# BRIDGE STUDY REPORT
# (P/PMS TASK No. 3370)

**Location**: Pedestrian Bridge over I-696 (East of Orchard Lake Road)

**Bridge Number**: P02 of 63101 (CS 63101)

**Job Number:** 58525E

**November 2002**

Spicer group

MDOT
Michigan Department of Transportation

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**ATTACHMENT A:** COST BREAKDOWN

**ATTACHMENT B:** OPTIONS ON GENERAL PLAN OF SITE DRAWINGS

**ATTACHMENT C:** EXISTING GENERAL PLAN OF SITE DRAWING

## I. PROJECT BACKGROUND

The existing steel tubular truss pedestrian bridge was scoped April 2002. The scoping study identified a 20% average section loss of the steel members and an existing minimum underclearance of 16.2 feet. The scoping study identified the replacement alternative as the preferred alternative based on life cycle costs. The construction cost estimate identified in the scope for the reconstruction option was $308,689. This cost was based on a new 142'x8' bridge with no approach treatment or revisions to substructures. The scoping study did not address site issues or address functional upgrades such as handicap access. The estimate was developed based on the 2002 CALL FOR PROJECTS – BRIDGE REPAIR COST ESTIMATE guide. The programmed amount is currently $226,090.

The purpose of the study is to identify feasible alternatives to rehabilitate or reconstruct the bridge. The alternatives have been developed to incorporate existing available information, ADA provisions, site issues, and functional requests of Farmington Hills and Harrison High School.

As several of the approach alternatives incorporate functional requests that extend beyond the ROW and all costs were significantly over the programmed amount, no preferred alternative was identified at this time. Receipt and incorporation of comments will complete this P/PMS Task 3370 - Structural Study.

## II. DESIGN CONSIDERATIONS

### A. PEDESTRIAN OVERPASS FUNCTIONAL

1. Farmington Hills and Harrison High School utilize the overpass extensively and desired to upgrade it.
2. The parking lot to the south (elementary school) is used as overflow parking for athletic events.
3. The south approach is currently lighted.
4. A straight ramp would be the most efficient for ADA requirements and pedestrian desire for the shortest route.
5. A straight stairway in conjunction with the switchback options to stay within the R.O.W. would still allow the shortest route for non-handicap pedestrians.

### B. BRIDGE GEOMETRICS

1. Height
   a. The proposed minimum underclearance of 17' – 3 is about 1 foot higher than the existing.
2. Width
   a. The proposed clear bridge width is 10 feet, as there is minimal difference in cost compared to the AASHTO minimum of 8 feet.
   b. The existing clear width is less than 5'.
3. Length (See Attachment C – Existing General Plan of Structure)
   a. The existing bridge abutments are 11 feet from edge of metal.
   b. The distance between the edge of metal EB and WB is 116'.
   c. The standards call for a clear distance of 34 feet from the edge of metal.

d. Options are given for replacement in-kind (142' main span) and to upgrade to current standards (190' min. main span).

4. Alignment
   a. Horizontal
      i. There is no apparent code or policy criteria dictating horizontal alignment beyond functionality.
      ii. The proposed horizontal alignment options were chosen based on function, constructability, R.O.W., and costs. (Also see "Maintaining Traffic)
   b. Vertical Alignment
      i. ADA and Michigan Barrier Free requirements govern the rate of elevation change (grades)
      ii. A grade of over 5% is considered a ramp, and thus required to meet the ramp requirements of ADA and Michigan Barrier Free.
      iii. A maximum allowable grade of 8.33% (1 vertical to 12 horizontal) was used in the layouts. This maximum grade requires a 5' landing every 30 feet.
5. Type
   a. A pre-engineered, pre-manufactured steel truss bridge was used for this study analysis. Weights and delivered costs were obtained from Continental Bridge Company.
   b. This bridge type and style was also used on the recently constructed pedestrian crossing over I-696 along Farmington Road 1.5 miles west.

## C. EXISTING SUBSTRUCTURES

1. Soil Boring information from the 1962 plans call out the soils at the footing elevation as "plastic yellow mottled silty clay". Blow count information was not given.
2. The existing substructures utilized a soil bearing of about 3000 psf.
3. The proposed dead load + live load bearing pressure would be about 4500 psf if the new bridge was placed on the existing 9'x9' spread footings.
4. It would not be feasible to geometrically utilize the existing abutments for the option to increase the bridge length to satisfy clear zone standards.

## D. MAINTAINING TRAFFIC

1. A detailed maintaining traffic plan was not included with this study. All reconstruction options would have similar issues and costs.
2. Construction Considerations
   a. Offset new bridge to west
      i. Allows maintaining pedestrian traffic during construction.
      ii. Reduces the number of expressway closures as the existing bridge superstructure can be removed at the same time the new one is installed.
   b. Span Entire Expressway
      i. Eliminates work and lane closures to construct a pier.
      ii. Would require closure of both EB and WB simultaneously.
      iii. Would require a 2-lane closure for each crane.
      iv. Anticipate two 15-minute expressway closures. One to remove the existing trusses and one to install new bridge. (Based on information from a rigging company, McNally-Nimergood).
      v. The cost difference between the one and two span options is minimal (within 10%).
3. Based on the above considerations and similar costs only the option to offset the bridge to the west and utilizing a 1-span main crossing is illustrated.

E. R.O.W.

1. The existing bridge and stairway approaches are within the existing R.O.W.
2. The property beyond the north R.O.W. is owned by Harrison High School.
3. The property beyond the south R.O.W. is privately owned by the Beachview Swim and Tennis Club.
4. Detailed R.O.W acquisition issues were not included with this study.
5. Grading easements would be required for all options.

Standing at southern boardwalk approach looking east at Beachview Swim and Tennis Club.

F. EARTH BERM (NORTH APPROACH)

1. The existing walkway cuts though the earthen sound and visual berm.
2. The school would like to maintain a continuous sound and visual berm/barrier and possibly land the bridge approach on the berm.
3. The berm is on the school's property and would require a grading permit to incorporate with the bridge.

Looking SW at existing walk through berm at north approach

G. BOARDWALK (SOUTH APPROACH)

1. The boardwalk at the south approach is not only the existing bridge approach, it is also part of a nature walkway trail system connecting a trail that runs parallel to the R.O.W.
2. It is considered necessary for the boardwalk to remain in place for all the options considered as it is part of the local trail system.
3. The boardwalk is currently in good condition and lighted.
4. The boardwalk crosses the wetland area.

Looking north along boardwalk.

H. WETLAND (SOUTH APPROACH)

1. The wetland is located outside the R.O.W. at the south approach and is privately owned by the Beachview Swim and Tennis Club.
2. Spanning the wetland with a bridge structure is considered necessary to minimize impacts for the option to extend the ramp through this area (in lieu of embankment).

Wetland area looking west from boardwalk.

I. UTILITIES

1. No utilities have been identified that would significantly influence costs or construction.

## III. STUDY OPTIONS

The options have been developed incorporating "Design Considerations" identified in the previous section. The north and south approach options have been separated due to differing site issues. The option plan layouts and detailed cost breakdowns are included as Attachments A and B.

### OPTION SUMMARY

| OPTION | DESCRIPTION | COST |
|---|---|---|
| SOUTH APPROACH - 1 (S) | SWITCHBACK RAMP WITHIN R.O.W. | $460,900 |
| SOUTH APPROACH - 2 (S) | STRAIGHT RAMP OVER WETLAND, 8.33% | $823,350 |
| NORTH APPROACH - 3 (N) | STRAIGHT EMBANKMENT, 5% | $136,400 |
| NORTH APPROACH - 4 (N) | STRAIGHT EMBANKMENT, 8.33% | $141,900 |
| NORTH APPROACH - 5 (N) | SWITCHBACK RAMP WITHIN R.O.W. | $430,100 |
| NORTH APPROACH - 6A (N) | STRAIGHT RAMP TO EXISTING BERM, 5% | $208,450 |
| NORTH APPROACH - 6B (N) | RELOCATE BERM, SWITCHBACK DOWN BERM, 5% | $208,450 |
| BRIDGE - 142' LENGTH | 1-SPAN, REPLACE IN KIND | $374,550 |
| BRIDGE - 190' LENGTH | 1-SPAN, EXTEND CLEAR ZONE | $462,000 |

### SAMPLE OPTIONAL COSTS

1. Option to stay within R.O.W., 190' main span

| | | |
|---|---|---|
| 1 (S) | = | $ 460,900 |
| 5 (N) | = | $ 430,100 |
| 190' Span | = | $ 462,000 |
| Total | = | $ 1,353,000 |

2. Option to span wetland and relocate berm, 190' main span

| | | |
|---|---|---|
| 2(S) | = | $ 823,350 |
| 6B (N) | = | $ 208,450 |
| 190' Span | = | $ 462,000 |
| Total | = | $ 1,562,800 |

## IV. REHABILITATION OPTIONS

Rehabilitation of the structure would consist of meeting minimal accepted standards both structurally and geometrically which is not considered feasible based on the following:

1. The minimum recommended clear width of 8' could not be feasibly obtained by modifying the existing 5' wide structure.
2. The minimum current pedestrian standards are intended to allow for handicap access. The approaches would require reconstruction to incorporate ramps.
3. The minimum recommended offset from the edge of metal to the face of the abutment would require a longer main span which would require reconstruction.
4. The current rate of deterioration would suggest a future closure if not stopped. It would not appear cost effective to invest the money into cathodic protection and paint considering the deficiencies noted above.

## V. PROJECT SCHEDULE

The project schedule will be dictated by the Michigan Department of Transportation and therefore has not been included with this structure study.

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## SUPPLEMENTAL PHOTOS

Looking north at Harrison H.S.

Looking SW at existing berm.

Looking west along centerline of berm.

Looking west at optional touchdown location on south side approach.

# PEDESTRIAN BRIDGE OVER I-696 (EAST OF ORCHARD LAKE ROAD)

| | OPTION # / CONSTRUCTION ITEM | PIER QUANTITY (EACH) | PIER COSTS (+/- $20,000 EACH) | PREFAB. RAMP QUANTITY (APPROACH SPAN) (FT) | PREFAB. RAMP COSTS (APPROACH SPAN) ($1500 / LIN. FT.) | RAMP EXCAVATION QUANTITY (CYD) | RAMP EXCAVATION COSTS ($10/CYD) | LIGHTING QUANTITY (# OF POLES) | LIGHTING COSTS($5,000 / POLE) | RAMP EMBANKMENT QUANTITY (CYD) | RAMP EMBANKMENT COSTS($10/ CYD) | CONCRETE SIDEWALK QUANTITY (SQ FT) | CONCRETE SIDEWALK COSTS ($8 / SQ FT) | PREFABRICATED STAIRCASE (EACH) | PREFABRICATED STAIRCASE COSTS ($25,000/EACH) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SOUTH SIDE OPTIONS | OPTION #1 (S) | 2 | $40,000 | 140 | $210,000 | 500 | $5,000 | 3 | $15,000 | 1,000 | $10,000 | 4,500 | $36,000 | 1 | $25,000 |
| | OPTION #1 (S) - (Switchback Ramp within R.O.W.) | | | | | | | | | | | | | | |
| | OPTION #2 (S) | 5 | $100,000 | 350 | $525,000 | 500 | $5,000 | 4 | $20,000 | 500 | $5,000 | 125 | $1,000 | N/A | N/A |
| | OPTION #2 (S) - (Straight Bridge Over Wetland, 8.33% Grade) | | | | | | | | | | | | | | |
| NORTH SIDE OPTIONS | OPTION #3 (N) | N/A | N/A | 35 | $52,500 | 500 | $5,000 | 3 | $15,000 | 2,000 | $20,000 | 2,250 | $18,000 | N/A | N/A |
| | OPTION #3 (N) - (Straight Embankment - 5% Max Grade - Straight) | | | | | | | | | | | | | | |
| | OPTION #4 (N) | N/A | N/A | 40 | $60,000 | 500 | $5,000 | 3 | $15,000 | 2,000 | $20,000 | 1,875 | $15,000 | N/A | N/A |
| | OPTION #4 (N) - (Straight Embankment - 8.33% Max Grade - Straight) | | | | | | | | | | | | | | |
| | OPTION #5 (N) | 2 | $40,000 | 140 | $210,000 | 500 | $5,000 | 3 | $15,000 | 2,000 | $20,000 | 3,500 | $28,000 | 1 | $25,000 |
| | OPTION #5 (N) - (Switchback Ramp within R.O.W.) | | | | | | | | | | | | | | |
| | OPTION #6A (N) | N/A | N/A | 40 | $60,000 | 3,000 | $30,000 | 3 | $15,000 | 3,000 | $30,000 | 2,250 | $18,000 | N/A | N/A |
| | OPTION #6A (N) - (Straight Embankment - 5% Max Grade - Switchback) | | | | | | | | | | | | | | |
| | OPTION #6B (N) | N/A | N/A | 40 | $60,000 | 3,000 | $30,000 | 3 | $15,000 | 3,000 | $30,000 | 2,250 | $18,000 | N/A | N/A |
| | OPTION #6B (N) - (Straight Embankment - 5% Max Grade - Relocated Berm - Switchback) | | | | | | | | | | | | | | |
| BRIDGE OPTIONS | 142' LENGTH | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | 190' LENGTH | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

*Quantities associated w/ each option only account for construction to the centerline of I-696.

Total estimated cost for the entire structure would require the combination of two Options (1N + 1S).

**R.O.W. Costs shall be provided by the Michigan Department of Transportation R.O.W. Quantity assumes 50' width)

***Traffic Control Costs will be universal accross all options and has not been included at this time.

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# PEDESTRIAN BRIDGE OVER I-6.. (EAST OF ORCHARD LAKE ROAD)

| | OPTION # / CONSTRUCTION ITEM | SWITCHBACK RETAINING WALL (CYD) | SWITCHBACK RETAINING WALL COSTS ($300 / CYD) | PERMANENT R.O.W. QUANTITY (ACRES) | R.O.W. COSTS ($XXXXX / ACRE)** | REMOVAL COSTS:(PIERS, ABUTMENTS, SUPERSTRUCTURE) | ERECTION DAYS | ERECTION COSTS ($20,000 / DAY) | ABUTMENT QUANTITY (EACH) | ABUTMENT COSTS (+/- $30,000 EACH) | CONCRETE DECK QUANTITY (CYD) | CONCRETE DECK COSTS ($500 / CYD) | TRAFFIC CONTROL COSTS: ($62,000 TOTAL)** | PREFABRICATED BRIDGE COSTS | MISCELLANEOUS & CONTINGENCIES (15%) | APPROXIMATE COST |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SOUTH SIDE OPTIONS | OPTION #1 (S) | 150 | $45,000 | 0 | N/A | N/A | 1.0 | $20,000 | N/A | N/A | 26 | $13,000 | $0 | N/A | $41,900 | $460,900 |
| | OPTION #1 (S) - (Switchback Ramp within R.O.W.) | | | | | | | | | | | | | | | |
| | OPTION #2 (S) | N/A | N/A | 0.35 | ? | N/A | 3.0 | $60,000 | N/A | N/A | 65 | $32,500 | $0 | N/A | $74,850 | $823,350 |
| | OPTION #2 (S) - (Straight Bridge Over Wetland, 8.33% Grade) | | | | | | | | | | | | | | | |
| NORTH SIDE OPTIONS | OPTION #3 (N) | N/A | N/A | 0 | N/A | N/A | 0.5 | $10,000 | N/A | N/A | 7 | $3,500 | $0 | N/A | $12,400 | $136,400 |
| | OPTION #3 (N) - (Straight Embankment - 5% Max Grade - Straight) | | | | | | | | | | | | | | | |
| | OPTION #4 (N) | N/A | N/A | 0 | N/A | N/A | 0.5 | $10,000 | N/A | N/A | 8 | $4,000 | $0 | N/A | $12,900 | $141,900 |
| | OPTION #4 (N) - (Straight Embankment - 8.33% Max Grade - Straight) | | | | | | | | | | | | | | | |
| | OPTION #5 (N) | 50 | $15,000 | 0 | N/A | N/A | 1.0 | $20,000 | N/A | N/A | 26 | $13,000 | $0 | N/A | $39,100 | $430,100 |
| | OPTION #5 (N) - (Switchback Ramp within R.O.W.) | | | | | | | | | | | | | | | |
| | OPTION #6A (N) | 75 | $22,500 | 0 | N/A | N/A | 0.5 | $10,000 | N/A | N/A | 8 | $4,000 | $0 | N/A | $18,950 | $208,450 |
| | OPTION #6A (N) - (Straight Embankment - 5% Max Grade - Switchback) | | | | | | | | | | | | | | | |
| | OPTION #6B (N) | 75 | $22,500 | 0 | N/A | N/A | 0.5 | $10,000 | N/A | N/A | 8 | $4,000 | $0 | N/A | $18,950 | $208,450 |
| | OPTION #6B (N) - (Straight Embankment - 5% Max Grade - Relocated Berm - Switchback) | | | | | | | | | | | | | | | |
| BRIDGE OPTIONS | 142' LENGTH | N/A | N/A | N/A | N/A | $15,000 | 1.0 | $20,000 | 2 | $30,000 | 27 | $13,500 | $62,000 | $200,000 | $34,050 | $374,550 |
| | 190' LENGTH | N/A | N/A | N/A | N/A | $15,000 | 1.0 | $20,000 | 2 | $30,000 | 36 | $18,000 | $62,000 | $275,000 | $42,000 | $462,000 |

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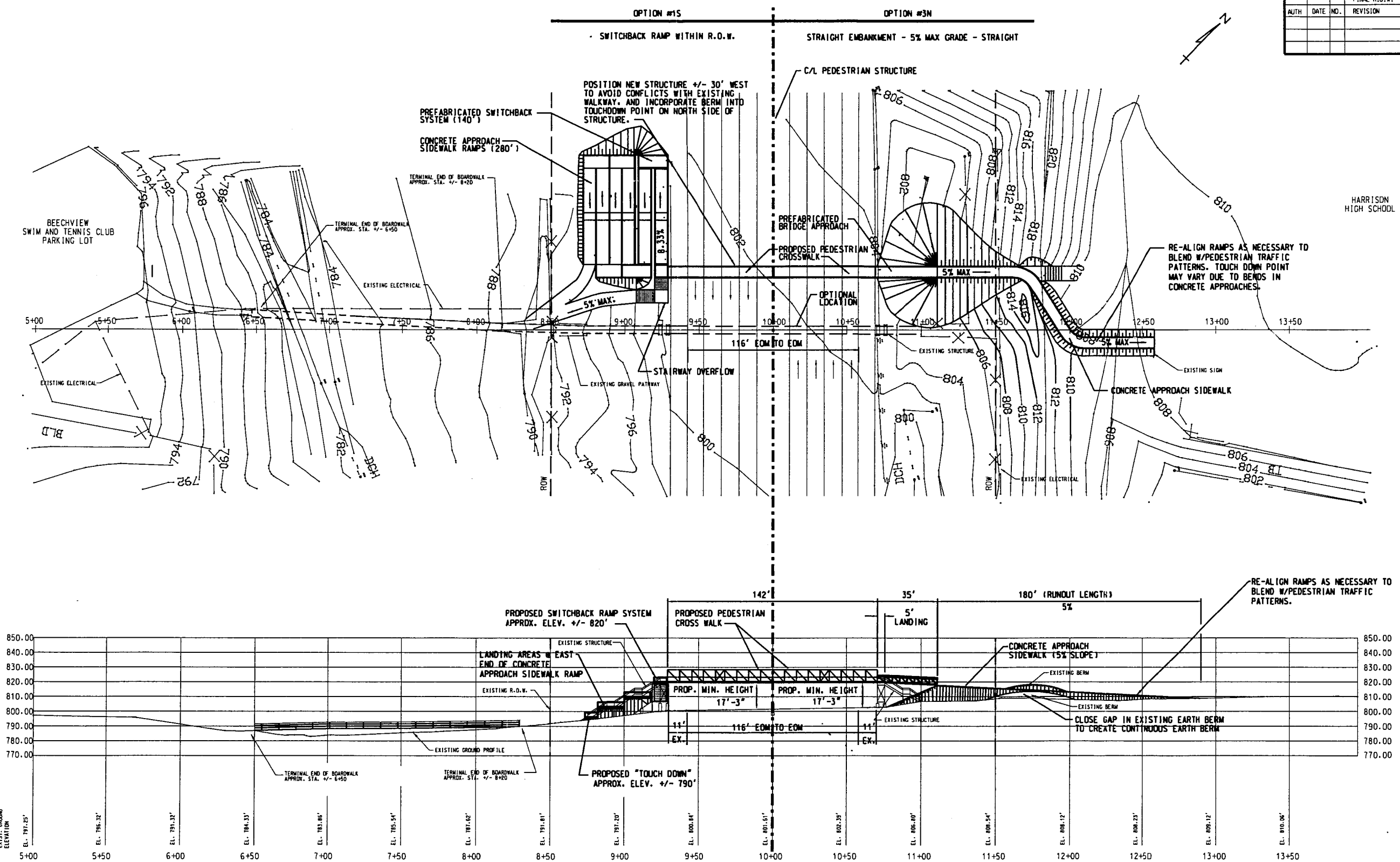





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APPROACH OPTIONS #1S AND #3N
(SHOWN WITH 142' MAIN SPAN OPTION)

PEDESTRIAN BRIDGE OVER I-696 EAST OF ORCHARD LAKE RD.
STUDY PHASE

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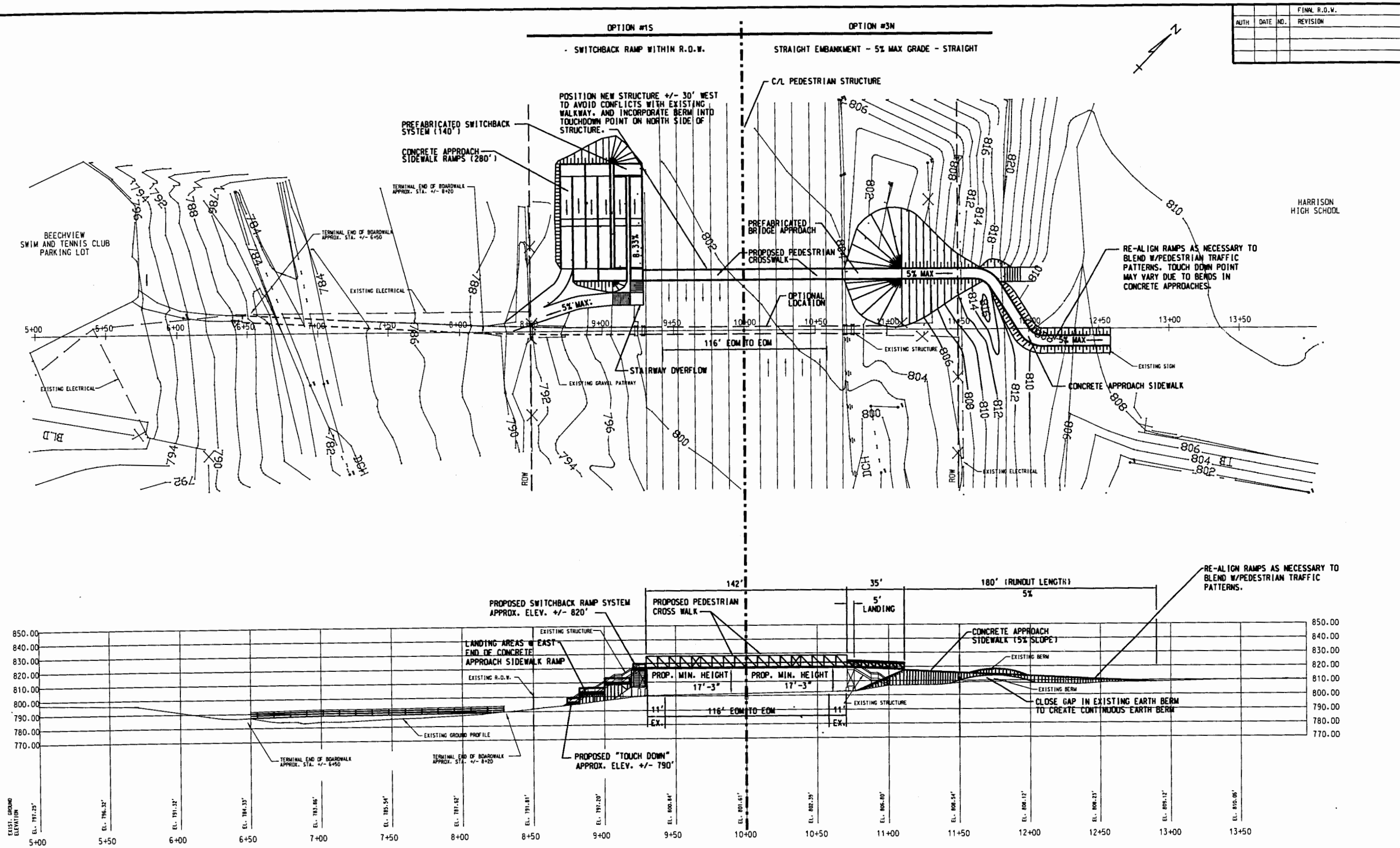


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APPROACH OPTIONS #1S AND #3N
(SHOWN WITH 142' MAIN SPAN OPTION)

PEDESTRIAN BRIDGE OVER I-696 EAST OF ORCHARD LAKE RD.
STUDY PHASE

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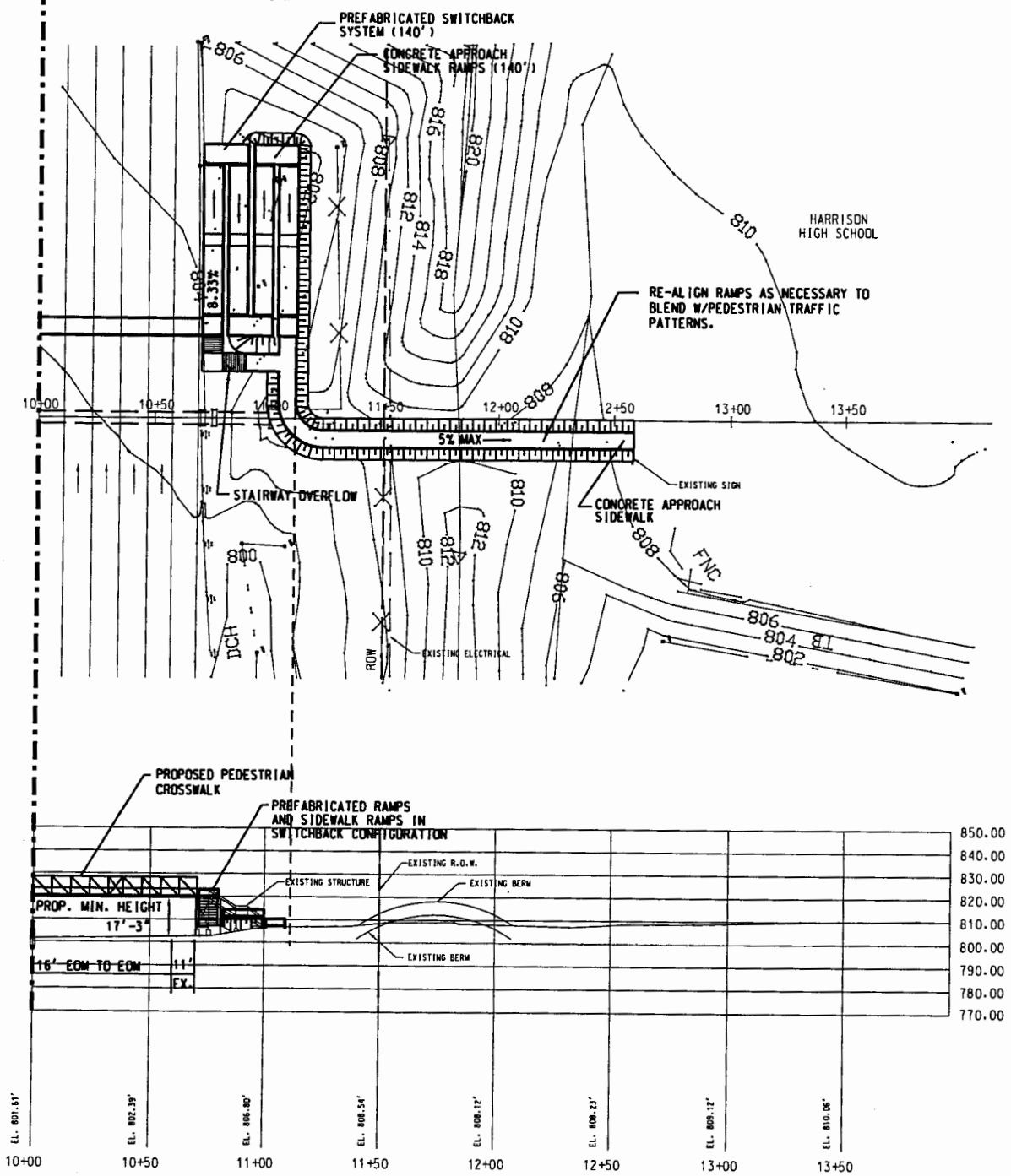
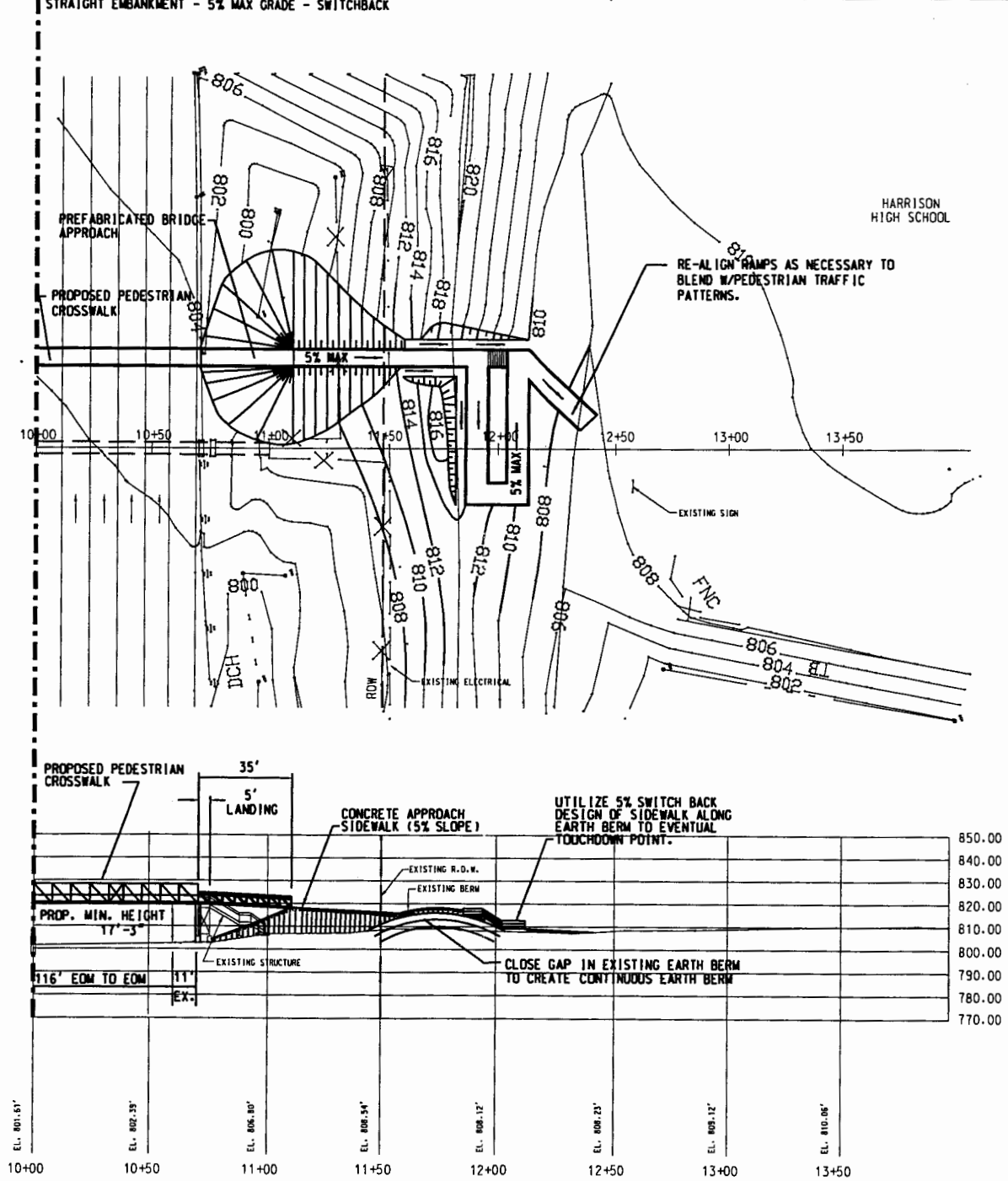
## OPTION #5N

SWITCHBACK RAMP WITHIN R.O.W.




## OPTION #6AN

STRAIGHT EMBANKMENT - 5% MAX GRADE - SWITCHBACK




APPROACH OPTIONS #5N AND #6AN
(SHOWN WITH 142' MAIN SPAN OPTION)

PEDESTRIAN BRIDGE OVER I-696 EAST OF ORCHARD LAKE RD.
STUDY PHASE

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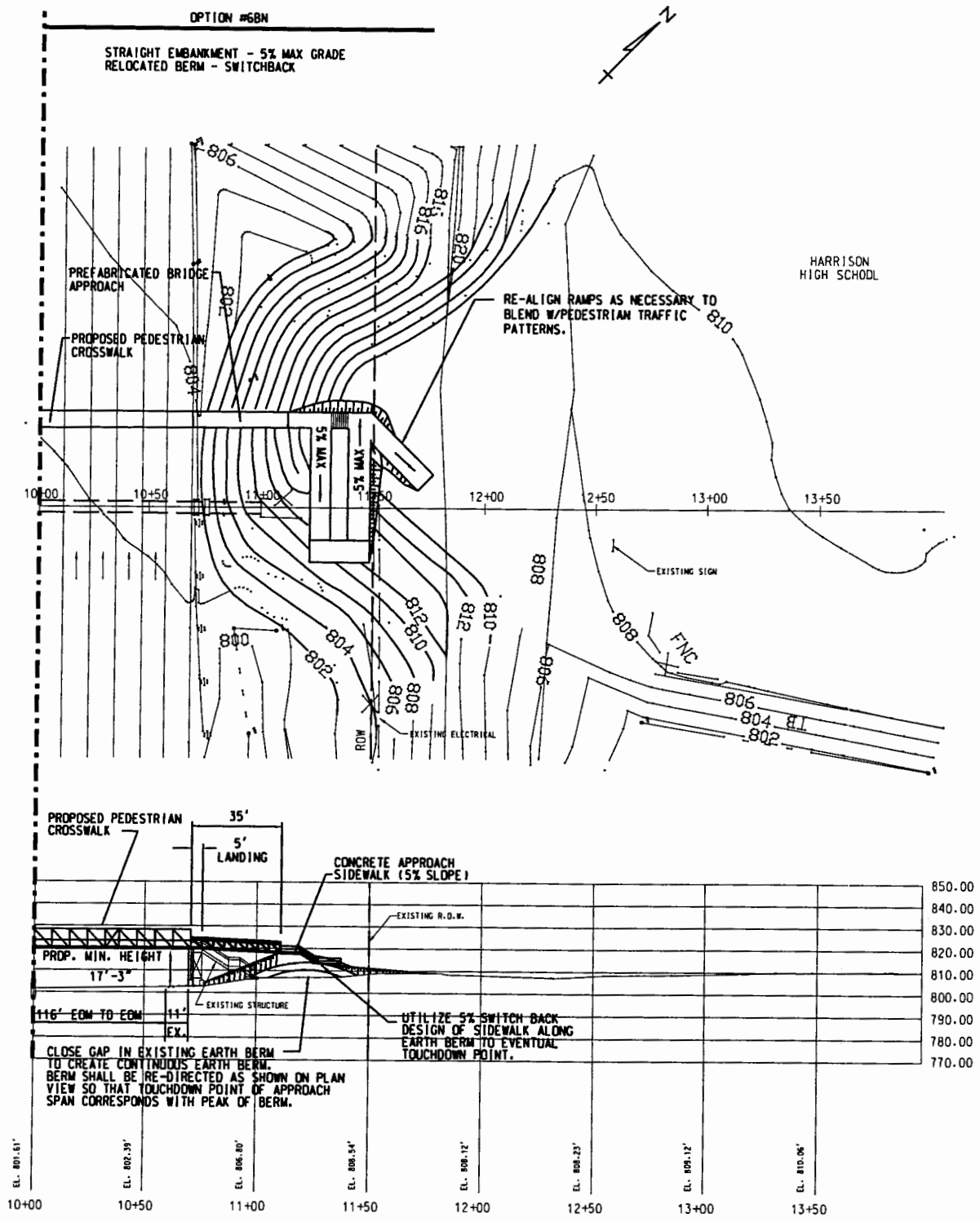
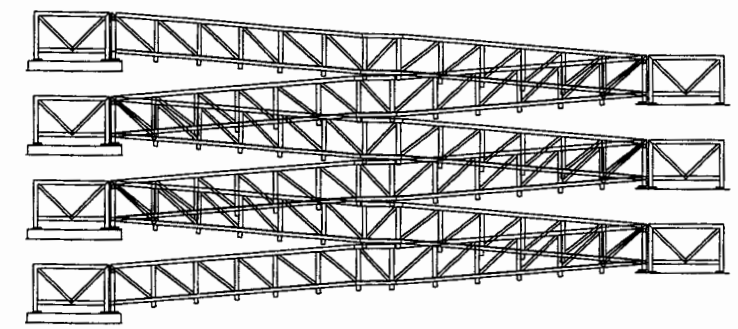
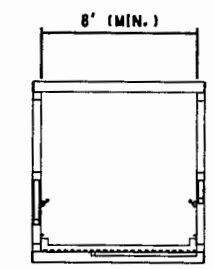
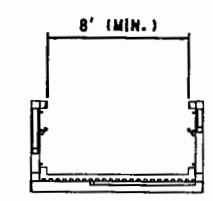


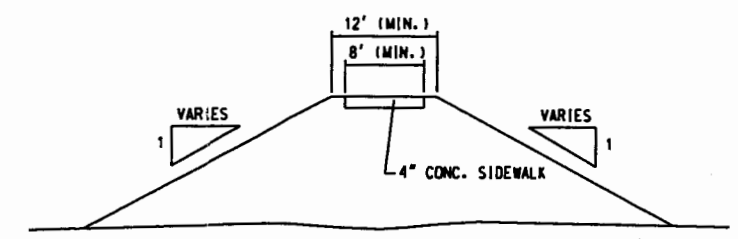
TYPICAL "SWITCHBACK" PREFABRICATED RAMP CONFIGURATION
OPTIONS #1 AND #5
(NUMBER OF SWITCHBACKS VARY)




PREFABRICATED BRIDGE CROSS SECTION (MAIN SPAN)




PREFABRICATED APPROACH SPAN CROSS SECTION




TYPICAL APPROACH (EMBANKMENT AREA)

| AUTH | DATE | NO. | FINAL R.O.W. REVISION |
|---|---|---|---|
| | | | |

APPROACH OPTION #6BN / MISC. DETAILS
(SHOWN WITH 142' MAIN SPAN OPTION)

PEDESTRIAN BRIDGE OVER I-696 EAST OF ORCHARD LAKE RD.
STUDY PHASE

| DATE | CONTROL SECTION | MDOT JOB NO. | DESIGN UNIT | SPICER DWG. NO. | SHEET NO. |
|---|---|---|---|---|---|
| 11/06/02 | CS-63101 | 58525E | | | 4 |

MDOT Michigan Department of Transportation

Spicer Group
230 S. Washington Ave.
P.O. BOX 1689
Saginaw, MI 48605-1689
Tel. 989-754-4717
Fax. 989-754-4440

APPROVED _____
DESIGN SUPERVISING ENGINEER

CONTROL SECTION CS-63101 JOB NO. 58525E SH. NO.

PLOT DATE: $$$$$DATE$$$$$
PLOT TIME: $$$$LONG_TIME$$$$
USERNAME: $$$USERNAME$$$

MICROSTATION FILE: $$$$$$$$$$$$$$$$$$$$DGNSPECIFICATION$$$$$$$$$$$$$$$$$$$$
PLOTTING SCALE:
APPROVED BY:
CHECKED BY:
DRAWN BY:
DESIGNED BY:
WORKORDER NO.:

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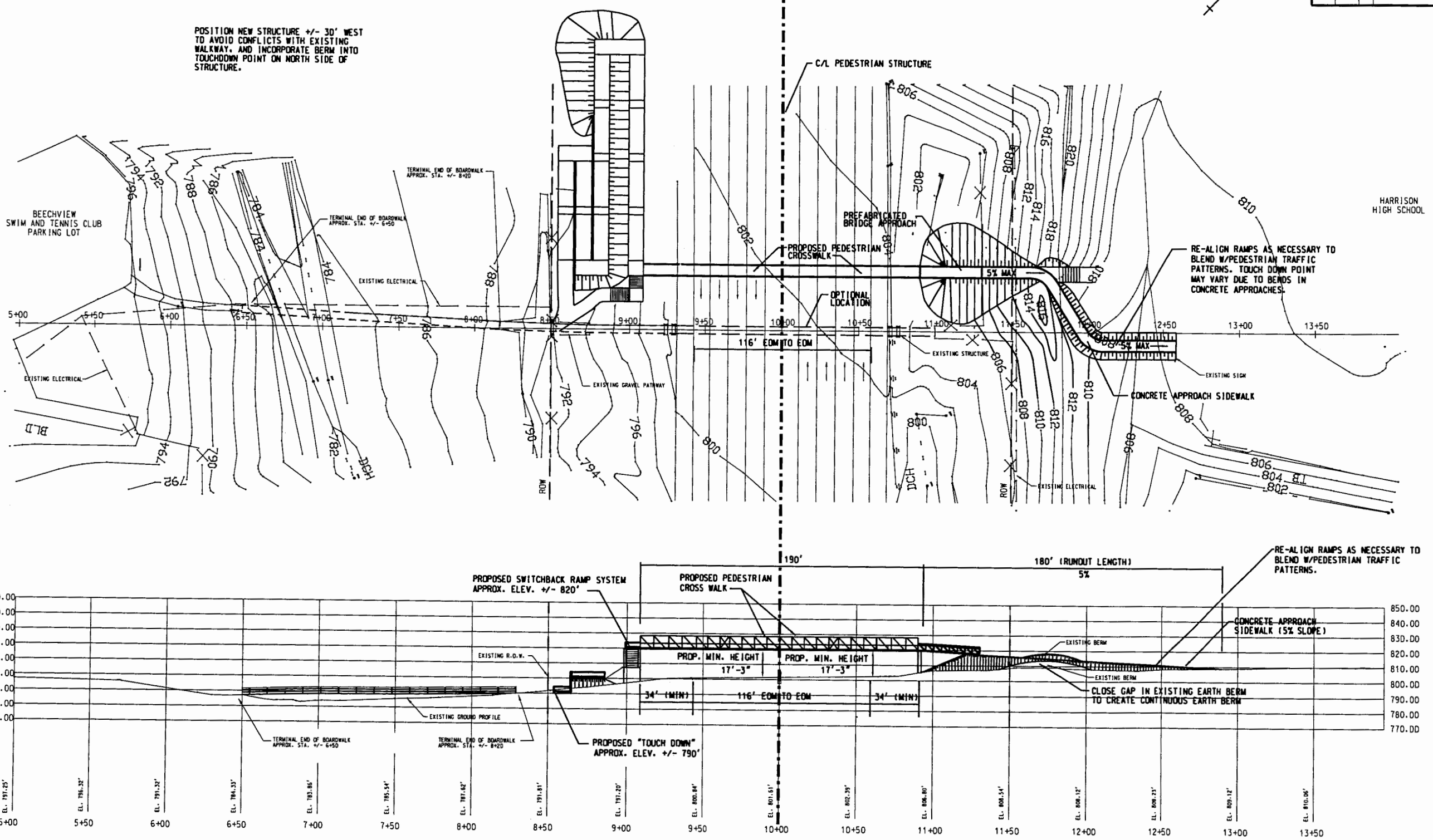
CONTROL SECTION CS-63101 | JOB NO. 58525E | SH. NO.

| AUTH | DATE | NO. | FINAL R.O.W. REVISION |
|---|---|---|---|
| | | | |

ALTERNATE BRIDGE OPTION (SHOWN WITH 190' MAIN SPAN)

SWITCHBACK RAMP WITHIN R.O.W. | STRAIGHT EMBANKMENT - 5% MAX GRADE - STRAIGHT

POSITION NEW STRUCTURE +/- 30' WEST TO AVOID CONFLICTS WITH EXISTING WALKWAY, AND INCORPORATE BERM INTO TOUCHDOWN POINT ON NORTH SIDE OF STRUCTURE.

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MDOT Michigan Department of Transportation

ALTERNATE BRIDGE OPTION
(SHOWN WITH 190' MAIN SPAN)

PEDESTRIAN BRIDGE OVER I-696 EAST OF ORCHARD LAKE RD.
STUDY PHASE

| DATE | CONTROL SECTION | MDOT JOB NO. | DESIGN UNIT | SPICER DWG. NO. | SHEET NO. |
|---|---|---|---|---|---|
| 11/06/02 | CS-63101 | 58525E | | | 5 |

MICROSTATION FILE: ##########DGNSPECIFICATION##########
PLOTTING SCALE:
APPROVED BY:
CHECKED BY: MAL
DRAWN BY:
DESIGNED BY:
WORKORDER NO.:

PLOT DATE: $$$$$DATE$$$$$
PLOT TIME: $$$$LONG.TIME$$$
USERNAME: $$$USERNAME$$$

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Orchard Lake Rd
& I-696

**BENCH MARK**

B.M. #41 Pk nail in root of 18" Elm, 106' Rt. of E.B. Survey Line Sta. 323+07, El. 793.56

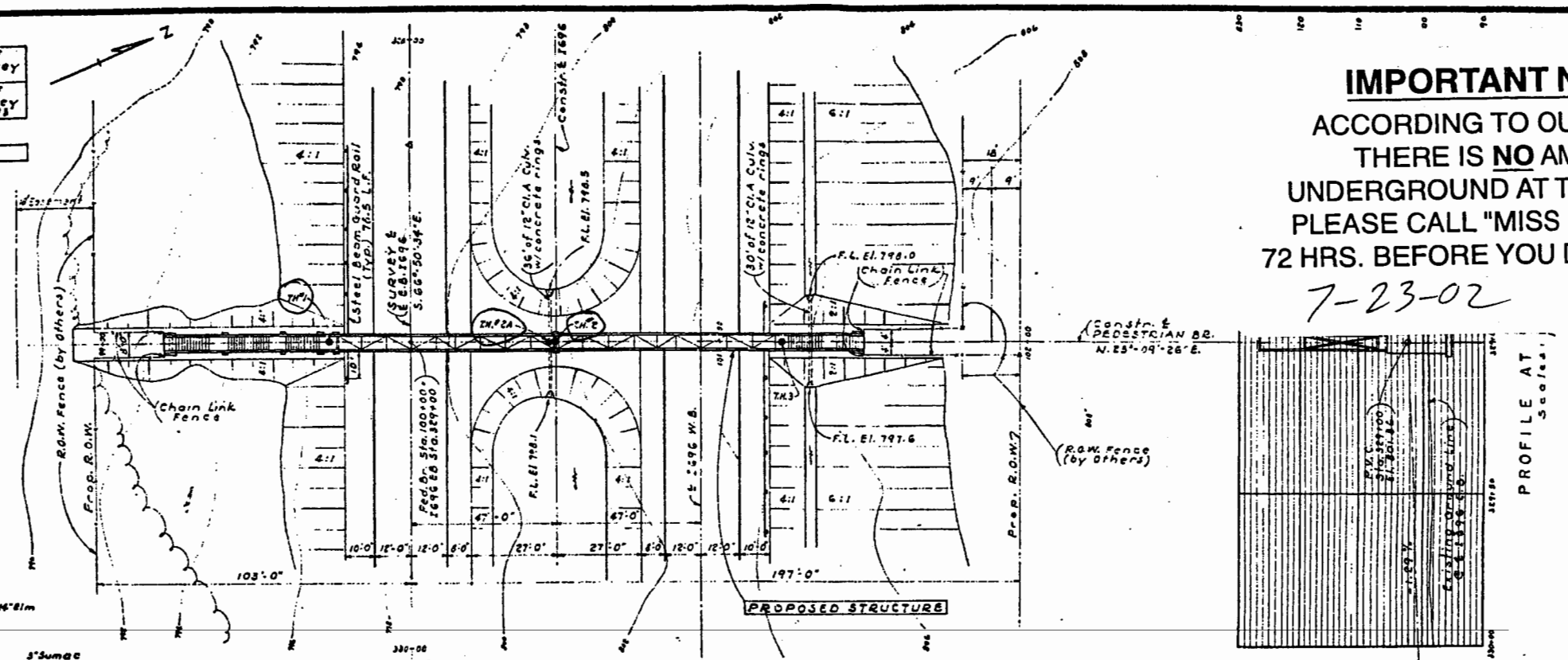
B.M. #42 Pk nail in root of 32" Elm, 295' Lt. of E.B. Survey Line Sta. 335+35, El. 796+93

**UTILITIES**

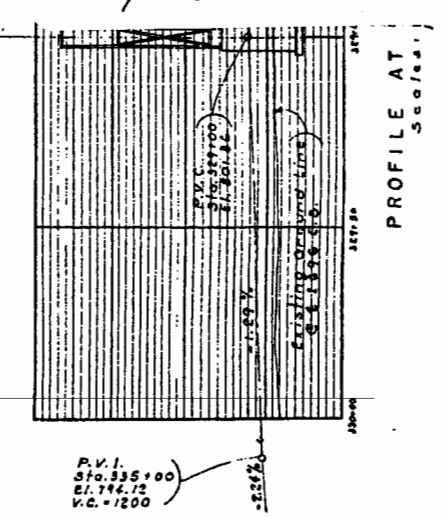
None

**CURVE DATA**

Δ = 26°-19'-40"
D = 2°
R = 2864.79'
L = 1316.59'
E = 77.37'
P.C. = 315+18.76
P.I. = 321+88.79
P.T. = 328+35.15
T = 670.03'



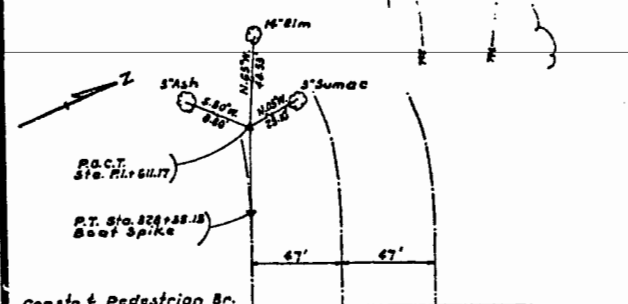

SITUATION PLAN
Scale: 1"=20'

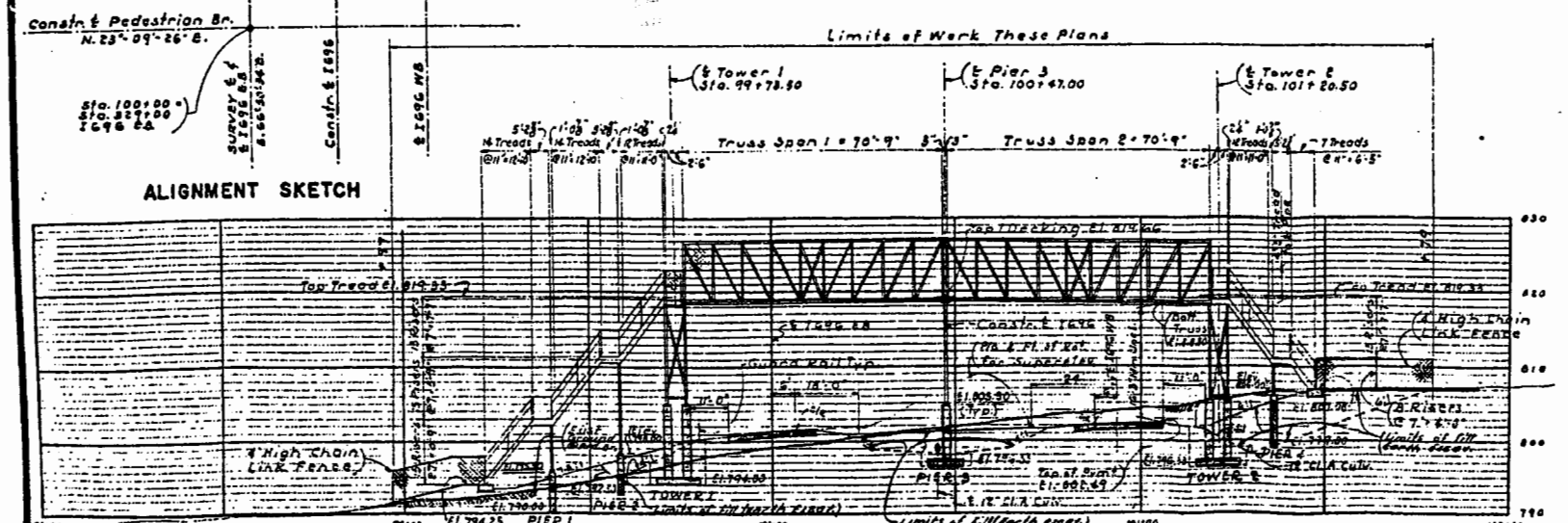



**IMPORTANT NOTICE!!**

ACCORDING TO OUR RECORDS THERE IS **NO** AMERITECH UNDERGROUND AT THIS LOCATION. PLEASE CALL "MISS DIG" AT LEAST 72 HRS. BEFORE YOU DIG. 800-482-7171

7-23-02 NWW




ALIGNMENT SKETCH