

MICHIGAN STATE
UNIVERSITY

ELECTRONIC BIDDING

PUBLICLY BID AND ADVERTISED
SPECIFICATION FOR

Electrical Distribution – Farm Ln Duct Bank Extension – Red Cedar to Farm Ln/Wilson Rd – Phase 1

PROJECT NUMBER

CP23036

Monday, December 02, 2024

AT

MICHIGAN STATE UNIVERSITY
EAST LANSING, MICHIGAN

Infrastructure Planning and Facilities
Planning, Design and Construction

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ADVERTISEMENT FOR BIDS

DATE: **November 25, 2024**

PROJECT TITLE: **Electrical Distribution – Farm Ln Duct Bank Extension – Red Cedar to Farm Ln/Wilson Rd – Phase 1**

PROJECT NUMBER: **CP23036**

for

MICHIGAN STATE UNIVERSITY

located at

EAST LANSING, MICHIGAN

OWNER: BOARD OF TRUSTEES
MICHIGAN STATE UNIVERSITY

ENGINEER/ARCHITECT: PLANNING, DESIGN AND CONSTRUCTION
Infrastructure Planning and Facilities
Michigan State University

DESIGN REPRESENTATIVE: **Adam Falkowski** **PHONE: 517-371-9131**

C2AE
106 West Allegan St., Suite 500
Lansing, MI 48933

PROJECT MANAGER: **Andy Linebaugh** **PHONE: 517-243-0029**

BID DUE DATE: Until **3:00 p.m. on Thursday, January 09, 2025**, the Owner will receive bids for the work as set forth in the Bidding Documents at via the Owner's Oracle Primavera Unifier Bid Manager, at which time and place all proposals will be publicly opened. Bidders are responsible for properly registering for this process, and familiarizing themselves with the system and its requirements. Registration information can be found at <https://ipf.msu.edu/construction/partners/prospective-partners>.

Proposals are invited for the following work:
Proposal 1 – General Construction Work

AB-2
ADVERTISEMENT
FOR BIDS

This project involves construction of approximately 2,225 feet of primarily 12x5” and 3x6” concrete encased electrical duct system, including seven (7) concrete manholes/vaults, approximately 690 feet of concrete encased electrical connector duct, including one (1) concrete manhole/vault, and approximately 150 feet of concrete encased communication duct, including one (1) concrete manhole/vault. The project also involves the affiliated asphalt, concrete, and turf restoration connected to the above duct installations.

Publicly Bid and Advertised: This project is publicly bid and advertised.

The substantial construction completion date for the project, as set forth in the project manual and drawings is **August 22, 2025**. See applicable start date and interim completion dates in the General Requirements (Division One) – Part 1 Work Sequence section.

LIQUIDATED DAMAGES:

Shall, or Shall not be assessed for Substantial Completion at:
\$ _____ PER DAY

Shall, or Shall not be assessed for Final Completion at:
\$ _____ PER DAY

EXCLUSIONS FROM MUTUAL WAIVERS OF CONSEQUENTIAL DAMAGES:

DEFAULT IS NONE. (If exclusions apply, project team to insert applicable exclusions below).

The complete set of documents is also available for viewing through our new [MSU Plan Room](#) or via the MSU Planning, Design and Construction (PDC) web page at <https://ipf.msu.edu/construction/partners/prospective-partners> and then select “dedicated plan room”.

PLAN ROOMS

The Bidding documents are on file and may be examined at the following locations during regular business hours, Monday through Friday:

Builders Exchange of Lansing &
Central Michigan
1240 East Saginaw
Lansing, MI 48906

Dodge Data & Analytics
25330 Telegraph Road, Suite 350
Southfield, MI 48009

Dodge Data & Analytics
914 E. Vine Street
Kalamazoo, MI 49001

Dodge Data & Analytics
1311 South Linden Road, Suite B
Flint, MI 48532

Builders Exchange
P.O. Box 2031
Grand Rapids, MI 49501

Tri-City Builders & Traders Exchange
334 South Water
Saginaw, MI 48607

Construction Association of Michigan
43636 Woodward Avenue
P. O. Box 3204
Bloomfield Hills, MI 48302-3204

Builders Exchange
3431 East Kilgore
Kalamazoo, MI 49001

CNS Construction News Service
of West Michigan, Inc.
1793 R. W. Berends Dr. SW.
Wyoming, MI 49509-4993

MMSDC Michigan Minority Supplier
Development Council.
100 River Place STE 300
Detroit, MI 48207

Builders Exchange of NW MI, Inc.
1373 Barlow St. , Suite 4
Traverse City, MI 49686

Capital Imaging
2521 East Michigan Avenue
Lansing, MI 48912

AB-4
ADVERTISEMENT
FOR BIDS

A pre-bid site inspection will be held on **Tuesday, December 10, 2024 at 10:30 a.m.** All interested Contractors or Bidders are encouraged to attend. Interested parties should meet at the **IPF Building, 1147 Chestnut Rd., East Lansing, MI 48824, Rms. 11 and 12**. All Contractors submitting bids for the work will be held to have visited the site prior to submitting bids.

Each proposal shall be accompanied by a bid security as set forth in the Instructions to Bidders.

The Owner reserves the right to reject any or all proposals either in whole or in part and to waive any irregularities.

Withdrawal of any proposal is prohibited for a period of 120 days after the actual date of the opening thereof.

Performance and Labor and Material Bonds are required as set forth in the Instructions to Bidders.

All prospective Bidders, their Subcontractors and suppliers must be awardable by and in compliance with the directives and guidelines of the Contract Compliance Division of the Michigan Civil Rights Commission.

SUBCONTRACTING AND SUPPLIER DIVERSITY

The University makes a continuous effort to broaden its business relationships with Minority Business Enterprise (MBE) contractors, Women Business Enterprise (WBE) contractors, and small business concerns (including veteran-owned small business, service-disabled veteran owned small business, HUB Zone small business, and small disadvantaged business concerns certified by the U.S. Small Business Administration). For the purposes of this provision, suppliers are considered subcontractors. If third parties are needed to fulfill contractual obligations to the University, you are strongly encouraged to consider all qualified sources, including WBE, MBE, and small business subcontractors. For purposes of this paragraph, MBE is defined as a business enterprise of which more than 50% of the voting shares or interest in the business is owned, controlled, and operated by individuals who are members of a minority and with respect to which more than 50% of the net profit or loss attributable to the business accrues to shareholders who are members of a minority. WBE is defined as a business enterprise of which more than 50% of the voting shares or interest in the business is owned, controlled, and operated by women and with respect to which more than 50% of the net profit or loss attributable to the business accrues to the women shareholders.

The apparent Low Bidder shall, within 24 hours, after receipt of bids, provide the names of any MBE/WBE/small business subcontractors, description of work to be done by each, dollar value of work, and percentage of contract price. This information shall be included with the contract breakdown specified in Section 012000.1.4 of the specifications.

The Michigan State University Purchasing Department maintains a list of known Minority and Women Business Enterprises in the region for informational purposes. Bidders can obtain a copy of this list by calling (517) 355-0357. This list is not intended to be comprehensive. Similarly, it does not constitute an endorsement or certification of acceptability of the contractors and vendors included.

INSTRUCTION TO BIDDERS

ARTICLE 1

DEFINITIONS

- 1.1 Bidding Documents include the Advertisement or Invitation to Bid, Instruction to Bidders, the Bid Form, other sample bidding and Contract forms and the proposed Contract Documents including any Addenda issued prior to receipt of Bids.
- 1.2 All definitions set forth in ConsensusDocs 200- Standard Agreement and General Conditions Between Owner and Constructor (as modified by MSU) and in other Contract Documents are applicable to the Bidding Documents.
- 1.3 **Addenda** are written or graphic instruments, issued by the Architect prior to the receipt of Bids, which modify or interpret the Bidding Documents by addition, deletions, clarifications or corrections.
- 1.4 A **Bid** is a complete and properly signed proposal to do the Work or designated portion thereof, for the sums stipulated therein, supported by data called for by the Bidding Documents.
- 1.5 **Base Bid** is the sum stated in the Bid for which the Bidder offers to perform the Work described as the base, to which Work may be added or deducted for sums stated in Alternate Bids.
- 1.6 An **Alternate Bid** (or Alternate) is an amount stated in the Proposal to be added to or deducted from the amount of the Base Bid if the corresponding change in project scope or materials or methods of construction described in the Bidding Documents is accepted.
- 1.7 A **Unit Price** is an amount stated in the Bid as a price per unit of measurement for materials or services as described in the Contract Documents.
- 1.8 A **Bidder** is one who submits a Bid for a prime Contract with the Owner for the Work described in the proposed Contract Documents.
- 1.9 A **Sub-bidder** is one who submits a Bid to a Bidder for materials or labor for a portion of the Work.
- 1.10 **Bid Manager** is the Oracle Primavera Unifier Bid Manager application used the by the Owner to received competitive bids for this project.

ARTICLE 2

BIDDER'S REPRESENTATION

- 2.1 Each Bidder, by making his/her Bid, represents that:
- 2.1.1 They have read and understand the Bidding Documents and their Bid is made in accordance therewith.
 - 2.1.2 They have visited the site and are familiar with the local conditions under which the Work is to be performed.
 - 2.1.3 Their Bid is based upon the materials, systems and equipment described in the Bidding Documents, without exceptions.

ARTICLE 3

BIDDING DOCUMENTS

3.1 COPIES

3.1.1 Bidders may obtain complete sets of the Bidding Documents via the MSU PLANNING, DESIGN AND CONSTRUCTION web page at <https://ipf.msu.edu/construction/partners/prospective-partners>, or as outlined in the Advertisement for Bids, page AB-2.

- 3.1.2 Complete sets of Bidding Documents shall be used in preparing Bids; neither the Owner nor the Architect assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
- 3.1.3 The Owner or Architect, in making copies of the Bidding Documents available on the above terms, does so only for the purpose of obtaining Bids on the Work and does not confer a license or grant for any other use.

3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

- 3.2.1 Bidders shall promptly notify the Architect of any ambiguity, inconsistency or error which they may discover upon examination of the Bidding Documents or of the site and local conditions.
- 3.2.2 Bidders requiring clarification or interpretation of the Bidding Documents shall make a written request to be received by the Architect at least fourteen days prior to the date for receipt of Bids.
- 3.2.3 Any interpretation, correction or change of the Bidding Documents will be made by Addendum. Interpretations, corrections or changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon such interpretations, corrections and changes.

3.3 SUBSTITUTIONS

3.3.1 The materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution.

3.3.2 No substitution will be considered unless written request for approval has been submitted by the Bidder and has been received by the Architect at least fourteen days prior to the date for receipt of Bids. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including drawings, cuts, performance and test data, and any other information necessary for an evaluation. A statement setting forth any changes in other materials, equipment or work that incorporation of the substitute would require shall be included. It is the burden of the bidder proposing the substitution to establish its merits. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

3.3.3 If the Architect approves any proposed substitution, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.

3.4 ADDENDA

3.4.1 The Architect and Owner will endeavor to notify all known plan holders of addenda issued, but it is the Bidder's responsibility to verify receipt of all addenda.

3.4.2 Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.

3.4.3 Normally Addenda will not be issued later than five days prior to the date for receipt of Bids except an Addendum, if necessary, postponing the date for receipt of Bids or withdrawing the request for Bids.

3.4.4 Each Bidder shall ascertain prior to submitting their Bid that they have received all Addenda issued, and receipt of all Addenda shall be acknowledged on their bid.

ARTICLE 4

BIDDING PROCEDURE

4.1 FORM AND STYLE OF BIDS

4.1.1 Bids shall be submitted via the Bid Manager on the form specified.

4.1.2 All fields on the Bid Form shall be completed.

4.1.3 All requested Alternates shall be listed and quoted in the Bid Manager. Failure to quote a requested Alternate will be cause to reject the Bid.

4.1.3.1 If an alternate is added via Addendum, bidders will include by [adding new line to bid form, clearly labeling ALTERNATE X(x being the number)] or [providing pricing on an attachment, also clearly labeling pricing for Alternate.]

4.1.4 All requested Unit Prices shall be listed and quoted via attachment in the Bid Manager. Failure to quote a requested Unit Price will be cause to reject the Bid.

4.1.5 Acknowledge the receipt of the last Addendum on the Bid Form. By acknowledging this addendum, Bidder also acknowledges receipt of all prior consecutive addenda (e.g., acknowledging Addendum 3 also acknowledges Addendum 1 and 2).

4.1.6 Bidder shall make no additional stipulations on the Bid Form nor qualify its Bid in any manner.

4.1.7 By submitting a Bid via the Bid Manager, the Bidder has committed the offer to perform the Work. The Owner will rely on this document as properly signed by the Bidder. The Owner may rely on this commitment, including submitting a claim on the Bidder's Bid Bond if they fail to enter into a contract per the project manual.

4.2 BID SECURITY

4.2.1 Any base bid greater than \$50,000 shall be accompanied by a Bid Security in the form of a bid bond made payable to the Board of Trustees, Michigan State University, in the amount of not less than five percent (5%) of the Base Bid, as a proposal guarantee, pledging that the Bidder will enter into a Contract with the Owner on the terms stated in its Bid, and will furnish bonds as described hereunder in Article 8 covering the faithful performance of the Contract and the payment of all obligations arising thereunder. Bidder shall attach a scanned copy of the bid bond to the bid in Unifier Bid Manager.

As an alternative to a bid bond, Bidders may provide certified check, cashiers' check, or money order made payable to the Board of Trustees, Michigan State University, in the amount of not less than five percent (5%) of the Base Bid, to be delivered to MSU Infrastructure Planning and Facilities, 1147 Chestnut Road, Room 101, East Lansing, MI 48824. The proposal guarantee of Bidders under consideration will be returned immediately after approval of contracts by the Owner; those of all others will normally be returned upon request within 48 hours after bid opening.

Should the Bidder refuse to enter into a Contract, or fail to furnish such bonds within 30 days of notification of intent to award, the amount of the Bid Security shall be forfeited to the Owner as liquidated damages, not as penalty.

4.2.2 The bonding firm must be listed on the current U.S. Department of Treasury Circular 570, rated A- or better by Best, and be licensed to do business in the State of Michigan. The bonds are to be made out to "Michigan State University, Board of Trustees."

4.2.3 The Owner will have the right to retain the Bid Security of Bidders under consideration until either (a) the Contract has been executed and bonds have been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn, or (c) all Bids have been rejected.

4.3 SUBMISSION OF BIDS

- 4.3.1 Bids shall be completed prior to the time and date for receipt of Bids indicated in the Advertisement or Invitation to Bid, or any extension thereof made by Addendum. Bids received after the time and date for receipt of Bids will not be considered.
- 4.3.2 Bidder shall assume full responsibility for timely delivery at location designated for receipt of Bids.
- 4.3.3 Oral, telephone, paper, or faxed Bids are invalid and will not receive consideration.

4.4 MODIFICATION OR WITHDRAWAL OF BID

- 4.4.1 A Bid may not be modified, withdrawn, or canceled by the Bidder during the stipulated time period following the time and date designated for the receipt of Bids, and Bidder so agrees in submitting his/her Bid.
- 4.4.2 Prior to the time and date designated for receipt of Bids, Bids submitted early may be modified or withdrawn only by withdrawing current Bid, and resubmitting within the Bid Manager.
- 4.4.3 Bid security shall be in an amount sufficient for the Bid as modified or resubmitted.

4.5 BIDDER REGISTRATION

- 4.5.1 The Owner will only receive Bids via the Bid Manager, which requires prior registration and invitation. The Bidder is responsible to familiarize itself with this system and request access in a timely manner.
- 4.5.2 The Owner will endeavor to maintain a list of all interested bidders, and invite to all public bids. Bidders interested in being added to this list must register. Registration information can be found at <https://ipf.msu.edu/construction/partners/prospective-partners>.
- 4.5.3 Bidders are encouraged to continue to monitor projects via plan rooms and other advertising venues. They must express interest to bid on MSU projects by request at least 7 days prior to a bid opening. Owner takes no responsibility for inviting a bidder after that date.

ARTICLE 5

CONSIDERATION OF BIDS

5.1 OPENING OF BIDS

- 5.1.1 Unless stated otherwise in the Advertisement or Invitation to Bid, the properly identified Bids received on time will be opened publicly and will be read aloud. Opening will generally take place in MSU Infrastructure Planning and Facilities Building, 1147 Chestnut Road, East Lansing, Michigan 48824.

5.1.1.1 Unless stated otherwise in the Advertisement or Invitation to Bid, the Owner will endeavor to share bid results within 24 hours of opening.

5.1.1.2 The Owner will endeavor to stream the bid opening, and will share details in the bid invitation

5.2 REJECTION OF BIDS

5.2.1 The Owner shall have the right to reject any or all Bids.

5.3 ACCEPTANCE OF BID (AWARD)

5.3.1 The Owner shall have the right to waive any informality or irregularity in any Bid received.

5.3.2 If the University accepts any alternates, it will do so in the order representing the Owner's opinion of the best value to Michigan State University. The Owner shall be the sole judge of value. The low bidder will be determined on the basis of the sum of the base bid and the alternates accepted.

5.4 ACCEPTANCE OF CONTRACTOR AND SUBCONTRACTORS

5.4.1 Each portion of the Work shall be performed by an organization equipped and experienced to do the Work in each particular field, and no portion shall be reserved by the Contractor unless they are so equipped and experienced. Within 24 hours after the receipt of Bids, the successful Contractor shall submit a list of each Subcontractor proposed for each section of the Work. Subcontractors shall be satisfactory to the Owner. Unless authorized to the contrary in writing from the Owner, Subcontracts shall be awarded to the firms named in this list. Acceptance of the Bid does not imply approval of the Subcontractors subsequently named, but each Subcontractor shall be approved individually.

ARTICLE 6

QUALIFICATION OF CONTRACTORS

6.1 SUBMISSION OF QUALIFICATION STATEMENT

6.1.1 Bidders to whom award of a Contract is under consideration shall submit to the Architect upon his/her request, a properly executed Contractor's Qualification Statement, Consensus Docs 221 – Constructor's Statement of Qualifications for a Specific Project, unless such a Statement has been previously required and submitted as a prerequisite to the issuance of Bidding Documents.

6.2 NONDISCRIMINATION

6.2.1 In performing under this Contract, the Contractor agrees not to discriminate against any employee, or applicant for employment, with respect to hire, tenure, terms, conditions or privileges of employment, or any matter directly or indirectly related to employment, because of race, color, religion, national origin, age, sex, height or weight, marital status or handicap. Subcontracts with each Subcontractor will contain a provision requiring nondiscrimination in employment, as herein specified. Any breach of this covenant may be regarded as a material breach of this Contract. The foregoing is included as a part of the University's institutional Affirmative Action/Equal Opportunity commitment.

6.3 APPROVED ASBESTOS ABATEMENT CONTRACTORS

6.3.1 The Department of Environmental Health and Safety (EHS) annually prequalifies asbestos abatement contractors to perform asbestos abatement work on Campus. Asbestos abatement work shall only be performed by one of the asbestos abatement contractors on the approved list. The current list is available from the PDC Project Representative, the Environmental Coordinator for EHS, and at <https://ehs.msu.edu/enviro/asbestos/index.html>.

ARTICLE 7

POST-BID INFORMATION

7.1 SUBMISSIONS

7.1.1 Unless waived by the Architect, the apparent low Bidder shall, within 24 hours after receipt of bids, submit the following information to the Architect:

7.1.1.1 A designation of the Work to be performed by the Bidder with their own forces.

7.1.1.2 The proprietary names and the suppliers of principal items or systems of material and equipment proposed for the Work.

7.1.1.3 A list of names of the Subcontractors or other persons or organizations (including those who are to furnish materials or equipment fabricated to a special design) proposed for each division and/or major subdivision, for the Owner's approval.

7.1.1.4 The names of the MBE/WBE and a description of work to be done by each, dollar value of Work and percentage of Contract price.

7.1.1.5 List of representatives authorized to perform Unifier functions on behalf of the contractor using the Unifier New Company Request, available at [Unifier System Vendor Information Form](#).

7.1.1.6 Certificate of Insurance demonstrating compliance with project requirements.

7.1.2 At the option of the Owner, the Bidder may be required to establish to the satisfaction of the Architect and the Owner the capability, reliability, and responsibility of the proposed Contractor and Subcontractors to furnish and perform the Work.

- 7.1.3 Subcontractors and other persons and organizations proposed by the Bidder and accepted by the Owner and the Architect must be used on the Work for which they were proposed and accepted and shall not be changed except with the written approval of the Owner and the Architect.

ARTICLE 8

PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND

8.1 OWNER'S RIGHT TO REQUIRE BONDS

- 8.1.1 Each Bidder under a proposal in which the base bid exceeds \$50,000, shall include the premiums for furnishing a Performance Bond and also Labor Material Bond, each in the full amount of the proposal sum as specified in the Owner / Constructor Agreement.
- 8.1.2 The bonding firm must be listed on the current U.S. Department of Treasury Circular 570, rated A- or better by Best, and be licensed to do business in the State of Michigan. The bonds are to be made out to "Michigan State University, Board of Trustees."
- 8.1.3 In assuming assigned Subcontractor by the successful Bidder for general building work as specified, each assigned Subcontractor for each Subcontract shall reimburse the General Contractor his/her proportionate share of the premiums for bonds.

8.2 TIME OF DELIVERY AND FORM OF BONDS AND INSURANCE

- 8.2.1 The Bidder shall deliver two (2) copies of the required bonds and insurance to the Owner not later than the date of execution of the Contract.
- 8.2.2 The Bidder shall require the Attorney-In-Fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of his/her Power of Attorney.

ARTICLE 9

FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

9.1 FORM TO BE USED

- 9.1.1 The Agreement for the Work will be governed by the project manual, and by the terms and conditions of ConsensusDocs 200- Standard Agreement and General Conditions Between Owner and Constructor (as modified by MSU).
- 9.1.2 If the project is under \$250,000, an MSU Purchase Order will be used and the terms and conditions of ConsensusDocs 200- Standard Agreement and General Conditions Between Owner and Constructor (as modified by MSU), will serve as the applicable General Conditions for administration of the Work.

- 9.1.3 If the project is over \$250,000, the ConsensusDocs 200- Standard Agreement and General Conditions Between Owner and Constructor will be used and the terms and conditions of that Agreement will be formalized through the execution of a Contract Finalization Form.

ARTICLE 10

APPLICATION FOR PAYMENT

10.1 FORM TO BE USED

- 10.1.1 Applications for Payment shall be submitted in Unifier in accordance with the Pay Apps (Pay Applications) business process. Refer to the MSU IPF website for more information

ARTICLE 11

ELECTRONIC TRANSACTIONS

11.1 UNIFIER

- 11.1.1 The Owner reserves the right to require that any or all transactions and submissions be conducted and delivered electronically through [Unifier](#), a web-based project management software system. Unifier functions on most popular web browsers. If the owner requires the use of Unifier, the owner will provide the necessary licenses for access into Unifier and the initial training necessary to use Unifier. Access to Unifier will be password restricted, and any proposal, acceptance, quote or other information submitted through Unifier through the use of a party's password shall be deemed to be the submission of such party and any proposal, acceptance, quote or other information in the submission shall be binding on such party as if such proposal, acceptance, quote or other information was in a writing signed by such party. Owner shall not be required to verify the validity of any such submission or inquire as to the authority of the user gaining access to Unifier through the use of a party's password. The following are the minimum Unifier user software and hardware requirements. It is the responsibility of the vendor to verify compatibility of their systems with Unifier. For more information, see [Unifier System Vendor Information Form](#).

11.2 CONTRACT EXECUTION

- 11.2.1 The Owner may choose to accept a scanned signed contract, provided through Unifier, as acceptance of the agreement. The Owner will rely on this document as properly signed by the Constructor.

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY OF WORK

A. Work Under This Contract

1. This Contract encompasses the furnishing of all labor, materials, services, equipment, and insurance to complete the following as shown on drawing and specified herein:
 - a. Construct approximately 2,225 feet of primarily 12x5” and 3x6” concrete encased electrical duct system, including 7 concrete manholes/vaults, from intersection of Trowbridge Rd/Red Cedar Rd, east along Trowbridge Rd, and north along Farm Ln to intersection of Farm Ln/Wilson Rd.
 - b. Construct approximately 690 feet of concrete encased electrical connector duct, including 1 concrete manhole/vault, at Trowbridge Rd/Red Cedar Rd, Trowbridge Rd/Farm Ln, and Farm Ln/Wilson Rd.
 - c. Construct approximately 150 feet of concrete encased communication duct, including 1 concrete manhole/vault, across Farm Ln at Wilson Rd.
2. Any premium time necessary to complete this project as scheduled, shall be included in the Base Bid.
3. All pertinent requirements of the Invitation to Bidders, Instructions to Bidders, and General Conditions shall form a part of these specifications and the Contractor shall consult them in detail for instructions pertaining to the work in the following divisions.

B. Work Performed Under Separate Contracts

1. The following will be provided by the Owner or by others under separate contracts:
 - a. Tie-back, pruning, removal and/or transplanting of existing plantings.
 - b. All topsoil supply and install, including fine grading, seeding, and mulching.
 - c. Construction testing
 - d. As-built Site Survey
 - 1) The Contractor shall notify the Project Representative when new underground utility installation starts, or when existing utilities are

exposed, to allow the Project Representative to coordinate with IPF Facility Information Services for documentation.

- 2) The Project Representative shall coordinate with IPF Facility Information Services for an As-built Survey upon completion of exterior improvements and utilities.
2. Coordinate pickup of the following site-related, owner-provided materials from Beaumont Supply at 4080 Beaumont Rd., Lansing, MI 48910, phone: (517) 643-6253 (Hours of operation are May 1st – October 31st 6am-4pm Monday – Friday excluding university holidays. November 1st – up until the Thanksgiving Holiday 6am-230pm Monday -Friday and following Thanksgiving Holiday – April 30th 5am-130pm to accommodate for snow) Extended hours are available with a minimum 24-hour notice. Contractor is responsible for transporting materials to the jobsite.
 - a. Soil Erosion and Sedimentation Control (SESC) materials: (removed and retained by Owner at end of permit)
 - 1) Erosion eels

C. Work Sequence

1. The Substantial construction completion date for this project is as specified in the Advertisement for Bids.

1.2 WORK RESTRICTIONS

A. Owner Occupancy

1. Unless otherwise stated, University buildings will continue to function and remain occupied during the construction process.
2. On every project involving new construction, additions or alterations to existing facilities, M.S.U. requires the ability of a person with physical disabilities to independently get to, enter, and use the site, facility, building or element. In no way shall a site, building or facility be restricted to individuals with disabilities, due to alterations or construction, which would normally be made accessible to individuals with no disabilities. Alternate routes for all new and alterations of existing facilities shall incorporate the latest federal, state and local barrier free standards and include temporary access accommodations for individuals with disabilities.

B. Use of Site

1. There shall be a pre-construction site walk-thru with the Project Representative to clarify and discuss limitations and concerns prior to construction.

2. Construction fence

- a. Along the south side of Trowbridge Rd and applicable turf areas such as the west side of Parking Lot 47, install a heavy duty orange safety fence (polyethylene/polypropylene) system including heavy duty 6-foot safety fence posts and fasteners such as zip ties to secure fencing to posts spaced approximately 10 feet apart on both sides of the trench allowing for construction operations; ‘move fence’ as duct bank construction progresses.
- b. Along/across HMA/concrete surfaces, install 6-foot tall temporary metal fence panes with anchor block/weight base and ‘move fence’ as necessary allowing construction operations; ‘move fence’ as duct bank construction progresses.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012000 - PRICE AND PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 PROPOSAL QUOTATION REQUIREMENTS

- A. Projects to be bid will be quoted as required by the front-end documents on the specification.

1.2 CONTRACT BREAKDOWNS

- A. Within twenty-four (24) hours after receipt of Bids, the apparent Low Bidder shall submit to the Architect/Engineer, the following:
1. A Schedule of Values (SOV), indicating the cost of each specified Division and/or Major Subdivision of the Bid. The approved SOV will be used as the basis for estimating partial payments to the Contractor when allowed per the front-end documents.
 - a. All contracts shall assign a minimum of 1% of the contract value for final completion and project closeout. This item must be identified as a separate line item labeled *Closeout* on the SOV. Exceptions must be approved by the Construction Superintendent.
 - b. Due to changes to Generally Accepted Accounting Practices, environmental remediation must be separately reported in the Owner's financial statements. Accordingly, all contracts shall carry remediation costs in separate lines clearly marked *remediation*. These titles should not be used in other line descriptions.
 2. Identify a Subcontractor for each Division and/or Major Subdivision for the Owner's approval. Once approved, no Subcontractors will be changed without the Owner's written consent. The List of Subcontractors will have indicated the MBE/WBE Contractors and their percentages of the Contract Price as specified in the "Cover Letter" or "Advertisement for Bids" of this project.
 3. A list of representatives authorized to perform Unifier functions on behalf of the Contractor using the [Unifier System - Vendor Information](http://ipf.msu.edu/index.cfm/capital-project-procedures/documents/unifier-system-vendor-information/) available at <http://ipf.msu.edu/index.cfm/capital-project-procedures/documents/unifier-system-vendor-information/>.

1.3 CONTRACT MODIFICATION PROCEDURES

A. Change Management Quotation Requirements

1. Quotations for changes in the Contract will be submitted via Unifier when requested, as outlined in Section 012000-1.5.B, Change Management Procedures. This section will not prohibit the Project Representative from requesting and receiving verbal quotations. It is intended that mutual cooperation will keep any changes to an absolute minimum. The Contractor shall promptly document any verbal request by initiating a Change Management or Change Request record in Unifier. The Contractor shall not engage in added work without proper authorization by the Owner. Any added work the Contractor engages in without authorization shall be at the Contractor's risk. In no event shall the failure of the Construction Representative to initiate a change constitute authorization for the Contractor to proceed with work.
2. The [Change Order Quotation Format Form](http://procedures.ipf.msu.edu/index.cfm/capital-project-delivery-procedures/) is available on the MSU [Capital Project Delivery Procedures](http://procedures.ipf.msu.edu/index.cfm/capital-project-delivery-procedures/) website (<http://procedures.ipf.msu.edu/index.cfm/capital-project-delivery-procedures/>). This Form shall be forwarded to each required Subcontractor, and is recommended as an outline of the information required by this Contract.
3. The Contractor will submit quotations through Unifier, including detailed breakdowns. Upon request, originals of any documents shall be provided to the Owner. The Project Representative will receive quotations from the Contractor only. Subcontractors will submit quotations through the Contractor. All Contractors will submit quotations with information and back-up data as indicated on the quotation form.

B. Change Management Procedures

1. Change Orders shall be issued as required to alter the Contract, (i.e. change the work scope, materials, dates, etc.), in accordance with the General Conditions of the Contract, and the following procedure:
 - a. The Contractor or the Project Representative shall initiate a Change Request in the Unifier Project Management System. Each Change Request will consist of only one change item of work.
 - b. Items brought up by the Department or Contractor shall be reviewed first with the Project Representative.
 - c. The Architect/Engineer will review the Change Request, and with the Project Representative, will determine the need for an item to be changed in the Contract by Change Order.
 - d. If the Change Request is approved, the Contractor will receive a request through Unifier to proceed with the work and/or provide pricing, as applicable. Provide a quotation for the item requiring change unless the Change Request is submitted as a lump sum with a quotation attached.

- e. The Contractor will submit a quotation for each Change Request item in accordance with the applicable Unifier business process. Overhead and profit shall be applied consistent with the General Conditions. +
- f. The Project Representative and Architect/Engineer will evaluate the quotations and accept or reject each item quoted. A Change Order will be created within the Unifier system and will be issued through the MSU Purchasing Department to change the contract amount if required.
- g. The Construction Supervisor or Director of Planning, Design and Construction has approval authority for the Contract Change.

1.4 CONTRACT PAYMENT PROCEDURES

A. Payment application requirements

1. Payment applications shall be submitted in Unifier, consistent with the contract documents.

1.5 ALTERNATES

A. Deductive Alternate for Conduit

1. Refer to Section 337119 – Electrical Underground Ducts and Manholes.
2. Provide five inch UL or ETL labeled, Type EB-20 manufactured by Prime Conduit Inc. or CANTEX Inc.
3. Owner may accept the deductive alternate based on available Project funding.
4. Acceptance of the deductive alternate by Owner shall have no effect on the Contract Times.

PART 2 - PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION 012000

SECTION 013000 - ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.1 PROJECT MANAGEMENT AND COORDINATION

A. Project Meetings

1. Project meetings may be called as deemed necessary by the Project Manager.

B. Project Scope Documentation

1. The Contractor shall use PlanGrid for coordination of changes in the field, punch list items, and potential use for plan review comments.

C. Project Coordination

1. The Contractor is ultimately responsible for coordination to complete all work shown on drawings and specified herein independent of the location of the work on drawings and within the specifications. The arrangement of work within the specification into Divisions and Sections shall be considered as given for convenience of reference only and shall not be held to conform to jurisdictional rules which may prevail in any particular trade. It shall be the responsibility of the Contractor to so arrange or group items of work under a particular trade to conform to the prevailing customs of that trade and best interest of the Owner. Specific items of work will be performed by specific subcontractors or workmen when so specified herein or subsequently deemed necessary by the Project Representative to produce competent results.
2. The Contractor shall lay out the work and be responsible for all lines and measurements of the work. Before ordering material or executing work the Contractor shall obtain field measurements and prepare the work to fit conditions properly.
3. The Contractor will be held responsible for any error resulting from his/her failure to verify the figures shown on the drawing before laying out the work.
4. No extra charge will be allowed on account of slight variations between field dimensions and dimensions given on the drawings.

D. Mechanical and Electrical Coordination

1. Connection to Existing Equipment

- a. The Contractor shall make arrangements with Planning, Design and Construction, through the Project Representative, before connecting to existing facilities. Unless otherwise noted, if interruption of service is required it shall be done at the convenience of the Owner.

1.2 CONSTRUCTION PROGRESS DOCUMENTATION

A. Construction Schedule Development/Coordination Responsibilities.

1. A simple bar chart construction schedule shall be prepared by the Contractor and initially submitted to the Owner prior to or at the first Pre-Construction Meeting.
2. The Construction Schedule shall include, without limitation, milestones, shop drawing submittals with time allowed for Owner approval, procurement and construction of all major items of work, depicted in weekly increments.
3. The Contractor shall submit updates to the Construction Schedule on no less than a monthly basis and shall submit updates with each Application for Payment, as required by paragraph 3.10 of the Conditions of the Contract.
4. The Contractor shall coordinate its work with the Owner and other Subcontractors and shall cooperate with other Subcontractors by utilizing orderly progress toward completion in accordance with the work scheduled.

1.3 SUBMITTALS

A. Submittal Schedule

1. Concurrently with the development of the Contractor's Construction Schedule, the Contractor shall prepare a complete schedule of submittals. Submit the initial Submittal Schedule along with the Construction Schedule, at, or prior to, the Pre-Construction Conference.
 - a. Coordinate the Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products, as well as the Contractor's Construction Schedule.
 - b. Prepare the schedule in chronological order. Provide the following information:
 - 1) Scheduled date for the first submittal
 - 2) Related section number or specification number
 - 3) Submittal category (Shop Drawing, Product Data, Calculations, Test Results or Samples).
 - 4) Name of the subcontractor
 - 5) Scheduled date for resubmittal
 - 6) Scheduled date for completion of the A/E's review

2. Distribution: Following the Owner’s response to the initial submittal, print and distribute copies to the Project representative, A/E, Owner, subcontractors, suppliers and other parties required to comply with the submittal dates indicated. Keep copies at the Project Site at all times.
 - a. When revisions are made, distribute to the same parties and post at the same locations. Delete parties for distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
 3. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting, or as requested by the Project Representative.
- B. Submittals are required for, but are not limited to, each of the following. The Contractor should refer to each of the following referenced sections for additional requirements of each submittal. All submittals are to be processed electronically using Unifier.
1. GENERAL SUBMITTALS
Section 012000 for Contract Breakdowns
Section 013000 for Safety Documentation
 2. AS-BUILT DRAWINGS
As-built Drawings are required as specified in Section 017000.
 3. CERTIFICATES OF INSPECTION
Certificates of Inspection are required as specified in Section 017000.
015000 for Soil Erosion and Sedimentation Control Inspection
 4. OPERATION AND MAINTENANCE DATA
Operation and maintenance data is required as specified in Section 017000.
 5. GUARANTEES
Guarantees are required as specified in Section 017000.
 7. SHOP DRAWINGS
Shop drawings are required as specified in Section 013000 for the following items:
 - a. Section 015000 for SESC measures
 - b. Section 071326 for waterproofing
 - c. Section 321216 for HMA pavement
 - d. Section 321313 for concrete pavement
 - e. Section 321613 for concrete curb and gutter

- f. Section 321723 for pavement markings
- g. Section 337119 for electrical and communication vaults, manholes, covers, conduit

C. Shop Drawings

1. The Shop Drawing will be identified by job name, date, Contractor name and name of person reviewing for compliance with Contract Documents. Shop Drawings are drawings, diagrams, schedules and other data specifically prepared by the Contractor to illustrate some portion of the Work for which submittals are required by the Contract Documents. The purpose of their submittal is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents.
2. The Contractor shall review for compliance with the Contract Documents, approve and submit to the Owner/Architect/Engineer all Shop Drawings required by the Contract Documents. Submittal shall be with reasonable promptness and in such sequence as to cause no delay in the Work or in activities of the Owner or their separate Contractors. Submittals which are not marked as reviewed for compliance with the Contract Documents and approved by the Contractor may be returned by the Owner/Architect/Engineer without action.
3. By approving and submitting Shop Drawings the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.
4. The Owner/Architect/Engineer will review and approve or take other appropriate action on the Shop Drawings submitted by the Contractor only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. Review of Shop Drawings is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Owner/Architect/Engineer's review shall not constitute approval of safety precautions or, unless otherwise stated by the Owner/Architect/Engineer, of any construction means, methods, techniques, sequences or procedures. The Owner/Architect/Engineer's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

1.4 SPECIAL PROCEDURES

A. Constructor Safety Requirements

1. MIOSHA regulations apply to all university projects. Each constructor is responsible for ensuring compliance with “all applicable requirements” that govern their work, including any additional regulations, interpretations, clarifications, and consensus standards incorporated therein by reference.
2. MSU-specific safety requirements are published in the Constructor Safety Requirements Manual. The most current version of this manual is available at <http://www.ehs.msu.edu/contractors>. Constructors will be held to the version of the manual in effect at the time of contract execution.
3. Requirements specific to work at Michigan State University generally fall into one of two categories:
 - a. Administrative Requirements, such as but not limited to communication, planning, documentation, submittals, notifications, reporting, and inspections.
 - b. Safety Requirements unique to work at MSU, such as but not limited to Control of Hazardous Energy/Lock Out Tag Out, Confined Space, Electrical, Excavations, Fall Protection, Hot Work, etc.
4. Constructor shall submit a Site-Specific Safety Plan or work under an existing Area-Specific Safety Plan where allowed, as described in the MSU Contractor Safety Requirements Manual.

B. Hazardous Materials

1. If the Contractor suspects a material, preexisting or newly discovered, within the scope of this project to be a hazardous material such as, asbestos, lead, polychlorinated biphenyl or any other potentially hazardous material, that has not already been identified and/or in the scope of work for the Contractor to abate, notify the Project Representative immediately. Do not impact or disturb the material in question until it has been determined to either be non-hazardous, included in the original scope of work, or until other arrangements can be made with the project representative and the MSU Department of Environmental Health and Safety (EHS).

2. Due to the age of buildings on the Michigan State University campus, all coated surfaces shall be assumed to contain lead-based paint. This includes but is not limited to any type of paint, primer, coating, lacquer, or varnish on any building component. Proper precautions must be taken to ensure that workers and building occupants are not exposed to airborne lead concentrations at or above the OSHA Action Level (AL) of 30 ug/m³.
3. If work will be conducted on any coated surface at MSU, the contractor must submit to the Department of Environmental Health and Safety (EHS) and Infrastructure Planning and Facilities Project Representative current proof of appropriate detailed written lead work plan in accordance with 29 CFR § 1926.62 (Michigan Part 603). This submittal will include proof of training, written respirator program, and negative exposure assessments from projects with similar conditions at a minimum. Contractors performing work on campus must follow the provisions of the MSU Lead Management Program from EHS.
4. Any work that impacts Lead shall comply with the provisions of the MSU EHS Lead Management Plan.
5. Any work that impacts Asbestos shall comply with the provisions of the MSU EHS Asbestos Management Plan.

1.5 Requests for Information

- A. Requests for Information (RFI's) shall be processed within PlanGrid, using the RFI business process in the [IPF PlanGrid Standardization Guide](#). Failure to complete the tasks within the PlanGrid time frames shall not be a basis for a delay claim.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION 013000

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 REGULATORY REQUIREMENTS

A. Applicable Codes, Standards, and Regulations

1. The following list of codes and regulations, establish the minimum requirements applied to work done at MSU. Where the specifications or plans, exceed the applicable code, the specifications and plans shall be followed.
 - a. NFPA National Fire Codes.
 - b. NFPA National Electrical Code.
 - c. ICC International Building Code.
 - d. ICC International Plumbing Code.
 - e. ICC International Mechanical Code.
 - f. State of Michigan Elevator Safety Act - Act 227, P.A. 1967.
 - g. State of Michigan Boiler Act - Act 290, P.A. 1965.
 - h. State of Michigan Construction Code Act - Act 230, P.A. 1972, as amended.
 - i. State of Michigan Occupational Safety and Health Act - Act 154, P.A. 1974, as amended.
 - j. Americans With Disabilities Act (ADA) Public Law 101-336.
 - k. Regulations of Air Pollution Control Commission State of Michigan, and the Federal Clean Air Act (42 U.S.C. 1857C - 8 © (1)).
 - l. Soil Erosion and Sedimentation Control - Act 451 of 1994, parts 31 and 91, as amended.
 - m. Environmental Impact Statement Executive Order 1974-4.
 - n. State Fire Safety Board's New Rules for Schools, Colleges, and Universities.
 - o. State of Michigan Safe Drinking Water Act, P.A. 339 of 1976, and Federal Water Pollution Control Act (33 U.S.G. 1319 ©).

- p. State of Michigan Energy Code (Adopting ASHRAE 90 by reference).

1.2 REFERENCES

A. Abbreviations and Symbols

1. AIA - American Institute of Architects
2. ACI - American Concrete Institute
3. AISC - American Institute of Steel Construction
4. ANSI - American National Standards Institute
5. ASTM - American Society for Testing Materials
6. BOCA - Building Officials and Code Administrators
7. LEED - Leadership in Energy and Environmental Design
8. NFPA - National Fire Protection Association
9. OSHA - Occupational Safety and Health Act
10. SMACNA - Sheet Metal and Air Conditioning Contractors National Association
11. MDOT - Michigan Department of Transportation
12. USGBC - U.S. Green Building Council

1.3 QUALITY CONTROL

A. Testing Laboratory Services

1. All work (materials and installation procedure) shall be tested and inspected by an independent testing and inspection agency, supplied by the Project Representative to provide the quality control requirements in accordance with these specifications. Results of these tests and inspections when performed in accordance with these specifications will not be disputed by either party. Failure of the Contractor to comply with the quality control in accordance with this specification may result in the replacement of the work at the Contractor's expense.

B. Contractor's Responsibilities

1. Advise the testing and inspection agency sufficiently in advance of the work to be inspected in the field to allow time to schedule personnel and equipment to perform the

required inspections. Failure of the work to be inspected shall be the sole responsibility of the Contractor regardless of the fault of the testing and inspection agency.

2. Furnish certificates to authenticate the type and or quality of products furnished for installation as required in these specifications.
3. Shall notify the Project Representative in a timely manner when and where testing is to take place to provide sufficient time for the Project Representative to be in attendance.

C. Testing & Inspection Agency Responsibilities

1. Perform all testing and inspection of the work in accordance with these specifications.
2. Furnish qualified personnel and sufficient equipment in a timely manner when required by the Contractor and/or Project Representative to perform all testing and inspection in accordance with these specifications.
3. Provide written reports (2 copies) in a timely manner of the work tested and inspected. The reports shall include complete material test results and for in-place material, a sketch showing the exact location where the test was taken on the project site.
4. The inspection and testing agency and its representatives are not authorized to revoke, alter, relax, enlarge or release any requirements of the Contract Documents, nor to approve or accept any portion of the work.
5. Work will be checked by representatives of the testing agencies as it progresses, but failure to detect any defective work or product will not in any way prevent later rejection when such defect is discovered, nor will it obligate the Owner to final acceptance. When it appears that the work or product furnished is in non-conformance with the Contract Documents, the representative of the testing agency will direct the attention of the Project Representative and Contractor to such non-conformance.
6. Quality control testing items shall include the following:
 - a. Soil densities
 - b. Proof roll
 - c. Concrete testing
 - d. Asphalt field testing (density and yield)
 - e. Bituminous mix design approval and batch plant verification
 - f. Asphalt plant mix verification
 - g. Verify pavement sections

h. Determine need for and extent of sub-grade undercutting and testing.

D. Authority of the Project Representative

1. May order additional tests and inspection beyond those required, if in their opinion, the subject work may not meet specification. The costs for these tests and inspections shall be borne by the Contractor.
2. May terminate the testing and inspection agency. The Contractor shall then furnish to the Project Representative the name of an additional agency for approval.
3. May perform quality control tests and inspections.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION 014000

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1- GENERAL

1.1 TEMPORARY UTILITIES

A. General

1. The Contractor for the general construction work shall be responsible for all items specified in Section 015000. The Contractor shall install and maintain all items until project is finished and shall remove same and restore areas to their original conditions.

B. Temporary Electricity

1. The Contractor may use any permanent electrical outlets in the construction area.
2. Construction lighting shall be turned off during unoccupied periods, with the exception of lighting required for safety reasons such as path of egress.
3. Temporary service for heavy loads, or where no other service is available, will be provided by the general Contractor at the Contractor's expense. Power for temporary service connected to public utility company lines, (before an MSU service meter) will be paid for by the Contractor. Power for temporary service connected to the MSU power system, or after an MSU service meter, will be furnished by the Owner at no charge.
4. The contractor shall install temporary lighting within the construction area consistent with MIOSHA requirements.

C. Temporary Heat

1. All equipment and labor for temporary heat shall be furnished by the Contractor. Use of University utilities for temporary heat will be at the discretion of the Owner. The cost of natural gas or steam for heating new structures or other applications requiring temporary heat will be paid by the Contractor.

D. Temporary Telephone Service

1. If there is no University phone at the immediate work site, the Contractor shall provide a temporary job site telephone and/or provide the Job Superintendent with a phone activated paging device or cell phone.

E. Temporary Water

1. Each Contractor may use water for construction purposes from the nearest University source.

F. Temporary Sanitary Facilities

1. A toilet in the work area may be used by the Contractor's employees.
2. Where there is no toilet in the work area, an approved chemical type portable toilet will be provided by the Contractor.

1.2 VEHICULAR ACCESS AND PARKING

A. Parking Regulations

1. Unless otherwise directed, all non-University personnel working on the Campus of Michigan State University are required to park as Visitors. Between 7:00 a.m. and 6:00 p.m., Monday through Friday, Visitors may park only in metered parking spaces or gate controlled parking lots.
2. Commercial permits are available from the Department of Police and Public Safety (355-8440), which will allow parking in specific areas. The cost of a commercial permit is the responsibility of the Contractor.
3. Permits for one day parking in areas reserved for university employees are available to Contractors or their personnel from the Department of Police and Public Safety at the current rate, with a signed note from the Project Representative.
4. Parking permits are not required for vehicles south of Mount Hope Road.

1.3 TEMPORARY BARRIERS AND ENCLOSURES

A. General

1. The Contractor shall provide, install, and maintain necessary temporary barriers, warning signs, and other safety measures to protect the public, property, and plant growth.
2. The Contractor will be required to work within limitations imposed by the University Police and Public Safety Department with respect to vehicular and pedestrian traffic. When approved by the Owner, if it becomes necessary to occupy a traffic lane for **ANY** length of time, proper directional signs, flashers and barricades shall be provided at the Contractor's expense in accordance with the most recent edition of the Michigan Manual of Uniform Traffic Control Devices. The Contractor will replace if damaged or stolen, all barricades, flares, and night protection at Contractor's expense, all being considered as incidental to the work.

B. Dust Control

1. Temporary Partitions

- a. The Contractor shall construct necessary temporary partitions to isolate the new work from the existing building.
- b. Unless noted otherwise, construct partitions of 2” x 4” wood studs, 16” on center and heavy mil, fire retardant plastic sheeting securely attached so as to keep dust, dirt, and debris from spreading beyond the work area.

2. Return Air Openings

- a. The Contractor shall block all return air openings in the work area so that dust will not carry into other areas of the building.

3. Site Dust

- a. The General Contractor shall be responsible for eliminating airborne dust in the work area and staging area by application of appropriate mitigation measures, as approved by the Owner.

C. Campus Woody Plant Protection

1. Coordinate all plant protection and site work limits with the Project Representative. SITE WORK CANNOT COMMENCE WITHOUT A PRE-CONSTRUCTION WALK-THROUGH.

All Contractor employees engaged on the project site shall attend, or are expected to have attended, the Contractor Woody Plant Protection Seminar, hosted by MSU’s Landscape Services (formerly Grounds Maintenance) Division. This seminar will be presented on an annual basis at a minimum. Coordinate with the Project Representative for times and locations of the seminar(s).

2. Work by Owner

- a. Tie-back of existing plantings. Pruning, thinning, and sealing of existing plantings. Root pruning and root protection of exposed roots. Watering of existing trees under stress. Salvaging of existing small trees, shrubs, and other plant growth that the Owner wishes to retain.
- b. Tree protection barricades will be provided by the Owner. Plant damage occurring within installed barricades does not absolve the Contractor from damage assessment.

- c. Work shall be performed by MSU Landscape Services Department unless otherwise arranged, as needed to provide either preventative or remedial care to plants on a construction site. Contractor shall immediately contact the Project Representative should “protected plants” be compromised in violation of agreed upon fencing locations and work limits. Failure to communicate promptly could result in 100% damage assessment of fines.

3. Protection of Plantings

- a. Protect existing trees and other vegetation indicated to remain in place. Prohibited practices include breaking of branches, scraping of bark, or unauthorized cutting; nailing or bolting into trees or plants; use of trees or plants as temporary support (i.e. for cables); unauthorized filling, excavating, trenching or auguring within the root zone; compaction/driving over the root zone; (see definitions below), storage of any materials or vehicles within the root zone; dumping of construction waste or materials (including liquids); unauthorized removal or relocation of woody plants; removal of tree protection barricades or construction fencing prior to completion of project.
- b. Compaction within the root zone is the increasing of the soil density caused by heavy equipment or concentrated foot traffic which significantly alters the soil conditions from that which was present prior to construction.
- c. The root zone of a tree is one and a half the distance of plant crown drip line outward from the stem, along undisturbed grade. Should placement of concrete be specified or authorized by the Owner within the root zone, a sulfur application will be applied by the Owner. The Contractor shall notify the Owner at least 48 hours prior to pouring concrete. Trees to receive sulfur shall be identified by Owner.

4. Damage

- a. Damage to campus woody plants shall include any of the items indicated in paragraph 3.a above as determined solely by the Owner. The Owner shall evaluate damage and establish proportional fines up to 100% of the value shown below, regardless of the current disposition of the plant.
- b. 100% Value Schedule for Campus Trees
 - 1" - 3" caliper \$200/inch
 - 3" - 6" DBH \$290/inch
 - 6" - 9" DBH \$380/inch
 - 9" - 12" DBH \$480/inch
 - 12" - 15" DBH \$670/inch
 - 15" DBH or greater \$960/inch
- c. DBH is the tree trunk diameter at breast height.

- d. Replacement value for shrubs, vines, and perennials shall be assessed at three times the current market cost of the plant.
- e. Alternatives to the above protective measures, or any variations, must be approved by the staff Landscape Architect and the Project Representative. (Measures may include: thinning and root pruning, fertilization, aeration, boring & jacking, hand excavation, supervision by campus arborist, seasonal schedule recommendations.) Alternatives would be based on the specific requirements of the plant species in question, as determined by the staff Landscape Architect.

1.4 TEMPORARY CONTROLS

A. Soil Erosion and Sediment Control (SESC)

1. The Contractor shall comply with all Contract Documents, approved SESC plans, permit conditions and with Parts 31 and 91 of Public Act 451 of 1994. The Owner shall obtain a Soil Erosion and Sedimentation Control (SESC) permit from the appropriate Municipal (MEA) or County (CEA) Enforcing Agency. Permit Fees and MEA/CEA routine inspections will be paid for by the Owner.
2. Prior to beginning any earth change, the Contractor shall retain a DEQ Certified Storm Water Operator (CSWO) to provide the required SESC reports (which include the weekly and storm event reports as well as all follow up reports for both violations and storm event corrections) on the standard DEQ form. The Contractor shall provide the reports to the Owner on a weekly basis, and retain those reports for 3 years.
3. Prior to beginning any earth change, and during the life of the contract, the Contractor shall install and maintain all temporary SESC measures as shown on the Contract Documents, SESC plans, and as directed by the Owner, CSWO, DEQ, or MEA/CEA, until MSU officially takes over responsibility for the site.
4. Immediately prior to MSU taking responsibility for the site, the Contractor:
 - a. Will be required to clean all catch basins affected by the construction, both within the Contract Limits and all surrounding roads and lawn areas when soil may have spread as the result of construction activities.
 - b. Shall put all temporary SESC measures in satisfactory condition as determined by the CSWO.
5. All temporary SESC measures will remain in place and will become the property of the Owner when responsibility for maintaining the SESC measures becomes the Owner's responsibility.

6. The Contractor shall conduct all excavation, filling, grading and clean-up operations in a manner such that sediment generated by wind or water is not discharged off site or into any storm sewer, drainage ditch, river, lake, air or underground utility system. Stage the work per plan to minimize the area of exposed soil, thereby reducing the opportunity for soil erosion.
7. Water from trenches and other excavation shall be passed through an approved filtration bag to remove sediments from the water before it is released into the storm water drainage system.
8. If sediment extends beyond the project limits, the Contractor shall be responsible for cleanup and restoration of all surfaces and utility systems to the condition that existed prior to the Contract award.
9. All SESC measures shall be maintained daily.
10. Should violations (irrespective of a fine being assessed) be identified by the Owner, CSWO, MEA/CEA or DEQ, they shall be corrected within 24 hours of notification. The correction(s) shall be approved by the Owner, CSWO, MEA/CEA or DEQ. All subsequent inspections performed by the Owner, CSWO, MEA/CEA or DEQ as a result of the violation (and any other associated costs) will be paid by the Contractor. If identified violations are not corrected within 24 hours of written notice, the Owner shall have the right to make necessary repairs at the Contractor's expense, without being required to provide further notice to Contractor.
11. Fines assessed as a result of the violation for non-compliance of the SESC provisions, will be paid by the Contractor. If a “Stop Work” order for non-compliance is issued, a time extension request for that time period will **not** be granted. (Fines could be assessed up to and including \$25,000/DAY for each violation.)
12. Only one Seven Day Notice will be issued for violations of the SESC provisions. Should subsequent violations be identified, the contractor will be expected to make the satisfactory correction within 24 hours of notification. Should the corrections not be made, the Owner, without further notice to the Contractor, will correct the violation. The cost of the corrective action will be charged to the Contractor.

1.5 CONSTRUCTION DEBRIS CONTROL

- A. The Contractor shall provide and administer a system for disposal of construction debris, and shall be responsible for seeing that the site and the new building are at all times free of accumulated debris caused by the construction. For purposes of this paragraph, debris shall include ALL materials used in construction including construction roads and pads. Special attention should be given to materials that could leach into the ground, including but not limited to lime based materials, all chemicals, and any liquids except clean water.

- B. The Contractor shall comply with LEED Materials & Resources Credit 2, including documentation of the Construction Waste materials recycled, reused and sent to the landfill, using the Construction Waste Management form and process provided by the Owner in Unifier. This form shall be submitted monthly, and will be generated from completed payment applications. Negative reports are required.
- C. This shall include, but not be limited to, rubbish containers conveniently located throughout the site for the daily disposal of debris directly into them from each work location. Debris shall not be allowed to accumulate on the ground through-out the site overnight.
- D. All combustible debris shall be removed to a solid waste disposal site properly licensed under Act 87 of the Public Acts of 1965 of the State of Michigan.
- E. No burning of debris will be permitted on the Project site or elsewhere on the Owner's property.
- F. Should the Contractor not execute the work required in this section, the Owner reserves the right to perform the work by other forces and deduct the cost from the contract price.

1.6 CONFINED SPACES

- A. The workplace may contain permit confined spaces and entry is allowed only through compliance with a confined space program as defined by 29 CFR 1910.146. The contractor is responsible for assessing real or potential atmospheric hazards and other serious safety and health hazards in the confined space. MSU will make available records of known confined space hazards. The contractor shall provide all necessary equipment for confined space entry. If MSU personnel will be working in or near confined spaces occupied by the contractor, the contractor is required to coordinate activities with the Project Representative. The contractor will inform the Project Representative of procedures followed and hazards confronted or created during entry operations.

1.7 LOCK-OUT/TAG-OUT PROCEDURE

- A. The Contractor shall conform to Michigan State University Infrastructure Planning and Facilities lock-out/tag-out procedure. Copies are available from Planning, Design and Construction, Infrastructure Planning and Facilities Building, Michigan State University.

1.8 HAZARDOUS SUBSTANCE SPILLS

- A. Releases of hazardous substances that pose a significant threat to health and safety, or that, by their very nature, require more than a routine response, are emergency situations. If a release of an emergency nature occurs, call 911 immediately. Provide all applicable information and stay on the phone until told to hang up. If a non-emergency release of a hazardous substance occurs, contact the MSU Infrastructure Planning and Facilities Project Representative immediately.

1.9 CRANE HOISTING

- A. Crane hoisting of equipment or materials over occupied spaces shall be performed at the convenience of the Owner, with arrangements made by the Project Representative.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Storage and Protection

1. The Contractor shall be responsible for work, material, and equipment until finally inspected, tested, and accepted. The project shall be protected against theft, injury, and damage. Material and equipment received on the site shall be carefully stored until installation.

B. Staging Area

1. Should the Contractor require exterior staging or on-site storage of materials - the location of this area must be agreed upon prior to actual use of the space by the Project Representative and the Contractor. The area will not be within the drip-line of any tree or in plant beds, as per Section 015000.1.3.D.3.
2. If this exterior area is outside the fenced project site, the area shall be enclosed with a minimum 4' high welded wire fence, with metal fence T-posts not exceeding 8' on center. Fence fabric shall be supported by either a top bar or a tension cable.
3. The Contractor shall be responsible for the cost of placing and removing the fence.
4. Each designated area shall have only one access route from the road or drive.
5. The area is not to be used for employee parking, but may be utilized by the Contractors' vehicles and equipment necessary to service the project.
6. Any areas damaged as a result of the staging operation shall be repaired by the Contractor, at no additional cost to the Owner.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017000 - EXECUTION REQUIREMENTS

PART 1- GENERAL

1.1 EXAMINATION

A. Pre-Bid Site Inspection

1. Each Bidder shall be held to have visited the site of the proposed work before submitting their proposal and to have familiarized themselves with all existing conditions affecting the execution of the work in this project. No allowance or extra consideration on behalf of the Contractor or Subcontractor will subsequently be made by reason of failure to observe the site conditions.

1.2 PREPARATION

A. Protection of Work and Property

1. Contractor shall protect existing and new work as required by this construction or as requested by the Project Representative.
2. Exterior Protection
 - a. The Contractor shall be responsible for any damage to existing facilities, including but not limited to the following: buildings, trees and shrubs, walks, roads, utility systems, terraces and steps, lights, and unreasonable turf damage as determined by the Project Representative. Damage shall be repaired by the Contractor in accordance with MSU's Construction Standards at no cost to the Owner.
 - b. No crawler cranes, bulldozers, or other equipment, fitted and running on steel treads, shall be permitted to traverse any walk, road, street, or other thoroughfare on the Campus of Michigan State University. Where it is necessary to unload such equipment on these thoroughfares, and when approved by the Project Representative, planking shall be provided to protect same. If this is not done, and damage is observed, the cost of replacing shall be the burden of the Contractor causing such damage.

B. Field Engineering

1. Quality Assurance

a. Surveyor

- 1) Engage a Registered Land Surveyor, registered in Michigan, to perform ALL project surveying, including construction layout, as outlined in Section 017000-1.2.B, "Field Engineering."

2. Submittals

a. Project Record Documents

- 1) Upon completion of Work requiring Field Engineering, submit a record of Work performed and record survey data as required in Section 017000-1.2.B.5.
- 2) Upon completion of Work requiring Field Engineering, submit a certificate signed by the Registered Land Surveyor, certifying the location and elevation of improvements comply with the Contract Documents.

3. Control Points

- a. The Owner will identify existing control points and property line corner stakes.
- b. Verify layout information shown on the Drawings in relation to the property survey and existing benchmarks before proceeding to lay out the Work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.
- c. If a discrepancy between the contract drawings and the existing site is found, contact the Project Representative for a resolution BEFORE any actual layout of the work is begun.
- d. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points, or requirements to relocate reference points because of necessary changes in grades or locations.
- e. Promptly replace lost or destroyed control points. Base replacements on the original survey control points.
- f. Establish and maintain a minimum of two permanent benchmarks on the site, referenced to data established by survey control points.
- g. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
- h. The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities and other construction.
- i. Prior to construction, verify the location and invert elevation at points of connection to existing utilities.

4. Benchmarks and Markers
 - a. Working from lines and levels established by the property survey, establish benchmarks and markers to set lines and levels at each story of construction and elsewhere as needed to properly locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Do no scale Drawings to determine dimensions.
 - b. Advise entities engaged in construction activities of marked lines and levels provided for their use.
 - c. As construction proceeds, check every major element for line, level, and plumb.
5. Registered Land Surveyor's Log
 - a. Maintain a surveyor's log of control and other survey Work. Make this log available for reference.
 - b. Record deviations from required lines and levels, and **immediately** advise the Project Representative when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.
 - c. On completion of foundation walls, major site improvements, and other Work requiring field engineering, submit this log and associated Project Drawings to the Project Representative.
6. Existing Utilities
 - a. Furnish information necessary to adjust, move or relocate existing structures, utility poles, lines, services or other appurtenances located in or affected by construction.
7. Site Improvements
 - a. Locate and layout all site improvements including, but not limited to, pavements, structures, earthwork and utility locations and grades.
8. Structure Lines and Levels
 - a. Locate and layout batter boards for structures, building foundations, column grids and locations, floor levels and control lines and levels required for mechanical and electrical Work.

1.3 EXECUTION

A. Cutting and Patching – Concrete and Masonry

1. The Contractor shall be responsible for any cutting, fitting, and patching that may be required to complete this project, except for core drilling required for mechanical and electrical installations, which shall be the responsibility of the Mechanical or Electrical Contractor.
2. The Contractor shall not endanger any work of any other Contractors by cutting, excavating, or otherwise altering any other work and shall not cut or alter the work of any other Contractor except with the written consent of the Architect/Engineer
3. To avoid damage to hidden utilities and structural re-enforcement any cutting or core drilling over one inch in diameter, through concrete floors and slabs will be x-rayed/scanned by the contractor prior to cutting.
 - a. A qualified engineer will conduct an on-site assessment before any cutting or drilling of a pre-tensioned or post-tensioned component or other structural component of a building or structure commences. The assessment will be documented and provided to the person contracted to carry out the work.
 - b. If any load bearing member is cut, cored or removed all the requirements of 29 CFR 1926 Subpart T (LARA Part 20) shall apply. This will require notifications to the DEQ 10 working days before cutting begins. Emergency notifications are possible under specific conditions.
 - c. The responsible person for the project shall ensure substantial compliance with the requirements for exposure to Silica Dust. Substantial compliance will also be required for all other construction safety standards and published by the State of Michigan or Federal OSHA.
 - d. Work shall be conducted outside of the regular hours to avoid disturbing the building occupants. An exception to this rule will be granted only by the project manager and shall be in writing.
 - e. The MSU project representative or employee shall be responsible for locating all utilities in the area to be cut. This part of the job is mandatory and shall be given appropriate attention. Minimally the responsible person shall review all available prints and consider structural scanning. The MSU representative or employee shall take necessary steps to isolate and lock out any energy sources that may be jeopardized by the cut to protect worker safety and avoid equipment damage. In some cases, utilities will need to be cut and relocated to conduct the work. The responsible person shall take steps to notify repair persons in advance of the anticipated timing and scope of the repair project or the need for temporary services.

- f. Responsible person shall inspect the area to ensure that no damage has occurred and that the area is cleaned to an acceptable level.
 - 4. Cutting and Patching for Electrical Work
 - a. The Electrical Contractor shall be responsible for any core drilling required to complete their work.
 - b. The Electrical Contractor shall be responsible for the accurate location of all openings necessary for the installation of the electrical work. Any additional openings required to move their work due to an error in the initial layout and the repair of inaccurate openings, shall be done at the expense of the Electrical Contractor.
- B. Salvaging of Materials
 - 1. Materials or equipment shown on drawing or specified herein to be removed, which are not to be reused or salvaged, shall become the property of the Contractor and will be removed from University property and disposed of legally.
 - 2. Salvage the following items to the locations as directed:
 - a. Post and chain fencing
 - b. Catch basin and/or manhole frames and covers
 - c. Bike racks and loops
 - d. Waste cans
 - e. Street and area light fixtures
 - f. Face brick for repair
 - g. Paver brick
 - h. Limestone cap
 - 3. Salvage of Brick and Stone
 - a. Salvage brick and stone for patching areas shown on the drawings. All materials shall be carefully palletized and stored at the site. The Contractor shall take special care in handling stone to avoid chipping corners and scarring faces.

1.4 CLEANING UP

- A. Cleaning up shall be in accordance with the General Conditions of the Contract.

- B. No rubble, dust, or debris shall be allowed to accumulate or be transported throughout the building.
- C. A thorough final cleaning of all of the adjacent streets, as specified by the Project Representative, will be required before final payment is made.
- D. If the Contractor fails to clean up, the Owner may do so and the cost thereof shall be charged to the Contractor.

1.5 STARTING AND ADJUSTING

- A. Refer to each Division for requirements.

1.6 CLOSEOUT PROCEDURES

- A. In general, one or more walk-throughs will be performed with the Contractor and punch lists developed of items to be completed before the project can be closed out.

1.7 CLOSEOUT SUBMITTALS AND PROJECT DELIVERABLES

A. Operation and Maintenance Data

1. The Contractor shall provide operation and maintenance data as required in this specification, and submit the required information through use of the Unifier and PlanGrid systems.
2. Submittals for equipment and systems shall contain the manufacturer's information on installation, balancing, operating, maintenance, lubrication, and repair instructions and parts list for each component.
3. Please refer to [MSU Document Submittal Standards](#) and [PlanGrid Standardization Guide](#). at: <http://ipf.msu.edu/construction/business-partners/standards-for-construction/index.html>

B. As-Built Drawings

1. Submission of all As-built Drawings called for in this specification shall precede request for final payment.
2. The Contractor shall submit As-built Drawings in electronic (.pdf) format, that is not password protected, indicating any deviations from the Contract Drawings, including contract Change Orders. Upon request of the Owner, printed copies of the As-Built drawings shall be provided as well.
3. Please refer to [MSU Document Submittal Standards](#)

C. Construction Safety Documentation

1. The Contractor shall provide written documentation of the following site safety information, as it pertains to the project only:
 - a. List of all lost time accidents.
 - b. Reportable incident rate (total hours worked).
 - c. Details of many MIOSHA site visits, including resulting citations, violations, or actions.

D. Certificates of Inspection

1. The Contractor shall provide a copy of all Certificates of Inspection called for in this specification. Refer to Section 013000 Part 1.4.B.

E. Construction Waste Management – LEED Documentation

1. The Contractor shall provide written documentation of the Construction Waste Management program, as required for LEED Materials & Resources Credit 2. A form for this purpose is provided within this specification. Refer to Section 024200, Construction Waste Management.

F. Warranty

1. The Contractor shall provide a written guarantee stating that all work performed and material furnished is free from all defects in workmanship, and material for a period of one year, unless noted otherwise, after the equipment has been accepted by the Owner. Final payment or Certificate of Substantial Completion, whichever is issued first, shall constitute Owner acceptance.
2. Additional warranties are required for site concrete pavement (Section 321313), curb/gutter (Section 321613), bituminous pavement (Section 321216), and specific mechanical equipment (Division 23)

G. Final payment

1. The contractor shall provide a sworn statement with final payment. The statement shall detail all subcontractors paid on the project and other information detailed in the link below:

<https://api.gis.msu.edu/edms/file/{C500C6DD-E852-11ED-0000-76DDD13A85C5}>

Michigan State University
Electrical Distribution – Farm Ln Duct Bank Extension
Red Cedar to Farm Ln/Wilson Rd – Phase 1
MSU Project Number CP23036

GENERAL REQUIREMENTS
EXECUTION REQUIREMENTS
PAGE 017000-8

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION 017000

SECTION 024113– SITE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.

1.2 SUMMARY

- A. Provide labor, materials and equipment as necessary to complete work as indicated on the Drawings and specified herein.
- B. This section includes the removal of existing structures, fences, pavements, and other items indicated on the Drawings or specified, or both.
- C. Related sections include the following:
 - 1. Division 01 Section “General Requirements – Temporary Facilities and Controls.”
 - 2. Division 31 Section “Site Clearing.”
 - 3. Division 31 Section “Earthwork.”

1.3 PROJECT CONDITIONS

- A. Do not close or obstruct streets, walks or other occupied or used facilities without permission from the Project Representative. Provide alternate routes around closed or obstructed traffic ways if required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 DEMOLITION OPERATIONS

- A. At the direction of the Project Representative, certain items within the Project limits may be salvaged by the Contractor to the Owner. Salvaged materials or equipment will be indicated on the Drawings or specified. Salvaged items not indicated or noted to be reinstalled shall be delivered to designated location(s) on campus as directed by Project Representative.

- B. Materials to be recycled shall be hauled from the project to Beaumont Landscape Supply, 4080 Beaumont Road, East Lansing MI 48824. Call (517) 884-4880 to coordinate drop-off time and location.
 - 1. Items to be salvaged include, but are not limited to:
 - a. Post and chain fencing
 - b. Ornamental fencing and gates
 - c. Chain link fence
 - d. Catch basins and manhole frames and covers
 - e. Bike racks
 - f. Litter receptacles and ash urns
 - g. Light fixtures and poles
 - h. Face brick
 - i. Paver brick
 - j. Limestone cap
 - k. Steel and concrete bollards
 - l. Irrigation system components, including but not limited to valves, heads, and vacuum breakers
 - 2. Materials to be recycled include, but are not limited to:
 - a. Concrete material (pavement, curb and gutter, walls and footings)
 - b. Bituminous pavement millings
 - c. Topsoil
 - d. Clean pavement base aggregate
- C. The use of explosives is not permitted.
- D. Conduct demolition operations and the removal of debris to ensure minimum interference with adjacent roads, streets, walks, and other facilities, operations and people.
- E. Conduct operations to prevent damage by falling debris or other cause to adjacent buildings, structures, vegetation to be retained, and other facilities as well as persons.

- F. Promptly repair damages caused to adjacent facilities by demolition operations, as directed by the Project Representative. Repairs shall be made at no cost to the Owner.

3.2 REMOVAL OF PAVEMENTS

- A. Saw cut concrete curb and gutter and flatwork on nearest existing joint beyond area required to be removed as shown on the Drawings.
- B. When the existing pavement cannot be used as the concrete form (with approval of the Project Representative), saw cut asphalt pavement with a near vertical edge.
- C. Provide a minimum of 18 inches between the new gutter pan edge and the bituminous paving edge.
- D. Remove curb and gutter and asphalt to saw cut line.

3.3 CLEANUP

- A. Contractor shall be responsible for disposing of debris from demolition and salvage operations. Disposal of debris shall be done legally off the Owner's property, except that specifically requested for salvage by the Project Representative. Burning of debris is not permitted.
- B. During demolition operations, keep dust to a minimum using appropriate methods.
- C. During demolition operations, access roads and adjacent concrete pathways shall be maintained broom clean. Roads shall be cleaned by using a pick-up type sweeper. A front-end tractor mounted sweeper is not permitted.
- D. The site shall be graded to provide surface drainage and shall be left in a clean condition.

END OF SECTION 024113

SECTION 024200– CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for the following:

- 1. Salvaging nonhazardous demolition and construction waste.
- 2. Recycling nonhazardous demolition and construction waste.
- 3. Disposing of nonhazardous demolition and construction waste.

- B. Related sections include the following:

- 1. Division 01 Section “General Requirements – Temporary Facilities and Controls.”

1.3 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations and clearing debris including soil, vegetation, and rocks are not to be included.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Collect, reprocess and reuse of materials diverted or recovered from solid waste stream.
- E. Salvage: Recovery of demolition or construction materials from existing buildings or construction sites and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction materials from existing buildings or construction sites and subsequent incorporation into the Work.

1.4 PERFORMANCE GOALS

- A. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of 50 (75) percent by weight of total waste generated by the Work.

1.5 SUBMITTALS

- A. Waste Management Plan: Submit 3 copies of plan within 14 days of date established for commencement of the Work
- B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit 2 copies of report. Include separate reports for demolition and construction waste. Include the following information:
 - 1. Material category.
 - 2. Generation point of waste.
 - 3. Total quantity of waste in tons.
 - 4. Quantity of waste salvaged, both estimated and actual in tons or cubic yards.
 - 5. Quantity of waste recycled, both estimated and actual in tons or cubic yards.
 - 6. Total quantity of waste recovered (salvaged plus recycled) in tons or cubic yards.
 - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- C. Waste Reduction Calculations: Before request for Substantial Completion, submit 2 copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- E. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- F. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licenses to accept them. Include manifests, weight tickets, receipts, and invoices.

- H. LEED Submittal: LEED letter template for Credit 2, signed by Contractor, tabulating total waste material, quantities and weight (tons) diverted and means by which it is diverted, and statement that requirements for the credit have been met.

1.6 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: LEED Accredited Professional by U.S. Green Building Council, or person familiar and experienced with LEED construction waste management requirements.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section. Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
 - 2. Review requirements for documenting quantities of each type of waste and its disposition.
 - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - 5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

- A. General: Develop plan consisting of waste identification, waste reduction plan, and cost/revenue analysis. Include separate sections in plan for demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.

2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses and telephone numbers.
 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses and telephone numbers.
 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 5. Disposed materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number for each landfill and incinerator facility.
 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.
- D. Plan for and describe the means for securing waste containers from unauthorized users.
- E. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:
1. Total quantity of waste.
 2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
 3. Total cost of disposal (with no waste management).
 4. Revenue from salvaged materials.
 5. Revenue from recycled materials.
 6. Savings in hauling and tipping fees by donating materials.
 7. Savings in hauling and tipping fees that are avoided.
 8. Handling and transportation costs. Include cost of collection containers for each type of waste.
 9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement waste management plan as approved by Owner. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 - 1. Comply with Division 01 Section “Temporary Facilities and Controls” for operation, termination, and removal requirements.
 - 2. Observe and follow site measures that prevent cross-contamination of waste. Cross-contamination could render some portion of waste to be non-recyclable, thereby disqualifying the Project from earning LEED Credit MR 2, and the exemplary performance credit of diverting 95% of waste from landfill.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project. The Construction Superintendent may perform the role of the Waste Management Coordinator.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at the Project site.
 - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
 - 2. Distribute waste management plan to entities upon execution of their contracts. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 - 2. Comply with Division 01 Section “Temporary Facilities and Controls” for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until installation.

4. Protect items from damage during transport and storage.
 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Sale and Donation: Not permitted on Project site.
- C. Salvaged Items for Owner's Use:
1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until delivery to Owner.
 4. Transport items to Owner's storage area off-site designated by Owner.
 5. Protect items from damage during transport and storage.
- D. Doors and Hardware: Brace open end of door frames. Except for removing door closes, leave door hardware attached to doors.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General:
1. Recycle paper and beverage containers used by on-site workers.
 2. Concrete, masonry, or asphalt crushed and reused are to be identified and include in calculations.
 3. Exclude hazardous waste from calculations.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.
- C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.

- b. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- c. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
- d. Store components off the ground and protect from the weather.
- e. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING CONSTRUCTION WASTE

A. Packaging:

- 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
- 2. Polystyrene Packaging: Separate and bag materials.
- 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
- 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Site-Clearing Wastes: Chip brush, branches, and trees on-site.

C. Wood Materials:

- 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
- 2. Clean Sawdust; Bag sawdust that does not contain painted or treated wood.

D. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.

- 1. Clean Gypsum board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

E. Metals: Separate metal by type or to meet requirements of recycling receiver or processor.

3.5 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 - 1. Except as otherwise specified, do not allow excessive on-site accumulation of waste materials.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Coordinate with each product manufacturer for take-back programs. Set aside scrap to be returned to manufacturer for recycling into new product.
- B. Burning: Do not burn waste materials.
- C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 024200

SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 M.S.U. ISSUES

- A. Below grade construction, including tunnels and underground vaults, should be protected by self-adhering sheet waterproofing in accordance with this standard. In situations where it is not practicable to apply waterproofing to the outside of the construction (e.g. elevator pits), an interior applied metallic system of waterproofing in accordance with SECTION 071619 – METAL OXIDE WATERPROOFING should be used. Normally, on alteration projects, either a membrane or a metallic system of waterproofing should protect all below-grade building spaces.
- B. Slabs on grade should be protected by either a membrane, mud mat, or by plastic sheets, depending on conditions.
- C. All above-grade construction, including slabs above grade in potentially wet areas, shall receive waterproofing in accordance with SECTION 071416 – COLD FLUID-APPLIED WATERPROOFING. Sleeves and openings in the slab shall be properly flashed. This protection is required over occupied spaces and under load-all situations, docks or penthouse floor slabs.
 - 1. NOTE: PENTHOUSE FLOORS, ESPECIALLY UNDER LARGE AIR HANDLERS AND INTERIOR COOLING TOWERS HAVE BEEN TROUBLESOME. THESE AREAS NEED SPECIAL ATTENTION.
- D. All horizontal areas should be tested by flooding, after the waterproof membrane system has been applied. A five-year warranty is required for all waterproofing work.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Rubberized-asphalt sheet waterproofing.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide waterproofing that prevents the passage of water.

1.4 SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

- B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
- C. Samples: For the following products:
 - 1. 12-by-12-inch square of waterproofing and flashing sheet.
- D. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.
- E. Product Test Reports: From a qualified independent testing agency indicating and interpreting test results of waterproofing for compliance with requirements, based on comprehensive testing of current waterproofing formulations.
- F. Sample Warranty: Copy of special waterproofing manufacturer's and Installer's warranty stating obligations, remedies, limitations, and exclusions before starting waterproofing.
- G. Warranties: Submit written special warranty as specified in this Section. Include contact information, description of coverage, and start date for each special warranty.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who is acceptable to waterproofing manufacturer to install manufacturer's products.
- B. Source Limitations: Obtain waterproofing materials through one source from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver liquid materials to project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- D. Store rolls according to manufacturer's written instructions.
- E. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 WARRANTY

- A. Special Manufacturer's Warranty: Written warranty, signed by waterproofing manufacturer agreeing to replace waterproofing material that does not comply with requirements or that does not remain watertight during specified warranty period.
 - 1. Warranty Period: Five years after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
- B. Products: Subject to compliance with requirements, provide one of the following products:
 - 1. Rubberized-Asphalt Sheet Waterproofing:
 - a. W. R. Grace & Co.; Bituthene 3000.
 - b. Polyguard Products, Inc.; Polyguard 650.

2.2 RUBBERIZED-ASPHALT SHEET WATERPROOFING

- A. Rubberized-Asphalt Sheet: 60-mil- thick, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated to a 4-mil- thick, polyethylene film with release liner on adhesive side.
 - 1. Physical Properties: As follows, measured per standard test methods referenced:
 - a. Tensile Strength: 250 psi minimum; ASTM D 412, Die C, modified.
 - b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.

- c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
- d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
- e. Puncture Resistance: 40 lbf minimum; ASTM E 154.
- f. Hydrostatic-Head Resistance: 150 feet minimum; ASTM D 5385.
- g. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
- h. Vapor Permeance: 0.05 perms; ASTM E 96, Water Method.

2.3 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
 - 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid waterborne primer recommended for substrate by manufacturer of sheet waterproofing material.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.
- D. Sheet Strips: Self-adhering, rubberized-asphalt composite sheet strips of same material and thickness as sheet waterproofing.
- E. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.
- F. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.
- G. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.
- H. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.
- I. Protection Course: Location and type as recommended by membrane manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
 - 1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
 - 2. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 3. Verify that compacted subgrade is dry, smooth, and sound; ready to receive HDPE sheet.
 - 4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
 - 1. Install sheet strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.
- F. Bridge and cover isolation joints, expansion joints and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips.
 - 1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.

- G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
 - 1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
 - a. At footing-to-wall intersections, extend liquid membrane each direction from corner or install membrane strip centered over corner.
 - b. At plaza deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.
- H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 RUBBERIZED-ASPHALT SHEET APPLICATION

- A. Install self-adhering sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.
- B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, rubberized-asphalt sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.
- D. Horizontal Application: Apply sheets from low point to high point of decks to ensure that side laps shed water.
- E. Apply continuous sheets over sheet strips bridging substrate cracks, construction, and contraction joints.
- F. Seal exposed edges of sheets at terminations not concealed by metal counterflashings or ending in reglets with mastic or sealant.
- G. Install sheet waterproofing and auxiliary materials to tie into adjacent waterproofing.
- H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheets extending 6 inches beyond repaired areas in all directions.
- I. Correct deficiencies in or remove sheet waterproofing that does not comply with requirements, repair substrates, reapply waterproofing, and repair sheet flashings.

3.4 PROTECTION AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071326

SECTION 311400 – SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.

1.2 SUMMARY

- A. Provide all labor, materials and equipment as necessary to complete all work as indicated on the Drawings and specified herein.
- B. This Section includes sod and topsoil stripping.
- C. Related sections include the following:
 - 1. Division 01 Section “General Requirements - Temporary Facilities and Controls.”
 - 2. Division 02 Section “Site Demolition.”
 - 3. Division 31 Section “Earthwork.”

1.3 DEFINITIONS

- A. Topsoil: Friable clay loam surface soil containing 2.5% to 12% organic matter. Topsoil shall be free of subsoil, clay lumps, stones, rocks, weeds, roots, construction debris, and other unsuitable materials as determined and approved by the Project Representative.

1.4 PLANT PROTECTION

- A. Refer to Division 01 Section “General Requirements - Temporary Facilities and Controls.”

PART 2 - PRODUCTS (Not Used.)

PART 3 - EXECUTION

3.1 SOD STRIPPING

- A. Stripping and stockpiling sod shall be done under reasonably dry conditions. Secure approval of soil quality in advance from the Project Representative to begin sod stripping. Sod removal shall include the entire root system but not an excess amount of topsoil. Contractor shall haul the sod to a campus location, as directed.

3.2 TOPSOIL STRIPPING

- A. Stripping and stockpiling topsoil shall be done under reasonably dry conditions. Stripping and stockpiling under wet conditions will not be allowed.
- B. Contractor shall strip available topsoil to its full depth from within the Contract limits, excluding areas in close proximity to trees designated to remain, unless otherwise specified or directed by the Project Representative.
- C. Contractor shall stockpile topsoil in a storage pile in an area shown on the Drawings or as directed by the Project Representative. Storage pile shall be shaped to freely drain surface water during and after stockpiling operations. Excess topsoil shall be hauled by the Contractor and stockpiled on the Owner's property as directed by the Project Representative. The stockpile shall be protected from soil and sediment erosion as required elsewhere in these Specifications.

END OF SECTION 311400

SECTION 312300 – EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.

1.2 SUMMARY

- A. Provide all labor, materials and equipment as necessary to complete all work as indicated on the Drawings and specified herein.
- B. Related sections include the following:
 - 1. Division 01 Section 15000-TEMPORARY FACILITIES AND CONTROLS
 - 2. Division 02 Section 024116-SITE DEMOLITION
 - 3. Division 31 Section 311400-SITE CLEARING
 - 4. Division 32 Section 321216-BITUMINOUS PAVEMENT
 - 5. Division 32 Section 321313-CONCRETE PAVEMENT

1.3 DEFINITIONS

- A. Excavation: Removal of material encountered to indicated subgrade elevations and subsequent disposal of materials removed. Excavation material is unclassified.
- B. Unauthorized Excavation: Removal of materials beyond indicated subgrade elevations or dimensions without specific direction by the Project Representative. Unauthorized excavation shall be at the Contractor's expense. Undermining of existing footings or disturbing the bearing soil shall not be permitted unless it is specifically indicated or specified in the Contract Documents.
- C. Additional Excavation: When excavation has reached required subgrade elevations the Contractor shall notify the Project Representative who will inspect conditions. If the Contractor encounters unsuitable bearing materials at the required subgrade elevations Contractor shall carry excavations deeper and replace excavated material as directed by the Project Representative. Removal of unsuitable material and its replacement, as directed, is part of this Contract.
- D. Backfilling: Placement of fill soil, either provided on site or Contractor-furnished, which shall be uniformly compacted to the required density.
- E. Bedding: The material placed around a utility between 4 inches below to 12 inches above the utility the full width of the trench.

- F. Building Compacted Areas: Areas under slabs on ground within the building line. Exterior concrete slabs attached to the building, such as entrances, shall be considered within the building line.
- G. Contract Limits: Those areas of the project site on which, or upon which, work will be done in accordance with the Contract.
- H. Fill: Imported material which is placed in structure undercut.
- I. Imported Material: Soil material which is purchased by Contractor and hauled onto the site.
- J. MDOT: Michigan Department of Transportation’s Standard Specifications for Construction, 2012.
- K. Proof-Rolling: The use of a loaded 10 CY capacity or larger truck driven over the subgrade and subbase to check for unstable areas that should be undercut. The method, pattern and frequency will be determined by the Project Representative.
- L. Quality Assurance (QA): All activities that have to do with the Owner ensuring the quality of the product as specified, including materials sampling and testing, construction inspection, and review of Contractor quality control documentation. This work will be performed by the Project Representative.
- M. Quality Control (QC): All activities that have to do with the Contractor producing the quality of the product as specified, including training, materials sampling and testing, project oversight and documentation.
- N. Rock Excavation:
 - 1. Excavation of igneous, metamorphic or sedimentary rock or hardpan which cannot be excavated without continuous drilling or continuous use of a ripper or other special equipment.
 - 2. Excavation of boulders of 1/2-cubic yard or more in volume.
- O. SESC: Soil Erosion and Sedimentation Control as required in Division 01 “General Requirements – Temporary Facilities and Controls” and elsewhere in these Specifications.
- P. Site Compacted Areas: Areas outside of the building line within the Contract limits.
- Q. Structure: A building, retaining wall, tank, footing, slab or other similar construction.
- R. Structure Backfill: Soil or other material which is placed against walls or sides of structures.

- S. Subbase: Compacted fine and coarse aggregate layers used in the pavement between the subgrade and the pavement.
- T. Subgrade: Compacted soil, either existing or provided as part of the Work, upon which new construction is to be installed.
- U. Undercut: Excavation of native material from below the bottom of footings, floors, structures and subbases.

1.4 SUBMITTALS

- A. Warranties: Submit written special warranty as specified in this Section. Include contact information, description of coverage, and start date for each special warranty.

1.5 SOIL EROSION AND SEDIMENTATION CONTROL

- A. Prior to and during earthwork operations refer to Division 01 Section “General Requirements - Temporary Facilities and Controls” to ensure that provisions of that section are fulfilled.

1.6 BACKFILL COMPACTION TESTING

- A. Contractor shall retain a licensed soils testing engineer, approved by the Owner, paid for as an allowance item, and shall submit to the Project Representative 3 copies of a report containing testing procedure, test results, and a statement that soil has been compacted in accordance with the specifications. The Project Representative shall give final approval of the backfill before construction continues. The following submittals shall be submitted directly to the Project Representative from the soils testing engineer, with one copy to the Contractor:
 - 1. Test reports of borrow material.
 - 2. Verification of each footing subbase.
 - 3. Field density test reports.
 - 4. One optimum moisture-maximum density curve for each type of soil.
- B. Where more than one lift of soil is being placed, the soils testing engineer shall be present during the entire filling operation to confirm that each lift is properly compacted with approved soil.
- C. Perform a maximum density test conforming to ASTM D1557 (Modified Proctor) for each type of soil encountered.
- D. Field density tests shall conform to ASTM D2922 - Nuclear Method.

- E. The frequency of testing shall be as follows:
1. Footing Subgrade: As required by Project Representative.
 2. Paved Areas and Building Slab Subbase: One test per 2000 square feet for Subbase and one test per 1500 square feet per lift.
 3. Footing and Trench Backfill: One test per 50 lineal feet per lift.
 4. Trench Backfill: One test per 50 lineal feet per lift.
 5. Post Backfill: One test per 12-inch lift (provided equipment is available).
 6. Tree Stump Backfill: One test per 12-inch backfill lift (same as above).
- F. Quality Assurance for Bituminous Pavement: The Project Representative will perform QA of existing and installed material below the bituminous pavement. In order to perform that function, Contractor shall contact the Project Representative 2 days prior to separately proof rolling the subgrade and subbase material, as well as keep the Project Representative informed of the schedule of the installation of aggregates prior to paving. The Project Representative will inform the Owner of deficient areas that have not been identified by Contractor as part of the Contractor's quality control procedure. This inspection by the Project Representative does not relieve Contractor of Contractor's responsibility to provide adequate quality control.

1.7 DESIGN AND PERFORMANCE REQUIREMENTS

A. Trench Bottom Suitability:

1. Contractor shall be responsible for the suitability of the normal trench bottom in supporting utility, bedding and backfill.
2. Contractor shall notify the Project Representative and await the Project Representative's decision if a possible unsuitable condition exists.
3. NOTE: Poor dewatering techniques or lack of excess water control shall not be a reason for additional payment for remedial measures.

B. Trench Wall Stability:

1. Contractor shall be responsible for trench configuration, including sheeting, shoring and bracing necessary to support trench side walls from collapsing.
2. Contractor shall be responsible for structural design and stability of a pipe-laying box if utilized on the Project to prevent trench walls from collapsing.
3. Excavation Side Stability: Be responsible for structural design of sheet piling, underpinning, shoring and bracing to prevent sides of excavation from collapsing and causing damage to adjacent structures pavements and materials.

1.8 MATERIAL STORAGE

- A. Stockpile satisfactory excavated materials in accordance with MDOT Standards where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain. Place silt fence around stockpile, if left overnight.

1.9 WARRANTY

- A. Failures of surface areas caused by settlement shall be repaired at Contractor's expense for a period of 3 years after completion of Contract.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil Materials: For backfill and fill, soils complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP. (Contractor shall note exceptions under Article 3.11 – Backfill and Fill.)
- B. Unsatisfactory Soil Materials: For backfill and fill, soils complying with ASTM D2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT.
- C. Granular Materials: In accordance with MDOT Sections 301, 302 and 902 for 22A aggregate, Class I, II and Class II Subbase materials, except no foundry sand is permitted. Granular material shall contain sufficient binder to provide fill capable of supporting construction equipment without displacement.
 - 1. Sections 2.11 and 8.02 for Class II Subbase and shall meet or exceed a minimum permeability requirement (K) of 8 feet per day as determined by the Michigan Test Method (MTM) 122.
 - 2. Quality control shall include a lab test prior to delivery and field testing each 1000 cubic yard delivered or fraction thereafter. Each test shall include taking 3 samples, testing them individually and averaging the results.
 - 3. The Michigan Test Method (MTM) shall be used to determine acceptable material. Once tested and accepted, Contractor shall acquire the material from the identical location.
 - 4. Contractor shall notify the Project Representative in advance of changing the source location.
 - 5. Field permeability test samples shall only be taken after the material has been spread uniformly on the subgrade and before compaction takes place. Material shall be less than 90% saturated upon completion of the test.

6. Material that fails the test shall be replaced at no cost to the Owner, and the cost for failed tests shall be paid by Contractor.

D. Sand:

1. Fill Sand: MDOT Class II granular material that is free of clay.
2. Washed Sand: MDOT 2NS.
3. Lean Concrete: Mixture of Portland cement, aggregate and water having compressive strength of 2,000 psi at 28 days.
4. Granular Surface Materials: In accordance with MDOT specifications.
5. Gravel Drives: 22A aggregate modified to minimum 6% wash.
6. Limestone Drives: 21AA limestone aggregate.
7. Construction Tracking Mat: 6A crushed limestone.
8. Pavement Subbase: If not specified on Drawings, place thicknesses and materials as follows:
 - a. For concrete pavement, use 2-inch Class II sand compacted in place (CIP).
 - b. For bituminous pavement in parking lots, use 6-inch -22A aggregate (CIP) over 6-inch Class II Subbase (CIP).
 - c. For bituminous pavement in roadways and loading docks with parking spaces, use 8-inch -21AA aggregate (CIP) over 12-inch Class II Subbase (CIP).

E. Topsoil

1. Topsoil (Owner-Provided & Placed).

PART 3 - EXECUTION

3.1 SOIL EROSION AND SEDIMENTATION CONTROL

- A. Prior to and during earthwork operations, refer to Division 01 Section “General Requirements - Temporary Facilities and Controls” to ensure that provisions of that section are fulfilled.

3.2 PREPARATION

- A. Plan the Work to minimize the time excavation remains open. If excavation remains open beyond the time approved in the Project schedule, additional requirements may be imposed at no additional cost to the Owner.
- B. Adequately barricade the excavation at all times to protect workers and the public from the danger of the open excavation.

3.3 EXCAVATION FOR STRUCTURES

- A. Excavations shall extend a sufficient distance from footings and foundations to permit placement and removal of concrete formwork, installation of services, other construction, and inspection. Care shall be taken not to disturb bottom of excavation. Trim bottoms to required lines and grades to leave solid base to receive concrete.
- B. Bracing and Sheeting:
 - 1. Do not install by jetting.
 - 2. Furnish, put in place and maintain sheeting, bracing and shoring, as may be required to properly support the sides of excavations and to prevent movement of earth which could in any way injure the Work or adjacent property.
 - 3. Exercise care in removal of sheeting, shoring, bracing and timbering to prevent collapse or caving of excavation faces being supported and damage to the Work and adjacent property.
 - 4. Do not leave sheeting or bracing in the excavation after completion of the Work, unless approved by the Project Representative.
- C. Undercut:
 - 1. If suitable bearing for foundations is not encountered at elevations indicated on the Drawings, immediately notify the Project Representative.
 - 2. If soft material, which in the opinion of the independent testing laboratory is not suitable, is encountered below a structure, the Project Representative may order removal of this soft material and its replacement with specified material in order to make a suitable foundation for construction of the structure.
 - 3. Undercutting made at the order of the Project Representative will be paid for on the basis of the actual quantity of material excavated. Do not proceed further until instructions are received and necessary measurements made for purposes of establishing additional volume of excavation.
 - 4. No extra payment will be made if removal is required as a result of poor dewatering techniques.

5. Undercutting, which is specifically indicated on the Drawings or herein specified, shall be included in the base bid.
6. Soil removed may be used as fill in areas not below driving surfaces, structures or utility structures.
7. Compact subgrade at bottom of undercut prior to placing fill.
8. Place and compact specified fill in undercut.
9. Lateral extent of undercut shall be a horizontal distance equal to the depth of undercut below structure.

D. Excavating:

1. Excavation shall be by open cut from the surface except as herein specified or as indicated on the Drawings.
2. Excavations for structures shall be made in such manner and to such depth and width as will give ample room for building the structures and for bracing, sheeting and supporting the side of the excavation, for pumping and draining groundwater and wastewater which may be encountered, and for removal of material excavated.
3. Excavate to required cross section and elevation indicated on the Drawings. Subgrade shall not vary more than 0.1 feet above or below the established elevations.
4. Depression caused by excess excavation, traffic or rolling shall be filled with MDOT 902 Granular Material Class II or approved fill and rerolled and compacted in place as specified herein.
5. If required because of excess water conditions, place stone stabilization course prior to proceeding with construction. Place filter fabric over stone stabilization course.

3.4 EXCAVATION FOR PAVEMENT

- A. Cut surface under pavements to comply with cross-sections, elevations and grades as indicated on Drawings.

3.5 EXCAVATION FOR UTILITIES

A. Width of Trenches:

1. Steam Tunnels: Widths at bottom of trench shall be 3 feet wider than the overall width of tunnel or vault, and shall at all times be of sufficient width to permit tunnel and vaults to be built properly, waterproofed and backfilled.

2. Pipelines: Widths of trenches for pipe lines shall allow for proper compaction of the haunching. The trench width at the spring line of the pipe for pipes less than 48 inches shall be pipe width plus 18 inches. The trench width for pipes larger than 48 inches shall be the pipe diameter plus 30 inches.
 3. Electric and Telephone Ducts: Trench shall be the proper width and depth for the duct bank, allowing a minimum of 3 inches of concrete on each side of the duct formation.
 4. Street Light Cable: Minimum trench width shall be 6 inches, maximum width shall be 12 inches, and minimum depth shall be 30 inches.
- B. Length of Trenches: Excavation shall be finished to the required grade for an adequate distance in advance of the completed installation. Unless otherwise permitted by the Project Representative, the amount of trench that shall be open in advance of the construction shall not exceed the following limits:
1. Steam Tunnels: Length between 2 vaults, minimum.
 2. Buried Steam Systems: Length between 2 vaults, minimum.
- C. Sewers: 50 lf.
1. Water Mains: 50 lf.
 2. Electric and Telephone Ducts: The amount that can be encased in concrete in a day.
 3. Street Light Cable: The amount of cable that can be laid in a day.

3.6 REMOVAL OF EXCESS SUBSOIL

- A. Excess subsoil shall be removed from the Owner's property and legally disposed.

3.7 UTILITIES TO BE ABANDONED

- A. When pipes, conduits, sewers or utility structures are removed from the trench, leaving dead ends in the ground, fully plug such ends with brick and mortar.
- B. Entirely remove abandoned utility structures unless otherwise specified or indicated on Drawings.
- C. Remove materials which can be readily salvaged from the excavation and store on site as indicated on the Drawings.
- D. Salvageable materials will remain the property of the Owner unless otherwise indicated on the Drawings.

3.8 BEDDING

- A. Place bedding material up to 1/8 the height of the utility. Compact as herein specified.
- B. Accurately shape bedding material to fit pipe shape. Recess bedding to relieve pressure on the bell or other projecting utility joint.
- C. After laying out the utility, tamp additional bedding in place up to the midpoint of the utility. Use hand-operated compactors to achieve required compaction.
- D. Place additional bedding up to 12 inches above top of utility. Use hand-operated compactors to achieve required compaction.
- E. Place bedding in maximum lifts of 12 inches.
- F. No payment shall be made for aggregate or stone bedding when used for Contractor convenience.
- G. Provide concrete encasement at utilities as indicated on the Drawings.

3.9 SHEETING, SHORING AND BRACING EXCAVATIONS

A. General:

1. Furnish, put in place and maintain sheeting, bracing and shoring as may be required to properly support side of excavations and to prevent movement of earth, which could in any way injure the Work or adjacent property.
2. Exercise care in the removal of sheeting, shoring, bracing and timbering to prevent collapse or caving of excavation faces being supported and damage to the Work or adjacent property.
3. A pipe-laying box may be used in lieu of sheeting.

B. Sheeting:

1. Do not install by jetting.
2. Remove as backfilling proceeds, unless ordered left in place by the Project Representative. Use care to fill and compact voids created by removal, especially below mid-height of utility.
3. Sheeting Left In Place:
 - a. Required written approval of the Project Representative.
 - b. Cut off minimum of 4 feet below finished grade.

3.10 BACKFILL AND FILL

A. General:

1. Commencement of Backfill Operations: Backfill excavations as promptly as work permits, but not until completion of the following:
 - a. Acceptance by Project Representative of construction below finish grade including where applicable, dampproofing, waterproofing and perimeter insulation.
 - b. Removal of trash and debris.
 - c. Permanent or temporary horizontal bracing is in place on horizontally supported wall.
 - d. Removal of concrete formwork.
 - e. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities. Contractor shall leave shoring to be embedded in the backfill of the trench or other excavation, for the purpose of preventing injury to the completed structure or other adjacent structures or property. Ends of sheeting, bracing or timber left embedded in the backfill shall be cut off and removed at least 2 feet below the established grade.
2. Acceptable Backfill: Place specified soil material in layers to required subgrade elevations, up to, but not including subbase material, for each area classification listed below:
 - a. In excavations, use approved excavated or borrow material, except as otherwise specified.
 - b. Under grassed areas use satisfactory excavated materials, unsatisfactory excavated soil classification groups GC, SC, ML, and CL, or approved borrow material.
 - c. Under pavement use satisfactory excavated Class II and Class II subbase granular material. Soil classification groups GC, SC, ML and CL may be used with the approval of the Project Representative.
 - d. Under building slabs, use Class II granular material.
 - e. In utility trenches, use Class II granular material.

3. Required Concrete Within Backfill:

- a. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and are carried below bottom of such footings, or which pass under wall footings. Place concrete to level of bottom of adjacent footing.
- b. For piping or conduit less than 2'-6" inches below surface of roadways, provide 4-inch thick concrete base slab support. After installation and testing of piping or conduit, provide minimum 4-inch thick encasement (sides and top of concrete) prior to backfilling or placement of roadway subbase.

B. Ground Surface Preparation:

1. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip, or break-up sloped surfaces steeper than 1-foot vertical to 4 feet horizontal so that fill material will bond with existing surface.
2. Subsoil Preparation Prior to Topsoiling: This procedure is required to prevent permanent establishment of a dense layer of soil caused by construction operations, that would make it difficult for vigorous plant growth and proper drainage. In areas of the Project site that are compacted during construction, as determined by Project Representative, and after completion of exterior building construction operations, where vehicles/equipment would be required to travel across the soil around the structure or the constructed site improvements, or both, the existing subsoil, as well as the top 12 inches of newly placed subsoil, shall be loosened using the following procedures:
 - a. Prior to beginning this work, notify Project Representative at least 1 business day in advance. Also, re-stake existing and new utilities that may be disturbed by these earthwork operations.
 - b. The moisture content of existing and new soil shall be optimum for this earthwork operation. Each step shall be approved by the Project Representative, prior to continuing to the next step, and prior to satisfactory completion of the final step.

- c. For areas where the existing subsoil grade is to remain and for areas which will receive additional soil:
- 1) STEP 1 – Loosening Existing Subsoil and Debris Removal: Existing subsoil shall be brought to a friable condition 12-inches deep, prior to placing additional subsoil fill. Possible equipment to use to loosen the soil include, but are not limited to, chisel plow, backhoe bucket, disc or harrow; followed by discing, if a disc is not initially used, to reduce the soil clump to the desired size. Contractor will submit a proposed method of loosening the subsoil to the Project Representative for approval at least 14 days prior to commencement of the work. The submittal shall include the method of equipment to be used. The soil shall be broken up sufficiently so that the resulting soil fragments are small. Also it is equally important to legally dispose of construction debris and rocks larger than 27 cubic inches exposed during this process.
 - 2) STEP 2 – Placing of Additional Subsoil Fill- Transitional Layer Blending: Where additional fill is required, place the initial “transitional” layer and blend with the existing subsoil utilizing methods mentioned in Step 1.
 - 3) STEP 3 –Subsoil Fill - Top Layer Loosening: Loosen top layer to a friable condition, blending in the first 1”-2” of topsoil. If no additional subsoil is required, delete Step 2.
 - 4) STEP 4 – Final Grading and Protection: Grade the disturbed area to the elevations as specified, in preparation for topsoil placement. Do not otherwise recompact the subsoil. Once the subgrade is approved, construction equipment and vehicles unrelated to topsoiling and planting operations shall be prohibited. (Contractor may be required to provide temporary construction fencing to prevent recompaction of the subsoils. Costs for temporary fencing is a Contractor expense.)
- d. For areas where existing subgrade is to be lowered:
- 1) STEP 1 – Existing Subsoil Excavation and Debris Removal: Excavate the subsoil, removing all excess material from the site to the proposed subgrade. Remove and legally dispose of construction debris exposed during this process.

- 2) STEP 2 – Subsoil Loosening: Existing subsoil shall be brought to a friable condition 12-inches deep. Possible equipment to use to loosen the soil include, but are not limited to, chisel plow, backhoe bucket, disc or harrow; followed by discing, if a disc is not initially used, to reduce the soil clump to the desired size. The resulting soil shall be broken up sufficiently so that the resulting soil fragments are small.
 - 3) STEP 3 – Final Grading and Protection: Grade the disturbed area, as specified, in preparation for topsoil placement. Do not otherwise recompact the subsoil. Once the subgrade is approved, construction equipment and vehicles, unrelated to topsoiling and planting operations, shall be prohibited. (Contractor may be required to provide temporary construction fencing to prevent recompaction of the subsoils. Costs for temporary fencing is a Contractor expense.)
3. Subsoil Preparation for Paved Areas:
- a. If, after rough grade has been achieved in cut areas and prior to placement of fill material in fill areas, the exposed subgrade has a density less than that specified under Article 3.12 – Compaction for particular area classification, break-up ground surface, pulverize, moisture condition to optimum moisture content, and compact to required depth and percentage of maximum density. Entire area shall be proof rolled with a heavy rubber-tired vehicle, such as a loaded scraper or loaded dump truck, to locate areas of extreme pumping and yielding, which shall be repaired as follows:
 - 1) Soft areas due to moisture laden soil shall be corrected by applying an appropriate soil stabilization procedure to be specified, or as directed by Project Representative.
 - 2) If required density cannot be obtained, the objectionable material shall be removed and replaced as ordered by the Project Representative.
 - 3) The cost of corrective measures incurred as a result of stabilizing poor subgrade conditions shall be paid on basis of contract conditions relative to changes in work.
- C. Placement and Compaction:
1. No backfill shall be placed without it being compacted in place. Backfill material shall be compacted in layers not exceeding 6 inches in compacted thickness.
 - a. Granular, non-cohesive soils shall be compacted with mechanical tamping or vibration-type compactors. Sand may be compacted by flooding the trench when water is available.

- b. When clays are encountered, a mechanical tamper or sheeps-foot roller shall be used to compact the soil. Manual mechanical tamping equipment shall have a rammer which weighs not less than 20 pounds and has surface area of not more than 36 square inches. Hand compaction is not acceptable.
2. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen or contain frost or ice.
3. Place backfill and fill materials evenly adjacent to structures, to required elevations. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around structure to approximately same elevation in each lift.
4. Existing Utilities: Where existing utilities are required to be tunneled under, the area under the utility shall be filled with compacted sand and have the pipe embedment reconstructed as for new piping.
5. Pipe Embedment: New piping shall be laid on a sand leveling bed compacted to maximum thickness of 6 inches. Dig holes in bedding for bells and fittings so pipe bears uniformly along its length. Hand compact the haunching under the spring line of the pipe. Take extra care to control the density of the haunching on plastic pipe in accordance with the manufacturer's instructions.

3.11 COMPACTION

- A. General: Control soil compaction during construction providing minimum percentage of density specified for each area classification. Perform all required tests.
- B. Moisture Control:
 1. Where soil material must be moisture conditioned before compaction, uniformly apply water to surface of subbase, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.
 2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
 3. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

C. Required Densities:

1. Structures, Building Slabs and Steps: Compact top 18 inches of subgrade and each layer of backfill or fill material to 95% of maximum density or greater.
2. Pavements: Compact disturbed soil to remain and subbase material to 95% maximum density or greater.
3. Lawn or Unpaved Areas: 80-85% maximum density, Refer to Article 3.11.B.
4. Trench Backfill: Compact layers 6 inches or less to 95% maximum density or greater.
5. Walkways: Compact top 6 inches of subgrade and each layer of backfill or fill material to 95% maximum density or greater.
6. Fill Under Existing Utilities: Compact top 6 inches of subgrade and each layer of backfill to 95% maximum density or greater.
7. Sand Pipe Bedding: Compact top 6 inches of subgrade and 6-inch layer of sand to 95% maximum density or greater.

3.12 FINISH GRADING

A. Finish surfaces free from irregular surface changes, and as follows:

1. Lawn or Unpaved Areas by Owner: Finish topsoil to within not more than 0.10 feet above or below specified finish grade as measured after settlement and/or specified compaction is attained.
2. Pavements: Shape surface of areas under pavement to line, grade and cross section, with finish surface not more than $\frac{3}{4}$ of an inch above or below required subgrade elevation.
3. Grading Surface of Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within tolerance of 2 inches when tested with a 10-foot straightedge.

B. After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

C. Proof Roll: Contractor shall arrange with the Project Representative to approve subgrade as indicated in Articles 3.11 and 3.12.

3.13 PAVEMENT SUBBASE COURSE

- A. Grade Control: During construction, maintain lines and grades including crown/cross-slope of subbase course.
- B. Placing: Place subbase course material on prepared subgrade in layers of uniform thickness of 6 inches or less, conforming to indicated cross section and thickness. Maintain optimum moisture content for compacting subbase material during placement operations.
- C. Class II subbase shall be spread and compacted identical to regular Class II material.
- D. Proof-roll before placing the bituminous pavement.

3.14 GRANULAR SURFACE COURSE

- A. Grade Control: During construction, maintain lines and grades including cross-slope of subbase course.
- B. Placing: Place granular course material (22A gravel for parking areas and 21AA for roadways and loading docks) on prepared subbase in a layer of uniform thickness, as indicated on the Drawings for cross section and thickness.

3.15 BUILDING SLAB SUBBASE

- A. Place subbase material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting material during placement operations.
- B. Compact subbase in maximum 6-inch lifts.

3.16 TOPSOIL OPERATIONS (SUBSOIL SURFACE PREPARATION, HAULING, SPREADING, ROUGH GRADING AND CLEAN-UP)

- A. Topsoil operations, including subsoil surface preparation, hauling, spreading, rough grading and clean-up, shall be by Owner.
- B. Place silt fence at locations designated on the Contract Documents and locations specified by the Project Representative prior to topsoil placement. Silt fence shall become property of Owner and removed by Owner.

3.17 INSPECTION

- A. Contractor shall notify the Project Representative when the excavation is complete. A visual subgrade inspection shall be performed prior to placing reinforcing steel, concrete, pipe beddings, etc. If satisfactory soil conditions are not found at the depths indicated, immediately notify the Project Representative in writing before proceeding further. Should Contractor fail to notify the Project Representative, all settlement and damage caused by new work resting on soft or unsound earth shall be made good at the sole expense of the Contractor.

3.18 PROTECTION

- A. Protect newly graded areas from traffic and erosion. Keep free of trash, debris and plant material, including weeds and grass.
- B. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances. Where settling is measurable or observable at excavated areas during Project warranty period, remove pavement, lawn or other finish, add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.
- C. Where completed compacted areas are disturbed beyond specified tolerances by subsequent construction operations or adverse weather, scarify, reshape, and restore surface to match surface of originally installed work. Eliminate evidence of the repair to the greatest extent possible.
- D. Continue to properly maintain soil erosion and sedimentation control measures. Perform and document required site inspections until the Owner has officially accepted the Project site.

3.19 CLEAN-UP

- A. Refer to Division 01 Section “General Requirements - Temporary Facilities and Controls.”
- B. The Contractor shall perform daily maintenance and cleanup of construction materials and debris tracked on and off site. Materials and debris that accumulate and are not removed or maintained after a 24-hour notification of a violation by the Owner, will be separately contracted by the Owner and all associated costs will be charged to the Contractor.

END OF SECTION 312300

SECTION 321216 – BITUMINOUS PAVEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.

1.2 SUMMARY

- A. Provide all labor, materials, and equipment as necessary to complete all work as indicated on the Drawings and specified herein.
- B. This section includes bituminous pavement.
- C. Work Excluded: This section does not apply to bituminous pavement patching.
- D. Related sections include the following:
 - 1. Division 02 Section 024113-SITE DEMOLITION
 - 2. Division 31 Section 312300-EARTHWORK
 - 3. Division 32 Section 321723-PAVEMENT MARKING
- E. Quality assurance
 - 1. Removal:
 - a. If the pavement density for a subplot (average of subplot cores) is less than 92.0 percent, the Contractor shall remove and replace the subplot.
 - b. The Engineer reserves the right to evaluate a subplot whose test results for asphalt binder content, Gmm, VMA, or air voids, exceed the single test tolerances indicated in Table 1 – Bituminous Quality Assurance Testing Tolerances (+ or -) from JMF, included at the end of this section. If the Engineer determines that the in-place mixture will not perform in accordance with normal standards, the Contractor shall remove and replace the subplot.
 - c. General: The cost of the mixture removed and the removal cost shall be borne by the Contractor. Removal decisions will be applied to individual sublots.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the Work of this section shall comply with the following:

1. ASTM:

- a. C 117 – Test Method for Materials Finer Than 75 μ -m (no. 200) Sieve in Mineral Aggregates by Washing.
- b. C 136 – Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- c. D 1559-89 – Test Method for Resistance to Plastic Flow of Bituminous Mixtures using Marshall Apparatus (section 4.5).
- d. D 2041 – Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
- e. D 2172 – Test Methods for Quantitative Extraction of Bitumen from Bituminous Paving Mixtures.
- f. D 2726 – Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens.
- g. E 29 – Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications. All equipment requirements to perform these sampling and testing procedures shall apply.

2. MTM (Michigan Test Method):

- a. 110 – Determining Deleterious and Objectionable Particles in Aggregates.
- b. 117 – Determining Percentage of Crushed Particles in Aggregates.
- c. 118 – Measuring Fine Aggregate Angularity.
- d. 311 – Determining Aggregate Gradation for Bituminous Mixture.
- e. 313 – Sampling Bituminous Mixtures.
- f. 319 – Determination of Asphalt Content from Asphalt Paving Mixtures by the Ignition Method.

1.4 DEFINITIONS

- A. Quality Control (QC): Activities that have to do with the Contractor producing a quality product as specified; including training, materials sampling and testing, project oversight and documentation.
- B. Quality Assurance (QA): Activities that have to do with the Owner ensuring a quality product, as specified; including materials sampling and testing, construction inspection, and review of Contractor quality control documentation. To perform this service, the Contractor shall notify the Engineer 2 days (see definition below) in advance so that QA activities can be properly performed.
- C. Bituminous Mix Design: The selection and proportioning of aggregate(s), mineral filler (if required), reclaimed asphalt pavement (RAP) and asphalt binder such that the specified mixture design criteria are met. Laboratory evaluation is required to determine if the stated mix design complies with specifications.
- D. Job Mix Formula (JMF): A bituminous mixture for a specific project. This may include adjustments to the mix design to optimize the field application.
- E. Target Value: A JMF parameter value that may be adjusted, if approved by the Engineer, to account for changes in the physical properties of the mixture.
- F. JMF Adjustment: The Contractor may propose an adjustment to the JMF based upon QC or QA test results; or both. The proposed JMF shall meet the requirements of MDOT 2012 Standard Specifications for Construction. When approved by the Engineer, a JMF adjustment may be applied retroactively to 1 lot, for parameters with target values. The Engineer may also require the Contractor to make adjustments to the mixture to assure that the parameters of the mix design are being met.
- G. Voids in Mineral Aggregate (VMA): The volume of void space between the aggregate particles of a compacted paving mixture that includes the air voids and the asphalt binder, including the absorbed asphalt binder, expressed as a percent of the total volume of mixture.
- H. Effective Specific Gravity (Gse): The ratio of the oven dry weight in air of a unit volume of an aggregate (excluding voids permeable to asphalt) at a stated temperature to the weight of an equal volume of water at a stated temperature.
- I. Bulk Specific Gravity of Aggregate (Gsb): The ratio of the oven dry weight in air of a unit volume of an aggregate at a stated temperature to the weight of an equal volume of water at a stated temperature.
- J. Maximum Specific Gravity of Mixture (Gmm): The ratio of the weight in air of a unit volume of an uncompacted bituminous paving mixture at a stated temperature to the weight of an equal volume of water at the same temperature.

- K. Lot: Bituminous mixtures produced and placed under this specification will be evaluated on a lot-by-lot basis. A lot is made up of a discrete tonnage of 1 mixture. Each lot consists of up to 3 sublots. These sublots shall be of approximately equal size up to a maximum of 2,000 tons. The subplot size shall be approved by the Engineer prior to the start of production. The Contractor may request a change in the subplot size during production based upon the Contractor's ability to produce a mixture that meets the specification contained within the Contract Documents, and upon approval of the Engineer. If only 1 or 2 sublots are included in a lot at the end of production, they shall be combined with the previous lot using the same mix, and this combined lot shall be evaluated based upon all subplot samples.
- L. Lot Average Test Result: The average of all subplot QA test results, for a specific parameter, for the lot. Test results for a subplot removed from the project shall not be used in calculating a lot average. However, the replacement material shall be tested and the results included in the lot average.
- M. Process Quality Control Targets: Targets established by the Contractor based upon initial production lot test results (and from an approved trial run) for air voids, VMA, asphalt binder content and Gmm. QC tolerances shall be applied to these established targets to determine the need for production changes, including stopping production, to control the quality of the product. Process quality control targets shall be reported to the Engineer prior to the end of placement of the second lot.
- N. Rounding of Numbers: Rounding of numerical data shall follow ASTM E 29-93a, as described in MDOT Bituminous QC/QA Procedures Manual of Field Testing.
- O. Random Sampling: Selection of QA samples (bituminous mixture and density) and verification samples may be by a random process managed by the Engineer. The Engineer may use a random number generating calculator to determine the locations of each density core and mixture sample. The Contractor will be given the opportunity to observe the sampling process. However, the random numbers selected and the sampling locations will not be revealed to the Contractor until the time of sampling in order to avoid bias in the random sampling process.
- P. Project Representative: An individual appointed by the Owner, Board of Trustees, Michigan State University.
- Q. Engineer: Third party testing and inspection agency. The Contractor will contract directly with the Engineer for the QA services under the allowance indicated the bid form.
- R. MDOT Specification: Michigan Department of Transportation 2012 Standard Specifications for Construction.
- S. RAP: Recycled Asphalt Pavement.

1.5 SUBMITTALS

- A. Submit a 4-point mix design, including regression chart, to the Owner for review and approval. Mix design shall follow the format as indicated in the Asphalt Institute Manual MS-2 Marshall Stability Method. It is the intent of this specification for the Contractor to produce mixtures at the parameters indicated in Table 3 – Mixture Type and Table 4 – Gradations (Percent Passing), both included at the end of this section.
- B. If the Engineer believes the Contractor is producing mixture at the high or low end of any of these specification limits, the Engineer shall have the authority to make changes necessary to bring the mixture back to the specified parameters.
- C. Quality Control Test: Provide test reports as described in this section.
- D. Project Documentation: Provide documentation as described in this section.
- E. Warranties: Submit written special warranty as specified in this Section. Include contact information, description of coverage, and start date for each special warranty.

1.6 QUALITY CONTROL

- A. Sampling and Testing:
 - 1. Follow the sampling and testing procedures listed in Article 1.2 - References in completing this work.
- B. The Contractor shall take random samples of loose mixture at a sampling frequency agreed upon with the Engineer. The Contractor shall provide the Engineer a split Sample of QC Samples. This Sample may be taken anywhere in the production process, except behind the paver. The Contractor shall be responsible for establishing process quality control targets for air voids, asphalt binder content, aggregate gradation, Gmm, obtaining QC Samples, and conducting QC testing in accordance with the Contractor's quality control plan (QCP).
- C. Each QC Sample shall be identified to allow test reports to be linked to a specific lot or subplot within the Project.
- D. The Contractor shall maintain daily control charts and have them available for review at Infrastructure Planning and Facilities at all times. Copies of these control charts shall be provided to the Engineer, if requested. Test results shall be plotted and used in quality control decisions. When corrective action is necessary, the Contractor shall notify the Engineer in writing of the specific action taken, if it required a JMF adjustment.

- E. The Contractor shall have available a density gauge for quality control testing during the compaction process and an apparatus for determining the temperature of the hot mix asphalt. The Contractor shall also have the capability to take 6-inch cores from random locations throughout the paved area for acceptance testing. The Contractor may take up to 3 informational cores from each mixture type, to help correlate the density gauge. The average in-place density shall be not less than 95 percent of the theoretical maximum density.

1.7 QUALITY ASSURANCE

- A. The Engineer may collect bituminous mixture quality assurance Samples and provide the Contractor with splits of these Samples. If the criteria for the verification procedure are satisfied, the Contractor's test results may be incorporated into the acceptance and payment decisions for the mixture. During the course of production, the Engineer may acquire random Samples at any point in the production process. These Samples may be tested to determine if the mixture, the aggregate and the binder meet the specification requirements contained in the Contract Documents. As the Samples are collected, the Engineer will assign an alphanumeric identifier to the sample and split, which can be used to trace the test results to the lot and subplot. This alphanumeric identifier must be included on Engineer test reports associated with that Sample. An example is 4-2-A, which would designate the Engineer's split (A) of the Sample from subplot 2 of lot 4 on a Project.
- B. A minimum 16,000 gram Sample may be taken. The Sample will be divided equally for Contractor and Engineer testing. The following tests may be conducted by the Engineer on the QA Sample splits.
1. Maximum Specific Gravity, Gmm (ASTM D 2041).
 2. Bulk Compacted Density (ASTM D 1559, paragraph 4.5).
 3. Air Voids (calculated).
 4. Voids in Mineral Aggregate, VMA (calculated).
 5. Composition of the Mixture: Asphalt binder content based on calculated value using subplot maximum specific gravity (Gmm) and current JMF effective specific gravity (Gse). The retained Gmm sample may be used for gradation (ASTM C 117 and C 136) and crushed particle content (MTM 117) from extracted (ASTM D 2172) or incinerated (MTM 319) aggregate, or from MTM 311.

- C. In-Place Density: The Engineer may identify random core sample locations for each subplot based on longitudinal and transverse measurements. The Engineer will mark each core location with a paint dot, which represents the center of the core. The Contractor shall drill a 6-inch core sample at each core location. The Contractor shall notify the Engineer sufficiently in advance of coring to ensure that a representative can be present to witness the coring. The core Samples shall be taken after final rolling.
1. As an option, when mutually agreed to by the Engineer and Contractor, the core Samples may be waived and the density gauge will be used for acceptance testing.
 2. Core Samples shall not be damaged during removal from the roadway. If, for any reason, a core is damaged or determined not to be representative at the time of coring, the Engineer will evaluate and document the problem and determine whether re-coring is necessary.
 3. All previous pavement, base aggregate or bond coat material shall be sawed off the bottom of the core Samples before the core density is calculated.
 4. The core holes shall be filled with hot mixture and thoroughly compacted as part of the coring operation. The method of filling holes and obtaining compaction shall be agreed upon prior to production. Pavement density acceptance testing will be completed within 1 work day after the cores were taken. Testing will be in accordance with ASTM D 2726. The test results on the compacted bituminous mixture may be used as a basis of acceptance and payment.
- D. Verification of Quality Control Test:
1. The Engineer will review the Contractor's sampling and testing procedures, test results and Engineer QA test results. If, in the opinion of the Engineer, sampling and testing procedures are proper, the Contractor's quality control test data may be used for acceptance decisions.
 2. The Contractor's QC test results may be considered verified if the following criteria are satisfied:
 - a. The difference between the Contractor's QC test results and the JMF fall within the single test tolerance indicated in Table 1 – Bituminous Quality Assurance Testing Tolerances (+ or -) from JMF, included at the end of this section, or
 - b. The difference between the Engineer's test results and the Contractor's test results fall within the single test tolerance indicated in Table 1 – Bituminous Quality Assurance Testing Tolerances (+ or -) from JMF, included at the end of this section.

3. If the difference between the Contractor's QC test results, compared to the JMF, exceed the single test tolerances indicated in Table 1 – Bituminous Quality Assurance Testing Tolerances (+ or -) from JMF, included at the end of this section, the Engineer's test results will be used as the acceptance test. If the subplot is not verified, the Contractor shall be notified and given a copy of the test results. Both the Contractor and the Engineer will verify that testing equipment is calibrated and operating properly, and correct testing procedures have been followed. Unless it is documented that the difference resulted from equipment or procedural problems, the Engineer's test results will remain as the acceptance test of record.

E. Project Documentation:

1. The format of test reports and QC charts to be submitted by the Contractor shall be approved by the Engineer before mixture production is allowed to commence. Suggested formats of reports and charts are available from the Engineer. Project documentation to be provided by the Contractor shall include, but may not be limited to, the following:
 - a. Lot Basis:
 - 1) A complete report of QA tests shall be submitted to the Engineer within 24 hours of the time the last tests were completed.
 - 2) Control charts of test data must be current (data should be plotted as soon as the test is complete) and available for review by the Engineer.
 - b. Project Summation:
 - 1) Control charts for test data indicating individual test values, lot averages and the running average of 5.
 - 2) A tabulation of test data including subplot data, lot averages, Project average, Project standard deviation and a projection of which lots are subject to a price adjustment.
2. Provide documentation to confirm that the material used on the Project meets or exceeds minimum specified requirements in accordance with MDOT 2012 specifications.
3. The Contractor shall provide a letter to the Owner certifying that materials approved in the mix design were, in fact, used in the production of the mixture installed on this Project.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Provide to the Engineer the asphalt delivery tickets showing asphalt cement grade, date of delivery, and quantity delivered.

1.9 PROJECT CONDITIONS

- A. Weather and seasonal limitations shall not exceed those specified in MDOT 2012
- B. MSU will reject loads with a temperature either below 250 deg F or greater than +/- 20 deg F from the recommended maximum mixing temperature selected by the binder producer at the time of discharge from behind the screed.

1.10 WARRANTY

- A. Furnish and sign 5 year written warranty (last page of this section) which shall cover the following conditions:
 - 1. Cracking: A crack caused by improper joints in the pavement, either a construction joint, a butt joint, or cracking caused by expansion or contraction of the pavement, or by any settlement of the pavement.
 - 2. Delamination: An instance where the surface course de-bonds from the underlying layer of asphalt pavement, causing slippage or complete separation.
 - 3. Raveling: An area where the aggregate or matrix becomes loose, or separates from the asphalt pavement. This condition will generally be caused by poor density or segregation.
- B. Remedies for the conditions described above shall be as follows:
 - 1. Cracking: Cracks over 3-inch in length or wider than 1/8-inch, or both, shall be corrected by routing/sawing and sealing or overband sealing, as directed by the Engineer, with a sealer approved by the Engineer.
 - 2. Delamination: Areas that exhibit delamination shall be repaired by removing the surface course and cleaning the leveling course, installing a bond coat, and furnishing and installing a new surface course of a like hot mix asphalt.
 - 3. Raveling: Areas that exhibit raveling, or a loss of aggregate or matrix, shall be repaired by removing the distressed area, cleaning the leveling course, applying a bond coat, and furnishing and installing a new surface course of a like hot mix asphalt.

- C. At least once a year, for the duration of the warranty period, Project Representative will inspect the pavement to determine if warranty work is necessary. If deficiencies are found, the Project Representative shall notify the Contractor in writing as to the extent of the repairs needed. The Contractor shall perform the repairs within 30 calendar days or other period as approved by the Project Representative. Should the Contractor not perform the required repairs, the Owner may make the repairs at the Contractor's expense. The Contractor may also inspect the lot from time to time to determine if warranty work is necessary. The Contractor will be allowed, with approval of the Project Representative, to perform warranty work that will retard any further deterioration of the warranted conditions. Any and all costs to repair deficiencies in the asphalt shall be paid for by the Contractor.

PART 2 - PRODUCTS

2.1 SUBBASE COURSE

- A. See Division 31 Section 312300-EARTHWORK.

2.2 BASE COURSE

- A. Not used.

2.3 BITUMINOUS MIXTURES

- A. See Table 3 – Mixture Type and Table 4 – Gradations, both included at the end of this section.

2.4 ASPHALT EMULSION

- A. The bond/tack coat shall conform to MDOT 2012 Specification for Asphalt Emulsion SS-1h.

2.5 ASPHALT CEMENT

- A. Final binder properties shall meet asphalt PG 58-28. The asphalt cement shall conform to MDOT 2012 Specification for Asphalt Cement and conform to the Project Specifications. If the binder obtained from the recycled asphalt pavement exceeds 17 percent of the total binder in the mixture, the Contractor shall furnish documentation (i.e., blending chart) in order to determine the proper grade of virgin binder required to achieve the desired final binder properties.

2.6 TRAFFIC PAINT

- A. See Division 32 Section 321723-PAVEMENT MARKING.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare subbase according to MDOT 2012 Specifications and Project requirements.
- B. Where entire pavement thickness is to be completely removed, cut existing pavement neatly with a saw. Otherwise, edges shall be cut straight and smooth allowing for a full depth pavement throughout.
- C. Proof roll subgrade and subbase to check for unstable areas and areas requiring additional compaction. Perform proof rolling as directed by the Engineer.
- D. Notify Project Representative of unsatisfactory conditions. Do not begin paving work until deficient subgrade areas have been corrected, tested, and approved by the Project Representative.
- E. Required Grades for Barrier Free Parking Areas:
 - 1. In areas designated on the Drawings as a barrier free parking space, either so noted or with a uniform barrier free graphic symbol, the slope of the parking space and adjacent access aisle shall not exceed 2 percent (1/4-inch per foot) in any direction.
 - 2. Should this provision conflict with the Drawings, inform the Project Representative so that the necessary revision(s) can be made.

3.2 INSTALLATION OF PAVEMENT

- A. General: Place bituminous pavement and bond coats over approved subbase or existing pavement according to MDOT 2012 Specifications, Division 5.
- B. Pavement Thickness and Type: Over the subbase, place bituminous pavement as indicated on the Drawings. For courses exceeding 3-inch, place bituminous pavement in 2 lifts with a bond coat between each layer. For patching, provide 4-inch leveling course and 2-inch surface course over compacted subbase.
 - 1. Mix Type:
 - a. Surface Course – Roadway and Dock Areas:
 - 1) Thickness: 1.5-inch.
 - 2) Yield: 165 lbs/syd.

- b. Surface Course – Parking:
 - 1) Thickness: 1.5-inch.
 - 2) Yield: 165 lbs/syd.
- c. Leveling Course – Roadway and Dock Areas:
 - 1) Thickness: 3.5-inch.
 - 2) Yield: 385 lbs/syd.
- d. Leveling Course – Parking:
 - 1) Thickness: 2.5-inch.
 - 2) Yield: 275 lbs/syd.
- C. Bond Coat: Uniformly apply a coat of SS-1h at a rate of 0.10 to 0.15 gallon per square yard over the entire surface of each bituminous course, except the last.
- D. Protection: After final rolling, protect pavement from vehicular traffic until the surface has cooled sufficiently to eliminate surface abrasion.

3.3 TABLES

TABLE 1 – BITUMINOUS QUALITY ASSURANCE TESTING TOLERANCES (+ OR -) FROM JMF		
Parameter	Single Test	Lot Average
Air Voids	1.00%	0.60%
Voids in Mineral Aggregate (VMA)*	1.20%	0.75%**
Maximum Specific Gravity (Gmm)*	0.019	0.012
Asphalt Binder Content*	0.50%	0.35%
* Parameters with Target Values		
** Or less, determined by VMA Value from MDOT 2012 Standard Specifications for Construction.		

Parameter (Lot Average)	Deviation (d)	Negative Unit Price Adjustment (%)
Asphalt Binder Content (deviation from JMF)	0.35 < d ≤ 0.55	10
	d > 0.55	25
Air Voids (deviation from JMF)	0.6 < d ≤ 0.7	2
	0.7 < d ≤ 0.8	4
	0.8 < d ≤ 1.0	6
	1.0 < d ≤ 1.1	8
	1.1 < d ≤ 1.2	10
	d > 1.2	25
Maximum Specific Gravity (Gmm) (deviation from JMF)	0.012 < d ≤ 0.014	2
	0.014 < d ≤ 0.015	4
	0.015 < d ≤ 0.017	6
	0.017 < d ≤ 0.019	8
	0.019 < d ≤ 0.021	10
	d > 0.021	25
Voids in Mineral Aggregate (VMA) (deviation below minimum value in the MDOT 2012 Standard Specifications for Construction)	0.0 < d ≤ 0.1	2
	0.1 < d ≤ 0.3	4
	0.3 < d ≤ 0.4	6
	0.4 < d ≤ 0.5	8
	0.5 < d ≤ 0.6	10
	d > 0.6	25

	Surface Course		Leveling Course	
	Roadway & Dock Area	Parking Only	Roadway & Dock Area	Parking Only
	Mixture Number	5C Modified	36A Modified	3C Modified
VMA % (Eff. Spec. Gravity)	16.0	16.5	15.0	15.5
Air Voids % *	3.0	2.5	3.0	2.5
Fines to Binder Ratio (Max.)	1.2	1.2	1.2	1.2
Fine Angularity (Min.) MTM 118	4.0	3.0	4.0	2.5
* Modified from MDOT specifications. No more than 50% of the material passing the #4 sieve shall pass the #30 sieve for Parking mixtures.				

TABLE 4 – GRADATIONS (PERCENT PASSING)

	Surface Course		Leveling Course	
	Roadway & Dock Area	Parking Only	Roadway & Dock Area	Parking Only
Mixture Number	5C Modified	36A Modified	3C Modified	13A Modified
1-inch	100	100	100	100
3/4-inch	100	100	99-100	100
1/2-inch	100	100	90 Max.	75-95
3/8-inch	99-100	92-100	77 Max.	60-90
#4	90 Max.	65-90	57 Max.	45-80
#8	55-70	55-75	15-45	30-65
#16	30-55		33 Max.	20-50
#30	20-30	25-45	25 Max.	15-40
#50	15-25		19 Max.	10-25
#100	15 Max.		15 Max.	5-15
#200	3-6	3-7	3-6	3-6
Crush (Min.) MTM 117*	90	60	90	50
* Modified from MDOT specifications. No more than 50% of the material passing the #4 sieve shall pass the #30 sieve for Parking mixtures.				

(BITUMINOUS PAVEMENT WARRANTY ON THE FOLLOWING PAGE.)

BITUMINOUS PAVEMENT WARRANTY

PROJECT:

CONTRACTOR:

**OWNER: BOARD OF TRUSTEES
MICHIGAN STATE UNIVERSITY**

We, the undersigned, hereby provide a five (5) year warranty to Owner against defects caused by deficiencies in the materials and/or workmanship of the bituminous pavement in accordance with the requirements set forth in the Drawings and Specifications for the above named project.

The warranty covers the following conditions:

1. Cracking as defined shall be any cracked caused by improper joints in the pavement, either a construction joint, a butt joint, or any cracking caused by expansion or contraction of the pavement, or by any settlement of the pavement, i.e., thermal cracking. Cracks caused by fatigue or settlement will not be covered by this Warranty.
2. Delamination as defined shall be any instance where the surface course de-bonds from the underlying layer of bituminous pavement, causing slippage or complete separation.
3. Raveling, as defined shall be any area where the aggregate or matrix becomes loose, or separates from the asphalt pavement. This condition is generally caused by poor density or segregation.

Remedies for the conditions described above will be as follows:

1. Cracking. Any cracks over 3” in length and/or wider than 1/8” shall be corrected by routing/sawing and sealing or band sealing, as directed by the Owner’s Representative, with a sealer approved by the Owner’s Representative.
2. Delamination. Any area that exhibits delamination will be repaired by removing the surface course and cleaning the leveling course, installing a bond coat and furnishing/installing a new surface course of a like hot mix asphalt.
3. Raveling. Any area that exhibits raveling, or a loss of aggregate or matrix, will be repaired by removing the distressed are, cleaning and leveling course, applying a bond coat and furnishing and installing a new surface course of a like hot mix asphalt.

At least once a year, for the duration of the Warranty period, Owner’s Representative will inspect the pavement to determine if any warranty work is necessary. If deficiencies are found, the Owner’s Representative will notify the Contractor, in writing, as the extent of the repairs needed. The Contractor will perform the repairs within 30 calendar days, or within period as approved by the Owner’s Representative. Should the Contractor not perform the required repairs, the Owner may make the repairs at the Contractor’s expense. The Contractor may also inspect the lot from time to time to determine if any warranty work is necessary. The Contractor will be allowed, with approval of the Owner’s Representative, to perform any warranty work that it appears will retard any further deterioration of any of the warranted conditions. Any and all costs to repair any deficiencies in the pavement shall be paid by this Contractor.

CONTRACTOR: _____ DATE _____

ADDRESS: _____

AUTHORIZED REPRESENTATIVE: _____
(Print) (Signature)

SUBSCRIBED AND SWORN TO BEFORE ME,
THIS ____ DAY OF _____
A.D. _____
NAME
MY COMMISSION EXPIRES

END OF SECTION 321216

SECTION 321313 – CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.

1.2 SUMMARY

- A. Provide all labor, materials and equipment as necessary to complete all work as indicated on the Drawings and specified herein.
- B. This section includes concrete pavement.
- C. Related sections include:
 - 1. Division 01 Section 014000-QUALITY REQUIREMENTS
 - 2. Division 31 Section 312300-EARTHWORK
 - 3. Division 33 Section 334000-STORM DRAINAGE

1.3 SUBMITTALS

- A. Shop Drawings: For heated walks, paving areas showing the layout of expansion joints, tubing and manifold areas.
 - 1. Submit to Project Representative for approval.
 - 2. Design tubing system to minimize the crossing of expansion joints. Adjustments can be made to correspond to design requirements of the tubing system, with approval from Project Representative.
- B. Warranties: Submit written special warranty as specified in this Section. Include contact information, description of coverage, and start date for each special warranty.

1.4 QUALITY ASSURANCE

- A. Provide required testing and inspection as indicated in Division 01 Section “General Requirements - Quality Requirements.”
- B. Concrete sampling, testing, and inspection shall conform to the following requirements:
 - 1. Sampling Fresh Concrete: ASTM C172, except initial Samples shall be taken immediately after first 1/4 cubic yard (CY) has been discharged and subsequent Samples shall be taken as specified herein. If found to be in non-conformance, the concrete shall be removed from the forms.

2. Slump: ASTM C143, except initial Sample shall be taken in accordance with paragraph above. Additional tests shall be made for each set of compressive strength test specimens, and as required by the Project Representative.
3. Air Content: ASTM C231, except as previously specified herein and additional tests at the end of the load, if possible.
4. Concrete Temperature: Taken each time compression test specimens are made and hourly when temperature is 40 degrees F and below and over 80 degrees F.
5. Unit Weight: ASTM C138, except the Sample volume shall be equal to air content specimen.
6. Compressive Strength: ASTM C31 and C39, except one set of 3 cylinders for every 40 cy or fraction thereof. One specimen shall be tested at 7 days and the remaining 2 specimens shall be tested at 28 days. Strength level of the concrete will be considered unsatisfactory if the 7 day compressive strength does not equal or exceed 60% of the 28 day design strength. Strength level of concrete will be considered satisfactory if the average compressive strength of two consecutive 28 day tests equals or exceeds the 28 day design strength, and neither individual strength test results falls below the specified compressive strength requirement by more than 100 psi.
7. Inspection: Monitored by the Project Representative.
8. Frequency: In accordance with Division 01 Section “General Requirements - Quality Requirements.”
9. Concrete Replacement: Failure of a test or to follow proper installation procedures will require that the concrete be removed and properly replaced at Contractor’s expense.
10. Additional Tests: Contractor may have the testing agency make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42. Contractor shall pay for all such tests conducted. Holes shall be patched at the Contractor’s expense.

1.5 SEQUENCING AND SCHEDULING

- A. Concrete shall not be placed after October 15 without written permission from the Project Representative.

1.6 WARRANTY

- A. Furnish and sign 2 year written warranty (last page of this section) which shall cover cracking, spalling, settling, finishing and forming.

PART 2 - PRODUCTS

2.1 CEMENT

- A. Portland cement conforming to the requirements of the current specifications for Portland Cement ASTM C150 Type 1.

2.2 AIR-ENTRAINING ADMIXTURE

- A. Conform to ASTM C260 for concrete.

2.3 FINE AGGREGATE

- A. Limestone or other fine aggregate that is free of soft particles or other material that could cause staining or pitting of the pavement surface. For gradation purposes only, the material shall conform to MDOT Specification 2NS.

2.4 COARSE AGGREGATE

- A. Well-graded limestone. Gradation and physical requirements to conform to MDOT Specification 6AA.

2.5 WATER

- A. Potable.

2.6 REINFORCEMENT

- A. Welded Wire Reinforcement:
 - 1. Standard; Welded wire fabric (6 x 6 - W4.0 / W4.0) in flat sheets only, conforming to ASTM A1064.
 - 2. Heavy duty and heated pavement; Welded wire fabric (4 x 4 - W4.0 / W4.0) in flat sheets only, conforming to ASTM A1064.
- B. Bar Reinforcement: No. 3, No. 4 and No. 5 bar reinforcement as specified on the Drawings. It shall be new billet stock of intermediate grade in accordance with ASTM A615.

2.7 DOWELS

A. Construction Expansion Joints:

1. No. 5 speed dowel 9 inches long, as manufactured by Greenstreak, Inc., 3400 Tree Court Industrial Blvd., St Louis, MO; 800-325-9504; or approved equal.
2. Dowel: 18 inches long, No. 5 smooth epoxy-coated rebar (coated all surfaces); or approved equal.
3. 1/4" x 4-1/2" x 4-1/2" electroplated zinc steel, ASTM A36, ASTM B633 with pocket formers
 - a. Diamond Dowel System as manufactured by PNA Construction Technologies www.PNA-INC.com ; 800-542-0214 ; or approved equal.

B. Construction Joints:

C. As specified above.

2.8 FORMED KEYWAY

- A. Standard keyway, 1-5/8-inch x 1-3/4-inch x 2-3/4-inch, as manufactured by Dee Concrete Accessories Company, P.O. Box 11119, Chicago, IL 60611; or approved equal.

2.9 ASPHALT EXPANSION JOINTS

- A. Conform with ASTM Specification D994-53. Fiber joint material is not acceptable.

2.10 JOINT SEALER

- A. Tremco Spectrem 800. Primer: Tremco Silicone Primer No. 23. Tremco-Sealant/Weatherproofing Division, 3735 Green Road, Beachwood, OH 44122; 800 321 7906.

2.11 CURING AND ANTI-SPALLING COMPOUNDS

A. Curing and Anti-Spalling Compound:

1. For use when the concrete is placed at 40 degrees F and above.
2. Sealtight brand Lin-Seal Emulsion curing and sealing compound; Clear emulsion product (not to be confused with Lin-Seal or Lin-Seal white).
3. Manufactured by M.G. by W.R. Meadows, Inc, PO Box 338, Hampshire, IL 60140 0338; 847-683-4500, 800-342-5976.

B. Waterproofing Compound:

1. For use when the concrete is placed below 40 degrees F or when the concrete pavement is within 50 feet of building entrances; or both. Either of the following will be accepted.
2. Products:
 - a. Lifetime™ Water Sealant by Coatings International, Inc., 112 North Monroe, N.E. Rockford, MI 49341; 616-863-6529; Fax: 616-863-1076; www.coatingsinternational.com
 - b. Consolideck Saltguard WB by PROSOCO, Inc., 3741 Greenway Circle, Lawrence, KS 66046; 785-865-4200; Fax: 785-830-9016; www.prosoco.com.

C. Evaporation Retardant:

1. Conspec Aquafilm by Conspec Marketing & Manufacturing, 636 S. 66th Terrace, Kansas City, Kansas 66111; 800-348-7351
2. Confilm Evaporation Reducer by BASF Construction Chemicals, LLC, 23700 Chagrin Boulevard, Cleveland, Ohio 44122-5544, 800-628-9990; Fax 216-839-8821
3. Approved equal

2.12 ADMIXTURES

- A. As approved by Project Representative.

2.13 FORMWORK

- A. Steel or wood forms of an approved section shall be used throughout the construction. On radii 3 feet or less, 1/4-inch plywood or masonite shall be used. All forms shall have a height equal to concrete thickness. Built-up, battered, bent, twisted, or broken forms shall be removed from the Work. Expansion joint materials shall not be used.

2.14 CONCRETE QUALITY

- A. The mixture shall contain 6 sack Portland cement concrete, coarse aggregate, fine aggregate admixtures and water. The concrete mix design shall have a minimum 4000 psi compressive strength at 28 days. The maximum allowable slump shall be 4.5 inches. Aggregates shall be batched by weight. Air content shall be 5% to 8%. Maintain a maximum water/cement ratio of 0.46 pounds of water per pound of cement.

- B. Contractor shall provide the Project Representative with delivery tickets which shall list slump, sack mix, percent of air entraining agent, time the truck left the plant, arrived on the site and departed the site, and water added at the site.
- C. When requested, Contractor shall provide documentation from the concrete supplier certifying that the concrete meets the specifications of this section.
- D. Color shall be limestone. Consistency of the color shall be uniform throughout the Project.

2.15 DETECTABLE WARNING PLATES

- A. 24" x 24" Duralast Detectable Warnings, Product number 00700571, Natural Finish by East Jordan Iron Works, Inc.; 800-626-4653

PART 3 - EXECUTION

3.1 PLACING FORMS

- A. Forms shall be so constructed and set as to resist, without springing or settlement, the pressure of the concrete. Forms shall not deviate more than 1/8-inch in 10 feet from the true horizontal alignment and no more than 1/8-inch in vertical alignment.
- B. Where forms are set above general surrounding area, earth shall be placed along outside edges of forms to ensure stability.
- C. Forms shall be cleaned and oiled each time they are used.
- D. Forms shall be reviewed by the Project Representative prior to pouring.

3.2 PLACING REINFORCEMENT

- A. Place reinforcement mesh as indicated on the Drawings and in the following areas:
 - 1. Where the pavement crosses a recently filled trench and extending a minimum of 5 feet beyond the trench wall.
 - 2. Where fill soil of 18 inches or more occurs.
 - 3. As directed by the Project Representative.
- B. Concrete shall be placed in 2 layers when mesh reinforcing is used. Use of brick, stones, etc., or unusual raising with bars or tools is prohibited. Proper positioning of the mesh can be achieved by either; (1) the use of metal or plastic chairs specifically intended for holding mesh reinforcement in the soil conditions present at the required depth, or (2) placing and consolidating a layer of concrete at the specified elevation of the reinforcement prior to placing reinforcement and a top layer of concrete

3.3 PLACING CONCRETE

- A. Placing 6-inch (or greater, if specified) concrete shall not commence until the subbase and forms have been approved. Subbase shall be moistened in advance of concreting, but shall not be muddy or excessively wet. A sufficient quantity of forms shall be placed to accommodate the concrete that is scheduled to be poured at any one time. Concrete shall be deposited with a minimum of re-handling and shall be spaded adjacent to forms and joints. In the case of isolation joints, concrete shall be placed simultaneously against both sides of the joint.
- B. Concreting shall not be continued when the air temperature is below 45 degrees F, unless the aggregates or water, or both, are heated to produce a placing temperature of the concrete between 60 degrees F and 90 degrees F., and unless adequate provisions are made for maintaining protection against freezing of the concrete for at least 7 days after placing. No concrete shall be placed on frozen subbase.
- C. Should placement of concrete be necessary over or near tree roots, a thin layer of sulfur shall be placed on the area of the subbase which may be affected by the roots. Owner shall place sulfur. Provide 2 day notice to coordinate work with Owner's crews.

3.4 JOINTING

- A. As indicated on the Drawings, as directed in the field by the Project Representative and in the following situations, unless otherwise specified:
 - 1. Control (contraction) joints shall ordinarily be placed at intervals equal to the width of the slab or 8 feet, whichever is less. They shall be 1/8-inch to 3/16-inch wide and 1-1/4 inch deep, or 1/4 the thickness of the slab, whichever is greater. Where slabs exceed 8 feet in width, a straight longitudinal control joint shall be placed along the centerline of the slab. This joint shall begin and end only at isolation or construction joints.
 - 2. Expansion joints shall be placed as indicated on the Drawings and if not conflicting with Drawings at intervals of at least every 40 lineal feet (LF), adjacent to footings and foundations, adjacent to curbs when required, adjacent to existing concrete where new concrete is to abut or at next available joint that is parallel to the edge of the existing concrete. Continue joints in adjoining concrete, in the same location as existed in the concrete that was removed, and where 2 or more walks intersect. Joints shall be placed in a vertical position through the entire slab thickness.
 - 3. Construction joints (with dowels) shall be installed when placing operations are delayed more than a 1/2-hour at locations where normal control joints would occur, as indicated on the Drawings and as directed by the Project Representative.

- B. Joints shall be tooled to the specified depth. If the pavement thickness is greater than 6 inches, sawing will be permitted after the joints have first been tooled. The only exception to this requirement is for basketball courts, where only saw cutting is permitted.
- C. Joints shall be perpendicular to the edge and tangents and normal to curves. The joints shall not vary from the true line more than 1/4-inch.
- D. When new walkways are adjacent to new curb and gutter or when required by the Project Representative, the Contractor shall install a Diamond Dowel System.
- E. Place sealant in non-heated pavement joints when specified, according to manufacturer's recommendations, using primer as specified.

3.5 FINISHING

- A. Concrete shall be placed and struck off with a straight board until voids are removed in the surface at the required grade and cross section.
- B. Adding water to the surface of the concrete to assist in finishing operations is not permitted. If a finishing aid is permitted by the Project Representative, it shall only be an approved product for that intended purpose and then applied according to the product recommendations.
- C. Immediately after the concrete has been struck off, the surface shall be floated with a magnesium bull float, just enough to produce a smooth surface free from irregularities. Edges shall be rounded to a radius of 1/4-inch with an approved edging tool. Jointing shall then commence immediately after edging and before the large aggregate in the concrete has started to settle.
- D. The entire surface shall then be steel-troweled so that the large aggregate is set and the surface is free of edging joints and trowel marks.
- E. The surface shall be heavy-broomed, keeping mortar out of joints. Brooming direction shall generally be perpendicular to the normal path of travel, unless otherwise directed by the Project Representative. Provide 2-inch retool at joints, if detailed on the Drawings.
- F. Surface variations greater than 1/8-inch in 10 feet are unacceptable.
- G. Walks shall be protected from pedestrian traffic for 2 days and vehicles for 7 days.
- H. Concrete shall be stamped at each end of the work with the Contractor's name and the current year.

CURING AND ANTI-SPALLING COMPOUND APPLICATION

- I. For temperatures above 40 degrees F, concrete shall be cured utilizing the specified curing/anti-spalling compound in accordance with product specifications using only a motorized sprayer. This application includes the sides of the concrete, once the forms have been removed.

- J. For temperatures between 32 degrees F and 40 degrees F and on concrete within 50 feet of building entrances, cure pavement using an approved wet cure method for a period of not less than 7 full days while maintaining a concrete temperature above 34 degrees F for 14 days. After 30 days, the specified water proofing compound shall be applied according to product specifications.

3.6 DETECTABLE WARNING PLATES

- A. Follow manufacturer's installation specifications to properly install detectable warning plates per site plan layout. Pay special attention to be sure the plastic concrete comes through all the holes in the plate to eliminate all cavities below the plate that could trap water.

(CONCRETE PAVEMENT WARRANTY ON THE FOLLOWING PAGE.)

CONCRETE PAVEMENT WARRANTY

PROJECT:

CONTRACTOR:

**OWNER: BOARD OF TRUSTEES
MICHIGAN STATE UNIVERSITY**

We, the undersigned, herewith warranty all the work to be free from defective workmanship and/or materials for **two (2) years** from November 1st of the calendar year of the date written below, in accordance with the requirements set forth in the Drawings and Specifications for the above-named Project.

The Contractor agrees that by acceptance of this Work and in consideration thereof, for them and for each of their Subcontractors, binds themselves to all warranties called for. The Contractor shall warranty all work, except as noted elsewhere in these Contract Documents in which a longer warranty is specified. This shall include, but not be limited to, the following defects:

1. Cracking
2. Spalling
3. Settling
4. Finishing
5. Forming

If during the warranty period, it is found by the Owner's Representative, that the warranty Work needs to be repaired or replaced because of the use of materials, equipment, or workmanship which is inferior, defective, or not in accordance with the terms of Agreement, the Contractor, upon notification, shall promptly and without additional expense to the Owner:

- a. Place in satisfactory condition all of such warranted Work,
- b. Make good all damage to the project, or contents thereof, which is a result of such unsatisfactory warranted Work, and
- c. Make good any Work, materials and equipment that are disturbed in fulfilling the Warranty, including any disturbed work, materials and equipment that may have been warranted under another contract.

Should the Contractor fail to proceed promptly in accordance with the Warranty, the Owner's Representative may have such work performed at the expense of the Contractor and their surety.

CONTRACTOR: _____ DATE: _____

ADDRESS: _____

AUTHORIZED REPRESENTATIVE: _____
(Print) (Signature)

SUBSCRIBED AND SWORN TO BEFORE ME,

THIS _____ DAY OF _____

A.D. _____

NAME

MY COMMISSION EXPIRES

END OF SECTION 321313

SECTION 321613 – CONCRETE CURBS AND GUTTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.

1.2 SUMMARY

- A. Provide all labor, materials and equipment as necessary to complete all work as indicated on the Drawings and specified herein.
- B. This section includes:
 - 1. Curb and gutters.
- C. Related sections include the following:
 - 1. Division 01 Section 015000-TEMPORARTY FACILITIES AND CONTROLS
 - 2. Division 31 Section 312300-EARTHWORK
 - 3. Division 32 Section 321218-BITUMINOUS PAVEMENT
 - 4. Division 32 Section 321313-CONCRETE PAVEMENT

1.3 SUBMITTALS

- A. Testing and Inspection: Provide reports as described in this section.
- B. Warranties: Submit written special warranty as specified in this Section. Include contact information, description of coverage, and start date for each special warranty.

1.4 QUALITY ASSURANCE

- A. Provide the required testing and inspection as indicated in Division 01 Section “General Requirements - Temporary Facilities and Controls.” Concrete sampling, testing, and inspection shall conform to the requirements found in Division 32 Section “Concrete Pavement.”

1.5 SCHEDULE

- A. Concrete shall not be placed after October 15 without written permission from the Project Representative.

1.6 WARRANTY

- A. Furnish and sign 2 year written warranty (last page of this section) which shall cover cracking, spalling, settling, finishing and forming.

PART 2 - PRODUCTS

2.1 Refer to Division 32 Section “Concrete Pavement” for all products, except for the following:

- A. Reinforcement: Shall be No. 4 bar reinforcement of new billet stock of intermediate grade in accordance with ASTM A615.

PART 3 - EXECUTION

3.1 PLACING FORMS

- A. Steel or wood forms of an approved section shall be used throughout the construction. On radii 3 feet or less, 1/4-inch plywood or masonite shall be used. All forms shall have a height equal to concrete thickness. Built-up, battered, bent, twisted, or broken forms shall be removed from the work. Expansion joint materials shall not be used.
- B. Forms shall be so constructed and set as to resist, without springing or settlement, the pressure of the concrete. On curbs of sharp radius, plywood or other approved flexible material shall be used in sections short enough to form a smooth, uninterrupted curb which shall not vary from the true radius by more than 1/4-inch. Forms shall not deviate more than 1/8-inch in 10 feet from the true horizontal alignment and no more than 1/8-inch in vertical alignment.
- C. Where forms are set above general surrounding area, earth shall be placed along outside edges of forms to ensure stability.
- D. Forms shall be cleaned and oiled each time they are used.
- E. Forms must be approved by the Project Representative prior to placing concrete.

3.2 PLACING REINFORCEMENT

- A. Place 2 bars in gutter pan as specified in Drawings and in the following areas:
 - 1. Where curb crosses a recently filled trench and extending a minimum of 5 feet beyond trench wall.
 - 2. Where fill soil of 18 inches or more occurs.
 - 3. In all valley gutter pans. (exception – 3 bars as shown on the detail drawing)
 - 4. In all path ramps and extending a minimum of eighteen inches beyond the bottom of the curb taper or curb transition.

5. As directed by the Project Representative.

3.3 PLACING CONCRETE

- A. Refer to Division 32 Section “Concrete Pavement.” However, the time restriction may be extended with the approval of the Project Representative.

3.4 JOINTING

- A. Control (contraction) joints shall be perpendicular to the curb edge, 1-1/2-inch deep, open and free of all excess concrete. Control joints shall be placed at intervals of not more than 10 feet as indicated on the Drawings.
- B. Expansion joints shall be placed at all points of curvature, tangency, and at intervals of not more than 100 lineal feet.

3.5 FINISHING

- A. Concrete shall be struck off true to cross section, after which it shall be finished smooth and even. Face forms, if used, shall be left in place until the concrete has set sufficiently so that they can be removed without injury to the curb. The remaining forms shall be rounded with an edging tool. No tool marks are to be left on exposed edges.
- B. A straight edge check is to be made while concrete is still plastic. Irregularities exceeding 1/8-inch shall be corrected. Finish surfaces shall not vary from the required cross section as indicated on Drawings by more than 1/8-inch. They shall not vary from the true horizontal alignment by more than 1/4-inch in 10 lineal feet. Sections exceeding those limitations are subject to rejection and replacing at Contractor's expense.
- C. Adding water to the surface of the concrete to assist in finishing operations is not permitted. If a finishing aid is permitted by the Project Representative, it shall only be an approved product for that intended purpose and then applied according to the product recommendations.
- D. For heated pavement (or snow melt) systems, the heated portion of the concrete shall be stamped with the words “Heated Walk Limit” at the edge of the heated pavement. If part of the system includes the curb or gutter, then the stamp shall be placed on the gutter pan. Stamp spacing shall be at approximately 20-foot increments and positioned exactly between each control joint. Stamp locations shall be approved by the Project Representative in advance. A stamp may be available for use from the Project Representative if arrangements are made in advance. Otherwise, the Contractor is responsible to secure a stamp that is approved by the Project Representative.

3.6 CURING AND ANTI-SPALLING COMPOUND APPLICATION

- A. Refer to Division 32 Section “Concrete Pavement.”

(CONCRETE CURB AND GUTTER WARRANTY ON FOLLOWING PAGE.)

CONCRETE CURB & GUTTER WARRANTY

PROJECT:

CONTRACTOR:

**OWNER: BOARD OF TRUSTEES
MICHIGAN STATE UNIVERSITY**

We, the undersigned, herewith warranty all the work to be free from defective workmanship and/or materials for **two (2) years** from November 1st of the calendar year of the date written below, in accordance with the requirements set forth in the Drawings and Specifications for the above-named Project.

The Contractor agrees that by acceptance of this Work and in consideration thereof, for them and for each of their Subcontractors, binds themselves to all warranties called for. The Contractor shall warranty all work, except as noted elsewhere in these Contract Documents in which a longer warranty is specified. This shall include, but not be limited to, the following defects:

1. Cracking
2. Spalling
3. Settling
4. Finishing
5. Forming

If during the warranty period, it is found by the Owner's Representative, that the warranty Work needs to be repaired or replaced because of the use of materials, equipment, or workmanship which is inferior, defective, or not in accordance with the terms of Agreement, the Contractor, upon notification, shall promptly and without additional expense to the Owner:

- a. Place in satisfactory condition all of such warranted Work,
- b. Make good all damage to the project, or contents thereof, which is a result of such unsatisfactory warranted Work, and
- c. Make good any Work, materials and equipment that are disturbed in fulfilling the Warranty, including any disturbed work, materials and equipment that may have been warranted under another contract.

Should the Contractor fail to proceed promptly in accordance with the Warranty, the Owner's Representative may have such work performed at the expense of the Contractor and their surety.

CONTRACTOR: _____ DATE: _____

ADDRESS: _____

AUTHORIZED REPRESENTATIVE: _____ (Print) _____ (Signature)

SUBSCRIBED AND SWORN TO BEFORE ME,

THIS _____ DAY OF _____

A.D. _____

NAME

MY COMMISSION EXPIRES

END OF SECTION 321613

SECTION 321723 – PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.

1.2 SUMMARY

- A. Provide all labor, materials and equipment as necessary to complete all work as indicated on the Drawings and specified herein.
- B. This section includes pavement markings.
- C. Related sections include the following:
 - 1. Division 32 Section “Bituminous Pavement.”
 - 2. Division 32 Section “Concrete Pavement.”

1.3 QUALITY ASSURANCE

- A. Approved installation contractors for both pavement marking types:
 - 1. P.K. Contracting, P.O. Box 184, Clawson, MI 48017; 313-362-2130.
 - 2. Parallel Contracting, Inc., 3420 E. Grand River, Williamston, MI 48895; 517-819-3853.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC PAVEMENT MARKINGS

- A. According to 2012 MDOT Section 811 specification. Color: White and yellow, as indicated on the Drawings.

2.2 PRE-FORMED THERMOPLASTIC BARRIER FREE SYMBOL

- A. Barrier Free Kit White on Blue Item #89230237HS, 40-inch x 40-inch size. Color: Blue.
- B. Manufacturer: Ennis-Flint, Inc. (allow 2 weeks for delivery), 115 Todd Court, Thomasville, NC 27360; 336-475-6600, Fax: 336-475-7900.

2.3 THERMOPLASTIC BIKE WITH HELMET SYMBOL

- A. Bicycle Rider Item #89230524(+)HS add “L” for Left or “R” for Right to indicate facing direction of marking. (Ennis-Flint, Inc.) 6'-6" x 3'-4".

2.4 THERMOPLASTIC BIKE LANE ARROW

- A. Yield Line (Shark's Teeth) Item #8231002 (Ennis-Flint, Inc.) 2-foot x 3-foot.

2.5 PRIMER FOR THERMOPLASTIC MATERIAL

- A. #623206-20 – 5 gallon.
- B. #623206-4 – 1 gallon.

2.6 GLASS BEADS

- A. According to 2012 MDOT Section 811 specification.

2.7 CONCRETE PAVEMENT MARKINGS/SPEED TABLES

- A. Liquid pavement markings using a polyurea coating material 3M Stamark, Epoplex L590; or approved equal.

2.8 TRAFFIC PAINT

- A. Regular dry pavement marking paint according to 2012 MDOT Section 811 specification.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Pavement cleaning and marking application shall be according to 2012 MDOT section 811 specification and as indicated on the Drawings.
- B. Use primer on installations as indicated in the manufacturer's specifications.
- C. Cyclist symbol with arrow to be located as indicated on the Drawings.
- D. Barrier Free Symbol Placement: Bottom edge of the symbol square shall be aligned with the end of the line striping closest to the travel aisle and in the center of the parking space.
- E. Place glass beads on thermoplastic lines.

- F. All thermoplastic pavement markings (symbols and line work) on bituminous pavement in roadways shall be recessed to the thickness of the pavement marking.
 - 1. The resulting surface interface between the markings and the bituminous shall be smooth.
 - 2. Concrete pavement shall not be recessed for pavement markings.
- G. Pavement markings in new bituminous pavement parking areas shall be thermoplastic unless otherwise noted on plans.
- H. Thermoplastic pavement markings in parking areas are not required to be recessed unless otherwise noted on the plans.

END OF SECTION 321723

SECTION 337119 – ELECTRICAL UNDERGROUND DUCTS AND MANHOLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. This Section specifies the underground electrical and communication utility duct bank systems for buildings and structures.
2. Provide all labor, materials, and equipment as necessary to complete all work as indicated on the drawings, and as specified herein for a complete operating system.
3. The Contractor shall furnish and install complete underground electrical and communication duct bank system with all necessary components for a complete system.

- B. Related Sections:

1. Applicable sections of Division 26 - Electrical

1.3 SUBMITTALS

- A. Shop Drawings

1. Duct bank conduit
2. Manholes and all hardware and components

- B. Guarantee: Provide guarantee as described in this section.

- C. Warranties: Submit written special warranty as specified in this Section. Include contact information, description of coverage, and start date for each special warranty.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- B. Comply with NFPA 70, “National Electrical Code”
- C. The underground electrical and communication duct bank shall be in accordance with ANSI C2 National Electrical Safety Code and NFPA 70 National Electrical Code.
- D. Guarantee
 - 1. Furnish full parts and labor warranty to cover the duct bank and manhole system for one year from date of installation.

1.5 DESIGN REQUIREMENTS

- A. In general, the electrical and communication underground duct bank system is composed of concrete encased conduit terminating at electrical and communication manholes. The duct bank shall be as straight as possible between manholes with the elevation varying to create a slope toward the manholes to drain any water that may enter the duct bank.

PART 2 - PRODUCTS

2.1 ELECTRICAL AND COMMUNICATION MANHOLES

- A. Manholes
 - 1. Manholes shall be either reinforced precast concrete or cast-in-place concrete.
 - 2. Manhole walls, base and roof shall all have a minimum thickness of 6”. Reinforcement will be Grade 60 rebar conforming to ASTM A706 and rebar cage shall be designed to meet AASHTO HS-20 loading conditions.
 - 3. Reinforced precast concrete manholes shall be in accordance with the standard manhole details as shown. Concrete shall be mixed to produce a 28-day minimum compressive strength of 4500 psi. Manholes shall be transported in such a manner so as to prevent cracking, chipping, or other damage. Manholes shall be installed under the manufacturer’s supervision or by installers having a minimum of five years of experience installing this manufacturer’s manholes. They shall be assembled in accordance with manufacturer’s recommendations.
 - 4. Reinforced precast concrete manholes shall have integral floor-to-wall construction and integral roof-to-wall construction. The two-piece precast concrete manholes joints shall be sealed with two rows of 1” butyl rope mastic per manufacturer’s instructions.
 - 5. Manholes shall be manufactured by Advance Concrete Products Co. or approved equal.

6. Cast-in-place manholes shall be constructed in accordance with the standard manhole detail as shown. Concrete shall be ready-mixed conforming to the standard specifications for ready-mixed concrete ASTM C-94 and mixed to produce a 28-day minimum compressive strength of 3000 psi.
7. In general, electric manholes shall have interior dimensions of 10 feet long x 8 feet wide x 7 feet tall. Communication manholes shall have interior dimensions of 8 feet long x 6 feet wide x 7 feet tall. Openings for duct shall be beveled.
8. Manholes shall have a 30" diameter clear opening. Manhole covers shall be heavy duty type with machined bearing surfaces and shall be lettered with words "ELECTRIC" or "COMMUNICATION". Covers shall have 1" diameter pick holes a minimum of three inches in from outside edge of cover. Ring and cover shall be Neenah No. R-1640-C or East Jordan Iron Works no. 1825 heavy duty cast iron frame and no. 1810 cover.
9. Manhole ring will set on two courses of brick or equivalent in precast concrete rings to allow for future grade adjustments.
10. Covers on electric and communication manholes will be secured by the Owner, only as required.
11. Beveled duct terminators shall be cast in the walls for conduit. Knockout windows or clear windows shall be provided as specified or shown on drawings for future conduit.

B. Cable Racks

1. Cable racks shall be installed in all manholes to properly support cables.
2. 1/2 inch threaded inserts shall be cast-in walls for cable rack connections with a horizontal spacing no greater than 24 inches on-center.
3. Concrete inserts for cable rack bolts will be hot-dipped galvanized.
4. In existing manholes plated steel expansion shield equal to "Phillips," or "A & J" may be used in lieu of inserts.
5. Manhole hardware shall be hot-dipped galvanized manufactured by Inwesco or approved equal. Cable racks shall #10A22, corner brackets shall be #10A50, sidewall brackets shall be #10A40, and cable support arms shall be #10A37 (10 inch long). Provide a 3I-3600 series 8 foot hooked ladder for each manhole.

C. Pull-in Irons

1. Each wall of each manhole will have at least one 1" hot-dipped galvanized pull-in iron. A pull-in iron shall be installed directly across from each set of duct bank

terminators, and new and future duct bank openings. Pull-in irons will be by Advance Concrete or approved equal.

D. Ground Rods

1. All electric and communication manholes shall have a minimum of two (2) 5/8" x 8'0" copper-clad steel ground rods, installed outside and adjacent to the manhole, one each where the duct banks enter the manholes. The top of the ground rods shall be at the same elevation as the duct banks.
2. A 4/0 THW ground cable shall be connected to each ground rod and brought into the manhole along with the ground cable from the adjacent duct bank.
3. Inside the manholes, all the ground cables shall be connected together along with the ground cables in the adjacent manhole (when an Electrical and Communication manhole are installed adjacent to each other) with a 4/0 THW ground cable.
4. Ground cables shall be neatly trained vertical and horizontal, and clamped to the manhole walls.
5. All connections shall be made using the exothermic weld method or the Burndy Hyground compression method.

E. Waterproofing

1. All cast-in-place manholes will be waterproofed with a modified asphalt membrane waterproofing or Bituthene waterproofing. Acceptable Products and Manufacturers: Bituthene by Grace Construction Products Division, Polyguard No. 650 by Polyguard Products, Inc.
2. All precast manholes shall be waterproofed with factory applied exterior waterproofing membrane on the top, bottom, and all four sides.
3. All cast-in-place and precast manholes shall have fanfold DOW Protection Board III applied over the waterproofing to protect the waterproof membrane during backfill.
4. All joints where the duct enters manholes shall have Durajoint PVC, Type 4 waterstop or equal. Waterstop shall be continuous, all joints shall be welded together as recommended by the manufacturer.

F. Drainage

1. Manholes With Sump Pits
 - a. Manholes with sump pits shall have PVC or cast iron, equal to James B Clow & Sons, Inc., No. F-4216 with No. F4230 extension as required.

- b. The sump pit shall be located in the center of the manhole floor.
- c. Slope the floor to the sump pit.

2.2 ELECTRICAL AND COMMUNICATION DUCT BANK

A. Duct Banks

1. All underground duct banks, including conduit, couplings, bends, and bells, and any special fillings shall be plastic duct. Plastic duct shall be as manufactured by Prime Conduit Inc. or CANTEX Inc.
2. Plastic duct and fittings shall be corrosion-resistant and not adversely affected by acids, alkalis, salts or organic matter. Fittings shall be of a type especially made for use with plastic duct for electrical service. All plastic conduit and fittings shall be joined by a solvent welding cement. Conduits shall be five inch UL or ETL labeled, Schedule 40.
3. Duct end bells shall have a minimum opening diameter of 6".
4. All joints in the ducts will be made water tight.
5. Factory bends and sharp sweeps in new duct banks shall not be allowed; unless specifically noted otherwise. If factory bends are installed, the minimum bend radius shall be 60".
6. Tracer Wire: Tracer wire shall be installed to enable the detection of plastic pipes, fiber optics, and non-conducting utilities. Tracer wire shall be 12 AWG (min.), THWN or RHW conductor embedded in the concrete envelope.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor shall locate existing utilities and confirm elevations prior to construction, as determined necessary by the Engineer to insure the continued service of these utilities. When locating such utilities the Contractor shall proceed with caution, using hand instead of machine excavation.
- B. Where exterior building walls are cored for conduit penetrations, follow the waterproofing guidelines described in this specification for manholes. Mechanical seals shall be installed as to allow future tightening or replacement of devices. Seals shall be sized, selected, and installed in accordance with Manufacturer's recommendations.

3.2 ELECTRICAL AND COMMUNICATION MANHOLES

A. General

1. Whenever a contractor has work to perform in an existing manhole and it is partially or entirely filled with water, it shall be the Contractor's responsibility to pump it out at his expense.
2. The Contractor shall be responsible for the removal and proper disposal of any and all asbestos fire proofing tape on any cables in existing electrical manholes involved in this project. The asbestos removal shall take place prior to performing any work in the manholes.
3. Manholes shall be set to grade established by the Engineers.

B. Waterproofing

1. Precast manhole waterproofing membrane will cover the top, bottom, and all sides. Membrane will be flashed tight to conduits and reinforcing dowels at duct bank entrance.
2. Cast-in-place manhole waterproofing membrane will cover the cove, top, and all sides down to 8 inches below the joint between the wall and floor. Membrane will be flashed tight to conduits and reinforcing dowels at duct bank entrance.
3. Membrane waterproofing shall be installed in the following manner:
 - a. All surfaces shall be primed with a manufacturer approved primer. Roll on membrane overlapped 2-1/2" min. at seams with primer. Apply elastomeric mastic to all seams and edges.
 - b. At all corners, cracks, and construction joints, two layers of membrane shall be applied.
4. All construction joints will have cast-in waterstops.

3.3 ELECTRICAL AND COMMUNICATION DUCT BANK

A. General

1. Primary distribution will be run in fiber or plastic duct with reinforced concrete encasement. Size, location, and elevation will be shown on drawings. The duct bank will be pitched to drain any seepage to a manhole. Duct banks entering buildings will pitch away from the building. Slope will not be less than 4 in./100 ft. of duct. Grade shots will be taken at least every 25 ft. to assure uniform pitch.

2. Duct banks shall have no pull boxes or short radius bends. Long radius sweeps are allowed as shown on the drawings. Any change in direction should take place at a manhole, one for electric and one for communications.
3. Duct banks shall be marked with a marker tape buried in the trench above the duct.

B. Duct Bank Encasement

1. Lay concrete blocks at 4 ft. on center to establish grade and tie ducts to blocks to make secure. Plastic separators shall be used to maintain space between ducts, 1-1/2 inches between electric ducts, 1-1/2 inches between communication duct, and 3 inches between electric and communication ducts.
2. In lieu of the blocks a 3 inch concrete pad may be poured and leveled to the grade established, with the wires inserted every four feet to secure ducts.
3. Reinforce the duct bank as follows.
 - a. Duct bank installed under non-hard surface areas shall be reinforced with two 5/8 inch steel reinforcing bars laid parallel to the ducts in the bottom of the duct bank in the outside corners.
 - b. Duct bank installed under hard surfaces such as roads, sidewalks, and parking lots, shall be reinforced with four 5/8 inch steel reinforcing bars laid parallel to the ducts, two on top and two on the bottom in the outside corners.
 - c. Where the duct bank enters manholes or buildings, the reinforcing bar shall penetrate the manhole or building wall as follows.
 - 1) Three inch penetration in walls that are six inches thick.
 - 2) Four inch penetration in walls that are over six inches and up to eight inches thick.
 - 3) Six inch penetration in walls that are over eight inches thick.
4. A concrete envelope of 3000 PSI test, using 6-AA limestone, shall be poured around ducts with low enough slump to be worked into all openings. When concrete is poured, some method of deflecting the concrete shall be employed to minimize force on the ducts.
5. The concrete shall cover the plastic duct a minimum of 3 inches on both sides, top, and bottom; encasing the reinforcing bars with a minimum thickness of two inches of concrete; and modified as follows:

- a. Under hard surfaces such as roadways, sidewalks, and parking lots, the concrete shall cover the ducts a minimum of 6 inches on top.
 - b. Where duct enters manholes or buildings, or where duct is to cross new utilities installed, or indicated as proposed, or where duct is to be installed in fresh fill, the duct shall have minimum of 4 inches of concrete on both sides, top, and bottom. Where a duct bank crosses a steam line, there shall be a minimum of 6 inches of sand fill between the outside of the concrete envelope and the insulation around the steam line.
6. There shall be a minimum separation of 12 inches between the concrete envelope of the duct bank and any existing or new gas main or line, water line, sewer line, or steam line or tunnel.
 7. Install twelve inches of high density extruded polystyrene insulation between the duct bank and any steam line or tunnel where the duct bank either crosses or is parallel to the steam line or tunnel.
 8. The minimum distance between the top of the concrete envelope of the duct bank and final grade shall be 30 inches, unless otherwise specified or special permission is obtained from the Owner.
 9. Excessive amounts of concrete shall not be poured around duct. Concrete covering the top and sides of the duct shall not exceed 6", unless special permission is obtained from the Owner. Forms shall be used where necessary to comply.
 10. Pour the concrete in several lifts and vibrate the concrete between lifts to remove air pockets.
 11. All new duct bank conduits shall be tested by pulling a nominal 4" mandrel through each 4" duct and a nominal 5" mandrel through each 5" duct.
- C. Pull String
1. Install a heavy duty nylon pull string in each conduit in the duct bank that is not receiving new cable on this project.
- D. Utility Marker Tape
1. Underground duct banks shall be marked with a plastic identifying tape buried in the trench directly above the duct bank at 8 to 12 inches below finished grade. The tape will be vivid opaque red in color with Caution Electric Line Buried Below continuously printed in black letters over the entire length of the tape. The tape will also be magnetic. Tape will be as manufactured by Allen Systems, Inc. or Terra Tape.
 2. If the duct bank is 18 inches or less in width the tape shall be 3 inches wide. If the duct bank is over 18 inches in width the tape shall be 6 inches wide.

E. Tracer Wire

1. All new duct banks shall be installed with tracer wire. The tracer wire shall be installed continuously along the new duct banks with access points at each manhole. The tracer wire shall be accessible at the ground surface without entering the manhole. Splices in the tracer wire shall be connected by means of a split bolt or compression type connector to ensure continuity. Wire nuts shall not be used. A waterproof or corrosion-proof connector for direct bury applications shall be used. After installation, the tracer wire shall be tested to verify continuity of the tracer wire system and a report indicating continuity shall be submitted to the Owner as part of the construction record documents.

F. Grounding Cable

1. The Contractor shall furnish and install a new 4/0 THW, stranded copper cable in the entire concrete envelope of all new electric and communication duct banks. All joints in the grounding cable shall be brazed or cadwelded.
2. In manholes, neatly clamp cable to the walls and ground rod.
3. In buildings, neatly clamp cable to the electrical grounding electrode system.

END OF SECTION 337119

**SPECIAL PROVISION
FOR
MAINTAINING TRAFFIC**

a. Description. This special provision consists of requirements and restrictions to maintain traffic on Trowbridge Rd, Red Cedar Rd, and Farm Ln on the Michigan State University (MSU) campus, in the city of East Lansing, Ingham County.

b. General. Maintain traffic throughout the project in accordance with the MDOT 2020 Standard Specifications for Construction, typicals, and supplemental specifications in the contract and as described on the plans for this project.

c. Construction Influence Area (CIA). The CIA includes the right-of-way of the following roadways, within the approximate limits described below:

1. On Trowbridge Rd from approximately Harrison Rd to Farm Ln, on Red Cedar Rd from Trowbridge Rd to Shaw Ln, and on Farm Ln from Service Dr to Shaw Ln.

2. In addition, the CIA includes the right-of-way of any designated detour route or alternate route, intersecting roads, and ramps adjacent to the work zone for a distance of approximately 1/4 mile in advance of the work zone or as far as the construction or detour signing extends. The roads include but are not limited to Wilson Rd, Harrison Rd, Service Rd, and Bogue St.

d. Traffic Restrictions. Maintain traffic in accordance with the Maintaining Traffic Typicals contained herein, except as noted below. Changes or adjustments to the Maintaining Traffic Typicals may be necessary to fit field conditions, subject to approval of the Engineer or as determined by the Engineer.

1. Utilize the following Maintaining Traffic Typicals:

- A. 100-GEN-KEY
- B. 101-GEN-SPACING-CHARTS
- C. 102-GEN-NOTES
- D. 110-TR-NFW-2L
- E. 112-TR-CLT
- F. 123-NFW-1LC-(R)
- G. 130-CLT-1(CLT)
- H. 133-CLT-1LC-(L)

- I. 137-CLT-SHIFT-0LC
- J. 203-FW-1LC-(R)

2. Do not work, deliver material, or close lanes during the holiday periods as defined in Table 1.

Table 1: 2025 Holiday Periods

Holiday	Start Date and Time	End Date and Time
Memorial Day	3:00 p.m. Friday, May 23rd	6:00 a.m. Tuesday, May 27th
Independence Day	3:00 p.m. Thursday, July 3rd	6:00 a.m. Monday, July 7th

3. When a lane is closed, place channelizing devices at cross streets and major drives to form a radius that clearly defines the approaches to the through and turning traffic.

4. Maintain access to all driveways as directed by the Engineer unless prior agreements are made with the respective property owners.

e. Traffic General.

1. For any lane open to traffic, provide a minimum lane width of 11 feet with 2 feet of shy distance on both sides unless identified otherwise on plans.

2. Place lane closures and traffic regulation operations only in areas as shown on the plans unless otherwise directed by the Engineer.

3. Prior to opening any lanes, remove, by sweeping all accumulated debris that has collected within the closed lane/shoulder.

4. A speed reduction will not be used.

5. Protect the work area at the end of each day. Close all open access points on the project to traffic with Type III barricades or other devices approved by the Engineer.

6. The Contractor will be responsible for notifying emergency services, transit agencies, law enforcement and schools prior to any lane closures, detours, or major traffic shifts. In addition, the Contractor will be responsible for working with and complying with any coordination that is necessary with MSU, City of East Lansing and emergency services, transit agencies, law enforcement and schools.

7. Obtain all necessary permits from MSU and local governments within areas of jurisdiction, including noise/dust ordinance waivers when required, prior to placing construction signing on roads.

8. Remove all temporary traffic control devices from right-of-way during any shut down periods unless needed for directly maintaining or channelizing traffic. No additional payment will be made for removal and/or redeployment of these devices except for in the case of an approved extension of time.

9. Once work is initiated that includes any lane restrictions, that work must be continued daily until completed. A lack of work activity for more than 3 days will require the removal of lane closures at no expense to the project.

f. Traffic Regulator Control.

1. Place the arrow panel, signs, and channelizing taper for the traffic regulator operation at locations approved by the Engineer for adequate visibility by oncoming traffic.

2. Crossroads must remain open to traffic at all times. Use intermediate traffic regulators at each intersection approach and commercial driveways within the closure limits, as directed by the Engineer. Use traffic regulator control as directed by the Engineer for cross street traffic while paving through intersections.

3. Follow the [Michigan Traffic Regulator's Instruction Manual](#) for operations at signalized intersections. Contact MSU and the City of East Lansing or applicable maintaining agency prior to work on traffic signals. Only the maintaining agency may make changes to the traffic signal controllers.

g. Stage Construction. Maintain traffic in accordance with the restrictions listed in section d. Traffic Restrictions and the sequence of operations contained herein. Use of an alternate traffic control plan is subject to review and approval by the Engineer.

1. Stage 1.

A. Construction

(1) Duct bank construction across EB and WB Trowbridge Rd south of Red Cedar Rd and across Trowbridge Rd east of Red Cedar Rd.

(2) Restore roadway with 6" aggregate surface.

(3) Replace curb & gutter, sidewalk, and sidewalk ramps.

B. Maintenance of Traffic

(1) Close EB and WB Trowbridge Rd on the east side of Chestnut Rd.

(2) Close NB and SB Red Cedar Rd on south side of west entrance to Ramp 5/Parking Lot 102 (Trowbridge Ramp); maintain west access to Ramp 5/Parking Lot 102 (Trowbridge Ramp).

(3) Close Trowbridge Rd on west side of south entrance to Ramp 5/Parking Lot 102 (Trowbridge Ramp) with soft closure at Farm Ln; maintain south access to Ramp 5/Parking Lot 102 (Trowbridge Ramp).

(4) Close bike lanes and sidewalks.

(5) Complete Stage 1 work prior to starting Stage 2 work.

2. Stage 2.

A. Construction

(1) Duct bank construction along south side of Trowbridge Rd (outside of roadway) from Red Cedar Rd to Farm Ln.

(2) Replace any removed curb and gutter.

B. Maintenance of Traffic

(1) Close EB lane and maintain traffic in accordance with MDOT 137-CLT-SHIFT-0LC maintaining traffic typical.

(2) Close outside right turn lane at Farm Ln.

(3) Close EB bike lane.

(4) Complete Stage 2 work prior to starting Stage 3 work.

3. Stage 3.

A. Construction

(1) Duct bank construction across west half of Farm Ln, at crossings south of Trowbridge Rd and south of Wilson Rd.

(2) Restore roadway with 6" aggregate surface.

(3) Replace curb & gutter, sidewalk, and sidewalk ramps.

B. Maintenance of Traffic

(1) Concurrent part-width closure of Farm Ln from Wilson Rd to south of Trowbridge Rd.

(2) Maintain northbound Farm Ln traffic and bike lane. Close left turn lane and bag south facing left turn lane signal heads at Trowbridge Rd and Wilson Rd. Close and detour south bound Farm Ln traffic. Detour route will be from Wilson Rd to Harrison Rd to Service Dr.

(3) Close sidewalks as needed.

(4) Complete Stage 3 work prior to starting Stage 4 work.

4. Stage 4.

A. Construction

(1) Duct bank construction across east half of Farm Ln, at crossings south of Trowbridge Rd and south of Wilson Rd.

(2) Restore roadway with 6" aggregate surface.

(3) Replace curb & gutter, sidewalk, and sidewalk ramps.

B. Maintenance of Traffic

(1) Concurrent part-width closure of Farm Ln from Wilson Rd to south of Trowbridge Rd.

(2) Maintain southbound Farm Ln traffic and bike lane. Close left turn lane. Close and detour north bound Farm Ln traffic. Detour route will be Service Dr to Bogue St to Wilson Rd.

(3) Close sidewalks as needed.

(4) Complete Stage 4 work prior to starting Stage 5 work.

5. Stage 5.

A. Construction

(1) Duct bank construction along Parking Lot 47/Greenhouse Parking Lot 53 (Employee Permit Parking) on east side of Farm Ln from Trowbridge Rd to Wilson Rd.

(2) Restore parking lot with 6" aggregate surface.

(3) Replace curb & gutter, sidewalk, and sidewalk ramps.

B. Maintenance of Traffic

(1) Close Parking Lot 47.

(2) Close sidewalk between Farm Ln and Parking Lot 47.

(3) Utilize daytime single outside lane closures along NB Farm Ln.

6. Stage 6.

A. Construction

(1) Duct bank construction across access drive to Greenhouse Parking Lot 53 (Employee Permit Parking).

(2) Restore roadway with 6" aggregate surface.

(3) Replace curb & gutter, sidewalk, and sidewalk ramps.

B. Maintenance of Traffic

(1) Close Greenhouse Parking Lot 53; close bike lanes and sidewalks.

(2) Closure is limited to two weekend periods.

(3) Greenhouse Parking Lot 53 access must be provided during the week.

7. Stage 7.

A. Construction

(1) Reconstruct removed roadway and parking lot pavement.

(2) Replace permanent pavement markings.

B. Maintenance of Traffic

(1) Utilize daytime single lane closures and traffic regulators to replace roadway crossings at the Trowbridge Rd/Red Cedar Rd intersection. MDOT maintaining traffic detail 10-TR-NFW-2L, 112-TR-CLT and 203-FW-1LC-(R).

(2) Utilize daytime lane shifts to complete any required road work along Trowbridge Rd. MDOT maintaining traffic typical 137-CLT-SHIFT-0LC.

(3) Utilize daytime single lane closures to replace roadway crossings along Farm Ln. MDOT maintaining traffic typical 123-NFW-1LC-(R) and 133-CLT-1LC-(L).

(4) Close Parking Lot 47 to replace parking lot pavement.

(5) Utilize daytime lane closures and lane shifts to replace roadway pavement crossing at Greenhouse Parking Lot 53 access driveway. MDOT maintaining traffic typical 130-CLT-1(CLT) and 137-CLT-SHIFT-0LC.

h. Detours.

1. Do not detour traffic until all proposed contract work on the detour route is completed, inspected, and approved by the Engineer.
2. Signs should be on both sides of the roadway when the work is taking place on a boulevard section.

i. Pedestrian or Non-Motorized Facilities.

1. Maintain all facilities in accordance with The Americans with Disability Act (ADA) requirements and the Public Rights-of Way Accessibility Guidelines (PROWAG). Provide facilities equivalent to or better than the route a person would have encountered prior to construction activities.
2. Close and detour any sidewalk ramps and crosswalk areas to pedestrian traffic that is impacted by the work. Cover pedestrian signal heads when the crosswalk or ramp is affected.
3. Keep sidewalk areas clear of any equipment or materials at all times the sidewalks are open to pedestrian traffic.

j. Earthwork and Excavation.

1. Restore undercuts or excavations in the work areas within 3 feet of the active traffic lanes to no steeper than a 1 on 4 slope from the edge of the roadway at the end of each work day. If this condition is not met, provide a nighttime closure.
2. Delineate excavated areas located within 3 feet of traffic with channelizing devices at 25 feet spacing along the excavated area or as shown on the maintaining traffic plans.
3. Use protective fencing to protect open excavations within the work zone during non-working hours.

k. Traffic Control Devices. Ensure all traffic control devices are in accordance with the MMUTCD and must meet the “acceptable” criteria as defined in the ATSSA publication entitled “Quality Guidelines for Temporary Traffic Control Devices and Features” at the time of initial deployment and after each major stage change.

1. During non-working periods, place applicable advance signs and channelizing devices at specific locations, as directed by the Engineer, at no additional cost.
2. Notify the Engineer 24 hours in advance of when traffic control devices are being delivered to the project site, to allow for initial inspection of devices to take place.
3. Remove from the project site all traffic control devices (including detour signing) no longer needed for a particular operation and equipment for construction within 14 calendar days of reopening the shoulder/lane/roadway.

4. Channelizing Devices.

A. Ensure all devices have sufficient ballast to prevent moving or tipping. If moving or tipping occurs, place additional ballast, as directed by the Engineer, at no additional cost. No more than two ballasts are allowed on each channelizing device.

B. Do not use caution tape on this project.

C. Space channelizing devices at 25 feet spacing for tapers and tangents or tighter as directed by the Engineer.

5. Temporary Signs.

A. W20-1 (ROAD WORK AHEAD) signs are included to be placed on all intersecting or adjacent roads where construction activities may be encountered.

B. Fabricate, install, and remove temporary sign overlays on existing signs in accordance with Sign, Type B, Temp, Prismatic, Furn. Attach the overlay in accordance with subsection 812.03.D.2 of the Standard Specifications for Construction.

I. Traffic Signals.

1. Prior to each stage, cover any signal indications or overhead signing in conflict with traffic movements during that stage. Methods of covering signs and signal indications require approval by the Engineer before placement.

m. Temporary Pavement Markings.

1. Remove conflicting pavement markings, pavement markings in taper/transition areas and other markings as directed by the Engineer, for operations occupying a location longer than 3 days. Durable markings in these areas should be covered rather than be removed.

2. Quantities for temporary tape to be placed during paving operations are based on the MDOT PAVE 900 Series standard plans.

3. When Type R or NR tape is used, ensure that all temporary pavement markings adhere to the pavement surface until permanent markings are installed.

4. Complete temporary pavement markings in each stage prior to shifting traffic as directed by the Engineer.

5. Replace all existing pavement markings that are removed for traffic control or obliterated during construction.

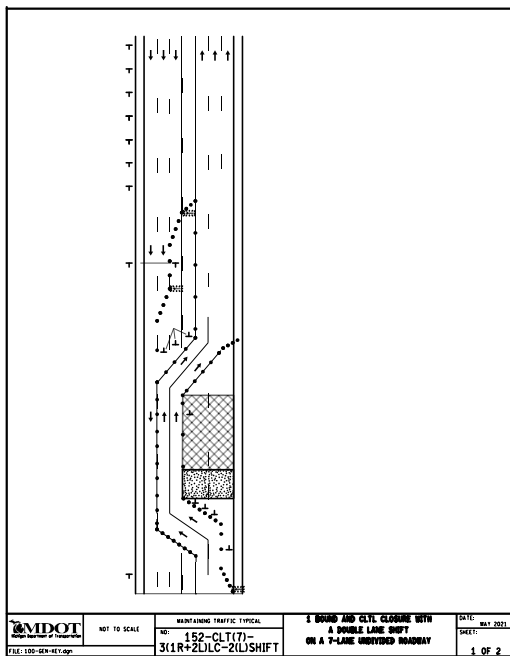
n. Measurement and Payment. No separate payment will be made for Maintaining Traffic, including the following activities:

1. Transporting traffic control items from site to site.
2. Providing sufficient vehicles and staff to make changes as needed on site during work.
3. Providing sufficient vehicles and staff to remove closures from the roadway.
4. Providing additional traffic control devices required to expedite the construction for the convenience of the Contractor.

TYPICAL NUMBER KEY

CODES

AB = ARROW BOARD AW = ADVANCE WARNING C = CLOSURE CLT = CENTER LEFT TURN LANE CROSS = CROSSOVER CruSha = CRUSH AND SHAPE EM = EARLY MERGE EnR = ENTRANCE RAMP ExR = EXIT RAMP FW = FREEWAY GEN = GENERAL INFORMATION GORE = FREEWAY GORE AREA IN = INSIDE INT = INTERSECTION L = LANE (L) = LEFT LC = LANE CLOSURE LD = LONG DURATION	LO = LANE OPEN O = OUTSIDE (LANE CLOSURE) OUT = OUTSIDE OF SHOULDER MID = MIDDLE OF INTERSECTION OR ROAD NFW = NON-FREEWAY PARK = PARKING LANE PCMS = PORTABLE CHANGEABLE MESSAGE SIGN (R) = RIGHT ROLL = ROLLING ROADBLOCK RUM = RUMBLE STRIP SD = SHORT DURATION SHL = SHOULDER CLOSURE SIGN = SIGN SP = SPECIAL SPEED = SPEED STA = STOPPED TRAFFIC ADVISORY TR = TRAFFIC REGULATOR TS = TEMPORARY SIGNAL ZIP = ZIPPER MERGE
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- 100 - GENERAL NOTES
- 110 - TRAFFIC REGULATORS
- 120 - NON-FREEWAY
- 130 - CENTER LEFT TURN (CLT) LANES
- 140 - PARKING LANES
- 150 - CLT 7 LANE SECTIONS
- 160 - SIGNAL WORK
- 200 - FREEWAY CLOSURES
- 210 - FREEWAY LANE SHIFTS
- 220 - FREEWAY ENTRANCE RAMPS
- 230 - FREEWAY EXIT RAMPS
- 300 - ADVANCE WARNINGS
- 310 - CROSSOVER CLOSURE
- 320 - CRUSH AND SHAPE
- 340 - MERGE SYSTEMS
- 350 - GORE LOCATIONS
- 360 - ROLLING ROADBLOCK
- 4000 - MAINTENANCE
- 5000 - SURVEY

EXAMPLE TYPICAL

CODE: 152-CTL(7)-3(1R+2L)LC-2(L)SHIFT

152 - TYPICAL NUMBER

CTL(7) = CENTER LEFT TURN LANE, 7 LANES TOTAL.

3(1R+2L)LC = 3 LANES CLOSED, (1 RIGHT LANE AND 2 LEFT LANES).

2(L)SHIFT = 2 LANES SHIFTED TO THE LEFT.

NOT TO SCALE

	NOT TO SCALE	MAINTAINING TRAFFIC TYPICAL	TYPICAL NUMBERING KEY	DATE: DECEMBER 2021
		NO: 100-GEN-KEY		SHEET: 1 OF 2
FILE: 100-GEN-KEY.dgn				1 OF 1

DISTANCE BETWEEN TRAFFIC SIGNS, "D"

"D" DISTANCES	POSTED SPEED LIMIT, MPH (PRIOR TO WORK AREA)										
	25	30	35	40	45	50	55	60	65	70	75
D (FEET)	250	300	350	400	450	500	550	600	650	700	750

GUIDELINES FOR LENGTH OF LONGITUDINAL BUFFER SPACE, "B"

"B" LENGTHS	SPEED*, MPH (PRIOR TO WORK AREA)											
	20	25	30	35	40	45	50	55	60	65	70	75
B (FEET)	33	50	83	132	181	230	279	329	411	476	542	625

* POSTED SPEED, OFF-PEAK 85TH PERCENTILE SPEED PRIOR TO WORK STARTING, OR THE ANTICIPATED OPERATING SPEED.

MINIMUM MERGING TAPER LENGTH, "L" (FEET)

OFFSET (FEET)	POSTED SPEED LIMIT, MPH (PRIOR TO WORK AREA)										
	25	30	35	40	45	50	55	60	65	70	75
1	11	15	21	27	45	50	55	60	65	70	75
2	21	30	41	54	90	100	110	120	130	140	150
3	32	45	62	80	135	150	165	180	195	210	225
4	42	60	82	107	180	200	220	240	260	280	300
5	53	75	103	134	225	250	275	300	325	350	375
6	63	90	123	160	270	300	330	360	390	420	450
7	73	105	143	187	315	350	385	420	455	490	525
8	84	120	164	214	360	400	440	480	520	560	600
9	94	135	184	240	405	450	495	540	585	630	675
10	105	150	205	267	450	500	550	600	650	700	750
11	115	165	225	294	495	550	605	660	715	770	825
12	125	180	245	320	540	600	660	720	780	840	900
13	136	195	266	347	585	650	715	780	845	910	975
14	146	210	286	374	630	700	770	840	910	980	1050
15	157	225	307	400	675	750	825	900	975	1050	1125

NOT TO SCALE

	NOT TO SCALE	MAINTAINING TRAFFIC TYPICAL	"B", "D" AND "L" TABLES CHANNELIZING DEVICE SPACING, SIGN BORDER KEY, AND ROLL-AHEAD SPACING	DATE: MAY 2021
		NO: 101-GEN-SPACING-CHARTS		SHEET: 1 OF 3

THE FORMULAS FOR THE MINIMUM LENGTH OF A MERGING TAPER IN DERIVING THE "L" VALUES SHOWN IN THE ABOVE TABLES ARE AS FOLLOWS:

"L" = $\frac{W \times S^2}{60}$ WHERE POSTED SPEED PRIOR TO THE WORK AREA IS 40 MPH OR LESS

"L" = W X S WHERE POSTED SPEED PRIOR TO THE WORK AREA IS 45 MPH OR GREATER

L = MINIMUM LENGTH OF MERGING TAPER
 S = POSTED SPEED LIMIT IN MPH PRIOR TO WORK AREA
 W = WIDTH OF OFFSET

TYPES OF TAPERS

UPSTREAM TAPERS

- MERGING TAPER
- SHIFTING TAPER
- SHOULDER TAPER
- 2 TO 1 LANE ROAD TAPER

TAPER LENGTH

- L - MINIMUM
- 1/2 L - MINIMUM
- 1/3 L - MINIMUM
- 100' - MAXIMUM

DOWNSTREAM TAPERS
 (USE IS RECOMMENDED)

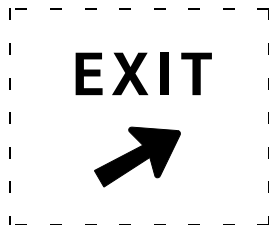
100' (PER LANE)

MAXIMUM SPACING FOR CHANNELIZING DEVICES

WORK ZONE SPEED LIMIT	DRUM AND 42" DEVICE SPACING (FT)		NIGHTTIME 42" DEVICE SPACING (FT)	
	TAPER	TANGENT	TAPER	TANGENT
< 45 MPH	1 x SPEED LIMIT	2 x SPEED LIMIT	25 FEET	50 FEET
≥ 45 MPH	50 FEET	100 FEET	25 FEET	50 FEET

SIGN OUTLINE KEY

DASHED OUTLINES INDICATE A SIGN THAT EXISTS ON SITE, AND NEEDS TO BE COVERED.



SOLID OUTLINES INDICATE A SIGN THAT IS TO BE PLACED ON THE PROJECT



NOT TO SCALE

	NOT TO SCALE	MAINTAINING TRAFFIC TYPICAL	"B", "D" AND "L" TABLES CHANNELIZING DEVICE SPACING SIGN BORDER KEY AND ROLL-AHEAD SPACING	DATE: MAY 2021
		NO: 101-GEN-SPACING-CHARTS		SHEET: 2 OF 3

GUIDELINES FOR ROLL-AHEAD DISTANCES FOR TMA VEHICLES – TEST LEVEL 2

WEIGHT OF TMA VEHICLE	PREVAILING SPEED (POSTED SPEED PRIOR TO WORK ZONE)	ROLL-AHEAD DISTANCE* (DISTANCE FROM FRONT OF TMA VEHICLE TO WORK AREA)
5.5 TONS (STATIONARY)	40 MPH OR LESS	25 FT

* ROLL-AHEAD DISTANCES ARE CALCULATED USING A 4,410 POUND IMPACT VEHICLE WEIGHT.

GUIDELINES FOR ROLL-AHEAD DISTANCES FOR TMA VEHICLES – TEST LEVEL 3

WEIGHT OF TMA VEHICLE	PREVAILING SPEED (POSTED SPEED PRIOR TO WORK ZONE)	ROLL-AHEAD DISTANCE* (DISTANCE FROM FRONT OF TMA VEHICLE TO WORK AREA)
5 TONS (MOBILE)	45 MPH	100 FT
	50-55 MPH	150 FT
	60-75 MPH	175 FT
12 TONS (STATIONARY)	45 MPH	25 FT
	50-55 MPH	25 FT
	60-75 MPH	50 FT

* ROLL-AHEAD DISTANCES ARE CALCULATED USING A 10,000 POUND IMPACT VEHICLE WEIGHT.



NOT TO SCALE

MAINTAINING TRAFFIC TYPICAL

NO: 101-GEN-SPACING-CHARTS

"B", "D" AND "L" TABLES
CHANNELIZING DEVICE SPACING
SIGN BORDER KEY AND ROLL AHEAD SPACING

DATE: MAY 2021

SHEET:

3 OF 3

THE FOLLOWING NOTES APPLY IF CALLED FOR ON THE TRAFFIC TYPICAL

GENERAL NOTES

- G1: SEE GEN-SPACING-CHARTS FOR COMMON VALUES INCLUDING:
 D = DISTANCE BETWEEN TRAFFIC CONTROL DEVICES
 L = MINIMUM LENGTH OF TAPER
 B = LENGTH OF LONGITUDINAL BUFFER
 ROLL AHEAD DISTANCE
- G2: DISTANCE BETWEEN SIGNS, "D", THE VALUES FOR WHICH ARE SHOWN IN TYPICAL GEN-KEY ARE APPROXIMATE AND MAY NEED ADJUSTING AS DIRECTED BY THE ENGINEER.
- G3: ALL TEMPORARY SIGNS, TYPE III BARRICADES, THEIR SUPPORT SYSTEMS AND LIGHTING MUST MEET NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM REPORT 350 (NCHRP 350) TEST LEVEL 3, OR MANUAL FOR ASSESSING SAFETY HARDWARE (MASH) TL-3 AS WELL AS THE CURRENT EDITION OF THE MICHIGAN MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, THE CURRENT EDITION OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION, THE STANDARD PLANS AND APPLICABLE SPECIAL PROVISIONS. ONLY DESIGNS AND MATERIALS APPROVED BY MDOT WILL BE ALLOWED.
- G4: DO NOT STORE EQUIPMENT, MATERIALS OR PERFORM WORK IN ESTABLISHED BUFFER AREAS.
- G5: ALL EXISTING PAVEMENT MARKINGS WHICH ARE IN CONFLICT WITH EITHER PROPOSED CHANGES IN TRAFFIC PATTERNS OR PROPOSED TEMPORARY TRAFFIC MARKINGS SHALL BE REMOVED BEFORE ANY CHANGE IS MADE IN THE TRAFFIC PATTERN. EXCEPTION WILL BE MADE FOR TRAFFIC PATTERNS FOR WORK LESS THAN THREE DAYS THAT ARE ADEQUATELY DELINEATED BY OTHER TRAFFIC CONTROL DEVICES.

SIGN NOTES

- S1: ALL NON-APPLICABLE SIGNING WITHIN THE CIA MUST BE MODIFIED TO FIT CONDITIONS, COVERED, OR REMOVED. FOR GUIDANCE SEE THE WORK ZONE SAFETY AND MOBILITY MANUAL, SECTIONS 6.01.09 AND 6.01.10.
- S2: R5-18b SIGNS ARE ONLY REQUIRED ON FREEWAY PROJECTS WITH A DURATION OF 15 DAYS OR LONGER OR NON-FREEWAY PROJECTS WITH A DURATION OF 90 DAYS OR LONGER. TO APPLY THIS TYPICAL WITHOUT R5-18b SIGNS, REMOVE THE SIGNS AND CONSOLIDATE THE SEQUENCE AS APPROPRIATE.
- S3: R5-18c IS ONLY REQUIRED IN THE INITIAL SIGNING SEQUENCE IN THE WORK ZONE. OMIT THIS SIGN IN SUBSEQUENT SEQUENCES IN THE SAME WORK ZONE.
- S4: ADDITIONAL SIGNING AND/OR ELONGATED SIGNING SEQUENCES SHOULD BE USED WHEN TRAFFIC VOLUMES ARE SIGNIFICANT ENOUGH TO CREATE BACKUPS BEYOND THE W20-5 SIGNS.
- S5: PLACE ADDITIONAL SPEED LIMIT SIGNS REFLECTING THE WORK ZONE SPEED AFTER EACH MAJOR CROSSROAD THAT INTERSECTS THE WORK ZONE, OR AFTER EACH ENTRANCE RAMP THAT COMES ONTO THE FREEWAY WHERE THE REDUCED SPEED IS IN EFFECT. PLACE ADDITIONAL SPEED LIMIT SIGNS AT INTERVALS ALONG THE ROADWAY SUCH THAT NO SPEED LIMIT SIGNS ARE MORE THAN 2 MILES APART. WHEN REDUCED SPEED LIMITS ARE UTILIZED IN THE WORK AREA, PLACE ADDITIONAL SPEED LIMIT SIGNS RETURNING TRAFFIC TO ITS NORMAL SPEED BEYOND THE LIMITS OF THE WORK AREA AS INDICATED. IF PERMANENT SIGNS DISPLAYING THE CORRECT SPEED LIMIT ARE POSTED, OMIT ALL W3-5b AND R2-1 SIGNS AND REDUCE SPACING ACCORDINGLY.
- S6: FABRICATE SPECIAL SIGNS IN ACCORDANCE WITH CURRENT SIGNING DESIGN STANDARDS.
- S7: PLACE ADDITIONAL R8-3 SIGNS AT A MAXIMUM 500' SPACING THROUGHOUT THE WORK ZONE.
- S8: WHEN SPEED LIMIT SIGNS CANNOT BE PLACED SIDE BY SIDE AS SHOWN, PLACE THEM "D" DISTANCE APART.
- S9: STOP SIGNS NOT REQUIRED IF SIGNALS ARE ON 4-WAY FLASHING RED. STOP AHEAD SIGNS ARE NOT REQUIRED IF THERE IS ADEQUATE VISIBILITY OF THE STOP SIGN OR IF SIGNALS ARE BEING USED TO CONTROL TRAFFIC.
- S10: PLACE REDUCED SPEED ZONE AHEAD SIGN (W3-5b) HERE WHEN USING A SPEED REDUCTION IN THIS DIRECTION.
- S11: THE NUMBER OF W1-6 SHIFT SIGNS TO PLACE FOR A SHIFT IS AS FOLLOWS:
 SHIFTS 4FT OR LESS, PLACE ONE W1-6(R)(L)
 SHIFTS 5FT TO 12FT, PLACE TWO W1-6(R)(L)
 SHIFTS MORE THAN 12FT, PLACE THREE OR MORE W1-6(R)(L) SIGNS DEPENDING UPON LENGTH OF SHIFT AND AS PER THE ENGINEER.
- S12: PLACE R2-1 SIGNS AS DETAILED IN NOTE S5 WHEN THERE IS A SPEED REDUCTION IN THIS DIRECTION

TRAFFIC REGULATOR NOTES

- TR1: TRAFFIC REGULATORS MUST FOLLOW ALL THE REQUIREMENTS IN THE STANDARD SPECIFICATIONS, THE STANDARD PLANS AND APPLICABLE SPECIAL PROVISIONS, THE CURRENT VERSIONS OF THE TRAFFIC REGULATOR'S INSTRUCTION MANUAL AND THE VIDEO "HOW TO SAFELY REGULATE TRAFFIC IN MICHIGAN". THE MAXIMUM DISTANCE BETWEEN THE TRAFFIC REGULATORS IS DETERMINED BY THE ROADWAY ADT, GEOMETRICS, AND AS DIRECTED BY THE ENGINEER.
- TR2: PROVIDE APPROPRIATE BALLOON LIGHTING TO SUFFICIENTLY ILLUMINATE TRAFFIC REGULATOR'S STATIONS WHEN TRAFFIC REGULATING IS ALLOWED DURING THE HOURS OF DARKNESS.
- TR3: PROVIDE EITHER A STOP/SLOW AFAD OR A RED/YELLOW LENS AFAD, MEETING THE REQUIREMENTS OF THE MMUTCD

TEMPORARY TRAFFIC CONTROL DEVICE NOTES

- TCD1: THE MAXIMUM DISTANCE IN FEET BETWEEN CHANNELIZING DEVICES IN A TAPER SHOULD NOT EXCEED 1.0 TIMES THE WORK ZONE SPEED LIMIT IN MPH FOR ROADWAYS WITH A POSTED WORK ZONE SPEED LIMIT LESS THAN 45 MPH AND SHOULD NOT EXCEED 50 FEET ON ROADWAYS WITH A POSTED WORK ZONE SPEED LIMIT OF 45 MPH OR GREATER. THE SPACING FOR 42 INCH CHANNELIZING DEVICE TAPERS ARE NOT TO EXCEED 25 FEET AT NIGHT.
- TCD2: THE MAXIMUM DISTANCE IN FEET BETWEEN CHANNELIZING DEVICES IN A TANGENT SHOULD NOT EXCEED TWICE THE WORK ZONE SPEED LIMIT IN MPH FOR ROADWAYS WITH A POSTED WORK ZONE SPEED LIMIT LESS THAN 45 MPH AND SHOULD NOT EXCEED 100 FEET ON ROADWAYS WITH A POSTED WORK ZONE SPEED LIMIT OF 45 MPH OR GREATER. THE SPACING FOR 42 INCH CHANNELIZING DEVICE TANGENTS ARE NOT TO EXCEED 50 FEET AT NIGHT.
- TCD3: TYPE III BARRICADES MUST BE LIGHTED FOR OVERNIGHT CLOSURES.
- TCD4: WHEN THE HAUL ROAD IS NOT IN USE, PLACE LIGHTED TYPE III BARRICADES WITH "ROAD CLOSED" EXTENDING COMPLETELY ACROSS THE HAUL ROAD.
- TCD5: USE OBJECT MARKER SIGNS IN LIEU OF THE TYPE B HIGH INTENSITY LIGHT SHOWN IN THE STANDARD PLAN FOR TEMPORARY CONCRETE BARRIER (R-53, AND R-126) WHEN USED WITH A TEMPORARY SIGNAL SYSTEM. THE OBJECT MARKERS MUST BE A MINIMUM OF 12 INCHES IN WIDTH AND 36 INCHES IN HEIGHT AND HAVE ORANGE AND WHITE RETROREFLECTIVE SHEETING. THE RETROREFLECTIVE SHEETING MUST HAVE ALTERNATING DIAGONAL ORANGE AND WHITE STRIPES SLOPING DOWNWARD AT AN ANGLE OF 45 DEGREES IN THE DIRECTION VEHICULAR TRAFFIC IS TO PASS.
- TCD6: PLACE LIGHTED ARROW PANELS AS CLOSE TO THE BEGINNING OF TAPERS AS PRACTICAL, BUT NOT IN A MANNER THAT WILL OBSCURE OR CONFUSE APPROACHING MOTORISTS WHEN PHYSICAL LIMITATIONS RESTRICT PLACEMENT. IN CURBED SECTIONS, IF ARROW BOARD CANNOT BE PLACED BEHIND CURB, PLACE ARROW BOARD IN THE CLOSED LANE AS CLOSE TO THE BEGINNING OF TAPER AS POSSIBLE.
- TCD7: ADDITIONAL TYPE III BARRICADES MAY BE REQUIRED TO COMPLETELY CLOSE OFF ROAD FROM EDGE OF PAVEMENT TO EDGE OF PAVEMENT.
- TCD8: WHERE THE SHIFTED SECTION IS SHORTER THAN 600 FEET, A DOUBLE REVERSE CURVE SIGN (W24-1) CAN BE USED INSTEAD OF THE FIRST REVERSE CURVE SIGN, AND THE SECOND REVERSE CURVE SIGN CAN BE OMITTED.
- TCD9: RUMBLE STRIPS ARE TO BE PLACED AS SPECIFIED IN THE CONTRACT. IF NOT SPECIFIED IN THE CONTRACT, PLACE RUMBLE STRIPS AS SHOWN, AND IN ACCORDANCE WITH THE RUMBLE STRIP MANUFACTURER'S RECOMMENDATIONS. AN ARRAY OF RUMBLE STRIPS CONTAINS THREE RUMBLE STRIPS. PLACE THE RUMBLE STRIPS IN THE ARRAY AT A CONSISTENT DISTANCE, BETWEEN 10' AND 20' APART.
- TCD10: SEE THE WORK ZONE SAFETY AND MOBILITY MANUAL, PORTABLE CHANGEABLE MESSAGE SIGN GUIDELINES FOR RECOMMENDED AND CORRECT PCMS MESSAGING. STAGGER PCMS THAT ARE ON OPPOSING SIDES OF THE ROAD 1000 FEET FROM EACH OTHER.

RAMP NOTES

- RMP1: WHEN CONDITIONS ALLOW, E5-1 SIGNS MUST BE REMOVED OR COVERED AND CHANNELIZING DEVICES MUST BE POSITIONED TO ENABLE RAMP TRAFFIC TO DIVERGE IN A FREE MANNER
- RMP2: STOP AND YIELD CONDITIONS SHOULD BE AVOIDED WHENEVER PRACTICAL. WHEN CONDITIONS WARRANT, R1-1 SIGNS MAY BE USED IN PLACE OF R1-2 SIGNS. WHEN R-1 SIGNS ARE USED, W3-1 SIGNS MUST BE USED IN PLACE OF W3-2 SIGNS. CONSIDERATION SHOULD BE GIVEN TO CLOSING THE RAMP TO COMPLETE WORK TO ALLOW AN ADEQUATE MERGE DISTANCE. WORK SHOULD BE EXPEDITED TO AVOID THE STOP AND/OR YIELD CONDITIONS.

	NOT TO SCALE	MAINTAINING TRAFFIC TYPICAL		<p align="center">TRAFFIC TYPICALS NOTE SHEET</p>	DATE: MAY 2022
		NO:	102-GEN-NOTES		SHEET:
FILE: 102-GEN-NOTES.dgn					

THE FOLLOWING NOTES APPLY IF CALLED FOR ON THE TRAFFIC TYPICAL

SIGNAL NOTES

- SIG1: EXISTING SIGNAL MUST BE EITHER 4-WAY FLASHING RED, BAGGED, OR TURNED OFF.
- SIG2: SIGNAL IS IN OPERATION.
- SIG3: DELINEATE THE WORK ZONE AREA WITH 28 INCH CONES FOR DAYTIME WORK, OR 42 INCH CHANNELIZING DEVICES FOR NIGHTTIME WORK.
- SIG4: THE CONTRACTOR MUST HAVE A DESIGNATED SPOTTER IF THE AERIAL BUCKET TRUCK IS LOCATED OVER ACTIVE TRAVEL LANES.
- SIG5: THE LOWEST POINT OF THE BUCKET MAY NOT TRAVEL BELOW 14 FOOT VERTICAL CLEARANCE. THE CONTRACTOR MUST UTILIZE AN ALTERNATE SET UP, OR PLACE THE INTERSECTION IN A 4 WAY STOP IF THE 14 FOOT VERTICAL CLEARANCE IS COMPROMIZED. USE TRAFFIC REGULATORS TO CONTROL TRAFFIC THROUGH THE INTERSECTION WHEN TRAFFIC IS PLACED IN A 4 WAY STOP.
- SIG6: DELINEATE THE TRUCK WITH CHANNELIZING DEVICES. THE POSITION OF THE TRUCK MAY BE MOVED TO FACILITATE WORK.

MAINTENANCE AND SURVEYING NOTES

- MS1: WHENEVER STOPPING SIGHT DISTANCE EXISTS TO THE REAR, THE SHADOW VEHICLES SHOULD MAINTAIN THE RECOMENDED DISTANCE FROM THE WORK AREA AND PROCEED AT THE SAME SPEED. THE SHADOW VEHICLE SHOULD SLOW DOWN AND TRAVEL AT A FARTHER DISTANCE TO PROVIDE ADEQUATE SIGHT DISTANCE IN ADVANCE OF VERTICAL OR HORIZONTAL CURVES.
- MS2: WORKERS OUTSIDE OF VEHICLES SHOULD WORK WITHIN 150' OF WORK VEHICLES WITH AN ACTIVATED BEACON, BETWEEN THE "BEGIN WORK CONVOY" SIGN AND THE "END WORK CONVOY" SIGN, OR BETWEEN THE "WORK ZONE BEGINS" AND "END ROAD WORK" SIGN.
- MS3: WORK OR SHADOW VEHICLES WITH OR WITHOUT A TMA MAY BE USED TO SEPARATE THE WORK SPACE FROM TRAFFIC. IF USED, THE VEHICLES SHOULD BE PARKED ACCORDING TO THE ROLL AHEAD DISTANCE TABLES.
- MS4: WORK AND SHADOW VEHICLES SHALL BE APPROPRIATELY EQUIPPED WITH AN ACTIVATED AMBER BEACON.
- MS5: WHEN WORKERS ARE OUTSIDE THEIR VEHICLES IN AN EXISTING LANE WHILE A MOBILE OPERATION IS OCCURRING DURING THE NIGHTTIME HOURS, CHANNELIZING DEVICES TO DELINEATE OPEN OR CLOSED LANES AT 50 FT SPACING MUST BE USED. AN EXAMPLE OF AN OPERATION (BUT NOT LIMITED TO) IS THE LAYOUT OF CONCRETE PATCHES.
- MS6: W21-6 AND W20-1 SIGNS MAY BE SUBSTITUTED AS DETERMINED BY THE TYPE OF WORK TAKING PLACE AS PER THE ENGINEER.



NOT TO SCALE

MAINTAINING TRAFFIC TYPICAL








NO: 102-GEN-NOTES

TRAFFIC TYPICALS
NOTE SHEET

DATE: MAY 2022
SHEET:

2 OF 2

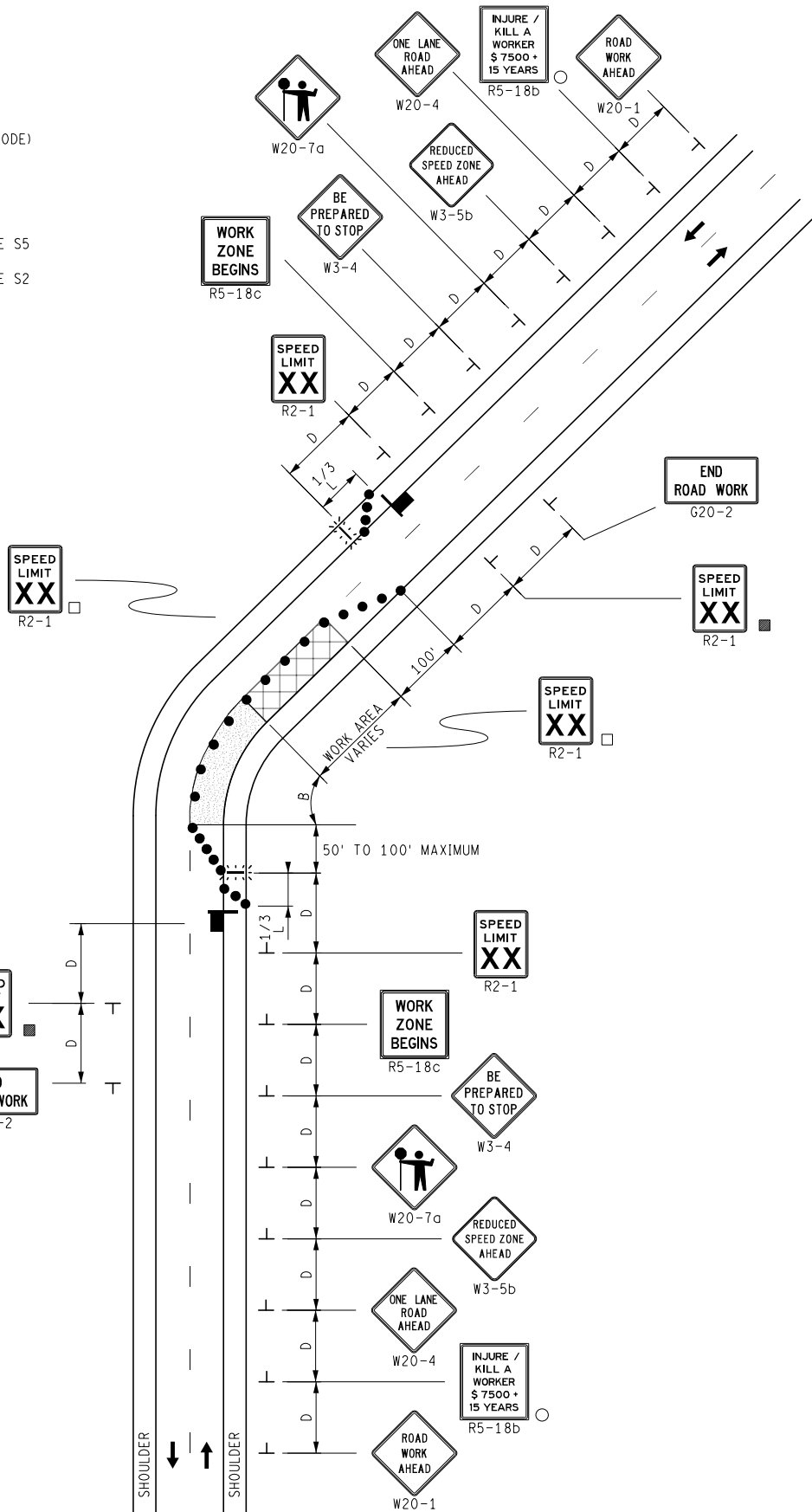
KEY

-  TRAFFIC REGULATOR
-  CHANNELIZING DEVICES
-  LIGHTED ARROW PANEL (CAUTION MODE)
-  TRAFFIC FLOW
-  REFLECTS EXISTING SPEED LIMIT
-  PLACE SIGN AS INDICATED IN NOTE S5
-  PLACE SIGN AS INDICATED IN NOTE S2

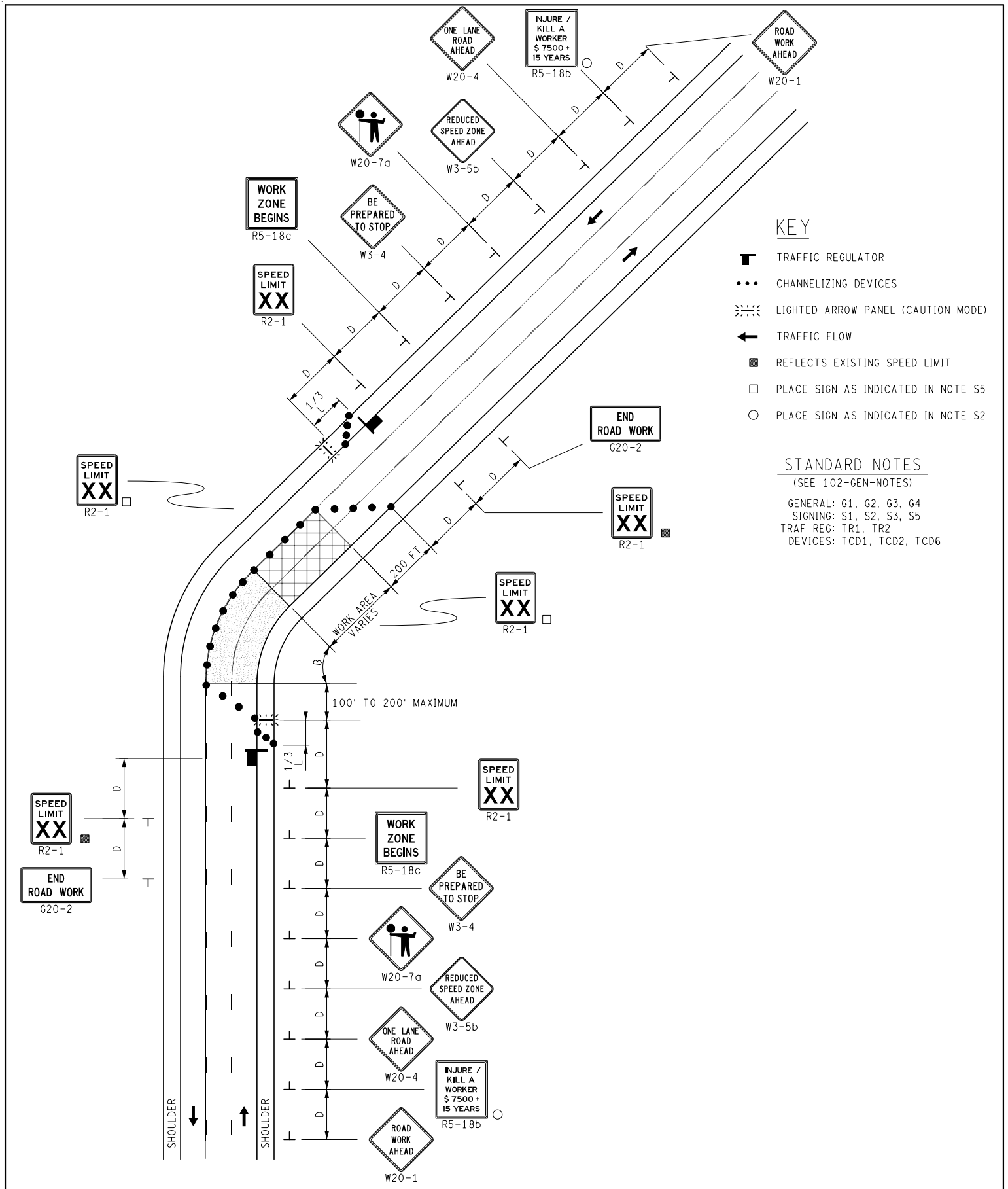
STANDARD NOTES

(SEE GEN-NOTES)

GENERAL: G1, G2, G3, G4
 SIGNING: S1, S2, S3, S4, S5
 TRAF REG: TR1, TR2
 DEVICES: TCD1, TCD2, TCD6



	NOT TO SCALE	MAINTAINING TRAFFIC TYPICAL	LANE CLOSURE UTILIZING TRAFFIC REGULATORS ON A 2-LANE UNDIVIDED ROADWAY	DATE: MAY 2021
		NO: 110-TR-NFW-2L		SHEET: 1 OF 1



NOT TO SCALE

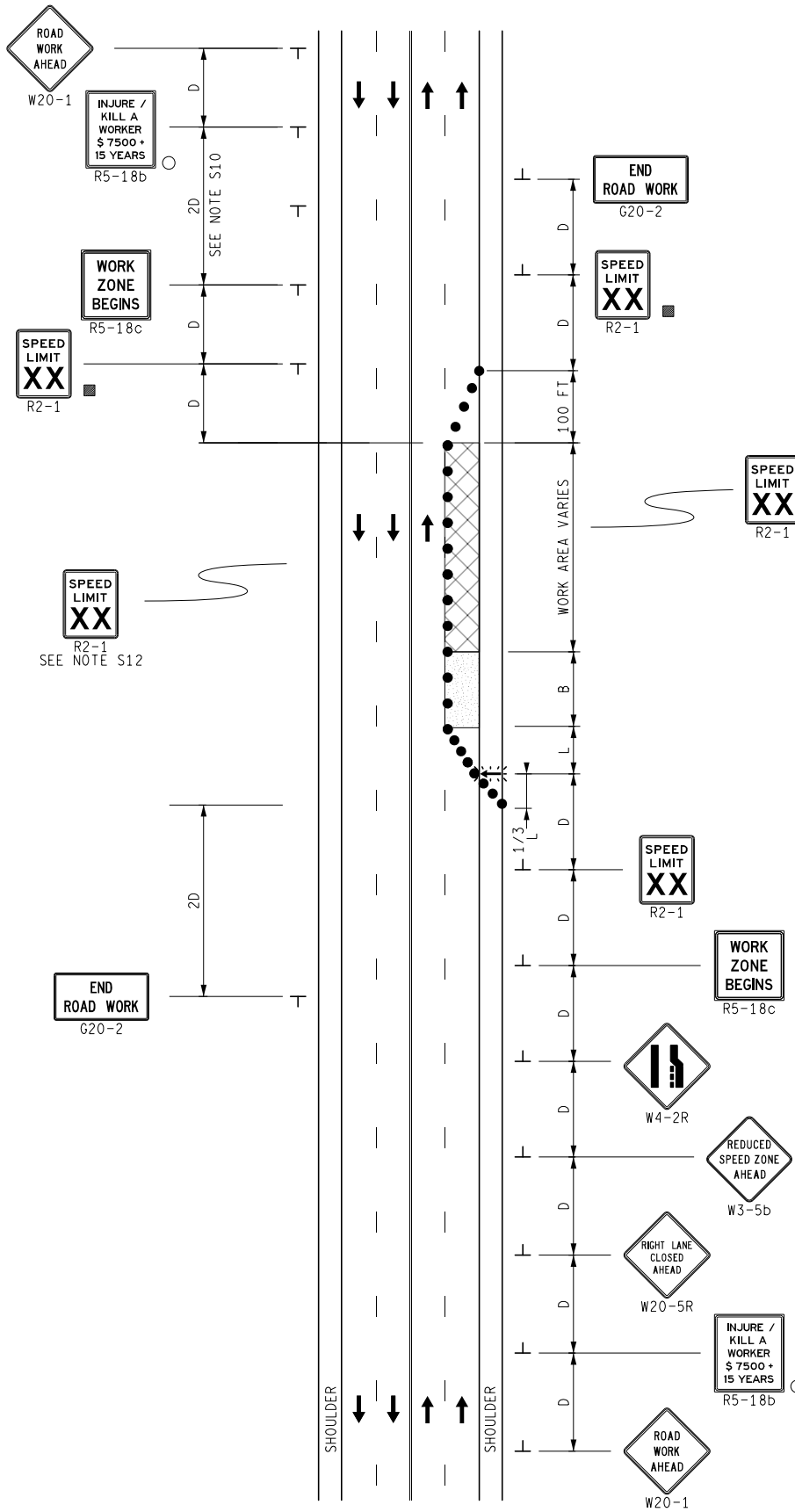
MAINTAINING TRAFFIC TYPICAL

NO:

112-TR-CLT

1-LANE AND CLTL CLOSURE
UTILIZING TRAFFIC REGULATORS
ON A 3-LANE UNDIVIDED ROADWAY

DATE: MAY 2021
SHEET:



KEY

- CHANNELIZING DEVICES
- ⚡ LIGHTED ARROW PANEL
- ← TRAFFIC FLOW
- REFLECTS EXISTING SPEED LIMIT
- PLACE SIGN AS INDICATED IN NOTE S5
- PLACE SIGN AS INDICATED IN NOTE S2

STANDARD NOTES

(SEE 102-GEN-NOTES)

GENERAL: G1, G2, G3, G4
 SIGNING: S1, S2, S3, S5, S10, S12
 DEVICES: TCD1, TCD2, TCD6



NOT TO SCALE

MAINTAINING TRAFFIC TYPICAL

NO: 123-NFW-1LC-(R)

1 RIGHT LANE CLOSURE
 ON A 4-LANE UNDIVIDED ROADWAY

DATE: MAY 2021
 SHEET:

KEY

- CHANNELIZING DEVICES
- ⚡ LIGHTED ARROW PANEL (CAUTION MODE)
- ← TRAFFIC FLOW
- REFLECTS EXISTING SPEED LIMIT
- PLACE SIGN AS INDICATED IN NOTE S2

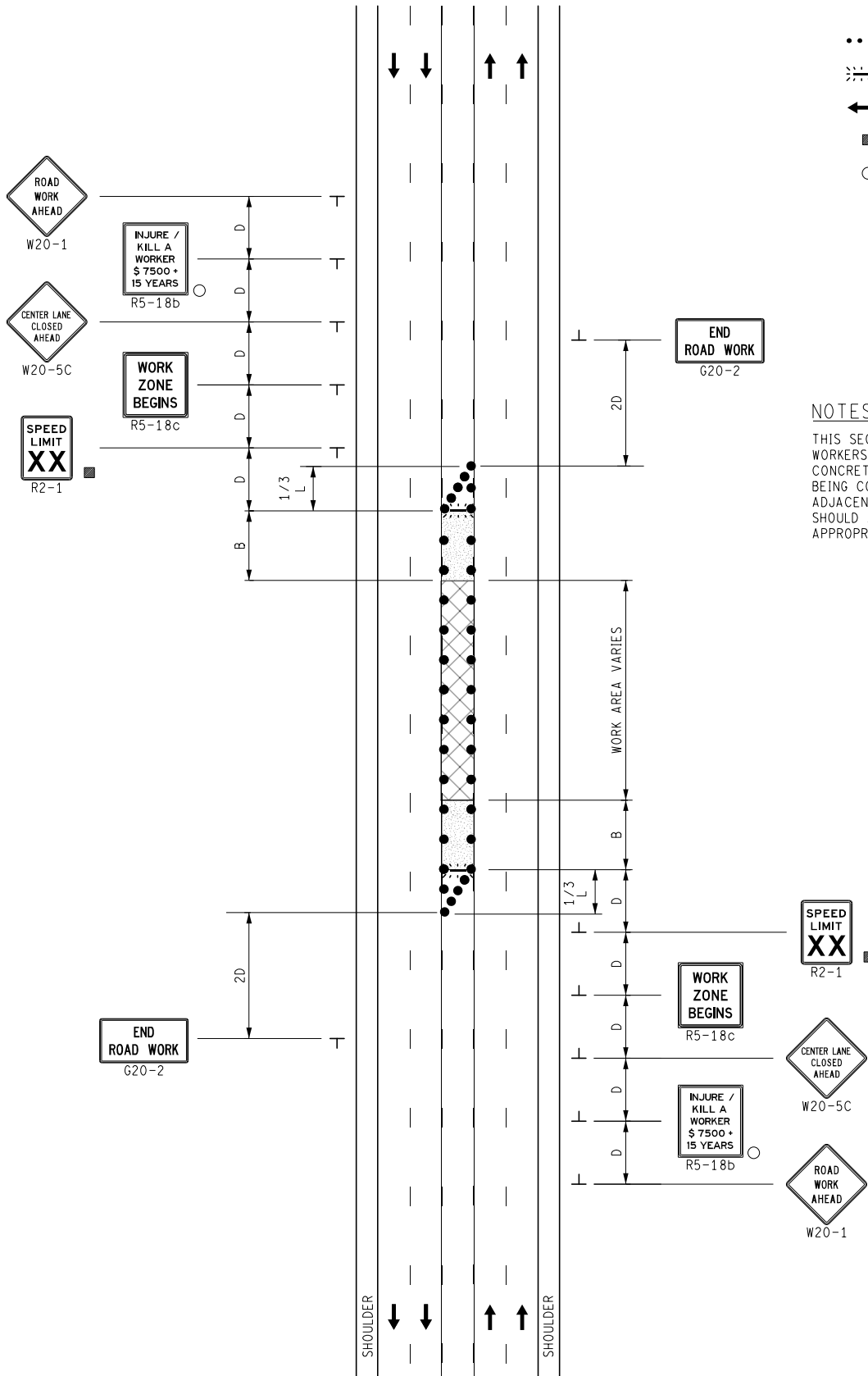
STANDARD NOTES

(SEE 102-GEN-NOTES)

GENERAL: G1, G2, G3, G4
 SIGNING: S1, S2, S3, S5
 DEVICES: TCD1, TCD2, TCD6

NOTES

THIS SEQUENCE SHOULD ONLY BE USED WHEN WORKERS ARE NOT PRESENT, E.G., FOR CURING CONCRETE OVERNIGHT, ETC. WHEN WORK IS BEING CONDUCTED IN THE CENTER LANE, AN ADJACENT LANE (IN ONE OR BOTH DIRECTIONS) SHOULD ALSO BE CLOSED UTILIZING THE APPROPRIATE TYPICAL SIGNING SEQUENCE



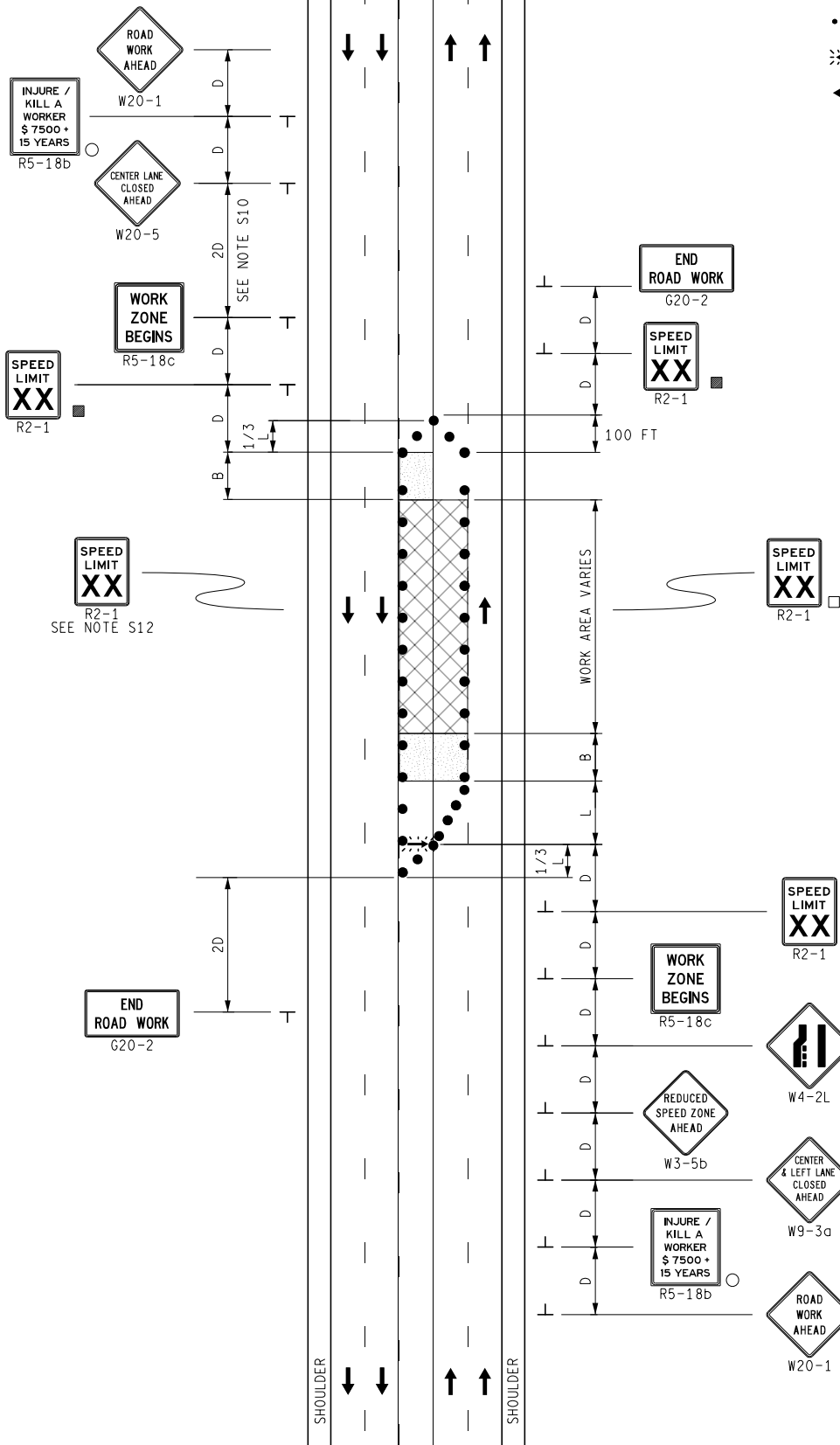
KEY

- CHANNELIZING DEVICES
- ⚡ LIGHTED ARROW PANEL
- ← TRAFFIC FLOW
- REFLECTS EXISTING SPEED LIMIT
- PLACE SIGN AS INDICATED IN NOTE S5
- PLACE SIGN AS INDICATED IN NOTE S2

STANDARD NOTES

(SEE 102-GEN-NOTES)

GENERAL: G1, G2, G3, G4
 SIGNING: S1, S2, S3, S5, S10, S12
 DEVICES: TCD1, TCD2, TCD6



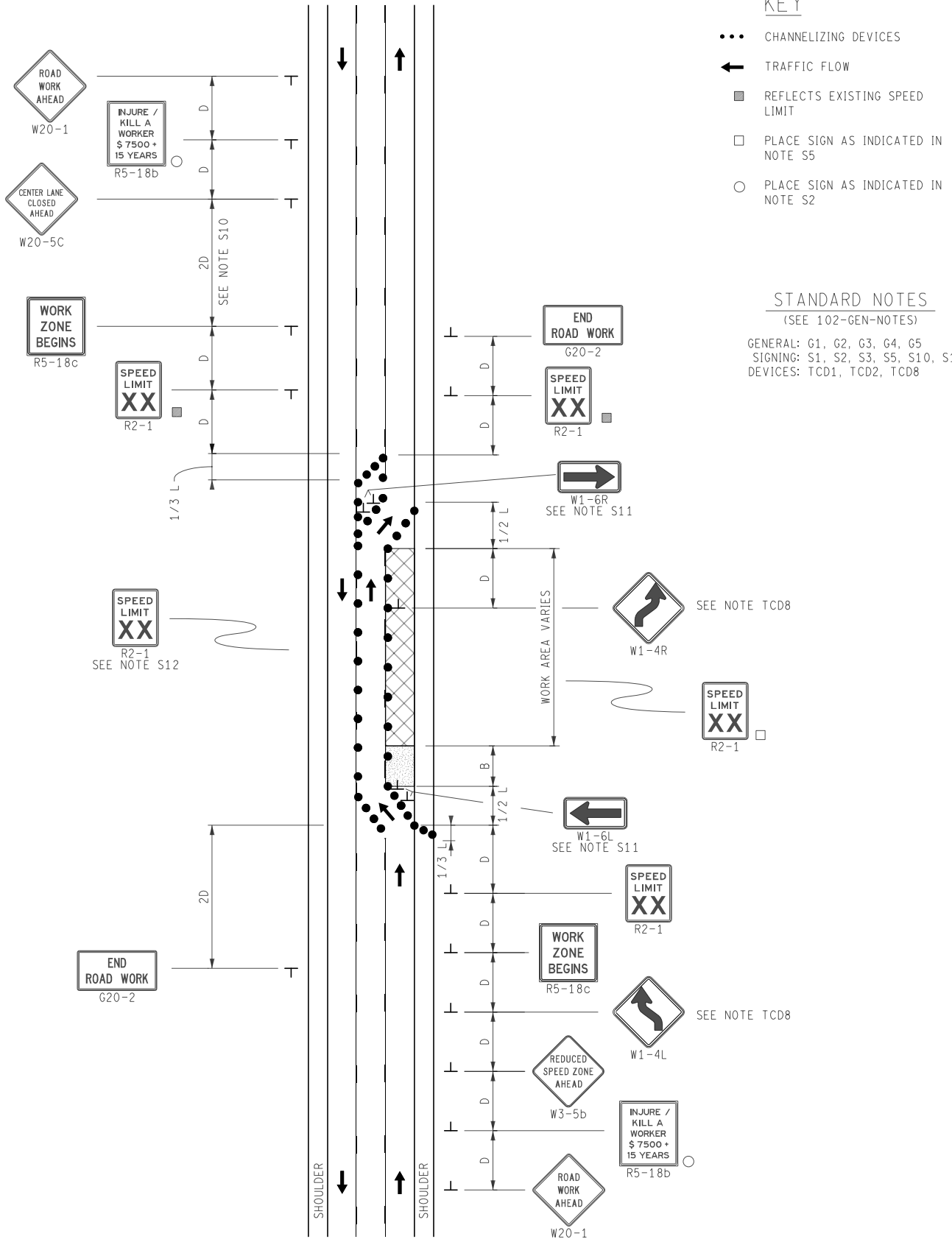
KEY

- CHANNELIZING DEVICES
- ← TRAFFIC FLOW
- REFLECTS EXISTING SPEED LIMIT
- PLACE SIGN AS INDICATED IN NOTE S5
- PLACE SIGN AS INDICATED IN NOTE S2

STANDARD NOTES

(SEE 102-GEN-NOTES)

GENERAL: G1, G2, G3, G4, G5
 SIGNING: S1, S2, S3, S5, S10, S11, S12
 DEVICES: TCD1, TCD2, TCD8



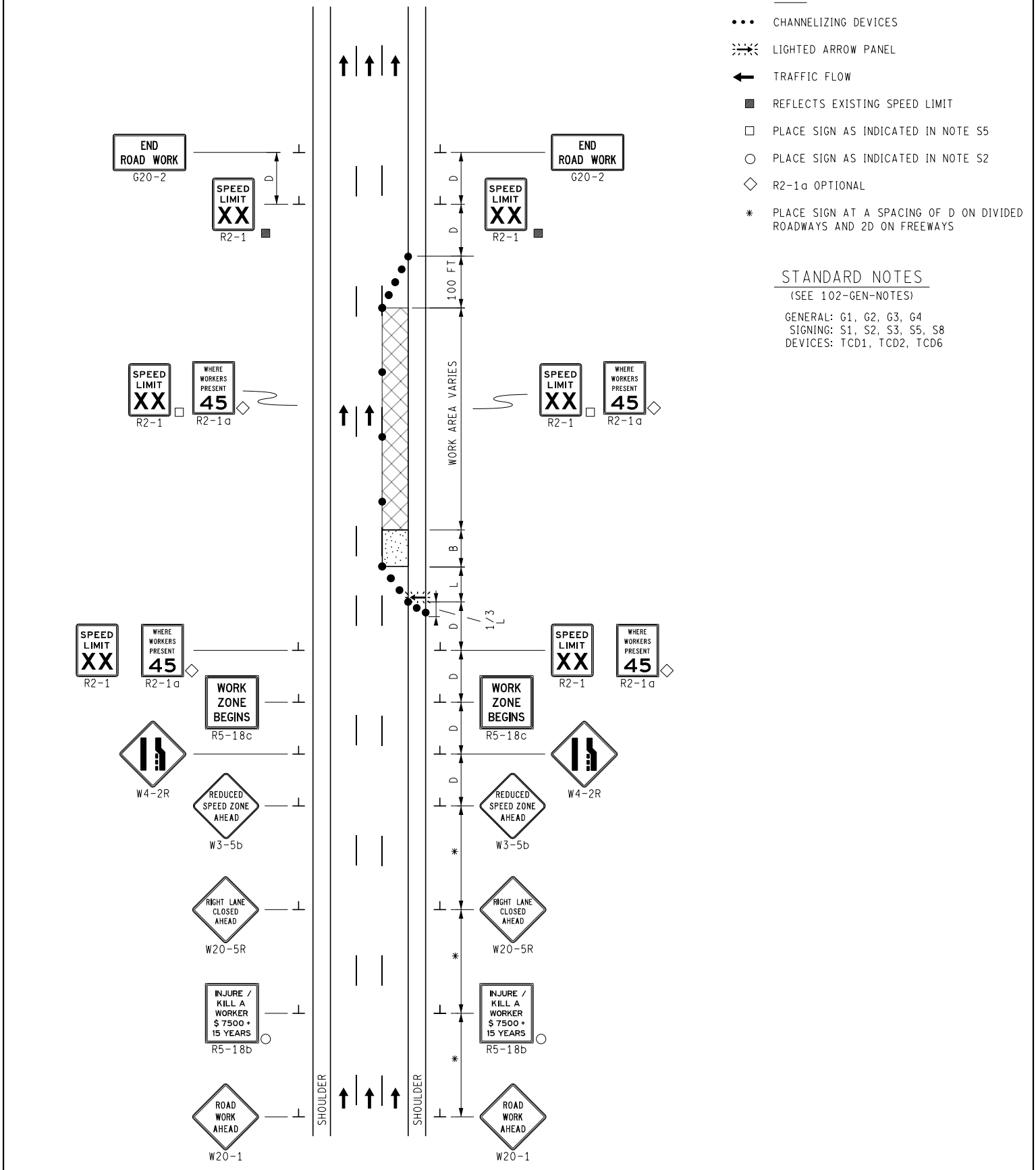
KEY

- CHANNELIZING DEVICES
- ⚡ LIGHTED ARROW PANEL
- ← TRAFFIC FLOW
- REFLECTS EXISTING SPEED LIMIT
- PLACE SIGN AS INDICATED IN NOTE S5
- PLACE SIGN AS INDICATED IN NOTE S2
- ◇ R2-1a OPTIONAL
- * PLACE SIGN AT A SPACING OF D ON DIVIDED ROADWAYS AND 2D ON FREEWAYS

STANDARD NOTES

(SEE 102-GEN-NOTES)

GENERAL: G1, G2, G3, G4
 SIGNING: S1, S2, S3, S5, S8
 DEVICES: TCD1, TCD2, TCD6



	NOT TO SCALE	MAINTAINING TRAFFIC TYPICAL	SINGLE RIGHT LANE CLOSURE ON A FREEWAY OR DIVIDED ROADWAY	DATE: MAY 2021
		NO: 203-FW-1LC-(R)		SHEET:
FILE: 203-FW-1LC-(R).dgn				1 OF 1

**SPECIAL PROVISION
FOR
FENCE, RUSTIC SPLIT RAIL (2 RAIL)**

MTP:BEA

APPR:DMG:DBP:03-30-22

a. Description. This work consists of furnishing and installing rustic split rail fence at the locations shown on the plans, in accordance with section 808 of the Standard Specifications for Construction and as directed by the Engineer.

b. Materials. Furnish posts and rails that are Western Red Cedar (*Thuja plicata*), Northern White Cedar (*Thuja occidentalis*), Black Locust (*Robinia pseudoacacia*) or approved equal and commercially available. Both the posts and the rails may vary considerably in width and thickness with specified dimensions being average and approximate only.

All longitudinal splitting must be by axe, froe or wedge. Cut, torn or rough grain will not be classified as defects. All knots must not exceed 1/2 inch and must be firmly in place.

Spiral grain must not exceed 1/4 twist in length. Kinks, bends or sweeps must not exceed the narrowest dimension from a straight line from center to center.

Outer bark, sap rot, char and other unsightly discolorations are not permitted, but limited heart rot in streaks and pockets as well as rusty colorations due to normal weathering and seasoning are permitted. Scars, wounds, splits or seasoning checks must not exceed 1/4 depth of area affected.

Ensure gravel material placed below posts is dense-graded aggregate Class 22A in accordance with section 902 of the Standard Specifications for Construction. Ensure backfill material for the posts is sound earth in accordance with section 205 of the Standard Specifications for Construction or as approved by the Engineer.

1. Post and Rail Specifications. Posts must measure 4 inches by 5 inches by 6 feet in length. The girth when measured between the two mortise openings must be at least 18 inches.

The distance from the top of the post to the first mortise opening must be 6 inches and the distance, center to center, between the mortise openings must be 14 to 16 inches. The mortise opening of end and corner posts must be 1¾ inches wide and approximately 4½ inches in length. End and corner posts will be required at the appropriate locations.

Rails must measure 2 inches by 4 inches by 8 to 10 feet in length with a minimum girth of 12 inches. Ensure tenon area is 3 inches in length by 1½ inches in thickness and 3½ inches in width ±1/2 inch. The bottom of the lower rail must be no more than 1 foot above the existing ground.

c. Construction. Place posts in 12 inch diameter holes 30 inches deep. Prior to installing post, place 6 inches of Class 22A aggregate in the bottom of the post hole and compact in place. Plumb and level posts, install rails and backfill with sound earth or other approved material and compact in place as directed by the Engineer.



**DRIESENKA &
ASSOCIATES, INC.**

Engineering • Surveying • Testing

12330 James Street, Suite H80
Holland, Michigan 49424
Ph. (616) 396-0255 • Fax (616) 396-0100
www.driesenga.com

October 10, 2023

via electronic mail

Mr. Adam Falkowski, PE
C2AE
106 West Allegan Street Suite 500
Lansing, MI 48933

**Re: Geotechnical Pavement Recommendations
MSU Duct Bank
Trowbridge Road from Red Cedar to Farm Lane
D&A Project No. 2350688.3A**

Dear Mr. Falkowski:

Driesenga & Associates, Inc. (D&A) is pleased to submit the following geotechnical exploration report and recommendations for the proposed MSU Duct Bank project. The project will consist of the installation of a utility duct that is anticipated to be about 5 feet below grade and add very little load to the underlying soils. This work was performed in accordance with D&A proposal dated July 26, 2023 as authorized via email on August 16, 2023 by Joseph Callahan of C2AE.

FIELD EXPLORATION AND LABORATORY PROCEDURES

Thirteen (13) soil borings, designated SB-1 to SB-13, were performed at selected locations on September 11 & 26 and October 2, 2023, as shown on the attached Soil Boring Location Map. The soil borings were advanced with hollow-stem augers to a depth of ten (10) feet below the ground surface. During sampling, soil samples were collected from split-spoon sampling via standard penetration testing (ASTM method D 1586) at intervals of 2.5 feet to a depth of 5 feet.

Upon completion, the boreholes were backfilled with soil cuttings and the surface was repaired approximating previous conditions. The collected samples from the split-spoon sampler were transported to our laboratory and characterized in general accordance with the Unified Soil Classification System (USCS). The estimated group symbol is shown on the boring logs, just before the soil description.

SOIL AND GROUNDWATER CONDITIONS

Surface materials encountered at the site generally consist of 2 to 6 inches of topsoil underlain by interchanging fill layers of sand and clay to depths ranging from 3 feet to as much as 10 feet. Underlying native soils consisted of loose to medium dense sands and stiff to hard clays to the explored depth of the soil test borings.

Groundwater was encountered at the borings between the depths of 4 to 10 feet. Hydrostatic groundwater levels and the elevations and volumes of groundwater should be expected to fluctuate throughout the year, based on variations in precipitation, evaporation, run-off, and other factors. The groundwater levels (or lack thereof) indicated by the soil borings and presented in this section



represent conditions at the time the readings were taken. The actual groundwater levels at the time of construction may vary.

ANALYSIS AND RECOMMENDATIONS

It is strongly recommended that the utility duct subgrade areas be evaluated by D&A after the areas have been cleared and stripped. Portions of the old fill were noted to have organics (SB-4) and those areas when exposed should be investigated additionally by D&A for suitability to remain beneath the duct bank. In all general fill areas, the exposed granular subgrade surface should be scarified to a depth of 12 inches and recompact to a minimum of 95% of Modified Proctor maximum dry density (MDD) per ASTM D 1557 method, or 98% of MDD as determined by the Michigan Cone Method. In any areas of backfill below the groundwater elevations, the use of a clean (less than 7% passing the No. 200 sieve), 1-inch to 3-inch open-graded crushed aggregate is recommended. Sand soils were encountered at or near the final subgrade level in some of the soil borings in the proposed duct route. Within the proposed building area the native sand should be proof-compacted by at least six (6) passes of a 10-ton vibratory roller.

The contractor should remove standing water from the subgrade and prevent surface water from reaching the excavations and the prepared subgrade. In addition, construction traffic should use haul roads and should not haphazardly traffic the site. Subgrade soils that become disturbed should be removed and replaced with structural fill or crushed aggregate. Under wet weather conditions, the subgrade may be protected by placing crushed aggregate on the exposed subgrade.

Where clay or clayey soils are exposed, significant disturbance of the subgrade may result from repeated construction traffic on the soils. The exposed subgrade may need to be stabilized after removal of topsoil to support construction traffic or to reduce subgrade disturbance. Also, the clays/clayey soils may become disturbed due to ponded water and/or repeated construction traffic. Therefore, the contractor should remove standing water from the subgrade and prevent surface water from reaching the excavations and the subgrade. In addition, construction traffic should use haul roads and should not haphazardly traffic the site. The client should understand that construction costs may be higher during wet, snowy and/or colder months and that site preparation may be more extensive due to the effects of moisture on the soils. The contractor should limit the number and size of construction equipment on the site, should grade the site during stripping operations to allow surface water to drain from areas of proposed development, and should remove water from areas where it collects. In addition, site utilities should be installed early in the project to channel groundwater into the sand-filled trenches. Even with the above precautions, a significant amount of subgrade disturbance may result. Subgrade soils that become disturbed should be removed and replaced with structural fill or crushed aggregate. We recommend including a contingency in the construction budget to provide for subgrade improvements.

It is recommended that any fill materials be placed in or near horizontal maximum 8-inch-thick loose lifts and compacted to a minimum of 95% of Modified Proctor MDD, or 98% of Michigan Cone MDD. If a vibratory roller is used for compaction, the loose lift thickness may be increased to 12 inches. Soils used for structural fill should consist of clean sand meeting SW or SP classification in accordance with USCS criteria.



Groundwater problems are not anticipated to be a significant issue during construction. However, because the clay materials generally tend to soften when exposed to free water, every effort should be made to keep the excavations dry if perched water is encountered or if rainfall occurs while the excavations are open. Any water which enters the excavation can likely be controlled by a gravity drain system, sump pump, or other minor dewatering procedure. Upon removal of any trapped water, the soils should be reviewed by a soils engineer and any soft areas replaced with structural fill

These recommendations assume typical conditions during the June through September construction season. Any substitution of materials or deviation from these stated assumptions should be reviewed to assess potential impact on the recommended design.

GENERAL COMMENTS

This report and any future reports or addenda performed for this site should be supplied to potential bidders prior to them submitting their proposals. We also recommend the construction contract include provisions for dealing with differing conditions. Contingency funds should be reserved for potential problems during earthwork and pavement construction.

This report has been prepared solely for the use of the client for the project specifically described in this report. This report cannot be relied upon by other parties not involved in this project, unless written permission is granted by Driesenga & Associates, Inc. If this report or any of its contents are utilized by parties other than our original client and the project team members, Driesenga & Associates, Inc. cannot be held responsible for the suitability of the field exploration, scope of services, or recommendations made for the new project. Driesenga & Associates, Inc. also is not responsible for the interpretation of our soil boring logs and the recommendations provided herein by other parties.

We appreciate the opportunity to be of service to you. If you have any questions, or if we can be of further service as design and construction progresses, please contact our office.

Sincerely,

DRISENGA & ASSOCIATES, INC.

Handwritten signature of Michael Stork in blue ink.

Michael Stork
Senior Project Geologist

Handwritten signature of Musana Nabil in blue ink.

Musana Nabil
Senior Project Engineer

Handwritten signature of Randy Pail in blue ink.

Randy Pail, P.E.
Director of Geotechnical Engineering

cc: James Henning, P.E. – Driesenga & Associates, Inc.

Attachments - Soil Boring Location Map / Soil Boring Logs
Soil Classification Sheets



Figure Number: 1

Site Location

Project Name

MSU Duct Bank

Project Number

2340688.3A

Project Location

Farm Lane, Red Cedar and
Trowbridge Road,
East Lansing, Michigan





Figure Number: 2

Boring Locations

Project Name

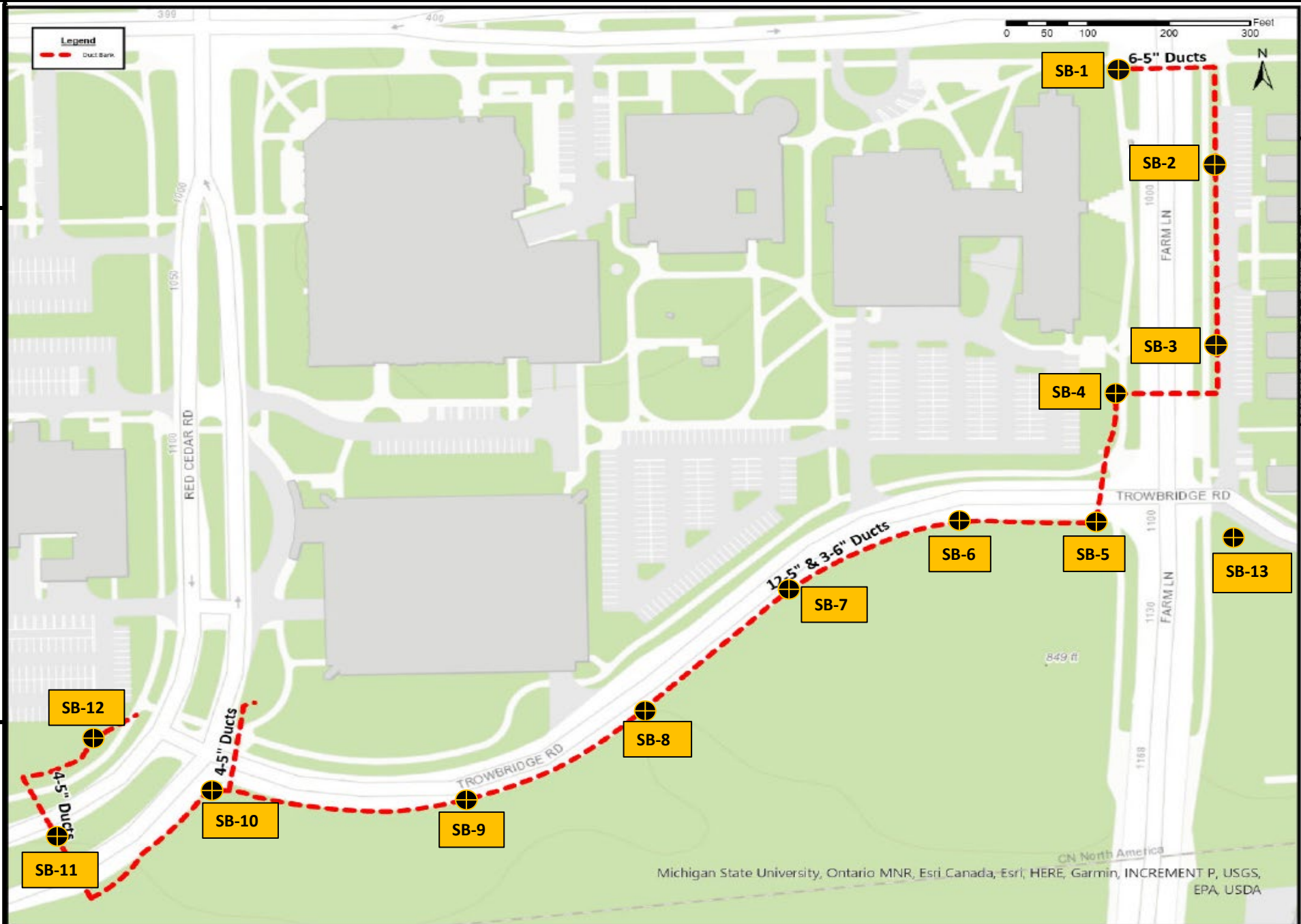
MSU Duct Bank

Project Number

2340688.3A

Project Location

Farm Lane, Red Cedar and
Trowbridge Road,
East Lansing, Michigan



MICHIGAN STATE UNIVERSITY
PROJECT: 20-0273
CLINTON COUNTY, MICHIGAN

MSU DUCT BANK



Engineering · Surveying · Testing

Project: MSU Duct Bank
Trowbridge Road from Red Cedar to Farm LN
East Lansing, Michigan
Project No. 2340688.3A
Client: C2AE

Date Started : September 11, 2023
Date Completed : September 11, 2023
Hole Diameter : 6-inches
Drilling Method : Hollow-Stem Auger
Sampling Method : Split-Spoon Sampler

Drilling Company : Midwest Envirotech
Field Sampling : J. Spaans
Reviewed By : A. Elsadek
GW Encountered : N/A
GW Completed : N/A

Depth in Feet	Elev.	USCS	GRAPHIC	Water Levels	Auto-Hammer Used for SPT	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
				▼ During Drilling ▽ After Completion							
DESCRIPTION											
0											
				TOPSOIL - 3 inches							
		SW/Fill		Fill - SAND, medium dense, dark brown, fine to medium grained, trace clay, trace gravel, moist		1	4	12			
							5				
							7				
5				Fill - Sandy CLAY, medium stiff to stiff, dark brown, trace gravel, moist		2	3	6			
		CL/Fill					3				
							2	4			
							2				
							2				
							2	4			
							2				
10				E.O.B @ 10'		4	2				
							2				
							2				
15							2				



DRIESENKA & ASSOCIATES, INC.

Engineering · Surveying · Testing

SB-12



Project: MSU Duct Bank
 Trowbridge Road from Red Cedar to Farm LN
 East Lansing, Michigan

Project No. 2340688.3A

Client: C2AE

Date Started : September 11, 2023
 Date Completed : September 11, 2023
 Hole Diameter : 6-inches
 Drilling Method : Hollow-Stem Auger
 Sampling Method : Split-Spoon Sampler

Drilling Company : Midwest Envirotech
 Field Sampling : J. Spaans
 Reviewed By : A. Elsadek
 GW Encountered : N/A
 GW Completed : N/A

Depth in Feet	Elev.	USCS	GRAPHIC	Water Levels	Auto-Hammer Used for SPT	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
				▼ During Drilling ▽ After Completion							
DESCRIPTION											
0				TOPSOIL - 3 inches							
		SC/Fill		Fill - Clayey SAND, loose, brown, fine to medium grained, trace gravel, moist		1	5 3 5	8			
		SW		SAND, loose to medium dense, brown and grey, fine to medium grained, trace gravel, moist		2	3 4 6	10			
						3	5 5 5	10			
						4	5 3 5	8			
10		E.O.B @ 10'									
15											






Engineering · Surveying · Testing

Project: MSU Duct Bank
Trowbridge Road from Red Cedar to Farm LN
East Lansing, Michigan
Project No. 2340688.3A
Client: C2AE

Date Started : October 2, 2023
Date Completed : October 2, 2023
Hole Diameter : 6-inches
Drilling Method : Hollow-Stem Auger
Sampling Method : Split-Spoon Sampler

Drilling Company : Midwest Envirotech
Field Sampling : J. Spaans
Reviewed By : A. Elsadek
GW Encountered : N/A
GW Completed : N/A

Depth in Feet	Elev.	USCS	GRAPHIC	Water Levels	Auto-Hammer Used for SPT	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
				▼ During Drilling ▽ After Completion							
DESCRIPTION											
0		CL/Fill		Fill - Silty Sandy Mottled CLAY, stiff, brown and grey, trace gravel, moist		1	6 6 7	13			
		CL		Silty Sandy CLAY, very stiff, grey, trace gravel, moist		2	3 1 3	4	1.5		
		CL				3	2 2 3	5	1.5		
						4	3 3 4	7	3.0		
10		E.O.B @ 10'									
15											

CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

**Per ASTM D 2487—00
(Based on Unified Soil Classification System)**

Soil Description: Secondary Soil Type BASIC SOIL TYPE, Consistency/Relative Density, Color, Supplemental Soil Type, Moisture, Miscellaneous comments.

Ex. Silty SAND, loose, brown, fine to medium, trace gravel, moist.

Secondary Soil Type – adjective for the BASIC SOIL TYPE describing material making up greater than 12% but less than 50% of the primary soil type by weight. For sands this also includes a description of grain size (fine, medium or coarse).

BASIC SOIL TYPE – primary constituent of sample; material making up greater than 50% of the sample by weight. Material is classified by grain size and material properties.

Consistency/Relative Density – a measurement of in-situ consistency or density of cohesive or cohesionless soils, respectively, based upon Standard Penetration Testing blow counts (N) per ASTM D 1586.

Color – visual inspection of soil appearance.

Supplementary Soil Type – a description of any other material that may be mixed with the BASIC SOIL TYPE. Qualifying terms are based on the percentage of the supplementary soil type in the sample by weight.

Moisture – description of the in-situ moisture content of the sample (dry, moist or wet).

Miscellaneous Comments – anything observed in the sample or in the field that does not fit into the above categories but should be noted (odor, etc.).

CALIBRATED AUTO HAMMER CONSISTENCY/RELATIVE DENSITY				
COHESIONLESS SOILS		COHESIVE SOILS		
SPT N-VALUES	IN-SITU RELATIVE DENSITY	SPT N-VALUES	SHEAR STRENGTH (PSF)	IN-SITU CONSISTENCY
0-3	VERY LOOSE	0-1	BELOW 250	VERY SOFT
4-8	LOOSE	2-3	250 - 500	SOFT
9-23	MEDIUM DENSE	4-6	500 - 1,000	MEDIUM STIFF
24-38	DENSE	7-12	1,000 - 2,000	STIFF
>38	VERY DENSE	13-25	2,000 - 4,000	VERY STIFF
		>26	OVER 4,000	HARD

STANDARD HAMMER CONSISTENCY/RELATIVE DENSITY				
COHESIONLESS SOILS		COHESIVE SOILS		
SPT N-VALUES	IN-SITU RELATIVE DENSITY	SPT N-VALUES	SHEAR STRENGTH (PSF)	IN-SITU CONSISTENCY
0-4	VERY LOOSE	0-2	BELOW 250	VERY SOFT
5-10	LOOSE	3-4	250 - 500	SOFT
11-30	MEDIUM DENSE	5-8	500 - 1,000	MEDIUM STIFF
31-50	DENSE	9-16	1,000 - 2,000	STIFF
>50	VERY DENSE	17-32	2,000 - 4,000	VERY STIFF
		>32	OVER 4,000	HARD

SUPPLEMENTAL TEXTURE QUALIFYING TERMS	
DESCRIPTOR	PERCENTAGE BY WEIGHT
TRACE	1-10%
LITTLE	10-20%
SOME	20-35%
AND	35-50%

SOIL CLASSIFICATION CHART (Per ASTM D2487)

Criteria for Assigning Symbols and Group Names Using Laboratory Tests ^A			Soil Classification		
			Group Symbol	Group Name	
COHESIONLESS SOILS More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 Sieve	Clean Gravels Less than 5% fines ^C	$Cu \geq 4$ and $1 \leq Cc \leq 3^E$	GW	Well-graded gravel ^F
			$Cu < 4$ and/or $1 > Cc > 3^E$	GP	Poorly graded gravel ^F
		Gravels with Fines More than 12% fines ^C	Fines classify as ML or MH	GM	Silty gravel ^{F,G,H}
			Fines classify as CL or CH	GC	Clayey gravel ^{F,G,H}
	Sands More than 50% of coarse fraction retained on No. 4 Sieve	Clean Sands Less than 5% fines ^D	$Cu \geq 6$ and $1 \leq Cc \leq 3^E$	SW	Well-graded sand ^F
			$Cu < 6$ and/or $1 > Cc > 3^E$	SP	Poorly graded sand ^F
		Sands with Fines More than 12% fines ^D	Fines classify as ML or MH	SM	Silty sand ^{G,H,I}
			Fines classify as CL or CH	SC	Clayey sand ^{G,H,I}
COHESIVE SOILS 50% or more passes the No. 200 Sieve	Silt and Clays Liquid limit less than 50	Inorganic	$PI \geq 7$ and plots on or above 'A' line ^J	CL	Lean clay ^{K,L,M}
			$PI < 4$ or plots below 'A' line ^J	ML	Silt ^{K,L,M}
		Organic	Liquid limit - oven dried < 0.75	OL	Organic clay ^{K,L,M,N}
			Liquid limit - not dried < 0.75		Organic silt ^{K,L,M,O}
	Silt and Clays Liquid limit 50 or more	Inorganic	PI plots on or above 'A' line	CH	Fat clay ^{K,L,M}
			PI plots below 'A' line	MH	Elastic Silt ^{K,L,M}
		Organic	Liquid limit - oven dried < 0.75	OH	Organic Clay ^{K,L,M,P}
					Organic silt ^{K,L,M,O}
			Liquid limit - not dried < 0.75		
		HIGHLY ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT

A Based on the material passing the 3-in. sieve

B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders or both" to group name

C Gravels with 5 to 12% fines require dual symbols:
 GW-GM well-graded gravel with silt
 GW-GC well-graded gravel with clay
 GP-GM poorly graded gravel with silt
 GP-GC poorly graded gravel with clay

D Sands with 5 to 12% fines require dual symbols:
 SW-SM well-graded sand with silt
 SW-SC well-graded sand with clay
 SP-SM poorly graded sand with silt
 SP-SC poorly graded sand with clay

E $Cu = D_{60}/D_{10}$ $Cc = (D_{30})^2/(D_{10} \cdot D_{60})$

F If soil contains $\geq 15\%$ sand, add "with sand" to group name.

G If fines classify as CL-ML, use dual symbol GC-GM or SC-SM

H If fines are organic, add "with organic fines" to group name.

I If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

J If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.

K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel" whichever is predominant

L If soil contains $\geq 30\%$ plus No. 200, predominantly sand, add "sandy" to group name.

M If soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name

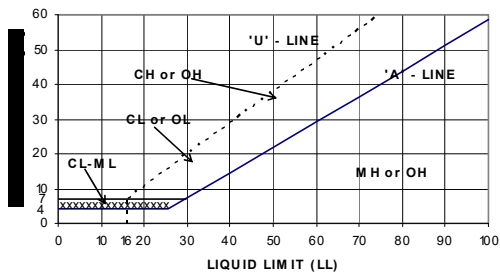
N $PI \geq 4$ and plots on or above 'A' line.

O $PI < 4$ or plots below 'A' line.

P PI plots on or above 'A' line.

Q PI plots below 'A' line.

For classification of fine-grained soils and fine-grained fraction of coarse-grained soils



SIEVE ANALYSIS

