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APPENDIX DR-01

Form LD-35
(Reference Document)

State of Ohio
Department of Transportation
Jolene M. Molitoris, Director

Innerbelt Bridge
Construction Contract Group 1 (CCG1)

Revision Date: December 10, 2009

FORM LD-35

GENERAL PROJECT INFORMATION

County Route Section

Attach Typical Section)

AFFECTED ROADWAYS:	Route	Average Daily Traffic	Rural / Urban
	INTERSTATE I-90		Urban
ARTERIALS AND COLLECTORS	West 14 Ext., New Commercial, East 9th, Carnegie, West 3rd Broadway/Ontario, West 14th		Urban
LOCALS	University, Old Commercial, Fire Sta. Drive, Canal, Abbey, Fairfield, Kenilworth, Starkweather, Abandoned St.		Urban

All Units are English:

PIPE POLICY:

The Pipe Policy of _____ODOT_____ will be used for this project. (See Section 1002 for additional information)

If a policy other than ODOT's is being used, the following material types are permitted:

Pipe policy for the City of Cleveland shall be used on all drainage facilities to be owned by the City of Cleveland at the conclusion of construction. This includes all proposed local street storm sewers. For standards, please see Appendix DR-11, City of Cleveland Drainage Provisions.

(Please attach a copy of the written pipe policy. In lieu of a written policy, documentation of locally funded construction practices may be provided)

POST CONSTRUCTION BMP POLICY:

The Post Construction BMP Policy of _____ODOT (with restrictions)__ will be used for this project..

If a policy other than ODOT's is being used, the following BMP's are permitted:

___See Project Scope Section 13.4 (Drainage Requirements) for BMP requirements._____

PROJECT SPECIFIC INFORMATION AFFECTING DRAINAGE:

Project is located in a close proximity to Lake Erie. Discharges to Cuyahoga River. City of Cleveland and Northeast Ohio Regional Sewer District (NEORSD) coordination required. No connection to existing system shall incur a net increase in 5, 10, 25 year peak flow at any point.

Section A. Roadway Culverts (Type A Conduits)

1. DESIGN STORM FREQUENCY (1004.2):

   a. Mainline _____50_____ Year

   b. Crossroads _____25 (ramps)_____ Year
   c. Local Roads _____10_____Year

2. BANKFULL DESIGN Yes____No __X__ (Circle yes if at least one culvert has bankfull design)
   attach a list of culverts with bankfull designs

3. FLOOD PLAIN CULVERT(S) NEEDED? Yes____No __X__(Circle yes if at least one culvert has flood plain culverts) *attach a list of culverts with flood plain culverts*

4. DURABILITY SERVICE LIFE _____50_____ Year *attach a list of culverts with their durability service life if multiple culverts have different frequencies.*

5. ABRASIVE SITE? Yes____No__X__(Circle yes if at least one culvert has an abrasive site) *attach a list of culverts with their abrasive site assumptions if multiple culverts are different*

6. MAXIMUM ALLOWABLE HEADWATER FOR DESIGN STORM (1006.2):

   a. 2 feet below the near, low edge of the pavement for drainage areas 1000 acres or greater and 1 foot below for culverts draining less than 1000 acres.

   b. 2 feet above the inlet crown of the culvert or above a tailwater elevation that submerges the inlet crown in flat to rolling terrain.

   c. 4 feet above the inlet crown of a culvert in a deep ravine

   d. 1 foot below the near edge of pavement for bicycle pathways.

7. METHOD USED TO ESTIMATE DESIGN DISCHARGE (Q) (1003):

   a. USGS Open File Report 93-135 “Estimation of Peak-Frequency Relations, Flood Hydrographs,

   and Volume – Duration – Frequency Relations of Ungaged Small Urban Streams in Ohio” shall be

   used in design of culverts and large storm sewers.

   b. The Rational Method shall be used in design of pavement inlets, roadway ditches and small storm

   sewers.

8. SCALE OF TOPOGRAPHIC MAPPING USED TO DELINEATE DRAINAGE AREAS (1101.1):

a. A 7.5 minute U.S. Geological Survey Quadrangle (drainage area greater than 100 acres)

b. 1”=50’ to 1”=800’ with rational method (drainage area less than 100 acres)

c.

9. MANNING’S “n” USED FOR (1105.6.5):

a. Smooth pipe _____0.012_____

b. Corrugated pipe:

2-$^{2}/_{3}$" x $^{1}/_{2"}$: Full flow Use Figure 1105-2

3" x 1": Full flow Use Figure 1105-2

6" x 2": Full flow Use Figure 1105-2

Section A. Roadway Culverts - Continued

10. ENTRANCE LOSS COEFFICIENT (k_e) (1105.6.6, table 1105-1):

a. Corrugated pipe: HW-4 Headwall __0.9_____ Full Headwall ____0.25_____

b. Smooth Concrete pipe HW-4 Headwall __0.2_____ Full Headwall ____0.2_____

d. Box Shape Full Headwall ___0.5_____

11. MINIMUM COVER (top of pipe to subgrade) FOR (1008):

a. Rigid pipe ___9”_____

b. Flexible pipe _12” for thermoplastic and 18” for corrugated pipe_____

12. MAXIMUM COVER FOR (1008):

a. Rigid pipe ____See Figures 1008-10 to 1008-14_____

b. Flexible pipe __See Figures 1008-1 to 1008-6 & Figures 1008-15 to 1008-19

13. MAXIMUM ALLOWABLE CULVERT OUTLET VELOCITY (1002.2.2) :

a. Bare earth channel _____5 f.p.s_____

b. Rock channel protection ___5 to 20 f.p.s.____ _____

c. Use roughness elements (protruding concrete rings inside the pipe) or other energy dissipators for velocities in excess of 20 f.p.s..

14. HEADWALL TYPE (1106.2):

a. Half-Height Headwalls - S.C.D. (HW-2.1 & HW-2.2)

b. Full-Height Headwalls – S.C.D. (HW-1.1)

15. CONTACT WILL BE MADE WITH COUNTY ENGINEER TO ESTABLISH: **(N/A)**

a.

b.

16. MINIMUM PIPE SIZE (1002.3.1, Figure 1002-1) :

a. Freeway or limited access facility _____24”_____

b. Other highways _____15”_____

Section B. Storm Sewers (Type B & C Conduits)

1. DESIGN FREQUENCY (Just Full) _____10_____ YEAR (1104.4.1)

2. HYDRAULIC GRADIENT SHALL NOT EXCEED (1104.4.2):

a. ____12”_____ inches below edge of pavement for ____25_____ year frequency storm.

b. Pavement catch basin grate or lip of inlet for ____25_____ year frequency storm.

c. A point in a depressed pavement sag that would result in an impassible highway for a ____50_____ year frequency storm.

d. Other: If the hydraulic grade line exceeds these limits, the controlling sewer size shall be increased.

e. The above is based on:

i. A pipe roughness “n” = _____0.015_____ for pipe sizes 60" and under and _____0.013_____ for larger sizes.

ii. _____

3. METHOD USED TO ESTIMATE DESIGN DISCHARGE (Q) (1003):

a. The rational method shall be used for small areas, 6 acres or less or areas contributing to sheet

flow only.

b. USGS Open File Report 93-135 “Estimation of Peak-Frequency Relations, Flood Hydrographs,

and Volume-Duration-Frequency Relations of Ungaged Small Urban Streams in Ohio” shall be

used in the design of large storm sewers.

4. COEFFICIENT OF RUNOFF "C" FOR (1101.2.3):

a. Pavement and paved shoulders _____0.9_____

b. Berms and slopes (4:1 and flatter) _____0.5_____

c. Berms and slopes (steeper than 4:1) _____0.7_____

d. Contributing areas:

Residential _0.3 – 0.7_ Woods _0.3__ Cultivated 0.3 – 0.6

5. METHOD USED TO DETERMINE TIME TO FIRST CATCH BASIN OR PAVEMENT INLET (1101.2):

a. ODOT L&D Volume 2, Figure 1101-1

b. Equations in Section 1101.2.2

6. MINIMUM TIME TO (1104.4.4):

a. Ditch catch basin ____15_____ minutes

b. Pavement inlet or catch basin _____10_____ minutes

Section B. Storm Sewers (Type B & C Conduits) - Continued

7. MINIMUM COVER OVER SEWERS (1104.2.1):

a. Rigid pipe:

i. Type B conduit (under pavement or paved shoulder) ____9”_____

ii. Type C conduit (beyond pavement or paved shoulder) ___18”_____

b. Flexible pipe:

i. Type B conduit (under pavement or paved shoulder) ___12”_____

ii. Type C conduit (beyond pavement or paved shoulder) ___18”_____

8. DESIRABLE MINIMUM VELOCITY FOR DESIGN FLOW _____3_____ f.p.s (1104.2.1).

9. MAXIMUM LENGTH BETWEEN MANHOLES OR SUITABLE CLEANOUT POINTS (1104.2.2) :

a. Under 36"diameter ____300’_____

b. 36" - 60" diameter ____500’_____

c. Over 60" diameter _____750’-1000’_____

10. MINIMUM PIPE SIZE UNDER PAVEMENT (1104.4.6):

a. Freeway or limited access facility _____15”_____

b. Other highways _____12”_____

11. PROCEDURE TO FOLLOW WHEN EXISTING PRIVATE DRAINS ARE CUT BY PROPOSED

SEWERS OR DITCHES: The names and addresses of the affected property owners shall be submitted to the District Deputy Director.

Section C. Roadway Ditches

1. METHOD USED TO ESTIMATE DESIGN DISCHARGE (Q) (1003):

a. The Rational Method shall be used for small areas, 6 acres or less.

b. USGS Open File Report 93-135 “Estimation of Peak-Frequency Relations, Flood Hydrographs,

and Volume – Duration – Frequency Relations of Ungaged Small Urban Streams in Ohio”.

2. DESIGN FREQUENCY TO DETERMINE (1102.3.1 or 1102.4):

ADT >2000:

a. Depth of flow determination _____10_____ year

b. Shear Stress determination (for protection and width of protection) _____5_____ year

ADT <2000:

c. Depth of flow determination ____5_____ year

d. Shear Stress determination (for protection and width of protection) _____2_____ year

3. METHOD USED TO DETERMINE TIME OF FLOW TO DITCH (1101.2):

__Use Figure 1101-1 or Overland flow equation given in Section 1101.2.2 _____

_____

4. ALLOWABLE SHEAR STRESS FOR DITCH LINING (1102.3):

Permanent Ditch Protection:

a. Seed lining ____0.40_____ psf.

b. Sod or other temporary ditch protection _____1_____ psf.

c. Turf Reinforcing Mat (SS836), Type 1 _____2_____ psf.

d. Turf Reinforcing Mat (SS836), Type 2 _____3_____ psf.

e. Turf Reinforcing Mat (SS836), Type 3 _____5_____ psf.

f. RCP, Type B_____6_____psf.

g. RCP, Type C_____4_____ psf.

h. RCP, Type D_____2____ psf.

Temporary Ditch Protection (Item 670):

a. Mat, Type A _____1.25_____ psf.

b. Mat, Type B _____1.50_____ psf.

c. Mat, Type C _____2.0_____ psf.

d. Mat, Type E _____2.25_____ psf.

e. Mat, Type F _____0.45_____ psf.

Section C. Roadway Ditches - Continued

f. Mat, Type G _____1.75_____ psf.

Tied Concrete Block Mat (Item 601)

a. Type 1 _____3_____ psf.

b. Type 2 _____5_____ psf.

c. Type31 ____7_____ psf.

5. MANNING'S "n" USED FOR (1102.3):

a. Seed lining ____0.03_____

b. Sod, jute, or other temporary linings ____0.04_____

c. Turf reinforcing mats ____0.04_____

d. Tied Concrete Block Matting ____0.03_____

e. Rock channel protection ____0.06_____

6. DITCH CONFIGURATION (1102.2):

a. _____Trapezoidal_____ for ADT > 2000, with ___12"_____ inch minimum depth

b. _____Trapezoidal_____ for ADT < 2000, with ____18"___ inch minimum depth

7. TYPE OF DITCH CATCH BASIN (1102.3.4):

a. Standard No. 4

b. Standard No. 5

c. Standard No. 8

8. MINIMUM LONGITUDINAL SLOPE OF DITCHES IN CUT SECTIONS (1102.1):

a. ____0.50%_____ desirable minimum

b. ____0.25%_____ absolute minimum

9. METHOD USED TO LOCATE EXISTING FARM TILE CROSSED BY HIGHWAYS? **(N/A)**

a.

b.

c.

d.

Section C. Roadway Ditches – Continued

10. MINIMUM WIDTH OF DITCH LININGS (1102.3.1) :

a. Sod ____7.5_____ ft.

b. Temporary linings ____7.5_____ ft.

c. Turf reinforcing mats ____7.5_____ ft.

11. DESIGN FREQUENCY DEPTH SHALL NOT EXCEED (1102.3.1):

a. The depth of flow shall be 1 foot below the edge of pavement for the design discharge

b. The depth of flow in toe of slope ditches for the design discharge shall not overtop the ditch bank

c.

Section D. Median Ditches

1. DITCH CONFIGURATIONS (1102.3):

a. Depressed: __4' Min or as directed by L&D Vol 2 if designed as biofilter swale BMP___

b. Type of barrier: For permanent median barrier, no drainage permeability required, but for temporary barrier used in the median for the bidirection condition, barrier must allow drainage to flow through bottom of barrier.

2. WIDTH BETWEEN PAVEMENT EDGES __Varies_____ ft.

3. ALLOWABLE SHEAR STRESS FOR DITCH LINING (1102.3):

Permanent Ditch Protection:

a. Seed lining _____0.40_____ psf.

i. Sod or other temporary ditch protection _____1.0_____ psf.

j. Turf Reinforcing Mat (SS836), Type 1 _____2.00_____ psf.

k. Turf Reinforcing Mat (SS836), Type 2 _____3.00_____ psf.

l. Turf Reinforcing Mat (SS836), Type 3 _____5.00_____ psf.

Temporary Ditch Protection (Item 670):

d. Mat, Type A _____1.25_____ psf.

e. Mat, Type B _____1.50_____ psf.

f. Mat, Type C _____2.0_____ psf.

g. Mat, Type E _____2.25_____ psf.

h. Mat, Type F _____0.45_____ psf.

i. Mat, Type G _____1.75_____ psf.

Tied Concrete Block Mat (Item 601)

a. Type 1 _____3_____ psf.

b. Type 2 _____5_____ psf.

c. Type 3 _____7_____ psf.

4. METHOD USED TO ESTIMATE DESIGN DISCHARGE (Q) (1101.2):

a. The Rational Method shall be used for small areas, 6 acres or less.

b. USGS Open File Report 93-135 “Estimation of Peak-Frequency Relations, Flood Hydrographs,

and Volume – Duration – Frequency Relations of Ungaged Small Urban Streams in Ohio”.

5. CATCH BASIN SPACING WILL BE DETERMINED BY HYDRAULIC ANALYSIS USING (1102.3.4):

a. ___5_____ year frequency and "n" = ___0.03_____ for velocity

b. ___10_____ year frequency and "n" = ____0.03____ for depth

c. Controls:

i. Design frequency depth shall not exceed:

(1) 12" below edge of pavement for the design discharge.

(2)

d. Catch basin spacing, depressed median, fill section:

	Median Width	84'	60'	40'
i.	Desirable maximum	_____1250 feet_____	1000 feet_____	800 feet_____
ii.	Absolute maximum	_____1500 feet_____	1250 feet_____	1000 feet_____

6. TYPE OF MEDIAN CATCH BASIN OR INLET (1102.3.4):

a. Standard No. 4 for depressed medians wider than 40 feet.

b. Standard No. 5 for 40 foot radius roadside or median ditches.

c. Standard No. 8 for 20 foot radius roadside or depressed medians 40 feet or less.

d. Standard 3A to e used for minor flows and at bridge terminals.

e. Median Barrier Inlets No. 3 and/or No. 4 used to drain median as appropriate.

7. MINIMUM LONGITUDINAL SLOPE OF DEPRESSED EARTH MEDIAN:

f. ¼ inch per foot (0.02)

Section E. Drainage for Curbed Pavements

8. CONTROLS FOR THE DETERMINATION OF INLET OR CATCH BASIN SPACING (1103):

g. Design storm frequency _____10_____ year

h. Check storm frequency____50_____ year (for underpasses or depressed roadways where the storm sewer is the only outlet)

c. METHOD USED TO DETERMINE TIME TO FIRST CATCH BASIN OR PAVEMENT INLET:

i. Equations in Section 1101.2.2

ii. Absolute minimum time of 10 minutes

d. Maximum spread of flow into traveled lane ____0_____ ft. (table 1103-1)

Outside lane width greater than 12 feet ____0_____ ft.

Total allowable spread on pavement ____0_____ ft.

e. Maximum depth of flow at curb _____5_____ in .

f. Manning's "n" for:

i. Reinforced concrete pavement ____0.015_____

ii. Asphaltic concrete pavement _____0.015_____

iii. Paved shoulders _____0.015_____

9. TYPE OF INLET OR CATCH BASIN PROPOSED FOR (1103):

a. Continuous grades - Grate or Combination Grate and Curb Opening Inlet CB-3A, CB-6,

b. Sags ____Standard No. 3 Catch Basin (CB-3)_____

10. INLET LIP OF CURB OPENING INLET WILL BE DEPRESSED ___2"__ INCHES BELOW NORMAL GUTTER.

a. A local depression of ____1/2"_____ inches will be used to determine spacing of combination grate and curb opening catch basins for a curb pavement section.

b. A local depression of ___1/2”_____ inches will be used to determine spacing of combination grate and curb opening catch basins for a combination curb and gutter section.