

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
SPUN CONCRETE POLE AND DRILLED SHAFT FOUNDATION

ITS:EG

1 of 8

APPR:MS:RWS:05-05-22
FHWA:APPR:05-05-22

a. Description. This work consists of designing, fabricating, furnishing, and installing a spun concrete pole for use as a closed circuit television (CCTV) camera pole. Also construct a drilled shaft foundation for the spun pole. Ensure this work is done in accordance with the standard specifications, the plans, and as specified herein.

Ensure the design of the spun concrete pole meets the following requirements:

1. Pre-stressed Spun Concrete Pole Specifications. Furnish complete detailed spun pole design calculations, shop drawings and QC plan to the Engineer for review and approval. Ensure the design for the spun pole is signed and sealed by a Professional Engineer licensed in the State of Michigan.

A. Spun poles are to be pre-stressed with the concrete applied by the centrifugal spinning process. Ensure the concrete has a minimum 28 day compressive strength of 8,000 psi. Maintain a minimum 3/4 inch cover over the reinforcing steel. The required release strength is 70 percent of 28 day compressive strength.

B. Furnish poles with a smooth form finish gray in color.

C. Design and construct spun poles in such a way that wiring and grounding facilities are concealed within the pole. Furnish a minimum inside diameter raceway of 5 inches throughout the shaft of the pole. Cast all hand-holes, couplings, through-bolt holes, drain holes and ground wires into the pole during the fabrication process. Drilling holes after casting is prohibited.

D. Fabricate all cable entry in accordance with the selected location based on the requirements as determined by the pole foundation and as approved by the Engineer. Size the cable entry holes as required and free of sharp edges for the passage of electrical wiring.

Ensure the correct location of openings and all appurtenances on the spun pole. Ensure any modifications to the pole or the drilled shaft necessary to add or relocate openings or appurtenances due to incorrect fabrication are approved by the Engineer and completed at no cost to the contract.

E. Furnish the spun pole with a specially designed tenon bolted to the top of the pole for the installation of a Camera Lowering Device (CLD) as noted on the plans. See 20SP-826F - Surveillance Systems, Remote Site.

F. Furnish a continuous spun pole as detailed on the plans. Splicing of the pole is

prohibited.

2. Design Specifications. Design poles and concrete skirts in accordance with the *AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals* and *ASTM C1089*.

Design poles to have a deflection not greater than 2.0 inches in a 30 mph continuous wind speed.

3. Identification Plate. The identification plate is to include the casting date, manufacturer, MDOT ID number and pole length. Ensure the identification plate is cast into the pole and connected in such a way that it cannot be easily removed.

b. Materials.

1. Pre-Stressed Spun Concrete Pole.

A. Concrete. Use concrete per the material requirements of section 1004.02 of the Standard Specifications for Construction and ensure maximum size of coarse aggregate is not greater than 3/4 the clear spacing between reinforcing steel and/or the surface of the pole. Ensure freeze-thaw dilation of coarse aggregate does not exceed 0.030 percent per 100 cycles. Type III cement is not permitted.

B. Reinforcing Steel. Use prestressing strands and steel bar reinforcement per section 905 of the Standard Specifications for Construction as modified by the contract, except Grade 75 steel bar reinforcement is permitted.

C. Spiral Reinforcement. Ensure spiral reinforcement conforms to *AASHTO M336M/M336 for steel wire and welded wire, plain and deformed, for concrete reinforcement*. Ensure welded wire reinforcement is equal to or greater than 0.15 inches in diameter.

D. Structural Steel. Use *ASTM A36/A36M* steel, hot-dip galvanized in accordance with *ASTM A123/A123M*.

E. Hardware. Use stainless steel nuts, bolts, and washers according to *ASTM A320/A320M*.

(1) Furnish and install tamper resistant operational handhole bolts. Ensure bolts are round button head, 6-point star-shaped (6-lobe). Use head diameter of 0.437 inches and 3/4 inch length from head to end of bolt. Ensure full thread with a 1/4 inch-20 size.

F. Electrical Ground. Use a continuous length of *Lightning Protection Institute (LPI) Class II* stranded copper down conductor cast into the pole's wall terminated at the pole top lug to pole base lug. Ensure grounds are *UL/LPI* compliant.

G. Identification Plate. Use aluminum plate 6061-0/6061-T6, 1100 alloy H14, or approved equal.

2. Drilled Shaft Foundation and Concrete Skirt.

A. Concrete. Furnish concrete in accordance with section 718 of the Standard Specifications for Construction.

B. Ensure permanent casing material is as specified in subsection 919.10 of the Standard Specifications for Construction unless otherwise shown on the plans.

C. Non-Structural Flowable Fill. Supply non-structural flowable fill consisting of a mixture of Portland cement, fly ash, sand (2NS) and water. Use materials in accordance with the standard specifications except as modified by this special provision. All non-structural flowable fill is intended to be removable using conventional mechanical excavation methods.

Use either Type I or IA Portland cement in accordance with section 901 of the Standard Specifications for Construction and Class F or C fly ash as specified by *ASTM C618* except there is no limit on loss on ignition.

Produce a mix of cement, fly ash, sand, and water in the following proportions.

Portland Cement	50 pounds per cubic yard (lb/cyd)
Fly Ash	500 lb/cyd
Sand	2850 lb/cyd
Water	approx. 376 lb/cyd (sufficient to produce desired flowability)

D. Rodent Screens. Furnish material in accordance with section 909 of the Standard Specifications for Construction.

Acceptance of the fabricated spun concrete pole will be based on "General Certification" per the *MQAP Manual*.

c. Construction.

1. Fabrication Requirements.

A. The spun pole manufacturer must have at least 5 years of experience designing and fabricating spun cast prestressed concrete poles.

B. Notify the Engineer a minimum of 14 days prior to start of fabrication. Furnish access to the Engineer or his representative for QA inspection. This inspection is not considered a substitute for the manufacturer's QC requirements as stated herein. The need and amount of QA will be determined by the Engineer. The Engineer may witness the following:

- (1) Set-up and strand placement/tensioning;
- (2) Concrete placement;
- (3) Cylinder casting/curing and breaking;
- (4) Sample strand for acceptance testing;

(5) Document progress of work.

C. Compressive strength tests are required for each pole. Furnish a QC manual to the Engineer prior to commencing fabrication.

D. Recess pre-stressing strands on the ends 1.5 inches from the concrete end surface. Fill the recess with non-shrink grout approved by the Engineer. As an alternative, cut pre-stressing strands flush with the ends and seal ends completely with an epoxy approved by the Engineer.

E. Manufacturing Tolerances.

(1) Ensure all dimensional tolerances are in accordance with *ASTM C1089*.

(2) Surface defects on the top bearing surface must not exceed 0.0625 inches per foot.

2. Workmanship. The manufacturer must make adequate tests and inspections to determine that each of the poles furnished is in accordance with this specification. At the request of the Department, the manufacturer must submit a QA report to the Department prior to the shipment of each pole and must include the following minimum information:

A. MDOT job number and MDOT's ID number;

B. Minimum and maximum tip wall thicknesses and steel coverages (to inside and outside) measurements must be made at 3 inches from the tip;

C. Minimum and maximum butt wall thicknesses and steel coverages (to inside and outside) measurements must be made at 3 inches from butt;

D. Condition of pole interior and evidence of exposed rings or reinforcement steel;

E. Proper hole and insert locations and sizes;

F. Evidence of cracking during or after two point handling;

G. Actual manufactured pole weight;

H. Report of any repairs made to the pole;

I. Date of manufacture and inspection(s);

J. Inspector's seal.

3. Testing and Inspection.

A. Workmanship, Finish and Appearance. Furnish a smooth finish free of any fractures, on all surfaces. Ensure the pole is within the tolerances mentioned above.

B. Repairs. Repair the pole, as approved by the Engineer, due to imperfections in manufacturing, handling damage or construction. Repair at no additional payment in

accordance with section 712 of the Standard Specifications for Construction.

C. Ensure repairs are sound, properly finished and cured, and the repaired section is in accordance with this special provision.

D. Possible causes for rejection include, but are not limited to, the following:

- (1) Fractures or cracks in the pole;
- (2) Defects that indicate imperfect proportioning, mixing, and/or forming;
- (3) Honeycombed or open textured surfaces;
- (4) Incorrect location of any couplings, handholes and/or grounding lugs.

E. Quality Assurance. All material and workmanship is subject to inspection, examination and testing for conformance to the requirements of this specification by the Engineer. The inspection, examination, or testing can be done at any time during material procurement, manufacturing, storage periods, transit, or at the pole destination. Inspection, examinations, and tests may be waived by the Engineer, but in no case must this be interpreted as releasing the manufacturer from the manufacturer's responsibilities for delivering poles that meet the requirements of this special provision.

The manufacturer must furnish certified test reports to the Engineer, upon request, showing the results of all of the tests required by this special provision as part of the QC plan. Ensure this is part of the manufacturer's QC plan. Ensure the QC plan is submitted along with the shop drawings for review and approval.

The manufacturer must furnish a General Certification in accordance with the *MQAP Manual* that all spun concrete poles have been inspected to ensure they are true to size, free from defects that may impair their strength and durability, and all other contract requirements are being met.

Failure of the manufacturer to comply with these requirements will be sufficient reason for rejection of any or all poles which do not comply with these specifications.

4. Pole Delivery. Notify the Engineer at least 5 days prior to delivery of the pole to the job site and submit to the Engineer an installation plan including equipment required, traffic control and installation schedule. Do not unload poles until the Engineer has inspected them for damage.

Support the poles while transporting them so their own dead load will not cause them to sag or oscillate.

Ensure the poles are lifted and supported during stockpiling, transporting and installation operations only at the points shown on the shop drawings.

Ensure upon delivery, poles are free of defects and blemishes which would have a detrimental effect on the structure capacity and/or longevity of the pole. Ensure they are smooth, unscarred and in new condition. Ensure poles not meeting these requirements are repaired or replaced by the manufacturer at no additional cost to the contract.

Poles failing to meet strength requirements, poles with circumferential or longitudinal cracks, poles failing to meet manufacturing tolerances or cover requirements, poles with exposed steel and poles with cavities that absorb water will be rejected by the Engineer and must be replaced by the manufacturer at no cost to the contract.

5. Pole Storage. If the pole is to be stored on site for more than 21 days prior to installation, ensure a pole storage plan is submitted to the manufacturer as well as the Engineer and approved by both prior to delivery. Ensure the pole is stored in a way to prevent any defects, including but not limited to the following:

- A. Sagging and oscillation;
- B. Circumferential and longitudinal cracks; and
- C. Blemishes and scarring.

Prior to installation, ensure stored poles are inspected for damage by the Engineer. Damaged poles will be rejected by the Engineer and replaced by the Contractor at no cost to the contract.

6. Drilled Shaft Requirements. Unless directed otherwise by the Engineer, ensure construction of the drilled shaft foundation is in accordance with the details on the plans, section 718 of the Standard Specifications for Construction, and this special provision.

Ensure the drilled shaft installation plan is submitted at the preconstruction meeting. Ensure permanent casings, if required, are advanced ahead of the drilling operation to ensure a quality bond between the shaft and surrounding soils and prevent damage of nearby structures or utilities, if present. A drilled shaft excavation that is uncased may not be left open overnight. If an uncased drilled shaft cannot be completed in one day, ensure excavation is backfilled with flowable fill. Ensure excavated materials removed from shaft excavations is disposed of in accordance with section 205 of the Standard Specifications for Construction. Keep excavated materials away from each open shaft excavation. Ensure surface water is directed away from shaft excavations. Ensure no excavated materials are allowed to enter rivers or drains.

Construct the drilled shaft to support the spun pole. Ensure the timing of shaft construction is coordinated so that the pole can be installed in the fresh shaft concrete. After fulfilling all the requirements for constructing the appropriate foundation and after receiving approval by the Engineer of the installation plan, the Contractor can install the pole. Ensure the spun pole is temporarily supported in the plumb position until the concrete reaches a minimum compressive strength of 2,000 psi. The Contractor must include the proposed means by which they plan to temporarily support the pole in the installation plan for approval by the Engineer. When utilizing temporary supports, connecting, or anchoring to infrastructure is prohibited.

7. Pole Placement. Ensure representatives of CLD manufacturer are in attendance during installation of the first pole. See 20SP-826F - Surveillance System, Remote Site.

Assemble the pole equipment and complete pole wiring and conduit installation on the ground. Coordinate with the Engineer to ensure that all the camera mounting equipment is attached to the pole prior to the pole's installation.

Ensure all pole orientations are approved by the Engineer prior to installation.

Install conduit sweeps inside pole as shown on the plans. Connect longitudinal conduits approaching the pole to the conduit elbow inside of the access panel below grade. Grout around conduit at access hole using a product from the QPL (702.02B) to make a watertight seal.

Ensure the spun pole is electrically bonded by way of a welded connection to the ground rod sub-system.

Ensure the air terminal is installed as indicated on the plans and in 20SP-826A - Grounding, Bonding, Lightning Protection, and Surge Protection for Intelligent Transportation System Equipment. The air terminal will be paid for separately.

8. Flowable Fill. Produce and deliver the non-structural flowable fill at a minimum temperature of 50 °F. Transport mixture to the point of placement in a revolving drum mixer or agitator.

Secure all conduits within the pole to counteract buoyant effect of non-structural flowable fill. Place the material evenly to avoid dislocating conduits.

9. Documentation Required. Submit all documentation required herein to the Engineer both in electronic format and hard copy.

d. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract unit price using the following pay items:

Pay Item	Pay Unit
Spun Conc Pole, Type _____	Each
Drilled Shaft and Conc Skirt, (type).....	Each
Drilled Shaft and Conc Skirt, Add Depth	Foot
Flowable Fill, Spun Pole Fdn	Cubic Yard

1. **Spun Conc Pole, Type __** includes designing, fabricating, furnishing, and installing a spun concrete pole, conduit and wiring, grounding, and mounting miscellaneous hardware cast with the pole.

2. **Drilled Shaft and Conc Skirt, Cased** includes furnishing and installing a 20 foot deep, 48 inch diameter spun concrete pole drilled shaft and concrete skirt. If as a result of the Contractor's construction operations and methods a casing is required, it will be at the Contractor's expense.

Drilled Shaft and Conc Skirt, Uncased includes furnishing and installing a 20 foot deep spun concrete pole drilled shaft and concrete skirt.

3. In the event that the geotechnical data requires a deeper than 20 foot drilled shaft, the portion of the drilled shaft past the 20 foot mark below grade will be paid as **Drilled Shaft and Conc Skirt, Add Depth**. This item includes furnishing the additional depth including multiple mobilizations, reinforcing steel, and permanent steel casings.

4. **Flowable Fill, Spun Pole Fdn** includes supplying and placing flowable fill for the purpose of filling the void of the concrete pole as detailed on the plans.