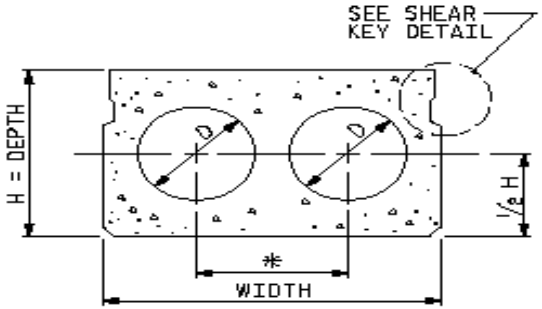
Cored Slab and Box Beam Bridges

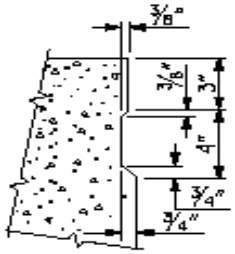
Cored Slab - Box Beam

- Cored Slab Units
  - 3 feet wide units
  - Depths
    - 18” (<45 ft)
    - 21” (<55 ft)
    - 24” (<70 ft)
- Box Beam Units
  - 3 feet wide units
  - Depths
    - 33” (<90 ft)
    - 39” (<100 ft)

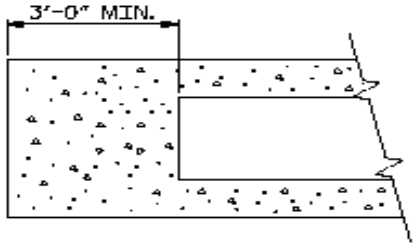
- Usually no more than 4 spans and less than 17 units in width.



SLAB SECTION



SHEAR KEY DETAIL



TYP. LONGITUDINAL SECTION

FOR APPROX. MAX. SPAN FOR HL-93, SEE FIGURE 11-3

18" CORED SLAB	
AREA: 483.4 in.^{2} 3.3568 ft.^{2}	
WEIGHT: 3.3568 X 150 = 504 lbs/ft.	
I_{XX} = 16289 in.^{4}	I_{YY} = 57817 in.^{4}
W = 3.00 ft.	J = 36880 in.^{4}
* = 15.00 in.	C_T = 9.080 in.
H = 18.00 in.	C_B = 8.920 in.
D = 10.00 in.	S_T = 1794 in.^{3}
	S_B = 1826 in.^{3}

21" CORED SLAB	
AREA: 522.3 in.^{2} 3.6268 ft.^{2}	
WEIGHT: 3.6268 X 150 = 544 lbs/ft.	
I_{XX} = 25390 in.^{4}	I_{YY} = 62796 in.^{4}
W = 3.00 ft.	J = 52094 in.^{4}
* = 16.00 in.	C_T = 10.596 in.
H = 21.00 in.	C_B = 10.404 in.
D = 12.00 in.	S_T = 2396 in.^{3}
	S_B = 2440 in.^{3}

24" CORED SLAB	
AREA: 630.3 in.^{2} 4.3768 ft.^{2}	
WEIGHT: 4.3768 X 150 = 657 lbs/ft.	
I_{XX} = 38910 in.^{4}	I_{YY} = 74460 in.^{4}
W = 3.00 ft.	J = 70159 in.^{4}
* = 16.00 in.	C_T = 12.097 in.
H = 24.00 in.	C_B = 11.903 in.
D = 12.00 in.	S_T = 3216 in.^{3}
	S_B = 3269 in.^{3}

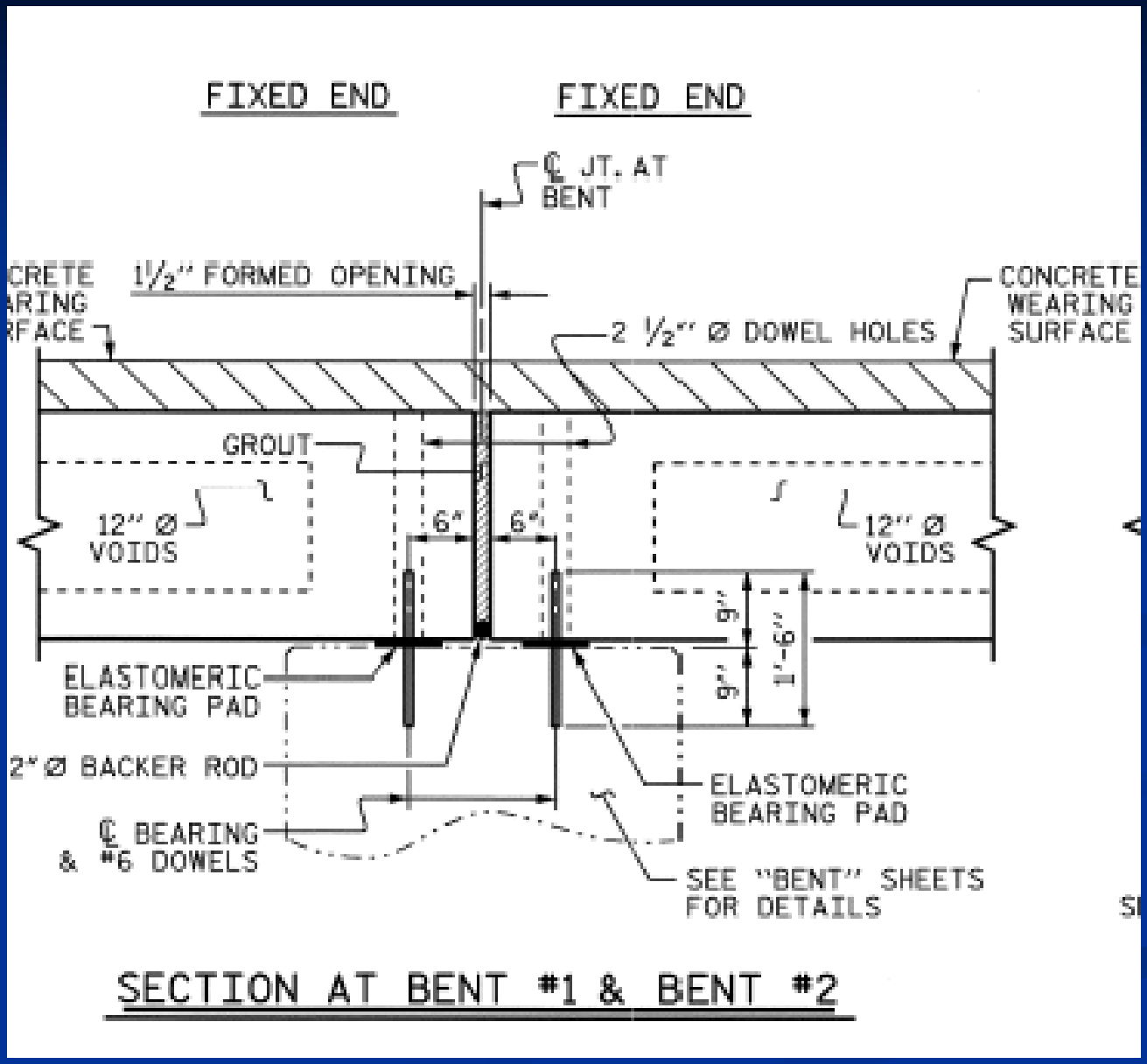
CORED SLAB PROPERTIES

FIGURE 6 – 81

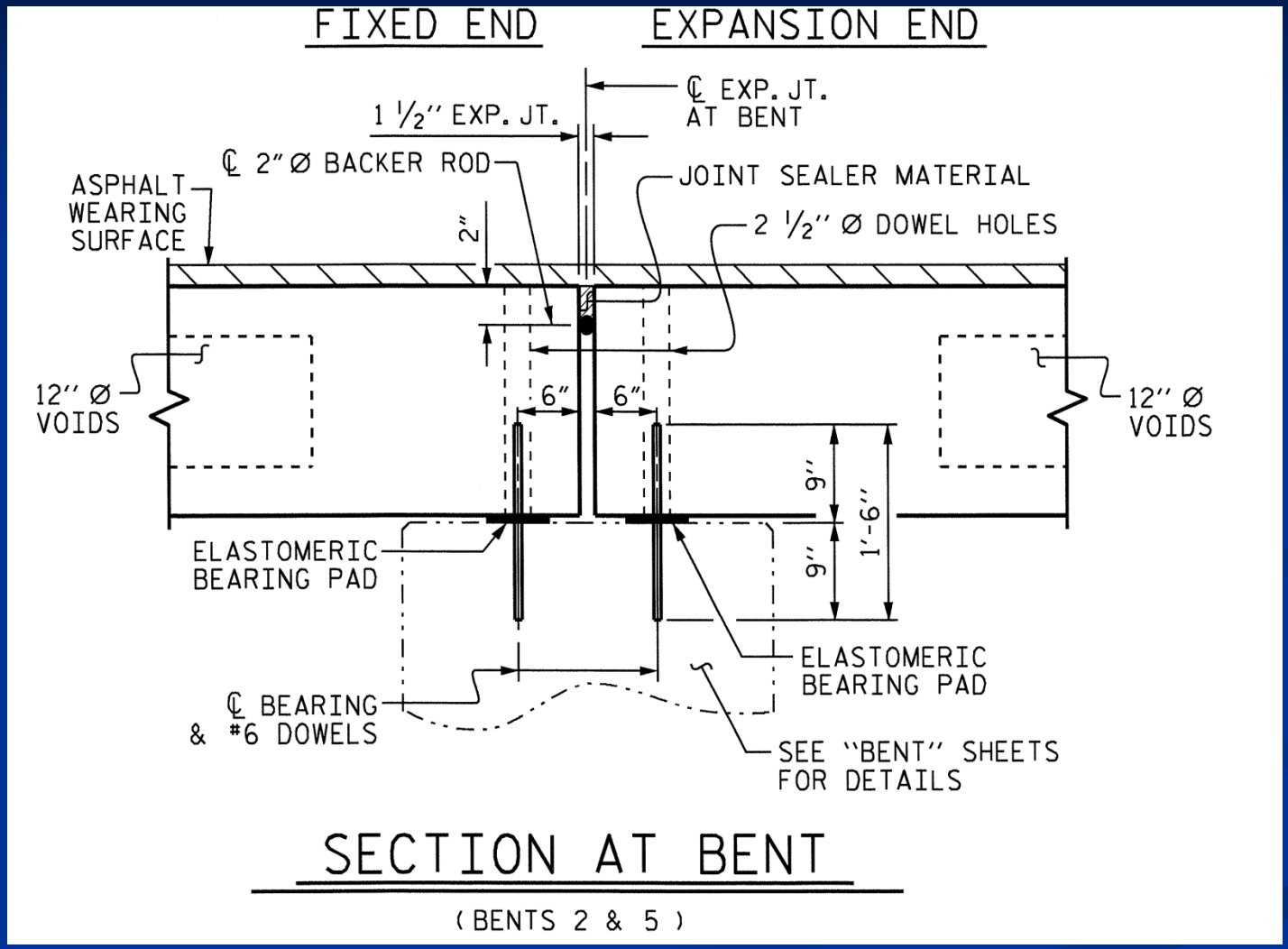
Substructure

- Similar to other bridges.
- Dowels in place of anchor bolts.
- Non-laminated elastomeric bearing pads.

Substructure



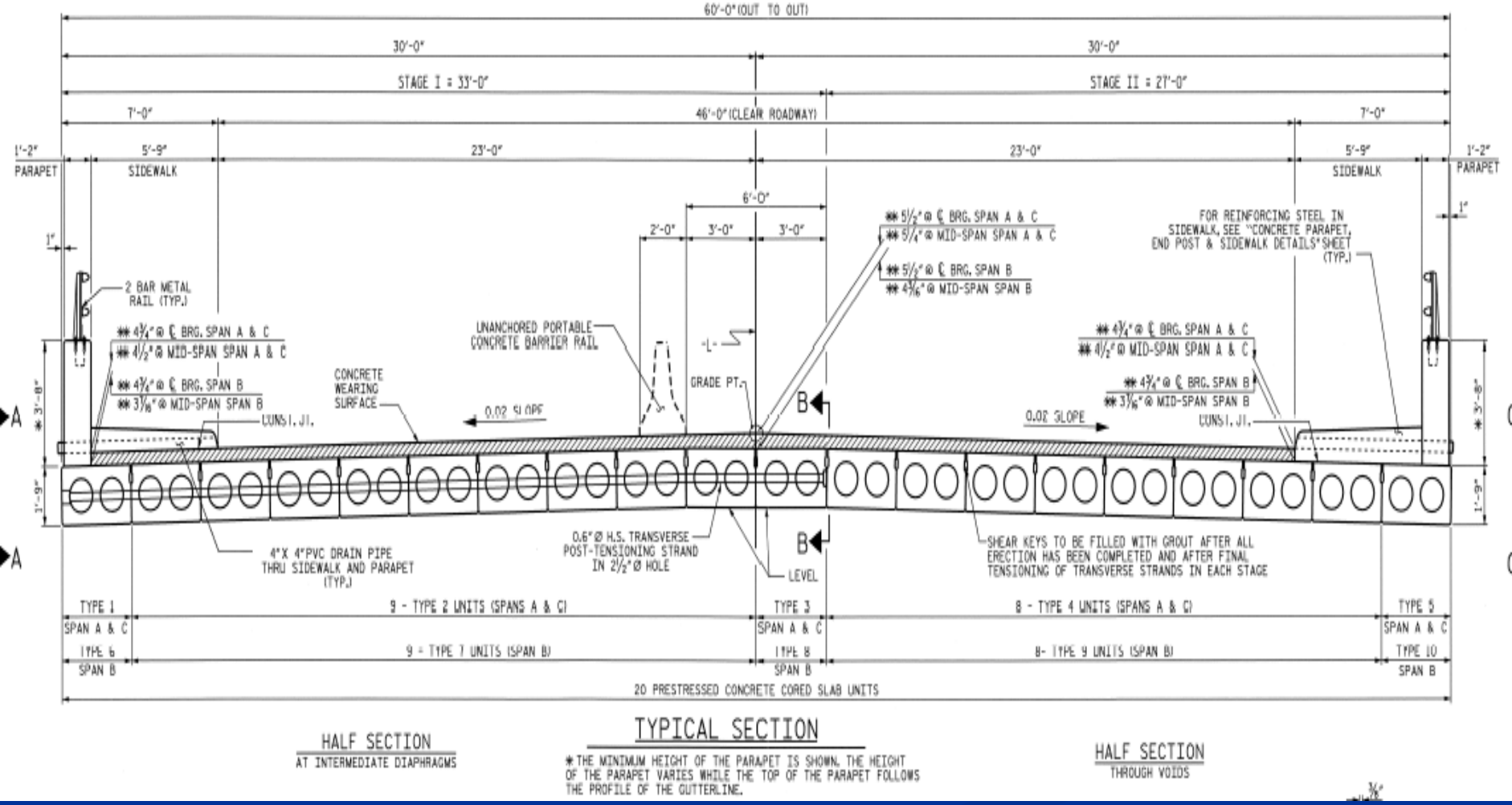
SECTION AT BENT #1 & BENT #2



SECTION AT BENT

(BENTS 2 & 5)

Typical Section



HALF SECTION
AT INTERMEDIATE DIAPHRAGMS

TYPICAL SECTION

* THE MINIMUM HEIGHT OF THE PARAPET IS SHOWN. THE HEIGHT OF THE PARAPET VARIES WHILE THE TOP OF THE PARAPET FOLLOWS THE PROFILE OF THE GUTTERLINE.

HALF SECTION
THROUGH VOIDS

Delivery

Delivery

- Verify correct slabs have been shipped.
- Collect material receipt documentation.
- M&T Approved Stamp?
- Inspect slabs for damage or repairs.
- Stored slabs should be supported off the ground on level dunnage placed at bearing locations.

Setting the Slabs

- ALWAYS lift from approved pick points.
- Begin setting slabs from center and work toward the outside. WHY?
  - Dimensional errors can be worked out toward the outside edges.
- Rearranging the slabs to accommodate excessive sweep in the units may be necessary.
- Extreme camber differentials may also require rearrangement, especially adjacent to exteriors.

Things to watch for!

- Camber in exterior slabs differ significantly from adjacent units.
  - Can cause reinforcing steel clearance issues on concrete overlays, may affect cover or crown slope.
  - May be necessary to adjust adjacent slab.
- Slab does not sit uniformly on bearing pad.
  - Slab may be pinching on adjacent slab, debris on the bearing pad, seat slope incorrect.
  - May need to pick up and investigate, adjust location of the unit, possibly install shim plate.

Things to watch for!

- Dowels don't line up.
  - Did not set from center out?
  - Layout incorrect, plan errors.
- Ends are out of alignment.
  - Skews are most common problem.
  - Can cause problems if joint is to be installed at approach slab.
  - Bond breaker for approach slab doesn't function correctly.
  - Adjustments should be made to improve alignment.

Alignment

M&T Match Marks

HiCAMS Materials Received

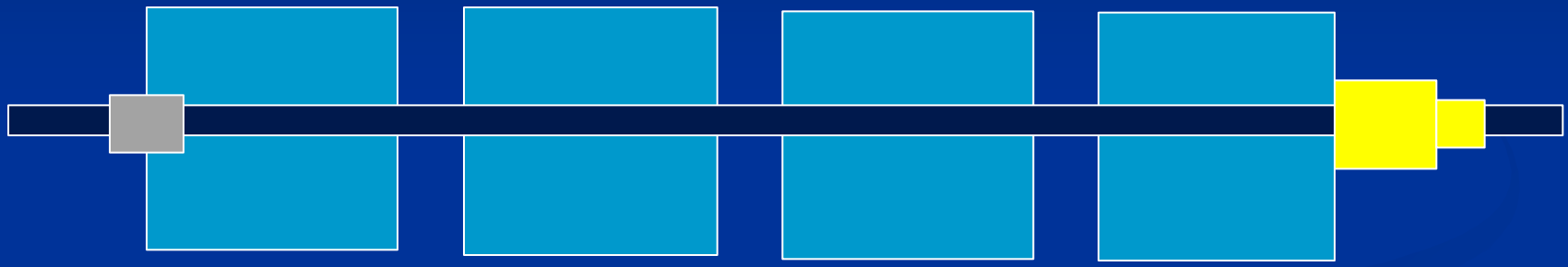

B1
B2
B3
B4
B5
B6
B7
B9
B10
B11
B12

Post-tensioning

- Once slabs are set, post-tensioning strands are tensioned to pull slabs together.
- 0.6 Inch strand inside a lubricated plastic sheath is threaded through strand duct (diaphragm).

After tensioning and grouting shear keys, slabs act as one unit and transfer load throughout all the slabs

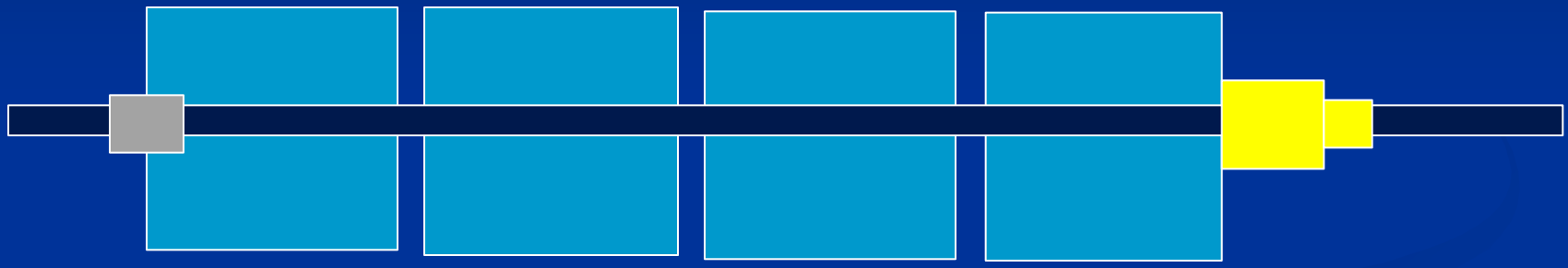
Post-tensioning



Tension to 43,950 lbs

Cored Slabs and Box Beams now use the same diameter strand and are tensioned to the same load

Post-tensioning



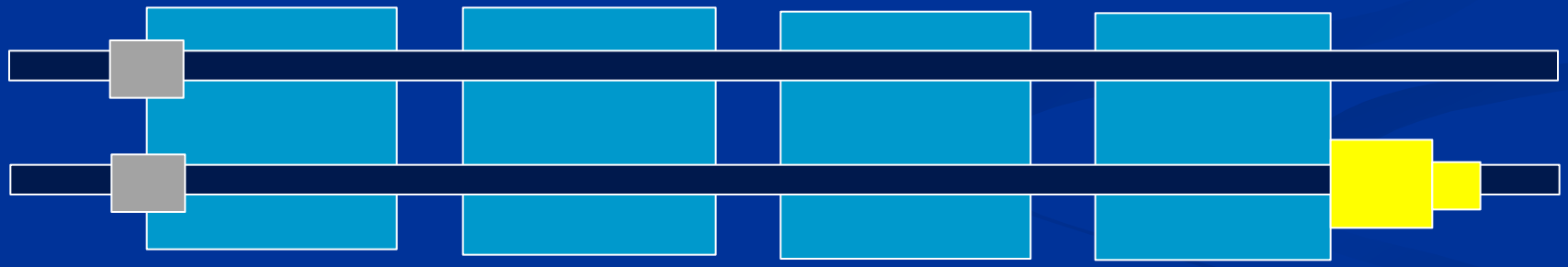
Tension to 43,950 lbs

Cored Slabs and Box Beams now use the same diameter strand and are tensioned to the same load

Post-tensioning

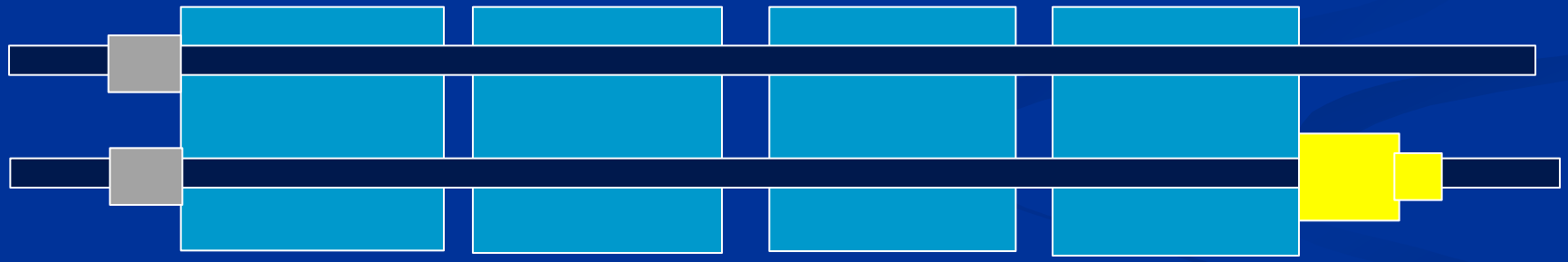
Post-tensioning

- Diaphragms with 2 strands must be tensioned symmetrically (Box Beams)



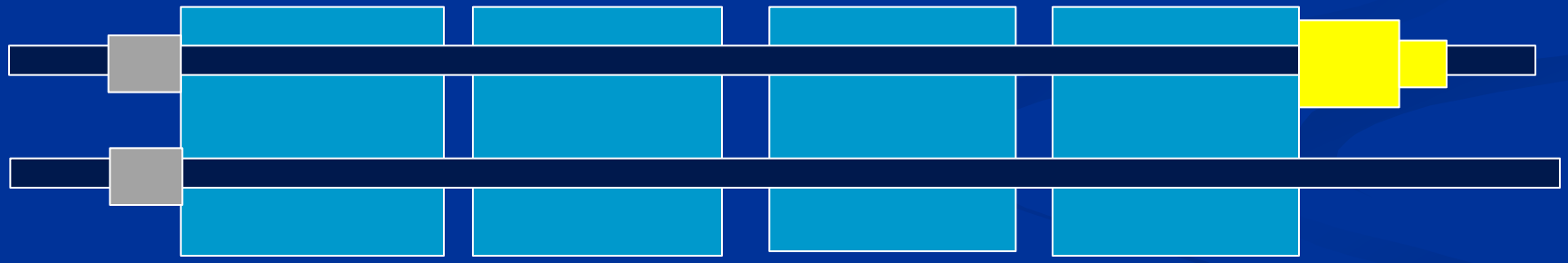
Article 430-6(C) - At each diaphragm location, maintain a symmetric tension force between each pair of strands in the diaphragm

Post-tensioning



Partially tension first strand

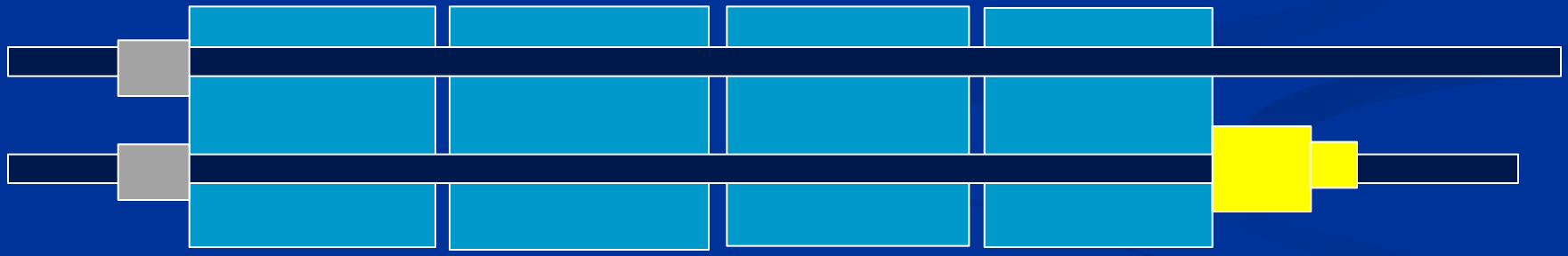
Post-tensioning



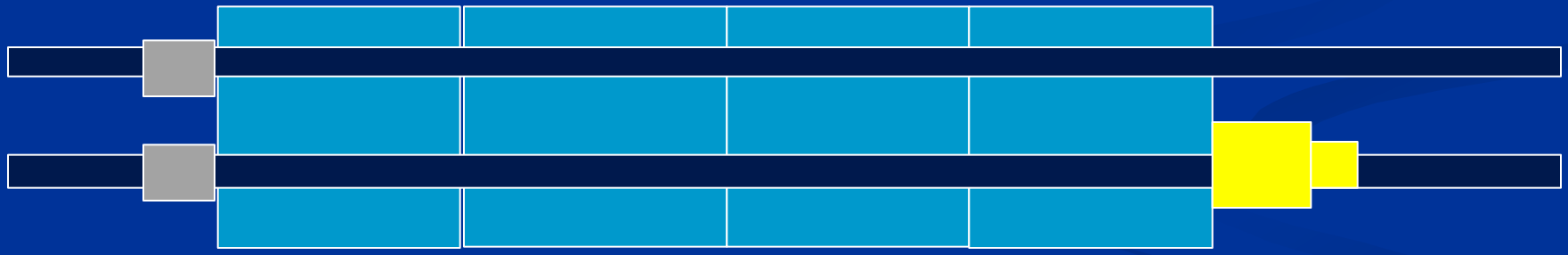
Post-tensioning

Fully tension next strand

Post-tensioning



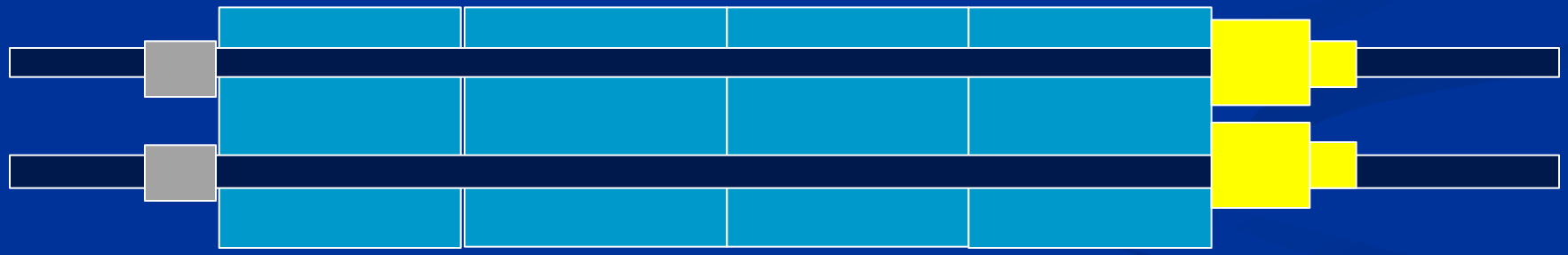
Post-tensioning



Complete tensioning first strand

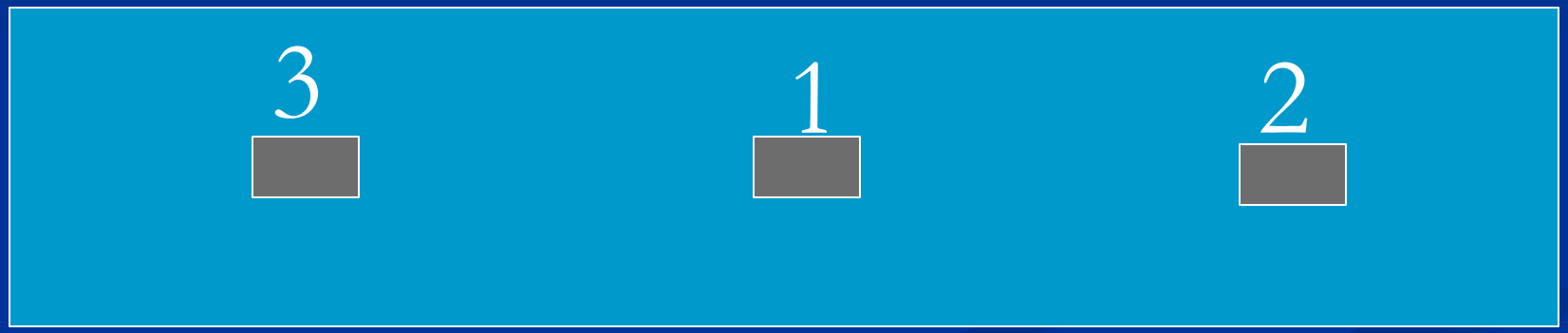
Post-tensioning

Multiple jacks can also be used



Complete tensioning first strand

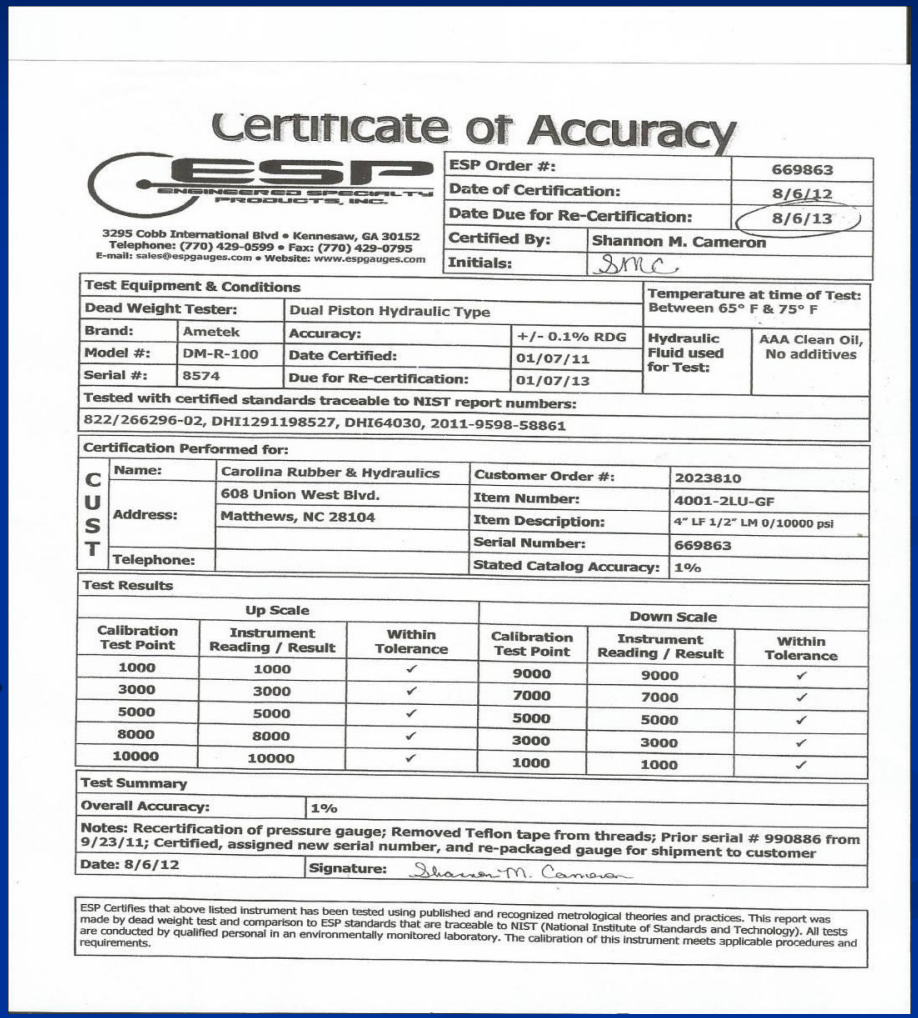
Post-tensioning



- Begin tensioning strand near mid-span first and work symmetrically along the length of the span.

Strand Jacks

- Must be calibrated by certified testing facility within 12 months.
- Contractor should provide calibration certificate and pressure/tension chart.



Certificate of Accuracy

ESP ENGINEERED SPECIALTY PRODUCTS, INC.

3295 Cobb International Blvd • Kennesaw, GA 30152
Telephone: (770) 429-0599 • Fax: (770) 429-0795
E-mail: sales@espgauges.com • Website: www.espgauges.com

ESP Order #:	669863
Date of Certification:	8/6/12
Date Due for Re-Certification:	8/6/13
Certified By:	Shannon M. Cameron
Initials:	SMC

Test Equipment & Conditions				Temperature at time of Test: Between 65° F & 75° F	
Dead Weight Tester:	Dual Piston Hydraulic Type				
Brand:	Ametek	Accuracy:	+/- 0.1% RDG	Hydraulic Fluid used for Test:	AAA Clean Oil, No additives
Model #:	DM-R-100	Date Certified:	01/07/11		
Serial #:	8574	Due for Re-certification:	01/07/13		

Tested with certified standards traceable to NIST report numbers:
822/266296-02, DHI1291198527, DHI64030, 2011-9598-58861

Certification Performed for:

CUST				
Name:	Carolina Rubber & Hydraulics	Customer Order #:	2023810
Address:	608 Union West Blvd.	Item Number:	4001-2LU-GF
	Matthews, NC 28104	Item Description:	4" LF 1/2" LM 0/10000 psi
		Serial Number:	669863
Telephone:		Stated Catalog Accuracy:	1%

Test Results

Up Scale			Down Scale		
Calibration Test Point	Instrument Reading / Result	Within Tolerance	Calibration Test Point	Instrument Reading / Result	Within Tolerance
1000	1000	✓	9000	9000	✓
3000	3000	✓	7000	7000	✓
5000	5000	✓	5000	5000	✓
8000	8000	✓	3000	3000	✓
10000	10000	✓	1000	1000	✓

Test Summary

Overall Accuracy:	1%

Notes: Recertification of pressure gauge; Removed Teflon tape from threads; Prior serial # 990886 from 9/23/11; Certified, assigned new serial number, and re-packaged gauge for shipment to customer

Date: 8/6/12	Signature: Shannon M. Cameron

ESP Certifies that above listed instrument has been tested using published and recognized metrological theories and practices. This report was made by dead weight test and comparison to ESP standards that are traceable to NIST (National Institute of Standards and Technology). All tests are conducted by qualified personal in an environmentally monitored laboratory. The calibration of this instrument meets applicable procedures and requirements.

Contractor should provide jack information.

ENERPAC

RCH-Series, Hollow Plunger Cylinders

rch.jpg [1]

- Enerpac hollow plunger cylinders provide versatility in testing, maintenance and tensioning applications. The hollow plunger design allows for both pull and push forces
- Single-acting spring return
- Cylinders are nickel-plated, floating center tube on models over 20 tons increases product life
- Baked enamel finish for increased corrosion resistance
- Collar threads for easy fixturing
- RCH-120 cylinders include AR-630 coupler and has 1/4 NPTF port
- RCH-121 and RCH-1211 cylinders have FZ-1630 reducer and AR-630 coupler, all other models feature CR-400 coupler

Cylinder Capacity	Stroke	Model Number	Cylinder Effective Area	Oil Capacity	Collapsed Height	Extended Height	Out-side Dia-meter	Center Hole Dia.	Weight
ton	inch		$inch^2$	$inch^3$	inch	inch	inch	inch	pound
13	0.31	**RCH-120**	2.76	0.86	2.19	2.5	2.75	0.77	3.2
	1.63	**RCH-121***	2.76	4.49	4.75	6.38	2.75	0.77	6.2
	1.63	**RCH-1211**	2.76	4.49	4.75	6.38	2.75	0.77	6.2
	3	**RCH-123**	2.76	8.29	7.25	10.25	2.75	0.77	9.8
20	2	**RCH-202***	4.73	9.46	6.38	8.38	3.88	1.06	17
	6.1	**RCH-206**	4.73	28.67	12.05	18.11	3.88	1.06	31
30	2.5	**RCH-302***	7.22	18.05	7.03	9.53	4.50	1.31	24
	6.13	**RCH-306**	7.22	44.23	13.00	19.13	4.50	1.31	48
60	3	**RCH-603***	12.73	38.20	9.75	12.75	6.25	2.12	62
	6	**RCH-606**	12.73	76.41	12.75	18.75	6.25	2.12	78
95	3	**RCH-1003***	20.63	61.88	10.00	13.00	8.38	3.11	132

* For lightweight aluminium models, see RACH-series
*Also available as cylinder-pump sets.

SC-Series, Single-Acting, Cylinder-Pump Sets [2]
700, 900-Series, High Pressure Hydraulic Hoses [3]

Verify correct pressure.

- Jack data sheet should provide effective area of cylinder.
- Tension = Pressure x Effective Area.
- Correct pressure would be 43,950 lb. /Eff. Area. (psi)

Check jack maximum stroke prior to tensioning.

Check maximum stroke

Max. stoke during tensioning =false tension readings.

Post-tensioning

- Contractor must use a reaction frame to allow access to set the wedges after tensioning.
- Tensioning against the wedges will not be allowed.

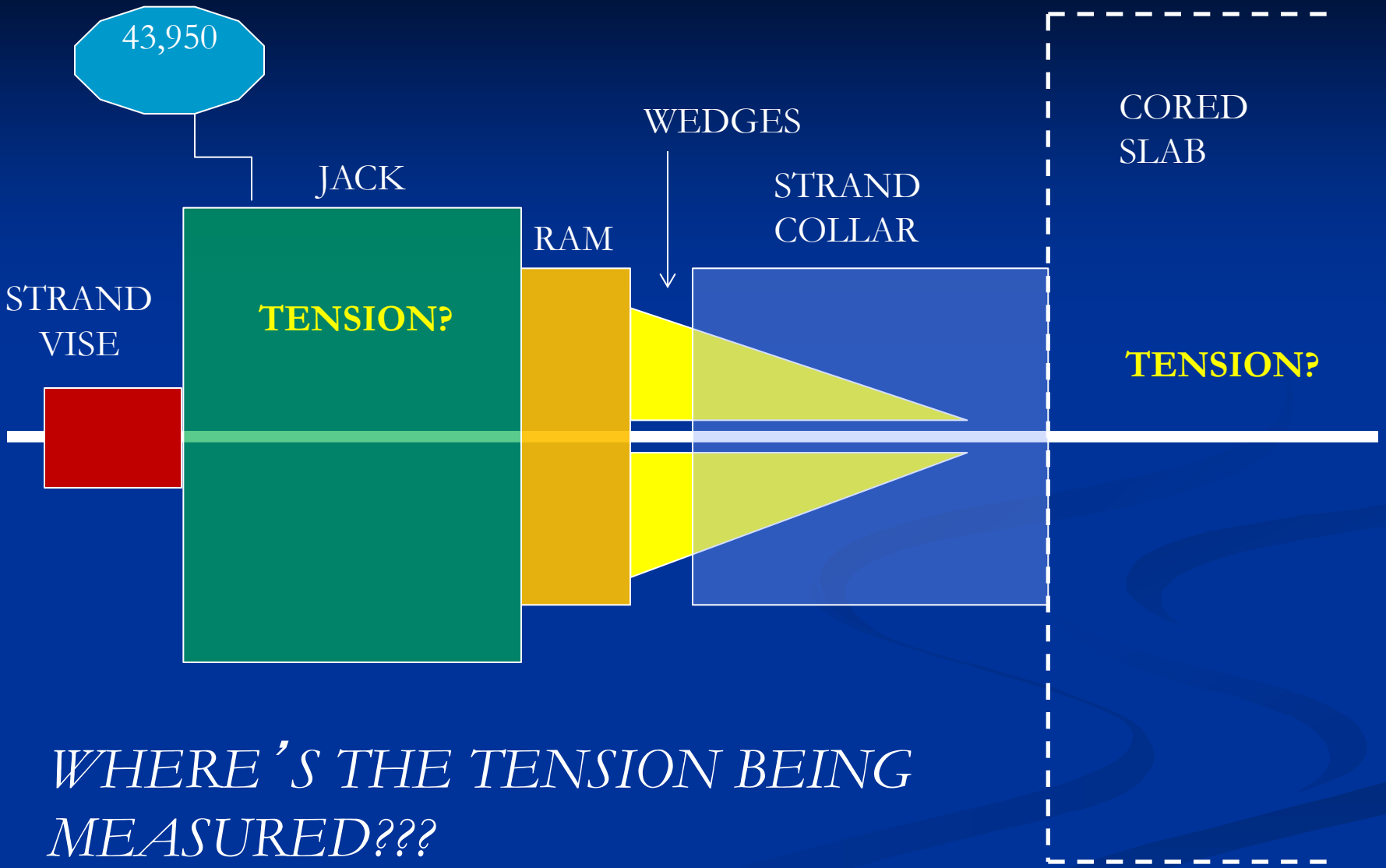
Strand Vise

- Strand Anchors consist of a collar and hardened wedges.
- Proper installation is critical to achieve correct tension in units.

Strand Vise

Double Strands

Strand Collar



WHERE'S THE TENSION BEING MEASURED???

Jacking against wedges setup
Not a good idea.

Jack Setup with reaction frame

Jack Setup with reaction frame

Double Acting Jack

Other Things To Consider

- Install strand vise on dry, clean cable only. No grease from strand should be on cable ends.
- Good idea to mark strand behind the strand vise to make sure the cable does not slip.
- Apply jack pressure to ensure proper tension is attained. 43,950 lbs. (need load charts for jack)
- Hold pressure for at least 2 minutes to ensure no pressure losses.
- Cut excess strand with saw. No flame cutting!

Cored Slabs/Box Beams Grouting

- 2012 Specifications and Other Resources
  - Division 4 (Section 430), Page 4-52, 53, 54
  - Construction Manual (Section 430), Page 4-43, 44
  - Plans
  - Project Special Provisions (Grout for Structures)
  - Division 10 (Section 1003), Page 10-19 (DOES NOT APPLY)

GROUT FOR STRUCTURES **(9-30-11)**

1.0 DESCRIPTION

This special provision addresses grout for use in pile blockouts, grout pockets, shear keys, dowel holes and recesses for structures. This provision does not apply to grout placed in post-tensioning ducts for bridge beams, girders, or decks. Mix and place grout in accordance with the manufacturer's recommendations, the applicable sections of the Standard Specifications and this provision.

Cored Slabs/Box Beams Grouting

Approved Mix Design

- Must have an approved concrete mix design.
- Cannot use grout that contains soluble chlorides or more than 1% soluble sulfate.

Approved Pre-Packaged

- A list of approved packaged grout is on M&T's web site.
- Must be non-metallic & non-shrink grout.
- Consult manufacturer to determine if it is suitable for the application & meets strength, durability, etc. requirements.

Product ID	Plant ID	Company Name	Product Group	Product Category	Product Name	Model Number	Product Status
NP99-2761	OT1186	BASF Building Systems, Inc.	Grouts	Non-Shrink	Construction Grout		Approved
NP99-2767	OT220	Kaufman Products	Grouts	Non-Shrink	Sure Grout	180-50	Approved
NP99-3447	OT1169	BASF Construction Chemicals	Grouts	Non-Shrink	Meyco RBA Grout		Approved
NP87-177	OT1156	Dayton Superior Corporation	Grouts	Non-Shrink	Sure-Grip High Performance Grout		Approved
NP95-1034	OT529	Lambert Corp.	Grouts	Non-Shrink	Vibropruf 11		Approved
NP95-1035	OT529	Lambert Corp.	Grouts	Non-Shrink	Vibropruf 20		Approved
NP95-1067	OT1156	Dayton Superior Corporation	Grouts	Non-Shrink	1107 Advantage Grout		Approved
NP99-2686	OT1186	BASF Building Systems, Inc.	Grouts	Non-Shrink	Masterflow 555		Approved
NP99-2726	OT80	ChemMasters	Grouts	Non-Shrink	Conset Grout	2310.50	Approved
NP99-2731	OT881	Kaufman Products, Inc	Grouts	Non-Shrink	Harris Construction Grout		Approved
NP99-2736	OT253	W.R. Meadows Of Georgia, Inc.	Grouts	Non-Shrink	CG-86		Approved
NP99-2741	OT495	A.W. Cook Cement	Grouts	Non-Shrink	MS Grout		Approved
NP99-2753	OT253	W.R. Meadows Of Georgia, Inc.	Grouts	Non-Shrink	Pac-It		Approved
NP99-2755	OT253	W.R. Meadows Of Georgia, Inc.	Grouts	Non-Shrink	588-10K		Approved
NP99-2757	OT1186	BASF Building Systems, Inc.	Grouts	Non-Shrink	Masterflow 928		Approved
NP99-2759	OT1186	BASF Building Systems, Inc.	Grouts	Non-Shrink	MasterFlow 713 Plus		Approved
NP05-4512	OT805	Sika Corporation	Grouts	Non-Shrink	Sika Grout 212		Approved
NP08-4808	OT1176	Quikrete Company	Grouts	Non-Shrink	General Purpose Grout	1585-01	Approved
NP08-4820	OT40	CTS Cement Manufacturing Corporation	Grouts	Non-Shrink	Rapid Set Cement All		Approved
NP09-4924	OT1187	SpecChem, LLC,	Grouts	Non-Shrink	SC Multipurpose Grout		Approved
NP09-5054	OT1186	BASF Building Systems, Inc.	Grouts	Non-Shrink	Masterflow 816		Approved
NP09-5055	OT1186	BASF Building Systems, Inc.	Grouts	Non-Shrink	Master Flow 1205		Approved
NP09-5078	OT1186	BASF Building Systems, Inc	Grouts	Non-Shrink	Masterflow 1341		Approved
NP09-5109	OT1185	A.W. Cook Cement Products	Grouts	Non-Shrink	Dry Pack Grout		Approved
NP99-2712	OT1176	Quikrete Company	Grouts	Non-Shrink	Anchoring Cement	1245-81	Approved
NP99-2771	OT859	Euclid Chemical Company	Grouts	Non-Shrink	NC Grout		Approved
NP99-2779	OT859	Euclid Chemical Co.	Grouts	Non-Shrink	NS Grout		Approved
NP12-6018		US Mix Co.	Grouts	Non-Shrink	US Spec NA-50	N/A	Under Evaluation
NP12-6019		US Mix Co.	Grouts	Non-Shrink	US Spec NA Grout	N/A	Approved
NP99-2777	OT859	Euclid Chemical Co.	Grouts	Non-Shrink	Hi-Flow Grout		Approved
NP05-4460	OT1176	Quikrete Company	Grouts	Non-Shrink	FastSet Non Shrink Grout	1585-09	Approved
NP08-4807	OT1176	Quikrete Company	Grouts	Non-Shrink	Non Shrink Precision Grout (CG)	1585-00	Approved

Cored Slabs/Box Beams Grouting

- Preparation To Place Grout:
  - Clean the areas (shear keys, dowel holes, recessed areas) to remove all dirt, debris, grease, oil, etc.
  - Saturate the concrete surfaces with clean water and remove excess water prior to placing grout.
  - Use backer rod or spray foam to seal cracks, holes, etc. Due to spray foam expansion, it should be trimmed as required.

Cored Slabs/Box Beams Grouting

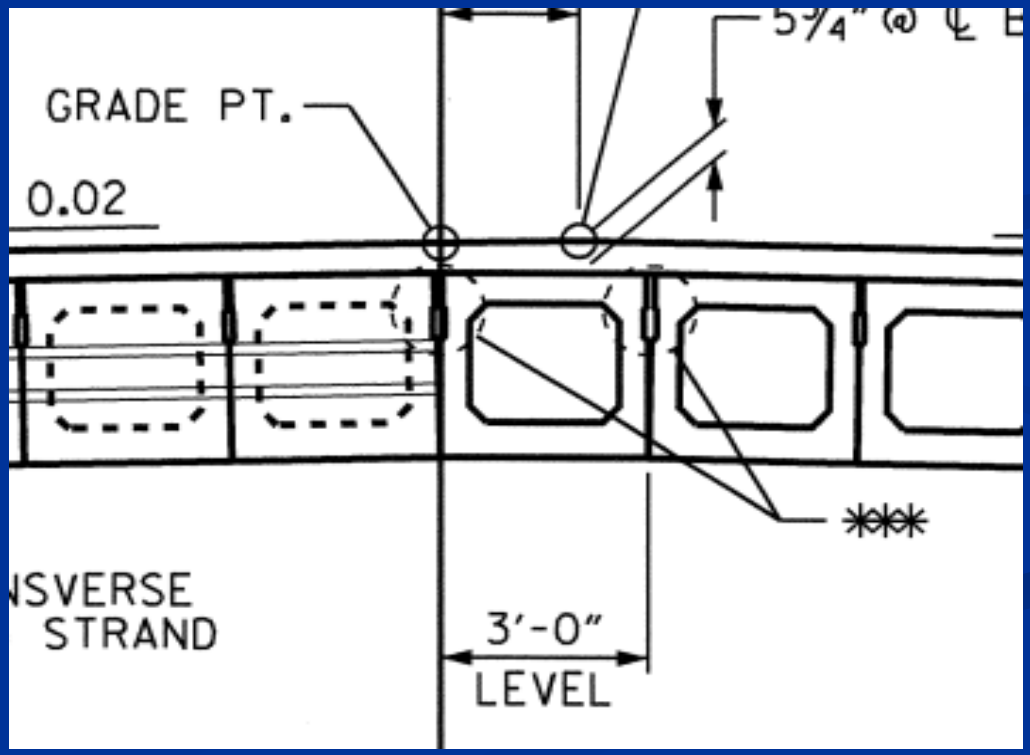
- Mixing Approved Pre-Packaged Grout:
  - Per Article 1024-4, use potable water only.
  - Follow Manufacturer's recommendations for mixing. Instructions should be printed on the packaging.
  - Per Project Special Provisions -
    - Aggregate may be added to the mix only where recommended or permitted by the manufacturer & Engineer.
    - The quantity & size of aggregate shall be in accordance with the manufacturer's recommendation.

Cored Slabs/Box Beams Grouting

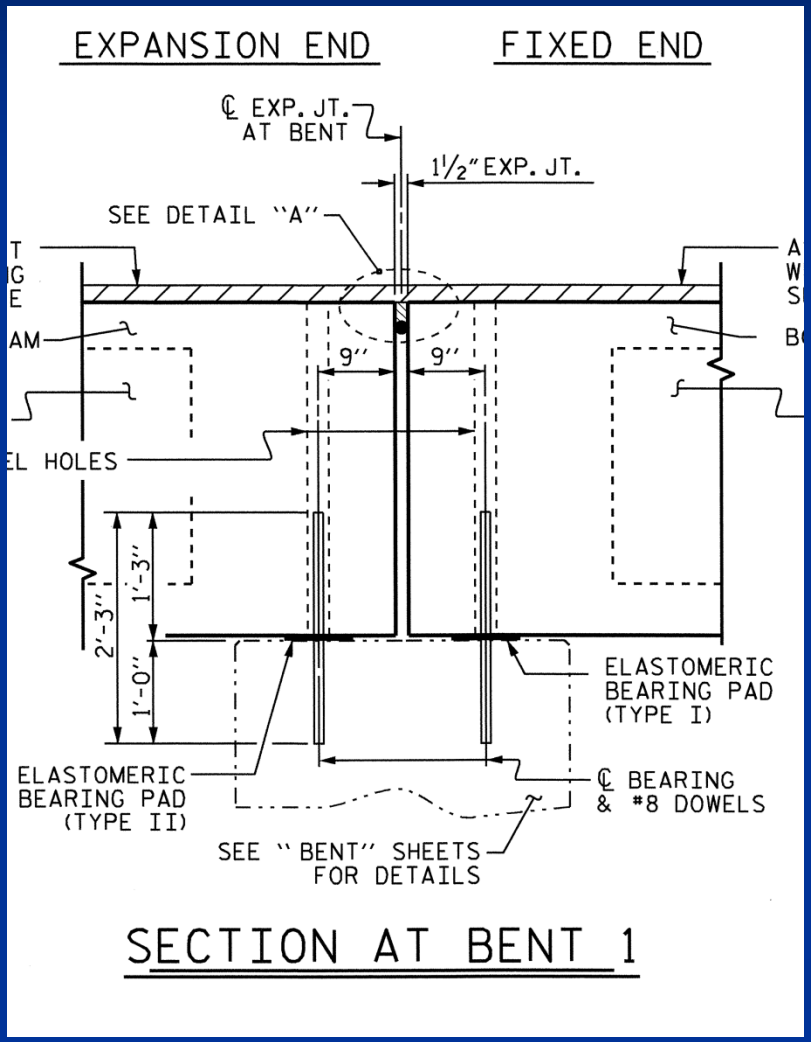
Cored Slabs/Box Beams Grouting

Cored Slabs/Box Beams Grouting

- Grouting on Crown Typical Sections:
  - Grout center shear keys **before** post-tensioning when the caps (of end bent/interior bents) are crowned.



Cored Slabs/Box Beams Grouting



- Dowel holes at fixed ends shall be filled with grout.
- Dowel holes at expansion ends shall be filled with joint sealer to 1 ½" above the dowels, then filled with grout.

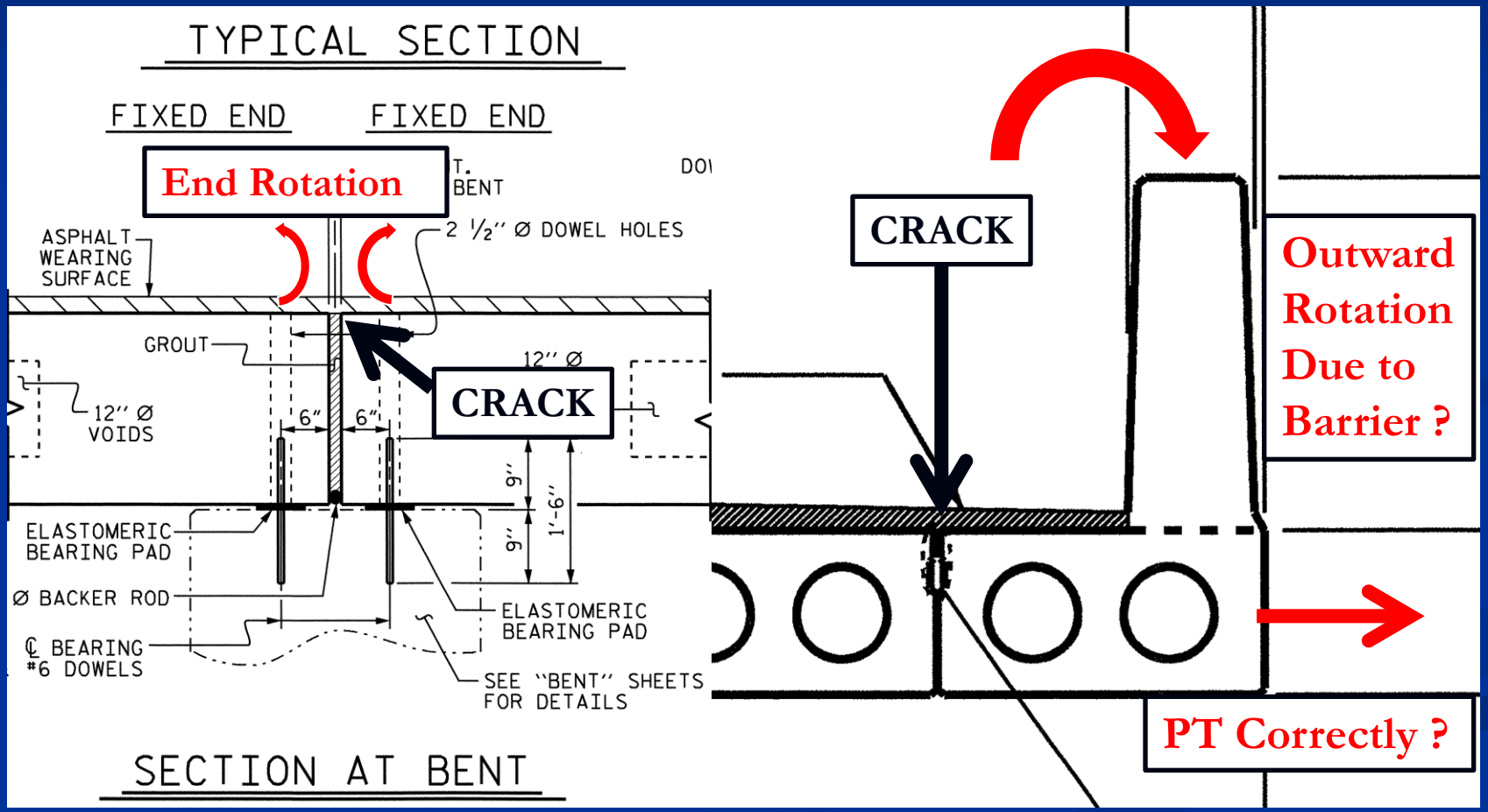
Cored Slabs/Box Beams Grouting

- Placing Loads on Cored Slabs/Box Beams:
  - Per Project Special Provisions, construction loading & traffic loading shall not be allowed until the 3 day compressive strength is achieved. (5000 psi)
  - Construction loading & traffic over legal load limit should be submitted for review & approval. This includes loading for top down construction.

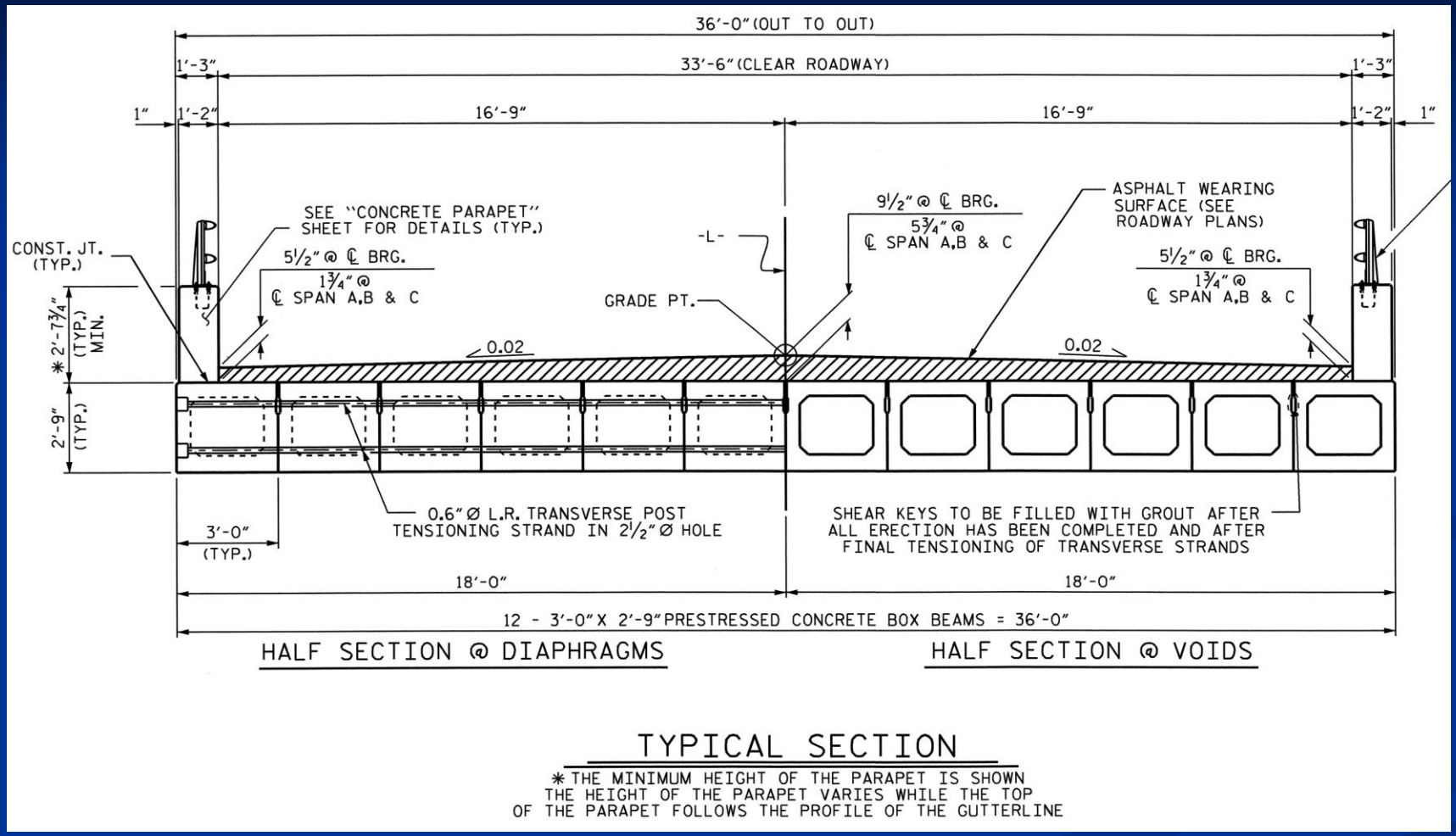
Cored Slabs/Box Beams Grouting

- If you observe cracks in the grout, prior to asphalt or concrete overlay, epoxy seal the cracks.

Cored Slabs/Box Beams Grouting



Typical Sections



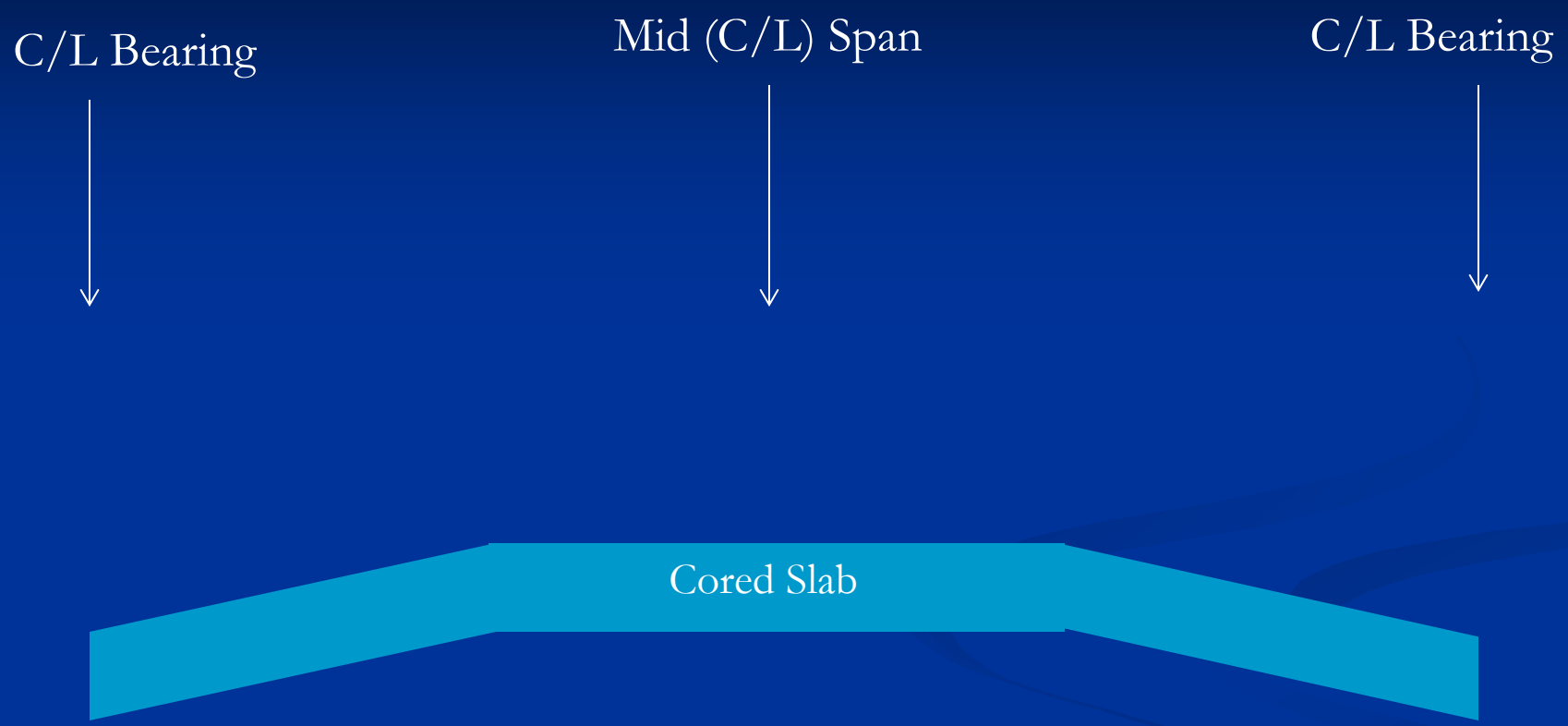
- Camber in the cored slab/box beam units requires varying overlay depths along the span. Mid-span depth is the minimum overlay.

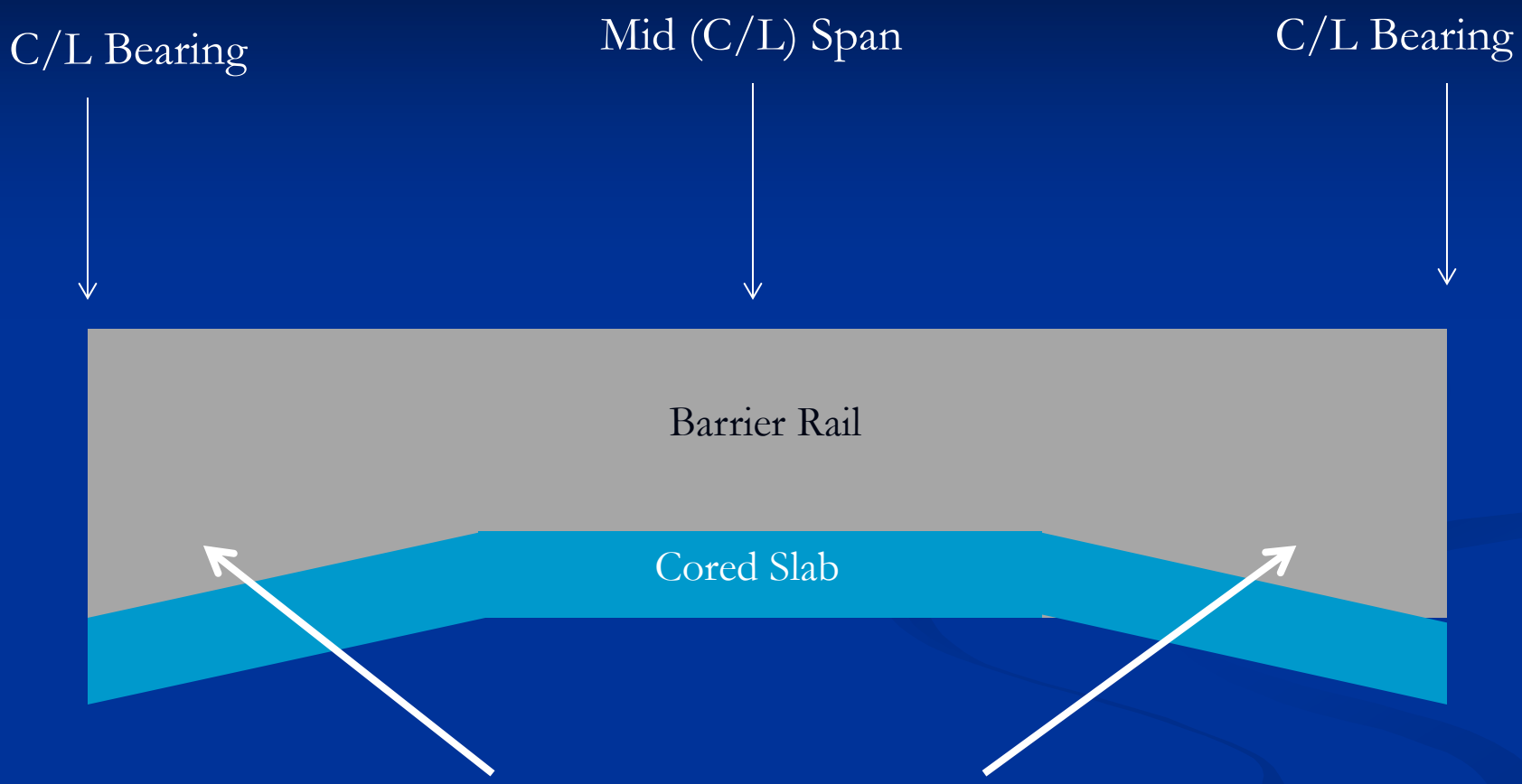
Barrier Rail

- Barrier rail is placed prior to overlay.
- Barrier rail will vary in depth to match the camber in the slabs.
- In addition to camber, overlay thickness must also be factored in to attain minimum rail height above finish grade.

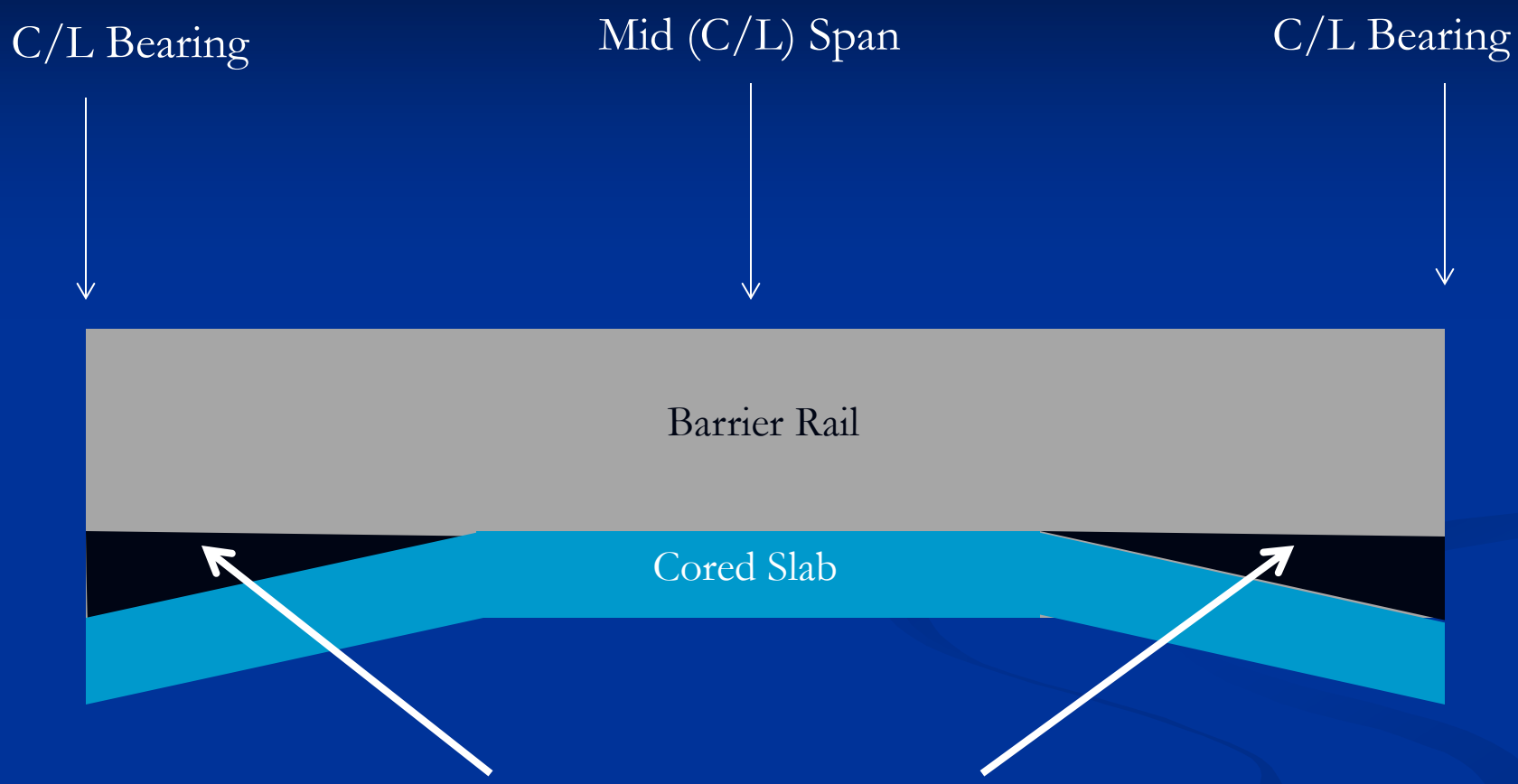
Asphalt Wearing Surface

- Establish the plan grade line to determine wedging limits.
- Grades should be provided along the centerline and gutter lines.
- Several paving lifts may be necessary to bring bearing locations to grade.

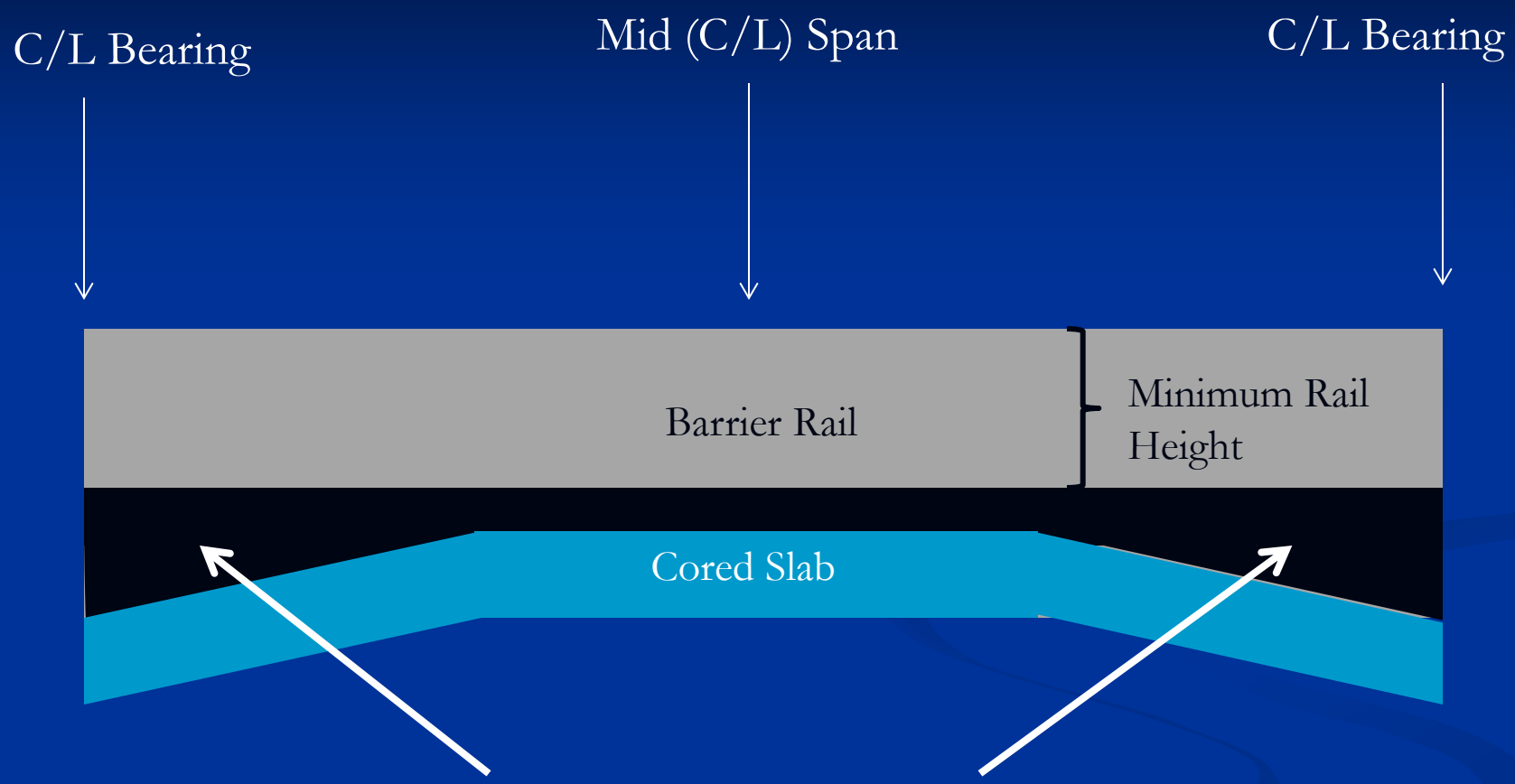

C/L Bearing
Mid (C/L) Span
C/L Bearing
Cored Slab



Variable height concrete in barrier rail.



Variable depth asphalt or concrete overlay.
(wedging areas)



Variable height concrete in barrier rail, and variable depth asphalt or concrete overlay

Concrete Wearing Surface

Concrete Wearing Surface (CWS)

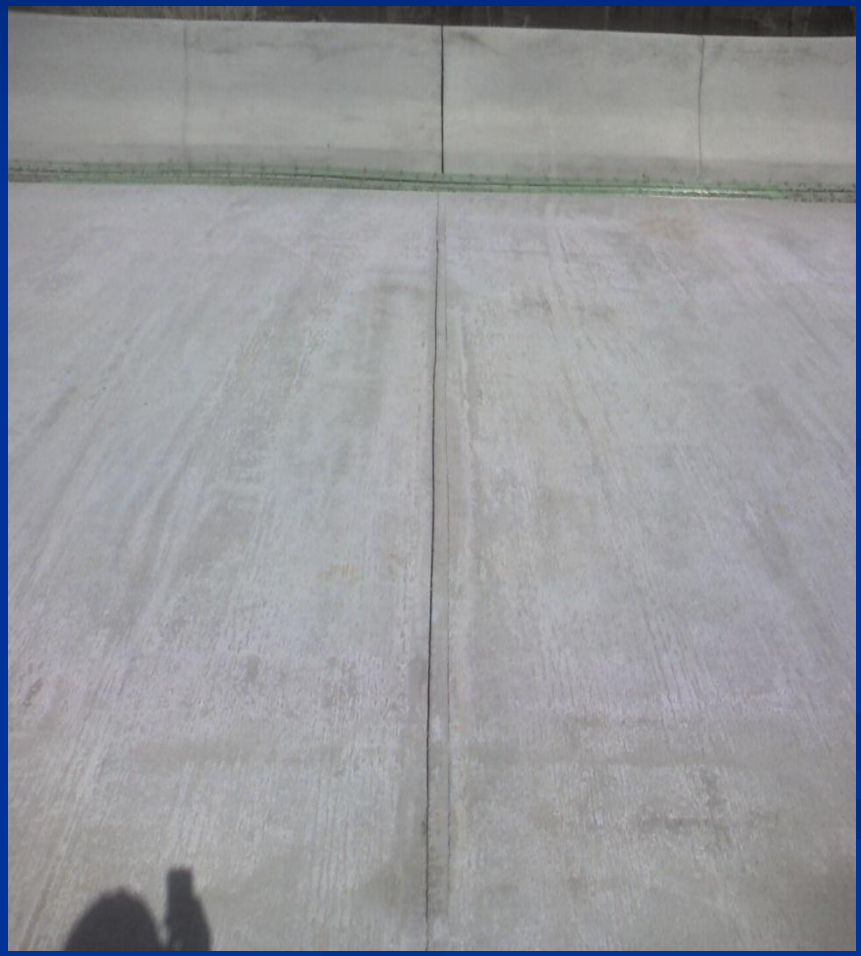
- Class AA – 78M mix design
- Place and finish according to 420-14 (just like cast in place decks on girder bridges)
- Adhere to 420-20 – 14 days cure and 4500 psi prior to placing loads on deck.
- Due to camber, deck thickness varies across the span. Grade lines are necessary to obtain proper depth and reinforcing steel cover.
- Screed set up must be based on finished grade elevations and rebar chairs adjusted to obtain proper cover.

CWS Screed Set Up

CWS Longitudinal Construction Joints

Cracking in CWS

- CWS will crack over the grout joint between spans.
- A tooled joint or sawed joint can control this crack.
- Sawed joints within 12 hours.
- Do not saw the joint if it has already cracked.



Sidewalks

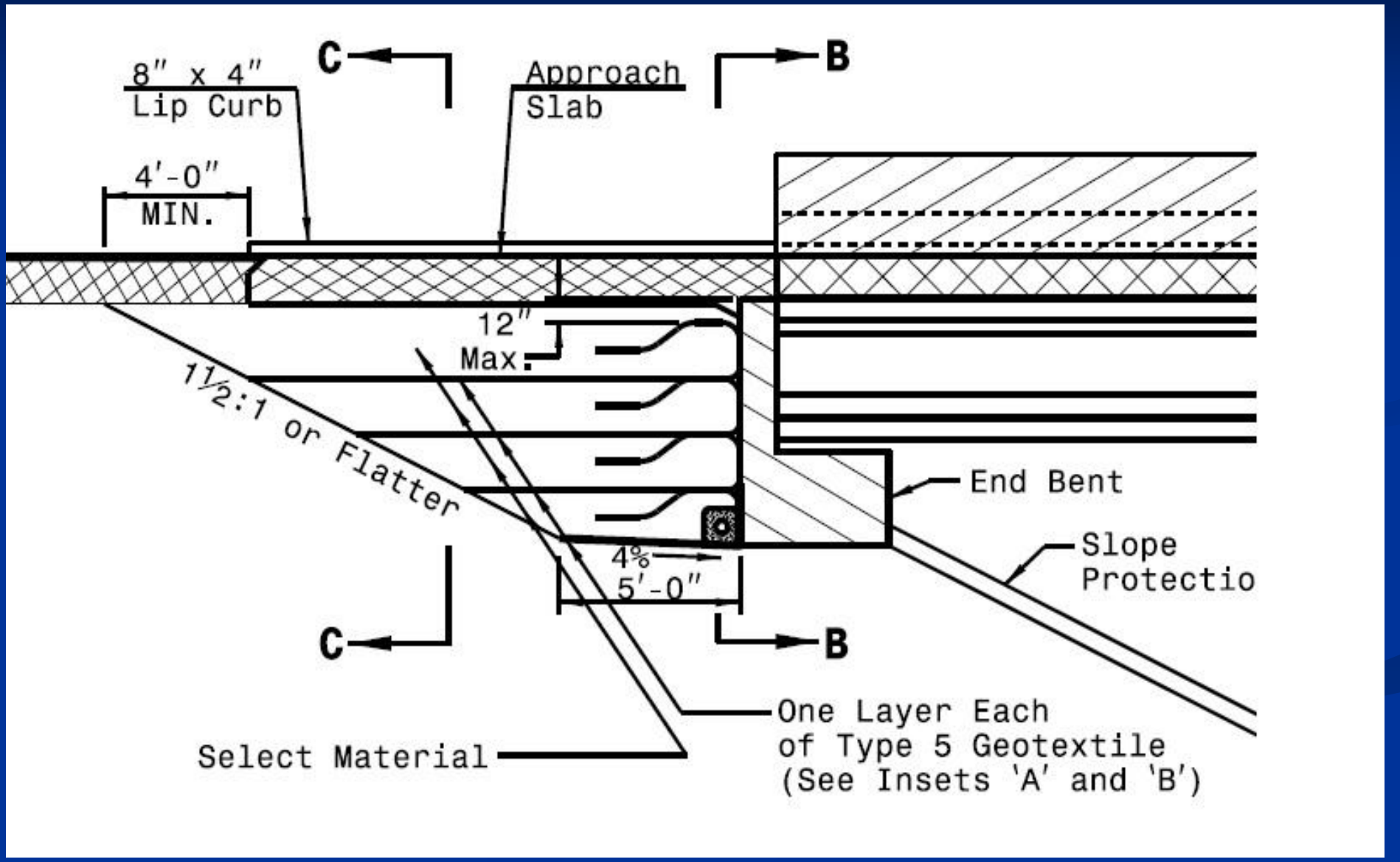
- Tool joints in sidewalk on skew and over grouted, fixed joints between spans.

Do Not Allow This!

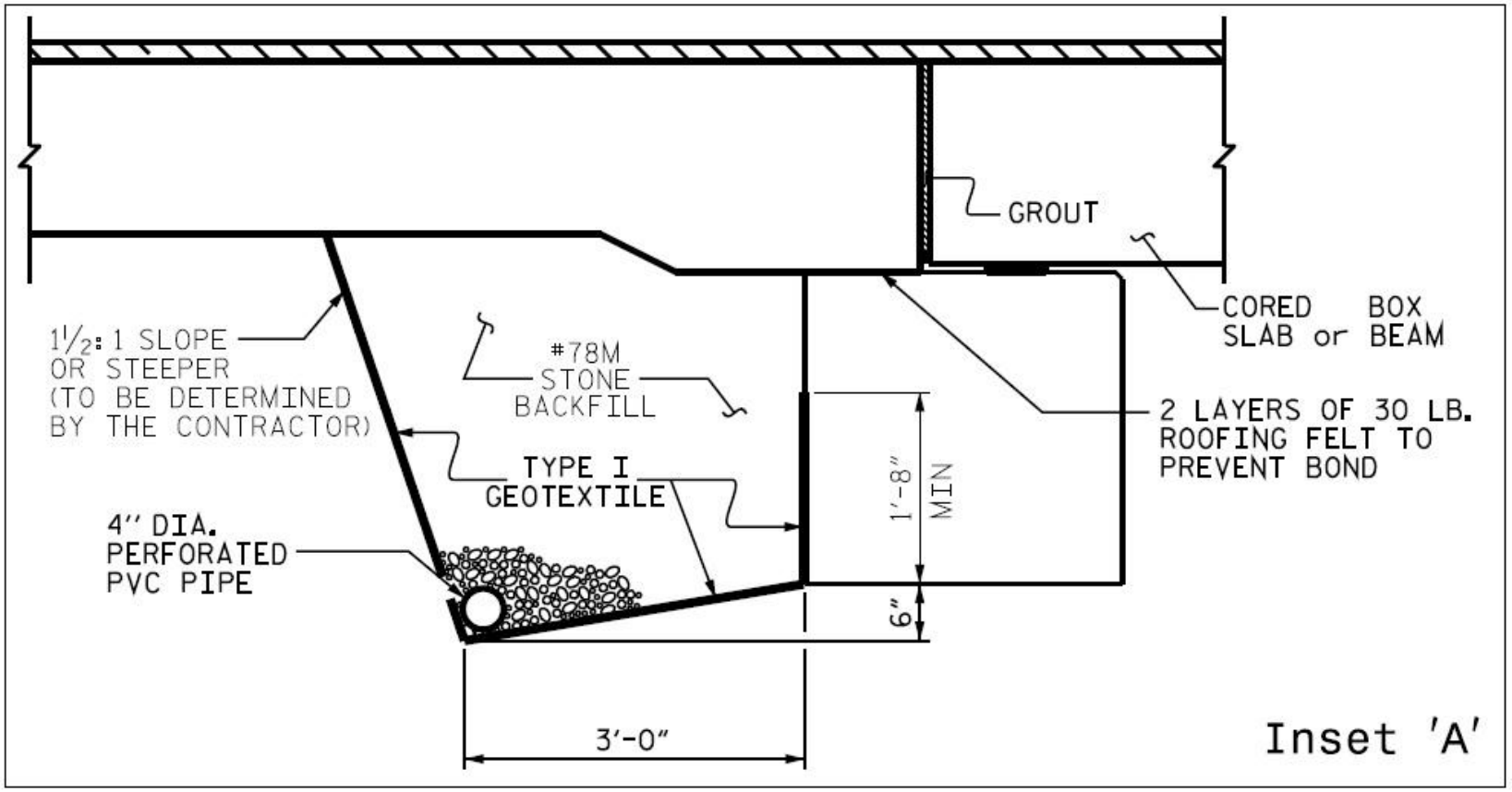
Reinforced Bridge Approach Fill

- Two types
  - Standard Design
    - Major routes – Interstate, Primary, Major collectors, etc.
  - Sub-Regional Tier Design
    - Minor collectors, local, and secondary roads.
    - Common for cored slabs and box beam bridges.
    - Not common in Coastal Plain

Standard RBAF



Subregional Tier



Materials

Standard RBAF

- Class III or V Select backfill
- Type 5 Geotextile Fabric
- PVC pipes, fittings and outlet pipes.
- PVC, HDPE, Linear low density polyethylene (LLDPE)– 30 mils thick
- Class B concrete outlet pads with rodent screens.
- 78M stone (drain)

Sub-Regional Tier

- Class V Select Backfill (78M)
- Type 1 Geotextile Fabric
- PVC pipes, fittings, and outlet pipes.
- Class B concrete outlet pads with rodent screens.

Geotextiles – Section 1056

Refer to 2012 Standard Specifications for required engineering properties of Type 1, Type 5, & Geomembrane

Refer to National Transportation Product Evaluation Program or NTPEP to verify geotextile meets requirements for specific type.

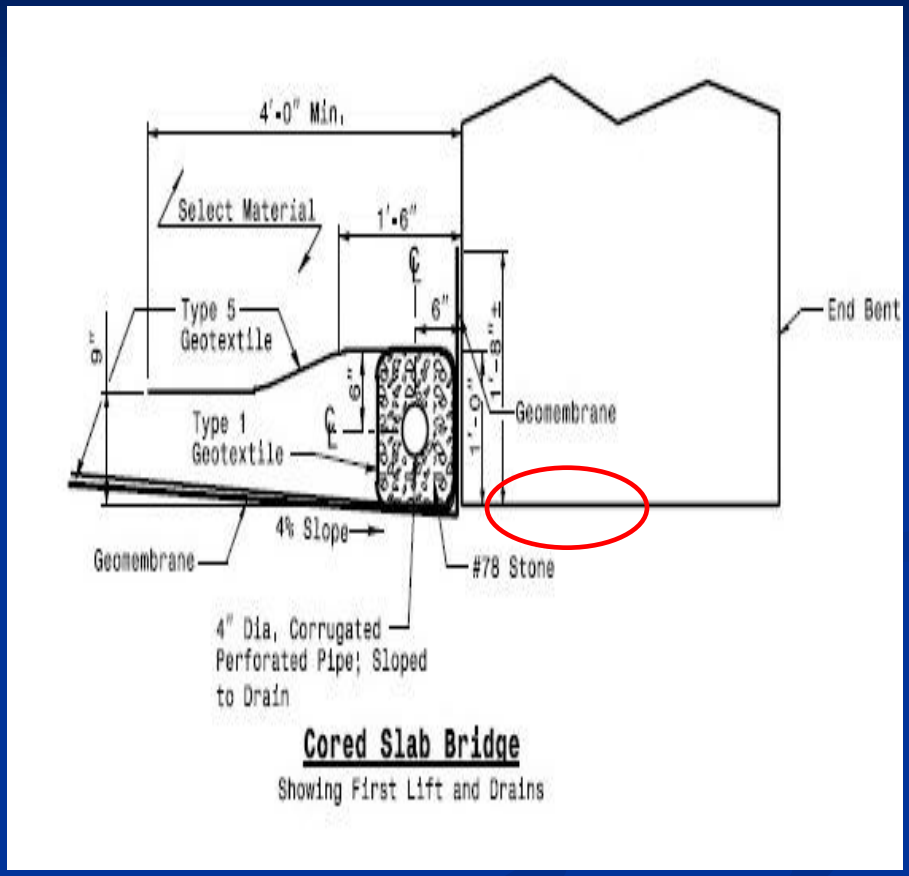
http://data.ntpep.org/Module/GTX/Data.aspx

RBAF – Construction Methods

- Excavation
  - Depth to bottom of cap.
  - 5 foot bottom width on 4 % slope toward cap.
  - Backslope 1 ½:1 or flatter extending 4 feet beyond end of approach slab.

RBAF- Construction Methods

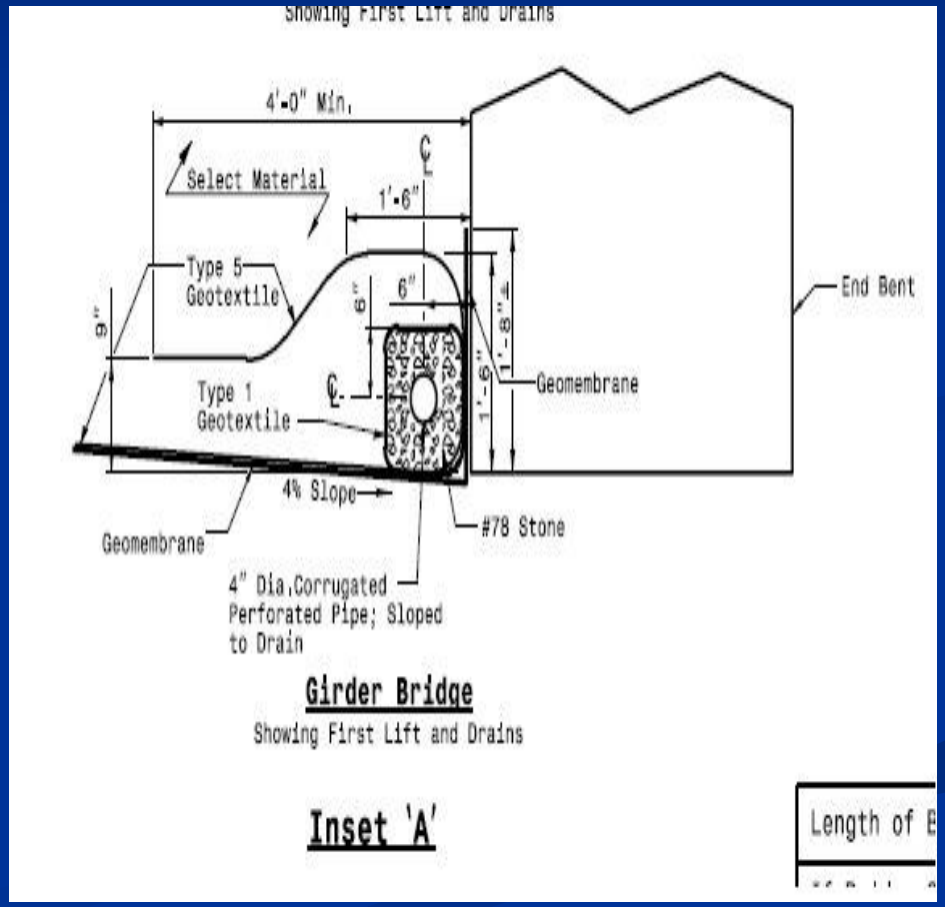
- Install Impermeable Geomembrane
  - Geomembrane necessary to make RBAF work correctly.
  - Attach to the cap and wings using adhesives, tape, etc. to hold in place.
  - Vertical limits as shown in std. drawing.
  - Glue or weld seams to prevent leakage between pieces.



Drain outlet through the impermeable membrane must be sealed to prevent leaking.

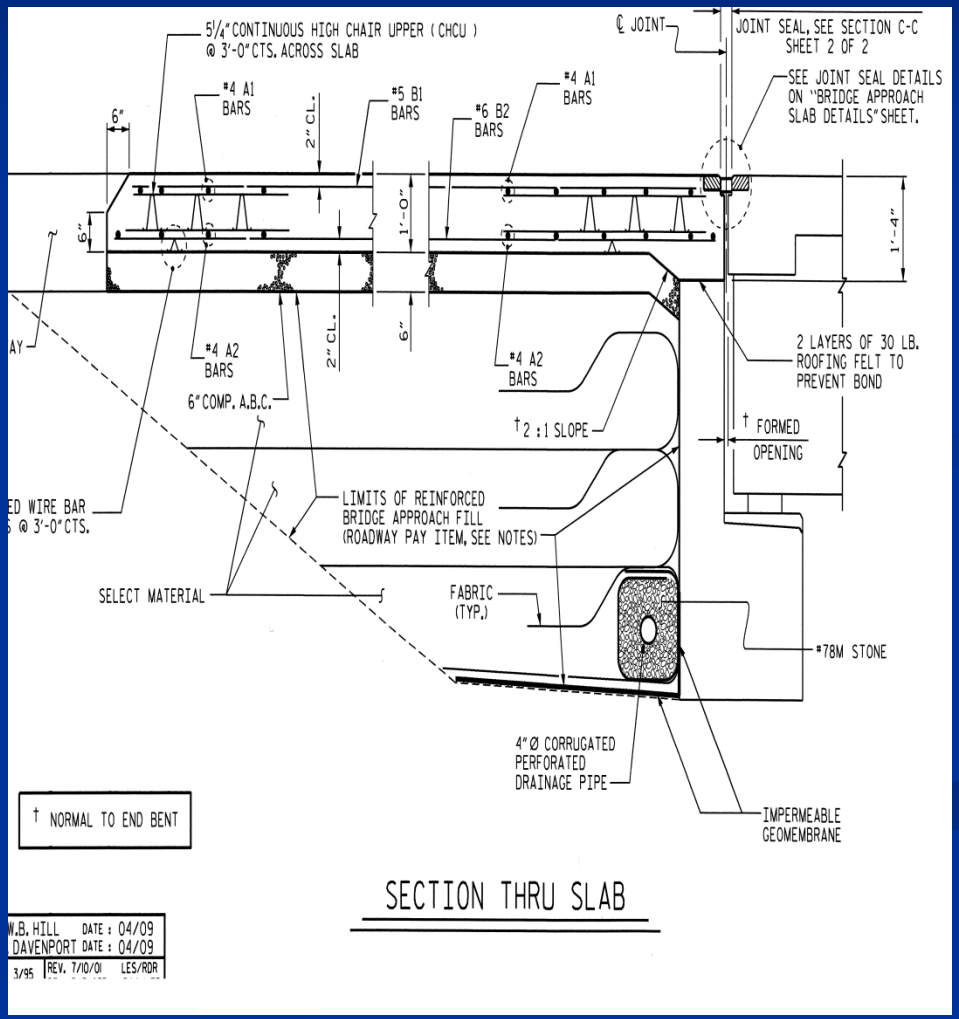
RBAF- Construction Methods

- Drain Installation
  - Place first layer of TYPE 5 geotextile and construct drainage as shown in details.
  - Slope perforated PVC pipe to drain.
  - Pipe and 78M stone wrapped in Type 1 geotextile.
  - Drain outside RBAF must be solid.

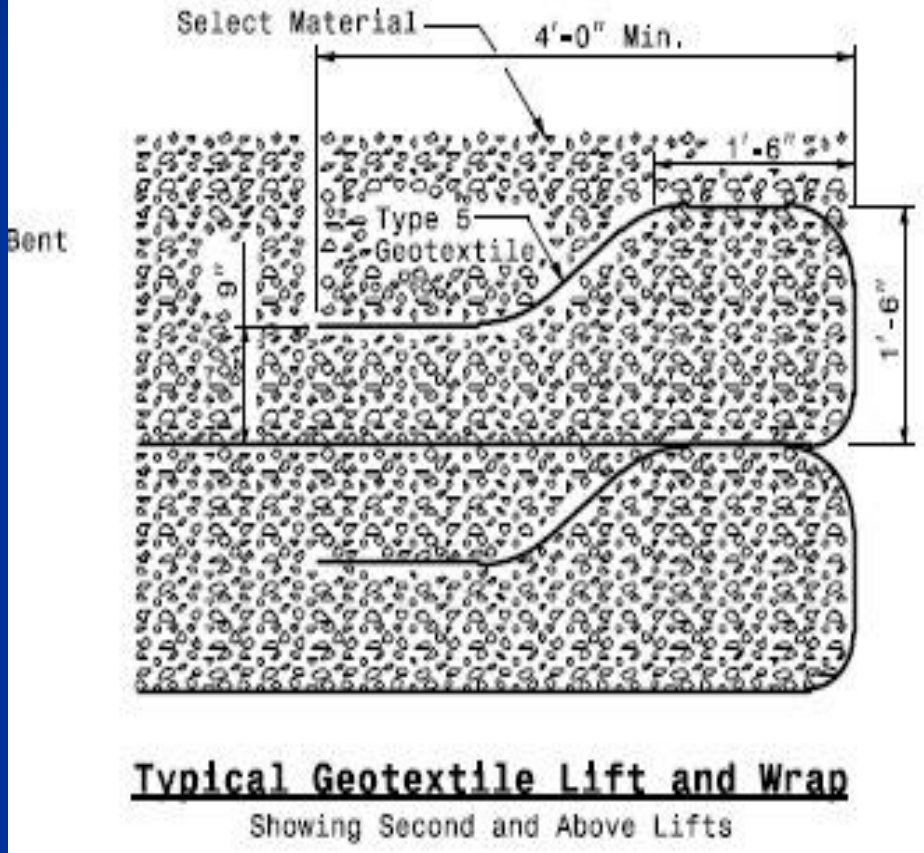


RBAF – Construction Methods

- 1’-6” Type 5 fabric layers
- 4 ft. overlap on top of each layer with 2 ½’ buried in the lift.
- Overlap on 3 sides.
- Overlap adjacent layers 18”.
- Number of layers based on height of the backwall. See Std. Drawings



Std. Drawing Details



Typical Geotextile Lift and Wrap

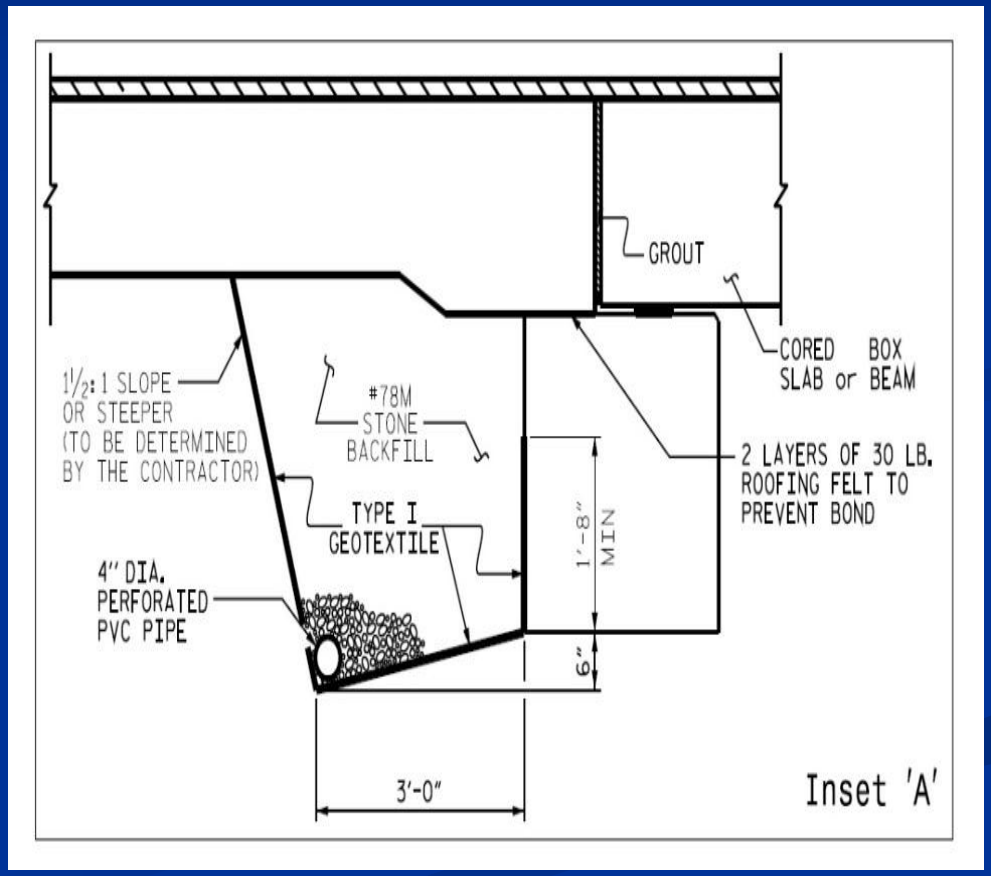
Showing Second and Above Lifts

Inset 'B'

Height of Backwall	Number of Fabric Layers
< 4'-6"	2
4'-6" - 5'-9"	3
5'-10" - 7'-2"	4
7'-3" - 8'-8"	5
8'-9" - 10'-1"	6
10'-2" - 11'-8"	7

Sub-regional Tier Construction Methods

- Excavation
  - Depth to bottom of cap.
  - 3 ft. bottom sloping 6” away from cap.
  - Must be graded to function as a drain.
  - 1 ½: 1or steeper backslope.



Sub-regional Tier Construction Methods

- Place Type 1 fabric on all excavated faces and 1'-8" minimum on cap face and wing walls.
- Place perforated PVC drain in bottom of excavation and lay on grade to drain.
- Backfill with 78M stone.


6 NATIONAL N/O 4" SCH-40 PLUMB-RITE PVC-1120 220 psi @ 73 °F ASTM D-1785 NSF-pw DWV ASTM D-2665 NSF-dwv G NY NATIONAL 1185 12:31 09-29-12
6 NATIONAL N/O 4" SCH-40 PLUMB-RITE PVC-1120 220 psi @ 73 °F ASTM D-1785 NSF-pw DWV ASTM D-2665 NSF-dwv G NY NATIONAL

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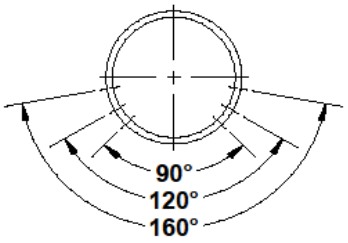

Nominal Pipe Size	Perforation Arrangement	
4"	Hole Size:	3/8"
	Center-to-Center:	3 " +/- 1/4"
	Rows of Holes:	2, 90° +/- 3°
6" – 10"	Hole Size:	3/8"
	Center-to-Center:	3" +/- 1/4"
	Rows of Holes:	4, 2 @ 90°, 2 @ 160° +/- 3°
12"	Hole Size:	3/8"
	Center-to-Center:	3" +/- 1/4"
	Rows of Holes:	6, 2 @ 90°, 2 @ 120°, 2 @ 160° +/- 3°

Note: **NATIONAL** ASTM D-1785 (SCH40/80), ASTM D-2665 (DWV) Pipe is manufactured from a PVC compound with a cell class 12454-B, as defined in ASTM D-1784, and meets the standard specifications of Penn-DOT Publication 408, Section 610.2

Standard pipe length: 20'

10/04