



Rushern L. Baker, III
County Executive

BOX CULVERT Design Review Checklist

Prince George's County
Department of Permitting, Inspections and Enforcement



Haitham A. Hijazi
Director

BOX CULVERT DESIGN REVIEW CHECKLIST AND PROCESS OUTLINE

This checklist serves as a guide for the consultant in the preparation of and for the County review of Box Culvert Plans. Any questions regarding items contained herein should be referred to the Prince George's County Department of Public Works and Transportation (DPW&T) and Department of Permitting, Inspections and Enforcement (DPIE) for clarification. See below **“Points of Contact (DPW&T) and (DPIE)”**. Below are some basic considerations:

- Designation of structural elements must be in accordance with the latest version of the Maryland State Highway Administration (MSHA) Policies and Procedures Manual (PPM) P-93-36(4) and Structural Standards Manuals (SSM), Volumes 1 and 2. Please contact SHA about getting the most recent copy of the relevant PPMs (contact MSHA's Assistant Division Chief, Local Government Bridge Coordinator, Office of Structure Jeff Robert at (410) 545-8327 or Jrobert@sha.state.md.us).
- Adhere to all requirements as described in the Prince George's County DPW&T “Specifications and Standards for Roadways and Bridges” (latest edition), Section I (“Roadway Development Guidelines”), Chapter 3, Part A, Unit 10, (“Bridges and Culverts”).
- Design must to adhere to methodology approved by MSHA for calculation of scour as stated in the Chapter 11 (Evaluating Scour at Bridges) of the “MSHA Manual for Hydrologic and Hydraulic Design” (latest revision) and using the latest MSHA bridge scour program (ABSCOUR) which is available from MSHA (see http://gishydro.eng.umd.edu/sha_soft.htm).
- **For structural design, the latest version of the Load Resistance and Factor Design (LRFD) method must be used.**
- Bridges, culverts, and similar roadway crossings of waterways shall be designed to pass or withstand the 100-year flood event while maintaining a 1-foot clearance between the lowest chord point of the superstructure and the floodwater surface.
- All box culverts, multiple cell pipe culverts, or simple span bridge structures that measure 17 feet or more, in accordance with the provisions of said standard, shall be resized to provide a minimum length of more than 20 feet as measured along the centerline of the roadway.
- Multiple pipe culverts shall be designed such that the clear distance between pipe openings shall be less than half of the size of the smallest inside pipe diameter (measured horizontally).

REVISION 06/13/2017

- **To avoid any interruption in flow, multiple pipe and box culvert configurations may not exceed a 3-cell configuration.**
- Culverts require a minimum horizontal (span) and vertical (rise) opening of 5 feet. Culverts 75 or more feet in length require a rise of 6 feet.
- To prolong the service life of box culvert structures (cast-in-place and precast), the following directions, as modified from the MSHA PPM (latest revision), shall be followed:
 - Mix No. 6 concrete and epoxy-coated reinforcing steel shall be used for the entire box for any depth of fill.
 - If the culvert has less than 3 feet of earth fill over the structure, a concrete reinforcing deck slab with epoxy coated reinforcement shall be provided. Concrete for the deck slab shall be MSHA Mix No. 11 or 12. The top of deck slab (including the sidewalk) shall receive a protective coating (silane penetrant sealer).
 - Provide a minimum of 2-inch clear cover to all reinforcement bars.
 - No openings for storm drain pipes shall be made in the sidewall or top slab of any culvert.
 - The exterior sides and top of all box culverts shall be covered with roll or sheet waterproofing membrane in accordance with SHA Specification 422.03.07.
 - All joints between the culvert units and between the end units and wing walls shall be water tight.
 - The culvert units shall be tightened using tie rods (along the full length of the culvert).
- **Prior the permit approval, load rating analysis per SHA PPM D97-47(4). During construction phase, if there is changes in the site conditions then the load rating analysis will need to be recalculated and resubmitted for approval prior to as-built approval and bond release.**
- All submissions should contain the following plan sheets (named to agree with the below checklist reference)
 - TITLE SHEET
 - GENERAL PLAN AND ELEVATION
 - SEDIMENT AND EROSION CONTROL (Can reference overall project Sediment and Erosion Control Plans)
 - GEOMETRIC PLAN
 - FOUNDATION PLAN (with Geotechnical recommendation and soil boring logs)
 - TYPICAL SECTION PLAN
 - SEQUENCE OF CONSTRUCTION PLAN (not required for new culverts)
- Sample plans and details are available on DPW&T ftp site at:
 - <ftp://ftp2.princegeorgescountymd.gov/>
 - Folder Name: Bridge and Culverts – Permit Review Guidelines
 - User Name: dpwt
 - User password: dpwt
- The Box Culvert plan shall be submitted in five (5) phases **after** the proposed hydraulic study for the bridge opening is completed and approved by DPIE. The Design Engineer may elect to submit the first two phases (i.e., Type Size & Location (TS&L) and Foundation Plans and Scour

Analysis Phase) concurrently. Upon approval of the first two phases, the Design Engineer may elect to submit the Structural and Final Design Plans concurrently.

1. **Type Size & Location (TS&L) Plans Phase**
2. **Foundation Plans and Scour Analysis Phase (with design calculations)**
3. **Structural Plans Phase (with design calculations)**
4. **Final Design Plans Phase**
5. **Shop Drawing Plans Phase (This occurs after approval of final design plans and typically after the permit issuance)**

Upon permit issuance, the permittee shall adhere to the requirements of the “BOX CULVERT CONSTRUCTION PHASE CHECKLIST”

Points of Contact (DPW&T)

Highway and Bridge Design Division
Office of Engineering and Project Management
Prince George's County DPW&T
9400 Peppercorn Place, Suite 310
Largo, Maryland 20774
General Office Phone: 301-883-5642

Erv T. Beckert, PE
Chief

e-mail: etbeckert@co.pg.md.us

Unmesh C. Patel, PE
Project Manager

Email: UCPatel@co.pg.md.us

Jay D. Shah, PE
Project Manager

Email: JDShah@co.pg.md.us

Points of Contact (DPIE)

Site/Road Plan Review Division
Bridge/NPDES Section
Prince George's County DPIE
9400 Peppercorn Place, Suite 230
Largo, Maryland 20774
General Office Phone: 301-636-2060

Tuan Duc, PE
Chief

Email: thduc@co.pg.md.us

The following Design Review Checklist must be filled out and signed by the applicant's Design Engineer with each stage of submission relevant to referenced phases

**NOTE: PLANS SUBMITTED WITHOUT A COMPLETED CHECKLIST MAY BE
RETURNED WITHOUT REVIEW**

Site/Project Name:			
Permit Number:		Today's Date:	
Consultant:		Applicant:	
Phone Number:		Phone Number:	
Email Address:		Email Address:	

Consultant: Please complete the checklist below by indicating the following:
✓ = Complete or checked; X = Not Applicable; O = Outstanding, need to address
Please place the appropriate symbol in the A/E column

PLAN CHECKLIST: BOX CULVERT

Type Size & Location Plans Phase

A/E	DPIE	Item #	Design Checklist Item (TS&L Plans)
			GENERAL
		1	Submit copy of the proposed Hydraulic study with proposed box culvert opening.
		2	Submit approved street grade establishment plan.
		3	Title Block information in accordance with PPM P-79-16(G).
		4	All details are to be drawn to scale. For Office of Structure lead projects, this includes details on highway, maintenance of stream flow, erosion and sediment control, and maintenance of traffic sheets. Details labeled "Scale: None" will not be accepted.
		5	Designation of Structural Elements in accordance with PPM P-93-36 (4).
		6	All views in accordance with PPM P-75-7 (4).
		7	All lettering in accordance with PPM P-76-9 (G).
		8	Title all views and details plan, section, or elevation. If we are titling a plan view of Abutment B, the title should read "PLAN ABUTMENT B". If we are titling a section cut through Abutment B showing reinforcing details the title should read "SECTION A-A - REINFORCING DETAILS".
		9	When cutting sections through a portion of a structure, it is not good drafting procedure to cut the section through another section. All sections should be cut through a plan view or elevation view of the area you wish to detail.
		10	All properties that are adjacent to our limit of disturbance should have a means of clear access to the property after our project is complete. Highway features such as W Beam Traffic Barrier, drainage ditches, etc. that could restrict access shall be designed to allow property owners access onto their property. If access cannot be maintained, the property owner may be entitled to a Right of Way settlement.
			TITLE SHEET
		11	All projects shall have a Structures Location Map in accordance with PPM P-83-24 (G) inserted in the Title Sheet plan.
			GENERAL PLAN AND ELEVATION
			General
		14	General Notes in accordance with PPM P-77-14 (4).
		15	Show a diagram of the proposed vertical curve and list the associated vertical curve data.
			Plan View
		17	Show Base Line of Construction (Line with Stationing) for roadway over and if applicable under the bridge. Orient with stations increasing from left to right. When it occurs that the orientation of the bridge does not match the orientation of the highway plans, then a bold note shall be placed on the plans calling the contractors attention to it. In all cases the labeling (Base Line of Construction and P.G.L. MD 00) of this line on the structure plans must match the highway plans.
		18	Show working line for curved alignments in accordance with PPM P-85-25(G).
		19	Show all PC and PT points on the Base Line and list the associated horizontal curve data.
		20	Show all existing utilities and their disposition (i.e. to be relocated under this contract, etc.). Utility designations and test pits to accurately locate them should be complete prior to submittal of TS&L.
		21	Show all proposed utilities and disposition. Indicate if the utility is to remain in

PLAN CHECKLIST: BOX CULVERT

Type Size & Location Plans Phase

		place or to be relocated. Indicate if the relocation will be done by others or the contractor and when the relocation needs to occur (i.e. 20" Gas main to be relocated others prior to start of construction) If applicable, show location of test pits. Reference location of test pit data in contract documents.
	22	Show existing right-of-way lines and existing easement areas.
	23	Show the proposed/actual right-of-way lines and easement areas. Sufficient right-of-way and/or easement areas must be provided to provide adequate space for maintenance purposes.
	24	Show any pertinent topographic features such as noise barrier walls, mechanically stabilized slopes, box culverts, drainage pipes, etc., including location of footings.
	25	Show all signs and light structures and indicate if these structures are designed as breakaway systems.
	26	Show station equality and an angle at all intersecting Base Lines and working lines.
	27	Show existing and proposed out to out, lane, shoulder, sidewalk and parapet widths tied to the Base Line of Construction or Working Line.
	28	Show a destination arrow and label for each direction of travel. Destinations for the road over the bridge shall be established as the nearest county road intersection. Destinations for the road under the bridge shall be established as the nearest county road intersection. In cases where there is no state route, an appropriate location may be used (i.e. To Baltimore).
	29	Show waterway name and direction of flow arrow for hydraulic structures.
	30	Show all traffic barrier attachments at end posts / head walls.
	31	Show existing structures in long dashed lines.
	32	Show a North Arrow and destination arrow.
	33	Show centerline of culvert intersecting the baseline. Include station and skew angle (to local tangent for curved baselines).
	34	Show length of culvert (out to out of head walls) measured along the centerline of culvert with dimensions tying to the Base Line/working line.
	35	Show the angle each head wall makes with the centerline of culvert.
	36	Label Roadway (MD 147) and stream (Deep Run).
	37	Label wing walls and show angle each makes with the culvert.
	38	Show limits and type of inlet and outlet riprap protection.
	39	Show where Typical Longitudinal Section View is cut.
	40	Show where Typical Section Culvert Barrel is cut.
	41	Show Base Line of Construction (Line with Stationing) for roadway over the culvert. Orient with stations increasing from bottom to top of sheet. In all cases the structure plans must match the highway plans with respect to labeling (Base Line of Construction and P.G.L.) of this line.
		Elevation View
	42	Show the elevation view of the structure as a projection of the General Plan.
	43	Show a datum line and datum elevation.
	44	Show all existing and proposed underground and overhead utilities within project limits and their disposition. Show location of test pit data or provide reference to location of data in Contract documents.
	45	Show any fencing or railing along the parapet.

PLAN CHECKLIST: BOX CULVERT**Type Size & Location Plans Phase**

		46	Show the following for all structures over water: 1. Design storm with elevation (10 year design storm - elevation 100.00) 2. 100 year storm with elevation (100 year storm - elevation 105.00) 3. Normal Water Surface elevation (NWS - elevation 98.00) 4. Waterway Invert elevation (invert - elevation 95.00) 5. Bottom of superstructure elevation at its lowest point 6. The lowest top of crown roadway elevation on the bridge
			Longitudinal Section
		47	Show a section view of the structure as a projection of the General Plan showing invert elevations (top of bottom slab and ultimate invert after siltation) and slope of culvert.
		48	Show location of expansion and contraction joints in culvert barrel.
		49	Show any fencing or railing along the headwalls and wing walls I.
		50	Show any fencing or railing along the headwalls and wing walls.
		51	Show location of traffic barrier.
		52	Show existing and proposed ground lines including proposed slope / channel protection.
		53	Show a datum line.
		54	Show all applicable water surface elevations (design storm, normal water surface).
		55	Show all underground utilities.
		56	Show minimum / maximum depth of fill and grading details over top of the culvert.
			SEDIMENT AND EROSION CONTROL
			General
		57	The terminology (Stage II, Phase 2, etc.) must be consistent for all sheets (Highway and Structure).
		58	Show maintenance of stream flow details (sand bags, dikes, de-watering basins etc.) and sediment and erosion control details for all stages (phases) of construction.
		59	Include a detailed sequence of construction showing the work to be completed for each stage/phase.
		60	Include a list of any Wetland /Buffer restrictions.
		61	Show Limit of Disturbance for each stage.
		62	Draw subsequent elevation views of the existing structure indicating how the stream is to be maintained during the various stages (phases) of construction / removal. Show temporary diversion devices, normal water surface elevation, which portions of the existing structure are to be removed and the proposed construction in the area that the stream is diverted away from.
			TYPICAL SECTION CULVERT BARREL
			Typical Section View
		63	Refer to Standard BC (6.07)-76-38 and BC (6.08)-76-39.
		64	Show size of all cell openings and slab/cell wall thickness/widths.
		65	Show construction joints for staged construction.
		66	Show normal water surface elevation. Show ultimate invert after siltation.
		67	Show approximate existing ground line.

PLAN CHECKLIST: BOX CULVERT**Type Size & Location Plans Phase**

SEQUENCE OF CONSTRUCTION		
General		
	68	When showing the sequence of construction/maintenance of traffic, only the word "Stage" shall be used. Do not use "Phase." The terminology (Stage I, Stage 2, etc.) must be consistent for all sheets (Highway and Structure). List your Stages as 1, 2, 3 etc., no Roman Numerals or A, B, C. If there are some preliminary road stages that must take place prior to beginning the bridge construction, then the bridge work may start in Stage 3. Add a note to the bridge Sequence of Construction sheets that states "No Bridge Work in Stage 1 or Stage 2".
	69	Show existing structure typical with out to out, lane, shoulder, offset from shoulder to slope, sidewalk and parapet / head wall widths tied to the Base Line of Construction or Working Line.
Substructure		
	72	Show the location of any sheeting necessary to maintain the existing or construct the new substructure. Show the location of each construction joint necessary for stage construction tied to the Base Line of Construction or Working Line.
Superstructure		
	73	Draw subsequent stage construction typical directly beneath the existing typical (Base Line of Construction on the existing view lines up with the Base Line of Construction for stage construction typical) which indicate the location of traffic for each stage.
	74	Show proposed lane, shoulder and sidewalk widths tied to the Base Line of Construction or Working Line.
	75	Show location of temporary barrier. Show the proper anchorage configuration for existing and proposed concrete decks. See applicable standards.
	76	Show typical for stage I removal with removal limits tied to the Base Line of Construction or Working Line. Show separate typical for stage I construction with build limits tied to the Base Line of Construction or Working Line. Repeat for each subsequent stage.
	77	Show gap between existing and proposed construction. Identify requirements for mechanical rebar couplers or lap splices.
	78	Show completed typical with out to out, lane, shoulder, sidewalk and parapet widths tied to the Base Line of Construction or Working Line.
HEAD WALLS AND WING WALLS		
Plan View		
	79	Show a plan view of the headwall / wing wall configuration for both the inlet and outlet end of the culvert.
	80	Show all working points from Geometric and Footing Layout.
	81	Show relation of walls to working line.
	82	Show angles between wing wall stems and headwall.
	83	Show a North Arrow and destination arrow.
Elevation View		
	84	Show wing walls and headwall with any aesthetic treatment.
Typical Section View		
	85	Show Typical Wing Wall Section with size of footing and stem shown.

PLAN CHECKLIST: BOX CULVERT**Foundation Plans And Scour Analysis Phase**

A/E	DPIE	Item #	Design Checklist Item(Foundation Plans Review)
			GENERAL
		1	Submit Geotechnical report with foundation recommendation prepared by registered Geotechnical Engineer in state of Maryland. PLEASE NOTE THAT ALL BOTTOMLESS CULVERT STRUCTURES MUST REST ON PILE FOUNDATIONS.
		2	Submit Scour analysis prepared by registered Civil Engineer in state of Maryland.
		3	Title Block information in accordance with PPM P-79-16(G).
		4	All details are to be drawn to scale. For Office of Structure lead projects, this includes details on highway, maintenance of stream flow, erosion and sediment control, and maintenance of traffic sheets. Details labeled "Scale: None" will not be accepted.
		5	Designation of Structural Elements in accordance with PPM P-93-36 (4).
		6	All views in accordance with PPM P-75-7 (4).
		7	All lettering in accordance with PPM P-76-9 (G).
		8	Title all views and details plan, section, or elevation. If we are titling a plan view of Abutment B, the title should read "PLAN ABUTMENT B". If we are titling a section cut through Abutment B showing reinforcing details the title should read "SECTION A-A - REINFORCING DETAILS".
		9	When cutting sections through a portion of a structure, it is not good drafting procedure to cut the section through another section. All sections should be cut through a plan view or elevation view of the area you wish to detail.
		10	All properties that are adjacent to our limit of disturbance should have a means of clear access to the property after our project is complete. Highway features such as W Beam Traffic Barrier, drainage ditches, etc. that could restrict access shall be designed to allow property owners access onto their property. If access cannot be maintained, the property owner may be entitled to a Right of Way settlement.
		11	STRUCTURES LOCATION MAP
		12	All projects with multiple structures shall have a Structures Location Map in accordance with PPM P-83-24 (G).
			GENERAL PLAN AND ELEVATION
			General
		13	General Notes in accordance with PPM P-77-14 (4)
		14	Show a diagram of the proposed vertical curve and list the associated vertical curve data
		15	Plan View
		16	Show Base Line of Construction (Line with Stationing) for roadway over and if applicable under the bridge. Orient with stations increasing from left to right. When it occurs that the orientation of the bridge does not match the orientation of the highway plans, then a bold note shall be placed on the plans calling the contractors attention to it. In all cases the labeling (Base Line of Construction and P.G.L. MD 00) of this line on the structure plans must match the highway plans
		17	Show working line for curved alignments in accordance with PPM P-85-25(G).
		18	Show all PC and PT points on the Base Line and list the associated horizontal curve data.

PLAN CHECKLIST: BOX CULVERT**Foundation Plans And Scour Analysis Phase**

		19	Show all existing utilities and their disposition (i.e. to be relocated under this contract, etc.). Utility designations and test pits to accurately locate them should be complete prior to submittal of TS&L
		20	Show all proposed utilities and disposition. Indicate if the utility is to remain in place or to be relocated. Indicate if the relocation will be done by others or the contractor and when the relocation needs to occur (i.e. 20" Gas main to be relocated others prior to start of construction) If applicable, show location of test pits. Reference location of test pit data in contract documents
		21	Show the proposed/actual right-of-way lines and existing easement areas.
		22	Show any pertinent topographic features such as noise barrier walls, mechanically stabilized slopes, box culverts, drainage pipes, etc., including location of footings.
		23	Show all signs and light structures and indicate if these structures are designed as breakaway systems
		24	Show station equality and an angle at all intersecting Base Lines and working lines.
		25	Show existing and proposed out to out, lane, shoulder, sidewalk and parapet widths tied to the Base Line of Construction or Working Line.
		26	Show a destination arrow and label for each direction of travel. Destinations for the road over the bridge shall be established as the nearest county road intersection. Destinations for the road under the bridge shall be established as the nearest county road intersection. In cases where there is no state route, an appropriate location may be used (i.e. To Baltimore).
		27	Show waterway name and direction of flow arrow for hydraulic structures.
		28	Show all traffic barrier attachments at end posts / head walls.
		29	Show existing structures in long dashed lines
		30	Show a North Arrow and destination arrow
		31	Show centerline of culvert intersecting the baseline. Include station and skew angle (to local tangent for curved baselines).
		32	Show length of culvert (out to out of head walls) measured along the centerline of culvert with dimensions tying to the Base Line / working line
		33	Show the angle each head wall makes with the centerline of culvert
		34	Label Roadway (MD 147) and stream (Deep Run)
		35	Label wing walls and show angle each makes with the culvert.
		36	Show limits and type of inlet and outlet riprap protection
		37	Show where Typical Longitudinal Section View is cut.
		38	Show where Typical Section Culvert Barrel is cut.
		39	Show Base Line of Construction (Line with Stationing) for roadway over the culvert. Orient with stations increasing from bottom to top of sheet. In all cases the structure plans must match the highway plans with respect to labeling (Base Line of Construction and P.G.L.) of this line.
			Elevation View
		40	Show the elevation view of the structure as a projection of the General Plan
		41	Show a datum line and datum elevation
		42	Show all existing and proposed underground and overhead utilities within project limits and their disposition. Show location of test pit data or provide reference to location of data in Contract documents.
		43	Show any fencing or railing along the parapet.

PLAN CHECKLIST: BOX CULVERT**Foundation Plans And Scour Analysis Phase**

		44	Show the following for all structures over water: 1. Design storm with elevation (10 year design storm - elevation 100.00) 2. 100 year storm with elevation (100 year storm - elevation 105.00) 3. Normal Water Surface elevation (NWS - elevation 98.00) 4. Waterway Invert elevation (invert - elevation 95.00) 5. Bottom of superstructure elevation at its lowest point 6. The lowest top of crown roadway elevation on the bridge
			Longitudinal Section
		45	Show a section view of the structure as a projection of the General Plan showing invert elevations (top of bottom slab and ultimate invert after siltation) and slope of culvert.
		46	Show location of expansion and contraction joints in culvert barrel
		47	Show any fencing or railing along the headwalls and wing walls.
		48	Show any fencing or railing along the headwalls and wing walls.
		49	Show location of traffic barrier
		50	Show existing and proposed ground lines including proposed slope / channel protection.
		51	Show a datum line
		52	Show all applicable water surface elevations (design storm, normal water surface).
		53	Show all underground utilities
		54	Show minimum / maximum depth of fill and grading details over top of the culvert
			SEDIMENT AND EROSION CONTROL
			General
		55	The terminology (Stage II, Phase 2, etc.) must be consistent for all sheets (Highway and Structure).
		56	Show maintenance of stream flow details (sand bags, dikes, de-watering basins etc.) and sediment and erosion control details for all stages (phases) of construction.
		57	Include a detailed sequence of construction showing the work to be completed for each stage/phase.
		58	Include a list of any Wetland /Buffer restrictions
		59	Show Limit of Disturbance for each stage
		60	Draw subsequent elevation views of the existing structure indicating how the stream is to be maintained during the various stages (phases) of construction / removal. Show temporary diversion devices, normal water surface elevation, which portions of the existing structure are to be removed and the proposed construction in the area that the stream is diverted away from.
			TYPICAL SECTION CULVERT BARREL
			Typical Section View
		61	Refer to Standard BC (6.07)-76-38 and BC (6.08)-76-39.
		62	Show size of all cell openings and slab/cell wall thickness/widths
		63	Show construction joints for staged construction
		64	Show normal water surface elevation. Show ultimate invert after siltation
		65	Show approximate existing ground line

PLAN CHECKLIST: BOX CULVERT**Foundation Plans And Scour Analysis Phase**

		66	Show any stone required to replace unsuitable material beneath culvert barrel
			SEQUENCE OF CONSTRUCTION
			General
		67	When showing the sequence of construction/maintenance of traffic, only the word "Stage" shall be used. Do not use "Phase." The terminology (Stage I, Stage 2, etc.) must be consistent for all sheets (Highway and Structure). List your Stages as 1, 2, 3 etc., no Roman Numerals or A, B, C. If there are some preliminary road stages that must take place prior to beginning the bridge construction, then the bridge work may start in Stage 3. Add a note to the bridge Sequence of Construction sheets that states "No Bridge Work in Stage 1 or Stage 2".
		68	Show existing structure typical with out to out, lane, shoulder, offset from shoulder to slope, sidewalk and parapet / head wall widths tied to the Base Line of Construction or Working Line
			Substructure
		69	Show the location of any sheeting necessary to maintain the existing or construct the new substructure. Show the location of each construction joint necessary for stage construction tied to the Base Line of Construction or Working Line.
			Superstructure
		70	Show proposed lane, shoulder and sidewalk widths tied to the Base Line of Construction or Working Line.
		71	Show location of temporary barrier. Show the proper anchorage configuration for existing and proposed concrete decks. See applicable standards
		72	Show typical for stage I removal with removal limits tied to the Base Line of Construction or Working Line. Show separate typical for stage I construction with build limits tied to the Base Line of Construction or Working Line. Repeat for each subsequent stage
		73	Show gap between existing and proposed construction. Identify requirements for mechanical rebar couplers or lap splices.
		74	Show completed typical with out to out, lane, shoulder, sidewalk and parapet widths tied to the Base Line of Construction or Working Line.
			HEAD WALLS AND WING WALLS
			Plan View
		75	Show a plan view of the headwall / wing wall configuration for both the inlet and outlet end of the culvert.
		76	Show all working points from Geometric and Footing Layout.
		77	Show relation of walls to working line
		78	Show angles between wing wall stems and headwall.
		79	Show a North Arrow and destination arrow
			Elevation View
		80	Show wing walls and headwall with any aesthetic treatment.
			Typical Section View

PLAN CHECKLIST: BOX CULVERT

Foundation Plans And Scour Analysis Phase

		81	Show Typical Wing Wall Section with size of footing and stem shown.
			BORING AND DRIVE TESTS
			General
		82	Refer to PPM P-75-3 (4).
		83	Submit Geotechnical Report with Foundation Recommendations

PLAN CHECKLIST: BOX CULVERT

Structural Plans Phase

A/E	DPIE	Item #	Design Checklist Item(Structural Plans Review)
		1	Title Block information in accordance with PPM P-79-16(G)
		2	All details are to be drawn to scale. For Office of Structure lead projects, this includes details on highway, maintenance of stream flow, erosion and sediment control, and maintenance of traffic sheets. Details labeled "Scale: None" will not be accepted
		3	Designation of Structural Elements in accordance with PPM P-93-36 (4).
		4	All views in accordance with PPM P-75-7 (4).
		5	All lettering in accordance with PPM P-76-9 (G).
		6	Title all views and details plan, section, or elevation. If we are titling a plan view of Abutment B, the title should read “PLAN ABUTMENT B”. If we are titling a section cut through Abutment B showing reinforcing details the title should read “SECTION A-A - REINFORCING DETAILS”.
		7	When cutting sections through a portion of a structure, it is not good drafting procedure to cut the section through another section. All sections should be cut through a plan view or elevation view of the area you wish to detail.
		8	All properties that are adjacent to our limit of disturbance should have a means of clear access to the property after our project is complete. Highway features such as W Beam Traffic Barrier, drainage ditches, etc. that could restrict access shall be designed to allow property owners access onto their property. If access cannot be maintained, the property owner may be entitled to a Right of Way settlement.
			STRUCTURES LOCATION MAP
		9	All projects with multiple structures shall have a Structures Location Map in accordance with PPM P-83-24 (G).
			Provide the structure number and the year built sign location on the appropriate location as per SHA standard detail S1-101 thru S1-201 series (go to the SHA Standard Details web site (click this link)). The only deviation from the referenced SHA details is that the the structure number shall be engraved in concrete and not stenciled with paint. The Structure Number should be requested by the applicant from DPIE’s Bridge and NPDES Section.
			GENERAL PLAN AND ELEVATION
			General
		10	General Notes in accordance with PPM P-77-14 (4)
		11	Show a diagram of the proposed vertical curve and list the associated vertical curve data
		12	Show load rating tables as per SHA PPM D97-47(4)
			Plan View
		13	Show Base Line of Construction (Line with Stationing) for roadway over and if applicable under the bridge. Orient with stations increasing from left to right. When it occurs that the orientation of the bridge does not match the orientation of the highway plans, then a bold note shall be placed on the plans calling the contractors attention to it. In all cases the labeling (Base Line of Construction and P.G.L. MD 00) of this line on the structure plans must match the highway plans
		14	Show working line for curved alignments in accordance with PPM P-85-25(G).
		15	Show all PC and PT points on the Base Line and list the associated horizontal curve data.

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PLAN CHECKLIST: BOX CULVERT

Structural Plans Phase

		16	Show all existing utilities and their disposition (i.e. to be relocated under this contract, etc.). Utility designations and test pits to accurately locate them should be complete prior to submittal of TS&L
		17	Show all proposed utilities and disposition. Indicate if the utility is to remain in place or to be relocated. Indicate if the relocation will be done by others or the contractor and when the relocation needs to occur (i.e. 20" Gas main to be relocated others prior to start of construction) If applicable, show location of test pits. Reference location of test pit data in contract documents
		18	Show existing right-of-way lines and existing easement areas
			Show the proposed/actual right-of-way lines and easement areas. Note areas that will not be clear by NTP.
		19	Show any pertinent topographic features such as noise barrier walls, mechanically stabilized slopes, box culverts, drainage pipes, etc., including location of footings.
		20	Show all signs and light structures and indicate if these structures are designed as breakaway systems
		21	Show station equality and an angle at all intersecting Base Lines and working lines.
		22	Show existing and proposed out to out, lane, shoulder, sidewalk and parapet widths tied to the Base Line of Construction or Working Line.
		23	Show a destination arrow and label for each direction of travel. Destinations for the road over the bridge shall be established as the nearest county road intersection. Destinations for the road under the bridge shall be established as the nearest county road intersection. In cases where there is no state route, an appropriate location may be used (i.e. To Baltimore).
		24	Show waterway name and direction of flow arrow for hydraulic structures.
		25	Show all traffic barrier attachments at end posts / head walls.
		26	Show existing structures in long dashed lines
		27	Show a North Arrow and destination arrow
		28	Show centerline of culvert intersecting the baseline. Include station and skew angle (to local tangent for curved baselines).
		29	Show length of culvert (out to out of head walls) measured along the centerline of culvert with dimensions tying to the Base Line / working line
		30	Show the angle each head wall makes with the centerline of culvert
		31	Label Roadway (MD 147) and stream (Deep Run)
		32	Label wing walls and show angle each makes with the culvert.
		33	Show limits and type of inlet and outlet riprap protection
		34	Show where Typical Longitudinal Section View is cut.
		35	Show where Typical Section Culvert Barrel is cut.
		36	Show Base Line of Construction (Line with Stationing) for roadway over the culvert. Orient with stations increasing from bottom to top of sheet. In all cases the structure plans must match the highway plans with respect to labeling (Base Line of Construction and P.G.L.) of this line.
		37	Elevation View
		38	Show the elevation view of the structure as a projection of the General Plan
		39	Show a datum line and datum elevation
		40	Show all existing and proposed underground and overhead utilities within project limits and their disposition. Show location of test pit data or provide reference to location of data in Contract documents.

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PLAN CHECKLIST: BOX CULVERT**Structural Plans Phase**

		41	Show any fencing or railing along the parapet.
		42	Show the following for all structures over water: 1. Design storm with elevation (10 year design storm - elevation 100.00) 2. 100 year storm with elevation (100 year storm - elevation 105.00) 3. Normal Water Surface elevation (NWS - elevation 98.00) 4. Waterway Invert elevation (invert - elevation 95.00) 5. Bottom of superstructure elevation at its lowest point 6. the lowest top of crown roadway elevation on the bridge
			Longitudinal Section
		43	Show a section view of the structure as a projection of the General Plan showing invert elevations (top of bottom slab and ultimate invert after siltation) and slope of culvert.
		44	Show location of expansion and contraction joints in culvert barrel
		45	Show any fencing or railing along the headwalls and wing walls l.
		46	Show any fencing or railing along the headwalls and wing walls.
		47	Show location of traffic barrier
		48	Show existing and proposed ground lines including proposed slope / channel protection.
		49	Show a datum line
		50	Show all applicable water surface elevations (design storm, normal water surface).
		51	Show all underground utilities.
		52	Show minimum / maximum depth of fill and grading details over top of the culvert
		53	Address limits where precast sections will be acceptable.
			GEOMETRIC AND FOOTING LAYOUT
		54	Prepare sheet in accordance with PPM P-86-28(G).
		55	Show location of construction joints for staged construction Show location construction joints required for maintenance of traffic and maintenance of stream flow.
		56	This layout should reference the working line only. A small exaggerated view may be included on this sheet to show the relationship between the baseline and working line. All piers and abutments shall be dimensioned to form a closed traverse around the footing. All working points shall be listed in a table with coordinate data provided.
		57	Show all pertinent horizontal curve data.
			SEDIMENT AND EROSION CONTROL
			General
		58	
		59	The terminology (Stage II, Phase 2, etc.) must be consistent for all sheets (Highway and Structure).
		60	Show maintenance of stream flow details (sand bags, dikes, de-watering basins etc.) and sediment and erosion control details for all stages (phases) of construction.
		61	Include a detailed sequence of construction showing the work to be completed for each stage/phase.
		62	Include a list of any Wetland /Buffer restrictions
		63	Show Limit of Disturbance for each stage

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PLAN CHECKLIST: BOX CULVERT

Structural Plans Phase

		64	Draw subsequent elevation views of the existing structure indicating how the stream is to be maintained during the various stages (phases) of construction / removal. Show temporary diversion devices, normal water surface elevation, which portions of the existing structure are to be removed and the proposed construction in the area that the stream is diverted away from.
TYPICAL SECTION CULVERT BARREL			
		65	Typical Section View
		66	Refer to Standard BC (6.07)-76-38 and BC (6.08)-76-39.
		67	Show size of all cell openings and slab/cell wall thickness/widths
		68	Show construction joints for staged construction
		69	Show normal water surface elevation. Show ultimate invert after siltation
		70	Label size and spacing of all rebar. Indicate which bars are epoxy coated.
		71	Show approximate existing ground line
		72	Show any stone required to replace unsuitable material beneath culvert barrel.
		73	Show any stone required to replace unsuitable material beneath culvert barrel
		74	Show lap lengths of all rebar splices. Show embedment and hook lengths for all rebar. Show clear cover to bars at face of concrete.
		75	Show 2 plies waterproofing membrane on earth sides of all construction joints with air on the other.
		76	Show waterproofing membrane on earth side of all sides (Top and Both Sides)
		77	Show Post tensioning bar details for connecting concrete box unit(s)
		78	Show water proofing joint details for the concrete box joints.

SEQUENCE OF CONSTRUCTION			
General			
		79	When showing the sequence of construction/maintenance of traffic, only the word "Stage" shall be used. Do not use "Phase." The terminology (Stage I, Stage 2, etc.) must be consistent for all sheets (Highway and Structure). List your Stages as 1, 2, 3 etc., no Roman Numerals or A, B, C. If there are some preliminary road stages that must take place prior to beginning the bridge construction, then the bridge work may start in Stage 3. Add a note to the bridge Sequence of Construction sheets that states "No Bridge Work in Stage 1 or Stage 2".
		80	Show existing structure typical with out to out, lane, shoulder, offset from shoulder to slope, sidewalk and parapet / head wall widths tied to the Base Line of Construction or Working Line
Substructure			
		81	Show the location of any sheeting necessary to maintain the existing or construct the new substructure. Show the location of each construction joint necessary for stage construction tied to the Base Line of Construction or Working Line.
Superstructure			
		82	Show proposed lane, shoulder and sidewalk widths tied to the Base Line of Construction or Working Line.

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PLAN CHECKLIST: BOX CULVERT**Structural Plans Phase**

		83	Show location of temporary barrier. Show the proper anchorage configuration for existing and proposed concrete decks. See applicable standards
		84	Show typical for stage I removal with removal limits tied to the Base Line of Construction or Working Line. Show separate typical for stage I construction with build limits tied to the Base Line of Construction or Working Line. Repeat for each subsequent stage
		85	Show gap between existing and proposed construction. Identify requirements for mechanical rebar couplers or lap splices.
		86	Show completed typical with out to out, lane, shoulder, sidewalk and parapet widths tied to the Base Line of Construction or Working Line.
			HEAD WALLS AND WING WALLS
			Plan View
		87	Show a plan view of the headwall / wing wall configuration for both the inlet and outlet end of the culvert.
		88	Show all working points from Geometric and Footing Layout.
		89	Show relation of walls to working line
		90	Show angles between wing wall stems and headwall.
		91	Show location of expansion / contraction joints (Refer to Standard BC (6.04) 75-10 and BC (6.06) 76-37)
		92	If proposed work is an extension to an existing culvert then show all pertinent connection details to the existing culvert including removal of portions of the culvert.
		93	Show layout of footing reinforcing steel in wing wall and how it ties into the wall of the box culvert barrel. Refer to Standard BC (6.09) 89-200. Label size and spacing of all rebar.
		94	Show a North Arrow and destination arrow
			Elevation View
		95	Show an elevation view of the headwall / wing wall configuration for both the inlet and outlet end of the culvert. This view should show how details from the two wings tie into the headwall (e.g. footings, fencing, etc.).
		96	Show wing walls and headwall with any aesthetic treatment.
		97	Show elevation of bottom and top of footing (bottom of wing wall footing should match bottom of the wall elevation at inlet / outlet end
		98	Show elevation of ends and break points along top of wing wall stem and along top of culvert headwall.
		99	Show where Typical Section is cut.
		100	Show drainage system behind wing wall stem.
		101	If proposed work is an extension to an existing culvert then show all pertinent connection details to the existing culvert including removal of portions of the culvert.
		102	Show any fencing or railing on top of the headwall / wing wall.
		103	Show location of expansion and contraction joints
		104	Show limits of slope and channel protection
		105	Show existing and proposed ground lines.
			Typical Section View

PLAN CHECKLIST: BOX CULVERT**Structural Plans Phase**

	106	Show Typical Wing Wall Section with size of footing and stem shown.
	107	Refer to PPM P-77-13(3) and BR-SB (0.01)-80-101
	108	Label size and spacing of all rebar. Refer to PPM P-89-32 (4) for size of longitudinal rebar in wing wall stem and vertical bars in the front face of wing wall. Indicate which bars is to be epoxy coated.
	109	Show any fencing or railing on top of the Headwall / wing wall
	110	Provide a stepped key at the stem to footing connection. Key shall be 6" high by ½ the width of the stem
	111	Show any sub foundation concrete required to replace unsuitable material beneath culvert wing walls
	112	Show lap lengths of all rebar splices. Show embedment and hook lengths for all rebar. Show clear cover to bars at face of concrete
	113	Show 2 ply waterproofing membrane on earth side of all construction joints with air on the other
		Details
	114	Show orientation of main rebar in box culvert slab (is it parallel to headwall or normal to culvert side walls). If normal to culvert side walls and the headwall is acting as an edge beam to carry the load from partial rears, then show details of headwall reinforcing
		BORING AND DRIVE TESTS
		General
	115	Refer to PPM P-75-3 (4).
	116	Provide the boring location plan, boring log chart with bottom of foundation and bottom of bedding if required. Also provide the Foundation recommendations with the brief existing foundation material condition.
	117	Submit Geotechnical Report with Foundation Recommendations
		STANDARDS
	118	Refer to the Departments Specification & standards for Roadways & bridges and PPM P-75-5(4)
		DESIGN CALCULATION
	119	Submit Box Culvert Structural design calculation using the Load Resistance and Factor Design (LRFD) method.
	120	Submit Calculation for Wingwall, Headwall, Retaining Wall and footing.
	121	Submit Rating Analysis in accordance with PPM-D-97-47(4)
	122	Submit approved plan and calculation of flood plain study by DPIE along with drainage plan
	123	Submit approved stability calculation & plan by DPIE for high embankment on culvert approaches.
	124	Submit approved settlement plate requirement with detail for monitoring the settlement by DPIE for high embankment on culvert approaches.

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**NOTE: COMPLIANCE WITH ALL ABOVE CHECKLIST
REQUIREMENTS IS REQUIRED FOR FINAL DESIGN PLAN
PHASE AND AS-BUILT PLAN PHASE**