Trinidad and Tobago Diego Martin Highway and Western Main Road

Canadian Consulting Engineering Awards
Transportation

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SUMMARY

The Government of Trinidad and Tobago needed a program to remove the severe congestion at the intersection of Western Main Road at Diego Martin Highway, 5-km west of the Capital, Port-of-Spain. WSP Canada was awarded the project following competitive international selection process. Services were delivered February-to-September 2015, recommending a four-stage improvement program to provide road users and pedestrians with affordable, safer and efficient connectivity with least impact to environment and community; and yielding economic benefit.

PROJECT HIGHLIGHTS

INNOVATION

Approximately 55,000 vehicle-day commuters were subject to peak-hour speed of 10 km/h to cross this interchange. In a 10-month period preceding the study, there were 43 collisions recorded with more than seven fatalities and maimings. The area is flood/landslip-prone but historically there has been no comprehensive drainage management. Existing concrete structures showed visible signs of deterioration. Corridor right-of-way was limited and conflicted with other agencies' development plans. Proposed improvement solution had to be constructible without disrupting traffic on the only arterial road west of Port-of-Spain.

Engineering/Traffic Surveys and data collection were undertaken using non-interference and non-destructive methods. Manual counts were supplemented with video recordings. In order to model existing and future traffic two models were built: a transportation demand model using EMME software that coded to a very detailed level and a micro-simulation model built to model the interaction between vehicles given the current road network and future potential road networks. The models were calibrated to existing conditions based on traffic count and travel time data. The findings indicated a 76% increase in traffic volumes over 25 years – with an alarming associated risk of traffic congestion and higher emissions.

Senior engineering staff from Canada assessed the health and integrity of existing bridge structures. A remotely operated camera was utilized to view and record otherwise inaccessible areas, elements, or confined spaces of existing structures. This negated the need for specialized access equipment or traffic control while enabling a thorough inspection of all bridge components – many of which have not been inspected since construction. Numerous defects and issues were identified including bridge bearings, culvert soffits, pier caps, and other hard to reach components. Some of the inspections were completed from a boat which enabled inspectors to identify severe deficiencies in the bridge concrete pier piles located in a brackish river-mouth. Use of satellite imagery for the concept study and the provision of unmanned aerial vehicles during the detailed phase were adopted to overcome schedule constraints.

The methods adopted for the traffic forecast, condition and ground surveys, and mapping; were the first such techniques adopted on a project of this scale in the country.

The deteriorated state of existing structures, loss of economic productivity and increased safety risks abundantly justified an early need for an improved interchange. The journey time saving with the improvements produced approximately Can$ 230M savings over 25 years, at 2015 prices.

COMPLEXITY

This project is located in an area with development on both sides of the road, coastline to the south and hills to the north. Western Main Road is the only continuous east west route that serves both as an arterial for long distance heavy traffic to the North-West Peninsula including Chaguramas (subject of a major eco-tourism development plan) and as a collector for local access. There are competing development plans from other agencies within the project-influence-area that severely limit the real-estate availability and the options for construction staging.

The quality and quantity of existing data was limited; this included traffic counts, future traffic projections, structural as-built drawings, maintenance information, etc. Traffic counts, ground surveys and geotechnical investigations had to be undertaken without interfering with traffic.

Satellite imagery for the concept study and the provision of unmanned aerial vehicles during the detail phase was adopted to overcome the schedule and regulatory constraint to access outside of Right-of-Way. Automated traffic counters were not used due to very high risk of theft or damage. The calibration of manual traffic counts with videoed counts was undertaken to eliminate potential count errors.

The stakeholder consultative group included privately operated maxi-taxi operators, who traditionally pick up and drop passengers in a hap-hazard way. Their support to the inclusion of ramps, through lanes and designated laybys in the design was successfully achieved through consultative inclusion.

SOCIAL AND/OR ECONOMIC BENEFITS

The existing land-use and socio-economic characteristics of the study area reflect its function as a close and easily accessible suburb of the capital, Port-of-Spain and its rapid growth during 1970 and 1990 from a series of small rural settlements in the valleys and coastal fishing villages, to the highly developed present suburb.

The subsequent slowdown in population growth was due to unavailability of vacant land for housing and changes in land use from residential to business. Increasing business activity has added to the continuing growth in travel due to economic and social influences, and vehicle ownership has contributed to the critical traffic and accessibility issues which led to the study.

Positive social and economic impacts of the project include:

- Increase in population growth and density as desired in the Regional Development Plan.
- Facilitation of housing and other development, and social facilities to match population growth.
- Improvement to accessibility, connectivity, interaction and congestion.
- Facilitation of job markets and poverty reduction by job-creation during the construction.
- New development opportunities especially in small business as proposed in the Plan.
- Domestic and international tourism spurred by improved access to Chaguaramas.
- Improved transportation network and reduced travel time will increase accessibility to attractions and activities in the study area.
- Improved access to existing archaeological, cultural and historical sites.
- Development and marketing of existing heritage sites.
- Discovery and development of new heritage sites.

Project benefits also include:

- Journey time savings;
- Savings in vehicle operating costs; and
- Savings in economic costs from less accidents and collisions.

ENVIRONMENTAL BENEFITS

A comprehensive Environmental Management Plan was developed defining appropriate mitigation measures both during and post construction. Impacts were assessed on the alignment, in rivers, and on the influence area. The residual (post-mitigation) impacts were quantified as:

Impact Post - Mitigation Impact

Construction Phase

- On Site Erosion Low
- Slope Instability Low
- Increased Surface Runoff Low
- Impaired Surface Water (Siltation / Sedimentation) Low
- Groundwater Contamination Low
- Noise Low
- Impaired Air Quality (Dust) Low
- Impacts to Terrestrial Fauna (Loss of Habitat) No significant concern
- Impacts to Riverine Fauna Low

Operation Phase

- Impacts to Aquifer (Use of Agrochemicals) No significant concern
- Noise No significant concern
- Improper Solid Waste Disposal Eliminated
- Impacts to Aquatic Fauna (Riverine and Marine) Eliminated

The devastating floods that have occurred in the past within the project area are to be eliminated through development of a properly designed and constructed drainage scheme that will:

- maintain post development run off to pre-development levels
- collect, control and channel surface run-off to adequately sized conduits
- install surface water detention facilities where required
- implement a programme of culvert cleaning and maintenance.

Environmental study recommended:

- to construct berms along the banks of Diego-Martin River to prevent localized flooding and to permit development of land adjacent to the river for recreational and commercial usage
- reconstruction and overlay paving thereby reducing road roughness, vehicle operating costs and potentially associated road noise and air pollution

Positive environmental impacts after the improvement of the interchange include reduced noise and improved air-quality due to reduce vehicle idling time.

MEETING CLIENT'S NEEDS

The Government's project objectives as stated in the TOR were:

- Accessibility – improved road access for existing residents and for proposed land developments
- Improved Connectivity – free-flow traffic eliminating existing congestion, and adequate for 25-year growth forecast
- Safe road conditions for pedestrian and vehicles
- Improved capacity of drainage to prevent future flooding
- Sound structural health of bridges and overpass.

At the end of the study, a four-stage implementation plan was recommended to:

1. immediately optimize existing traffic signals to improve traffic flow and repair the structures,
2. construct additional lanes and reconfigure some of the existing lanes to improve capacity and safety adequate to handle the 2020 growth forecast,
3. improve a number of other intersections in the region for improved traffic flow dispersion for 2030 growth forecast, and
4. consider having major/improved public transport such as Light Rail Transit or Bus Rapid Transit to handle the growth forecast of 2040 and beyond.

The concepts and ideas were shared with a cross-section of stakeholders including the central and local governments, NGOs, and the private sector; public transport and taxi operators; hospitals and retail representatives; and advocacy groups. The environmental impact of the improved infrastructure was rigorously assessed in compliance with the national EPA's guidelines.

Applying the principles of Canadian best practices, the project was developed such that it could be implemented in stages using alternative delivery models, such as Design-Build.

The Government agreed with the recommendation. The project is now being implemented in phases using Design-Build method.

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