CROSSINGS
NEWSLETTER OF THE WOOD IN TRANSPORTATION PROGRAM

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Synopsis of the Wood In Transportation Demonstration Projects Funded in Fiscal Year 1999

The USDA Forest Service Wood In Transportation Program is funding three demonstration projects in fiscal year 1999 that focus on the commercialization of proven technology. The projects will focus on the following objectives:

1. Commercialization of modern timber bridge technology that has been successfully developed,
2. Innovation that leads to cost-saving strategies,
3. Innovation that leads to improving the performance of existing designs.

The purpose of Wood In Transportation demonstration projects is to foster the commercialization of wood-in-transportation technology by designing, fabricating, and installing the most cost-effective, structurally sound timber structures that preferably use local timber resources as well as local businesses and employees.

A brief description of each project is listed below:

Michigan project: The MI Association of Resource Conservation and Development Councils will receive $139,000 for the construction of five bridges. This project will replace four existing bridges and construct one new bridge. All five bridges will consist of stress-laminated, longitudinal decks constructed from red pine lumber native to Michigan. The bridges will vary from a single span up to three spans, lengths range from 22 feet to 81 feet, widths range from 14 feet to 24 feet. Preservative treatment will be chromated copper arsenate (CCA).

This project will assist with the overall goal of the Michigan Timber Bridge Initiative in establishing an in-state industry to design, fabricate, treat and erect timber bridges.

West Virginia project: The WV Division of Highways (DOH) will receive $95,000 for the construction of nine bridges. All bridges will be approximately 20 feet in length and 16 feet in width and be constructed with red oak or southern pine lumber. Preservative treatment will be CCA. These bridges will provide improved access to homes in WV that have historically been accessed by privately maintained roads and bridges. The inadequacy of current access roads has been made evident by several flash floods in recent years that have washed out some bridges. To address the needs of private homeowners the WV DOH has initiated a Home Access Roads Program to bring some of these roads and bridges into the state's highway system. The bridges will be a combination of three different superstructures and two different substructures. The combinations are listed below:

1. Nail laminated/steel stringer with gabion abutment,
2. Nail laminated/steel stringer with crib abutment,
3. Timber plank/steel stringer with gabion abutment,
4. Timber plank/steel stringer with crib abutment,
5. Stress laminated deck with gabion abutment,
6. Stress laminated deck with crib abutment.

Massachusetts project: A $75,000 grant will be awarded to the Mount Wachusett Community College, Forest & Wood Products Institute to fund the development and coordination of a WIT program in Massachusetts. The State of Massachusetts has already set aside $5,000,000 to cover construction costs for a MA Wood In Transportation Program. USDA Forest Service funds will cover a portion of the costs of a MA WIT coordinator for two years. In addition, the project will result in the design, construction and installation of four red maple glued-laminated timber bridges. The bridges will incorporate a common design and the use of factory built, prefabricated, glued-laminated, sectional components. Two of the bridges will be 30 feet in length and 17.5 feet in width. The other bridges will be 20 feet in length and 15.5 feet in width. Preservative treatment will be creosote.

For additional information about these projects, please contact the National Wood In Transportation Information Center at 304-285-1591.

Gold-Rush Ghost Town, Gets a New Alaska Yellow-Cedar Bridge

INTRODUCTION

Skagway, a picturesque restored gold rush town, is located in a spectacular fjord at the head of Lynn Canal, the northernmost end of Alaska's Inside Passage. The City of Skagway, responding to increasing visitor and tourist traffic, recently decided to improve access to the old abandoned ghost town of Dyea. Dyea is located about three miles from Skagway "as the crow flies", but it is nine road miles over a narrow gravel road that winds around two deep fjords.

Dyea and Skagway were the booming, thriving gateways to the Yukon gold fields at the beginning of the fabled gold rush "Trail of '98". In 1898, thousands of stampeders crowded into Skagway and Dyea by ship from the "lower 48". There, they began the grueling toil of their trek up the infamous White Pass from Skagway, or the shorter but still brutal Chilkoot Pass from Dyea, on to Lake Bennett to build boats, then down the Yukon River, and finally, Dawson City - the fabulous gold strike! The Royal Canadian Mounted Police, stationed at the summit of Chilkoot Pass, would let no one through unless they had 2000 pounds of supplies - all of which had to be packed up the last steep pitch, "The Golden Staircase", on men's backs, fifty pounds at a time!

The White Pass and Yukon Railroad was built to Skagway, which is still an active community and popular tourist destination. Dyea was abandoned and is a true "ghost town". No structures remain in Dyea, only stumps of wooden pilings show where piers and wharves once stood. The old Dyea cemetery is a popular tourist attraction.

The only public access to most of the Dyea Flats required fording Nelson Slough in the area of tidal influence. Dyea has one of the largest tidal ranges in the world, as much as 24 feet in six hours. The normal eighteen inches of water at the Nelson Slough ford becomes about four feet deep on an extremely high tide, so access was problematical, unless you were on a tall horse! Since the year-round-flowing Nelson Slough runs through the area, a bridge was needed to provide reliable access to Dyea Flats at all tidal stages. The bridge is located about a quarter mile below the ford crossing.

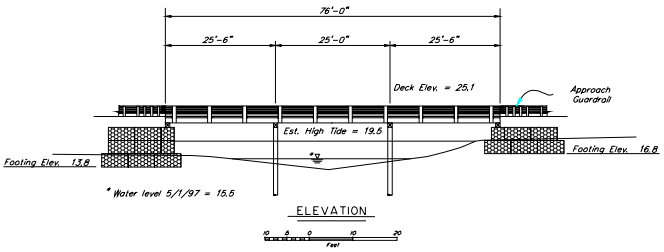
Another interesting feature is that the Skagway-Dyea area is "glacially rebounding" at the rate of about one inch per year. This means that the bridge site is over eight feet higher than it was a century ago!

The USDA Forest Service administers the Wood In Transportation (WIT) cost-share demonstration grant program "to promote cost-effective, structurally sound bridges, preferably utilizing local timber resources, as well as local businesses and employees". The City of Skagway applied for, and received, a grant from the Forest Service for assistance in design and construction of a timber bridge. The grant specified the bridge would be constructed from untreated Alaska yellow-cedar, a naturally decay-resistant wood species, using recently developed stressed-deck technology.

DESIGN

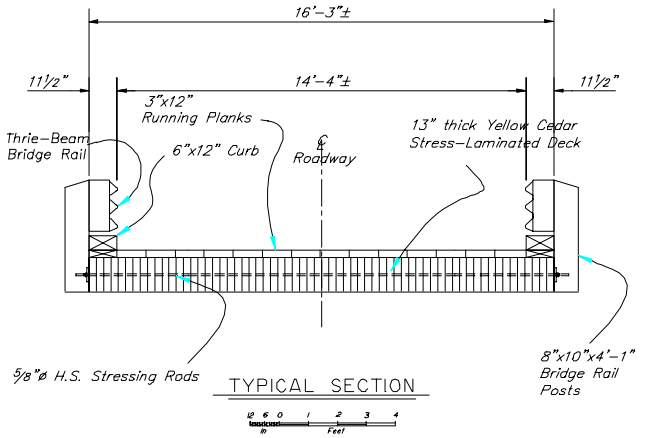
In the spring of 1997, the City of Skagway retained Muchmore Engineering International, of Juneau, Alaska, to design the bridge across Nelson Slough.

Criteria for bridge aspects relating to stress-laminating were based on Chapter 9, Design of Longitudinal Stress-laminated Deck Superstructures, Timber Bridges, Design, Construction, Inspection and Maintenance, USDA Forest Service Publication EM 7700-8, Aug. 1992. (Also Guide Specifications for the Design of Stress-laminated Wood Decks, published by the American Association of State Highway and Transportation Officials (AASHTO)). All other aspects of the bridge design were based on the Standard Specifications for Highway Bridges, also published by AASHTO, 1996.



The bridge is designed for AASHTO HS20-44 loading, a bridge length of 76 feet, a width of 16'-3" out-to-out (14'-4" roadway width), and a skew of 0 degrees. The bridge has three spans of 25 feet each, center to center of bearing.

The stress-laminated deck is 13" deep, and consists of 3"x13" rough sawn Alaska yellow-cedar lams and is continuous for the full length of the bridge. Individual lams are 16 feet in length with 12 foot, 8 foot and 4 foot lams staggered at each end of the bridge. This allows joints to be staggered such that no joints are closer than 4 feet in adjacent lines of laminations.



The stressing system is designed for 5/8" diameter high-strength galvanized steel thread-bars, conforming to the requirements of ASTM A722 (American Society for Testing and Materials, 1988). The 18-foot long stressing bars are spaced at two foot centers through holes drilled at mid-depth of the deck lams, with heavy galvanized steel bearing plates at each end. Prestressing tension is applied with a center-hole hydraulic jack, one rod at a time. Rods are sequentially tensioned several times until each rod is "squeezing" the lams together with about 29,000 pounds of force.

The two piers are bents consisting of three pressure-treated Class A Douglas-fir piles (ASTM D25-91) driven to a minimum of 20 ton bearing capacity with a 12"x12" cap and 3"x13" cross bracing. Because of environmental constraints, the normal creosote or pentachlorophenol treatments are not allowed, so the piles are treated with copper naphthenate in heavy oil by Perma Post Products of Hillsboro, Oregon.

The abutments are U-shaped retaining walls consisting of rock-filled gabion baskets, topped with 12"x12" cedar sills to support the bridge ends. Curbs and rail posts, including approach rail posts, are also of Alaska yellow-cedar. Bridge rail posts are spaced at eight-foot centers. Bridge railing is thrie-beam galvanized steel, and approach railing is W-beam galvanized steel, with a galvanized transition rail between.

Important features of this stress-laminated timber bridge include:

1. Utilization of locally harvested and milled decay-resistant timber.
2. Fabrication and construction requiring only readily-available materials, normal carpentry and construction skills, and commonly used construction equipment.
3. The maximum length piece in the stress-laminated deck is 16 feet.

CONSTRUCTION

The construction permit from the State Department of Fish & Game specified an in-stream construction window of June 1 to August 7. Since the construction contract was not signed until late June, the piling had to be driven before any of the Alaska yellow-cedar was delivered. Pile driving was completed by mid-July.

The City of Skagway procured part of the bridge materials prior to advertising the construction contract. This included galvanized hardware, stressing rods, gabion wire baskets, metal railing components, and treated Douglas-fir piling, all purchased from regular commercial suppliers. However, procuring the Alaska yellow-cedar timbers for the bridge proved not so simple.

The City hired Whitestone Logging of Hoonah, Alaska, to harvest the cedar trees on Chichagof Island and to transport them to Icy Straits Lumber Company's mill for processing. Difficulty in finding a sufficient number of large cedar trees for bridge timbers delayed timber production. About two-thirds of the cedar was delivered to Skagway in late July 1998 and the remainder in September 1998.

The sawmill, located on Chichagof Island, is over 100 miles by water from Skagway. Since no overland roads connect any towns in southeast Alaska, the rough-cut timbers had to be shipped on trailers from the mill, via State ferry to Juneau, and then by commercial barge to Skagway.

Hamilton Construction Company, of Skagway, was awarded the construction contract in late June 1998. The contract was to drive the piling, build the roadway approaches, fabricate the timber, and construct the bridge.

While the contractor was waiting for the cedar to arrive, he built the two pile bents and the gabion abutments. When the cedar arrived, it was fabricated and drilled. Temporary false-work bents were built in each span, the deck lams were assembled, then stressed together. The bridge went together "like tinker toys", very rapidly, with no problems.

The rods were re-stressed in the spring of 1999, and it is expected that no further stressing will be required.

The Skagway City Manager, Bob Ward, summed the project up as follows: "It is a terrific looking bridge, smelling of fresh cut cedar."

Built exactly a century after Dyea sprang to life, the bridge will serve visitors to this historic area for many, many years to come.

For additional information about this project, contact Frank Muchmore at 907-463-2513.

—— Frank Muchmore
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Article contributions, questions or comments may be sent to Ed Cesa, Program Manager, National Wood In Transportation Information Center or Mr. Chris Grant, Program Assistant, USDA Forest Service, 180 Canfield Street, Morgantown, WV 26505; Phone: 304-285-1591 or FAX: 304-285-1564; or E-mail to cgrant/na_mo@fs.fed.us.

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