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Hydraulic Design of Highway Culverts A Guide to Computer Software Tools for Culvert Design and Analysis Hydraulic Design of Highway Culverts (3rd Edition) Concrete Culvert Design and Detailing Manual Hydraulic Design of Highway Culverts Hydraulic Design of Improved Inlets for Culverts In-Chamber Longitudinal Culvert Design for Lock Filling and Emptying System Some Important Factors of Culvert Design Highway Drainage Guidelines: Guidelines for the hydraulic design of culverts Hydraulic Design of Highway Culverts An Introduction to Surface Drainage Culvert Design for Professional Engineers Cost-effective Concrete Box-culvert Design Culvert Design Aids An Introduction to Hydraulic Design Data for Culverts Hydraulic Design of Highway Culverts A Guide to Farm Lane and Culvert Design and Management Culvert Design Interactive Computer Design of Culverts Design Procedures for Flexible Metal Culvert Structures Optimum Hydraulic and Srtucrural Design of Multi-cell Box Culvert Concrete Culvert Design and Detailing Manual One Piece Reinforced Concrete Box Culvert Design C D S (culvert Design System) Handbook of Concrete Culvert Pipe Hydraulics Culvert Design Manual Prototype Hydroinformatics-based System for Supporting Decision Making in Culvert Design and Monitoring Debris-control Structures Hydraulics of Culvert Design Including Constant Energy Concept A Study of Bankfull Culvert Design Effectiveness Instructions for Use of Culvert Design Charts Culvert Design Manual Culvert Design Procedure Design of Single Box Culverts Behavior and Design of Long-open Metal Culvert Structures How to Structurally Design a Concrete Slab Culvert? RC Slab Deck Design Using the FORTRAN-95 Program The Structural Analysis and Design of Reinforced Concrete Culvert Pipe for the California Aqueduct Hydraulic Design of a Longitudinal Culvert for Lock Filling and Emptying Systems Engineering and Design Culvert Design and Analysis Software Urban Flood Channel Design and Culvert Hydraulics

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"The main purpose of this project is to design a one-piece reinforced concrete box culvert and to establish whether it is a viable alternative to the two-piece design currently being used and produced by the Roads Corporation. The design of the one-piece box culvert is in accordance with the specifications produced by the National Association of the Australian State Road Authorities (NAASRA) 1976, Road Design Manual 1985, the Australian Standards for Concrete Structures (AS3600) 1988, and finally in accordance with VIC ROADS (Roads Corporation) own design specifications. Conclusions were based upon the overall design of the one-piece box culvert taking into account, its configuration (i.e. wall thicknesses, reinforcement layout), the formwork's suitability for repetitive use, and in general, the work associated with such a culvert design during the manufacturing, and installation stages. These factors will then be compared to those associated with the current two-piece box culvert process, to determine whether in fact, the one-piece is a viable alternative based upon these economic and ergonomic factors. " -- Synopsis. The economical design of culvert is a vital engineering decision due to the multiple repetitive requirements in the construction of highway facility. It is therefore important to seek for the cost effective design technique in order to reduce the project cost of highways with high demand of such structures. The economic design can be achieved through conventional culvert design practice, but the maximum economy can only be achieved by optimizing the design. The optimization procedure shall be applied from the hydrologic design, via the hydraulic design to the structural design in order to yield hydrological, hydraulic, and structurally optimal designed culvert structure. The hydraulic design determined the size of the culvert and barrel number requirement for the structure to control the passage of storm water flow through it, with risk, economy, property damage, highway overtopping and damage, in mind. Effective structural design is necessary for the resistance of the structure to various load combination induced from the highway traffic, overfill material, backfill material, hydrostatic thrust, self-weight, and the pressure due to the pipe flow condition. When site conditions warrant, it is more economical to provide a multi-cell box culvert structure than to embark on the construction of resources consuming bridge structure. The hydraulic design is according to the method developed by American Association of State Highway and Transportation Officials (AASHTO Methods) and Federal Highway Administration. The structure analysis is done using computer frame analysis software developed by Department of Civil and Structures, Manchester, United Kingdom. The structural design is according to BD/37 "Design of buried concrete structures" and BS8110 "Structural Use of Concrete: Part 1 Code of Practice for Design and Construction", Hydraulic Design of Highway Culverts, Third Edition Hydraulic Design Series Number 5 (HDS 5) originally merged culvert design information contained in Hydraulic Engineering Circulars (HEC)

5, 10, and 13 with other related hydrologic, storage routing and special culvert design information. This third edition is the first major rewrite of HDS 5 since 1985, updating all previous information and adding new information on software solutions, aquatic organism passage, culvert assessment, and culvert repair and rehabilitation. The result is a comprehensive culvert design publication. The appendices of the publication contain the equations and methodology used in developing the design charts (nomographs) and software programs, information on hydraulic resistance of culverts, the commonly used design charts, and Design Guidelines (DG) illustrating various culvert design calculation procedures. The number of design charts provided has been reduced recognizing the increased use of software solutions; however, the full set of culvert design charts will continue to be available in the archived second edition of HDS 5. FHWA Publication Number: HIF-12-026 Publication Year: 2012 Notice: This is a Color Printed Paperback version of the "Hydraulic Design of Highway Culverts, Third Edition". Full version, All Chapters included. This publication is available (Electronic version) in the official website of the U.S. Department of Transportation and Federal Highway Administration. Disclaimer: "The use or appearance of U.S. Department of Transportation and Federal Highway Administration, text, images or logos, Seals on this version does not imply or constitute endorsement of the distribution service." This publication contains clear and consise guidelines for the hydraulic design of culverts and describes the hydraulic behaviour of culverts in as simple a form as is consistent with the complexities of their actual behaviour. As part of the certification under the Clean Water Act 404 Nationwide Permit, the Ohio EPA mandated that the Ohio DOT install bankfull culverts in all new culvert installations subject to the permit. In addition, by embedding the culvert, the bottom of the culvert is to take on the characteristics of the natural streambed and promote the passage of fish and other aquatic organisms. The OEPA's requirement to install bankfull culverts has resulted in increased design and construction costs. The objectives of the study were to examine the parameters which control the benefits of bankfull culverts when installed, including how the benefits alleged are affected by culvert diameter, slope and length, and the size of the stream in which the culvert is placed. Ultimately, the research was designed to determine if bankfull culverts, as currently installed, provide the benefit of allowing movement of aquatic biota better than traditional culverts, if there is any impact on flood attenuation, and if the bankfull culverts installed in Ohio have caused quantitative environmental changes or cumulative impacts (as measured by the QHEI). The physical survey of the culverts revealed that of the 61 culverts identified by ODOT as being designed as embedded bankfull culverts (EBCs), there are only 12 that are actually embedded. ODOT should develop and implement a system of inspecting and verifying that culverts specified to be embedded bankfull culverts are actually installed as such. An important finding is that many of the culverts with greater than 1% slope had no sediment present inside of the culvert. The results of the survey indicate that, at the 90% confidence interval, sediments are being washed through culverts with a slope 1% or greater. Therefore it is recommended that EBCs should not be installed at slopes greater than 1%. Of the 12 embedded culverts, only two were found to be effectively allowing for the continuity of sedimentation patterns through the reach of a culvert. Because of the low numbers, the results found are not statistically significant. To better understand the functionality of culverts and the trends presented, more research is needed. ODOT should consider funding additional research in this area to confirm preliminary trends and provide more guidance in the design of embedded bankfull culverts. This is a study of the analysis and design of reinforced concrete box culverts (RCB), commonly used as underground conduits in Nebraska. Three major areas were emphasized: 1) soil pressures, 2) live loads and, 3) design procedures. Introductory technical guidance for civil engineers interested in surface drainage culverts. Here is what is discussed: 1. INTRODUCTION 2. FISH PASSAGE CONSIDERATIONS, 3. DESIGN STORM, 4. HYDRAULIC DESIGN DATA FOR CULVERTS. The U.S. Army Corps of Engineers is planning navigation improvements for many projects to meet predicted increases in tow traffic. Some of these improvements include the addition or replacement of the navigation lock.

Innovative design and construction techniques are being investigated for reducing construction costs, as well as operation and maintenance costs. The Corps identified that a savings in lock construction could be achieved if the conventional concrete gravity lock walls with culverts inside them could be replaced with thin walls and longitudinal culverts located inside the chamber. This culvert design was designated the In-chamber Longitudinal Culvert System (ILCS). This report provides the results of research conducted under Work Unit 33140, "In-Chamber Longitudinal Culvert Design for Lock Filling and Emptying Systems," of the Innovations for Navigation Projects Research Program. Design guidance for the ILCS is provided for low- to medium-lift locks. The guidance includes culvert location; port size, location, and spacing; port extensions; roof overhang; and wall baffles. Guidance is also provided for modified ILCS designs and single-culvert designs. Lock chamber performance guidance, based on acceptable filling and emptying operations, is also included. The results show that the ILCS is a feasible design based on the hydraulic performance determined from the investigation. The objective of this course is to provide understanding of culvert hydraulics and instruct in the design of both conventional and improved inlet culverts. Master's Thesis from the year 2013 in the subject Engineering - Civil Engineering, grade: Very Good (A), Addis Ababa University (Addis Ababa University Institute of Technology), course: Structural Engineering, language: English, abstract: This thesis focuses on the development of a FORTRAN 95 program for the structural design of the superstructure part of a concrete slab culvert. FORTRAN 95 is a programming language used in the fields of scientific, numerical, and engineering fields. In this thesis, this language has been used to develop the program for the structural design of reinforced concrete slab culvert deck. The input data for at grade and at fill slab culverts are saved on a note pad in the external file folder which constitute the material properties, geometric features and proposed diameter of reinforcement bars of the slab culvert and its deck in the folder which contains FORTRAN 95 program. The output data is written on the note pad in the external folder based on the format assigned for each output in the folder which contains the design results of slab deck thickness and area, spacing and length of main, distribution and temperature reinforcement bars. Besides Edge beam design parallel to the traffic is executed and shown in the output result by the developed program. Concrete slab culvert is an important structure used to convey trucks and pedestrian along a road corridor or in one of a range of other situations. This structure is highly constructed in highway road projects in Ethiopia. In this study, a FORTRAN program is developed for the structural design of reinforced concrete slab culvert deck according to the provisions given in AASHTO LRFD Bridge 2005 Edition.The developed program is expected to assist the structural designers and users to design the superstructure part of a reinforced concrete slab culvert deck efficiently with great accuracy. Both at grade and at fill slab deck thicknesses are computed according to the specification specified in AASHTO LRFD Bridge 2005 Edition. The reinforcement bars are also designed based on the requirements specified in the code. Within the context of this work the program is developed in four steps. The first step is to define and analyze the problem; the second step is to develop an optimal solution and designing the program, the third step is coding the program and the final step is testing and documenting the program. Introductory technical guidance for civil engineers interested in design of culverts. Here is what is discussed: 1. GENERAL 2. INLET CONTROL 3. OUTLET CONTROL 4. PROCEDURE FOR SELECTION OF CULVERT SIZE 5. INSTRUCTIONS FOR USE OF INLET-CONTROL 6. INSTRUCTION FOR USE OF OUTLET-CONTROL NOMOGRAPHY. Hydraulic Design Series Number 5 (HDS 5) originally merged culvert design information contained in Hydraulic Engineering Circulars (HEC) 5, 10, and 13 with other related hydrologic, storage routing and special culvert design information. This third edition is the first major rewrite of HDS 5 since 1985, updating all previous information and adding new information on software solutions, aquatic organism passage, culvert assessment, and culvert repair and rehabilitation. The result is a comprehensive culvert design publication. The appendices of the publication contain the equations and methodology used in developing

the design charts (nomographs) and software programs, information on hydraulic resistance of culverts, the commonly used design charts, and Design Guidelines (DG) illustrating various culvert design calculation procedures. The number of design charts provided has been reduced recognizing the increased use of software solutions... Hydraulic Design Series Number 5 (HDS 5) originally merged culvert design information contained in Hydraulic Engineering Circulars (HEC) 5, 10, and 13 with other related hydrologic, storage routing and special culvert design information. This third edition is the first major rewrite of HDS 5 since 1985, updating all previous information and adding new information on software solutions, aquatic organism passage, culvert assessment, and culvert repair and rehabilitation. The result is a comprehensive culvert design publication. This publication contains the equations and methodology used in developing the design charts (nomographs) and software programs, information on hydraulic resistance of culverts, the commonly used design charts, and Design Guidelines (DG) illustrating various culvert design calculation procedures. This third edition is the first major rewrite of HDS 5 since 1985, updating all previous information and adding new information on software solutions, aquatic organism passage, culvert assessment, and culvert repair and rehabilitation. The result is a comprehensive culvert design publication. The appendices of the publication contain the equations and methodology used in developing the design charts (nomographs) and software programs, information on hydraulic resistance of culverts, the commonly used design charts, and Design Guidelines (DG) illustrating various culvert design calculation procedures. The number of design charts provided has been reduced recognizing the increased use of software solutions; however, the full set of culvert design charts will continue to be available in the archived second edition of HDS 5. The current guideline for culverts design account for hydrologic, hydraulic, and geomorphological conditions at the construction site. Less attention is given to the assessment of the potential for sedimentation within and in the culvert vicinity. Sedimentation becomes an increasing concern for regions where the soil erodibility is historically high (such as the US Midwest) as the recent changes in the land use and climate exacerbate the problem. Culvert design is based on a wide variety of data sources typically stored in various formats in multiple data provider repositories. Assembly of the data needed for design as currently conducted is time consuming and inefficient while the wealth of information garnered through post-construction monitoring is not used to inform the construction of new culverts in the same geographical area. This thesis presents a solution to the issues above using Hydroinformatics approaches. The end product of the thesis is a geo-platform designed to achieve automated culvert design, sediment mitigation design, and digital culvert inspection. The platform has two primary workflows: culvert design and culvert monitoring. All the functions and tools inside the platform are developed using information and GIS technologies. The platform is web assessable, light weighted, and user friendly.

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