Research Notes

Drainage Facility Asset Management:
More than an inventory of pipes

In July of 2003 the ODOT Research Unit undertook a research project to begin the development of a "Drainage Facility Management System." Software development of this system continues at this time, but the research project is nearing completion, followed by publication of a final report.

There were two primary circumstances that gave rise to the research project. The first was a need to better anticipate expenses for maintaining and rehabilitating the drainage facility component of the highway system. The second was the increasing environmental regulatory demands regarding drainage facilities.
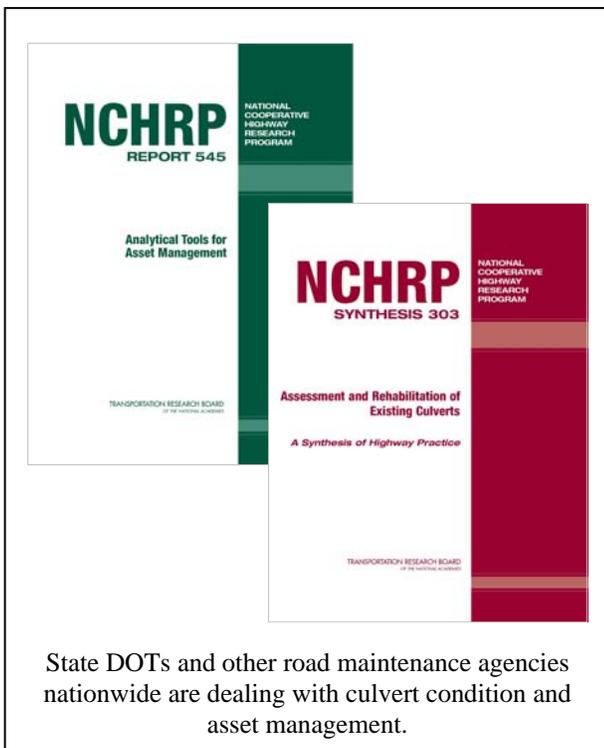
These two motivations are important to understanding the project, because at the same

ODOT intends to extend their asset management system beyond culverts and pipes to other drainage facilities such as this detention basin and dry well.

time a separate, broader asset management effort was also getting underway in state DOTs across the nation. These asset management efforts are tied to the adoption of Government Accounting Standards Board (GASB) Statement 34 in June of 1999. This triggered a continuing flurry of inventory and asset management activity, including publications.

ODOT currently has the Bridge Management System (BMS), Congestion Management System (CMS), Freight & Intermodal Management System (FIMS), Pavement Management System (PMS), Public Transportation Management System (PTMS), Safety Management System (SMS), and Traffic Monitoring System for Highways (TMS-H). Conceptually the Drainage Facility Management System is intended to do for drainage facilities what these other systems do for their respective parts of the highway system.

State DOTs and other road maintenance agencies nationwide are dealing with culvert condition and asset management.

The primary objectives for the research project were twofold:

1) To develop and implement an Oregon-specific system for inventorying and evaluating the condition of pipes, culverts, and stormwater facilities based on the FHWA Culvert Management System (CMS); and
2) To determine the time and effort required to collect and input data on all culverts, pipes, and stormwater facilities within the entire ODOT transportation system, based on data collected during a small pilot project.

ODOT has two data systems related to culverts and pipes. The first is the Integrated Transportation and Inventory System (ITIS) – a decades-old, fixed-field, character-based database that included culverts and pipes along with numerous other features of the roadway. The other is Oregon's portion of the National Bridge Inventory (NBI), which includes culverts larger than 6 feet.

ITIS is nominally complete for culverts between 3 and 6 feet and also includes a large proportion of culverts in the 18-inch to 36-inch size range. Maintenance activities relating to culverts are generally tracked on note cards or spreadsheets that are maintained on a District level.

The research project has examined the approaches offered by the FHWA Culvert Management System and work by other states on the issue of drainage facility asset management.

While FHWA's Culvert Management System provides some good features and functionality, the research project is reaching the conclusion that it does not completely meet Oregon's needs.

States such as California, Connecticut, Maine, Maryland, Minnesota, New York, North Carolina, and Pennsylvania have some sort of culvert management system operating. These systems include an inventory of culverts above some minimum size and have varying features for tracking conditions and maintenance activities.

Oregon's needs and system development objectives extend beyond all of these earlier efforts in a number of critical ways:

1) The desire to integrate fish passage data into the system. There is no indication that anyone else has done this.
2) A desire to include all culverts with less than a 20 foot span. With few exceptions, culverts smaller than 3 feet seem to have been excluded from prior efforts.
3) The general approach to inventorying the culverts has been to use existing data sources rather than to conduct a purpose-specific enumeration and inspection of all the culverts in the right-of-way.
4) The inclusion of all drainage facilities, not just culverts and pipes, seems to be a novel intention.

In addition, Oregon is starting to look at developing better integration between its disparate asset management systems.

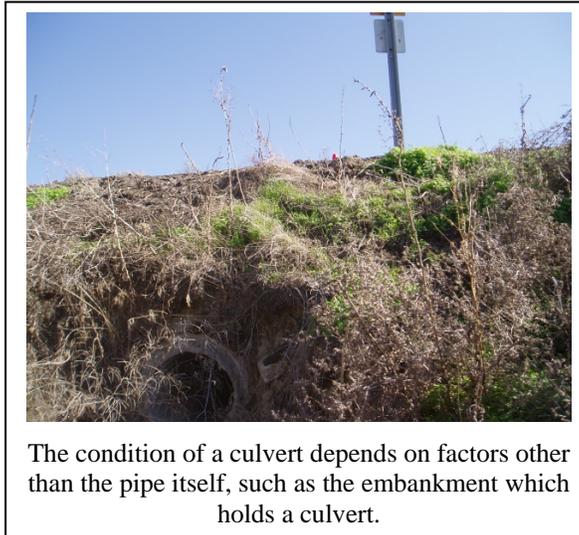Fish Passage is an important factor in culvert asset management in Oregon.
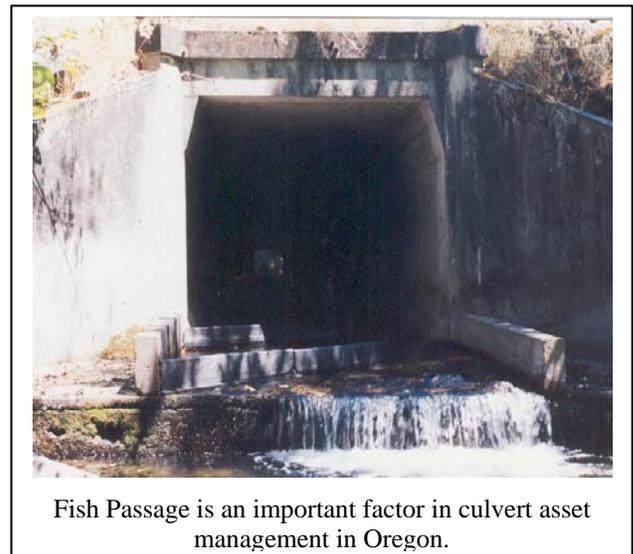
To achieve all the functional objectives for the Drainage Facility Management System requires a field visit and inspection of each facility to be included in the database. The milepoint locations and some attributes of some culverts and pipes are available from ITIS, but the scope of the available attributes is inadequate. Other drainage facilities are absent from ITIS. Such an enumeration cannot be accomplished in a reasonable period of time with existing resources. Thus an estimate of the required resources is an objective of the research project.

The data fields needed for the Drainage Facility Management System can be organized into a categorical matrix with location, highway,

structure, hydraulics, geotechnical, watershed, maintenance, and inspection data categories on one axis and required, optional, derived, and time varying data categories on the other axis.

To illustrate some examples: the milepoint location is required, but it cannot be reliably derived from any other data source and should be invariant over time. The lane width of the highway associated with a drainage facility can be reliably derived from other databases and will be updated in those systems. The design load of a culvert might not be known, nor be computable, and therefore is optional. The condition of the barrel of a culvert is not reliably available anywhere else, is essential for asset management, and will be time varying.

The design objectives for the Drainage Facility Management System can be summarized as

The condition of a culvert depends on factors other than the pipe itself, such as the embankment which holds a culvert.

follows. The system must be able to store the spectrum of data essential for managing all drainage facility assets. It must also have the ability to store additional data that will be collected for some of the facilities that will help in managing them.

A history of data that changes over time needs to be maintained for effective management. The system should be integrated with other existing asset management systems so that data values need only be maintained in one system and can be automatically propagated to other systems. The data required spans operational, fiscal, environmental, geotechnical, hydraulic, and watershed issues.

A final report on the Drainage Facilities Management System research project is expected to be published by summer 2007. Future research notes will address additional aspects of the project.

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**When the final report for this project is completed it will be available on the Research Unit
web page: http://www.oregon.gov/ODOT/TD/TP_RES/ResearchReports.shtml**

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*For more information on ODOT's Research Program and Projects,
check our website at*

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