

Appendix 5-A

Symbols and Acronyms

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If you require assistance accessing this information or require it in an alternative format, contact the Michigan Department of Transportation's (MDOT) Americans with disabilities Act (ADA) coordinator at Michigan.gov/MDOT-ADA.

Symbols

Symbol	Definition	Unit
A	Area of cross section of flow	sft
HW _a	Allowable headwater	feet
d	Overtopping discharge coefficient	-
C _r	Discharge coefficient	-
D	Culvert diameter or rise	in or ft
d _c	Critical depth of flow	ft
d _n	Normal depth	ft
EL _i	Invert elevation at inlet section	ft
EL _o	Invert elevation at outlet section	ft
EL _{hi}	Inlet control headwater elevation	ft
EL _{ho}	Outlet control headwater elevation	ft
EL _{TW}	Tailwater elevation	ft
g	Acceleration due to gravity	ft/s ²
H	Head loss in culvert	ft
H _b	Bend head loss	ft
H _e	Entrance head loss	ft
H _f	Friction head loss	ft
H _g	Grate head loss	ft
H _j	Junction head loss	ft
H _L	Total energy loss	ft
H _o	Outlet or exit head loss	ft
H _v	Velocity head	ft
h _o	Hydraulic grade line height above outlet invert	ft
HW	Headwater depth (subscript indicates section)	ft
HW _a	Allowable headwater	ft

Symbol	Definition	Unit
HW_i	Inlet control headwater	ft
HW_o	Outlet control headwater	ft
HW_{ov}	Height of roadway crest above inlet invert	ft
HW_r	Upstream depth measured above roadway crest	ft
K_e	Entrance loss coefficient	-
k_t	Submergence coefficient	-
L	Length of culvert	ft
L_r	Length of roadway crest (Section 9.4)	ft
LS	Drop through culvert	ft
L_1	Adjusted culvert length	ft
n	Manning's roughness coefficient	-
n_1	Desired Manning n value	-
P	Wetted perimeter	ft
Q	Rate of discharge flow rate	cfs
Q_b	Flow rate through barrel	cfs
Q_o	Overtopping flow rate	cfs
R	Hydraulic radius (A/WP)	ft
S, S_o	Slope of culvert	ft/ft
TW	Tailwater depth above invert of culvert	ft
V	Mean velocity of flow with barrel full	fps
V_d	Mean velocity of flow in downstream channel	fps
V_o	Mean velocity of flow at culvert outlet	fps
V_u	Mean velocity of flow in upstream channel	fps

Acronyms

2D	Two Dimensional
AASHTO	American Association of State Highway and Transportation Officials
ADT	Average Daily Traffic
AEP	Annual Exceedance Probability
ARI	Annual Recurrence Interval
BLM	Bureau of Land Management
CIPP	Cured-in-Place Pipe
CMP	Corrugated Metal Pipe
CPE	Corrugated Polyethylene
CPV	Corrugated Polyvinyl Chloride
DEM	Digital Elevation Model
EGL	Energy Grade Line
EGLE	Michigan Department of Environment, Great Lakes, and Energy
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
HDS	Hydraulic Design Series
HEC	Hydraulic Engineering Circular
HEC-RAS	Hydraulic Engineering Center's River Analysis System
HGL	Hydraulic Grade Line
MCL	Michigan Compiled Laws
MDOT	Michigan Department of Transportation
MiASIM	Michigan Ancillary Structures Inspection Manual
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NREPA	Natural Resources Environmental Protection Act, Michigan Act 451, Public Acts of 1994, as amended
PVC	Polyvinyl Chloride

Acronyms

ROW	Right-of-Way
SMS	Surface-Water Modeling System
US	United States
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
USGS	United States Geological Survey
VPD	Vehicles per day