

ADDENDUM NO. 3

To the Contract Document and Project Specifications for the

Wayne High School Campus Improvements

Fort Wayne Community Schools (FWCS)

Fort Wayne, Indiana

November 14, 2025

To: All holders of the contract documents for the above project.

The items in this addendum are to become a part of the original documents as if included therein. The remainder of the original contract document is to remain in its entirety. This Addendum modifies the Contract Documents and Specifications as follows:

Part 1 – General Clarifications

Part 2 – Specifications

Part 3 – Construction Drawings/Details

Part 4 – Questions

PART 1 – GENERAL CLARIFICATIONS

PART 2 – SPECIFICATIONS (Replace - See Attached)

1. SECTION 000111 TABLE OF CONTENTS DIVISION 2-35
REVISED: Table of Contents to add division 27 sections
2. SECTION 084313 - ALUMINUM-FRAMED STOREFRONTS
REVISED: Removed section 2.2.D.2.a. Operable Units.
REVISED: Changed section 3.2.A. from "Install glazing as specified in Section 088000 "Glazing."" to "Install glazing as specified in Section 088100 "Security Glass.""
2. SECTION 270500 - BASIC COMMUNICATIONS SYSTEMS REQUIREMENTS
ADD specification section to contract documents.
3. SECTION 270526 - COMMUNICATIONS BONDING
ADD specification section to contract documents.
4. SECTION 270543 - EXTERIOR COMMUNICATION PATHWAYS
ADD specification section to contract documents.
5. SECTION 270553 - IDENTIFICATION FOR COMMUNICATION SYSTEMS
ADD specification section to contract documents.
6. SECTION 271100 - COMMUNICATION EQUIPMENT ROOMS (CER)
ADD specification section to contract documents.
7. SECTION 271300 - BACKBONE CABLING REQUIREMENTS
ADD specification section to contract documents.
8. SECTION 271500 - HORIZONTAL CABLING REQUIREMENTS

ADD specification section to contract documents.

9. SECTION 271710 – TESTING

ADD specification section to contract documents.

10. SECTION 271720 - STRUCTURED CABLING SYSTEM WARRANTY

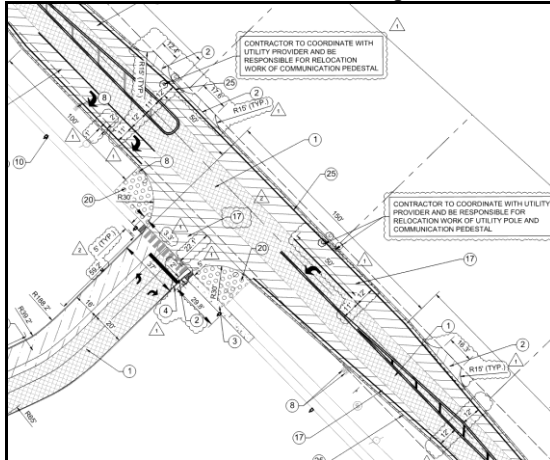
ADD specification section to contract documents.

PART 3 – CONSTRUCTION DRAWING / DETAILS (Replace - See Attached)

1. Plan Sheet C2.5 – Site Dimensional Plan – Zone E

REVISED: Keynote #2 on entrance drive to keynote #17.

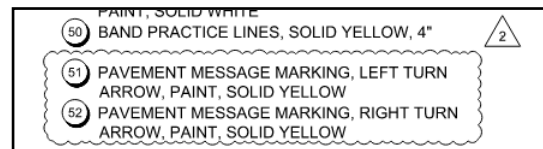
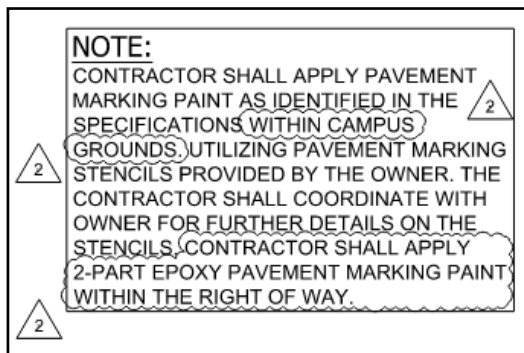
ADDED: Dimension for curb end tapers.



2. Plan Sheet C2.8 – Pavement Marking Plan – Zone A

REVISED: Changed color on keynote #51 and #52 from “white” to “yellow”.

REVISED: Contractor note for pavement markings within the right of way to be 2-part epoxy paint.



3. Plan Sheet C2.9 – Pavement Marking Plan – Zone B

REVISED: Changed color on keynote #51 and #52 from “white” to “yellow”.

REVISED: Contractor note for pavement markings within the right of way to be 2-part epoxy paint.

4. Plan Sheet C2.10 – Pavement Marking Plan – Zone C

REVISED: Changed color on keynote #51 and #52 from “white” to “yellow”.

REVISED: Contractor note for pavement markings within the right of way to be 2-part epoxy paint.

5. Plan Sheet C2.11 – Pavement Marking Plan – Zone D

REVISED: Changed color on keynote #51 and #52 from “white” to “yellow”.

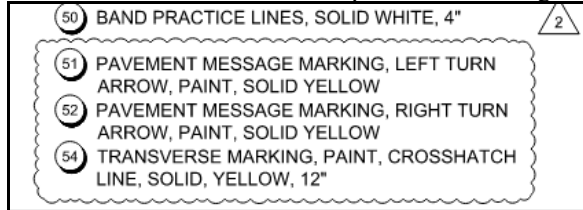
REVISED: Contractor note for pavement markings within the right of way to be 2-part epoxy paint.

6. Plan Sheet C2.12 – Pavement Marking Plan – Zone E

REVISED: Changed color on keynote #51 and #52 from “white” to “yellow”.

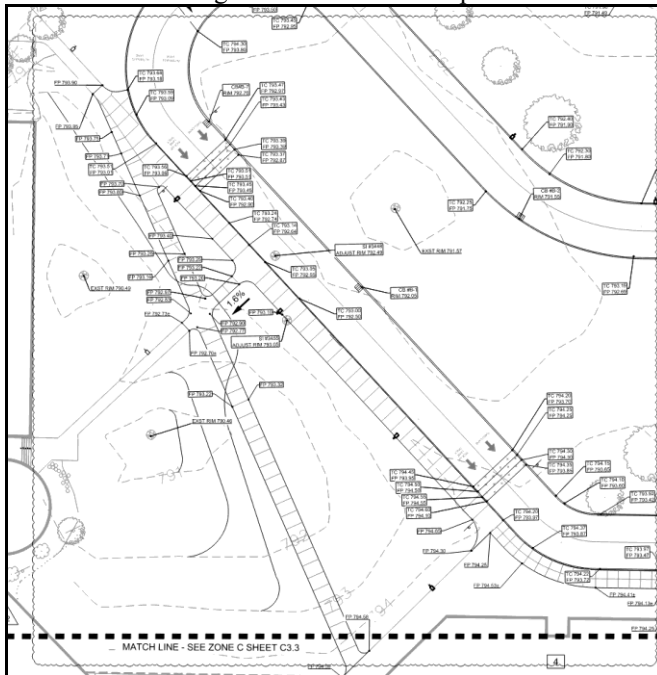
ADDED: Keynote #52 for Winchester Road passing blister transverse marking crosshatch.

REVISED: Contractor note for pavement markings within the right of way to be 2-part epoxy paint.



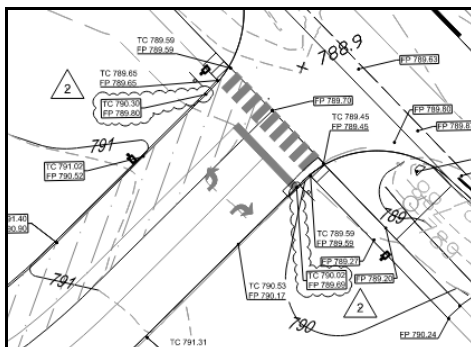
7. Plan Sheet C3.2 – Site Grading Plan – Zone B

REVISED: Existing contours have been updated to reflect accurate existing conditions.



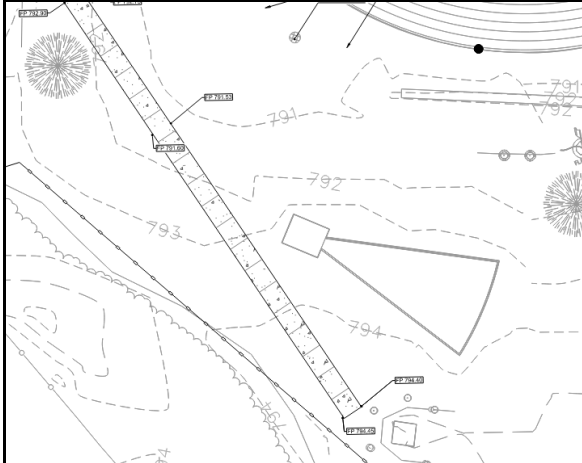
8. Plan Sheet C3.5 – Site Grading Plan – Zone E

ADDED: Spot elevations added at curb end tapers.



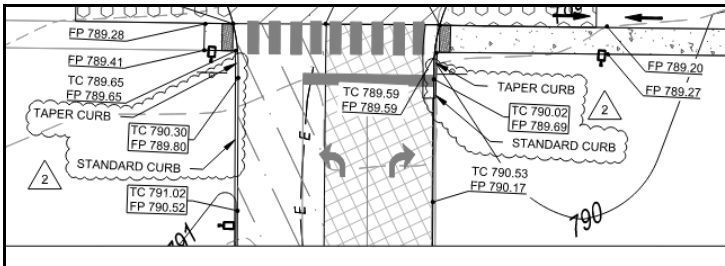
9. Plan Sheet C3.7 – Site Grading Plan – Zone G

REVISED: Existing contours have been updated to reflect accurate existing conditions.



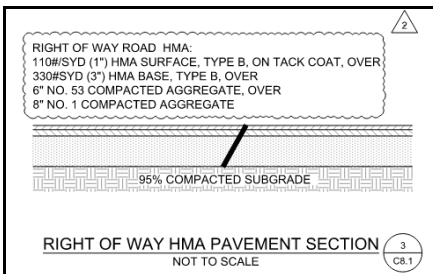
10. Plan Sheet C3.8 – Curb Ramp and Turn Lane Details

ADDED: Spot elevations and curb taper labels added.



11. Plan Sheet C8.1 – Site Details Sheet I

REVISED: Right of way HMA pavement section (3/C8.1) to match Allen County Highway Department standards.



12. T211 - SITE TECHNOLOGY PLAN

UPDATE Technology Site pathways and locations.

DELETE drawing in its entirety and replace with attached revised drawing. See clouded area(s) for floor plan revisions.

13. T211D - SITE TECHNOLOGY PLAN - ZONE D

UPDATE Technology Site pathways and locations.

ADD Handhole.

DELETE drawing in its entirety and replace with attached revised drawing. See clouded area(s) for floor plan revisions.

14. T211F - SITE TECHNOLOGY PLAN - ZONE F

UPDATE Technology Site pathways and locations.

UPDATE Keynote 3.

DELETE drawing in its entirety and replace with attached revised drawing. See clouded area(s) for floor plan revisions.

15. T300 - TECHNOLOGY ENLARGEMENTS

ADD Rack equipment.

UPDATE notes.

DELETE drawing in its entirety and replace with attached revised drawing. See clouded area(s) for floor plan revisions.

16. T400 - TECHNOLOGY DETAILS

ADD Bonding bar detail.

DELETE drawing in its entirety and replace with attached revised drawing. See clouded area(s) for floor plan revisions.

17. T500 - TECHNOLOGY DIAGRAMS

UPDATE riser diagrams.

DELETE drawing in its entirety and replace with attached revised drawing. See clouded area(s) for floor plan revisions.

18. T600 - TECHNOLOGY SCHEDULES

REVISE equipment list.

DELETE drawing in its entirety and replace with attached revised drawing. See clouded area(s) for floor plan revisions.

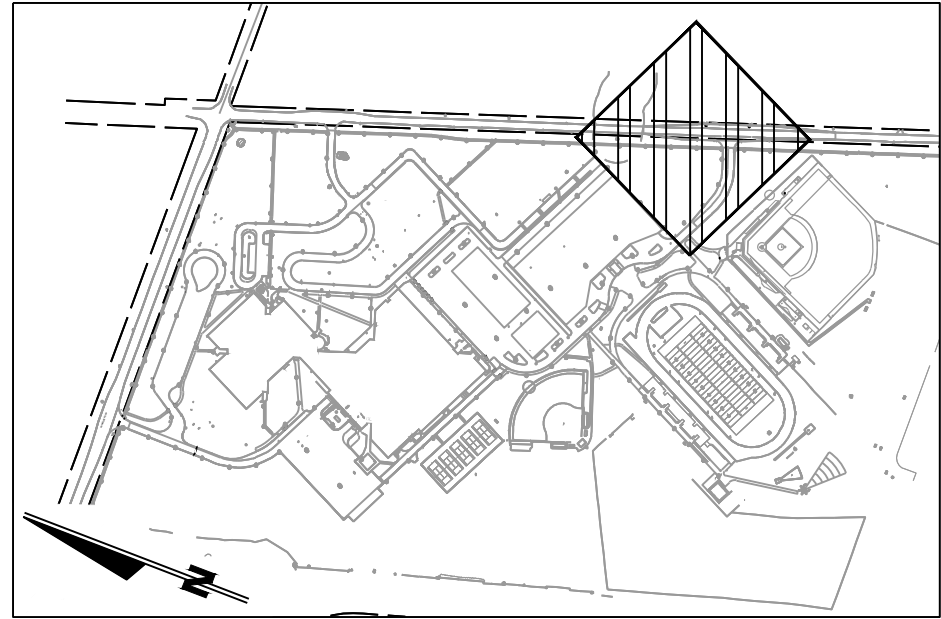
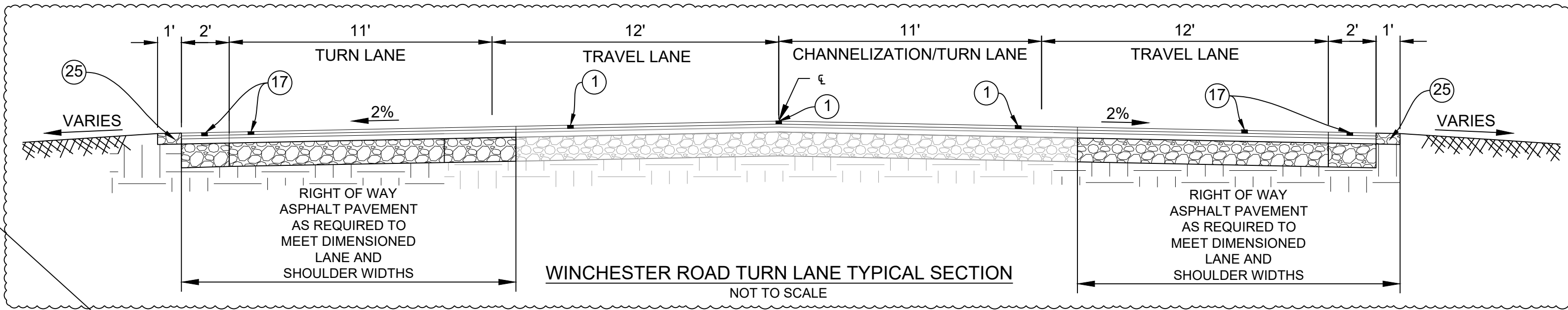
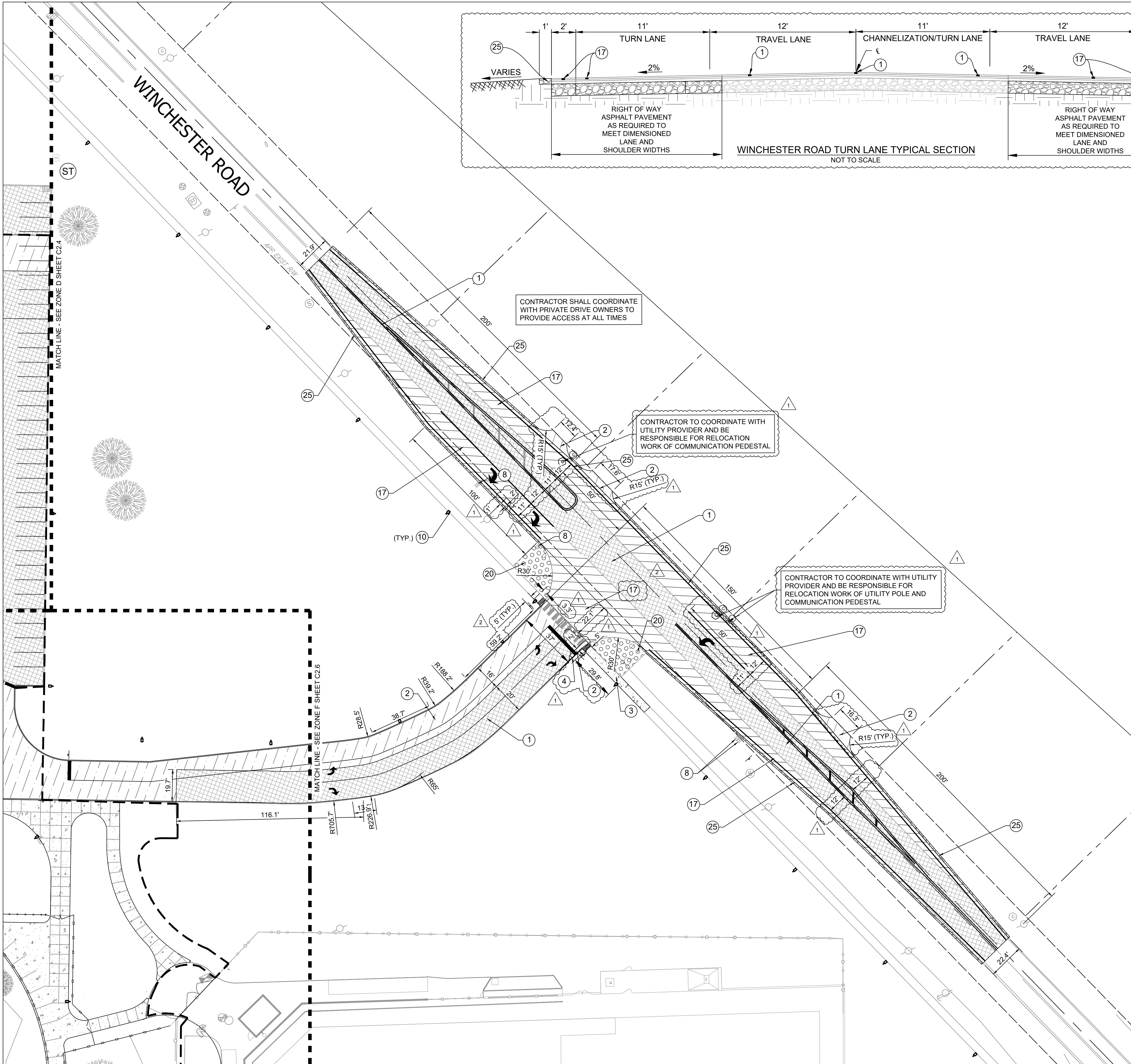
PART 4 – QUESTIONS

1. *I saw the response for the allowances, I just wanted to confirm. For instance if Allowance #1 is \$50/CY that would be a total allowance of \$75,000. This specific dollar amount needs to be IN our base bid amount. So, if our total base bid comes out to \$1,000,000, with allowance #1 the total amount that I will write in the “Base Bid Amount” on the bid form will be \$1,075,000?*
 - a. This is correct. The allowance will be included in the “Base Bid Amount”.
2. *Looking through the plans noticed that on sheet C4.4 the three catch basin seem to fall into the delineation of Alternate #4. Will the catch basins be part of Alternate #4 or should they be included in our base bid?*
 - a. Yes, CB#D-1, CB#D-2, and CB#D-3 along with associated storm piping and pavement replacement will be included in base bid.
3. *On sheet C2.5, the approach tying into Winchester Rd. is hatched as ROW Pavement but labeled “2” which is “Asphalt Parking Lot Pavement”. Is this intended to be ROW Pavement?*
 - a. Yes, this approach is intended to be ROW pavement. This has been revised on sheet C2.5.
4. *On sheet C2.0A it states “PERIMETER FENCE IMPROVEMENTS A PART OF ALTERNATE #5”, but sheet C2.7 it appears the sidewalk area is all apart of the base bid, how is this fence to be installed as part of the alternate but the sidewalk that goes through the existing fence is part of the base bid?*

- a. The fence will be part of base bid. Sheet C2.0A has been revised to remove “perimeter fence improvements” from Alternate 5.
- 5. *The storefront window shows no operable windows for the 'ticket booth'.*
 - a. SECTION 084313 has been revised and included in this addendum. These windows will be fixed.
- 6. *The 08 43 13 spec released in ADD 1, mentions operable, but does not list what that is supposed to be.*
 - a. SECTION 084313 has been revised and included in this addendum.
- 7. *What fiber will need to be installed from existing handhole to ticket booth? Is this supposed to be a 6 strand OS2 SM? (T211F)*
 - a. Refer to Addendum #3 information for clarification
- 8. *What fiber is to be installed from ticket booth to band tower? Is this supposed to be the same 6 strand OS2 SM? (T211D)*
 - a. Refer to Addendum #3 information for clarification
- 9. *Does the band tower have a room where the VS-CAB-1 will be mounted or does this rack need to be waterproof type enclosure? (T211D)*
 - a. Refer to Addendum #3 information for clarification
- 10. *Who is responsible for Headend equipment and seat licensing for these new cameras? If we are to cover the licensing, I will need to know what system it is and how many more licenses it can hold.*
 - a. Refer to Addendum #3 information for clarification

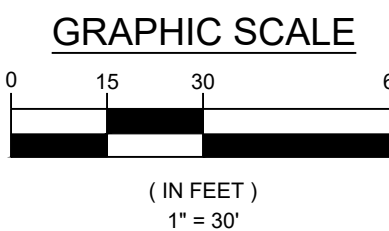
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DETAILS LEGEND:

1	MILL & RESURFACE ASPHALT PAVEMENT	DETAIL 4 / C8.1
2	ASPHALT PARKING LOT PAVEMENT - FULL DEPTH REPLACEMENT	DETAIL 1 OR 2 / C8.1
3	4" CONCRETE	DETAIL 5 / C8.1
4	STANDARD CONCRETE CURB	DETAIL 7 / C8.1
5	INTEGRAL CONCRETE CURB	DETAIL 8 / C8.1
6	CURB RAMP	REFER TO SHEET C3.8
7	PERIMETER CHAIN LINK FENCE	DETAIL 11 / C8.1
8	MAILBOX ASSEMBLY	DETAIL 5 / C8.4
9	FENCE GATE	DETAIL 12 / C8.1 (SINGLE GATE) DETAIL 13/C8.1 (DOUBLE GATE)
10	LIGHT POLE	REFER TO LIGHTING PLAN
11	REMOVABLE BOLLARDS	DETAIL 10 / C8.1
12	8" CONCRETE	DETAIL 6 / C8.1
13	8' BLACK VINYL COATED CHAIN LINK FENCE	DETAIL 11 / C8.1
14	4' BLACK VINYL COATED CHAIN LINK FENCE	DETAIL 11 / C8.1
15	NEW TICKET BOOTH	REFER TO ARCHITECTURAL PLAN
16	NEW MAINTENANCE BUILDING	BY OTHERS
17	RIGHT OF WAY ASPHALT PAVEMENT	DETAIL 3 / C8.1
18	HEAVY DUTY ASPHALT PAVEMENT	DETAIL 2 / C8.1
19	8' ORNAMENTAL FENCE	DETAIL 6 / C8.3
20	EROSION CONTROL SURFACE FLEXAMAT OR APPROVED EQUAL	DETAIL 3 / C5.3
21	ORNAMENTAL FENCE GATE	REFER TO ARCHITECTURAL PLAN
22	MONUMENT COLUMN	REFER TO ARCHITECTURAL PLAN
23	STANDARD ROLLED CURB	DETAIL 3 / C8.5
24	CONCRETE WHEEL STOP	DETAIL 7 / C8.3
25	AGGREGATE	DETAIL 4 / C8.3
26	EMERGENCY SPILLWAY	DETAIL 9 / C8.2
27	RETAINING WALL	DETAIL 3 / C8.2
28	RAMP HANDRAIL	DETAIL 5 / C8.3
29	SPEED TABLE	DETAIL 5 OR 6 / C8.5
30	BUS PARKING LOT GATE	DETAIL 14 / C8.1
31	EROSION CONTROL TURF REINFORCEMENT	DETAIL 7 / C5.2



WAYNE HIGH SCHOOL CAMPUS IMPROVEMENTS	
FORT WAYNE COMMUNITY SCHOOLS 1200 S CLINTON STREET FORT WAYNE, INDIANA	
SITE DIMENSIONAL PLAN - ZONE E	
DESIGNED BY: JPR TEAM REVIEWED BY: CEE, AC	DATE: NOVEMBER 7, 2025
DRAWN BY: JPR TEAM REVIEWED BY: CEE, AC	JOB NUMBER: 2025-01487
HORIZ. SCALE: 1" = 30" VERTICAL SCALE: N/A	
C2.5	

RRM 11-14-2025
RRM 11-07-2025
BY DATE

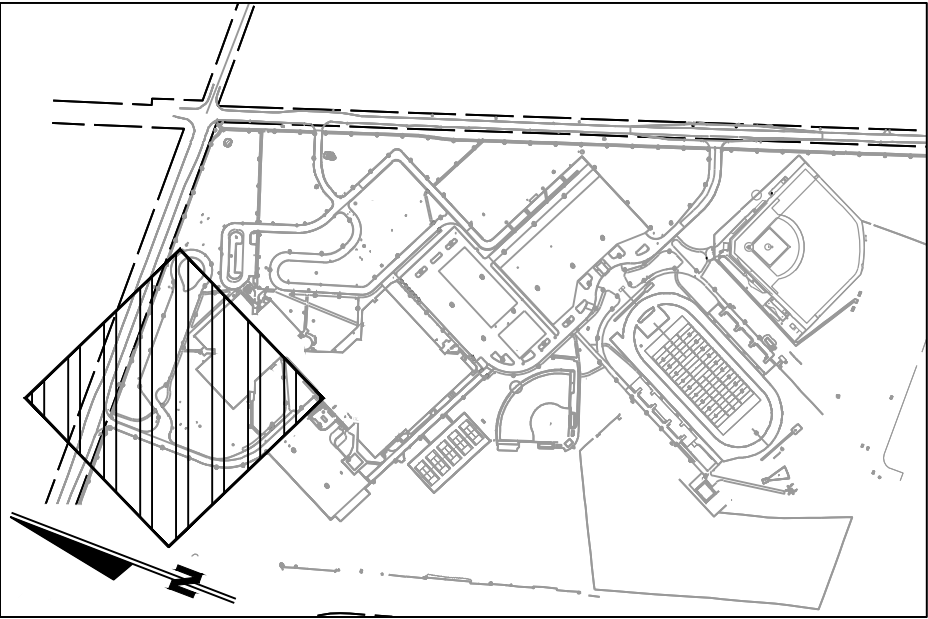
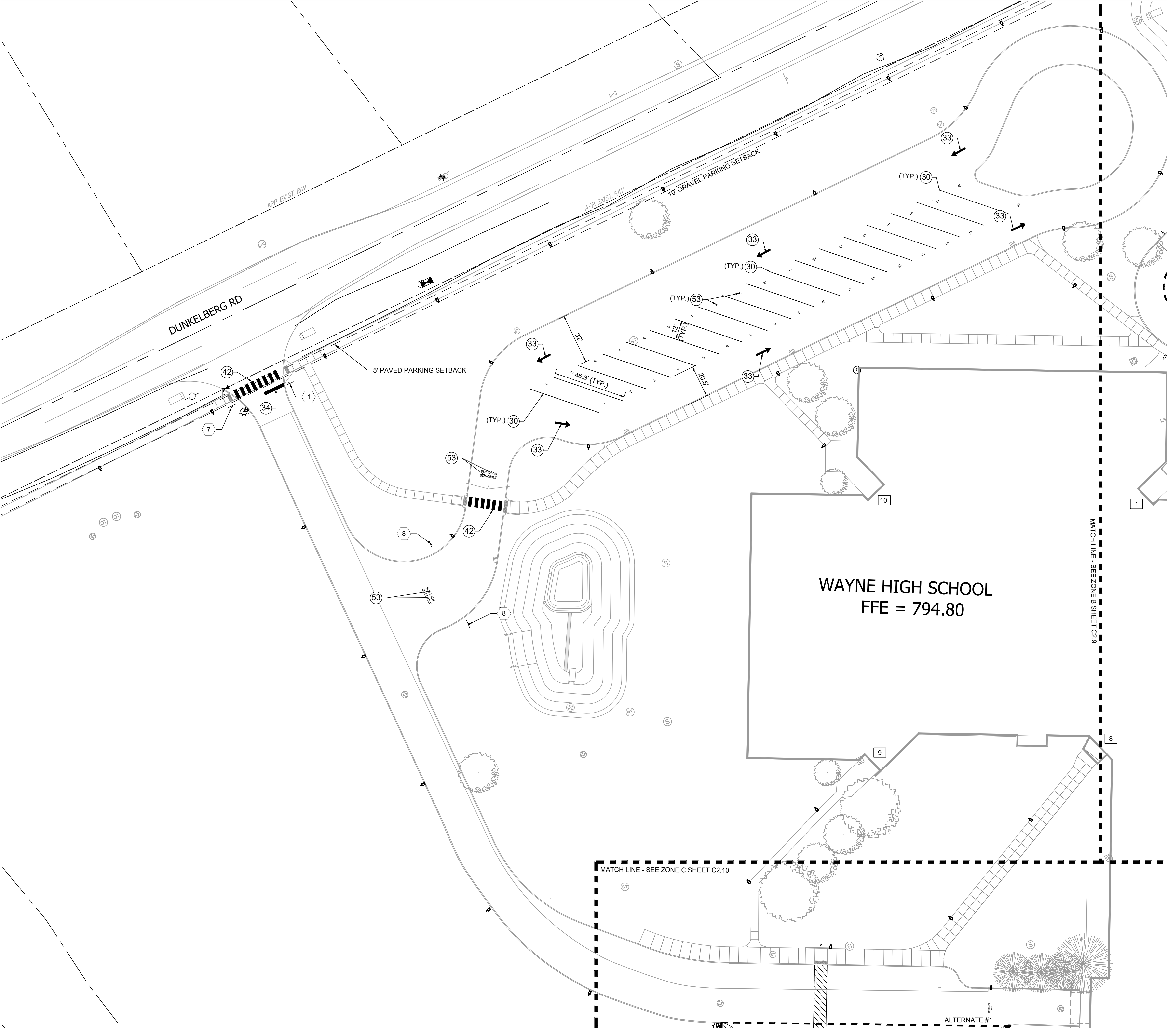
REVISION 2 FOR ADDENDUM 3
REVISION 1 FOR ADDENDUM 1
DESCRIPTION

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JONES
P E T R I E
R A F A N S K I

IMEG

CLARENCE REGISTERED
No. 12000703
STATE OF INDIANA
PROFESSIONAL ENGINEER



KEYNOTE PLAN - 1" = 600'

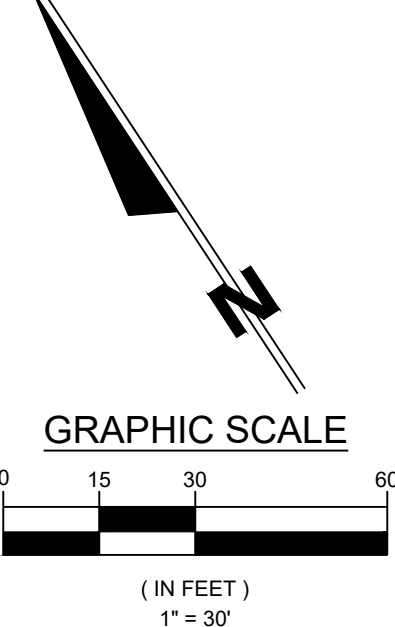
PAVEMENT MARKINGS LEGEND:

- 30 LINE, PAINT, SOLID, WHITE, 4"
- 31 TRANSVERSE MARKING, PAINT, CROSSHATCH LINE, SOLID WHITE, 4"
- 32 PAVEMENT MESSAGE MARKING, "ALTERNATE", PAINT, SOLID, WHITE
- 33 PAVEMENT MESSAGE MARKING, ARROW, PAINT, SOLID WHITE
- 34 STOP BAR, PAINT, SOLID, WHITE, 24"
- 35 PAVEMENT MESSAGE MARKING, "PICK-UP", PAINT, SOLID WHITE
- 36 PAVEMENT MESSAGE MARKING, "THRU LANE", PAINT, SOLID WHITE
- 37 PAVEMENT MESSAGE MARKING, "LANE", PAINT, SOLID WHITE
- 38 PAVEMENT MESSAGE MARKING, "ONLY", PAINT, SOLID WHITE
- 39 LINE, PAINT, SOLID, BLUE, 4"
- 40 TRANSVERSE MARKING, PAINT, CROSSHATCH LINE, SOLID, BLUE, 4"
- 41 PAVEMENT MESSAGE MARKING, ADA SYMBOL, PAINT, SOLID, BLUE
- 42 CROSSWALK, PAINT, SOLID, WHITE, 24"
- 43 PAVEMENT MESSAGE MARKING, "RESERVED", PAINT, SOLID WHITE
- 44 PAVEMENT MESSAGE MARKING, "PARKING", PAINT, SOLID WHITE
- 45 PAVEMENT MESSAGE MARKING, "NO", PAINT, SOLID WHITE
- 46 LINE, PAINT, SOLID, YELLOW, 4"
- 47 TRANSVERSE MARKING, PAINT, CROSSHATCH LINE, SOLID, YELLOW, 4"
- 48 LINE, PAINT, MULTI-COMPONENT, YELLOW, 4"
- 49 PAVEMENT MESSAGE MARKING, "VISITOR", PAINT, SOLID WHITE
- 50 BAND PRACTICE LINES, SOLID YELLOW, 4"
- 51 PAVEMENT MESSAGE MARKING, LEFT TURN ARROW, PAINT, SOLID YELLOW
- 52 PAVEMENT MESSAGE MARKING, RIGHT TURN ARROW, PAINT, SOLID YELLOW
- 53 PAVEMENT MESSAGE MARKING, MISC., PAINT, SOLID WHITE

NOTE:
CONTRACTOR SHALL APPLY PAVEMENT MARKING PAINT AS IDENTIFIED IN THE SPECIFICATIONS WITHIN CAMPUS GROUNDS UTILIZING PAVEMENT MARKING STENCILS PROVIDED BY THE OWNER. THE CONTRACTOR SHALL COORDINATE WITH OWNER FOR FURTHER DETAILS ON THE STENCILS. CONTRACTOR SHALL APPLY 2-PART EPOXY PAVEMENT MARKING PAINT WITHIN THE RIGHT OF WAY.

SIGN LEGEND:

- | | |
|--|-----------------|
| 1 STOP SIGN | DETAIL 3 / C8.2 |
| 2 ADA PARKING SIGN | DETAIL 3 / C8.2 |
| 3 ADA VAN ACCESSIBLE SIGN | DETAIL 3 / C8.2 |
| 4 DO NOT ENTER SIGN | DETAIL 3 / C8.2 |
| 5 DO NOT ENTER SIGN - TRUCKS ONLY | DETAIL 3 / C8.2 |
| 6 LANE SHIFT - BEGIN TWO WAY TRAFFIC SIGN | DETAIL 3 / C8.2 |
| 7 RELOCATED EXISTING SIGN: WAYNE HIGH SCHOOL STAFF PARKING MINI BUS FREIGHT DELIVERERS | DETAIL 3 / C8.2 |
| 8 "BUS PARKING ONLY" SIGN | DETAIL 3 / C8.2 |
| 9 DIRECTIONAL SIGNAGE | DETAIL 3 / C8.2 |
| 10 "BEGIN DROPOFF PULL FORWARD" SIGN | DETAIL 3 / C8.2 |
| 11 ONE WAY SIGN | DETAIL 3 / C8.2 |
| 12 "LEFT TURN ONLY" YIELD SIGN | DETAIL 3 / C8.2 |
| 13 NO PARKING, DROP OFF/ PICKUP ZONE SIGN ASSEMBLY | DETAIL 3 / C8.2 |
| 14 RELOCATED "NO IDLING ZONE TURN OFF ENGINE" SIGN ON EXISTING POST | DETAIL 3 / C8.2 |
| 15 RELOCATED "NO PARKING" SIGN ON EXISTING POST | DETAIL 3 / C8.2 |
| 16 RELOCATED "WAYNE HIGH SCHOOL" SIGN ON EXISTING POSTS | DETAIL 3 / C8.2 |
| 17 "PULL FORWARD SLOWLY TO STOP SIGN" SIGN | DETAIL 3 / C8.2 |
| 18 RELOCATED MEMORIAL PANEL, SIGN AND POST | N/A |
| 19 RELOCATED "YIELD" SIGN ON EXISTING POST | DETAIL 3 / C8.2 |



WAYNE HIGH SCHOOL CAMPUS IMPROVEMENTS	
FORT WAYNE COMMUNITY SCHOOLS 1200 S CLINTON STREET FORT WAYNE, INDIANA	
PAVEMENT MARKING PLAN - ZONE A	
DESIGNED BY: JPR TEAM REVIEWED BY: CEE, AC	DATE: NOVEMBER 7, 2025
DRAWN BY: JPR TEAM REVIEWED BY: CEE, AC	JOB NUMBER: 2025-01487
HORIZ. SCALE: 1" = 30' VERTICAL SCALE: N/A	
C2.8	

JONES
PETRIE
RAFINSKI

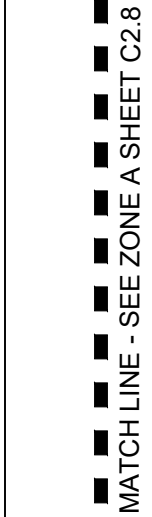
IMEG

CLARENCE B. JONES, P.E.
REGISTERED PROFESSIONAL ENGINEER
No. 12000703
STATE OF INDIANA
10-16-23

REVISION 2 FOR APPENDUM 3

REV	DESCRIPTION	BY	DATE
2		RRM	11-14-2025

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PAVEMENT MARKINGS LEGEND:

- 30 LINE, PAINT, SOLID, WHITE, 4"
- 31 TRANSVERSE MARKING, PAINT, CROSSHATCH LINE, SOLID WHITE, 4" 2
- 32 PAVEMENT MESSAGE MARKING, "ALTERNATE", PAINT, SOLID, WHITE
- 33 PAVEMENT MESSAGE MARKING, ARROW, PAINT, SOLID WHITE
- 34 STOP BAR, PAINT, SOLID, WHITE, 24" 2
- 35 PAVEMENT MESSAGE MARKING, "PICK-UP", PAINT, SOLID WHITE
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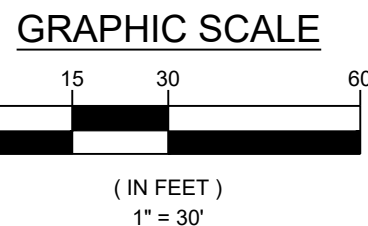
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GROUNDS. UTILIZING PAVEMENT MARKING STENCILS PROVIDED BY THE OWNER. THE CONTRACTOR SHALL COORDINATE WITH OWNER FOR FURTHER DETAILS ON THE STENCILS. CONTRACTOR SHALL APPLY 2-PART EPOXY PAVEMENT MARKING PAINT WITHIN THE RIGHT OF WAY.

SIGN LEGEND:

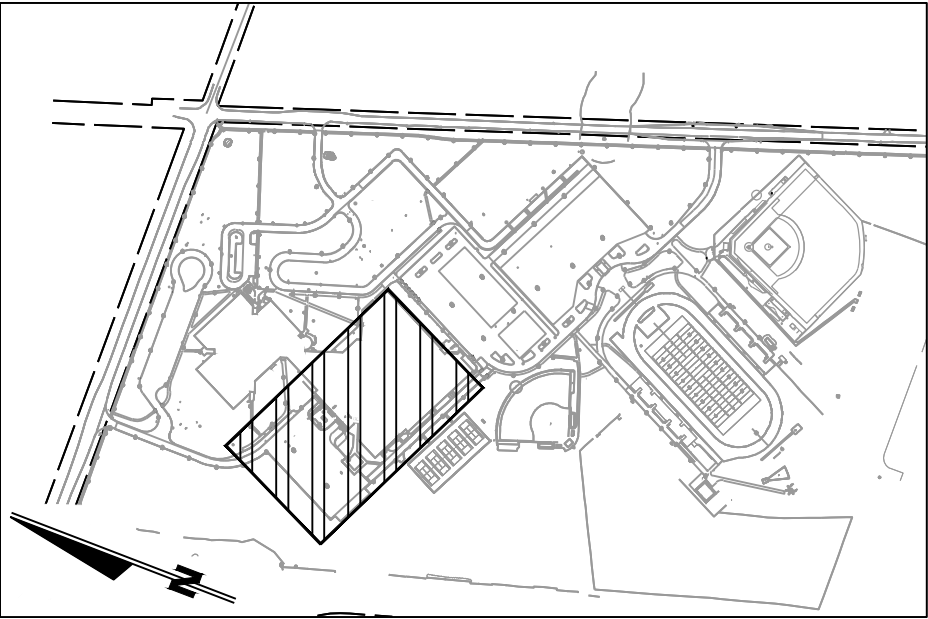
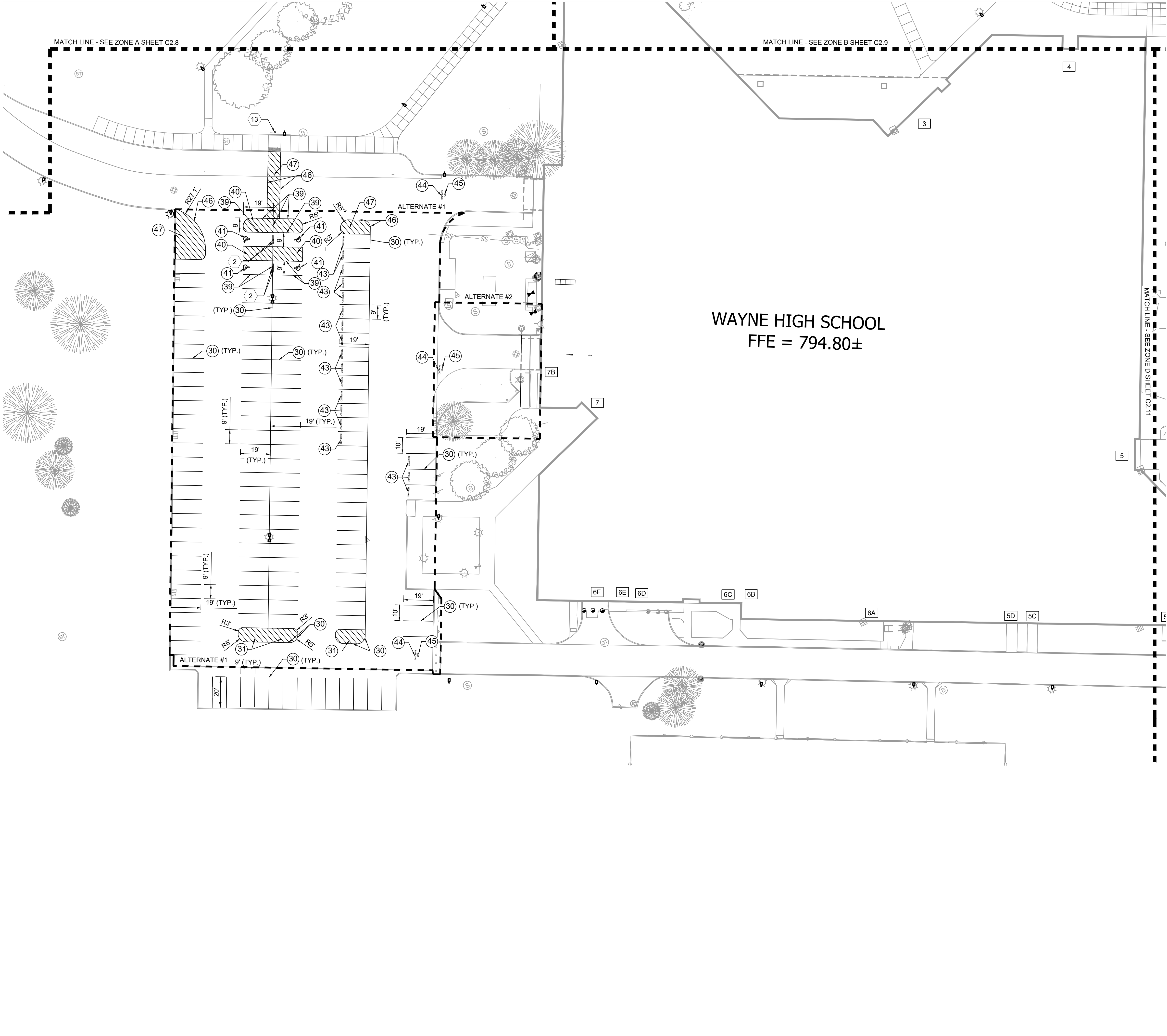
- | | | |
|----|--|-----------------|
| 1 | STOP SIGN | DETAIL 3 / C8.2 |
| 2 | ADA PARKING SIGN | DETAIL 3 / C8.2 |
| 3 | ADA VAN ACCESSIBLE SIGN | DETAIL 3 / C8.2 |
| 4 | DO NOT ENTER SIGN | DETAIL 3 / C8.2 |
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| 11 | ONE WAY SIGN | DETAIL 3 / C8.2 |
| 12 | "LEFT TURN ONLY" YIELD SIGN | DETAIL 3 / C8.2 |
| 13 | NO PARKING, DROP OFF/ PICKUP ZONE SIGN ASSEMBLY | DETAIL 3 / C8.2 |
| 14 | RELOCATED "NO IDLING ZONE TURN OFF ENGINE" SIGN ON EXISTING POST | DETAIL 3 / C8.2 |
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| 18 | RELOCATED MEMORIAL PANEL, SIGN AND POST | N/A |
| 19 | RELOCATED "YIELD" SIGN ON EXISTING POST | DETAIL 3 / C8.2 |

ALTERNATES:

ALTERNATE #6: VISITOR PARKING LOT IMPROVEMENTS



WAYNE HIGH SCHOOL CAMPUS IMPROVEMENTS		DESIGNED BY: JPR TEAM REVIEWED BY: CEE, AC	
FORT WAYNE COMMUNITY SCHOOLS FORT WAYNE, INDIANA		DRAWN BY: JPR TEAM REVIEWED BY: CEE, AC	
1200 S CLINTON STREET		DATE: NOVEMBER 7, 2025	
PAVEMENT MARKING PLAN - ZONE B		JOB NUMBER: 2025-01487	
HORIZ. SCALE: 1" = 30'		VERTICAL SCALE: N/A	
C2.9			



KEYNOTE PLAN - 1" = 600'

PAVEMENT MARKINGS LEGEND:

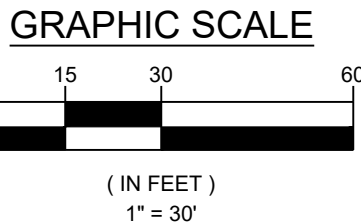
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- 31 TRANSVERSE MARKING, PAINT, CROSSHATCH LINE, SOLID WHITE, 4"
- 32 PAVEMENT MESSAGE MARKING, "ALTERNATE", PAINT, SOLID, WHITE
- 33 PAVEMENT MESSAGE MARKING, ARROW, PAINT, SOLID WHITE
- 34 STOP BAR, PAINT, SOLID, WHITE, 24"
- 35 PAVEMENT MESSAGE MARKING, "PICK-UP", PAINT, SOLID WHITE
- 36 PAVEMENT MESSAGE MARKING, "THRU LANE", PAINT, SOLID WHITE
- 37 PAVEMENT MESSAGE MARKING, "LANE", PAINT, SOLID WHITE
- 38 PAVEMENT MESSAGE MARKING, "ONLY", PAINT, SOLID WHITE
- 39 LINE, PAINT, SOLID, BLUE, 4"
- 40 TRANSVERSE MARKING, PAINT, CROSSHATCH LINE, SOLID, BLUE, 4"
- 41 PAVEMENT MESSAGE MARKING, ADA SYMBOL, PAINT, SOLID, BLUE
- 42 CROSSWALK, PAINT, SOLID, WHITE, 24"
- 43 PAVEMENT MESSAGE MARKING, "RESERVED", PAINT, SOLID WHITE
- 44 PAVEMENT MESSAGE MARKING, "PARKING", PAINT, SOLID WHITE
- 45 PAVEMENT MESSAGE MARKING, "NO", PAINT, SOLID WHITE
- 46 LINE, PAINT, SOLID, YELLOW, 4"
- 47 TRANSVERSE MARKING, PAINT, CROSSHATCH LINE, SOLID, YELLOW, 4"
- 48 LINE, PAINT, MULTI-COMPONENT, YELLOW, 4"
- 49 PAVEMENT MESSAGE MARKING, "VISITOR", PAINT, SOLID WHITE
- 50 BAND PRACTICE LINES, SOLID YELLOW, 4"
- 51 PAVEMENT MESSAGE MARKING, LEFT TURN ARROW, PAINT, SOLID YELLOW
- 52 PAVEMENT MESSAGE MARKING, RIGHT TURN ARROW, PAINT, SOLID YELLOW

NOTE:
CONTRACTOR SHALL APPLY PAVEMENT MARKING PAINT AS IDENTIFIED IN THE SPECIFICATIONS WITHIN CAMPUS GROUNDS) UTILIZING PAVEMENT MARKING STENCILS PROVIDED BY THE OWNER. THE CONTRACTOR SHALL COORDINATE WITH OWNER FOR FURTHER DETAILS ON THE STENCILS. CONTRACTOR SHALL APPLY 2-PART EPOXY PAVEMENT MARKING PAINT WITHIN THE RIGHT OF WAY.

SIGN LEGEND:

1	STOP SIGN	DETAIL 3 / C8.2
2	ADA PARKING SIGN	DETAIL 3 / C8.2
3	ADA VAN ACCESSIBLE SIGN	DETAIL 3 / C8.2
4	DO NOT ENTER SIGN	DETAIL 3 / C8.2
5	DO NOT ENTER SIGN - TRUCKS ONLY	DETAIL 3 / C8.2
6	LANE SHIFT - BEGIN TWO WAY TRAFFIC SIGN	DETAIL 3 / C8.2
7	RELOCATED EXISTING SIGN: WAYNE HIGH SCHOOL STAFF PARKING MINI BUS FREIGHT DELIVERERS	DETAIL 3 / C8.2
8	"BUS PARKING ONLY" SIGN	DETAIL 3 / C8.2
9	DIRECTIONAL SIGNAGE	DETAIL 3 / C8.2
10	"BEGIN DROPOFF PULL FORWARD" SIGN	DETAIL 3 / C8.2
11	ONE WAY SIGN	DETAIL 3 / C8.2
12	"LEFT TURN ONLY" YIELD SIGN	DETAIL 3 / C8.2
13	NO PARKING, DROP OFF/ PICKUP ZONE SIGN ASSEMBLY	DETAIL 3 / C8.2
14	RELOCATED "NO IDLING ZONE TURN OFF ENGINE" SIGN ON EXISTING POST	DETAIL 3 / C8.2
15	RELOCATED "NO PARKING" SIGN ON EXISTING POST	DETAIL 3 / C8.2
16	RELOCATED "WAYNE HIGH SCHOOL" SIGN ON EXISTING POSTS	DETAIL 3 / C8.2
17	"PULL FORWARD SLOWLY TO STOP SIGN" SIGN	DETAIL 3 / C8.2
18	RELOCATED MEMORIAL PANEL, SIGN AND POST	N/A
19	RELOCATED "YIELD" SIGN ON EXISTING POST	DETAIL 3 / C8.2

ALTERNATES:
ALTERNATE #1: MILL AND RESURFACE STAFF PARKING LOT
ALTERNATE #2: STAFF PARKING LOT LOADING DOCK EXPANSION



WAYNE HIGH SCHOOL CAMPUS IMPROVEMENTS	
FORT WAYNE COMMUNITY SCHOOLS FORT WAYNE, INDIANA 1200 S CLINTON STREET	
PAVEMENT MARKING PLAN - ZONE C	
DESIGNED BY: JPR TEAM REVIEWED BY: CEE, AC	DATE: NOVEMBER 7, 2025
DRAWN BY: JPR TEAM REVIEWED BY: CEE, AC	JOB NUMBER: 2025-01487
HORIZ. SCALE: 1" = 30' VERTICAL SCALE: N/A	
C2.10	

REVISION 2 FOR ADDENDUM 3

REV

DESCRIPTION

RRM 11-14-2025

BY

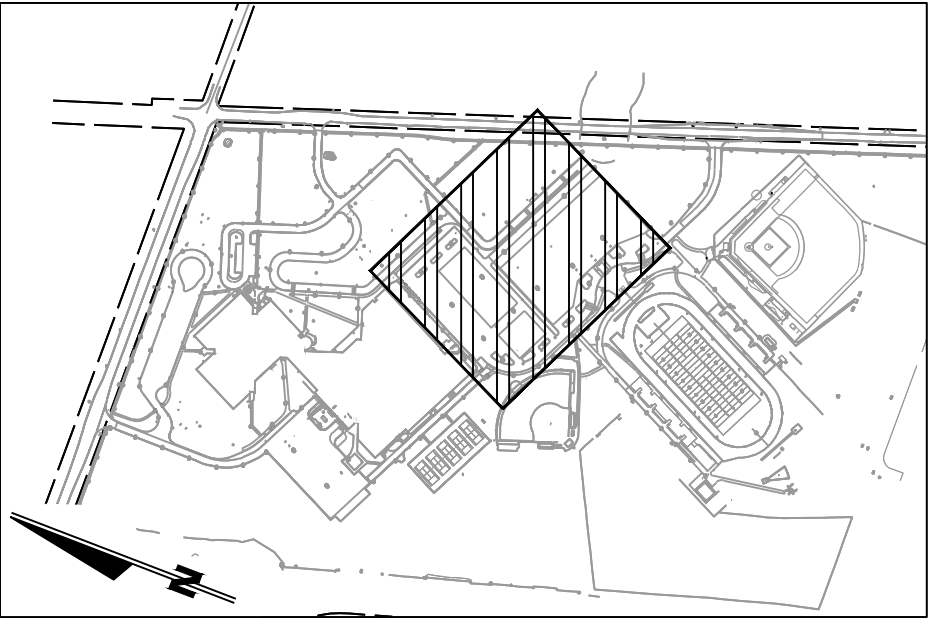
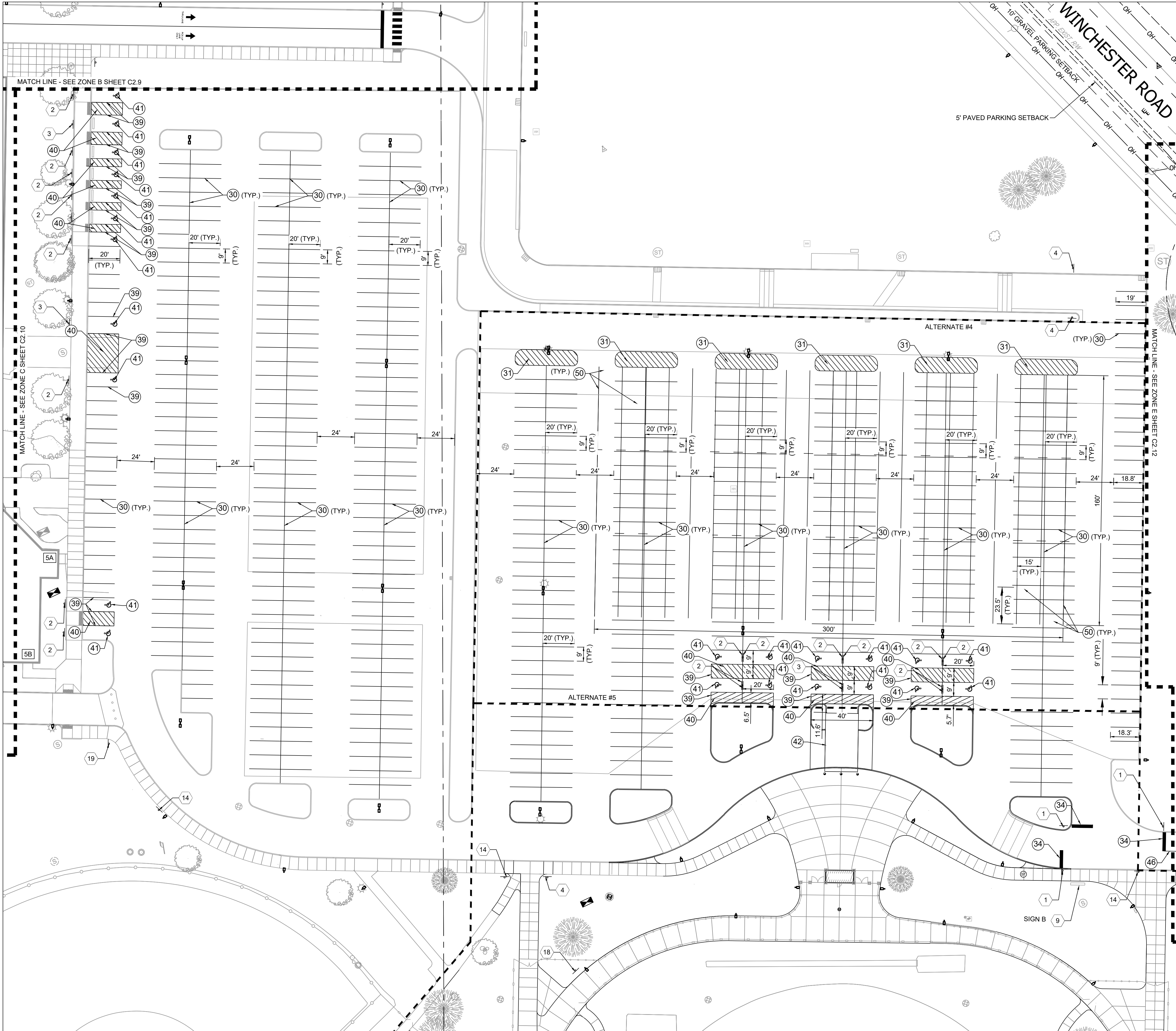
DATE

JONES
PETRIE
RAFINSKI

IMEG

CLARENCE A. BETA, P.E.
REGISTERED PROFESSIONAL ENGINEER
No. 12000703
STATE OF INDIANA
10-16-23

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KEYNOTE PLAN - 1" = 600'

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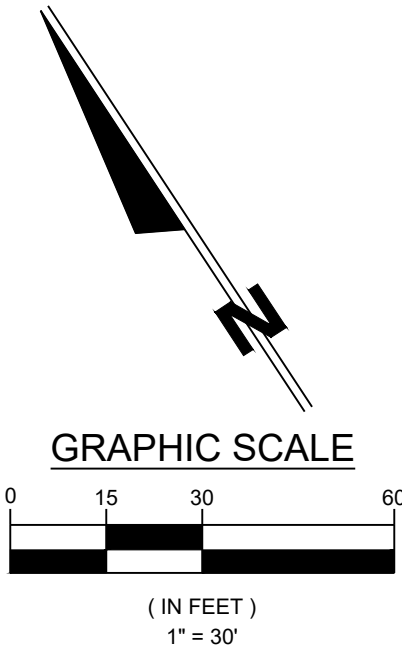
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- 31 TRANSVERSE MARKING, PAINT, CROSSHATCH LINE, SOLID WHITE, 4"
- 32 PAVEMENT MESSAGE MARKING, "ALTERNATE", PAINT, SOLID, WHITE
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- 36 PAVEMENT MESSAGE MARKING, "THRU LANE", PAINT, SOLID WHITE
- 37 PAVEMENT MESSAGE MARKING, "LANE", PAINT, SOLID WHITE
- 38 PAVEMENT MESSAGE MARKING, "ONLY", PAINT, SOLID WHITE
- 39 LINE, PAINT, SOLID, BLUE, 4"
- 40 TRANSVERSE MARKING, PAINT, CROSSHATCH LINE, SOLID, BLUE, 4"
- 41 PAVEMENT MESSAGE MARKING, ADA SYMBOL, PAINT, SOLID, BLUE
- 42 CROSSWALK, PAINT, SOLID, WHITE, 24"
- 43 PAVEMENT MESSAGE MARKING, "RESERVED", PAINT, SOLID WHITE
- 44 PAVEMENT MESSAGE MARKING, "PARKING", PAINT, SOLID WHITE
- 45 PAVEMENT MESSAGE MARKING, "NO", PAINT, SOLID WHITE
- 46 LINE, PAINT, SOLID, YELLOW, 4"
- 47 TRANSVERSE MARKING, PAINT, CROSSHATCH LINE, SOLID, YELLOW, 4"
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- 49 PAVEMENT MESSAGE MARKING, "VISITOR", PAINT, SOLID WHITE
- 50 BAND PRACTICE LINES, SOLID YELLOW, 4"
- 51 PAVEMENT MESSAGE MARKING, LEFT TURN ARROW, PAINT, SOLID YELLOW
- 52 PAVEMENT MESSAGE MARKING, RIGHT TURN ARROW, PAINT, SOLID YELLOW

NOTE:
CONTRACTOR SHALL APPLY PAVEMENT MARKING PAINT AS IDENTIFIED IN THE SPECIFICATIONS WITHIN CAMPUS GROUNDS UTILIZING PAVEMENT MARKING STENCILS PROVIDED BY THE OWNER. THE CONTRACTOR SHALL COORDINATE WITH OWNER FOR FURTHER DETAILS ON THE STENCILS. CONTRACTOR SHALL APPLY 2-PART EPOXY PAVEMENT MARKING PAINT WITHIN THE RIGHT OF WAY.

SIGN LEGEND:

- | | |
|--|-----------------|
| 1 STOP SIGN | DETAIL 3 / C8.2 |
| 2 ADA PARKING SIGN | DETAIL 3 / C8.2 |
| 3 ADA VAN ACCESSIBLE SIGN | DETAIL 3 / C8.2 |
| 4 DO NOT ENTER SIGN | DETAIL 3 / C8.2 |
| 5 DO NOT ENTER SIGN - TRUCKS ONLY | DETAIL 3 / C8.2 |
| 6 LANE SHIFT - BEGIN TWO WAY TRAFFIC SIGN | DETAIL 3 / C8.2 |
| 7 RELOCATED EXISTING SIGN: WAYNE HIGH SCHOOL STAFF PARKING MINI BUS FREIGHT DELIVERERS | DETAIL 3 / C8.2 |
| 8 "BUS PARKING ONLY" SIGN | DETAIL 3 / C8.2 |
| 9 DIRECTIONAL SIGNAGE | DETAIL 3 / C8.2 |
| 10 "BEGIN DROPOFF PULL FORWARD" SIGN | DETAIL 3 / C8.2 |
| 11 ONE WAY SIGN | DETAIL 3 / C8.2 |
| 12 "LEFT TURN ONLY" YIELD SIGN | DETAIL 3 / C8.2 |
| 13 NO PARKING, DROP OFF/PICKUP ZONE SIGN ASSEMBLY | DETAIL 3 / C8.2 |
| 14 RELOCATED "NO IDLING ZONE TURN OFF ENGINE" SIGN ON EXISTING POST | DETAIL 3 / C8.2 |
| 15 RELOCATED "NO PARKING" SIGN ON EXISTING POST | DETAIL 3 / C8.2 |
| 16 RELOCATED "WAYNE HIGH SCHOOL" SIGN ON EXISTING POSTS | DETAIL 3 / C8.2 |
| 17 "PULL FORWARD SLOWLY TO STOP SIGN" SIGN | DETAIL 3 / C8.2 |
| 18 RELOCATED MEMORIAL PANEL, SIGN AND POST | N/A |
| 19 RELOCATED "YIELD" SIGN ON EXISTING POST | DETAIL 3 / C8.2 |

ALTERNATES:
ALTERNATE #4: MILL AND RESURFACE MAIN PARKING LOT
ALTERNATE #5: STADIUM CONCOURSE AND PLAZA IMPROVEMENTS



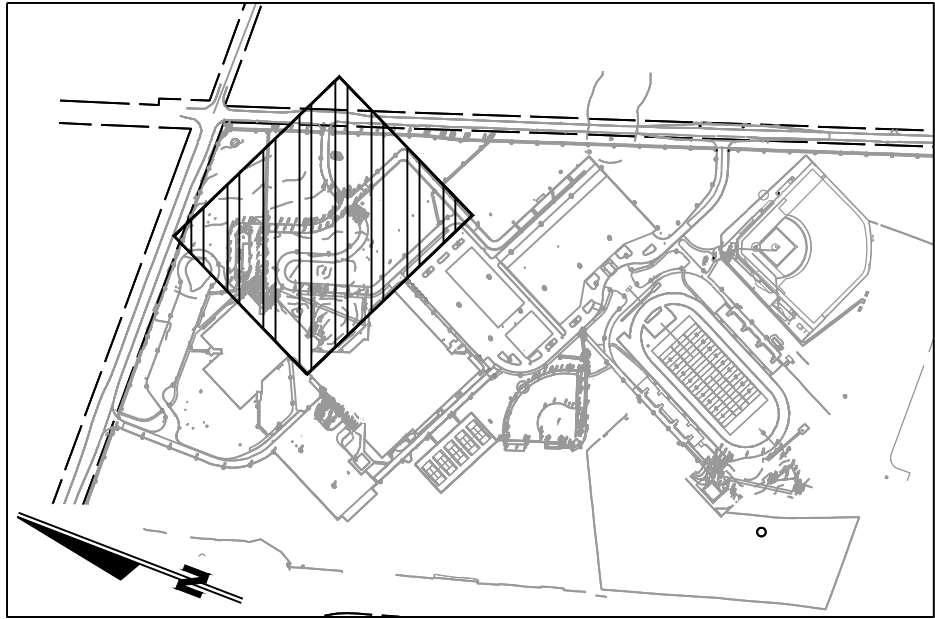
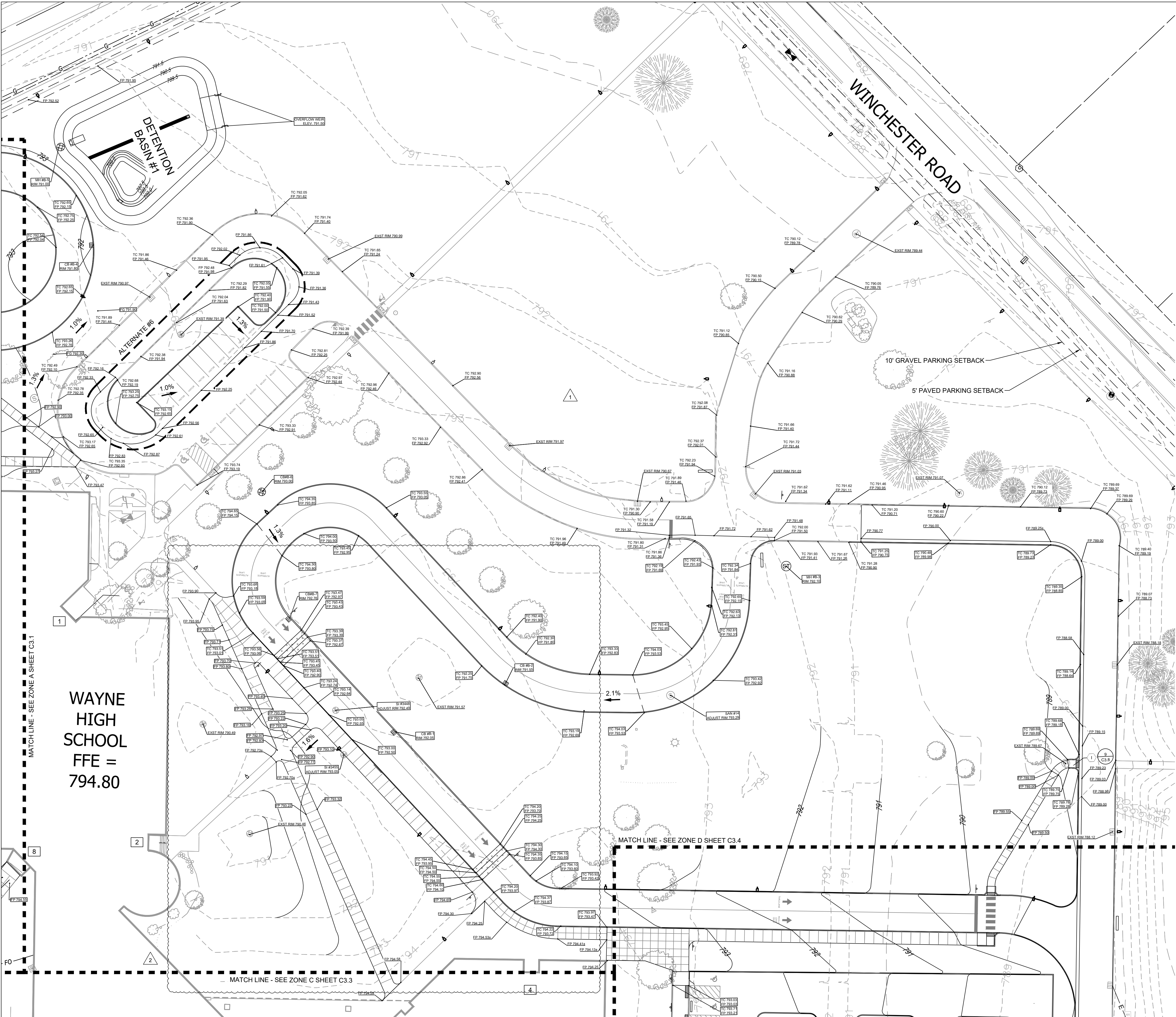
WAYNE HIGH SCHOOL CAMPUS IMPROVEMENTS	
FORT WAYNE COMMUNITY SCHOOLS 1200 S CLINTON STREET FORT WAYNE, INDIANA	
PAVEMENT MARKING PLAN - ZONE D	
DESIGNED BY: JPR TEAM REVIEWED BY: CEE, AC	DATE: NOVEMBER 7, 2025
DRAWN BY: JPR TEAM REVIEWED BY: CEE, AC	JOB NUMBER: 2025-01487
HORIZ. SCALE: 1" = 30' VERTICAL SCALE: N/A	
C2.11	

IMEG

JONES
PETRIE
RAFINSKI

REGISTERED PROFESSIONAL ENGINEER
No. 12000703
STATE OF INDIANA
10-16-23

File: J:\Projects\2025-01-487 Wayne High School\07_Design\ENG\Plans\C301 GRADING PLAN.dwg
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KEYNOTE PLAN - 1" = 600'

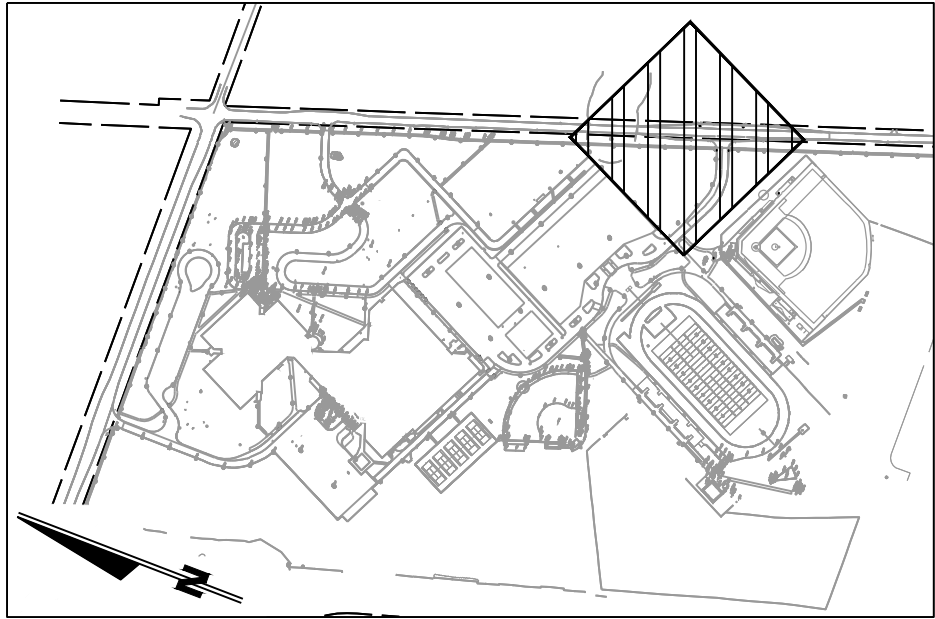
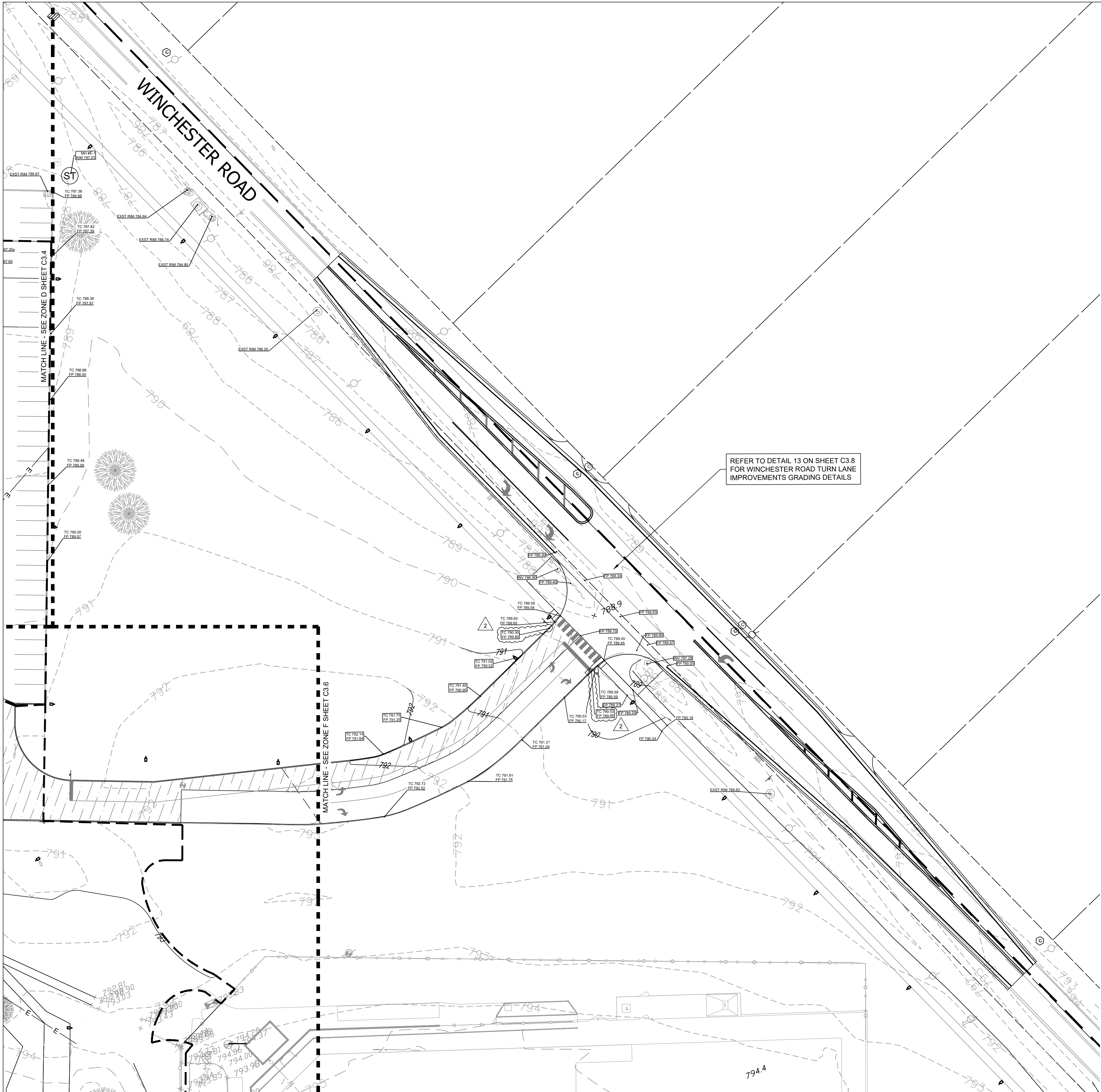
LEGEND

- XXX.XX EXISTING GRADE
- XXX.XX PROPOSED GRADE
- PROPOSED CATCH BASIN/STORM INLET
- PROPOSED CATCH BASIN/STORM INLET
- PROPOSED STORM MANHOLE
- PROPOSED STORM GRADE BREAK
- TOP OF CURB
- FINISHED PAVEMENT
- FINISHED GRADE
- TOP OF WALL
- STORM SEWER OUTLET PROTECTION
- PLACED OVER GEOTEXTILE FABRIC
- EXISTING CONTOURS
- PROPOSED CONTOURS

DESIGNED BY: BPE	REVIEWED BY: AC	DATE: NOVEMBER 7, 2025
DRAWN BY: BS	REVIEWED BY: CEE, AC	JOB NUMBER: 2025-01487
HORIZ. SCALE: 1" = 30'		VERTICAL SCALE: N/A
C3.2		

WAYNE HIGH SCHOOL CAMPUS IMPROVEMENTS	JONES PETRIE RAFAFSKI	REVISION 2 FOR ADDENDUM 3	CEE 11-14-2025
FORT WAYNE COMMUNITY SCHOOLS	FOR WAYNE, INDIANA	DESCRIPTION	BY DATE
1200 S CLINTON STREET	SUITE 210	The company, designs, plans, creates and other information as shown on this document, is the property of the company. All rights are reserved. No part of this document may be reproduced or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage and retrieval system, without the prior written permission of the company. © 2025 JPR. All rights reserved.	
SITE GRADING PLAN - ZONE B	INDIANA PROFESSIONAL ENGINEER	No. 12000703	STATE OF INDIANA

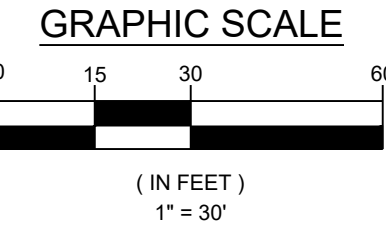
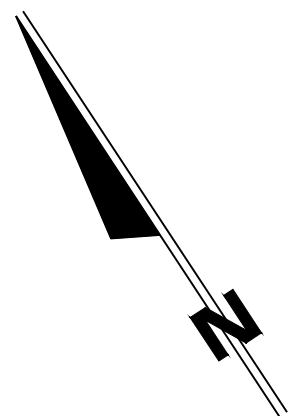
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KEYNOTE PLAN - 1" = 600'

LEGEND

- | | |
|----------|--|
| XXX.XX | EXISTING GRADE |
| XXX.XX | PROPOSED GRADE |
| [Symbol] | PROPOSED CATCH BASIN/STORM INLET |
| [Symbol] | PROPOSED CATCH BASIN/STORM INLET |
| [Symbol] | PROPOSED STORM MANHOLE |
| [Symbol] | PROPOSED GRADE BREAK |
| TC | TOP OF CURB |
| FP | FINISHED PAVEMENT |
| FG | FINISHED GRADE |
| TW | TOP OF WALL |
| [Symbol] | STORM SEWER OUTLET PROTECTION
PLACED OVER GEOTEXTILE FABRIC |
| -787- | EXISTING CONTOURS |
| -789- | PROPOSED CONTOURS |



WAYNE HIGH SCHOOL CAMPUS IMPROVEMENTS	
FORT WAYNE COMMUNITY SCHOOLS 1200 S CLINTON STREET	
SITE GRADING PLAN - ZONE E	
DESIGNED BY: RPE	REVIEWED BY: AC
DRAWN BY: BS	REVIEWED BY: CEE, AC
DATE: NOVEMBER 7, 2025	
JOB NUMBER: 2025-01487	
HORIZ. SCALE:	1" = 30'
VERTICAL SCALE:	N/A
C3.5	

INDEX

REVISION 2 FOR APPENDIX 3

REV 2

DESCRIPTION

RRM 11-14-2025

BY DATE

JONES
P E T R I E
R A F A N S K I

IMEG

CLIMATELLA BETA E.L.T.A. REGISTERED
No. 12000703
STATE OF INDIANA
PROFESSIONAL ENGINEER
10-16-23

WAYNE HIGH SCHOOL CAMPUS IMPROVEMENTS

FORT WAYNE COMMUNITY SCHOOLS

1200 S CLINTON STREET

SITE GRADING PLAN - ZONE E

DESIGNED BY: RPE

REVIEWED BY: AC

DRAWN BY: BS

REVIEWED BY: CEE, AC

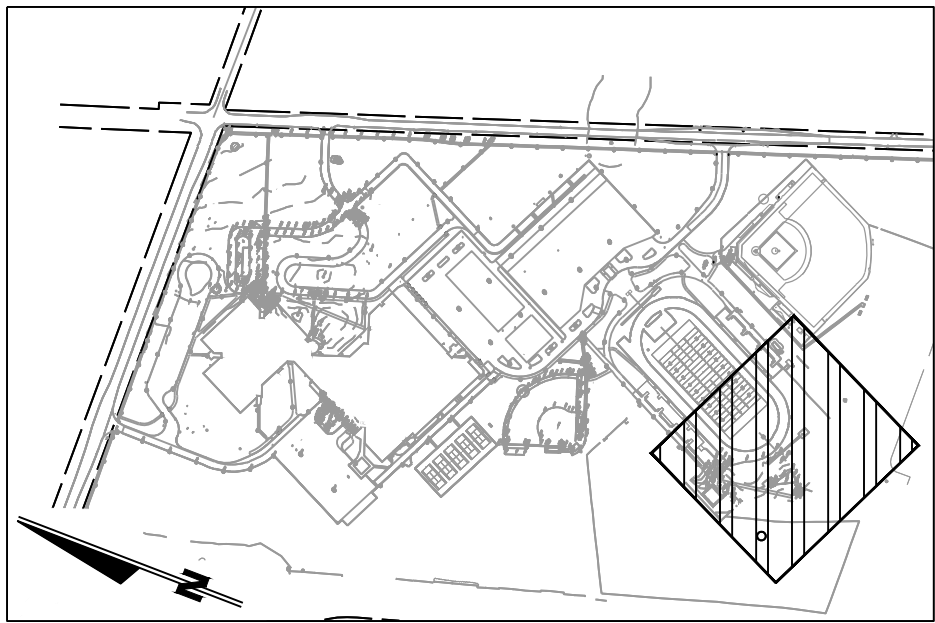
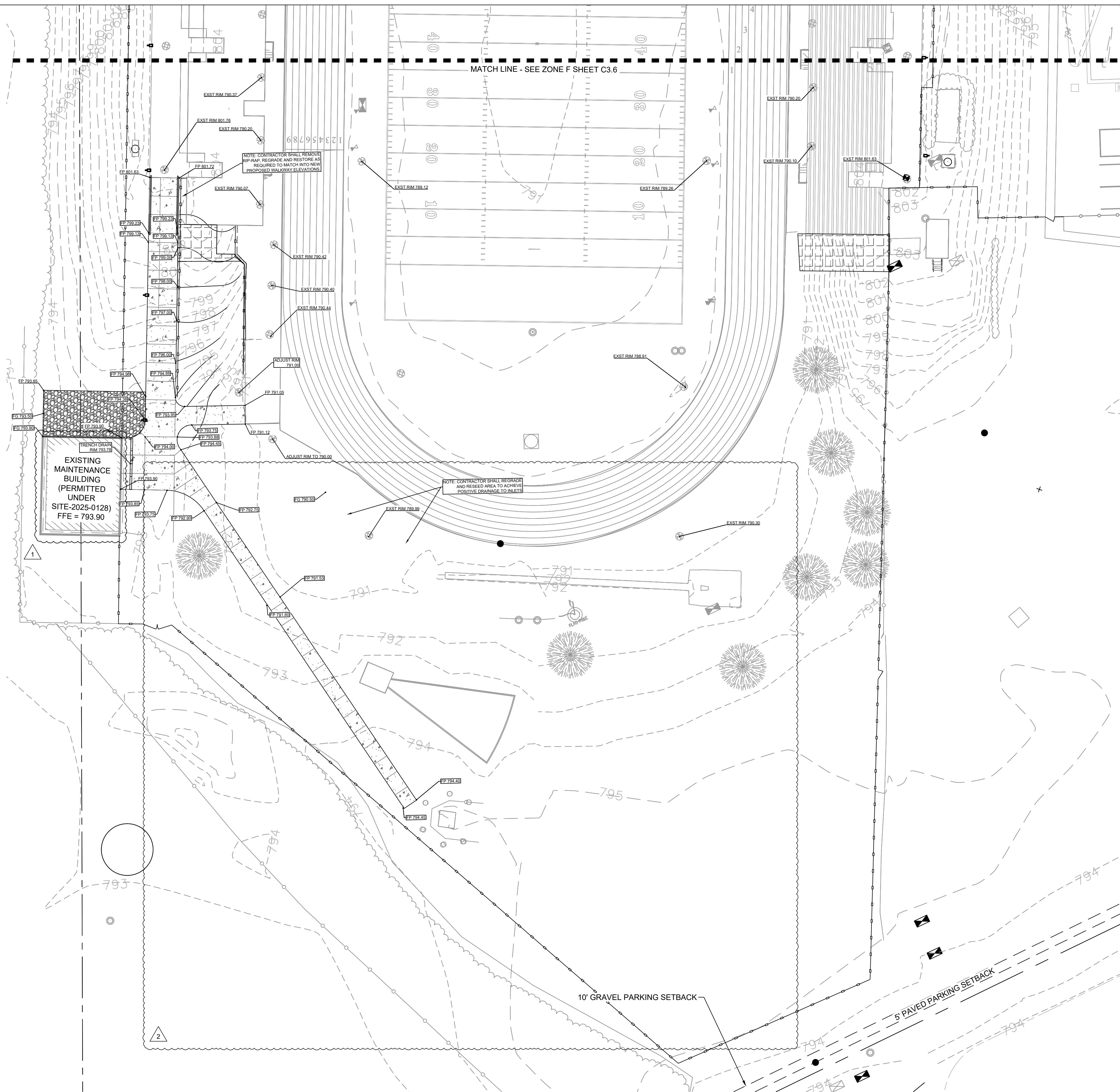
DATE: NOVEMBER 7, 2025

JOB NUMBER: 2025-01487

HORIZ. SCALE: 1" = 30'

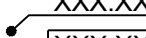
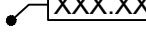
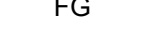
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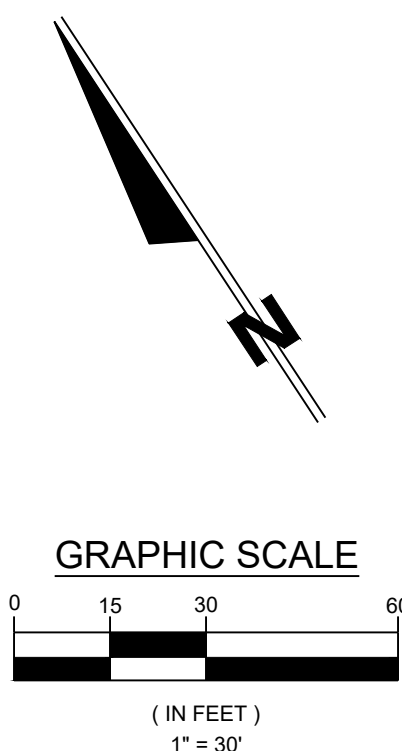
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KEYNOTE PLAN - 1" = 600'

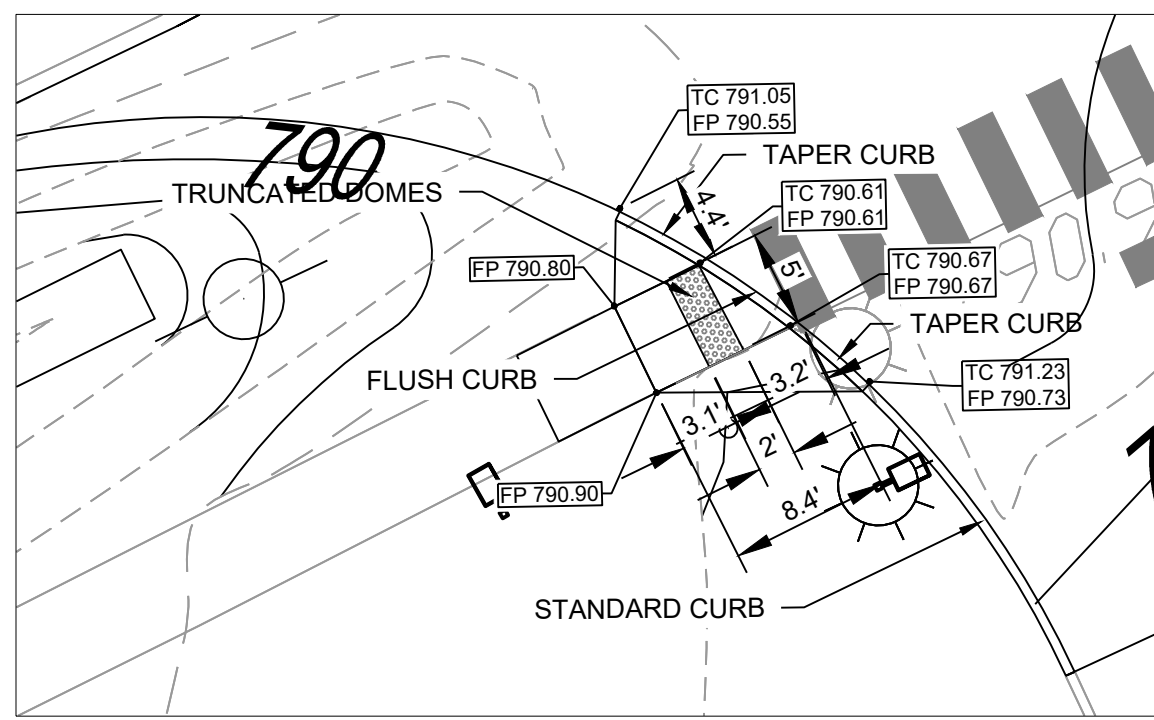
LEGEND

- | | |
|---|--|
|  | EXISTING GRADE |
|  | PROPOSED GRADE |
|  | PROPOSED CATCH BASIN/STORM INLET |
|  | PROPOSED CATCH BASIN/STORM INLET |
|  | PROPOSED STORM MANHOLE |
|  | PROPOSED GRADE BREAK |
| TC | TOP OF CURB |
| FP | FINISHED PAVEMENT |
| FG | FINISHED GRADE |
| TW | TOP OF WALL |
|  | STORM SEWER OUTLET PROTECTION
PLACED OVER GEOTEXTILE FABRIC |
|  | EXISTING CONTOURS |
|  | PROPOSED CONTOURS |

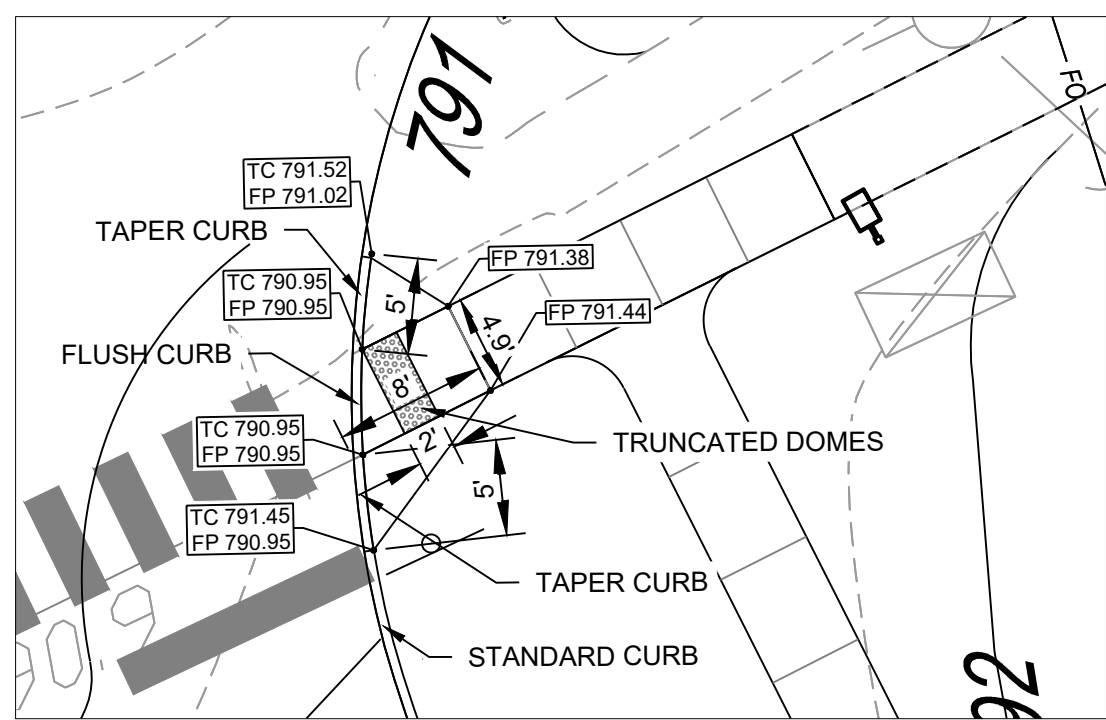


WAYNE HIGH SCHOOL CAMPUS IMPROVEMENTS FORT WAYNE COMMUNITY SCHOOLS FORT WAYNE, INDIANA 1200 S CLINTON STREET SITE GRADING PLAN - ZONE G		DESIGNED BY: BS REVIEWED BY: AC DRAWN BY: BS REVIEWED BY: CEE, AC	
DATE: NOVEMBER 7, 2025		JOB NUMBER: 2025-01487	
HORIZ. SCALE: 1" = 30' VERTICAL SCALE: N/A		C3.7	

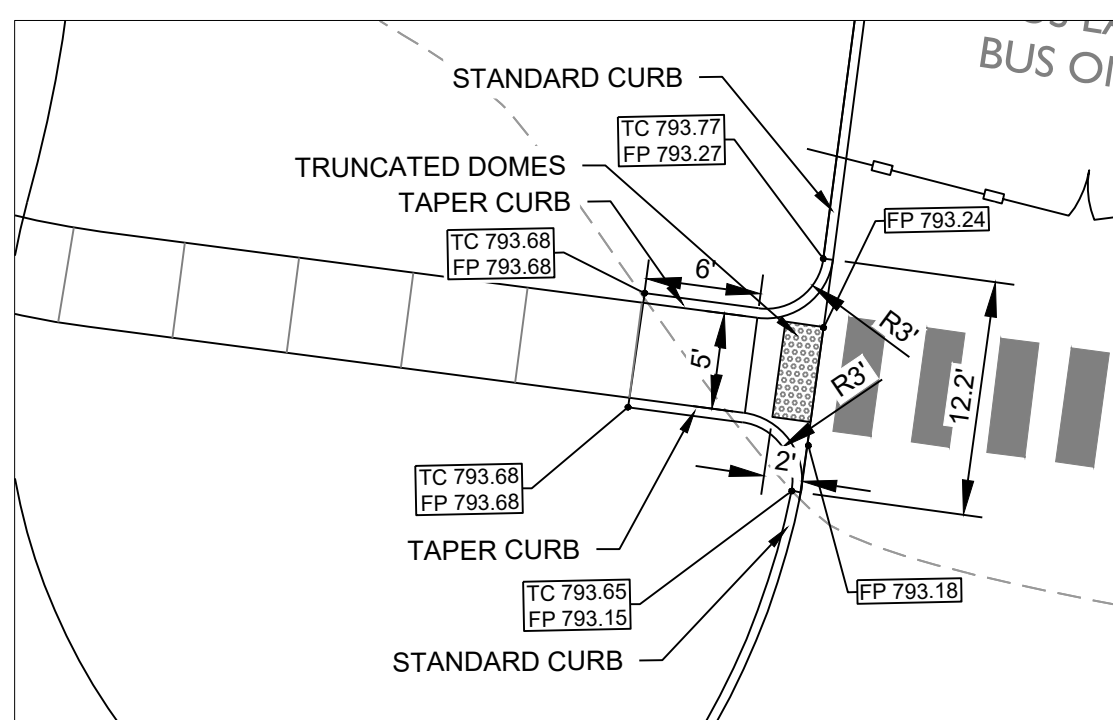
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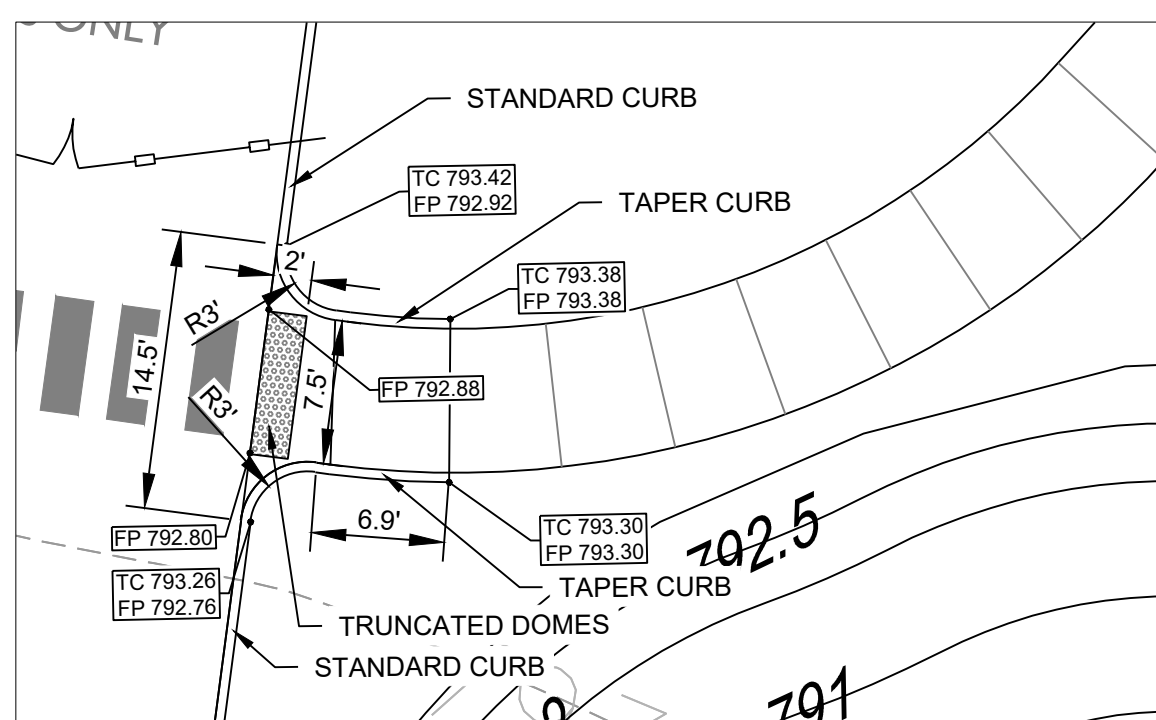
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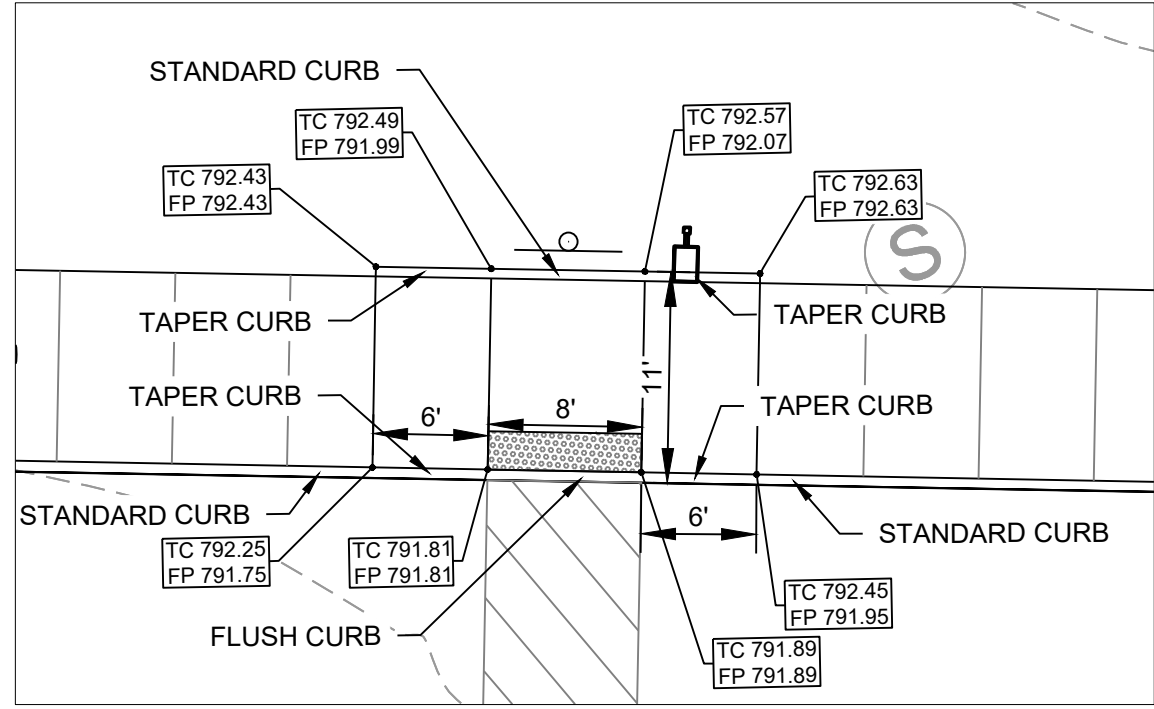
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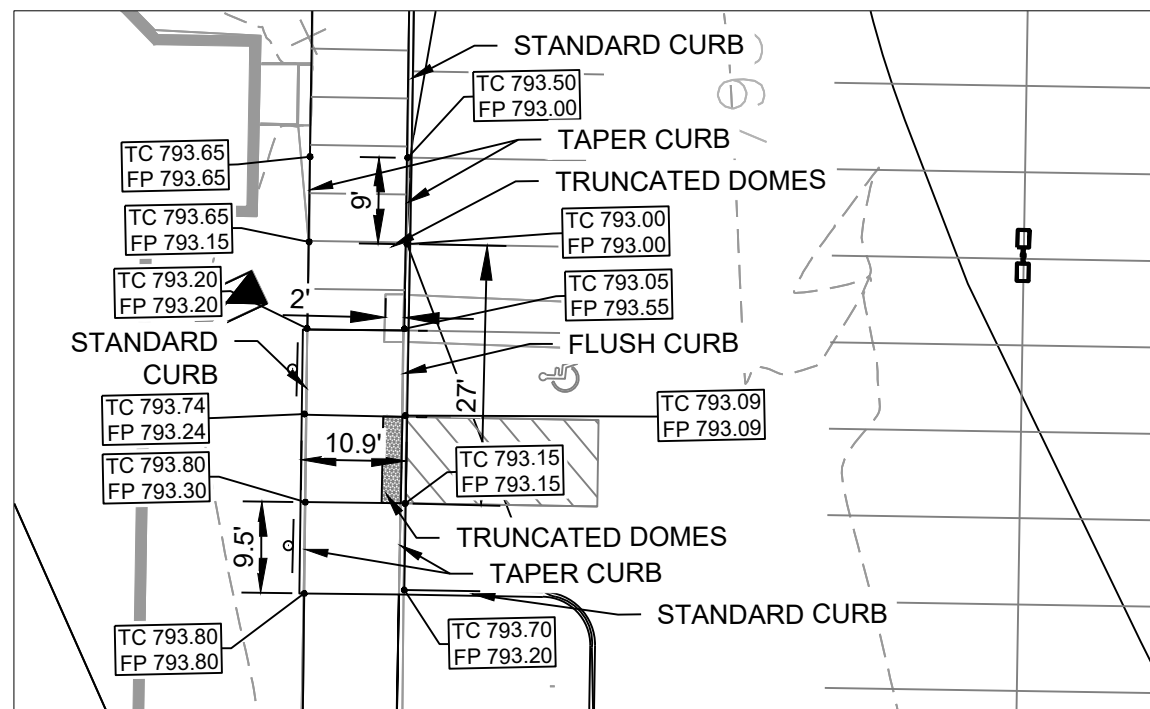
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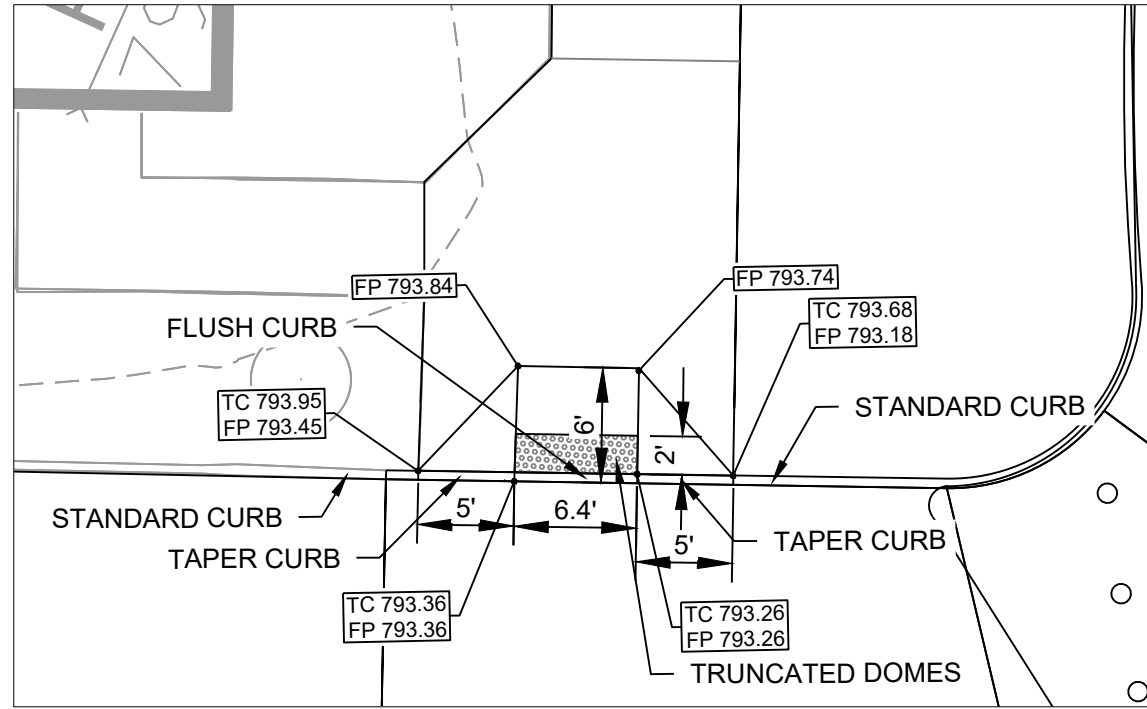
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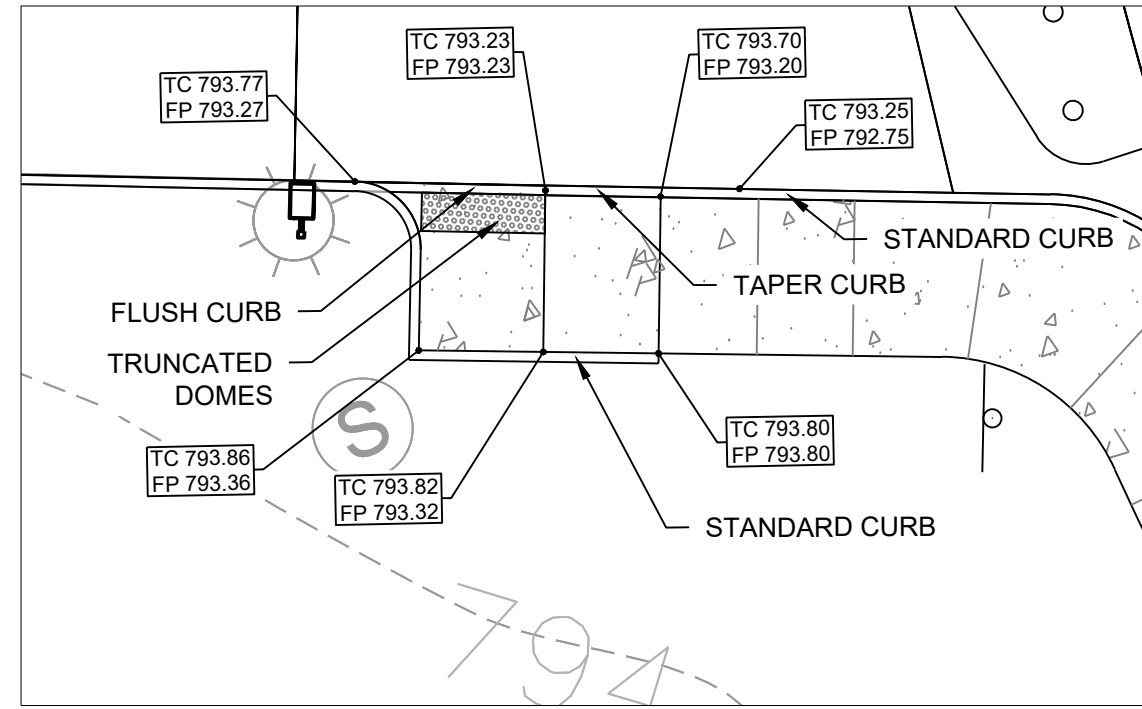
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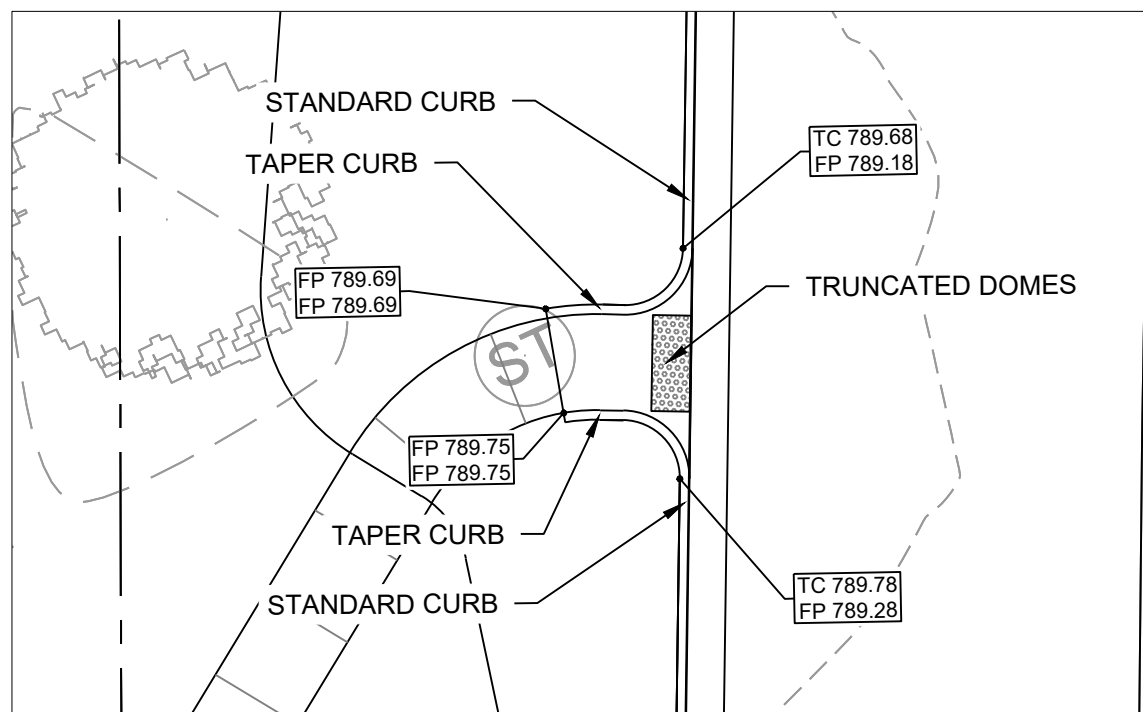
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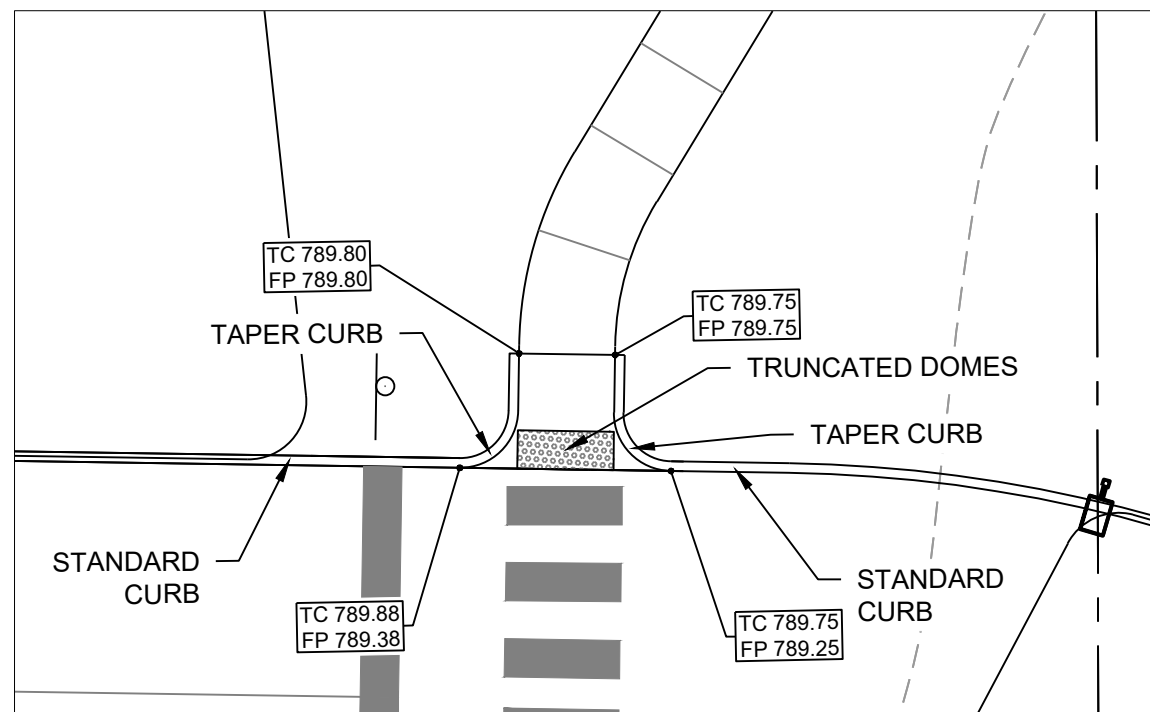
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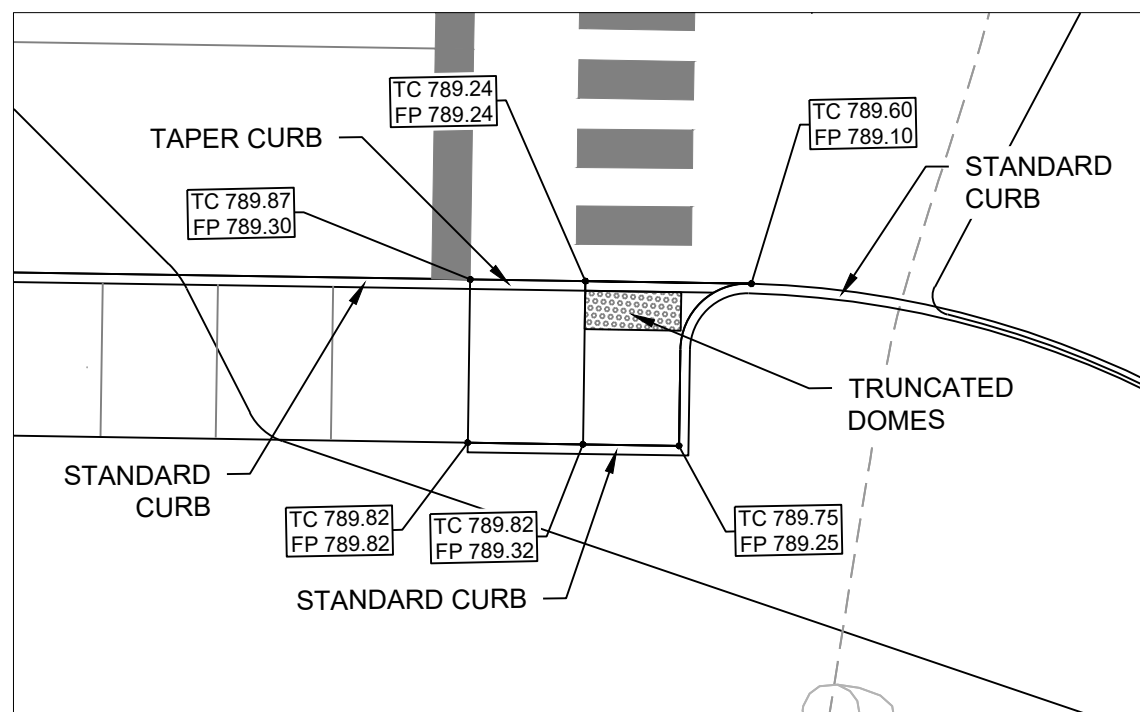
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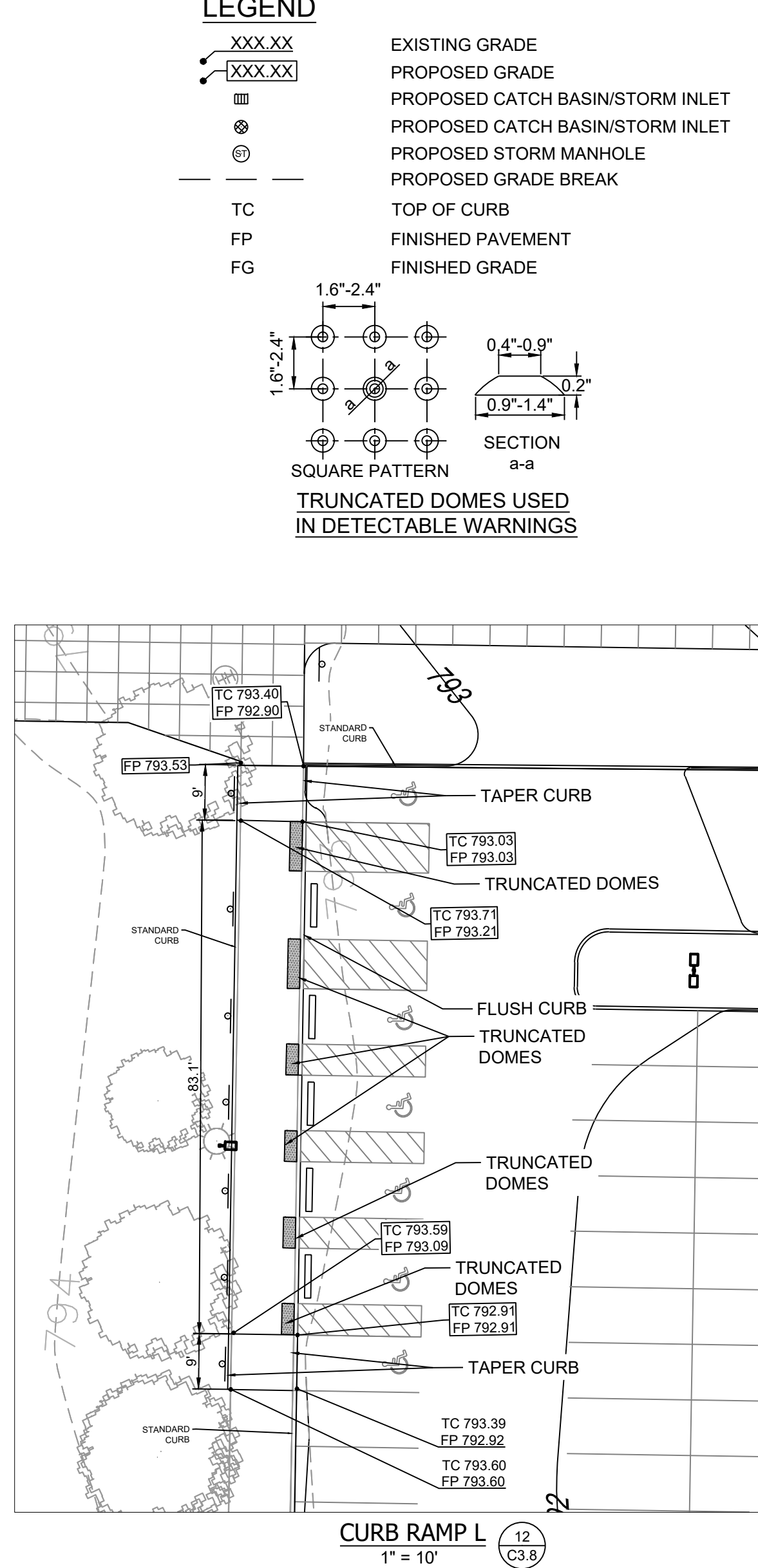
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1" = 10'



CURB RAMP J
1" = 10'



CURB RAMP K
1" = 10'

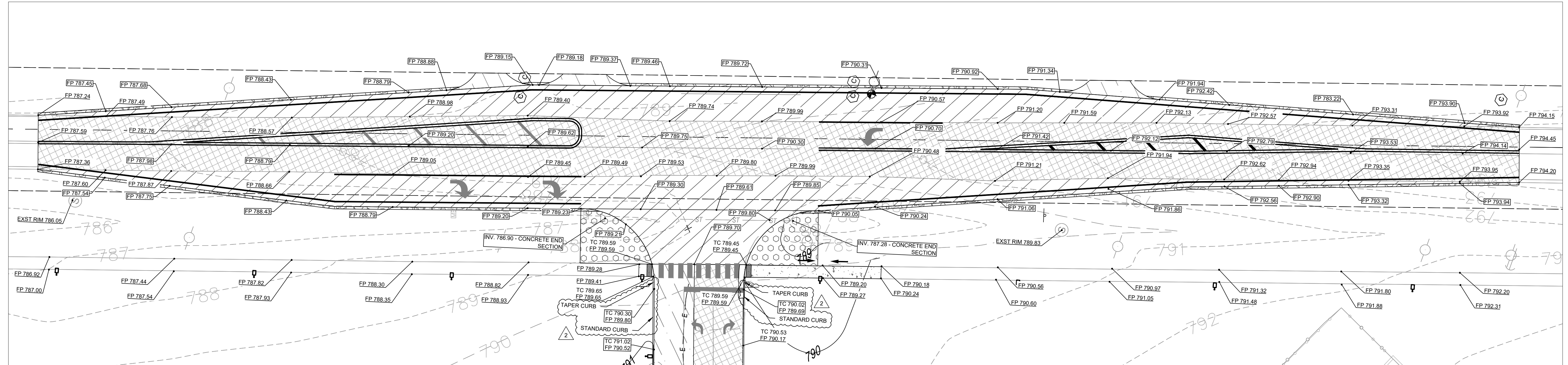
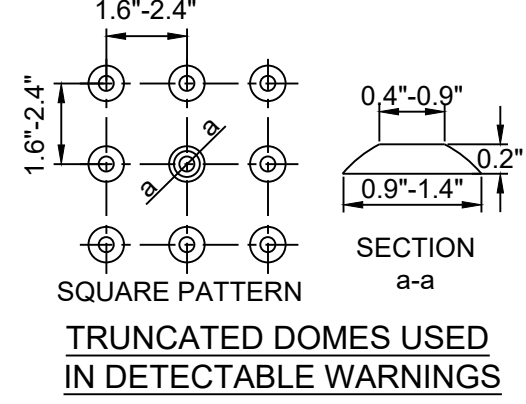


CURB RAMP L
1" = 10'

LEGEND

XXX.XX
XXX.XX
TC
FP
FG

EXISTING GRADE
PROPOSED GRADE
PROPOSED CATCH BASIN/STORM INLET
PROPOSED STORM MANHOLE
PROPOSED GRADE BREAK
TOP OF CURB
FINISHED PAVEMENT
FINISHED GRADE



WINCHESTER ROAD TURN LANE IMPROVEMENTS
1" = 20'

WAYNE HIGH SCHOOL CAMPUS IMPROVEMENTS

FORT WAYNE COMMUNITY SCHOOLS
FORT WAYNE, INDIANA

1200 S CLINTON STREET
CURB RAMP AND TURN LANE DETAILS

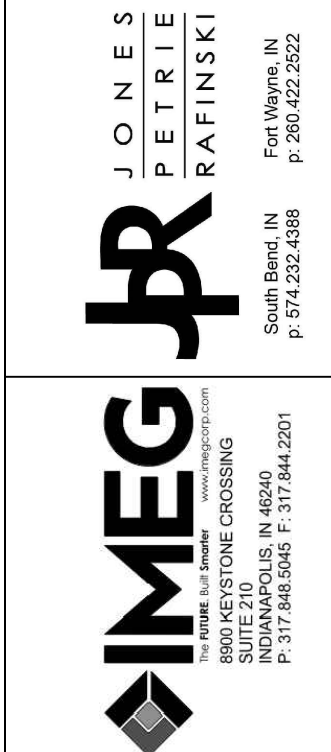
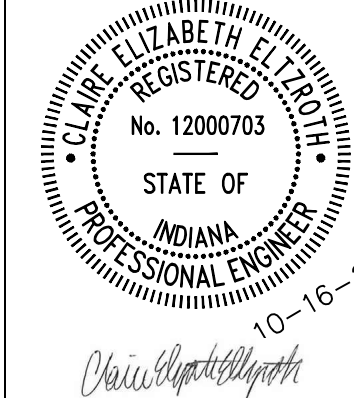
DESIGNED BY: BS
REVIEWED BY: CEE, AC
DRAWN BY: BS
REVIEWED BY: CEE, AC

DATE: NOVEMBER 7, 2025

JOB NUMBER: 2025-01487

HORIZ. SCALE: ---
VERTICAL SCALE: ---

C3.8



REV	DESCRIPTION	BY	DATE
2	REVISION 2 FOR ADDENDUM 3	RM	11-14-2025

A cross-sectional diagram of a road structure. The top layer is a thin, dark horizontal line. Below it is a thicker layer with a diagonal hatching pattern. The bottom layer is a thick, light gray area with a brick-like pattern. A diagonal line separates the hatched layer from the brick-patterned layer. The text "95% COMPACTED SUBGRADE" is written in bold, black, uppercase letters within the brick-patterned area.

1
C8.1

95% COMPACTED SUBGRADE

2
C8.1

95% COMPACTED SUBGRADE

3
C8.1

MILL AND RESURFACE 2" MINIMUM THICKNESS OR AS CALLED OUT PLANS, #9.5 M.M. HMA SURFACE COURSE

EXISTING HMA BASE

The diagram shows a cross-section of a road surface. The top layer is a thin, dark line representing the mill and resurface layer. Below it is a thicker, cross-hatched layer representing the existing HMA base. Arrows point from the text labels to their respective layers in the diagram.

4
C8.1

SAWO
CONTROL JO
WELDED WIRE
REINFORC

5
C8.1

6
C8.1

NOTE:
ALL CURB TO BE CONSTRUCTED
OF CLASS "A" CONCRETE.

7
C8.1



8
C8.1

9
C8.1

Diagram illustrating the components of the R8471RA Retractable Bollard Assembly:

- WHITE REFLECTIVE TAPE
- R8471RA RETRACTABLE BOLLARD ASSEMBLY
- R8471R RETRACTABLE BOLLARD RECEIVER

10
C8.1

NOTE:
1. ALL STEEL POSTS, FABRIC & HARDWARE TO BE BLACK, VINYL COATED.
2. CONTRACTOR SHALL COORDINATE WITH OWNER PRIOR TO ORDERING FENCING.

11
C8.1

FINISHED PAVEMENT

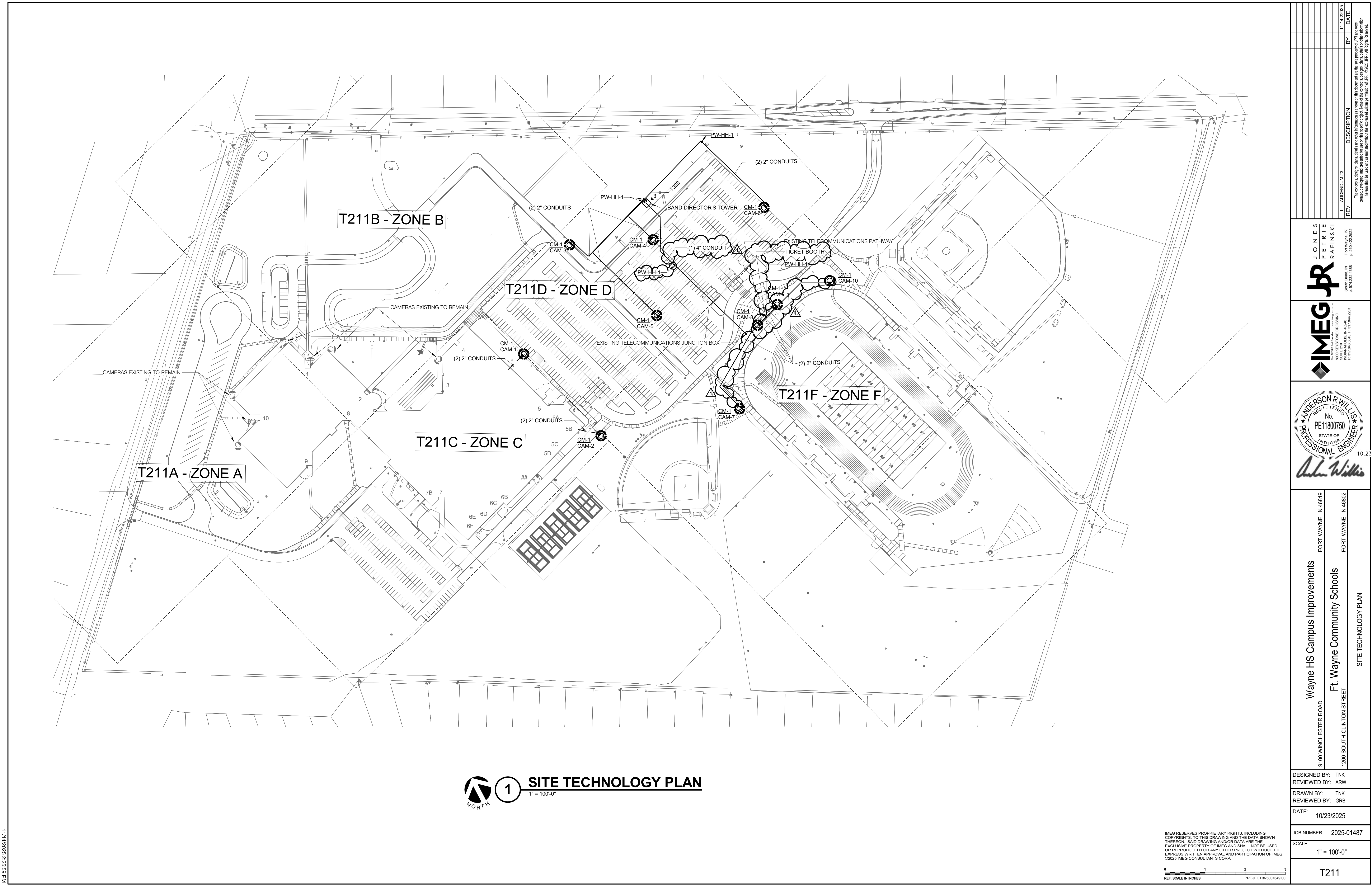
12
C8.1

3'-10" FOR POSTS 8 5/8" OD
3'-4" FOR POSTS 6 5/8" OD

13

NOTE:
1. 28" SENTINEL DOUBLE
GATE, FINISHED
GALVANIZED AND
PAINTED BLACK,
PRODUCT NUMBER
14020-28 FROM DF
SUPPLY, INC OR
APPROVED EQUAL.
PHONE 888 378 1157





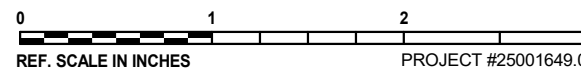
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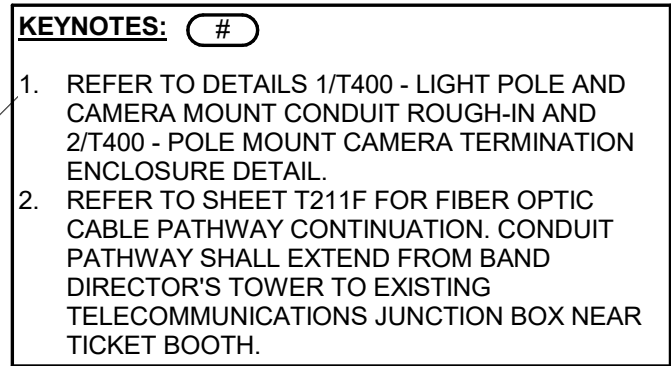
1 SITE TECHNOLOGY PLAN

1" = 100'-0"

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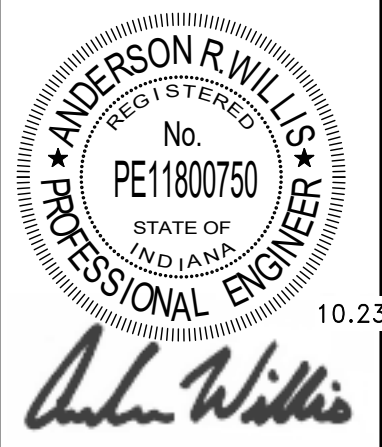
Wayne HS Campus Improvements		FORT WAYNE, IN 46819
Ft. Wayne Community Schools		FORT WAYNE, IN 46802
1200 SOUTH CLINTON STREET		
SITE TECHNOLOGY PLAN		
DESIGNED BY: TNK		
REVIEWED BY: ARW		
DRAWN BY: TNK		
REVIEWED BY: GRB		
DATE: 10/23/2025		
JOB NUMBER: 2025-01487		
SCALE: 1" = 100'-0"		
T211		
JONES PETRIE RAFINSKI		Fort Wayne, IN South Bend, IN P: 514.232.4888 F: 514.232.4888
IMEG		BROOKSTONE CROSSING BROOKSTONE CROSSING INDIANAPOLIS, IN 46240 P: 317.848.0046 F: 317.844.2201
ANDERSON R. WILLIS		REGISTERED No. PE11800750 STATE OF INDIANA PROFESSIONAL ENGINEER
10.23.25		
11/4/2025		
REV		DESCRIPTION BY DATE
1		ADDITION #3 11/4/2025



REV	ADDENDUM #3	DESCRIPTION	BY	DATE
1		1. The enclosed drawings, specifications, and contract documents shall be used in their entirety for the design and construction of the project. No substitutions, omissions, or additions shall be made without the written consent of the Engineer. 2. The drawings, specifications, and contract documents shall be used in their entirety for the design and construction of the project. No substitutions, omissions, or additions shall be made without the written consent of the Engineer. 3. The drawings, specifications, and contract documents shall be used in their entirety for the design and construction of the project. No substitutions, omissions, or additions shall be made without the written consent of the Engineer.		11-14-2020/25

JONES
PETRIE
RAFINSKI

IMEG
The Future, Built Smarter www.imeg-corp.com
8900 KEYSTONE CROSSING
SUITE 210
INDIANAPOLIS, IN 46240
P: 317.848.5045 F: 317.844.2201



10.23.25

Wayne HS Campus Improvements

Ft. Wayne Community Schools

SITE TECHNOLOGY PLAN - ZONE D

DESIGNED BY: TNK
REVIEWED BY: ARW

DRAWN BY: TNK
REVIEWED BY: GRB

DATE: 10/23/2025

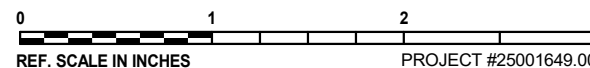
JOB NUMBER: 2025-01487

SCALE: _____

$$1'' = 30'-0''$$

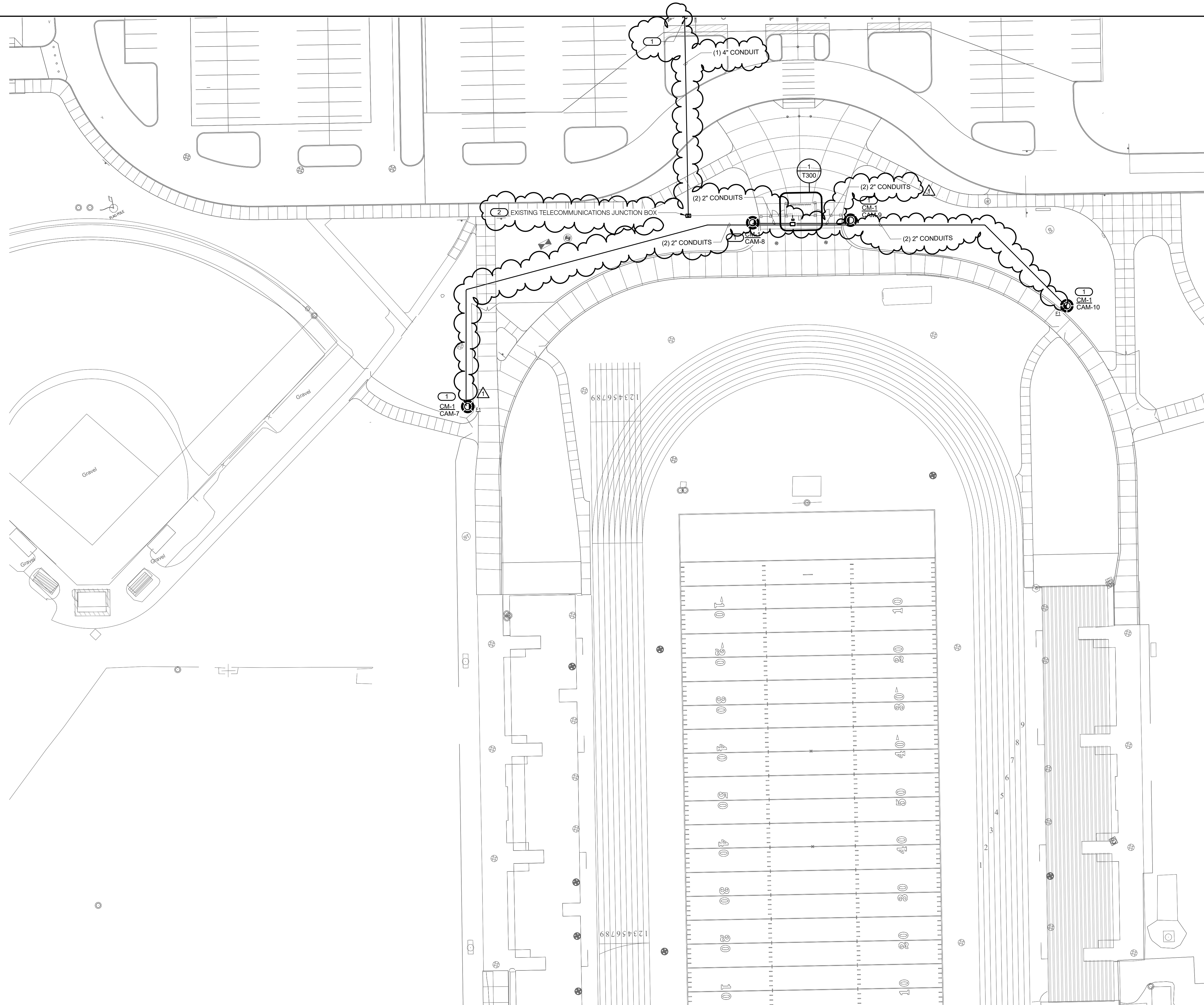
T211D

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11/4/2025 2:22:00 PM



- KEYNOTES:** #
1. REFER TO DETAILS 1/T400 - LIGHT POLE AND CAMERA MOUNT CONDUIT ROUGH-IN AND 2/T400 - POLE MOUNT CAMERA TERMINATION ENCLOSURE DETAIL.
 2. UTILIZE EXISTING JUNCTION BOX PATHWAY TO SERVE NEW TICKET BOOTH EQUIPMENT RACK CONNECTION TO BOILER ROOM MDF.
 3. REFER TO SHEET T211D FOR FIBER OPTIC CABLE PATHWAY CONTINUATION. CONDUIT PATHWAY SHALL EXTEND FROM EXISTING TELECOMMUNICATIONS JUNCTION BOX NEAR TICKET BOOTH TO BAND DIRECTOR'S TOWER.



1

SITE TECHNOLOGY PLAN - ZONE F

1" = 30'-0"

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0 1 2 3
REF. SCALE IN INCHES PROJECT #22001640.00

DESIGNED BY: TNK REVIEWED BY: ARW	
DRAWN BY: TNK REVIEWED BY: GRB	
DATE: 10/23/2025	
JOB NUMBER: 2025-01487	
SCALE: 1" = 30'-0"	
T211F	

Wayne HS Campus Improvements	
9100 WINCHESTER ROAD	FORT WAYNE, IN 46819
Ft. Wayne Community Schools	
1200 SOUTH CLINTON STREET	FORT WAYNE, IN 46802
SITE TECHNOLOGY PLAN - ZONE F	

IMEG

8800 WESTSTONE CROSSING
BROOKVILLE, IN 46500
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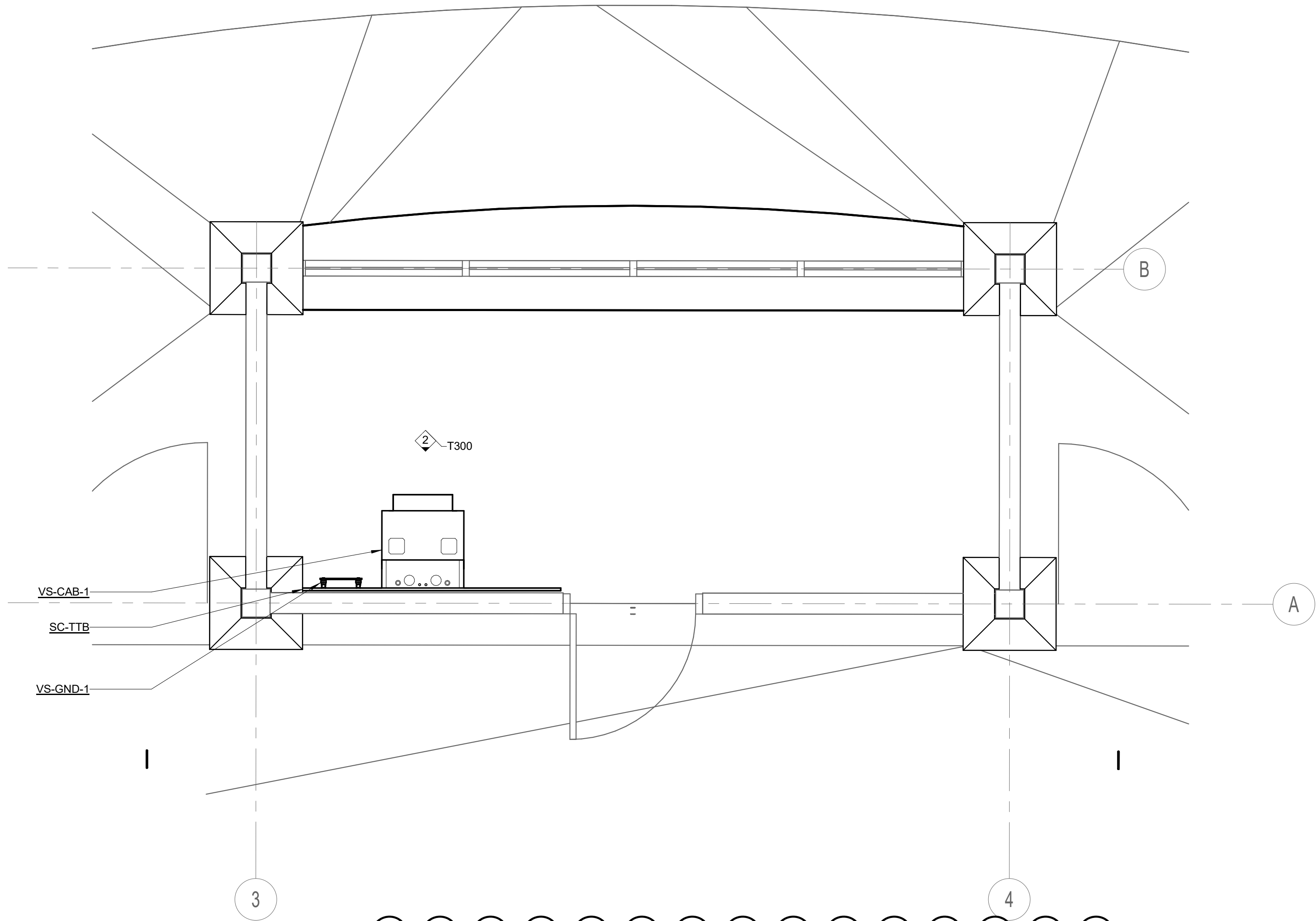
JONES
PETRIE
RAFINSKI

Fort Wayne, IN
South Bend, IN
P: 574.232.4388
P: 260.422.2022

ANDERSON R. WILLIS
REGISTERED PROFESSIONAL ENGINEER
No. PE11800750
STATE OF INDIANA

10.23.25

REV	1	ADDED	11-4-2025	DATE
DESCRIPTION	BY	DATE	This drawing, including all data, shall be used only for the project and site shown on this drawing. It shall not be used for any other project without the express written approval and participation of IMEG. ©2025 IMEG CONSULTANTS CORP.	



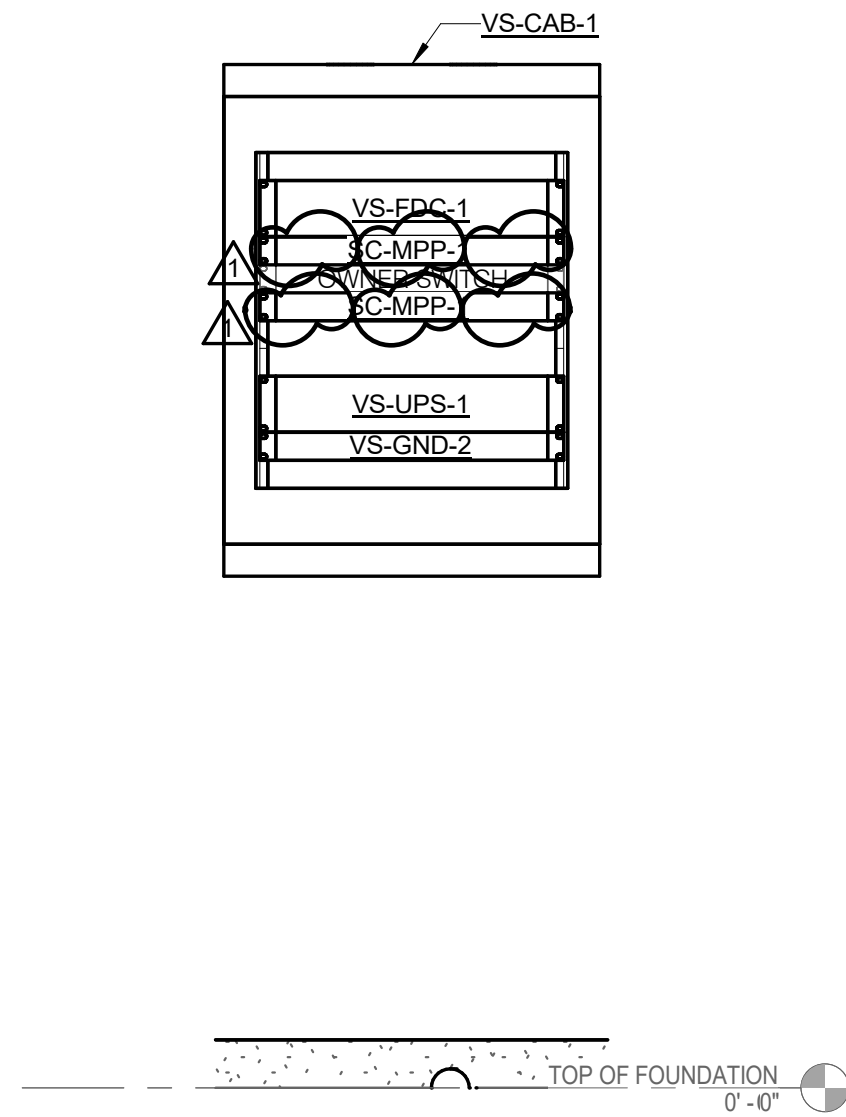
NOTES:

1. TELECOMMUNICATIONS ENCLOSURE SERVED FROM MAIN BOILER ROOM VIA EXISTING TELECOMMUNICATIONS JUNCTION BOX.



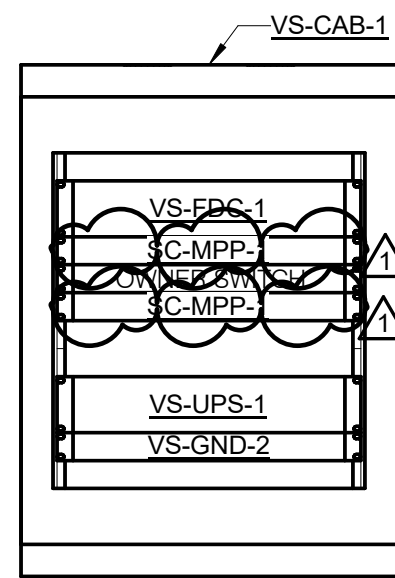
1 ENLARGED TICKET BOOTH - TECHNOLOGY

1/2" = 1'-0"



2 TICKET BOOTH - EQUIPMENT RACK ELEVATION

1" = 1'-0"



3 BAND DIRECTOR'S TOWER - EQUIPMENT RACK ELEVATION

1" = 1'-0"

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0 1 2 3
REF. SCALE IN INCHES PROJECT #20201640.00

REV	DESCRIPTION	BY	DATE
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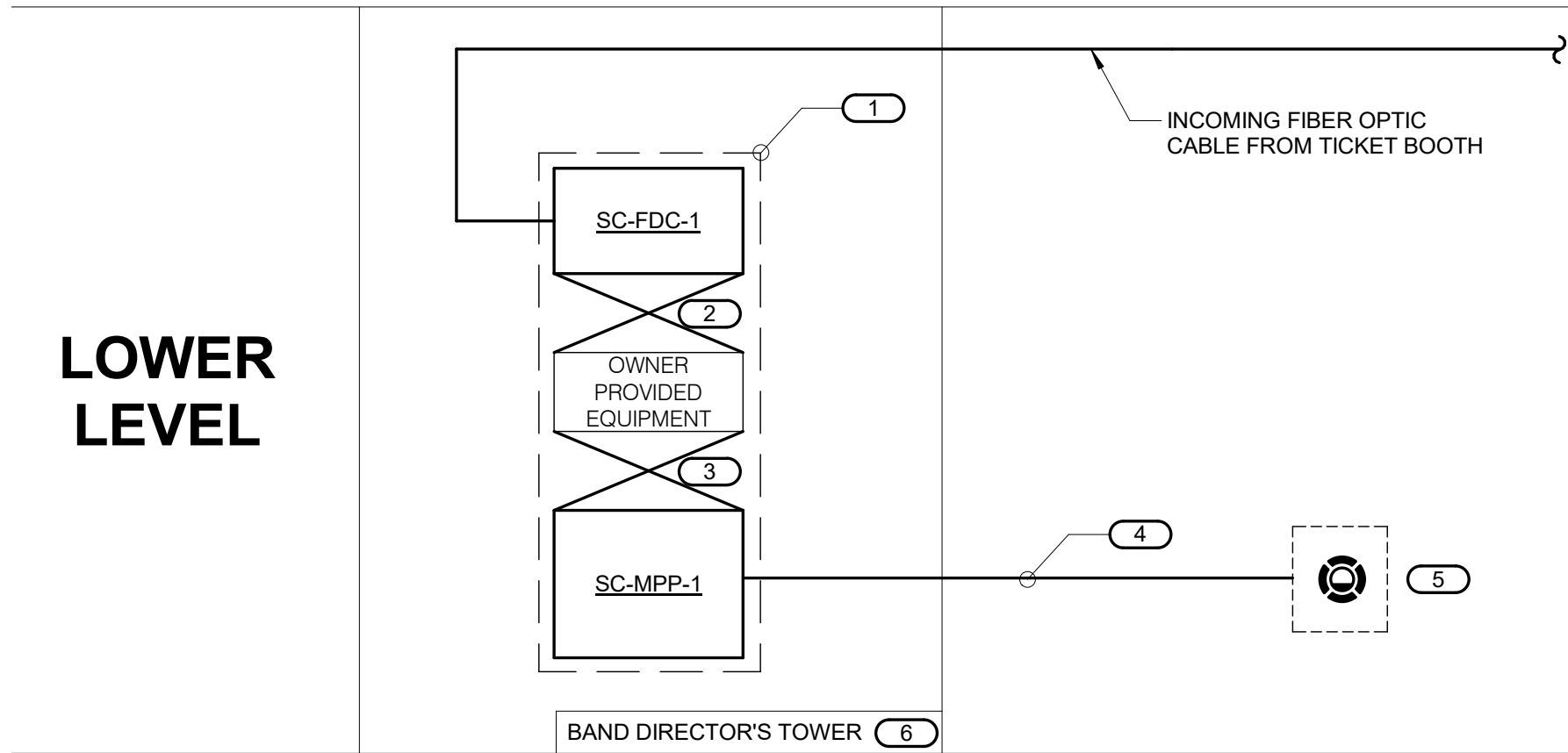
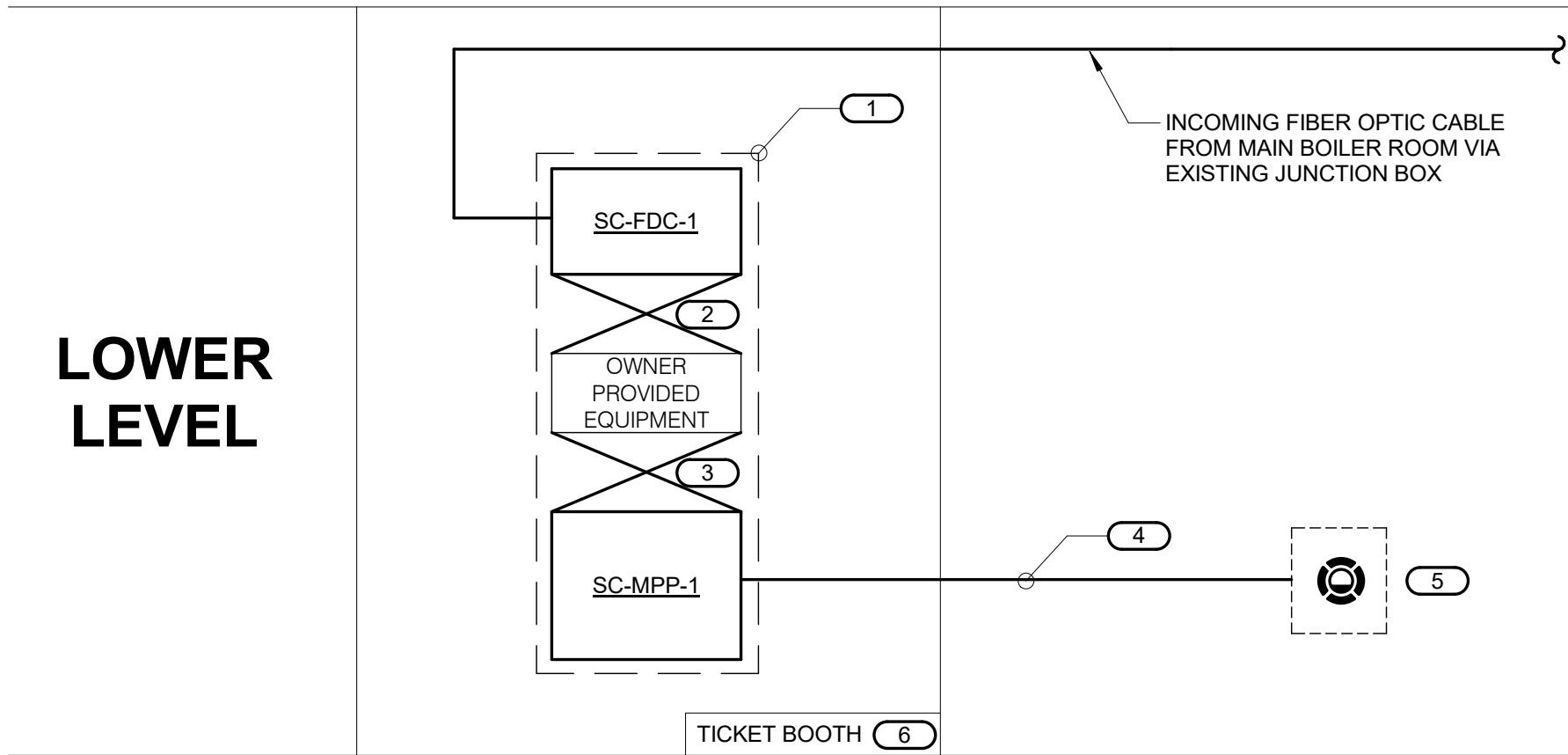
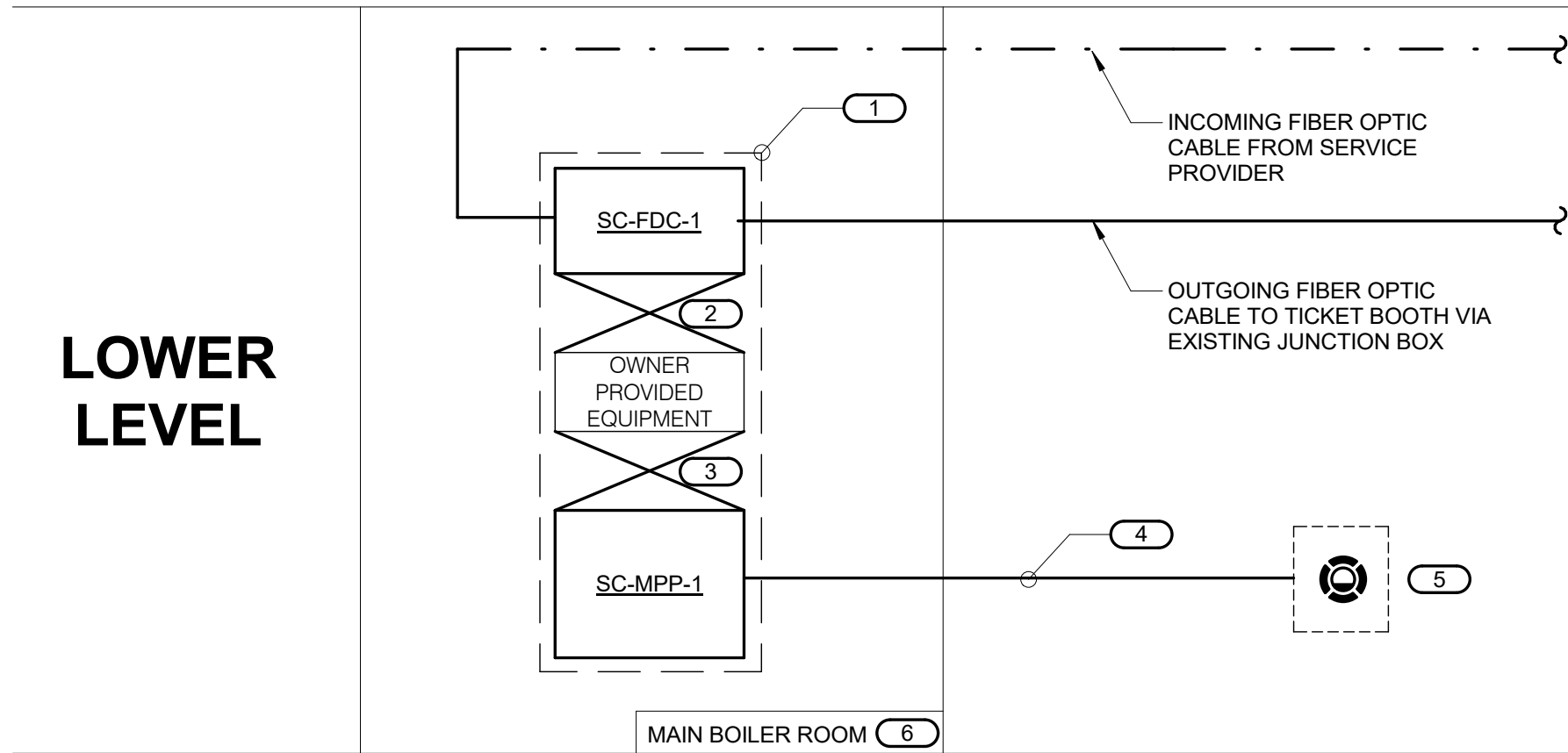
JONES
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RAFINSKI
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South Bend, IN
P: 514.272.4388
P: 200.422.2022

IMEG
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BROOKSTONE CROSSING

ANDERSON R WILLIS
REGISTERED
No. PE11800750
STATE OF INDIANA
PROFESSIONAL ENGINEER
10.23.25
Anders Willis

Wayne HS Campus Improvements
9100 WINCHESTER ROAD
FORT WAYNE, IN 46819
Ft. Wayne Community Schools
1200 SOUTH CLINTON STREET
FORT WAYNE, IN 46802
TECHNOLOGY ENLARGEMENTS

DESIGNED BY: TNK
REVIEWED BY: ARW
DRAWN BY: TNK
REVIEWED BY: GRB
DATE: 10/23/2025
JOB NUMBER: 2025-01487
SCALE: As indicated
T300



NOTES:

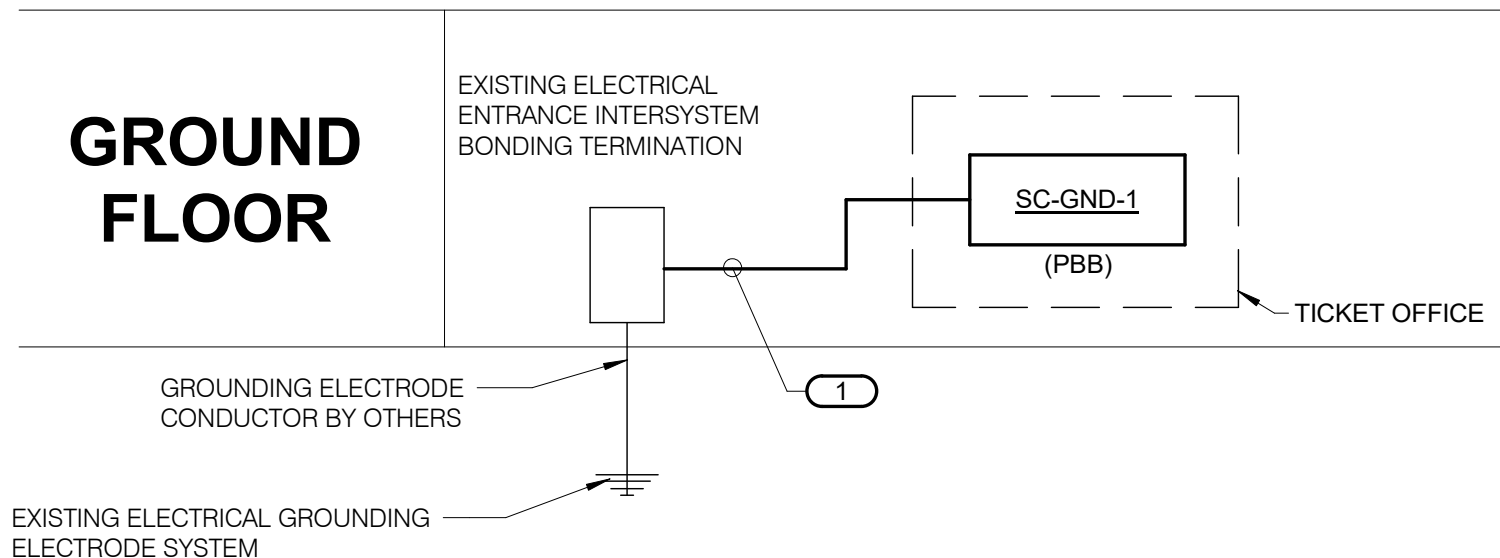
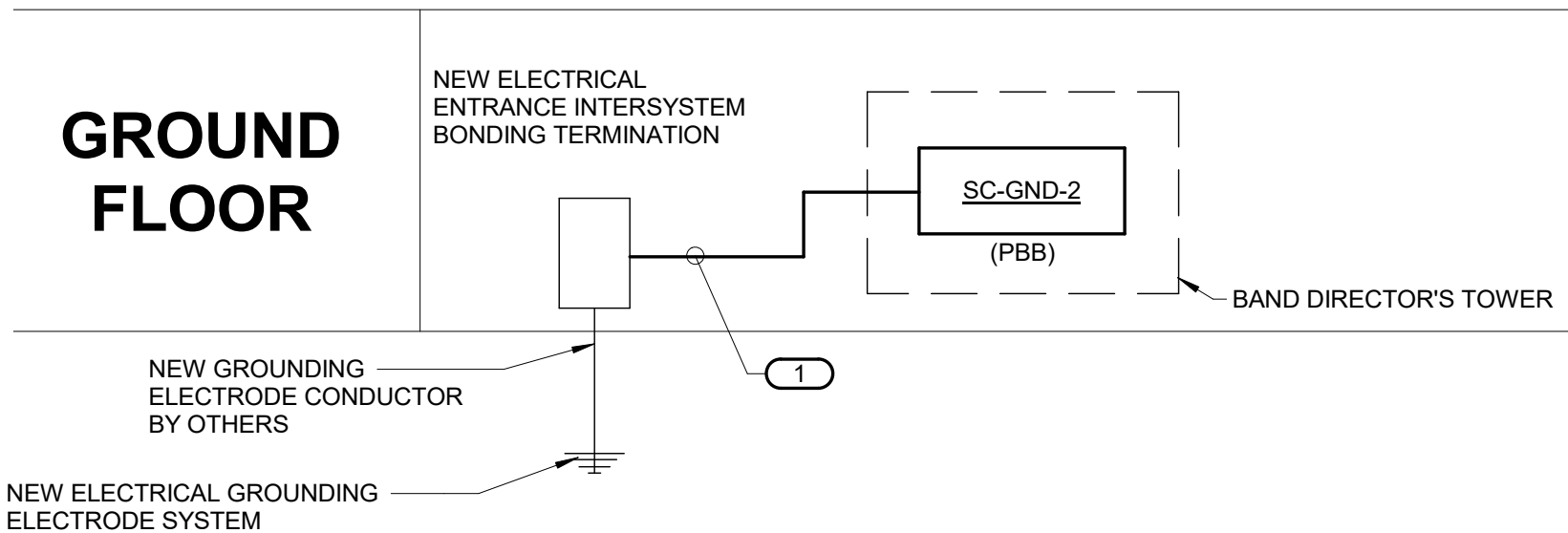
1. THIS RISER IS DIAGRAMMATIC AND MAY NOT SHOW ACTUAL ROUTING OR QUANTITIES OF MATERIALS SHOWN. THIS RISER IS SHOWN FOR CLARIFICATION OF CONNECTION(S), LOCATIONS AND CABLE TYPE. ALL INFORMATION OUTLETS ARE TYPICAL OF THE OUTLETS IN THE AREA SHOWN. REFER TO FLOOR PLANS FOR MORE SPECIFIC ROUTING INFORMATION. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
2. REFER TO FLOOR PLANS FOR QUANTITY OF CABLES AND JACKS TO BE INSTALLED AT EACH INFORMATION OUTLET.

KEYNOTES: #

1. RACK OR CABINET AS DEFINED ON THE TELECOM ROOM LAYOUT. REFER TO THE TELECOM ROOM REFERENCES MATRIX ON THE COVERPAGE FOR LOCATION.
2. REFER TO SPECIFICATIONS FOR FIBER PATCH CORD REQUIREMENTS.
3. RJ-45 TO RJ45 CATEGORY 6 UTP PATCH CORDS.
4. 4-PAIR, CATEGORY 6, UNSHIELDED TWISTED PAIR CABLE. CONTRACTOR SHALL UTILIZE PAIGE DATACOM SOLUTIONS' "GAMECHANGER" CABLE WHERE RUN DISTANCES EXCEED 328 FT.
5. DEVICE REQUIRES DATA CONNECTION. REFER TO TECHNOLOGY EQUIPMENT SCHEDULE FOR ADDITIONAL INFORMATION. COORDINATE CABLING WITH DEVICE PROVIDER.

1 FIBER AND COPPER RISER DIAGRAM

NO SCALE



NOTES:

1. THIS RISER IS DIAGRAMMATIC AND MAY NOT SHOW ACTUAL ROUTING OR QUANTITIES OF MATERIALS. THIS RISER IS SHOWN FOR CLARIFICATION OF CONNECTION LOCATIONS AND CONDUCTOR TYPE. ALL CONNECTIONS AND SYSTEM DEVICES SHOWN ARE TYPICAL AND NOT REPRESENTATIVE OF ACTUAL PROJECT QUANTITIES. REFER TO FLOOR PLANS AND ENLARGED FLOOR PLANS FOR ACTUAL QUANTITIES AND LOCATIONS OF DEVICES AND MORE SPECIFIC ROUTING INFORMATION. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
2. TELECOM BONDING BACKBONE SHALL BE PROVIDED PER BONDING CONDUCTOR SIZING SCHEDULE.
3. ALL CONDUCTORS IN THE TECHNOLOGY BONDING SYSTEM SHALL BE (PLENUM RATED) COPPER (GREEN OR MARKED WITH A DISTINCTIVE GREEN COLOR). REFER TO BONDING CONDUCTOR SIZING SCHEDULE FOR SIZING CRITERIA FOR CONDUCTORS. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
4. ALL BONDING CONDUCTORS AND BONDING JUMPERS SHALL BE CONNECTED BY COMPRESSION LUGS, EXOTHERMIC WELDING, OR IRREVERSIBLE COMPRESSION CONNECTORS. SOLDER IS NOT AN ACCEPTABLE MEANS OF CONNECTION. SHEET METAL SCREWS SHALL NOT BE USED TO CONNECT COMMUNICATIONS BONDING CONDUCTORS TO EQUIPMENT. WHERE NECESSARY, REMOVE PAINT AND/OR USE PAINT-PIERCING WASHERS TO PROVIDE PROPER ELECTRICAL BOND AT ALL CONNECTIONS.
5. SC-GND-1 IS THE PRIMARY BONDING BUSBAR (PBB) WHICH CONNECTS TO THE (TBC) AND CONNECTS ALL SECONDARY BONDING BUSBAR (SBB) VIA THE (BBC).
6. REFER TO FOR TYPICAL TELECOM ROOM BONDING FLOW DIAGRAM.
7. REFER TO TELECOM ROOM REFERENCES SCHEDULE FOR TELECOMMUNICATIONS ROOM NUMBER AND LOCATION INFORMATION.

KEYNOTES: #

1. TELECOMMUNICATIONS BONDING CONDUCTOR (TBC). TBC SHALL BE THE SAME SIZE AS THE TBB OR LARGER. REFER TO BONDING CONDUCTOR SIZING SCHEDULE FOR SIZING REQUIREMENTS.

BONDING CONDUCTOR SIZING SCHEDULE	
CONDUCTOR LENGTH IN FEET	MINIMUM ACCEPTABLE SIZE - AWG
LESS THAN 13'	6
14' - 20'	4
21' - 26'	3
27' - 33'	2
34' - 41'	1
42' - 52'	1/0
53' - 66'	2/0
67' - 84'	3/0
85' - 105'	4/0
106' - 125'	250 kcmil
126' - 150'	300 kcmil
151' - 175'	350 kcmil
176' - 250'	500 kcmil
251' - 300'	600 kcmil
GREATER THAN 301'	750 kcmil

2 TECHNOLOGY BONDING RISER DIAGRAM

NO SCALE

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0 1 2 3
REF. SCALE IN INCHES PROJECT #22001648.00

REV	DESCRIPTION	BY	DATE
1	ADDITIONAL #3		11-14-2025

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RAFINSKI
Fort Wayne, IN
South Bend, IN
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P: 514.232.2022

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ANDERSON R WILLIS
REGISTERED
No. PE11800750
STATE OF INDIANA
PROFESSIONAL ENGINEER
10.23.25
Anders Willis

Wayne HS Campus Improvements
9100 WINCHESTER ROAD
FORT WAYNE, IN 46819
Ft. Wayne Community Schools
1200 SOUTH CLINTON STREET
FORT WAYNE, IN 46802
TECHNOLOGY DIAGRAMS

DESIGNED BY: TNK
REVIEWED BY: ARW

DRAWN BY: TNK
REVIEWED BY: GRB

DATE: 10/23/2025

JOB NUMBER: 2025-01487

SCALE: 12" = 1'-0"

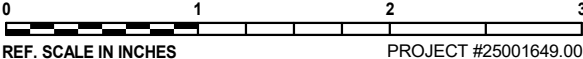
T500

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INDIVIDUAL CAMERA REQUIREMENTS SCHEDULE								
CAMERA #	CAMERA TYPE	CAMERA ENVIRONMENT	TELECOM ROOM #	LOCATION	FIELD OF VIEW DESCRIPTION	MOUNTING TYPE	DETAIL REFERENCE	ADDITIONAL INFORMATION
CAM-1	CM-1	EXTERIOR	BUILDING INTERIOR	SITE	SITE EXTERIOR - PARKING LOT	POLE	1/T400	
CAM-2	CM-1	EXTERIOR	BUILDING INTERIOR	SITE	SITE EXTERIOR - PARKING LOT	POLE	1/T400	
CAM-3	CM-1	EXTERIOR	BAND DIRECTOR'S TOWER	SITE	SITE EXTERIOR - PARKING LOT	POLE	1/T400	
CAM-4	CM-1	EXTERIOR	BAND DIRECTOR'S TOWER	SITE	SITE EXTERIOR - PARKING LOT	POLE	1/T400	
CAM-5	CM-1	EXTERIOR	BAND DIRECTOR'S TOWER	SITE	SITE EXTERIOR - PARKING LOT	POLE	1/T400	
CAM-6	CM-1	EXTERIOR	BAND DIRECTOR'S TOWER	SITE	SITE EXTERIOR - PARKING LOT	POLE	1/T400	
CAM-7	CM-1	EXTERIOR	TICKET BOOTH	SITE	SITE EXTERIOR - STADIUM	POLE	1/T400	
CAM-8	CM-1	EXTERIOR	TICKET BOOTH	SITE	SITE EXTERIOR - STADIUM	POLE	1/T400	
CAM-9	CM-1	EXTERIOR	TICKET BOOTH	SITE	SITE EXTERIOR - STADIUM	POLE	1/T400	
CAM-10	CM-1	EXTERIOR	TICKET BOOTH	SITE	SITE EXTERIOR - STADIUM	POLE	1/T400	

TECHNOLOGY EQUIPMENT SCHEDULE		
THE EQUIPMENT LIST ABBREVIATIONS AND THE TECHNOLOGY EQUIPMENT SCHEDULE ARE FOR THE CONVENIENCE OF THE CONTRACTOR. EACH CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFICATION OF QUANTITIES AND SHALL FURNISH ALL MATERIAL REQUIRED, WHETHER SPECIFIED OR NOT, TO PRODUCE A SATISFACTORY WORKING SYSTEM.		
CATALOG NUMBERS ARE NOT TO BE CONSIDERED COMPLETE BUT ARE GIVEN ONLY TO AID THE CONTRACTOR IN THE SEARCH FOR MATERIAL. NO MATERIAL SHALL BE ORDERED BY MANUFACTURER AND CATALOG NUMBER ONLY. EACH CONTRACTOR SHALL FIRST READ THE COMPLETE DESCRIPTION OF THE MATERIAL ON THESE DRAWINGS AND SPECIFICATIONS. THE FIRST MANUFACTURER LISTED IS THE BASIS OF DESIGN. "STANDARD COLOR" INDICATES FACTORY FINISH AVAILABLE AT NO ADDITIONAL CHARGE.		
EQUIPMENT LIST ABBREVIATION	EQUIPMENT LIST DESCRIPTION	MANUFACTURER AND MODEL
PW-HH-1	HANDHOLE COMPOSITE POLYMER CONCRETE BODY AND COVER. STAINLESS STEEL HARDWARE BOLTED NON-SKID COVER RATED FOR 15,000LB. DESIGN LOAD OCCASIONAL NON-DELIBERATE VEHICULAR TRAFFIC. STACK UNITS TO ACIEVE DEPTH SHOWN ON PLANS. UNITS IN LANDSCAPED AREAS SHALL BE GREEN IN COLOR. "COMMUNICATIONS" LOGO ON HANHOLE COVER. CONTRACTOR SHALL FIELD VERIFY QUANTITY AND LOCATIONS. REFER TO 2/T400 FOR DETAIL. PW-HH-1 = 24"WX24"L.	HUBBELL/QUAZITE PG2424BB24 PG2424HA00 CARSON INDUSTRIES ARMORCAST HIGHLINE PRODUCTS SYNERTECH
SC-MPP-1	MODULAR PATCH PANEL, 48 MODULAR RJ-45 SATISFICATIONS, MOUNTS DIRECTLY TO ENITIA STANDARD 19" RELAY RACK, PORT IDENTIFICATION NUMBERS PROVIDED WITH COLOR CODING AND LABEL HOLDER KITS, U.L. LISTED. REQUIRES (2) 1.75" MOUNTING SPACES.	PANDUIT CPPL48WBLY
SC-TTB	TELECOMMUNICATION TERMINAL BOARD 4' X 8' X 3/4" A-C GRADE FIRE RATED PLYWOOD. EXPOSED SIDE SHALL BE SMOOTH MOUNT VERTICALLY WITH TOP OF PLYWOOD AT 8'6" AFF.	*
VS-CAB-1	SERVER RACK ENCLOSURE, 12RU, 28" D X 28" W X 28" H, POWDER COATED FINISH STEEL, SUITABLE FOR INDOOR/OUTDOOR CONDITIONS. BUILT-IN INTERNAL FANS, DOUBLE KEY LOCK. NEMA 3R RATED.	TRIPP-LITE SRN3RG12US
VS-CM-1	SECURITY CAMERA: MULTI-DIRECTIONAL, MULTI-LENS VARIFOCAL LENS INTERIOR OR EXTERIOR IP CAMERA. 4 x 5 MEGAPIXEL SENSORS, VARIFOCAL: 4.13-9.4 mm, MIN ILLUMINATION: COLOR: 0.05 LUX; B/W: 0.00 LUX. FEATURES: WIDE DYNAMIC RANGE, IR ILLUMINATION: VIDEO COMPRESSION: H.264, H.265, MOTION JPEG; CASING: IP66-RATED; IK RATING: IK10 IMPACT-RESISTANT CASING WITH HARD-COATED DOME; POWER: TYPICAL 33.7W, MAX 45W; OPERATING CONDITIONS: -40-55 DEG C.; INCLUDES VANDAL RESISTANT SCREWS. CAMERA COLOR: CONTRACTOR TO PROVIDE CUSTOM PAINTING OF SECURITY CAMERAS AND MOUNTS UNDER ARCHITECT'S DIRECTION. INFORMATION OUTLET FOR CAMERA SHALL BE TERMINATED ON AN RJ-45 PLUG. REFER TO THE INFORMATION OUTLET SCHEDULE ON SHEET T701.3 FOR ADDITIONAL INFORMATION. THE TECHNOLOGY EQUIPMENT SCHEDULE ONLY DESCRIBES CAMERA SERIES AND PERFORMANCE INFORMATION. REFER TO INDIVIDUAL CAMERA SCHEDULE ON SHEET T600 FOR ADDITIONAL INFORMATION ON INDIVIDUAL CAMERA REQUIREMENTS, ROUGH-IN, AND MOUNTING.	AXIS P3737-PVE
VS-FDC-1	OPTICAL FIBER DISTRIBUTION CABINET, RACK MOUNT, .96 FIBER MAXIMUM CAPACITY, FRONT LOCKING DOOR, SLIDE OUT RAILS TO FACILITATE FRONT ACCESS. JUMPER TROUGHS IN CONNECTOR PANELS TO REDUCE MOUNTING SPACE. REQUIRES (2) 19" x 1.75" RACK MOUNTING SPACES. PROVIDE WITH CLAMP AND GROUNDING KIT, COUPLING PANEL(S), JUMPERS, AND REAR MOUNTED CLOSET HOUSING PANELS(S). REFER TO SPECIFICATIONS SECTION 27 11 00 FOR ADDITIONAL INFORMATION.	CORNING CCH-01U CCH-CP06-E4-P03SH
VS-GND-1	GROUNDING BUSBAR, WALL MOUNT, 4" H X 12" L X 1/4" D SOLID COPPER, ELECTRICALLY ISOLATED BY INSULATORS INTEGRAL TO STAINLESS STEEL MOUNTING BRACKETS. PROVIDE UNIT CONFIGURED WITH 15 SETS OF 5/16" HOLES SPACED 5/8" ON CENTER TO ACCOMMODATE "A" SPACED TWO-HOLE COMPRESSION LUGS AND 3 SETS OF 7/16" HOLES SPACED 1" ON CENTER TO ACCOMMODATE "C" SPACED TWO-HOLE COMPRESSION LUGS. ANSI/EIA/TIA-607 AND BICSI COMPLIANT. UL LISTED. REFER TO SPECIFICATION 27 11 00 FOR ADDITIONAL INFORMATION.	PANDUIT GB4B0612TPI-1
VS-GND-2	RACK-MOUNT GROUNDING BUSBAR KIT. 19" LENGTH, TIN PLATED, 20 HOLES WITH #12-24 X 1/2" HEX HEAD SCREWS, MOUNTING HOLES 5/8" SPACING. THREAD FORMING SCREWS AUTOMATICALLY CREATES BONDS UPON INSTALLATION. ANSI/EIA/TIA-607 AND BICSI COMPLIANT. UL LISTED.	PANDUIT RGRB19U
VS-UPS-1	UNINTERRUPTABLE POWER SUPPLY, 2U RACK MOUNTED, INSTANT BACKUP BATTERY POWER, 2.2KVA POWER CAPACITY, 5.5MIN RUN TIME, 1920W POWER. INCLUDE NETWORK MANAGEMENT CARD, 120V NEMA 5-20P. CONFIRM ELECTRICAL CONNECTION WITH E.C.	TRIPP-LITE SMART2200RML2U

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11/4/2025

DATE

BY

DESCRIPTION

REV

1

ADDITION #3

JONES
PETRIE
RAFINSKI

Wayne HS Campus Improvements

9100 WINCHESTER ROAD

FORT WAYNE, IN 46819

Ft. Wayne Community Schools

1200 SOUTH CLINTON STREET

FORT WAYNE, IN 46802

TECHNOLOGY SCHEDULES

DESIGNED BY: TNK

REVIEWED BY: ARW

DRAWN BY: TNK

REVIEWED BY: GRB

DATE: 10/23/2025

JOB NUMBER: 2025-01487

SCALE:

T600



We Are Your Schools

DIVISION 2 – EXISTING CONDITIONS

02 4113 - Building and Site Demolition

DIVISION 3 – CONCRETE

03 3200 - Concrete Reinforcing

03 3000 - Cast-In-Place Concrete

03 4500 - Precast Architectural Concrete

DIVISION 4 – MASONRY

04 2613 – Masonry Veneer

DIVISION 5 – METALS

05 1200 – Structural Steel Framing

05 3100 - Steel Decking

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

07 4113.16 – Standing Seam Metal Roof Panels

07 4213.13 – Formed Metal Wall Panels

07 4293 – Soffit Panels

07 7100 - Roof Specialties

07 7253 – Snow Guards

07 9200 - Joint Sealants

DIVISION 08 – OPENINGS

08 1113 – Hollow Metal Doors and Frames

08 7100 – Door Hardware

08 8100 – Security Glass

DIVISION 09 – FINISHES

09 9600 - High Performance Coatings (MPI Standards)

Division 10 – SPECIALTIES

10 1419 – Dimensional Letter Signage



We Are Your Schools

DIVISION 26 – ELECTRICAL

260500 - Basic Electrical Requirements
260505 - Electrical Demolition For Remodeling
260513 - Wire And Cable
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260533 - Conduit And Boxes
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260933 - Lighting Control Systems
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DIVISION 27 – TECHNOLOGY

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270526 - Communications Bonding
Section 270543 - Exterior Communication Pathway
Section 270553 - Identification For Communication Systems
Section 271100 - Communication Equipment Rooms (Cer)
Section 271300 - Backbone Cabling Requirements
Section 271500 - Horizontal Cabling Requirements
Section 271710 – Testing
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DIVISION 31 – EARTHWORK

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31 1000 - Site Clearing
31 2000 - Earth Moving
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31 2316 - Excavation
31 2316.13 – Trenching
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32 1313 - Concrete Paving
32 1373 - Concrete Paving Joint Sealants
32 1723 – Pavement Markings



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32 3113 - Chain Link Fencing and Gates
32 3119 – Decorative Metal Fence and Gates
32 9113 - Soil Preparation
32 9200 - Turf and Grasses
32 9300 - Plants

DIVISION 33 – UTILITIES

33 4100 - Storm Drainage
33 4200 - Stormwater Conveyance
33 4600 - Subdrainage

SECTION 084313 - ALUMINUM-FRAMED STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aluminum-framed storefront systems.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For aluminum-framed storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- C. Samples: For each type of exposed finish required.

1.3 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. CMI Architectural.
2. EFCO Corporation.
3. Kawneer North America, an Arconic company.
4. Manko Window Systems, Inc.
5. Tubelite Inc.
6. YKK AP America Inc.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 1. Aluminum-framed storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Structural Loads:
 1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: As indicated on Drawings.
- D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches.
 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.
 3. Cantilever Deflection: Limited to 2l/175 at unsupported cantilevers.
- E. Structural: Test in accordance with ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, storefront assemblies do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..
- G. Energy Performance: Certified and labelled by manufacturer for energy performance as follows:
1. Thermal Transmittance (U-factor):
 - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.58 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
 2. Solar Heat Gain Coefficient (SHGC):
 - a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.63 as determined in accordance with NFRC 200.
 3. Air Leakage:
 - a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft. when tested in accordance with ASTM E283.
 4. Condensation Resistance Factor (CRF):
 - a. Fixed Glazing and Framing Areas: CRF for the system of not less than 70 as determined in accordance with AAMA 1503.
- H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.3 ALUMINUM-FRAMED STOREFRONT SYSTEMS

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Exterior Framing Construction: Thermally broken.
 - 2. Glazing System: Retained mechanically with structural sealant on four sides as required by Security Glass manufacturer.
 - 3. Glazing Plane: Center.
 - 4. Finish: Clear anodic finish.
 - 5. Fabrication Method: Field-fabricated stick system.
 - 6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 7. Steel Reinforcement: As required by manufacturer.
- B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.4 GLAZING

- A. Glazing: Comply with Section 088100 "Security Glass."
- B. Glazing Sealants: As recommended by Security Glass manufacturer.

2.5 MATERIALS

- A. Sheet and Plate: ASTM B209.
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
- C. Structural Profiles: ASTM B308/B308M.
- D. Steel Reinforcement:
 - 1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
 - 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
 - 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

- E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.6 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from [exterior] [interior] [interior for vision glass and exterior for spandrel glazing or metal panels].
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.7 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, or thicker.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.

- D. Rigidly secure nonmovement joints.
- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Seal perimeter and other joints watertight unless otherwise indicated.
- G. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- H. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.
- I. Install joint filler behind sealant as recommended by sealant manufacturer.
- J. Install components plumb and true in alignment with established lines and grades.

3.2 INSTALLATION OF GLAZING

- A. Install glazing as specified in Section 088100 "Security Glass."

END OF SECTION

SECTION 270500 - BASIC COMMUNICATIONS SYSTEMS REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Basic Communications Systems Requirements specifically applicable to Division 27 sections, in addition to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 SCOPE OF WORK

- A. This Specification and the associated drawings govern furnishing, installing, testing and placing into satisfactory operation the Communications Systems.
- B. The Contractor shall furnish and install all new materials as indicated on the drawings, and/or in these specifications, and all items required to make the portion of the Communications Work a finished and working system.
- C. Separate contracts will be awarded for the following work. The division of work listed below is for the contractors' convenience and lists a normal breakdown of the work. Please refer to the Construction Manager's scope statements for complete scope of work description.
- D. Description of Systems include, but are not limited to, the following:
 - 1. Complete Structured Cabling System for exterior video surveillance cameas including, but not limited to:
 - a. Exterior Backbone cabling and terminations.
 - b. Exterior Horizontal cabling and terminations.
 - c. Information outlets (IOes) including faceplates, jacks and labeling.
 - d. Equipment cabinets, cable management, and equipment.
 - e. Telecommunication equipment including patch panels and optical distribution cabinets.
 - f. Cabling pathways.
 - g. Grounding and bonding
 - h. Testing
 - 2. Low Voltage Communications Wiring (less than +120VAC) as specified and required for proper system control and communications.

3. All associated electrical backboxes, conduit, miscellaneous cabling, and power supplies required for proper system installation and operation as defined in the "Suggested Matrix of Scope Responsibility".

1.3 DIVISION OF WORK BETWEEN ELECTRICAL AND COMMUNICATIONS CONTRACTORS

- A. Division of work is the responsibility of the Prime Contractor. Any scope of work described in the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described in the contract documents. The following division of responsibility is a guideline based on typical industry practice.
- B. Definitions:
 1. "Electrical Contractor" as referred to herein refers to the Contractors listed in Division 26 of this Specification.
 2. "Electrical Contractor" shall also refer to the Contractor listed in Division 27 of this specification when the "Suggested Matrix of Scope Responsibility" indicates the work shall be provided by the EC. Refer to the Contract Documents for the "Suggested Matrix of Scope Responsibility".
 3. "Technology Contractor" as referred to herein refers to the Contractors listed in Division 27 of this Specification.
 4. Low Voltage Technology Wiring: The wiring (less than 120VAC) associated with the Technology Systems, used for analog and/or digital signals between equipment.
 5. Telecommunications/Technology Rough-in: Relates specifically to the backboxes, necessary plaster rings and other miscellaneous hardware required for the installation and mounting of the telecommunications equipment..
- C. General:
 1. The purpose of these specifications is to outline typical Electrical and Technology Contractor's work responsibilities as related to technology systems including telecommunications rough-in, conduit, power wiring, and low voltage communications and technology wiring. The prime contractor is responsible for all divisions of work.
 2. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals are approved. Therefore, only known wiring, conduits, raceways, and electrical power as related to such items, is shown on the technology drawings. Other wiring, conduits, raceways, junction boxes, and electrical power not shown on the technology drawings but required for the successful operation of the systems shall be the responsibility of the Technology Contractor and included in the Contractor's bid.



3. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of technology systems, the final installation shall not begin until a coordination meeting between the Electrical Contractor and the Technology Contractor has convened to determine the exact location and requirements of the installation.
4. Where the Electrical Contractor is required to install cable pathways that will contain low voltage technology wiring, the installation shall not begin until the Technology Contractor has completed a coordination review of the pathway shop drawing.

D. Electrical Contractor's Responsibility:

1. Assumes all responsibility for all required conduit and power connections when shown on the "Suggested Matrix of Scope Responsibility" to be provided by the Electrical Contractor.
2. Responsible for Communications Systems grounding and bonding.
3. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

E. Technology Contractor's Responsibility:

1. Assumes all responsibility for the low voltage technology wiring of all systems, including cable support where open cable is specified.
2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being provided by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility."
3. Assumes all responsibility for providing and installing all ladder rack and other cable management hardware (as defined herein).
4. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of technology equipment which is required to be bonded to the technology bonding system.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.4 QUALITY ASSURANCE

A. Telecommunications Structured Cabling System Standards:

1. All work and equipment shall conform to the most current ratified version of the following published standards unless otherwise indicated that draft standards are to be followed:

- a. ANSI/NECA/BICSI 568 - Standard for Installing Commercial Building Telecommunications Cabling
 - b. ANSI/TIA-568-0-D - Generic Telecommunications Cabling for Customer Premises
 - 1) 1-D - Commercial Building Telecommunications Standard
 - 2) 2-D - Balanced Twisted-Pair Telecommunications Cabling and Components Standard
 - 3) 3-D - Optical Fiber Cabling Components Standard
 - 4) 4-D - Broadband Coaxial Cabling and Components Standard
 - c. ANSI/TIA-569-E - Telecommunications Pathways and Spaces
 - d. ANSI/TIA-606-C - Administration Standard for Commercial Telecommunications Infrastructure
 - e. ANSI/TIA-607-D - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
 - f. ANSI/TIA-1152 - Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
 - g. ANSI/TIA/EIA-598-C - Optical Fiber Cable Color Coding
 - h. NFPA 70 (NEC) - National Electrical Code (Current Edition)
 - i. UL 444 - Standard for Safety for Communications Cable
- B. Refer to individual sections for additional Quality Assurance requirements.
- C. Qualifications:
- 1. Only products of reputable manufacturers as determined by the Architect/Engineer will be acceptable.
 - 2. The installing Contractor shall be certified by the manufacturer of the structured cabling system. Certification of Contractor shall have been in place for a minimum of one (1) year prior to bidding this project. Documentation of certification is required at the time of bid. Shop drawings will not be approved until proof of certification is submitted. Refer to the end of this specification section for certification documentation requirements.
 - 3. Each Contractor and their subcontractors shall employ only workers who are skilled in their respective trades and fully trained. All workers involved in the termination of cabling shall be individually certified by the manufacturer.
 - 4. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size.
 - 5. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and copper structured cabling systems and have personnel adequately trained in the use of such tools and equipment.
 - 6. The Contractor must have a BICSI RCDD (Registered Communications Distribution Designer) or CNet CNIDP (Certified Network Infrastructure Design Professional) on-staff serving as a project manager. Project shop drawings and test reports shall be stamped by the RCDD or CNIDP.

D. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the City of Fort Wayne Codes, Laws, Ordinances and other regulations having jurisdiction.
2. In the event there are no local codes having jurisdiction over this job, the current issue of the National Electrical Code shall be followed.
3. If there is a discrepancy between the codes and regulations having jurisdiction over this installation, and these specifications, Architect/Engineer shall determine the method or equipment used.
4. If the Contractor notes, at the time of bidding, any parts of the drawings and specifications which are not in accordance with the applicable codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time to follow this procedure, he shall submit with the proposal, a separate price required to make the system shown on the drawings comply with the codes and regulations.
5. Verify the installation environment prior to purchasing or installing any cable. Cable installed in a plenum environment shall be appropriately rated. Bring all discrepancies between the contract documents and installation conditions to the attention of the Architect/Engineer prior to purchase or installation.
6. All changes to the system made after the letting of the contract, in order to comply with the applicable codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.

E. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all applicable laws, regulations, ordinances, and other rules of the State or Political Subdivision wherein the work is done, or as required by any duly constituted public authority.
3. Pay all applicable charges for such permits or licenses that may be required.
4. Pay all applicable fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections due to codes, permits, licenses or as otherwise may be required by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized independent agency/consultant.
7. Pay any charges by the service provider related to the service or change in service to the project.
8. All equipment and materials shall be as approved or listed by the following (unless approval or listing is not applicable to an item by all acceptable manufacturers):
 - a. Factory Mutual
 - b. Underwriters' Laboratories, Inc.

F. Examination of Drawings:

1. The drawings for the technology systems work are diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and the exact routing of cabling to best fit the layout of the job. Scaling of the drawings will not be sufficient or accurate for determining this layout. Where a specific route is required, such route will be indicated on the drawings.
3. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
4. If an item is either shown on the drawings, called for in the specifications or required for proper operation of the system, it shall be considered sufficient for including same in this contract.
5. The determination of quantities of material and equipment required shall be made by the Contractor from the drawings. Schedules on the drawings and in the specifications are completed as an aid to the Contractor but where discrepancies arise, the greater number shall govern.
6. Where words "provide", "install", or "furnish" are used on the drawings or in the specifications, it shall be taken to mean, to furnish, install and terminate completely ready for operation, the items mentioned.

G. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
4. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
5. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
6. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
7. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.



H. Field Measurements:

1. Before ordering any materials, this Contractor shall verify all pertinent dimensions at the job site and be responsible for their accuracy.
2. Field conditions that will result in telecommunications drops that exceed the length limitations identified in the contract documents shall be brought to the attention of the Architect/Engineer prior to installation. The cost of reworking cabling that is too long, that was not brought to the written attention of the Architect/Engineer will be borne entirely by the Contractor.
3. This Contractor shall provide the Architect/Engineer with written documentation of any cabling drops that will not be able to use the cable tray (where cable tray is available) due to the resulting cabling lengths. This documentation shall be submitted prior to installation and installation shall not commence until approved by the Architect/Engineer.

1.5 WEB-BASED PROJECT SOFTWARE

- A. The General Contractor shall provide a web-based project software site for the purpose of hosting and managing project communication and documentation until completion of the warranty phase.
- B. The web-based project software shall include, at a minimum, the following features: construction schedule, submittals, RFIs, ASIs, construction change directives, change orders, drawing management, specification management, payment applications, contract modifications, meeting minutes, construction progress photos.
- C. Provide web-based project software user licenses for use by the Architect/Engineer. Access will be provided from the start of the project through the completion of the warranty phase.
- D. At project completion, provide digital archive of entire project in format that is readable by common desktop software applications in format acceptable to Architect/Engineer. Provide data in locked format to prevent further changes.

1.6 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to prevent damage to fixtures, equipment and materials.
- B. Store materials on the site to prevent damage.
- C. Keep fixtures, equipment and materials clean, dry and free from deleterious conditions.



1.7 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.8 WARRANTY

- A. At a minimum, provide a one (1) year warranty for all equipment, materials, and workmanship. Individual specifications sections within Division 27 may require additional warranty requirements for specific equipment or systems.
- B. The warranty period for the entire installation described in this Division of the specifications shall commence on the date of substantial completion unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner or their representative.
- C. Warranty requirements shall extend to correction, without cost to the final user, of all work and/or equipment found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from such defects or nonconformance with contract documents exclusive of repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.9 INSURANCE

- A. Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.10 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the first named manufacturer constitutes the basis for job design and establishes the equipment quality required.



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- B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meets all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors. The Architect/Engineer shall make the final determination of whether a product is equivalent.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor bears full responsibility for the unnamed manufacturers equipment adequately meeting the intent of design. The Architect/Engineer may reject manufacturer at time of shop drawing submittal. The Contractor assumes all costs incurred by other trades on the project as a result of changes necessary to accommodate the offered material, equipment or installation method.
- D. Should this Contractor be unable to secure approval from the Architect/Engineer for other unnamed manufacturers as outlined above, this Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder. Should a voluntary alternate material be accepted, This Contractor shall assume all costs that may be incurred as a result of using the offered material, article or equipment necessitating extra expense on This Contractor or on the part of other Contractors whose work is affected.

PART 2 - PRODUCTS

2.1 CABLE JACKET RATING

- A. This project does not require all cable jackets to carry a plenum rating.



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2.2 Refer to individual sections.

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Installation of all conduit and cabling shall comply with Sections 26 05 33 and 26 05 13. Additional conduit requirements described within this Division shall be supplemental to the requirement described in Section 260533. Should conflicts exist between the two Divisions the more stringent (more expensive material and labor) condition shall prevail until bidding addendum or construction clarification or RFI can be submitted and responded to. In no case shall the Contractor carry the least stringent condition in the pricing.
- B. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.
- C. The Contractor shall be responsible for identifying and reporting to the Architect/Engineer any existing conditions including but not limited to damage to walls, flooring, ceiling and furnishings prior to start of work. All damage to interior spaces caused by this Contractor shall be repaired at this Contractor's expense to pre-existing conditions, including final colors and finishes.
- D. All cables and devices installed in damp or wet locations, including any underground or underslab location, shall be listed as suitable for use in such environments. Follow manufacturer's recommended installation practices for installing cables and devices in damp or wet locations. Any cable or device that fails as a result of being installed in a damp or wet location shall be replaced at the Contractor's expense.

3.3 FIELD QUALITY CONTROL

A. General:

1. Refer to specific Division 27 sections for further requirements.
2. The Contractor shall conduct all tests required and applicable to the work both during and after construction of the work.
3. The necessary instruments and materials required to conduct or make the tests shall be supplied by the Contractor who shall also supply competent personnel for making the tests who has been schooled in the proper testing techniques.
4. In the event the results obtained in the tests are not satisfactory, This Contractor shall make such adjustments, replacements and changes as are necessary and shall then repeat the test or tests which disclose faulty or defective work or equipment, and shall make such additional tests as the Architect/Engineer or code enforcing agency deems necessary.
5. All communications cable tests that fail, including those due to excessive cabling lengths, shall be remedied by the Contractor without cost to the project.

B. Protection of cable from foreign materials:

1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited, to overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid or compound that could come in contact with the cable, cable jacket or cable termination components.
2. Application of foreign materials of any kind on any cable, cable jacket or cable termination component will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed. This requirement is regardless of the PASS/FAIL test results of the cable containing overspray. Should the manufacturer and warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced. In the case of plenum cabling, in addition to the statement from the manufacturer, the Contractor shall also present to the Owner a letter from the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be intact and acceptable.



3.4 INSTRUCTING THE OWNER'S REPRESENTATIVE

- A. Adequately instruct the Owner's designated representative or representatives in the maintenance, care, and operation of the complete systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representative or representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. The Architect/Engineer shall be notified of the time and place for the verbal instructions to be given to the Owner's representative so that their representative can be present if desirable.
- D. Refer to the individual specification sections for minimum hours of instruction time for each system.
- E. Operating Instructions:
 - 1. The Contractor is responsible for all instructions to the Owner and/or Owner's operating staff on the Communications Systems.
 - 2. If the Contractor does not have Engineers and/or Technicians on staff who can adequately provide the required instructions on system operation, performance, troubleshooting, care and maintenance, they shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.5 SYSTEM STARTING AND ADJUSTING

- A. The Communications Systems included in the construction documents are to be complete and operating systems. The Architect/Engineer will make periodic job site observations during the construction period. The system start-up, testing, configuration, and satisfactory system performance is the responsibility of the Contractor. This shall include all calibration and adjustments of electrical equipment controls, equipment settings, software configuration, troubleshooting and verification of software, and final adjustments that may be required.
- B. All operating conditions and control sequences shall be simulated and tested during the start-up period.



- C. The Contractor, subcontractors, and equipment suppliers are expected to have skilled technicians to ensure that the system performs as designed. If the Architect/Engineer is requested to visit the job site for the purpose of trouble shooting, assisting in the satisfactory start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period through no fault of the design; the Contractor shall reimburse the Owner on a time and material basis for services rendered at the Architect/Engineer's standard hourly rates in effect at the time the services are requested. The Contractor shall be responsible for making payment to the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.6 RECORD DOCUMENTS

- A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.
- B. Mark specifications to indicate approved substitutions, change orders, and actual equipment and materials used.
- C. This Contractor shall maintain at the job site, a separate and complete set of technology drawings which shall be clearly and permanently marked and noted in complete detail any changes made to the location and arrangement of equipment or made to the Technology Systems and wiring as a result of building construction conditions or as a result of instructions from the Architect or Engineer. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should This Contractor fail to complete Record Documents as required by this contract, This Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.
- D. Record actual routing of all conduits sized 2" or larger.
- E. The above record of changes shall be made available for the Architect and Engineer's examination during any regular work time.
- F. Upon completion of the job, and before final payment is made, This Contractor shall give the marked-up drawings to the Architect/Engineer.

3.7 ADJUST AND CLEAN

- A. Contractor shall thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.



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- B. Contractor shall clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from equipment.
- C. Contractor shall remove all rubbish, debris, etc., accumulated during the Contractor's operations from the premises.

STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION

To assist the contractor in a timely close-out of the project, it is crucial that the final jobsite observation is not conducted prior to the project being ready. The contractor is required to review the completion status of the project at the time the observation is scheduled. This review, and the subsequent submittal of this form to the Architect/Engineer, shall indicate the contractor's agreement that the area of the project being requested for final observation is ready as defined below. The following list represents the degree of completeness required prior to requesting a final observation:

1. All cabling pathways (cable tray, ladder rack, conduit sleeves, etc.) are installed and all cabling has been pulled through them.
2. All mechanical firestop products are installed and all other penetrations have been sealed.
3. All telecommunications jacks are installed in the faceplates.
4. All telecommunications cabling is pulled and at least 90% of all jacks have been terminated at the jack and at the telecom room.
5. Telecommunications testing is in progress and at least 50% of testing has been completed.
6. Telecommunications labeling has been provided on at least 50% of each type of component requiring a label.
7. All telecommunications related grounding is complete.

Prime Contractor: _____ By: _____

Requested Observation Date _____ Today's Date: _____

Contractor shall sign this readiness statement and transmit to Architect/Engineer at least 10 days prior to the requested date of observation.

It is understood that if the Architect/Engineer finds that the project is not complete as defined above and that the final jobsite observation cannot be completed on the requested date, the Architect/Engineer will return to the site at a later date. All additional visits to the site for the purposes of completing the final observation will be billed T&M to the Contractor at our standard hourly rates, including travel expenses or the contractor's retainage may be deducted for the same amount.



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TELECOMMUNICATIONS - PROOF OF CERTIFICATION

There are specific Contractor qualification requirements for this project as defined in Section 270500, which may include Manufacturer Certification and RCDD or CNIDP credentials. This Proof of Certification document, and the supporting documentation require herein, is required to be submitted at the time of bid to show compliance with the requirements of 27 05 00.

Statement of Compliance:

The named Contractor's base bid is a structured cabling solution from the connectivity manufacturer: _____. Named Contractor is trained and certified, under the named manufacturer's formal certification program to provide and install all materials and work required by this project. Further, said Contractor is authorized, by the named manufacturer, to offer all product, labor and system assurance warranties required for this project by these contract documents.

The certification of this named manufacturer is valid, current and in effect as of the bid day of this project, the _____ day of _____, 20____.

The named Contractor is not employing any other sub-contractor on the telecommunications portion of this project that does not also meet this certification requirement.

Contractor Company Name: _____

Authorized Representative: (print) _____

Date: _____

Manufacturer Certification Number (if any): _____

If this project requires RCDD certification, complete the following:

RCDD or CNIDP Name: _____

RCDD #: _____ Expiration: _____

Submit the following with the bid:

This form.

Proof of Manufacturer Certification indicated above.

Proof of RCDD or CNIDP status.

END OF SECTION



SECTION 270526 - COMMUNICATIONS BONDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Bonding Conductors
- B. Bonding Connectors
- C. Grounding Busbar (PBB and SBB)
- D. Rack-mount Telecommunications Grounding Busbar

1.2 RELATED WORK

- A. Section 260533 - Conduit and Boxes
- B. Section 260513 - Wire and Cable
- C. Section 260526 - Grounding and Bonding
- D. Section 264100 - Lightning Protection Systems
- E. Section 270500 - Basic Communications Systems Requirements
- F. Section 271100 - Communication Equipment Rooms
- G. Section 270528 - Interior Communication Pathways
- H. Section 270553 - Identification and Administration

1.3 QUALITY ASSURANCE

- A. Refer to Section 270500 for relevant standards.
- B. Communications bonding system component, device, equipment, and material manufacturer(s) shall have a minimum of five (5) years documented experience in the manufacture of communications bonding products.
- C. The entire installation shall comply with all applicable electrical codes, safety codes, and standards. All applicable components, devices, equipment, and material shall be listed by Underwriters' Laboratories, Inc.



1.4 REFERENCES

- A. ANSI/IEEE 1100 - Recommended Practice for Power and Grounding Sensitive Electronic Equipment in Industrial and Commercial Power Systems
- B. ANSI/TIA 568-C - Commercial Building Telecommunications Cabling Standard
- C. ANSI/TIA 569-A - Commercial Building Standard for Telecommunications Pathways and Spaces
- D. ANSI/TIA 606 - Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- E. ANSI/TIA 758 - Customer Owned Outside Plant
- F. ANSI/TIA-607-D - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
- G. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements
- H. IEEE 837 - IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding
- I. NFPA 70 - National Electrical Code
- J. NFPA 780 - Standard for the Installation of Lightning Protection Systems
- K. UL 96 - Lightning Protection Components
- L. UL 96A - Installation Requirements for Lightning Protection Systems
- M. UL 467 - Grounding and Bonding Equipment

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the site under the provisions of Section 270500.
- B. Store and protect products under the provisions of Section 270500.
- C. Contractor shall exercise care to prevent corrosion of any products prior to installation. Corroded products shall not be acceptable for use on this project.

1.6 SYSTEM DESCRIPTION

- A. This section describes the requirements for the furnishing, installation, adjusting, and testing of a complete turnkey communications bonding system, including connection to the electrical ground grid.



- B. Performance Statement: This specification section and the accompanying drawings are performance based, describing the minimum material quality, required features, operational requirements, and performance of the system. These documents do not convey every wire that must be installed, every equipment connection that must be made, or every feature and function that must be configured. Based on the equipment constraints described and the performance required of the system as presented in these documents, the Contractor is solely responsible for determining all components, devices, equipment, wiring, connections, and terminations required for a complete and operational system that provides the required performance.
- C. This document describes the major components of the system. All additional hardware, subassemblies, supporting equipment, and other miscellaneous equipment required for complete, proper system installation and operation shall be provided by the Contractor.
- D. Basic System Requirements:
 - 1. A complete communications bonding infrastructure is required for this project. Refer to the drawings and the requirements of ANSI-J-STD-607-D and NFPA 70 for complete information.
 - 2. The bonding system shall include, but not be limited to, the following major components:
 - a. Telecommunications Bonding Conductor (TBC)
 - b. Primary Bonding Busbar (PBB)
 - c. Telecommunications Bonding Backbone (TBB)
 - d. Secondary Bonding Busbar(s) (SBB)
 - e. Rack mount Telecommunications Grounding Busbar(s)
 - f. Bonding Conductor(s) (BC)
 - g. Bonding Connectors
 - h. Bonding system labeling and administration as defined in Section 270553.

1.7 PROJECT RECORD DOCUMENTS

- A. Submit documents under the provisions of Section 270500.
- B. Provide final system block diagram showing any deviations from approved shop drawing submittal.
- C. Provide floor plans that document the following:
 - 1. Actual locations of system components, devices, and equipment.
 - 2. Actual conductor routing.
 - 3. Actual system component, device, equipment, and conductor labels.

- D. Provide statement that system checkout test, as outlined in the approved shop drawing submittal, is complete and test results were satisfactory.
- E. Complete all operation and maintenance manuals as described below.

PART 2 - PRODUCTS

2.1 BONDING CONDUCTORS

- A. Bare Copper:
 - 1. Annealed uncoated stranded conductor.
 - 2. Minimum size 6 AWG.
- B. Insulated Copper:
 - 1. Annealed uncoated stranded conductor.
 - 2. Insulation:
 - a. PVC insulation with nylon outer jacket.
 - b. Rated at 600 volts.
 - c. Green.
 - 3. Minimum size 6 AWG.
- C. All bonding conductors shall be listed and recognized by a nationally recognized testing laboratory as being suitable for the intended purpose and for installation in the space in which they are installed.
- D. Bonding Conductor Sizing:
 - 1. All communications bonding system conductors shall be sized by length as follows:

Length Linear ft (m)	Size (AWG)
Less than 13 (4)	6
14 - 20 (4 - 6)	4
21 - 26 (6 - 8)	3
27 - 33 (8 - 10)	2
34 - 41 (10 - 13)	1
42 - 52 (13 - 16)	1/0
53 - 66 (16 - 20)	2/0
67 - 84 (20 - 26)	3/0
85 - 105 (26 - 32)	4/0

Length Linear ft (m)	Size (AWG)
106 - 125 (32 - 38)	250 kcmil
126 - 150 (38 - 46)	300 kcmil
151 - 175 (46 - 53)	350 kcmil
176 - 250 (53 - 76)	500 kcmil
251 - 300 (76 - 91)	600 kcmil
Greater than 301 (91)	750 kcmil

2. The TBC shall be the same size as the TBB or larger.

2.2 BONDING CONNECTORS

A. Acceptable Types:

1. Two-hole compression lug
2. Exothermic weld
3. Irreversible compression

- B. Connectors shall be provided in kit form and selected per manufacturer's written instructions.

- C. Connectors shall comply with IEEE 837 and UL 467 and be listed for use for specific types, sizes, and combinations of conductors and connected items.

2.3 GROUNDING BUSBAR (PBB AND SBB)

A. Features:

1. Wall-mount configuration.
2. Listed and recognized by a nationally recognized testing laboratory as being suitable for intended purpose.
3. Hole patterns compliant with BICSI recommendations and ANSI-J-STD-607-D standards.
4. Predrilled holes.
5. Integral insulators.
6. Stainless steel offset mounting brackets.

B. Specifications:

1. Material: Electrolytic tough pitch copper bar with tin plating.
2. Refer to drawings for grounding busbar size(s).
 - a. Minimum Dimensions: Refer to drawings.
 - b. Increase dimensions and/or quantity furnished and installed as required to accommodate all terminations required by the project, plus 20% spare capacity.

- c. Hole patterns on busbars accommodate two-hole lugs per the recommendation of ANSI/BICSI N3-20 and ANSI/TIA-607 standards.

2.4 RACK-MOUNT TELECOMMUNICATIONS GROUNDING BUSBAR

A. Features:

1. Listed and recognized by a nationally recognized testing laboratory as being suitable for intended purpose.
2. Predrilled holes.
3. Mounts in a standard 19" equipment rack.

B. Specifications:

1. Material: Electrolytic tough pitch copper bar with tin plating.
2. Minimum Dimensions: 3/16" thick x 3/4" high x 19" long.
 - a. Increase dimensions and/or quantity furnished and installed as required to accommodate all terminations required by the project, plus 20% spare capacity.
3. Hole pattern shall include:
 - a. A minimum of eight (8) 6-32 tapped lug mounting holes on 1" centers.
 - b. A minimum of two (2) pairs of 5/16" diameter holes spaced 3/4" apart.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Bonding Requirements:

1. The communications bonding system shall be a complete system. Contractor shall furnish and install all necessary miscellaneous components, devices, equipment, material, and hardware, including, but not limited to, lock washers, paint-piercing washers, hex nuts, compression lugs, insulators, mounting screws, lugs, etc., to provide a complete system.
2. A licensed electrician shall perform all bonding.
3. Comply with the manufacturer's instructions and recommendations for installation of all products.

B. Main Cross Connect and Service Entrance Room Bonding Requirements:

1. Locate the PBB in the service entrance room unless otherwise noted on the drawings.

2. The location of the PBB shall be the shortest practical distance from the telecommunications primary lightning protection devices.
3. Bond the telecommunications primary protectors to the PBB. Maintain a minimum 1 foot separation of the bonding conductor from all DC power cables, switchboard cable, and high frequency cable.

C. Primary Bonding Busbar (PBB) Requirements:

1. Install PBB such that it is insulated from its support with a minimum 2" standoff.
2. Bond the PBB to the electrical service ground via the TBC.
 - a. A minimum of 1 foot separation shall be maintained between the TBC and any DC power cables, switchboard cable, or high frequency cables.
3. PBB shall be bonded to all electrical panels located in the same room or space as the PBB. PBB shall be bonded to all electrical panels providing electrical power to communications equipment located in the same room or space as the PBB.
4. PBB shall be bonded to accessible metallic building structure located within the same room or space as the PBB.
5. All metallic continuous cable pathways, including, but not limited to, cable trays, basket trays, ladder racks, raceways, conduits, conduit sleeves, and fire-rated cable pathway devices, located within the same room or space as the PBB, shall be bonded to the PBB.
6. All metallic communications equipment, including, but not limited to, cable pair protectors, surge suppressors, cross-connect frames, patch panels, equipment cabinets, etc., located within the same room or space as the PBB, shall be bonded to the PBB.

D. Secondary Bonding Busbar (SBB) Requirements:

1. Provide a SBB in each telecommunications equipment room.
2. Install SBB such that it is insulated from its support with a minimum 2" standoff.
3. Bond each SBB to the PBB via the TBB.
 - a. A minimum of 1 foot separation shall be maintained between the TBB and any DC power cables, switchboard cable, or high frequency cables.
 - b. The TBB may be routed from PBB to SBB or as a radial feed to each SBB as the layout requires.
4. When two or more TBBs are used within a multi-story building, the TBBs shall be bonded together with a BBC at the top floor and at a minimum of every third floor in between the lowest floor level.
5. If more than one (1) SBB is provided within the same room or space, they shall all be bonded together via a BC the same size as the TBB.
6. SBBs shall be bonded to accessible metallic building structure located within the same room or space as the SBBs.



7. SBBs shall be bonded to all electrical panels located in the same room or space as the SBB. SBBs shall be bonded to all electrical panels providing electrical power to communications equipment located in the same room or space as the SBB.
 8. All metallic continuous cable pathways, including, but not limited to, cable trays, basket trays, ladder racks, raceways, conduits, conduit sleeves, and fire-rated cable pathway devices, located within the same room or space as the SBB, shall be bonded to the SBB.
 9. All metallic communications equipment, including, but not limited to, cable pair protectors, surge suppressors, cross-connect frames, patch panels, equipment cabinets, etc., located within the same room or space as the SBB, shall be bonded to the SBB.
- E. Rack Bonding Busbar Requirements (RBB):
1. Provide a rack-mount telecommunications ground bar in each equipment rack and equipment rack enclosure.
 2. Install RBB such that it is electrically bonded to the rack. Where necessary, remove paint and/or use paint-piercing washers to provide proper electrical bond between RBB and equipment rack.
 3. Bond each RBB to the PBB/SBB via a telecommunications equipment bonding conductor (TEBC).
 4. If more than one (1) RBB is provided within the same room or space, they shall all be bonded together via a TEBC.
 5. All contractor-furnished and/or contractor-installed metallic communications equipment, including, but not limited to patch panels, fiber optic distribution enclosures, splice enclosures, active electronics, uninterruptible power supplies, etc., mounted within the same equipment rack as the RBB, shall be bonded to the RBB. Where necessary, remove paint and/or use paint-piercing washers to provide proper electrical bond between equipment rack and installed metallic communications equipment. Active electronics and uninterruptible power supplies shall be bonded to the RBB via a dedicated unit bonding conductor (UBC) for each device.
- F. Metallic Interior Communication Pathway Bonding Requirements:
1. All metallic interior continuous communication cable pathways, including, but not limited to, conduit, conduit sleeves, fire-rated cable pathway devices, cable tray, basket tray, and ladder rack, shall be bonded to the communications bonding system.
- G. Bonding Conductor Requirements:
1. Bonding conductors shall be green or marked with a distinctive green color.
 2. Bonding conductors shall be routed parallel and perpendicular to building structure along shortest and straightest paths possible. Number of bends and changes in direction should be minimized. Install and secure conductors in a manner that protects the conductors from impact and from physical or mechanical strain or damage.
 3. Bonding conductors shall not be installed in metallic conduit.

4. All conductors, including, but not limited, to the TBC, TBB, BBC, and TEBC(s), shall be installed splice-free. If the Contractor believes that site conditions do not allow a splice-free installation, the Contractor may request permission from the Architect/Engineer to splice a specific communications bonding system conductor.
 - a. Where documented permission to splice a conductor is granted:
 - 1) The number of splices shall be limited to as few as possible.
 - 2) Splices shall be made using exothermic welding or irreversible compression-type connections only. Splice hardware shall be listed for grounding and bonding. Solder is not an acceptable means of splicing conductors.
 - 3) Splices shall be made in telecommunications spaces in accessible locations to facilitate future inspection and maintenance.
 - 4) Splices shall be adequately supported and protected from impact and from physical or mechanical strain or damage.
 5. All bonding conductors shall be labeled in accordance with the requirements of Section 270553. In addition to the requirements of Section 270553:
 - a. Labels shall be nonmetallic.
 - b. Labels shall be printer-generated.
 - c. Labels shall be located on conductors as close as is practical to their point of termination in a readable position.
 - d. Additionally, conductors shall be labeled as follows:
 - 1) "IF THIS CONNECTOR OR CABLE IS LOOSE OR MUST BE REMOVED, PLEASE CALL THE BUILDING TELECOMMUNICATIONS MANAGER."
 6. Interior water piping is not acceptable for use as a communications bonding system bonding conductor.
 7. Metallic cable shields are not acceptable for use as communications bonding system bonding conductors.
- H. Bonding Connection Requirements:
1. Make all connections in accessible locations to facilitate future inspection and maintenance.
 2. Communications bonding system connections shall be made using exothermic welding, two-hole compression lugs, or other irreversible compression-type connections. The use of 1-hole lugs is prohibited, except for connections to a rack-mount telecommunications ground bar. Connection hardware shall be listed for grounding and bonding. Sheet metal screws shall not be used to make communications bonding system connections.
 3. Thoroughly clean conductors before installing lugs and connectors.



4. Install and tighten all connectors in accordance with manufacturer's instructions, using the appropriate purpose-designed tool(s) recommended by the manufacturer for that purpose. Exercise care not to tighten connectors beyond manufacturer's recommendations.
5. Where necessary, remove paint and/or use paint-piercing washers to provide proper electrical bond at all connections.
6. All bonding connections shall be coated in anti-oxidant joint compound that is purpose-designed and purpose-manufactured for that use. Anti-oxidant joint compound shall be applied in accordance with manufacturer's recommendations and instructions.
7. All installed connectors on conductors installed in damp locations shall be sealed with dielectric grease and then covered with heat shrink tubing to protect against moisture ingress. Applied heat shrink tubing shall overlap conductor's outer jacket a minimum of four (4) inches past connector and be installed in accordance with manufacturer's recommendations and instructions.

3.2 FIELD QUALITY CONTROL

- A. Field testing shall be performed under provisions of Section 270500.
- B. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product from a reputable manufacturer that meets the requirements of the specifications.
- C. Periodic observations will be performed during construction to verify compliance with the requirements of the specifications. These services do not relieve the Contractor of responsibility for compliance with the contract documents.

3.3 ADJUSTING

- A. Adjust work under provisions of Section 270500.
- B. Contractor shall make any and all adjustments to the communications bonding system necessary to ensure that the installed system meets all requirements listed herein. Modifications necessary to comply with listed requirements or to provide specified performance shall be completed by the Contractor at no additional cost to the Owner.

3.4 TESTING

- A. Measure and document resistance to ground at PBB, each SBB, each RBB, and each electrical distribution panel bonded to the PBB or a SBB.



1. Measurements shall be made not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage, and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the fall-of-potential method according to IEEE 81.
 2. The preferred measured resistance to ground for the grounding electrode system is 15 ohms or less. Refer to Division 26 for exact project requirements.
 3. Under no circumstances shall any point in the communications bonding system have a lower resistance to ground than that of nearby electrical distribution system components that it is bonded to.
- B. Measure and document voltage between screen of installed and terminated ScTP, FTP, and/or SSTP horizontal cables and electrical ground of electrical outlet(s) serving the information outlet location area.
- C. Include measurement documentation in test data submitted at completion of project under provisions of Section 271710.

END OF SECTION

SECTION 270543 - EXTERIOR COMMUNICATION PATHWAYS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes the products and execution requirements relating to furnishing and installing exterior racks, ladders, conduits, sleeves, innerduct, etc. for an exterior cabling plant.

1.2 QUALITY ASSURANCE

- A. Refer to Section 270500 for relevant standards.
- B. Precast Manufacturer (if applicable): Company specializing in precast concrete structures with three (3) years documented experience.

1.3 REFERENCES

- A. Section 270500 - Basic Communications Systems Requirements.
- B. ASTM A123 - Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strips.

1.4 SUBMITTALS

- A. Under the provisions of Section 270500 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
 - 2. Manufacturer's installation instructions.
- B. Submit shop drawings and product data under provisions of Division 1.
- C. Coordination Drawings:
 - 1. Include manholes, hand holes, and conduits 1.5" and larger in coordination files. Include all in-floor and underfloor conduit in coordination files. Refer to Section 270500 for coordination drawing requirements.

1.5 REGULATORY REQUIREMENTS

- A. Equipment and material shall be UL (Underwriters Laboratory) listed and labeled.



PART 2 - PRODUCTS

2.1 OUTSIDE PLANT CONDUIT

A. Rigid Non-Metallic Conduit (RNC) and Fittings:

1. UL listed, NEMA TC2 and TC6 Schedule 40 or 80 rigid polyvinyl chloride (PVC) approved for direct burial without concrete encasement.
2. Fittings: NEMA TC3 and TC9, sleeve type suitable for and manufactured especially for use with the conduit by the conduit manufacturer.
3. Plastic cement for joining conduit and fittings shall be provided as recommended by the manufacturer.
4. Manufacturers:
 - a. Carlon (Lamson & Sessions) Type 40
 - b. Cantex
 - c. J.M. Mfg.
 - d. or pre-approved equal

B. Fittings:

1. Sweeps: Factory manufactured RMC wrapped with 4 mil vinyl tape with a bend radius as follows:
 - a. Conduit internal diameter of 2" or less is 6 times the internal conduit diameter.
 - b. Conduit internal diameter of more than 2" is 10 times the internal conduit diameter.
2. End Caps (Plugs): Pre-manufactured and watertight. Tape is not an acceptable end cap or cover.

2.2 HAND-HOLES

A. Type:

1. Polymer concrete

B. Dimensions:

1. As indicated on the drawings.

C. Requirements:



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1. Includes polymer concrete cover.

D. Acceptable Manufacturers

1. Quazite
2. Old Castle Precast Christy®
3. New Basis.

2.3 UNDERGROUND WARNING TAPE

- A. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, compounded for direct-burial service.
- B. Overall Thickness: 5 mils.
- C. Foil Core Thickness: 0.35 mil.
- D. Orange colored tape 3-wide with 1-inch high black letters permanently imprinted with "CAUTION - BURIED COMMUNICATIONS LINE BELOW". Printing on tape shall be permanent and shall not be damaged by burial operations.
- E. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- F. Comply with ANSI Z535.1 through ANSI Z535.5.

2.4 FOUNDATION - UNDERGROUND SLEEVES AND SEALS

- A. Refer to Division 26 for additional information on foundation sleeves and seals.

PART 3 - EXECUTION

3.1 INSTALLATION - DUCTBANK

- A. Make duct bank installations and penetrations through foundation walls watertight.
- B. Top of duct banks shall be a minimum of 24 inches below grade, unless otherwise indicated on drawings.
- C. Assemble duct banks using non-magnetic saddles, spacers and separators. Position separators to provide 3-inch minimum separation between the outer surfaces of the ducts.



- D. Transition from non-metallic to galvanized rigid steel conduit where duct banks enter buildings, manholes, and hand-holes.
- E. Where ducts enter structures such as manholes, hand-holes, pullboxes and buildings, terminate the ducts in suitable end bells.
- F. Slope duct runs for drainage toward manholes and away from buildings with a slope of approximately 3-inches per 100 feet.
- G. After completion of the duct bank and prior to pulling cable, pull a mandrel, not less than 12 inches long and with a cross section approximately 1/4 inch less than the inside cross section of the duct, through each duct. Then pull a rag swab or sponge through to make certain that no particles of earth, sand, or gravel have been left in the duct.
- H. Plug and seal empty spare ducts entering buildings and structures. Seal watertight all ducts in use entering buildings and structures.

3.2 INSTALLATION - HAND-HOLES

- A. Install gravel drainage bed a minimum of 6" depth below hand-hole using a minimum gravel size of 1 inch.
- B. Provide units and/or extensions as required by conduit depth for hand-hole cover to be flush with finished grade.
- C. Slope grade away from cover with a slope of approximately 1 inch in 3 feet.
- D. Conduit entry penetrations shall not exceed 25% of side wall area.

3.3 EXCAVATION, FILL, BACKFILL, COMPACTION

- A. General:
 - 1. The Contractor shall do all necessary excavating, securing, filling, backfilling, compacting, and restoration in connection with their work.
- B. Excavation:
 - 1. Excavations for trenches shall be excavated to proper dimensions to permit installation and inspection of work.
 - 2. Where excavations are carried in error below indicated levels, thoroughly compacted sand-gravel fill, shall be placed in such excess excavations.
 - 3. Excavations shall be protected against frost action and freezing.



4. Care shall be exercised in excavating so as to not damage surrounding structures, equipment, and buried utilities. In no case shall any major structural footing or foundation be undermined.
5. Excavation shall be performed in all ground characteristics, including rock, if encountered. Each bidder shall visit the premises and determine, by actual observations, borings, or other means, the nature of the soil conditions. The cost of all such inspections, borings, etc., shall be borne by the bidder.
6. In the case where the trench is excavated in rock, a compacted bed with a depth of 3" (minimum) of sand and gravel shall be used to support the conduit unless masonry cradles or encasements are used.
7. Where satisfactory bearing soil is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately and no further work shall be done until further instructions are given.
8. Mechanical excavation of the trench to line and grade of the conduit, unless otherwise indicated on the drawings.

C. Dewatering:

1. The Contractor shall be responsible for the furnishing, installation, operation and removal of all dewatering pumps and lines necessary to keep the excavation free of water at all times.

D. Underground Obstructions:

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locators can be found by calling 811. The Contractor is responsible for obtaining all utility locates for all trades on the project to determine obstructions indicated. The Contractor shall use great care in installing in the vicinity of underground obstruction.

E. Fill and Backfilling:

1. No rubbish or waste material shall be permitted in excavations for trench fill and backfill.
2. The Contractor shall provide the necessary sand for backfilling.
3. Dispose of the excess excavated earth as directed.
4. Soils for backfill shall be suitable for required stability and compaction, clean and free from perishable materials, frozen earth, debris or earth with an exceptionally high void content, and free from stones greater than 4 inches in diameter. Under no circumstances shall water be permitted to rise in unbackfilled trenches after installation has been placed.
5. All trenches shall be backfilled immediately after installation of conduit, unless other protection is directed.



6. All conduit shall be laid on a compacted bed of sand at least 3" deep. Backfill around the conduit with sand, spread in 6" layers, then compact each layer.
7. Use sand for backfill up to grade for all conduit located under building slabs or paved areas. Native soil materials may be used as backfill if approved by the Geotechnical Engineer. All other conduit shall have sand backfill to 6" above the top of the conduit.
8. The backfilling above the sand shall be placed in uniform layers not exceeding 6" in depth. Each layer shall be placed, then carefully and uniformly tamped, so as to eliminate the possibility of lateral or vertical displacement.
9. Install a warning tape approximately 12 inches below finished grade over all underground duct banks. The identifying warning tape shall be as specified above.
10. Where the fill and backfilling will ultimately be under a building, floor or paving, each layer of fill shall be compacted to 95% of the maximum density as determined by AASHTO Designation T-99 or ASTM Designation D-698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content as determined by AASHTO T-99 or ASTM D-698 test.
11. After backfilling of trenches, no superficial loads shall be placed on the exposed surface of the backfill until a period of 48 hours has elapsed.

3.4 RESTORATION REQUIREMENTS

- A. Where soil and sod has been removed, it shall be replaced as soon as possible after backfilling is completed. All areas disturbed by work shall be restored to their original condition. The restoration shall include any necessary topsoiling, fertilizing, liming, seeding, or mulching,

END OF SECTION

SECTION 270553 - IDENTIFICATION FOR COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes the identification requirements relating to the structured cabling system and its termination components and related subsystems.
- B. Identification and labeling.

1.2 RELATED WORK

- A. Section 270500 - Basic Communications Systems Requirements

1.3 QUALITY ASSURANCE

- A. Refer to Section 270500 for relevant standards.

1.4 SUBMITTALS

- A. Under the provisions of Section 270500 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Documentation of labeling scheme.

PART 2 - PRODUCTS

2.1 LABELING

- A. Adhesive labels shall meet the requirements of UL 969 (Ref D-16) for legibility, defacement and adhesion. Exposure requirements of UL 969 for indoor and outdoor (as applicable) use shall be met.
- B. Insert labels shall meet the requirements of UL 969 for legibility, defacement and general exposure.
- C. Labeling shall be consistent for all common elements in the project. This consistency shall include label size, color, typeface and attachment method.
- D. Labels incorporating bar codes shall be either Code 39 conforming to USS-39 or Code 128 conforming to USS-128.



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1. All Code 39 bar codes shall have a ratio between 2.5:1 and 3.0:1. Provide a minimum "quite zone" of 0.25" on each side of the bar code.
 2. A descriptive label for reading by personnel shall be provided with any bar code. Bar codes by themselves are not acceptable.
- E. Tag all CAT 3, CAT 5E, CAT 6, and optical fiber cables at both the Communications Equipment Room and the information outlets using the following alphanumeric labeling system:
1. (Telecom Room Number) - (Patch Panel Letter) - (Patch Panel Port Number).
 2. "Telecom Room Number" shall be as indicated on the drawings.
 3. "Patch Panel Letter" shall start with 'A' for the top modular patch panel, increasing sequentially from top to bottom across the equipment rack.
 4. "Patch Panel Port Number" shall start with '1' for the upper left port in each modular patch panel, increasing sequentially from left to right and top to bottom across the modular patch panel face.
 5. Example #1: MC/1-A3 indicates the third modular patch panel port in modular patch panel 'A' in Main Equipment Room (MC/1).
 6. Example #2: HC/2-C39 indicates the thirty-ninth modular patch panel port in modular patch panel C in Horizontal Cross-Connect room (HC/2).

2.2 DOCUMENTATION/AS-BUILTS/RECORDS

A. General:

1. Upon completion of the installation, the Contractor shall submit as-builts per the requirements of Section 270500 and Division 1. Documentation shall include the items detailed in the subsections below.
2. All documentation, including hard copy and electronic forms shall become the property of the Owner.

B. Record Drawings:

1. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons and drawing conventions used shall be consistent throughout all documentation provided.

PART 3 - EXECUTION

3.1 IDENTIFICATION AND LABELING

A. Cable Labeling:

1. Horizontal cables shall be labeled at each end.

- a. Cables that differ only by performance class shall have a suitable marking or label to indicate the higher performance class. For example, station cabling utilizing the blue color may include blue with a white stripe to indicate the higher performance class station cabling.
2. Backbone cables shall be labeled at each end.
 - a. Provide additional cable labeling at each manhole and pull box.
 - b. Cables that are routed through multiple pathway segments shall contain reference to all pathway segments in the pathway linkage field.
 - c. Cables that differ only by performance class shall have a suitable marking or label to indicate the higher performance class. For example, station cabling utilizing the blue color, may include blue with a white stripe to indicate the higher performance class station cabling.
- B. Information Outlet Labeling: Tag all voice and data jacks as defined herein.

END OF SECTION

SECTION 271100 - COMMUNICATION EQUIPMENT ROOMS (CER)

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes the products and execution requirements related to furnishing and installing equipment for communication equipment rooms.

1.2 RELATED WORK

- A. Section 270500 - Basic Communications Systems Requirements
- B. Section 270526 - Communications Bonding
- C. Section 271500 - Horizontal Cabling Requirements

1.3 QUALITY ASSURANCE

- A. Refer to Section 270500 for applicable standards.

1.4 SUBMITTALS

- A. Under the provisions of Section 270500 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Manufacturer's data covering all products including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.

PART 2 - PRODUCTS

2.1 EQUIPMENT GROUNDING

- A. Refer to specification section 270526 for grounding requirements.
- B. All equipment required to be grounded shall be provided with a grounding lug suitable for termination of the specified size electrode conductor.

2.2 EQUIPMENT RACKS AND CABINETS

- A. Where identified on the drawings in Communication Equipment Rooms, equipment racks and/or equipment cabinets shall be furnished and installed by the Contractor to house cable termination components (e.g., copper, optical fiber, coax) and network electronics.

B. The equipment rack shall conform to the following requirements:

1. Standard TIA/EIA 19" Wall Cabinet:

- a. The equipment cabinets shall be constructed of painted steel or aluminum and offer a usable mounting height of 15 RU. Racks shall be a minimum of 21 inches deep. Access to the rear of the cabinet-mounted equipment shall be by a hinged arrangement.
- b. The equipment cabinet shall be equipped with a lockable steel front door and furnished with two (2) keys that shall be usable on all cabinets furnished under this Contract.
- c. The equipment cabinet shall be configured to allow for adjustment of the channel uprights (front to rear) in 1-inch increments and be spaced to accommodate industry standard 19-inch mounting. The cabinet shall be tapped to accept 12-24 screws.
- d. The equipment cabinet shall be vented to allow for airflow through the cabinet.
- e. Provide exterior grade equipment cabinet for locations that are exterior.

2.3 CABLE MANAGEMENT - HORIZONTAL

A. Equipment Racks:

1. Equipment racks shall be equipped with horizontal cable management hardware in the form of rings and guides. Racks shall incorporate horizontal covers, to allow an orderly, hidden, routing of copper and optical fiber from the modular patch panels and/or 110-type termination blocks to the customer provided network electronics. Vertical and horizontal cable management hardware shall be as follows:
 - a. Horizontal cable management hardware shall be 16 gauge cold rolled steel construction with six (6) pass-thru holes and seven (7) front-mounted 3.5" steel rod D-rings. Provide with cover designed to conceal and protect cable.
 - b. At a minimum, horizontal cable management hardware shall be positioned above and below (a) each grouping of two rows of jacks on modular patch panels, and (b) above and below each optical fiber patch panel and (c) each grouping of two rows of F-type connectors on coax patch panels.
2. Each equipment rack shall be supplied with a minimum of 12 releasable (e.g., "hook and loop") cable support ties.
3. Where cable termination hardware is wall-mounted, the Contractor shall be responsible for establishing a cable pathway for jumpers routed from the equipment rack(s) to the wall. This shall be in the form of slotted ducts or troughs. Routing of jumpers via the overhead cable tray or ladder rack system is NOT acceptable. The proposed method shall be included in the submittals required by this document and shall be approved by the Architect/Engineer prior to installation.



B. Equipment Cabinets

1. Equipment cabinets shall be equipped with vertical and horizontal cable management hardware, in the form of rings and guides, to allow an orderly routing of optical fiber and copper jumpers from the modular patch panel and/or 110-type termination blocks to the customer provided network electronics. At a minimum, one such horizontal cable management panel shall be provided with each equipment cabinet. Horizontal cable management panels shall be 3.5" in height and have a minimum of five (5) jumper distribution rings.

2.4 PATCH PANELS

- A. Where identified on the drawings in Communication Equipment Rooms, modular patch panels shall be furnished and installed by the Contractor for termination of copper cable.
- B. Copper cabling shall be terminated in Communication Equipment Rooms on modular patch panels consisting of a modular connector system incorporating modular jacks meeting the specifications for the jacks detailed in Section 271500.
- C. The largest single modular patch panel configuration shall not exceed 48-Ports. Modular patch panels shall be fully populated (all ports occupied by jacks) and be provided in increments of no less than 12 jacks. High-density modular patch panels will not be accepted.
- D. The modular patch panel blocks shall have the ability to seat and cut eight (8) conductors (4 pairs) at a time and shall have the ability of terminating 22- through 26-gauge plastic insulated, solid and stranded copper conductors. Modular patch panel blocks shall be designed to maintain the cables' pair twists as closely as possible to the point of mechanical termination.
- E. Modular patch panels shall incorporate cable support and/or strain relief mechanisms to secure the horizontal cables at the termination block and to ensure that all manufacturers minimum bend radius specifications are adhered to.

2.5 OPTICAL FIBER PANELS

- A. All terminated optical fibers shall be mated to simplex LC-type couplings mounted on enclosed fiber distribution cabinets. Couplings shall be mounted on a panel that, in turn, snaps into the enclosure. The proposed enclosure shall be designed to accommodate a changing variety of connector types including SC, ST, Fixed Shroud Duplex (e.g., "FDDI Connector"), Biconic, FC, and MT-RJ by changing panels on which connector couplings are mounted.



- B. The fiber distribution cabinet shall be sized to accommodate the total fiber count to be installed at each location as defined in the specifications and drawings, including those not terminated (if applicable). Connector panels and connector couplings (sleeves, bulkheads, etc.) adequate to accommodate the number of fibers to be terminated shall be furnished and installed by the Contractor.
- C. The fiber distribution cabinet shall be an enclosed assembly affording protection to the cable subassemblies and to the terminated ends. The enclosures shall incorporate a hinged or retractable front cover designed to conceal and protect the optical fiber couplings, connectors, and cable.
- D. Access to the inside of the fiber distribution cabinet's enclosure during installation shall be from the front and/or rear. Panels that require any disassembly of the fiber distribution cabinet to gain entry will not be accepted.
- E. The fiber distribution cabinet's enclosure shall provide for strain relief of incoming optical fiber cables and shall incorporate radius control mechanisms to limit bending of the optical fiber to the manufacturer's recommended minimums or 1/2", whichever is larger.
- F. All fiber distribution cabinets shall provide protection to both the "facilities" and "user" side of the coupling. The fiber distribution cabinet's enclosure shall be configured to require front access only when patching. The incoming optical fiber cables (e.g., backbone, riser, horizontal, etc.) shall not be accessible from the patching area of the panel. The fiber distribution cabinet's enclosure shall provide a physical barrier to access such optical fiber cables.
- G. Where "Loose Buffered" cables are installed, the 250 um coated optical fibers contained in these cables may be terminated either by (1) splicing of factory-terminated cable assemblies ("pigtailed") or (2) the use of a "fan-out" kit. In the latter approach, individual fibers are to be secured in a protective covering, an Aramid (e.g., Kevlar) reinforced tube for example, with connectors mated to the resulting assembly. In both instances, the proposed termination hardware shall incorporate a mechanism by which cable and subassemblies are secured to prevent damage. Splicing shall be by the "fusion" method. Individual splice loss shall not exceed 0.3 dB for multi-mode fibers. Direct termination of 250 um coated optical fibers shall not be permitted.
- H. Fiber distribution cabinets for horizontal cabling: Where optical fiber horizontal cabling is to be terminated, the enclosure shall be compliant to all the above requirements plus the enclosure shall incorporate a storage mechanism designed to allow simplified identification, access to and termination of individual optical fibers. This may be in the form of a storage cassette, tray or other appropriate mechanism.

2.6 OPTICAL FIBER COUPLERS/ADAPTERS

- A. Optical Fiber Couplings (LCtype) (Multimode/Singlemode):



1. LC-type optical fiber couplings shall be used to terminate optical fiber backbone cable on fiber distribution cabinet panels in communication equipment rooms. Horizontal optical fiber cables shall also be terminated using optical fiber couplings at their designated work area locations on information outlet faceplates for "fiber to the desk."
2. LC-type optical fiber couplings shall be snap-type with locking washer and nut.
3. LC-type optical fiber couplings shall incorporate domed zirconia ferrule and shall utilize a PC polish to ensure fiber-to-fiber physical contact for low loss and reflections.
4. LC-type optical fiber couplings shall accept 125-micron outside diameter multimode fiber.
5. The attenuation per mated pair shall not exceed 0.7 dB (individual) and 0.5 dB (average). Connectors shall sustain a minimum of 200 mating cycles per TIA/EIA-455-21 without violating specifications.
6. LC-type optical fiber couplings shall meet the following performance criteria:

Test Procedure	Maximum Attenuation Change
Cable Retention (FOTP-6)	0.2 dB
Durability (FOTP-21)	0.2 dB
Impact (FOTP-2)	0.2 dB
Thermal Shock (FOTP-3)	0.2 dB
Humidity (FOTP-5)	0.2 dB

7. Performance Requirements:
 - a. Length: 2 inches
 - b. Operating Temperature: -40C to 85C

2.7 D-RINGS

- A. Rounded edge D-rings for support of cabling in vertical and horizontal configurations.
- B. EIA 310D compliant, manufactured from materials meeting UL94-V0 specifications.
- C. Provide 1/4" screw holes for wall mounting.

2.8 POWER STRIPS

- A. Provide power strips on all equipment racks, unless noted otherwise. These power strips shall have the following characteristics:
 1. Standard Rack Mount:
 - a. TIA/EIA 19" equipment rack mountable.
 - b. Compliant with UL-1449 Third Edition and UL-497A.
 - c. Provide transient suppression to 12,000-A. Protection shall be in all three modes (line-neutral, line-ground and neutral-ground).

- d. Shall meet or exceed ANSI C62 Category A3 requirements.
- e. Provide high-frequency noise suppression as follows:
 - 1) Greater than 20-dB @ 50 kHz
 - 2) Greater than 40-dB @ 150 kHz
 - 3) Greater than 80-dB @ 1 MHz
 - 4) Greater than 30-dB @ 6 to 1000 MHz
- f. Protection Modes and UL 1449 Clamping Voltage: 475 volt L-N, L-G, and N-G.
- g. Components: Nonmodular units composed of 20mm metal oxide varistors (MOV). Series inductors, SAD, or selenium cells may be used in addition to MOVs.
- h. Be equipped with a 10-foot power cord.

2.9 COPPER PATCH CORDS

A. Modular Patch Panel:

- 1. Provide Category 6 Enhanced copper patch cords for 50% of all assigned ports on the modular patch panel. Of these cords, 60% shall be 3' in length and 40% shall be 5' in length. These patch cords shall be the cross-connect between the network electronics and the horizontal RJ-45 modular patch panel. Copper patch cords shall be equipped with a 4-pair RJ-45 connector on each end.
- 2. Refer to Section 271500 for cable and connector performance requirements.
- 3. Patch cords shall not be made-up in the field.

2.10 FIBER PATCH CORDS

A. Optical Fiber Patch Cords (Singlemode):

- 1. The optical fiber patch cord shall be 8.3/3 mm singlemode (SM) optical fiber, utilizing tight buffer construction. The optical fiber patch cords shall be a minimum of 5 feet in length.
- 2. Provide 8.3/3 mm singlemode (SM) optical fiber utilizing tight buffer construction for 50% of all assigned ports on the fiber distribution cabinet. These patch cords shall be the cross-connect between the backbone fiber distribution cabinet and the Owner's network electronics (hub/switch). Optical fiber patch cords shall be equipped with a ceramic tipped LC-type connector on each end and shall be a minimum of 5 feet in length. Connector body shall be of materials similar to that used in the proposed couplings. Provide required lengths as determined on the plans.
- 3. Channels shall be of equal length.
- 4. Refer to Section 271500 for cable and connector performance requirements.

PART 3 - EXECUTION

3.1 EQUIPMENT RACKS

- A. Equipment racks shall be furnished and installed as shown on the drawings.
- B. The Contractor shall bolt the rack to the floor as recommended by the manufacturer. Multiple racks shall be joined and the ground made common on each. The rack shall be stabilized by extending a brace to the wall. Alternately, overhead ladder rack by which the cabling accesses the equipment rack(s) may provide this function.
- C. A space between the rack upright and the wall (approximately 4") should be provided to allow for cabling in that area. The rear of the rack should be approximately 40" from the wall to allow for access by maintenance personnel. In all cases, a minimum of 40" workspace in front of the rack is also required. Locations where these guidelines cannot be followed should be brought to the attention of the Architect/Engineer for resolution prior to installation.
- D. All hardware and equipment is to be mounted between 18" and 79" above floor level. This is to afford easy access and, in the case of the lower limit, prevent damage to the components. Positioning of hardware should be reviewed and approved by the Architect/Engineer and Site Coordinator(s) prior to installation.
- E. Equipment racks shall be equipped with cable management hardware as to allow an orderly and secure routing of optical fiber and/or copper cabling to the optical fiber distribution cabinets and/or modular patch panels. At minimum, one such horizontal jumper management panel shall be placed below each optical fiber distribution cabinet installed by the Contractor. Additional Jumper Management panels may be required pending installation of other cable types on the equipment rack.
- F. Each rack shall be grounded to the telecommunications ground bar (GND) using a #6 AWG (or larger) insulated stranded copper conductor (GREEN jacket) directly or via an adjacent grounded equipment rack. Refer to grounding requirements below.

3.2 D-RINGS

- A. Provide D-rings for cable routing and management in all areas where open cabling is routed along the wall in an Equipment Room.
- B. Locate D-rings on 24" centers vertically and horizontally.
- C. Securely attach D-rings to the wall as required by the manufacturer.

3.3 GROUNDING

- A. Provide a complete grounding system in accordance with the requirements of Section 270526.



3.4 CROSS CONNECT INSTALLATION

- A. Bend radius of cable shall not exceed 4 times the outside cable diameter or manufacturer's recommendation, whichever is less.
- B. Cables shall be neatly bundled and dressed to their respective panels and/or blocks. Each shall be fed by an individual bundle separated and dressed to the point of cable entrance into the rack and/or frame.
- C. The cable jacket shall be maintained as close as possible to the termination point.
- D. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that is visible without removing the bundle support.

3.5 OPTICAL FIBER TERMINATION

- A. All fiber slack shall be neatly coiled within fiber splice enclosures or splice trays. No slack loops shall be allowed external to the enclosure.
- B. Each cable shall be individually attached to the respective fiber enclosure by mechanical means. The cable strength member shall be securely attached to the cable strain relief bracket in the enclosure.
- C. Each cable shall be clearly labeled at the entrance to all enclosures.
- D. A maximum of 12 strands shall be spliced in any tray.

3.6 CONDUITS AND CABLE ROUTING

- A. Refer to Section 260533 for additional requirements.
- B. Where conduits enter a telecommunications room, conduits shall be terminated on the wall where shown on the contract documents. Conduits entering the room from the floor shall extend 3" above the floor slab.
- C. Where cabling rises vertically in a telecommunications rooms, provide vertical cable management to support the cabling from floor to ceiling level.
- D. All conduits shall be reamed and shall be installed with a nylon bushing.
- E. Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of 2" or less, maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter greater than 2", maintain a bend radius of at least 10 times the internal diameter.



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END OF SECTION

SECTION 271300 - BACKBONE CABLING REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes the products and execution requirements relating to furnishing and installing backbone communications cabling and termination components and related subsystems as part of a cabling plant. The cabling plant consists of both optical fiber and/or copper cabling.

1.2 RELATED WORK

- A. Section 270500 - Basic Technology Systems Requirements.
- B. Section 271500 - Horizontal Cabling Requirements.
- C. Section 271720 - Structured Cabling System Warranty.

1.3 QUALITY ASSURANCE

- A. Refer to Section 270500 for relevant standards.

1.4 SUBMITTALS

- A. Under the provisions of Section 270500 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The basis of design is listed herein. Refer to Section 271720 for additional acceptable manufacturers.

2.2 OPTICAL FIBER BACKBONE - OUTSIDE PLANT

- A. Exterior Conduit (Multimode/Singlemode):



1. This optical fiber cable shall be suitable for installation in underground duct and in innerduct.
2. Optical fiber cable materials shall be all dielectric (no conductive materials).
3. Optical fiber cable shall be filled with a water-blocking material.
4. Outer Sheath: Polyethylene (PE). The outer sheath shall be marked with the manufacturer's name, words identifying the cable type (e.g., "Optical Fiber Cable" or "Fiber Optic Cable"), year of manufacture, and sequential length markings. The actual length of the optical fiber cable shall be within -0/+1% of the length markings. The marking shall be in a contrasting color to the cable jacket.
5. Temperature Range:
 - a. Storage: -40C to +70C (no irreversible change in attenuation).
 - b. Operating: -40C to +70C.
6. Humidity Range: 0% to 100%.
7. Maximum Tensile Strength:
 - a. During Installation: 2700 Newton (600 lb. force) (no irreversible change in attenuation).
 - b. Long Term: 890 N (200 lb. force).
8. Bending Radius:
 - a. During Installation: 20 times cable diameter.
 - b. No Load: 10 times cable diameter.
9. Basis of Design Manufacturer (Singlemode):
 - a. Corning.
 - b. Additional acceptable manufacturers:
 - 1) Hubbell
 - 2) Mohawk
 - 3) Berk-Tek
 - 4) Superior Essex

2.3 OPTICAL FIBER CONNECTORS

A. Optical Fiber Pigtails (Singlemode):

1. Single-fiber fiber optic pigtails shall be constructed from singlemode (SM) optical fiber of the same grade as the singlemode fiber optic backbone cable utilizing tight buffer construction.

2. Fiber optic pigtails shall be factory terminated with a ceramic tipped LC-type connector on one end and shall be a minimum of 5 feet (1.5m) in length or as indicated on the drawings. Channels shall be of equal length.
3. Connector body shall be of materials similar to that used in the proposed couplings. Refer to Section 271500 for connector performance requirements.
4. Provide in quantity to terminate all backbone fiber optic cable strands on each end.
5. Basis of Design:
 - a. Singlemode optical fiber pigtails shall be from the same manufacturer as used for the fiber optic termination equipment.

B. Optical Fiber Connectors (LC-type) (Multimode/Singlemode):

1. LC-type Optical Fiber Connectors: Shall be used to terminate optical fiber in communication equipment rooms.
2. LC-type optical fiber connector plugs shall be snap-type with an integrated pull-proof design.
3. LC-type optical fiber connector plugs shall incorporate a zirconium ceramic ferrule and shall utilize a factory pre-polish end face to ensure fiber-to-fiber physical contact for low loss and reflections.
4. LC-type optical fiber connector plugs shall accept 1.6mm - 2.0mm and 3.0mm outside diameter fiber.
5. The average insertion loss is 0.3db for multimode and single mode connectors
6. LC-type optical fiber connector plugs shall meet the following performance criteria:

Test Procedure	Maximum Attenuation Change
Cable Retention (FOTP-6)	0.2dB
Durability (FOTP-21)	0.2dB
Impact (FOTP-2)	0.2dB
Thermal Shock (FOTP-3)	0.2dB
Humidity (FOTP-5)	0.2dB

7. Additional Performance Requirements:
 - a. Length: 2.23 inches
 - b. Operating Temperature: -40C to 85C
8. Basis of Design:
 - a. Optical fiber connectors shall be from the same manufacturer as fiber cable manufacturer.



2.4 OPTICAL FIBER BACKBONE PERFORMANCE

A. Singlemode (SM):

1. Fiber Type: Singlemode; doped silica core surrounded by a concentric glass cladding.
2. Core Diameter: 8 to 9 μm . All optical fibers shall be of the same nominal core diameter and profile.
3. Cladding Diameter: $125 \pm 1.0 \mu\text{m}$.
4. Cladding Non-circularity: Less than or equal to 1%.
5. Core to Cladding Offset: Less than or equal to 0.8 μm .
6. Fiber Coating Diameter:
 - a. $245 \pm 15 \mu\text{m}$ (primary coating).
 - b. 900-nm (nominal) secondary coating (tight buffer).
 - c. All coatings shall be mechanically strippable without damaging the optical fiber.
7. Cut-off Wavelength (cabled fiber): Less than or equal to 1260-nm.
8. Mode Field Diameter: 8.3 to 9.8 μm at 1300-nm; $10.5 \pm 1.0 \mu\text{m}$ at 1550-nm.
9. Zero Dispersion Wavelength: 1301.5 nm less than the initial length of 1321.5 nm.
10. Zero Dispersion Slope: Less than 0.092 ps/nm²*km.
11. Fiber Attenuation (maximum @ $23 \pm 5^\circ\text{C}$; Backbone):
 - a. @ 1300-nm: 2.0 dB/km
 - b. @ 1550-nm: 1.75 dB/km
 - 1) When tested in accordance with FOTP-3, "Procedure to Measure Temperature Cycling Effects on Optical Fibers, Optical Cable, and Other Passive Fiber Optic Components," the average change in attenuation over the rated temperature range of the optical fiber cable shall not exceed 0.05 dB/km at 1550-nm. The magnitude of the maximum attenuation change of each individual optical fiber shall not be greater than 0.15 dB/km at 1550-nm.
12. Fiber Dispersion (maximum):
 - a. @ 1285 to 1330-nm: 3.2-ps/nm*km
 - b. @ 1550-nm: 18-ps/nm*km
13. No optical fiber shall show a point discontinuity greater than 0.1 dB at the specified wavelengths. Such a discontinuity or any discontinuity showing a reflection at that point shall be cause for rejection of that optical fiber by the Owner.

PART 3 - EXECUTION

3.1 CABLE INSTALLATION REQUIREMENTS

- A. Cable slack shall be provided in each backbone fiber optic cable. This slack is exclusive of the length of fiber that is required to accommodate termination requirements and is intended to provide for cable repair and/or equipment relocation. The cable slack shall be stored in a fashion as to protect it from damage and be secured in the termination enclosure or a separate enclosure designed for this purpose. Multiple cables may share a common enclosure.
- B. A minimum of 5 meters (approximately 15 feet) of slack cable (each cable if applicable) shall be coiled and secured at both ends located in the entrance room, telecommunications room or main equipment room, for backbone and intra-building cable.
- C. Where exposed, all backbone fiber optic cable shall be installed in protective inner duct. This includes areas where the cable is routed in cable tray and where making a transition between paths (e.g., between conduit and cable tray or into equipment racks). The inner duct should extend into the termination and/or storage enclosure(s) at system endpoints.

3.2 CROSS-CONNECTS

- A. The Owner will be responsible for all cross-connects between the data backbone cabling and network electronics and between the data network electronics and horizontal cabling.
- B. The Owner shall be responsible for the cross-connect wiring between the horizontal and backbone voice cabling.
 - 1. Fastening cables directly to support brackets with wire or plastic ties will not be accepted. All cabling shall be neatly laced, dressed and supported. Avaya 88A retainer clips (or equivalent) shall be used on each 110-type termination block to secure jumper wires on the wiring block(s).
- C. This Contractor shall not be responsible for cross-connects between the cabling terminations at the entrance room and the telephone utility network point-of-presence. It shall be the responsibility of the Contractor, to work with the Owner and provide the necessary assistance to allow Owner and/or telephone company personnel to make the necessary connections to establish service on the new cable system. These activities include, but are not limited to cross-connect documentation, general wiring overview and cable pair identification.

END OF SECTION

SECTION 271500 - HORIZONTAL CABLING REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes the products and execution requirements relating to furnishing and installing horizontal communications cabling and termination components and related subsystems as part of a cabling plant. The cabling plant consists of copper cabling.

1.2 RELATED WORK

- A. Section 270500 - Basic Communications Systems Requirements
- B. Section 271720 - Structured Cabling System Warranty

1.3 QUALITY ASSURANCE

- A. Refer to Section 270500 for relevant standards and plenum or non-plenum cable requirements.
- B. The channel shall be required to meet the performance requirements indicated herein. The manufacturer shall warranty the performance of their system to the required performance (and not just to the Standard, should the required performance exceed the Standard).
- C. Specific components of the channel shall be required, at a minimum, to meet the Standard component requirements for that particular component.
- D. The installing contractor must be certified by the manufacturer of the structured cabling system.

1.4 SUBMITTALS

- A. Under the provisions of Section 270500 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLE

A. CAT 6 Cable:

1. The horizontal cable requirements must be met, as well as the following channel requirements.
2. CAT 6 cable shall terminate on rack-mounted modular patch panels in their respective communication equipment room as indicated on the drawings.
3. Performance tests shall be conducted using swept frequency testing through 250 MHz for the channel. All numbers given are for a 4-connection channel. Discrete frequency testing results at 250 MHz is not acceptable.
4. Performance data shall be characterized as "Guaranteed Headroom" and shall be guaranteed by the manufacturer to perform at guaranteed margins over ANSI/TIA/EIA-568-C.2. Performance data that is not warranted by the manufacturer will not be considered.
5. The structured cabling and connectivity must be provided by the same company. For the purpose of this specification that shall mean that the cabling and connectivity must be marketed, branded, supported, warranted, and distributed by the same company. Specifically, ally or partnerships between cabling manufacturers and connectivity manufacturers do not meet this requirement unless otherwise listed below. Specifically, products made by others through an OEM relationship are acceptable if the products are marketed, branded, supported, warranted, and distributed by the same company.
6. The 4-connector channel performance margins listed in the below criteria shall be guaranteed minimum margins above ANSI/TIA/EIA-568-C.2 with electrical parameters between 1-250 MHz.
 - a. Insertion Loss: 5%
 - b. NEXT: 3.0 dB
 - c. PS NEXT: 5.0 dB
 - d. ACR-F (ELFEXT): 4.0 dB
 - e. PS ACR-F (PS ELFEXT): 5.0 dB
 - f. Return Loss: 2 dB

2.2 CONNECTORS/COUPLERS/ADAPTERS

- #### A.
- Refer to Section 271100 for requirements and 27 13 00 for requirements.

2.3 FACEPLATES/JACKS

- #### A. CAT 6 Jacks:

1. CAT 6 horizontal cable shall each be terminated at their designated work area location on RJ-45 modular jacks. These modular jack assemblies shall snap into a modular mounting frame. The combined modular jack assembly is referred to as an information outlet.
2. The same orientation and positioning of modular jacks shall be utilized throughout the installation. Prior to installation, the Contractor shall submit the proposed configuration for each information outlet type for review by the Architect/Engineer.
3. Information outlet faceplates shall incorporate recessed designation strips at the top and bottom of the frame for identifying labels. Designation strips shall be fitted with clear plastic covers.
4. Where standalone CAT 6 only modular jacks are identified, the information outlet faceplate shall be configured as to allow for the addition of one (1) additional modular jack (CAT 3, CAT 5E, or CAT 6) to be installed to supplement each such modular jack as defined by this project. The installation of these supplemental modular jacks is NOT part of this project.
5. Any unused modular jack positions on an information outlet faceplate shall be fitted with a removable blank inserted into the opening.
6. All modular jacks will be fitted with a dust cover. Modular jacks shall incorporate a dust cover that fits over and/or into the modular jack opening. The dust cover shall be designed to remain with the modular jack assembly when the modular jack is in use. No damage to the modular jack pinning shall result from insertion or removal of these covers. Dust covers that result in deformation of the modular jack pinning, will not be accepted.
7. The information outlet faceplate shall be constructed of high impact plastic (except where noted otherwise). The information outlet faceplate color shall:
 - a. Match the receptacle color used for other utilities in the building, or
 - b. When installed in surface raceway (if applicable), match the color of that raceway.
8. Different faceplate and frame designs for locations, which include optical fiber cabling relative to those, that terminate only copper cabling are acceptable. Information outlets that incorporate optical fiber shall be compliant with the above requirements plus:
 - a. Be a low-profile assembly.
 - b. Incorporate a mechanism for storage of cable and fiber slack needed for termination.
 - c. Position the optical fiber couplings to face downward or at a downward angle to prevent contamination.
 - d. Incorporate a shroud that protects the optical fiber couplings from impact damage.
9. All information outlets and the associated modular jacks shall be of the same manufacturer throughout the project.
10. The CAT 6 modular jacks shall be non-keyed 8-pin modular jacks.

11. The interface between the modular jack and the horizontal cable shall be a 110-type termination block or insulation displacement type contact. Termination components shall be designed to maintain the horizontal cable's pair twists as closely as possible to the point of mechanical termination.
12. CAT 6 modular jacks shall be pinned per TIA-568B.
13. CAT 6 termination hardware shall, as a minimum, meet all the mechanical and electrical performance requirements of the following standards:
 - a. ANSI/TIA/EIA-568-A-5
 - b. ANSI/TIA/EIA-568A
 - c. ISO/IEC 11801
 - d. IEC 603-7
 - e. FCC PART 68 SUBPART F

PART 3 - EXECUTION

3.1 CABLE INSTALLATION REQUIREMENTS

A. Horizontal Cabling:

1. The maximum horizontal cable drop length for Data UTP shall not exceed 295 feet in order to meet data communications performance specifications. This length is measured from the termination panel in the wiring closet to the outlet and must include any slack required for the installation and termination. The Contractor is responsible for installing horizontal cabling in a fashion so as to avoid unnecessarily long runs. Any area that cannot be reached within the above constraints should be identified and reported to the Architect/Engineer prior to installation. Changes to the contract documents shall be approved by the Architect/Engineer.
2. All cable shall be free of tension at both ends. In cases where the cable must bear some stress, Kellum grips may be used to spread the strain over a longer length of cable.
3. Manufacturer's minimum bend radius specifications shall be observed in all instances.
4. Horizontal cabling installed as open cabling shall be supported at a maximum of 5' between supports. Refer to the specifications for required cable supports.
5. Horizontal cabling installed as open cable or in cable tray shall be bundled at not less than 10' intervals with hook-and-loop tie wraps. The use of plastic cable ties is strictly prohibited.
6. The maximum conduit fill for horizontal cabling shall not exceed 40% regardless of conduit length.
7. Cable sheaths shall be protected from damage from sharp edges. Where a cable passes over a sharp edge, a bushing or grommet shall be used to protect the cable.
8. Cabling shall not be routed through wall(s) without a pathway. Provide conduit sleeve pathways through wall(s) for proper installation of horizontal cabling.



- B. A coil of 3 feet in each cable shall be placed in the ceiling at the last support (e.g., J-hook, bridle ring, etc.) before the cables enter a fishable wall, conduit, surface raceway or box. At any location where cables are installed into movable partition walls or modular furniture via a service pole, approximately 15-feet of slack shall be left in each horizontal cable under 250 feet in length to allow for change in the office layout without re-cabling. These "service loops" shall be secured at the last cable support before the cable leaves the ceiling and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.
 - 1. To reduce or eliminate EMI, the following minimum separation distances from 480V power lines shall be adhered to:
 - a. Twelve (12) inches from power lines of less than 5-kVa.
 - b. Eighteen (18) inches from high-voltage lighting (including fluorescent).
 - c. Thirty-nine (39) inches from power lines of 5-kVa or greater.
 - d. Thirty-nine (39) inches from transformers and motors.
 - 2. Information outlets shown on floor plans with the subscript "W" are intended to be used for wall mounted telephones. Back boxes for wall mounted telephones shall not be located within 12" vertically, or horizontally, from any light switches, power receptacles, nurse call devices, thermostats, or any other architectural element that would otherwise prevent the installation of a wall mounted telephone on the mating lugs.

3.2 CABLE TERMINATION REQUIREMENTS

- A. Cable Terminations - Data UTP:
 - 1. Modular patch panels shall be designed and installed in a fashion as to allow future horizontal cabling to be terminated on the panel without disruption to existing connections.
 - 2. If the "last" patch (per rack) is greater than 50% utilized, one additional patch panel shall be provided for future use..
 - 3. At information outlets and modular patch panels, the Contractor shall ensure that the twists in each cable pair are preserved to within 0.5-inch of the termination for data cables. The cable jacket shall be removed only to the extent required to make the termination.

END OF SECTION

SECTION 271710 - TESTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes the testing requirements relating to the structured cabling system and its termination components and related subsystems.

1.2 RELATED WORK

- A. Section 270500 - Basic Communications Systems Requirements

1.3 QUALITY ASSURANCE

- A. Refer to Section 270500 for relevant standards.

1.4 SUBMITTALS

- A. Under the provisions of Section 270500 and Division 1, prior to the start of work, the Contractor shall submit:
 - 1. Complete information on testing procedure as described herein.
 - 2. Test plan summary for each cable type to be tested including equipment to be used, setup, test frequencies or wavelengths, results format, etc.

PART 2 - PRODUCTS

2.1 TESTING COPPER

- A. General Requirements:
 - 1. Perform acceptance tests as indicated below for each sub-system (e.g., backbone, horizontal, etc.) as it is completed.
 - 2. Supply all equipment and personnel necessary to conduct the acceptance tests. The method of testing shall be approved by the Architect/Engineer.
 - 3. Visually inspect all cabling and termination points to ensure that they are complete and conform to the wiring pattern defined herein. Provide the Architect/Engineer with a written certification that this inspection has been made.

4. Conduct acceptance testing according to a schedule coordinated with the Owner/Architect/Engineer. Representatives of the Owner may be in attendance to witness the test procedures. Provide a minimum of one (1) week's advance notice to the Architect/Engineer to allow for such participation. The notification shall include a written description of the proposed conduct of the tests, including copies of blank test result sheets to be used.
5. Tests related to connected equipment of others shall only be done with the permission and presence of the Contractor involved. The Contractor shall ascertain that testing only is required to prove the wiring connections are correct.
6. Provide test results and describe the conduct of the tests including the date of the tests, the equipment used, and the procedures followed. At the request of the Architect/Engineer, provide copies of the original test results in their native format.
7. All cabling shall be 100% fault-free unless noted otherwise. If any cable is found to be outside the specification defined herein, that cable and the associated termination(s) shall be replaced at the expense of the Contractor. The applicable tests shall then be repeated.
8. Should it be found by the Architect/Engineer that the materials or any portion thereof furnished and installed under this Contract fail to comply with the specifications and drawings with respect or regard to the quality, amount, or value of materials, appliances, or labor used in the work, it shall be rejected and replaced by the Contractor and all work disturbed by changes necessitated in consequence of said defects or imperfections shall be made good at the Contractor's expense.
 - a. CAT 6 Cable:
 - 1) Testing shall be from the modular jack at the information outlet to the modular patch panel in the communication equipment room.
 - 2) Horizontal cable shall be free of shorts within the pairs, and be verified for continuity, pair validity and polarity, and conductor position on the modular jack (e.g., wire map). Any defective, split, or mis-positioned pairs must be identified and corrected.
 - 3) CAT 6 horizontal cable shall be tested to 250 MHz as defined by TIA/EIA-568-C.2. Measurements shall be of the "Permanent Link", including cabling and modular jacks at the information outlet and modular patch panel. Parameters to be tested must include:
 - a) Wire Map
 - b) Length
 - c) NEXT Loss (Pair-to-Pair)
 - d) NEXT (Power Sum)
 - e) ELFEXT (Pair-to-Pair)
 - f) ELFEXT (Power Sum)
 - g) Return Loss
 - h) Attenuation

- i) Propagation Delay
 - j) Delay Skew
- 4) The maximum length of horizontal cable shall not exceed 295 feet, which allows 33 feet for technology equipment and modular patch cords.
- 5) To establish testing baselines, cable samples of known length and of the cable type and lot installed shall be tested. The cable may be terminated with an eight-position CAT 6 modular connector (8-pin) to facilitate testing. Nominal Velocity of Propagation (NVP) and nominal attenuation values shall be calculated based on this test and be utilized during the testing of the installed cable plant. This requirement can be waived if NVP and nominal attenuation data is available from the cable manufacturer for the exact cable type under test.
- 6) CAT 6 horizontal cable testing shall be performed using a test instrument designed for testing to 250 MHz or higher. Test records shall verify, "PASS" on each cable and display the specified parameters, comparing test values with standards based "templates" integral to the unit. Test records that report a PASS*, FAIL*, or FAIL result for any of the parameters will not be accepted.
- 7) In the event results of the tests are not satisfactory, the Contractor shall make adjustments, replacements, and changes as necessary and shall then repeat the test or tests that disclosed faulty or defective material, equipment, or installation methods, and shall make additional tests as the Architect/Engineer deems necessary at no additional expense to the project or user agency.

2.2 TESTING FIBER

A. General Requirements:

- 1. Perform acceptance tests as indicated below for each optical fiber sub-system (e.g., backbone, horizontal, etc.) as it is completed.
- 2. Supply all equipment and personnel necessary to conduct the acceptance tests. The method of testing shall be approved by the Architect/Engineer.
- 3. Visually inspect all optical fiber cabling and termination points to ensure that they are complete and conform to the standards defined herein. Provide the Architect/Engineer with a written certification that this inspection has been made.
- 4. Conduct acceptance testing according to a schedule coordinated with the Owner/Architect/Engineer. Representatives of the Owner may be in attendance to witness the test procedures. Provide a minimum of one (1) week's advance notice to the Architect/Engineer to allow for such participation. The notification shall include a written description of the proposed conduct of the tests, including copies of blank test result sheets to be used.



5. Tests related to connected equipment of others shall only be done with the permission and presence of the Contractor involved. The Contractor shall ascertain that testing only is required to prove that the optical fiber connections are correct.
 6. Provide test results and describe the conduct of the tests including the date of the tests, the equipment used and the procedures followed. At the request of the Architect/Engineer, provide copies of the original test results.
 7. All optical fiber cabling shall be 100% fault-free unless noted otherwise. If any optical fiber cable is found to be outside the specification defined herein, that optical fiber cable and the associated connector(s) shall be replaced at the expense of the Contractor. The applicable tests shall then be repeated.
 8. Should it be found by the Architect/Engineer that the materials or any portion thereof furnished and installed under this Contract fail to comply with the specifications and drawings with respect or regard to the quality, amount, or value of materials, appliances, or labor used in the work, it shall be rejected and replaced by the Contractor and all work disturbed by changes necessitated in consequence of said defects or imperfections shall be made good at the Contractor's expense.
 9. The optical fibers utilized in the installed cable shall be traceable to the manufacturer. Upon request by the Owner, provide cable manufacturer's test report for each reel of cable provided. These test reports shall include manufacturer's on-reel attenuation test results at 850-nm and 1300-nm for each optical fiber of each reel prior to shipment from the manufacturer.
 - a. On-the-reel bandwidth performance as tested at the factory. Factory data shall be provided upon request.
 - b. The testing noted for optical fiber cabling utilizes an Optical Time Domain Reflectometer (OTDR). However, the Contractor may submit to the Architect/Engineer for pre-approval of alternate fiber optic testing equipment.
- B. Tests Prior to Installation: The Contractor, at their discretion and at no cost to the Owner, may perform an attenuation test with an OTDR at 850-nm or 1300-nm on each optical fiber of each cable reel prior to installation. Supply this test data to the Architect/Engineer prior to installation.
- C. Tests After Installation: Upon completion of cable installation and termination, the optical fiber cabling shall be tested to include:
1. Optical Attenuation ("Insertion Loss" Method):

- a. Optical Attenuation shall be measured on all terminated optical fibers in one direction of transmission using the "Insertion Loss" method measurement in accordance with the TIA/EIA 526-14, Method B, and be inclusive of the optical connectors and couplings installed at the system endpoints. Access jumpers shall be used at both the transmit and receive ends to ensure that an accurate measurement of connector losses is made. Multimode optical fibers shall be tested at 850 ± 30 nm. Singlemode optical fibers (if applicable) shall be tested at 1300 ± 20 nm.
2. Verification of Link Integrity (OTDR):
- a. All optical fibers shall be documented in one direction of transmission using an Optical Time Domain Reflectometer (OTDR). Multimode optical fibers shall be tested at 850-nm and 1300-nm (nominal). Singlemode optical fibers (if applicable) shall be tested at 1310-nm and 1550-nm (nominal). The OTDR(s) shall incorporate high-resolution optics optimized for viewing of short cable sections. Access jumpers of adequate length to allow viewing of the entire length of the cable, including the connectors at the launch and receive end, shall be used. Access jumpers used for testing shall match the type and core diameter of the fiber optic strand under test.
 - b. Set OTDR's test variables to the manufacturer's published backscatter coefficient and velocity of propagation figure for the specific strand of fiber under test. OTDR's range should be set to approximately 1.5 times the length of the strand under test, pulse width should be optimized for the length of the fiber optic strand under test, and number of averages should be adjusted to approximately 120 seconds per wavelength.
 - c. OTDR traces revealing a point discontinuity greater than 0.2 dB in a multimode optical fiber or 0.1 dB in a singlemode optical fiber (if applicable) at any of the tested wavelengths or any discontinuity showing a reflection at that point shall be a valid basis for rejection of that optical fiber by the Owner. The installation of that optical fiber cable shall be reviewed in an effort to remove any external stress that may be causing the fault. If such efforts do not remove the fault, that optical fiber cable and the associated terminations shall be replaced at the expense of the Contractor.

2.3 DOCUMENTATION/AS-BUILTS/RECORDS

A. General:

1. Upon completion of the installation, submit as-builts per the requirements of Section 270500 and Division 1. Documentation shall include the items detailed in the subsections below.
2. All documentation, including hard copy and electronic forms, shall become the property of the Owner.



3. The Architect/Engineer may request that a 10% random field retest be conducted on the cable system at no additional cost to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the Contractor, additional testing can be requested to the extent determined necessary by the Architect/Engineer, including a 100% retest. This retest shall be at no additional cost to the Owner.
- B. Copper Media Test Data:
1. Test results shall include a record of test frequencies, cable type, conductor pair and cable (or Outlet) I.D., measurement direction, test equipment type, model and serial number, date, reference setup, and crew member name(s).
 2. Printouts generated for each cable by the wire test instrument shall be submitted as part of the documentation package. The Contractor shall furnish this information in electronic form (USB thumb drive). The thumb drive shall contain the electronic equivalent of the test results as defined by the bid specification and be in the tester's native format as well as summaries of each test in pdf format. Provide a licensed copy of the software required to view and print the data that is provided in a proprietary format. Furnish one (1) copy of the data and display (if applicable) software.
- C. Optical Fiber Media Test Data:
1. Test results shall include a record of test wavelengths, cable type, fiber and cable (or Outlet) I.D., measurement direction, test equipment type, model and serial number, date, reference setup, and crew member name(s).
 2. OTDR traces of individual optical fiber "signatures" obtained as specified above shall be provided to the Architect/Engineer in electronic form for review. Trace files shall be so named as to identify each individual optical fiber by location in the cable system and optical fiber number or color. Where traces are provided in electronic form, provide along with the above documentation, one (1) licensed copy of software that will allow for the display of OTDR traces provided. The software shall run on a Microsoft Windows-based personal computer.
- D. Record Drawings:
1. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided.



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PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 271720 - STRUCTURED CABLING SYSTEM WARRANTY

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes support and warranty requirements relating to the structured cabling system and related subsystems.

1.2 RELATED WORK

- A. Section 270500 - Basic Technology Systems Requirements.
- B. Section 271100 - Communication Equipment Room (CER).
- C. Section 271300 - Backbone Cabling Requirements.
- D. Section 271500 Horizontal Cabling Requirements.

1.3 QUALITY ASSURANCE

- A. Refer to Section 270500 for relevant standards.

1.4 SUBMITTALS

- A. Under the provisions of Section 270500 and Division 1, prior to close of the project the Contractor shall submit:
 - 1. A numbered certificate from the manufacturing company registering the installation.

PART 2 - PRODUCTS

2.1 WARRANTY

- A. A twenty-five (25) year Product Installation Warranty and System Assurance Warranty shall be provided for the structured cabling system as described in the contract documents.
- B. The Product Installation Warranty shall cover the replacement or repair of the defective product(s) and labor for the replacement or repair of such defective product(s).



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- C. The system assurance warranty shall cover the failure of the wiring system to support the application it was designed to support, as well as additional applications introduced in the future by recognized standards or user forums that use the TIA/EIA 568A component and link/channel specifications for cabling.
- D. Upon successful completion of the installation and subsequent inspection, the Owner shall be provided with a numbered certificate from the manufacturing company registering the installation.

PART 3 - EXECUTION

3.1 WARRANTY REQUIREMENTS

- A. This Contractor shall be responsible for providing, installing and testing a structured cabling system that will meet the manufacturer's warranty requirements.

END OF SECTION