



SUBJECT Culvert Renewal Contract Plans CAD Guidance	FINAL NUMBER GE20-02(B)	EFFECTIVE DATE 09/01/2020	VALIDATION DATE N/A	SUPERSEDES or RESCINDS New
TOPIC/PROGRAM Hydraulics CAD Manual-Culvert Renewal / Major Culvert Maintenance Program (MCM)		WEB LINK(S) https://www.oregon.gov/ODOT/Engineering/Pages/Technical-Guidance.aspx		
		Original Signed by: Susan Haupt Environmental and Hydraulic Engineering Section Manager		

PURPOSE

ODOT created the [“Major Culvert Maintenance” \(MCM\) program](#) to fund trenchless culvert repair and rehabilitation projects for culverts that are in poor or critical condition. ODOT is allowed to make these repairs, as part of a programmatic agreement with ODFW, as long as improvements to aquatic passage can be made. The goal of the program is to focus on repair opportunities for all culverts within the transportation system.

Culvert renewal design requires engineers to use their expertise to make sound engineering judgements that differ from designing an entirely new culvert. Culvert renewal projects, designed to include aquatic passage and waterway enhancement, require the addition of specific CAD elements to our current suite of CAD standards. This guidance describes the CAD and drafting standards used to develop culvert renewal plans. Links to guidance materials are included where applicable. ODOT’s CAD standards are available through the MicroStation workspace, downloadable from [ODOT’s Engineering Application Support Team “Workspace & Updates”](#) webpage.

GUIDANCE

ODOT’s Engineering Workspace

ODOT’s MicroStation Engineering Workspace contains the most current and up-to-date standards available for ODOT’s engineering disciplines. Discipline specific CAD elements, such as levels, line styles, cell libraries, seed files, etc., are provided in the Workspace along with tools necessary for preparing culvert renewal contract plan sheets.

Plan Sheet Standards

This bulletin will serve as guidance specific to development of culvert renewal plans. Basic rules of ODOT Engineering plans development standards apply. Sheet setup and layout shall incorporate standard text styles, naming conventions, sheet borders, Title

Block, etc. as detailed in the [Contract Plans Manual \(CPM\)](#). Guidance on general plan development and profile sheet layout guidance can be found in both the Contract Plans Manual and in the [Roadway CAD Manual \(RCM\)](#), respectively.

DEFINITIONS

CPM – The “Contract Plans Manual” (CPM) presents the policies, procedures, methods, and standards for developing and preparing final contract plans for ODOT Highway Projects. The CPM is intended to provide accurate and complete guidance in accordance with established CAD and drafting standards. The CPM covers standards that are the same across all disciplines. These standards ensure all disciplines are using the same basic sheet set-up, layout, and cross discipline elements required for plan sheets.

HCM – The “Hydraulics CAD Manual” (HCM) is intended to guide users in the use of CAD and drafting tools, policies, procedures, and methods established for preparing final hydraulics contract plans. The HCM is to be used in conjunction with the CPM in the preparation of ODOT’s contract plans. Disciplines covered by the HCM are: Stormwater, Culverts, Aquatic Passage, Temporary Water Management, Bank Protection, and Waterway Enhancement.

RCM – The intent of the “Roadway CAD Manual” (RCM) is to provide instructions and procedures to prepare ODOT contract plans. It is specific to the discipline of Roadway, but in general may also apply to other disciplines as part of the contract plans set. In this case specifically regarding the layout of profiles sheets. This manual is used in conjunction with the CPM.

MicroStation Workspace – The CAD workspace in MicroStation is a customized drafting environment in which MicroStation can be set up for specific purposes. The workspace consists of “components” and “configuration files” containing the standard tools needed for the design and drafting of various discipline specific products. The workspace contains the most accurate up-to-date standards available for ODOT’s engineering disciplines.

Culvert – A culvert is a conduit or passageway under a road, trail or waterway obstruction. Culverts convey stream flow or storm runoff. A culvert differs from a bridge in that it usually consists of structural material around its entire perimeter. Culvert selection factors include roadway profiles, channel characteristics, aquatic passage requirements, etc., to be determined by the hydraulic engineer. A culvert may be a cost-effective alternative to building a bridge.

BACKGROUND/REFERENCE

The CAD standards for “Culvert Renewal” plans development are new to the Hydraulics suite of engineering disciplines. This Technical Bulletin is used in conjunction with the Culvert CAD standards provided in the engineering workspace, the CPM, and the RCM.

Design guidance for culvert renewal projects is found in the Culvert Renewal Design Guidance technical bulletin, as well as in the [Hydraulics Design Manual](#).

Standards guidance documents and tools are provided to project development staff to develop contract plans according to established standards and ensure consistency statewide.

EXPLANATION

Described in the following pages are culvert renewal CAD and Drafting standards. Guidance consists of, basic instructions for the set up and development of culvert renewal plans, and includes a drawing check list, plus a link to example drawings. Commonly used elements are easily accessed in the MicroStation workspace and described in this guidance.

Tasks and Workflows

ODOT's MicroStation workspace contains a "Culvert" workflow and tasks. The tasks link to the standard symbols, tables, patterns, etc., specific to the development of culvert renewal plans. The culvert tasks are a work in progress and will be added to and revised over time. Please see the example drawings for how CAD elements are used on culvert renewal plan sheets.

Cell Library

The Hydro.cel library contains the cell drawings used in the development of culvert renewal plan sheets. These cells range from plan view symbols, to standard notes and tables. Included are individual boulders, trees, etc., that can be used to create project specific details for culvert renewal plans that include Waterway Enhancements and Aquatic Passage design. These cell drawings are accessed by the "Culvert" workflow tasks.

Levels

Use Hydro levels as appropriate (i.e. P_HY_DESIGN_.....) for line work and text on all culvert repair plan sheets.

Retain the level structure of referenced drawings.

File Name

ODOT uses a set list of CAD file names, based on an approved file naming convention developed for use within ODOT's data management system [ProjectWise](#).

The approved file naming for culvert plans is located in the [ProjectWise File Naming Tool](#).

Sheet Name (Title)

Sheet titles for each discipline are located in the **seed_titleblock.dgn** file. Access seed files, when creating a new drawing file, by browsing to the seed file location and choosing the correct seed for your project plans. The title block seed file contains a

separate model for each sheet series, organized by discipline. Sheet names are controlled by managing levels within each model. A reference for the level and respective sheet title, located right of the Title Block, will provide guidance on what level(s) to turn on/off for the correct sheet name. The sheet title for culvert plans is located in the “H_Sheets” model.

Refer to [Chapter 3 of the CPM](#) for detailed guidance on the title block seed file, its use, and a list of correct sheet names.

Drawing Sequence

Culvert plans are located in the “H” series section of ODOT’s Contract Plans. The “H” series is reserved for the hydraulic disciplines. Culvert plan sheets follow Stormwater plans and precede Aquatic Passage plans within the “H” series.

See [Chapter 2 of the CPM](#) for drawing order and sheet numbering for culvert plans.

Sheet Numbering

Culvert plan sheets generally begin with a plan and a profile / elevation of the culvert on the same sheet. This first sheet of a single culvert project is numbered “HB01”, the second sheet is numbered “HB02”, and so on. Subsequent sheets may contain details / cross sections, plus tables and notes, etc.

Sheet numbering options for projects with multiple culverts are described in chapter 2 of the CPM.

Title Sheet

The first sheet of a Contract Plans set is a title sheet. This includes discipline specific stand-alone plan sets, such as MCM Culvert renewal and other maintenance projects. Title sheets are assigned sheet number “A01”, regardless of discipline. For title sheet development guidance see the [RCM](#).

Plan and Profile / Elevation Sheet Layouts

Arrange culvert renewal sheets to clearly show the culvert design. Provide a plan sheet that includes existing features, contours, culvert alignment and stationing, etc. (See drafting check list provided in this document). Include on this first plan sheet the general notes for the project, construction and other notes, hydraulic data table(s) and any other information directed by the EOR.

Note: A culvert that has a total span (width) of greater than 20 ft. is considered a bridge for purposes of the National Bridge Inspection Standards. For culverts of this size use the Bridge CAD Manual for plan sheet development and CAD standards.

A profile view of the culvert may be placed below the plan view on the plan sheet, or may be placed on the following sheet depending on the project. When placed on the plan sheet, the profile must be placed directly below the plan view. Key points always align with each other and project up or down from one view to the other view. See the CPM for orthographic drawing guidance. See the RCM for plan and profile sheet layout.

A profile placed on the next sheet also follows the format described in the chapter 2 of the [RCM](#). This sheet contains any notes specific to the view and the features of the culvert that are shown. Always include stationing across the bottom, plus incremental elevation ticks along the left side on all profiles. Subsequent sheets contain details specific to the culvert design. This may include elevations, sections, and details of the culvert pipe, aquatic passage features (such as baffles or weirs), plus details of waterway enhancements, when included on the plan view. Include any relevant notes.

Aquatic Passage

Aquatic Passage (previously known as Fish Passage) may be shown on a separate sheet. Aquatic passage measures, in and around the culvert, include features that enhance the passage of fish, such as weirs, baffles, fish rocks and roughened channels.

Waterway Enhancements

When applicable, a separate plan sheet may be used to detail waterway enhancements, upstream and downstream. Waterway enhancement measures, which serve to enhance the passage of fish, consist of similar features to aquatic passage measures. Included are rootwads, log clusters, vegetated stream banks and step pools.

Standard details are provided to aid in the development of Aquatic Passage and Waterway Enhancement plans. Refer to [Det5100-5199-Bank Protection](#), [Det5200-5299-Culverts](#) and [Det5500-5599-Waterway Enhancements](#).

Note: When creating separate plans for Aquatic Passage and Waterway Enhancements, refer to the CPM for sheet names, sheet numbering and drawing sequence.

Temporary Water Management

Temporary Water Management (TWM) plans detail water management measures during construction. These measures detail how water will be diverted to bypass the culvert and ensure adequate downstream aquatic passage.

TWM plans have a standard sheet title and sheet number in the H series. ODOT's MicroStation workspace includes a seed_TWM.dgn for developing this plan. TWM example drawings for full and partial isolation plans are in pdf format on the [website](#). See [Technical Bulletin GE14-01\(B\)](#) for further guidance on drafting a TWM plan.

Culvert ID Markers

Clearly show the location of all culvert facility ID markers on the plan view. Specify the exact information that must be included on the field marker in the construction notes, and include a reference to ODOT's standard drawing [RD398 Culvert ID Marker](#).

Include the Culvert ID Marker Table to provide the facility ID number, type and location of each marker for the culvert. Include a structure number if applicable. This table is included in the cell library and accessed in the workspace tasks.

See the GHE [CAD Manual](#) and the [Hydraulics Design Manual](#) for more information on Facility Identification Field Marker requirements.

Standard Details

The standard details to accompany culvert renewal plans are located in the [Hydro 5000's series](#). ODOT's standard details are supported by engineering analysis, calculation, and/or justification. Standard details can be used as-is in a set of plans, or they can be modified on a project-by-project basis and placed on detail sheets signed by the EOR.

See ODOT's engineering [website](#) for more detailed information regarding the use of standard details and standard drawings.

Check List

The drafting check list contains all items to be included on Culvert plan sheets. (Depending on the project, some items may not apply).

- ☐ Border, title block, sheet title, sheet number
- ☐ Title block information complete
- ☐ Professional of record stamp
- ☐ "V" number or project status stamp
- ☐ Index sheet (if needed)
- ☐ Plan view
- ☐ Profile view
- ☐ North arrow
- ☐ Scales noted
- ☐ Existing roadway
- ☐ Existing structures (e.g. bridge, culvert, wall, sign bridge, etc.)
- ☐ Existing utilities
- ☐ Existing contours
- ☐ Contours labeled
- ☐ Proposed roadway with alignment and stationing
- ☐ Proposed structures
- ☐ Proposed utilities
- ☐ Proposed contours
- ☐ All culverts labeled with assigned structure numbers
- ☐ All culverts labeled with assigned DFI numbers
- ☐ Waterway(s) labeled and flow direction shown
- ☐ Right-of-way lines
- ☐ Temporary construction easements
- ☐ Construction limits
- ☐ Detail(s)
- ☐ Legend, notes and field marker table
- ☐ Marker type
- ☐ Marker location
- ☐ Marker symbol
- ☐ Marker callout
- ☐ Marker label information

Example Drawing(s)

[Example drawings](#) provided on the website demonstrate typical sheet layouts for proposed culvert repair plans. Refer to the workspace for the most recent CAD standards elements available.

RESPONSIBILITIES

The EOR is responsible for developing the culvert repair design and providing the drafter with the design files.

The project drafter is responsible for developing plan sheets, that reference project base files and culvert design files, in a format consistent with the current CAD and drafting standards provided in the ODOT MicroStation Workspace, the Contract Plans Manual (CPM), and this bulletin.

ODOT's MCM program lead is the owner of the culvert repair CAD standards. The program lead reviews, recommends, and approves CAD and drafting standards for culvert repair plans development.

The Geotech, Hydraulic and Environmental Drafting Standards Program Lead is responsible for approving, developing, maintaining and ensuring accessibility of CAD and drafting standards. Anyone preparing culvert repair plans for ODOT will use these standards.

ACTION REQUIRED

Implementation of the guidance identified in this document shall be performed by anyone developing Contract Plans for ODOT projects.

SPECIAL INSTRUCTIONS

At such time this information is transferred to the CAD Manual, this bulletin will be rescinded and any further additions to culvert repair CAD standards will appear on ODOT's Engineering Workspace and in future updates of the CAD Manual.

CONTACT INFORMATION

Title: Senior Culvert Maintenance Hydraulic Engineer
Branch/Section: Environmental and Hydraulic Engineering Section
Phone: (503) 986-4046
E-mail: Wade Holaday – Wade.Holaday@ODOT.state.or.us

Title: Drafting Standards Program Lead
Geotechnical, Hydraulics and Environmental
Branch/Section: Environmental and Hydraulic Engineering Section
Phone: (503) 986-3380
E-mail: Kim Taylor – Kim.E.Taylor@ODOT.state.or.us