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Resolution No. 110-1952

RESOLVED that the Commission does hereby approve the report submitted to it by its committee upon drain-pipe design criteria, comprised of Messrs. McKay, Teagarden, Kauer, and Morrison, and adopts the criteria therein set forth.

Adoption moved by Mr. McKay.

Motion seconded by Mr. Teagarden.

Voting Yes: All

110-1952

Ohio Turnpike Commission

361 EAST BROAD STREET
COLUMBUS
MAin 6641

Memorandum **December 6, 1952**

To: Messrs. Shocknessy, Teagarden, Allen, McKay, Linzell
From: Drainage Committee
Re: Drainage Design Criteria

In accordance with instructions of the Chairman the Drainage Committee, consisting of Messrs. J. Gordon McKay, O. L. Teagarden, N. J. Morrison and T. J. Kauer, met on December 5, 1952 to consider minor changes in criteria relating to the use of corrugated metal pipe and to the use of larger sizes of pipe.

The following are the Committee's recommendations for making the desired changes in the Drainage Design Criteria:

A. General

1. The use of corrugated metal pipe under the Turnpike pavement and paved shoulders in sizes smaller than 30 inches will not be prohibited.

2. The maximum size of pipe to be used for pipe culverts will not be limited, excepting by hydraulic, structural, and other engineering factors including relative economics.

B. All other provisions of the Design Criteria, excepting except as otherwise herein provided, to **those which have been previously amended, remain in effect.**

C. The design of pipe culverts larger than 72 inches in diameter but not exceeding 96 inches, and of pipe-arch culverts larger than 72 inches in height but not exceeding 96 inches, shall be in accordance with the following provisions:

1. Pipe culverts and pipe-arch culverts larger than 72 inches in size may be used provided that the depth of flow in the pipe does not exceed 72 inches for a 100-year frequency. Where pipe culverts larger than 72 inches in size are used, the elevation of the water

surface at the culvert entrance shall be not more than 96 inches above the invert of the culvert for a 100-year frequency."

2. Drainage Details

(a) Type and use of pipe: Reinforced Concrete or Corrugated Metal

(b) The gauges of corrugated metal pipe shall be as follows:

Gauges for Various Fills Over Top of Pipe

Diam. of Pipe Inches	Fill Over Top of Pipe - Ft. Up to 10	10 to 15	15 to 20	20 to 25	25 to 30	30 to 35	35 to 40	40 to 45	45 to 50	50 to 60	60 to 80	80 to 100	Max. Fill Without Vertical Elongation
15	16	16	16	16	16								
18	16	16	16	14	14								
24	14	14	14	14	14	12	12						
30	14	14	12	12	10	10	10	10	10	8	8		
36	12	12	10	10	10	10	8	8	8	8	8	20	20
42	12	12	10	10	10	10	8	8	8	8	8	16	15
48	12	10	10	10	10	10	8	8	8	8		12	12
54	12	10	10	10	8	8	8	8	8			10	10
60	10	8	8	8	8	8	10	8	8	7	5	3	10
66	8	8	8	8	8	10	8	8	8	7	5	3	10
72	8	8	8	8	10	8	8	8	7	5	3	1	10
78	10	10	10	8	8	8	8	7	7	5	3	1	10
84	10	10	8	8	8	8	7	7	5	3	1		10
90	8	8	8	8	8	7	7	5	5	3	1		10
96	8	8	8	8	7	7	5	5	3	3	1		10

Culverts below the heavy line in the table above are to be multi-plate pipe culverts. The gauges given for these multi-plate pipes are for pipes having corrugations 2 inches in depth. Multi-plate pipes are to be investigated for shearing strength in the longitudinal seams. Multi-plate pipes are to be used whenever the fill over the top of the pipe exceeds 80 feet.

(c) The gauges of corrugated metal arches shall be as follows:

Gauges of Pipe-Arch Culverts for Various Fills

Span Inches	Rise Inches	Fill Over Top of Culvert - Ft. 1	2	3	4	5	6	7	8	9	10
29	18	14	14	14	14	14	14	14	14	14	14
36	22	12	12	12	12	12	12	12	12	12	12
43	27	12	12	12	12	12	12	12	12	12	12
50	31	12	12	12	12	12	12	12	12	10	10
58	36	10	10	10	10	10	10	10	10	10	10
65	40	10	10	10	10	8	8	8	8	8	8
72	44	8	8	8	8	8	8	8	8	8	8
		Multi-Plate Pipe Arches									
6'-1"	4'-7"	10	10	10	10	10	10	10	10	10	10
6'-4"	4'-9"	10	10	10	10	10	10	10	10	10	10
6'-9"	4'-11"	8	10	10	10	10	10	10	10	10	10
7'-0"	5'-1"	8	10	10	10	10	10	10	10	10	10
7'-3"	5'-3"	8	8	10	10	10	10	10	10	10	10
71-8"	5'-5"	8	8	8	8	8	8	8	8	8	8
7'-11"	5'-7"	8	8	8	8	8	8	8	8	8	8
8'-2"	5'-9"	8	8	8	8	8	8	8	8	8	8
8'-7"	5'-11"	8	8	8	8	8	8	8	8	8	8
8'-10"	6'-1"	8	8	8	8	8	8	8	8	8	8
9'-4"	6'-3"	7	8	8	8	8	8	8	8	8	8
9'-6"	6'-5"	7	7	8	8	8	8	8	8	8	8
9'-9"	6'-7"	7	7	8	8	8	8	8	8	8	8
10'-3"	6'-9"	7	7	8	8	8	8	8	8	8	8
10-8"	6"-11"	7	7	7	8	8	8	8	8	8	8
10'-11"	7'-1"	7	7	7	8	8	8	8	8	8	7
11'-5"	7'-3"	6	7	7	7	8	8	8	8	7	7
11'-7"	7'-5"	6	7	7	7	7	8	8	7	7	7
11'-10"	7'-7"	5	7	7	7	7	7	7	7	7	7
12'-4"	7'-9"	5	6	7	7	7	7	7	7	7	7
12'-6"	7'-11"	5	5	7	7	7	7	7	7	7	7

D. The design of pipe culverts and pipe-arch culverts having diameters or heights greater than 96 inches shall be in accordance with the following provisions:

1. The depth of flow in the culvert for a 25-year flood shall be not greater than six-tenths the normal span of the culvert, and for the maximum design flood shown on Figure 15 shall be not greater than three-fourths the normal span of the culvert.

2. Culvert outlets shall be investigated for the possibility of erosion caused by high outlet velocities and by turbulence resulting from the dissipation of energy which occurs when the water in the culvert is discharged into a less confined channel. Adequate protection against erosion shall be provided in the form of riprap, stream bed paving, or energy dissipators.

3. The culverts shall be designed structurally. Compute the live and dead loads which the culvert must carry, and by structural analysis determine the required culvert section.

4. Plans for culverts must be adequate. Headwalls, riprap, ditch paving, energy dissipators, special foundations, etc., are to be detailed on the contract plans. When beveled ends are used on corrugated metal culverts in lieu of endwalls, the slopes at entrance and outlet ends shall be ripraped to a height 18 inches above the top of the culvert. The width of the riprap shall be determined by requirements for erosion protection and by considerations of appearance. Skewed ends shall not be beveled.

5. Pipe culverts and pipe-arch culverts shall be used only where the economy of such construction as opposed to concrete culverts can be readily demonstrated. Comparative estimates must take into consideration all items of cost.

O L Eagarden

J. Gordon McKay — O. L. TEagarden

N. J. Morrison — R. J. Kauer