Appendix E. Engineering Drawings

(Part 6 of 10)
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NORTHERN INDIANA COMMUTER TRANSPORTATION DISTRICT

WEST LAKE CORRIDOR
MILEPOST 61.38 TO MILEPOST 69.18
DYER TO HAMMOND, INDIANA

PROJECT PLANS

PROJECT MAP
Not to Scale
**Sheet Index**

**General**
1. STGN-01  COVER SHEET
2. STGN-02  SHEET INDEX

**Systems**

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<td>231 - 244</td>
<td>TPHP-23 - TPHP-36</td>
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1. THIS NORTHERN INDIANA COMMUTER TRANSPORTATION DISTRICT (NICTD) "CATENARY DESIGN PACKAGE" IS FOR ELECTRIC TRACTION DISTRIBUTION WORK REQUIRED OVER THE NEW MAINLINE WEST AND BETWEEN MILE POST K-1 TO K-10 K&M AND INTERFACES TO NEW BRIDGES, MAINTENANCE FACILITY, AND LAYOVER FACILITY.

2. THE CONTRACT PLANS OUT THE DESIGN AND DIMENSIONAL REQUIREMENTS FOR THE INSULATED ASSEMBLIES AND COMPONENTS TO BE PURCHASED FOR THE PROPOSED WEST LAKE CORRIDOR SINGLE TRACK. THE CONSTRUCTION OF ASSEMBLIES AND THE INSTALLATION OF MATERIALS ARE THE RESPONSIBILITY OF THE CONTRACTOR. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY THE DRAWINGS AND SPECIFICATIONS. ASSEMBLY DRAWINGS ARE AN ILLUSTRATION OF AVAILABLE, SERVICE PROOF AND COMPONENTS THAT WILL PERFORM THE FUNCTION REQUIRED. WHENEVER AN ARTICLE OR MATERIAL IS DEFINED OR THE NAME OF MANUFACTURER OR VENDOR IS IDENTIFIED, SUCH REFERENCE HAS BEEN MADE FOR THE PURPOSE OF INDICATING THE STANDARDS QUALITY REQUIRED BY NICTD. ALL SUPPLIERS AND MATERIALS SHALL BE SUBJECT TO APPROVAL OF NICTD AND THE MANUFACTURER.

3. ASSEMBLY AND STRUCTURE ALLOCATIONS ILLUSTRATED IN THE PACKAGE REFER TO STANDARD ARRANGEMENT AS DETAILED ON THESE DRAWINGS.

4. THE CONTRACTOR SHALL USE REASONABLE AND ACCEPTABLE INDUSTRY PRACTICES AND CONSTRUCTION PROCEDURES, AND FOLLOW STANDARDS OF MANUFACTURER'S PROCEDURES DURING THE GENERAL INSTALLATION.

5. THE CONTRACTOR SHALL FILL ALL DIMENSIONS NECESSARY FOR CONSTRUCTION PRIOR TO COMPLETION OF FABRICATION AND INSTALLATION.

6. BEFORE COMMENCEMENT OF WORK THE CONTRACTOR SHALL ENSURE THAT THE EXACT SEQUENCE AND PROCEDURE OF THE ACTUAL WORK IS IN ACCORDANCE WITH SPECIFICATIONS.

7. THE CONTRACTOR SHALL ENSURE THAT ALL DRAWINGS ARE COMPLETE AND CORRECT PRIOR TO PREPARATION OF MATERIALS AND START OF CONSTRUCTION.

8. CONSTRUCTION WORK SHALL BE IN ACCORDANCE WITH THE AMERICAN CONCRETE INSTITUTE BUILDING CODE REQUIREMENTS.

9. CONCRETE AND STEEL/CONCRETE INTERFACES SHALL HAVE SEALANT APPLIED IN ACCORDANCE WITH THE ACI MANUAL OF REINFORCED CONCRETE STRUCTURES.

10. REINFORCEMENT DETAILS SHALL CONFORM TO THE REQUIREMENTS OF THE ACI MANUAL OF REINFORCED CONCRETE STRUCTURES.

11. REINFORCING STEEL SHALL CONFORM TO ASTM A615 GRADE 60 UNLESS OTHERWISE NOTED.

12. CONCRETE SHALL DEVELOP A MINIMUM COMPRESSION STRENGTH OF 4000 PSI AFTER 28 DAYS.

13. CONSTRUCTION DETAILS SHALL CONFORM TO THE REQUIREMENTS OF THE ACI MANUAL OF STANDARD PRACTICE FOR DETAILING PRECAST AND Prestressed Concrete Structures.

14. CONCRETE WORK SHALL BE IN ACCORDANCE WITH THE AMERICAN CONCRETE INSTITUTE BUILDING CODE REQUIREMENTS.

15. STEEL CONSTRUCTION DETAILS SHALL BE IN ACCORDANCE WITH THE IPEX MANUAL OF STEEL CONSTRUCTION, ARTISTATION.

16. FIELD CONNECTIONS SHALL BE BOLTED UNLESS OTHERWISE NOTED.

17. TYPICAL WOOD TO STEEL CONNECTIONS SHALL BE IN CONFORMITY WITH THE REQUIREMENTS OF THE ACI MANUAL OF REINFORCED CONCRETE STRUCTURES.

18. FIELD WELDING SHALL CONFORM TO STRUCTURAL WELDING CODE, AWS D1.1, LATEST EDITION.

19. EMBEDDED STEEL WORK SHALL HAVE A MINIMUM CLEAR CONCRETE COVER OF 3".

20. STEEL CONSTRUCTION DETAILS SHALL BE IN ACCORDANCE WITH THE CONTRACT SPECIFICATION.

21. ASSEMBLY NUMBERS ARE DEVELOPED USING A DRAWING NUMBER PREFIX AND NUMBER SUFFIX.

22. EXAMPLE: 401-1 PULL-OFF SINGLE TRACK CANTILEVER ASSEMBLY NUMBERS ARE DEVELOPED USING A DRAWING NUMBER PREFIX AND NUMBER SUFFIX.

23. EXAMPLE: 401-1 PULL-OFF SINGLE TRACK CANTILEVER ASSEMBLY NUMBERS ARE DEVELOPED USING A DRAWING NUMBER PREFIX AND NUMBER SUFFIX.

24. WOOD POLES SPECIFIED FOR NICTD FACILITIES ONLY SHALL BE SOUTHERN YELLOW PINE, CLASS H. ALL WOOD POLES TO BE PRETREATED WITH ARL, CONFORM TO AWPA SPECIFICATION C1 & C4.

25. ALL WOOD POLES TO HAVE VISIBLE MARKERS REPRESENTING THE TOP OF RAIL (T/R) ELEVATION. DRILLING OF HOLES IN POLES SHALL BEGIN FROM THE TOP OF POLE AND SHALL BE REFERENCED TO THE TOP OF RAIL. EXCESS LENGTH OF POLES SHALL BE CUT FROM TOP.

26. ASSEMBLY VISTANDARDS:

1. ASSEMBLY NUMBERS ARE DEVELOPED USING A DRAWING NUMBER PREFIX AND NUMBER SUFFIX.

2. EXAMPLE: 401-1 PULL-OFF SINGLE TRACK CANTILEVER ASSEMBLY NUMBERS ARE DEVELOPED USING A DRAWING NUMBER PREFIX AND NUMBER SUFFIX.

3. COMPONENT/HARDWARE INSTALLATION SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDED PROCEDURES AND THE STANDARD DRAWINGS.
NOTES:

1. SYMBOLS REQUIRED NOT SHOWN HERE MAY BE FOUND ON SPECIFIC DRAWINGS WHERE USED.
PROPOSED SECTIONALIZING PLAN

NOTE 1:
1. NO Feeder Taps Between Feeder Wire and Catenary From Air Break to Substation #2.

2. See Plan of Construction, SYSGN-6 for Substation Locations and Orientation.
<table>
<thead>
<tr>
<th>CONDUCTOR PARTICULARS</th>
<th>UNITS</th>
<th>SIMPLE CATENARY AUTO TENSION</th>
<th>YARD SIMPLE CATENARY FIXED TERMINATION</th>
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<td>235 MCM</td>
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<td>MATERIAL</td>
<td>-</td>
<td>CW/CU COMPOSITE</td>
<td>BZ ALLOY 90</td>
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<td>WEIGHT OF SYSTEM</td>
<td>LB/FT</td>
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<td>CONDUCTOR BREAKING LOAD</td>
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**CONDUCTOR TENSION AT:**

- **0° F NO WIND**
  - LB: 5000

- **120° F NO WIND**
  - LB: 5000

- **0° AT 40 MPH WIND 1/2° RADIAL ICE**
  - LB: 6180

- **-20° F NO ICE**
  - LB: 5850

**CONDUCTOR SAG ON 170° SPAN:**

- **0° F NO WIND**
  - FT: 1.44

- **120° F NO WIND**
  - LB: 5000

- **0° AT 40 MPH WIND 1/2° RADIAL ICE**
  - FT: 1.44

- **-20° F NO ICE**
  - LB: 5850

- **MODULUS OF ELASTICITY**
  - PSI: 1.726-07

- **COEFFICIENT OF LINEAR EXPANSION**
  - °F: 8.45E-06

- **FACTOR OF SAFETY**
  - FT: 3.37

**BASED ON TYPICAL 170 FT SPANS.**
NOTATION OF GENERAL LOADING:

I. GRAVITY LOADS (G)
   Gs = Wt. of Crossarm Assembly (Resultant can be applied directly to the crossarm)
   Gm = Wt. of Messenger wire + Hangers
   Ga = Axial load due to Guy Wire(s)
   Gp = Wt. of Pole
   Gc = Wt. of Contact Wire (can be applied to Messenger)
   Gcat = Wt. of Catenary
   Gx = Radial Load on Midpoint Pole

II. WIND LOADS (W)
   Ws = Wind on Span Wire
   Wc = Wind on Contact Wire
   Wm = Wind on Messenger Wire
   Wc = Load on Contact Wire
   Wm = Load on Messenger Wire
   W = Wind on Pole

III. WIND LOADS (W)
   Ws = Wind on Span Wire
   Wc = Wind on Contact Wire
   Wm = Wind on Messenger Wire
   Wc = Load on Contact Wire
   Wm = Load on Messenger Wire
   W = Wind on Pole

IV. DIMENSIONS (FT)
   D1, D2, D3, ... Dn = Horizontal Dimension
   For Steel Poles or Ground Line for Wood Poles
   (Moment Arm) Refer to Top of Base Plate
   (Moment Arm) Refer to CL of Pole

V. TENSIONS (AT CATenary)
   Tm = Midway (lbs)
   Tc = 5000 lbs.
   Tm = 5000 lbs.
   W = Wind on Pole

NOTES:

1. Wind Load, (W) and Gravity Load of Poles (G) are not included in above table.
2. Wind Pressure (mph)
   Wires and other cylindrical surfaces = 16.4 PSF
   H Shaped Surfaces = 19.68 PSF
   Flat Surfaces = 22.96 PSF
3. Wind Pressure (mph)
   Wires and other cylindrical surfaces = 4.1 PSF
   H Shaped Surfaces = 4.92 PSF
   Flat Surfaces = 5.74 PSF
4. Radial Loads are calculated based on 60°
5. Loads on poles supporting special overhead equipment shall be calculated and designed individually.
6. Live Load Deflection shall not exceed 4 1/2" at Contact Wire Level. This does not include deflection due to 100% of Fatal Load on the Catenary Systems such as (L, R).
7. Additional Wind Load, Radial Load and Gravity Load shall be calculated and added when pole is used to support other facilities.
8. Loads shown or diagram will be those that produce maximum Moments from either 20 MPH Wind, live wire or 0° Ice load, 40 MPH Wind Load Cases.
NOTATION OF GENERAL LOADS:

I. GRAVITY LOADS (G)
   Gx = WT. OF CROSSARM ASSEMBLY (RESULTANT CAN BE APPLIED DIRECTLY TO THE POLE)
   Gm = WT. OF MESSENGER WIRE + HANGERS + ICE
   Gc = WT. OF CONTACT WIRE + ICE
   GC = WT. OF CONTACT WIRE (CAN BE APPLIED TO MESSENGER) + ICE
   GS = WT. OF MIDPOINT GUY/STRAND
   Ga = AXIAL LOAD DUE TO GUY WIRE(S)
   L1, L2, L3,.....Ln = VERTICAL DIMENSION
   D1, D2, D3,....Dn = HORIZONTAL DIMENSION

II. RADIAL LOADS (R)
   Rc = HORIZONTAL COMPONENT DUE TO TENSION IN CONTACT WIRE
   Rm = HORIZONTAL COMPONENT DUE TO TENSION IN MESSENGER WIRE

III. TENSIONS (AT CATENARY)
   Tc = WT. OF CONTACT WIRE
   Tm = WT. OF MESSENGER WIRE
   Ws = WIND ON SPAN WIRE
   Wc = WIND ON CONTACT WIRE
   Wm = WIND ON MESSENGER WIRES
   Wp = WIND ON POLE

IV. DIMENSION (FT)
   1, 1.1, 1.2, 1.3 = VERTICAL DIMENSION
   R = RADIUS OF CURVE
   D = DISTANCE CL POLE TO CL TRACK (FT)
   L = DISTANCE BETWEEN POLES

V. TENSIONS (AT CATENARY)
   Tc = WT. OF CONTACT WIRE
   Tm = WT. OF MESSENGER WIRE
   Ws = WIND ON SPAN WIRE
   Wc = WIND ON CONTACT WIRE
   Wm = WIND ON MESSENGER WIRES
   Wp = WIND ON POLE

VI. OTHER DIMENSIONS/SYMBOLS
   S = SPAN (FT)
   R = RADIUS OF CURVE
   D = DISTANCE CL POLE TO CL TRACK (FT)
   G = DEGREE OF CURVE
   R = RADIUS OF CURVE
   G = DEGREE OF CURVE
   M = MOMENT ARM REFER TO TOP OF BASE PLATE
   L = DISTANCE BETWEEN POLES
   X = AXIAL LOAD DUE TO GUY WIRE(S)

NOTES:
1. WIND LOAD (W), AND GRAVITY LOAD OF POLES (Gx) ARE NOT INCLUDED IN ABOVE TABLE.
2. WIND PRESSURE BEMPI
   WIND RESISTANCE TO WIND IS EXPLAINED IN PRACTICAL EXAMPLES
   WIND PRESSURE ON FLAT SURFACES = 1.60 PSF
   WIND PRESSURE ON H SHAPED SURFACES = 3.0 PSF

3. WIND PRESSURE WINDING WIRE TYPE SURFACES = 4.1 PSF
   OVERHEAD WINDING WIRE = 4.1 PSF
   FLAT SURFACE = 3.0 PSF
   FLAT SURFACE = 5.0 PSF

4. MESSENGER IS ALL NATURAL WITH ICE IN INCHES
5. RADIAL LOADS ARE CALCULATED BASED ON DEGREE OF CURVATURE
6. LOADS ON POLES SUPPORTING SPECIAL OVERHEAD EQUIPMENT SHALL BE CALculated AND DETERMINED INDIVIDUALLY
7. LOADS ON POLES SUPPORTING SPECIAL OVERHEAD EQUIPMENT SHALL BE CALculated AND DETERMINED INDIVIDUALLY
8. ADDITIONAL WIND, RADIAL, LOAD AND GRAVITY LOAD SHALL BE CALculated AND ADDED WHEN POLE IS USED TO SUPPORT OTHER FACILITIES
9. LOADS SHOWN ON DIAGRAMS ARE THOSE THAT PRODUCE MAXIMUM MINTS FROM EITHER WIND, 40 MPH WIND, BASE WIND OR FROM THE ICE LOAD CASES.
PARAMETERS USED TO ESTABLISH DISPLACEMENT

NICTD (NIPPON-SHARYO) PANTOGRAPH PARAMETERS EFFECT AT

16'-3" IN.
19'-0" IN.
24'-8" IN.

1/2 PANOTGRAPH WIDTH EXTREME CONDITIONS
1/2 PANOTGRAPH WIDTH
TOTAL HORIZONTAL DISPLACEMENT
SWAY (independent of car)
PANTOGRAPH TOTAL DISPLACEMENT
ROTATIONAL LATERAL CAR TOTAL DISPLACEMENT
GAGE CROSS-LEVEL LATERAL SHIFT TRACK (CLASS 4)

50% OF 3 DEG. AT 1'-6" T/R
1"
1"
1 1/2"

59.66
43.81
15.85
1.18"

6.63
4.63
2
8.04
6.04
1.5

61.75
43.81
17.94
1.18"

7.7
5.5
2
9.06
7.06
0.5

65.43
43.81
21.62
1.18"

9.27
7.27
2
11.17
9.17
0.5

NOTE:
STRAINS DUE TO UNDER EXTREME CONDITIONS OF DISPLACEMENT BASED ON DATA FURNISHED BY NICTD. (PANT. BY NIPPON SHARYO DWG. NO VO135B13764.)

NOTE:
CLEARANCE ENVELOPE PANTOGRAPH VEHICLE ROLL POINT

NOT FOR CONSTRUCTION
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**NOTES**
1. DETAIL: MISC PARALLEL FEEDER PER PLANS.
2. DETAIL: MISC FEEDER DRAWINGS FOR PLAN.

**OCS PLAN SHEET**
NOT FOR CONSTRUCTION

PLAN STA 3266+25 TO 3280+25
SYSTEM
DYER TO HAMMOND, INDIANA

NOTES
1. INSTALL NICTD PARALLEL FEEDER PER PLANS.
2. INSTALL NICTD FIBER OPTIC LINES PER PLANS.

MISC. ASSEMBLIES AND FEEDERS 2
427-1, 427-2

SUPPORT ASSOCIATION REFERENCE
415-6, 417-2, 422

IN-SPAN ASSEMBLIES
324-12

HANGERS
210-14

TROLLEY WIRE HEIGHT
6"
### Table: Stationing

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<thead>
<tr>
<th>Structure No.</th>
<th>Stationing</th>
<th>Stagger</th>
<th>Face of Pole to Centerline Track</th>
<th>Terminations</th>
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### Notes
- **NOTES**
  - **1.** SHEET-NEAR PARALLEL FEEDER PER PLANS.
  - **2.** SHEET-NORTH POWER DRAINAGE POND.
  - **3.** ALL STATION LOCATIONS FOR Catenary Poles and Piers are approximate. See the Structural Foundation Reference for exact locations.
  - **4.** INSTALL NICTD FIBER OPTIC LINES PER PLANS.
  - **5.** INSTALL NICTD PARALLEL FEEDER PER PLANS.

### Diagram

- **To Muni Bridge**
- **To Hammond Gateway**

- **Installation of Catenary Poles and Pedestals**
- **Support Registration Reference**
- **Foundation Reference**

- **Diagram Details**:
  - **Regional Drainage Pond**
  - **CSXT**

- **System**
  - **WEST LAKE CORRIDOR**
  - **MP WL 61.38 TO WL 69.18**

- **Scale**: 1" = 50'
NOTES

SYSPL-38 SYSTEM PLAN STA 3308+25 TO 3322+25

1. INSTALL NICTD PARALLEL FEEDER PER PLANS.
2. INSTALL NICTD FIBER OPTIC LINES PER PLANS.
3. TO HAMMOND GATEWAY
4. TO MUNSTER/DYER

DRAWN: 7/21/17
CHECKED: 07/21/17
DESIGNED: 6/21/17
ISSUE: AS NOTED
SHT_WL_OCS_PL_106.dgn
FILENAME: SHT_WL_OCS_PL_106.dgn
SHEET: 3308+25 TO 3322+25
SCALE: 1" = 50'

HAGGRY POWER ASSEMBLY
MISC. ASSEMBLIES AND FEEDERS 1
MISC. ASSEMBLIES AND FEEDERS 2
SUPPLIES
SUPPORT, ASSEMBLATION REFERENCE
DOWN SPAN ASSEMBLY
MISC. ASSEMBLIES
TENSIONING HEIGHT
FOUNDATION REFERENCE
FACE REFERENCE
STAGGER
WATER main HEIGHT
HEIGHT OF WIRE TO CENTERLINE TRACK
STATIONING
STRUCTURAL

NOT FOR CONSTRUCTION

OCS PLAN SHEET

NOTES:

1. INSTALL NICTD PARALLEL FEEDER PER PLANS.
2. INSTALL NICTD FIBER OPTIC LINES PER PLANS.
3. INSTALL FEEDER WIRE INSTALL 1000 MCM
4. INSTALL FEEDER WIRE INSTALL 1000 MCM
5. INSTALL FEEDER WIRE INSTALL 1000 MCM

HDR Engineering, Inc.
8550 W Bryn Mawr Ave., Suite 900
Chicago, IL 60631
www.hdrinc.com

CHICAGO, IL

DATE: 07/19/2017
PLOT DATE: 9:02:02 PM

HDR - WEST LAKE CORRIDOR
NORTHERN INDIANA COMMUTER TRANSPORTATION DISTRICT
33 East Highway 12
Chesterton, Indiana 46304

20 OF 248
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**NOTES**

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**NOT FOR CONSTRUCTION**
### Pole Reference

- Foundation Reference
- Down Guy Assembly
- Support Registration Reference
- Trolley Wire Height
- Miscellaneous Assemblies and Feeders 1
- Messenger Wire Height
- Structure No.
- Stationing
- Stagger
- Face of Pole to Centerline Track
- Hangers
- Jumpers
- Termination Height
- In-Span Assemblies
- Miscellaneous Assemblies and Feeders 2

### Notes

1. XXXX
2. XXXX
3. XXXX
4. XXXX

### Image

- OCS Plan Sheet
- Syspl-38 System
- T0 Hammond Gateway
- To Munster/Dyer

### Scale

- 1" = 50'

### Date

- 7/19/2017

### Schematic

- Chesterton, Indiana 46304
- 33 East Highway 12
- Transportation District - Northern Indiana Commuter Transportation District
- NICTD - West Lake Corridor

### Description

- Occupational Safety and Health Administration
- West Lake Corridor
- Plan STA 3378+25 to 3392+25
- System

### Design

- HDR Engineering, Inc.
- Chicago, IL 60631
- 8550 W Bryn Mawr Ave., Suite 900

### Plot Date

- 9:05:19 PM

### Drawing Metadata

- Sht_Wl_OCS_P1_111.dgn
- Filename
- Scale
- Date
- File Created:
- Check:
- Signed:

### Dimensions

- 3384+76
- 3382+76
- 3380+76
- 3378+76
- 3390+76
- 3388+76
- 3386+76

### Notes

- Not for Construction

### System

- West Lake Corridor
- Plan STA 3378+25 to 3392+25
- System

### Scale

- 1" = 50'
NOTES

1. ALL STATION LOCATIONS FOR Catenary Poles and
   Overhead Wire Assemblies are Approximate. See the Structural
   Drawings for Exact Location and Layout.

PLAN STA 3392+25 TO 3406+25

SYSTEM

DYER TO HAMMOND, INDIANA

NICTD - WEST LAKE CORRIDOR - MP WL 61.38 TO WL 69.18

SCALE: 1" = 50'

TO MUNSTER SOUTH

TO HAMMOND GATEWAY

DATE: 7/19/2017

PLOT DATE: 9:05:52 PM

FILENAME: SHT_WL_OCS_PL_112.dgn

DIMENSIONS

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**NOTES:**

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**SOURCE:**

Pole Drawn by HDR

**SCALE:**

1" = 50'
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**NOT FOR CONSTRUCTION**

**NOTES**

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**SCALE:** 1" = 50'

**DATE:** 7/19/2017

**PLOT DATE:** 9:12:05 PM

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**Notes:**

- Syspl-38
- Plan Sta 3518+25 To 3532+25
- Single Track

**Location:** Chesterton, Indiana 46304

**HDR Engineering, Inc.**

- 33 East Highway 12
- Transportation District Northern Indiana Commuter

**www.hdrinc.com**

- Chicago, IL 60631
- 8550 W Bryn Mawr Ave., Suite 900
### Table: OCS Plan Summary

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### Diagram:
- **PLAN STA 3560+25 TO 3574+25**
- **SYSTEM:**
  - **DYER TO HAMMOND, INDIANA**

---

**NOTES:**
1. XXXX
2. XXXX
3. XXXX
4. XXXX

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**HDR Engineering, Inc.**
- Chicago, IL 60631
- 8550 W Bryn Mawr Ave., Suite 900
- www.hdrinc.com
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**Notes**

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- XXX
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**SCALE:** 1" = 50'

**DATE:** 07/21/17

**FILE NAME:** SHT_WL_OCS_PL_130.dgn
NOTES

1. XXXX
2. XXXX
3. XXXX
4. XXXX

Y = YARD
WRA = WASH RUN-AROUND
LO = LAYOVER
MJA = MASTER JUNCTION AND ACCESS
MP = MASTER POINT
RSW = RAIL SYSTEM WALLEY

OCS PLAN SHEET
SYSPL-32
SYSTEM

DRAWN: AS NOTED
CHECKED: 07/21/17
DESCRIPTION: NICTD - WEST LAKE CORRIDOR - MP WL 61.38 TO WL 69.18
DATE: 07/19/2017
PLOT DATE: 07/19/2017
FILENAME: SHT_WL_OCS_PL_132.dgn
DYS PLN SHEET

SHEET

NOT FOR CONSTRUCTION

HDR Engineering, Inc.
Chicago, IL 60631
8550 W Bryn Mawr Ave., Suite 900
TRANSPORTATION DISTRICT
NORTHERN INDIANA COMMUTER
DYER TO HAMMOND, INDIANA

DATE
SHEET

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9 :1 9 :2 8  P M

12.5'
25'
0'

LO1
YP14
XO1
LO3
LO2
TP16
LO4
TP20
YP17
LO1
YP18
LO2
YP19
LO3
YP15
XO2
YP13
YP12

LO4
LO3
LO2
LO1

TP16
TP20
YP17
YP18
LO1
LO2
LO3
LO4

LO1
LO2
LO3
LO4

XO1
YP14
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| VPL1 | Y1 | 10'-9" | 525-40-8 | 416-1 (2), 417-1, 417-2 (2) | 460-1, 460-2 | 400-1 | 509-1 |
| VPL2 | Y1 | 10'-9" | 525-40-8 | 416-1 (2), 417-1, 417-2 (2) | 460-1, 460-2 | 400-1 | 509-1 |
| VPL3 | W | 10'-9" | 525-40-8 | 416-1 (2), 417-1, 417-2 (2) | 460-1, 460-2 | 400-1 | 509-1 |
| VPL4 | W | 10'-9" | 525-40-8 | 416-1 (2), 417-1, 417-2 (2) | 460-1, 460-2 | 400-1 | 509-1 |
| VPL5 | Y1 | 10'-9" | 525-40-8 | 416-1 (2), 417-1, 417-2 (2) | 460-1, 460-2 | 400-1 | 509-1 |
| VPL6 | Y1 | 10'-9" | 525-40-8 | 416-1 (2), 417-1, 417-2 (2) | 460-1, 460-2 | 400-1 | 509-1 |
| VPL7 | Y1 | 10'-9" | 525-40-8 | 416-1 (2), 417-1, 417-2 (2) | 460-1, 460-2 | 400-1 | 509-1 |
| VPL8 | Y1 | 10'-9" | 525-40-8 | 416-1 (2), 417-1, 417-2 (2) | 460-1, 460-2 | 400-1 | 509-1 |

**NOT FOR CONSTRUCTION**

**Sheet 49 of 248**
NOTES:

1. REPLACE CATERANARY ON EB TRACK FROM FIXED TERMINATION AT STRUCTURE 3621+83 (68-22) TO FUTURE SPLICE LOCATION NEAR 3627+18.

2. REPLACE CATENARY ON WB TRACK FROM FIXED TERMINATION AT STRUCTURE 3623+50 (68-23) TO FUTURE SPLICE LOCATION NEAR 3627+18.

3. INSTALL TEMPORARY DOWN GUYS NEAR 68-21 FOR CONSTRUCTION OVERLAP ON EB END.

4. INSTALL TEMPORARY DOWN GUYS NEAR 68-21 FOR CONSTRUCTION OVERLAP ON EB END.

5. SOME STRUCTURES ARE OMITTED FOR CLARITY. SEE REFERENCE DRAWINGS.

SYSTEM:

SYSPL-38 OF SYSPL-38
ADJUSTMENTS TO HANGER LENGTHS

1. FOR NON-STANDARD SYSTEM HEIGHTS

\[ H' = H + \left[ \frac{(A - A_s) - (A - A_r) X}{L} \right] \]

WHERE:
- \( H' \) = ADJUSTED HANGER (in)
- \( H \) = HANGER LENGTH (in)
- \( A \) = STANDARD SYSTEM HEIGHT (in)
- \( A_s \) = STANDARD SYSTEM HEIGHT (in)
- \( A_r \) = ADJUSTED SYSTEM HEIGHT (in)
- \( X \) = DISTANCE TO HANGER (in)
- \( L \) = SPAN LENGTH (in)

2. FOR POINT LOADS

\[ H' = H - \left( \frac{M(X)(L-XP)}{(T*L)} \right) \]

\[ H' = H - \left( \frac{M(XP)(L-XH)}{(T*L)} \right) \]

WHERE:
- \( T \) = TENSION (lb)
- \( L \) = SPAN LENGTH (ft)
- \( XH \) = LOCATION OF HANGER (ft)
- \( XP \) = LOCATION OF POINT LOAD (ft)
- \( M \) = MASS OF POINT LOAD (lb)
- \( H \) = HANGER LENGTH (ft)
- \( H' \) = ADJUSTED HANGER (ft)

HANGER ADJUSTMENT FOR POINT LOADS

\[ H' = H + \left( \frac{(A - A_s) - (A - A_r) X}{L} \right) \]

WHERE:
- \( H' \) = ADJUSTED HANGER (in)
- \( H \) = HANGER LENGTH (in)
- \( A \) = STANDARD SYSTEM HEIGHT (in)
- \( A_s \) = STANDARD SYSTEM HEIGHT (in)
- \( A_r \) = ADJUSTED SYSTEM HEIGHT (in)
- \( X \) = DISTANCE TO HANGER (in)
- \( L \) = SPAN LENGTH (in)
- \( T \) = TENSION (in)
### HANGER LENGTHS - ANCHOR SPAN

**Simple Catenary**

<table>
<thead>
<tr>
<th>SPAN &quot;L&quot; (FT)</th>
<th>NO. OF HANGER</th>
<th>CDS SYSTEM HEIGHT</th>
<th>TROLLEY RISE &quot;R&quot;</th>
<th>HANGER SPACING &quot;L&quot;</th>
<th>HANGER LENGTHS</th>
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<tbody>
<tr>
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<tr>
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<td>2' 10 1/2&quot;</td>
<td>2' 4 1/2&quot;</td>
<td>3' 5 1/2&quot;</td>
</tr>
</tbody>
</table>

**NOTES:**
1. FOR HANGER LENGTH ADJUSTMENTS ON NON-STANDARD SYSTEM HEIGHTS SEE DRAWINGS SYSDT-2.
2. WHEN ADJUSTING HANGER LENGTHS FOR BWA E.D. SPANS, USE L-10' AS THE SPAN LENGTH (L) FOR THE ADJUSTMENT FORMULA CALCULATION.
3. THE TROLLEY WIRE RISE (R) IS USED FOR ALL DEAD END SPANS.
4. WHEN ADJUSTING HANGER LENGTHS FOR BWA D.E. SPANS, USE L-10' AS THE SPAN LENGTH (L) FOR THE ADJUSTMENT FORMULA CALCULATION.
5. P.R. IS THE POINT OF RISE.
6. HANGER LENGTHS ARE MEASURED FROM THE CENTER OF TROLLEY WIRE TO THE CENTER OF MESSNER WIRE.
7. L1 IS THE ASSEMBLY NUMBER EQUALS THE SPAN LENGTH.
### Hanger Lengths - Overlap Spans (Uninsulated)

#### Simple Catenary

<table>
<thead>
<tr>
<th>Span Length (ft)</th>
<th>No. of Hangers</th>
<th>System Height</th>
<th>Hanger Spacing</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td>L1</td>
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<tr>
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<tr>
<td>215</td>
<td>7</td>
<td>3'-0&quot;</td>
<td>3'-0&quot;</td>
</tr>
<tr>
<td>225</td>
<td>6</td>
<td>3'-0&quot;</td>
<td>3'-0&quot;</td>
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<tr>
<td>235</td>
<td>5</td>
<td>3'-0&quot;</td>
<td>3'-0&quot;</td>
</tr>
<tr>
<td>245</td>
<td>4</td>
<td>3'-0&quot;</td>
<td>3'-0&quot;</td>
</tr>
</tbody>
</table>

#### Notes:
1. Hanger lengths are based on overlap spans with 3'-0" system height, added to the normal 3'-0" system height. Standard hanger lengths are shown here.
2. The trolley wire rise (R) is used for all dead-end spans.
3. Hanger lengths are measured from center of trolley wire to center of messenger wire.
4. A rigid anti-torsional hanger is required only where un twisted torque from stranded wires may damage strand insulator.
5. XXX in the assembly number equals the span length.

**Example:**
- Hanger 214: L1-L2-L3-L4
- Hanger 213: L1-L2-L3-L4

---

**Diagram:**
- Overlap Span Hangers
- Anchor Span
- System Height
- Trolley Datum
- Hanger Spacing

---

**References:**
- HDR Engineering, Inc.
- Chicago, IL 60631
- 8550 W Bryn Mawr Ave., Suite 900
- HDR.com
Typical section at station

Typical section at station

C Pole

Feeder

Stagger (Typ.)

9'-0" Min

C Track

Feeder

Stagger (Typ.)

9'-0" Min

Dyer to Hammond, Indiana

NORTHERN INDIANA COMMUTER TRANSPORTATION DISTRICT
33 East Highway 12
Chesterton, Indiana 46304

Syndt-53 System

Syndt-6 System

Station Cantilever System

MJA

MP

L

9'-0" Min

Stagger (Typ.)

3'-0" Min

Typical section at station

Typical section at station
DOUBLE TRACK BEAM WITH WOOD POLES
N.T.S.

DOUBLE TRACK BEAM WITH STEEL POLES
N.T.S.
CAISSON 3'-0" DIA.
FEEDER BUS ACROSS BEAM
FEEDER TRANSITION
9'-0" MIN.
9'-6" MIN.
FEEDER TRANSITION
9'-0" MIN.
9'-6" MIN.
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FEEDER TRANSITION
9'-0" MIN.
9'-6" MIN.
FEEDER TRANSITION
9'-0" MIN.
9'-6" MIN.
FEEDER TRANSITION
9'-0" MIN.
AERIAL SIDE POLE

AERIAL PORTAL

N.T.S

SYSDT-53

SYSTEM

N.T.S

SYSDT-9

SYSDT-53

AERIAL CANTILEVER

NORTHERN INDIANA COMMUTER TRANSPORTATION DISTRICT
33 East Highway 12
Cherlerston, Indiana 46304

DYER TO HAMMOND, INDIANA

NOT FOR CONSTRUCTION
NOTES:

1. SHOP HANGER DESIGN USES DOUBLE INSULATED BONDING WIRE TO ISOLATE BUILDING STEEL FROM RETURN RAIL. THE HANGER STRAND WIRE IS BONDED TO NEGATIVE RAIL RETURN.
NOTES:
1. Heights for messenger and contact wire are given in reference to top of rail at each location.
2. Conductor heights shown are for illustration. For conductor heights at each overlap see catenary layout sheets.
Bill of Material for Assembly 321-1

<table>
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<th>DESCRIPTION</th>
<th>QTY</th>
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<tr>
<td>FLEXIBLE HANGER</td>
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<td>KNUCKLE ASSEMBLY</td>
<td>427-1</td>
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<tr>
<td>CW SPREADER BAR</td>
<td>427-2</td>
</tr>
</tbody>
</table>

NOTES:
1. Section views show relative positions of the contact wire when the contact wires are separated by 3 feet in the horizontal plane.
2. Adjust hanger spacings and lengths as required.
SECTIONALIZING SWITCH AT INSULATED OVERLAP

Chesterton, Indiana 46304

TRANSPORTATION DISTRICT
NORTHERN INDIANA COMMUTER

SINGLE TRACK
NICTD - WEST LAKE CORRIDOR - MP WL 61.38 TO WL 69.18

1000 MCM FEEDER
SECTIONALIZING SWITCH 330

MAINLINE TRACK CL
CATENARY

426-1
453-1
428-1

 syst-53

460-1
449-1
462-1

428-3
453-3
454-1

RSD-18
CHG
DSS
17/07/2017
07/21/17

HDR Engineering, Inc.
8550 W Bryn Mawr Ave., Suite 900
Chicago, IL 60631
www.hdrinc.com
NOTES:
1. FOR THE AMOUNT AND DIRECTION OF STAGGER, REFER TO CANTILEVER CONFIGURATION BASED ON LOADING AND DOES NOT EXPAND AT EACH INDIVIDUAL LOCATION.
2. CONTRACTOR TO ESTABLISH CANTILEVER CONFIGURATION BASED ON LOADING AND DOES NOT EXPAND AT EACH INDIVIDUAL LOCATION.
3. CONTRACTOR TO ESTABLISH CANTILEVER CONFIGURATION BASED ON LOADING AND DOES NOT EXPAND AT EACH INDIVIDUAL LOCATION.
4. STEADY ARM TO BE STRAIGHT OR CURVED TO SUIT LOADING CONDITION AND POLE SET OUT DIMENSIONS AT EACH INDIVIDUAL LOCATION.

LOADING DIAGRAM

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<tr>
<th>MAXIMUM BEARING</th>
<th>MAXIMUM LOADING (LBS)</th>
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BILL OF MATERIAL FOR ASSEMBLY 401-1

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<td>PIPE END INSULATOR</td>
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<td>4</td>
<td>PIPE CLAMP CLIP TYPE</td>
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PULL-OFF SINGLE TRACK CANTILEVER
401-1 (SINGLE STEADY ARM)
1. For the amount and direction of stagger, refer to catenary layout plan.
2. For design system height, refer to catenary layout plan.
3. Contractor to establish cantilever configuration based on loading and pole set out dimension at each individual location.
4. Steady arm to be straight or curved to suit loading condition subject to manufacturer's limitations.

### Bill of Material for Assembly 406-1

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<tr>
<th>Item</th>
<th>Description</th>
<th>Vendor/Cat #</th>
<th>Quantity</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Cantilever Mount Bracket</td>
<td>GOYAL INDS 60032</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Hinge Bracket</td>
<td>GOYAL INDS 60021</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Pipe End Insulator</td>
<td>GOYAL INDS 60032</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Pipe Clamp Clevis Type</td>
<td>GOYAL INDS 60019</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>Pipe to Clevis End Fitting</td>
<td>GOYAL INDS 60019</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>2&quot; Dia. SCH. 40 Galvanized Pipe</td>
<td>GOYAL INDS 60037</td>
<td>AS REQ'D</td>
</tr>
<tr>
<td>9</td>
<td>Messenger Swivel Suspension Clamp</td>
<td>GOYAL INDS 60034</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>Cap - 2&quot; Dia. Pipe</td>
<td>GOYAL INDS 60011</td>
<td>2</td>
</tr>
</tbody>
</table>

**NOTES:**
- For the amount and direction of stagger, refer to catenary layout plan.
- For design system height, refer to catenary layout plan.
- Contractor to establish cantilever configuration based on loading and pole set out dimension at each individual location.
- Steady arm to be straight or curved to suit loading condition subject to manufacturer's limitations.
### Bill of Material for Assembly 410-1

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Vendor/Cat #</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Messenger Dead End</td>
<td>ASSEMBLY 401-1</td>
<td>200</td>
</tr>
<tr>
<td>2</td>
<td>Down Guy</td>
<td>ASSEMBLY 401-1</td>
<td>2</td>
</tr>
<tr>
<td>300</td>
<td>0.613&quot; Dia. Copperweld Wire</td>
<td>-</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>Wire Rope Clips</td>
<td>ASSEMBLY 401-1</td>
<td>5</td>
</tr>
</tbody>
</table>

### Notes:

1. Single Track MEP 5" Dead End, 3 Track Display. Double the Quantities.
2. Add (2) Heavy Pole Bands for Attachment of MEP Down Guy.
3. OMIT Turnbuckle In Messenger Dead End.

### Beam Structure MID-POINT Anchor

- MID-POINT Anchor 410 (Single Track)
- MID-POINT Anchor 440-1
- MID-POINT Anchor 449-1

### Section A

- Beam or Cantilever (Typ)
- Section A

---

**NOT FOR CONSTRUCTION**

**FILE NAME:** SHT_WL_OCS_DT_410.dgn

**DATE:** 7/19/2017

**DRAWN:** JK JeLLMA

**CHECKED:**

**Designed:** HDR Engineering, Inc.

**Check Ed.:**

**Plotted:** 9:28:22 PM

**Plotted Date:**

**Scale:**

**Plotting Info:**

**Design:** MID-DT-02

**Drawing:** MID-DT-02

**Plotted By:**

**Institution:** Northern Indiana Commuter Transportation District

**Address:** 33 East Highway 12

**City:** Chesterton, Indiana 46304

**State:** IN

**ZIP Code:** 46304

**Project:** West Lake Corridor - MP WL 61.38 TO WL 69.18

**System:** Single Track

**Description:** Single Track

**Issue:**

**Drawn By:**

**Checked By:**

**Plotted By:**

**FOR REVIEW ONLY:**

**Date:** 07/19/17

**Document No.:** 74 of 248

---
### BILL OF MATERIAL FOR ASSEMBLIES 416-1, 416-2, 416-3 & 416-6

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>VENDOR/CAT #</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>SUSPENSION INSULATOR</td>
<td>GOYALINDS 90122</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>25</td>
<td>BALL EYE</td>
<td>GOYALINDS 70602</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>26</td>
<td>SUSPENSION CLAMP FOR DUTY WIRE</td>
<td>GOYALINDS 70630</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>27</td>
<td>SUSPENSION CABLE ASSEMBLY</td>
<td>GOYALINDS 70626</td>
<td>1 2 0 0</td>
</tr>
<tr>
<td>28</td>
<td>SOCKET CONNECTOR</td>
<td>GOYALINDS 90123</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>29</td>
<td>SUSPENSION CLAMP</td>
<td>GOYALINDS 70604</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>40</td>
<td>SINGLE EYE SUPPORT SPANK CLAMP (3 1/2-5)</td>
<td>GOYALINDS 70605</td>
<td>1 2 0 0</td>
</tr>
<tr>
<td>41</td>
<td>PULLEY AND PULLEY HOUSING ASSEMBLY</td>
<td>GOYALINDS 63130</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>42</td>
<td>ARMOR ROD 60&quot;</td>
<td>GOYALINDS 60124</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>104</td>
<td>SYNTHETIC SUSPENSION INSULATOR NO WEATHER SHIELDS</td>
<td>1 1 1 1</td>
<td></td>
</tr>
<tr>
<td>108</td>
<td>SLIDING CLAMP</td>
<td>GSOAL INDS 501205</td>
<td>1 1 1 1</td>
</tr>
</tbody>
</table>

### NOTES:

1. ARMOR ROD SHOULD BE CENTERED ON ASSEMBLY AT 60°.
# Bill of Material for Assemblies 417-1, 417-2-L & 417-5

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>VENDOR/CAT #</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>Shoulder PBY Bolt</td>
<td>Goyal 90213</td>
<td>2</td>
</tr>
<tr>
<td>21</td>
<td>Stainless Steel Strand</td>
<td>Goyal 90213</td>
<td>1</td>
</tr>
<tr>
<td>25</td>
<td>Strain Insulator</td>
<td>Goyal 90213</td>
<td>3</td>
</tr>
<tr>
<td>26</td>
<td>3/8&quot; Galvanized Steel Strand</td>
<td>Goyal 90213</td>
<td>AS RQ'D</td>
</tr>
<tr>
<td>22</td>
<td>Curved Washer</td>
<td>Goyal 90213</td>
<td>2</td>
</tr>
<tr>
<td>30</td>
<td>Contact Wire Snap Clamp</td>
<td>Goyal 90213</td>
<td>2</td>
</tr>
<tr>
<td>45</td>
<td>Strap Clip</td>
<td>Goyal 90213</td>
<td>1</td>
</tr>
<tr>
<td>159</td>
<td>Registration Arm 1 L/H Fits EC, 4P</td>
<td>Goyal 90213</td>
<td>1</td>
</tr>
<tr>
<td>159</td>
<td>Turnbuckle MA to MA</td>
<td>Goyal 90213</td>
<td>1</td>
</tr>
<tr>
<td>160</td>
<td>Double MA to MA</td>
<td>Goyal 90213</td>
<td>1</td>
</tr>
<tr>
<td>161</td>
<td>Support and Suspension Cable Assembly</td>
<td>Goyal 90213</td>
<td>1</td>
</tr>
<tr>
<td>162</td>
<td>Support and Suspension Cable Assembly</td>
<td>Goyal 90213</td>
<td>1</td>
</tr>
</tbody>
</table>

**NOTE:**
1. Items that are not within the same electrical section should be insulated.
### BILL OF MATERIAL FOR ASSEMBLIES 425-1, 425-2 & 425-3

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>VENDOR/CAT #</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>53</td>
<td>CRIMP SLEEVE FOR FLEXIBLE CABLE</td>
<td>GOYAL INDS 90217</td>
<td>2</td>
</tr>
<tr>
<td>54</td>
<td>&quot; DIA. PHOSPHOR BRONZE GRADE E - FLEXIBLE AS REQ'D</td>
<td>GOYAL INDS 90218</td>
<td>2</td>
</tr>
<tr>
<td>55</td>
<td>CONTACT WIRE CLAMP</td>
<td>GOYAL INDS 90219</td>
<td>1</td>
</tr>
<tr>
<td>56</td>
<td>TERMINAL END</td>
<td>GOYAL INDS 90220</td>
<td>2</td>
</tr>
</tbody>
</table>

### NOTES:
1. HANGER LENGTHS AND MEASUREMENTS ARE FROM CENTER OF WIRE TO CENTER OF NEST.
2. ALL DETAILING FOR HANGERS IN MURAL.
3. REFER TO SHEET OCS-210 FOR PLACEMENT OF HANGERS IN SPANS.

---

### SYSTEM
- **NORTHERN INDIANA COMMUTER TRANSPORTATION DISTRICT**
  - **Dyer to Hammond, Indiana**
  - **HANGERS 425**

---

**DRAWN:** JLD
**CHECKED:**
**DATE:** 07/21/17
**SYSDT-25 OF SYSDT-53**
NOTES
1. HANGER LENGTHS ARE MEASURED FROM THE CENTER OF WIRE TO CENTER OF WIRE.
2. H DESIGNATES NTH HANGER IN THE SPAN.
3. REFER TO DRAWING SYSDET-1 FOR PLACEMENT OF HANGERS IN SPANS.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>VENDOR/CAT #</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>CLAMP FOR 3/8&quot; IDA, MESSENGER</td>
<td>GOYAL INDS 90212</td>
<td>2</td>
</tr>
<tr>
<td>19</td>
<td>COMP ALUM FOR 1/2&quot; IDA, MESSENGER</td>
<td>GOYAL INDS 90214</td>
<td>2</td>
</tr>
<tr>
<td>20</td>
<td>3/8&quot; IDA, ALLOY 80 MCM GROOVED</td>
<td>GOYAL INDS 90217</td>
<td>45</td>
</tr>
<tr>
<td>21</td>
<td>TERMINAL END</td>
<td>GOYAL INDS 90218</td>
<td>2</td>
</tr>
<tr>
<td>22</td>
<td>3/8&quot; IDA, ALLOY 80 MCM GROOVED</td>
<td>GOYAL INDS 90219</td>
<td>1</td>
</tr>
<tr>
<td>23</td>
<td>TROLLEY - MESSENGER WIRE CLAMP</td>
<td>GOYAL INDS 90220</td>
<td>1</td>
</tr>
<tr>
<td>58</td>
<td>TROLLEY WIRE 3/8&quot; IDA, MESSENGER</td>
<td>ALLOY 80 335 MCM GROOVED</td>
<td>1</td>
</tr>
<tr>
<td>59</td>
<td>MINIMUM HANGER ASSEMBLY</td>
<td>ALLOY 80 335 MCM GROOVED</td>
<td>1</td>
</tr>
<tr>
<td>59</td>
<td>SHOP HANGER ASSEMBLY</td>
<td>ALLOY 80 335 MCM GROOVED</td>
<td>1</td>
</tr>
</tbody>
</table>

NOT FOR CONSTRUCTION

SYSDT-27 OF SYSDT-63

HANGERS 426 SYSTEM

DYER TO HAMMOND, INDIANA
BILL OF MATERIAL FOR ASSEMBLIES 427-1 & 427-2

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>VENDOR/CAT</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>CONTACT WIRE CLAMP HOLDER</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>35</td>
<td>CONTACT WIRE SWIVEL CLAMP</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>66</td>
<td>U-BOLT ASSEMBLY</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>78</td>
<td>18&quot; DIA. SCH 40 TUBE</td>
<td>-</td>
<td>1</td>
</tr>
</tbody>
</table>

NOTES:
1. HANGER LENGTHS ARE MEASURED FROM THE CENTER OF WIRE TO CENTER OF WIRE.
2. REFER TO DRAWINGS SYSDT-1 FOR PLACEMENT OF HANGERS IN SPANS.

KNUCKLE ASSEMBLY

CROSS CONTACT SPREADER BAR ASSEMBLY
<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>VENDOR/CAT #</th>
</tr>
</thead>
<tbody>
<tr>
<td>72</td>
<td>TROLLEY CONTRACT CLAMP 500 MCM - 335 MCM CROCHET</td>
<td>GYAAL IN DS 6309</td>
</tr>
<tr>
<td>73</td>
<td>PARALLEL CLAMP (BRONZE)</td>
<td>GYAAL IN DS 6309</td>
</tr>
<tr>
<td>77</td>
<td>72-01 HOOK IND. INSULATED CL. COPER</td>
<td>AS REQ'D</td>
</tr>
</tbody>
</table>

**Diagram**

- **Full Feed Jumper 428-1**
- **Contact Wire**
- **In Running Contact Wire**
- **Out of Running Contact Wire**

- **In Span Jumper 428-2**
- **Contact Wire**
- **Out of Running Contact Wire**
- **In Running Contact Wire**
- **Equalizing Jumper 428-3**
- **Contact Wire**
- **Out of Running Contact Wire**

*NOT FOR CONSTRUCTION*
**BILL OF MATERIAL FOR ASSEMBLIES 429-1, 429-2, 429-3, 429-4, 429-5 & 429-6**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>VENDOR/CAT #</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>74</td>
<td>2&quot; EX. BUS BAR, COPPER</td>
<td></td>
<td>429-1</td>
</tr>
<tr>
<td>75</td>
<td>HORIZONTAL BUS SUPPORT</td>
<td></td>
<td>429-2</td>
</tr>
<tr>
<td>76</td>
<td>STATION POST INSULATOR, PORCELAIN T.G. 300</td>
<td></td>
<td>429-3</td>
</tr>
<tr>
<td>77</td>
<td>7/8&quot; MCM 2 KV INSULATED CABLE</td>
<td></td>
<td>429-4</td>
</tr>
<tr>
<td>78</td>
<td>PORCELAIN CABLE CLAMP</td>
<td></td>
<td>429-5</td>
</tr>
<tr>
<td>79</td>
<td>SLOTTED TYP H 1/2&quot; CHANNELED 1/4&quot; LONG</td>
<td></td>
<td>429-6</td>
</tr>
<tr>
<td>80</td>
<td>1/4&quot; EX. ANCHOR 1/2&quot;</td>
<td></td>
<td>AS REQ'D</td>
</tr>
<tr>
<td>81</td>
<td>5/8&quot; MCM SUPPORT EX. BUS CABLE</td>
<td></td>
<td>AS REQ'D</td>
</tr>
<tr>
<td>82</td>
<td>TAP - BUS BAR TO CABLE BRONZE ALLOY</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>TROLLEY CONTACT CLAMP 500 MCM TO 335 MCM GROOVED</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>83</td>
<td>PARALLEL CLAMP, BRONZE 500 MCM TO 0.613&quot; DIA. CW</td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>

**NOTES:**

1. ALL MATERIAL & HARDWARE NEW UNLESS NOTED OTHERWISE.
2. MOUNTING HARDWARE TO BE PROVIDED AS INCIDENTAL TO ASSEMBLY MATERIALS.
ITEM | DESCRIPTION | VENDOR/CAT # | 431-1 | 431-2 | 431-3 | 431-4
--- | --- | --- | --- | --- | --- | ---
83 | DOUBLE BEAM SECTION INSULATOR | GOYAL INDS 63001 | 1 | - | - | -
84 | COMPRESSION EYE END FOR 6 1/2" DIA MESSENGER | GOYAL INDS 63077 | 2 | 2 | - | 1
85 | CLEVIS/CLEVIS INSULATOR | GOYAL INDS 63080 | 1 | 1 | 1 | 1
86 | DEAD END CLAMP FOR 336.4 MCM GROOVED WIRE | GOYAL INDS 63040-4001 | 1 | - | 2 | 3
87 | EXTENSION LINK | GOYAL INDS 90111 | - | - | 2 | 3
88 | PHILLY STRAN | GOYAL INDS 90222 | R3 R0222 | - | - | -

NOTES:

1. SECTION INSULATORS IN CROSSOVERS SHALL BE INSTALLED AT A POINT EQUAL DISTANCE FROM BOTH ADJACENT TRACKS.
2. ADAPT HANGER SPACING AND LENGTHS TO ACCOMMODATE SECTION INSULATOR.
3. REFER TO LAYOUT PLANS FOR APPLICATION OF RECOMMENDED ASSEMBLY AT EACH LOCATION.
4. FOR WIRE TENSION AND LOADING CONDITION SEE DWG SYSGN-8, SYSGN-10, SYSGEN-11.
5. TROLLEY WIRE END MUST HAVE AT LEAST FULL BREAKING STRENGTH OF THE TROLLEY WIRE.
NOTES:

1. INSTALL SPLICES USING TOOL, CUTS AS PER MANUFACTURE RECOMMENDATION.

2. SPLICES TO BE CHECKED WITH FORC GAGE PRIOR TO ACCEPTANCE FOR MESSENGER WIRE ONLY.

3. SPLICES 436-1 & 436-2

FULL TENSION MESSENGER SPLICE

THE SPLICE SHALL DEVELOP THE FULL BREAKING STRENGTH OF MESSENGER
## BILL OF MATERIAL FOR ASSEMBLIES 440-1, 440-2, 440-3, 440-4 & 440-5

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>VENDOR/CAT #</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>440</td>
<td>POLE BAND, HEAVY DUTY STEEL</td>
<td>GOYAL INDS 90119</td>
<td>1</td>
</tr>
<tr>
<td>440</td>
<td>TIE-RING, BOLT TYPE, 1&quot; NOMINAL</td>
<td>GOYAL INDS 90109</td>
<td>1</td>
</tr>
<tr>
<td>440</td>
<td>TURNBUCKLE, 1&quot; X 18&quot;</td>
<td>GOYAL INDS 63072</td>
<td>1</td>
</tr>
<tr>
<td>440</td>
<td>CLEVIS/CLEVIS INSULATOR</td>
<td>GOYAL INDS 63039</td>
<td>1</td>
</tr>
<tr>
<td>440</td>
<td>DEAD-END CLAMP FOR 336.4 MCM GROOVED WIRE</td>
<td>GOYAL INDS 70002-4001</td>
<td>1</td>
</tr>
<tr>
<td>440</td>
<td>COMPRESSION EYE END FOR 0.613&quot; DIA. MESS</td>
<td>GOYAL INDS 63077</td>
<td>1</td>
</tr>
<tr>
<td>440</td>
<td>EXTENSION LINK</td>
<td>GOYAL INDS 63077</td>
<td>1</td>
</tr>
<tr>
<td>440</td>
<td>3&quot; CONNECTING LINK</td>
<td>GOYAL INDS 90209</td>
<td>2</td>
</tr>
<tr>
<td>440</td>
<td>ANCHOR SHACKLE, BOLT TYPE, 1&quot; NOMINAL</td>
<td>GOYAL INDS 90125</td>
<td>1</td>
</tr>
</tbody>
</table>

### NOTE:
1. Trolley wire dead end must withstand full breaking strength of the trolley wire.
BALANCE WEIGHT PARAMETERS

1. Weight to tension ratio = 3:1
2. Wire to weights travel ratio = 3:1
3. Temperature range = 0°F to 120°F

DIMENSIONS

- F = Free upward movement required
- D = Minimum movement required for 120°F (FTE)
- P = Distance between pulley centers
- G = Gage bracket support centers

CONTRACTOR TO ESTABLISH SETTING UP DIMENSIONS AT VARIOUS TEMPERATURES FOR EACH Location.

NOTES:

1. Trolley wire dead end must withstand full breaking strength of the trolley wire.
2. Anti-sag wire must support the weights under broken wire conditions.
3. Balance weight supports and covers to be developed as an integral assembly using the parameters and dimensions given on the drawings.

BELL OF MATERIAL FOR ASSEMBLY 441-1

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>VENDOR/CAT #</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>84</td>
<td>Compression eye end for 0.613&quot; messenger</td>
<td>GOYAL IND. 63077</td>
<td>1</td>
</tr>
<tr>
<td>85</td>
<td>Clevis/clevis insulator</td>
<td>GOYAL IND. 63039</td>
<td>2</td>
</tr>
<tr>
<td>86</td>
<td>Dead end clamp for 336.4 MCM grooved wire</td>
<td>GOYAL IND. 70002-4001</td>
<td>2</td>
</tr>
<tr>
<td>87</td>
<td>Extension line</td>
<td>GOYAL IND. 62059</td>
<td>1</td>
</tr>
<tr>
<td>88</td>
<td>Turnbuckle 1&quot; x 10&quot; Malleable</td>
<td>GOYAL IND. 62052</td>
<td>2</td>
</tr>
<tr>
<td>89</td>
<td>Yoke plate</td>
<td>GOYAL IND. 62051</td>
<td>1</td>
</tr>
<tr>
<td>90</td>
<td>Counterweight sheave</td>
<td>GOYAL IND. 62075</td>
<td>1</td>
</tr>
<tr>
<td>91</td>
<td>Stainless steel wire rope 6X19</td>
<td>GOYAL IND. 90209</td>
<td>1</td>
</tr>
<tr>
<td>92</td>
<td>Extension link pair</td>
<td>GOYAL IND. 62056</td>
<td>1</td>
</tr>
<tr>
<td>93</td>
<td>Hinge heavy duty</td>
<td>GOYAL IND. 62048</td>
<td>1</td>
</tr>
<tr>
<td>94</td>
<td>Anchor shackle, bolt type, 1' nominal size</td>
<td>GOYAL IND. 62043</td>
<td>1</td>
</tr>
<tr>
<td>95</td>
<td>Weight support rod assembly</td>
<td>GOYAL IND. 62042</td>
<td>1</td>
</tr>
<tr>
<td>96</td>
<td>Counterweight slugs, 2, 50LBS, cast iron</td>
<td>GOYAL IND. 62049</td>
<td>15</td>
</tr>
<tr>
<td>97</td>
<td>Incremental weight, cast iron</td>
<td>GOYAL IND. 62043</td>
<td>AS REQ'd</td>
</tr>
<tr>
<td>98</td>
<td>Globe support</td>
<td>GOYAL IND. 62049</td>
<td>1</td>
</tr>
<tr>
<td>99</td>
<td>Globe support</td>
<td>GOYAL IND. 62043</td>
<td>2</td>
</tr>
<tr>
<td>100</td>
<td>Weight guide bracket</td>
<td>GOYAL IND. 62040</td>
<td>2</td>
</tr>
<tr>
<td>101</td>
<td>Temperature stop</td>
<td>GOYAL IND. 62040</td>
<td>2</td>
</tr>
</tbody>
</table>

TOTALS

- 125 items
- 122 sheets
- 122 pages

Engineer: HDR

Dyer to Hammond, Indiana

WEST LAKE CORRIDOR - MP WL 61.38 TO WL 69.18

NOT FOR CONSTRUCTION

HDR Engineering, Inc.
Chicago, IL 60631
8550 W Bryn Mawr Ave., Suite 900
HDR Engineering, Inc.
Chesterton, Indiana 46304
NOTES:
1. ONE GUY WIRE AND ANCHOR ASSEMBLY IS REQUIRED FOR EACH WIRE TERMINATED.
2. FOR INSTALLATION OF SCREW ANCHORS FOLLOW MANUFACTURER'S RECOMMENDATIONS.
3. FOR LOCATIONS ALONG RETAINING WALLS OR AERIAL STRUCTURES, USE DOWN GUY ASSEMBLY.

BILL OF MATERIAL FOR ASSEMBLIES 449-1 & 449-2

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>VENDOR/CAT #</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>109</td>
<td>SCREW TYPE TIE BACK TENSION ANCHOR</td>
<td>CORAL 3MD 71627</td>
<td>1</td>
</tr>
<tr>
<td>110</td>
<td>ANCHOR EXTENSION</td>
<td>CORAL 3MD 91625</td>
<td>AS REQ'D</td>
</tr>
<tr>
<td>111</td>
<td>THIMBLE EYE ADAPTER FOR SCREW TYPE ANCHOR</td>
<td>CORAL 3MD 91626</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>3/8&quot; WIRE ROPE CLIPS</td>
<td>CORAL 3MD 85026</td>
<td>3</td>
</tr>
<tr>
<td>112</td>
<td>3/8&quot; OVAL STEEL STRAND</td>
<td>GOYAL INDS 85035</td>
<td>AS REQ'D</td>
</tr>
<tr>
<td>113</td>
<td>PREFORM BIG GAP LOAD END</td>
<td>CORAL 3MD 85022</td>
<td>1</td>
</tr>
<tr>
<td>114</td>
<td>THIMBLE FOR 3/8&quot; OVAL STRAND, GALV. STEEL</td>
<td>CORAL 3MD 91627</td>
<td>1</td>
</tr>
<tr>
<td>85</td>
<td>CURVED EYE RGULATOR</td>
<td>CORAL 3MD 91329</td>
<td>1</td>
</tr>
</tbody>
</table>

DESCRIPTION
VENDOR/CAT #

110 SCREW TYPE TIE BACK TENSION ANCHOR CORAL 3MD 71627
110 ANCHOR EXTENSION CORAL 3MD 91625
111 THIMBLE EYE ADAPTER FOR SCREW TYPE ANCHOR CORAL 3MD 91626
12 3/8" WIRE ROPE CLIPS CORAL 3MD 85026
112 3/8" OVAL STEEL STRAND GOYAL INDS 85035
113 PREFORM BIG GAP LOAD END CORAL 3MD 85022
114 THIMBLE FOR 3/8" OVAL STRAND, GALV. STEEL CORAL 3MD 91627
85 CURVED EYE RGULATOR CORAL 3MD 91329

NOT FOR CONSTRUCTION
### Bill of Material for Assembly 452-1

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>VENDOR/CAT #</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>113</td>
<td>LIGHTNING ARRESTER</td>
<td>GOYAL INDS 9202</td>
<td>1</td>
</tr>
<tr>
<td>114</td>
<td>ARRESTER MOUNTING BRACKET</td>
<td>GOYAL INDS 9202</td>
<td>1</td>
</tr>
<tr>
<td>117</td>
<td>LAG SCREWS</td>
<td>GOYAL INDS 9102</td>
<td>2</td>
</tr>
<tr>
<td>128</td>
<td>#2, 2KV INSULATED CABLE HRR-2</td>
<td>CHANCE 9966-3/4</td>
<td>FT</td>
</tr>
<tr>
<td>119</td>
<td>WIRE GUARD</td>
<td>CHANCE 9966-3/4</td>
<td>3</td>
</tr>
<tr>
<td>120</td>
<td>GUARD STRAPS</td>
<td>CHANCE 9966-3/4</td>
<td>3</td>
</tr>
<tr>
<td>121</td>
<td>COPPER COATED STAPES</td>
<td>CHANCE 9696-3/4</td>
<td>40 4020</td>
</tr>
<tr>
<td>122</td>
<td>&quot;X10' COPPER CLAD GROUND ROD</td>
<td>CHANCE 9966-3/4</td>
<td>1</td>
</tr>
<tr>
<td>123</td>
<td>EXOTHERMIC CONNECTION #2 TO GROUND ROD</td>
<td>CHANCE 9696-3/4</td>
<td>1</td>
</tr>
<tr>
<td>124</td>
<td>BRONZE PARALLEL CONNECTOR</td>
<td>GOYAL INDS 91033</td>
<td>1</td>
</tr>
</tbody>
</table>

### Notes:

1. INSTALL GROUND WIRE GUARD TO 8' ABOVE GROUND LINE.
2. SECURE GROUND CABLE WITH COPPER COATED STAPLES 8' C-C MAXIMUM SPACING.
**Bill of Material for Assembly 456-1A**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>VENDOR/CAT #</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>129</td>
<td>Narrow Profile Dead End Arm w/ Eye Nuts</td>
<td>Hughes Bros. 28940-A48</td>
<td>2</td>
</tr>
<tr>
<td>130</td>
<td>Dead End Insulator</td>
<td>Goyal Ind. 90136</td>
<td>2</td>
</tr>
<tr>
<td>131</td>
<td>Dead End Clamp</td>
<td>Reliable 61LD</td>
<td>2</td>
</tr>
<tr>
<td>132</td>
<td>#6 Solid Awg, HD Copper</td>
<td></td>
<td>AS REQ'd</td>
</tr>
<tr>
<td>133</td>
<td>Cable Tap #6 to #6</td>
<td>Hughes Bros. 28940-A48</td>
<td>4</td>
</tr>
<tr>
<td>134</td>
<td>5/8&quot; Double Armig Bolt-HDG</td>
<td>Burndy UCG25R2R</td>
<td>2</td>
</tr>
<tr>
<td>135</td>
<td>5/8&quot; Eye Nut-HDG</td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>

**System**

Signal Power Dead End 456

**Not for Construction**

HDR Engineering, Inc.
Chicago, IL 60631
8550 W Bryn Mawr Ave., Suite 900
### BILL OF MATERIAL FOR ASSEMBLIES 460-1 & 460-2

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>VENDOR/CAT #</th>
<th>QUANTITY 460-1</th>
<th>QUANTITY 460-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>141</td>
<td>SUSPENSION BRACKET</td>
<td>GOYAL IND. 63065</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>142</td>
<td>BALL CLEVIS</td>
<td>GOYAL IND. 63066</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>143</td>
<td>SUSPENSION INSULATOR</td>
<td>GOYAL IND. 90122</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>144</td>
<td>SUSPENSION CLAMP</td>
<td>GOYAL IND. 90162</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>145</td>
<td>HEX HEAD BOLT W/ NUT (8&quot;)</td>
<td>HUGHES BRO. HB612-4</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>146</td>
<td>CURVED WASHERS (4&quot;x8&quot;)</td>
<td>GOYAL IND. 90162</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>147</td>
<td>1/8&quot; NC-12 GA STRUT</td>
<td>B-LINE N255</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>148</td>
<td>1/8&quot; NC-12 GA STRUT</td>
<td>B-LINE N255</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>149</td>
<td>SPRING NUT</td>
<td>B-LINE N255</td>
<td>4</td>
<td>-</td>
</tr>
</tbody>
</table>

**NOTES:**

1. LOCATION OF FEEDER TO BE DETERMINED IN THE FIELD BASED ON NESC CLEARANCES.

2. ADJUST THE HEIGHT OF OTHER NICTD APPURTENANCES AS REQUIRED.

---

**SYSTEM:**

FEEDER SUPPORT 460

**SHEET:**

SHT_WL_OCS_DT_460.dgn

**DATE:**

7/19/2017

**DRAWN:**

**CHECKED:**

**DESIGNED:**

**MATERIALS:**

1000 MCM FEEDER SUPPORT WOOD POLE

**SECTION A**

1000 MCM FEEDER SUPPORT STEEL POLE

**SCALE:**

1/4 = 1'-0"
### Bill of Material for Assemblies 461-1, 461-2 & 461-3

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>VENDOR/CAT #</th>
<th>461-1</th>
<th>461-2</th>
<th>461-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>47</td>
<td>POLE BAND, HEAVY DUTY STEEL</td>
<td>GOYAL IND. 90119</td>
<td>1</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>51</td>
<td>&quot; CONNECTING LINK</td>
<td>GOYAL IND. 90119</td>
<td>1</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>52</td>
<td>TURNBUCKLE, 3&quot; JAW/EYE</td>
<td>GOYAL IND. 90126</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>54</td>
<td>ANCHOR SHACKLE, BOLT TYPE, 1&quot; NOMINAL SIZE</td>
<td>GOYAL IND. 90127</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>55</td>
<td>CLEVIS/CLEVIS INSULATOR</td>
<td>GOYAL IND. 90128</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>56</td>
<td>EXTENSION LINK</td>
<td>GOYAL IND. 90129</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>148</td>
<td>HEAD END CLAMP</td>
<td>GOYAL IND. 90130</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>127</td>
<td>PARALLEL CLAMP</td>
<td>GOYAL IND. 90131</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

" SUPPORT ASSEMBLY | ASSEMBLY 460-1 | 1 | 1 | 1 |
### BILL OF MATERIAL FOR ASSEMBLIES 462-1, 462-2 & 462-3

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>VENDOR/CAT #</th>
<th>462-1</th>
<th>462-2</th>
<th>462-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>81</td>
<td>502 MCM SUPERFLEX BARE CU. CABLE</td>
<td>GOYAL IND. 70608</td>
<td>FT</td>
<td>FT</td>
<td>-</td>
</tr>
<tr>
<td>127</td>
<td>PARALLEL CLAMP</td>
<td>GOYAL IND. 70607</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>73</td>
<td>SUPPORT ARM</td>
<td>ASSEMBLY 180-1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>149</td>
<td>502 MCM 2KV INSULATED CABLE</td>
<td>GOYAL IND. 90248</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>150</td>
<td>CABLE STRAP</td>
<td>GOYAL IND. 70607</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>151</td>
<td>TROLLEY CONTACT CLAMP 500 MCM - 335 MCM GROOVED</td>
<td>GOYAL IND. 70607</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>154</td>
<td>CABLE DROP SUPPORT</td>
<td>GOYAL IND. 70607</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
</tbody>
</table>
### Bill of Material for Assembly 463-1

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>VENDOR/CAT #</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>FEEDER DEAD END</td>
<td>ASSEMBLY 461-2</td>
<td>2</td>
</tr>
<tr>
<td>-</td>
<td>DOWN guy</td>
<td>ASSEMBLY 461-1</td>
<td>2</td>
</tr>
<tr>
<td>-</td>
<td>2X750 MCM, 2KV INSULATED CABLE</td>
<td>-</td>
<td>AS REQ'D</td>
</tr>
<tr>
<td>-</td>
<td>BUS BAR ASSEMBLY</td>
<td>ASSEMBLY 429-4</td>
<td>4</td>
</tr>
<tr>
<td>-</td>
<td>PARALLEL CLAMP</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>-</td>
<td>TAP-BUS TO CABLE</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>-</td>
<td>BUS ANGLE COUPLER</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>-</td>
<td>2&quot; X 2&quot; TRIM BAR, COPPER</td>
<td>-</td>
<td>AS REQ'D</td>
</tr>
</tbody>
</table>

**Section A**

**Feeder Transition**

From Side Pole to Center Pole

OR Side Pole to Side Pole

**Feeder Deadend 463**

**System**

NORTHERN INDIANA COMMUTER TRANSPORTATION DISTRICT

33 East Highway 12

Chesterton, Indiana 46304

DYER TO HAMMOND, INDIANA
T/F T
S
1
1
(F O R  I N S T A L L A T I O N)

NOTES:
1. FOR GENERAL NOTES, ABBREVIATIONS AND SYMBOLS 
   SEE DRAWINGS SYSTEM 1 THROUGH SYSTEM 4.
2. POLE REFERENCE: 500-XX WHERE XX IS POLE LENGTH IN FT.

1. 2. 

SECTION A

3/8" GROUNDING PLATE

W12X79

SECTION B

1'-4 1/2"

RSW

VJC

MP

SYSDT-53

SYSDT-43

SYSTEM

STEEL POLE BWA 500

3/4" PL (TYP)

NOT FOR CONSTRUCTION

SEE DRAWINGS SYSGN-1 THROUGH SYSGN-4.

STEEL POLE

SHEET W L_OCS_DT_500.dgn
### Pole Assembly Table

<table>
<thead>
<tr>
<th>Pole Type</th>
<th>Shaft Size</th>
<th>Base Plate</th>
<th>Welding Dimensions</th>
<th>Allowable Moment</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A</td>
<td>BC</td>
<td>D</td>
<td>(INCHES)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10&quot;</td>
<td>10&quot;</td>
<td>1.5&quot;</td>
</tr>
<tr>
<td>501-1.0X</td>
<td>W10x39</td>
<td>10&quot;</td>
<td>10&quot;</td>
<td>1.5&quot;</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>501-2.0X</td>
<td>W10x49</td>
<td>10&quot;</td>
<td>10&quot;</td>
<td>1.5&quot;</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>501-3.0X</td>
<td>W12x53</td>
<td>10&quot;</td>
<td>10&quot;</td>
<td>1.5&quot;</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>18&quot;</td>
<td>20&quot;</td>
<td>20&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20&quot;</td>
<td>20&quot;</td>
<td>20&quot;</td>
</tr>
</tbody>
</table>

XX denotes length of pole in ft in pole type designation.

### Notations:

1. Welding at the base shall be continuous except as defined in detail 3, along the perimeter of the cross section of the pole.
2. For pole lengths see OCS layout plan and schedule drawing.
3. Any additional holes required by contractor are detailed by contractor, and made by pole manufacturer prior to galvanizing. No field hole drilling allowed.

---

### Scale Notation:

- **W1**: Leg size
- **W2**: Leg size
- **Tb**: Diameter of hole
- **A**: Flange to base plate welding
- **K**: Flange to base plate welding

---

### Design:

- **BASE PLATE**: 18" or 20" with holes.
- **CL POLE**: Width varies depending on length.

---

### Notes:

- **NOTES:**
  - Galvanizing. No field hole drilling allowed.
  - Contractor, and made by pole manufacturer prior to any additional holes required by contractor are detailed by contractor, and made by pole manufacturer prior to galvanizing.

---

### System:

- **STEEL POLE AERIAL 501**
- **NORTHERN INDIANA COMMUTER TRANSPORTATION DISTRICT**
- **DYER TO HAMMOND, INDIANA**

---

### Additional Information:

- **Date of Design**: 7/19/2017
- **Plot Date**: 9:32:42 PM
CATENARY BEAM ASSEMBLY

<table>
<thead>
<tr>
<th>DETAIL</th>
<th>NUMBER PER BEAM ASSEMBLY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA-1</td>
<td>2</td>
<td>LOWER PLATE 6&quot; x 4&quot;</td>
</tr>
<tr>
<td>AA-2</td>
<td>4</td>
<td>ANGLE 25°</td>
</tr>
<tr>
<td>A-1</td>
<td>2</td>
<td>LOWER PLATE 6&quot; x 4&quot;</td>
</tr>
<tr>
<td>A-2</td>
<td>2</td>
<td>UPPER PLATE 6&quot; x 4&quot;</td>
</tr>
<tr>
<td>A-3</td>
<td>4</td>
<td>ANGLE 25° LENGTH 6'-6&quot; WITH NERVOUS PLATE BETWEEN ANGLES</td>
</tr>
<tr>
<td>A-4</td>
<td>2</td>
<td>ANGLE 25° LENGTH 2'-10&quot;</td>
</tr>
<tr>
<td>C1</td>
<td>2</td>
<td>CHANNEL FOR W12 x 65 BEAM, DIAM 6&quot; WITH 1&quot; SPACING BETWEEN HOLES</td>
</tr>
<tr>
<td>24</td>
<td></td>
<td>HEX HEAD BOLT &amp; HEX NUT TYPE 2, BEDGE</td>
</tr>
<tr>
<td>24</td>
<td></td>
<td>HEX WASHER &amp; &quot;X6&quot; X 4&quot; PLATE</td>
</tr>
</tbody>
</table>

SECTION A
ANCHOR ANGLES ASSEMBLY

ANCHOR BOLT 1" DIA. - A449
CAISSON 3/8" THK. X 3'-0" DIA.
ROUND NEATFORM 42" I.D. X 2'-6"

BILL OF MATERIAL

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>UNIT</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLASS &quot;A&quot; CONCRETE</td>
<td>CY</td>
<td>4.71</td>
</tr>
<tr>
<td>DEFORMED STEEL BARS #4</td>
<td>LB</td>
<td>1239</td>
</tr>
<tr>
<td>DEFORMED STEEL BARS #9</td>
<td>LB</td>
<td>850</td>
</tr>
<tr>
<td>CAISSON 3/8&quot; THK. X 3'-0&quot; DIA.</td>
<td>FT</td>
<td>15</td>
</tr>
<tr>
<td>ANCHOR BOLT 1&quot; DIA. - A449</td>
<td>EA</td>
<td>4</td>
</tr>
<tr>
<td>NON-SHRINK GROUT</td>
<td>CY</td>
<td>0.028</td>
</tr>
<tr>
<td>ANCHOR ANGLES ASSEMBLY</td>
<td>EA</td>
<td>1</td>
</tr>
</tbody>
</table>

NOTES:
1. REDUCE NEATFORM DIAMETER TO 36" IN RETAINING WALL SECTIONS.
2. TOP OF FOUNDATION EQUAL TO TOP OF RAIL AT ALL LOCATIONS.
<table>
<thead>
<tr>
<th>FOUNDATION TYPES</th>
<th>REF. POLE TYPE</th>
<th>DIMENSIONS</th>
<th>ANCHOR BOLT DIAMETER</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>522-1</td>
<td>521-1 (W10x39)</td>
<td>18&quot; x 18&quot;</td>
<td>2&quot;</td>
<td>(4) 1-3/4&quot; Ø</td>
</tr>
<tr>
<td>522-2</td>
<td>521-2 (W10x49)</td>
<td>20&quot; x 20&quot;</td>
<td>2 1/4&quot;</td>
<td>(4) 3 1/4&quot; Ø</td>
</tr>
<tr>
<td>522-3</td>
<td>521-3 (W10x53)</td>
<td>20&quot; x 20&quot;</td>
<td>2 1/8&quot;</td>
<td>TBD</td>
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<tr>
<td>522-4</td>
<td>521-4 (W10x72)</td>
<td>24&quot; x 24&quot;</td>
<td>TBD</td>
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</tbody>
</table>

NOTES:

1. ALL ANCHOR BOLTS (THREADED RODS) SHALL HAVE 6 HEX NUTS AND 4 PLAIN WASHERS FOR POLES.
2. ALL ANCHOR BOLTS (THREADED RODS) SHALL HAVE 4 HEX NUTS AND 4 PLAIN WASHERS FOR DOWN GUY ANCHOR.
3. SUPPLY BACKUP PLATES AND BEVEL WASHERS AS REQUIRED.
4. ALL STEEL PLATES AND HARDWARE SHALL BE HOT DIP GALVANIZED.
<table>
<thead>
<tr>
<th>TYPE</th>
<th>DIMENSIONS</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>G23-2.00</td>
<td>3'-0&quot; x 18&quot;</td>
<td>1</td>
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<tr>
<td>G23-2.00</td>
<td>3'-0&quot; x 20&quot;</td>
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<tr>
<td>G23-3.00</td>
<td>3'-0&quot; x 22&quot;</td>
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<tr>
<td>N3 OEA X8</td>
<td>3'-0&quot; x 3&quot;</td>
<td>2</td>
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**BILL OF MATERIAL**

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>UNIT</th>
<th>QTY</th>
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<tbody>
<tr>
<td>CLASS &quot;A&quot; CONCRETE</td>
<td>CY</td>
<td>3.77</td>
</tr>
<tr>
<td>DEFORMED STEEL BARS #4</td>
<td>LB</td>
<td>139.57</td>
</tr>
<tr>
<td>DEFORMED STEEL BARS #9</td>
<td>LB</td>
<td>880.7</td>
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<tr>
<td>CAISSON 3/8&quot; THK. X 3'-0&quot; DIA.</td>
<td>FT</td>
<td>12</td>
</tr>
<tr>
<td>ANCHOR RODS, 3/8&quot; DIA. AA49</td>
<td>EA</td>
<td>4</td>
</tr>
<tr>
<td>NON-SHRINK GROUT</td>
<td>CY</td>
<td>0.028</td>
</tr>
<tr>
<td>ANCHOR ANGLES ASSEMBLY</td>
<td>EA</td>
<td>1</td>
</tr>
<tr>
<td>ROUND NEAT FORM 42&quot;O.D. X 2'-6&quot;</td>
<td>EA</td>
<td>1</td>
</tr>
</tbody>
</table>

**QUANTITIES FOR D = 12'-0" FOUNDATION**

**NOT FOR CONSTRUCTION**

- DATE: 07/21/17
- SHEET: SHT_WL_OCS_DT_523.dgn
- DRAWN: J K J E L L M A
- CHECKED: R S W V J C
- MP: NICTD - WEST LAKE CORRIDOR - WL 61.38 TO WL 69.18
- SYSTEM: OCS FOUNDATIONS
- FOUNDATION TYPE: 3'-0"
- FOUNDATION RET WALL 523
- SERIES OF: SINGLE TRACK
- TRANSPORTATION DISTRICT
- NORTHERN INDIANA COMMUTER TRANSPORTATION DISTRICT
- Dyer to Hammond, Indiana
- 33 East Highway 12
- Chesterton, Indiana 46304
- HDR Engineering, Inc.
- 8550 W Bryn Mawr Ave., Suite 900
- Chicago, IL 60631
- www.hdrinc.com
- DATE: 7/19/2017
- PLOT DATE: 9:34:19 PM

**SECTION A**

- SCALE 1"=1'-0"
- ANCHOR ANGLES DETAIL
- SCALE 1"=1'-0"
- ANCHOR BOLT DETAIL
- SCALE 1"=1'-0"
- ANCHOR BOLT DETAIL
- SCALE 1"=1'-0"
- ANCHOR BOLT DETAIL
- SCALE 1"=1'-0"

**SECTION B**

- SCALE 1"=1'-0"
- ANCHOR ANGLES DETAIL

**NOTICE**

- NOT FOR CONSTRUCTION
- HDR ENGINEERING, INC.
- 33 EAST HIGHWAY 12
- CHESTERTON, INDIANA 46304
- www.hdrinc.com
- CHICAGO, IL 60631
- 8550 W BRYN MAWR AVE., SUITE 900
- HDR ENGINEERING, INC.
- 8550 W BRYN MAWR AVE., SUITE 900
- CHICAGO, IL 60631
- www.hdrinc.com
- CHICAGO, IL 60631
1. POLE REF. = 525-XX

2. ON SLOPING GROUND, HOLE DEPTH IS RELATED TO LOW SIDE OF HOLE. ADJUST VALUES WHERE XX IS POLE LENGTH IN FT. AND YY IS SETTING DEPTH.

3. HOLE DIAMETER TO BE SUFFICIENT TO ALLOW TAMING TO FULL DEPTH OF HOLE WITH POLE IN PLACE.

4. POLE ANCHOR TO BE SET STRAIGHT UPWARD TO APPLICATION OF HORIZONTAL LOAD ON THE POLE AT CANTILEVER LOCATIONS.

5. PRIOR TO TRANSPORTING POLE TO SITE, CONTRACTOR SHALL INSPECT THE SPECIFIC LOCATION AND ADJUST POLE LENGTH TO SUIT THE GROUND PROFILE.

6. POLE ANCHOR IS ONLY USED AT DEADEND AND TERMINATION POLES.

**NOTES:**

- POLE SETTING DIM. (SEE PLANS)
- POLE SETTING DEPTHS (FT)
- POLE REF. = 525-XX
- WHERE XX IS POLE LENGTH IN FT.
14. TRACK CIRCUITS OUTSIDE THE INTERLOCKINGS SHALL BE ELECTRIFIED ENCLOSED
   A) THE MAXIMUM LENGTH OF ELECTRIFIED ENCLOSED TRACK CIRCUIT IS 5000 FEET
      THEREFORE, ENCLOSED CIRCUIT LOCATIONS ARE REQUIRED.

15. THERE ARE TEN QUIET ZONE HIGHWAY GRADE CROSSINGS ON THE WEST LAKE CORRIDOR.
   A) FISHER ST. WILL HAVE A 100' FOOT MEDIAN ON BOTH SIDES OF THE TRACKS.
   B) THE OTHER CROSSINGS WILL HAVE FOUR QUADRANT ENTRANCE/EXIT GATES AND A VEHICLE
      DETECTION LOOP SYSTEM.
   C) APPROACH CIRCUITS SHALL BE DESIGNED TO PROVIDE 20 SECONDS MINIMUM WARNING TIME
      PRIOR TO THE ARRIVAL OF THE TRAIN AT THE CROSSING.
   D) AUDIO FREQUENCY OVERLAY (AFO) TRACK CIRCUITS ARE USED FOR TRAIN DETECTION AND
      ACTIVATION OF THE HIGHWAY GRADE CROSSING DISPLAY. CONTRACTOR SHALL DESIGN ON AFO
      ASSIGNMENT PLAN TO GIVE 20 SECONDS MINIMUM WARNING TIME PRIOR TO THE ARRIVAL
      OF THE TRAIN AT THE CROSSING. 200 SERIES PHASE SHIFT OVERLAY IS NOT COMPATIBLE
      WITH 114 RE ELECTROCODE (5' ORDER HARMONIC).
   E) ALL CROSSINGS WILL HAVE CROSS BUCKS, TRACK SIGNS, GATES, FLASHERS, ELECTRONIC
      BELLS AND HIGHWAY PAVEMENT MARKINGS REQUIRED FOR A COMPLETE CROSSING
      INSTALLATION.
   F) ALL CROSSINGS LOCATIONS SHALL HAVE NEW PRE-WIRED INSTRUMENT HOUSES.
   G) THE MAIN GATE SHALL EXTEND TO 50% OF THE WIDEST LANE BUT SHALL NOT EXCEED 34 FEET.
   H) CARE SHOULD BE EXERCISED TO MAKE CERTAIN THAT GATE ARMS WILL ALWAYS BE
      SAFELY CLEAR OF OVERHEAD OBSTRUCTIONS. GATE MECHANISMS SHALL BE LOCATED SUCH THAT A
      FAILED GATE WILL NOT CONTACT AERIAL, ELECTRICAL WIRES AND CABLES.
   I) GATE MECHANISM SHALL BE GROUNDED.
   J) PEDESTRIAN GATES ARE REQUIRED AT CROSSINGS WITH SIDEWALKS. THE PEDESTRIAN GATE
      SHALL HAVE A SEPARATE MECHANISM FROM THE MAIN GATE.

16. THERE WILL BE PEDESTRIAN CROSSINGS AT THE PROPOSED HAMMOND-GATEWAY PASSENGER
      STATION. WARNING SYSTEMS SHALL INCLUDE ALL SIGNS, PEDESTRIAN GATES, FLASHERS AND
      PAVEMENT MARKINGS. THE ELECTRONIC BELLS SHALL BE SOFT TONE. THE FUNCTION OF THESE
      SYSTEMS IS TO PERMIT SAFE AND EFFICIENT OPERATION OF PASSENGER SERVICE WHILE PROVIDING
      PROTECTION FOR PEDESTRIANS.

17. RUDGE AVE CROSSING PREP-EMPTS THE TRAFFIC SIGNALS AT MANOR AVE.

18. 137' ST CROSSING IS LOCATED WITHIN CP 85.3 INTERLOCKING LIMITS
   A) MINI-POSITION IS USED IN INTERLOCKING LIMITS
   B) INTERLOCKING SIGNAL IS REQUESTED. PERMISSIVE ASPECT ON INTERLOCKING SIGNAL
      SHALL NOT BE DISPLAYED UNTIL CROSSING GATE REPEATER IS SET
   C) WHEN TRAIN MEETS CROSSING DIRECTIIONAL, STICK CIRCUITS MUST BE RELEASED
      BEFORE OPPOSING TRAIN MOVEMENT ACTIVATES CROSSING WARNING DEVICES.

19. NIPSCO POWER WILL BE INSTALLED AT ALL CONTROL POINTS, INTERMEDIATE SIGNAL LOCATIONS
      ELECTROCODE REPEATER LOCATIONS, HIGHWAY GRADE CROSSEINGS AND CROSSING START
      LOCATIONS
   A) THE CONTROL POINTS WILL HAVE A NATURAL GAS GENERATOR FED BY A NIPSCO GAS LINE FOR
      STANDBY POWER.
   B) ALL LOCATIONS WILL HAVE BATTERY CHARGERS AND BATTERIES. THE BATTERIES SHALL BE
      SIZED TO PROVIDE A MINIMUM OF EIGHT HOURS OF STANDBY SERVICE AT MAXIMUM LOAD
      AFTER A POWER FAILURE.

20. FIBER OPTIC CABLE INSTALLATION IN TRACK AREA
   A) 144 STRAND FIBER OPTIC CABLES WILL BE INSTALLED ON BOTH SIDES OF THE TRACKS IN 1 1/4
      INCH DUCT. ONE CABLE WILL HAVE CONNECTIONS TO PASSENGER STATIONS, FOTS HOUSES,
      INTERMEDIATE SIGNAL LOCATIONS, HIGHWAY GRADE CROSSING HOUSES AND THE
      MAINTENANCE STORAGE FACILITY. THE SECOND CABLE WILL BE AN EXPRESS FOR THE ENTIRE
      LENGTH OF THE Corridor.
   B) BOTH CABLES WILL BE BURIED FOUR FEET BELOW THE BOTTOM OF THE TIE IN THE BALLASTED
      TRACK AREA.
   C) MARKING TAPE WILL BE INSTALLED ABOVE ALL BURIED CABLES.
   D) FIBER OPTIC CABLES ON THE GUIDEWAY WILL BE INSTALLED ON BOTH SIDES OF THE TRACKS IN
      1 1/4 INCH DUCT. THE INSTALLATION METHOD IS TO BE DETERMINED.
   E) FIBER OPTIC CABLES ARE TO BE INSTALLED AWAY FROM CATENARY POLES.
   F) TRAIL HOLE JUNCTION BOXES ARE TO BE INSTALLED EVERY 200 FEET.
   G) ALL CABLES MAY BE INSTALLED AERIALLY WHERE INSTALLATION IN DUCT IS NOT
      PRACTICABLE.
   H) BOTH CABLES WILL BE TERMINATED IN THE CP 69.2 FOTS HOUSE.
   I) 144 STRAND FO CABLE WILL BE TERMINATED IN THE HAMMOND/GATEWAY STATION, SOUTH
      HAMMOND STATION, MUNSTER/RIDGE STATION, MUNSTER/DYER STATION, THE MAINTENANCE
      STORAGE FACILITY, AND ALL FIVE FOTS HOUSES.
   J) 2 STRAND FO CABLE WILL BE TERMINATED IN EACH OF THE HIGHWAY GRADE CROSSINGS.
   K) 4 STRAND FO CABLE WILL BE TERMINATED IN EACH OF THE INTERMEDIATE SIGNAL LOCATIONS.
SYMBOLS FOR WAYSIDE SIGNALS

GENERAL

The aspects displayed by a signal, method of control, type of signal, etc. are shown by suitable combination of symbols.

ASPECTS

- GREEN
- YELLOW
- RED
- LUNAR WHITE
- FLASHING

TYPE OF CONTROL

- CONTROLLED
- AUTOMATIC

NOTES

1. Permissive signals shall be shown by means of a number plate, number plate is depicted as a rectangle.
2. Aspect normally displayed: denoted with a heavy line.

GROUND MAST

BRACKET POST

SIGNAL BRIDGE

GROUND MAST

HIGHWAY CROSSING SIGNALS

ONE WAY BOTH WAYS
FLASHING LIGHTS

WAYSIDE HORN

CANTILEVER

TRACK

PEDESTRIAN GATE

AUTOMATIC CROSSING GATES

WITH FLASHING LIGHT SIGNALS

AND BELLS

CANTILEVER W/ GATE ARM

LOOP DETECTORS W/ EXIT GATES
1. CONTRACTOR SHALL VERIFY BLOCK VALIDATION.
**Data Entry**

<table>
<thead>
<tr>
<th><strong>Block Definition</strong></th>
<th><strong>Chaining Station</strong></th>
<th><strong>Block Length</strong></th>
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<tbody>
<tr>
<td>669</td>
<td>849</td>
<td>79.4</td>
</tr>
</tbody>
</table>

**Formulas**

- **Block Length**: 79.4
- **Air Scale (Full Blocks)**: 0.01407599
- **Pass Speed**: 79
- **Pass Exp Met (ft)**: 705
- **Pass Exp Met (m)**: 640
- **Pass Reduce to 40**: 243
- **Pass Reduce to 15**: 243

**Notes:**

1. CONTRACTOR SHALL VERIFY BLOCK VALIDATION.
NOTES:
1. CONTRACTOR SHALL VERIFY BLOCK VALIDATION.
### Block Definition

- **CP 64.8**
- **CP 65.3**

### Chaining Station
- **3492.50**
- **3494.05**

### Aspects
- **_**
- **_**

### Formulas

<table>
<thead>
<tr>
<th>Description</th>
<th>Formula</th>
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</thead>
<tbody>
<tr>
<td>Block Length</td>
<td>105</td>
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<tr>
<td>Air Grade of Block</td>
<td>0.3487</td>
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<tr>
<td>Pass Eq (Full)</td>
<td>1 62</td>
</tr>
<tr>
<td>Pass Eq ( Panic )</td>
<td>1 62</td>
</tr>
<tr>
<td>Pass Barking ( Full)</td>
<td>1 62</td>
</tr>
<tr>
<td>Pass Reduction to 40</td>
<td>0.5</td>
</tr>
<tr>
<td>Pass Reduction to 15</td>
<td>1 00</td>
</tr>
</tbody>
</table>

### Notes:

1. CONTRACTOR SHALL VERIFY BLOCK VALIDATION.
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### Data Entry

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
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<tbody>
<tr>
<td>Block Length</td>
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<tr>
<td>Rise</td>
<td>6</td>
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<tr>
<td>Deflection</td>
<td>3</td>
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<tr>
<td>Air Grade (all blocks)</td>
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<tr>
<td>Pass Speed</td>
<td>79</td>
</tr>
<tr>
<td>Block Start Chaining</td>
<td>35664</td>
</tr>
<tr>
<td>Block Start Elevation</td>
<td>109.1</td>
</tr>
<tr>
<td>Block End</td>
<td>354738</td>
</tr>
</tbody>
</table>

### Formulas

- **Block Length**: \( \text{Block Length} = \text{Block Start Chaining} + \text{Block Start Elevation} \times \text{Rise} \)
- **Air Grade (all blocks)**: \( \text{Air Grade} = \frac{\text{Deflection}}{1000} \times \text{Block Length} \)
- **Pass Speed**: \( \text{Pass Speed} = \frac{\text{Deflection} \times \text{Block Length}}{\text{Block Start Elevation}} \)

### Notes

- **NOT FOR CONSTRUCTION**

### System

- **Location**: Dyer to Hammond, Indiana
- **Scale**: 1/2 inch = 1 foot
- **Date**: 07/21/17
- **Plot Date**: 07/21/17
- **Time**: 9:36:54 PM

### Additional Information

- **NOT FOR CONSTRUCTION**
- **Block Validation North**
- **CP 61.9 to INT SIG 633**
- **System**: NICTD - West Lake Corridor - MP WL 61.38 to WL 69.18

---

**NOTES:**

1. CONTRACTOR SHALL VERIFY BLOCK VALIDATION.
### Data Entry

<table>
<thead>
<tr>
<th>Block Deflection</th>
<th>Chaining Station</th>
<th>Aspects</th>
<th>Block Start</th>
<th>Block End</th>
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<tbody>
<tr>
<td>CP 61.5</td>
<td>3348.11</td>
<td>A</td>
<td>508369</td>
<td>338649</td>
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### Formulas

- **Block Length**: 818
- **Pass Braking (Max)**: 826
- **Pass Braking (Max)**: 826
- **Pass Braking (Max)**: 826
- **Pass Braking (Max)**: 826
- **Pass Braking (Max)**: 826
- **Pass Braking (Max)**: 826

### Notes

1. CONTRACTOR SHALL VERIFY BLOCK VALIDATION.
### Notes:

1. CONTRACTOR SHALL VERIFY BLOCK VALIDATION.
### Data Entry

<table>
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<tbody>
<tr>
<td>Block length</td>
</tr>
<tr>
<td>Am. Grade (1/2 Block)</td>
</tr>
<tr>
<td>Pass Eq. Out (mi)</td>
</tr>
<tr>
<td>Pass Eq. Out (ft)</td>
</tr>
<tr>
<td>Pass &amp; Finish Formula (ft)</td>
</tr>
<tr>
<td>Pass &amp; Finish Formula (ft)</td>
</tr>
<tr>
<td>Pass &amp; Finish Formula (ft)</td>
</tr>
</tbody>
</table>

### Notes:
1. CONTRACTOR SHALL VERIFY BLOCK VALIDATION.
1. CONTRACTOR SHALL VERIFY BLOCK VALIDATION.

NOT FOR CONSTRUCTION

NOTES:

- Speed restriction from 300 to 390 to 330 to 40 MPH.
- Estimated design speed: 40 MPH (not to be exceeded).
- Design for single track signals.
- All killer curves are to be 750 to 2,500.
- Design speed at short curves is 76 MPH.
- Design speed at long curves is 60 MPH.
- Design speed at long curves is 60 MPH.
### Data Entry

<table>
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<tr>
<td>Ave Grade (Full Block)</td>
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<tr>
<td>Pass Eq Dist (All)</td>
<td>205</td>
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<tr>
<td>Pass Brake (All)</td>
<td>610</td>
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<tr>
<td>Pass Rise at 40</td>
<td>420</td>
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<tr>
<td>Pass Rise at 15</td>
<td>420</td>
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</tbody>
</table>

### Formulas

<table>
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<th>Value</th>
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<tbody>
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<td>Pass Eq Dist (All)</td>
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<tr>
<td>Pass Brake (All)</td>
<td>610</td>
</tr>
<tr>
<td>Pass Rise at 40</td>
<td>420</td>
</tr>
<tr>
<td>Pass Rise at 15</td>
<td>420</td>
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</tbody>
</table>

### Notes:

1. CONTRACTOR SHALL VERIFY BLOCK VALIDATION.
NOTES:  
1. CONTRACTOR SHALL VERIFY BLOCK VALIDATION.
### SEC 4: PASSENGER STOP FULL BLOCK

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Driver No.</th>
<th>Block No.</th>
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### SEC 5: PASSENGER REDUCE

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Driver No.</th>
<th>Block No.</th>
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<tbody>
<tr>
<td>7/21/17</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Formulas

- **Block Length**: 819
- **Am. Grade (for Block)**: 0.035
- **Pass. Eq.diff. (mill)**: 500
- **Pass. B. Formula (mill)**: using Originating Inclination
- **Pass. B. Formula (mill)**: using Originating Inclination
- **Pass. B. Formula (mill)**: using Originating Inclination
- **Pass. Reductions**: 15
- **Pass. Reductions**: 10
- **Pass. Reductions**: 5

### Notes:
1. CONTRACTOR SHALL VERIFY BLOCK VALIDATION.
NOTES:

1. CONTRACTOR SHALL VERIFY BLOCK VALIDATION.