CANADIAN CONSULTING ENGINEERING AWARDS 2015

Highway 63

project category:
TRANSPORTATION

Project Information

Project name: Highway 63:02 Twinning
Location of project: Alberta Highway 63, Control Section 02, from km 0.675 to km 34.000
Category: Transportation

ENTERING FIRMS

Firm name: WSP Canada Inc.
Firm address: 11446 Winterburn Road, Edmonton, Alberta T5S 2C4, Canada
Role in the project: Prime consultant
Member of the Association of Consulting Engineering Companies of Canada? : Yes

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Project Outline

Alberta Transportation's mandate is to complete the twinning construction of Highway 63 by 2016. WSP was awarded a 34-kilometre segment in 2009 for: the design of the highway twinning, modernized vehicle inspection facility and bridges; construction management and contract administration; fish habitat compensation; and wetland enhancement. Cost saving measures along with innovative design and environmental protection strategies were implemented without compromising the safety of motoring public. These measures achieved $30 million cost savings for Alberta Transportation.

INNOVATION

Highway 63 is a 250-kilometre major transportation corridor to the Fort McMurray area that requires twinning by 2016. Construction budget control was vital to the project and was achieved through the implementation of the following key strategies: (i) an innovative median VIS with weigh scales, accessible by both northbound and southbound movements; (ii) modification of the current Alberta Transportation design philosophy which require a much wider initial road top for future asphalt concrete overlays; (iii) increasing of outer lane width in the northbound direction from the conventional 3.7m to 4.5m to accommodate oversized vehicles; (iv) maximized utilization of existing two lane highway infrastructure. These creative design approaches resulted in a $30 million cost savings to Alberta Transportation for the 34-kilometre segment.

There was an absolute requirement to minimize interruption to traffic flow in order to maintain efficient movement of goods and services, and work zone safety. The original conventional highway design required the installation of several bridge size culverts (culverts greater than 1,500mm in diameter) through open cutting of the existing highway, and temporary traffic diversions along with speed reductions. A creative design approach was sought where all bridge size culverts were installed through trenchless methodology, thus eliminating the need for temporary detours and speed reduction through the work zones. The culvert diameters ranged from 1800mm to 3600mm.

Utility conflicts within the project limits were evident as the highway crosses several crude oil pipelines ranging from 300mm to 1,050mm in diameter. Coordination of the design and construction with the pipeline owners was crucial to the delivery of this project. The highway vertical profile and horizontal geometry required careful engineering in order to minimize impact to these pipelines, and the cost of horizontal and vertical relocations.

A concerted effort was made to minimize destruction of wetlands along the project corridor during construction. WSP engineered wetland compensation areas to provide new habitat for moose, birds and various aquatic species, including utilizing native vegetation to re-establish natural habitat. A fish habitat compensation area was also developed along the La Biche River to provide spawning grounds for various fish species, including expansion of the existing bank for a total area of 900m^2 and re-vegetation with native plants among others. The site was isolated with sheet piles during the construction; and the river was protected at all times by employing various erosion and sediment controls, and constant environmental monitoring.

COMPLEXITY

The specified completion date required aggressive design and construction scheduling, including creative construction methodologies such as winter grading, the development of winter construction specifications, operational techniques to prevent freezing of earth embankment, and a 24-hour, 7 days a week operation.

Expansive muskeg locations along the new alignment presented significant challenges due to the depth of removal and constructability issues arising from the soft yielding materials. Winter grading was necessary for the muskeg removal to provide a stable foundation for construction equipment.

The installation of several large diameter bridge-sized culverts was required to meet the new watershed design standards. Construction of the new structures was significantly hampered by the restricted activity period for fish bearing streams, which prevented completion of the project by the required date. Creative trenchless installation methods were utilized to extend the available construction season into the winter months, resulting in timely contract completion.

Utilities, including both pipelines and power lines, required expedited relocation in order to avoid impacting or delaying construction. Extensive coordination between the utility contractors, the highway construction contractor, WSP and the owner was crucial to facilitating a successful utility relocation.

Difficult land acquisition negotiations were successfully completed with over eighty individual parcel owners and with minimal expropriations required.

All-season grading presented significant erosion and sediment control issues, and required very specific and detailed mitigation measures to prevent releases into waterbodies. On-site sediment storage systems were required to deal with the large volumes of water, and innovative installation methods for erosion control devices into frozen ground conditions were developed.

SOCIAL AND/OR ECONOMIC BENEFITS

Reduced road user cost is the predominant benefit emanating from the highway twinning. Highway 63 in general has a high collision rate, with higher instances of injury, fatality and property damage. This higher-than-average and personal injury accident rates are also taking a serious toll on the local volunteer emergency response personnel, including many that are leaving the service due to fatigue, stress and overwork. The twinning of the highway is expected to significantly lower the number of collisions.

The twinning also provides an efficient movement of oversize loads and passing opportunities which are currently unavailable. The posted highway speed will increase from 100 km/ to 110 km/h, reducing overall travel time.

Highway 63 is used to transport a wide range of goods (including many oversize loads) on a daily basis. The construction of the VIS provides a tool to enforce axle weight limits on the highway, thereby ensuring that the desired service life of the highway pavement is achieved. Through enforcement, frequent future maintenance and resurfacing triggered by overloading are greatly reduced, minimizing unnecessary capital spending. Reduced construction conserves precious aggregate resources and reduces the overall carbon footprint created during the production of hot asphalt mixes for resurfacing.

Considering that this highway also transports toxic and dangerous goods that are harmful to both flora and fauna, the twinning design included containment considerations for potential spills in close proximity to watercourses. These areas provide a holding mechanism that prevents direct inflow into watercourses.

ENVIRONMENTAL BENEFITS

There are over 90 combined watercourses and wetlands within the project's geographical scope. The creation of new wetland habitat on public lands was instrumental in offsetting destruction of existing wetlands along the construction corridor. Additional wetlands were developed to imitate natural wetlands and provide native vegetative growth at the conclusion of the project. Stream and river crossings had native wetland soils with vegetative propagules salvaged and stored for later re-use in order to speed up the transition back to pre-disturbance conditions.

The creation of a fish habitat compensation area on the La Biche River provides an enhanced fish spawning location and improved natural vegetation. This offsetting was larger than required, based upon the project footprint, thus allowing other projects along this 100-kilometre corridor to be included in the compensation balance.

Various erosion and sediment control measures were implemented to mitigate any potential environmental releases throughout the duration of the project. The inclusion of a Certified Professional in Erosion and Sediment Control (CPESC) added an additional level of compliance monitoring for erosion and sediment control measures, as well as consistency throughout the project.

Borrow locations were designed to blend into the surrounding topography and landforms. Typical rectangular borrow excavations were replaced with flowing multi-depth sites with irregular contours, and re-vegetated as soon as possible including wetland soils salvaged from various project locations. This helped to speed up the re-vegetation process and ensure previous native and wetland species propagules were utilized to reduce the possibility of introducing invasive or non-native species.

MEETING CLIENT'S NEEDS

Alberta Transportation's main goals for twinning Highway 63 by 2016 are to improve safety and commercial traffic enforcement; accelerate economic investment within the project corridor; ameliorate access to markets and optimize traffic flow to and from the Fort McMurray Region; and reduce the environmental impacts of construction activities on the local landscape.

Project timelines and budgets provided a limited margin for variation. Under tight timelines, WSP completed the highway design and issued four separate tenders for the work. Grading operations were undertaken in winter months to accelerate project schedule and facilitate construction through soft yielding areas (i.e. muskeg). It was also necessary to employ day and night time construction crews during the grading to increase productivity. A creative design approach resulted in $30 million cost savings, minimizing potential project delays due to lack of funding.

Trenchless installation of five bridge-sized culverts was undertaken during winter, permitting accelerated project completion with minimal disturbance to travelling public, and eliminating multiple detour construction and reduced user costs. This method reduced chances of water quality deterioration as it permitted the work to be completed while under frozen conditions. In other situations, the low flows in the winter period provided convenience for channel diversion and permitted the isolation to be less invasive, and reduced the impacts as the disturbances occurred outside the restriction window.

Wetland compensation was a key environmental focus as destruction of wetlands along the new alignment was unavoidable. Additional compensation areas were provided to offset the initial destruction.

ANNEX 1

CONSENT FORM

ANNEX 2

OFFICIAL RECEIPT - ONLINE ENTRY FORM

WSP