

DIVISION OF RESEARCH, INNOVATION & SYSTEM INFORMATION
Research Initial Scope of Work
SUBMITTAL FORM - FY 16/17

I. Project Number: P858
Project Title: Culvert Project Planning Cost Estimate Tool

II. Task Number: 3051
Task Title: Developing a Life Cycle Cost Analysis for Fish Passage Retrofit
Projects and Structures

III. Project Problem Statement:

Caltrans needs methods to estimate and compare life cycle costs for designing, constructing and maintaining culverts that provide safe passage of aquatic organisms and other wildlife with conventional culvert designs. Caltrans needs reliable project planning cost estimates to be able to properly justify projects, analyze various project alternatives, budget for projects, and program projects. At the present time there is not a cost estimating tool to be able to compare the various alternatives for moving water and maintaining fish and wildlife passage. The relative success and efficiency of fish passage culvert retrofit projects (e.g. baffles, weirs, fish ladders and roughened channels) at improving fish passage are not well studied or documented in California. More cost and field analyses are needed to show the initial and long-term costs (construction, maintenance and operational costs) of fish passage projects and overall effectiveness of fish passage remediation projects. In addition, there is not enough information on the costs and benefits of providing opportunities for a dual purpose, terrestrial wildlife connectivity solutions, as part of the final solution at known fish barrier locations.

IV. Objective:

This task will compare the efficiency and life cycle costs of culverts retrofitted for fish passage with west coast bridges, hydraulically designed culverts, and stream simulation culvert designs and develop a life cycle cost analysis methodology.

V. Task Description of Work and Expected Deliverables:

This task will include the following:

- Develop a study/review of the costs, life-span and effectiveness of past fish passage retrofit projects on west coast state highway systems (CA, OR, WA)
 - Range of costs to construct;
 - Effectiveness of retrofit to provide access to anadromous fish at all life stages;
 - Costs of continued annual inspections, maintenance work and initiation of projects to resolve damage, cleaning and deficiencies;

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- Develop a full economic analysis that quantifies the total cost of constructing and maintaining transportation projects for fish;
- Contact research entities and western state DOTs for updated information and available data on life cycle costs analyses;
- Develop field studies and collect field data of completed and proposed Fish Passage projects in California on overall effectiveness of remediating fish and wildlife passage; and
- Develop an economic analysis that includes wildlife passage elements (e.g. fully spanning river channels, funnel fencing, etc.), in final solutions for fish passage remediation projects;
 - benefits to wildlife;
 - benefits to safety.

The expected deliverables are the data, information, and analyses developed in the project delivered to Caltrans in interim reports and a final research report.

VI. Background:

Culverts are an important part of a highway complex allowing water to flow through a roadway section. They are necessary to protect both the roadway and adjacent property from water damage and are often a major portion of the cost of a road. Additionally culverts can be used by fish and wildlife to traverse a highway helping the Department to meet its obligations under environmental law, policy, and Caltrans goals. In the past when culverts were designed to insure fish passage emphasis was often given to accommodating returning spawning runs of anadromous salmonids. However, now designs may consider the stream and shoreline habitat requirements and need for unimpeded movement of slower and smaller fishes along with amphibians, turtles, and other aquatic and terrestrial organisms. These approaches generally result in constructing larger culverts than conventional hydraulic approaches. At times existing culverts are retrofitted to provide conditions conducive to fish and wildlife passage. To be able to compare alternatives and plan for transportation projects it is necessary to be able to provide planning level estimates based on life cycle costs for culverts that facilitate fish and wildlife passage.

VII. Estimate of Duration: 36 Months

VIII. Related Research:

Caltrans Preliminary Investigation: Comparing Life Cycle Costs of Fish- and Wildlife-Friendly Culverts with Conventional Culvert Designs. There is much in the literature that addresses culvert design, with a wealth of recommendations on the design, construction and maintenance of conventional culverts as well as designs that accommodate fish passage. What the current literature appears to fail to address in any significant way are cost comparisons of conventional and fish-

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friendly culverts. This study noted a common theme when the topic of life cycle costing for culvert design appears in the literature: More data are needed. For example, a 2009 Minnesota DOT report concluded that additional research is required to determine if benefits such as reduced erosion and reduced maintenance costs will offset the additional costs associated with the larger culverts designed for fish passage. A 2007 FHWA report comes to a similar conclusion, noting that development of a database of standardized costs would allow agencies to compare costs for culvert operations on a life cycle basis, and recommending that state DOTs adopt a standard procedure when describing design and maintenance costs of culverts.

NCHRP 25-25/Task 93 [Active] Long-Term Construction and Maintenance Cost Comparison for Road Stream Crossing Hydraulic Design vs. Bankfull Width

Design: The goal of this research is to quantify the long-term costs of road stream crossings that span the bankfull width of a waterway in order to provide an accurate picture of the total life-cycle cost of the structure. These costs will then be compared to the costs of structures that constrict stream flows. Understanding the true cost of each structure type would help project designers make the most cost-effective structure choice and better comply with state and federal environmental regulations. This project is active but delinquent.

IX. Deployment Potential:

This is one task of a larger project to develop a cost estimating tool for the different options of maintaining both fish and wildlife passage while adequately moving water across highways. A portion of this project is currently being done in NCHRP 25-25/Task 93 described above. The deployable product for this task will be data and other information about the technical success and economic efficiency of fish passage culvert retrofit projects (e.g. baffles, weirs, fish ladders and roughened channels) at improving fish passage in comparison with the technical success of west coast bridges, hydraulically designed culverts, and stream simulation culverts. The information will be used in developing a life cycle cost analysis methodology. The sponsor for this task is the Caltrans Division of Environmental Analysis.

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