OHIO DEPARTMENT OF TRANSPORTATION
CENTRAL OFFICE, 1980 W. BROAD ST., COLUMBUS, OHIO 43216-0899

July 16, 2004

To: Users of the Bridge Design Manual

From: Tim Keller, Administrator, Office of Structural Engineering

By: Sean Meddles, Bridge Standards Engineer

Re: 2004 Third Quarter Revisions

Revisions have been made to the ODOT Bridge Design Manual, January 2004. This package contains the revised pages. They have been designed to replace the corresponding pages in the book and are numbered accordingly. Revisions, additions, and deletions are marked in the revised pages by the use of one vertical line in the right margin. The header of the revised pages are dated accordingly.

To keep your Manual correct and up-to-date, please replace the appropriate pages in the book with the pages in this package.

To ensure proper printing, make sure your printer is set to print in the 2-sided mode.

The January 2004 edition of the Bridge Design Manual may be downloaded at no cost using the following link: http://www.dot.state.oh.us/se/BDM/BDM2004/bdm2004.htm

The January 2004 edition, is also available for purchase from the Ohio Department of Transportation, Office of Contracts, 1980 W. Broad St., Columbus, Ohio 43223.

Attached is a brief description of each revision.

Summary of Third Quarter, 2004 Revisions to the ODOT BDM

302.4.1.5 This revision provides design guidance for estimating the pay quantity for Item 514 – Grinding Fins, Tears, Slivers on Existing Structural Steel.

303.4.1.1 This revision addresses an error regarding the safety factor applied to the passive soil pressure in front of a pile supported abutment.

605.3 Notes **[26]** and **[27]** were revised to eliminate an erroneous CMS reference for Type B granular material. The 703.16C material is for the backfill of unclassified excavation only and is not intended for the construction of embankments.

610.5 Note **[46]** has been revised to coincide with the modification to CMS 501.05, Approval of Construction Plans, as specified in Proposal Note 101 dated May 7, 2004.

702.10 A new plan note, **[97]**, has been added to ensure the correct information regarding camber is included in the plans for I-beams.

702.12 Plan note **[77]** was revised to correct the asphalt for intermediate course from Type 1 to Type 2. This change was made in BDM Section 302.1.3.1 in January 2003 but was inadvertently excluded from Section 702.12 at that time.

field application on existing steel since the organic zinc prime coat is more surface-tolerant.

For widened structures, the new steel shall be coated with the inorganic zinc prime coat in the shop and the existing steel shall receive the organic prime coat. The intermediate and finish coats are the same for each system.

Field metallizing is another option but its current costs are more than twice the cost of OZEU.

When estimating the quantity for Item 514, Grinding Fins, Tears, Slivers on Existing Structural Steel, provide 1 minute for each linear foot of beam/girder to be coated.

302.4.1.6 STEEL PIER CAP

Steel pier caps are non-redundant, fracture critical members. As specified in Section 301.2, these structure types require a concurrent detail design review to be performed by the Office of Structural Engineering. In general, structure designs that require stringers to be continuous through, and in the same plane with a steel pier cap or cross beam, should be avoided if at all possible.

302.4.1.7 OUTSIDE MEMBER CONSIDERATIONS

The designer is to evaluate the actual loads for outside main members. Heavy sidewalks, large overhangs of the concrete deck slab and/or live loads may cause higher loads on an outside member than loads on an internal member. This analysis requirement does not alleviate the designer from conforming to AASHTO Section 3.23.2.3.1.4.

In order to facilitate forming, deck slab overhang should not exceed 4'-0" [1200 mm]. On over the side drainage structures the minimum overhang shall be 2'-3" [700 mm]. Where scuppers are required for bridge deck drainage the overhang shall be 1'-6" [450 mm].

302.4.1.8 CAMBER AND DEFLECTIONS

When establishing dead load deflection for determining the required shop camber of non-composite steel beam or girder bridges with concrete deck slabs and determining deck screed elevations, the weight of curbs, railings, parapets and separate wearing surface, may be equally distributed to all beams. Future wearing surfaces shall not be included in determining required camber. This weight may be assumed (for dead load deflection only) to be supported by the beams acting compositely, based on a moment of inertia approximately twice that of the beam. Therefore, deflection due to dead loads above the deck slab may be based on one-half of the weight distributed to each beam, using the beam moment of inertia.

When establishing dead load deflection for determining the required shop camber of composite beam or girder bridges with concrete deck slabs and determining deck screed elevations, the weight of curbs, railings, parapets and separate wearing surface may be equally distributed to all beams. Future wearing surfaces shall not be included in determining required camber.

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The deflection and camber table in the design plans shall detail all points for each beam or girder line for the full length of the bridge. Bearing points, quarter-span points, mid-span points and splice points shall be detailed and any additional points required to meet a maximum spacing between points of 30'-0" [10 meters].

In cases of special geometry, i.e. spirals, horizontal or vertical curves, superelevation transitions, etc., additional points are to be detailed in the deflection and camber table if the normally required points do not adequately define a beam or girder required curvature.

The required shop camber shall in all cases be the algebraic sum of the computed deflections, vertical curve adjustment, horizontal curve adjustment and adjustment due to heat curving. Camber shall be measured to a chord between adjacent bearing points.

A camber diagram shall be provided showing the location of the points developed above and giving vertical offset dimensions at the bearing points from a “Base” or “Work” line between abutment bearings.

302.4.1.9 FATIGUE

The following paragraphs are intended to clarify the application of the AASHTO Section 10.3 regarding fatigue stresses.

For allowable fatigue stresses, reference shall be made to the AASHTO specifications.

302.4.1.9.a LOADING

In applying loads for fatigue stresses, a single lane of traffic shall be used and positioned to produce maximum stress ranges in the member under consideration. The design loading shall be HS20 [MS18] for all structures.

In computing live load stress ranges for fatigue stresses in structures with concrete decks supported on steel beams, a distribution fraction of S/7 shall be used.

To establish the Case of loading for a structure, according to AASHTO Section 10.3.2, an estimated Average Daily Truck Traffic shall be determined for the Design Year. Consideration shall be given to the potential traffic volumes of the proposed roadway as a result of future industrial or commercial development.

For steel beam bridges designed for Case I loading, the intermediate cross frames shall be connected to the stringers by the use of plate stiffeners shop welded to the stringer webs and flanges.

B. The bottom of footing shall not be less than 4 feet [1200 mm] below, measured normal to, the finished groundline.

C. Due to the probability of stream meander, pier footings of waterway crossings in the overflow section should not be above channel bottom unless the channel slopes are well protected against scour. Founding pier footings at or above the flow line elevation is discouraged.

Where footings are founded on bedrock (note that undisturbed shale is rock) the minimum depth of the bottom of the footing below the stream bed, D, in feet [meters], shall be as computed by the following:

$$D = T + 0.50Y$$

Where:
T = Thickness of footing in feet [meters]
Y = distance from bottom of stream bed to surface of bedrock in feet [meters]

The footing depth from the above formula shall place the footing not less than 3 inches [75 mm] into the bedrock.

Adjustment may be made to the minimum depth of the bottom of a footing due to actual frost line at the structure site.

303.4.1.1 FOOTING, RESISTANCE TO HORIZONTAL FORCES

The safety factor against horizontal movement at the base of a structure; i.e., the ratio of available resistance to movement to the forces tending to cause movement, shall be not less than 1.5 except as specified below for footings on bearing piles.

The friction resistance between a concrete footing and a cohesionless soil may be taken as the vertical pressure on the base times the coefficient of friction "f" of concrete on soil.

For coarse-grained soil without silt..f = 0.55

For coarse-grained soil with silt...f = 0.45

For silt ....f = 0.35

If the footing bears upon clay, the resistance against sliding shall be based upon the cohesion of the clay, which may be taken as one-half the unconfined compressive strength provided, however, that the frictional resistance against sliding should not be considered to be greater than that obtained using the coefficient "f" of 0.35. If the clay is very stiff or hard, the surface of the clay shall be roughened before the concrete is placed.

If the footing bears upon bedrock, consideration shall be given to features of the bedrock structure that may constitute planes of weakness such as laminations or inter-bedding. If there is no evidence of such weakness, the coefficient of friction "f" may be taken as 0.55 for shale and 0.7 for rock.

If the frictional or shearing resistance of the supporting material is inadequate to withstand the horizontal force, one or more of the following means shall provide additional resistance:

A. Increase the footing width and/or use footing keys.

B. Make allowance for the passive pressure developed at the face of the footing.

C. Use battered piles , footing struts, sheeting or anchors .

For footings with keys, allowance shall be made for the shearing resistance furnished by the supporting material at the elevation of the bottom of the key. Keys generally shall be located within the middle-half of the footing width.

For footings on piles, no allowance shall be made for the frictional resistance of the footing concrete on soil. For such footings, the horizontal component of the axial load on battered piles shall be taken at full value, without the application of the safety factor of 1.5. The safety factor shall apply for any required additional resistance provided by the passive pressure developed in the soil in front of such foundations. The above may be expressed by the following formula:

$$\frac{A}{B - C} \geq 1.5$$

Where:
A = passive pressure developed in the soil in front of the footing
B = force tending to cause movement
C = horizontal component of the axial load in battered piles

For structures on piles or soils, the passive resistance developed on the face of a foundation (assuming a level ground surface) may be based on an equivalent passive fluid weight W_p (lb/ft^3) [kN/m^3] for the undisturbed material encountered or anticipated. The equivalent passive fluid weight may be based on the following equation:

$$W_p = W \tan^2 (45 + Ø/2) \text{ lb/ft}^3 \ [\text{kN/m}^3]$$

Where:
W = unit soil weight, lb/ft^3 [kN/m^3]
Ø = angle of internal friction, in degrees.

For wall type abutments on spread footings with no new embankment provide note **[26]** or **[27]** and the following note:

[25] CONSTRUCTION CONSTRAINTS: Fill the void created by excavating for the abutment footings with Type B granular material, 703.16.C. After the footing and the breastwall have been constructed, fill the void behind each abutment up to the beam seat elevation and from the beam seat up on a 1:1 slope to the subgrade elevation prior to constructing the backwall and setting the beams on the abutment.

605.3 EMBANKMENT CONSTRUCTION NOTE

In an attempt to reduce settlements of the roadway approaches, specify the placement of embankment materials in 6 inch [150 mm] lifts. Include one of the following plan notes in the Project General Notes and make reference to the work defined below at the appropriate locations within the plans.

Note that Item 203 is a roadway quantity and coordination with the roadway plans is necessary.

To define the limits of measured pay quantities for bridges with wall-type abutments, provide excavation, backfill, and embankment diagrams (or a composite diagram, where suitable), using schematic abutment cross-sections, showing the boundaries between structure and roadway excavation, and between structure backfill and roadway embankment.

[26] ITEM 203 EMBANKMENT, AS PER PLAN: Place and compact granular embankment material in 6 inch [150 mm] lifts for the construction of the approach embankment between stations __**__ to __**__.

** The approximate limits should be 100 feet behind each abutment

[27] ITEM 203 EMBANKMENT, AS PER PLAN: Place and compact granular embankment material in 6 inch [150 mm] lifts for the construction of the approach embankment.

605.4 UNCLASSIFIED EXCAVATION

Compute and use pay items for Item 503 as follows:

When an excavation includes 10 yd^3 [m^3] or more of rock (or shale), itemize the quantity of rock excavation separately under:

Item 503 - Rock (or Shale) Excavation

When the rock (or shale) excavation is under 10 yd^3 [m^3], do not itemize the rock (or shale) excavation separately. Provide the following pay item:

Item 503 - Unclassified excavation, including rock (and/or shale)

When excavation includes no rock (or shale), provide the following pay item:

Item 503 - Unclassified excavation

In computing the quantity of Item 503 excavation, the designer should confirm that all removals under items 201, 202 or 203 have been excluded, according to CMS 503.01. Generally, the basis of payment for Item 503 should be yd^3 [m^3]. Lump sum quantities may be used if authorized by the District and with the understanding that cost may be higher than when specific quantities are used.

Provide the following note when there is a pay item for Item 503:

[28] ITEM 503, UNCLASSIFIED EXCAVATION _***_, AS PER PLAN: The backfill material behind the abutments shall be Type B granular material, 703.16.C, placed and compacted in 6 inch [150 mm] lifts.

*** Use of excavation 503 items as defined above.

606 FOUNDATIONS

606.1 PILES DRIVEN TO BEDROCK

The following note generally will apply where steel-H piles are to be driven to bedrock:

[29] PILES TO BEDROCK: Drive piles to refusal on bedrock. The Department will consider refusal to be obtained by penetrating soft bedrock for several inches to a minimum resistance of 20 blows per inch [25 mm] or by contacting hard bedrock and the pile receiving at least 20 blows. Select the hammer size to achieve the required depth to bedrock and refusal.

The Ultimate Bearing Value is _#_ tons [kN] per pile for the ____ abutment piles. The Ultimate Bearing Value is _#_ tons [kN] per pile for the ____ pier piles.

Abutment piles:
____ piles ____ feet [meters] long, order length

Pier piles:
____ piles ____ feet [meters] long, order length

* Delete the reference to 513.04 if structural steel is not involved.

610.2 REINFORCING STEEL REPLACEMENT

Place the following note in the plans where the preserved existing reinforcing steel which projects from the existing structure after partial removal is to be lapped with new reinforcing steel.

[43] ITEM 509 REINFORCING STEEL, REPLACEMENT OF EXISTING REINFORCING STEEL, AS PER PLAN: Replace all existing reinforcing bars deemed by the Engineer to be unusable because of corrosion. The Department will measure the replacement reinforcing steel by the number of pounds accepted in place.

Replace all existing reinforcing steel bars which are to be incorporated into the new work and are deemed by the Engineer to be made unusable by concrete removal operations with new epoxy coated reinforcing steel of the same size at no cost to the Department.

NOTE TO DESIGNER: Include a bid item as defined above with a specific weight of reinforcing steel.

On rehabilitation plans where new reinforcing steel may require field bending and cutting, use the following note. Clearly designate in the plans the bar marks to which this note applies.

[43a] ITEM 509 - EPOXY COATED REINFORCING STEEL, AS PER PLAN: In addition to the provisions of item 509, field bend and/or field cut the reinforcing steel designated in the plans, as necessary, in order to maintain the required clearances and bar spacings. Repair all damage to the epoxy coating, as a result of this work, according to 709.00.

610.3 REHABILITATION – STRUCTURAL STEEL

Use the following note on bridge rehabilitation projects where repair or replacement of members not designed to carry tension live loads (i.e. cross frames, bearing plates, etc.) consist of materials readily available from a structural warehouse (i.e. angles, channels, bars, etc.) and must be field fabricated to dimensions obtained in the field after contract letting. The recommended bid item quantity for rehabilitation work is in pounds [kilograms] rather than Lump Sum. The Designer should adequately define all steel members to be included in this pay item.

[44] ITEM 513 - STRUCTURAL STEEL MEMBERS, LEVEL UF , AS PER PLAN: All requirements of 513 apply to shop fabricated members. Perform work for field-fabricated members according to Item 513, except as modified herein. The Department will not require the contractor performing field fabrication to be pre-qualified as specified in Supplement 1078. Submit a written letter of material acceptance, 501.06, to the Engineer. Provide shop drawings according to 513.04 or supply the Engineer with "as-built" drawings meeting 513.04 after completion of field fabrication. The Engineer will review the submitted drawings for concurrence with the final as-built condition. If necessary, the Engineer may contact the Office of Structural Engineering for technical assistance. If the Engineer is satisfied with the "as-built" drawings and the delivered materials, supply a copy of the drawings, stamped and dated, along with microfilm, to the Structural, Welding and Metals Section of the Office of Material Management for record purposes.

The following members are included in this item: _____ , _____ and _____ .

[44a] Note retired - see appendix

610.4 REFURBISHED BEARINGS

When the following note is used, a separate plan note and pay quantity for jacking or temporary support of the superstructure is required. Revise this note, as appropriate, to describe the work for the type of bearing being refurbished.

[45] ITEM 516 - REFURBISHING BEARING DEVICES , AS PER PLAN: This item shall include all work necessary to properly align bridge bearings as well as their cleaning and painting. Included shall be the disassembly of the bearings, hand tool cleaning (grinding if necessary), painting according to Item 514, replacement of any damaged sheet lead with preformed bearing pads (711.21), installation of any necessary steel shims of the same size as the bearings to provide a snug fit, realignment of the upper bearing plate by removing existing welds and rewelding so that the bearings are vertically aligned at 60° F [15° C], lubricating sliding surfaces, and reassembly of the bearings. Assure all bearings are shimmed adequately and that no beams and/or bearing devices are "floating". At no additional cost to the State, the Contractor may install new bearings of the same type as the existing in place of refurbishing the bearings. All work shall be to the satisfaction of the Engineer. Payment for all of the above described labor and materials will be made at the contract price bid for Item 516 - Refurbish Bearing Devices, As Per Plan.

610.5 JACKING BRIDGE SUPERSTRUCTURES

Use the following note, modified as necessary, where jacking and/or temporary support of the existing superstructure is required. Modifications to this note are often not being performed by the designers. Use of this not without a review of the project may add un-necessary requirements to the jacking process or, in reverse, not be restrictive enough. Designers are again cautioned to appropriately review this note before incorporation into a set of plans.

[46] ITEM 516, JACKING AND TEMPORARY SUPPORT OF SUPERSTRUCTURE, AS PER PLAN:

This work consists of raising or re-positioning existing structures to the dimensions and requirements defined in the project plans.

Submit construction plans in accordance with CMS 501.05.

If, during the jacking operations, cracking of the concrete superstructure, separation of the concrete deck from the steel stringers, or other damage to the structure is visually observed, immediately cease the jacking operation and install supports to the satisfaction of the Engineer. Analyze the damage and submit a method of correction to the Engineer for approval. Epoxy inject all beams that separate from the deck for the distance of the separation in accordance with ODOT's proposal note "Concrete Repair by Epoxy Injection". The Department will not pay for the cost of this epoxy injection or other required repairs. The bridge bearings shall be fully seated at all contact areas. If full seating is not attained, submit a repair plan to the Engineer. The Department will not pay for the repair costs to ensure full seating on bearings.

The Department will measure this work on a lump sum basis.

The Department will pay for the accepted quantities at the contract price for Item 516, Jacking and Temporary Support of Superstructure, As Per Plan.

610.6 FATIGUE MEMBER INSPECTION

When re-decking a continuous beam bridge containing top flange fillet-welded cover plates and/or field butt-welded beams, provide the following note to facilitate the Engineer's inspection of the welded connections.

[47] INSPECTION OF EXISTING STRUCTURAL STEEL: The Engineer will visually inspect all existing butt-welded splices and/or top flange cover plate fillet welds to ensure the welds, plates and beams or girders are free of defects and cracks. If necessary, remove all deck slab haunch forms immediately adjacent to such welds that may interfere with the Engineer's inspection. The inspection will not take place until the top flanges are cleaned according to 511.10, but it will be done before the deck slab reinforcement is installed. The Department will pay for the cost associated with this inspection with Item 511, Superstructure Concrete. The Engineer will report all cracks found to the Office of Construction Administration, Bridge Construction Specialist, along with specific information on location of the cracks, length, and depth so an evaluation and repair or replacement recommendation can be made.

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702.9 CONCRETE DECK HAUNCH WIDTHS

[74] Note retired - see appendix

702.10 PRESTRESSED CONCRETE I-BEAM BRIDGES

For prestressed concrete I-beam bridges with concrete deck, compute the concrete topping depth over the top of the beams as follows:

A = Design slab thickness.
B = Anticipated total midspan camber due to the design prestressing force at time of release
C = Deflection at midspan due to the self weight of the beam
D = Deflection at midspan due to dead load of the slab, diaphragms and other non-composite loads.
E = Deflection due at midspan to dead load of railing, sidewalk and other composite dead loads not including future wearing surface
F = Adjustment for vertical curve. Positive for crest vertical curves
G = Sacrificial haunch depth (2" [50 mm])
H = Total Topping Thickness at beam bearings = A + 1.8B - 1.85C - D - E - F + G. (If F> 1.8 B - 1.85C - (D+E) then H = A + G)
I = Total Topping Thickness at mid-span = A + G. If F > 1.8B - 1.85C - (D +E) then I = A - (1.8B - 1.85C) + D + E + F + G

Use the gross moment of inertia for the non-composite beam to calculate the camber and deflection values B, C, and D. For E, use the moment of inertia for the composite section.

Show a longitudinal superstructure cross section in the plans detailing the total Topping Thickness including the design slab thickness and the haunch thickness at the centerline of spans and bearings. Also show screed elevation tables similar to 702.16.2. Provide the following note in the plans:

[97] Calculated camber at the time of release is _____ inches [mm].

Calculated camber at the time of erection is _____ inches [mm].

Calculated long-term camber is _____ inches [mm].

NOTE TO DESIGNER: The camber at the time of release is (B-C), the camber at the time of erection is (1.8B – 1.85C), and the long-term camber is (2.45B- 2.40C).

[75] DECK SLAB THICKNESS FOR CONCRETE QUANTITY : The Topping thicknesses shown from the top of the deck slab to the top of the top flange along the centerline of the I-beam are theoretical dimensions. The haunch depth is the Topping thickness minus the design slab thickness. The Department will pay for superstructure concrete based on the design slab thickness and the average of the theoretical haunch depths at mid-span and at each beam bearing even though deviation from the dimensions shown may be necessary to place the deck surface at the finished grade. Once all beams are set in their final position, the actual camber for each member will be the top of beam elevation at mid-span minus the average top of beam elevation at each bearing. The actual Topping thickness at mid-span will be the theoretical dimension plus or minus the difference between the actual and anticipated camber.

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Use the following note when the length of the I-beam, measured along the grade, differs from the length, measured horizontally, by more than 3/8" [10mm]:

[94] NOTE TO FABRICATOR: The dimensions measured along the length of the beam, marked with a _*_, do not contain an allowance for the effect of the longitudinal grade. Include the proper allowance for these dimensions in the shop drawings.

NOTE TO DESIGNER: Indicate the dimensions that require a grade adjustment with an asterisk or some other easily recognizable symbol and include that symbol in the note above.

702.11 PRESTRESSED CONCRETE BOX BEAM BRIDGE

For prestressed concrete box beam bridges, the asphalt or concrete topping depth over the top of the beams shall be computed as follows:

A = Minimum topping thickness
B = Anticipated total midspan camber due to the design prestressing force at time of release
C = Deflection due to the self weight of the beam (including diaphragms)
D = Deflection due to dead load of the topping and other non-composite loads
E = Deflection due to dead load of railing, sidewalk and other composite dead loads not including future wearing surface
F = Adjustment for vertical curve. Positive for crest vertical curves
G = Total Topping Thickness at beam bearings = A + 1.8B - 1.85C - D - E – F. If F > 1.8B - 1.85C - (D + E) then G = A
H = Total Topping Thickness at mid-span = A
If F > 1.8B - 1.85C - (D + E) then H = A - (1.8B - 1.85C) + D + E + F

Use the gross moment of inertia for the non-composite beam to calculate the camber and deflection values B, C, and D. For E, use the moment of inertia for the composite section when designing a composite box beam otherwise use the non-composite section. Note that with the exception of when F > 1.8B - 1.85C - (D + E), the dead load deflection adjustment (D + E) is made by adjusting the beam seat elevations upward.

For non-composite prestressed concrete box beam bridges with an asphaltic concrete surface course provide a note similar to **[76]**. For composite prestressed concrete box beam bridges with a concrete surface course provide a note similar to **[76a]**.

[76] Calculated camber at the time of release is ______ inches [mm].

Calculated camber at time of paving is ______ inches [mm].

Long term camber is ______ inches [mm].

Calculated deflection due to dead load applied after the beams are set (weight of surface course, railings, sidewalks, etc.) is ____ inches [mm].
The vertical curve adjustment to the topping thickness at midspan is ______ inches [mm] upward.

The vertical curve adjustment to the topping thickness at each bearing is _______ inches [mm] upward/downward.

(1) The thickness of the intermediate asphalt course shall be 1½ inches [38 mm]. No variation in thickness is required.

(2) The thickness of the intermediate asphalt course shall vary from 1½ inches [38 mm] at each centerline of beam bearing to _____ inches [mm] at midspan.

(3) The thickness of the intermediate asphalt course shall vary from _______ inches [mm] at each centerline of beam bearing to 1½ inches [38 mm] at midspan.

[76a] Calculated camber at the time of release is ______ inches [mm].

Calculated camber at time of paving is ______ inches [mm].

Long term camber is ______ inches [mm].

Calculated deflection due to dead load applied after the beams are set (weight of surface course, railings, sidewalks, etc.) is ____ inches [mm].

The vertical curve adjustment to the topping thickness at midspan is ______ inches [mm] upward.

The vertical curve adjustment to the topping thickness at each bearing is _______ inches [mm] upward/downward.

(1) The concrete thickness shall be 6 inches [150 mm]. No variation in thickness of concrete is required.

(2) The concrete thickness shall vary from 6 inches [150 mm] at each centerline of beam bearing to _____ inches [mm] at midspan.

(3) The concrete thickness shall vary from _______ inches [mm] at each centerline of beam bearing to 6 inches [150 mm] at midspan.

NOTE TO DESIGNER: The calculated camber at the time of release is (B – C), at the time of paving is (1.8B - 1.85C), and long term is (2.45B – 2.40C). The calculated deflection due to dead load applied after the beams are set is (D + E). The vertical curve adjustment at midspan is (F) when F > 1.8B - 1.85C - D - E. The vertical curve adjustment at each bearing is (F) when F

< 1.8B - 1.85C - D - E and may be upward for sag curves or downward for crest curves. Remove the reference to the vertical curve adjustment that does not apply.

Conclude note **[76]** with note (1), (2) or (3) as appropriate. Note (1) should be used when after placement of the topping, the top surface of the beam parallels the profile grade. Note (2) should be used when F > 1.8B - 1.85C - D - E. Note (3) should be used for all other cases.

For non-composite designs, include in the bridge plans a diagram similar to Figure 702 showing the thickness of the Item 448 Intermediate course and the Item 448 surface course at each centerline of bearing and at midspan.

For composite design, show a longitudinal superstructure cross section in the plans detailing the total Topping Thickness at each centerline of bearings and at midspan. Also show screed elevation tables similar to 702.16.3.

Use the following note when the length of the box beam, measured along the grade, differs from the length, measured horizontally, by more than 3/8" [10mm]:

[95] NOTE TO FABRICATOR: The dimensions measured along the length of the beam, marked with a _*_, do not contain an allowance for the effect of the longitudinal grade. Include the proper allowance for these dimensions in the shop drawings.

NOTE TO DESIGNER: Indicate the dimensions that require a grade adjustment with an asterisk or some other easily recognizable symbol and include that symbol in the note above.

702.12 ASPHALT CONCRETE SURFACE COURSE

Place note **[77]** on the plans for prestressed concrete box beam bridges having an asphalt concrete surface course. If the nominal thickness of 448 varies from the 1½" [38 mm] shown, revise the note accordingly.

While this note specifies how to place only the two 448 bid items, the designer should recognize that two Item 407 tack coat items are also required. One tack coat is applied before the intermediate asphalt concrete course. The other tack coat is applied between the intermediate and surface course.

[77] ASPHALT CONCRETE SURFACE COURSE shall consist of a variable thickness of 448 asphalt concrete intermediate course, Type 2, PG64-28 and a 1½" [38 mm] thickness of 448 asphalt concrete surface course, Type 1H. Place the 448 intermediate course in two operations. The first portion of the course shall be of 1½" [38 mm] uniform thickness. Feather the second portion of the course to place the surface parallel to and 1 ½" [38 mm] below final pavement surface elevation.