Integral abutment bridges eliminate the need for joints in bridge decks and thereby provide better protection from water and salt damage to the superstructure. These structures have proven to decrease maintenance costs and increase service life. The Department has always strived to increase the number of structures eligible for integral design through research, engineering judgment and experience but recognized that more comprehensive research was necessary to expand the applications of our integral structures. Accordingly, the Department has invested in a series of extensive research efforts and has completed the first two phases. This memorandum highlights the new integral policies and details with the implementation plan.

**Summary of Changes**

The following summary highlights the significant changes in the Department's policies and details and corresponds to the new figures in this memorandum and the new base sheets on the IDOT website.

1. An Integral Abutment Pile Selection Chart was developed. It is a function of the effective expansion length and skew of the structure. Structure lengths up to 550 feet and skews up to 45 degrees are permitted for integral structures. The specifics of this chart and directions on how to apply it follow later in this memorandum.

2. The pile orientation at the abutments shall be weak axis bending where the pile web is always perpendicular to the centerline of the structure. The pile orientation at the pier will remain unchanged with the web of the pile perpendicular to the face of the pier. See Figures 8 and 9.

3. The corbel has been eliminated and absorbed into the abutment cap. The approach seat has been increased to 12 inches. See Figures 2 through 7.

4. Beam flange clipping details have been provided to eliminate interference with the approach slab for high skews and steep grades. See Figures 11 through 13.

5. Pile encasement around HP piles at integral abutments has been eliminated; however, the reinforcement in the top portions of metal shell piles at abutments (Base Sheet F-MS) shall remain.
6. A 2'-0” diameter # 4 spiral reinforcement is required around abutment piles for HP 12X74 piles and larger.

7. Standard integral abutment cap widths for various superstructures are:
   a. Slabs: 3'-0”
   b. Steel beams: 3'-4”
   c. Concrete beams: 3'-8” (May need to be increased due to profile grade and camber)

8. The backfill shall be Granular Backfill according to GBSP #76 (Granular Backfill for Structures) available at the following link: http://www.dot.il.gov/bridges/GBSP76.pdf. The backfill is not required to be compacted; however, the backfill is recommended to be compacted for structures with steel railings extending beyond the bridge. This provides for secure railing posts and was accounted for in the design assumptions.

9. Steel and concrete superstructures shall connect the diaphragm to the cap with an equivalent area of steel of # 8 bars at 12” centers in the front and back face for the full length of the cap. The diaphragm shall also be reinforced with a minimum shear stirrup reinforcement of # 5 bars at 12” centers.

10. Slab bridges shall be connected to the abutment cap with # 5 bars at 12” in the front and back face for the full length of the cap and their approach slab shall be connected with # 5 bars at 12” centers. See Figures 6 and 7.

11. The bar splicer connecting the superstructure to the approach slab has been eliminated.

12. A formed joint with bridge relief joint sealer is provided full width at the end of the bridge deck to provide a controlled crack due to possible differential rotation.

13. The beam anchorages into the diaphragm have been set further back from the face of the diaphragm. See Figures 14 and 15.

14. The centerline of bearing from the end of beam is 5 inches for steel beams and 6 inches for PPC I-Beams and Bulb T-Beams. The bearing for steel beams is a 2 inch rocker plate and the bearing for concrete beams is a 1 inch thick fabric bearing pad with cellular polystyrene filling the remaining area under the beam in the diaphragm. See Figures 10 and 18.

15. Integral slab bridges are limited to a total structure length of 130 feet and a maximum individual span of 40 feet. Consequently piles larger than HP 10X57 are not expected and therefore spiral reinforcement around piles will not be used on slab bridges. Likewise precast approach slabs should not be used for integral slab bridges since they are ≤ 130 feet in length.
16. Wingwalls shall be parallel to the centerline of the abutment. The wingwall length shall continue to be determined as illustrated in Section 3.8.3 of the Bridge Manual. The maximum length of wingwall connected to the structure shall remain at 10 feet. The minimum length of wingwall extension shall be 4 feet.

17. Abutments shall be parallel. Flared structures are permitted. Integral structures with curved girders are not permitted.

18. Integral structures are not permitted with MSE abutment walls. When MSE abutment walls are required, semi-integral abutments or standard stub abutments should be considered.

19. Similar Integral abutment detail changes have been applied to semi-integral abutments. See Figures 20 through 23.

20. Precast Bridge Approach Slabs have been added for certain applications. Refer to the new base sheets available on the Department’s web site.

The bridge deck is required to be cast prior to backfilling behind the abutment and casting the approach slab. This procedure is primarily for constructability issues and to avoid placing an initial rotation on the abutment. However, the bridge typically contracts in the evening as the temperature falls and pulls on the freshly poured approach slab. This can cause transverse cracks in the new approach slab. Over the last several years we have experimented with precast approach slabs on longer structures which exhibit more of this contracting movement and they appear to have mitigated this problem.

The upper expansion limit of a 4” PJS expansion joint is 130 feet and the Department has elected to use this limit to determine when to use the current cast-in-place (CIP) approach slab details and when to use the new precast approach slab details. The Integral Abutment Pile Selection Chart discussion in this memorandum describes how the centroid of stiffness of a structure is determined. If the longest distance from the centroid of stiffness to the back of the abutment is > 130 feet then the structure shall utilize the precast bridge approach slab on both ends of the bridge, regardless if the distance on the other end of the bridge is ≤ 130 feet. The designer should not use the effective expansion length (EEL) for determining whether a precast bridge approach slab is necessary. The Qu correction factor used to obtain the EEL is only necessary for the Integral Abutment Pile Selection Chart. The precast bridge approach slabs will have a 5 inch concrete wearing surface on top and shall utilize a shallow strip seal expansion joint suitable for concrete wearing surfaces. If the distance from the centroid of stiffness to the back of abutment is ≤ 130 feet at both abutments, then the current full depth CIP bridge approach slab with the PJS expansion joint at the end shall be used. In either application a rigid pavement connector is necessary just beyond the approach slab for proper installation of the expansion joints.
The precast approach slabs may vary in width from 3'-0" to 6'-0" as necessary to satisfy the location of the stage construction line and edge of pavement. The Department recommends utilizing wider precast units when possible to minimize the number of joints. The reinforcement details on the base sheets are adequate for all widths in this range. The precast bridge approach slab beams shall be separated by a 2 inch Styrofoam block full length along the bottom of the beam. This enables the shear keys to be cast with the concrete wearing surface.

Application and Examples for the Integral Abutment Pile Selection Chart

The Bridge Planner shall use the Integral Abutment Pile Selection Chart to determine whether a structure may be integral. The chart requires two pieces of structure data, the EEL and the skew. The EEL is calculated the same for steel and concrete superstructures.

The Department’s preference for the superstructure to the substructure pier connection on integral abutment structures is fixed bearings for flexible pier types such as pile bents, encased pile bent piers and the P-DS and P-DSSW drilled shaft piers; and expansion bearings for stiffer piers such as wall and rigid frame piers. IDOT recognizes that the superstructure to pier connection, span ratios, and the pier stiffness can all affect the behavior of an integral structure. However, IDOT also has ongoing research indicating that there is a degree of flexibility that exists in their pier designs which is difficult to estimate. Therefore, until further research is completed, IDOT has elected to consider only the stiffnesses of the abutments on integral structures when determining the EEL at an abutment.

The EEL is a function of the controlling expansion length and subsequently the centroid of stiffness of the abutments. To determine the stiffness of each abutment, the soil borings within the critical pile depth shall be evaluated. The critical pile depth is taken to be the first ten feet of soil directly beneath the abutment. The average Qu within the critical pile depth at each abutment shall be determined. If the abutment is planned to be constructed on a new embankment the Qu shall be assumed to be 1.5 tsf. If a granular soil layer exists within the critical pile depth, it shall be converted to a cohesive soil using the following formula:

\[
Qu = 0.75\ln(N) + 0.7
\]

where:

\[N = \text{SPT blow count}\]

If the average Qu at each abutment is \(\leq 1.5\) tsf and each abutment has the same number of piles, then the centroid of stiffness of the structure may be assumed to be at the center of the structure and the controlling expansion length may be assumed to be half the total structure length measured back to back of abutment along the longitudinal axis of the superstructure. In these cases there are no
additional corrections to be applied to the controlling expansion length and therefore it may be assumed to be the EEL and entered into the Pile Selection Chart. Where the average Qu within the critical pile depth exceeds 1.5 tsf, a pile stiffness modifier (M), shall be used in determining the centroid of stiffness of the structure. The pile stiffness modifier accounts for the differences in soil stiffness and shall be calculated using the following formula:

\[ M = \frac{1}{1.45 - 0.3Qu} \]

There is also a difference in pile stiffness for each pile type in the Integral Abutment Pile Selection Chart; however, the Department requires that the same pile type and size be used at both abutments of an integral structure and therefore no additional adjustment is necessary for the pile type. The centroid of stiffness is determined as a function of the relative difference in stiffness between the two abutments. When the centroid of stiffness of the structure has been determined, the longer distance from the centroid of stiffness to back of abutment shall be the controlling expansion length.

The Integral Abutment Pile Selection Chart is based on soils with a Qu \( \leq \) 1.5 tsf. If the Qu at the controlling abutment is > 1.5 tsf, the EEL shall be determined by multiplying the controlling expansion length by the “Qu correction factor” which is the ratio of the Qu for that abutment over 1.5. If the EEL exceeds the highest available pile line in the chart, then an integral abutment structure is not suitable for this structure. In these cases, a joint in the structure may still be avoided by utilizing a semi-integral abutment structure. Semi-Integral abutments may be used with structures whose total structure length does not exceed 550 feet and whose skew is \( \leq \) 45 degrees.

Piles indicated on the lines at or above the point entered in the chart may be used for the integral structure. In addition, the selected piles shall also have sufficient factored resistance for the design axial load as determined by Section 3.10.1.3 and the Structure Geotechnical Report (SGR). The structural capacity of the piles for combined bending and axial loads has already been taken into consideration in development of the limitations included herein and need not be investigated for AASHTO LRFD Strength Load Combinations.

The maximum pile spacing shall be 8 feet along the centerline of an integral abutment structure. When possible, IDOT prefers that the piles for integral abutments be designed for axial load in a manner that results with an arrangement of one pile placed under each girder line. Structures with different abutment lengths, but with the same number of piles at each abutment (i.e., flared beams), may also be considered and evaluated as possible integral abutment structures without additional adjustments for determining the centroid of stiffness of the structure, other than what was previously described. Structures with different abutment lengths and number of piles at each abutment may also be considered as a possible integral abutment structure provided the number of piles is addressed in the abutment stiffness calculations.
The Integral Abutment Pile Selection Chart is based upon the following design criteria and assumptions:

1. A cohesive soil with an average Qu ≤ 1.5 tsf in the critical pile depth.

2. The critical pile depth is the first 10 feet immediately below the abutment cap where the soil has the greatest affect on the lateral stiffness of the pile.

3. Soils with an average Qu >1.5 tsf and ≤ 3.0 tsf within the critical pile depth at an abutment may still apply the chart provided a pile stiffness modifier (M) is used in determining the controlling expansion length. If the abutment at the controlling expansion length has an average Qu > 1.5 tsf the controlling expansion length shall be additionally increased by the “Qu correction factor” which is the ratio of the Qu at the controlling abutment divided by 1.5 tsf. This yields the EEL.

4. Granular soils within the critical pile depth shall be converted to an equivalent cohesive soil by using the relationship Qu = 0.75ln(N) + 0.7 where N is the SPT blow count.

5. Abutment piles shall be oriented with their webs perpendicular to the centerline of the roadway.

6. Abutments shall be parallel to each other.

7. The chart is based upon a moment connection between the pile cap and superstructure. See associated new IDOT Integral Abutment details.

8. There is no distinction between concrete and steel superstructures as it relates to the EEL.

9. The maximum end span permitted in a multi-span structure is 200 feet.

10. The maximum simple span is 170 feet.

11. End spans and simple spans exceeding 150 ft. shall only utilize HP piles of HP 12 X 74 size and larger.

12. The maximum total slab bridge length is 130 feet and the maximum individual slab span is 40 feet.
Example 1

The structure is a continuous 450 ft. long structure consisting of three – 150 ft. spans with a zero degree skew. The structure is the same width throughout. Determine the effective expansion length for the structure and whether the structure may be integral.

Determine the average $Q_u$ for the critical pile depth at each abutment.

West Abutment Boring B-1

$$Q_u = \frac{(1.0)(1.5) + (2.5)(1.8) + (2.5)(1.0) + (2.5)(1.3) + (1.5)[0.75\ln(9) + 0.7]}{10}$$

$= 1.53 \text{ (say 1.5 tsf.)}$

East Abutment Boring B-2

$$Q_u = \frac{(3.5)(1.5) + (5.0)(1.0) + (1.5)(1.5)}{10} = 1.25 \text{ tsf.}$$
The average $Q_u$ at each abutment is $\leq 1.5$ tsf which is within the default parameters of the Integral Abutment Pile Selection Chart. Therefore, the controlling expansion length does not need to be adjusted by either the pile stiffness modifier or the $Q_u$ correction factor and the effective expansion length (EEL) may be assumed to be one half the structure length (225 ft.). Applying the EEL and skew to the Integral Abutment Pile Selection Chart indicates that the HP 12x74, HP 14x73 and all pile choices above this line may be used for an integral structure. The specific pile type shall be determined by the designer based on the pile spacing and axial load.

**Example 2**

Use the same geometric configuration from Example 1 except the average $Q_u$ within the critical pile depth is 1.5 tsf at the west abutment and 2.0 tsf at the east abutment. Calculate the centroid of stiffness of the structure and the controlling EEL to determine whether this structure can remain integral.

Determine the pile stiffness modifier ($M$) for the east abutment since it has an average $Q_u > 1.5$ tsf.

$$M_{(East)} = \frac{1}{1.45 - 0.3(2.0)} = 1.18$$

Assume 6 beam lines in the structure with a pile placed beneath each beam and calculate the centroid of stiffness from the west abutment.

$$\Sigma \text{Stiff.W. Abut.} = \frac{(6 \text{ piles})(0 \text{ ft.})+(6 \text{ piles})(1.18)(450 \text{ ft.})}{(6 \text{ piles})+(6 \text{ piles})(1.18)} = 243.6 \text{ ft.}$$

The distance from the centroid of stiffness to the East Abutment is

$$450 - 243.6 = 206.4 \text{ ft.}$$

The distance from the centroid of stiffness to the west abutment is longer; therefore this is the controlling expansion length. Since the $Q_u$ for the west abutment is $\leq 1.5$ tsf, no $Q_u$ correction factor adjustment to this length is necessary for determining the EEL. The EEL for the structure is therefore 243.6 ft. This structure may be an integral structure based on the chart.

**Note:** If Example 2 had an average $Q_u$ within the critical pile depth of 2.0 tsf at the west abutment and 2.5 tsf at the east abutment, the west abutment would also require a pile stiffness modifier which results in the distance from the centroid of stiffness to the west abutment and controlling expansion length only increasing to 246.6 ft. However, this length would need to be adjusted for the $Q_u$ correction factor at the west abutment by multiplying by the ratio of (2.0 tsf/1.5), the $Q_u$ at the abutment divided by the base $Q_u$ of the design chart. The EEL would therefore be 328.8 ft. and the Integral Abutment Pile Selection Chart would indicate that this structure could not be integral.
Example 3

This example is similar to Example 2 (a continuous 450 ft. long structure consisting of 3 – 150 ft. spans; average Qu at west abutment = 1.5 tsf and average Qu at east abutment = 2.0 tsf), except the structure is flared. The west abutment is wider than the east abutment and has 10 piles compared to 6 piles at the east abutment.

Determine the centroid of stiffness from the west abutment.

\[ \Sigma \text{Stiff. W. Abut.} = \frac{(10 \text{ piles})(0 \text{ ft.})+(6 \text{ piles})(1.18)(450 \text{ ft.})}{(10 \text{ piles})+(6 \text{ piles})(1.18)} = 186.5 \text{ ft.} \]

The distance from the centroid of stiffness to the centerline of the east abutment is 263.5 ft. and is the controlling expansion length. However, because the Qu at the east abutment is 2.0 tsf, the Qu correction factor would cause the EEL to be:

\[ (263.5 \text{ ft.})(\frac{2.0 \text{ tsf.}}{1.5}) = 351.3 \text{ ft.} \]

The Integral Abutment Pile Selection Chart indicates that this structure cannot be integral.

Implementation

The figures in this memorandum illustrate the new integral policies and also contain designer notes for application. Several CADD libraries of base sheets have also been updated for the new integral policies and are available on the Department’s website. The current integral details will remain available in separate CADD libraries during the transition period. The new integral abutment policies and details shall be effective for all projects with TSL’s approved after August 31, 2012. Projects with TSL’s approved prior to this date may also utilize the new integral policies with approval from the District or owner.
All drainage system components shall extend to 2'-0" from the end of each wingwall except an outlet pipe shall extend until intersecting with the side slopes. The pipes shall drain into concrete headwalls. (See Article 601.05 of the Standard Specifications and Highway Standard 60101)

Figure 1

TYPICAL SECTION THRU INTEGRAL ABUTMENT
INTEGRAL ABUTMENT FOR STEEL BEAMS 24" THRU 40"

2-8"

1-8"

1-4"

3-4"

1-8"

1-0"

8"

1/4" x 3/4" Formed joint with bridge relief joint sealer (full width) See Special Provisions.

1" Drilled holes for #5 m (E) bars

2" Chamfer

2" Thick rocker plate

2-0" pile embedment

3-6"

m (E)

s (E)

v (E)

Const. jts.

 Const. jts.

1" x 12" anchor bolt

V

jts.

const.

m (E)

s (E)

v (E)

sp (E)

Abut. bearings and piles

1'-8"

3'-4"

Sawed joint

Back of Abut.

* 1/8" Elastomeric neoprene leveling pad

** Only provide spiral reinforcement around HP 12 x 74 piles and larger.

*** Omit with precast approach slabs.

See Fig. 19
INTEGRAL ABUTMENT FOR STEEL BEAMS GREATER THAN 40"

* 1/8" Elastomeric neoprene leveling pad
** Only provide spiral reinforcement around HP 12 x 74 piles and larger.
*** Omit with precast approach slabs.

2" Chamfer

2" Thick rocker plate typ.

1" @ Drilled holes for #5 m (E) bars

m (E)

s (E)

v (E)

v (E)

const. jts.

Const. jts. min. (See Fig. 16)

3'-6"

2'-0" pile embedment

1'-8"

1'-0"

2'-4"

1/4" x 3/4" Formed joint with bridge relief joint sealer (full width) See Special Provisions.

**sp (E)

STEEL BEAMS GREATER THAN 40"

Figure 3

See Fig. 19

HP 12 x 74 piles and larger.

const. jts.

s (E)

m (E)

2" col.

v (E)

s (E)

s (E)

p (E)

Fig. 16
INTEGRAL ABUTMENT FOR CONCRETE BEAMS 36"

* Only provide spiral reinforcement around HP 12 x 74 piles and larger.

** Omit with precast approach slabs.

---

\[ \text{1/4'' x 3/4'' Formed joint with bridge relief joint sealer (full width) See Special Provisions.} \]

\[ \text{1/4'' \& pile embedment} \]

\[ \text{\& pile embedment} \]

\[ \text{2'' Chamfer} \]

\[ \text{1'' Cellular polystyrene} \]

\[ \text{3''-6''} \]

\[ \text{See Fig. 19} \]

---

\[ \text{2''-8''} \]

\[ \text{1''-0''} \]

---

\[ \text{\& Abut., bearings, and piles} \]

\[ \text{m (E)} \]

\[ \text{**v (E)} \]

\[ \text{s (E)} \]

\[ \text{sp (E)} \]

---

\[ \text{3''-8''} \]

\[ \text{***} \]
CONCRETE BEAMS 42'' THRU 72''

INTEGRAL ABUTMENT FOR

** Only provide spiral reinforcement around HP 12 x 74 piles and larger.**

** Omit with precast approach slabs.**

Note:
- PPC I-beam shown, Bulb T-beam similar.
- See Figure 13 for potential adjustments.

Figure 5
**INTEGRAL ABUTMENT FOR SLAB BRIDGES ≤ 14″**

- **Tilt hook if necessary** for 2'4" (±1/4") cl.
- **Embedment** 2'-0" pile
- **Back of Abut.**
- **Const. joints**
- **V (E)**
- **S (E)**
- **p (E)**
- ** aforementioned.**
- **See Fig. 19**
- **Note:** Pour bridge slab before pouring approach slab.

* **Place bars parallel to C of roadway.**

**BAR x (E)**

**BAR x (E)**

**See Fig. 19**

---

- **For Slab Bridges ≤ 14″**
- **Note:** Pour bridge slab before pouring approach slab.

---

- **#5 x (E) bars at 12″ cts.**
- **#5 x (E) bars. Alternate between top b (E) bars**

---

**Figure 6**

---

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2'-0&quot;</td>
<td>Embedment</td>
</tr>
<tr>
<td>1'-0&quot;</td>
<td></td>
</tr>
<tr>
<td>3'-6&quot;</td>
<td></td>
</tr>
<tr>
<td>1'-11&quot;</td>
<td></td>
</tr>
<tr>
<td>3'-0&quot;</td>
<td></td>
</tr>
<tr>
<td>8'-0&quot;</td>
<td></td>
</tr>
<tr>
<td>6'-0&quot;</td>
<td></td>
</tr>
<tr>
<td>1'-0&quot;</td>
<td></td>
</tr>
<tr>
<td>2'-0&quot;</td>
<td></td>
</tr>
</tbody>
</table>

---

* See Special Provisions.
FOR SLAB BRIDGES > 14″ & < 24″

INTEGRAL ABUTMENT

** Figure 7

** #5 x (E) bars at 12″ cts.

** #5 x (E) bars. Alternate between top b (E) bars

* Tilt hook if necessary for 2 1/4″ (± 1/4″) cl.

2″ cl.

8″

1′-0″

2′-0″

1/4″ x 3/4″ Formed joint with bridge relief joint sealer (full width). See Special Provisions.

** Figure 7

* Note:
Pour bridge slab before pouring approach slab.

* Place bars parallel to θ of roadway.

** Determine dimension based on 4 1/2″ clearance from top of slab.

BAR x (E)

BAR x (E)

See Fig. 19
Note:
For integral abutments, the pile web is always perpendicular to the \( \theta \) of structure.

Figure 8
Figure 9
1" Cellular polystyrene according to ASTM C 578 (Types I-II and IV-XV)
TOP FLANGE PLAN - NO CLIP
(Showing top flange of steel beam at integral abutment)

TOP FLANGE PLAN - CLIPPED
(Showing top flange of steel beam at integral abutment)

Notes:
Clip top flange when dimension “A” is less than 1”. Calculate dimension “B” based on skew angle. Dimension “C” is half the top flange width minus half the web thickness.

B = C tan (skew)
TOP FLANGE PLAN - NO CLIP
(Showing top flange of Bulb T-beam at integral abutment. PPC I-beams similar)

B = C \tan (\text{skew})

TOP FLANGE PLAN - CLIPPED
(Showing top flange of Bulb T-beam at integral abutment. PPC I-beams similar)

Note:
Clip top flange when dimension "A" is less than 1'. Calculate dimension "B" based on skew angle. Dimension "C" is provided in table.

### Beam Size: 
<table>
<thead>
<tr>
<th>Beam Size</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>72&quot;, 63&quot;</td>
<td>1'-4&quot;</td>
</tr>
<tr>
<td>54&quot;</td>
<td>6 1/2&quot;</td>
</tr>
<tr>
<td>48&quot;</td>
<td>4 3/4&quot;</td>
</tr>
<tr>
<td>42&quot;</td>
<td>4 1/2&quot;</td>
</tr>
<tr>
<td>36&quot;</td>
<td>2 1/2&quot;</td>
</tr>
</tbody>
</table>

Figure 12
SECTION THRU ABUTMENT
(Showing bulb T-beam on a steep grade)

* Increase as needed to maintain 1” minimum clearance between beam and approach pavement. The skew angle will also need to be considered (See top flange clip details) as well as the camber.

Notes:
The grade of the bridge shall be considered when detailing integral abutments with PPC beams. Since the beams are cast such that the beam ends are 90 degrees to the top and bottom flanges the beam ends will not be vertical if the beams are placed on a grade. In addition beam camber will cause further rotation of the beam end.

Abutment caps shall be sloped to match the grade when the change in elevation exceeds 1’ from the front face of abutment to the end of the beam. This is done to ensure the fabric bearing pad and polystyrene are under a more uniform bearing pressure. Reinforcement as shown on the base sheets may need to be adjusted to accommodate the slope.

Integral abutments with steel beams do not need these adjustments since the beam ends can be clipped vertically and the steel rocker plate can accommodate grades.

INTEGRAL ABUTMENT DETAILS
FOR PPC BEAMS ON LARGE GRADES

Figure 13
STEEL BEAM TO DIAPHRAGM CONNECTION DETAIL
FOR INTEGRAL ABUTMENTS

Figure 14
END ELEVATION
(Bulb T-beam)

* Adjust these dimensions to miss draped strands.

END ELEVATION
(PPC I-beam)

#5 m (E) bars 4'-0'' long placed thru 1'' φ formed holes and secured by Contractor such that bars remain centered and level during pouring of the concrete. Bend in field to match skew.

PLAN
(Showing bottom flange of beam at integral abutment)

<table>
<thead>
<tr>
<th>Beam Size</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>36''</td>
<td>10''</td>
<td>11''</td>
<td>1'-3''</td>
</tr>
<tr>
<td>42''</td>
<td>10''</td>
<td>1'-3''</td>
<td>1'-5''</td>
</tr>
<tr>
<td>48''</td>
<td>1'-0''</td>
<td>1'-5''</td>
<td>1'-7''</td>
</tr>
<tr>
<td>54''</td>
<td>1'-0''</td>
<td>1'-11''</td>
<td>1'-7''</td>
</tr>
</tbody>
</table>

PPC BEAM TO DIAPHRAGM CONNECTION DETAIL FOR INTEGRAL ABUTMENTS

Figure 15
Approach slab ledge or top of cap for slab bridges

2" PJF (per Article 1051.09 of the Standard Specifications) bonded to wingwall with suitable adhesive as recommended by supplier.

Note:
The approach slab ledge shall have a constant slope determined from the control points shown.

* For slab bridges, this dimension will likely be larger based on the summation of bridge slab thickness and haunch.
* Add u (E) bars when the spacing between s (E) bars exceeds what is required by design or 12″.

** Block out sharp corner of abutment cap and diaphragm as shown for skews 25 degrees and larger.

*** Detail legs of u (E) bars such that they do not all come to a point causing congestion.
\[ b = \pm 50\% \text{ of flange width} \]

\[ \frac{b}{2} \times 2'' \times 9'' \times (\text{bottom flange width}) \]

A Shim plate if required

\( \frac{1}{8}'' \) elastomeric neoprene leveling pad according to the material properties of Article 1052.02(a) of the Standard Specifications. Cost included with Structural Steel.

\[ \phi 1'' \times 12'' \text{ anchor bolts with } 2\frac{1}{4}'' \times 2\frac{1}{4}'' \times \frac{3}{16}'' \text{ washer under nut.} \]

\( 1\frac{3}{8}'' \times 2'' \text{ slotted hole in flange.} \)

\( 1\frac{1}{2}'' \phi \text{ holes in bearing plate.} \)

**SECTION A-A**

**INTEGRAL ABUTMENT BEARING FOR STEEL BEAMS**

Figure 18
STREAM CROSSINGS

TOE STONE RIPRAP TREATMENT
STREAM CROSSINGS

Figure 19

<table>
<thead>
<tr>
<th>Riprap Class</th>
<th>t_R</th>
<th>t_B</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>A4</td>
<td>16''</td>
<td>6''</td>
<td>4'</td>
<td>8'</td>
</tr>
<tr>
<td>A5</td>
<td>22''*</td>
<td>8''</td>
<td>5'</td>
<td>10'</td>
</tr>
<tr>
<td>A6</td>
<td>26''*</td>
<td>10''</td>
<td>6'</td>
<td>12'</td>
</tr>
<tr>
<td>A7</td>
<td>30''*</td>
<td>12''</td>
<td>7'</td>
<td>14'</td>
</tr>
</tbody>
</table>

* Check abutment depth and increase as necessary to match depth of riprap and bedding.

\[
\text{Slope Intercept} = \frac{A}{B}
\]

\[
\text{Theoretical \ Slope \ Intercept} = \frac{1}{2} \left( \frac{A}{B} \right) + \frac{1}{2} \left( \frac{t_B}{t_R} \right)
\]

\[
\text{Bedding} = 1' - 0'' \text{ min.}
\]

\[
1' - 0'' \text{ min.} \quad 2' - 0'' \text{ max. (for integral structures)}
\]

\[
\text{Filter Fabric}
\]

\[
\text{Stone Riprap} \quad \text{L's} \quad \text{R's} \quad 1' - 0''
\]

\[
\text{Berm or Streambed}
\]

\[
\text{Bedding} = 1' - 0'' \text{ min.}
\]
Granular Backfill
(See Special Provisions)

Excavation is paid for as Structure Excavation.

Fabric Reinforced Elastomeric Mat according to Section 1028 of the Std. Specs. Fabric mat shall be 24" wide and attached full width and vertically at edges to the abutment cap with a 3/8" x 5" steel plate and 1/2" studs with nuts and washers at 12" cts. See Fig. 21. Cost included with Concrete Superstructure.

* Geotechnical Fabric for French Drains

* Drainage Aggregate

* 4" @ Perforated pipe drain

All drainage system components shall extend to 2'-0" from the end of each wingwall except an outlet pipe shall extend until intersecting with the side slopes. The pipes shall drain into concrete headwalls. (See Article 601.05 of the Standard Specifications and Highway Standard 601101).
SEMI-INTEGRAL
ABUTMENT DETAILS

SECTION A-A

PLAN
(Parapet and approach included)

PLAN
(Parapet and approach not included)

Limits of fabric
reinforced elastomeric
mat. See Fig. 20.

Optional
Construction Joint

Figure 21
SECTION AT ABUTMENT

PLATE GIRDER AND STEEL BEAMS > 24"

* Omit with precast approach slabs.
SECTION AT ABUTMENT

For preformed joints, see Figure 20.

For PPC I-Beams (See Fig. 16)

* Omit with precast approach slabs.