SECTION 401 -- LIGHTING AND TRAFFIC SIGNAL GENERAL REQUIREMENTS

401.01 -- Description

1. The requirements in this Section apply when the Contractor furnishes and/or installs all or part of the following systems:

   a. Sign lighting system.

   b. Traffic signal system.

   c. Permanent lighting system.

   d. Temporary lighting system.

2. When the pay item listed in the Basis of Payment Subsection of each Section includes the word "Install", then the Department will furnish the item and the Contractor shall install it. If the word "Install" is not in the pay item listed in the Basis of Payment Subsection of each Section, then the Contractor shall furnish the item at no additional cost to the Department and install it.

401.02 -- Material Requirements

1. The Contractor shall, prior to ordering any material, submit to the NDR Construction Division, for approval, 7 copies of a list showing all lighting, sign, and traffic signal items to be used on the project. This list of items shall be known as the "Materials List."

2. All equipment and material must be approved before installation. Once approved, there shall be no substitutions for any of the items on the "Materials List" without a prior written request for a substitution and written approval by the Engineer. The Department shall not be liable for any equipment or materials ordered or purchased by the Contractor before approval.

3. Materials will be checked for compliance with the applicable submittals as required by Table 401.01.

4. The Contractor shall transfer all manufacturer's warranties and guarantees to the Department. All manufacturer's warranty and guarantee documentation and all operation and part manuals shall also be given to the Department.

5. All items shown on the "Materials List" will be checked for compliance with the plans and specifications. Two copies of the reviewed "List", showing approval or disapproval of each specific item, will be returned to the Contractor. If sufficient data is not available to determine compliance, additional data will be requested in the form of catalog cuts, test data, or actual samples.

6. The Contractor shall inform his/her supplier(s) that all items supplied to the project must be suitably stamped, stenciled, tagged, or otherwise marked to allow for easy identification with the descriptive markings, brand names, and catalog numbers shown on the "Materials List" and shop drawings.

7. The Contractor shall furnish samples, upon request, of any item or material to be furnished on the project. Unless destructive testing is required, the sample will be returned.

Table 401.01

Required Submittals					
	Item	**Mfr.'s Model or Cat. No.**	**Shop Drawings**	**Certificate of Compliance**	**Other**
a.	Traffic Signal Pole		X	X	
b.	Light Pole/Tower (Metal)		X	X	
c.	Pole (Wood)				✷
d.	Anchor Bolt		X	X	
e.	Pull Box	X			
f.	Luminaire	X			✷✷
g.	Photo Control	X			
h.	Power Foundation	X	X		
i.	Traffic Signal Controller	X			
j.	Street Lighting Control Cabinet	X			
k.	Signal Head	X			
l.	Ped. Pushbutton and Sign	X			
m.	Signal Mounting	X			
n.	Relay & Cabinet	X			
o.	Disconnect & Cabinet	X			
p.	Vehicle Detector	X			
q.	Vehicle Detector Sealant	X			
r.	Lamp	X			
s.	Electrical Wire and Cable	X			
t.	Conduit	X			
u.	Ground Rod	X			
v.	Mechanical Connector	X			
w.	Fuse Holder	X			
x.	Fuse	X			
y.	Expansion Coupling	X			
z.	Lightning Arrestor	X			
aa.	Recessed Junction Box	X			
bb.	Utility Pedestal	X			
cc.	Breakaway Device	X			
dd.	Grounding Connector	X			
ee.	Permanent Identification Tag	X			
✷	Manufacturer's data describing specie, size, class, and treatment.				
✷✷	Photometric data base diskette in standard IES format.				

8. All materials shall conform to the requirements of Table 401.02.

Table 401.02

Material Requirements	
Item	**Section**
Portland Cement Concrete	1002
Reinforcing Steel	1020
Gray Iron Castings	1051
Zinc Coating on Hardware	1059
Painting	1077
Light Standards	1073
Traffic Signal Standards	1073
Anchor Bolts	1073
Ground Rods	1073
High Mast Towers	1073
Control Centers	1073
Photoelectric Controls	1073
High Mast Luminaires and Lamps	1073
Wall Mounted Luminaires	1073
Electrical Wire and Cable	1073
Miscellaneous Materials	1073

401.03 -- Tests of Systems

1. a. The Contractor shall demonstrate to the Engineer's satisfaction that the complete system is in proper working order before final acceptance. The Contractor shall furnish all equipment and personnel necessary to perform operating circuit and resistance tests at no additional cost to the Department.

b. Each circuit's voltage and current readings shall be taken ahead of the contactor and in the base of the light pole furthest from the source.

c. Data from the above tests shall be furnished to the NDR Lighting Engineer in writing.

d. Resistance to ground shall be measured at random locations for noncurrent-carrying components, and insulation resistance tests shall be conducted when required by the Engineer.

2. The system shall be placed in normal operational mode after satisfactory completion of all required tests. Final acceptance will not be made until the system has operated satisfactorily for a period of not less than 14 days.

401.04 -- Grounding

1. a. All poles, controllers, and control centers shall be properly grounded by means of a copper clad ground rod and copper grounding electrode conductor.

b. Unless indicated otherwise, grounding conductors of 2.94 mm or larger diameter wire shall be stranded.

2. a. All permanent lighting systems shall have a grounding conductor (equipment ground) installed throughout the system. A grounding conductor is usually not required in temporary lighting systems except that in some service areas the servicing electrical utility company may require a grounding conductor be used.

b. The grounding conductor shall be grounded at the control center and bonded to all poles, ground rods, and all non-current carrying components within the system.

c. The grounding conductor shall not be used for a neutral wire in the system and shall be tied to the AC neutral wire only in the controller cabinet or lighting control center.

3. When using a transformer type, breakaway base, the grounding conductor shall be attached to the breakaway base.

401.05 -- General Construction Requirements

1. Electrical Services:

a. In most instances, the electric services for a lighting system will be prearranged with the local utility and their locations shown in the plans. Services not predetermined shall be arranged for by the Contractor.

b. Electrical services for traffic signals will usually be arranged by the Contractor at the approximate location shown in the plans.

c. Electric service locations shown in the plans are subject to changes in order to adapt to field conditions. Changes will be determined by the utility and the Engineer.

2. System Operation:

a. Workable segments of the installation shall be "turned on" and made to operate normally as soon as possible if the road is open to public travel.

b. The NDR Traffic or Lighting Engineer shall be notified at least 2 NDR work days before energizing any electrical system.

c. Electrical systems shall not be put into operation until the NDR Traffic or Lighting Engineer's authorized representative is present.

d. Unenergized circuits may be tested at any time.

e. Operation of the system shall not be construed as an acceptance of the system or any part of the system or as a waiver of any contract provisions.

f. The Contractor shall be fully responsible for proper operation of the system before final acceptance and shall remedy any defects or damages which may occur at no additional cost to the Department.

3. The installation shall be in accordance with the *National Electric Code* and all governing local ordinances and regulations. Roadway lighting and traffic signal systems are not subject to inspection by the state, county, or city electrical inspectors. Area lighting at scale stations and rest areas are subject to this inspection.

4. All work shall be performed by competent tradespersons experienced in their craft and under the supervision of a licensed journeyperson electrician or lineperson. The licensed supervisor shall be on the job site whenever work is being performed. Any portion of the installation which presents an appearance of careless or shoddy work will be rejected.

5. The Contractor shall not attach or connect any equipment to any utility without specific permission from the owner of the facility. The Contractor shall contact the local electrical utility company 3 work days prior to installing any equipment on the utility's poles or requesting final service connections.

6. The Contractor shall replace and restore all plant materials and roadway structures disturbed by trenching, excavating, or backfilling operations. The Contractor shall dispose of all excess excavation and trenching material.

7. The Contractor shall be responsible for any tree trimming required.

8. The Contractor shall not be required to pay for electrical energy consumed by the permanent lighting system or traffic signal system.

9. With the exception of "Safety Lighting Systems", the Contractor shall not be required to pay for electrical energy consumed by temporary lighting systems.

10. The Contractor shall verify the location of all underground utilities as prescribed in the One Call Notification System Act.

401.06 -- Secondary Electrical Connections

1. Cable connections shall only be made in pull boxes, pole bases, luminaries, traffic signal heads, and junction boxes. Connections will not be allowed in earth or in conduit. All connections shall be made in accordance with the cable manufacturer's recommendations and the *National Electric Code*. Submersible, secondary, mechanical connectors meeting ANSI C119.1 are required in all pull boxes, on all detector circuits, and at other locations susceptible to moisture.

2. Cable connections at the control cabinet shall be made at the terminal boards provided for this purpose. All stranded wires inserted under a binder screw shall be equipped with a solderless pressure type spade connector. Only one wire shall be used with each spade connector. No more than 3 spade connectors shall be inserted under the same screw without specific approval of the Engineer. Spade connectors shall not be used on solid wire.

3. Breakaway Connectors:

a. "Breakaway Type" connectors shall be installed in each breakaway pole base as shown in the plans. Line and load sides of the connector shall be identified.

b. The phase conductor(s) shall be fused and shall have the female part of the connector on the line side.

c. The neutral conductor, when such is employed in the circuit, shall not be fused and shall have the female part of the connector on the load side.

4. An antioxidant compound shall be used on all dissimilar metal connections.

5. a. The Engineer may inspect 5 electrical connections at random.

b. If any of the 5 connections are found unacceptable, 10 additional connections shall be selected by the Engineer for inspection. If any of these connections are found unacceptable, the Contractor shall remake all connections on the project at no additional cost to the Department.