

DESIGN MEMORANDUM NO. 4-81

TO: General Managers
Active Consultants
All Design Engineers

FROM: L. S. Blevins *LSB*
Director
Division of Design

DATE: April 13, 1981

SUBJECT: Drainage Design Summary Sheet
Form TD 61-100 (1 of 2) (2 of 2)
Revised 1-81

The information presented in the drainage folders should allow for a review of the design process used to size a drainage structure. This review may be of a Preliminary Drainage Folder to check compliance with drainage design standards. An Advance Situation Folder is reviewed to check compliance with the Drainage Inspection Report and to determine C.O.E. Permit requirements. The Final Folder then becomes a record document and must contain information for all drainage structures for a project. This is a legal document and should depict the design standards used and document fully any variations from these standards.

Structure sizes may change during the design phase due to conceptual changes of the highway. Form TD 61-100, as revised 1-81, contains a format which allows the necessary reviews of the design process and allows modification of the structures during the design process, if needed. Form TD 61-101 is voided. Page 2 of 2 contains material from that form.

The format for this form is listed below and the significant changes in each portion is noted:

Form Heading

The pertinent change is the listing of the inlet and outlet treatment which will allow the specification of the type of drop box inlet, type wingwalls, or the type of bridge. Skews should be kept to multiples of 15° whenever practical and 5° increments as a minimum, unless rigid controls such as buildings, rock formations or fixed inlet-outlet channels are present.

Open Channel Summary

This section should depict the Normal Water Surface (NWS) and velocity of flow for the Design, Basic, and Flood-of-Record at

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a point one bridge length or one culvert width upstream of the structure. The effect of the existing structure shall be shown by depicting two sets of elevations and velocities. These numbers are important for determining the adequacy of the existing opening and the effect of leaving the existing structure in place. The other information (OHW, etc.) facilitates the review of the design.

Structure Summary

This section contains the flood elevation information for the structure selected and the physical requirements for the structure.

Design Control Summary

Show control elevations, etc. as before.

Highwater Data

As before.

Discharge Summary

Calculate at least two methods for comparison.

Existing Structure

This is a condensed version of the outdated form, but the same information is required.

Bottom Portion of Page 2 of 2

The form TD 61-101 has been condensed and incorporated into this form. This section shall be used for culverts and detour structures when required.

Attached is an example of the TD 61-100 completed for a bridge in Nelson County. The information pertinent to a bridge is included and the portions of the form designated for culverts are crossed out. This form shall be used for all Preliminary Folders submitted after April 30, 1981. Any questions pertaining to the use of this form shall be addressed to the Drainage Section, Division of Design.

This memo becomes void when its contents are placed in the Manual of Instruction for Drainage Design.

LSB:CSR:jc

Attachment

County	Nelson	Station	106 + 83	Item No.	4-152.0	M.P.	
U.P.N.	FSP 090 31E 26-27 4 D	Federal No.	BRF 1501 10	Class Road	RC Major		
Road	Bardstown - Louisville Road	Comp. By	JW & A	Date	11/14/79		
Recommendation	50'-50'-50' Bridge			Skew	0°		
End Treatment	Inter	Spill - thru	Outlet	Rdwy. Gr.	495.77		

OPEN CHANNEL SUMMARY

Drainage Area	20.9 (mi. ²)	Stream	East Fork of Cox Creek				
	50 Yr. (Design Flood)	100 Yr. (Basic Flood)	200+ Yr. (Flood of Record)				
Discharge (cfs.)	6,879	7,912	9,500				
Headwater Depth	486.4★	486.1★★	487.0★	486.6★★	487.9★	487.4★★	
Velocity	9.4★	8.5★★	9.9★	8.7★★			
Q.H.W.	485	Streambed Material	Rock outcropping w/ gravel		Drift	Light	

★ w/ Existing Bridge
★★ NWS

STRUCTURE SUMMARY

Inlet Elev.	_____	Outlet Elev.	_____	Design Slope	0.005 (1/1)	Fill Ht.	17'	
Item	Design Flood	Basic Flood	Flood of Record	Acid Data for Pipes				
Discharge (cfs.)	6879	7912	9500	pH	Date	Resistivity	Date	
H.W. with Conc. Structure (ft.)	486.4	487.0	487.9	Acid Drainage Potential				
H.W. with Metal Structure (ft.)	—	—	—					
H.W. with Drop Box Inlet (ft.)	—	—	—					
100-yr. Outlet Vel. or Mean Vel. (Conc.)	9.9	100-yr. Outlet Vel. (Metal)	—	Recommended Alternate Pipe				
Volume of Slope Protection	CLASS III 114 Tbx	Depth/Elev.	2' / 490					
Volume	—	Original Length of Channel	—					
Channel Change Exc.	Inlet	_____	Outlet	_____	Total	_____	Fill Old Channel	_____
Bridge Water Treatment	ⓐ Sta. 107 + 59 Y=0.25' SP=4.7'-Use Bridge End Drainage Rt. 107 + 70 (±)							

DESIGN CONTROL SUMMARY

Existing 40'-40'-40' Bridge performs well hydraulically.

Match Existing with proposed.

One Story residence 300' US Elev. 488'

HIGHWATER DATA

(Obtain 3 witnesses to Highwater when possible)

Elevation	1. 489.42	2. 487.6	3. 486.41
Date	9-14-79	9-14-79	9-14-79
Location	250' US of U.S. 31E	100' DS of U.S. 31E	200' DS of US 31E
Source	Owner	Mr. & Mrs. Hauck	Ruth Hays
Years Residing	(?)	40	75
Descr. Highwater Mark	mark on bottle gas tank	Elev. on telephone pole	1 st Floor Elevation
Back or Head Water ?	Head	Head	Head

SUBMITTED: *John S. Powers*
CHIEF DRAINAGE ENGINEER
APPROVED: *[Signature]*
ASST. DIRECTOR DIVISION OF DESIGN

EFFECTIVE DATE _____ TITLE _____

DESIGN SUMMARY SHEET
TD 61-100 (1 of 2)

KENTUCKY
BUREAU OF
HIGHWAYS





TD 61-100 (1 of 2)
Rev. 1-8'

DISCHARGE SUMMARY

RATIONAL DISCHARGE, Q = CIA					"FLOODS IN KENTUCKY", 1976			
Length	42,000	Height/DH	302	T _c	189	Geographic Area	6	Area Factor R = 1.417
Zone of Influence		Louisville			Drainage Area (mi ²)		20.9	
$Q_{50} = \frac{0.21}{(c)} \times \frac{.9}{(l)} \times \frac{13400}{(A)} = 2533 \text{ (cfs)}$					From Exhibit No. 2-511:			-USE-
$Q_{100} = \frac{0.21}{(c)} \times \frac{1.0}{(l)} \times \frac{13400}{(A)} = 2814 \text{ (cfs)}$					Q ₈₀	= 638 x (20.9) ^{.633} x (1.417) ^{1.040}	= 6879	cfs
FHWA Method					R = 170			
$\hat{q}_{10} = \frac{1111.47}{A} R^{\frac{0.67899}{R}} \text{ DH}^{\frac{-0.76204}{R}} = \frac{0.58914}{DH} = 5054 \text{ cfs.}$					Q ₅₀ = 1.46 $\hat{q}_{10}^{\frac{1.023}{1.46}}$ = 8978 cfs.			
					Q ₁₀₀ = 1.64 $\hat{q}_{10}^{\frac{1.029}{1.64}}$ = 10,614 cfs.			

EXISTING STRUCTURE (S)

Culvert or Bridge Location	existing crossing			
Type and Geometrics	3-40' Concrete Cast in place deck grider			
Opening Below Bottom of Beams (ft ²)	1347			
Opening Below Highwater (ft ²)	1158			
Av. Sect. Area of Appr. Overflow (ft ²)	N/A			
Performance	Good			

Wingwall Angles for Box Culverts & Arch Culverts				
Location	1	2	3	4
Required Angle				
Standard Angle = 30°				

DESIGN CALCULATIONS

Culvert Description							
Q							
Headwater Computation	Inlet Cont.	HW/D					
		HW					
	Outlet Control HW = HW = H + h _o + Outlet Elev.	K _e					
		H					
		d _c					
		$\frac{d+D}{2}$					
		TW					
		h _o					
		HW					
	Controlling HW						
Outlet Velocity							
Cost							