

CITY OF WICHITA, KANSAS
SPECIFICATIONS

TRAFFIC SIGNAL INSTALLATION

STATE	PROJECT NO.	YEAR	SHEET NO	TOTAL SHEETS
KANSAS	—	2007	9	19

BY	DATE
REFERENCES NOTED	REFERENCES CHECKED

01. GENERAL

The contractor shall have a licensed journeyman electrician on site while traf-
fic installation work is performed.

The contractor shall notify the appropriate power company prior to any service
connection or attachment to determine the proper type and method of hook-up or
installation. The cost of any initial hook-up charge shall be borne by the con-
tractor. This shall include, but not be limited to, the cost of power supplied
for all testing until the signal installation is accepted.

02. CONDUIT

All conductors shall be run between bases, junction boxes pull boxes, and
service boxes in rigid conduit conforming to the provisions of Section 2 of
these specifications. The size of the conduit used shall be of the size as
shown on the plans.

The ends of all conduit shall be well reamed to removes burrs and rough edges.
Field cuts shall be made square and true so that the ends will butt or come
together for the full diameter thereof. Slip joints or running threads will not
be permitted for coupling conduit. When a standard coupling cannot be used, an
approved threaded union shall be used. The threads on all conduit shall be
pointed with a good quality of lead or rust preventative paint before couplings
are made. All couplings shall be fitted and tightened until the end of the
conduits are brought together. Where coating on conduit has been injured in
handling, or installing, such injured places shall be thoroughly painted with
rust preventative paint.

All conduit ends shall be threaded and capped with standard pipe caps until
wiring is started. When caps are removed, the threaded ends shall be provided
with approved conduit bushings.

Conduit bends, except factory bends, shall have a radius of not less than six
(6) times the inside diameter of the conduit. Where factory bends are not used,
conduit bends shall be made without crimping or flattening, using the longest
radius practicable.

Conduit set in bases shall extend two to three inches (2" to 3") vertically from
the top of the base. A plastic or metal conduit bushing shall be installed on
the end of all conduit terminating within a base. Conduit shall enter through
the sides of a pull box and shall leave the major portion of the box clear.
Conduit entering concrete service and junction boxes shall not extend more than
5" inside of service or junction box as measured along the longitudinal axis of
the conduit. Conduit entering service boxes shall be at least six inches (6")
above the crushed rock bottom of the service hole. Conduit should be sloped to
drain as directed by the Engineer. At all outlets, conduits shall enter from
the direction of the run.

Wherever possible, the conduit shall be installed by trenching. Trenches shall
run in straight lines between pull boxes and bases. The location of the conduit
shall be as shown on the plans, except that where physical obstructions dictate,
the location shall be determined by the Engineer. Conduit shall be installed to
a depth of at least thirty inches (30") below finish grade. This requirement may
be waived by the Engineer where physical conditions or obstructions warrant.

Trenches shall be backfilled with material free of rock and compacted in lifts
by hand tamping or with mechanical tampers to the density noted on the plans.
If a density is not specified on the plans, trench backfill shall be compacted
until, in the opinion of the Engineer, no significant future settlement will
occur.

Existing underground conduit to be incorporated into a new system shall be
cleaned with a mandrel and blown out with compressor air.

Conduit runs shown on the plans are for bidding purposes only, and may be
changed with permission of the Engineer to avoid underground obstructions.

Conduit placed under existing pavement or sidewalk shall be installed by an
approved jacking or drilling method. The existing pavement shall not be
disturbed unless otherwise noted on the plans or approved by the Engineer.
Excessive use of water such that the pavement might be undermined, or the
subgrade softened, will not be permitted.

03. CONCRETE BASE FOR POLES AND CONTROLLER CABINET

Bases for poles and cabinets shall be reinforced concrete as detailed on the
plans. The reinforcing bars shall be free of rust and dirt and shall be of the
size, number and dimensions shown on the plans.

Anchor bolts shall extend uniformly above the finish grade of the concrete base
a height equal to the manufacturer's recommendations (leaving at least three
threads exposed when secured).

The anchor bolt sizes for the pole bases are to be standardized as follows:

- Mast arm lengths 16' through 38'
4 - 1.5" Dia. x 54" long x 6" hook
Bolt Circle = 16"
- Mast arm lengths 39' through 55'
4 - 1.75" Dia. x 84" long x 6" hook
Bolt Circle = 20"

The contractor shall design an anchor bolt assembly which shall be welded to the
rebar cage and the resulting unit inserted in the form for the concrete base.
The unit shall be designed and constructed such that, after insertion in the
form, it can be checked for proper orientation, elevation and verticality.
"Stabbing" of anchor bolts or ground rods will not be permitted.

The location of the bases shall be as shown on the plans. Any variation from
the plan location shall be only with the approval of the Engineer.

Steel traffic signal pole bases shall be constructed in two pours. The initial
concrete placement shall end six inches (6") below finish grade. A six inch (6")
thick, thirty-six inch (36") square concrete cap shall be poured when the pole has
been erected, plumbed, and approved by the Engineer. The top of the base shall
be slightly (1/4" to 1/2") higher than the adjacent curb and gutter,
or finish grade if no curb and gutter. Aluminum pedestal bases shall be con-
structed in one pour as detailed on the plans.

04. WIRING

Wiring shall conform to the appropriate articles of the National Electric Code
or subsequent revisions. The conductors from the terminal block in the con-
troller to the signal base shall be a continuous run. No splices of cable will
be permitted in conduit or outside of junction boxes, service boxes or pole
bases unless otherwise specified in the supplemental specifications, special
provisions, or on the plans for an overhead wiring system. All signal cable
splices shall be made above ground in pole or pedestal bases.

When conductors and cables are pulled into the conduit, all ends shall be taped
to exclude moisture, and shall be so kept until the splices are made or terminal
appliances attached. Ends of spare conductors shall remain taped.

When pulling conductors through conduits, a powdered soapstone, talc or other
approved lubricant shall be used. Cable shall not be taped or bundled together
to be pulled or left in conduit.

Six feet (6') of slack or excess cable, as applicable, shall be left in each
service box for traffic signal cable, and detector lead-in wire.

Two feet (2') of slack or excess cable shall be left in each junction box and at
each termination point.

Excess cable to be uniformly bundled and secured with threaded stud, as
close as possible to top of service boxes and junction boxes.

A. Splices

- Signal conductor cable - Conductors shall be joined by twisting the
conductors. Conductor insulation shall be penciled, trimmed to conical
shape, before applying splice insulation. Splice insulation shall
consist of layers of thermoplastic or neoprene insulation electrical
tape bearing the label of the Underwriters Laboratories, Inc., applied
to a thickness equal to and well lapped over the original insulation,
except that on high voltage splices two layers of rubber tape con-
forming to the requirements at A.S.T.M. designation: D 119 shall be
applied over the conductor before placing the thermoplastic tape. The
splice shall then be well covered with two layers of friction or other
approved tape. At least two feet (2') of slack shall be left for each
cable splice in pedestal and pole bases.

- When terminating ends of cable at all terminal blocks an approved #14
insulated spade terminal shall be properly crimped on end of each
conductor to provide a secure connection.

- Locking spade terminals shall not be used.

B. Wiring Notes

- The Contractor shall furnish and install all loop wire, shielded loop
lead-in wire, power supply cable and traffic signal cable for the
complete operation of the traffic signal.
- One seven conductor cable shall be run from the controller to each
signal pole for pedestrian movement. The following color codes shall
be used:

Red	Don't Walk (Phase 2 or 6)
Green	Walk (Phase 2 or 6)
Orange	Push Button (Phase 2 or 6)
White w/Black	Don't Walk (Phase 4 or 8)
Blue	Walk (Phase 4 or 8)
Black	Push Button (Phase 4 or 8)
White	Common

- One five conductor cable shall be run from the pole base to each
3-section signal head. The following color codes shall be used:

Black	Not Used
White	Common
Red	Red Ball
Green	Green Ball
Orange	Yellow Ball

- One seven conductor cable per conflicting movement shall be run from
the controller to each signal pole. The following color codes shall be
used:

White	Common
Red	Red Ball
Green	Green Ball
Orange	Yellow Ball
Blue	Green Arrow
Black	Yellow Arrow
White w/Black	Street Name Sign (where applicable)

- Each signal head mounted on a signal pole or mast arm shall have one
continuous multi-conductor cable run from the pole base to the signal
head. A five-section signal head (left turn signal) shall have a seven
conductor cable. A three-section signal head (through movement) shall
have a five conductor cable; Pedestrian signal heads shall have a five
conductor cable; Each push-button shall have a two conductor cable.

- A single conductor stranded No. 8 green wire shall carry the equipment
ground from the grounding lug of all signal poles to the controller
cabinet and the power disconnect box.

- One five conductor cable shall be run from the pole base to pedestrian
signal head. The following color codes shall be used:

White	Common (All Phases)
Red	Don't Walk (Phase 2 or 6)
Green	Walk (Phase 2 or 6)
Orange	Don't Walk (Phase 4 or 8)
Black	Walk (Phase 4 or 8)

- Identify cable runs in cabinet.

05. 332 CABINET WIRING AND CABLE IDENTIFICATION

The following is the standard City of Wichita specifications for wiring and
labeling cables in a 332 cabinet and shall be closely followed, any deviation
from these specifications must be approved by the Engineer or his representa-
tive:

A. Cabinet Wiring

- All cables shall have adequate excess cable at their terminations so
there is no tension on the conductors.

- Traffic signal cables shall be five (5) feet in length and
stripped back three (3) feet.

All drain wires to terminate at terminal L of the corresponding
slot.

- Pedestrian signal cables shall be the same as the signal cables
except the push button conductors shall be seven (7) feet in
length to reach the proper terminal point without the use of a
butt splice.

b. Pedestrian Pushbuttons

- EB PEDS. - I-12-D
- NB PEDS. - I-12-J
- WB PEDS. - I-13-D
- SB PEDS. - I-13-J

- Detector feeder cable shall be eight (8) feet in length and
stripped back eight (8) inches.

- If any additional loop or field wire terminations are necessary, their
location will be determined by the Engineer or his representative.

06. MAST ARM AND POLE BASE CABLE IDENTIFICATION

The following is the specification for identifying all cables used in the com-
plete operation of the traffic signals which are located in mast arms and pole
bases.

The through traffic and pedestrian signal cables shall be legibly identified
with the use of Nylon Identification Cable Ties. The marking pad size shall be
1/2 inch x 7/8 inches (i.e., TY-RAP #TY546M). The legend shall be made with a
permanent type marking pen.

The pushbutton cables shall be legibly identified with the use of Nylon Identifi-
cation Cable Ties. The marking pad size shall be 1 inch x 5/16 inches (i.e.,
TY-RAP #TY551M). The legends shall be made with a permanent type marking pen.

A. Mast Arm Traffic and Pedestrian Signal Cable Legends

- Mast Arm Signal Cables

- "L. Turn Sig." - Left Turn Signal
- "Out Bd. Sig." - Farthest Through Traffic Signal from Pole
- "Center Sig." - Next Farthest Through Traffic Signal from Pole
(If Applicable)
- "In Bd. Sig." - Closest Thru Traffic Signal to Pole
- "SOP Sig." - Side of Pole Through Traffic Signal

- Pole Mounted Pedestrian Signals and Pushbuttons

- "Ped. Sig." - Pedestrian Signal
- "Ph.2 P.B." - All Phase 2 Pushbuttons
- "Ph.4 P.B." - All Phase 4 Pushbuttons
- "Ph.6 P.B." - All Phase 6 Pushbuttons
- "Ph.8 P.B." - All Phase 8 Pushbuttons

07. TRAFFIC SIGNAL HEADS

Traffic signal heads mounted on the side of poles or on pedestals shall be
ten feet (10') from the ground to the bottom of the signal head.

Type II side-of-pole pedestrian signal bracket to be mounted on back side of
pole 135' clockwise from mast arm.

Traffic signal heads mounted on mast arms or span wire shall be no less than
sixteen feet (16') and no more than nineteen feet (19') from the pavement to
the bottom of the signal head. In some instances the Engineer may require
signal to be mounted above sixteen feet (16') for better visibility. Under no
circumstances shall the bottom of the signal be more than nineteen feet (19')
above the pavement.

The Engineer shall direct the final positioning of the signal heads. Signal
heads shall not be installed at any intersection until all other signal equip-
ment, including the controller, is in place and ready for operation at that
intersection, except that the signal heads may be mounted if the faces are not
directed toward traffic or if the faces are covered.

08. POLE INSTALLATION

When installed, the traffic signal poles shall be back raked according to the
manufacturer's recommendation to allow for deflection, such that the pole will
be plumb when loaded.

09. LOOP DETECTOR INSTALLATION

The field loop conductor installed in the pavement shall run continuously from
the terminating service box, junction box, or base with no splices permitted.
The field loop conductors shall be spliced to the lead-in cable and the lead-in
cable shall run continuously from the terminating service box, junction box, or
base to the sensing unit, except on multiple loop installations where additional
loop conductors may be spliced to the lead-in cable as directed by the Engineer.

All lengths of loop wires that are not embedded in the pavement shall be twisted
with at least six (6) turns per meter, including lengths in conduits and hand-
holes.

The electrical splice between the loop lead-in cable to the controller and the
loop wire shall be made by the following method:

- Remove all lead-in cable coverings and ground wire, leaving
four (4) inches of insulated wire exposed.
- Remove the insulation from each conductor of the lead-in cable and
scrape both copper conductors with knife until bright.
- Remove appropriate length of insulation from the ends of the loop wires
and scrape both copper conductors with knife until bright.

Conductors shall be joined by using a #14 butt splice. The two splices
shall be staggered to provide adequate insulation. Each splice shall
be insulated with layers of thermoplastic or neoprene insulation elec-
trical tape bearing the label of the Underwriters Laboratories, Inc.,
applied to a thickness equal to and well lapped over the original
insulation.

The two splices shall then be over-wrapped with layers of thermoplastic or
neoprene insulation as above and then coated thoroughly with a water proof
electrical coating.

The location of each loop shall be marked on the pavement with crayon or spray
paint. The contractor shall obtain the approval of the Engineer prior to
cutting the saw slots.

The saw shall be equipped with a depth gauge and horizontal guide to assure
proper depth and alignment of the slot. The blade used for the saw cut shall
provide a clean, straight, well-defined one-fourth (1/4") wide saw cut without
damage to adjacent areas. The depth of the saw cut shall be 3 1/2 inches
deep. Where the loop changes direction, the saw cuts shall be overlapped
to provide full depth at all corners. Right angle or corners less than 90'
shall not be used.

Before installing the loop wire, the saw cuts shall be checked for the presence
of jagged edges or protrusions. Should these exist, they must be removed. The
slots must be cleaned and dried to remove cutting dust, grit, oil, moisture or
other contaminants. Cleaning shall be achieved by flushing clean with a stream
of water, and following this, the slots should be cleared of water and dried
using oil-free compressed air.

Loop detector conductor shall be installed using a one-eighth (1/8) inch to
three sixteenth (3/16) inch thick wood paddle.

Each loop shall be coiled clockwise (or per manufacturer's recommended practice)
and the beginning conductor stranded in the terminating handle or base with a
symbol "S" to denote start of conductor. Each loop shall be further identified
by phase or function as shown on the project plans, with durable tags, or as
directed by the Engineer.

Each loop spliced to lead-in cable, checked at control cabinet, shall not
measure less than 100 megohms to ground.

Contractor to supply City of Wichita with a typed record of loop inductance and
resistance to ground of each loop measured at cabinet. Provide the date each
loop was checked.

10. COMMUNICATIONS CABLE

A. Cable

Cable used for intersection communication shall be six pair #19 AWG shielded
cable conforming to the requirements of Specification 20-2 of the IMSA.
Shielding shall also conform to IMSA Specifications.

B. Splices General

Communications cable splices shall be made at the communications terminal
block within the signal controller cabinet whenever possible. Other
necessary cable splices shall be made only with approval of the project
engineer in the manner dictated below.

C. Underground Splices

Underground communications cable splices shall be made only within service
boxes or utility manholes using an approved waterproof, re-entenable splice
kit with multiple port and caps if necessary. The splices shall be
staggered heat shrinkable insulated butt splices. The splice kits shall be
filled with an approved non-hardening, waterproof encapsulant.
The enclosure shall be transparent and capable of
being racked in the service box or manhole immediately after filling with
encapsulant. The contractor shall rack all splice kits after filling with
encapsulant.

D. Aerial Splices

Aerial splices shall be made using a terminal block.

J:\Civill\07174\dwg\prop\Trsp1.dwg 11/16/2007 9:57:48 AM

3				
2				
1				
NO.	DATE	REVISIONS	BY	APP'D
KANSAS DEPARTMENT OF TRANSPORTATION BUREAU OF TRAFFIC TRANSPORTATION				
TRAFFIC SIGNAL SPECIFICATION				
9/19				
FHWA APPROVAL	SCALE	APP'D		
DESIGNED	DETAILED	QUANTITIES		
DESIGN CK.	DETAL CK.	QUAN. CK.	DATE:	