

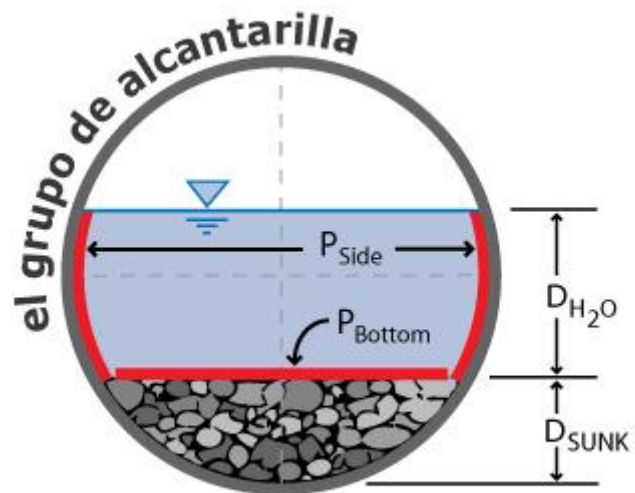
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Texas Department of Transportation
Culvert Inventory Geodatabase

Prepared by:
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Introduction

Summary

Culvert systems preserve the road base by draining water usually from ditches along the road, keeping the road surface dry and free of debris. In Texas, especially on secondary roads, culverts provide an excellent means of controlling water in areas that are prone to flooding. This would otherwise block the flow of traffic, stranding hundreds or perhaps thousands of people in a hazardous area. Over the years these culverts have become deteriorated, corroded, or damaged due to construction and weather. The Texas Department of Transportation (TxDOT) oversees these culverts, that are of many sizes and shapes along major highways and thoroughfares throughout the Lone Star State. Culverts that are less than twenty feet in diameter and are not cataloged by TxDOT need to have some means to identify them for cataloging and managing information. A geodatabase would need to be created in order to help inventory a portion of these culverts and to be used as a model to serve TxDOT for statewide implementation.

Purpose

The mission is to help TxDOT devise a plan by which they can catalog the hydraulic and maintenance characteristics of culverts. After researching and gathering data from TxDOT, the team can then focus on designing, building, and implementing a geodatabase to meet the client's needs. TxDOT can then use this geodatabase to analyze and decide on such needs as budgeting and scheduled repair and replacement. The geodatabase will contain information pertaining to designing and maintaining culverts, such as location, route and age. It will also recommend future planning for TxDOT throughout the state of Texas.

Scope

The geographic extent of the study area will be a road section in Hays County that will be used to test the usability of the geodatabase. The route will be selected with the aid of a maintenance field worker from the local TxDOT maintenance office who is familiar with the area and who could provide much needed information to the team, such as what areas would best represent culvert diversity and age.

Data

The data required to complete the TxDOT Culvert Inventory Geodatabase will include client supplied culvert and road section data derived from the Texas Reference Marker (TRM) System and road network/hydrography features downloaded from government agencies. Orthoimagery from 2008 will also be necessary to verify the locations of culverts along the road section selected as the representative sample to test the functionality of the geodatabase.

Data Sources

Texas Reference Marker (TRM) System culverts	Client supplied
Texas Reference Marker (TRM) System control sections	Client supplied
Texas Reference Marker (TRM) System maintenance sections	Client Supplied
National Hydrography Dataset	United States Geologic Survey
TxDOT Roadways 2010	Texas Natural Resources Information System
StratMap County Boundaries	Texas Natural Resources Information System
San Marcos, Texas Orthoimagery 2008	Capital Area Council of Governments

Software Requirements

ESRI ArcGIS 9.3

Microsoft Office Professional 2010

Methodology

Before the geodatabase is designed, the group will gather the source information necessary for creating the attribute fields of the tables in the geodatabase. The major source of information for this project will be the Texas Reference Marker System (TRM). The TRM is a program used by TxDOT to inventory road features, the attribute fields of the TRM files describe the locations of culverts and shape of culverts among other characteristics. These attribute fields will be incorporated into the tables of the geodatabase. Another source of information will be TxDOT maintenance office in San Marcos, Texas. Maintenance workers interact with these road features on a daily basis, the information they gather daily needs to be preserved in order to evaluate overtopping incidents over time. The team will investigate which additional information the maintenance workers gather in order to incorporate this into the tables that will be created in the geodatabase. The design of the geodatabase will begin once the data has been obtained and the group decides on how to organize the attribute fields and tables.

The geodatabase will be designed in ArcGIS and will be able to open in Microsoft Access. Tables will be created for the culvert attributes and the datasets mentioned in the data section of the proposal. The datasets will be projected in the same datum to establish a spatial reference. In ArcGIS, the user will be able to examine the spatial distribution of culverts as point features in a road segment. The attributes of these features can also be accessed through attribute tables. In Microsoft Access, the user will be able to open up tables and query any information desired.

Once the design of the geodatabase is completed, a Graphical User Interface (GUI) will be developed for inputting data into the geodatabase. The GUI will consist of an electronic form in Microsoft Access where the maintenance worker can input the data gathered in the field. The form will be very simplified and easy to use in order to accommodate those with little experience with Microsoft Access. A printable version of the form will also be available for the maintenance workers. While on the field the workers will be able to record the data on the form, the worker then can open up the geodatabase in Microsoft Access and fill out the GUI. Data entry through ArcGIS is another option, however for users with less technical training the GUI will be the most simple.

To demonstrate the functionality of the geodatabase, a road segment from Hays County, Texas will be chosen to use as an example. The road segment chosen will have culvert diversity in design and age. The San Marcos TxDOT Maintenance Office will be used as a resource in deciding which road to use. Once the road has been chosen, the TRM data for the road will be imported into the geodatabase. The additional data for the attribute fields not included in the TRM will also be inputted. The culverts from the road will be displayed in ArcGIS. Due to the mismatch of the culvert locations and the roads dataset, the group will correct the culvert locations using orthoimagery.

The final objective of the project is to develop a user's manual for the geodatabase. The user's manual will demonstrate how to input data into the geodatabase through ArcGIS or Microsoft Access. The road chosen from Hays County will serve as an example in the user's manual on how to input the data. The manual will be easy to understand for users who are not familiar with these programs because the language used for the guidelines will be non-technical. The objective of the manual is to train the users on data entry in an understandable way.

Implications

The culvert inventory geodatabase can be a very useful tool for hydrologic analysis that can assist engineers during the designing of new highway projects. Also, the geodatabase will be a very effective way of record keeping. The geodatabase will be distributed to local TxDOT maintenance offices where maintenance workers will have the ability to input information they have gathered on culverts. The result of this project will be the creation of an extensive database on culverts which will help in the design process of new road projects and a more efficient way of determining where maintenance work is necessary.

Budget

Data Collection

Total Hours (10 hours/week * 5 weeks * 2 consultants) + (5 hours/week * 5 weeks) + (7 hours/week * 5 weeks)	160
Hourly Pay	\$27.00
Total	\$4,320.00

Data Analysis

Total Hours (10 hours/week * 5 weeks * 2 consultants) + (5 hours/week * 5 weeks) + (7 hours/week * 5 weeks)	160
Hourly Pay	\$36.00
Total	\$5,760.00

System Management

Project Manager

Total Hours	50
Hourly Pay	\$50.00
Pay	\$2,500.00

Assistant Project Manager

Total Hours	30
Hourly Pay	\$45.00
Pay	\$1,350.00
Total	\$3,850.00

Equipment Costs (for 10 weeks)

Supplies (\$150/workstation * 4 workstations)	\$600.00
Maintenance (\$200/workstation * 4 workstations)	\$800.00
Depreciation (\$8,000 [total value of computers]/36 [equipment life in months]) * 2.5 [months equipment will be in exclusive use for project]	\$555.56
Total Equipment Costs	\$1,955.56

Software

Software License for 10 weeks (ESRI)	\$5,000.00
Microsoft Office Professional 2010	\$499.99
MS Office 2010 Product Key (3 @ 349.99)	\$1,049.97
Total Software Costs	\$6,549.96

TOTAL COSTS **\$22,435.52**

Timetable

Data Collection/Interpretation: Organizing the data will take 2 weeks. The entire team will communicate with the client to assure that the data collection process is complete for the project. Once the data collection process is complete the group will then begin the geodatabase design process.

Geodatabase Design: This stage depends on how quickly the group receives the data and specific objectives from the client. A geodatabase structure will then be designed to meet the client's specific requirements. Group members will then organize and edit the data into a compatible format for implementation into the geodatabase structure. The design process will take 2-3 weeks.

Develop GUI and User's Manual: The development of the graphical user interface (GUI) and user's manual will take 2 weeks. Team members will work with the local TxDOT maintenance office to determine the needs of the end user and to identify the most appropriate design guidelines.

Preparation of Final Report and Deliverables: This stage of the project will take 2 weeks. The final report and deliverables will be prepared for the client; the functionality of the geodatabase will be tested to assure it meets all requirements.

2/23 Project Proposal

2/23-3/9 Complete Logical Geodatabase Design
Complete Data Collection and Interpretation

3/9-3/30 Develop Physical Geodatabase Design

3/30 Project Progress Report

3/30-4/13 Develop Graphical User Interface (GUI) and
User's Manual for Geodatabase

4/13-5/4 Preparation of Final Report and Deliverables

5/6 Delivery of Final Report

Project Milestones

- Submit Proposal and Presentation 2/23
- Project Progress Report 3/30
- Delivery of Final Report 5/6

Final Deliverables

- TxDOT culvert inventory geodatabase, graphical user interface, and user's manual
- Detailed Final Report
- Professional Poster for Geography Department
- CD (2 copies) containing:
 - o All Data
 - o Metadata
 - o Report
 - o Poster
 - o PowerPoint Presentation
 - o Instructions for CD- Readme file

Conclusion

A simple and concise geodatabase capable of cataloging and managing information will allow TxDOT to properly repair and maintain culverts before failure occurs. This way, instead of reacting to failures, TxDOT can be proactive in preventing failures. The asset inventory and inspection model is the foundation in developing any management strategy for preserving TxDOT's culvert infrastructure. The geodatabase developed in this research project will assist TxDOT and local agencies in making proper decisions and in implementing a good inventory management program.

Participation

Cover Page	Thomas Platt
Title Page	Thomas Platt
Table of Contents	Kyle Vonderau
Introduction	Thomas Platt
Data	Jason Kleinert
Methodology	Andres Aguirre
Implications	Andres Aguirre
Budget	Jason Kleinert
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Conclusion	Thomas Platt
Participation	Jason Kleinert
Logo Design	Thomas Platt, Jason Kleinert