

Bid Date: **Tuesday, April 3, 2018**
Bid Time: **11:00 a.m.**

Client: **Traverse City Light & Power**
Project Name: **Substation Underground Exit
Replacement**
Project No.: **18-0920.01**
Issue Date: **March 21, 2018**

NOTICE:

Bidder will acknowledge receipt of this Addendum by returning signed & dated copy with the Bid Form.

This Addendum to the drawings and specifications for the above captioned project supersedes all contrary and/or conflicting information on said drawings and specifications, which are hereby amended in certain particulars, as follows:

DRAWINGS:

1. Drawing #T – Title Sheet, Location Map & Drawing Index (*Re-issued.*)
 - a. Revised drawing list.
2. Drawing #1 – Key Map, General Notes, Legend & Utility Contacts (*Re-issued.*)
 - a. Revised General Note #1, 7, 10, 13 & 14.
 - i. Note #1 – Delete sentence regarding minor site restoration requirements.
 - ii. Note #7 – Contractor shall restore the site to original conditions.
 - iii. Note #10 – Contractor is responsible to field bend conduits as required.
 - iv. Note #13 – Swap with #14.
 - v. Note #14 – Swap with #13.
 - b. Conduit Sweep Key
 - i. Revised to add S23 – S26.
 - c. Electrical Layout Legend
 - i. Revised symbol and text for PMH switchgear to include PME, deadfront padmount switchgear.
3. Drawing #BW_2 – Barlow Substation Circuits One-Line Diagram (*Re-issued.*)
 - a. Added Removal One-Line Diagram
 - b. Added conductor color codes, cable reel designations, & maximum cable pulling tension.
 - c. Added note to complete cable replacement during scheduled substation outage from May 15th to June 1st.

4. Drawing #BW_3 – Barlow Substation Circuits Conduit Layout (*Re-issued.*)
 - a. Added Layout Detail Reference Bubbles.
 - b. Added notes on Substation outage dates, requirement to remove PMH switchgear and coordinate work with customer outages, and to cap all spare conduits and install 2,500# pull tape.

5. Drawing #BW_4 – Barlow Riser Stand Elevations (*Re-issued.*)
 - a. Added Bill of Material item designations.
 - b. Added notes on replacing threaded rod conduit supports on riser stands as required.

6. Drawing #BW_6 – Underground Equipment Area Layout Details (*Issued.*)

7. Drawing #CD_2 – Cass Substation Circuits One-Line Diagram (*Re-issued.*)
 - a. Added Removal One-Line Diagram
 - b. Added conductor color codes, cable reel designations, & maximum cable pulling tension.
 - c. Added note to complete cable replacement between the ATS and Tyson’s switchgear during scheduled outage on July 6th.

8. Drawing #CD_3 – Cass Substation Circuits Conduit Layout (*Re-issued.*)
 - a. Added Layout Detail Reference Bubbles.
 - b. Revised Notes #1 to clarify Tyson outage date of July 6th.
 - c. Added new 6” conduit installation for circuit CD31.

9. Drawing #CD_4 – Cass Riser Stand Elevations (*Re-issued.*)
 - a. Added Bill of Material item designations.
 - b. Added notes on replacing threaded rod conduit supports on riser stands as required.

10. Drawing #CD_6 – Underground Equipment Area Layout Details (*Issued.*)

11. Drawing #PC_2 – Parsons Substation Circuits One-Line Diagram (*Re-issued.*)
 - a. Added Removal One-Line Diagram
 - b. Added conductor color codes, cable reel designations, & maximum cable pulling tension.
 - c. Added note to complete cable and switchgear replacement during scheduled outage on July 3rd.

12. Drawing #PC_3 – Parsons Substation Circuits Conduit Layout (*Re-issued.*)
 - a. Added Layout Detail Reference Bubbles.
 - b. Added notes regarding need to provide detour signage for all TART trail closures.

13. Drawing #PC_4 – Parsons Riser Stand Elevations (*Re-issued.*)

- a. Added Bill of Material item designations.
- b. Added notes on replacing threaded rod conduit supports on riser stands as required.

14. Drawing #PC_6 – Underground Equipment Area Layout Details (*Issued.*)

PROJECT MANUAL:

1. Bid Bond

- a. Revise Bid Due Date on Bid Bond Form to April 3, 2018

2. Unit Lists (*Re-issued*)

a. Cass Substation – New Construction Units with Quantity Revisions

- i. Trench, Backfill & Compact (1 to 2 Conduits)
- ii. 6" PVC SCH 40/80
- iii. 6" 90° Fiberglass STD (30") Radius (SF19)
- iv. 6" 45° Fiberglass, 60" Radius (SF21)
- v. 15kV Terminator 750kCM
- vi. Note additional site restoration required (substation stone surfacing, gravel drive, & Sybrandt Road patching) due to CD31 conduit replacement.

b. Parsons Substation – New Construction Units

- i. Added 600A Switchgear Removal/Reinstallation, Quantity one (1).
- ii. Added 6" 45° Fiberglass, 60" Radius (SF21), Quantity two (2).
- iii. Revised 6" 90° Fiberglass, 60" Radius (SF22), Quantity one (1).

3. Contract Agreement

- a. Revise Milestone #3 (PC21/PC30 Cable & Switchgear Replacement) date to July 3, 2018.

4. Specifications

- a. Add Section 02751 Cement Concrete Paving
- b. Add Section 03300 Cast-in-Place Concrete
- c. Add Section 02741 Hot-Mix Asphalt Concrete Paving

BILL OF MATERIALS:

1. Issued the Bill of Materials noting material to be furnished by the Owner & Contractor.

- a. Barlow Substation
- b. Cass Substation
- c. Parsons Substation

Bidder

Date

Signed

BID BOND

Any singular reference to Bidder, Surety, Owner, or other party shall be considered plural where applicable.

BIDDER (Name and Address):

SURETY (Name, and Address of Principal Place of Business):

OWNER (Name and Address): Traverse City Light & Power Department
1131 Hastings Street
Traverse City, MI 49686

BID

Bid Due Date: April 3, 2018
Description (Project Name— Include Location): Substation Underground Exit Replacement

BOND

Bond Number: _____
Date: _____
Penal sum _____ \$ _____
(Words) (Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

BIDDER _____ (Seal) **SURETY** _____ (Seal)
Bidder's Name and Corporate Seal Surety's Name and Corporate Seal

By: _____ By: _____
Signature Signature (Attach Power of Attorney)

Print Name Print Name

Title Title

Attest: _____ Attest: _____
Signature Signature

Title Title

Note: Addresses are to be used for giving any required notice.
Provide execution by any additional parties, such as joint venturers, if necessary.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder any difference between the total amount of Bidder's Bid and the total amount of the Bid of the next lowest, responsible Bidder that submitted a responsive Bid as determined by Owner for the work required by the Contract Documents, provided that:
 - 1.1 If there is no such next Bidder, and Owner does not abandon the Project, then Bidder and Surety shall pay to Owner the penal sum set forth on the face of this Bond, and
 - 1.2 In no event shall Bidder's and Surety's obligation hereunder exceed the penal sum set forth on the face of this Bond.
 - 1.3 Recovery under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation shall be null and void if:
 - 3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
 - 3.2 All Bids are rejected by Owner, or
 - 3.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from Bid due date without Surety's written consent.
6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after the Bid due date.
7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

CONTRACT AGREEMENT
TRAVERSE CITY LIGHT & POWER DEPARTMENT
SUBSTATION UNDERGROUND EXIT REPLACEMENT

THIS AGREEMENT is by and between Traverse City Light & Power Department (“Owner”) and _____ (“Contractor”).

Owner and Contractor hereby agree as follows:

ARTICLE 1 – WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

The overall scope of the project consists of the replacement of twelve substation underground circuit exits with new conduit installed via open trench and directional boring, installation of 750kCM 15kV CU cable, plus seven risers, five new riser poles, and replacement of one padmount switchgear. Work covered under this contract includes conduit, cable, termination, and padmount equipment installation, system testing and energization, removal of the existing cables where installed in conduit, and all necessary site restoration.

ARTICLE 2 – THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows:

Substation Underground Exit Replacement

ARTICLE 3 – ENGINEER

3.01 The part of the Project that pertains to the Work has been designed by:

GRP Engineering
459 Bay Street
Petoskey, MI 49770

3.02 The Owner has retained GRP Engineering, Inc. 459 Bay St. Petoskey, MI 49770 (“Engineer”) to act as Owner’s representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

ARTICLE 4 – CONTRACT TIMES

4.01 *Time of the Essence*

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 *Contract Times: Dates*

A. The Work will be substantially completed on or before August 31, 2018, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before September 14, 2018.

B. Parts of the Work shall be substantially completed on or before the following Milestone(s):

1. Milestone 1: Barlow Substation Underground Exit Replacement (in conjunction with scheduled substation outage from May 15, 2018 to June 1, 2018). June 1, 2018.

2. Milestone 2: CD22 Cable Replacement / Outage (in conjunction with scheduled plant outage). July 6, 2018.
3. Milestone 3: PC21/PC30 Cable & Switchgear Replacement / Outage (in conjunction with scheduled plant outage). July 3, 2018.

4.03 *Liquidated Damages*

- A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with the Contract. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):
1. Substantial Completion: Contractor shall pay Owner \$1,000.00 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified in Paragraph 4.02.A above for Substantial Completion until the Work is substantially complete.
 2. Completion of Remaining Work: After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner \$1,000.00 or each day that expires after such time until the Work is completed and ready for final payment.
 3. Liquidated damages for failing to timely attain Substantial Completion and final completion are not additive and will not be imposed concurrently.
 4. Milestones: Contractor shall pay Owner \$1,000.00 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for achievement of Milestone 1, until Milestone 1 is achieved.

ARTICLE 5 – CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents the amounts that follow, subject to adjustment under the Contract:

- A. For all Unit Price Work, an amount equal to the sum of the extended prices (established for each separately identified item of Unit Price Work by multiplying the unit price times the actual quantity of that item):

The extended prices for Unit Price Work set forth as of the Effective Date of the Contract are based on estimated quantities. As provided in Paragraph 13.03 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by Engineer.

_____ (\$ _____)
 (words) (numerals)

ARTICLE 6 – PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

- A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

- A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment on or about the 3rd day of each month during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.
1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract
 - a. Ninety percent of Work completed (with the balance being retainage). If the Work has been 80 percent completed as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work remain satisfactory to Owner and Engineer, the Owner may reduce the retainage to 5%; and
 - b. ninety percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).
- B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to ninety-five percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less one-hundred percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

- A. Upon final completion and acceptance of the Work in accordance with Paragraph 15.06 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by Engineer as provided in said Paragraph 15.06.

ARTICLE 7 – INTEREST

7.01 All amounts not paid when due shall bear interest at the rate of **six** percent per annum.

ARTICLE 8 – CONTRACTOR'S REPRESENTATIONS

- 8.01 In order to induce Owner to enter into this Contract, Contractor makes the following representations:
- A. Contractor has examined and carefully studied the Contract Documents, and any data and reference items identified in the Contract Documents.
 - B. Contractor has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
 - C. Contractor is familiar with and is satisfied as to all Laws and Regulations that may affect cost, progress, and performance of the Work.
 - D. Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.
 - E. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from

visits to the Site; the Contract Documents; and the Site-related reports and drawings identified in the Contract Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (3) Contractor's safety precautions and programs.

- F. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.
- G. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
- H. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
- I. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
- J. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

ARTICLE 9 – CONTRACT DOCUMENTS

9.01 Contents

- A. The Contract Documents consist of the following:
 - 1. This Agreement (pages 1 to 6, inclusive).
 - 2. Bid Form (pages 1 to 5, inclusive).
 - 3. Performance bond (pages 1 to 2, inclusive).
 - 4. Payment bond (pages 1 to 2, inclusive).
 - 5. General Conditions (pages 1 to 67, inclusive).
 - 6. Supplementary Conditions (pages 1 to 6, inclusive).
 - 7. Specifications as listed in the table of contents of the Project Manual dated March 2018.
 - 8. Drawings (not attached but incorporated by reference) consisting of the Drawings listed on the attached sheet index.
 - 9. Addenda (numbers ■■■ to ■■■, inclusive).
 - 10. Iran Economic Sanctions Act (page 1, inclusive)
 - 11. Exhibits to this Agreement (enumerated as follows):
 - a. Contractor's Bid (pages ■■■ to ■■■, inclusive).
 - 12. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
 - a. Notice to Proceed.
 - b. Work Change Directives.
 - c. Change Orders.
 - d. Field Orders.

- B. The documents listed in Paragraph 9.01.A are attached to this Agreement (except as expressly noted otherwise above).
- C. There are no Contract Documents other than those listed above in this Article 9.
- D. The Contract Documents may only be amended, modified, or supplemented as provided in the General Conditions.

ARTICLE 10 – MISCELLANEOUS

10.01 *Terms*

- A. Terms used in this Agreement will have the meanings stated in the General Conditions and the Supplementary Conditions.

10.02 *Assignment of Contract*

- A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party hereto of any rights under or interests in the Contract will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

10.03 *Successors and Assigns*

- A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

10.04 *Severability*

- A. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

10.05 *Contractor's Certifications*

- A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 10.05:
 1. “corrupt practice” means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process or in the Contract execution;
 2. “fraudulent practice” means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
 3. “collusive practice” means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and
 4. “coercive practice” means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

10.06 *Other Provisions*

- A. Owner stipulates that if the General Conditions that are made a part of this Contract are based on EJCDC® C-700, Standard General Conditions for the Construction Contract, published by the Engineers Joint Contract Documents Committee®, and if Owner is the party that has furnished said

General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor, through a process such as highlighting or “track changes” (redline/strikeout), or in the Supplementary Conditions.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on _____ (which is the Effective Date of the Contract).

1.

OWNER:

CONTRACTOR:

Traverse City Light & Power

By: _____

By: _____

Title: Chairman

Title: _____

(If Owner is a corporation, attach evidence of authority to sign. If Owner is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)

(If Contractor is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest: _____

Attest: _____

Title: Secretary

Title: _____

Address for giving notices:

Address for giving notices:

1131 Hastings Street

Traverse City, MI 49686

Approved as to substance:

Timothy J. Arends, Executive Director

Approved as to form:

W. Peter Doren, Counsel

SECTION 02741

HOT-MIX ASPHALT PAVING

PART 1. GENERAL

1.01 SUMMARY

- A. This Section includes Hot-mix asphalt paving.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
- B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
- C. Material certificates.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer shall be registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.
- B. Regulatory Requirements: Comply with MDOT Standard Specifications for Construction, current edition with addendums.
- C. Asphalt-Paving Publication: Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.
- D. Installer Qualifications: An employer trained and experienced in hot-mixed asphalt paving.

1.04 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
 - 1. Tack Coat: Minimum surface temperature of 60 deg F.
 - 2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

PART 2. PRODUCTS

2.01 AGGREGATES

- A. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or properly cured, crushed blast-furnace slag.
- B. Fine Aggregate: ASTM D 1073 sharp-edged natural sand or sand prepared from stone, gravel, properly cured blast-furnace slag, or combinations thereof.
- C. Mineral Filler: ASTM D 242 rock or slag dust, hydraulic cement, or other inert material.

2.02 ASPHALT MATERIALS

- A. Asphalt Binder: AASHTO MP 1, pg 58-28.
- B. Tack Coat: ASTM D 977 emulsified asphalt or ASTM D 2397 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

2.03 RELATED MATERIALS

- A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with FS TT-P-115, Type I or AASHTO M 248, Type N.
 - 1. Color: As required.

2.04 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction; designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:
 - 1. Leveling Course: MDOT HMA Mixture No. 13A.
 - 2. Surface Course: MDOT HMA Mixture No. 13A.
 - 3. MDOT controlled roadways, full depth: MDOT HMA Mixture No. 4E10.

PART 3. EXECUTION

3.01 SURFACE PREPARATION

- A. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- B. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
 - 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

- C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.02 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Spread mix at minimum temperature of 250 deg F.
 - 2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
- C. Complete paving operations to insure no longitudinal cold joints occur in surface course.
- D. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.03 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- F. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.04 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/2 inch.
 - 2. Surface Course: Plus 1/4 inch, no minus.

- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch.
 - 2. Surface Course: 1/8 inch.
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.05 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Owner.

- B. Sweep and clean surface to eliminate loose material and dust.

- C. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.06 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified independent, MDOT approved testing and inspecting agency to perform field tests and inspections and to prepare test reports.

- B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

- C. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

END OF SECTION 02741

SECTION 02751

CEMENT CONCRETE PAVING

PART 1. GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Driveways and roadways.
2. Curbs and gutters.
3. Walkways/Sidewalks.

1.02 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed pavement work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94/C 94 M requirements for production facilities and equipment.
- C. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by the requirements of the Contract Documents.

PART 2. PRODUCTS

2.01 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.02 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. Deformed-Steel Welded Wire Fabric: ASTM A 497, flat sheet.

- C. Reinforcement Bars: ASTM A 615, Grade 60 deformed.
- D. Steel Bar Mats: ASTM A 184; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.
- E. Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.
- F. Tie Bars: ASTM A 615, Grade 60, deformed.
- G. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement bars, welded wire fabric, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
 - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2.03 CONCRETE MATERIALS

- A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project.
- B. Portland Cement: ASTM C 150, Type I or III, gray.
- C. Normal Weight Aggregates: ASTM C 33, coarse aggregate, uniformly graded, provided from a single source.
 - 1. Maximum coarse aggregate size: one (1) inch.
- D. Water: ASTM C 94/C 94M.

2.04 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures.
- B. Air-Entraining Admixture: ASTM C 260.
- C. Water-Reducing Admixture: ASTM C 494/C 494M, of the type suitable for application, certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

2.05 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

- C. Water: Potable.
- D. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
- E. Curing Compound for colored concrete shall be as approved for use with coloring products by manufacturer of the coloring agents.

2.06 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Coloring Agent: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis. Color as indicated.
- C. Colored Dry-Shake Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, coloring pigments, and plasticizing admixture. Use coloring pigments that are finely ground, nonfading mineral oxides interground with cement. Color as indicated.

2.07 CONCRETE MIXES

- A. Prepare design mixes, proportioned according to ACI 301 with the following properties:
 - 1. Compressive Strength (28 Days): 4000 psi.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 - 3. Slump Limit: 3 inches, plus or minus 1 inch.
 - 4. Air Content: 6 percent plus or minus 1.5 percent.

2.08 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94 and ASTM C 1116.
 - 1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Furnish batch certificates for each concrete batch discharged and used in the performance of the Work.

PART 3. EXECUTION

3.01 PREPARATION

- A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Proceed with pavement only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

- B. Remove loose material from compacted subbase surface immediately before placing concrete.

3.02 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

3.03 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for placing and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

3.04 JOINTS

- A. General: Construct construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
 - 1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour, unless pavement terminates at isolation joints.
 - 1. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
 - 2. Provide tie bars at sides of pavement strips where indicated.
 - 3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals of 50 feet, unless otherwise indicated.
 - 2. Extend joint fillers full width and depth of joint.
- D. Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.
- E. Contraction Joints (Control Joints): Form weakened-plane contraction joints, sectioning concrete into areas not exceeding 36 square feet. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness.
- F. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to the following radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces. Radius: 1/4 inch

3.05 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.
- D. Comply with requirements and with recommendations in ACI 301 for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery, at Project site, or during placement without specific prior written approval of Owner or Engineer.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 301.
- H. Screed pavement surfaces with a straightedge and strike off. Screed pavement surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading dry-shake surface treatments.
- I. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish,

and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.

- J. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 - 2. Do not use frozen materials or materials containing ice or snow.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- K. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 - 3. Fog-spray forms, reinforcement steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.06 CONCRETE FINISHING

- A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots, and fill low spots. Refloat surface immediately to uniform granular texture.
 - 1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
 - 2. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
 - 3. Medium-to-Course-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.07 SPECIAL FINISHES

- A. Colored Dry-Shake Hardener Finish: After initial floating, apply colored dry-shake materials to pavement surfaces according to manufacturer's written instructions and as follows:

1. Uniformly apply colored dry-shake materials at a rate of 100 lb./100 sq. ft., unless greater amount is recommended by manufacturer to match pavement color required or unless application rate otherwise indicated on the drawings.

3.08 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and follow recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.
- D. Curing Methods: Cure concrete by curing compound, as follows:
 1. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period. Utilize curing compound approved by dry shake colorant manufacturer at colored concrete areas.

3.09 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
 1. Elevation: 1/4 inch.
 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/4 inch.
 4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
 5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
 6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
 8. Joint Spacing: 3 inches.
 9. Contraction Joint Depth: Plus 1/4 inch, no minus.
 10. Joint Width: Plus 1/8 inch, no minus.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.
- B. Testing Services: Testing shall be performed according to the following requirements:

1. Sampling Fresh Concrete: Representative samples of fresh concrete shall be obtained according to ASTM C 172, except modified for slump to comply with ASTM C 94/C 94M.
 2. Slump: ASTM C 143/C 143 M; one test at point of placement for each compressive-strength test. Additional tests will be required when concrete consistency changes.
 3. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test.
 4. Compression Test Specimens: ASTM C 31/C 31M; one set of four standard cylinders for each compressive-strength test, unless otherwise indicated. Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.
 5. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class plus one set for each additional 150 cu. yd.. One specimen shall be tested at 7 days and two specimens at 28 days; one specimen shall be retained in reserve for later testing if required.
 6. When frequency of testing will provide fewer than five compressive-strength tests for a given class of concrete, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, current operations shall be evaluated and corrective procedures shall be provided for protecting and curing in-place concrete.
 8. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive compressive-strength test results equal or exceed specified compressive strength and no individual compressive-strength test result falls below specified compressive strength by more than 500 psi.
- C. Test results shall be reported in writing to Owner, Engineer and concrete manufacturer, within 24 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Owner but will not be used as the sole basis for approval or rejection.
- E. Additional Tests: Testing agency shall make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Owner. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.11 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.
- B. Drill test cores where directed by Owner when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

- D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 02751

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1. GENERAL

1.01 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture.
- C. Shop Drawings: For steel reinforcement.
- D. Material test reports and certificates.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment:
 - 1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

PART 2. PRODUCTS

2.01 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.02 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
 - 1. Epoxy-coated Reinforcing Bars: ASTM A 775, epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.

- B. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.
- C. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884, Class A coated, Type 1, deformed steel.
- D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

2.03 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I.
 - 2. High-early-strength Portland Cement: ASTM C150, Type III for encased conduit duct banks.
- B. Normal-Weight Aggregates: ASTM C 33, graded, 1-inch nominal maximum coarse-aggregate size.
 - 1. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M and potable.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
- F. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, ½ to 1-1/2 inches long.

2.04 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Water: Potable.
- C. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

2.05 RELATED MATERIALS

- A. Expansion-and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

2.06 CONCRETE MIXTURES

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength 4000 psi at 28 days at exterior slabs on grade.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.40.
 - 3. Slump Limit: 4 inches without admixtures or 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
 - 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.
 - 5. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd.

2.07 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.08 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3. EXECUTION

3.01 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork according to ACI 301 to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Chamfer exterior corners and edges of permanently exposed concrete where indicated.

3.02 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

3.03 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8 inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

3.04 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
- C. Cold-Weather Placement: Comply with ACI 306.1 as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing action, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- D. Hot-Weather Placement: Comply with ACI 301 and as follows:
 - 1. Maintain concrete temperature below 90 deg F and time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

- E. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample of each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 2. Slump: ASTM C 143/C 143 M; one test at point of placement for each compressive-strength test. Additional tests will be required when concrete consistency changes.
 3. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test.
 4. Compression Test Specimens: ASTM C 31/C 31M; one set of four standard cylinders for each compressive-strength test, unless otherwise indicated. Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.
 5. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class, plus one set for each additional 150 cu. yd.. One specimen shall be tested at 7 days and two specimens at 28 days; one specimen shall be retained in reserve for later testing if required.
 6. When frequency of testing will provide fewer than five compressive-strength tests for a given class of concrete, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, current operations shall be evaluated and corrective procedures shall be provided for protecting and curing in-place concrete.
 8. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive compressive-strength test results equal or exceed specified compressive strength and no individual compressive-strength test result falls below specified compressive strength by more than 500 psi.
- F. Test results shall be reported in writing to Owner, Engineer and concrete manufacturer, within 24 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- G. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Owner but will not be used as the sole basis for approval or rejection.
- H. Additional Tests: Testing agency shall make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Owner. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.05 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and

patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.06 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated. While concrete is still plastic, slightly scarify surface with a fine broom.
- C. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

3.07 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Cure concrete according to ACI 308.1, by one or a combination of the following methods.
 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
 2. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.08 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.

3.09 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Contractor will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
 1. Testing Services: Tests shall be performed according to ACI 301.

END OF SECTION 03300

**TRAVERSE CITY LIGHT & POWER
CASS SUBSTATION UNDERGROUND EXIT REPLACEMENT
NEW CONSTRUCTION UNIT LIST**

UNIT ITEM DESCRIPTION	UNIT	QUANTITY	UNIT LABOR	EXTENDED TOTAL
45-3	EA	2		
55-3	EA	1		
C7A	EA	2		
C7A-H	EA	1		
C9-3N	EA	1		
HD-T-14	EA	1		
E1-3Fi	EA	6		
5.0' EXT.	EA	4		
TA-2H	EA	4		
Transfer 1OWS	EA	2		
K10	EA	2		
M2-11	EA	3		
M5-2	EA	6		
M5-4	EA	1		
Splice 3Ø #336.4 ACSR	EA	2		
Transfer 3Ø #336.4 ACSR	EA	3		
Transfer 3Ø #336.4 Hendrix	EA	2		
Transfer M5-26	EA	9		
Transfer Yard Light	EA	1		
UC5-1U	EA	3		
#336.4 18/1 ACSR, "Merlin"	LFT	80		
Trench, Backfill & Compact (1 to 2 Conduits)	LFT	570		
Directional Bore 1-6" HDPE SDR13.5 ¹	LFT	115		
6" PVC SCH 40/80	LFT	570		
6" 45° Fiberglass STD (30") Radius (SF18)	EA	1		
6" 90° Fiberglass STD (30") Radius (SF19)	EA	7		
6" 45° Fiberglass, 60" Radius (SF21)	EA	2		
6" 90° Fiberglass, 60" Radius (SF22)	EA	3		
Sand Backfill, Class II (LM) ¹	CU YD	10		
Trench Spoils, Haul & Dispose	CU YD	10		
Riser Stand Conduit / Connections	EA	4		
15kV Terminator 750kCM	EA	12		
600A 15kV Deadbreak Elbow 750kCM	EA	3		
#750kCM CU, 15kV 133% EPR, 1/3 CN	LFT	2,985		
Site Restoration ¹	LS	1		
Ouages Allowance	LS	1	\$7,500.00	\$7,500.00
Traffic Control & Signage ¹	LS	1		
Mobilization, Insurance & Bonding	LS	1		
NEW CONSTRUCTION TOTAL:				

¹All material required to be supplied by Contractor.

**TRAVERSE CITY LIGHT & POWER
PARSONS SUBSTATION UNDERGROUND EXIT REPLACEMENT
NEW CONSTRUCTION UNIT LIST**

UNIT ITEM DESCRIPTION	UNIT	QUANTITY	UNIT LABOR	EXTENDED TOTAL
45-3	EA	1		
C7A-10	EA	1		
C9-3N	EA	1		
E2-3Fi	EA	1		
M2-11	EA	1		
M5-26	EA	3		
Transfer 3Ø #336.4 ACSR	EA	2		
UC5-1U	EA	1		
Trench, Backfill & Compact (1 to 2 Conduits)	LFT	450		
Directional Bore 1-6" HDPE SDR13.5 ¹	LFT	150		
6" PVC SCH 40/80	LFT	450		
6" 45° Fiberglass STD (30") Radius (SF18)	EA	1		
6" 90° Fiberglass STD (30") Radius (SF19)	EA	1		
6" 45° Fiberglass, 60" Radius (SF21)	EA	2		
6" 90° Fiberglass, 60" Radius (SF22)	EA	1		
Sand Backfill, Class II (LM) ¹	CU YD	15		
Trench Spoils, Haul & Dispose	CU YD	15		
PME-10 Switchgear Box Pad	EA	1		
Ground Rod, 3/4" x 10'	EA	4		
#2/0 CU Stranded Bare	LFT	600		
Exothermic Weld, Inc. Mold & Metal ¹	EA	6		
600A Switchgear (PME-9/10/11)	EA	1		
Switchgear Grounding	EA	1		
600A Switchgear Removal/Reinstallation	EA	1		
15kV Terminator 750kCM	EA	15		
600A 15kV Deadbreak Elbow 500kCM	EA	3		
600A 15kV Deadbreak Elbow 750kCM	EA	6		
#750kCM CU, 15kV 133% EPR, 1/3 CN	LFT	3,195		
Site Restoration ¹	LS	1		
Ouages Allowance	LS	1	\$8,500.00	\$8,500.00
Traffic Control & Signage ¹	LS	1		
Mobilization, Insurance & Bonding	LS	1		
NEW CONSTRUCTION TOTAL:				

¹All material required to be supplied by Contractor.

**TRAVERSE CITY LIGHT & POWER
BARLOW SUBSTATION UNDERGROUND EXIT REPLACEMENT
MATERIAL LIST**

ITEM NO.	QUANTITY	OWNER FURNISHED	ITEM DESCRIPTION	UTILITY ITEM #	UTILITY CATALOG #
A-621	3	X	Switch, Distribution, 12" Blade, 600A, 14.4kV, 110kV BIL, Cypoxy Insulator	S&C	4942R10-E-D2
A-661	1	X	Cutout, 100A, 15kV, 95/110kV BIL, 10 KAIC, Polymer, Type XS	MacLean	SC15HG110-C-D
B-024	2	X	Insulator, Spool, Polymer, 3" X 3 1/8", 5/8" Pin, 3,000#, ANSI 53-2	Hendrix	HPI-53-2
B-041	3	X	Guard, Guy Guard, 8' Yellow, PVC, Helical Pigtail Wrap	MacLean	J5518
B-051	3	X	Insulator, Guy Strain, Porcelain, 1/2", 12,000#, ANSI 54-2	MacLean	L-504
B-126	2	X	Insulator, Guy Strain, Fiberglass, Clevis-Clevis Roller, 54", 21,000#	MacLean	GCC21-54R
B-165	1	X	Bracket, 0° Extension, Three-Phase, 3-Holes per Phase, 48" x 13"	MacLean	G3MA014813DDB
B-250	4	X	Suspension, Polymer, 15kV, SML 15,000#, Clevis-Eye, Type PDI-15	Ohio Brass	401015-0215
B-711	3	X	Arrester, Riser Pole Class, 8.4kV MCOV, Polymer	MacLean	ZRP010-0000100
B-853	9	X	Guard, Bushing Animal Guard, Riser Pole Arrester	<i>Verify Size Required & TCL&P Stock</i>	
B-854	21	X	Guard, Bushing Animal Guard, 750kCM QT-III Terminator	<i>Verify Size Required & TCL&P Stock</i>	
C-004	2	X	Bracket, Spool, 3" Spool, 5/8" Pin	MacLean	J1300
C-038	3	X	Pole Eye Plate, 4-5", 21,000#	MacLean	UGA-66-4
C-050	1	X	Clevis, Thimble, Dead-End, 20,000#	MacLean	CT-88
C-1038	1	X	Crossarm, Composite, Dead End, 3-5/8" X 4-5/8" X 8", 10,000#	Pupi	DA2500-096E2-B72
C-228	12	X	Grip, Guy Dead-End, 10M Alumoweld	Preformed	AWDE-4116
C-260	6	X	Crossarm, Wood, 3-3/4" X 4-3/4" X 8", DF, Penta, REA Spec, WQC, Type 03	Brooks	
C-280	6	X	Brace, Wood Crossarm, 60" Span, 18" Drop	Alumaform	RA6018
C-314	2	X	Screw, Lag 1/2" X 4"	Chance	508754
C-317_6	12	X	Bolt, Machine, 1/2" X 6" w/Nut	Chance	8706
C-318_10	6	X	Bolt, Machine, 5/8" X 10" w/Nut	Chance	8810
C-318_12	23	X	Bolt, Machine, 5/8" X 12" w/Nut	Chance	8812
C-318_14	30	X	Bolt, Machine, 5/8" X 14" w/Nut	Chance	8814
C-318_16	13	X	Bolt, Machine, 5/8" X 16" w/Nut	Chance	8816
C-319_14	6	X	Bolt, Machine, 3/4" X 14" w/Nut	Chance	8914
C-324_7	2	X	Bolt, Carriage, 3/8" X 7" w/Nut	Chance	8637
C-328_20	9	X	Bolt, Double Arming, 5/8" X 20" w/Nuts	Chance	8870
C-328_22	9	X	Bolt, Double Arming, 5/8" X 22" w/Nuts	Chance	8872
C-328_24	9	X	Bolt, Double Arming, 5/8" X 24" w/Nuts	Chance	8874
C-335_12	1	X	Bolt, Oval Eye, 5/8" X 12" w/ Nut	Chance	29962
C-353	12	X	Nut, Locknut, 1/2"	Chance	3511
C-354	78	X	Nut, Locknut, 5/8"	Chance	3512
C-355	6	X	Nut, Locknut, 3/4"	Chance	3513
C-364	3	X	Nut, Eye, 5/8"	Chance	6502
C-377	12	X	Washer, Round 1-3/8" Dia., 9/16" Hole	Hubbell	PS6803
C-382	82	X	Washer, 2-1/4" X 2-1/4" X 3/16" Square, 11/16" Hole	Hubbell	6813
C-385	5	X	Washer, 3" X 3" X 1/4" Square Curved Washer, 11/16" Hole	Chance	682312
C-390_C	6	X	Washer, Cast, 4" X 4" X 1/4" Square Curved Washer, 13/16" Hole	Chance	GCW41
C-440	21	X	Bracket, Cable Positioner	Alumaform	CS-820
C-700	2	X	Grip, Service, Dead End, #2 TX Neutral	Preformed	SG-4504
C-852	6	X	Clamp, Straight Line Dead-End, Side Opening, #2 - #336.4 ACSR, 9,000#	MacLean	HDSO-70
D-001	120	X	Wire, #6 CU Solid, Bare, Soft Drawn	Southwire	
D-016	90	X	Cable, #2 CU 7-Strand, Bare, Soft Drawn	Southwire	
D-019	50	X	Cable, #4/0 CU 7-Strand, Bare, Soft Drawn	Southwire	
D-021	135	X	Cable, 350 MCM CU 19-Strand, Bare, Soft Drawn	Southwire	
D-034	100	X	Cable, 500 MCM CU Strand, Bare, Medium Hard Drawn	Southwire	
D-052	15	X	Wire, Covered Line, #6 CU, Solid	Southwire	6CSPS S ###

**TRAVERSE CITY LIGHT & POWER
BARLOW SUBSTATION UNDERGROUND EXIT REPLACEMENT
MATERIAL LIST**

ITEM NO.	QUANTITY	OWNER FURNISHED	ITEM DESCRIPTION	UTILITY ITEM #	UTILITY CATALOG #
D-206	20	Stock	Cable, #4 7/1 ACSR, "Swanate"	Southwire	
D-215	40	Stock	Cable, 336.4 kcmil 18/1 ACSR, "Merlin"	Southwire	
D-413	3510	PLS Order	Cable, Concentric Neutral, 750 MCM CU 133% EPR 15kV, 33% Neutral <i>(3) 2,700' Reels -- Total for Project</i>	Kerite/Okonite	
D-666	135	X	Cable, Guy Strand, 10M Alumoweld	Alumoweld	
D-697	1500	CONTRACTOR	Mule Tape, Polyester, 3/4" Width, Printed Sequential Footages, 2500#	Muletape	WP2500P
D-1040	4	X	Lubricant, Cable Pulling, Water-based, Non-flammable, Summer-grade, 5 Gallon Pail	Polywater	Polywater J
D-1047	9	X	Grip, Suspension, Offset Eye, Single Weave, 1-5/8" - 2-1/2", 5,000#	Lewis	OE-162-SW
E-001	1	X	Ground Rod, 5/8" X 8' Copper Clad	Erico	615883
E-050	1	X	Clamp, Ground Rod, Bronze, 5/8"	Blackburn	JAB58H
E-097	45	X	Staples, Zinc Plated, Diamond Point, Down Lead	Chance	7511
E-130	3	X	PVC Solvent Cement, Clear, Quart Can	Carlson	VC9962
E-132	7	X	Duct Seal	Duxseal	
E-136	24	X	Bracket, Conduit 6" Stand-off w/ 12" 4-way T-Slot Rail	Alumaform	6-CSO-12
E-157	24	X	Conduit Support Strap Kit, 6"	Alumaform	STK-6
E-184	280	CONTRACTOR	Pipe, 6" HDPE Type SDR 13.5, Red	A-D Technologies	
E-259	103	X	Conduit, 6" PVC SCH 40, 10' Lengths	Carlson	
E-516	3	X	Conduit, 6" Rigid Galvanized Steel, 10' Length		
E-642	4	X	Coupler, Transition 6" PVC to 6" HDPE, Push-On	Arco E-Loc	IA554600
E-668	8	X	Coupler, 6" PVC	Carlson	E940R
E-679	8	X	End Bell, 6" PVC	Carlson	E997R
E-695	3	X	Female Threaded Adapter, 6" PVC	Carlson	E942R
E-1035	4	X	End Cap, 6" PVC	Carlson	E958R
E-1595	2	X	Elbow, 6", 22.5°, 60" Radius, Fiberglass with (2) PVC Couplings (SF20)	Champion	60B-HW-64-P-2D
E-1635	1	X	Elbow, 6", 45°, 36" Radius, Fiberglass with (2) PVC Couplings (SF18)	Champion	60B-HW-82-P-2D
E-1661	10	X	Elbow, 6", 90°, 36" Radius, Fiberglass with (2) PVC Couplings (SF19)	Champion	60B-HW-92-P-2D
E-1673	8	X	Elbow, 6", 90°, 60" Radius, Fiberglass with (2) PVC Couplings (SF22)	Champion	60B-HW-94-P-2D
F-024	6	X	Connector, Compression, #2,4,6 ACSR to #2,4,6 ACSR or #2,4,6 CU	Blackburn	WR159
F-033	1	X	Connector, Compression, #477,336,4/0 ACSR to #2/0,1/0,2,4 ACSR or #2/0,1/0,2,4,6CU	Blackburn	WR815
F-034	9	X	Connector, Compression, #477,336,4/0 ACSR to #4/0,3/0,2/0,1/0 ACSR or #4/0,1/0 CU	Blackburn	WR835
F-036	9	X	Connector, Compression, #477,336,4/0 ACSR to #477,336,4/0 ACSR or #4/0 CU	Blackburn	WR885
F-059	9	X	Connector, Compression, Crimp-It, #6 Sol, #4 Str CU to #6 Sol/Str CU	Burndy	YC4C6
F-063	9	X	Connector, Compression, Crimp-It, #1/0 Sol - #2/0Str CU to #8 Sol - #2 Str CU	Burndy	YC26C2
F-080	2	X	Automatic Splice, Full Tension, #4 7/1 ACSR, "Swanate" - Orange	Fargo	GL-402A
F-086	4	X	Automatic Splice, Full Tension, #336.4 ACSR 18/1 "Merlin" - Green	Fargo	GL-411
F-1284	12	X	Connector, Parallel, 1/2" 2 U-Bolt, #1/0 Sol-350 MCM CU to #1/0 Sol-3/0 MCM CU	Anderson	LC-1144-5
F-1380	2	X	Tape, Vinyl, Black, 3/4"	3M	33+SUPER-3/4X66F
F-1381	3	X	Tape, Vinyl, Blue, 3/4"	3M	35-Blue-3/4
F-1386	3	X	Tape, Vinyl, Red, 3/4"	3M	35-Red-3/4
F-1705	1	Stock	Connector, Power Grip, #4/0 - #4 ACSR to #2/0 - #8	Utilico	SCH-40-9/16P
F-574	39	X	Connector, Bolted, #1/0 Sol - #500 Cable to Flat, Double, Bronze	Anderson	TLD-62
F-595	21	X	Connector, Bolted, Cable T-Tap, Bronze, #500 to #2/0	Anderson	TCC4050022
F-797	21	X	Connector, Compression, Terminal, CU/AL, #750 to 2 Hole NEMA PAD	Burndy	YA39A5
F-805	21	X	Terminator, 15kV QT-III Silicone Rubber, #500-#1000 JCN/CN	3M	7655-S-4
G-106	2	X	Handhole, HDPE, 14" x 20" x 15" w/ Cover, "Electric"	Associated Plast.	SGA142015Y000
I-093	1	Stock	Wood Pole, 45-3, SYP or MRP, PENTA		
I-596	2	X	Anchor, Multi-Helix, 8 & 10" Helix, 24" Spacing, 3' Long, 1-1/2" Square Shaft	MacLean	D6632

**TRAVERSE CITY LIGHT & POWER
 BARLOW SUBSTATION UNDERGROUND EXIT REPLACEMENT
 MATERIAL LIST**

ITEM NO.	QUANTITY	OWNER FURNISHED	ITEM DESCRIPTION	UTILITY ITEM #	UTILITY CATALOG #
I-611	4	X	Anchor, Extension, 1-1/2" Square x 5', Square Shaft	MacLean	D6620U
I-640	2	X	Anchor, Eyebolt Adapter, Tripleye	MacLean	D6606US
J-005	Lot	CONTRACTOR	Tags, Black Lamacoid, White Lettering, Size as Required	Contractor Furnished	-----
L-002	650	X	Marker Tape, 6" Wide, Red, "Caution - Buried Electric Lines"		

**TRAVERSE CITY LIGHT & POWER
CASS SUBSTATION UNDERGROUND EXIT REPLACEMENT
MATERIAL LIST**

ITEM NO.	QUANTITY	OWNER FURNISHED	ITEM DESCRIPTION	UTILITY ITEM #	UTILITY CATALOG #
A-621	9	X	Switch, Distribution, 12" Blade, 600A, 14.4kV, 110kV BIL, Cyproxy Insulator	S&C	4942R10-E-D2
B-010	10	X	Insulator, Pin, Polymer, 15kV, F-Neck, ANSI 55-4	Hendrix	HPI-55-4
B-024	1	X	Insulator, Spool, Polymer, 3" X 3 1/8", 5/8" Pin, 3,000#, ANSI 53-2	Hendrix	HPI-53-2
B-031	2	X	Wire Holder, Nylon, 5/16" X 2-1/4" Lag Screw, 7/8" X 13/16" Slot	Chance	2070138
B-041	6	X	Guard, Guy Guard, 8' Yellow, PVC, Helical Pigtail Wrap	MacLean	J5518
B-051	6	X	Insulator, Guy Strain, Porcelain, 1/2", 12,000#, ANSI 54-2	MacLean	L-504
B-126	6	X	Insulator, Guy Strain, Fiberglass, Clevis-Clevis Roller, 54", 21,000#	MacLean	GCC21-54R
B-165	3	X	Bracket, 0° Extension, Three-Phase, 3-Holes per Phase, 48" x 13"	MacLean	G3MA014813DDB
B-250	9	X	Suspension, Polymer, 15kV, SML 15,000#, Clevis-Eye, Type PDI-15	Ohio Brass	401015-0215
B-711	9	X	Arrester, Riser Pole Class, 8.4kV MCOV, Polymer	MacLean	ZRP010-0000100
B-853	9	X	Guard, Bushing Animal Guard, Riser Pole Arrester	Verify Size Required & TCL&P Stock	
B-854	18	X	Guard, Bushing Animal Guard, 750kCM QT-III Terminator	Verify Size Required & TCL&P Stock	
C-004	1	X	Bracket, Spool, 3" Spool, 5/8" Pin	MacLean	J1300
C-025	6	X	Pin, Pole Top, 20", 1" Thread	Chance	2199
C-030	3	X	Pin, Crossarm, Saddle-Type, 1" Thread	Chance	14322
C-034	1	X	Adapter, Insulator	Chance	4258
C-038	7	X	Pole Eye Plate, 4-5", 21,000#	MacLean	UGA-66-4
C-050	4	X	Clevis, Thimble, Dead-End, 20,000#	MacLean	CT-88
C-1038	3	X	Crossarm, Composite, Dead End, 3-5/8" X 4-5/8" X 8', 10,000#	Pupi	DA2500-096E2-B72
C-153	1	X	Grips, Dead-End, Hendrix Preformed, 052 AWA Messenger	Hendrix	MG-4128
C-182	3	X	Grips, Dead-End, .889"-.945" Dia., #336.4 AAC Hendrix, 15kV TP	Hendrix	CG-0120
C-228	24	X	Grip, Guy Dead-End, 10M Alumoweld	Preformed	AWDE-4116
C-260	6	X	Crossarm, Wood, 3-3/4" X 4-3/4" X 8', DF, Penta, REA Spec, WQC, Type 03	Brooks	
C-261	1	X	Crossarm, Wood, 3-3/4" X 4-3/4" X 10', Penta, REA Spec, WQC, Type 05	Brooks	
C-280	7	X	Brace, Wood Crossarm, 60" Span, 18" Drop	Alumaform	RA6018
C-314	4	X	Screw, Lag 1/2" X 4"	Chance	508754
C-317_6	14	X	Bolt, Machine, 1/2" X 6" w/Nut	Chance	8706
C-318_10	8	X	Bolt, Machine, 5/8" X 10" w/Nut	Chance	8810
C-318_12	23	X	Bolt, Machine, 5/8" X 12" w/Nut	Chance	8812
C-318_14	53	X	Bolt, Machine, 5/8" X 14" w/Nut	Chance	8814
C-318_16	14	X	Bolt, Machine, 5/8" X 16" w/Nut	Chance	8816
C-318_5	3	X	Bolt, Machine, 5/8" X 5" w/Nut	Chance	8805
C-319_14	14	X	Bolt, Machine, 3/4" X 14" w/Nut	Chance	8914
C-324_7	6	X	Bolt, Carriage, 3/8" X 7" w/Nut	Chance	8637
C-328_20	9	X	Bolt, Double Arming, 5/8" X 20" w/Nuts	Chance	8870
C-328_22	9	X	Bolt, Double Arming, 5/8" X 22" w/Nuts	Chance	8872
C-328_24	9	X	Bolt, Double Arming, 5/8" X 24" w/Nuts	Chance	8874
C-335_12	2	X	Bolt, Oval Eye, 5/8" X 12" w/ Nut	Chance	29962
C-353	14	X	Nut, Locknut, 1/2"	Chance	3511
C-354	109	X	Nut, Locknut, 5/8"	Chance	3512
C-355	14	X	Nut, Locknut, 3/4"	Chance	3513
C-364	3	X	Nut, Eye, 5/8"	Chance	6502
C-377	14	X	Washer, Round 1-3/8" Dia., 9/16" Hole	Hubbell	PS6803
C-382	110	X	Washer, 2-1/4" X 2-1/4" X 3/16" Square, 11/16" Hole	Hubbell	6813
C-385	10	X	Washer, 3" X 3" X 1/4" Square Curved Washer, 11/16" Hole	Chance	682312
C-390_C	12	X	Washer, Cast, 4" X 4" X 1/4" Square Curved Washer, 13/16" Hole	Chance	GCW41
C-440	18	X	Bracket, Cable Positioner	Alumaform	CS-820

**TRAVERSE CITY LIGHT & POWER
CASS SUBSTATION UNDERGROUND EXIT REPLACEMENT
MATERIAL LIST**

ITEM NO.	QUANTITY	OWNER FURNISHED	ITEM DESCRIPTION	UTILITY ITEM #	UTILITY CATALOG #
C-461	1	X	Bracket, Hendrix Tangent w/ MC-2 Messenger Clamp, 14" Offset	Hendrix	BM-14
C-465	1	X	Bracket, Hendrix Antisway, 14"	Hendrix	BAS-14F
C-479	1	X	Bracket, Hendrix Tangent Stirrup	Hendrix	TS-1
C-563	10	X	Pre-Formed Ties, Wraplock, #336.4 ACSR 18/1, F-Neck, ANSI 55-4	Preformed	WTF-0221
C-661_E	1	X	Spool Tie, EZ-Wrap, #366.4 ACSR, ANSI 53-2	Preformed	EZSP-4380
C-696	2	X	Grip, Service, Dead End, #6 TX Neutral	Preformed	SG-4500
C-852	8	X	Clamp, Straight Line Dead-End, Side Opening, #2 - #336.4 ACSR, 9,000#	MacLean	HDSO-70
D-001	205	X	Wire, #6 CU Solid, Bare, Soft Drawn	Southwire	
D-016	90	X	Cable, #2 CU 7-Strand, Bare, Soft Drawn	Southwire	
D-021	135	X	Cable, 350 MCM CU 19-Strand, Bare, Soft Drawn	Southwire	
D-085	20	X	Cable, #4/0 CU 19-Strand, RHW/USE 600V	Southwire	
D-215	80	X	Cable, 336.4 kcmil 18/1 ACSR, "Merlin"	Southwire	
D-413	2985	PLS Order	Cable, Concentric Neutral, 750 MCM CU 133% EPR 15kV, 33% Neutral <i>(3) 2,700' Reels -- Total for Project</i>	Kerite/Okonite	
D-666	270	X	Cable, Guy Strand, 10M Alumoweld	Alumoweld	
D-697	900	CONTRACTOR	Mule Tape, Polyester, 3/4" Width, Printed Sequential Footages, 2500#	Muletape	WP2500P
D-1040	4	X	Lubricant, Cable Pulling, Water-based, Non-flammable, Summer-grade, 5 Gallon Pail	Polywater	Polywater J
D-1047	9	X	Grip, Suspension, Offset Eye, Single Weave, 1-5/8" - 2-1/2", 5,000#	Lewis	OE-162-SW
E-001	3	X	Ground Rod, 5/8" X 8' Copper Clad	Erico	615883
E-050	3	X	Clamp, Ground Rod, Bronze, 5/8"	Blackburn	JAB58H
E-097	145	X	Staples, Zinc Plated, Diamond Point, Down Lead	Chance	7511
E-104	40	X	Staples, Coppercoated, Down Lead, Rolled/Diamond Point, #4/0 CU Stranded	Joslyn	J6496
E-130	3	X	PVC Solvent Cement, Clear, Quart Can	Carlton	VC9962
E-132	7	X	Duct Seal	Duxseal	
E-136	24	X	Bracket, Conduit 6" Stand-off w/ 12" 4-way T-Slot Rail	Alumaform	6-CSO-12
E-157	24	X	Conduit Support Strap Kit, 6"	Alumaform	STK-6
E-184	115	CONTRACTOR	Pipe, 6" HDPE Type SDR 13.5, Red	A-D Technologies	
E-259	66	X	Conduit, 6" PVC SCH 40, 10' Length	Carlton	
E-516	3	X	Conduit, 6" Rigid Galvanized Steel, 10' Length		
E-642	1	X	Coupler, Transition 6" PVC to 6" HDPE, Push-On	Arnco E-Loc	IA554600
E-668	8	X	Coupler, 6" PVC	Carlton	E940R
E-679	6	X	End Bell, 6" PVC	Carlton	E997R
E-695	3	X	Female Threaded Adapter, 6" PVC	Carlton	E942R
E-1595	2	X	Elbow, 6", 22.5°, 60" Radius, Fiberglass with (2) PVC Couplings (SF20)	Champion	60B-HW-64-P-2D
E-1635	1	X	Elbow, 6", 45°, 36" Radius, Fiberglass with (2) PVC Couplings (SF18)	Champion	60B-HW-82-P-2D
E-1661	7	X	Elbow, 6", 90°, 36" Radius, Fiberglass with (2) PVC Couplings (SF19)	Champion	60B-HW-92-P-2D
E-1647	2	X	Elbow, 6", 45°, 60" Radius, Fiberglass with (2) PVC Couplings (SF21)	Champion	60B-HW-84-P-2D
E-1673	3	X	Elbow, 6", 90°, 60" Radius, Fiberglass with (2) PVC Couplings (SF22)	Champion	60B-HW-94-P-2D
F-028	2	X	Connector, Compression, #4/0,3/0 ACSR to #2,4,6 ACSR or #2,4,6 CU	Blackburn	WR379
F-033	3	X	Connector, Compression, #477,336,4/0 ACSR to #2/0,1/0,2,4 ACSR or #2/0,1/0,2,4,6CU	Blackburn	WR815
F-034	9	X	Connector, Compression, #477,336,4/0 ACSR to #4/0,3/0,2/0,1/0 ACSR or #4/0,1/0 CU	Blackburn	WR835
F-036	9	X	Connector, Compression, #477,336,4/0 ACSR to #477,336,4/0 ACSR or #4/0 CU	Blackburn	WR885
F-056	2	X	Connector, Compression, #0052AWA to #0052AWA, #052AWA to #052AWA, or #4/0 CU	Blackburn	WR419
F-059	9	X	Connector, Compression, Crimp-It, #6 Sol, #4 Str CU to #6 Sol/Str CU	Burndy	YC4C6
F-063	9	X	Connector, Compression, Crimp-It, #1/0 Sol - #2/0Str CU to #8 Sol - #2 Str CU	Burndy	YC26C2
F-086	8	X	Automatic Splice, Full Tension, #336.4 ACSR 18/1 "Merlin" - Green	Fargo	GL-411
F-1380	2	X	Tape, Vinyl, Black, 3/4"	3M	33+SUPER-3/4X66F

**TRAVERSE CITY LIGHT & POWER
CASS SUBSTATION UNDERGROUND EXIT REPLACEMENT
MATERIAL LIST**

ITEM NO.	QUANTITY	OWNER FURNISHED	ITEM DESCRIPTION	UTILITY ITEM #	UTILITY CATALOG #
F-1381	3	X	Tape, Vinyl, Blue, 3/4"	3M	35-Blue-3/4
F-1386	3	X	Tape, Vinyl, Red, 3/4"	3M	35-Red-3/4
F-574	36	X	Connector, Bolted, #1/0 Sol - #500 Cable to Flat, Double, Bronze	Anderson	TLD-62
F-595	18	X	Connector, Bolted, Cable T-Tap, Bronze, #500 to #2/0	Anderson	TCC4050022
F-797	21	X	Connector, Compression, Terminal, CU/AL, #750 to 2 Hole NEMA PAD	Burndy	YA39A5
F-805	21	X	Terminator, 15kV QT-III Silicone Rubber, #500-#1000 JCN/CN	3M	7655-S-4
I-093	2	X	Wood Pole, 45-3, SYP or MRP, PENTA		
I-104	1	X	Wood Pole, 55-3, SYP or MRP, PENTA		
I-596	4	X	Anchor, Multi-Helix, 8 & 10" Helix, 24" Spacing, 3' Long, 1-1/2" Square Shaft	MacLean	D6632
I-611	8	X	Anchor, Extension, 1-1/2" Square x 5', Square Shaft	MacLean	D6620U
I-640	4	X	Anchor, Eyebolt Adapter, Tripleye	MacLean	D6606US
J-005	Lot	CONTRACTOR	Tags, Black Lamacoid, White Lettering, Size as Required	Contractor Furnished	-----
L-002	600	X	Marker Tape, 6" Wide, Red, "Caution - Buried Electric Lines"		

**TRAVERSE CITY LIGHT & POWER
PARSONS SUBSTATION UNDERGROUND EXIT REPLACEMENT
MATERIAL LIST**

ITEM NO.	QUANTITY	OWNER FURNISHED	ITEM DESCRIPTION	UTILITY ITEM #	UTILITY CATALOG #
A-119	1	X	Switchgear Padmount, 15kV Dead Front, 600A, 4 Switch	S&C	PME-10
A-621	3	X	Switch, Distribution, 12" Blade, 600A, 14.4kV, 110kV BIL, Cyproxy Insulator	S&C	4942R10-E-D2
B-010	3	X	Insulator, Pin, Polymer, 15kV, F-Neck, ANSI 55-4	Hendrix	HPI-55-4
B-024	1	X	Insulator, Spool, Polymer, 3" X 3 1/8", 5/8" Pin, 3,000#, ANSI 53-2	Hendrix	HPI-53-2
B-051	1	X	Insulator, Guy Strain, Porcelain, 1/2", 12,000#, ANSI 54-2	MacLean	L-504
B-126	1	X	Insulator, Guy Strain, Fiberglass, Clevis-Clevis Roller, 54", 21,000#	MacLean	GCC21-54R
B-165	1	X	Bracket, 0° Extension, Three-Phase, 3-Holes per Phase, 48" x 13"	MacLean	G3MA014813DDB
B-250	3	X	Suspension, Polymer, 15kV, SML 15,000#, Clevis-Eye, Type PDI-15	Ohio Brass	401015-0215
B-711	3	X	Arrester, Riser Pole Class, 8.4kV MCOV, Polymer	MacLean	ZRP010-0000100
B-853	3	X	Guard, Bushing Animal Guard, Riser Pole Arrester	Verify Size Required & TCL&P Stock	
B-854	15	X	Guard, Bushing Animal Guard, 750kCM QT-III Terminator	Verify Size Required & TCL&P Stock	
C-004	1	X	Bracket, Spool, 3" Spool, 5/8" Pin	MacLean	J1300
C-030	3	X	Pin, Crossarm, Saddle-Type, 1" Thread	Chance	14322
C-038	2	X	Pole Eye Plate, 4-5", 21,000#	MacLean	UGA-66-4
C-050	1	X	Clevis, Thimble, Dead-End, 20,000#	MacLean	CT-88
C-1048	1	X	Crossarm, Composite, Dead End, 3-5/8" X 4-5/8" X 10', 10,000#	Pupi	DA3000-120E4-B92
C-228	4	X	Grip, Guy Dead-End, 10M Alumoweld	Preformed	AWDE-4116
C-260	4	X	Crossarm, Wood, 3-3/4" X 4-3/4" X 8', DF, Penta, REA Spec, WQC, Type 03	Brooks	
C-261	1	X	Crossarm, Wood, 3-3/4" X 4-3/4" X 10', Penta, REA Spec, WQC, Type 05	Brooks	
C-280	3	X	Brace, Wood Crossarm, 60" Span, 18" Drop	Alumaform	RA6018
C-314	1	X	Screw, Lag 1/2" X 4"	Chance	508754
C-317_6	6	X	Bolt, Machine, 1/2" X 6" w/Nut	Chance	8706
C-318_10	2	X	Bolt, Machine, 5/8" X 10" w/Nut	Chance	8810
C-318_12	12	X	Bolt, Machine, 5/8" X 12" w/Nut	Chance	8812
C-318_14	10	X	Bolt, Machine, 5/8" X 14" w/Nut	Chance	8814
C-318_16	3	X	Bolt, Machine, 5/8" X 16" w/Nut	Chance	8816
C-318_5	3	X	Bolt, Machine, 5/8" X 5" w/Nut	Chance	8805
C-319_14	6	X	Bolt, Machine, 3/4" X 14" w/Nut	Chance	8914
C-324_7	4	X	Bolt, Carriage, 3/8" X 7" w/Nut	Chance	8637
C-328_20	3	X	Bolt, Double Arming, 5/8" X 20" w/Nuts	Chance	8870
C-328_22	3	X	Bolt, Double Arming, 5/8" X 22" w/Nuts	Chance	8872
C-328_24	3	X	Bolt, Double Arming, 5/8" X 24" w/Nuts	Chance	8874
C-335_12	1	X	Bolt, Oval Eye, 5/8" X 12" w/ Nut	Chance	29962
C-353	6	X	Nut, Locknut, 1/2"	Chance	3511
C-354	32	X	Nut, Locknut, 5/8"	Chance	3512
C-355	6	X	Nut, Locknut, 3/4"	Chance	3513
C-364	1	X	Nut, Eye, 5/8"	Chance	6502
C-377	6	X	Washer, Round 1-3/8" Dia., 9/16" Hole	Hubbell	PS6803
C-382	38	X	Washer, 2-1/4" X 2-1/4" X 3/16" Square, 11/16" Hole	Hubbell	6813
C-385	3	X	Washer, 3" X 3" X 1/4" Square Curved Washer, 11/16" Hole	Chance	682312
C-390_C	6	X	Washer, Cast, 4" X 4" X 1/4" Square Curved Washer, 13/16" Hole	Chance	GCW41
C-440	15	X	Bracket, Cable Positioner	Alumaform	CS-820
C-563	3	X	Pre-Formed Ties, Wraplock, #336.4 ACSR 18/1, F-Neck, ANSI 55-4	Preformed	WTF-0221
C-661_E	1	X	Spool Tie, EZ-Wrap, #366.4 ACSR, ANSI 53-2	Preformed	EZSP-4380
C-852	4	X	Clamp, Straight Line Dead-End, Side Opening, #2 - #336.4 ACSR, 9,000#	MacLean	HDSO-70
D-001	65	X	Wire, #6 CU Solid, Bare, Soft Drawn	Southwire	
D-016	30	X	Cable, #2 CU 7-Strand, Bare, Soft Drawn	Southwire	

**TRAVERSE CITY LIGHT & POWER
PARSONS SUBSTATION UNDERGROUND EXIT REPLACEMENT
MATERIAL LIST**

ITEM NO.	QUANTITY	OWNER FURNISHED	ITEM DESCRIPTION	UTILITY ITEM #	UTILITY CATALOG #
D-018	125	X	Cable, #2/0 CU 7-Strand, Bare, Soft Drawn	Southwire	
D-021	100	X	Cable, 350 MCM CU 19-Strand, Bare, Soft Drawn	Southwire	
D-413	3195	PLS Order	Cable, Concentric Neutral, 750 MCM CU 133% EPR 15kV, 33% Neutral	Kerite/Okonite	
			(3) 2,700' Reels -- Total for Project		
D-666	100	X	Cable, Guy Strand, 10M Alumoweld	Alumoweld	
D-697	750	CONTRACTOR	Mule Tape, Polyester, 3/4" Width, Printed Sequential Footages, 2500#	Muletape	WP2500P
D-1040	2	X	Lubricant, Cable Pulling, Water-based, Non-flammable, Summer-grade, 5 Gallon Pail	Polywater	Polywater J
D-1047	3	X	Grip, Suspension, Offset Eye, Single Weave, 1-5/8" - 2-1/2", 5,000#	Lewis	OE-162-SW
E-001	1	X	Ground Rod, 5/8" X 8' Copper Clad	Erico	615883
E-008	4	X	Ground Rod, 3/4" X 10' Copper Clad, Threaded	Eritech	613400
E-016	2	CONTRACTOR	Exothermic Weld, Horizontal Tee, #2/0 CU Str to #2/0 CU Str (Include mold & metal)	Cadweld	TAC-2G2G (Metal 90
E-033_2	4	X	Exothermic Weld, (2) Cables to Ground Rod, 3/4" Rod to #2/0 Str., One-Shot	Erico	GT1-182G
E-050	1	X	Clamp, Ground Rod, Bronze, 5/8"	Blackburn	JAB58H
E-097	45	X	Staples, Zinc Plated, Diamond Point, Down Lead	Chance	7511
E-130	3	X	PVC Solvent Cement, Clear, Quart Can	Carlton	VC9962
E-132	5	X	Duct Seal	Duxseal	
E-136	8	X	Bracket, Conduit 6" Stand-off w/ 12" 4-way T-Slot Rail	Alumaform	6-CSO-12
E-157	8	X	Conduit Support Strap Kit, 6"	Alumaform	STK-6
E-184	150	CONTRACTOR	Pipe, 6" HDPE Type SDR 13.5, Red	A-D Technologies	
E-259	50	X	Conduit, 6" PVC SCH 40, 10' Length	Carlton	
E-516	1	X	Conduit, 6" Rigid Galvanized Steel, 10' Length		
E-642	2	X	Coupler, Transition 6" PVC to 6" HDPE, Push-On	Arnco E-Loc	IA554600
E-668	4	X	Coupler, 6" PVC	Carlton	E940R
E-679	5	X	End Bell, 6" PVC	Carlton	E997R
E-695	1	X	Female Threaded Adapter, 6" PVC	Carlton	E942R
E-1635	1	X	Elbow, 6", 45°, 36" Radius, Fiberglass with (2) PVC Couplings (SF18)	Champion	60B-HW-82-P-2D
E-1647	2	X	Elbow, 6", 45°, 60" Radius, Fiberglass with (2) PVC Couplings (SF21)	Champion	60B-HW-84-P-2D
E-1661	1	X	Elbow, 6", 90°, 36" Radius, Fiberglass with (2) PVC Couplings (SF19)	Champion	60B-HW-92-P-2D
E-1673	1	X	Elbow, 6", 90°, 60" Radius, Fiberglass with (2) PVC Couplings (SF22)	Champion	60B-HW-94-P-2D
F-032	4	X	Connector, Compression, #336,4/0 ACSR to #336,4/0 ACSR or #4/0 CU	Blackburn	WR775
F-033	1	X	Connector, Compression, #477,336,4/0 ACSR to #2/0,1/0,2,4 ACSR or #2/0,1/0,2,4,6CU	Blackburn	WR815
F-034	3	X	Connector, Compression, #477,336,4/0 ACSR to #4/0,3/0,2/0,1/0 ACSR or #4/0,1/0 CU	Blackburn	WR835
F-036	3	X	Connector, Compression, #477,336,4/0 ACSR to #477,336,4/0 ACSR or #4/0 CU	Blackburn	WR885
F-059	3	X	Connector, Compression, Crimp-It, #6 Sol, #4 Str CU to #6 Sol/Str CU	Burndy	YC4C6
F-063	3	X	Connector, Compression, Crimp-It, #1/0 Sol - #2/0Str CU to #8 Sol - #2 Str CU	Burndy	YC26C2
F-173	12	X	Connector, Six Position, Set Screw, #10 - 250MCM	CMC	NA250-6I
F-1072	3	X	Elbow, 600A Deadbreak, 15kV 133%, 500 AL/CU Strand	Elastimold	K655LR-K0330
F-1072	6	X	Elbow, 600A Deadbreak, 15kV 133%, 750 AL/CU Strand	Elastimold	K655LR-LM0360
F-1284	9	X	Connector, Parallel, 1/2" 2 U-Bolt, #1/0 Sol-350 MCM CU to #1/0 Sol-3/0 MCM CU	Anderson	LC-1144-5
F-1380	2	X	Tape, Vinyl, Black, 3/4"	3M	33+SUPER-3/4X66FT
F-1381	1	X	Tape, Vinyl, Blue, 3/4"	3M	35-Blue-3/4
F-1386	1	X	Tape, Vinyl, Red, 3/4"	3M	35-Red-3/4
F-574	21	X	Connector, Bolted, #1/0 Sol - #500 Cable to Flat, Double, Bronze	Anderson	TLD-62
F-595	24	X	Connector, Bolted, Cable T-Tap, Bronze, #500 to #2/0	Anderson	TCC4050022
F-797	18	X	Connector, Compression, Terminal, CU/AL, #750 to 2 Hole NEMA PAD	Burndy	YA39A5
F-805	18	X	Terminator, 15kV QT-III Silicone Rubber, #500-#1000 JCN/CN	3M	7655-S-4
F-881	3	X	Insulated Cap, 15kV, 600A	Elastimold	656DR

**TRAVERSE CITY LIGHT & POWER
PARSONS SUBSTATION UNDERGROUND EXIT REPLACEMENT
MATERIAL LIST**

ITEM NO.	QUANTITY	OWNER FURNISHED	ITEM DESCRIPTION	UTILITY ITEM #	UTILITY CATALOG #
G-352	1	X	Boxpad, Polymer-Concrete, 74"x76"x20", 15kV, PME-6,9,10,11,12	Concast	FC-74-76-20
H-462	3	X	Fault Indicator, OH, Current/Normal Reset, 100A Trip, 12 Hr. Reset	Power Delivery	41-20-01-103
I-093	1	X	Wood Pole, 45-3, SYP or MRP, PENTA		
J-005	Lot	CONTRACTOR	Tags, Black Lamacoid, White Lettering, Size as Required	Contractor Furnished	-----
L-002	500	X	Marker Tape, 6" Wide, Red, "Caution - Buried Electric Lines"		