS NOT MORE THAN 10" IN THICKNESS.



NOTE:
TRENCH MAY BE UNDERCUT BELOW CULVERT AND THE UNDERCUT MATERIAL REPLACED WITH GRANULAR MATERIAL.

CROSS-SECTION SHOWING CULVERT INSTALLATION IN STABLE SOIL

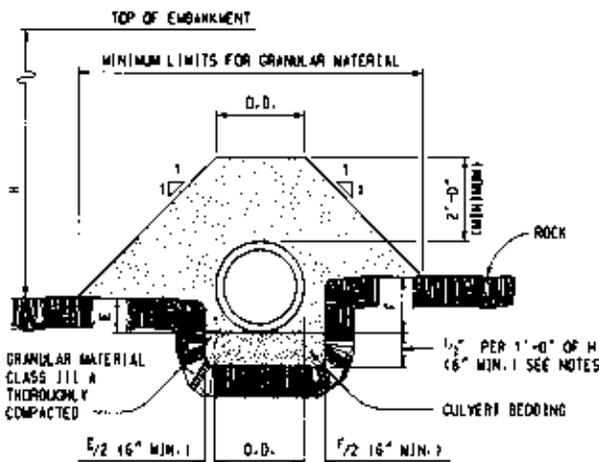
EMBANKMENT BETWEEN GROUND LINE AND 2'-0" MINIMUM ABOVE TOP OF PIPE CULVERT SHALL CONSIST OF GRANULAR MATERIAL CLASS 111A COMPACTED TO 95% OF ITS MAXIMUM UNIT WEIGHT. THE MATERIAL SHALL BE DEPOSITED AND COMPACTED IN LAYERS NOT MORE THAN 10" IN THICKNESS.



NOTE:
PLACE AND COMPACT CULVERT BEDDING TO THE LEVEL OF 1/4 THE DIAMETER OF THE PIPE CULVERT AND THEN EXCAVATE AND SHAPE A TRENCH TO FIT THE PIPE. AFTER PLACING CULVERT, CONTINUE FILLING WITH CULVERT BEDDING TO GROUND LINE.

CROSS-SECTION SHOWING CULVERT INSTALLATION IN UNSTABLE SOIL

EMBANKMENT BETWEEN GROUND LINE AND 2'-0" MINIMUM ABOVE TOP OF PIPE CULVERT SHALL CONSIST OF GRANULAR MATERIAL CLASS 111A COMPACTED TO 95% OF ITS MAXIMUM UNIT WEIGHT. THE MATERIAL SHALL BE DEPOSITED AND COMPACTED IN LAYERS NOT MORE THAN 10" IN THICKNESS.



NOTE:
PLACE AND COMPACT GRANULAR MATERIAL CLASS 111A TO THE LEVEL OF 1/4 THE DIAMETER OF THE PIPE CULVERT AND THEN EXCAVATE AND SHAPE A TRENCH TO FIT THE PIPE.

CROSS-SECTION SHOWING CULVERT INSTALLATION IN ROCK

NOTES:

CORRUGATED STEEL PIPE, CORRUGATED POLYETHYLENE, AND ALUMINUM ALLOY PIPE SHALL HAVE A MINIMUM OF 12" OF GRANULAR MATERIAL CLASS 111A PLACED COMPLETELY AROUND THE PIPE FOR ITS FULL LENGTH EXCEPT FOR BEDDING.

THE ENGINEER SHALL DESIGNATE THE REQUIRED DETAIL BASED ON SOIL CONDITIONS ENCOUNTERED.

UNSTABLE SOIL IS SOIL TOO SOFT OR SPONGY TO PROVIDE A FIRM BED FOR THE PIPE CULVERT.

NO REDUCTION SHALL BE MADE IN THE REGULAR EMBANKMENT QUANTITY FOR THE SPACE OCCUPIED BY THE CULVERT.

PIPE CULVERTS IN CUT SECTIONS SHALL BE PLACED ACCORDING TO THE DETAILS SPECIFIED ON STANDARD PLAN R-83-SERIES.

WHEN AN END SECTION IS USED IN LIEU OF A HEADWALL, A STABLE FUNDATION SHALL BE PROVIDED FOR THE END SECTION COMPARABLE TO THAT PROVIDED BY THE CULVERT.

WHEN BELL AND SPIGOT PIPE IS USED IN A ROCK TRENCH, A MINIMUM OF 4" OF CULVERT BEDDING WILL BE REQUIRED UNDER THE BELL.

MDOT

ENGINEER OF CONSTRUCTION & TECHNOLOGY

ENGINEER - ROAD DESIGN

PREPARED BY
DESIGN DIVISION

ENGINEER OF MAINTENANCE

ENGINEER OF DESIGN
DEPARTMENT DIRECTOR
Gregory J. Roebke

DRAWN BY: B.L.T.

BY:

CHIEF ENGINEER/DEPUTY DIRECTOR
BUREAU OF HIGHWAY TECHNICAL SERVICES

CHECKED BY: J.E.P.

ENGINEER OF TRAFFIC AND SAFETY

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR

**BEDDING AND FILLING
AROUND PIPE CULVERTS**

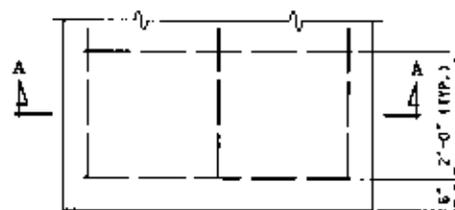
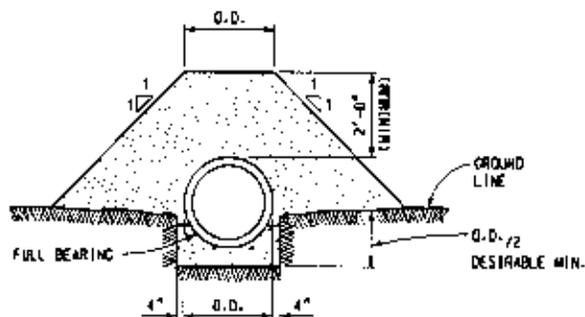
F.H.W.A. APPROVAL

6-25-2002
PLAN DATE

R-82-D

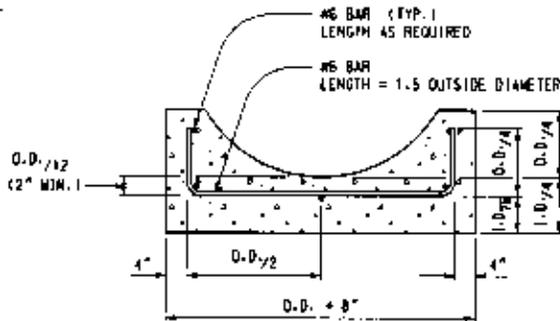
SHEET
1 OF 2

EMBANKMENT BETWEEN GROUND LINE AND 2'-0" MINIMUM ABOVE TOP OF PIPE CULVERT SHALL CONSIST OF GRANULAR MATERIAL CLASS 111A COMPACTED TO 95% OF ITS MAXIMUM UNIT WEIGHT. THE MATERIAL SHALL BE DEPOSITED AND COMPACTED IN LAYERS NOT MORE THAN 10" IN THICKNESS.



PLAN

TABLE OF QUANTITIES BASED ON THE OUTSIDE DIAMETER (O.D.) OF PIPE			
INSIDE DIAMETER OF PIPE	OUTSIDE DIAMETER OF PIPE	CYD CONCRETE PER LFT	LBS STEEL PER LFT
18"	1.916"	0.061	9.7
24"	2.500"	0.096	10.3
30"	3.083"	0.140	11.0
36"	3.667"	0.191	11.6
42"	4.250"	0.250	12.3



SECTION A - A

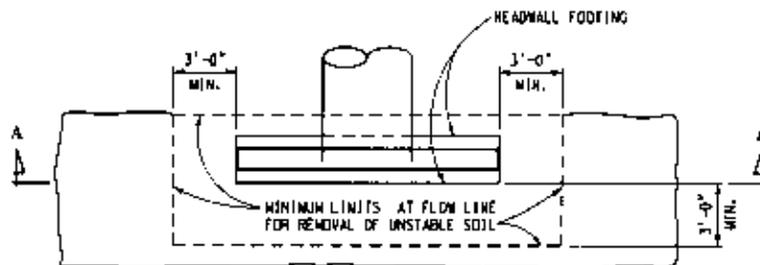
ALL CONCRETE SHALL BE GRADE N.

ALL EXCAVATION AND FORMS NECESSARY TO CONSTRUCT THE CONCRETE CRADLE SHALL BE INCLUDED IN THE UNIT PRICE PER CYD FOR CONCRETE.

THE CONCRETE CRADLE SHALL BE CONTINUOUS THROUGH THE ENTIRE LENGTH OF THE PIPE CULVERT.

LAP LONGITUDINAL BARS 2'-0" MINIMUM AT ALL SPLICES.

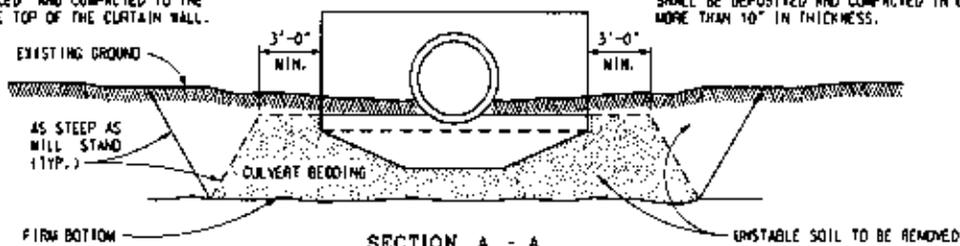
CULVERT INSTALLATION WITH CONCRETE CRADLE



PLAN

NOTE:
THE TRENCH FOR THE CURTAIN WALL SHALL BE EXCAVATED AFTER THE GRANULAR MATERIAL CLASS 111A IS PLACED AND COMPACTED TO THE ELEVATION OF THE TOP OF THE CURTAIN WALL.

BACKFILL SHALL CONSIST OF GRANULAR MATERIAL CLASS 111A THOROUGHLY COMPACTED. THE MATERIAL SHALL BE DEPOSITED AND COMPACTED IN LAYERS NOT MORE THAN 10" IN THICKNESS.



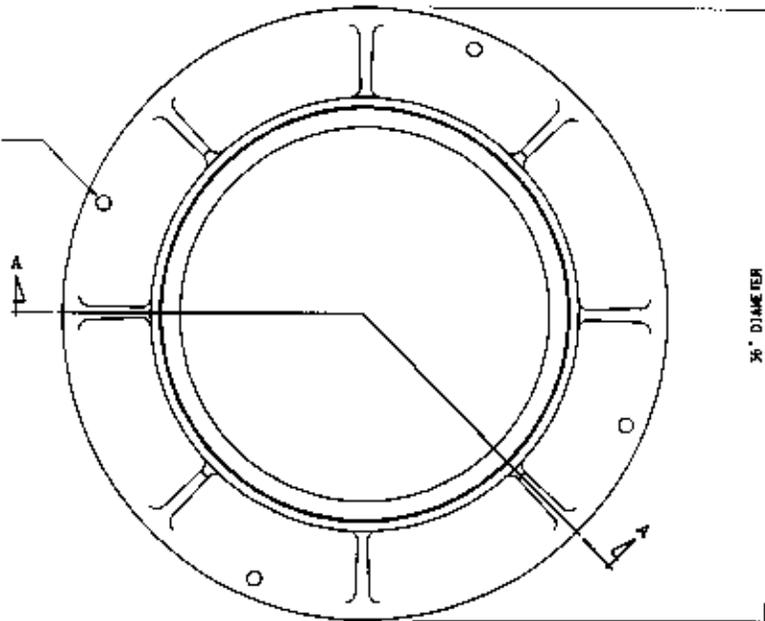
SECTION A - A

CULVERT HEADWALL INSTALLATION IN UNSTABLE SOIL

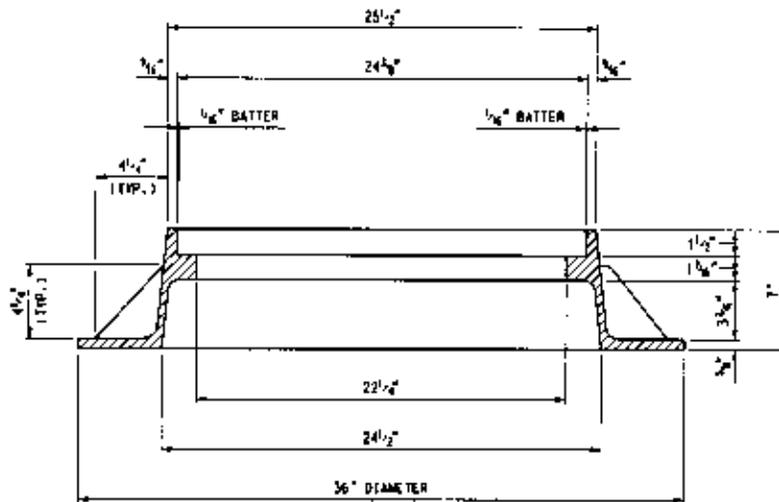
MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR

**BEDDING AND FILLING
AROUND PIPE CULVERTS**

FOUR 1/2" DIAMETER HOLES ON
33 1/2" DIAMETER BOLT CIRCLE



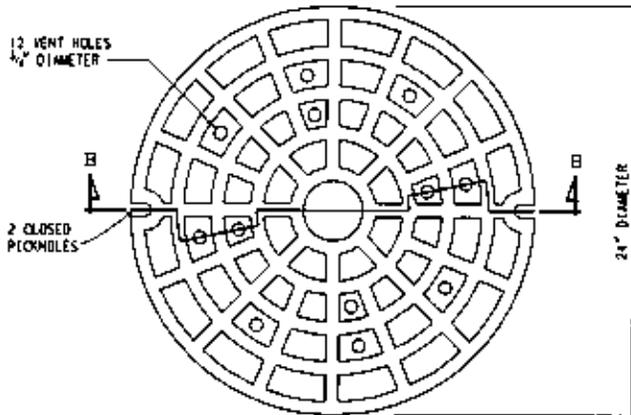
TOP VIEW OF FRAME



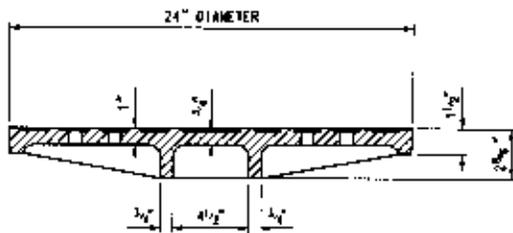
SECTION A - A

	ENGINEER OF CONSTRUCTION & TECHNOLOGY _____	ENGINEER - ROAD DESIGN _____	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR		
	PREPARED BY DESIGN DIVISION _____	ENGINEER OF DESIGN DEPARTMENT DIRECTOR Gregory L. Rasinski	COVER B FOR USE ON MANHOLES		
DRAWN BY: B.L.T.	BY: CHIEF ENGINEER/DEPUTY DIRECTOR BUREAU OF HIGHWAY TECHNICAL SERVICES	9-14-2001 F.H.S.A. APPROVAL			
CHECKED BY: M.K.P.	ENGINEER OF TRAFFIC AND SAFETY _____	R-7-C			

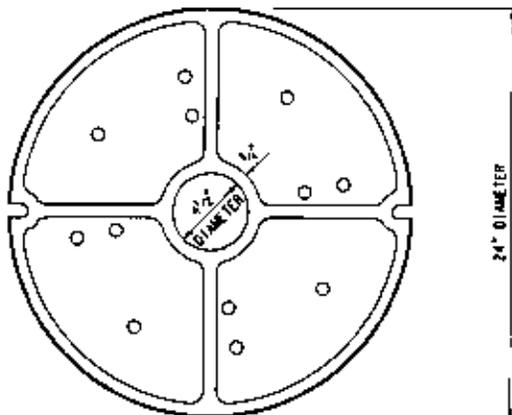
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TOP VIEW OF LID



SECTION B · B



BOTTOM VIEW OF LID

NOTES:

THE CASTINGS SHALL MEET THE REQUIREMENTS OF THE CURRENT STANDARD SPECIFICATION FOR GRAY - IRON CASTINGS AASHTO M 105, AND SHALL HAVE A MINIMUM STRENGTH AS PROVIDED FOR CLASS NO. 35 GRAY - IRON CASTINGS.

ALL CASTINGS SHALL BE CLEANED BY CURRENT APPROVED BLASTING METHODS.

THE SEATING FACE OF THE LID AND THE SEAT FOR THE SAME ON THE FRAME SHALL BE GROUND OR MACHINED SO THAT THE LID WILL HAVE AN EVEN BEARING ON ITS SEAT TO PREVENT ROCKING OR TILTING.

THE CASTINGS SHALL BE FREE OF POURING FAULTS, BLOW HOLES, CRACKS AND OTHER IMPERFECTIONS. THEY SHALL BE SOUND, TRUE TO FORM AND THICKNESS, CLEAN AND NEATLY FINISHED, AND SHALL BE COATED WITH COAL TAR PITCH VARNISH.

THIS COVER IS DESIGNED TO FIT IN ANY MANHOLE OR ON ANY EXISTING SENIAR STRUCTURE WHEN SO DESIGNATED ON THE PLANS.

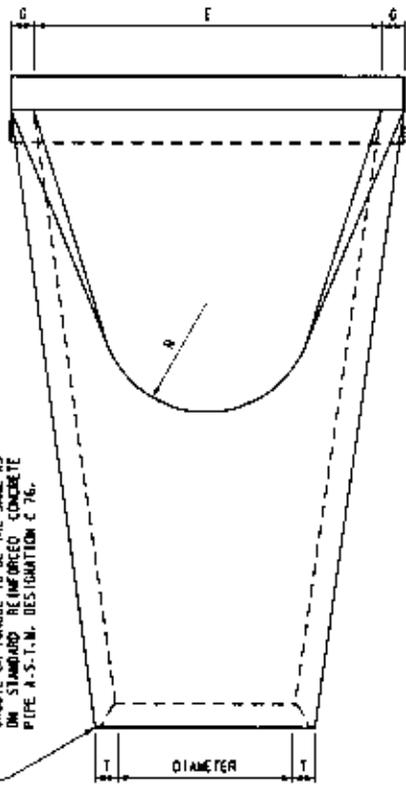
MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR

COVER B
FOR USE ON MANHOLES

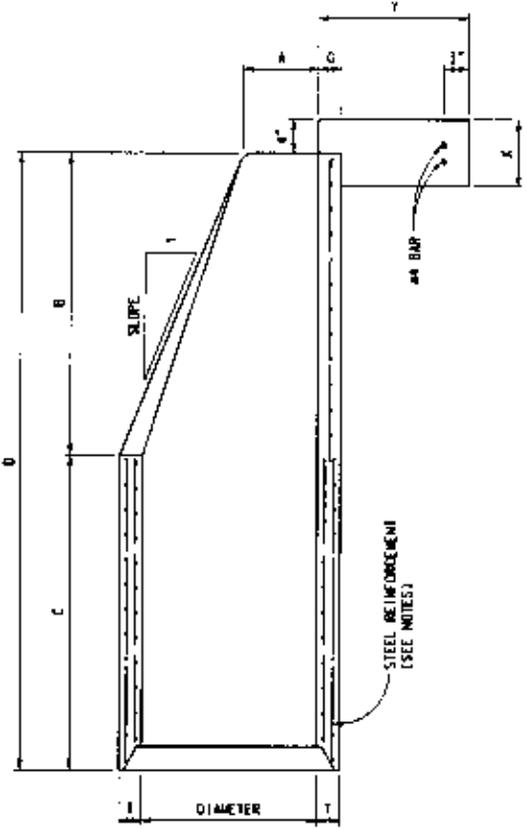
9-14-2001 F.H.B.A. APPROVAL	2-26-2001 PLAN DATE	R-7-C	SHEET 2 OF 2
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NOTE: THIS PLAN IS NOT A LEGAL ENGINEERING DOCUMENT BUT AN ELECTRONIC DUPLICATE. THE ORIGINAL SIGNED COPY APPROVED FOR PUBLICATION, IS KEPT ON FILE AT THE MICHIGAN DEPARTMENT OF TRANSPORTATION.

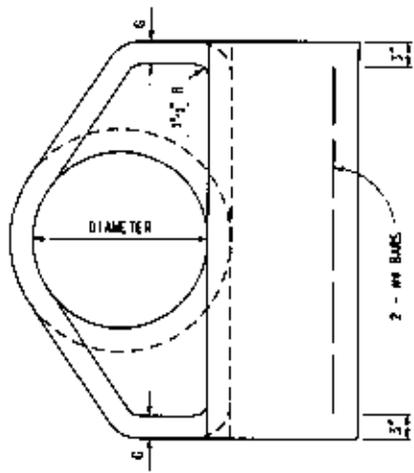
GROUPED END OR OUTLET END SECTION
 TONGUE END OR INLET END SECTION
 GROOVE OR TONGUE TO BE THE SAME AS
 IN STANDARD REINFORCED CONCRETE
 PIPE A.S.T.M. DESIGNATION C 76.



PLAN VIEW



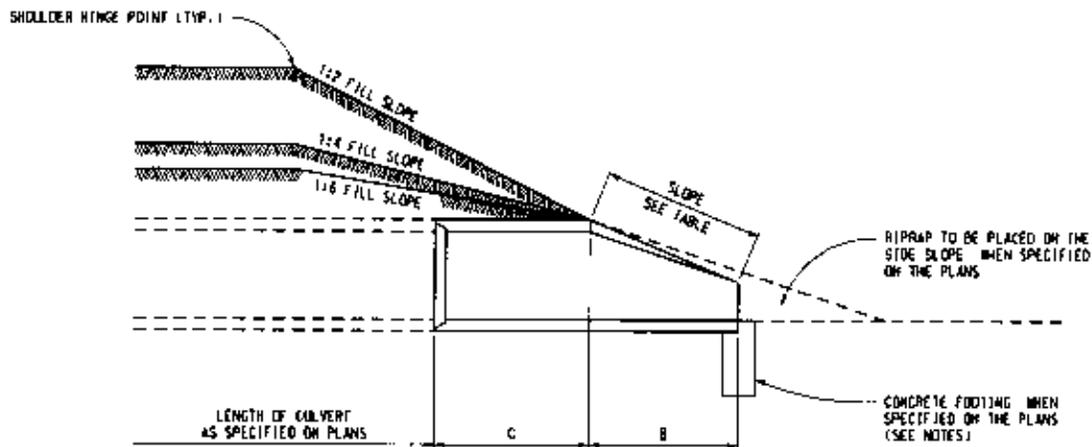
LONGITUDINAL SECTION



END ELEVATION

	ENGINEER OF CONSTRUCTION & TECHNOLOGY _____	ENGINEER - ROAD DESIGN _____	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR PRECAST CONCRETE END SECTION FOR PIPE CULVERT		
	PREPARED BY DESIGN DIVISION _____	ENGINEER OF DESIGN DEPARTMENT DIRECTOR Gregory J. Roane			
DRAWN BY: B.L.T.	ENGINEER OF TRAFFIC AND SAFETY _____	BY: CHIEF ENGINEER/DEPUTY DIRECTOR BUREAU OF HIGHWAY TECHNICAL SERVICES	9-14-2001 F.H.S.A. APPROVAL	2-26-2001 PLAN DATE	R-86-C
CHECKED BY: M.K.P.	_____	_____	SHEET 1 OF 2		

NOTE: THIS PLAN IS NOT A LEGAL ENGINEERING DOCUMENT BUT AN ELECTRONIC DUPLICATE. THE ORIGINAL SIGNED COPY APPROVED FOR PUBLICATION, IS KEPT ON FILE AT THE MICHIGAN DEPARTMENT OF TRANSPORTATION.



SLOPE DETAIL

TABLE OF DIMENSIONS

PIPE DIAMETER (INCHES)	APPROX. SLOPE	F (INCHES)	A (INCHES)	B (INCHES)	C (INCHES)	D (INCHES)	E (INCHES)	G (INCHES)	H (INCHES)	K (INCHES)	Y (INCHES)
12	2.4 to 1	2	4	24	49	73	24	2	9	8	18
15	2.4 to 1	2 1/4	6	27	46	73	30	2 1/4	11	8	18
18	2.3 to 1	2 1/2	9	27	46	73	36	2 1/2	12	8	18
21	2.4 to 1	2 3/4	9	36	37 1/2	73 1/2	42	2 3/4	13	8	18
24	2.5 to 1	3	9 1/2	43 1/2	30 1/2	73 1/2	48	3	14	8	18
27	2.5 to 1	3 1/4	10 1/2	49 1/2	24 1/2	73 1/2	54	3 1/4	14 1/2	8	18
30	2.5 to 1	3 1/2	12	51	19 1/4	73 1/2	60	3 1/2	15	8	18
36	2.5 to 1	4	15	63	34 1/2	97 1/4	72	4	20	8	18
42	2.5 to 1	4 1/2	21	63	35	98	78	4 1/2	22	10	24
48	2.5 to 1	5	24	72	26	98	84	5	22	10	24
54	2.0 to 1	5 1/2	27	65	33 1/4	98 1/4	90	5 1/2	24	10	24
60	1.9 to 1	6	35	60	39	99	96	5	*	12	24
66	1.7 to 1	6 1/2	30	72	27	99	102	5 1/2	*	12	24
72	1.8 to 1	7	36	78	21	99	108	6	*	12	24
78	1.8 to 1	7 1/2	36	90	21	111	114	6 1/2	*	12	24
84	1.6 to 1	8	36	90 1/2	21	111 1/2	120	6 1/2	*	12	24

* AS FURNISHED BY THE MANUFACTURER

NOTES:

CONCRETE IN THESE END SECTIONS SHALL BE THE SAME GRADE AND STRENGTH AS SPECIFIED FOR REINFORCED CONCRETE PIPE, A.S.T.M. DESIGNATION C 76 CLASS II, EXCEPT AS MODIFIED BY THE STANDARD SPECIFICATION.

REINFORCEMENT IN THE "C" PORTION SHALL BE THE SAME AS SPECIFIED FOR REINFORCED CONCRETE, A.S.T.M. DESIGNATION C 76 CLASS II FOR THE SIZE OF CONNECTING PIPE.

REINFORCEMENT IN THE "B" PORTION SHALL HAVE A CROSS-SECTIONAL AREA EQUAL TO THAT OF ONE LAYER OF STEEL IN THE "C" PORTION.

THE END OF THE PIPE CULVERT SHALL BE PLACED IN THE CONCRETE END SECTION SO THAT THE FLOW LINES ARE FLUSH. THE JOINT SHALL BE COMPLETELY FILLED WITH MORTAR.

TO CHANGE THE FILL SLOPE TO THE SLOPE OF THE END SECTION USE A TRANSITION SLOPE OF APPROXIMATELY 10' IN LENGTH TO PROVIDE A PLEASING APPEARANCE.

VARIATIONS IN DIMENSIONS - THE THICKNESS OF CONCRETE, THE POSITION OF STEEL, AND THE INTERNAL DIAMETER OF THE PIPE SHALL CONFORM WITH THE VARIATIONS IN DIMENSIONS AS PROVIDED IN THE SPECIFICATIONS FOR REINFORCED CONCRETE CULVERT, STORM DRAINS, AND SCHER PIPE, A.S.T.M. DESIGNATION C 76.

PLACE CONCRETE FOOTING WHEN CULVERT GRADE IS 4% OR MORE, OR WHEN SPECIFIED ON THE ROAD PLANS.

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR

PRECAST CONCRETE END SECTION
FOR PIPE CULVERT

9-14-2001

F.H.W.A. APPROVAL

2-26-2001

PLAN DATE

R-86-C

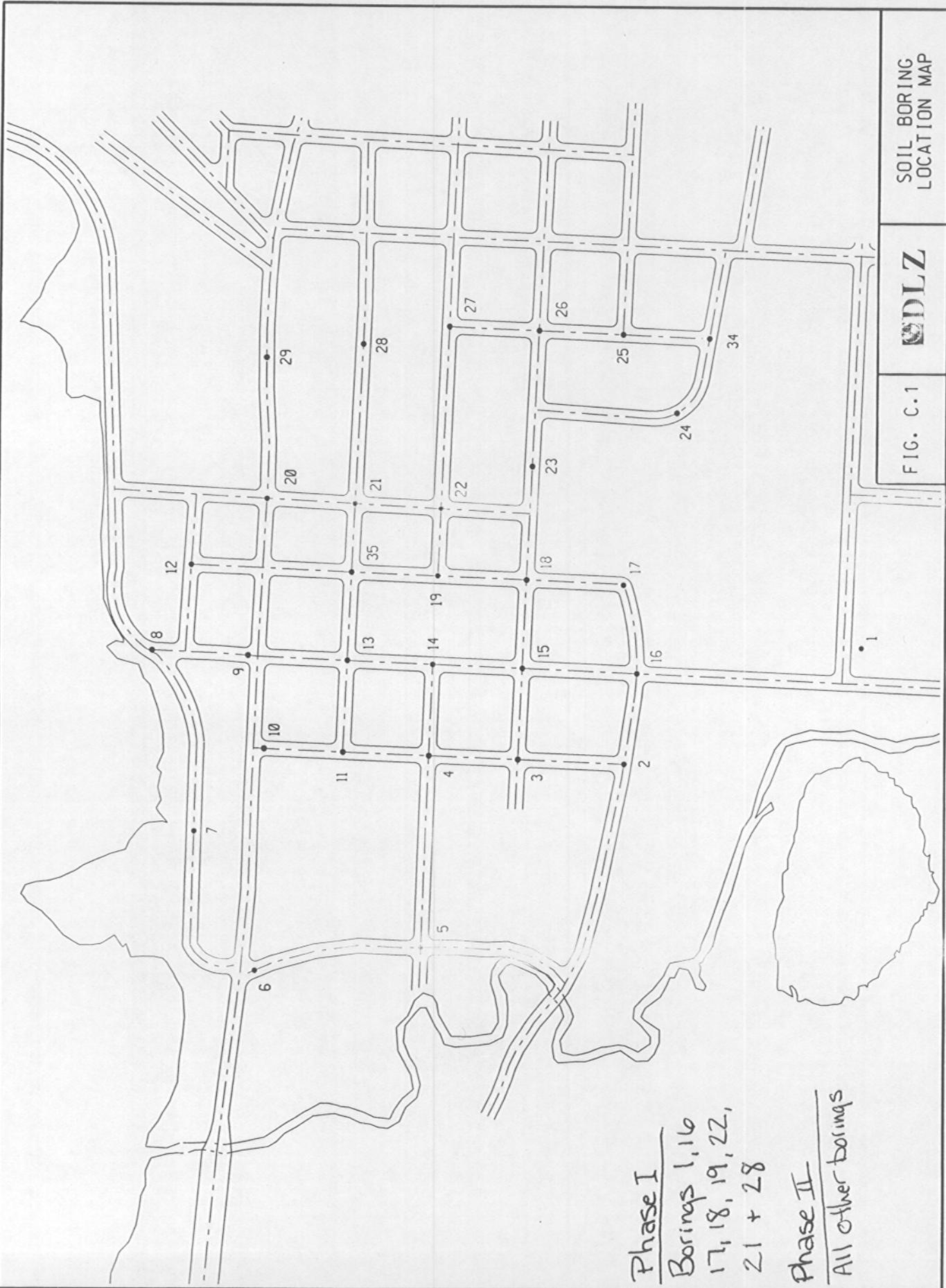
SHEET

2 OF 2

SOIL BORING
LOCATION MAP



FIG. C.1



Phase I
Borings 1, 16
17, 18, 19, 22,
21 + 28

Phase II
All other borings



OWNER
City of Wakefield

PROJECT NAME
Wakefield Storm Sewer Improvements

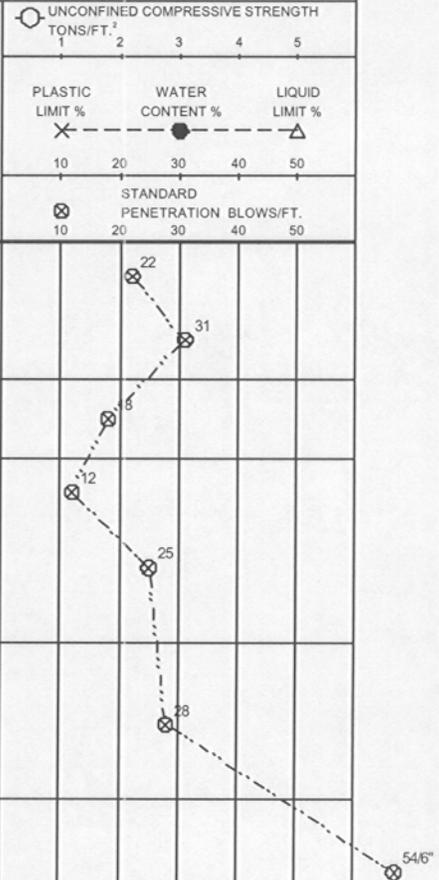
LOG OF BORING NUMBER
B-2

ARCHITECT-ENGINEER
DLZ

SITE LOCATION

Wakefield, Michigan

DEPTH (FT) ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	% Passing No. 200 Sieve	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. ²			PLASTIC LIMIT %			WATER CONTENT %			LIQUID LIMIT %			STANDARD PENETRATION BLOWS/FT.
							1	2	3	10	20	30	40	50	10	20	30	40	
					SURFACE ELEVATION														
					Asphalt 1-inch														
	1	SS			Fill - brown silty fine to coarse sand (SM) - trace clay, trace fine to coarse gravel - trace wood and ash from 2.5 ft. to 4.5 ft. - moist														
	2	SS																	
5.0																			
	3	SS			Reddish brown silty fine to medium sand (SM) - trace fine gravel - moist - medium dense														
	4	SS																	
10.0																			
	5	SS			Reddish brown clayey fine to medium sand (SC) - trace silt, trace fine gravel - medium dense														
		RB																	
15.0																			
	6	SS			Brown fine to medium sand (SP-SM) - little silt - moist to wet - medium dense														
		RB																	
20.0																			
	7	SS			Sandy silty fine to coarse gravel (GM) - wet - extremely dense														
		RB																	
22.5																			
					Boulder or bedrock														
					End of boring														
					Practical refusal at 22.5 ft. - apparent boulder or bedrock														
					Boring advanced to 7.5 ft. with solid stem auger														
					Boring advanced from 7.5 to 22.5 ft. with roller bit and drilling fluids														
					HW casing driven to 8 ft.														
					Boring backfilled with 3/8 inch chipped bentonite														



The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	5.0 WS	BORING STARTED	3/20/03	STS OFFICE	02 - Marquette
WL	5.1 Before casing	BORING COMPLETED	3/20/03	ENTERED BY	SKD
WL		RIG/FOREMAN	CME 55/Dale M	APP'D BY	MDC
				SHEET NO.	1 OF 1
				STS JOB NO.	2-10417

BORING LOG 10417.GPJ STS.GDT 4/17/03



STS Consultants Ltd.

OWNER
City of Wakefield

LOG OF BORING NUMBER **B-3**

PROJECT NAME
Wakefield Storm Sewer Improvements

ARCHITECT-ENGINEER
DLZ

SITE LOCATION

Wakefield, Michigan

DEPTH(FT) ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. ²						
						1	2	3	4	5		
						PLASTIC LIMIT %			WATER CONTENT %		LIQUID LIMIT %	
						⊗	●	△				
						10	20	30	40	50		
						STANDARD PENETRATION BLOWS/FT.						
						⊗	⊗	⊗	⊗	⊗		
						10	20	30	40	50		
					SURFACE ELEVATION							
					Asphalt 3 inches							
	1	SS			Fill - dark brown fine to coarse sand (SM) - trace fine gravel to little fine gravel, little silt - moist						42	
	2	SS										50.4
5.0					Reddish brown silty fine to medium sand (SM) - trace fine to coarse gravel - moist - medium dense to dense						20	
	3	SS										8
10.0												33
	4	SS			Reddish brown silty fine to coarse sand (SM) - little fine to coarse gravel - wet - medium dense							
	5	SS										27
15.0												23
	6	SS			Reddish brown silty fine to coarse sand (SM) - little fine to coarse gravel - wet - medium dense							
20.0												
	7	SS			End of boring Practical refusal at 23.3 ft. - apparent boulder or bedrock Boring advanced to 23.3 ft. with solid stem auger Boring backfilled with 3/8 inch chipped bentonite							
23.3												

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	15.0 WS	BORING STARTED	3/19/03	STS OFFICE	02 - Marquette	
WL		BORING COMPLETED	3/19/03	ENTERED BY	SKD	SHEET NO. 1 OF 1
WL		RIG/FOREMAN	CME 55/Dale M	APP'D BY	MDC	STS JOB NO. 2-10417

BORING LOG 10417.GPJ STS.GDT 4/17/03



OWNER
City of Wakefield

PROJECT NAME
Wakefield Storm Sewer Improvements

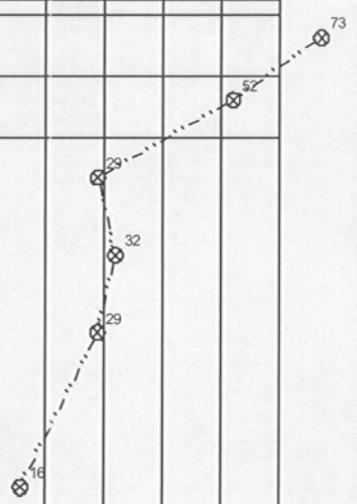
LOG OF BORING NUMBER
B-4

ARCHITECT-ENGINEER
DLZ

SITE LOCATION

Wakefield, Michigan

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	% Passing No. 200 Sieve	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. ²							
								1	2	3	4	5			
								PLASTIC LIMIT %		WATER CONTENT %		LIQUID LIMIT %			
								10	20	30	40	50			
								STANDARD PENETRATION BLOWS/FT.							
								10	20	30	40	50			
						SURFACE ELEVATION									
						Asphalt 2 inches									
		1	SS			Base course 5 inches									
						Fill - dark brown clayey fine to medium sand (SC) - trace silt - moist									
		2	SS			Frost to 2.6 ft.									
						Possible fill - reddish brown fine to medium sand (SM) - little silt - moist									
	5.0														
		3	SS												
		4	SS			Reddish brown silty fine to medium sand (SM) - little fine to coarse gravel - moist - dense to medium dense									
	10.0														
		5	SS												
	15.0														
		6	SS												
			RB												
			RB			Driller indicated gravel while drilling and hard drilling									
	20.0					Boulder or bedrock									
						End of boring									
						Practical refusal at 20 ft - apparent boulder or bedrock									
						Boring advanced to 15 ft. with solid stem auger									
						Boring advanced from 15 to 20 ft. with roller bit and drilling fluids									
						HW casing driven to 18 ft.									
						Boring backfilled with 3/8 inch chipped bentonite									



The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	15.9 WS	BORING STARTED	3/19/03	STS OFFICE	02 - Marquette
WL	15.9 Before casing	BORING COMPLETED	3/19/03	ENTERED BY	SKD
WL		RIG/FOREMAN	CME 55/JHC	APP'D BY	MDC
				SHEET NO.	1 OF 1
				STS JOB NO.	2-10417

BORING LOG 10417.GPJ STS.GDT 4/17/03



OWNER
City of Wakefield

PROJECT NAME
Wakefield Storm Sewer Improvements

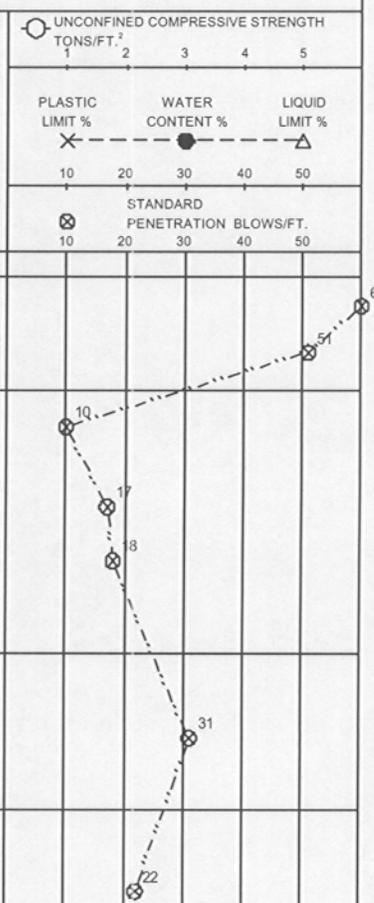
LOG OF BORING NUMBER
B-5

ARCHITECT-ENGINEER
DLZ

SITE LOCATION

Wakefield, Michigan

DEPTH(FT)	ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. ²			% Passing No. 200 Sieve		
							1	2	3			
							PLASTIC LIMIT %	WATER CONTENT %	LIQUID LIMIT %			
							⊗	●	△			
							10	20	30	40	50	
							STANDARD PENETRATION BLOWS/FT.					
							⊗	⊗	⊗	⊗	⊗	
							10	20	30	40	50	
						SURFACE ELEVATION						
						Asphalt 2.5 inches						
						Base course 7 inches						
		1	SS			Fill - dark brown clayey fine to medium sand (SC) - trace silt - moist to wet Frost to 3.8 inches						
		2	SS									
	5.0					Possible fill - brown fine to medium sand (SM) - little silt - moist - medium dense						
		3	SS									
		4	SS									
	10.0					Reddish brown silty fine to medium sand (SM) - trace fine to coarse gravel - moist - dense						
		5	SS									
						Brown silty fine sand - moist - medium dense						
		6	SS									
	15.0					Brown silty fine sand - moist - medium dense						
		7	SS									
						Driller indicated hard drilling						
	20.0					Boulder or bedrock						
	25.0					End of boring Practical refusal at 25.5 ft. - apparent boulder or bedrock Boring advanced to 6 ft. with solid stem auger Boring advanced from 6 to 45 ft. with roller bit and drilling fluids HW casing driven to 13 ft. Boring backfilled with 3/8 inch chipped bentonite						
	25.5											



The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	5.7 WS	BORING STARTED	3/19/03	STS OFFICE	02 - Marquette
WL		BORING COMPLETED	3/19/03	ENTERED BY	SKD
WL		RIG/FOREMAN	CME 55/JHC	SHEET NO.	1 OF 1
				APP'D BY	MDC
				STS JOB NO.	2-10417

BORING LOG 10417.GPJ STS.GDT 4/17/03



OWNER
City of Wakefield
 PROJECT NAME
Wakefield Storm Sewer Improvements

LOG OF BORING NUMBER
B-6A
 ARCHITECT-ENGINEER
DLZ

SITE LOCATION

Wakefield, Michigan

DEPTH(FT)	ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. ²							
							1	2	3	4	5			
X						SURFACE ELEVATION	PLASTIC LIMIT %			WATER CONTENT %		LIQUID LIMIT %		
							10	20	30	40	50	10	20	30
							STANDARD PENETRATION BLOWS/FT.							
							10	20	30	40	50			
						Driller indicated silty sand with large pieces of crushed rock base course								
		1	SS			Possible fill - reddish brown clayey fine to coarse sand (SC) - trace fine to coarse gravel - moist Frost to 3.8 ft.								41
5.0		2	SS			Reddish brown fine to coarse sand (SM) - little silt, little fine to coarse gravel - moist - dense								35
						Boulder								
9.5		3	SS			Brown fine to medium sand (SP-SM) - little silt, little fine to coarse gravel - wet - medium dense								29
						Bore hole cave-in - practical refusal End of boring Boring advanced to 8 ft. with solid stem auger Boring advanced from 8 to 9.5 ft. with roller bit and drilling fluids HW casing driven to 8 ft. Boring backfilled with 3/8" bentonite chips								

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	2.5 WS	BORING STARTED	3/25/03	STS OFFICE	02 - Marquette	
WL		BORING COMPLETED	3/25/03	ENTERED BY	SKD	SHEET NO. 1 OF 1
WL		RIG/FOREMAN	CME 55/JHC	APP'D BY	MDC	STS JOB NO. 2-10417

BORING LOG 10417.GPJ STS.GDT 4/17/03



OWNER
City of Wakefield

PROJECT NAME
Wakefield Storm Sewer Improvements

LOG OF BORING NUMBER
B-7

ARCHITECT-ENGINEER
DLZ

SITE LOCATION

Wakefield, Michigan

DEPTH(FT) ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE RECOVERY	DESCRIPTION OF MATERIAL	% Passing No. 200 Sieve	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. ²									
						1	2	3	4	5					
						PLASTIC LIMIT %			WATER CONTENT %		LIQUID LIMIT %				
						10	20	30	40	50					
						STANDARD PENETRATION BLOWS/FT.									
						10	20	30	40	50					
				SURFACE ELEVATION											
	1	SS		Asphalt 3.5 inches Base course 8 inches Fill - dark brown clayey fine to medium sand (SC) - moist to wet											43
	2	SS		Possible fill - reddish brown silty fine to medium sand (SM) - some fine to coarse gravel - moist Frost to 3.9 ft.											85
5.0															
	3	SS													43
	4	SS													
10.0															
	5	SS		Brown fine to coarse sand (SP-SM) - little silt, little fine to coarse gravel - moist - dense to loose Driller indicated hard drilling from 2.5 ft. to 10.0 ft.											49
		RB													
15.0															
	6	SS													
		RB													
20.0															
	7	SS		Reddish brown clayey fine to medium sand (SC)											14
		RB													
23				Driller indicated hard drilling Boulder or bedrock End of boring Practical refusal at 23 ft. - apparent boulder or bedrock Boring advanced to 7.5 ft. with solid stem auger Boring advanced from 7.5 to 23 ft. with roller bit and drilling fluids HW casing driven to 10 ft. Boring backfilled with 3/8 inch chipped bentonite											

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	6.3 WS	BORING STARTED	3/20/03	STS OFFICE	02 - Marquette
WL	6.1 Before casing	BORING COMPLETED	3/20/03	ENTERED BY	SKD
WL		RIG/FOREMAN	CME 55/JHC	APP'D BY	MDC
				SHEET NO.	1 OF 1
				STS JOB NO.	2-10417

BORING LOG 10417.GPJ STS.GDT 4/17/03

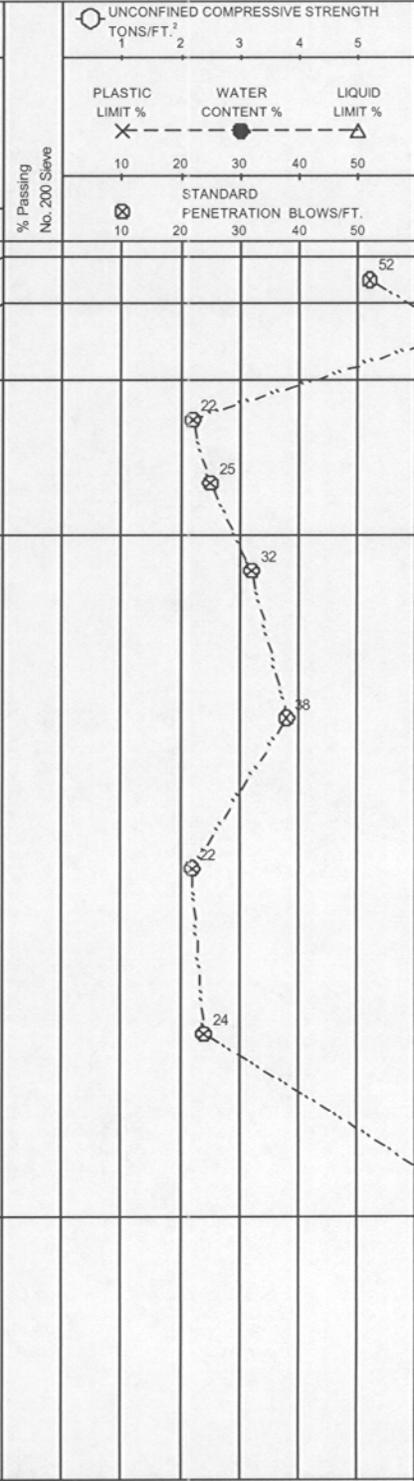


OWNER
City of Wakefield
 PROJECT NAME
Wakefield Storm Sewer Improvements

LOG OF BORING NUMBER
B-8
 ARCHITECT-ENGINEER
DLZ

SITE LOCATION
Wakefield, Michigan

DEPTH(FT) ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE RECOVERY	DESCRIPTION OF MATERIAL
				SURFACE ELEVATION
				Base course
	1	SS		Fill- reddish brown silty fine to coarse sand (SM) - little fine to coarse gravel - moist
	2	SS		Dark brown clayey fine to medium sand (SC) - trace fine to coarse gravel - moist to wet
5.0				
	3	SS		Reddish brown clayey fine to medium sand (SC) - some fine to coarse gravel - moist to wet - medium dense
	4	SS		
10.0				
	5	SS		Brown fine to coarse sand (SM) - little silt, little fine to coarse gravel to some fine to coarse gravel - moist - dense Driller indicated hard drilling throughout boring
		RB		
15.0				
	6	SS		
		RB		
20.0				
	7	SS		
		RB		
25.0				
	8	SS		
		RB		
30.0				
31.5	9	SS		



The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL 5.7 WS	BORING STARTED 3/21/03	STS OFFICE 02 - Marquette
WL 5.8 Before casing	BORING COMPLETED 3/21/03	ENTERED BY SKD
WL	RIG/FOREMAN CME 55/JHC	APP'D BY MDC
		SHEET NO. 1 OF 1
		STS JOB NO. 2-10417

BORING LOG 10417.GPJ STS.GDT 4/17/03



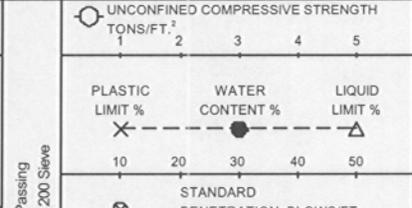
OWNER
City of Wakefield
 PROJECT NAME
Wakefield Storm Sewer Improvements

LOG OF BORING NUMBER
B-9
 ARCHITECT-ENGINEER
DLZ

SITE LOCATION
Wakefield, Michigan

DEPTH(FT)
 ELEVATION(FT)
 SAMPLE NO.
 SAMPLE TYPE
 SAMPLE DISTANCE
 RECOVERY

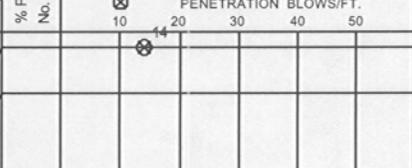
DESCRIPTION OF MATERIAL



SURFACE ELEVATION

1 SS Concrete 4 inches
 Base course 2 inches

2 Fill - dark brown fine to coarse sand (SP-SM) - little silt - wet - medium dense
 End of boring
 Refusal at 2.0 ft. - moved 2 ft. west to B-9A



The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	BORING STARTED 3/25/03	STS OFFICE 02 - Marquette
WL	BORING COMPLETED 3/25/03	ENTERED BY SKD
WL	RIG/FOREMAN CME 55/JHC	APP'D BY MDC
		SHEET NO. 1 OF 1
		STS JOB NO. 2-10417

BORING LOG 10417.GPJ STS.GDT 4/17/03



OWNER
City of Wakefield

PROJECT NAME
Wakefield Storm Sewer Improvements

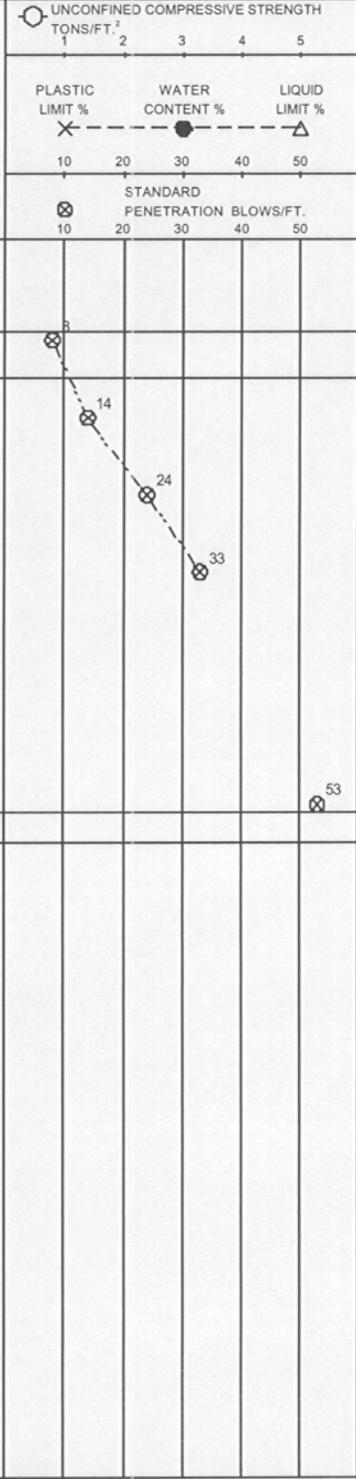
LOG OF BORING NUMBER
B-9A

ARCHITECT-ENGINEER
DLZ

SITE LOCATION

Wakefield, Michigan

DEPTH(FT) ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE RECOVERY	DESCRIPTION OF MATERIAL	% Passing No. 200 Sieve	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. ²					
						1	2	3	4	5	
						PLASTIC LIMIT %			WATER CONTENT %		LIQUID LIMIT %
						10	20	30	40	50	
						STANDARD PENETRATION BLOWS/FT.					
						10	20	30	40	50	
				SURFACE ELEVATION							
		SS		Blind drill to 3.0 ft.							
5.0	2	SS		Fill - dark brown fine to coarse clayey sand to sand clay (SC-CL) - little silt, trace fine gravel - wet - loose							
	3	SS									
	4	SS									
10.0	5	SS		Reddish brown fine to medium sand (SM) - little silt, trace fine to coarse gravel - moist - medium dense to extremely dense Driller indicated hard drilling from 13 to 18.5 ft.							
	6	RB									
15.0	7	SS		Boulder or bedrock							
	8	RB									
19.5				End of boring Practical refusal at 19.5 ft. - apparent boulder or bedrock Boring advanced to 10 ft. with solid stem auger Boring advanced from 10 to 19.5 ft. with roller bit and drilling fluids HW casing driven to 10 ft. Boring backfilled with 3/8 inch chipped bentonite							



The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	8.7 WS	BORING STARTED	3/25/03	STS OFFICE	02 - Marquette	
WL	8.7 BC	BORING COMPLETED	3/25/03	ENTERED BY	SKD	SHEET NO. 1 OF 1
WL		RIG/FOREMAN	CME 55/JHC	APP'D BY	MDC	STS JOB NO. 2-10417

BORING LOG 10417.GPJ STS.GDT 4/17/03



OWNER
City of Wakefield

PROJECT NAME
Wakefield Storm Sewer Improvements

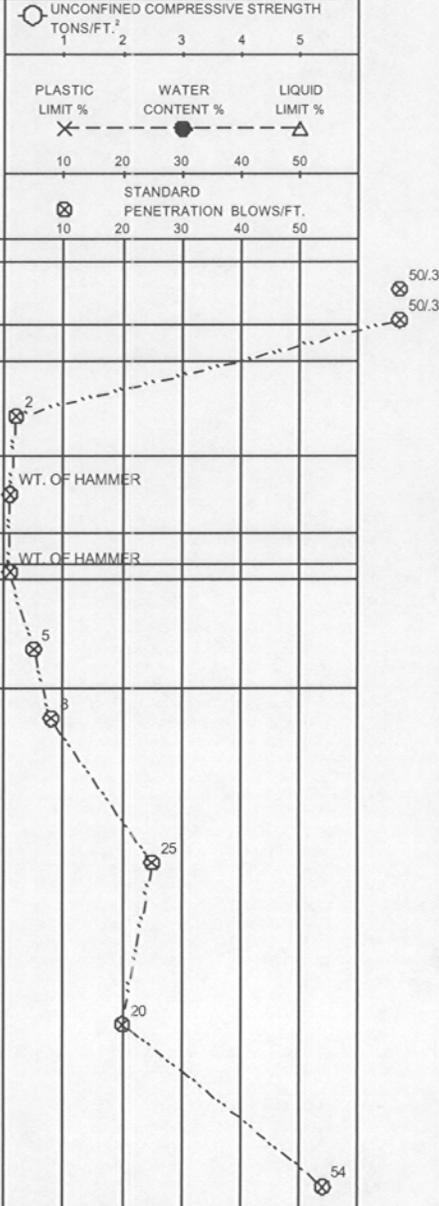
LOG OF BORING NUMBER
B-10

ARCHITECT-ENGINEER
DLZ

SITE LOCATION

Wakefield, Michigan

DEPTH(FT) ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE RECOVERY	DESCRIPTION OF MATERIAL	% Passing No. 200 Sieve	UNCONFINED COMPRESSIVE STRENGTH TONS/FT ²				
						1	2	3	4	5
						PLASTIC LIMIT %		WATER CONTENT %		LIQUID LIMIT %
						⊗	⊗	●	⊗	△
						10	20	30	40	50
						STANDARD PENETRATION BLOWS/FT.				
						⊗	⊗	⊗	⊗	⊗
						10	20	30	40	50
SURFACE ELEVATION										
				Asphalt 4 inches						
				Base course 5 inches						
	1	SS		Fill - brown silty fine to medium sand (SM) - little fine to coarse - trace petroleum odor - moist						
	2	SS		Boulder						
5.0										
	3	SS		Black - fibrous peat (Pt) - moist - very loose						
	4	SS		Brown organic silt (OL) - trace peat fibers - wet - very loose						
10.0										
	5	SS		Reddish brown silty clay (CL) - moist - soft						
				Brown organic silt (OL) - moist - very loose						
	6	SS		Brown clayey fine sand (SC) - wet - loose						
15.0										
	7	SS								
		RB								
20.0										
	8	SS		Brown fine to coarse sand (SM) - little fine to coarse gravel to some fine to coarse gravel - wet - loose to very dense						
		RB								
25.0										
	9	SS								
		RB								
30.0										
31.5	10	SS								
End of boring Boring advanced to 12.5 ft. with solid stem auger Boring advanced from 12.5 to 31.5 ft. with roller bit and drilling fluids HW casing driven to 20 ft. Boring backfilled with 3/8 inch chipped bentonite										



The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	5.2 WS	BORING STARTED	3/20/03	STS OFFICE	02 - Marquette	
WL	5.2 Before casing	BORING COMPLETED	3/20/03	ENTERED BY	SKD	SHEET NO. 1 OF 1
WL		RIG/FOREMAN	CME 55/JHC	APP'D BY	MDC	STS JOB NO. 2-10417

BORING LOG 10417.GPJ STS.GDT 4/17/03



OWNER
City of Wakefield

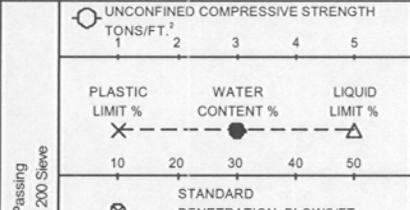
LOG OF BORING NUMBER
B-11

PROJECT NAME
Wakefield Storm Sewer Improvements

ARCHITECT-ENGINEER
DLZ

SITE LOCATION
Wakefield, Michigan

DEPTH(FT)	ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL
4		2	SS			Possible fill - reddish brown fine to medium sand (SM) - little silt - trace fine to coarse gravel

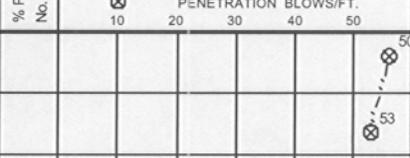


DEPTH(FT) SURFACE ELEVATION

Asphalt 1-inch

Fill - brown silty fine to coarse sand (SM) - some fine to coarse gravel - wet - extremely dense

End of boring
Practical refusal at 4.0 ft. - moved west to B-11A



The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	Dry WS	BORING STARTED	3/24/03	STS OFFICE	02 - Marquette
WL	Dry AB	BORING COMPLETED	3/24/03	ENTERED BY	SKD
WL		RIG/FOREMAN	CME 55/JHC	APP'D BY	MDC
				SHEET NO.	1 OF 1
				STS JOB NO.	2-10417

BORING_LOG 10417.GPJ STS.GDT 4/17/03



OWNER
City of Wakefield

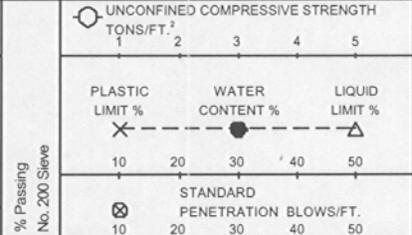
PROJECT NAME
Wakefield Storm Sewer Improvements

LOG OF BORING NUMBER
B-11A

ARCHITECT-ENGINEER
DLZ

SITE LOCATION
Wakefield, Michigan

DEPTH(FT)	ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL
						SURFACE ELEVATION
						Blind drill to 5 ft.
5.0		3	SS			Possible fill - reddish brown clayey silty fine to medium sand (SM-SC) - trace fine to coarse gravel - moist - medium dense
		4	SS			Possible fill - brown fine to medium sand (SM) - little silt - trace fine to coarse gravel - moist - medium dense to extremely dense
10.0		5	SS			
11.7						Boulder or bedrock End of boring Practical refusal at 11.7 ft. - apparent boulder or bedrock Boring advanced to 11.7 ft. with solid-stem auger Boring backfilled with 3/8 inch chipped bentonite



The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	Dry WS	BORING STARTED	3/24/03	STS OFFICE	02 - Marquette
WL	Dry AB	BORING COMPLETED	3/24/03	ENTERED BY	SKD
WL		RIG/FOREMAN	CME 55/JHC	APP'D BY	MDC
				SHEET NO.	1 OF 1
				STS JOB NO.	2-10417

BORING LOG 10417.GPJ STS.GDT 4/17/03



OWNER
City of Wakefield

PROJECT NAME
Wakefield Storm Sewer Improvements

LOG OF BORING NUMBER
B-12

ARCHITECT-ENGINEER
DLZ

SITE LOCATION

Wakefield, Michigan

DEPTH(FT) ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE RECOVERY	DESCRIPTION OF MATERIAL	% Passing No. 200 Sieve	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. ²				
						1	2	3	4	5
SURFACE ELEVATION						PLASTIC LIMIT %				
						10	20	30	40	50
						WATER CONTENT %				
						10	20	30	40	50
						LIQUID LIMIT %				
						10	20	30	40	50
						STANDARD PENETRATION BLOWS/FT.				
						10	20	30	40	50
				Asphalt 1-inch						
	1	SS		Fill - dark brown clayey fine to medium sand (SC) - moist						24
	2	SS		Fill - reddish brown clayey fine to medium sand (SC)						78
5.0										
	3	SS		Possible fill - brown fine to coarse sand (SP-SM) - little silt, trace fine to coarse gravel - moist - medium dense						23
	4	SS								21
10.0										
	5	SS		Reddish brown silty fine to medium sand (SM) - trace fine to coarse gravel to little gravel - moist - medium dense Driller indicated large gravel and cobbles while drilling from 13.8 ft to 14.1 ft.						17
		RB								
15.0										
	6	SS								20
		RB								
20.0										
	7	SS		Brown fine to coarse sand (SP-SM) - little silt, some fine to coarse gravel - moist - medium dense to extremely dense Driller indicated large gravel and cobbles while drilling from 20 ft to 25 ft.						27
		RB								
25.0										
	8	SS								83
		RB								
30.0										
31.5	9	SS		End of boring Boring advanced to 10 ft. with solid stem auger Boring advanced from 10 to 31.5 ft. with roller bit and drilling fluids HW casing driven to 11 ft. Boring backfilled with 3/8 inch chipped bentonite						75

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

BORING LOG 10417.GPJ STS.GDT 4/17/03

WL	8.0 WS	BORING STARTED	3/25/03	STS OFFICE	02 - Marquette	
WL		BORING COMPLETED	3/25/03	ENTERED BY	SKD	SHEET NO. 1 OF 1
WL		RIG/FOREMAN	CME 55/JD	APP'D BY	MDC	STS JOB NO. 2-10417



OWNER
City of Wakefield

PROJECT NAME
Wakefield Storm Sewer Improvements

LOG OF BORING NUMBER
B-13

ARCHITECT-ENGINEER
DLZ

SITE LOCATION

Wakefield, Michigan

DEPTH(FT) ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE RECOVERY	DESCRIPTION OF MATERIAL	% Passing No. 200 Sieve	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. ²				
						1	2	3	4	5
						PLASTIC LIMIT %	WATER CONTENT %	LIQUID LIMIT %		
						X	●	▲		
						10	20	30	40	50
						STANDARD PENETRATION BLOWS/FT.				
						⊗	⊗	⊗	⊗	⊗
						10	20	30	40	50
	1	SS		Fill - reddish brown clayey fine to medium sand (SC) - little fine to coarse gravel, trace silt - wet - dense						
5.0	2	SS		Reddish brown silty fine to medium sand (SM) - trace clay, trace fine to coarse gravel - moist - dense to loose						
	3	SS								
	4	SS								
10.0	5	SS		Reddish brown fine to coarse sand (SM) - little silt, little fine to coarse gravel - wet -- medium dense						
	6	SS								
15.0	7	SS		Reddish brown silty fine to medium sand (SM) - trace fine to coarse gravel - moist - dense to extremely dense						
	8	SS								
	9	SS								
20.0		RB								
25.0		RB								
30.0		RB								
				End of boring Boring advanced to 15 ft. with solid stem auger Boring advanced from 15 to 30 ft. with roller bit and drilling fluids HW casing driven to 8 ft. Boring backfilled with 3/8 inch chipped bentonite						

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

BORING LOG 10417.GPJ STS.GDT 4/17/03

WL	10.0 - 15.0 WD	BORING STARTED	3/20/03	STS OFFICE	02 - Marquette
WL		BORING COMPLETED	3/20/03	ENTERED BY	SKD
WL		RIG/FOREMAN	CME 55/Dale M	SHEET NO.	1 OF 1
				APP'D BY	MDC
				STS JOB NO.	2-10417



OWNER
City of Wakefield

LOG OF BORING NUMBER
B-14

PROJECT NAME
Wakefield Storm Sewer Improvements

ARCHITECT-ENGINEER
DLZ

SITE LOCATION
Wakefield, Michigan

DEPTH(FT) ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE RECOVERY	DESCRIPTION OF MATERIAL	% Passing No. 200 Sieve	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. ²				
						1	2	3	4	5
						PLASTIC LIMIT %		WATER CONTENT %		LIQUID LIMIT %
						10	20	30	40	50
						STANDARD PENETRATION BLOWS/FT.				
						10	20	30	40	50
				SURFACE ELEVATION						
	1	SS		Asphalt 2 inches Base course 10 inches Possible fill - reddish brown fine to medium sand (SM) - little silt - trace fine gravel - moist Frost to 3.5 ft.						61
	2	SS								50/3
5.0										
	3	SS		Reddish brown silty fine to medium sand (SM) - trace fine to coarse gravel - moist - medium dense						25
	4	SS								23
10.0										
	5	SS								20
				Driller indicated hard drilling Boulder or bedrock						
14.5				End of boring Practical refusal at 14.5 - apparent boulder or bedrock Boring advanced to 14.5 ft. with solid stem auger Boring backfilled with 3/8 inch chipped bentonite						

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	Dry WS	BORING STARTED	3/26/03	STS OFFICE	02 - Marquette
WL	Dry AB	BORING COMPLETED	3/26/03	ENTERED BY	SKD
				SHEET NO.	1 OF 1
WL		RIG/FOREMAN	CME 55/JHC	APP'D BY	MDC
				STS JOB NO.	2-10417

BORING LOG 10417.GPJ STS.GDT 4/17/03



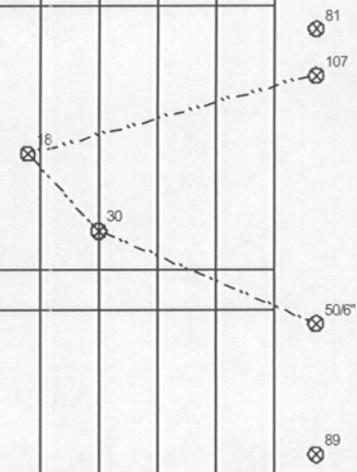
OWNER
City of Wakefield
 PROJECT NAME
Wakefield Storm Sewer Improvements

LOG OF BORING NUMBER
B-15
 ARCHITECT-ENGINEER
DLZ

SITE LOCATION

Wakefield, Michigan

DEPTH(FT) ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE RECOVERY	DESCRIPTION OF MATERIAL	% Passing No. 200 Sieve	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. ²				
						1	2	3	4	5
						PLASTIC LIMIT %	WATER CONTENT %	LIQUID LIMIT %		
						X	●	△		
						10	20	30	40	50
						STANDARD PENETRATION BLOWS/FT.				
						⊗	⊗	⊗	⊗	⊗
						10	20	30	40	50
				SURFACE ELEVATION						
	1	SS		Asphalt 2 inches Base course 10 inches Petroleum odor						
	2	SS		Reddish brown silty fine to medium sand (SM) - trace fine to coarse gravel - moist - medium dense to dense						
5.0	3	SS								
	4	SS								
10.0				Boulder						
	5	SS		Trace petroleum odor in S-5						
				Reddish brown silty fine to coarse sand (SM) - little fine to coarse gravel - moist - extremely dense						
15.0	6	SS								
18				End of boring Practical refusal at 18 ft. - apparent boulder or bedrock Boring advanced to 18 ft. with solid stem auger Boring backfilled with 3/8 inch chipped bentonite						



The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL Dry WS	BORING STARTED 3/26/03	STS OFFICE 02 - Marquette
WL Dry AB	BORING COMPLETED 3/26/03	ENTERED BY SKD
WL	RIG/FOREMAN CME 55/JHC	SHEET NO. 1 OF 1
		APP'D BY MDC
		STS JOB NO. 2-10417

BORING LOG 10417.GPJ STS.GDT 4/17/03



OWNER
City of Wakefield

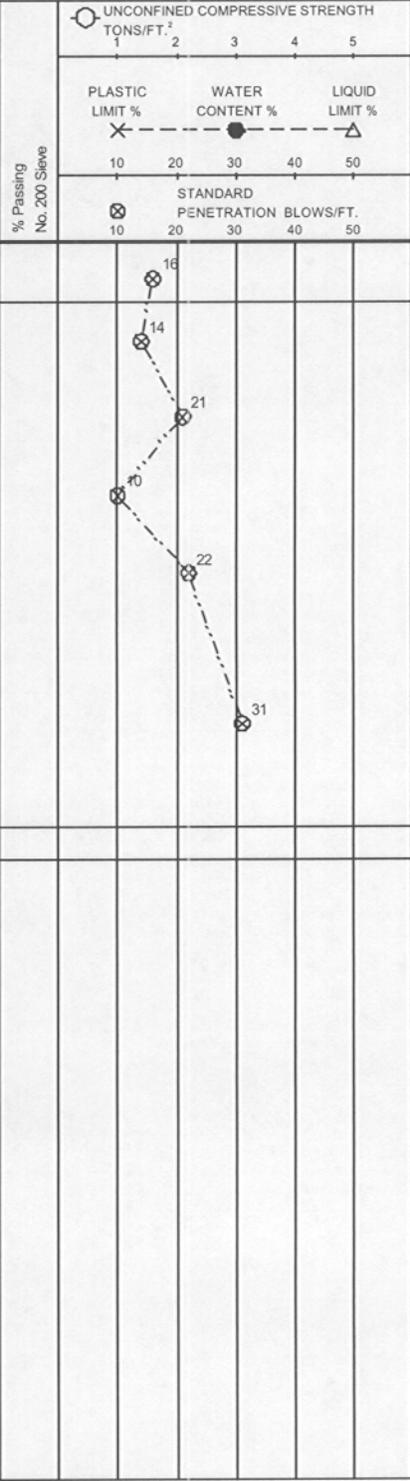
LOG OF BORING NUMBER
B-20

PROJECT NAME
Wakefield Storm Sewer Improvements

ARCHITECT-ENGINEER
DLZ

SITE LOCATION
Wakefield, Michigan

DEPTH(FT)	ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL
						SURFACE ELEVATION
						Asphalt 1-inch
		1	SS			Fill - dark brown clayey fine to medium sand (SC) - little fine to coarse gravel - moist - medium dense
		2	SS			
5.0						
		3	SS			
						Reddish brown silty fine to medium sand (SM) - trace clay, trace fine to coarse gravel to little fine to coarse gravel - moist - medium dense to dense
		4	SS			
10.0						
		5	SS			
			RB			
15.0						
		6	SS			
			RB			
20.0						Boulder or bedrock
						End of boring Practical refusal at 20.0 ft. - apparent boulder or bedrock Boring advanced to 10 ft. with solid stem auger Boring advanced from 10 to 20 ft. with roller bit and drilling fluids HW casing driven to 11 ft. Boring backfilled with 3/8 inch chipped bentonite



The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	8.0 WS	BORING STARTED	3/25/03	STS OFFICE	02 - Marquette
WL		BORING COMPLETED	3/25/03	ENTERED BY	SKD
WL		RIG/FOREMAN	CME 55/JD	APP'D BY	MDC
				SHEET NO.	1 OF 1
				STS JOB NO.	2-10417

BORING LOG 10417.GPJ STS.GDT 4/17/03



OWNER
City of Wakefield

PROJECT NAME
Wakefield Storm Sewer Improvements

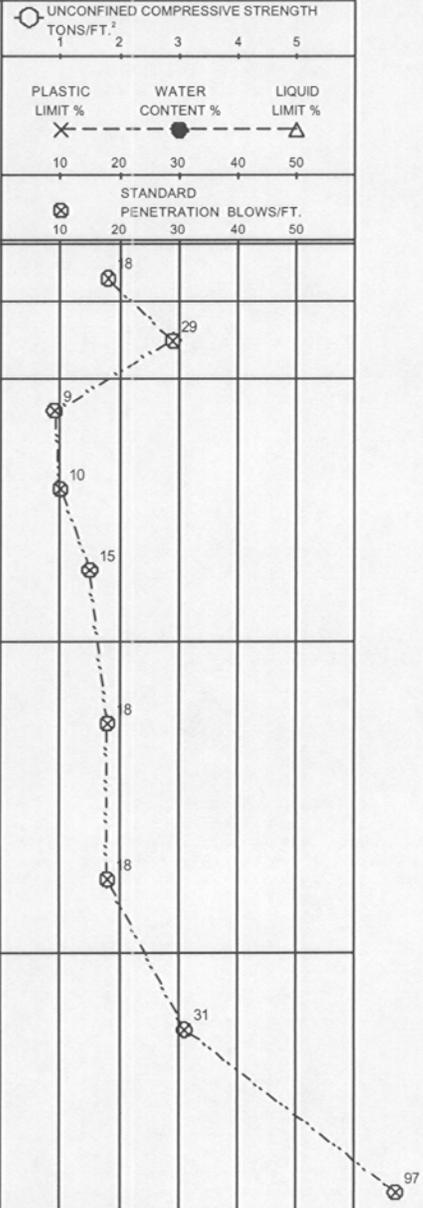
LOG OF BORING NUMBER
B-23

ARCHITECT-ENGINEER
DLZ

SITE LOCATION

Wakefield, Michigan

DEPTH (FT) ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE RECOVERY	DESCRIPTION OF MATERIAL	% Passing No. 200 Sieve	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. ²				
						1	2	3	4	5
						PLASTIC LIMIT %		WATER CONTENT %		LIQUID LIMIT %
						10	20	30	40	50
						STANDARD PENETRATION BLOWS/FT.				
						10	20	30	40	50
				SURFACE ELEVATION						
				Asphalt 1.5 inches						
	1	SS		Fill - dark brown silty fine to medium sand (SM) - little fine to coarse gravel - moist - medium dense						
	2	SS		Fill - reddish brown clayey fine to medium sand (SC) - little silt - moist - medium dense						
5.0										
	3	SS		Brown fine to coarse sand (SM) - little silt, little fine to coarse gravel - moist - loose to medium dense						
	4	SS								
10.0										
	5	SS								
		RB								
15.0										
	6	SS		Reddish brown clayey silty fine to medium sand (SC-SM) - trace fine to coarse gravel - wet - medium dense						
		RB								
20.0										
	7	SS								
		RB								
25.0										
	8	SS		Reddish brown fine to coarse sand (SM) - little silt and fine to coarse gravel - wet - dense to extremely dense						
		RB								
30.0										
	9	SS								
31.5										
				End of boring Boring advanced to 10 ft. with solid stem auger Boring advanced from 10 to 31.5 ft. with roller bit and drilling fluids HW casing driven to 11 ft. Boring backfilled with 3/8 inch chipped bentonite						



The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

BORING LOG 10417.GPJ STS.GDT 4/17/03

WL	7.0 WS	BORING STARTED	3/25/03	STS OFFICE	02 - Marquette
WL	5.7 Before casing	BORING COMPLETED	3/25/03	ENTERED BY	SKD
WL		RIG/FOREMAN	CME 55/JD	APP'D BY	MDC
				SHEET NO.	1 OF 1
				STS JCB NO.	2-10417



OWNER
City of Wakefield

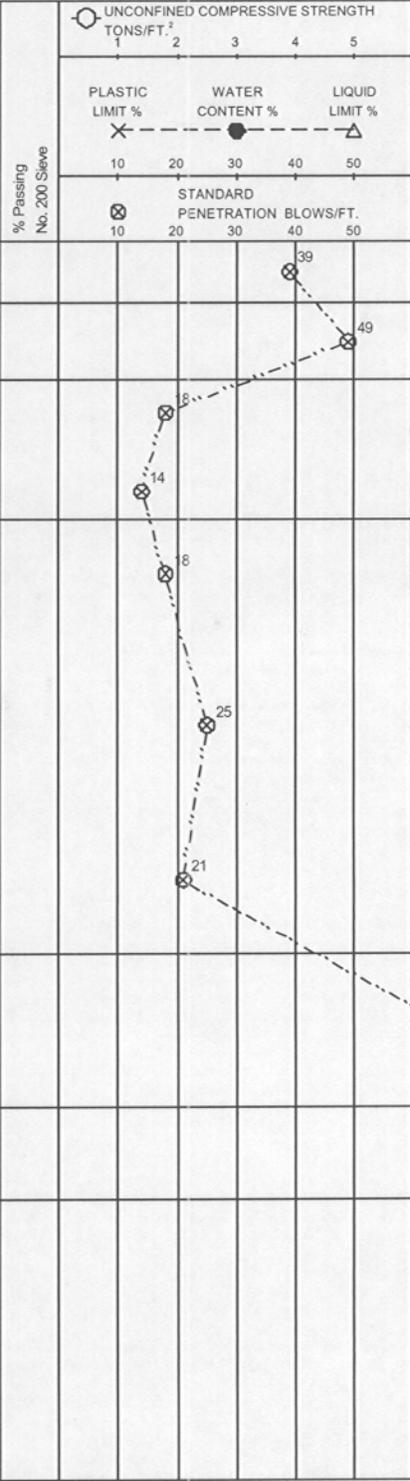
LOG OF BORING NUMBER
B-24

PROJECT NAME
Wakefield Storm Sewer Improvements

ARCHITECT-ENGINEER
DLZ

SITE LOCATION
Wakefield, Michigan

DEPTH(FT)	ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE RECOVERY	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION
		1	SS		Fill - reddish brown fine to coarse sand (SM) - some fine to coarse gravel - little silt - wet - dense
		2	SS		Reddish brown clayey fine to medium sand (SC) - little silt - trace fine gravel - wet - dense
5.0		3	SS		Reddish brown silty fine to medium sand (SM) - trace clay, trace fine to coarse gravel - moist - medium dense
			RB		
		4	SS		Reddish brown silty fine sand (SM) - trace fine gravel - moist - medium dense
10.0			RB		
		5	SS		Reddish brown silty fine sand (SM) - trace fine gravel - moist - medium dense
			RB		
15.0		6	SS		Brown fine to coarse sand (SP-SM) - little silt - moist - extremely dense
			RB		
20.0		7	SS		Brown fine to medium sand (SP-SM) - little silt - moist - extremely dense
			RB		
25.0		8	SS		Brown fine to medium sand (SP-SM) - little silt - moist - extremely dense
			RB		
30.0		9	SS		End of boring Boring advanced to 5 ft. with solid stem auger Boring advanced from 5 to 31 ft. with roller bit and drilling fluids HW casing driven to 6 ft. Boring backfilled with 3/8 inch chipped bentonite
31					



The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	1.0 WS	BORING STARTED	3/27/03	STS OFFICE	02 - Marquette
WL	1.0 Before casing	BORING COMPLETED	3/27/03	ENTERED BY	SKD
WL		RIG/FOREMAN	CME 55/JD	APP'D BY	MDC
				SHEET NO.	1 OF 1
				STS JOB NO.	2-10417

BORING LOG 10417.GPJ STS.GDT 4/7/03



OWNER
City of Wakefield

PROJECT NAME
Wakefield Storm Sewer Improvements

LOG OF BORING NUMBER
B-25

ARCHITECT-ENGINEER
DLZ

SITE LOCATION

Wakefield, Michigan

DEPTH (FT) ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE RECOVERY	DESCRIPTION OF MATERIAL	% Passing No. 200 Sieve	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. ²				
						1	2	3	4	5
						PLASTIC LIMIT %		WATER CONTENT %		LIQUID LIMIT %
						X	---	●	---	△
						10	20	30	40	50
						STANDARD PENETRATION BLOWS/FT.				
						⊗	⊗	⊗	⊗	⊗
						10	20	30	40	50
				SURFACE ELEVATION						
				Asphalt 1.5 inches						
	1	SS		Fill - dark brown clayey fine to medium sand (SC) - moist				8		
	2	SS		Reddish brown fine to coarse sand (SP-SM) - little silt, trace fine gravel - moist					40	
5.0										
	3	SS		Brown fine to medium sand (SP) - trace silt and fine gravel - moist - medium dense				12		
		RB								
	4	SS						14		
		RB								
10.0										
	5	SS		Reddish brown silty fine to medium sand (SM) - trace fine to coarse gravel - moist to wet - medium dense to extremely dense					22	
		RB								
	6	SS						14		
		RB								
20.0										
	7	SS							19	
		RB								
25.0										
	8	SS								71
		RB								506"
30.0										
	9	RB		Driller indicated hard drilling - no sample						
				End of boring Boring advanced to 5 ft. with solid stem auger Boring advanced from 5 to 30 ft. with roller bit and drilling fluids Boring backfilled with 3/8 inch chipped bentonite						

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	5.0 WS	BORING STARTED	3/27/03	STS OFFICE	02 - Marquette
WL	4.9 Before casing	BORING COMPLETED	3/27/03	ENTERED BY	SKD
WL		RIG/FOREMAN	CME 55/JD	APP'D BY	MDC
				SHEET NO.	1 OF 1
				STS JOB NO.	2-10417

BORING LOG 10417.GPJ STS.GDT 4/17/03



OWNER
City of Wakefield

PROJECT NAME
Wakefield Storm Sewer Improvements

LOG OF BORING NUMBER
B-26

ARCHITECT-ENGINEER
DLZ

SITE LOCATION

Wakefield, Michigan

DEPTH(FT)	ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. ²		
							1	2	3
							PLASTIC LIMIT %	WATER CONTENT %	LIQUID LIMIT %
							X	●	△
							10	20	30
							STANDARD PENETRATION BLOWS/FT.		
							⊗	⊗	⊗
							10	20	30
						SURFACE ELEVATION			
						Asphalt 1-inch Base course 3 inches			
		1	SS			Fill - dark brown clayey fine to medium sand (SC) - little silt - wet - medium dense			23
		2	SS			Possible fill - reddish brown fine to medium sand (SP-SM) - little silt - trace fine gravel - moist to wet - medium dense			38
	5.0	3	SS						10
			RB						10
		4	SS			Reddish brown clayey fine to medium sand (SC) - little silt - trace fine to coarse gravel - wet - medium dense			9
	10.0	5	SS						9
			RB						
	15.0	6	SS			Reddish brown silty fine to coarse sand (SM) - little fine to coarse gravel - wet - medium dense			15
			RB						
	20.0	7	SS						12
			RB						
	25.0	8	SS			Reddish brown fine to coarse sand (SP-SM) little silt, little fine to coarse gravel - wet - extremely dense			50.4
			RB						
	30.0	9	SS						50.5
	31					End of boring Boring advanced to 5 ft. with solid stem auger Boring advanced from 5 to 31 ft. with roller bit and drilling fluids HW casing driven to 6 ft. Boring backfilled with 3/8 inch chipped bentonite			

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	5.0 WS	BORING STARTED	3/26/03	STS OFFICE	02 - Marquette
WL	4.8 Before casing	BORING COMPLETED	3/26/03	ENTERED BY	SKD
WL		RIG/FOREMAN	CME 55/JD	SHEET NO.	1 OF 1
				APP'D BY	MDC
				STS JOB NO.	2-10417

BORING LOG 10417.GPJ STS.GDT 4/17/03



OWNER
City of Wakefield

PROJECT NAME
Wakefield Storm Sewer Improvements

LOG OF BORING NUMBER
B-27

ARCHITECT-ENGINEER
DLZ

SITE LOCATION

Wakefield, Michigan

DEPTH (FT) ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE RECOVERY	DESCRIPTION OF MATERIAL	% Passing No. 200 Sieve	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. ²				
						1	2	3	4	5
						PLASTIC LIMIT %		WATER CONTENT %		LIQUID LIMIT %
						⊗	⊗	⊗	⊗	⊗
						10	20	30	40	50
						STANDARD PENETRATION BLOWS/FT.				
						⊗	⊗	⊗	⊗	⊗
						10	20	30	40	50
				SURFACE ELEVATION						
				Asphalt 2 inches						
				Base course 8 inches						
	1	SS		Fill - reddish brown clayey fine to medium sand (SC) - moist						40
	2	SS		Possible fill - light brown fine to medium sand (SP-SM) - little silt, trace clay - moist						83
5.0				Frost to 4 ft.						
	3	SS		Possible fill - reddish brown clayey fine to medium sand (SC) - moist - dense						32
	4	SS		Reddish brown silty fine to medium sand (SM) - moist - medium dense						25
10.0										
	5	SS		Reddish brown clayey fine to medium sand (SC) - trace fine gravel - wet - medium dense						13
15.0										
	6	SS		Reddish brown silty fine to medium sand (SM) - some fine to coarse gravel - trace clay to little clay - moist - dense to extremely dense						
		RB								
20.0										
	7	SS								47
										70.6"
25.0										
	8	SS								84
30.0										
31.5										
	9	SS								56

End of boring
 Boring advanced to 10 ft. with solid stem auger
 Boring advanced from 10 to 31.5 ft. with roller bit and drilling fluids
 HW casing driven to 12 ft.
 Boring backfilled with 3/8 inch chipped bentonite

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	8.8 WS	BORING STARTED	3/26/03	STS OFFICE	02 - Marquette	
WL	9.0 Before casing	BORING COMPLETED	3/26/03	ENTERED BY	SKD	SHEET NO. 1 OF 1
WL		RIG/FOREMAN	CME 55/JHC	APP'D BY	MDC	STS JOB NO. 2-10417

BORING LOG 10417.GPJ STS.GDT 4/17/03



OWNER
City of Wakefield

LOG OF BORING NUMBER
B-29

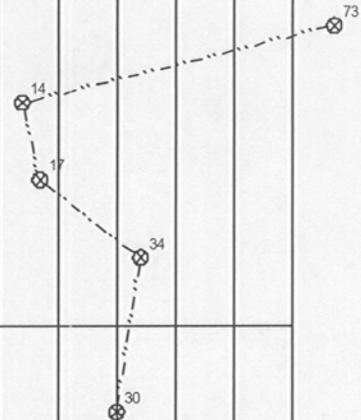
PROJECT NAME
Wakefield Storm Sewer Improvements

ARCHITECT-ENGINEER
DLZ

SITE LOCATION

Wakefield, Michigan

DEPTH(FT) ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE RECOVERY	DESCRIPTION OF MATERIAL	% Passing No. 200 Sieve	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. ²				
						1	2	3	4	5
						PLASTIC LIMIT %		WATER CONTENT %		LIQUID LIMIT %
						⊗	⊗	⊗	⊗	⊗
						10	20	30	40	50
						STANDARD PENETRATION BLOWS/FT.				
						⊗	⊗	⊗	⊗	⊗
						10	20	30	40	50
⊗				SURFACE ELEVATION						
	1	SS		Asphalt 3 inches Base course 9 inches						
	2	SS								
	5.0									
	3	SS		Reddish brown silty fine to medium sand (SM) - little fine to coarse gravel, trace clay - moist to wet - medium dense to dense Frost to 4 ft.						
	4	SS								
	10.0									
	5	SS								
		RB								
	15.0									
	6	SS		Brown fine to coarse sand (SP-SM) - trace to little silt, little fine to coarse gravel - moist - dense						
		RB								
	19									
				Driller indicated hard drilling						
				<u>Boulder or bedrock</u> End of boring Practical refusal at 19.0 ft. - apparent boulder or bedrock Boring advanced to 7.5 ft. with solid stem auger Boring advanced from 7.5 to 19 ft. with roller bit and drilling fluids HW casing driven to 8 ft. Boring backfilled with 3/8 inch chipped bentonite						



The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	5.5 WS	BORING STARTED	3/27/03	STS OFFICE	02 - Marquette
WL	5.0 Before casing	BORING COMPLETED	3/27/03	ENTERED BY	SKD
WL		RIG/FOREMAN	CME 55/JHC	APP'D BY	MDC
				SHEET NO.	1 OF 1
				STS JOB NO.	2-10417

BORING LOG 10417.GPJ STS.GDT 4/17/03



OWNER
City of Wakefield

PROJECT NAME
Wakefield Storm Sewer Improvements

LOG OF BORING NUMBER
B-34

ARCHITECT-ENGINEER
DLZ

SITE LOCATION

Wakefield, Michigan

DEPTH(FT) ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE RECOVERY	DESCRIPTION OF MATERIAL	% Passing No. 200 Sieve	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. ²				
						1	2	3	4	5
						PLASTIC LIMIT %		WATER CONTENT %		LIQUID LIMIT %
						X	●	▲		
						10	20	30	40	50
						STANDARD PENETRATION BLOWS/FT.				
						⊗	⊗	⊗	⊗	⊗
						10	20	30	40	50
SURFACE ELEVATION										
				Asphalt 1-inch						
	1	SS		Fill - reddish brown fine to coarse sand (SM) - some fine to coarse gravel, little silt - moist						23
	2	SS								
5.0										
	3	SS		Reddish brown clayey fine to medium sand (SC) - trace fine gravel - moist - medium dense						22
		RB								
	4	SS		Reddish brown silty fine to medium sand (SM) - trace clay - wet - medium dense						2
		RB								
10.0										
	5	SS		Reddish brown clayey fine to medium sand (SC) - little silt - wet - medium dense to dense						20
		RB								
15.0										
	6	SS								34
		RB								
20.0										
	7	SS		Reddish brown silty fine to medium sand (SM) - little fine to coarse gravel - moist - medium dense Driller indicated large gravel and cobbles while drilling						72
		RB								
25.0										
	8	SS								16
		RB								
30.0										
30.9	9	SS		Brown fine to coarse sand (SM) - little silt, little fine to coarse gravel - moist - extremely dense						
End of boring Boring advanced to 5 ft. with solid stem auger Boring advanced from 5 to 30.9 ft. with roller bit and drilling fluids HW casing driven to 6 ft. Boring backfilled with 3/8 inch chipped bentonite										

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	1.3 WD	BORING STARTED	3/27/03	STS OFFICE	02 - Marquette	
WL	1.6 Before casing	BORING COMPLETED	3/27/03	ENTERED BY	SKD	SHEET NO. 1 OF 1
WL		RIG/FOREMAN	CME 55/JD	APP'D BY	MDC	STS JOB NO. 2-10417

BORING LOG 10417.GPJ STS.GDT 4/17/03

General Decision Number: MI030064 03/26/2004 MI64

Superseded General Decision Number: MI020064

State: Michigan

Construction Types: Heavy

Counties: Baraga, Gogebic, Houghton, Iron, Keweenaw and Ontonagon Counties in Michigan.

HEAVY CONSTRUCTION PROJECTS (does not include airport or bridge construction projects, or sewer or water line work if it is incidental to a highway construction project)

Modification Number	Publication Date
0	06/13/2003
1	03/26/2004

* BOIL0169-005 07/01/2003

	Rates	Fringes
Boilermaker (Excluding tank building).....	\$ 28.853	25% + 5.10

* BRMI0006-002 05/01/2003

	Rates	Fringes
Bricklayer; marble, terrazzo and tile setter.....	\$ 21.89	10.01
Cement Mason.....	\$ 21.89	10.01
Pointer, caulker and cleaner....	\$ 20.89	10.01

FOOTNOTES: Stacks: Work on industrial and powerhouse stacks shall receive \$2.00 per hour above the journeyman bricklayer rate.

Industrial: Refinishing work on digesters, tanks, lime kilns, chests, boilers, and boiler tubes shall receive \$2.00 per hour above the journeyman bricklayer rate.

* CARP1510-002 05/01/2003

	Rates	Fringes
Carpenter (Includes concrete form work).....	\$ 22.97	8.20
Millwright.....	\$ 26.59	8.42
Piledriver.....	\$ 23.17	8.20

FOOTNOTES: Waterfront work on the Great Lakes or connecting water

navigable to Lake carriers: \$0.20 per hour additional.

Work on industrial construction, defined as industrial manufacturing and processing plants such as ore plants, paper mills, power houses, foundries, saw mills, wood processing plants, or other industrial complexes: \$.30 per hour additional.

* ELEC0219-002 06/02/2003

IRON COUNTY:

	Rates	Fringes
Electricians:		
Electrical contracts of \$90,000 or less.....	\$ 22.06	10.48
Electrical contracts over \$90,000.....	\$ 24.74	10.58

FOOTNOTES:

All industrial work over 30 ft. above the ground, unless on solid flooring or grating permanently attached in place: 10% per hour additional. Over 60 ft.: 20% per hour additional. Over 90 ft.: 30% per hour additional.

Work performed within 3 ft. of an unguarded opening at the above-mentioned heights to receive the above-mentioned premiums.

Work in underground mines, except mine shaft work: 10% per hour additional.

* ELEC0219-012 06/02/2003

BARAGA, GOGEBIC, HOUGHTON, KEWEENAW AND ONTONAGON COUNTIES:

	Rates	Fringes
Electricians:		
Electrical contracts of \$70,000 or less.....	\$ 19.38	10.38
Electrical contracts over \$70,000.....	\$ 24.74	10.58

FOOTNOTES: All industrial work over 30 ft. above the ground, unless on solid flooring or grating permanently attached in place: 10% per hour additional. Over 60 ft.: 20% per hour additional. Over 90 ft.: 30% per hour additional.

Work performed within 3 ft. of an unguarded opening at the above-mentioned heights to receive the above-mentioned premiums.

Work in underground mines, except mine shaft work: 10% per hour additional.

ELEC0876-004 06/01/2002

Rates	Fringes
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Line Construction: cable
 splicer.....\$ 28.30 21.5% + 2.20

Line Construction: ground
 person.....\$ 13.86 21.5% + 2.20

Line Construction: light
 equipment operator/ground
 person/truck driver/ground
 pe
 winch, A-frame, diggers
 when used for
 distribution line
 truck and used for
 distribution work.
 Distribution truck
 driver, 5th wheel type
 trucks, bucket trucks,
 ladder trucks and all
 live boom trucks, all
 equipment 85 hp or under....\$ 18.06 21.5% + 2.20

Line Construction: line
 technician.....\$ 27.18 21.5% + 2.20

Line Construction:
 operator/ground person
 digger, tractor and
 setting rig with tracks
 or rough terrain
 vehicle, large
 bombardier, backhoe
 over 85 hp, hydraulic
 crane 10 ton or over.....\$ 20.56 21.5% + 2.20

Line Construction: truck
 driver/ground person
 trucks with winch or
 boom or dump, other
 than distribution work.....\$ 17.21 21.5% + 2.20

FOOTNOTE:

Operators of 5/8 yd. rated capacity backhoe or over, and
 operators of 25 ton, rated capacity, crane or over, and
 operators of heavy duty tension or pulling machinery on 345
 KV and above, shall receive the line technician rate of pay.

 ENGI0324-012 05/01/2002

	Rates	Fringes
Power Equipment Operator (STEEL ERECTION):		
Compressor; forklift; welder.....	\$ 20.84	11.40
Crane operator, main boom & jib 120' or longer.....	\$ 24.59	11.40

Crane operator, main boom & jib 140' or longer.....	\$ 24.84	11.40
Crane operator, main boom & jib 220' or longer.....	\$ 25.09	11.40
Mechanic with truck and tools.....	\$ 25.59	11.40
Oiler and fire tender.....	\$ 19.54	11.40
Regular operator.....	\$ 24.09	11.40

 ENGI0326-001 05/01/2002

	Rates	Fringes
Power equipment operators - gas distribution and duct installation work:		
GROUP 1.....	\$ 22.39	11.65
GROUP 2-A.....	\$ 22.29	11.65
GROUP 2-B.....	\$ 22.07	11.65
GROUP 3.....	\$ 21.29	11.65
GROUP 4.....	\$ 20.79	11.65

SCOPE OF WORK:

The construction, installation, treating and reconditioning of pipelines transporting gas vapors within cities, towns, subdivisions, suburban areas, or within private property boundaries, up to and including private meter settings of private industrial, governmental or other premises, more commonly referred to as "distribution work," starting from the first metering station, connection, similar or related facility, of the main or cross country pipeline and including duct installation.

POWER EQUIPMENT - GAS DISTRIBUTION CLASSIFICATIONS

GROUP 1: Mechanic, crane (over 1/2 yd. capacity), backhoe (over 1/2 yd. capacity), grader (Caterpillar 12 equivalent or larger)

GROUP 2-A: Trencher, backhoe (1/2 yd. capacity or less)

GROUP 2-B: Crane (1/2 yd. capacity or less), compressor (2 or more), dozer (D-4 equivalent or larger), endloader (1 yd. capacity or larger), pump (1 or 2 six-inch or larger), side boom (D-4 equivalent or larger)

GROUP 3: Backfiller, boom truck (powered), concrete saw (20 hp or larger), dozer (less than D-4 equivalent), endloader (under 1 yd. capacity), farm tractor (with attachments), pump (2-4 under six-inch capacity), side boom tractor (less than D-4 equivalent), tamper (self-propelled)

GROUP 4: Oiler, grease person

 ENGI0326-014 05/01/2002

Rates	Fringes
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Power equipment operators
(includes underground
construction):

Crane operator, main boom & jib 120' or longer.....	\$ 24.19	11.40
Crane operator, main boom & jib 140' or longer.....	\$ 24.44	11.40
Crane operator, main boom & jib 220' or longer.....	\$ 24.69	11.40
GROUP 1.....	\$ 23.69	11.40
GROUP 2.....	\$ 20.44	11.40
GROUP 3.....	\$ 19.86	11.40
GROUP 4.....	\$ 18.92	11.40
Mechanic with truck and tools.....	\$ 25.19	11.40

FOOTNOTES:

Swing boom truck operator over 15 tons: \$.50 per hour
additional.

Hydraulic crane operator 75 tons and under: \$.75 per hour
additional.

Hydraulic crane operator over 75 tons: \$1.00 per hour
additional.

Lattice boom crane operator: \$1.50 per hour additional.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Regular equipment operator, crane, dozer, front end
loader, job mechanic, pumpcrete and squeezecrete, welder

GROUP 2: Air track drill, boom truck (non-swing), concrete
mixer, material hoist and tugger, pump 6" and over,
beltcrete, sweeping machine, trencher, winches, well points
and freeze systems

GROUP 3: Air compressor, conveyor, concrete saw, farm tractor
(without attachments), fork truck, generator, guard post
driver, mulching machine, pumps under 6-in., welding machine
and grease person

GROUP 4: Oiler, fire tender and heater operator

ENGI0326-016 10/01/2001

	Rates	Fringes
Power equipment operators - sewer relining:		
GROUP 1.....	\$ 23.67	8.11
GROUP 2.....	\$ 22.28	8.11

SEWER RELINING CLASSIFICATIONS

GROUP 1: Operation of audio-visual closed circuit TV system,
including remote in-ground cutter and other equipment used in
connection with the CCTV system

GROUP 2: Operation of hot water heaters and circulation
systems, water jetters and vacuum and mechanical debris
removal systems

ENGI0326-017 10/01/2001

	Rates	Fringes
Power equipment operators - hazardous waste removal:		
LEVEL A:		
Engineer when operating crane with boom and jib or leads 140' or longer.....	\$ 29.22	11.15
Engineer when operating crane with boom and jib or leads 220' or longer.....	\$ 29.52	11.15
GROUP 1.....	\$ 26.57	11.15
GROUP 2.....	\$ 22.87	11.15
Regular crane operator, mechanic, dragline operator, boom truck operator and concrete pump with boom operator.....	\$ 27.54	11.15
LEVEL B AND C:		
Engineer when operating crane with boom and jib or leads 140' or longer.....	\$ 28.27	11.15
Engineer when operating crane with boom and jib or leads 220' or longer.....	\$ 28.57	11.15
GROUP 1.....	\$ 25.62	11.15
GROUP 2.....	\$ 21.93	11.15
Regular crane operator, mechanic, dragline operator, boom truck operator and concrete pump with boom operator.....	\$ 26.59	11.15
LEVEL D WHEN CAPPING		
LANDFILL:		
Engineer when operating crane with boom and jib or leads 140' or longer.....	\$ 26.72	11.15
Engineer when operating crane with boom and jib or leads 220' or longer.....	\$ 27.02	11.15
GROUP 1.....	\$ 24.07	11.15
GROUP 2.....	\$ 20.38	11.15

Regular crane operator, mechanic, dragline operator, boom truck operator and concrete pump with boom operator.....	\$ 25.04	11.15
LEVEL D:		
Engineer when operating crane with boom and jib or leads 140' or longer.....	\$ 26.97	11.15
Engineer when operating crane with boom and jib or leads 220' or longer.....	\$ 27.27	11.15
GROUP 1.....	\$ 24.32	11.15
GROUP 2.....	\$ 20.63	11.15
Regular crane operator, mechanic, dragline operator, boom truck operator and concrete pump with boom operator.....	\$ 25.29	11.15

HAZARDOUS WASTE REMOVAL CLASSIFICATIONS

GROUP 1: Backhoe, batch plant operator, clamshell, concrete breaker when attached to hoe, concrete cleaning decontamination machine operator, concrete pump, concrete paver, crusher, dozer, elevating grader, endloader, farm tractor (90 h.p. and higher), gradall, grader, heavy equipment robotics operator, loader, pug mill, pumpcrete machines, pump trucks, roller, scraper (self-propelled or tractor drawn), side boom tractor, slip form paver, sloop paver, trencher, ultra high pressure waterjet cutting tool system operator, vactors, vacuum blasting machine operator, vertical lifting hoist, vibrating compaction equipment (self-propelled), and well drilling rig

GROUP 2: Air compressor, concrete breaker when not attached to hoe, elevator, end dumps, equipment decontamination operator, farm tractor (less than 90 h.p), forklift, generator, heater, mulcher, pigs (portable reagent storage tanks), power screens, pumps (water), stationary compressed air plant, sweeper, and welding machine

* IRON0008-006 05/01/2003

	Rates	Fringes
Ironworker, reinforcing and structural General contracts \$10,000,000 or greater.....	\$ 25.07	12.51
General contracts less than \$10,000,000.....	\$ 22.50	12.51

* IRON0008-009 05/01/2003

	Rates	Fringes
Ironworker - pre-engineered metal building erector Contracts \$10,000,000 or greater.....	\$ 25.07	12.51
Contracts less than \$10,000,000.....	\$ 22.50	12.51

LABO0005-021 10/01/2001

	Rates	Fringes
Laborers - hazardous waste abatement: Work performed inside the building and up to and including 5 ft. outside the building: Level A, B or C.....	\$ 19.75	6.06
Work performed in conjunction with site preparation not requiring the use of personal protective equipment; Also, Level D.....	\$ 18.75	6.06
Work performed over 5 ft. outside the building: Level A, B or C.....	\$ 18.93	5.26
Work performed in onjunction with site preparation not requiring the use of personal protective equipment; Also, Level D.....	\$ 17.93	5.26

* LABO0259-004 09/01/2003

	Rates	Fringes
Laborers - tunnel, shaft and caisson: GROUP 1.....	\$ 20.75	8.67
GROUP 2.....	\$ 20.86	8.67
GROUP 3.....	\$ 20.96	8.67
GROUP 4.....	\$ 21.10	8.67
GROUP 5.....	\$ 21.35	8.67
GROUP 6.....	\$ 21.68	8.67
GROUP 7.....	\$ 14.96	8.67

TUNNEL LABORER CLASSIFICATIONS

GROUP 1: Tunnel, shaft and caisson laborer, dump, shanty, hog
house tender, testing (on gas)

GROUP 2: Manhole, headwall, catch basin builder, bricklayer tender, mortar, material mixer, fence erector and guard rail builder

GROUP 3: Air tool operator (jackhammer, bush hammer and grinder), first bottom, second bottom, cage tender, car pusher, carrier, concrete, concrete form, concrete repair, cement invert laborer, cement finisher, concrete shoveler, conveyor, floor, gasoline and electric tool operator, gunite, grout operator, welder, heading dinky person, inside lock tender, pea gravel operator, pump, outside lock tender, scaffold, top signal person, switch person, track, tugger, utility person, vibrator, winch operator, pipe jacking, wagon drill and air track operator and concrete saw operator (under 40 h.p.)

GROUP 4: Tunnel, shaft and caisson mucker, bracer, liner plate, long haul dinky driver and well point

GROUP 5: Tunnel, shaft and caisson miner, drill runner, key board operator, power knife operator, reinforced steel or mesh (e.g. wire mesh, steel mats, dowel bars, etc.)

GROUP 6: Dynamite and powder

GROUP 7: Restoration laborer, seeding, sodding, planting, cutting, mulching and top soil grading; and the restoration of property such as replacing mailboxes, wood chips, planter boxes, flagstones, etc.

SCOPE OF WORK: Tunnel, shaft and caisson work of every type and descripton and all operations incidental thereto, including, but not limited to, shafts and tunnels for sewers, water, subways, transportation, diversion, sewerage, caverns, shelters, aquafers, reservoirs, missile silos and steel sheeting for underground construction.

LABO0260-008 08/01/2001

	Rates	Fringes
Asbestos Laborer Includes removing and disposing of all insulation materials from walls, ceilings, floors, columns, and all other non-mechanical surfaces; and removal of insulating materials from mechanical systems that are to be demolished; loading/unloading of bagged and tagged materials at the disposal site (includes lead paint abatement clean-up).....	\$ 17.73	6.07

* LABO0334-002 09/01/2003

	Rates	Fringes
Laborers - open cut:		
GROUP 1.....	\$ 18.45	6.35
GROUP 2.....	\$ 18.59	6.35
GROUP 3.....	\$ 18.72	6.35
GROUP 4.....	\$ 18.77	6.35
GROUP 5.....	\$ 18.82	6.35
GROUP 6.....	\$ 16.20	6.35
GROUP 7.....	\$ 14.31	6.35

LABORER CLASSIFICATIONS

GROUP 1: Construction laborer

GROUP 2: Mortar and material mixer, concrete form person, signal person, well point person, manhole, headwall and catch basin builder, guard rail builder, headwall, seawall, breakwall, dock builder and fence erector

GROUP 3: Air, gasoline and electric tool operator, vibrator operator, driller, pump person, tar kettle operator, bracer, rodder, reinforced steel or mesh person (e.g., wire mesh, steel mats, dowel bars, etc.), welder, pipe jacking and boring person, wagon drill and air track operator and concrete saw operator (under 40 h.p.), windlass and tugger person and directional boring person

GROUP 4: Trench or excavating grade person

GROUP 5: Pipe layer (including crock, metal pipe, multi-plate or other conduits)

GROUP 6: Grouting person, audio-visual television operations and all other operations in connection with closed circuit television inspection, pipe cleaning and pipe relining work

GROUP 7: Restoration laborer, seeding, sodding, planting, cutting, mulching and top soil grading; and the restoration of property such as replacing mailboxes, wood chips, planter boxes, flagstones, etc.

SCOPE OF WORK:

Open cut construction work shall be construed to mean work which requires the excavation of earth including industrial, commercial and residential building site excavation and preparation, land balancing, demolition and removal of concrete and underground appurtenances, grading, paving, sewers, utilities and improvements; retention, oxidation, flocculation and irrigation facilities, and also including but not limited to underground piping, conduits, steel sheeting for underground construction, and all work incidental thereto, and general excavation.

Open cut construction work shall not include any structural modifications, alterations, additions and repairs to

buildings, or highway work, including roads, streets, bridge construction and parking lots or steel erection work and excavation for the building itself and back filling inside of and within 5 ft. of the building and foundations, footings and piers for the building. Open cut construction work shall not include any work covered under Tunnel, Shaft and Caisson work.

* LABO1329-002 05/01/2003

	Rates	Fringes
Laborers:		
General contracts \$15 million and over:		
GROUP 1.....	\$ 19.80	6.85
GROUP 2.....	\$ 19.90	6.85
GROUP 3.....	\$ 20.20	6.85
GROUP 4.....	\$ 20.35	6.85
GROUP 5.....	\$ 20.55	6.85
GROUP 6.....	\$ 21.85	6.85
General contracts less than \$15 million:		
GROUP 1.....	\$ 18.43	6.85
GROUP 2.....	\$ 18.53	6.85
GROUP 3.....	\$ 18.83	6.85
GROUP 4.....	\$ 18.98	6.85
GROUP 5.....	\$ 19.18	6.85
GROUP 6.....	\$ 20.48	6.85

FOOTNOTE: Work on waterfront work (working over water) on the Great Lakes or connecting waters navigable to lake carriers: \$0.75 per hour additional.

LABORER CLASSIFICATIONS

GROUP 1: All construction laborers on building and heavy construction work, storm and sanitary sewers, tool crib attendant, rod person, oxi-gun operator, worker using propane or acetylene cutting torch, motor-driven buggies, chipping hammers, tamping machines, green cutting (whether run by air, electric or gas), and sandblasters

GROUP 2: Mortar mixer, material mixer (whether done by hand or machine), vibrator operator, concrete mixer, laborer with concrete crew, mixer to pour, including pour from trucks

GROUP 3: Cement gun nozzle operator, blaster, miner, driller, buster operator, layer of all non-metallic pipe

GROUP 4: Caisson worker

GROUP 5: Air track

GROUP 6: Digester, tanks & kilns

* PLUM0190-006 05/01/2003

Rates	Fringes
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Gas Distribution Pipeline		
All other work.....	\$ 17.11	7.12
Welding in conjunction with gas distribution pipeline work.....	\$ 26.25	10.16

* PLUM0506-009 06/01/2003

BARAGA, HOUGHTON, KEWEENAW AND ONTONAGON COUNTIES:

	Rates	Fringes
Pipefitter		
All other work.....	\$ 25.71	12.05
Hvac contracts \$50,000 or less.....	\$ 20.57	12.05

FOOTNOTES: Welders working on Chrome Moly or PP Stamp work:
\$.50 per hour additional.

Workers working in a confined space as defined in Title 29
Code of Federal Regulations 1910.146, and required to wear a
selfcontained breathing apparatus: \$1.00 per hour additional.

Workers working with or around hazardous materials as
specified in Title 29 Code of Federal Regulations 1926.65,
and required to wear protective rubber gloves, boots and a
selfcontained breathing apparatus or a complete hazardous
materials protective bodysuit (Level B or more protective):
\$1.00 per hour additional.

* PLUM0506-010 06/01/2003

GOGEBIC AND IRON COUNTIES:

	Rates	Fringes
Pipefitter		
All other work.....	\$ 25.71	12.05
Hvac contracts \$50,000 or less.....	\$ 20.57	12.05

FOOTNOTES: Welders working on Chrome Moly or PP Stamp work:
\$.50 per hour additional.

Workers working in a confined space as defined in Title 29
Code of Federal Regulations 1910.146, and required to wear a
selfcontained breathing apparatus: \$1.00 per hour additional.

Workers working with or around hazardous materials as
specified in Title 29 Code of Federal Regulations 1926.65,
and required to wear protective rubber gloves, boots and a
selfcontained breathing apparatus or a complete hazardous
materials protective bodysuit (Level B or more protective):
\$1.00 per hour additional.

SHEE0007-019 01/01/2000

Rates	Fringes
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Sheet metal worker.....\$ 22.30 9.87

SUMI2000-006 05/05/2000

	Rates	Fringes
BUILDING CONSTRUCTION (TANK BUILDER).....	\$ 19.50	1.04
Laborer: Chain Saw.....	\$ 14.29	
Landscape Laborer.....	\$ 13.20	4.01
Truck drivers:		
Boom truck.....	\$ 17.40	5.52
Truck driver - 2-axle.....	\$ 16.41	4.30
Truck driver - 3-axle.....	\$ 16.83	7.44
Well Driller (water well).....	\$ 27.59	.13

* TEAM0328-002 05/01/2003

	Rates	Fringes
Truck drivers (does not include boom truck, or two- or three-axle trucks):		
GROUP 1.....	\$ 19.62	3.76/hr.+ 17
GROUP 2.....	\$ 19.77	3.76/hr.+ 17
GROUP 3.....	\$ 19.83	3.76/hr.+ 17
GROUP 4.....	\$ 19.98	3.76/hr.+ 17

PAID HOLIDAYS: Memorial Day, Fourth of July, Labor Day and
Thanksgiving Day, if the regular work day immediately
preceding or following the holiday is either worked or an
excused absence.

TRUCK DRIVER CLASSIFICATIONS

GROUP 1: All other trucks

GROUP 2: Heavy duty and semi trucks

GROUP 3: Truck repair and maintenance

GROUP 4: Euclid type equipment

WELDERS - Receive rate prescribed for craft performing
operation to which welding is incidental.
=====

Unlisted classifications needed for work not included within
the scope of the classifications listed may be added after
award only as provided in the labor standards contract clauses
(29CFR 5.5 (a) (1) (ii)).

In the listing above, the "SU" designation means that rates listed under the identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations

Wage and Hour Division

U.S. Department of Labor

200 Constitution Avenue, N.W.

Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator

U.S. Department of Labor

200 Constitution Avenue, N.W.

Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board

U.S. Department of Labor

200 Constitution Avenue, N.W.

Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

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SECTION 02220a

DEMOLITION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (1996) U.S. Army Corps of Engineers Safety and Health Requirements Manual

1.2 GENERAL REQUIREMENTS

The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Rubbish and debris shall be removed from Government property daily, unless otherwise directed, to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Contracting Officer. In the interest of occupational safety and health, the work shall be performed in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections. In the interest of conservation, salvage shall be pursued to the maximum extent possible (in accordance with Section 01572, CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT, if applicable); salvaged items and materials shall be disposed of as specified. All work activities shall be described in Work Plan, as indicated in SUBMITTALS paragraph.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330, SUBMITTAL PROCEDURES:

SD-03 Product Data

Work Plan; G, AOF

The procedures proposed for the accomplishment of the work. The procedures shall provide for safe conduct of the work, including procedures and methods to provide necessary supports, lateral bracing and shoring when required, careful removal and disposition of materials specified to be salvaged, protection of property which is to remain undisturbed, coordination with other work in progress, and timely disconnection of utility services. The procedures shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of

operations in accordance with EM 385-1-1.

1.4 DUST CONTROL

The amount of dust resulting from demolition shall be controlled to prevent the spread of dust to occupied portions of the construction site and to avoid creation of a nuisance in the surrounding area. Use of water will not be permitted when it will result in, or create, hazardous or objectionable conditions such as ice, flooding and pollution.

1.5 PROTECTION

1.5.1 Protection of Personnel

During the demolition work the Contractor shall continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site. No area, or section will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.5.2 Protection of Structures

Structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, shall remain standing without additional bracing, shoring, or lateral support until demolished, unless directed otherwise by the Contracting Officer. The Contractor shall ensure that no elements determined to be unstable are left unsupported and shall be responsible for placing and securing bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

1.5.3 Protection of Existing Property

Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The Contractor shall take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government; any damaged items shall be repaired or replaced as approved by the Contracting Officer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

1.5.4 Protection of Trees

Trees within the project site which might be damaged during demolition, and which are indicated to be left in place, shall be protected by a 6 foot high fence. The fence shall be securely erected a minimum of 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Any tree designated to remain that is damaged during the work under this contract shall be replaced in kind or as approved by the Contracting Officer.

1.5.5 Environmental Protection

The work shall comply with the requirements of Section 01130, ENVIRONMENTAL PROTECTION.

1.6 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

1.7 USE OF EXPLOSIVES

Use of explosives will be permitted.

1.8 AVAILABILITY OF WORK AREAS

Areas in which the work is to be accomplished will be available in accordance with local requirements.

1.9 CHECK SURVEYS

The Contractor shall verify elevations and dimensions as shown on the construction drawings and notify the COR of any discrepancies. Before beginning any excavation work, the Contractor shall survey the site and examine the drawings and specifications to determine the extend of work. The Contractor shall coordinate the work of this section with all other work.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 EXISTING STRUCTURES

Existing structures indicated shall be removed as indicated. Sidewalks, curbs, gutters and street light bases shall be removed as indicated.

3.2 UTILITIES

When utility lines are encountered that are not indicated on the drawings, the Contracting Officer shall be notified prior to further work in that area.

3.3 FILLING

Holes, and other hazardous openings shall be filled in accordance with Section 02300a, EXCAVATION AND BACKFILL FOR UTILITIES.

3.4 DISPOSITION OF MATERIAL

Title to material and equipment to be demolished, except Government salvage and historical items, is vested in the Contractor upon receipt of notice to proceed. The Government will not be responsible for the condition, loss or damage to such property after notice to proceed.

3.4.1 Salvageable Items and Material

Contractor shall salvage items and material to the maximum extent possible.

3.4.1.1 Material Salvaged for the Contractor

Material salvaged for the Contractor shall be stored as approved by the Contracting Officer and shall be removed from Government property before completion of the contract. Material salvaged for the Contractor shall not be sold on the site.

3.4.1.2 Items Salvaged for the Using Service

Items reserved as property of the using service as directed by the COR shall be removed prior to commencement of work under this contract.

3.4.1.3 Historical Items

Historical items shall be removed in a manner to prevent damage. The following historical items shall be delivered to the Government for disposition: Corner stones, contents of corner stones, and document boxes wherever located on the site.

3.4.2 Unsalvageable Material

Concrete, masonry, and other noncombustible material, except concrete permitted to remain in place, shall be disposed of in the disposal area located and approved by the Contracting Officer. The fill in the disposal area shall remain below elevation and after disposal is completed, the disposal area shall be uniformly graded to drain. Combustible material shall be disposed of off the site.

3.5 CLEAN UP

Debris and rubbish shall be removed from holes and similar excavations. Debris shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

3.6 PAVEMENTS

Existing pavements designated for removal shall be saw cut and removed in accordance with the details shown on the drawings and to the limits and depths indicated on the drawings.

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SECTION 02230a

SITE WORK

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

MICHIGAN DEPARTMENT OF TRANSPORTATION (MDOT)

MDOT SEC 107	Standard Specifications for Construction, "LEGAL RELATIONS AND RESPONSIBILITIES TO THE PUBLIC"; Dated 2003
MDOT SEC 150	Standard Specifications for Construction, "MOBILIZATION"; Dated 2003
MDOT SEC 201	Standard Specifications for Construction, "CLEARING"; Dated 2003
MDOT SEC 202	Standard Specifications for Construction, "REMOVING TREES, STUMPS, AND CORDUROY"; Dated 2003
MDOT SEC 204	Standard Specifications for Construction, "REMOVING MISCELLANEOUS STRUCTURES AND MATERIALS"; Dated 2003
MDOT SEC 205	Standard Specifications for Construction, "ROADWAY EARTHWORK"; Dated 2003
MDOT SEC 208	Standard Specifications for Construction, "SOIL EROSION AND SEDIMENTATION CONTROL"; Dated 2003
MDOT SEC 502	Standard Specifications for Construction, "HOT MIX ASPHALT CONSTRUCTION PRACTICES"; Dated 2003
MDOT SEC 808	Standard Specifications for Construction, "FENCING"; Dated 2003
MDOT SEC 813	Standard Specifications for Construction, "SLOPE PROTECTION"; Dated 2003
MDOT SEC 907	Standard Specifications for Construction, "FENCING MATERIALS"; Dated 2003
MDOT SEC 916	Standard Specifications for Construction, "EROSION CONTROL MATERIALS"; Dated 2003

1.2 DEFINITIONS

1.2.1 Clearing

Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including down timber, snags, brush, and rubbish occurring in the areas to be cleared.

1.2.1.1 Protection of Trees

Existing trees indicated as requiring protection shall be fenced to protect branches, roots, and trunks from construction damage. Root zones shall of existing plants shall be protected from trenching and compaction during construction. The Contractor shall repair any damage to existing trees and shrubs, and replace existing plants which are extensively damaged or die as a result of construction damage. The Contractor shall maintain tree protection during the entire length of construction.

1.2.2 Grubbing

Grubbing shall consist of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas.

1.3 WORK AND STORAGE

The Contractor shall locate and seek approval in writing from the Government for a work and storage area prior to mobilization on-site and will utilize this area as a stockpile/staging area to the maximum extent possible. Under no circumstances shall the work and storage area be located within a regulated wetland area.

As material is excavated, it may be temporarily stockpiled in the work and storage area prior to disposal. The temporary stockpiles shall not exceed 8 feet in height or have a slope greater than 1V:2H. Surface stockpiles shall be maintained in neat and well drained condition. At the completion of the work, all temporarily stockpiled materials shall have been placed in the work, in the required locations, or at a location as directed by the Government. All temporarily stockpiled material is to be removed from it's temporary location and the area finish graded and reseeded in accordance with Section 02921a, SEEDING.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330, SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction Equipment; F, AOF

At least ten (10) calendar days prior to starting work, a list of all equipment, tools and machines, including their sizes, capacities and operating speeds, to be used in the performance of

the work, shall be submitted. All equipment shall be maintained in satisfactory working condition at all times.

Work Plan; G, AOF

At least ten (10) calendar days prior to proceeding with the work at the site, submit a work plan for the work required under this Section. The plan shall include a description of the means, methods, procedures, and sequence in which the required work will be performed. The protective measures which will be taken to prevent damage to areas outside the specified work area shall be described. The proposed location of the Work and Storage area including all necessary documentation from the landowner, to include assurance the location is not within a regulated wetland area. The proposed locations of temporary stockpiles or excavated material shall be described in detail. The locations of equipment storage, vehicle parking, office trailers, and other Contractor facilities shall be described and shown.

Check Survey Reports; F, AOF

A copy of the records of each check survey shall be provided on the next work day following the survey.

Utility Verification; G, AOF

The Contractor shall submit all utility correspondence including verification of buried utilities no later than 10 calendar days following notice to proceed. The Contractor shall also include a schedule of regular meetings anticipated with the utility companies during critical work stages in the vicinity of the buried utilities.

Erosion Control Plan; F, AOF

At least 14 calendar days prior to proceeding with the work at the site, submit an erosion control plan that complies with the Gogebic County Soil Erosion and Sedimentation Control Permit pursuant to Part 91 of the Michigan Natural Resources Environmental Protection Act (P.A. 451 of 1994, as amended).

SD-03 Product Data

Materials Other Than Salable Timber; G, AOF

Written permission to dispose of such products on private property shall be filed with the Contracting Officer.

1.5 EXISTING CONDITIONS

- A. Known underground utilities are indicated on the drawings.
- B. The Contractor shall contact the indicated utilities at least 30 days prior to mobilization on site to locate, identify and mark all buried utilities.
- C. The Contractor shall become familiar with the existing site conditions prior to bidding.

Results of the Contractor's utility verification shall be clearly identified and included in the Contractor's work plan.

1.6 REGULATORY REQUIREMENTS

- A. Conform to applicable code for disposal of debris.
- B. Conform to all federal, state and local permit requirements for construction within the waterway regarding dredged and/or fill material.
- C. Coordinate reconstruction activities including clearing, filling and excavation with utility companies.
- D. The Contractor is responsible for obtaining permits according to MDOT SEC 107. At a minimum, the following permits or certifications are required;

- 1. MDNR (Michigan Department of Natural Resources) Certificate of Approval of Construction in a Floodway

- 2. U.S. Army Corps of Engineers Permit (Section 404 of the Clean Water Act)

1.7 CHECK SURVEYS

The Contractor shall verify elevations and dimensions as shown on the construction drawings and notify the Contracting Officer's Representative (COR) of any discrepancies. Before beginning any excavation work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of work. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain cofferdams, shoring (if required), bracing, and supports as required. The Contractor shall verify all tree removal with the COR in order to minimize removal to the greatest extent possible. Check survey reports shall be submitted in accordance with the SUBMITTALS paragraph.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Tree Protection

Materials for fencing of trees to be protected are at the Contractor's option subject to the approval of the Government. Minimum acceptable materials are standard 42 inch wood and wire snow fence or wire farm fence supported by studded "T" posts.

2.1.2 Fencing

All materials for fencing shall conform to specifications contained in MDOT SEC 808 and MDOT SEC 907.

PART 3 EXECUTION

3.1 MOBILIZATION AND DEMOBILIZATION

Mobilization and demobilization shall conform to specifications contained in MDOT SEC 150. The Contractor shall only mobilize construction equipment as necessary to complete the work.

3.2 EROSION CONTROL

Erosion control shall conform to specifications contained in MDOT SEC 208, MDOT SEC 916, and as follows. Protect existing drainage swales, streams and water impoundments from sediment and pollutants resulting from construction activities. Erosion control materials and methods shall be maintained during construction. Reroute drainage around site to prevent water from coming in contact with disturbed areas. All water leaving the work site shall have less than 50 parts per million (ppm) suspended solids or no visible sediment. Contractor shall provide an erosion control plan as specified in paragraph SUBMITTALS. At a minimum, silt fencing shall be placed around the perimeter of the required construction limits, as indicated on the drawings and in the channel to act as a turbidity curtain during channel excavation operations. The Contractor shall ensure the bottom edge of the silt fencing is buried throughout the duration of construction. All methods of erosion control including, but not limited to, filter bags, sand bags, and silt fencing shall be in accordance with MDOT SEC 208 and dependent on site conditions. Slope protection, if required by the COR, shall be in accordance with MDOT SEC 813.

3.3 TEMPORARY FENCING

Temporary fencing shall conform to specifications contained in MDOT SEC 808, MDOT SEC 907, and as follows. Fencing must be erected around work site to restrict public access. Acceptable types are chain link, high-density polyethylene fencing and wood snow fencing. Gates shall be provided at vehicle access points.

3.4 CLEARING

Clearing shall conform to specifications contained in MDOT SEC 201, and as follows. Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the original ground surface, except such trees and vegetation as may be indicated or directed to be left standing. Trees designated to be left standing within the cleared areas shall be trimmed of dead branches 1-1/2 inches or more in diameter and shall be trimmed of all branches the heights indicated or directed. Limbs and branches to be trimmed shall be neatly cut close to the bole of the tree or main branches. Cuts more than 1-1/2 inches in diameter shall be painted with an approved tree-wound paint. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work.

3.4.1 Tree Protection

A. Fence existing trees to remain at outer edge of tree branching as minimum or as approved by Government.

1. Install tree protection prior to the start of any other construction activities, materials delivery or storage on site.

2. Maintain tree protection throughout project construction and until removal is approved by Government.

B. Protect root zones of existing trees to remain from compaction during

construction.

1. Construction vehicles and/or construction workers vehicle parking, and storage of construction materials is not permitted inside the drip line (spread or branches) of trees to remain. All excavation required within the drip line of trees to remain shall be performed by hand.

2. Construction roads shall not pass beneath the drip line of trees to remain unless approved by COR.

3.4.2 Tree Repair

- A. Remove any branches which are damaged or die as a result of construction.

- B. Make all cuts back to a bud, branch or main trunk.

- C. Make all cuts flush, leaving no stubs. Proper cutting techniques shall be used to prevent bark stripping on adjacent stems or branches.

- D. Trees bruised or scarred during construction shall have the injured cambium layer traced back to living tissue and removed. Wounds should be tapered longitudinally to promote sap flow and healing to entire perimeter of wound.

- E. Smooth and shape all wounds so as not to retain water.

3.4.3 Tree Replacement

- A. Replace any existing trees scheduled to remain which are extensively damaged such as to change the natural habit or shape of the plant; or which die as a result of construction damage.

1. Replace in size and kind any trees 6" and less in diameter measured 6" above the base.

2. Replace trees larger than 6" in diameter with trees of the same kind having a minimum diameter of 6" measured 6" above the base.

3.5 GRUBBING

Grubbing shall conform to specifications contained in MDOT SEC 201, MDOT SEC 202, and as follows. Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas to be paved. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform with the original adjacent surface of the ground.

3.6 TRENCHING

Trenching shall conform to specifications contained in MDOT SEC 205, and as follows.

- A. Trenching within the drip lines of trees to remain should be avoided

whenever possible. If required to properly execute construction, no trenching operations shall exceed the following minimum distances as measured from the base of the plant:

Less than 6" trunk diameter	- 8' min.
6"-12" trunk diameter	- 12' min.
Greater than 12" trunk diameter	- 16' min.

B. Trenching closer to trees than indicated herein shall be approved by the Government prior to trenching. Any trenching required within the drip line of trees, required to execute the work will necessitate tunneling under the larger roots and shall be approved by the COR prior to construction.

3.7 TREE REMOVAL

Tree removal shall conform to specifications contained in MDOT SEC 201, MDOT SEC 202, and as follows. Where indicated or directed, trees and stumps that are designated as trees shall be removed from areas outside those areas designated for clearing and grubbing. This work shall include the felling of such trees and the removal of their stumps and roots as specified in paragraph GRUBBING. Trees shall be disposed of as specified in paragraph DISPOSAL OF MATERIALS.

3.8 DISPOSAL OF MATERIALS

3.8.1 Materials Other Than Salable Timber

Sidewalk removal, logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations shall be promptly disposed of outside the limits of Government-controlled land at the Contractor's responsibility, except when otherwise directed in writing. Burning or burial of material on site is strictly prohibited. Such directive will state the conditions covering the disposal of such products and will also state the areas in which they may be placed. The Contractor shall be responsible for compliance with all Federal, State, and Local laws and regulations related to proper disposal of materials.

3.9 PAVEMENT REMOVAL

Pavement removal shall conform to specifications contained in MDOT SEC 204.

3.10 Pavement Cold Milling

Pavement Cold Milling shall conform to specifications contained in MDOT SEC 502.

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SECTION 02302

EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN CONCRETE PIPE ASSOCIATION (ACPA)

ACPA 01-103 (1990) Concrete Pipe Installation Manual

ASPHALT INSTITUTE (AI)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 14 (1995) Concrete Sewer, Storm Drain, and Culvert Pipe

ASTM C 76 (1997) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

ASTM D 698 (1991) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft (600 kN-m/m))

ASTM D 1556 (1990; R 1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D 1557 (1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft (2,700 kN-m/m))

ASTM D 1586 (1984; R 1992) Penetration Test and Split-Barrel Sampling of Soils

ASTM D 2487 (1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 2855 (1996) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings

ASTM D 2922 (1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

ASTM D 3017 (1996) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

ASTM D 3786 (1987) Hydraulic Bursting Strength of

	Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Tester Method
ASTM D 4253	(1993) Maximum Index Density of Soils Using a Vibratory Table
ASTM D 4254	(1991) Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
ASTM D 4355	(1992) Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
ASTM D 4491	(1996) Water Permeability of Geotextiles by Permittivity
ASTM D 4533	(1991; R 1996) Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	(1991; R 1996) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751	(1995) Determining Apparent Opening Size of a Geotextile
ASTM D 4759	(1988; R 1996) Determining the Specification Conformance of Geosynthetics
ASTM D 4833	(1988; R 1996) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM F 402	(1993) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(1996) Safety and Health Requirements Manual
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MICHIGAN DEPARTMENT OF TRANSPORTATION (MDOT)

MDOT SEC 902	Standard Specification for Construction, "AGGREGATES"; Dated 2003
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1.2 DEFINITIONS

1.2.1 Backfill

Material used in refilling a cut, trench or other excavation.

1.2.2 Cohesive Materials

Soils classified by ASTM D 2487 as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesive only when fines have a plasticity index greater than zero.

1.2.3 Cohesionless Materials

Soils classified by ASTM D 2487 as GW, GP, SW, and SP. Materials classified as GM and SM will be identified as cohesionless only when the fines have a plasticity index of zero.

1.2.4 Compaction

The process of mechanically stabilizing a material by increasing its density at a controlled moisture condition. "Degree of Compaction" is expressed as a percentage of the maximum density obtained by the test procedure described in ASTM D 698 or ASTM D 1557 for general soil types, abbreviated in this specification as "95 percent ASTM D 698 maximum density."

1.2.5 Embankment

A "fill" having a top that is higher than adjoining ground.

1.2.6 Excavation

The removal of soil, rock, or hard material to obtain a specified depth or elevation.

1.2.7 Fill

Specified material placed at a specified degree of compaction to obtain an indicated grade or elevation.

1.2.8 Granular Pipe Bedding

A dense, well-graded aggregate mixture of sand, gravel, or crushed stone (mixed individually, in combination with each other, or with suitable binder soil) placed on a subgrade to provide a suitable foundation for pipe. Granular bedding material may also consist of poorly graded sands or gravels where fast draining soil characteristics are desired.

1.2.9 Hard Material

Weathered rock, dense consolidated deposits, or conglomerate materials (excluding man made materials such as concrete) which are not included in the definition of "rock" but which usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal. Material indicated in the soil boring logs as having a standard penetration resistance as determined by ASTM D 1586 between 60 and 600 blows per foot is arbitrarily defined herein as "Hard Material."

1.2.10 In-Situ Soil

Existing in place soil.

1.2.11 Lift

A layer (or course) of soil placed on top of subgrade or a previously prepared or placed soil in a fill or backfill.

1.2.12 Porous Fill

A granular soil material having a large void ratio when placed and compacted, allowing a free flow of fluid to or from the surrounding soil, with no more than 5 percent of the material passing the No. 200 Sieve.

1.2.13 Refill

Material placed in excavation to correct overcut in depth.

1.2.14 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding 1/2 cubic yard in volume. Removal of "hard material" will not be considered rock excavation because of intermittent use of backhoe-mounted pneumatic hole puncher or rock breaker that is performed merely to increase production. Material identified in the soil boring logs as having a standard penetration resistance as determined by ASTM D 1586 greater than 600 blows per foot is arbitrarily defined herein as "Rock."

1.2.15 Soil

The surface material of the earth's crust resulting from the chemical and mechanical weathering of rock and organic material.

1.2.16 Subgrade

The material in excavation (cuts) and fills (embankments) immediately below any subbase, base, pavement, or other improvement. Also, as a secondary definition, the level below which work above is referenced.

1.2.17 Topsoil

In natural or undisturbed soil formations, the fine-grained, weathered material on the surface or directly below any loose or partially decomposed organic matter. Topsoil may be a dark-colored, fine, silty, or sandy material with a high content of well decomposed organic matter, often containing traces of the parent rock material. Gradation and material requirements specified herein apply to all topsoil references in this contract. The material shall be representative of productive soils in the vicinity.

1.2.18 Unyielding Material

Rock rib, ridge, rock protrusion, or soil with cobbles in the trench bottom requiring a covering of finer grain material or special bedding to avoid bridging in the pipe or conduit.

1.2.19 Unsatisfactory Material

In-Situ soil or other material which can be identified as having insufficient strength characteristics or stability to carry intended loads in the trench without excessive consolidation or loss of stability. Also backfill material which contains refuse, frozen material, large rocks, debris, soluble particles, and other material which could damage the pipe or cause the backfill not to compact. Materials classified as PT, OH, or OL by ASTM D 2487 are unsatisfactory.

1.2.20 Unstable Material

Material in the trench bottom which lacks firmness to maintain alignment and prevent joints from separating in the pipe, conduit, or appurtenance structure during backfilling. This may be material otherwise identified as satisfactory which has been disturbed or saturated.

1.2.21 Working Platform

A layer of compacted crushed rock or natural stone that replaces the in situ soil to provide a stable, uniform bearing foundation for construction equipment to facilitate further site construction.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330, SUBMITTAL PROCEDURES:

SD-06 Test Reports

Trench backfill material tests; G, AOF
Pipe bedding; G, AOF
Material tests; G, AOF
Topsoil tests; G, AOF
Test for moisture-density relation; G, AOF
Density and moisture tests; G, AOF
Subsurface drains granular fill tests; G, AOF
Fill tests; G, AOF
Backfill tests; G, AOF
Granular fill tests; G, AOF

Submit Test reports within 15 days of completion.

SD-07 Certificates

Shoring and sheeting plan; G, AOF
Dewatering plan; G, AOF

Submit plans within 10 days of award of contract.

1.4 REGULATORY REQUIREMENTS

Materials and workmanship specified herein with reference to MDOT State

Standard shall be in accordance with the referenced articles, sections, and paragraphs of the standard except that contractual and payment provisions do not apply. Where the term "Engineer" is used, it shall mean the Contracting Officer. Where the term "state" is used, it shall mean "Federal Government."

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver and store materials in a manner to prevent contamination, segregation, freezing, and other damage. Store synthetic fiber filter fabric to prevent exposure to direct sunlight.

1.6 CRITERIA FOR BIDDING

Base bids on the following criteria:

- a. Surface elevations are as indicated.
- b. No pipes or other man-made obstructions, except those indicated, will be encountered.
- c. The character of the material to be excavated or found in the trench is as indicated. In addition to rock as indicated and as defined in paragraph entitled "Definitions," hard material in the form of conglomerate clay, sand, silt, or gravel will be encountered. Remove such hard material to the lines and grades indicated regardless of the hardness or quantity. Removal of rock to the lines and grades indicated shall be done at the unit price bid for "Rock Excavation." Base bids on cubic yards of rock excavation.
- d. Ground water elevations indicated are those existing at the time subsurface investigations were made and do not necessarily represent ground water elevation at the time of construction.
- e. Suitable backfill and bedding material in the quantities required is not available at the project site.
- f. Blasting will be permitted.

1.7 PROTECTION

1.7.1 Dewatering Plan

Base on site surface and subsurface conditions, available soil and hydrological data.

1.7.2 Utilities

Miss-Dig shall be called three (3) working days prior to the start of construction to verify the location of the existing utilities. Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. Perform work adjacent to utilities as indicated in accordance with procedures outlined by utility company. Excavation made with power-driven equipment is not permitted within two feet of marked utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is

uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

1.8 QUALITY ASSURANCE

1.8.1 Shoring and Sheeting Plan

Describe materials of shoring system to be used. Indicate whether or not components will remain after filling or backfilling. Provide plans, sketches, or details along with calculations by a professional engineer registered in any jurisdiction. Indicate sequence and method of installation and removal.

1.8.2 Dewatering Plan

Describe methods for removing collected water from open trenches and diverting surface water or piped flow away from work area. Record performance and effectiveness of method or system in use and submit weekly. Verify the water being discharged meets the State of Michigan water quality standards.

1.8.3 Test for moisture-density relation

Submit 7 days prior to commencing utility excavation.

1.8.4 Topsoil tests

Submit topsoil tests verifying conformance to required parameters prior to commencing seeding operations.

1.8.5 Density and moisture tests

Submit field test data not listed above sufficiently in advance of construction so as not to delay work. Submit within 14 days of test date.

1.8.6 Trench backfill material tests

Submit field test data not listed above sufficiently in advance of construction so as not to delay work. Submit within 14 days of test date.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

Provide soil materials as specified below free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, ice, or other deleterious and objectionable materials.

2.1.1 Backfill

Bring trenches to grade indicated on the drawings using material, classified as MDOT SEC 902 State Standard.

2.1.1.1 Fill for Subbase Underdrains

Provide clean sand, stone, or gravel fill meeting the following

requirements:

- a. Perforated or slotted wall pipe: Provide fill meeting requirements Class II material as described in MDOT SEC 902 State Standard.

2.1.2 Special Backfill for Structures and Pavements

Backfill trenches under roads, structures, and paved areas with material conforming to class II, MDOT SEC 902 State Standard.

2.1.3 Sand

Clean, coarse-grained sand classified as fine aggregate in accordance with Section gradation 2NS, 2 MS, or 2SS of the MDOT SEC 902 State Standard.

2.1.4 Gravel

Clean, coarsely graded natural gravel, crushed stone or a combination thereof identified as dense-graded coarse aggregates in accordance with Section grade 21AA, 21A, 22A, or 23A of the MDOT SEC 902 State Standard.

2.1.5 General Site Fill, Backfill and Embankment Material

Provide a soil material from the site or borrow that can be readily compacted to the specified densities. Materials shall be classified according to the MDOT SEC 902 State Standard.

2.1.6 Working Platform

Material and thicknesses of working platform for support of construction equipment shall be at the discretion of the construction contractor. The gradation and placement of such material shall not create large void spaces upon which overlying work is indicated to be placed.

2.1.7 Topsoil Material

Salvaged topsoil from stockpile. Furnish additional topsoil from approved sources off the site if stockpiled material is insufficient to complete work indicated.

Free of subsoil, stumps, rocks larger than 3/4 inch in diameter (with maximum 3 percent retained on 1/4 inch sieve), brush, weeds, toxic substances, and other material or substance detrimental to plant growth. Topsoil shall be a natural, friable soil representative of productive soils in the vicinity.

2.1.8 Borrow

Provide materials meeting requirement for pipe bedding, fill, special backfill, sand, gravel, backfill, granular fill, and topsoil. Obtain borrow materials in excess of those furnished from excavations specified herein from approved sources off the site.

2.1.9 Pipe Bedding

TABLE 02302-1 UTILITY EARTHWORK REFERENCES

<u>PIPE MATERIALS</u>	<u>ARMY SPECIFICATION</u>	<u>SOIL MATERIALS REFERENCE</u>	<u>INSTALLATION REF</u>
a. Concrete Gravity, Sewer, Culvert	02630a 02531	ASTM C 76 (Reinforced) ASTM C 14 (Non-Reinforced) Class A, B, or C, bedding material	ACPA 01-103

Provide material for pipe bedding gradation class II of the MDOT SEC 902 State Standard.

2.2 FILTER FABRIC

Provide a pervious sheet of polyester, nylon, glass or polypropylene, ultraviolet resistant filaments woven, spun bonded, fused, or otherwise manufactured into a nonraveling fabric with uniform thickness and strength. Fabric shall have the following manufacturer certified minimum average roll properties as determined by ASTM D 4759:

	<u>Class A</u>	<u>Class B</u>
a. Grab tensile strength (ASTM D 4632) machine and transversed direction	min. 200	90 lbs.
b. Grab elongation (ASTM D 4632) machine and transverse direction	min. 15	15 percent
c. Puncture resistance (ASTM D 4833)	min. 75	45 lbs.
d. Mullen burst strength (ASTM D 3786)	min. 200	140 psi.
e. Trapezoidal Tear (ASTM D 4533)	min. 75	45 lbs.
f. Apparent Opening Size (ASTM D 4751)	min. .21	.21 mm
g. Permeability (ASTM D 4491)	k fabric greater than k soil	
h. U.V. Degradation (ASTM D 4355)	70% Strength retained at 150 hours	

2.3 DETECTION WIRE FOR NON-METALLIC PIPING

Detection wire shall be insulated single strand, solid copper with a minimum diameter of 12 AWG.

2.4 SUBBASE UNDERDRAIN PIPE

Type and size indicated conforming to the requirements specified below:

2.4.1 Plastic Pipe

2.4.1.1 Polyvinyl Chloride (PVC) Perforated Pipe and Fittings

ASTM F 949 with perforations conforming to AASHTO M252. Diameter of pipe shall be as shown on the drawings. Make solvent cement joints in accordance with ASTM D 2855. ASTM F 402 for safe handling of solvent cement.

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Shoring and Sheet piling

Provide shoring bracing trench boxes and sheet piling where indicated. In addition to Section 25 A and B of EM 385-1-1 and other requirements set forth in this contract, include provisions in the shoring and sheet piling plan that will accomplish the following:

- a. Prevent undermining of pavements, foundations and slabs.
- b. Prevent slippage or movement in banks or slopes adjacent to the excavation.

3.1.2 Drainage and Dewatering

Plan for and provide the structures, equipment, and construction for the collection and disposal of surface and subsurface water encountered in the course of construction.

3.1.2.1 Drainage

Surface water shall be directed away from excavation and construction sites so as to prevent erosion and undermining of foundations. Diversion ditches, dikes and grading shall be provided and maintained as necessary during construction. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site and the area immediately surrounding the site and affecting operations at the site shall be continually and effectively drained.

3.1.3 Dewatering

All water being discharged must comply with the State of Michigan water quality standards prior to discharge.

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously, at least 1 foot below the working level.

Operate the dewatering system until construction work below existing water levels is complete. Measure and record the performance of the dewatering system. Have a back-up pump and system available for immediate use.

3.1.4 Underground Utilities

Location of the existing utilities indicated is approximate. The Contractor shall physically verify the location and elevation of the existing utilities indicated prior to starting construction. The Contractor shall contact the "MISS DIG" alert system at (1-800-482-7171) for assistance in locating existing utilities.

3.1.5 Structures and Surfaces

Protect newly backfilled areas and adjacent structures, slopes, or grades from traffic, erosion settlement, or any other damage. Repair and reestablish damaged or eroded grades and slopes and restore surface construction prior to acceptance. Protect existing streams, ditches, and storm drain inlets from water-borne soil by means of filter fabric dams as indicated on the contract drawings. Perform work in accordance with requirements specified in Section 01575, TEMPORARY ENVIRONMENTAL CONTROLS.

3.1.5.1 Disposal of Excavated Material

Dispose of excavated material so that it will not obstruct the flow of runoff, streams, endanger a partly finished structure, impair the efficiency or appearance of any facilities, or be detrimental to the completed work.

3.1.5.2 Stockpile Rock

Stockpile rock from trench excavations in the location indicated and use for constructing sides and bottoms of channels (rip-rap), as directed by Contracting Officer. Remove excess stockpiled rock upon completion of construction.

3.1.6 Channels and Ditches

Construct (rip-rap) rock protection in areas indicated to the lines and thicknesses specified to dissipate stream energy and prevent channel erosion. Place rip-rap in bedding of on a layer of filter fabric.

3.2 SURFACE PREPARATION

3.2.1 Clearing and Grubbing

Perform as specified in Section 02230A, "Site Work."

3.2.2 Stockpiling Topsoil

Strip suitable soil from the site where excavation or grading is indicated and stockpile separately from other excavated material. Material unsuitable for use as topsoil shall be wasted. Locate topsoil so that the material can be used readily for the finished grading. Where sufficient existing topsoil conforming to the material requirements is not available on site, provide borrow materials suitable for use as topsoil. Protect topsoil and keep in segregated piles until needed.

3.2.3 Unsatisfactory Material

Remove organic matter, sod, muck, rubbish, and unsuitable soils under embankments which are less than 3 feet in thickness and under pavements or slabs on grade. Typical depth of removal of such unsuitable material shall be as indicated.

3.2.3.1 Subgrade Proof Rolling

After removal of topsoil or other overburden, proof roll the existing subgrade with six passes of a minimum 15 ton pneumatic-tired roller. Operate the roller in a systematic manner to assure the number of passes over all areas, and at speeds between 2.5 and 3.5 miles per hour. Proof rolling shall be done in the presence of the Contracting Officer. Rutting or pumping shall indicate unsatisfactory material and that material shall be undercut as directed by the Contracting Officer, and replaced with the appropriate fill material. Perform proof rolling only when weather conditions permit. Do not proof roll wet or saturated subgrades. Materials degraded by proof rolling a wet or saturated subgrade shall be replaced by the Contractor as directed by the Contracting Officer at no cost to the Government. Notify the Contracting Officer 3 days prior to proof rolling.

3.2.4 Cutting Pavement, Curbs, and Gutters

Saw cut with neat, parallel, straight lines one foot wider than trench width on each side of trenches and one foot beyond each edge of pits. When the saw cut is within 6 feet of an existing joint, remove pavement to the existing joint.

3.3 GENERAL EXCAVATION AND TRENCHING

Excavate to contours and dimensions indicated. Keep excavations free from water while construction is in progress. Notify the Contracting Officer immediately in writing if it becomes necessary to remove rock or hard, unstable, or otherwise unsatisfactory material to a depth greater than indicated. Make trench sides as nearly vertical as practicable except where sloping of sides is allowed. Sides of trenches shall not be sloped from the bottom of the trench up to the elevation of the top of the pipe. Excavate ledge rock, boulders, and other unyielding material to an overdepth at least 6 inches below the bottom of the pipe and appurtenances unless otherwise indicated or specified. Blasting will be permitted. Overexcavate soft, weak, or wet excavations as indicated. Use bedding material placed in 6 inch maximum layers to refill overdepths to the proper grade. At the Contractor's option, the excavations may be cut to an overdepth of not less than 4 inches and refilled to required grade as specified. Refill excavations cut below the depths indicated with general fill and compact as specified herein. Excavate soil disturbed or weakened by construction operations or soils soften from exposure to weather. Refill with general fill and compact as specified herein. Grade bottom of trenches accurately to provide uniform bearing and support for each section of pipe and structure on undisturbed soil, or bedding material as specified at every point along its entire length except for portions where it is necessary to excavate for bell holes and for making proper joints. Dig bell holes and depressions for joints after trench has been graded. Dimension of bell holes shall be as required for properly making the particular type of joint to ensure that the bell does not bear on the bottom of the excavation. Trench dimensions shall be as indicated.

3.3.1 Shoring and Sheet piling

Shore and sheet excavations as described in the plan submitted with various member sizes arranged to prevent injury to persons and damage to structures. Arrange shoring and sheet piling to preclude injurious caving during removal. Obtain approval from the Contracting Officer prior to

removing shoring, sheeting, or bracing in excavations adjacent to on-grade slabs, foundations, or other structural elements.

3.3.2 Subbase Underdrain Trenches

Excavate in accordance with lines, grades, and sections indicated.

3.4 BORROW MATERIALS

Select borrow materials to meet requirements and conditions of the particular fill or backfill materials to be used. Perform necessary clearing, grubbing, disposal of debris, and satisfactory drainage of borrow pits as incidental operations to the borrow excavation. Obtain borrow materials from sources off the site.

3.5 BEDDING

Of materials and depths as specified for utility lines and utility line structures. Place bedding in 6 inch maximum loose lifts. Provide uniform and continuous support for each section of structure except at bell holes or depressions necessary for making proper joints.

3.6 BURIED DETECTION WIRE

Bury detection wire directly above non-metallic piping at a distance not to exceed 12 inches above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 3 feet of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over its entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal.

3.7 FILLING AND BACKFILLING

3.7.1 Backfilling

Construct backfill in two operations (initial and final) as indicated and specified in this section. Place initial backfill in 6 inch maximum loose lifts to 1 foot above pipe unless otherwise specified. Ensure that initially placed material is tamped firmly under pipe haunches. Bring up evenly on each side and along the full length of the pipe, or structure. Ensure that no damage is done to the utility or its protective coating. Place the remainder of the backfill (final backfill) in 10 inch maximum loose lifts unless otherwise specified. Compact each loose lift as specified in the paragraph entitled "General Compaction" before placing the next lift. Do not backfill in freezing weather or where the material in the trench is already frozen or is muddy, except as authorized. Provide a minimum cover from final grade of 3 feet for water piping, storm drains, and for sewer mains. Where settlements greater than the tolerance allowed herein for grading occur in trenches and pits due to improper compaction, excavate to the depth necessary to rectify the problem, then backfill and compact the excavation as specified herein and restore the surface to the required elevation. Coordinate backfilling with testing of utilities. Testing for the following shall be complete before final backfilling: water distribution, storm drainage, sanitary sewer, and gas distribution systems.

3.7.2 Subgrade Preparation

Scarify the underlying subgrade surface to a depth of 6 inches before the fill is started. Step, bench, or break up sloped surfaces steeper than one vertical to 4 horizontal so that the fill material will bond with or be securely keyed to the existing material. Scarify existing surface to a minimum depth of 6 inches if subgrade density is less than the degree of compaction specified and recompact. When the subgrade is part fill and part excavation or natural ground, scarify the excavated or natural ground portion to a depth of 6 inches and recompact as specified for the adjacent or overlying fill. Compact with equipment well suited to the soil being compacted. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used.

3.7.3 General Fill, and General Backfill

Construct fill, backfill and embankment at the locations and to lines and grades indicated. Use only approved materials in constructing fill on the prepared subgrade. Place satisfactory material in horizontal lifts not exceeding 9 inches in loose depth. Do not place material on surfaces that are muddy, frozen, or contain frost. Compact with equipment well suited to the soil being compacted. Compact each lift as specified before placing the overlying lift.

3.7.4 Fill for Subbase Underdrains

Install drain and construct filter of granular fill as indicated and as described below using materials specified herein. Place granular fill in 6 inch lifts and tamp or vibrate firmly. Place final backfill in trench in 6 inch lifts and compact as specified herein for adjacent or overlying work.

- a. Perforated or Slotted Wall Pipe: Place granular material as the pipe is laid and extend it for a minimum of one pipe diameter on each side of and 18 inches above the top of the pipe. Place filter fabric on top of the granular fill before continuing with the backfill.

3.7.5 Weather Limitations

Fill and backfill shall not be constructed when weather conditions detrimentally affect the quality of the finished course. Place fill and backfill only if the atmospheric temperature is above freezing in the shade and is rising. Do not construct fill and backfill in the rain or on saturated subgrades. If weather conditions are windy, hot or arid, with high rate of evaporation, schedule the placement in cooler portions of the day and furnish equipment to add moisture to the fill or backfill during and after placement.

3.8 INSTALLATION OF PIPE FOR SUBBASE UNDERDRAINS

3.8.1 Pipelaying

Do not lay damaged or defective pipe. Laying of pipe shall proceed upgrade beginning at lower end of the pipeline. Pipe shall not be laid in water or when the trench conditions or weather is unsuitable for such work. Remove water from trenches by sump pumping or other approved methods. Lay pipe to the grades and alignment as indicated. Bed pipe to the established gradeline. Orient perforations on the bottom half of the pipe. Lay bell-and spigot or tongue-and-groove type pipe with the bell or groove end upstream. Obtain approval for pipe in place before backfilling.

3.8.2 Jointing

3.8.2.1 Poly(Vinyl Chloride) (PVC) Pipe

Joints shall be in accordance with the requirements of ASTM D 3212.

3.9 COMPACTION

Use hand-operated, plate-type, vibratory, or other suitable hand tampers in areas not accessible to larger rollers or compactors. Avoid damaging pipes and protective pipe coatings. Compact material in accordance with the following unless otherwise specified. If necessary, alter, change, or modify selected equipment or compaction methods to meet specified compaction requirements. Hydraulic compaction (flooding the trench) shall not be allowed.

3.9.1 Compaction of Material in Subcuts or Overexcavations

In rock, compact to 95 percent of ASTM D 1557 maximum density. In stable soils, compact to 95 percent of maximum density ASTM D 1557.

3.9.2 Compaction of Pipe and Conduit Bedding

In rock, compact to 95 percent and in soil, compact to 95 percent of ASTM D 1557 maximum density.

3.9.3 Compaction of Backfill

Compact initial backfill material surrounding pipes, cables, conduits, or ducts, to 95 percent of ASTM D 698, ASTM D 1557, ASTM D 4254 maximum density except where bedding and backfill are the same material. Where bedding and backfill are the same material, compact initial backfill to the density of the bedding. Under areas to be seeded or sodded, compact succeeding layers of final backfill to 85 percent of ASTM D 698, ASTM D 1557, ASTM D 4254 maximum density. For utilities under structures and pavements compact succeeding layers of final backfill as specified under paragraph entitled "Special Earthwork Installation Requirements."

3.10 SPECIAL EARTHWORK INSTALLATION REQUIREMENTS

3.10.1 Manholes and Other Appurtenances

Provide at least 12 inches clear from outer surfaces to the embankment or shoring. Remove rock as specified herein. Refill overdepths with gravel to the required grade and compact as specified.

3.10.2 Compaction for Structures and Pavements

Place final backfill in 10 inch maximum loose lifts. If a vibratory roller is used for compaction of final backfill, the lift thickness can be increased to 10 inches. Compact all backfill surrounding pipes, ducts, conduits, and other structures to 95 percent of ASTM D 1557 maximum density except compact the top 12 inches of subgrade to 95 percent of ASTM D 1557 maximum density. Backfill to permit the rolling and compacting of the completed excavation with the adjoining material, providing the specified density necessary to enable paving of the area immediately after backfilling has been completed.

3.11 FINISH OPERATIONS

3.11.1 Grading

Finish to grades indicated within one-tenth of a foot. Provide sod or topsoil in areas to be seeded or sodded in accordance with requirements specified in Section 02921a, SEEDING. Grade areas to drain water away from structures and to provide suitable surfaces for mowing machines. Grade existing grades that are to remain but have been disturbed by the Contractor's operations.

3.11.2 Finishing Subgrades Under Structures and Pavements

Finish surface of top lift of fill or top of subgrade to the elevation and cross section indicated. Finished surface shall be smooth and of uniform texture. Lightly scarify or blade the finished surface to bring the finished surface to within 0.083 foot of the indicated grade and to eliminate imprints made by compaction and shaping equipment.

3.11.3 Spreading Topsoil

Clear areas to receive topsoil for the finished surface of materials that would interfere with planting and maintenance operations. Scarify subgrade to a depth of 2 inches. Do not place topsoil when the subgrade is frozen, extremely wet or dry, or in other conditions detrimental to seeding, planting, or grading. Spread topsoil to a uniform depth of 4 inches over the designated areas.

3.11.4 Disposition of Surplus Material

Surplus or other soil material not required or suitable for filling, backfilling, or grading shall be removed to approved location outside of project site. Comply with requirements of Section 01575, TEMPORARY ENVIRONMENTAL CONTROLS.

3.11.5 Protection of Surfaces

Protect newly graded areas from traffic, erosion, and settlements that may occur and as required in Section 01575, "Temporary Environmental Controls." Repair or reestablish damaged grades, elevations, or slopes.

3.11.6 Pavement Repair

Repair pavement, curbs, and gutters as specified in Section 02770a, CONCRETE SIDEWALKS AND CURBS AND GUTTERS. Do not repair pavement until trench or pit has been backfilled and compacted as specified herein. Provide a temporary road surface of gravel over backfilled portion until permanent pavement is repaired. Remove and dispose of temporary road surface material when permanent pavement is placed. As a minimum, maintain one-way traffic on roads and streets crossed by trenches.

3.12 FIELD QUALITY CONTROL

Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. If the Contractor elects to establish testing facilities, no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved by the Contracting Officer. Test sand, gravel, bedding, backfill, and topsoil for

conformance to specified requirements. Test backfill to be used under roads and paved areas for conformance to special requirements. Test bedding and backfill for moisture-density relations in accordance with ASTM D 698, ASTM D 1557 and ASTM D 4253 as specified herein. Perform at least one of each of the required tests for each material provided. Perform sufficiently in advance of construction so as not to delay work. Provide additional tests as specified above for each change of source. Perform density and moisture tests in randomly selected locations and in accordance with ASTM D 1556, ASTM D 2922 and ASTM D 3017 as follows:

- a. Bedding and backfill in trenches: One test per 50 linear feet in each lift.
- b. Appurtenance structures: One test per 100 square feet or fraction thereof in each lift.

Where ASTM D 2922 and ASTM D 3017 are used to test field compaction densities, verify test results by performing at least one test per day using ASTM D 1556 at a location already tested in accordance with ASTM D 2922. Perform at least one additional test using ASTM D 1556 for every ten tests performed with a nuclear device, at locations checked in accordance with ASTM D 2922.

-- End of Section --

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SECTION 02317

ROCK REMOVAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 495 Code for Manufacture, Transportation, Storage, and Use of Explosive Materials.

1.2 MEASUREMENT AND PAYMENT

1.2.1 Rock Removal

A. Basis of Measurement: By the cubic yard measured after removal. Limits of removal shall be pipe diameter plus 2.5 feet for the width and 1 foot below the specified pipe invert for the depth unless otherwise directed by the engineer.

B. Basis of Payment: Includes preparation of rock for removal, explosive or mechanical disintegration of rock, removal from position, loading and removing from site. For over excavation, payment will not be made for over excavated work nor for replacement materials.

1.2.2 DEFINITIONS

A. Site and Trench Rock: Solid mineral material with volume in excess of 0.5 cu yd or solid material that cannot be removed with 3/4 cu yd capacity excavator without drilling or blasting.

B. Rock: Solid mineral material of size that cannot be removed with 3/4 cu yd capacity excavator.

C. Rock Removal: Section includes removal of identified and discovered rock during excavation, and the use of expansive tools or explosives to assist rock removal. The use of explosives will only be permitted after discussion with the Contracting Officer's Representative (COR), the local community and the Michigan State Police as to where and when explosives are to be used. The Contractor shall ensure use of any explosives complies with NFPA 495.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office

that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330, SUBMITTAL PROCEDURES:

SD-01 Permits

Permits; G, AOF

Submit copies of all required permits to the COR for documentation prior to transporting explosives to the work site.

SD-02 Shop Drawings

Shop Drawings; F, AOF

Indicate proposed method of blasting, delay pattern, explosive types, type of blasting mat or cover, and intended rock removal method.

SD-03 Blasting Plans

Blasting Plans; G, AOF

Submit for information not less than 30 days prior to starting a new phase of work a proposed Blasting Plan(s) for accomplishing excavation by use of explosives. The Blasting Plan(s) shall include the following data concerning the proposed blasting operation:

- A. Location, depth, area, anticipated neat lines, and relationship to adjacent excavations and work.
- B. Diameter spacing, burden, depth, pattern and inclination of blast holes.
- C. Type, strength, amount in terms of weight and cartridges of explosives to be used in each hole, on each delay, and total of each blast.
- D. Distribution of charge in each hole and priming of each hole.
- E. Type, sequence, and number of delays; delay pattern, including delays in trunklines; wiring/detonation chord/shock tube diagram including any for blast, size and type of hookup/trunk/signal lines, and lead lines; type and capacity of firing source; type, size and locations of safety switches and lighting gaps if electrical detonators are used.
- F. Scaled range of distance used to calculate scaled range if blast will exceed vibration limits.
- G. Stemming of holes and matting or covering of blast area, including surface detonating chords, shock tubes, and delays.
- H. Qualifications of person directly responsible for supervising loading of shot and for firing it.
- I. Other information required by law, regulation and ordinance.

SD-06 Test Reports

Survey Report; G, AOF

Submit survey report on conditions of buildings near locations of rock removal.

Blasting Records; G, AOF

Complete, maintain, and submit permanent blast reports, including logs of each blast. Complete reports shall be prepared and submitted after each blast and shall include:

- A. Date, time of shot, and limits of blast by depth or station.
- B. Amount of explosive used and number of cartridges.
- C. Total number of delays used, and number of holes used for each delay period.
- D. A diagram of the reviewed blast pattern showing holes not drilled, holes added and drilled but not loaded, changes in spacing or pattern of delays, or in loading of holes.
- E. Total number of holes, maximum charge per hole, and corresponding delay number.
- F. Evaluation of blast including tights, areas of significant overbreak and recommended adjustments to the blast pattern for the next blast.
- G. Other information required by law, regulation or ordinance such as a permit.

1.4 QUALITY ASSURANCE

A. Seismic Survey Firm: Licensed company specializing in seismic surveys with five years documented experience. The independent testing agency, shall be acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:

1. Report types of explosive and size of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operation, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
2. Seismographic monitoring during blasting operations.

B. Explosives Firm: Company specializing in explosives for disintegration of rock, with five years documented experience. The Contractor shall ensure all requirements as described in the required permits are followed at a minimum. The Contractor, in cooperation with the explosives firm, shall submit detailed shop drawings, blasting plans and blasting records in accordance with SUBMITTALS paragraph.

1.5 PROJECT CONDITIONS

A. Conduct survey and document conditions of buildings near locations of rock removal, prior to blasting, and photograph existing conditions identifying existing irregularities. The Contractor shall submit a detailed survey report in accordance with SUBMITTALS paragraph.

B. Advise owners of adjacent buildings or structures in writing, prior to

executing seismographic survey. Explain planned blasting and seismic operations.

C. Obtain seismic survey prior to rock excavation to determine maximum charges that can be used at different locations in area of excavation without damaging adjacent properties or other work.

1.6 SCHEDULING

- A. Schedule Work to avoid disruption to occupied buildings nearby
- B. Conduct blasting operations between hours of 10:00 A.M. and 3:00 P.M. only.

1.7 STORAGE OF EXPLOSIVES

- A. All explosives shall be stored in a secure manner in compliance with all laws and ordinances, and such storage shall be clearly identified. Where no local laws or ordinances may apply, storage shall be provided in a manner satisfactory to the COR, but no closer than 1000 feet from a traveled road, building or other area of human occupancy. Storage of explosives shall be in accordance with NFPA 495.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Explosives

Type recommended by explosive firm following seismic survey and required by authorities having jurisdiction.

2.1.2 Delay Device

Type recommended by explosives firm.

2.1.3 Blast Mat Materials

Type recommended by explosives firm.

PART 3 EXECUTION

3.1 EXAMINATION

Verify site conditions and note subsurface irregularities affecting Work of this section.

3.2 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. The Contractor shall contact all utility owners within the area of proposed blasting and inform them of the intent to use explosives and inquire as to any additional requirements as needed. This contact shall be made as soon as practical in advance of the use of explosives so that the utility company can mobilize to protect their property
- C. The Contractor shall be solely responsible for the safe use of

explosives under this contract, including any structural or other property damage resulting from transportation, storage, and use of explosives in rock excavation, control of fly rock, and control of noise and vibrations from blasting. Storage, transportation and use of explosives shall comply with all requirements of Michigan Occupational Safety and Health Administration (MIOSHA).

3.3 ROCK REMOVAL BY MECHANICAL METHOD

Excavate and remove rock by mechanical method.

- A. Drill holes and use expansive tools or wedges to fracture rock.
- B. Cut away rock at bottom of excavation to form level bearing.
- C. Remove shaled layers to provide sound and unshattered base for sewer pipe and structures.
- D. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.
- E. Remove excavated materials from site.
- F. Correct unauthorized rock removal in accordance with backfilling and compacting requirements of Section 02302N.

3.4 ROCK REMOVAL BY EXPLOSIVE METHODS

- A. Techniques such as the use of proper hole diameter, hole depth, hole angle, burden and spacing distances, types and distribution of explosives, delay intervals and sequence, removal of muck piles between each shot, special handling techniques that may be required as necessary to achieve the desired elevations are the responsibility of the Contractor and should be included in the Blasting Plan. All aspects of blasting shall be specifically designed so that the end product is not damaged from the blasting technique and that the excavation is suitable for the intended purpose, and completely complies with these specifications.
- B. When rock is uncovered requiring explosives method for rock disintegration, notify COR.
- C. Provide seismographic monitoring during progress of blasting operations.
- D. Drill blasting holes within 12 feet of finished slope.
- E. The Contractor shall erect signboards of adequate size stating that blasting operations are taking place in the area and such signs shall be clearly visible at all points of the access to the area. The Contractor shall notify homeowners within 500 feet of the intent to use explosives in the vicinity of their house. Contact shall include door hangers/flyers placed in the mailbox a minimum of 72 hours prior to the intended use of explosives. Contractor shall notify the local municipality of the intent to use explosives a minimum of 48 hours prior to the use of the explosives. Use a reliable warning system incorporating MIOSHA, Standard Audible Signals established for the project, to ensure that all personnel in the area are forewarned of the impending detonation of explosives. Signals of danger shall be given

and displayed before firing any blasts.

F. Disintegrate rock and remove from excavation. All loaded holes shall be exploded at the completion of drilling and loading during working hours. No explosives will be permitted to remain within a loaded hole overnight.

G. Remove rock at excavation bottom to form level bearing.

H. Remove shaled layers to provide sound and unshattered base for sewer pipe and structures.

I. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.

J. Remove excavated material from site.

K. Correct unauthorized rock removal in accordance with backfilling and compacting requirements of Section 02302.

3.5 SAFEGUARDS

A. Exercise extreme care in blasting in the work under this Contract.

B. Obey all rules and regulations for the protection of life and property that may be required by law relative to the transporting, storing and handling of explosives and the firing of blasts.

C. Limit the amount of the explosive charge for each to no larger than necessary to blast the rock it is intended to remove and so place the explosive to minimize the amount of rock breakage outside the lines of the finished work.

3.6 CONTROL OF FLY ROCK

A. Blasting mats, temporary covers or other suitable means shall be used to control fly rock and reduce blast noise. All blast holes shall be properly stemmed and detonating cord covered to control noise.

3.7 NOISE AND VIBRATION CONTROL DURING BLASTING

A. The first blasting operation at each location shall be considered as a test case, and the proper drilling pattern and amount of explosive to be used shall be determined from the vibration test. Further testing and recording shall be made until the proper safe resulting vibration is established.

B. Furnish, install, calibrate, maintain and operate instrumentation for measuring and recording blasting vibrations and air blast over-pressures.

C. The recording instruments shall be a 4-component velocity seismograph, one component of which measures and records air blast over-pressures. Additional instruments shall be provided as necessary to evaluate propagation of blasting vibrations and air blast in different directions. At least one instrument shall be available at each site to record each blast event. All instruments shall be periodically checked for proper calibration and shall be maintained in

first-class working order. Instruments shall be replaced, repaired or re-calibrated when needed and when directed by the COR.

D. The recording shall be taken under the supervision of the Vibration Monitoring consultant. In addition, the consultant shall interpret the readings and shall establish the vibration limitations at the various locations, but under no circumstances shall the limit exceed the value as discussed below, or such lesser limit as established by ordinance or regulation.

E. Provide trained personnel to operate the monitoring equipment and interpret the recordings. Provide names and resumes of personnel to the COR.

F. Conduct all blasting in such a manner as to reduce vibrations which reach adjacent structures and facilities to or below acceptable limits as established by the Contractor, but which shall not exceed the limits as specified below or limits as established by ordinance or regulation, whichever is lower.

1. 0.2 inch per second at a frequency 1 Hertz.
2. 0.5 inch per second at frequencies between 2.6 Hertz and 40 Hertz.
3. Velocities less than that defined by a straight line variation between 1 Hertz and 2.6 Hertz, per 1. and 2. above.

G. Air blast overpressures and impact or impulsive noise (noise of duration less than 1 second) shall not exceed 0.029 pounds per square inch or 140 dB measured with an impact noise meter or seismograph at the edge of the shafts, or limits as established by ordinance or regulation, whichever is lower.

H. Compliance with the vibration and noise levels specified herein shall not relieve the Contractor of his responsibilities with respect to structural or other property damages or his responsibilities under law, ordinance or regulation.

I. Suspend all blasting and submit a report to the COR immediately in the event any recordings indicate a caution or danger classification is being approached. Reduce the size of the loads, use millisecond delay detonators or otherwise cause appropriate measures to be taken to reduce the resulting vibrations to the safe limits.

J. Provide results and interpretation of all blasting records to the COR within 24 hours of blasting.

3.8 BLASTING RECORDS

A. Maintain a record of each blast detonated and make the record available to the COR or his designated representatives at all times. This record shall include the following:

1. Plan of the blast hole spacings, depths of blast holes, and the location of the blast point in relation to project stationing.
2. Drilling record showing any unusual joint or seam conditions

encountered in the rock and/or concrete.

3. Type and strength of explosives, type of blasting caps, and distribution of delays used.

4. Total explosive loadings per round and per group of delays.

5. Comments by blaster in charge regarding any misfires, unusual results, or effects.

6. Prevailing weather conditions at the blast site, including direction and approximate velocity of wind, atmospheric temperature, relative humidity, and cloud conditions at the time of blast.

7. Date and exact firing time of blast.

8. Name of person in responsible charge of loading and firing and blaster permit number.

9. Signature and title of person making record entries.

3.9 FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements: Testing and Inspection Services.

B. Request visual inspection of foundation bearing surfaces by inspection agency and COR before installing subsequent work.

C. Report all complaints to the COR within 24 hours of receipt thereof. Include the name, address, date, time received, date and time of blast complained about, and a brief description of the alleged damages or other circumstances upon which the complaint is predicated in each report.

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SECTION 02531

SANITARY SEWERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 150	(2002) Portland Cement
ASTM C 270	(2001a) Mortar for Unit Masonry
ASTM C 443	(2001) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C 478	(1997) Precast Reinforced Concrete Manhole Sections
ASTM C 94	(2000e2) Ready-Mixed Concrete
ASTM C 923	(2003) Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM C 990	(2001a) Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealers
ASTM D 2321	(2000) Underground Installation of Thermoplastic Pipe for Sewers and other Gravity-Flow Applications
ASTM D 3034	(2000) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1996a) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM F 477	(1999) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 949	(2001) Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS A-A-60005	(1998) Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole
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UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-3	(1992) Recommended Practice for the Installation of Polyvinyl Chloride (PVC) Pressure Pipe (Nominal Diameters 4-36 Inch)
UBPPA UNI-B-6	(1990) Recommended Practice for the Low-Pressure Air Testing of Installed Sewer Pipe

1.2 SYSTEM DESCRIPTION

1.2.1 Sanitary Sewer Gravity Pipeline

Provide mains and laterals of PVC plastic pipe. Provide building connections 4 or 6 inch lines of polyvinyl chloride (PVC) plastic pipe to match existing lateral size.

Provide new and modify existing exterior sanitary gravity sewer piping and appurtenances. Provide each system complete and ready for operation. The exterior sanitary gravity sewer system includes equipment, materials, installation, and workmanship as specified herein. Provide all necessary couplings for the connection of the new service lateral to the existing pipe material at the property line. Provide a cleanout at grade for each lateral. The cleanout shall be located at the property line.

1.3 GENERAL REQUIREMENTS

The construction required herein shall include appurtenant structures and building sewers to points of connection with the building drains 5 feet outside the building to which the sewer system is to be connected. The Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Government. Excavation and backfilling is specified in Section 02302N, EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES. Backfilling shall be accomplished after inspection by the Contracting Officer. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe shall be stored in accordance with the manufacturer's recommendation and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330, SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Precast concrete manhole; G, AOF

Frames, covers, and gratings; G, AOF

SD-03 Product Data

Pipeline materials including joints, fittings, gaskets and couplings; G, AOF

Submit manufacturer's standard drawings or catalog cuts.

SD-07 Certificates

Portland Cement; G, AOF

Certificates of compliance stating the type of cement used in manufacture of concrete pipe, fittings and precast manholes.

Joints; G, AOF

Certificates of compliance stating that the fittings or gaskets used for waste drains or lines designated on the plans are oil resistant.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery and Storage

1.5.1.1 Piping

Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

1.5.1.2 Cement, Aggregate, and Reinforcement

As specified in Section 03307a, CONCRETE FOR MINOR STRUCTURES.

1.5.2 Handling

Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. Take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry, do not drag, pipe to trench.

PART 2 PRODUCTS

2.1 PIPELINE MATERIALS

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 PVC Plastic Gravity Sewer Piping

2.1.1.1 PVC Plastic Gravity Pipe and Fittings

ASTM D 3034, SDR 26, or ASTM F 949 with ends suitable for elastomeric

gasket joints.

2.1.1.2 PVC Plastic Gravity Joints and Jointing Material

Joints shall conform to ASTM D 3212. Gaskets shall conform to ASTM F 477.

2.2 CONCRETE MATERIALS

2.2.1 Cement Mortar

Cement mortar shall conform to ASTM C 270, Type M with Type II cement.

2.2.2 Portland Cement

Portland cement shall conform to ASTM C 150, Type II for concrete used in concrete pipe, concrete pipe fittings, and manholes and type optional with the Contractor for cement used in concrete cradle, concrete encasement, and thrust blocking.

2.2.3 Portland Cement Concrete

Portland cement concrete shall conform to ASTM C 94, compressive strength of 4000 psi at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 2500 psi minimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.

2.3 MISCELLANEOUS MATERIALS

2.3.1 Precast Concrete Manhole.

Precast concrete manhole risers, base sections, and tops shall conform to ASTM C 478; base and first riser shall be monolithic.

2.3.2 Gaskets and Connectors

Gaskets for joints between manhole sections shall conform to ASTM C 443. Resilient connectors for making joints between manhole and pipes entering manhole shall conform to ASTM C 923 or ASTM C 990.

2.3.3 External Preformed Rubber Joint Seals

An external preformed rubber joint seal shall be an accepted method of sealing cast iron covers to precast concrete sections to prevent ground water infiltration into sewer systems. All finished and sealed manholes constructed in accordance with paragraph entitled "Manhole Construction" shall be tested for leakage in the same manner as pipelines as described in paragraph entitled "Leakage Tests." The seal shall be multi-section with a neoprene rubber top section and all lower sections made of Ethylene Propylene Di Monomer (EPDM) rubber with a minimum thickness of 60 mils. Each unit shall consist of a top and bottom section and shall have mastic on the bottom of the bottom section and mastic on the top and bottom of the top section. The mastic shall be a non-hardening butyl rubber sealant and shall seal to the cone/top slab of the manhole/catch basin and over the lip of the casting. Extension sections shall cover up to two more adjusting rings.

2.3.4 Metal Items

2.3.4.1 Frames, Covers, and Gratings for Manholes

FS A-A-60005, cast iron; figure numbers shall be as indicated:

Frames and covers shall be cast iron, ductile iron. Cast iron frames and covers shall be as indicated or shall be of type suitable for the application, circular, without vent holes. The frames and covers shall have a combined weight of not less than 400 pounds. The word "Sewer" shall be stamped or cast into covers so that it is plainly visible.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

3.1.1 General Requirements for Installation of Pipelines

Apply except where specific exception is made in the following paragraphs entitled "Special Requirements."

3.1.1.1 Location

The work covered by this section shall terminate at a point approximately 5 feet from the building, unless otherwise indicated. Where the location of the sewer is not clearly defined by dimensions on the drawings, do not lay sewer line closer horizontally than 10 feet to a water main or service line. Where sanitary sewer lines pass above water lines, encase sewer in concrete for a distance of 10 feet on each side of the crossing, or substitute rubber-gasketed pressure pipe for the pipe being used for the same distance. Where sanitary sewer lines pass below water lines, lay pipe so that no joint in the sewer line will be closer than 3 feet, horizontal distance, to the water line.

a. Sanitary piping installation parallel with water line:

(1) Normal conditions: Sanitary piping or manholes shall be laid at least 10 feet horizontally from a water line whenever possible. The distance shall be measured edge-to-edge.

(2) Unusual conditions: When local conditions prevent a horizontal separation of 10 feet, the sanitary piping or manhole may be laid closer to a water line provided that:

(a) The top (crown) of the sanitary piping shall be at least 18 inches below the bottom (invert) of the water main.

(b) Where this vertical separation cannot be obtained, the sanitary piping shall be constructed of AWWA-approved ductile iron water pipe pressure tested in place without leakage prior to backfilling.

(c) The sewer manhole shall be of watertight construction and tested in place.

b. Installation of sanitary piping crossing a water line:

(1) Normal conditions: Lay sanitary piping crossing water lines to provide a separation of at least 18 inches between the top of the sanitary piping and the bottom of the water line whenever possible.

(2) Unusual conditions: When local conditions prevent a vertical separation described above, use the following construction:

(a) Sanitary piping passing over or under water lines shall be constructed of AWWA-approved ductile iron water pipe, pressure tested in place without leakage prior to backfilling.

(b) Sanitary piping passing over water lines shall, in addition, be protected by providing:

1. A vertical separation of at least 18 inches between the bottom of the sanitary piping and the top of the water line.

2. Adequate structural support for the sanitary piping to prevent excessive deflection of the joints and the settling on and breaking of the water line.

3. That the length, minimum 20 feet, of the sanitary piping be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the water line.

c. Sanitary sewer manholes: No water piping shall pass through or come in contact with any part of a sanitary sewer manhole.

3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 02302N, EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES.

3.1.1.3 Pipe Laying and Jointing

Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Provide proper facilities for lowering sections of pipe into trenches. Lay nonpressure pipe with the bell ends in the upgrade direction. Adjust spigots in bells to give a uniform space all around. Blocking or wedging between bells and spigots will not be permitted. Replace by one of the proper dimensions, pipe or fittings that do not allow sufficient space for installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. The contractor shall use the laser beam method for all pipes 24 inches or less in diameter to check and ensure that pipe invert elevations are as indicated.

Branch connections shall be made by use of regular fittings or solvent cemented saddles as approved. Saddles for PVC pipe shall conform to Table 4 of ASTM D 3034.

3.1.1.4 Connections to Existing Lines

Obtain approval from the Contracting Officer before making connection to existing line. Conduct work so that there is minimum interruption of service on existing line.

3.1.2 Special Requirements

3.1.2.1 Installation of PVC Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the

requirements of ASTM D 2321 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of ASTM D 2321 for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.1.3 Concrete Work

Cast-in-place concrete is included in Section 03307a, CONCRETE FOR MINOR STRUCTURES.

The pipe shall be supported on a concrete cradle, or encased in concrete where indicated or directed.

3.1.4 Manhole Construction

Construct base slab of cast-in-place concrete or use precast concrete base sections. Make inverts in cast-in-place concrete and precast concrete bases with a smooth-surfaced semi-circular bottom conforming to the inside contour of the adjacent sewer sections. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert of as large a radius as manhole size will permit. For cast-in-place concrete construction, either pour bottom slabs and walls integrally or key and bond walls to bottom slab. No parging will be permitted on interior manhole walls. For precast concrete construction, make joints between manhole sections with the gaskets specified for this purpose; install in the manner specified for installing joints in concrete piping. Parging will not be required for precast concrete manholes. Cast-in-place concrete work shall be in accordance with the requirements specified under paragraph entitled "Concrete Work" of this section. Make joints between concrete manholes and pipes entering manholes with the resilient connectors specified for this purpose; install in accordance with the recommendations of the connector manufacturer. Where a new manhole is constructed on an existing line, remove existing pipe as necessary to construct the manhole. Cut existing pipe so that pipe ends are approximately flush with the interior face of manhole wall, but not protruding into the manhole. Use resilient connectors as previously specified for pipe connectors to concrete manholes.

3.1.5 Miscellaneous Construction and Installation

3.1.5.1 Connecting to Existing Manholes

Pipe connections to existing manholes shall be made so that finish work will conform as nearly as practicable to the applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping. The connection shall be centered on the manhole. Holes for the new pipe shall be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe but no larger than 1.5 times the diameter of the pipe. Cutting the manhole shall be done in a manner that will cause the least damage to the walls.

3.1.6 Installations of Wye Branches

The wye branches shall be installed in accordance with the details on the drawings.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications.

3.2.2 Tests for Nonpressure Lines

Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically full circle of light through the pipeline when viewed from the adjoining end of line. When pressure piping is used in a nonpressure line for nonpressure use, test this piping as specified for nonpressure pipe.

3.2.2.1 Leakage Tests

Test lines for leakage by either infiltration tests or exfiltration tests, or by low-pressure air tests. Prior to testing for leakage, backfill trench up to at least lower half of pipe. When necessary to prevent pipeline movement during testing, place additional backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

- a. Infiltration tests and exfiltration tests: Perform these tests in accordance with ASTM F 1417-92. Except where indicated on the drawings, or where directed by the Government.
- b. Low-pressure air tests: Perform tests as follows:
 - (5) PVC plastic pipelines: Test in accordance with UBPPA UNI-B-6. Allowable pressure drop shall be as given in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.

3.2.2.2 Deflection Testing

Perform a deflection test on entire length of installed plastic pipeline upon completion of work adjacent to and over the pipeline, including leakage tests, backfilling, placement of fill, grading, paving, concreting. Deflection of pipe in the installed pipeline under external loads shall not exceed 4.5 percent of the average inside diameter of pipe. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection measuring device. Deflection Testing is required no sooner than thirty (30) days after installation, but not to exceed ninety (90) days after installation. Testing will be coordinated with the Contracting Officer Representative, forty-eight (48) hours in advance of the test being performed.

- a. Pull-through device: This device shall be a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section. Pull-through device may also be of a design promulgated by the Uni-Bell Plastic Pipe Association, provided the device meets the

applicable requirements specified in this paragraph, including those for diameter of the device, and that the mandrel has a minimum of 9 arms. Ball, cylinder, or circular sections shall conform to the following:

- (1) A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.
 - (2) Homogeneous material throughout, shall have a density greater than 1.0 as related to water at 39.2 degrees F, and shall have a surface Brinell hardness of not less than 150.
 - (3) Center bored and through-bolted with a 1/4 inch minimum diameter steel shaft having a yield strength of not less than 70,000 pounds per square inch, with eyes or loops at each end for attaching pulling cables.
 - (4) Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.
- b. Deflection measuring device: Sensitive to 1.0 percent of the diameter of the pipe being tested and shall be accurate to 1.0 percent of the indicated dimension. Deflection measuring device shall be approved prior to use.
 - c. Pull-through device procedure: Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions.
 - d. Deflection measuring device procedure: Measure deflections through each run of installed pipe. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, replace pipe which has excessive deflection and completely retest in same manner and under same conditions.

3.2.3 Tests for Pressure Lines

Test pressure lines in accordance with the applicable standard specified in this paragraph, except for test pressures. For hydrostatic pressure test, use a hydrostatic pressure 50 psi in excess of the maximum working pressure of the system, but not less than 100 psi, holding the pressure for a period of not less than one hour. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test. Test PVC plastic pressure lines in accordance with the requirements of UBPPA UNI-B-3 for pressure and leakage tests, using the allowable leakage given therein.

3.2.4 Field Tests for Concrete

Field testing requirements are covered in Section 03307a, CONCRETE FOR MINOR STRUCTURES.

-- End of Section --

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SECTION 02630A

STORM-DRAINAGE SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 198 (1998) Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 48 (1994a) Gray Iron Castings

ASTM A 536 (1999e1) Ductile Iron Castings

ASTM B 26 (2002) Aluminum-Alloy Sand Castings

ASTM C 32 (1999e1) Sewer and Manhole Brick (Made from Clay or Shale)

ASTM C 55 (1999) Concrete Brick

ASTM C 62 (1997a) Building Brick (Solid Masonry Units Made from Clay or Shale)

ASTM C 139 (1999) Concrete Masonry Units for Construction of Catch Basins and Manholes

ASTM C 231 (1997e1) Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C 270 (1997) Mortar for Unit Masonry

ASTM C 443 (1998) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets

ASTM C 478 (1997) Precast Reinforced Concrete Manhole Sections

ASTM C 923 (1998) Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Materials

ASTM D 1557 (1998) Laboratory Compaction

	Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 1751	(1999) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996e1) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 2922	(1996e1) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1996e1) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330, SUBMITTAL PROCEDURES:

SD-03 Product Data

Placing Pipe; G, AOF

Submit a minimum of 15 days following award of contract printed copies of the manufacturer's recommendations for installation procedures of the material being placed, prior to installation.

SD-04 Samples

Pipe for Culverts and Storm Drains; G, AOF

SD-07 Certificates

Resin Certification; G, AOF
 Pipeline Testing; G, AOF
 Hydrostatic Test on Watertight Joints; G, AOF
 Determination of Density; G, AOF
 Frame and Cover for Gratings; G, AOF

Provide certified copies of test reports no later than 15 days following award of contract demonstrating conformance to applicable pipe specifications, before pipe is installed. Certification on the ability of frame and cover or gratings to carry the imposed live load.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install plastic pipe shall be stored in accordance with the manufacturer's recommendations and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.3.2 Handling

Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

1.4 QUALITY ASSURANCE

Contractor shall submit test report certificates for resin certification, pipeline testing, hydrostatic test on watertight joints, determination of density, and a certificate of loading for frame and cover for gratings.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

2.1.1 Concrete Pipe

ASTM C76, Class II for 18" and 30" pipe, Class III for 12" and 24" pipe, and Class IV for 42" pipe unless otherwise indicated.

2.2 MISCELLANEOUS MATERIALS

2.2.1 Concrete

Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements for 4000 psi concrete under Section 03307a, CAST-IN-PLACE STRUCTURAL CONCRETE. The concrete mixture shall have air content by volume of concrete, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 1-1/2 inches. Air content shall be determined in accordance with ASTM C 231. The concrete covering over steel reinforcing shall not be less than 1 inch thick for covers and not less than 1-1/2 inches thick for walls and flooring. Concrete covering deposited directly against the ground shall have a thickness of at least 3 inches between steel and ground. Expansion-joint filler material shall conform to ASTM D 1751, or ASTM D 1752, or shall be resin-impregnated fiberboard conforming to the physical requirements of ASTM D 1752.

2.2.2 Mortar

Mortar for pipe joints, connections to other drainage structures, and brick or block construction shall conform to ASTM C 270, Type M, except that the maximum placement time shall be 1 hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar. Water shall be clean and free of harmful acids, alkalies, and organic impurities.

The mortar shall be used within 30 minutes after the ingredients are mixed with water. The inside of the joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with a proper covering until satisfactorily cured.

2.2.3 Precast Concrete Segmental Blocks

Precast concrete segmental block shall conform to ASTM C 139, not more than 8 inches thick, not less than 8 inches long, and of such shape that joints can be sealed effectively and bonded with cement mortar.

2.2.4 Brick

Brick shall conform to ASTM C 62, Grade SW; ASTM C 55, Grade S-I or S-II; or ASTM C 32, Grade MS. Mortar for jointing and plastering shall consist of one part portland cement and two parts fine sand. Lime may be added to the mortar in a quantity not more than 25 percent of the volume of cement. The joints shall be filled completely and shall be smooth and free from surplus mortar on the inside of the structure. Brick structures shall be plastered with 1/2 inch of mortar over the entire outside surface of the walls. For square or rectangular structures, brick shall be laid in stretcher courses with a header course every sixth course. For round structures, brick shall be laid radially with every sixth course a stretcher course.

2.2.5 Precast Reinforced Concrete Manholes

Precast reinforced concrete manholes shall conform to ASTM C 478. Joints between precast concrete risers and tops shall be made with flexible watertight, rubber-type gaskets meeting the requirements of paragraph JOINTS.

2.2.6 Frame and Cover for Gratings

Frame and cover for gratings shall be cast gray iron, ASTM A 48, Class 35B; cast ductile iron, ASTM A 536, Grade 65-45-12; or cast aluminum, ASTM B 26, Alloy 356.OT6. Weight, shape, size, and waterway openings for grates and curb inlets shall be as indicated on the plans.

2.2.7 Joints

2.2.7.1 Flexible Watertight Joints

- a. Materials: Flexible watertight joints shall be made with rubber gaskets for concrete pipe. The design of joints and the physical requirements for shall conform to ASTM C 443. Gaskets shall have not more than one factory-fabricated splice.
- b. Test Requirements: Watertight joints shall be tested and shall meet test requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS. Rubber gaskets shall comply with the oil resistant gasket requirements of ASTM C 443. Certified copies of test results shall be delivered to the Contracting Officer before gaskets or jointing materials are installed. Alternate types of watertight

joint may be furnished, if specifically approved.

2.3 RESILIENT CONNECTORS

Flexible, watertight connectors used for connecting pipe to manholes and inlets shall conform to ASTM C 923.

2.4 HYDROSTATIC TEST ON WATERTIGHT JOINTS

2.4.1 Concrete Pipe

A hydrostatic test shall be made on the watertight joint types as proposed.

Only one sample joint of each type needs testing; however, if the sample joint fails because of faulty design or workmanship, an additional sample joint may be tested. During the test period, gaskets or other jointing material shall be protected from extreme temperatures which might adversely affect the performance of such materials. Performance requirements for joints in reinforced and nonreinforced concrete pipe shall conform to AASHTO M 198 or ASTM C 443.

PART 3 EXECUTION

3.1 EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Section 02302N, EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES and the requirements specified below.

3.1.1 Trenching

The width of trenches shall conform to MDOT R-85-B to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheeting and bracing, where required, shall be placed within the trench width as specified. Contractor shall not overexcavate. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures will be necessary. Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Government.

3.1.2 Removal of Rock

Rock in either ledge or boulder formation shall be replaced with suitable materials to provide a compacted earth cushion having a thickness between unremoved rock and the pipe of at least 8 inches or 1/2 inch for each foot of fill over the top of the pipe, whichever is greater, but not more than three-fourths the nominal diameter of the pipe. Where bell-and-spigot pipe is used, the cushion shall be maintained under the bell as well as under the straight portion of the pipe. Rock excavation shall be as specified and defined in Section 02302N, EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES.

3.1.3 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Contracting Officer, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING. When removal of unstable

material is due to the fault or neglect of the Contractor in his performance of shoring and sheeting, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the government.

3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

3.2.1 Concrete Pipe Requirements

Bell holes and depressions for joints shall be not more than the length, depth, and width required for properly making the particular type of joint.

3.3 PLACING PIPE

Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary.

3.3.1 Concrete Pipe

Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.

3.4 JOINTING

3.4.1 Concrete Pipe

3.4.1.1 Flexible Watertight Joints

Gaskets and jointing materials shall be as recommended by the particular manufacturer in regard to use of lubricants, cements, adhesives, and other special installation requirements. Surfaces to receive lubricants, cements, or adhesives shall be clean and dry. Gaskets and jointing materials shall be affixed to the pipe not more than 24 hours prior to the installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Gaskets and jointing materials shall be inspected before installing the pipe; any loose or improperly affixed gaskets and jointing materials shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pushed home. If, while the joint is being made the gasket becomes visibly dislocated the pipe shall be removed and the joint remade.

3.4.1.2 External Sealing Band Joint for Noncircular Pipe

Surfaces to receive sealing bands shall be dry and clean. Bands shall be installed in accordance with manufacturer's recommendations.

3.5 DRAINAGE STRUCTURES

3.5.1 Manholes and Inlets

Construction shall be of reinforced concrete, plain concrete, brick,

precast reinforced concrete, precast concrete segmental blocks, complete with frames and covers or gratings; and with fixed galvanized steel ladders where indicated. Pipe connections to concrete manholes and inlets shall be made with flexible, watertight connectors.

3.5.2 Walls and Headwalls

Construction shall be as indicated.

3.6 BACKFILLING

3.6.1 Backfilling Pipe in Trenches

After the pipe has been properly bedded, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 6 inches in compacted depth. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe. The fill shall be thoroughly compacted under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compacting shall continue until the fill has reached an elevation of at least 12 inches above the top of the pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding 12 inches. Tests for density shall be made as necessary to ensure conformance to the compaction requirements specified below. Where it is necessary, in the opinion of the Contracting Officer, that sheeting or portions of bracing used be left in place, the contract will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.

3.6.2 Backfilling Pipe in Fill Sections

For pipe placed in fill sections, backfill material and the placement and compaction procedures shall be as specified below. The fill material shall be uniformly spread in layers longitudinally on both sides of the pipe, not exceeding 6 inches in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 12 inches above the top of the pipe shall extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 12 feet, whichever is less. After the backfill has reached at least 12 inches above the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted in layers not exceeding 12 inches.

3.6.3 Movement of Construction Machinery

When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

3.6.4 Compaction

3.6.4.1 General Requirements

Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clays,

silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils will show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.

3.6.4.2 Minimum Density

Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted at the approved moisture content to the following applicable minimum density, which will be determined as specified below.

- a. Under paved roads, streets, parking areas, and similar-use pavements including adjacent shoulder areas, the density shall be not less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material, up to the elevation where requirements for pavement subgrade materials and compaction shall control.
- b. Under unpaved or turfed traffic areas, density shall not be less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material.
- c. Under nontraffic areas, density shall be not less than that of the surrounding material.

3.6.5 Determination of Density

Testing shall be the responsibility of the Contractor and performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Tests shall be performed in sufficient number to ensure that specified density is being obtained. Laboratory tests for moisture-density relations shall be made in accordance with ASTM D 1557 except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017 or ASTM D 2922. Test results shall be furnished the Contracting Officer. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

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SECTION 02721A

SUBBASE COURSES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO T 180 (1997) Moisture-Density Relations of Soils
Using a 10-lb Rammer and an 18-in Drop

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29 (1997) Bulk Density ("Unit Weight") and
Voids in Aggregates

ASTM C 117 (1995) Materials Finer Than No. 200 Sieve
in Mineral Aggregates by Washing

ASTM C 131 (1996) Resistance to Degradation of
Small-Size Coarse Aggregate by Abrasion
and Impact in the Los Angeles Machine

ASTM C 136 (1996) Sieve Analysis of Fine and Coarse
Aggregates

ASTM D 75 (1987; R 1997) Sampling Aggregates

ASTM D 422 (1963; R 1998) Particle-Size Analysis of
Soils

ASTM D 1556 (1990; R 1996el) Density and Unit Weight
of Soil in Place by the Sand-Cone Method

ASTM D 1557 (1998) Laboratory Compaction
Characteristics of Soil Using Modified
Effort (56,000 ft-lbf/cu. ft. (2,700
kN-m/cu.m.))

ASTM D 2487 (1998) Classification of Soils for
Engineering Purposes (Unified Soil
Classification System)

ASTM D 2922 (1996el) Density of Soil and
Soil-Aggregate in Place by Nuclear Methods
(Shallow Depth)

ASTM D 3017 (1988; R 1996e1) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

ASTM D 4318 (1998) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

ASTM E 11 (1995) Wire-Cloth Sieves for Testing Purposes

MICHIGAN DEPARTMENT OF TRANSPORTATION (MDOT)

MDOT SEC 902 Standard Specifications for Construction, "AGGREGATES"; Dated 2003

MSG Material Source Guide; Dated 2003

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330, SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment; G, AOF

Within 15 days following the award of contract provide a list of proposed equipment to be used in performance of construction work, including descriptive data.

Waybills and Delivery Tickets; G, AOF

Within 15 days following the award of contract provide copies of waybills and delivery tickets during the progress of the work. Certified waybills and delivery tickets for all aggregates actually used.

SD-06 Test Reports

Sampling and Testing; G, AOF

Copies of initial and in-place test results.

1.3 DEGREE OF COMPACTION

Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 and AASHTO T 180, Method D. In this specification, degree of compaction shall be a percentage of laboratory maximum density.

1.4 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved testing laboratory in accordance with Section 01451, CONTRACTOR QUALITY CONTROL. Tests shall be performed at the specified frequency. No work requiring testing will be

permitted until the testing laboratory has been inspected and approved. The materials shall be tested to establish compliance with the specified requirements.

1.4.1 Sampling

Samples for laboratory testing shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.4.2 Tests

1.4.2.1 Sieve Analysis

Sieve analysis shall be made in conformance with ASTM C 117 and ASTM C 136 and ASTM D 422. Sieves shall conform to ASTM E 11.

1.4.2.2 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318.

1.4.2.3 Moisture-Density Determinations

The maximum density and optimum moisture shall be determined in accordance with ASTM D 1557 and AASHTO T 180, Method D.

1.4.2.4 Density Tests

Density shall be field measured in accordance with ASTM D 1556 and ASTM D 2922. The base plate, as shown in the drawing shall be used. The calibration curves shall be checked and adjusted, if necessary, using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with ASTM D 2922 result in a wet unit weight of soil and, when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration, in ASTM D 2922, on each different type of material to be tested at the beginning of a job and at intervals as directed.

1.4.2.5 Wear Test

Wear tests shall be made on subbase course material in conformance with ASTM C 131.

1.4.2.6 Weight of Slag

Weight per cubic foot of slag shall be determined in accordance with ASTM C 29 on the subbase course material.

1.4.3 Testing Frequency

1.4.3.1 Initial Tests

One of each of the following tests shall be performed on the proposed material prior to commencing construction to demonstrate that the proposed

material meets all specified requirements prior to installation.

- a. Sieve Analysis including 0.02 mm size material
- b. Liquid limit and plasticity index moisture-density relationship

1.4.3.2 In-Place Tests

One of each of the following tests shall be performed on samples taken from the placed and compacted subbase course. Samples shall be taken in accordance with MSG.

- a. Sieve Analysis including 0.02 mm size material
- b. Field Density
- c. Moisture liquid limit and plasticity index

1.4.4 Approval of Material

The source of the material shall be selected from an approved source or passing gradation received at least 1 week prior to incorporation. Approval of the materials will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and compacted subbase course. The Contractor shall submit all material waybills and delivery tickets in accordance with SUBMITTALS paragraph.

1.5 WEATHER LIMITATIONS

Construction shall be done when the atmospheric temperature is above 35 degrees F. When the temperature falls below 35 degrees F, the Contractor shall protect all completed areas by approved methods against detrimental effects of freezing. Completed areas damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

1.6 EQUIPMENT

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Subbase Course

Aggregates shall consist of crushed stone or slag, gravel, shell, sand, or other sound, durable, approved materials processed and blended or naturally combined. Aggregates shall be durable and sound, free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign material. Material retained on the No. 4 sieve shall have a percentage of wear not to exceed 50 percent after 500 revolutions when tested as specified in ASTM C 131. Aggregate shall be reasonably uniform in density and quality. Slag shall be an air-cooled, blast-furnace product having a dry weight of not less than 65 pcf. Aggregates shall have a maximum size of 1.5 inch and shall be within the limits specified in MDOT SEC 902.

The portion of any blended component and of the completed course passing

the No. 40 sieve shall be either nonplastic or shall have a liquid limit not greater than 25 and a plasticity index not greater than 5 and shall be within the limits specified in MDOT SEC 902.

PART 3 EXECUTION

3.1 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Contracting Officer so as to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

3.2 PREPARATION OF UNDERLYING MATERIAL

Prior to constructing the subbase course, the underlying course or subgrade shall be cleaned of all foreign substances. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. Ruts, or soft yielding spots, in the underlying courses, subgrade areas having inadequate compaction, and deviations of the surface from the specified requirements, shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses or subgrades containing sands or gravels, as defined in ASTM D 2487, the surface shall be stabilized prior to placement of the subbase course. Stabilization shall be accomplished by mixing subbase-course material into the underlying course, and compacting by approved methods. The stabilized material shall be considered as part of the underlying course and shall meet all requirements for the underlying course. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the subbase course is placed.

3.3 GRADE CONTROL

The finished and completed subbase course shall conform to the lines, grades, and cross sections shown. The lines, grades, and cross sections shown shall be maintained by means of line and grade stakes placed by the Contractor at the work site.

3.4 MIXING AND PLACING MATERIALS

The materials shall be mixed and placed to obtain uniformity of the subbase material at the water content specified. The Contractor shall make such adjustments in mixing or placing procedures or in equipment as may be directed to obtain the true grades, to minimize segregation and degradation, to reduce or accelerate loss or increase of water, and to insure a satisfactory subbase course.

3.5 LAYER THICKNESS

The compacted thickness of the completed course shall be as indicated. When a compacted layer of 6 inches is specified, the material may be placed in a single layer; when a compacted thickness of more than 10 inches is required, no layer shall exceed 10 inches.

3.6 COMPACTION

Each layer of the subbase course shall be compacted as specified with approved compaction equipment. Water content shall be maintained during the compaction procedure at a moisture content less than saturation, as determined from laboratory tests, as specified in paragraph SAMPLING AND TESTING. In all places not accessible to the rollers, the mixture shall be compacted with hand-operated power tampers. Compaction shall continue until each layer is compacted through the full depth to at least 95 percent of laboratory maximum density. The Contractor shall make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory subbase course. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

3.7 PROOF ROLLING

Areas designated on the drawings to be proof rolled shall receive an application of 30 coverages with a heavy pneumatic-tired roller having four or more tires abreast, each tire loaded to a minimum of 30,000 pounds and inflated to a minimum of 150 psi. A coverage is defined as the application of one tire print over the designated area. In the areas designated, proof rolling shall be applied to the top layer of the subbase course. Water content of the top layer of the subbase course shall be maintained at a moisture content less than saturation, as determined from laboratory tests, as specified in paragraph SAMPLING AND TESTING. Any material in the subbase courses or underlying materials indicated to be unsatisfactory by the proof rolling shall be removed, dried, and recompact, or removed and replaced with satisfactory materials.

3.8 EDGES

Approved material shall be placed along the edges of the subbase course in such quantity as will compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, at least a 1 foot width of the shoulder shall be rolled and compacted simultaneously with the rolling and compacting of each layer of the subbase course, as directed.

3.9 SMOOTHNESS TEST

The surface of each layer shall not show deviations in excess of 3/8 inch when tested with a 12 foot straightedge applied parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding this amount shall be corrected by removing material, replacing with new material, or reworking existing material and compacting, as directed.

3.10 THICKNESS CONTROL

The completed thickness of the subbase course shall be in accordance with the thickness and grade indicated on the drawings. The thickness of each course shall be measured at intervals providing at least one measurement for each 500 square yards or part thereof of subbase course. The thickness measurement shall be made by test holes, at least 3 inches in diameter through the course. The completed subbase course shall not be more than 1/2 inch deficient in thickness nor more than 1/2 inch above or below the established grade. Where any of these tolerances are exceeded, the

Contractor shall correct such areas by scarifying, adding new material of proper gradation or removing material, and compacting, as directed. Where the measured thickness is 1/2 inch or more thicker than shown, the course will be considered as conforming with the specified thickness requirements plus 1/2 inch. The average job thickness shall be the average of the job measurements as specified above but within 1/4 inch of the thickness shown.

3.11 MAINTENANCE

The subbase course shall be maintained in a satisfactory condition until accepted.

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SECTION 02722A

AGGREGATE AND/OR GRADED-CRUSHED AGGREGATE BASE COURSE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO T 180	(1997) Moisture-Density Relations of Soils Using a 10-lb Rammer and an 18-in Drop
AASHTO T 224	(1996) Correction for Coarse Particles in the Soil Compaction Test

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29	(1997) Bulk Density ("Unit Weight") and Voids in Aggregates
ASTM C 88	(1999a) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 117	(1995) Materials Finer Than No. 200 Sieve in Mineral Aggregates by Washing
ASTM C 127	(1988; R 1993e1) Specific Gravity and Absorption of Course Aggregate
ASTM C 128	(1997) Specific Gravity and Absorption of Fine Aggregate
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 75	(1987; R 1997) Sampling Aggregates
ASTM D 422	(1963; R 1998) Particle-Size Analysis of Soils
ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991; R 1998) Laboratory Compaction

Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft.)

ASTM D 2487	(2000) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996el) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1996el) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(2000) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM E 11	(1995) Wire-Cloth Sieves for Testing Purposes

MICHIGAN DEPARTMENT OF TRANSPORTATION (MDOT)

MDOT SEC 902	Standard Specifications for Construction, "AGGREGATES"; Dated 2003
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1.2 DEFINITIONS

For the purposes of this specification, the following definitions apply.

1.2.1 Aggregate Base Course

Aggregate base course (ABC) is well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction.

1.2.2 Graded-crushed Aggregate Base Course

Graded-crushed aggregate (GCA) base course is well graded, crushed, durable aggregate uniformly moistened and mechanically stabilized by compaction. GCA is similar to ABC, but it has more stringent requirements and it produces a base course with higher strength and stability.

1.2.3 Degree of Compaction

Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 and AASHTO T 180, Method D and corrected with AASHTO T 224.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330, SUBMITTAL PROCEDURES:

SD-03 Product Data

Plant, Equipment, and Tools; G, AOF

Within 15 days of award of contract provide a list of proposed equipment to be used in performance of construction work, including descriptive data.

Waybills and Delivery Tickets; G, AOF

Provide copies of waybills and delivery tickets during the progress of the work. Before the final statement is allowed, the Contractor shall file certified waybills and certified delivery tickets for all aggregates actually used.

SD-06 Test Reports

Sampling and testing; G, AOF
Field Density Tests; G, AOF

Calibration curves and related test results prior to using the device or equipment being calibrated. Copies of field test results within 24 hours after the tests are performed. Certified copies of test results for approval not less than 30 days before material is required for the work.

1.4 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by a testing laboratory approved in accordance with Section 01451, CONTRACTOR QUALITY CONTROL. Work requiring testing will not be permitted until the testing laboratory has been inspected and approved. The materials shall be tested to establish compliance with the specified requirements; testing shall be performed at the specified frequency. The Contracting Officer may specify the time and location of the tests. Copies of test results shall be furnished to the Contracting Officer within 24 hours of completion of the tests.

1.4.1 Sampling

Samples for laboratory testing shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.4.2 Tests

The following tests shall be performed in conformance with the applicable standards listed.

1.4.2.1 Sieve Analysis

Sieve analysis shall be made in conformance with ASTM C 117 and ASTM C 136. Sieves shall conform to ASTM E 11. Particle-size analysis of the soils shall also be completed in conformance with ASTM D 422.

1.4.2.2 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318.

1.4.2.3 Moisture-Density Determinations

The maximum density and optimum moisture content shall be determined in accordance with ASTM D 1557 and AASHTO T 180, Method D and corrected with AASHTO T 224. To maintain the same percentage of coarse material, the "remove and replace" procedure as described in the NOTE 8 in Paragraph 7.2 of AASHTO T 180 shall be used..

1.4.2.4 Field Density Tests

Density shall be field measured in accordance with ASTM D 1556 ASTM D 2922.

For the method presented in ASTM D 1556 the base plate as shown in the drawing shall be used. For the method presented in ASTM D 2922 the calibration curves shall be checked and adjusted if necessary using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with ASTM D 2922 result in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration of ASTM D 2922, on each different type of material being tested at the beginning of a job and at intervals as directed.

1.4.2.5 Wear Test

Wear tests shall be made on ABC and GCA course material in conformance with ASTM C 131.

1.4.2.6 Soundness

Soundness tests shall be made on GCA in accordance with ASTM C 88.

1.4.2.7 Weight of Slag

Weight per cubic foot of slag shall be determined in accordance with ASTM C 29 on the ABC and GCA course material.

1.4.3 Testing Frequency

1.4.3.1 Initial Tests

One of each of the following tests shall be performed on the proposed material prior to commencing construction to demonstrate that the proposed material meets all specified requirements when furnished. If materials from more than one source are going to be utilized, this testing shall be completed for each source.

- a. Sieve Analysis including No. 635 size material.
- b. Liquid limit and plasticity index.
- c. Moisture-density relationship.

1.4.3.2 In Place Tests

Each of the following tests shall be performed on samples taken from the placed and compacted ABC and GCA. Samples shall be taken and tested at the rates indicated.

a. Density tests shall be performed on every lift of material placed and at a frequency of one set of tests for every 250 square yards, or portion thereof, of completed area.

b. Sieve Analysis including No. 635 size material shall be performed for every 500 tons, or portion thereof, of material placed.

c. Liquid limit and plasticity index tests shall be performed at the same frequency as the sieve analysis.

1.4.4 Approval of Material

The source of the material shall be selected from an approved source or possible gradation received at least 1 week prior to incorporation. Tentative approval of material will be based on initial test results. Final approval of the materials will be based on sieve analysis, liquid limit, and plasticity index tests performed on samples taken from the completed and fully compacted ABC and GCA. The Contractor shall submit material waybills and delivery tickets in accordance with SUBMITTALS paragraph.

1.5 WEATHER LIMITATIONS

Construction shall be done when the atmospheric temperature is above 35 degrees F. When the temperature falls below 35 degrees F, the Contractor shall protect all completed areas by approved methods against detrimental effects of freezing. Completed areas damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

1.6 PLANT, EQUIPMENT, AND TOOLS

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

PART 2 PRODUCTS

2.1 AGGREGATES

The ABC and GCA shall consist of clean, sound, durable particles of crushed stone, crushed slag, crushed gravel, crushed recycled concrete, angular sand, or other approved material. ABC shall be free of lumps of clay, organic matter, and other objectionable materials or coatings. GCA shall be free of silt and clay as defined by ASTM D 2487, organic matter, and other objectionable materials or coatings. The portion retained on the No. 4 sieve shall be known as coarse aggregate; that portion passing the No. 4 sieve shall be known as fine aggregate.

2.1.1 Coarse Aggregate

Coarse aggregates shall be angular particles of uniform density. When the coarse aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements and shall be stockpiled separately.

a. Crushed Gravel: Crushed gravel shall be manufactured by crushing

gravels, and shall meet all the requirements specified below.

b. Crushed Stone: Crushed stone shall consist of freshly mined quarry rock, and shall meet all the requirements specified below.

c. Crushed Recycled Concrete: Crushed recycled concrete shall consist of previously hardened portland cement concrete or other concrete containing pozzolanic binder material. The recycled material shall be free of all reinforcing steel, bituminous concrete surfacing, and any other foreign material and shall be crushed and processed to meet the required gradations for coarse aggregate. Crushed recycled concrete shall meet all other applicable requirements specified below.

d. Crushed Slag: Crushed slag shall be an air-cooled blast-furnace product having an air dry unit weight of not less than 65 pcf as determined by ASTM C 29, and shall meet all the requirements specified below.

2.1.1.1 Aggregate Base Course

ABC coarse aggregate shall not show more than 50 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C 131. The amount of flat and elongated particles shall not exceed 30 percent. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, the crushed aggregates shall contain at least 50 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the piece. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Crushed gravel shall be manufactured from gravel particles 50 percent of which, by weight, are retained on the maximum size sieve listed in MDOT SEC 902.

2.1.1.2 Graded-Crushed Aggregate Base Course

GCA coarse aggregate shall not show more than 50 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C 131. GCA coarse aggregate shall not exhibit a loss greater than 50 percent weighted average, at five cycles, when tested for soundness in magnesium sulfate in accordance with ASTM C 88. The amount of flat and elongated particles shall not exceed 20 percent for the fraction retained on the 1/2 inch sieve nor 20 percent for the fraction passing the 1/2 inch sieve. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, the crushed aggregate shall contain at least 90 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the piece. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Crushed gravel shall be manufactured from gravel particles 90 percent of which by weight are retained on the maximum size sieve listed in TABLE 1.

2.1.2 Fine Aggregate

Fine aggregates shall be angular particles of uniform density. When the fine aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements.

2.1.2.1 Aggregate Base Course

ABC fine aggregate shall consist of screenings, angular sand, crushed recycled concrete fines, or other finely divided mineral matter processed or naturally combined with the coarse aggregate.

2.1.2.2 Graded-Crushed Aggregate Base Course

GCA fine aggregate shall consist of angular particles produced by crushing stone, slag, recycled concrete, or gravel that meets the requirements for wear and soundness specified for GCA coarse aggregate. Fine aggregate shall be manufactured from gravel particles 95 percent of which by weight are retained on the 1/2 inch sieve.

2.1.3 Gradation Requirements

The specified gradation requirements shall apply to the completed base course. The aggregates shall have a maximum size of 1.5 inches and shall be continuously well graded within the limits specified in MDOT MDOT SEC 902. Sieves shall conform to ASTM E 11.

NOTE 1: The values are based on aggregates of uniform specific gravity. If materials from different sources are used for the coarse and fine aggregates, they shall be tested in accordance with ASTM C 127 and ASTM C 128 to determine their specific gravities. If the specific gravities vary by more than 10 percent, the percentages passing the various sieves shall be corrected as directed by the Contracting Officer.

2.1.4 Liquid Limit and Plasticity Index

Liquid limit and plasticity index requirements shall apply to the completed course and shall also apply to any component that is blended to meet the required gradation. The portion of any component or of the completed course passing the No. 40 sieve shall be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

When the ABC or GCA is constructed in more than one layer, the previously constructed layer shall be cleaned of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Adequate drainage shall be provided during the entire period of construction to prevent water from collecting or standing on the working area. Line and grade stakes shall be provided as necessary for control. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

3.2 OPERATION OF AGGREGATE SOURCES

Aggregates shall be obtained from offsite sources.

3.3 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material

available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Contracting Officer to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

3.4 PREPARATION OF UNDERLYING COURSE

Prior to constructing the ABC and GCA, the underlying course or subgrade shall be cleaned of all foreign substances. At the time of construction of the ABC and GCA, the underlying course shall contain no frozen material. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. The underlying course shall conform to Section 02721a, SUBBASE COURSES. Ruts or soft yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses containing sands or gravels, as defined in ASTM D 2487, the surface shall be stabilized prior to placement of the ABC and GCA. Stabilization shall be accomplished by mixing ABC or GCA into the underlying course and compacting by approved methods. The stabilized material shall be considered as part of the underlying course and shall meet all requirements of the underlying course. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the ABC and GCA is placed.

3.5 INSTALLATION

3.5.1 Mixing the Materials

The coarse and fine aggregates shall be mixed in a stationary plant, or in a traveling plant or bucket loader on an approved paved working area. The Contractor shall make adjustments in mixing procedures or in equipment as directed to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to insure a satisfactory ABC and GCA meeting all requirements of this specification.

3.5.2 Placing

The mixed material shall be placed on the prepared subgrade or subbase in layers of uniform thickness with an approved spreader. When a compacted layer 6 inches or less in thickness is required, the material shall be placed in a single layer. When a compacted layer in excess of 6 inches is required, the material shall be placed in layers of equal thickness. No layer shall exceed 6 inches. The layers shall be so placed that when compacted they will be true to the grades or levels required with the least possible surface disturbance. Where the ABC and GCA is placed in more than one layer, the previously constructed layers shall be cleaned of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Such adjustments in placing procedures or equipment shall be made as may be directed to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to insure an acceptable ABC and GCA.

3.5.3 Grade Control

The finished and completed ABC and GCA shall conform to the lines, grades,

and cross sections shown. Underlying material(s) shall be excavated and prepared at sufficient depth for the required ABC and GCA thickness so that the finished ABC and GCA with the subsequent surface course will meet the designated grades.

3.5.4 Edges of Base Course

Approved fill material shall be placed along the outer edges of ABC and GCA in sufficient quantities to compact to the thickness of the course being constructed, or to the thickness of each layer in a multiple layer course, allowing in each operation at least a 2 foot width of this material to be rolled and compacted simultaneously with rolling and compacting of each layer of ABC and GCA. If this base course material is to be placed adjacent to another pavement section, then the layers for both of these sections shall be placed and compacted along this edge at the same time.

3.5.5 Compaction

Each layer of the ABC and GCA shall be compacted as specified with approved compaction equipment. Water content shall be maintained during the compaction procedure to within plus or minus 98 percent of the optimum water content determined from laboratory tests as specified in paragraph SAMPLING AND TESTING. Rolling shall begin at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. Speed of the roller shall be such that displacement of the aggregate does not occur. In all places not accessible to the rollers, the mixture shall be compacted with hand-operated power tampers. Compaction shall continue until each layer has a degree of compaction that is at least 98 percent of laboratory maximum density through the full depth of the layer. The Contractor shall make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory ABC and GCA. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

3.5.6 Thickness

Compacted thickness of the aggregate course shall be 6 inches. No individual layer shall exceed 6 inches in compacted thickness. The total compacted thickness of the ABC and GCA course shall be within 1/2 inch of the thickness indicated. Where the measured thickness is more than 1/2 inch deficient, such areas shall be corrected by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 1/2 inch thicker than indicated, the course shall be considered as conforming to the specified thickness requirements. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 1/4 inch of the thickness indicated. The total thickness of the ABC and GCA course shall be measured at intervals in such a manner as to ensure one measurement for each square yards of base course. Measurements shall be made in 3 inch diameter test holes penetrating the base course.

3.5.7 Proof Rolling

Proof rolling of the areas indicated shall be in addition to the compaction specified and shall consist of the application of 30 coverages with a heavy

pneumatic-tired roller having four or more tires, each loaded to a minimum of 30,000 pounds and inflated to a minimum of 150 psi. In areas designated, proof rolling shall be applied to the top of the underlying material on which ABC and GCA is laid and to each layer of ABC and GCA. Water content of the underlying material shall be maintained at optimum or at the percentage directed from start of compaction to completion of proof rolling of that layer. Water content of each layer of the ABC and GCA shall be maintained at the optimum percentage directed from start of compaction to completion of proof rolling. Any ABC and GCA materials or any underlying materials that produce unsatisfactory results by proof rolling shall be removed and replaced with satisfactory materials, recompacted and proof rolled to meet these specifications.

3.5.8 Finishing

The surface of the top layer of ABC and GCA shall be finished after final compaction and proof rolling by cutting any overbuild to grade and rolling with a steel-wheeled roller. Thin layers of material shall not be added to the top layer of base course to meet grade. If the elevation of the top layer of ABC and GCA is 1/2 inch or more below grade, then the top layer should be scarified to a depth of at least 3 inches and new material shall be blended in, compacted and proof rolled to bring to grade. Adjustments to rolling and finishing procedures shall be made as directed to minimize segregation and degradation, obtain grades, maintain moisture content, and insure an acceptable base course. Should the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, the unsatisfactory portion shall be scarified, reworked and recompacted or it shall be replaced as directed.

3.5.9 Smoothness

The surface of the top layer shall show no deviations in excess of 3/8 inch when tested with a 10 foot straightedge. Measurements shall be taken in successive positions parallel to the centerline of the area to be paved. Measurements shall also be taken perpendicular to the centerline at 50 foot intervals. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

3.6 TRAFFIC

Traffic shall not be allowed on the completed ABC and GCA course. Completed portions of the ABC and GCA course may be opened to limited traffic, provided there is no marring or distorting of the surface by the traffic. Heavy equipment shall not be permitted except when necessary to construction, and then the area shall be protected against marring or damage to the completed work.

3.7 MAINTENANCE

The ABC and GCA shall be maintained in a satisfactory condition until the full pavement section is completed and accepted. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact. Any ABC and GCA that is not paved over prior to the onset of winter, shall be retested to verify that it still complies with the requirements of this specification. Any area of ABC and GCA that is damaged shall be reworked or replaced as necessary to comply with this specification.

3.8 DISPOSAL OF UNSATISFACTORY MATERIALS

Any unsuitable materials that must be removed shall be disposed of as directed. No additional payments will be made for materials that must be replaced.

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SECTION 02731A

AGGREGATE SURFACE COURSE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 117	(1995) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 75	(1987; R 1997) Sampling Aggregates
ASTM D 422	(1963; R 1998) Particle-Size Analysis of Soils
ASTM D 1556	(1990; R 1996e1) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991; R 1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft.)
ASTM D 2167	(2001) Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2922	(1996e1) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1996e1) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 3740	(1999c) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

ASTM D 4318 (1998) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

ASTM E 11 (1995) Wire-Cloth Sieves for Testing Purposes

1.2 DEGREE OF COMPACTION

Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated herein as present laboratory maximum density.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330, SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment; G, AOF

Within 15 days of award of contract provide a list of proposed equipment to be used in performance of construction work including descriptive data.

SD-06 Test Reports

Sampling and Testing; G, AOF
Density Tests; G, AOF

Provide calibration curves and related test results prior to using the device or equipment being calibrated. Provide copies of field test results within 48 hours after the tests are performed. Test results from samples, not less than 7 days before material is required for the work. Results of laboratory tests for quality control purposes, for approval, prior to using the material.

1.4 EQUIPMENT

All plant, equipment, and tools used in the performance of the work covered by this section will be subject to approval by the Contracting Officer before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, and meeting the grade controls, thickness controls, and smoothness requirements set forth herein.

1.5 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved commercial testing laboratory or by the Contractor, subject to approval. If the Contractor elects to establish its own testing facilities, approval of such facilities will be based on compliance with ASTM D 3740. No work requiring testing will be permitted until the Contractor's facilities have been inspected and approved.

1.5.1 Sampling

Sampling for material gradation, liquid limit, and plastic limit tests shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.5.2 Testing

1.5.2.1 Gradation

Aggregate gradation shall be made in conformance with ASTM C 117, ASTM C 136, and ASTM D 422. Sieves shall conform to ASTM E 11.

1.5.2.2 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318.

1.5.3 Approval of Materials

Approval of sources not already approved by the Corps of Engineers will be based on an inspection by the Contracting Officer. Tentative approval of materials will be based on appropriate test results on the aggregate source. Final approval of the materials will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and compacted surface course.

1.6 WEATHER LIMITATIONS

Aggregate surface courses shall not be constructed when the ambient temperatures is below 35 degrees F and on subgrades that are frozen or contain frost. It shall be the responsibility of the Contractor to protect, by approved method or methods, all areas of surfacing that have not been accepted by the Contracting Officer. Surfaces damaged by freeze, rainfall, or other weather conditions shall be brought to a satisfactory condition by the Contractor.

PART 2 PRODUCTS

2.1 AGGREGATES

Aggregates shall consist of clean, sound, durable particles of natural gravel, crushed gravel, crushed stone, sand, slag, soil, or other approved materials processed and blended or naturally combined. Aggregates shall be free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign materials. The Contractor shall be responsible for obtaining materials that meet the specification and can be used to meet the grade and smoothness requirements specified herein after all compaction and proof rolling operations have been completed.

2.1.1 Coarse Aggregates

The material retained on the No. 4 sieve shall be known as coarse aggregate. Coarse aggregates shall be reasonably uniform in density and quality. The coarse aggregate shall have a percentage of wear not to exceed 50 percent after 500 revolutions as determined by ASTM C 131. The amount of flat and/or elongated particles shall not exceed 20 percent. A flat particle is one having a ratio of width to thickness greater than three; an elongated particle is one having a ratio of length to width

greater than three. When the coarse aggregate is supplied from more than one source, aggregate from each source shall meet the requirements set forth herein.

2.1.2 Fine Aggregates

The material passing the No. 4 sieve shall be known as fine aggregate. Fine aggregate shall consist of screenings, sand, soil, or other finely divided mineral matter that is processed or naturally combined with the coarse aggregate.

2.1.3 Gradation Requirements

Gradation requirements specified in MDOT SEC 902 shall apply to the completed aggregate surface. It shall be the responsibility of the Contractor to obtain materials that will meet the gradation requirements after mixing, placing, compacting, and other operations. Sieves shall conform to ASTM E 11.

2.2 LIQUID LIMIT AND PLASTICITY INDEX REQUIREMENTS

The portion of the completed aggregate surface course passing the No. 40 sieve shall have a maximum liquid limit of 35 and a plasticity index of 4 to 9.

PART 3 EXECUTION

3.1 STOCKPILING MATERIALS

Prior to stockpiling the material, the storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled in such a manner that will prevent segregation. Aggregates and binders obtained from different sources shall be stockpiled separately.

3.2 PREPARATION OF UNDERLYING COURSE SUBGRADE

The underlying course and subgrade, including shoulders, shall be cleaned of all foreign substances. At the time of surface course construction, the underlying course and subgrade shall contain no frozen material. Ruts or soft yielding spots in the underlying course and subgrade areas having inadequate compaction and deviations of the surface from the requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade and recompacting to density requirements specified in Section 02721a, SUBBASE COURSES. The completed underlying course and subgrade shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the surface course is placed.

3.3 GRADE CONTROL

During construction, the lines and grades including crown and cross slope indicated for the aggregate surface course shall be maintained by means of line and grade stakes placed by the Contractor in accordance with the SPECIAL CONTRACT REQUIREMENTS.

3.4 MIXING AND PLACING MATERIALS

The materials shall be mixed and placed to obtain uniformity of the material and a uniform optimum water content for compaction. The Contractor shall make adjustments in mixing, placing procedures, or in equipment to obtain the true grades, to minimize segregation and degradation, to obtain the desired water content, and to ensure a satisfactory surface course.

3.5 LAYER THICKNESS

The aggregate material shall be placed on the underlying course and subgrade in layers of uniform thickness. When a compacted layer of 6 inches or less is specified, the material may be placed in a single layer; when a compacted thickness of more than 6 inches is required, no layer shall exceed 6 inches.

3.6 COMPACTION

Each layer of the aggregate surface course shall be compacted with approval compaction equipment. The water content during the compaction procedure shall be maintained at a moisture content of less than saturation or at the percentage specified by the Contracting Officer. In locations not accessible to the rollers, the mixture shall be compacted with mechanical tampers. Compaction shall continue until each layer through the full depth is compacted to at least 98 percent of laboratory maximum density. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked to produce a satisfactory material.

3.7 PROOF ROLLING

Proof rolling of the areas designated shall be in addition to compaction specified above and shall consist of application of 30 coverages with a heavy rubber-tired roller having four tires abreast with each tire loaded to 30,000 pounds and tires inflated to 150 psi. In the areas designated, proof rolling shall be applied to the top lift of layer on which surface course is laid and to each layer of the base course. Water content of the lift of the layer on which the surface course is placed and each layer of the aggregate surface course shall be maintained at optimum or at the percentage directed from the start of compaction to the completion of a proof rolling. Materials in the aggregate surface course or underlying materials indicated unacceptable by the proof rolling shall be removed and replaced, as directed, with acceptable materials.

3.8 EDGES OF AGGREGATE-SURFACED ROAD

Approved material shall be placed along the edges of the aggregate surface course in such quantity as to compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, at least 1 foot of shoulder width shall be rolled and compacted simultaneously with the rolling and compacting of each layer of the surface course.

3.9 SMOOTHNESS TEST

The surface of each layer shall not show any deviations in excess of 3/8 inch when tested with a 10 foot straightedge applied both parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding this amount shall be corrected by the Contractor by removing material, replacing with new material, or reworking existing material and

compacting, as directed.

3.10 THICKNESS CONTROL

The completed thickness of the aggregate surface course shall be within 1/2 inch, plus or minus, of the thickness indicated on plans. The thickness of the aggregate surface course shall be measured at intervals in such manner that there will be a thickness measurement for at least each 500 square yards of the aggregate surface course. The thickness measurement shall be made by test holes at least 3 inches in diameter through the aggregate surface course. When the measured thickness of the aggregate surface course is more than 1/2 inch deficient in thickness, the Contractor, at no additional expense to the Government, shall correct such areas by scarifying, adding mixture of proper gradation, reblading, and recompacting, as directed. Where the measured thickness of the aggregate surface course is more than 1/2 inch) thicker than that indicated, it shall be considered as conforming with the specified thickness requirements plus 1/2 inch. The average job thickness shall be the average of the job measurements determined as specified above, but shall be within 1/4 inch of the thickness indicated. When the average job thickness fails to meet this criterion, the Contractor shall, at no additional expense to the Government, make corrections by scarifying, adding or removing mixture of proper gradation, and reblading and recompacting, as directed.

3.11 DENSITY TESTS

Density shall be measured in the field in accordance with ASTM D 1556, ASTM D 2167 and ASTM D 2922. For the method presented in ASTM D 1556 the base plate as shown in the drawing shall be used. For the method presented in ASTM D 2922 the calibration curves shall be checked and adjusted, if necessary, using only the sand cone method as described in paragraph Calibration of the ASTM publication. Tests performed in accordance with ASTM D 2922 result in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration of ASTM D 2922, on each different type of material being tested at the beginning of a job and at intervals, as directed.

3.12 WEAR TEST

Wear tests shall be made in conformance with ASTM C 131.

3.13 MAINTENANCE

The aggregate surface course shall be maintained in a condition that will meet all specification requirements until accepted.

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SECTION 02741A

HOT-MIX ASPHALT (HMA) FOR ROADS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO TP53 (1998; Interim 1999) Determining Asphalt Content of Hot Mix Asphalt by the Ignition Method

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29 (1997) Bulk Density ("Unit Weight") and Voids in Aggregates

ASTM C 88 (1999a) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

ASTM C 117 (1995) Materials Finer than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing

ASTM C 131 (1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

ASTM C 136 (1996a) Sieve Analysis of Fine and Coarse Aggregates

ASTM C 566 (1997) Evaporable Total Moisture Content of Aggregate by Drying

ASTM C 1252 (1998) Uncompacted Void Content of Fine Aggregate (as Influenced by Particle Shape, Surface Texture, and Grading)

ASTM D 140 (1998) Sampling Bituminous Materials

ASTM D 242 (1995) Mineral Filler for Bituminous Paving Mixtures

ASTM D 995 (1995b) Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures

ASTM D 1461 (1985)) Moisture or Volatile Distillates in Bituminous Paving Mixtures

ASTM D 1559 (1989) Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus

ASTM D 2041 (1995) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures

ASTM D 2172 (1995) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures

ASTM D 2419 (1995) Sand Equivalent Value of Soils and Fine Aggregate

ASTM D 2489 (1984; R 1994e1) Degree of Particle Coating of Bituminous-Aggregate Mixtures

ASTM D 2726 (1996e1) Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixture

ASTM D 2950 (1997) Density of Bituminous Concrete in Place by Nuclear Method

ASTM D 3665 (1999) Random Sampling of Construction Materials

ASTM D 3666 (1998) Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials

ASTM D 4125 (1994e1) Asphalt Content of Bituminous Mixtures by the Nuclear Method

ASTM D 4791 (1999) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

ASTM D 5444 (1998) Mechanical Size Analysis of Extracted Aggregate

ASTM D 6307 (1998) Asphalt Content of Hot Mix Asphalt by Ignition Method

ASPHALT INSTITUTE (AI)

AI MS-2 (1997) Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types

AI MS-22 (1998; 2nd Edition) Construction of Hot-Mix Asphalt Pavements

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 171 (1995) Test Method for Determining

Percentage of Crushed Particles in
Aggregate

STATE OF MICHIGAN, DEPARTMENT OF TRANSPORTATION STANDARD (MDOT)

MDOT SEC 501	Standard Specifications for Construction "PLANT MIXED HOT MIX ASPHALT"; Dated 2003
MDOT SEC 502	Standard Specifications for Construction "HOT MIX ASPHALT CONSTRUCTION PRACTICES"; Dated 2003
MDOT SEC 503	Standard Specifications for Construction "CONTRACTOR QUALITY CONTROL FOR HOT MIX ASPHALT"; Dated 2003
MDOT SEC 504	Standard Specifications for Construction "FURNISHING AND PLACING HOT MIX ASPHALT MIXTURES (QUALITY ASSURANCE)"; Dated 2003
MDOT SEC 902	Standard Specifications for Construction "AGGREGATES"; Dated 2003
MDOT SEC 904	Standard Specifications for Construction "ASPHALTIC MATERIALS"; Dated 2003

1.2 DESCRIPTION OF WORK

The work shall consist of pavement courses composed of mineral aggregate and asphalt material heated and mixed in a central mixing plant and placed on a prepared course. HMA designed and constructed in accordance with this section shall conform to the lines, grades, thicknesses, and typical cross sections shown on the drawings. Each course shall be constructed to the depth, section, or elevation required by the drawings and shall be rolled, finished, and approved before the placement of the next course.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330, SUBMITTAL PROCEDURES:

SD-03 Product Data

Mix Design; G, AOF.

Proposed JMF.

Contractor Quality Control; G; AOF.

Quality control plan.

Material Acceptance and Percent Payment; G, AOF.

Acceptance test results and pay calculations.

SD-04 Samples

Asphalt Cement Binder; G, AOF.

(5 gallon) sample for mix design verification.

Aggregates; G, AOF.

Sufficient materials to produce 200 lb of blended mixture for mix design verification.

SD-06 Test Reports

Aggregates; G, AOF.

QC Monitoring; G, AOF.

Aggregate and QC test results.

SD-07 Certificates

Asphalt Cement Binder; G, AOF.

Copies of certified test data.

Testing Laboratory; G, AOF.

Certification of compliance.

Plant Scale Calibration Certification

1.4 ASPHALT MIXING PLANT

Plants used for the preparation of hot-mix asphalt shall conform to the requirements of MDOT SEC 501 and ASTM D 995 with the following changes:

a. Truck Scales. The asphalt mixture shall be weighed on approved certified scales at the Contractor's expense. Scales shall be inspected and sealed at least annually by an approved calibration laboratory.

b. Testing Facilities. The Contractor shall provide laboratory facilities at the plant for the use of the Government's acceptance testing and the Contractor's quality control testing.

c. Inspection of Plant. The Contracting Officer shall have access at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant; verifying weights, proportions, and material properties; checking the temperatures maintained in the preparation of the mixtures and for taking samples. The Contractor shall provide assistance as requested, for the Government to procure any desired samples.

1.5 HAULING EQUIPMENT

Trucks used for hauling hot-mix asphalt shall have tight, clean, and smooth metal beds. To prevent the mixture from adhering to them, the truck beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other approved material. Petroleum based products shall not be used as a release agent. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary to ensure that

the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated or heated and covers (tarps) shall be securely fastened.

1.6 ASPHALT PAVERS

Asphalt pavers shall be self-propelled, with an activated screed, heated as necessary, and shall be capable of spreading and finishing courses of hot-mix asphalt which will meet the specified thickness, smoothness, and grade. The paver shall have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface.

1.6.1 Receiving Hopper

The paver shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed without segregation. The screed shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

1.7 ROLLERS

Rollers shall be in good condition and shall be operated at slow speeds to avoid displacement of the asphalt mixture. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. Equipment which causes excessive crushing of the aggregate shall not be used.

1.8 WEATHER LIMITATIONS

The hot-mix asphalt shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than specified in MDOT SEC 502. The temperature requirements may be waived by the Contracting Officer, if requested; however, all other requirements, including compaction, shall be met.

PART 2 PRODUCTS

2.1 AGGREGATES

All aggregates shall conform to specifications contained in MDOT SEC 902 and as follows:

Aggregates shall consist of crushed stone, crushed gravel, crushed slag, screenings, natural sand and mineral filler, as required. The portion of material retained on the No. 4 sieve is coarse aggregate. The portion of material passing the No. 4 sieve and retained on the No. 200 sieve is fine aggregate. The portion passing the No. 200 sieve is defined as mineral filler. All aggregate test results and samples shall be submitted to the Contracting Officer at least 14 days prior to start of construction.

2.1.1 Coarse Aggregate

Coarse aggregate shall consist of sound, tough, durable particles, free from films of material that would prevent thorough coating and bonding with the asphalt material and free from organic matter and other deleterious substances. All individual coarse aggregate sources shall meet the following requirements:

a. The percentage of loss shall not be greater than 40 percent after 500 revolutions when tested in accordance with ASTM C 131.

b. The percentage of loss shall not be greater than 18 percent after five cycles when tested in accordance with ASTM C 88 using magnesium sulfate .

c. At least 75 percent by weight of coarse aggregate shall have at least two or more fractured faces when tested in accordance with COE CRD-C 171. Fractured faces shall be produced by crushing.

d. The particle shape shall be essentially cubical and the aggregate shall not contain more than 20% percent, by weight, of flat and elongated particles (3:1 ratio of maximum to minimum) when tested in accordance with ASTM D 4791.

e. Slag shall be air-cooled, blast furnace slag, and shall have a compacted weight of not less than 75 lb/cu ft when tested in accordance with ASTM C 29.

2.1.2 Fine Aggregate

Fine aggregate shall consist of clean, sound, tough, durable particles. The aggregate particles shall be free from coatings of clay, silt, or any objectionable material and shall contain no clay balls. All individual fine aggregate sources shall have a sand equivalent value not less than 45 when tested in accordance with ASTM D 2419.

The fine aggregate portion of the blended aggregate shall have an uncompacted void content not less than 43.0 percent when tested in accordance with ASTM C 1252 Method A.

2.1.3 Mineral Filler

Mineral filler shall be nonplastic material meeting the requirements of ASTM D 242.

2.1.4 Aggregate Gradation

The combined aggregate gradation shall conform to gradations specified in MDOT SEC 902, when tested in accordance with ASTM C 136 and ASTM C 117, and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa, but grade uniformly from coarse to fine.

2.2 ASPHALT CEMENT BINDER

Asphalt cement binder shall conform to specifications contained in MDOT SEC 501, MDOT SEC 904 and as follows:

Test data indicating grade certification shall be provided by the supplier at the time of delivery of each load to the mix plant. Copies of these certifications shall be submitted to the Contracting Officer. The supplier is defined as the last source of any modification to the binder. The Contracting Officer may sample and test the binder at the mix plant at any time before or during mix production. Samples for this verification testing shall be obtained by the Contractor in accordance with ASTM D 140 and in the presence of the Contracting Officer. These samples shall be furnished to the Contracting Officer for the verification testing, which

shall be at no cost to the Contractor. Samples of the asphalt cement specified shall be submitted for approval not less than 14 days before start of the test section.

2.3 MIX DESIGN

The mix design shall conform to the specifications contained in MDOT SEC 501 for the mix called out in the plan documents.

2.3.1 JMF Requirements

The job mix formula shall be submitted in writing by the Contractor for approval at least 14 days prior to the start of the test section and shall include as a minimum:

- a. Percent passing each sieve size.
- b. Percent of asphalt cement.
- c. Percent of each aggregate and mineral filler to be used.
- d. Asphalt viscosity grade, penetration grade, or performance grade.
- e. Number of blows of hammer per side of molded specimen.
- f. Laboratory mixing temperature.
- g. Lab compaction temperature.
- h. Temperature-viscosity relationship of the asphalt cement.
- i. Plot of the combined gradation on the 0.45 power gradation chart, stating the nominal maximum size.
- j. Graphical plots of stability, flow, air voids, voids in the mineral aggregate, and unit weight versus asphalt content as shown in AI MS-2.
- k. Specific gravity and absorption of each aggregate.
- l. Percent natural sand.
- m. Percent particles with 2 or more fractured faces (in coarse aggregate).
- n. Fine aggregate angularity.
- o. Percent flat or elongated particles (in coarse aggregate).
- p. Tensile Strength Ratio(TSR).
- q. Antistrip agent (if required) and amount.
- r. List of all modifiers and amount.

Table 3: Marshall Design Criteria

<u>Test Property</u>	<u>75 Blow Mix</u>	<u>50 Blow Mix</u>
Stability, pounds minimum	*1800	*1000
Flow, 0.01 inch	8-16	8-18
Air voids, percent	3-5	3-5
Percent Voids in mineral aggregate VMA, (minimum)		
Gradation 1	13.0	13.0
Gradation 2	14.0	14.0
Gradation 3	15.0	15.0
TSR, minimum percent	75	75

* This is a minimum requirement. The average during construction shall be significantly higher than this number to ensure compliance with the specifications.

** Calculate VMA in accordance with AI MS-2, based on ASTM D 2726 bulk specific gravity for the aggregate.

2.3.2 Adjustments to Field JMF

The Laboratory JMF for each mixture shall be in effect until a new formula is approved in writing by the Contracting Officer. Should a change in sources of any materials be made, a new laboratory JMF design shall be performed and a new JMF approved before the new material is used. The Contractor will be allowed to adjust the Laboratory JMF within the limits specified below to optimize mix volumetric properties with the approval of the Contracting Officer. Adjustments to the Laboratory JMF shall be applied to the plant established JMF and limited to those values as shown. Adjustments shall be targeted to produce or nearly produce 4 percent voids total mix (VTM).

TABLE 4. Plant Established JMF Tolerances
Sieves Adjustments (plus or minus), percent

No. 4	3
No. 8	3
No. 200	1
Binder Content	0.40

If adjustments are needed that exceed these limits, a new mix design shall be developed. Tolerances given above may permit the aggregate grading to be outside the limits shown in Table 2; while not desirable, this is acceptable.

2.4 RECYCLED HOT MIX ASPHALT

Recycled HMA shall consist of reclaimed asphalt pavement (RAP), coarse aggregate, fine aggregate, mineral filler, and asphalt cement. The RAP shall be of a consistent gradation and asphalt content and properties.

When RAP is fed into the plant, the maximum RAP chunk size shall not exceed 2 inches. The recycled HMA mix shall be designed using procedures contained in AI MS-2 and AI MS-22. The job mix shall meet the requirements of paragraph MIX DESIGN. The amount of RAP shall not exceed 30 percent.

2.4.1 RAP Aggregates and Asphalt Cement

The blend of aggregates used in the recycled mix shall meet the requirements of paragraph AGGREGATES. The percentage of asphalt in the RAP shall be established for the mixture design according to ASTM D 2172 using the appropriate dust correction procedure.

2.4.2 RAP Mix

The blend of new asphalt cement and the RAP asphalt binder shall meet the requirements in paragraph ASPHALT CEMENT BINDER. The virgin asphalt cement shall not be more than two standard asphalt material grades different than that specified in paragraph ASPHALT CEMENT BINDER.

PART 3 EXECUTION

Execution shall conform to specifications contained in MDOT SEC 501, MDOT SEC 502 and as follows:

3.1 PREPARATION OF ASPHALT BINDER MATERIAL

The asphalt cement material shall be heated avoiding local overheating and providing a continuous supply of the asphalt material to the mixer at a uniform temperature. The temperature of unmodified asphalts shall be no more than 325 degrees F when added to the aggregates. Modified asphalts shall be no more than 350 degrees F when added to the aggregates.

3.2 PREPARATION OF MINERAL AGGREGATE

The aggregate for the mixture shall be heated and dried prior to mixing. No damage shall occur to the aggregates due to the maximum temperature and rate of heating used. The temperature of the aggregate and mineral filler shall not exceed 350 degrees F when the asphalt cement is added. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

3.3 PREPARATION OF HOT-MIX ASPHALT MIXTURE

The aggregates and the asphalt cement shall be weighed or metered and introduced into the mixer in the amount specified by the JMF. The combined materials shall be mixed until the aggregate obtains a uniform coating of asphalt binder and is thoroughly distributed throughout the mixture. Wet mixing time shall be the shortest time that will produce a satisfactory mixture, but no less than 25 seconds for batch plants. The wet mixing time for all plants shall be established by the Contractor, based on the procedure for determining the percentage of coated particles described in ASTM D 2489, for each individual plant and for each type of aggregate used.

The wet mixing time will be set to at least achieve 95 percent of coated particles. The moisture content of all hot-mix asphalt upon discharge from the plant shall not exceed 0.5 percent by total weight of mixture as measured by ASTM D 1461.

3.4 PREPARATION OF THE UNDERLYING SURFACE

Immediately before placing the hot mix asphalt, the underlying course shall be cleaned of dust and debris. A tack coat shall be applied in accordance with the contract specifications.

3.5 TESTING LABORATORY

The laboratory used to develop the JMF shall meet the requirements of MDOT SEC 503, MDOT SEC 504 and ASTM D 3666. A certification signed by the manager of the laboratory stating that it meets these requirements or clearly listing all deficiencies shall be submitted to the Contracting Officer prior to the start of construction. The certification shall contain as a minimum:

- a. Qualifications of personnel; laboratory manager, supervising technician, and testing technicians.
- b. A listing of equipment to be used in developing the job mix.
- c. A copy of the laboratory's quality control system.
- d. Evidence of participation in the AASHTO Materials Reference Laboratory (AMRL) program.

3.6 TRANSPORTING AND PLACING

Transporting and placing shall conform to specifications contained in MDOT SEC 502 as follows:

3.6.1 Transporting

The hot-mix asphalt shall be transported from the mixing plant to the site in clean, tight vehicles. Deliveries shall be scheduled so that placing and compacting of mixture is uniform with minimum stopping and starting of the paver. Adequate artificial lighting shall be provided for night placements. Hauling over freshly placed material will not be permitted until the material has been compacted as specified, and allowed to cool to 140 degrees F. To deliver mix to the paver, the Contractor shall use a material transfer vehicle which shall be operated to produce continuous forward motion of the paver.

3.6.2 Placing

The mix shall be placed and compacted at a temperature suitable for obtaining density, and other specified requirements. Upon arrival, the mixture shall be placed to the full width by an asphalt paver; it shall be struck off in a uniform layer of such depth that, when the work is completed, it shall have the required thickness and conform to the grade and contour indicated. The speed of the paver shall be regulated to eliminate pulling and tearing of the asphalt mat. Unless otherwise permitted, placement of the mixture shall begin along the centerline of a crowned section or on the high side of areas with a one-way slope. The mixture shall be placed in consecutive adjacent strips having a minimum width of 10 feet. The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least 1 foot; however, the joint in the surface course shall be at the centerline of the pavement. Transverse joints in one course shall be offset by at least 10 feet from transverse joints in the previous course. Transverse joints in adjacent lanes shall be offset a minimum of 10 feet. On isolated areas

where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread and luted by hand tools.

3.7 COMPACTION OF MIXTURE

Compaction of mixture shall conform to specifications contained in MDOT SEC 501, MDOT SEC 502 and as follows:

After placing, the mixture shall be thoroughly and uniformly compacted by rolling. The surface shall be compacted as soon as possible without causing displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor. The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected at once. Sufficient rollers shall be furnished to handle the output of the plant. Rolling shall continue until the surface is of uniform texture, true to grade and cross section, and the required field density is obtained. To prevent adhesion of the mixture to the roller, the wheels shall be kept properly moistened but excessive water will not be permitted. In areas not accessible to the roller, the mixture shall be thoroughly compacted with hand tampers. Any mixture that becomes loose and broken, mixed with dirt, contains check-cracking, or is in any way defective shall be removed full depth, replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be done at the Contractor's expense. Skin patching will not be allowed.

3.8 JOINTS

Joints shall conform to specifications contained in MDOT SEC 502 and as follows:

The formation of joints shall be made ensuring a continuous bond between the courses and to obtain the required density. All joints shall have the same texture as other sections of the course and meet the requirements for smoothness and grade.

3.8.1 Transverse Joints

The roller shall not pass over the unprotected end of the freshly laid mixture, except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course. The tapered edge shall be cut back to its full depth and width on a straight line to expose a vertical face prior to placing material at the joint. The cutback material shall be removed from the project. In both methods, all contact surfaces shall be given a light tack coat of asphalt material before placing any fresh mixture against the joint.

3.8.2 Longitudinal Joints

Longitudinal joints which are irregular, damaged, uncompacted, cold (less than 175 degrees F at the time of placing adjacent lanes), or otherwise defective, shall be cut back a minimum of 2 inches from the edge with a cutting wheel to expose a clean, sound vertical surface for the full depth of the course. All cutback material shall be removed from the project. All contact surfaces shall be given a light tack coat of asphalt material

prior to placing any fresh mixture against the joint. The Contractor will be allowed to use an alternate method if it can be demonstrated that density, smoothness, and texture can be met.

3.9 CONTRACTOR QUALITY CONTROL

Contractor quality control shall conform to specifications contained in MDOT SEC 503 and as follows:

3.9.1 General Quality Control Requirements

The Contractor shall develop an approved Quality Control Plan. Hot-mix asphalt for payment shall not be produced until the quality control plan has been approved. The plan shall address all elements which affect the quality of the pavement including, but not limited to:

- a. Mix Design
- b. Aggregate Grading
- c. Quality of Materials
- d. Stockpile Management
- e. Proportioning
- f. Mixing and Transportation
- g. Mixture Volumetrics
- h. Moisture Content of Mixtures
- i. Placing and Finishing
- j. Joints
- k. Compaction

3.9.2 Quality Control Testing

The Contractor shall perform all quality control tests applicable to these specifications and as set forth in the Quality Control Program. The testing program shall include, but shall not be limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, moisture in the asphalt mixture, laboratory air voids, stability, flow, in-place density, grade and smoothness. A Quality Control Testing Plan shall be developed as part of the Quality Control Program.

3.9.2.1 Asphalt Content

A minimum of two tests to determine asphalt content will be performed per lot (a lot is defined in paragraph MATERIAL ACCEPTANCE AND PERCENT PAYMENT) by one of the following methods: the extraction method in accordance with ASTM D 2172, Method A or B, the ignition method in accordance with the AASHTO TP53 or ASTM D 6307, or the nuclear method in accordance with ASTM D 4125, provided the nuclear gauge is calibrated for the specific mix being used. For the extraction method, the weight of ash, as described in ASTM D 2172, shall be determined as part of the first extraction test performed at the beginning of plant production; and as part of every tenth extraction

test performed thereafter, for the duration of plant production. The last weight of ash value obtained shall be used in the calculation of the asphalt content for the mixture.

3.9.2.2 Gradation

Aggregate gradations shall be determined a minimum of twice per lot from mechanical analysis of recovered aggregate in accordance with ASTM D 5444. When asphalt content is determined by the nuclear method, aggregate gradation shall be determined from hot bin samples on batch plants, or from the cold feed on drum mix plants. For batch plants, aggregates shall be tested in accordance with ASTM C 136 using actual batch weights to determine the combined aggregate gradation of the mixture.

3.9.2.3 Temperatures

Temperatures shall be checked at least four times per lot, at necessary locations, to determine the temperature at the dryer, the asphalt cement in the storage tank, the asphalt mixture at the plant, and the asphalt mixture at the job site.

3.9.2.4 Aggregate Moisture

The moisture content of aggregate used for production shall be determined a minimum of once per lot in accordance with ASTM C 566.

3.9.2.5 Moisture Content of Mixture

The moisture content of the mixture shall be determined at least once per lot in accordance with ASTM D 1461 or an approved alternate procedure.

3.9.2.6 Laboratory Air Voids, Marshall Stability and Flow

Mixture samples shall be taken at least four times per lot and compacted into specimens, using 50 or 75 blows per side with the Marshall hammer as described in ASTM D 1559. After compaction, the laboratory air voids of each specimen shall be determined, as well as the Marshall stability and flow.

3.9.2.7 In-Place Density

The Contractor shall conduct any necessary testing to ensure the specified density is achieved. A nuclear gauge may be used to monitor pavement density in accordance with ASTM D 2950.

3.9.2.8 Grade and Smoothness

The Contractor shall conduct the necessary checks to ensure the grade and smoothness requirements are met in accordance with paragraph MATERIAL ACCEPTANCE AND PERCENT PAYMENT.

3.9.2.9 Additional Testing

Any additional testing, which the Contractor deems necessary to control the process, may be performed at the Contractor's option.

3.9.2.10 QC Monitoring

The Contractor shall submit all QC test results to the Contracting Officer

on a daily basis as the tests are performed. The Contracting Officer reserves the right to monitor any of the Contractor's quality control testing and to perform duplicate testing as a check to the Contractor's quality control testing.

3.9.3 Sampling

When directed by the Contracting Officer, the Contractor shall sample and test any material which appears inconsistent with similar material being produced, unless such material is voluntarily removed and replaced or deficiencies corrected by the Contractor. All sampling shall be in accordance with standard procedures specified.

3.10 MATERIAL ACCEPTANCE

Material acceptance shall conform to specifications contained in MDOT SEC 504 and as follows:

Testing for acceptability of work will be performed by an independent laboratory hired by the Contractor. Test results and payment calculations shall be forwarded daily to the Contracting Officer. Acceptance of the plant produced mix and in-place requirements will be on a lot to lot basis.

A standard lot for all requirements will be equal to 2000 tons. Where appropriate, adjustment in payment for individual lots of hot-mix asphalt will be made based on in-place density, laboratory air voids, grade and smoothness in accordance with the following paragraphs. Grade and surface smoothness determinations will be made on the lot as a whole. Exceptions or adjustments to this will be made in situations where the mix within one lot is placed as part of both the intermediate and surface courses, thus grade and smoothness measurements for the entire lot cannot be made. In order to evaluate laboratory air voids and in-place (field) density, each lot will be divided into four equal sublots.

3.10.1 Sublot Sampling

One random mixture sample for determining laboratory air voids, theoretical maximum density, and for any additional testing the Contracting Officer desires, will be taken from a loaded truck delivering mixture to each sublot, or other appropriate location for each sublot. All samples will be selected randomly, using commonly recognized methods of assuring randomness conforming to ASTM D 3665 and employing tables of random numbers or computer programs. Laboratory air voids will be determined from three laboratory compacted specimens of each sublot sample in accordance with ASTM D 1559. The specimens will be compacted within 2 hours of the time the mixture was loaded into trucks at the asphalt plant. Samples will not be reheated prior to compaction and insulated containers will be used as necessary to maintain the temperature.

3.10.2 Additional Sampling and Testing

The Contracting Officer reserves the right to direct additional samples and tests for any area which appears to deviate from the specification requirements. The cost of any additional testing will be paid for by the Government. Testing in these areas will be in addition to the lot testing, and the requirements for these areas will be the same as those for a lot.

3.10.3 Laboratory Air Voids

Laboratory air voids will be calculated by determining the Marshall density

of each lab compacted specimen using ASTM D 2726 and determining the theoretical maximum density of every other subplot sample using ASTM D 2041.

Laboratory air void calculations for each subplot will use the latest theoretical maximum density values obtained, either for that subplot or the previous subplot. The mean absolute deviation of the four laboratory air void contents (one from each subplot) from the JMF air void content will be evaluated. All laboratory air void tests will be completed and reported within 24 hours after completion of construction of each lot.

3.10.4 In-place Density

3.10.4.1 General Density Requirements

For determining in-place density, one random core will be taken by the Government from the mat (interior of the lane) of each subplot, and one random core will be taken from the joint (immediately over joint) of each subplot. Each random core will be full thickness of the layer being placed.

When the random core is less than 1 inch thick, it will not be included in the analysis. In this case, another random core will be taken. After air drying to a constant weight, cores obtained from the mat and from the joints will be used for in-place density determination.

3.10.5 Grade

The final wearing surface of pavement shall conform to the elevations and cross sections shown and shall vary not more than 0.05 foot from the plan grade established and approved at site of work. Finished surfaces at juncture with other pavements shall coincide with finished surfaces of abutting pavements. Deviation from the plan elevation will not be permitted in areas of pavements where closer conformance with planned elevation is required for the proper functioning of drainage and other appurtenant structures involved. The final wearing surface of the pavement will be tested for conformance with specified plan grade requirements. The grade will be determined by running lines of levels at intervals of 25 feet, or less, longitudinally and transversely, to determine the elevation of the completed pavement surface. Within 5 working days, after the completion of a particular lot incorporating the final wearing surface, the Contracting Officer will inform the Contractor in writing, of the results of the grade-conformance tests. In areas where the grade exceeds the tolerance by more than 50 percent, the Contractor shall remove the surface lift full depth; the Contractor shall then replace the lift with hot-mix asphalt to meet specification requirements, at no additional cost to the Government. Diamond grinding may be used to remove high spots to meet grade requirements. Skin patching for correcting low areas or planing or milling for correcting high areas will not be permitted.

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SECTION 02748A

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SECTION 02748A

BITUMINOUS TACK COATS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO T 40 (1978; R 1996) Sampling Bituminous
Materials

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 140 (200) Sampling Bituminous Materials

ASTM D 2995 (1999) Determining Application Rate of
Bituminous Distributors

MICHIGAN DEPARTMENT OF TRANSPORTATION (MDOT)

MDOT SEC 502 Standard Specifications for Construction
"Hot Mix Asphalt Construction Practices";
Dated 2003

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330, SUBMITTAL PROCEDURES:

SD-03 Product Data G, AOF

Waybills and Delivery Tickets

Waybills and delivery tickets, during progress of the work.

SD-06 Test Reports G, AOF

Sampling and Testing

Copies of all test results for bituminous materials, within 24 hours of completion of tests. Certified copies of the manufacturer's test reports indicating compliance with applicable specified requirements, not less than 30 days before the material is required in the work.

1.3 PLANT, EQUIPMENT, MACHINES AND TOOLS

1.3.1 General Requirements

Plant, equipment, machines and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times. The Contractor shall submit all material waybills and delivery tickets in accordance with SUBMITTALS paragraph.

1.3.2 Bituminous Distributor

The distributor shall have pneumatic tires of such size and number to prevent rutting, shoving or otherwise damaging the base surface or other layers in the pavement structure. The distributor shall be designed and equipped to spray the bituminous material in a uniform coverage at the specified temperature, at readily determined and controlled rates with an allowable variation from the specified rate of not more than plus or minus 5 percent, and at variable widths. Distributor equipment shall include a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gauges, volume-measuring devices, adequate heaters for heating of materials to the proper application temperature, a thermometer for reading the temperature of tank contents, and a hand hose attachment suitable for applying bituminous material manually to areas inaccessible to the distributor. The distributor shall be equipped to circulate and agitate the bituminous material during the heating process.

1.3.3 Power Brooms

Power brooms shall be suitable for cleaning the surfaces to which the bituminous coat is to be applied.

1.4 WEATHER LIMITATIONS

Bituminous coat shall be applied only when the surface to receive the bituminous coat is dry. Bituminous coat shall be applied only when the atmospheric temperature in the shade is 50 degrees F or above and when the temperature has not been below 35 degrees F for the 12 hours prior to application.

PART 2 PRODUCTS

2.1 TACK COAT

Asphalt shall conform to MDOT SEC 502 Grade SS-1h, CSS-1h.

PART 3 EXECUTION

3.1 PREPARATION OF SURFACE

Immediately before applying the bituminous coat, all loose material, dirt, clay, or other objectionable material shall be removed from the surface to be treated. The surface shall be dry and clean at the time of treatment.

3.2 APPLICATION RATE

The exact quantities within the range specified, which may be varied to suit field conditions, will be determined by the Contracting Officer.

3.2.1 Tack Coat

Bituminous material for the tack coat shall be applied in quantities of not less than 0.05 gallon nor more than 0.15 gallon per square yard of pavement surface.

3.3 APPLICATION TEMPERATURE

3.3.1 Temperature Ranges

The viscosity requirements shall determine the application temperature to be used. The normal range of application temperatures shall be according to MDOT SEC 904.

3.4 APPLICATION

3.4.1 General

Following preparation and subsequent inspection of the surface, the bituminous coat shall be applied at the specified rate with uniform distribution over the surface to be treated. All areas and spots missed by the distributor shall be properly treated with the hand spray. Until the succeeding layer of pavement is placed, the surface shall be maintained by protecting the surface against damage and by repairing deficient areas at no additional cost to the Government. If required, clean dry sand shall be spread to effectively blot up any excess bituminous material. No smoking, fires, or flames other than those from the heaters that are a part of the equipment shall be permitted within 25 feet of heating, distributing, and transferring operations of bituminous material other than bituminous emulsions. All traffic, except for paving equipment used in constructing the surfacing, shall be prevented from using the underlying material, whether primed or not, until the surfacing is completed. The bituminous coat shall conform to all requirements as described herein.

3.4.2 Tack Coat

Tack coat shall be applied first at all the locations where bituminous material is to be applied.

3.5 CURING PERIOD

Following application of the bituminous material and prior to application of the succeeding layer of pavement, the bituminous coat shall be allowed to cure and to obtain evaporation of any volatiles or moisture.

3.6 FIELD QUALITY CONTROL

Samples of the bituminous material used shall be obtained by the Contractor as directed, under the supervision of the Contracting Officer. The sample may be retained and tested by the Government at no cost to the Contractor.

3.7 SAMPLING AND TESTING

Sampling and testing shall be performed by an approved commercial testing laboratory or by facilities furnished by the Contractor. No work requiring testing will be permitted until the facilities have been inspected and approved.

3.7.1 Sampling

The samples of bituminous material, unless otherwise specified, shall be in accordance with ASTM D 140 or AASHTO T 40. Sources from which bituminous materials are to be obtained shall be selected and notification furnished the Contracting Officer within 15 days after the award of the contract.

3.7.2 Calibration Test

The Contractor shall furnish all equipment, materials, and labor necessary to calibrate the bituminous distributor. Calibration shall be made with the approved job material and prior to applying the bituminous coat material to the prepared surface. Calibration of the bituminous distributor shall be in accordance with ASTM D 2995.

3.7.3 Sampling and Testing During Construction

Quality control sampling and testing shall be performed as required in paragraph FIELD QUALITY CONTROL.

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SECTION 02761

PAVEMENT MARKINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-B-1325 (1993; 2000; Rev. C) Beads (Glass Spheres)
Retro-Reflective

INTERNATIONAL CONCRETE REPAIR INSTITUTE (ICRI)

STATE OF MICHIGAN, DEPARTMENT OF TRANSPORTATION STANDARD (MDOT)

MDOT SEC 811 Standard Specifications for Construction
"PERMANENT PAVEMENT MARKINGS"; Dated 2003

MDOT SEC 920 Standard Specifications for Construction
"PERMANENT PAVEMENT MARKINGS MATERIALS";
Dated 2003

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330, SUBMITTAL PROCEDURES:

SD-03 Product Data

Reflective media for roads and streets; G, AOF.

Paints for roads and streets; G, AOF.

waterborne Marking Material; G, AOF.

Thermoplastic compounds and primer; G, AOF.

Raised Pavement Markers and Adhesive; G, AOF.

SD-06 Test Reports

Reflective media for roads and streets; G, AOF.

Paints for roads and streets; G, AOF.

Waterborne Marking Material; G, AOF.

Thermoplastic compounds and primer; G, AOF.

Raised Pavement Markers and Adhesive; G, AOF.

Report from sampling and testing made in accordance with paragraph entitled "Sampling and Testing."; G, AOF.

SD-07 Certificates

Reflective media for roads and streets; G, AOF.

Paints for roads and streets; G, AOF.

Thermoplastic compounds and primer; G, AOF.

Construction equipment list; G, AOF.

SD-08 Manufacturer's Instructions

Paints for roads and streets; G, AOF.

Thermoplastic compounds and primer; G, AOF.

Submit manufacturer's Material Safety Data Sheets; G, AOF.

1.3 DELIVERY AND STORAGE

Deliver paints, paint materials and thermoplastic compound materials in original sealed containers that plainly show the designated name, specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer. Provide storage facilities at the job site for maintaining materials at temperatures recommended by the manufacturer. Make available paint stored at the project site or segregated at the source for sampling not less than 30 days prior to date of required approval for use to allow sufficient time for testing. Notify the Contracting Officer when paint is available for sampling.

1.4 WEATHER LIMITATIONS

Apply paint to clean, dry surfaces, and unless otherwise approved, only when air and pavement temperatures are above 50 degrees F and less than 110 degrees F for water-based materials. Maintain paint temperature within these same limits.

1.5 EQUIPMENT

Machines, tools, and equipment used in the performance of the work shall be approved by the Contracting Officer and maintained in satisfactory operating condition. Submit construction equipment list approval by the Contracting Officer.

1.5.1 Paint Applicator

Provide hand-operated push-type applicator machine of a type commonly used for application of paint to pavement surfaces. Paint applicator machine shall be acceptable for marking small street and parking areas. Applicator

machine shall be equipped with the necessary paint tanks and spraying nozzles, and shall be capable of applying paint uniformly at coverage specified. Applicator for water-based markings shall be equipped with non-stick coated hoses; metal parts in contact with the paint material shall be constructed of grade 302, 304, 316, or equal stainless steel.

Provide self-propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. Provide machine having a speed during application capable of applying the stripe widths indicated at the paint coverage rate specified herein and of even uniform thickness with clear-cut edges. Provide equipment used for marking streets and highways capable of placing the prescribed number of lines at a single pass as solid lines, intermittent lines, or a combination of solid and intermittent lines using a maximum of three different colors of paint as specified. Provide paint applicator with paint reservoirs or tanks of sufficient capacity and suitable gages to apply paint in accordance with requirements specified. Equip tanks with suitable air-driven mechanical agitators. Equip spray mechanism with quick-action valves conveniently located, and include necessary pressure regulators and gages in full view and reach of the operator. Install paint strainers in paint supply lines to ensure freedom from residue and foreign matter that may cause malfunction of the spray guns. The paint applicator shall be readily adaptable for attachment of an air-actuated dispenser for the reflective media approved for use. Provide pneumatic spray guns for hand application of paint in areas where the mobile paint applicator cannot be used. Applicator for water-based markings shall be equipped with non-stick coated hoses; metal parts in contact with the paint material shall be constructed of grade 302, 304, 316, or equal stainless steel.

1.5.2 Reflective Media Dispenser

Attach dispenser for applying the reflective media to the paint dispenser and operate automatically and simultaneously with the paint applicator through the same control mechanism. Use dispenser capable of adjustment and designed to provide uniform flow of reflective media over the full width of the stripe at the rate of coverage specified herein at all operating speeds of the paint applicator to which it is attached.

1.5.3 Portable Application Equipment

The portable applicator shall be defined as hand-operated equipment, specifically designed for placing special markings such as crosswalks, stopbars, legends, arrows, and short lengths of lane, edge and centerlines.

The portable applicator shall be capable of applying thermoplastic pavement markings by the extrusion method. It is intended that the portable applicator will be loaded with hot thermoplastic composition from the melting kettles on the mobile applicator. Equip the portable applicator with all the necessary components, including a materials storage reservoir, bead dispenser, extrusion shoe, and heating accessories, so as to be capable of holding the molten thermoplastic at a temperature of 375 to 425 degrees F, of extruding a line of 3 to 12 inches in width, and in thickness of not less than 0.125 inch nor more than 0.190 inch and of generally uniform cross section.

PART 2 PRODUCTS

2.1 MATERIALS

Provide materials conforming to MDOT SEC 811, MDOT SEC 920, and the requirements specified herein.

2.1.1 Paints for Roads and Streets

MDOT SEC 920 Waterborne Marking Material, color as indicated.

2.1.2 Reflective Media for Roads and Streets

FS TT-B-1325, Type I, Gradation A.

2.1.3 Waterborne Marking Material

Waterborne marking material must have a moisture resistant coating and a silane coating to promote adhesion. When marking rest areas, roadside parks, and car pool lots, glass beads are not required.

PART 3 EXECUTION

Pavement marking application shall comply with specifications contained in MDOT SEC 811 and as follows:

3.1 SURFACE PREPARATION

Allow new pavement surfaces to cure for a period of not less than 1 day before application of marking materials. Thoroughly clean surfaces to be marked before application of the paint. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods as required. Remove rubber deposits, and other coatings adhering to the pavement by water blasting. Scrub affected areas, where oil or grease is present on old pavements to be marked, with several applications of trisodium phosphate solution or other approved detergent or degreaser and rinse thoroughly after each application. After cleaning oil-soaked areas, seal with shellac or primer recommended by the manufacturer to prevent bleeding through the new paint. Do not commence painting in any area until pavement surfaces are dry and clean.

3.2 APPLICATION

3.2.1 Rate of Application

3.2.1.1 Reflective Markings

Apply paint evenly to the pavement area to be coated at a rate of 105 plus or minus 5 square feet per gallon. Apply glass spheres uniformly to the wet paint on road and street pavement at a rate of six (6) plus or minus 0.5 pounds of glass spheres per gallon.

3.2.1.2 Waterborne

Waterborne paint shall be applied when the surface temperature of the pavement is 50 degrees F or higher and the pavement is dry. The Contractor shall be responsible for making the decision to apply waterborne paint on any specific day when there is a high probability of rain in the forecast. If applied lines are washed away because of rain the Contractor shall be responsible for re-applying the lines at no additional expense to the government. Waterborne pavement marking materials may be placed immediately

on new bituminous pavement. waterborne pavement marking material shall not be placed before May 1 nor after October 1.

3.2.2 Painting

Apply paint pneumatically with approved equipment at rate of coverage specified herein. Provide guidelines and templates as necessary to control paint application. Take special precautions in marking numbers, letters, and symbols. Manually paint numbers, letters, and symbols. Sharply outline all edges of markings. The maximum drying time requirements of the paint specifications will be strictly enforced, to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. Discontinue painting operations if there is a deficiency in drying of the markings until cause of the slow drying is determined and corrected.

3.2.3 Reflective Media

Application of reflective media shall immediately follow the application of paint. Accomplish drop-on application of the glass spheres to ensure even distribution at the specified rate of coverage. Should there be malfunction of either paint applicator or reflective media dispenser, discontinue operations until deficiency is corrected.

3.3 FIELD TESTING AND INSPECTION

3.3.1 Inspection

Examine material at the job site to determine that it is the material referenced in the report of test results or certificate of compliance. A certificate of compliance shall be accompanied by test results substantiating conformance to the specified requirements.

3.3.1.1 Surface Preparations and Application Procedures

Surface preparations and application procedures will be examined by the Contracting Officer to determine conformance with the requirements specified. Approve each separate operation prior to initiation of subsequent operations.

3.4 TRAFFIC CONTROL AND PROTECTION

Place warning signs near the beginning of the work site and well ahead of the work site for alerting approaching traffic from both directions. Place small markers along newly painted lines to control traffic and prevent damage to newly painted surfaces. Mark painting equipment with large warning signs indicating slow-moving painting equipment in operation. Do not use foil-backed material for temporary pavement marking because of its potential to conduct electricity during accidents involving downed power lines.

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SECTION 02770A

CONCRETE SIDEWALKS AND CURBS AND GUTTERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 185	(1997) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 615	(1996a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 616	(1996a) Rail-Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 617	(1996a) Axle-Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM C 31	(1996) Making and Curing Concrete Test Specimens in the Field
ASTM C 143	(1990a) Slump of Hydraulic Cement Concrete
ASTM C 172	(1997) Sampling Freshly Mixed Concrete
ASTM C 173	(1996) Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 231	(1997) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 309	(1997) Liquid Membrane-Forming Compounds for Curing Concrete

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330, SUBMITTAL PROCEDURES:

SD-03 Product Data

Concrete; G, AOF

Submit copies of certified delivery tickets for all concrete used in the construction within 24 hours of delivery of concrete.

SD-06 Test Reports

Field Quality Control; G, AOF

Submit copies of all test reports within 24 hours of completion of the test.

1.3 WEATHER LIMITATIONS

1.3.1 Placing During Cold Weather

Concrete placement shall not take place when the air temperature reaches 40 degrees F and is falling, or is already below that point. Placement may begin when the air temperature reaches 35 degrees F and is rising, or is already above 40 degrees F. Provisions shall be made to protect the concrete from freezing during the specified curing period. If necessary to place concrete when the temperature of the air, aggregates, or water is below 35 degrees F, placement and protection shall be approved in writing.

Approval will be contingent upon full conformance with the following provisions. The underlying material shall be prepared and protected so that it is entirely free of frost when the concrete is deposited. Mixing water and aggregates shall be heated as necessary to result in the temperature of the in-place concrete being between 50 and 85 degrees F. Methods and equipment for heating shall be approved. The aggregates shall be free of ice, snow, and frozen lumps before entering the mixer. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period.

1.3.2 Placing During Warm Weather

The temperature of the concrete as placed shall not exceed 85 degrees F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. The placing temperature shall not exceed 95 degrees F at any time.

1.4 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.4.1 General Requirements

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times. The equipment shall have the capability of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified. Use of the equipment shall be discontinued if it produces unsatisfactory results. The Contracting Officer shall have access at all times to the plant and equipment to ensure proper operation and compliance with specifications.

PART 2 PRODUCTS

2.1 CONCRETE

Concrete shall conform to the applicable requirements of Section 03307a

CONCRETE FOR MINOR STRUCTURES except as otherwise specified. Concrete shall have a minimum compressive strength of 3500 psi at 28 days. Maximum size of aggregate shall be 1-1/2 inches.

2.1.1 Air Content

Mixtures shall have air content by volume of concrete of 5 to 7 percent, based on measurements made immediately after discharge from the mixer.

2.1.2 Slump

The concrete slump shall be 2 inches plus or minus 1 inch where determined in accordance with ASTM C 143.

2.1.3 Reinforcement Steel

Reinforcement bars shall conform to ASTM A 615, ASTM A 616, or ASTM A 617. Wire mesh reinforcement shall conform to ASTM A 185.

2.2 CONCRETE CURING MATERIALS

2.2.1 White Pigmented Membrane-Forming Curing Compound

White pigmented membrane-forming curing compound shall conform to ASTM C 309, Type 2.

2.3 JOINT FILLER STRIPS

2.3.1 Contraction Joint Filler for Curb and Gutter

Contraction joint filler for curb and gutter shall consist of hard-pressed fiberboard.

2.4 FORM WORK

Form work shall be designed and constructed to ensure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Forms shall be of wood or steel, straight, of sufficient strength to resist springing during depositing and consolidating concrete. Wood forms shall be surfaced plank, 2 inches nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of 10 feet. Radius bends may be formed with 3/4 inch boards, laminated to the required thickness. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Ends of steel forms shall be interlocking and self-aligning. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Steel forms shall have a nominal length of 10 feet with a minimum of 3 welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips designed for use with steel forms.

2.4.1 Sidewalk Forms

Sidewalk forms shall be of a height equal to the full depth of the finished sidewalk.

2.4.2 Curb and Gutter Forms

Curb and gutter outside forms shall have a height equal to the full depth of the curb or gutter. The inside form of curb shall have batter as indicated and shall be securely fastened to and supported by the outside form. Rigid forms shall be provided for curb returns, except that benders or thin plank forms may be used for curb or curb returns with a radius of 10 feet or more, where grade changes occur in the return, or where the central angle is such that a rigid form with a central angle of 90 degrees cannot be used. Back forms for curb returns may be made of 1-1/2 inch benders, for the full height of the curb, cleated together. In lieu of inside forms for curbs, a curb "mule" may be used for forming and finishing this surface, provided the results are approved.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

The subgrade shall be constructed to the specified grade and cross section prior to concrete placement. Subgrade shall be placed and compacted in conformance with Section 02721a, SUBBASE COURSE.

3.1.1 Sidewalk Subgrade

The subgrade shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

3.1.2 Curb and Gutter Subgrade

The subgrade shall be tested for grade and cross section by means of a template extending the full width of the curb and gutter. The subgrade shall be of materials equal in bearing quality to the subgrade under the adjacent pavement.

3.1.3 Maintenance of Subgrade

The subgrade shall be maintained in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade shall be in a moist condition when concrete is placed. The subgrade shall be prepared and protected to produce a subgrade free from frost when the concrete is deposited.

3.2 FORM SETTING

Forms shall be set to the indicated alignment, grade and dimensions. Forms shall be held rigidly in place by a minimum of 3 stakes per form placed at intervals not to exceed 4 feet. Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Clamps, spreaders, and braces shall be used where required to ensure rigidity in the forms. Forms shall be removed without injuring the concrete. Bars or heavy tools shall not be used against the concrete in removing the forms. Any concrete found defective after form removal shall be promptly and satisfactorily repaired. Forms shall be cleaned and coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.

3.2.1 Sidewalks

Forms for sidewalks shall be set with the upper edge true to line and grade with an allowable tolerance of 1/8 inch in any 10 foot long section.

After forms are set, grade and alignment shall be checked with a 10 foot straightedge. Forms shall have a transverse slope of 1/4 inch per foot with the low side adjacent to the roadway. Side forms shall not be removed for 12 hours after finishing has been completed.

3.2.2 Curbs and Gutters

The forms of the front of the curb shall be removed not less than 2 hours nor more than 6 hours after the concrete has been placed. Forms back of curb shall remain in place until the face and top of the curb have been finished, as specified for concrete finishing. Gutter forms shall not be removed while the concrete is sufficiently plastic to slump in any direction.

3.3 SIDEWALK CONCRETE PLACEMENT AND FINISHING

3.3.1 Formed Sidewalks

Concrete shall be placed in the forms in one layer. When consolidated and finished, the sidewalks shall be of the thickness indicated. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted. The concrete shall be consolidated with an approved vibrator, and the surface shall be finished to grade with a strike off.

3.3.2 Concrete Finishing

After straightedging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished with a wood float or darby to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic, followed by edging.

3.3.3 Edge and Joint Finishing

All slab edges, including those at formed joints, shall be finished with an edger having a radius of 1/8 inch. Transverse joint shall be edged before brooming, and the brooming shall eliminate the flat surface left by the surface face of the edger. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished.

3.3.4 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 5/16 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

3.4 CURB AND GUTTER CONCRETE PLACEMENT AND FINISHING

3.4.1 Formed Curb and Gutter

Concrete shall be placed to the section required in a single lift. Consolidation shall be achieved by using approved mechanical vibrators. Curve shaped gutters shall be finished with a standard curb "mule".

3.4.2 Concrete Finishing

Exposed surfaces shall be floated and finished with a smooth wood float until true to grade and section and uniform in texture. Floated surfaces shall then be brushed with a fine-hair brush with longitudinal strokes. The edges of the gutter and top of the curb shall be rounded with an edging tool to a radius of 1/2 inch. Immediately after removing the front curb form, the face of the curb shall be rubbed with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. The front curb surface, while still wet, shall be brushed in the same manner as the gutter and curb top. The top surface of gutter and entrance shall be finished to grade with a wood float.

3.4.3 Joint Finishing

Curb edges at formed joints shall be finished as indicated.

3.4.4 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 1/4 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

3.5 SIDEWALK JOINTS

Sidewalk joints shall be constructed to divide the surface into rectangular areas. Transverse contraction joints shall be spaced at a distance equal to the sidewalk width or 5 feet on centers, whichever is less, and shall be continuous across the slab. Longitudinal contraction joints shall be constructed along the centerline of all sidewalks 10 feet or more in width. Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs. Where the sidewalk is not in contact with the curb, transverse expansion joints shall be installed as indicated. Expansion joints shall be formed about structures and features which project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated.

3.5.1 Sidewalk Contraction Joints

The contraction joints shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness, using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw, unless otherwise approved. Sawed joints shall be constructed by sawing a groove in the concrete with a 1/8 inch blade to the depth indicated. An ample supply of saw blades shall be available on the job before concrete placement is started, and at least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operations.

3.5.2 Sidewalk Expansion Joints

Expansion joints shall be formed with 1/2 inch joint filler strips. Immediately after finishing operations are completed, joint edges shall be rounded with an edging tool having a radius of 1/8 inch, and concrete over the joint filler shall be removed.

3.5.3 Reinforcement Steel Placement

Reinforcement steel shall be accurately and securely fastened in place with

suitable supports and ties before the concrete is placed.

3.6 CURB AND GUTTER JOINTS

Curb and gutter joints shall be constructed at right angles to the line of curb and gutter.

3.6.1 Contraction Joints

Contraction joints shall be constructed directly opposite contraction joints in abutting portland cement concrete pavements and spaced so that monolithic sections between curb returns will not be less than 5 feet nor greater than 15 feet in length. Contraction joints shall be constructed by means of 1/8 inch thick separators and of a section conforming to the cross section of the curb and gutter. Separators shall be removed as soon as practicable after concrete has set sufficiently to preserve the width and shape of the joint and prior to finishing.

3.6.2 Expansion Joints

Expansion joints shall be formed by means of preformed expansion joint filler material cut and shaped to the cross section of curb and gutter. Expansion joints shall be provided in curb and gutter directly opposite expansion joints of abutting portland cement concrete pavement, and shall be of the same type and thickness as joints in the pavement. Where curb and gutter do not abut portland cement concrete pavement, expansion joints at least 1/2 inch in width shall be provided at intervals not exceeding 10 feet. Expansion joints shall be provided in nonreinforced concrete gutter at locations indicated.

3.7 CURING AND PROTECTION

3.7.1 General Requirements

Concrete shall be protected against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

3.7.1.1 Membrane Curing Method

A uniform coating of white-pigmented membrane-curing compound shall be applied to the entire exposed surface of the concrete as soon after finishing as the free water has disappeared from the finished surface. Formed surfaces shall be coated immediately after the forms are removed and in no case longer than 1 hour after the removal of forms. Concrete shall not be allowed to dry before the application of the membrane. If any drying has occurred, the surface of the concrete shall be moistened with a fine spray of water and the curing compound applied as soon as the free water disappears. Curing compound shall be applied in two coats by hand-operated pressure sprayers at a coverage of approximately 200 square feet per gallon for the total of both coats. The second coat shall be applied in a direction approximately at right angles to the direction of application of the first coat. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. If pinholes, abrasion, or other

discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above. Areas where the curing compound is damaged by subsequent construction operations within the curing period shall be resprayed. Approved standby facilities for curing concrete pavement shall be provided at a location accessible to the jobsite for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing compound at the proper time. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

3.7.2 Backfilling

After curing, debris shall be removed and the area adjoining the concrete shall be backfilled, graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.

3.7.3 Protection

Completed concrete shall be protected from damage until accepted. The Contractor shall repair damaged concrete and clean concrete discolored during construction. Concrete that is damaged shall be removed and reconstructed for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Removed damaged portions shall be disposed of as directed.

3.8 FIELD QUALITY CONTROL

3.8.1 General Requirements

The Contractor shall perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing.

Based upon the results of these inspections and tests, the Contractor shall take the action and submit reports as required below, and any additional tests to insure that the requirements of these specifications are met.

3.8.2 Concrete Testing

3.8.2.1 Strength Testing

The Contractor shall provide molded concrete specimens for strength tests. Samples of concrete placed each day shall be taken not less than once a day nor less than once for every 250 cubic yards of concrete. The samples for strength tests shall be taken in accordance with ASTM C 172. Cylinders for acceptance shall be molded in conformance with ASTM C 31 by an approved testing laboratory. Each strength test result shall be the average of 2 test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 500 psi.

3.8.2.2 Air Content

Air content shall be determined in accordance with ASTM C 173 or ASTM C 231.

ASTM C 231 shall be used with concretes and mortars made with relatively dense natural aggregates. Two tests for air content shall be made on randomly selected batches of each class of concrete placed during each shift. Additional tests shall be made when excessive variation in concrete workability is reported by the placing foreman or the Government inspector.

If results are out of tolerance, the placing foreman shall be notified and he shall take appropriate action to have the air content corrected at the plant. Additional tests for air content will be performed on each truckload of material until such time as the air content is within the tolerance specified.

3.8.2.3 Slump Test

Two slump tests shall be made on randomly selected batches of each class of concrete for every 250 cubic yards, or fraction thereof, of concrete placed during each shift. Additional tests shall be performed when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noted along the edges of slip-formed concrete.

3.8.3 Thickness Evaluation

The anticipated thickness of the concrete shall be determined prior to placement by passing a template through the formed section.

3.8.4 Surface Evaluation

The finished surface of each category of the completed work shall be uniform in color and free of blemishes and form or tool marks.

3.9 SURFACE DEFICIENCIES AND CORRECTIONS

3.9.1 Thickness Deficiency

When measurements indicate that the completed concrete section is deficient in thickness by more than 1/4 inch the deficient section will be removed, between regularly scheduled joints, and replaced.

3.9.2 High Areas

In areas not meeting surface smoothness and plan grade requirements, high areas shall be reduced either by rubbing the freshly finished concrete with carborundum brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the concrete is 36 hours old or more. The area corrected by grinding the surface of the hardened concrete shall not exceed 5 percent of the area of any integral slab, and the depth of grinding shall not exceed 1/4 inch.

Pavement areas requiring grade or surface smoothness corrections in excess of the limits specified above shall be removed and replaced.

3.9.3 Appearance

Exposed surfaces of the finished work will be inspected by the Government and any deficiencies in appearance will be identified. Areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work shall be removed and replaced.

-- End of Section --

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SECTION 02921A

SEEDING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 602	(1995a) Agricultural Liming Materials
ASTM D 2028	(1976; R 1997) Cutback Asphalt (Rapid-Curing Type)
ASTM D 4972	(1995a) pH of Soils
ASTM D 5268	(1992; R 1996) Topsoil Used for Landscaping Purposes
ASTM D 5883	(1996e1) Use of Rotary Kiln Produced Expanded Shale, Clay or Slate (ESCS) as a Mineral Amendment in Topsoil Used for Landscaping and Related Purposes
ASTM D 977	(1998) Emulsified Asphalt

U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS Seed Act	(1995) Federal Seed Act Regulations Part 201
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MICHIGAN DEPARTMENT OF TRANSPORTATION (MDOT)

MDOT SEC 816	Standard Specification for Construction, "Turf Establishment"; Dated 2003
MDOT SEC 917	Standard Specification for Construction, "Turf and Landscaping Materials"; Dated 2003

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330, SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment; G, AOF
Surface Erosion Control Material; G, AOF
Chemical Treatment Material; G, AOF

Submit manufacturer's literature including physical characteristics, application and installation instructions for equipment, surface erosion control material and chemical treatment material within 15 days of award of contract.

A listing of equipment to be used for the seeding operation.

Delivery; G, AOF

Delivery schedule.

Finished Grade and Topsoil; G, AOF

Finished grade status.

Topsoil; G, AOF

Submit availability of topsoil from the barrow source within 15 days of award of contract.

Quantity Check; G, AOF

Within 24 hours of application provide bag count or bulk weight measurements of material used compared with area covered to determine the application rate and quantity installed.

Seed Establishment Period; G, AOF

Submit calendar time period for the seed establishment period within 15 days after award of contract. When there is more than one seed establishment period, the boundaries of the seeded area covered for each period shall be described.

Maintenance Record; G, AOF

Within 7 days of performance of maintenance work submit a record of the maintenance work performed, area repaired or reinstalled, diagnosis for unsatisfactory stand of grass plants.

Application of Pesticide; G, AOF

15 days prior to application of pesticide provide a pesticide treatment plan with sequence of treatment work with dates and times. The pesticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area treated, amount applied; and the name and state license number of the state certified applicator shall be included.

SD-04 Samples

Delivered Topsoil; G, AOF

Within 15 days of award of contract submit samples taken from

several locations at the source.

Soil Amendments; G, AOF

Within 15 days of award of contract submit A 10 pound sample.

Mulch; G, AOF

Within 15 days of award of contract submit A 10 pound sample.

SD-06 Test Reports

Equipment Calibration; G, AOF

Prior to performing any testing, submit certification of calibration tests conducted on the equipment used in the seeding operation.

Soil Test; G, AOF

Within 24 hours of completion of testing submit certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

SD-07 Certificates

Seed; G, AOF

Topsoil; G, AOF

pH Adjuster; G, AOF

Fertilizer; G, AOF

Organic Material; G, AOF

Soil Conditioner; G, AOF

Mulch; G, AOF

Mulch Blanket; G, AOF

Asphalt Adhesive; G, AOF

Pesticide; G, AOF

30 days prior to the delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following:

a. Seed. Classification, botanical name, common name, percent pure live seed, minimum percent germination and hard seed, maximum percent weed seed content, and date tested.

b. Topsoil. Particle size, pH, organic matter content, textural class, soluble salts, chemical and mechanical analyses.

c. pH Adjuster. Calcium carbonate equivalent and sieve analysis.

d. Fertilizer. Chemical analysis and composition percent.

e. Organic Material: Composition and source.

- f. Soil Conditioner: Composition and source.
- g. Mulch: Composition and source.
- h. Mulch Blanket: Composition and source.
- i. Asphalt Adhesive: Composition.
- j. Pesticide. EPA registration number and registered uses.

1.3 SOURCE INSPECTION

The source of delivered topsoil shall be subject to inspection.

1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.4.1 Delivery

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

1.4.1.1 Delivered Topsoil

Prior to the delivery of any topsoil, its availability shall be verified in paragraph TOPSOIL. A soil test shall be provided for topsoil delivered to the site.

1.4.1.2 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

1.4.1.3 Pesticide

Pesticide material shall be delivered to the site in the original, unopened containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses.

1.4.2 Inspection

Seed shall be inspected upon arrival at the job site for conformity to species and quality. Seed that is wet, moldy, or bears a test date five months or older, shall be rejected. Other materials shall be inspected for compliance with specified requirements. The following shall be rejected: open soil amendment containers or wet soil amendments; topsoil that contains slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 1-1/2 inch diameter; and topsoil that contains viable plants and plant parts. Unacceptable materials shall be removed from the job site.

1.4.3 Storage

Materials shall be stored in designated areas. Seed, lime, and fertilizer shall be stored in cool, dry locations away from contaminants. Chemical treatment material shall be stored according to manufacturer's instructions and not with seeding operation materials.

1.4.4 Handling

Except for bulk deliveries, materials shall not be dropped or dumped from vehicles.

1.4.5 Time Limitation

Hydroseeding time limitation for holding seed in the slurry shall be a maximum 24 hours.

1.4.6 Equipment

The Contractor shall submit specifications of all equipment used in the work in accordance with SUBMITTALS paragraph.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Seed Classification

State-certified seed of the latest season's crop shall be provided in original sealed packages bearing the producer's guaranteed analysis for percentages of mixture, purity, germination, hard seed, weed seed content, and inert material. Labels shall be in conformance with AMS Seed Act and applicable state seed laws.

2.1.2 Permanent Seed Species and Mixtures

Permanent seed species and mixtures shall be proportioned by weight in accordance with MDOT SEC 816 and MDOT SEC 917.

2.1.3 Temporary Seed Species

Temporary seed species for surface erosion control or overseeding shall be in accordance with MDOT SEC 816 and MDOT SEC 917

2.1.4 Quality

Weed seed shall be a maximum 1 percent by weight of the total mixture.

2.1.5 Seed Mixing

The mixing of seed may be done by the seed supplier prior to delivery, or on site as directed.

2.1.6 Substitutions

Substitutions will not be allowed without written request and approval from the Contracting Officer.

2.2 TOPSOIL

Topsoil shall be as defined in ASTM D 5268. When available, the topsoil shall be the existing surface soil stripped and stockpiled onsite in accordance with Section 02302N, EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES. When additional topsoil is required beyond the available topsoil from the stripping operation, topsoil shall be delivered and

amended as recommended by the soil test for the seed specified. Topsoil shall be free from slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 1-1/2 inch diameter. Topsoil shall be free from viable plants and plant parts.

2.3 SOIL AMENDMENTS

Soil amendments shall consist of pH adjuster, fertilizer, organic material and soil conditioners meeting the following requirements. Vermiculite shall not be used.

2.3.1 pH Adjuster

The pH adjuster shall be an agricultural liming material in accordance with ASTM C 602. These materials may be burnt lime, hydrated lime, ground limestone, sulfur, or shells. The pH adjuster shall be used to create a favorable soil pH for the plant material specified.

2.3.1.1 Limestone

Limestone material shall contain a minimum calcium carbonate equivalent of 80 percent. Gradation: A minimum 95 percent shall pass through a No. 8 sieve and a minimum 55 percent shall pass through a No. 60 sieve. To raise soil pH, ground limestone shall be used.

2.3.1.2 Hydrated Lime

Hydrated lime shall contain a minimum calcium carbonate equivalent of 110 percent. Gradation: A minimum 100 percent shall pass through a No. 8 sieve and a minimum 97 percent shall pass through a No. 60 sieve.

2.3.1.3 Burnt Lime

Burnt lime shall contain a minimum calcium carbonate equivalent of 140 percent. Gradation: A minimum 95 percent shall pass through a No. 8 sieve and a minimum 35 percent shall pass through a No. 60 sieve.

2.3.2 Fertilizer

Fertilizer shall be in accordance with MDOT SEC 817 and MDOT SEC 917. Fertilizer shall be controlled release commercial grade, free flowing, uniform in composition, and consist of a nitrogen-phosphorus-potassium ratio. The fertilizer shall be derived from sulphur coated urea, urea formaldehyde, plastic or polymer coated pills, or isobutylenediurea (IBDU). Fertilizer shall be balanced with the inclusion of trace minerals and micro-nutrients.

2.3.3 Organic Material

Organic material shall consist of either bonemeal, rotted manure, decomposed wood derivatives, recycled compost, or worm castings.

2.3.3.1 Bonemeal

Bonemeal shall be finely ground, steamed bone product containing from 2 to 4 percent nitrogen and 16 to 40 percent phosphoric acid.

2.3.3.2 Rotted Manure

Rotted manure shall be unleached horse, chicken or cattle manure containing a maximum 25 percent by volume of straw, sawdust, or other bedding materials. It shall contain no chemicals or ingredients harmful to plants.

The manure shall be heat treated to kill weed seeds and be free of stones, sticks, and soil.

2.3.3.3 Decomposed Wood Derivatives

Decomposed wood derivatives shall be ground bark, sawdust, yard trimmings, or other wood waste material that is free of stones, sticks, soil, and toxic substances harmful to plants, and is fully composted or stabilized with nitrogen.

2.3.3.4 Recycled Compost

Compost shall be a well decomposed, stable, weed free organic matter source. Compost shall be derived from food; agricultural or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. The compost shall possess no objectionable odors and shall not resemble the raw material from which it was derived. The material shall not contain substances toxic to plants. Gradation: The compost material shall pass through a 3/8 inch screen, possess a pH of 5.5 to 8.0, and have a moisture content between 35-55 percent by weight. The material shall not contain more than 1 percent by weight of man-made foreign matter. Compost shall be cleaned of plastic materials larger than 2 inches in length. The Contractor shall comply with EPA requirements in accordance with Section 01670, RECYCLED / RECOVERED MATERIALS.

2.3.3.5 Worm Castings

Worm castings shall be screened from worms and food source, and shall be commercially packaged.

2.3.4 Soil Conditioner

Soil conditioner shall be sand, super absorbent polymers, calcined clay, or gypsum for use singly or in combination to meet the requirements of the soil test.

2.3.4.1 Sand

Sand shall be clean and free of toxic materials. Gradation: A minimum 95 percent by weight shall pass a No. 10 sieve and a minimum 10 percent by weight shall pass a No. 16 sieve. Greensand shall be balanced with the inclusion of trace minerals and nutrients.

2.3.4.2 Super Absorbent Polymers

To improve water retention in soils, super absorbent polymers shall be sized and applied according to the manufacturer's recommendations. Polymers shall be added as a soil amendment and be cross-linked polyacrylamide, with an absorption capacity of 250-400 times its weight. Polymers shall also be added to the seed and be a starch grafted polyacrylonitrile, with graphite added as a tacky sticker. It shall have an absorption capacity of 100 plus times its weight.

2.3.4.3 Calcined Clay

Calcined clay shall be granular particles produced from montmorillonite clay calcined to a minimum temperature of 1200 degrees F. Gradation: A minimum 90 percent shall pass a No. 8 sieve; a minimum 99 percent shall be retained on a No. 60 sieve; and a maximum 2 percent shall pass a No. 100 sieve. Bulk density: A maximum 40 pounds per cubic foot.

2.3.4.4 Gypsum

Gypsum shall be commercially packaged, free flowing, and a minimum 95 percent calcium sulfate by volume.

2.3.4.5 Expanded Shale, Clay, or Slate (ESCS)

Rotary kiln produced ESCS material shall be in conformance with ASTM D 5883.

2.4 MULCH

Mulch shall be free from weeds, mold, and other deleterious materials. Mulch materials shall be native to the region.

2.4.1 Straw

Straw shall be stalks from oats, wheat, rye, barley, or rice, furnished in air-dry condition and with a consistency for placing with commercial mulch-blowing equipment.

2.4.2 Hay

Hay shall be native hay, sudan-grass hay, broomsedge hay, or other herbaceous mowings, furnished in an air-dry condition suitable for placing with commercial mulch-blowing equipment.

2.4.3 Wood Cellulose Fiber

Wood cellulose fiber shall not contain any growth or germination-inhibiting factors and shall be dyed an appropriate color to facilitate placement during application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 4.5 to 6.0.

2.4.4 Paper Fiber

Paper fiber mulch shall be recycled news print that is shredded for the purpose of mulching seed.

2.4.5 Mulch Blankets

Straw Mulch Blankets must meet MDOT subsection 917.15.B.1.b except that the netting must be on one side.

2.4.5.1 High Velocity Mulch Blankets

The blankets must have net covering on two sides. The net for the blanket must meet MDOT subsection 917.15.D.1. The net must provide the necessary reinforcement for protecting the blanket during shipping, handling, and installation.

2.4.5.2 High Velocity Straw Mulch Blankets

Furnish high velocity straw mulch blankets made of a uniform layer of

straw. The straw must be clean wheat straw free of weeds and weed seed. The straw and net covering must be securely stitched together to create a uniform mat. The blankets must weigh (dry) 8 ounces per square yard, ± 10 percent. Weight of each roll and name of manufacturer must be written or stenciled on the roll wrapper or on an attached tag. Blankets must be shipped in the form of a tightly compressed roll.

2.5 ASPHALT ADHESIVE

Asphalt adhesive shall conform to the following: Emulsified asphalt, conforming to ASTM D 977, Grade SS-1; and cutback asphalt, conforming to ASTM D 2028, Designation RC-70.

2.6 WATER

Water shall be the responsibility of the Contractor, unless otherwise noted. Water shall not contain elements toxic to plant life.

2.7 PESTICIDE

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide or miticide. For the purpose of this specification, a soil fumigant shall have the same requirements as a pesticide. The pesticide material shall be EPA registered and approved.

2.8 SURFACE EROSION CONTROL MATERIAL

Surface erosion control material shall conform to the following:

2.8.1 Surface Erosion Control Blanket

Blanket shall be machine produced mat of wood excelsior formed from a web of interlocking wood fibers; covered on one side with either knitted straw blanket-like mat construction; covered with biodegradable plastic mesh; or interwoven biodegradable thread, plastic netting, or twisted kraft paper cord netting.

2.8.2 Surface Erosion Control Fabric

Fabric shall be knitted construction of polypropylene yarn with uniform mesh openings $3/4$ to 1 inch square with strips of biodegradable paper. Filler paper strips shall have a minimum life of 6 months.

2.8.3 Surface Erosion Control Net

Net shall be heavy, twisted jute mesh, weighing approximately 1.22 pounds per linear yard and 4 feet wide with mesh openings of approximately 1 inch square.

2.8.4 Surface Erosion Control Chemicals

Chemicals shall be high-polymer synthetic resin or cold-water emulsion of selected petroleum resins.

2.8.5 Hydrophilic Colloids

Hydrophilic colloids shall be physiologically harmless to plant and animal life without phytotoxic agents. Colloids shall be naturally occurring, silicate powder based, and shall form a water insoluble membrane after

curing. Colloids shall resist mold growth.

2.8.6 Erosion Control Material Anchors

Erosion control anchors shall be as recommended by the manufacturer.

PART 3 EXECUTION

3.1 INSTALLING SEED TIME AND CONDITIONS

3.1.1 Seeding Time

Seed shall be installed from May 1st to Sept 20th.

3.1.2 Seeding Conditions

Seeding operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture, or other unsatisfactory conditions prevail, the work shall be stopped when directed.

When special conditions warrant a variance to the seeding operations, proposed alternate times shall be submitted for approval.

3.1.3 Equipment Calibration

Immediately prior to the commencement of seeding operations, calibration tests shall be conducted on the equipment to be used. These tests shall confirm that the equipment is operating within the manufacturer's specifications and will meet the specified criteria. The equipment shall be calibrated a minimum of once every day during the operation. The calibration test results shall be provided within 1 week of testing.

3.1.4 Soil Test

Delivered topsoil, existing soil in smooth graded areas, and stockpiled topsoil shall be tested in accordance with ASTM D 5268 and ASTM D 4972 for determining the particle size, pH, organic matter content, textural class, chemical analysis, soluble salts analysis, and mechanical analysis. Sample collection on site shall be random over the entire site. Sample collection for stockpiled topsoil shall be at different levels in the stockpile. The soil shall be free from debris, noxious weeds, toxic substances, or other materials harmful to plant growth. The test shall determine the quantities and type of soil amendments required to meet local growing conditions for the seed species specified.

3.2 SITE PREPARATION

3.2.1 Finished Grade and Topsoil

The Contractor shall verify that finished grades are as indicated on drawings, and the placing of topsoil, smooth grading, and compaction requirements have been completed in accordance with Section 02302N, EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES, prior to the commencement of the seeding operation.

3.2.2 Application of Soil Amendments

3.2.2.1 Applying pH Adjuster

The pH adjuster shall be applied as recommended by MDOT SEC 816 and MDOT

SEC 917. The pH adjuster shall be incorporated into the soil to a maximum 4 inch depth or may be incorporated as part of the tillage operation.

3.2.2.2 Applying Fertilizer

The fertilizer shall be applied as recommended by MDOT SEC 816 and MDOT SEC 917. Fertilizer shall be incorporated into the soil to a maximum 4 inch depth or may be incorporated as part of the tillage or hydroseeding operation.

3.2.2.3 Applying Soil Conditioner

The soil conditioner shall be as recommended by MDOT SEC 816 and MDOT SEC 917. The soil conditioner shall be spread uniformly over the soil a minimum 1 inch depth and thoroughly incorporated by tillage into the soil to a maximum 4 inch depth.

3.2.2.4 Applying Super Absorbent Polymers

Polymers shall be spread uniformly over the soil as recommended by the manufacturer and thoroughly incorporated by tillage into the soil to a maximum 4 inch depth.

3.2.3 Tillage

Soil on slopes up to a maximum 3-horizontal-to-1-vertical shall be tilled to a minimum 4 inch depth. On slopes between 3-horizontal-to-1-vertical and 1-horizontal-to-1 vertical, the soil shall be tilled to a minimum 2 inch depth by scarifying with heavy rakes, or other method. Rototillers shall be used where soil conditions and length of slope permit. On slopes 1-horizontal-to-1 vertical and steeper, no tillage is required. Drainage patterns shall be maintained as indicated on drawings. Areas compacted by construction operations shall be completely pulverized by tillage. Soil used for repair of surface erosion or grade deficiencies shall conform to topsoil requirements. The pH adjuster, fertilizer, and soil conditioner may be applied during this procedure.

3.2.4 Prepared Surface

3.2.4.1 Preparation

The prepared surface shall be a maximum 1 inch below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas. The prepared surface shall be completed with a light raking to remove debris.

3.2.4.2 Lawn Area Debris

Debris and stones over a minimum 5/8 inch in any dimension shall be removed from the surface.

3.2.4.3 Field Area Debris

Debris and stones over a minimum 3 inch in any dimension shall be removed from the surface.

3.2.4.4 Protection

Areas with the prepared surface shall be protected from compaction or

damage by vehicular or pedestrian traffic and surface erosion.

3.3 INSTALLATION

Prior to installing seed, any previously prepared surface compacted or damaged shall be reworked to meet the requirements of paragraph SITE PREPARATION. Seeding operations shall not take place when the wind velocity will prevent uniform seed distribution.

3.3.1 Installing Seed

Seeding method or as directed by contracting officer shall be Broadcast or Seeding Hydroseeding. Seeding procedure shall ensure even coverage. Gravity feed applicators, which drop seed directly from a hopper onto the prepared soil, shall not be used because of the difficulty in achieving even coverage, unless otherwise approved. Absorbent polymer powder shall be mixed with the dry seed at the rate recommended by the manufacturer.

3.3.1.1 Broadcast Seeding

Seed shall be uniformly broadcast at a rate to ensure even coverage using broadcast seeders. Half the total rate of seed application shall be broadcast in 1 direction, with the remainder of the seed rate broadcast at 90 degrees from the first direction. Seed shall be covered a maximum 1/4 inch depth by disk harrow, steel mat drag, cultipacker, or other approved device.

3.3.2 Hydroseeding

Seed shall be mixed to ensure broadcast at a rate to ensure even coverage using hydroseeding. Seed and fertilizer shall be added to water and thoroughly mixed to meet the rates specified. The time period for the seed to be held in the slurry shall be a maximum 24 hours. Slurry shall be uniformly applied under pressure over the entire area. The hydroseeded area shall not be rolled.

3.3.3 Mulching

3.3.3.1 Hay or Straw Mulch

Hay or straw mulch shall be spread uniformly at the rate of 2 tons per acre. Mulch shall be spread by hand, blower-type mulch spreader, or other approved method. Mulching shall be started on the windward side of relatively flat areas or on the upper part of steep slopes, and continued uniformly until the area is covered. The mulch shall not be bunched or clumped. Sunlight shall not be completely excluded from penetrating to the ground surface. All areas installed with seed shall be mulched on the same day as the seeding. Mulch shall be anchored immediately following spreading.

3.3.3.2 Mulch Blanket

Furnish, install and anchor blankets. Select type of mulch blanket desired based on slope. Place mulch blankets within one day after seeding. Overlap blanket side edges two inches. Shingle lap blanket ends 6 inches. Place staples or pegs along all joint edges and along blanket centerlines at a maximum spacing of two feet. However, in waterways shingle lap blankets with an overlap of 12 inches on the downslope edge. Place blankets on backslopes at right angles to the roadbed. On foreslopes, lay the first

strip adjacent to the road parallel to the road, with the remainder of the strips placed either parallel or at right angles to the road. When blankets are installed from the top of the slope, do not allow them to free fall down the slope. Use net anchors (pins or staples) according to MDOT subsection 917.13.D.2. Place and anchor blankets according to the manufacturer's directions if those requirements are greater than these minimum requirements.

Use high velocity blankets on slopes 1:2 or steeper and on ditch bottoms (12 inches up the slope). High velocity blankets may be substituted for mulch blankets at no increase of cost.

Use Mulch blankets on slopes flatter than 1:2, next to shoulders and behind curbs. Place mulch blankets with the netting on top and mulch fibers in contact with the soil. These blankets may only be used on ditch bottoms with slopes up to 1.5 percent.

3.3.4 Watering Seed

Watering shall be started immediately after completing the seeding of an area. Water shall be applied to supplement rainfall at a rate sufficient to ensure moist soil conditions to a minimum 1 inch depth. Run-off and puddling shall be prevented. Watering trucks shall not be driven over turf areas, unless otherwise directed. Watering of other adjacent areas or plant material shall be prevented.

3.4 SURFACE EROSION CONTROL

3.4.1 Surface Erosion Control Material

Where indicated or as directed, surface erosion control material shall be installed in accordance with manufacturer's instructions. Placement of the material shall be accomplished without damage to installed material or without deviation to finished grade.

3.4.2 Temporary Seeding

When directed during contract delays affecting the seeding operation or when a quick cover is required to prevent surface erosion, the areas designated shall be seeded in accordance with temporary seed species listed under Paragraph SEED.

3.4.2.1 Soil Amendments

When soil amendments have not been applied to the area, the quantity of 1/2 of the required soil amendments shall be applied and the area tilled in accordance with paragraph SITE PREPARATION. The area shall be watered in accordance with paragraph Watering Seed.

3.4.2.2 Remaining Soil Amendments

The remaining soil amendments shall be applied in accordance with the paragraph Tillage when the surface is prepared for installing seed.

3.5 QUANTITY CHECK

For materials provided in bags, the empty bags shall be retained for recording the amount used. For materials provided in bulk, the weight certificates shall be retained as a record of the amount used. The amount

of material used shall be compared with the total area covered to determine the rate of application used. Differences between the quantity applied and the quantity specified shall be adjusted as directed.

3.6 APPLICATION OF PESTICIDE

When application of a pesticide becomes necessary to remove a pest or disease, a pesticide treatment plan shall be submitted and coordinated with the installation pest management program.

3.6.1 Technical Representative

The certified installation pest management coordinator shall be the technical representative, and shall be present at all meetings concerning treatment measures for pest or disease control. They may be present during treatment application.

3.6.2 Application

A state certified applicator shall apply required pesticides in accordance with EPA label restrictions and recommendations. Clothing and personal protective equipment shall be used as specified on the pesticide label. A closed system is recommended as it prevents the pesticide from coming into contact with the applicator or other persons. Water for formulating shall only come from designated locations. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation. Prior to each day of use, the equipment used for applying pesticide shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately. A pesticide plan shall be submitted.

3.7 RESTORATION AND CLEAN UP

3.7.1 Restoration

Existing turf areas, pavements, and facilities that have been damaged from the seeding operation shall be restored to original condition at Contractor's expense.

3.7.2 Clean Up

Excess and waste material shall be removed from the seeded areas and shall be disposed offsite. Adjacent paved areas shall be cleaned.

3.8 PROTECTION OF INSTALLED AREAS

Immediately upon completion of the seeding operation in an area, the area shall be protected against traffic or other use by erecting barricades and providing signage as required, or as directed.

3.9 SEED ESTABLISHMENT PERIOD

3.9.1 Commencement

The seed establishment period to obtain a healthy stand of grass plants shall begin on the first day of seeding work under this contract and shall continue through the remaining life of the contract and end 12 months after the last day of the seeding operation required by this contract. Written calendar time period shall be furnished for the seed establishment period.

When there is more than 1 seed establishment period, the boundaries of the seeded area covered for each period shall be described. The seed establishment period shall be modified for inclement weather, shut down periods, or for separate completion dates of areas. The Contractor shall submit a maintenance record of seeding in accordance with SUBMITTALS paragraph.

3.9.2 Satisfactory Stand of Grass Plants

Grass plants shall be evaluated for species and health when the grass plants are a minimum 1 inch high.

3.9.2 Lawn Area

A satisfactory stand of grass plants from the seeding operation for a lawn area shall be a minimum 100 grass plants per square foot. Bare spots shall be a maximum 6 inches square. The total bare spots shall be a maximum 2 percent of the total seeded area.

3.9.2.2 Field Area

A satisfactory stand of grass plants from the seeding operation for a field area shall be a minimum 100 grass plants per square foot. The total bare spots shall not exceed 2 percent of the total seeded area.

-- End of Section --

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SECTION 02980A

PATCHING OF RIGID PAVEMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 31	(1998) Making and Curing Concrete Test Specimens in the Field
ASTM C 78	(1994) Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading)
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 143	(1998) Slump of Hydraulic Cement Concrete
ASTM C 150	(1999a) Portland Cement
ASTM C 173	(1994ael) Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 192	(1998) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(1997el) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(1998) Air-Entraining Admixtures for Concrete
ASTM C 881	(1999) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM D 75	(1987; R 1997) Sampling Aggregates

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 104	(1980) Method of Calculation of the Fineness Modulus of Aggregate
COE CRD-C 300	(1990) Specifications for Membrane-Forming Compounds for Curing Concrete
COE CRD-C 400	(1963) Requirements for Water for Use in

Mixing or Curing Concrete

1.2 DESIGN

The concrete mixtures shall be designed to produce concrete having an average compressive strength of 3,500 psi at 28 days of age, determined in accordance with ASTM C 39. The concrete mixtures shall also be designed to produce concrete having an average flexural strength of 650 psi at 28 days of age, determined in conformance with ASTM C 78, using standard 6 x 6 inch beam specimens. The concrete mixtures shall be designed to secure an air content by volume of 5-7 percent, plus or minus 1-1/2 percent, based on measurements made on concrete immediately after discharge from the mixer in conformance with ASTM C 231. Mix design studies and tests shall be made in accordance with ASTM C 78 and ASTM C 192, and the test results submitted for approval.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330, SUBMITTAL PROCEDURES:

SD-03 Product Data

Patching System; G, AOF.

Three copies of the proposed mix design, prior to placement. The mix design shall indicate the weight of each ingredient of the mixture. No concrete shall be placed prior to approval of the proposed mix design. No deviation from the approved job-mix formula will be permitted without prior approval.

SD-06 Test Reports

Patching System; G, AOF.

Three copies of test results, within 24 hours of physical completion of laboratory testing. Manufacturer's certifications may be submitted rather than laboratory test results for proposed materials. Certificates should certify compliance with the appropriate specification referenced herein. No materials shall be placed without prior approval from the Contracting Officer.

1.4 EQUIPMENT; APPROVAL AND MAINTENANCE

Dependable and sufficient equipment that is appropriate and adequate to accomplish the work specified shall be assembled at the site of the work a sufficient time before the start of paving to permit thorough inspection, calibration of weighing and measuring devices, adjustment of parts, and the making of any repairs that may be required. The equipment shall be maintained in good working condition.

1.5 SAMPLING AND LABORATORY TESTING OF MATERIALS

Sampling and testing shall be performed by an approved commercial laboratory or by the Contractor subject to approval. Should the Contractor elect to establish testing facilities, no work requiring testing shall be

permitted until the Contractor's facilities have been inspected and approved. The first laboratory inspection shall be at the expense of the Government and the cost of any subsequent inspection resulting from failure of the first inspection shall be at the expense of the Contractor. Such costs shall be deducted from the total amount due the Contractor. All testing shall be performed at no additional cost to the Government.

1.5.1 Cement

Cement shall be tested as prescribed in the referenced specification under which it is furnished. Cement may be accepted on the basis of mill tests and the manufacturer's certification of compliance with the specification, provided the cement is the product of a mill with a record for the production of high-quality cement for the past 3 years.

1.5.2 Aggregate

Aggregate samples for laboratory testing shall be taken in conformance with ASTM D 75 and tested in accordance with ASTM C 136.

1.5.3 Epoxy-Resin Grout

Epoxy-resin grout shall be tested for conformance with ASTM C 881.

1.6 DELIVERY AND STORAGE OF MATERIALS

1.6.1 Cement

Cement may be furnished in bulk or in suitable bags used for packaging cements and shall be stored in a manner to prevent absorption of moisture.

1.6.2 Aggregates

Aggregates shall be handled and stored in a manner to avoid breakage, segregation, or contamination by foreign materials.

1.6.3 Epoxy-Resin Grout

Epoxy-resin grout shall be delivered to the site in such manner as to avoid damage or loss. Storage areas shall be in a windowless and weatherproof, but ventilated, insulated noncombustible building, with provision nearby for conditioning the material to 70 degrees F to 85 degrees F for a period of 48 hours prior to use. The ambient temperature in the storage area of the epoxy materials shall at no time be higher than 100 degrees F.

1.7 WEATHER LIMITATIONS

Concrete shall not be placed when weather conditions detrimentally affect the quality of the finished product. No concrete shall be placed when the air temperature is below 40 degrees F in the shade. When air temperature is likely to exceed 90 degrees F, the concrete shall have a temperature not exceeding 90 degrees F when deposited, and the surface of such placed concrete shall be kept damp with a water fog until the approved curing medium is applied.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Coarse Aggregate

2.1.1.1 Composition

Coarse aggregate shall consist of gravel, crushed gravel, crushed stone, or a combination thereof, or crushed blast-furnace slag.

2.1.1.2 Quality

Aggregate as delivered to the mixers shall consist of clean, hard, unweathered, and uncoated particles. Dust and other coatings shall be removed from the coarse aggregates by adequate washing.

2.1.1.3 Particle Shape

Particles of the coarse aggregate shall be generally spherical or cubical in shape.

2.1.1.4 Size and Grading

The maximum nominal size of the coarse aggregate shall be 1/2 inch. The coarse aggregate shall be well graded within the limits specified, and when tested in accordance with ASTM C 136, shall conform to the following grading requirements as delivered to the batching hoppers:

Sieve designation U.S. Standard square mesh	Percentage by weight passing individual sieves No. 4 to 1/2 inch
3/4 inch	100
1/2 inch	90-100
3/8 inch	40-70
No. 4	0-15
No. 8	0-5

2.1.2 Fine Aggregate

2.1.2.1 Composition

Fine aggregate shall consist of either natural sand, manufactured sand, or a combination of natural and manufactured sand, and shall be composed of clean, hard, durable particles.

2.1.2.2 Particle Shape

Particles of the fine aggregate shall be generally spherical or cubical in shape.

2.1.2.3 Grading

Grading of the fine aggregate as delivered to the mixer shall conform to the following requirements when tested in accordance with ASTM C 136.

Sieve designation U.S. Standard square mesh	Percentage by weight, passing
3/8 inch	100
No. 4	95-100
No. 8	80-90
No. 16	60-80
No. 30	30-60
No. 50	12-30
No. 100	2-10

In addition, the fine aggregate, as delivered to the mixer, shall have a fineness modulus of not less than 2.40 nor more than 2.90, when calculated in accordance with COE CRD-C 104.

2.1.3 Air-Entraining Admixture

Air-entraining admixture shall conform to ASTM C 260.

2.1.4 Cement

Cement shall be portland cement conforming to ASTM C 150.

2.1.5 Curing Materials

2.1.5.1 Curing Compound

Membrane-forming curing compound shall be a pigmented type conforming to COE CRD-C 300.

2.1.6 Epoxy-Resin Grout

Epoxy-resin grout shall be a two-component material formulated to meet the requirements of ASTM C 881, Type I or II. Type I material shall be used when pavement, materials, or atmospheric temperatures are 70 degrees F or above. Type II material shall be used when pavement, materials, or atmospheric temperatures are below 70 degrees F.

2.1.7 Water

Water shall be clean, fresh, and free from injurious amounts of oil, acid, salt, alkali, organic matter, or other deleterious substances. Water approved by Public Health authorities for domestic consumption may be accepted for use without being tested. Water that is of questionable quality, in the opinion of the Contracting Officer, shall be tested in accordance with COE CRD-C 400.

PART 3 EXECUTION

The Contractor shall submit details of a patching system in accordance with SUBMITTALS paragraph.

3.1 CONDITIONING OF EXISTING PAVEMENT

3.1.1 Preparation of Existing Surfaces

In the area to be patched, the surface of the existing concrete shall be removed to a minimum depth of 2 inches and to such additional depth where necessary to expose a surface of sound, unweathered concrete that is uncontaminated by oils, greases, or deicing salts or solutions. A vertical saw cut at least 2 inches deep shall be made a minimum of 1 inch outside of the area to be repaired. The surface shall be thoroughly cleaned by sweeping and blowing with compressed air. Prior to coating with the epoxy-resin grout, areas showing traces of oils or grease shall be cleaned by sandblasting.

3.1.2 Preparation of Joints

Joint-sealing and expansion-joint materials shall be removed flush with the prepared surface, and, if on the pavement surface to be patched, shall be removed by sandblasting. The use of solvents will not be permitted. Care shall be used to prevent bonding of the adjacent concrete slabs at the location of the existing joints. Maintenance of these existing joints shall be accomplished by the use of fiberboard or other approved inserts of appropriate dimensions.

3.1.3 Bonding Course

Prior to placing concrete, the previously prepared surfaces shall be washed with a high pressure water jet followed by an air jet to remove free water.

The clean surface shall then be coated with a 20 to 40 mil thick film of the epoxy-resin grout. The epoxy-resin grout shall be placed in one application, just prior to concrete placement, with the use of mechanical combination, mixing and spraying equipment, or shall be applied in two coats with stiff brushes. The first brush coat shall be scrubbed into the concrete surface, followed by an additional brush coat to obtain the required thickness. When the brush method is used, the initial coat may be allowed to dry; however, the final coat shall be applied just prior to placement of the concrete.

3.1.3.1 Mixing Epoxy-Resin Grout Components

Epoxy-resin grout components shall be mixed in the proportions recommended by the manufacturer. The components shall be conditioned to 70 degrees F to 85 degrees F for 48 hours prior to mixing. The two epoxy components shall be mixed with a power-driven, explosion-proof stirring device in a metal or polyethylene container having a hemispherical bottom. The polysulfide-curing-agent component shall be added gradually to the epoxy-resin component with constant stirring until a uniform mixture is obtained. The rate of stirring shall be such that the entrained air is a minimum.

3.1.3.2 Tools and Equipment

Tools and equipment used further in the work shall be thoroughly cleaned before the epoxy-resin grout sets.

3.1.3.3 Health and Safety Precautions

The following health and safety precautions shall be followed:

- a. Full face shields shall be provided for all mixing and blending operations and for placing operations as required.
- b. Protective coveralls and neoprene-coated gloves shall be provided

for all workmen engaged in the operations.

- c. Protective creams of a suitable nature for the operation shall be supplied.
- d. Adequate fire protection shall be maintained at all mixing and placing operations.
- e. Smoking or the use of spark- or flame-producing devices shall be prohibited within 50 feet of mixing and placing operations.
- f. The mixing, placing, or storage of epoxy-resin grout or solvent shall be prohibited within 50 feet of any vehicle, equipment, aircraft, or machinery that could be damaged from fire or could ignite vapors from the material.

3.2 BATCHING, MIXING AND PROPORTIONING

3.2.1 Equipment

The Contractor shall provide adequate facilities for the accurate measurement and control of each of the materials entering the concrete. The Contracting Officer shall have free access to the batching and mixing plant at all times. Mixing equipment shall be capable of combining the aggregate, cement, admixture, and water into a uniform mixture and discharging this mixture without segregation.

3.2.2 Conveying

Concrete shall be conveyed from mixer to repair area as rapidly as practicable by methods that will prevent segregation or loss of ingredients.

3.2.3 Facilities for Sampling

Suitable facilities shall be provided for readily obtaining representative samples of aggregate and concrete for uniformity test purposes. Necessary platforms, tools, and equipment for obtaining samples shall be furnished by the Contractor.

3.2.4 Mix Proportions

The proportions of materials entering into the concrete mixtures shall be in accordance with the approved job-mix formula. The proportions shall be changed whenever necessary to maintain the workability, strength, and standard of quality required, and to meet the varying conditions encountered during the construction. However, no changes will be made without prior approval.

3.2.5 Measurement

Equipment necessary to measure and control the amount of each material in each batch of concrete shall be provided. Bulk cement shall be weighed, but cement in unopened bags as packed by the manufacturer may be used without weighing. If bagged cement is used, batches shall be proportioned so that fractional bags will not be required. One bag of portland cement will be considered as weighing 94 pounds. Mixing water and air-entraining admixtures may be measured by volume or by weight. One gallon of water will be considered as weighing 8.33 pounds.

3.2.6 Workability

The slump of the concrete shall be maintained at the lowest practicable value, not exceeding 2 inches when tested in accordance with ASTM C 143.

3.3 PLACING

Concrete shall be placed within 45 minutes from the time all ingredients are charged into the mixing drum, before the concrete has obtained its initial set, and while the epoxy-resin bonding course is tacky. The temperature of the concrete, as deposited in the form, shall be not less than 40 degrees F nor more than 90 degrees F. Concrete shall be deposited in such manner as to require a minimum of rehandling, and placement shall be in such manner as to require a minimum of rehandling and in such a manner as to least disturb the epoxy-resin grout. The placing of concrete shall be rapid and continuous for each area. Workmen shall not walk on the bonding-course surface or in the concrete during placing and finishing operations. The concrete shall be thoroughly consolidated by tamping or by means of suitable vibrating equipment.

3.4 FIELD TEST SPECIMENS

3.4.1 General

Concrete samples shall be furnished by the Contractor, and shall be taken in the field and tested to determine the slump, air content, and strength of the concrete. Test beams shall be made for determining conformance with the strength requirements of these specifications and, when required, for determining the time at which pavements may be placed in service. The air content shall be determined in conformance with ASTM C 173. Test beams shall be molded and cured in conformance with ASTM C 31 and as specified below. The Contractor shall furnish all materials, labor, and facilities required for molding, curing, and protecting test beams at the site and under the supervision of the Contracting Officer. Curing facilities for test beams shall include furnishing and operating water tanks equipped with temperature-control devices that will automatically maintain the temperature of the water at 73 degrees F plus or minus 5 degrees F. The Contractor shall also furnish and maintain at the site, boxes or other facilities suitable for storing the specimens while in the mold at a temperature of 73 degrees F plus or minus 10 degrees F. Tests of the fresh concrete and of the hardened concrete beams shall be made by and at the expense of the Contractor.

3.4.2 Specimens for Strength Tests

Flexural test beams shall be made each shift that concrete is placed. Each group of test beams shall be molded from the same batch of concrete, and shall consist of a sufficient number of specimens to provide two flexural-strength tests at each test age. One group of specimens shall be made during the first half of each shift, and the other during the last portion of the shift. However, at the start of paving operations and each time the aggregate source, aggregate characteristics, or mix design is changed, one additional set of test beams shall be made.

3.5 FINISHING

Finishing operations shall be started immediately after placement of the concrete. The finished surfaces of patched areas shall have a surface texture approximating that of the adjacent undisturbed pavements.

3.6 CURING

3.6.1 General

Concrete shall be cured by protection against loss of moisture and rapid temperature changes for a period of not less than 7 days from the beginning of the curing operation. Unhardened concrete shall be protected from rain and flowing water. The Contractor shall have all equipment needed for adequate curing and protection of the concrete on hand and ready to install before actual concrete placement begins. Failure to comply with curing requirements shall be cause for immediate suspension of concreting operations.

3.6.1.1 Membrane-Forming Curing Compound

Membrane-forming curing compound shall be applied immediately to exposed concrete surfaces after removing burlap coverings. The curing compound shall be applied with an overlapping coverage that will give a two-coat application at a coverage of not more than 200 square feet per gallon for both coats. When application is made by hand-operated sprayers, the second coat shall be applied in a direction approximately at right angles to the first coat. Concrete shall be properly cured at joints, but no curing compound shall enter joints that are to be sealed with joint-sealing compounds. The compound shall form a uniform, continuous, cohesive film that will not check, crack, or peel, and that will be free from pinholes and other imperfections. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed at the coverage specified above and at no additional cost to the Government. Areas covered with curing compound that are damaged by pedestrian and vehicular traffic or by subsequent construction operations within the specified curing period shall be resprayed at no additional cost to the Government.

3.7 FINISH TOLERANCE

The finished surfaces of patched areas shall meet the grade of the adjoining pavements and shall not deviate more than 1/8 inch from a true plan surface within the patched area.

3.8 PAVEMENT PROTECTION

The Contractor shall protect the patched areas against damage prior to final acceptance of the work by the Government. Traffic shall be excluded from the patched areas by erecting and maintaining barricades and signs until the completion of the curing period of the concrete.

3.9 JOINTS

Joints shall conform in detail and be in alignment with the existing joints.

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SECTION 03150A

EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4 (1995) Basic Hardboard

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1751 (1999) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

ASTM D 1752 (1984; R 1996e1) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

ASTM D 2628 (1991; R 1998) Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements

ASTM D 5249 (1995) Backer Material for Use With Cold and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330, SUBMITTAL PROCEDURES:

SD-03 Product Data

Preformed Expansion Joint Filler; G, AOF
Sealant; G, AOF

Manufacturer's literature, including safety data sheets, for preformed fillers and the lubricants used in their installation; and primers (when required by sealant manufacturer).

SD-07 Certificates

Preformed Expansion Joint Filler; G, AOF
Sealant; G, AOF

Certificates of compliance stating that the joint filler and sealant materials conform to the requirements specified.

1.3 DELIVERY AND STORAGE

Material delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants. Sealants shall be delivered in the manufacturer's original unopened containers. Sealants whose shelf life has expired shall be removed from the site.

PART 2 PRODUCTS

2.1 CONTRACTION JOINT STRIPS

Contraction joint strips shall be 1/8 inch thick tempered hardboard conforming to AHA A135.4, Class 1. In lieu of hardboard strips, rigid polyvinylchloride (PVC) or high impact polystyrene (HIPS) insert strips specifically designed to induce controlled cracking in slabs on grade may be used. Such insert strips shall have removable top section.

2.2 PREFORMED EXPANSION JOINT FILLER

Expansion joint filler shall be preformed material conforming to ASTM D 1751 or ASTM D 1752. Unless otherwise indicated, filler material shall be 3/8 inch thick and of a width applicable for the joint formed. Backer material, when required, shall conform to ASTM D 5249.

2.3 SEALANT

Joint sealant shall conform to the following:

2.3.1 Preformed Polychloroprene Elastomeric Type

ASTM D 2628.

PART 3 EXECUTION

3.1 JOINTS

Joints shall be installed at locations indicated and as authorized.

3.1.1 Contraction Joints

Contraction joints may be constructed by inserting tempered hardboard strips or rigid PVC or HIPS insert strips into the plastic concrete using a steel parting bar, when necessary, or by cutting the concrete with a saw after concrete has set. Joints shall be approximately 1/8 inch wide and shall extend into the slab one-fourth the slab thickness, minimum, but not less than 1 inch.

3.1.1.1 Joint Strips

Strips shall be of the required dimensions and as long as practicable. After the first floating, the concrete shall be grooved with a tool at the joint locations. The strips shall be inserted in the groove and depressed until the top edge of the vertical surface is flush with the surface of the

slab. The slab shall be floated and finished as specified. Working of the concrete adjacent to the joint shall be the minimum necessary to fill voids and consolidate the concrete. Where indicated, the top portion of the strip shall be sawed out after the curing period to form a recess for sealer. The removable section of PVC or HIPS strips shall be discarded and the insert left in place. True alignment of the strips shall be maintained during insertion.

3.1.1.2 Sawed Joints

Joint sawing shall be early enough to prevent uncontrolled cracking in the slab, but late enough that this can be accomplished without appreciable spalling. Concrete sawing machines shall be adequate in number and power, and with sufficient replacement blades to complete the sawing at the required rate. Joints shall be cut to true alignment and shall be cut in sequence of concrete placement. Sludge and cutting debris shall be removed.

3.1.2 Expansion Joints

Preformed expansion joint filler shall be used in expansion and isolation joints in slabs around columns and between slabs on grade and vertical surfaces where indicated. The filler shall extend the full slab depth, unless otherwise indicated. The edges of the joint shall be neatly finished with an edging tool of 1/8 inch radius, except where a resilient floor surface will be applied. Where the joint is to receive a sealant, the filler strips shall be installed at the proper level below the finished floor with a slightly tapered, dressed and oiled wood strip temporarily secured to the top to form a recess to the size shown on the drawings. The wood strip shall be removed after the concrete has set. Contractor may opt to use a removable expansion filler cap designed and fabricated for this purpose in lieu of the wood strip. The groove shall be thoroughly cleaned of laitance, curing compound, foreign materials, protrusions of hardened concrete, and any dust which shall be blown out of the groove with oil-free compressed air.

3.1.3 Joint Sealant

Sawed contraction joints and expansion joints in slabs shall be filled with joint sealant, unless otherwise shown. Joint surfaces shall be clean, dry, and free of oil or other foreign material which would adversely affect the bond between sealant and concrete. Joint sealant shall be applied as recommended by the manufacturer of the sealant.

3.2 CONSTRUCTION JOINTS

Construction joints are specified in Section 03307a, CONCRETE FOR MINOR STRUCTURES except that construction joints coinciding with expansion and contraction joints shall be treated as expansion or contraction joints as applicable.

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SECTION 03200A

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 318/318R (1995) Building Code Requirements for Structural Concrete and Commentary

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53 (1999) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A 82 (1997a) Steel Wire, Plain, for Concrete Reinforcement

ASTM A 184 (1996) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement

ASTM A 496 (1997) Steel Wire, Deformed, for Concrete Reinforcement

ASTM A 497 (1997) Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement

ASTM A 615 (1996a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

ASTM A 675 (1990a; R 1995e1) Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties

ASTM A 706 (1998) Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement

ASTM A 767 (1997) Zinc-Coated (Galvanized) Steel Bars in Concrete Reinforcement

ASTM A 775 (1997e1) Epoxy-Coated Reinforcement Steel Bars

ASTM A 884 (1996ae1) Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement

AMERICAN WELDING SOCIETY (AWS)

AWS D1.4 (1998) Structural Welding Code -
Reinforcing Steel

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI MSP-1 (1996) Manual of Standard Practice

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330, SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Reinforcement; G, AOF

Detail drawings showing reinforcing steel placement, schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes and spacing.

SD-03 Product Data

Welding; G, AOF

A list of qualified welders names.

SD-07 Certificates

Reinforcement; G, AOF

Certified copies of mill reports attesting that the reinforcing steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified herein, prior to the installation of reinforcing steel.

1.3 WELDING

Welders shall be qualified in accordance with AWS D1.4. Qualification test shall be performed at the worksite and the Contractor shall notify the Contracting Officer 24 hours prior to conducting tests. Special welding procedures and welders qualified by others may be accepted as permitted by AWS D1.4.

1.4 DELIVERY AND STORAGE

Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.

PART 2 PRODUCTS

2.1 DOWELS

Dowels shall conform to ASTM A 675, Grade 80. Steel pipe conforming to ASTM A 53, Schedule 80, may be used as dowels provided the ends are closed

with metal or plastic inserts or with mortar.

2.2 FABRICATED BAR MATS

Fabricated bar mats shall conform to ASTM A 184.

2.3 REINFORCEMENT

Reinforcing steel shall be deformed bars conforming to ASTM A 615 or ASTM A 706, grades and sizes as indicated. Cold drawn wire used for spiral reinforcement shall conform to ASTM A 82. In highly corrosive environments or when directed by the Contracting Officer, reinforcing steel shall conform to ASTM A 767 or ASTM A 775 as appropriate.

2.4 WELDED WIRE FABRIC

Welded wire fabric shall conform to ASTM A 496 OR ASTM A 497. When directed by the Contracting Officer for special applications, welded wire fabric shall conform to ASTM A 884.

2.5 WIRE TIES

Wire ties shall be 16 gauge or heavier black annealed steel wire.

2.6 SUPPORTS

Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI MSP-1 and shall be steel or precast concrete blocks. Precast concrete blocks shall have wire ties and shall be not less than 4 inches square when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within 1/2 inch of concrete surface shall be galvanized, plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

PART 3 EXECUTION

3.1 REINFORCEMENT

Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318/318R. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill. Bars shall not be bent after embedment in concrete. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety. Wire tie ends shall face away from the forms.

3.1.1 Placement

Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete. Reinforcement shall be placed in accordance with ACI 318/318R at locations shown plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through

construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318/318R. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.

3.1.2 Splicing

Splices of reinforcement shall conform to ACI 318/318R and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical or welded butt connection; except that lap splices shall not be used for bars larger than No. 11 unless otherwise indicated. Welding shall conform to AWS D1.4. Welded butt splices shall be full penetration butt welds. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or 6 inches. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Bars shall be flame dried before butt splicing. Adequate jigs and clamps or other devices shall be provided to support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line.

3.2 WELDED-WIRE FABRIC PLACEMENT

Welded-wire fabric shall be placed in slabs as indicated. Fabric placed in slabs on grade shall be continuous between expansion, construction, and contraction joints. Fabric placement at joints shall be as indicated. Lap splices shall be made in such a way that the overlapped area equals the distance between the outermost crosswires plus 2 inches. Laps shall be staggered to avoid continuous laps in either direction. Fabric shall be wired or clipped together at laps at intervals not to exceed 4 feet. Fabric shall be positioned by the use of supports.

3.3 DOWEL INSTALLATION

Dowels shall be installed in slabs on grade at locations indicated and at right angles to joint being doweled. Dowels shall be accurately positioned and aligned parallel to the finished concrete surface before concrete placement. Dowels shall be rigidly supported during concrete placement. One end of dowels shall be coated with a bond breaker.

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SECTION 03307A

CONCRETE FOR MINOR STRUCTURES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 308	(1992; R 1997) Standard Practice for Curing Concrete
ACI 318/318R	(1999) Building Code Requirements for Structural Concrete and Commentary
ACI 347R	(1994; R 1999) Guide to Formwork for Concrete

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 185	(1997) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 615	(2000) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 143	(2000) Slump of Hydraulic Cement Concrete
ASTM C 150	(1999a) Portland Cement
ASTM C 171	(1997a) Sheet Materials for Curing Concrete
ASTM C 172	(1999) Sampling Freshly Mixed Concrete
ASTM C 231	(1997e1) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(2000) Air-Entraining Admixtures for Concrete
ASTM C 309	(1998a) Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 31	(2000e1) Making and Curing Concrete Test Specimens in the Field
ASTM C 39	(2001) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 494	(1999ae1) Chemical Admixtures for Concrete

ASTM C 685	(2000) Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C 94	(2000e2) Ready-Mixed Concrete
ASTM D 75	(1987; R 1997) Sampling Aggregates
ASTM D 98	(1998) Calcium Chloride
U.S. ARMY CORPS OF ENGINEERS (USACE)	
COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330, SUBMITTAL PROCEDURES:

SD-03 Product Data

Air-Entraining Admixture; G, AOF
 Accelerating Admixture; G, AOF
 Water-Reducing or Retarding Admixture; G, AOF
 Curing Materials; G, AOF
 Reinforcing Steel; G, AOF

Manufacturer's literature is available from suppliers which demonstrates compliance with applicable specifications for the above materials.

Batching and Mixing Equipment; G, AOF

Batching and mixing equipment will be accepted on the basis of manufacturer's data which demonstrates compliance with the applicable specifications.

Conveying and Placing Concrete; G, AOF

The methods and equipment for transporting, handling, depositing, and consolidating the concrete shall be submitted prior to the first concrete placement.

Formwork; G, AOF

Formwork design shall be submitted prior to the first concrete placement.

SD-06 Test Reports

Aggregates; G, AOF

Aggregates will be accepted on the basis of certificates of compliance and test reports that show the material(s) meets the

quality and grading requirements of the specifications under which it is furnished.

Concrete Mixture Proportions; G, AOF

Ten days prior to placement of concrete, the contractor shall submit the mixture proportions that will produce concrete of the quality required. Applicable test reports shall be submitted to verify that the concrete mixture proportions selected will produce concrete of the quality specified.

SD-07 Certificates

Cementitious Materials; G, AOF

Certificates of compliance attesting that the concrete materials meet the requirements of the specifications shall be submitted in accordance with the Special Clause "CERTIFICATES OF COMPLIANCE". Cementitious material will be accepted on the basis of a manufacturer's certificate of compliance, accompanied by mill test reports that the material(s) meet the requirements of the specification under which it is furnished.

Aggregates; G, AOF

Aggregates will be accepted on the basis of certificates of compliance and tests reports that show the material(s) meet the quality and grading requirements of the specifications under which it is furnished.

1.3 DESIGN AND PERFORMANCE REQUIREMENTS

The Government will maintain the option to sample and test aggregates and concrete to determine compliance with the specifications. The Contractor shall provide facilities and labor as may be necessary to assist the Government in procurement of representative test samples. Samples of aggregates will be obtained at the point of batching in accordance with ASTM D 75. Concrete will be sampled in accordance with ASTM C 172. Slump and air content will be determined in accordance with ASTM C 143 and ASTM C 231, respectively, when cylinders are molded. Compression test specimens will be made, cured, and transported in accordance with ASTM C 31. Compression test specimens will be tested in accordance with ASTM C 39. Samples for strength tests will be taken not less than once each shift in which concrete is produced. A minimum of three specimens will be made from each sample; two will be tested at 28 days for acceptance, and one will be tested at 7 days for information.

1.3.1 Strength

Acceptance test results will be the average strengths of two specimens tested at 28 days. The strength of the concrete will be considered satisfactory so long as the average of three consecutive acceptance test results equal or exceed the specified compressive strength, $f'c$, and no individual acceptance test result falls below $f'c$ by more than 500 psi.

1.3.2 Construction Tolerances

A Class "C" finish shall apply to all surfaces except those specified to receive a Class "D" finish. A Class "D" finish shall apply to all surfaces

which will be permanently concealed after construction. The surface requirements for the classes of finish required shall be as specified in ACI 347R.

1.3.3 Concrete Mixture Proportions

Concrete mixture proportions shall be the responsibility of the Contractor.

Mixture proportions shall include the dry weights of cementitious material(s); the nominal maximum size of the coarse aggregate; the specific gravities, absorptions, and saturated surface-dry weights of fine and coarse aggregates; the quantities, types, and names of admixtures; and quantity of water per cubic yard of concrete. All materials included in the mixture proportions shall be of the same type and from the same source as will be used on the project. Specified compressive strength f'c shall be 4000 psi at 28 days. The maximum nominal size coarse aggregate shall be 3/4 inch, in accordance with ACI 318/318R. The air content shall be between 4.5 and 7.5 percent. The slump shall be between 2 and 5 inches. The maximum water cement ratio shall be 0.50.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Cementitious Materials

Cementitious materials shall conform to the appropriate specifications listed:

2.1.1.1 Portland Cement

ASTM C 150, Type I, IA, III, or IIIA.

2.1.2 Aggregates

Aggregates shall meet the quality and grading requirements of .

2.1.3 Admixtures

Admixtures to be used, when required or approved, shall comply with the appropriate specification listed. Chemical admixtures that have been in storage at the project site for longer than 6 months or that have been subjected to freezing shall be retested at the expense of the contractor at the request of the Contracting Officer and shall be rejected if test results are not satisfactory.

2.1.3.1 Air-Entraining Admixture

Air-entraining admixture shall meet the requirements of ASTM C 260.

2.1.3.2 Accelerating Admixture

Calcium chloride shall meet the requirements of ASTM D 98. Other accelerators shall meet the requirements of ASTM C 494, Type C or E.

2.1.3.3 Water-Reducing or Retarding Admixture

Water-reducing or retarding admixture shall meet the requirements of ASTM C 494, Type A, B, or D. High-range water reducing admixture Type F or G may be used only when approved, approval being contingent upon particular

placement requirements as described in the Contractor's Quality Control Plan.

2.1.4 Water

Water for mixing and curing shall be fresh, clean, potable, and free from injurious amounts of oil, acid, salt, or alkali, except that unpotable water may be used if it meets the requirements of COE CRD-C 400.

2.1.5 Reinforcing Steel

Reinforcing steel bar shall conform to the requirements of ASTM A 615, Grade 60. Welded steel wire fabric shall conform to the requirements of ASTM A 185. Details of reinforcement not shown shall be in accordance with ACI 318/318R, Chapters 7 and 12.

2.1.6 Formwork

The design and engineering of the formwork as well as its construction, shall be the responsibility of the Contractor.

2.1.7 Curing Materials

Curing materials shall conform to the following requirements.

2.1.7.1 Membrane-Forming Curing Compound

ASTM C 309, Type 2, Class A.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 General

Construction joints shall be prepared to expose coarse aggregate, and the surface shall be clean, damp, and free of laitance. Ramps and walkways, as necessary, shall be constructed to allow safe and expeditious access for concrete and workmen. Snow, ice, standing or flowing water, loose particles, debris, and foreign matter shall have been removed. Earth foundations shall be satisfactorily compacted. Spare vibrators shall be available. The entire preparation shall be accepted by the Government prior to placing.

3.1.2 Embedded Items

Reinforcement shall be secured in place; joints, anchors, and other embedded items shall have been positioned. Internal ties shall be arranged so that when the forms are removed the metal part of the tie will be not less than 2 inches from concrete surfaces permanently exposed to view or exposed to water on the finished structures. Embedded items shall be free of oil and other foreign matters such as loose coatings or rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. All equipment needed to place, consolidate, protect, and cure the concrete shall be at the placement site and in good operating condition.

3.1.3 Formwork Installation

Forms shall be properly aligned, adequately supported, and mortar-tight. The form surfaces shall be smooth and free from irregularities, dents, sags, or holes when used for permanently exposed faces. All exposed joints and edges shall be chamfered, unless otherwise indicated.

3.1.4 Production of Concrete

3.1.4.1 Ready-Mixed Concrete

Ready-mixed concrete shall conform to ASTM C 94 except as otherwise specified.

3.1.4.2 Concrete Made by Volumetric Batching and Continuous Mixing

Concrete made by volumetric batching and continuous mixing shall conform to ASTM C 685.

3.1.4.3 Batching and Mixing Equipment

The contractor shall have the option of using an on-site batching and mixing facility. The facility shall provide sufficient batching and mixing equipment capacity to prevent cold joints. The method of measuring materials, batching operation, and mixer shall be submitted for review.

3.2 CONVEYING AND PLACING CONCRETE

Conveying and placing concrete shall conform to the following requirements.

3.2.1 General

Concrete placement shall not be permitted when weather conditions prevent proper placement and consolidation without approval. When concrete is mixed and/or transported by a truck mixer, the concrete shall be delivered to the site of the work and discharge shall be completed within 1-1/2 hours or 45 minutes when the placing temperature is 85 degrees F or greater unless a retarding admixture is used. Concrete shall be conveyed from the mixer to the forms as rapidly as practicable by methods which prevent segregation or loss of ingredients. Concrete shall be in place and consolidated within 15 minutes after discharge from the mixer. Concrete shall be deposited as close as possible to its final position in the forms and be so regulated that it may be effectively consolidated in horizontal layers 18 inches or less in thickness with a minimum of lateral movement. The placement shall be carried on at such a rate that the formation of cold joints will be prevented.

3.2.2 Consolidation

Each layer of concrete shall be consolidated by rodding, spading, or internal vibrating equipment. Internal vibration shall be systematically accomplished by inserting the vibrator through the fresh concrete in the layer below at a uniform spacing over the entire area of placement. The distance between insertions shall be approximately 1.5 times the radius of action of the vibrator and overlay the adjacent, just-vibrated area by a few inches. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the layer below, if such a layer exists. It shall be held stationary until the concrete is consolidated and then withdrawn slowly at the rate of about 3 inches per second.

3.2.3 Cold-Weather Requirements

No concrete placement shall be made when the ambient temperature is below 35 degrees F or if the ambient temperature is below 40 degrees F and falling. Suitable covering and other means as approved shall be provided for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing and at a temperature above freezing for the remainder of the curing period. Salt, chemicals, or other foreign materials shall not be mixed with the concrete to prevent freezing. Any concrete damaged by freezing shall be removed and replaced at the expense of the contractor.

3.2.4 Hot-Weather Requirements

When the rate of evaporation of surface moisture, as determined by use of Figure 1 of ACI 308, is expected to exceed 0.2 pound per square foot per hour, provisions for windbreaks, shading, fog spraying, or covering with a light-colored material shall be made in advance of placement, and such protective measures shall be taken as quickly as finishing operations will allow.

3.3 FORM REMOVAL

Forms shall not be removed before the expiration of 24 hours after concrete placement except where otherwise specifically authorized. Supporting forms and shoring shall not be removed until the concrete has cured for at least 5 days. When conditions on the work are such as to justify the requirement, forms will be required to remain in place for longer periods.

3.4 FINISHING

3.4.1 General

No finishing or repair will be done when either the concrete or the ambient temperature is below 50 degrees F.

3.4.2 Finishing Formed Surfaces

All fins and loose materials shall be removed, and surface defects including tie holes shall be filled. All honeycomb areas and other defects shall be repaired. All unsound concrete shall be removed from areas to be repaired. Surface defects greater than 1/2 inch in diameter and holes left by removal of tie rods in all surfaces not to receive additional concrete shall be reamed or chipped and filled with dry-pack mortar. The prepared area shall be brush-coated with an approved epoxy resin or latex bonding compound or with a neat cement grout after dampening and filled with mortar or concrete. The cement used in mortar or concrete for repairs to all surfaces permanently exposed to view shall be a blend of portland cement and white cement so that the final color when cured will be the same as adjacent concrete.

3.4.3 Finishing Unformed Surfaces

All unformed surfaces that are not to be covered by additional concrete or backfill shall be float finished to elevations shown, unless otherwise specified. Surfaces to receive additional concrete or backfill shall be brought to the elevations shown and left as a true and regular surface. Exterior surfaces shall be sloped for drainage unless otherwise shown. Joints shall be carefully made with a jointing tool. Unformed surfaces shall be finished to a tolerance of 3/8 inch for a float finish and 5/16

inch for a trowel finish as determined by a 10 foot straightedge placed on surfaces shown on the plans to be level or having a constant slope. Finishing shall not be performed while there is excess moisture or bleeding water on the surface. No water or cement shall be added to the surface during finishing.

3.4.3.1 Float Finish

Surfaces to be float finished shall be screeded and darbied or bullfloated to eliminate the ridges and to fill in the voids left by the screed. In addition, the darby or bullfloat shall fill all surface voids and only slightly embed the coarse aggregate below the surface of the fresh concrete. When the water sheen disappears and the concrete will support a person's weight without deep imprint, floating should be completed. Floating should embed large aggregates just beneath the surface, remove slight imperfections, humps, and voids to produce a plane surface, compact the concrete, and consolidate mortar at the surface.

3.4.3.2 Broom Finish

The concrete shall be screeded and floated to required finish plane with no coarse aggregate visible. After surface moisture disappears, the surface shall be broomed or brushed with a broom or fiber bristle brush in a direction transverse to that of the main traffic or as directed.

3.4.3.3 Expansion and Contraction Joints

Expansion and contraction joints shall be made in accordance with MDOT English Standard Plans or as otherwise specified.

3.5 CURING AND PROTECTION

Beginning immediately after placement and continuing for at least 7 days, all concrete shall be cured and protected from premature drying, extremes in temperature, rapid temperature change, freezing, mechanical damage, and exposure to rain or flowing water. All materials and equipment needed for adequate curing and protection shall be available and at the site of the placement prior to the start of concrete placement. Preservation of moisture for concrete surfaces not in contact with forms shall be accomplished by one of the following methods:

- a. Continuous sprinkling or ponding.
- b. Application of absorptive mats or fabrics kept continuously wet.
- c. Application of sand kept continuously wet.
- d. Application of impervious sheet material conforming to ASTM C 171.
- e. Application of membrane-forming curing compound conforming to ASTM C 309, Type 1-D, on surfaces permanently exposed to view and Type 2 on other surfaces shall be accomplished in accordance with manufacturer's instructions.

The preservation of moisture for concrete surfaces placed against wooden forms shall be accomplished by keeping the forms continuously wet for 7 days. If forms are removed prior to end of the required curing period, other curing methods shall be used for the balance of the curing period. During the period of protection removal, the temperature of the air in

contact with the concrete shall not be allowed to drop more than 25 degrees F within a 24 hour period.

3.6 TESTS AND INSPECTIONS

3.6.1 General

The individuals who sample and test concrete as required in this specification shall have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field Testing Technicians, Grade I.

3.6.2 Inspection Details and Frequency of Testing

3.6.2.1 Preparations for Placing

Foundation or construction joints, forms, and embedded items shall be inspected in sufficient time prior to each concrete placement by the Contractor to certify that it is ready to receive concrete.

3.6.2.2 Air Content

Air content shall be checked at least twice during each shift that concrete is placed for each class of concrete required unless directed otherwise by the Engineer. Samples shall be obtained in accordance with ASTM C 172 and tested in accordance with ASTM C 231.

3.6.2.3 Slump

Slump shall be checked twice during each shift that concrete is produced for each class of concrete required unless directed otherwise by the Engineer. Samples shall be obtained in accordance with ASTM C 172 and tested in accordance with ASTM C 143.

3.6.2.4 Consolidation and Protection

The Contractor shall ensure that the concrete is properly consolidated, finished, protected, and cured.

3.6.3 Action Required

3.6.3.1 Placing

The placing foreman shall not permit placing to begin until he has verified that an adequate number of acceptable vibrators, which are in working order and have competent operators, are available. Placing shall not be continued if any pile is inadequately consolidated.

3.6.3.2 Air Content

Whenever a test result is outside the specification limits, the concrete shall not be delivered to the forms and an adjustment shall be made to the dosage of the air-entrainment admixture.

3.6.3.3 Slump

Whenever a test result is outside the specification limits, the concrete shall not be delivered to the forms and an adjustment should be made in the batch weights of water and fine aggregate. The adjustments are to be made

so that the water-cement ratio does not exceed that specified in the submitted concrete mixture proportion.

3.6.4 Reports

The results of all tests and inspections conducted at the project site shall be reported informally at the end of each shift and in writing weekly and shall be delivered within 3 days after the end of each weekly reporting period. See Section 01451, CONTRACTOR QUALITY CONTROL.

-- End of Section --