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Case Study | British Columbia Ministry of Highways

Customer Profile

Organization: EBA Engineering, consulting firm hired by the British Columbia Ministry of Highways

Responsibility: Transportation network of highways, bridges, regional airports, ferries, buses and rail transit

Network: Project involved 50 km of highway

Determining the best treatment options for a difficult stretch of highway

Highlights

Challenge: EBA Engineering was hired to determine the optimal treatment options for a 50-mile highway with widely varying road conditions.

Solution: Using GIS and dTIMS CT, EBA Engineering recommended the most cost-effective options for each segment of the highway.

Outcome: British Columbia Ministry of Highways saved 30% in treatment costs and applied the best possible strategies for the maintenance of the highway.

When British Columbia Ministry of Highways began investigating the maintenance needs for a 50 km highway in British Columbia, they expected to spend $7 million on maintenance and upgrades. Using an innovative approach and dTIMS CT, EBA Engineering was able to find the best treatment options for the highway at a 30% savings.

CHALLENGE: Dealing with varying road conditions

When EBA Engineering was hired by British Columbia Ministry of Highways to provide maintenance strategies for the highway, they knew that changing elevations and varying road conditions would make analysis difficult.

EBA Engineering found huge variations in the road base thickness, ranging from 100 mm to 700 mm, and the asphalt thickness, ranging from practically zero to 240 mm. Other conditions, such as the pavement modulus, strength requirements, drainage, slope, problem locations, and cracking varied widely as well. For example, some segments had no cracking while others had experienced severe cracking. EBA Engineering knew that treating the highway as a single homogeneous section wasn't the best approach, since money would be wasted by applying unneeded treatments to some areas.

Because of these issues, EBA Engineering decided to divide the highway into 58 pavement sections and treat these sections as a pavement management network. To provide British Columbia Ministry of Highways with feasible maintenance approaches, EBA Engineering would need to perform a project-level cost analysis for the entire network.

SOLUTION: Creating a GIS model

Based on their experience with dTIMS CT, EBA Engineering knew that the software would allow them to model the complex engineering procedures needed for this project. EBA Engineering decided to work in a GIS environment right from the start in order to produce the best results for British Columbia Ministry of Highways. GIS allowed EBA Engineering to make use of existing data for the province, along with their own data collection, bring all of the data into dTIMS CT for analysis, then create a detailed GIS map outlining the current road conditions and suggested treatment options.

Collecting data on each segment of the highway
Using GIS as a source meant EBA Engineering was able to take advantage of existing sources of data, such as Google data and topographical information. This was particularly important due to significant elevation differences in the highway, which started in a valley and wound its way up a mountain.

EBA Engineering also needed to collect all of the data typically needed for a pavement engineering project but over a network of segments. Extensive data collection on the 50-mile two-lane highway included IRI, rutting, cracking, road radar, asphalt, crack classification and base thickness in each lane. Bore hole testing was used to validate the road radar. A falling weight deflectometer was used every 50 metres, a visual distress survey was done to assess drainage problems and possible slope failure areas, and video was taken every 6 metres so EBA Engineering could review the results and ensure valid treatments were selected.

Choosing from over 20,000 life cycle strategies
Using dTIMS CT, project-level pavement design was performed on each of the 58 segments for each year over the next 50 years, resulting in a detailed graph with all feasible combinations of sequential treatments for each segment. “Feasible treatments” were defined as no more than 15% cracking, an IRI less than 3, and a remaining 10 years of service life at end of the analysis period.

The dTIMS CT analysis presented EBA Engineering with approximately 20,000 separate life cycle strategies and the present value cost for each strategy. With the graph, the firm was able to compare approaches with similar costs but potentially different benefits. For example, they were able to see that a reclaimed strategy was only slightly more costly than a overlay for the same stretch of road, providing significant benefits for almost the same cost.

Based on the dTIMS CT findings, it was easy for EBA Engineering to find the most cost-effective approaches and make recommendations to British Columbia Ministry of Highways. Using traditional pavement engineering methods, it would have been nearly impossible for the firm to determine all of the possible strategies and find the best approach.

OUTCOME: Custom treatments bring British Columbia Ministry of Highways significant savings

British Columbia Ministry of Highways received EBA Engineering's findings as a GIS map, containing all of the data collected and the recommended treatment strategies. British Columbia Ministry of Highways was able to click on areas of the map to view more detailed information, such as the data collected at each bore hole location. Videos of the entire project were linked to the map as well, so British Columbia

Ministry of Highways could virtually drive along the highway and view the entire project. This approach gave British Columbia Ministry of Highways a very visual view of the road conditions and the results were much easier to understand than traditional reports, which typically consist of stacks of paper with appendix after appendix of data.

Planning an effective treatment program

Using the GIS report, British Columbia Ministry of Highways was able to plan an implementation program for the next few years. British Columbia Ministry of Highways decided to treat the most urgent concerns first and address less serious issues in the future.

A major part of British Columbia Ministry of Highways program involved repaving. Because EBA Engineering had divided the highway into segments, British Columbia Ministry of Highways was able to tailor the thickness of adding new asphalt to the strength requirements of each segment, instead of using the same treatment on the entire highway. For example, some stretches of road required only a 2-inch overlay, with others required 3 or more inches. A traditional engineering approach would have been to pick a strategy somewhere in the middle and apply a 3-inch overlay to the entire lane. Knowing the specific requirements of each segment resulted in significant savings for British Columbia Ministry of Highways.

Cutting costs in half

Using dTIMS CT, EBA Engineering was able to determine the best possible treatments for the highway and reduce the overall treatment cost by more than 30% over standard design methods.

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