



Office of Structural Services

Production Conference 2008

SIGNIFICANCE OF SS&T, A REMINDER

- CRITICAL EVENT IN THE PROJECT DEVELOPMENT PROCESS BECAUSE:
- Sets the basis (Skeleton) for the rest of the project.
- SS&T items are a major portion of Stage 1.
- Determines the course of action for the detailed design phase and approximate construction cost of the structure.
- Most evaluation items are rated.



SIGNIFICANCE OF SS&T, A REMINDER

SS&T is a major portion of Stage 1 submission which occurs a minimum of 60 days after the hydraulic submittal per section 14-2.04(01). Plans should be approximately 25% complete at this stage, while the SS&T is almost 100%.



SOURCES OF INFORMATION FOR SS&T

- Chapter 59 of IDM.
- Chapter 14 of IDM, Stage 1 Review Submission.
- Refer to previously accepted practices, on a case by case basis.
- Project scope, Engineering Assessment



INDOT's SS&T Expectations

- Highlight the pertinent SS&T items, per IDM section 14-2.04(02), or other source of preliminary information to start the SS&T process.
- In general the bridge design will accommodate the roadway design, and be according to project scope of work.
- Provisions of IDM 59-1.01(01) and 59-1.01(02) generally apply to all bridges and deviations must be clarified for approvals or design exceptions.



INDOT's SS&T Expectations

- 2. SS&T DESIGN COMPUTATIONS & SELECTION
- A- Waterway Crossings, IDM59-1.04.
- Generally can be a spill through type beam or slab bridge , a three sided structure, or a box culvert
- Waterway opening required, in accordance with Hydraulics Approval. Include a copy of the approval letter.
- Sketches and geometry of the existing and proposed channel shape (channel clearing and spill slope, etc.)



INDOT's SST Expectations

A- Waterway Crossings, IDM59-1.04 (cont'd).

- Center to center of end bents and the final area of waterway provided .
- Freeboard will be checked after superstructure depth is determined.
- IDM Fig. 59-1J shows a sample. Suit your project situation

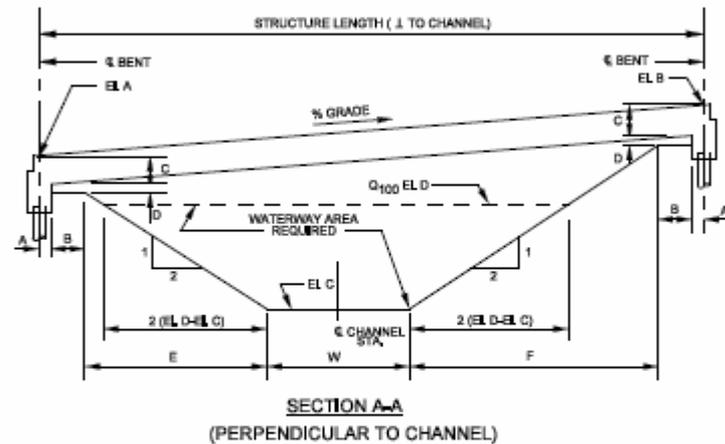
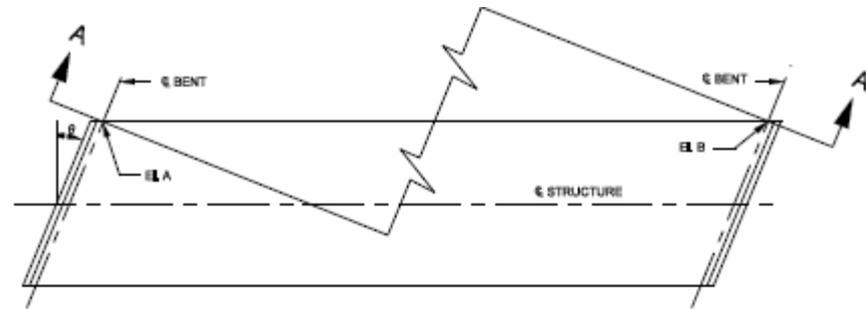


INDOT's SS&T Expectations

Waterway area provided
below $Q_{100} > \text{Reqd.}$
below Q_{100}

Maintain Req'd.
Freeboard

Minimize Channel
changes



- A ■ One half of the cap width
- B ■ Width of berm
- C ■ Anticipated thickness of reinforced concrete slab
- D ■ Distance from bottom of slab to berm elevation
- E ■ $2 (EL A - C - D - EL C)$
- F ■ $2 (EL B - C - D - EL C)$
- W ■ Width of channel (perpendicular to channel)
- EL A = Elevation of top of slab
- EL B = Elevation of top of slab
- EL C = Bottom of channel elevation

Note: Waterway Area Required will be determined in the waterway opening analysis. Interior supports are not shown.

STRUCTURE LENGTH FOR STREAM CROSSING
(Reinforced Concrete Slab Structure)

Figure 59-1J



■ INDOT's SS&T Expectations

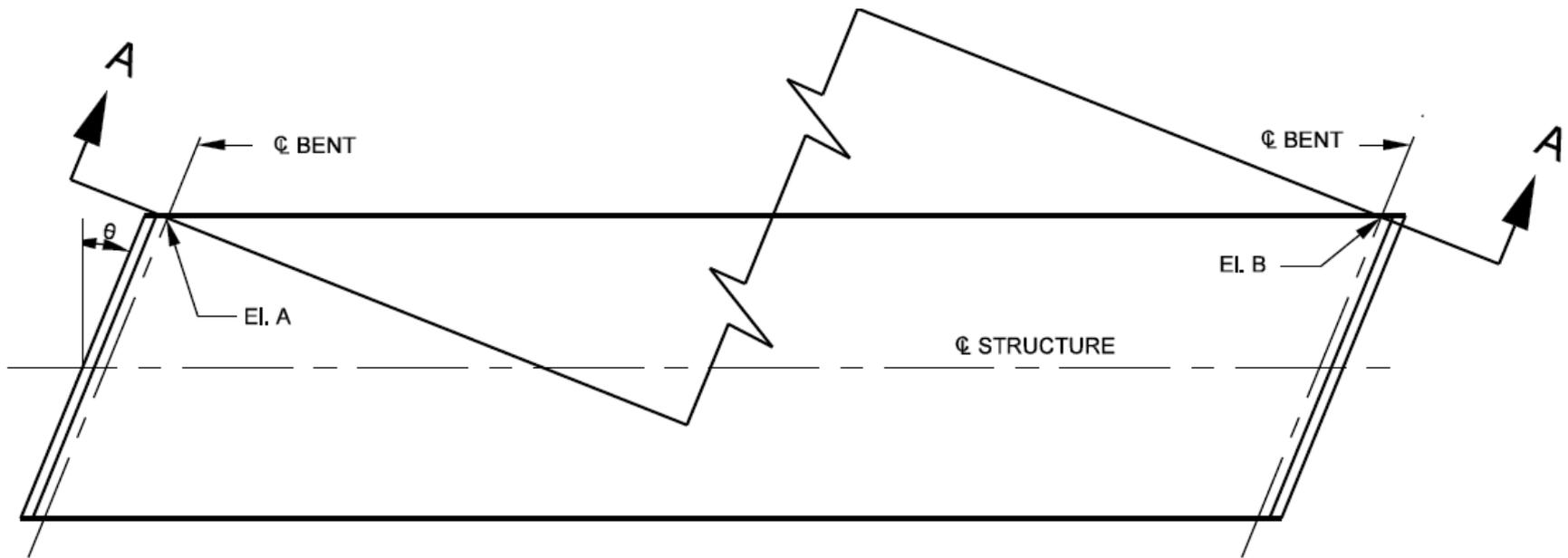
A- Waterway Crossings, IDM59-1.04 (cont'd).

- **Waterway area provided below Q100 > Req'd. below Q100**
- **Maintain Req'd. Freeboard**
- **Minimize Channel changes**



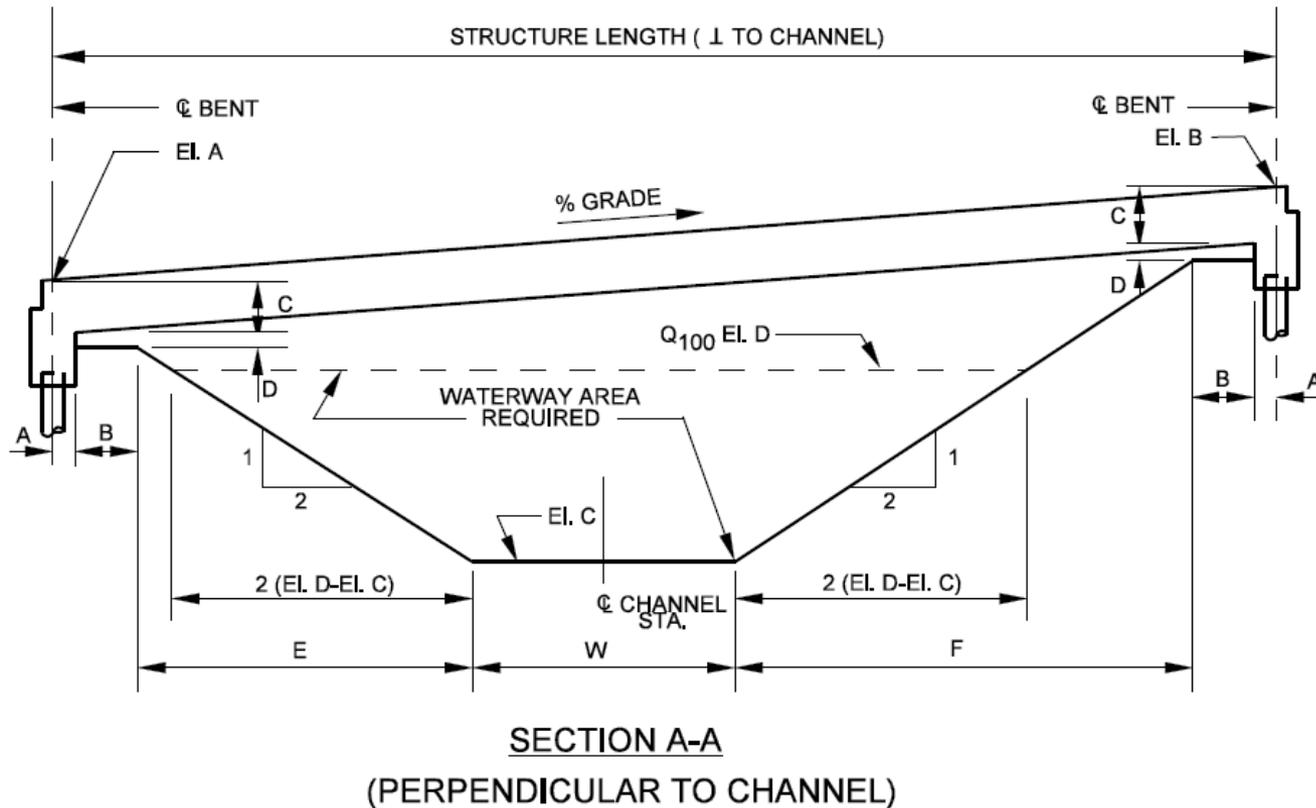
INDOT's SST Expectations

A- Waterway Crossings, IDM59-1.04 (cont'd).



INDOT's SST Expectations

A- Waterway Crossings, IDM59-1.04 (cont'd).



INDOT's SST Expectations

A- Waterway Crossings, IDM59-1.04 (cont'd).

- A = One half of the cap width
- B = Width of berm
- C = Anticipated thickness of reinforced concrete slab
- D = Distance from bottom of slab to berm elevation
- E = (2) (El. A - C - D - El. C)
- F = (2) (El. B - C - D - El. C)
- W = Width of channel (perpendicular to channel)
- El. A = Elevation of top of slab
- El. B = Elevation of top of slab
- El. C = Bottom of channel elevation

Note: Waterway Area Required will be determined in the waterway opening analysis. Interior supports are not shown.

STRUCTURE LENGTH FOR STREAM CROSSING (Reinforced Concrete Slab Structure)



INDOT's SST Expectations

- B- Highway Crossings, IDM 59-1.02 & 59-1.03
- Must accommodate the provisions of these sections.
- Sketches in plan view and elevation view required with the appropriate dimensions. Fig. 59-1k thru 59-1m are some samples. Include MSE walls if proposed.
- Critical roadway plans and sections should be included for reference only.



INDOT's SST Expectations

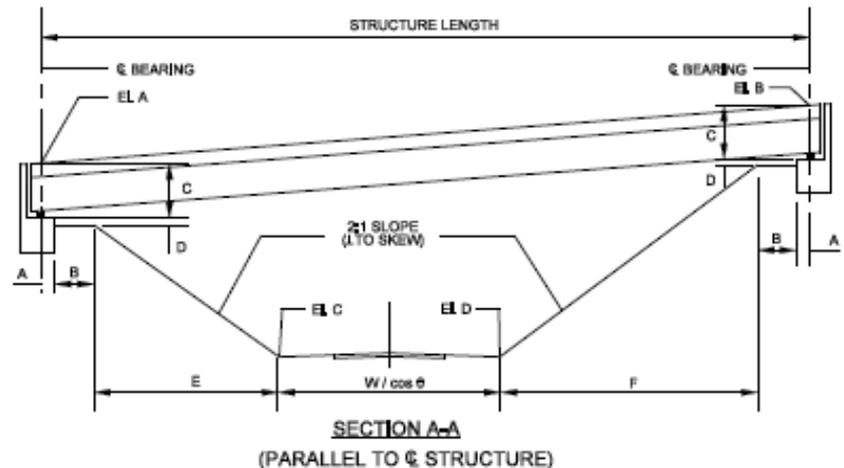
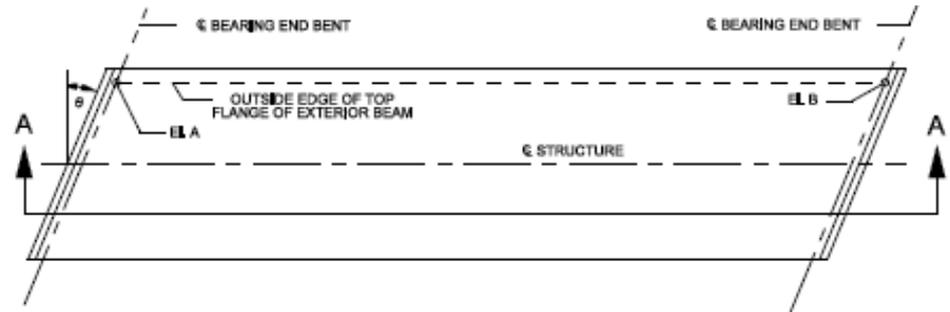
B- Highway Crossings, IDM 59-1.02 & 59-1.03 (cont'd)

- Show bridge length calculations.
- If software was used for superstructure design, highlight the applicable input and output portions.
- Add any appropriate notes to the reviewer on the output.
- Do not submit "hundreds of pages" at this stage unless requested by the reviewer.



■ INDOT's SS&T Expectations

- Minimum opening length must accommodate the requirements of roadway, shoulder, guardrail or CZ, or OF., etc.
- MSE or other retaining walls can be used, if costs are lower.
- Vertical clearance per Figure 59-1N
- See IDM 59-1.02 for details



- A ■ (Distance from bearing to front face of cap) / cos θ
 - B ■ (Width of berm) / cos θ
 - C ■ Construction depth plus height of bearing pad
 - D ■ Distance from top of cap to berm elevation
 - E ■ $(2) (EL A - C - D - EL C) / \cos \theta$
 - F ■ $(2) (EL B - C - D - EL D) / \cos \theta$
 - W ■ Width of traveled way plus width of obstruction-free or clear zone
 - EL A ■ Elevation of top of slab
 - EL B ■ Elevation of top of slab
 - EL C ■ Elevation of toe of slope
 - EL D ■ Elevation of toe of slope
- STRUCTURE LENGTH FOR HIGHWAY CROSSING
(Beam Type Superstructure)
- Figure 59-1K

Note: Interior supports are not shown.

STRUCTURE LENGTH FOR HIGHWAY CROSSINGS
(Beam Type Superstructures)

Figure 59-1K



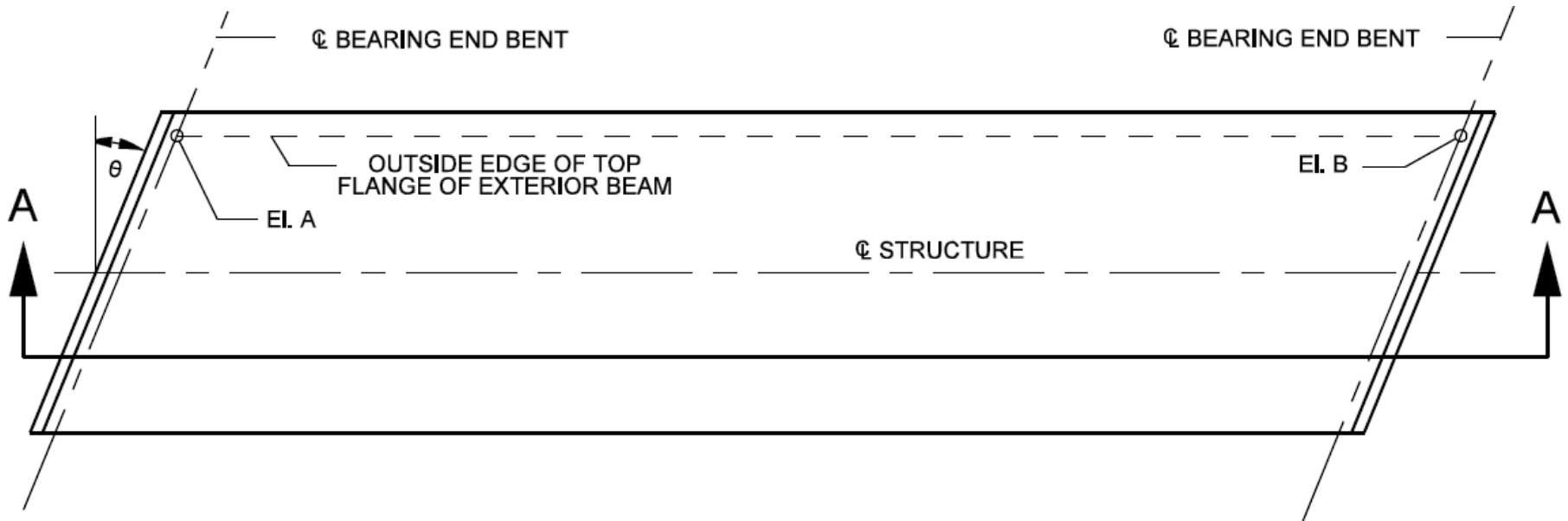
INDOT's SS&T Expectations

- **Minimum opening length must accommodate the requirements of roadway ,shoulder,guardrail or CZ,or OF. ,etc.**
- **MSE or other retaining walls can be used, if costs are lower.**
- **Vertical clearance per Figure 59-1N**
- **See IDM 59-1.02 for details**



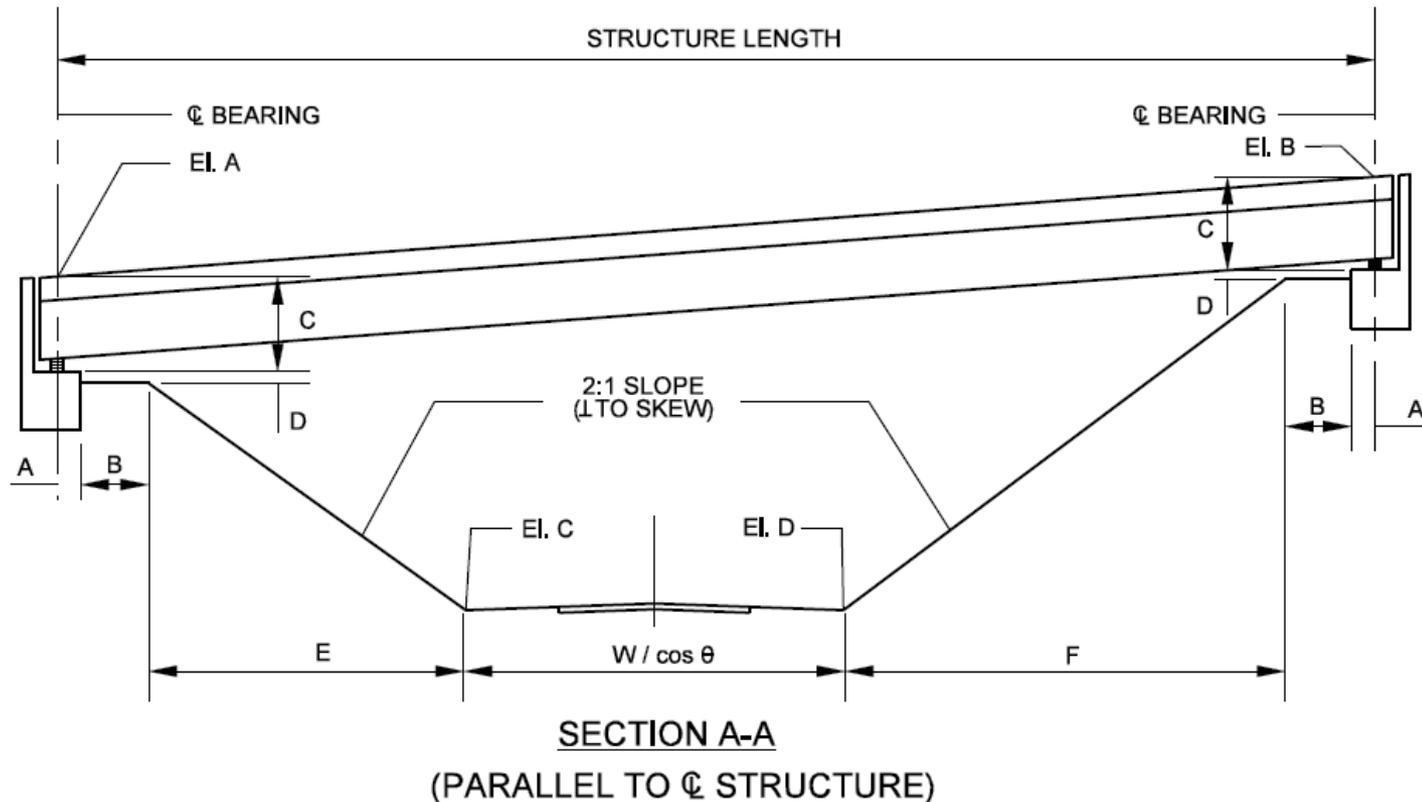
INDOT's SS&T Expectations

B- Highway Crossings, IDM 59-1.02 & 59-1.03 (cont'd)



INDOT's SS&T Expectations

B- Highway Crossings, IDM 59-1.02 & 59-1.03 (cont'd)



INDOT's SS&T Expectations

B- Highway Crossings, IDM 59-1.02 & 59-1.03 (cont'd)

- A = (Distance from bearing to front face of cap) / $\cos \Theta$
- B = (Width of berm) / $\cos \Theta$
- C = Construction depth plus height of bearing pad
- D = Distance from top of cap to berm elevation
- E = $(2) (\text{El. A} - \text{C} - \text{D} - \text{El. C}) / \cos \Theta$
- F = $(2) (\text{El. B} - \text{C} - \text{D} - \text{El. D}) / \cos \Theta$
- W = Width of traveled way plus width of obstruction-free or clear zone
- El. A = Elevation of top of slab
- El. B = Elevation of top of slab
- El. C = Elevation of toe of slope
- El. D = Elevation of toe of slope

Note: Interior supports are not shown.

STRUCTURE LENGTH FOR HIGHWAY CROSSING
(Beam Type Superstructure)

Figure 59-1K

STRUCTURE LENGTH FOR HIGHWAY CROSSINGS
(Beam Type Superstructures)



INDOT's SS&T Expectations

- C- Railroad Crossings. Chapter 69
- Follow the provisions of this chapter if you can find it, otherwise:
- Document the railroad company's agreed upon specs. and requirements.
- Satisfy the new LRFD clearance/protection requirements.
- Look for the upcoming INDOT memo on this.



INDOT's SS&T Expectations

- SUPERSTRUCTURE SELECTION, IDM 59-3.0
- IDM figs. 59-3B and 59-3C indicate a range of span lengths and superstructure characteristics.
- Need to submit a brief, highlighted, design input and output, if a software is used for design.
- Comparative or alternative cross-sections including beam or slab types should be clearly sketched.



INDOT's SS&T Expectations

- If the depth of superstructure changes other project items, these should be accounted in the cost analysis.
- Certain structure types will require special inspection arrangements or maintenance during their life. Cost of that should be accounted for. If the depth of superstructure changes other project items, these should be accounted in the cost analysis.



INDOT's SS&T Expectations

- VERTICAL CLEARANCES & GRADE CHECK
- IDM FIG. 59-1N gives min. vertical clearances
- A calculation or a highlighted portion of an output should indicate how the actual clearance was obtained. Show actual vs. required clearance.
- After the superstructure type and depth are established, recheck to make sure the grade is still satisfied and show a short calculation.



INDOT's SS&T Expectations

- SUBSTRUCTURE SELECTION, IDM 59-2.0
- End bent types can be selected with almost certainty at this stage in most cases. IDM fig. 59-2B indicates generally accepted limitations.
- Interior bents can have alternates indicated and discussed for comparative purposes.
- Piles can be indicated but the size is not established. For Geotechnical Investigation Request, the designer will provide pile load requirements if the selected structure type will require pile capacity beyond 70 tons.



INDOT's SS&T Expectations

- A SUGGESTION:
- SUBMIT THE INPUT PAGES OF A DESIGN SOFTWARE WITH RELEVANT SKETCHES, AND HIGHLIGHTED APPLICABLE OUTPUT PAGES. DO NOT HAVE TO SUBMIT ALL OUTPUT PAGES OF A DESIGN SOFTWARE AT THIS STAGE UNLESS REQUESTED BY THE REVIEWER



INDOT's SS&T Expectations

- MAINTENANCE OF TRAFFIC
 - Plans should clearly indicate which of the following is proposed:
 - Detour Route
 - Runaround
 - Phase construction, lane closure
- Cost analysis of MOT should be included, unless the bridge is part of a Roadway Project .



INDOT's SS&T Expectations

3. CONFORMANCE

Make sure the SS&T conforms with the Level One controlling design criteria listed in Section 40-8.02(01). Note any apparent or possible design exceptions. Also note any discrepancies from the Level Two design criteria listed in Section 40-8.02(02).



INDOT's SS&T Expectations \$\$\$\$\$\$\$

- 4. ECONOMIC ANALYSIS
- A very essential and important step.
- Include a copy of the structural economic analysis that was conducted to determine the most economic structural alternative. It should preferably include the cost comparison of all items "not common" in the proposed alternates. It is more valid to rely upon future costs than the historic data, if possible. Cost may be extrapolated from historic data.



INDOT's SS&T Expectations \$\$\$\$

- Guidelines for this analysis are listed in Section 59-5.0. A Cost Estimate shall be provided for the selected alternative, with all major items included and a contingency allowed for minor items.



INDOT's SS&T Expectations \$\$\$\$\$\$\$

- ALTERNATIVE DESIGN PROCESS, IDM59-5.03
- Required on INDOT routes if deck area > 20,000 Sq.ft
- Cost bases include at least one Concrete & two Steel, structural member decks.
- Criteria of comparison & decision is in IDM.
- Cost of structure > \$10m (or very close), both alternates should be designed.
- Unit prices should be as accurate as possible if close tie.



INDOT's SST Expectations

- TO SUMMARIZE, IN A SHORT NARRATIVE FORM:
- Describe the structure type options considered and analyzed. Depending on the span lengths, these will generally include slab , pre-stressed or steel beam bridges. For stream crossings, three sided or box structures must also be considered if the flow requirements can be met
- Comparative costs must include consideration of non-common major items.
- Describe the advantages of the selected alternate over other options.
- The final SS&T cost estimate should have all major items with an allowance for items not yet finalized.



INDOT's SST Expectations

- 5. PLAN SHEETS--SS&T GENERALLY HAS:
- Index and Title Sheet
 - At this project stage, the Index and Title Sheet should include the information as follows:
 - a. project numbers;
 - b. description (des) number (include all des numbers kin to the project);
 - c. bridge file number;
 - d. county location map;
 - e. project location map including north arrow and scales;
 - f. description of the project work type and location;



INDOT's SST Expectations

- Index and Title Sheet (cont'd).
 - g. design data including design speed, project design criteria, functional classification, terrain and traffic data;
 - h. applicable reference point (does not apply to local agency project);
 - i. signature block(s); note that these blocks will not be completed at this stage;
 - j. an index of plan sheets at this stage. Note that sheet numbers will change for future submittals; and
 - k. latitude and longitude.



INDOT's SST Expectations

- Typical Cross Sections.
- Typical cross sections for this submittal should only show basic configuration and design features. This will typically include the following:
 - a. lane and shoulder widths;
 - b. profile grade, construction centerline, paper relocation line, and survey line locations; and
 - c. basic design features including curbs, sidewalks, pavement and shoulder cross slopes, side slopes, ditches, shoulder corrugations if warranted, etc.



INDOT's SST Expectations

- Road Plan and Profile Sheets.
- At this project stage, the Road Plan and Profile sheets will generally only include the preliminary design information. Some of the details that should be addressed include the following:
 - a. plotting of existing topography should be complete;
 - b. beginning and end of project;
 - c. horizontal alignment (e.g., horizontal curve data, PC, PI, PT, bearings);
 - d. vertical alignment and its relationship to grade controlling features;



INDOT's SST Expectations

Road Plan and Profile Sheets (cont'd).

- e. preliminary drainage design including mainline culverts;
- f. preliminary public road approach and drive locations;
- g. approximate construction limits; and
- h. proposed guardrail limits.



INDOT's SST Expectations

- Layout Sheet.
- The Layout sheet should include the preliminary design information for the following:
 - a. existing ground contours;
 - b. horizontal alignment;
 - c. vertical alignment;
 - d. drainage structures;
 - e. public road approach and drive locations;
 - f. approximate construction limits;



INDOT's SST Expectations

- Layout Sheet (cont'd).
- g. plan view showing bridge centerline station and skew;
- h. proposed structure geometrics (span lengths and clear roadway widths in the Title Block);
- i. channel protection;
- j. utility owners;
- k. existing structure data; and
- l. hydraulic data.



INDOT's SST Expectations

- Channel Change Layout Sheet.
- Include this sheet when the extent of the channel change goes beyond the general layout. The Channel Change Layout sheet should include the preliminary design information for the following:
 - a. stream profile;
 - b. new channel geometrics;
 - c. channel typical cross section; and
 - d. slope protection



INDOT's SST Expectations

- General Plan Sheet.

The General Plan sheet should include the information as follows:

- a. plan view;
- b. elevation view;
- c. Typical bridge cross-section



INDOT's SST Expectations

- General Plan Sheet (cont'd).
- d. design data. A note should be included which reads as follows:
 - "Superstructure and substructure designed for HL-93 loading, in accordance with the *AASHTO LRFD Bridge Design Specifications, Third Edition, 2004* and interims through 20__;
 - Substructure foundation designed for HS 25 loading, in accordance with the *AASHTO Standard Specifications for Highway Bridges, Seventeenth Edition, 2002*;



INDOT's SST Expectations

- General Plan Sheet (cont'd).
- e. suggested substructure type, and
- f. minimum vertical clearance.



INDOT's SST Expectations

- Maintenance of Traffic sheet should be conceptually complete.
- Summary of Bridge Quantities sheet should be included in the package. But it will not be possible to fill this sheet.



INDOT's SST Expectations

- Cross Sections.

The preliminary cross sections should include the following:

- a. templates of the typical sections placed on the existing cross sections;
- b. profile grade elevations; and
- c. drainage structures.



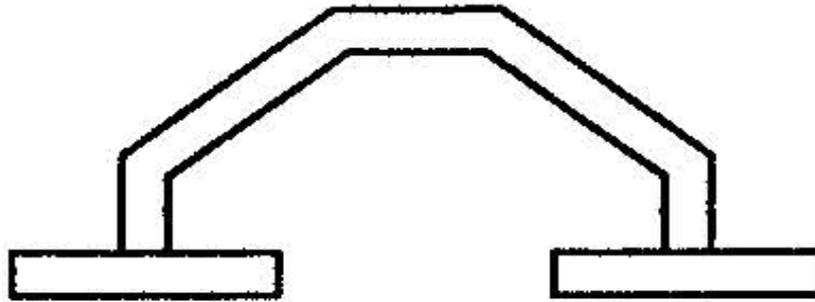
INDOT's SST Expectations

- 6. Certification. Provide an up-to-date copy of the Scope/Environmental Compliance Certification/Permit Application Certification Form with this submission.
- 7. QA Form.



INDOT's SST Expectations

AFTER ALL THE ABOVE NOTED STEPS,
IF YOUR 3-SIDED STRUCTURE STILL
LOOKS IDM-FIG.59-3A-M, MARCH
2004, EDITION, IMMEDIATELY CALL....



**THREE-SIDED
CULVERT**

