Case Study

Peace Bridge Rehabilitation Project

The Peace Bridge Rehabilitation Project was one component of a $186 million, fully self-financed, five-year capital plan approved by the Peace Bridge Authority's Board. With a budget of $80.5 million, it included the completed replacement of the structural slab and widening of the structure, as well as the addition of a walkway/bikeway and observation platform. The rehabilitation project served as a key effort in making passage between Western New York and Southern Ontario as efficient as possible.

It's comprised of five arch spans, one 400-foot -0 Thru Truss, and a super-elevated deck at the Eastern Approach. The scope of the rehabilitation project included 350 new fascia girders, 788 new stringers, 120 new & longer sidewalk brackets, 800 fascia brace beams, 914 floor beam reinforcement cover plates, and reinforcement angles for the full height of the 20 arch span columns. Each new element of the rehabilitation project had to be detailed in coordination with the original shop drawings from 1926, as well as existing rivet locations to be matched.

DBM Vircon's use of 3D modeling provided invaluable insight for the size and complexity of the Peace Bridge rehabilitation project. It helped to determine survey information needed for detailing purposes, material sizes, grades of steels, design clarification and beyond. In all cases, DBM Vircon's 3D modeling was key to reaching a solution for the teams involved.

CHALLENGE #1

Dealing With Fit Up Issues

When the project first began, a small portion of the Canadian approach was detailed by another company using a traditional 2D method, which resulted in a number of fit up issues and additional costly field work.

DBM Vircon's use of 3D modeling helped uncover a number of design questions, for both the engineers and the detailing crews involved.

Snapshots from the model were used to write requests for information (RFI's), helping to establish design intent early on in the project lifecycle, while also building a positive rapport with the design team.

Scupper elevations were not provided on the design, and the plan was to have a survey done in the future, thus creating an issue. To remedy the issue, nominal height was agreed upon for the modeling process, allowing a visual of adjacent members and connection conflicts, as well as determining whether the concrete slab thickness would be sufficient.

In a rehabilitation project, fitting new steel and existing steel can pose a challenge. DBM Vircon's expertise in Tekla helped to determine the necessary balance of what to model from the existing steel in order to fit the new steel. The difference could mean discovering that an existing "WT" horizontal brace clashes with a catwalk hanger or a design connection detail is not as it appears as compared to the final product.

With 3D modeling, projects can be analyzed interactively to detect clash and collision issues early on, and improve overall efficiency. Files can also be coordinated amongst subcontractors and vendors involved in the project to streamline communication.

Project Details

Client: Burnco MFG. Inc.

Location: Buffalo, New York / Fort Erie, Ontario

Capex: $80.5 Million

Project duration: June 2016-2019

CHALLENGE #2

Utilizing Shop Drawing From 1926

The rehabilitation project required the use of existing shop drawings from 1926, as well as remedial drawings from every decade thereafter, making the review process challenging for the teams involved.

All of these pieces, as well as negligible sag reported in the preliminary survey, had to be considered when requesting survey information and laying out the basic geometry for calculating the model.

With a built 3D model based on existing shop drawings, preliminary survey and even some assumptions by the design team, it became an invaluable tool for confirming survey or design adjustments as the project progressed. The advantages went far beyond the structural steel fit up between existing and new material, and also allowed the design team to ensure slab thickness was correct for sidewalks and the cross slope from the North to South ends of the bridge.

Rehabilitation projects utilizing older drawings and existing steel benefit greatly from 3D scanning equipment. The bridges can be back modeled from the scans making rehabilitation, maintenance, and repair work more straightforward and efficient in the future. It also allows for budget savings as data files can be exported directly from the model and provided to the teams involved.

CHALLENGE #3

Managing Alignment Issues

A significant misalignment issue was discovered at the south side of the U.S. approach where new edge girders were intended to align with edge girders erected in 2014. The alignment was off by 8 inches, which was initially missed in the AutoCAD drawing and design plan dimensions.

These types of misalignment are easily discovered in the 3D model, which led the project engineer to defer to DBM Vircon's model layout whenever there was a geometry conflict.

DBM Vircon used snapshots from the 3D model to request specific points to be surveyed. As a result, the layout issues were resolved with a newly determined plan radius allowing the project to stay on schedule and avoid otherwise costly repairs later discovered in the field.

CHALLENGE #4

Positioning The Hand Railing System

The hand railing system used in the rehabilitation project was provided by another subcontractor with 2D drawings, leaving coordination details and positioning in the hands of DBM Vircon.

The 3D model enabled us to combine x, y, & z values with the details from the 2D drawings to dictate post positions and eliminate back and forth dialogue.

Modeling also helped to establish base plate elevations for Gantry posts as they related to each other across the bridge deck. This allowed for confirmation of the signage structure and was especially helpful at the super elevated portions of the U.S. approach.

With access to the 3D model and project snapshots, work progress is more easily tracked. Everything is tagged by color and managed closely so opportunities for streamlining are never missed.

CHALLENGE #5

Overcoming Field Condition Issues

Field conditions of a rehabilitation project can become issues at any point in a project's lifecycle despite thorough planning and precautionary measures. This was the case with the Peace Bridge rehabilitation where a number of severely skewed brackets that needed to connect to field cut existing members, were difficult to measure.

DBM Vircon's team checked the dimensions in the 3D model and sent snapshots that were helpful for coordinating field conditions and replacements for one off unique connections. In all cases of questions or confirmations needed about elevations, snapshots were created and sent the same day, usually within the hour.

The 3D model provides insight that allows teams to engage in constructive discussion and arrive at solutions sooner, which helps maintain project efficiencies and schedule.

CHALLENGE #6

Visualizing Connections and Elevations

During the rehabilitation project, existing brackets were removed and replaced with longer ones. This meant not only connection details had to be considered but also new transverse elevations needed to be accounted for. An expansion joint, adjacent to the Thru Truss on the south side of the bridge posed a challenge for the project which was how to best determine the top of steel for the stringers in the surrounding areas.

DBM Vircon used 3D modeling to set the elevation by projecting lines in the model relative to the existing bracket. The Trimble Connect model allowed both designer and engineer to view the cross slope and visualize top steel elevation enabling them to allow enough of a concrete slab without being too excessive.

With subcontractors and teams able to access the 3D model on their own time, coordination and confirmations from design to erection are easier to achieve. There is also the added benefit of progress being more thoroughly tracked and issues are highlighted earlier on to allow for the team to develop solutions before they have significant cost and/or schedule impact.

Conclusion

With large and complex projects, the unexpected is typically the expected; whether it's survey information needed for detailing purposes, varied material sizes, grades of steel not available, or clarification of design. In all instances, DBM Vircon provided solutions and shifted their crew's energies to other tasks and coordinating the documentation of the required changes.

Having the 3D model was an invaluable resource for all parties involved in the project. The design team used the visuals to help streamline meetings and discussions, while they also helped to assist in modifying connections and coordinating with other subcontractors to confirm project expectations. The use of 3D modeling was further implemented to identify fouling issues at the modeling stage, allowing the EOR to modify connection details before revision costs were necessary.

The Peace Bridge rehabilitation project was completed at a pace much faster than expected. DBM Vircon's 3D modeling was crucial for establishing the project geometry and key elevations which eliminated the requirement of call backs from the field for fit up issues.