AECOM

Canadian Consulting
Engineer Awards 2011

Northeast Stoney Trail

Stoney Trail Constructors (STC), a joint venture of Flatiron, Graham Construction and Parsons was retained by the Stoney Trail Group to undertake the design and construction portions of the multimillion-dollar Northeast Extension of the Stoney Trail Freeway (NEST) project. The project included 21 kilometers of four- and six-lane highway and 24 bridge structures including six interchanges and two railway crossing twin bridges. Stoney Trail is an integral part of the province's overall transportation network, and will enhance mobility and safety for Albertans.

A partnership relationship, open communications and an emphasis on innovative thinking prevailed throughout the planning, design and construction stages of the NEST project. These were significant factors leading to the successful and timely completion of this project.

New application of existing techniques/ originality/ innovation

Environmental permitting posed one of the largest challenges to this project. The project had a short window for approval of impacted wetlands and provision of compensation ratios before the start of construction season and within the requirements of the Migratory Birds Convention Act. The potential cost of the 239 ha of wetland compensation required to replace impacted wetlands was substantial. The stormwater drainage approval process was also a challenge with 28 naturalized stormwater ponds in the drainage design and a requirement to hold stormwater flows within the flat terrain of the alignment. The team approached Alberta Environment with a method to compensate wetlands through naturalized stormwater ponds linked through widened, naturalized ditching and restoration of uplands with native grass. The approach contributed to securing permitting within three months and is the largest example of landscape level compensation in Alberta, replacing 207 ha of wetlands and improving 262 ha of upland habitat.

The project used an external panel of professionals to provide a Peer Review, expediting the process from what would typically have been over a year to 5 months. The process was well received by all regulatory bodies. Modification to the stormwater drainage modeling software was required and contributed to the approvals process and wetlands compensation.

By designing the master drainage plan to encourage infiltration and maximizing evaporation, the runoff volume was minimized. Stormwater quality is improved prior to discharge with sediment removal exceeding Alberta Environment objectives. City of Calgary wet and dry pond guidelines were modified because of the unique circumstances of the land within the Transportation Utility Corridor, allowing for storage depths greater than the standard 2 M. Pond layouts accommodate turning points in utility corridors, future expansion and easier maintenance.

The P3 model used for NEST can act as a successful example of unique funding and quick completion for future P3 projects. The use of a web-based, virtual project office facilitated collaboration at design offices throughout North America. Delivering the project on budget and as required by the 18 month schedule was a result of "just on time" construction sequencing that allowed construction to occur concurrent with design. Well documented work plans, project specific training, detail standardization, mass haul balancing and large scale subcontracts contributed to a quality, cost-effective design.

The structure design of the bridge maximized labour resources by allowing the earthworks and the bridges to be built independently. Bridge spans and decks were reduced by 15-20% from the functional planning study through the use of mechanically stabilized earth walls and allowing for the use of integral abutment design and the elimination of bridge bearings from expansion joints. As a result, the superstructure depth was reduced, lowering the road profile and reducing the amount of required fill material. Traffic interruption was minimized through the use of temporary lane crossovers, erection of girders at night and combining different bridge foundations at 16th Avenue and Stoney Trail.

Complexity

Management of resources was an important component of this project. The complex organizational structure which included AECOM staff in offices across Canada and in the United States, demanded effective communication across the team and with STC. Regular meetings and efficient issues management were essential. The compressed project schedule didn't allow for any redesign or hold-ups and required design and construction to occur concurrently. The AECOM implemented design deliverable management program kept construction and design on schedule and allowed for timely completion of constructability and technical compliance reviews.

The management of risk and quality were both critical to the success of the project. A comprehensive risk management plan identified, analysed, mitigated and controlled any risks, and a quality management system based on the requirements of ISO 9001-2000 Standards allowed for STC, STG and O&M reviews ahead of formal submissions to AT. Bridge structures received independent design reviews.

Environmental, social and economic impact

AECOM's design had to consider several environmental factors including 250 wetlands and the hydrological modelling and environmental design of 10 ponds and over 80 wetlands, evaporative basins and infiltration areas. A Low Impact Development approach required the extensive use of shallow infiltration and evapotranspiration techniques. All wetland losses were compensated.

NEST will alleviate traffic congestion on Alberta's heaviest travelled road, the Deerfoot Trail and provide an inter-provincial link between Highway 1 and Highway 2. As a major part of the City's ring road, the completion of NEST brings relief to inner-city traffic congestion and improved mobility for existing and new communities in the northern part of the city. The design of NEST has also reduced the number of conflict points from a typical cross-road intersection.

Meeting and exceeding owner's/ client's needs

At the time of its award, the NEST project was the largest transportation contract ever awarded by Alberta Transportation. Completed on time and budget and quicker and less costly than the Northwest portion of Stoney Trail, the design breakthroughs and P3 model are transferable to future, large-scale projects. The project earned Alberta Transportation's 2009 Minister's Award of Excellence for Process Innovation and the Consulting Engineer's of Alberta 2011 Showcase Award of Excellence, Transportation Infrastructure.

AECOM

Canadian Consulting
Engineer Awards 2011

Northeast Stoney Trail

1. Introduction

The Transportation Utility Corridor (TUC) was originally planned by the Province of Alberta and the City of Calgary in the late 1970s and is commonly referred to as the Calgary Ring Road (Ring Road). During the 1980s and 1990s, the Province of Alberta, who is responsible for the development of the Ring Road, purchased most of the land required for the TUC.

The Northeast Extension of the Stoney Trail Freeway (NEST), which forms the northeast link of the Ring Road, extends east from the Deerfoot Trail (Highway 2) to the eastern city limits, then south to 17 Avenue SE (Highway 1A), as highlighted in dark turquoise in Figure 1.

Figure 1.

In December 2005, the City of Calgary announced it was in talks with the Province of Alberta to fast-track construction of the East Freeway, previously thought to be decades away from completion. Alberta Transportation undertook a DBFO procurement similar to the model used for the Edmonton Southeast Anthony Henday Drive. Three teams were shortlisted to provide a proposal for the project. On February 22, 2007, Alberta Transportation awarded a contract to the Stoney Trail Group (STG), a P3 consortium, to construct the first stage and to maintain the northwest and northeast sections of the ring road for 30 years following completion. Construction began in 2007.

STG, a consortium led by Bilfinger Berger BOT, was the prime entity responsible for the overall design, construction, financing, and operation of NEST through the Design Build Finance and Operation term. Stoney Trail Constructors (STC), a joint venture between Flatiron Constructors Canada Ltd., Graham Infrastructure LP and Parsons Overseas Company of Canada Ltd., was retained by STG to undertake the design and construction portions of the project. AECOM Canada Ltd. led the design on behalf of STC. The overall design structure of the P3 is shown in Figure 3.

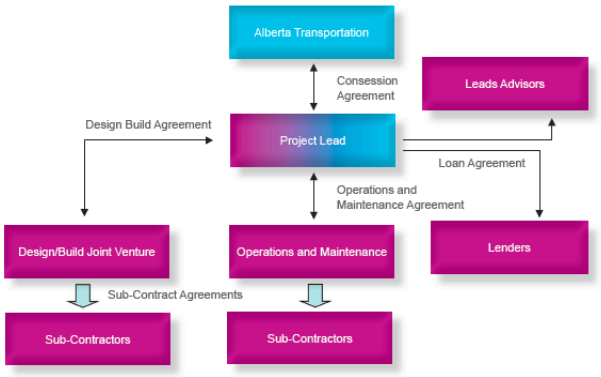


Figure 3.

The project included 21 kilometers of four- and six-lane highway and 24 bridge structures, including six interchanges and two railway crossing twin bridges. As shown in Figure 2, the bridges and interchanges are located at:

- Deerfoot Trail
- Métis Trail
- 60th Street NE
- Country Hills Boulevard
- Airport Trail
- McKnight Boulevard
- 16 Avenue NE (Highway 1)
- 2 CN Railway crossings including new twin bridges and rehabilitation of the two existing bridges at the Conrich overpass
- Signalized intersections at Stoney Trail and 17th Avenue.

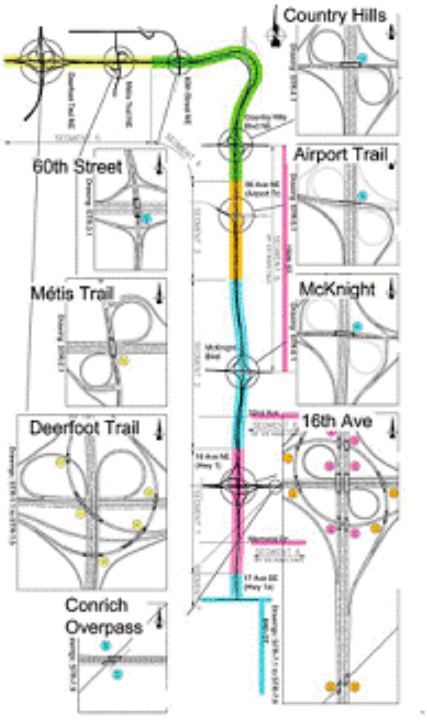


Figure 2.

A partnership relationship, open communications and an emphasis on innovative thinking prevailed throughout the planning, design and construction stages of the NEST project. These were significant factors leading to the successful and timely completion of this project.

The constraints and challenges during both the design and construction stages of this complex project required many innovative, unique and creative solutions. Technical excellence employing the latest advancements in infrastructure and environmental technology resulted in the production of a workable and economical design. The full time, hands on, experienced project management resulted in the coordination of work between consultants, Municipal, Provincial and Federal governmental departments, contractors and utility companies. The identification of risk items and the timely solutions ensured the advancement of the work and the achievement of the project milestones.

The City of Calgary and specifically the residential and business communities in northeast Calgary will benefit in having improved transportation systems including new interchanges and connecting roadways to the rest of the city and Highways 1 and 2.

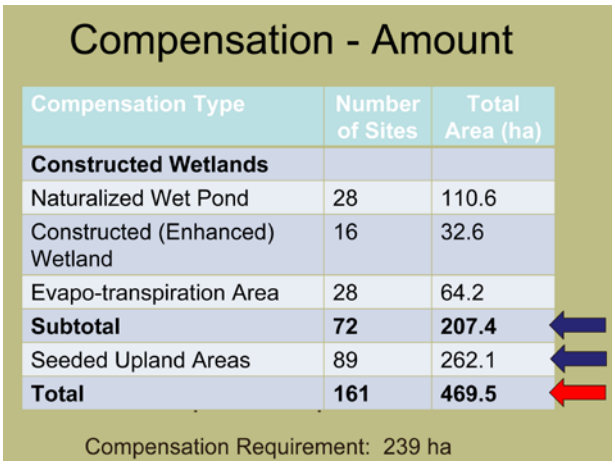
2. New application of existing techniques/ originality/ innovation

Environmental Permitting in a P3 Model

The NEST project was faced with several challenges regarding environmental permitting. P3 projects are driven by tight scheduling constraints and this project was awarded just two months before the spring construction season and a three month timing restriction for clearing work under the Migratory Birds Convention Act. Further, the project lay within a wetland-rich area and wetland loss due to construction would be unavoidable. Wetlands could not be impacted without an approval under the provincial Water Act and provision of compensation for all impacted wetlands, a process that normally would take 3 -4 months for this scale of project. A total of 239 ha of wetland compensation would be required to replace impacted wetlands, a substantial cost to the project through Ducks Unlimited (about $4.06 million, at then compensation rates), one option for compensation.

The second major challenge was in the stormwater drainage approval process, a provincial approval required for stormwater pond design. Flat terrain along the alignment and a requirement to hold stormwater flows within the alignment necessitated creation of numerous stormwater management facilities along the route. A total of 28 naturalized stormwater ponds were included in the overall drainage design, with drainage flow to designated discharge points at the northwest (Nose Creek) and south (Shepard Slough system) extents of the project area. A third area in the middle section of the alignment had no natural drainage and was instead designed to discharge through evaporation only, a method previously unused in the Calgary area. Alberta Environment has delegated technical review for stormwater system approvals to the City of Calgary. The NEST project alone was double the normal number of approvals processed by the City annually. Completing the technical review for the NEST project would not have been possible within the construction schedule for this project.

To expedite permitting for wetland compensation and minimize overall compensation costs, the team approached AB Environment with a conceptual approach: to compensate wetland loss through creation of naturalized stormwater ponds, linked through widened, naturalized ditching and restoration of uplands with the TUC to native grassland. This concept was sufficient to secure permitting within three months (a concern expressed by a public stakeholder prevented an earlier approval). This approach also provided a landscape level compensation package that replaced 207 ha of wetland habitat, improved 262 ha of upland habitat around existing ponds, and enhanced connectivity amongst wetlands within the entire TUC, mainly by enhancing deliverables required in the construction contract. This project, the largest example of landscape level compensation undertaken in the province, provided an innovative alternative to the typical compensation approach and set a precedent for highway projects in the province.



To expedite the City of Calgary review, the team proposed a Peer Review process through an external panel of professionals from the Calgary consulting industry (AMEC), the Owner's Engineer (UMA, now AECOM) and the University of Calgary. Concerns identified by the review team were addressed by the design team over a one month period, and responses to each issue were reviewed as a group with representatives from the City of Calgary, Alberta Environment, the Peer Review team, and the design-build team during a one day workshop session. The approval process was completed within 5 months (September 2007 to January 2008). Within the City's existing capacity, the review would have required well over one year. The Peer Review process was an innovative approach to regulatory review that was well-received by all of the regulatory authorities on the project. From a technical standpoint, the design hinged on a modification to the QUAL HYMO software used to model stormwater drainage to include evaporative loss, a factor previously not considered within the software and in regulatory reviews for Calgary projects. The modifications provided a lasting technical improvement on stormwater design, adding to the procedural innovations contributed to the approvals process for stormwater systems and wetland compensation.

This process earned the team Alberta Transportation's 2009 Minister's Award of Excellence for Process Innovation.

Project Management / Fast Track Design

Typical of P3 projects, AECOM's design team worked for the construction team (STC). This is a substantial deviation from the typical industry bid-build process. The design team needed to constantly think "outside the box" to provide the most cost effective design while meeting technical requirements and an aggressive schedule, adding an element of difficulty to the project. The design innovations during the bid preparation process contributed to a lower capital and lifecycle cost, a key factor in reducing the bid price and helping STG win the project.

Upon award, AECOM continued its innovative approach by establishing a virtual project office on a web-based work sharing platform allowing for effective and efficient allocation of the design to multiple offices throughout North America.

Design quality and consistency were assured by well documented work plans and project specific training delivered to the teams by the design management team. Design schedules were aggressively set and prioritized around the construction sequencing under the premise of "just on time" delivery. This method of delivery allowed for efficient turnaround, kept the work on time and on budget and enabled construction to proceed concurrent with design.The detailed design for 21 km of divided freeway with 24 bridges was delivered on time and on budget in 18 months.

The P3 model and the partnerships established at the beginning of the project were important components in completing NEST much quicker and at a lower cost than the Northwest portion of Stoney Trail. The large scale of Alberta Transportation's P3 projects have provided opportunities for economies of scale not found in conventional design-bid-build models. Detail standardization, mass haul balancing, and large scale subcontracts all contributed to value-for-money for the project.

The success of the P3 model paired with the concurrent design-build concept of this project have given the Province of Alberta and Alberta Transportation a unique way to fund and quickly complete future large-scale projects. NEST will not only act as a successful case study for future transportation projects, but the project management and funding partnerships formed can be applied to other construction-based, provincially driven projects in the future.

Bridge structure design

To accommodate the aggressive construction schedule, produce the most cost-effective design, and minimize the impact of construction on existing traffic, extensive effort was put into the planning and design of the bridge structures.

To provide flexibility in the timing between earthworks and bridge construction, structures were designed to allow the earthworks and the bridges to be built independently. This allowed the construction team to advance either earthworks or bridge construction as site conditions and labour resource constraints varied.

Mechanically stabilized earth (MSE) walls were used in the majority of the interchanges, reducing bridge span lengths and the overall bridge deck area by 15-20% compared to those presented in the functional planning study. Reducing the bridge spans made it possible to utilize integral abutment designs for most of the bridges, eliminating the need for bridge bearings and expansion joints. The combination of these innovations reduced the overall superstructure depths which, through effective multi-disciplinary planning and design with the roads team, allowed the road profile to be lowered, reducing the fill material required for the bridge structures. This approach provided significant construction cost savings to the design build team.

By implementing temporary lane crossovers and erecting girders at night, work at the Deerfoot interchange was accomplished with minimal interruption to the high volume traffic. As well, combining different types of bridge foundations into the design for the main bridges at the 16th Avenue and Stoney Trail interchange minimized the construction impact on traffic at 16th Avenue.

Master drainage plan concepts

The drainage from the NEST Transportation and Utility Corridor (TUC) contributes stormwater runoff to two different watersheds. The north end outlet contributes stormwater runoff to the Nose Creek watershed and the outlet at 17th Avenue S.E., which is the south end of the project limit contributes to the proposed Shepard Wetland stormwater management system, and eventually the Bow River.

Stormwater runoff from NEST drains into ten wetland storage facilities and five evaporation ponds via ditches and culverts. The runoff is contained within the TUC and is discharged at the south end of the project to the Shepard Wetland stormwater management system. Runoff volume is minimized by encouraging infiltration and maximizing the exposure to evaporation.

AECOM's design of the system of wetlands improves the quality of stormwater (sediment removal) prior to discharges. Sediment removal efficiency exceeds Alberta Environment's objective of 85% removal of sediment sizes greater than or equal to 75 microns.

The fast track construction schedule meant that design had to proceed in parallel with construction. Borrow material required for roadway construction was extracted from the preliminary design ponds and the final detailed pond grading and control works were implemented after the details of the Master Drainage Plan (MDP) were reviewed and approved by the regulatory agencies.

AECOM applied single and continuous stormwater modeling approaches to estimate the storage requirements for the proposed stormwater storage facilities. This helped to ensure that stormwater is directed efficiently with the least impact on the Shepard Wetland area.

Stormwater facility design guidelines

A primary objective of the NEST pond designs was to follow the City of Calgary standard design practice guidelines. Although NEST is technically under AT jurisdiction, its location within the City's limits made it highly desirable to have the stormwater storage facilities consistent with other City of Calgary infrastructure in terms of aesthetics and operation.

Depending on the location, a number of constraints and guidelines had to be considered and evaluated for necessity and functionality. Design guidelines for wet and dry ponds located in residential areas or where they are public-use facilities are primarily intended to address safety issues. Because land use within the TUC is substantially different, these guidelines were modified based on discussions with the City. Modifications included the City's acceptance of active storage depths greater than their standard 2 m guideline. This parameter was implemented as a drowning prevention measure, and to reduce risk of flooding nearby residents. However, since the NEST ponds were at a much lower elevation than the neighboring communities, the City was convinced to accept this non-standard deviation.

As a general guideline, the layout of the ponds had to accommodate any turning points in the utility corridors and provide provisions for possible future expansions. Permanent pools were located 30 m from the corners or bends of existing lines wherever possible. A 6 m wide access was provided to existing power poles, with a 12 m total width peninsula if the pole was surrounded by water. To accommodate easier maintenance, the forebays provided a permanent pool depth of 3.5 m. A deeper permanent pool allows accumulated sediment to consolidate, making it easier to clean out.

3. Complexity

Client Interface

Due to the complexity of the design and organizational structure, substantial effort was placed on human resource management, with an emphasis on locating experts and experienced staff to undergo each design component so that time and costs could be minimized.

Since the design process was integrated with construction, efficient transmission of relevant information to and from STC was critical. This was achieved through regular weekly meetings at all levels of the organization chart such that information and concerns were conveyed top to bottom and vice versa for all issues in a timely manner. The design team interfaced with STC's construction staff and AT representatives on a continuous basis, starting with the commencement of design. All submittals were reviewed and approved by STC and AT prior to being issued for construction.

Interface during Design: The design team and the construction staff interfaced during the design phase for several areas including: project controls, constructability reviews, construction packaging, construction phasing and sequencing, and over-the-shoulder design reviews. The design team's project management worked very closely with the project controls staff to set, track, and maintain the schedule for engineering and design activities and to monitor progress utilizing an earned value methodology.

Weekly discipline meetings were held with the construction managers and the design staff.

The Design Discipline (Roadway, Bridge, Utility, Survey) leads chaired these meetings and invited managers from other disciplines as deemed appropriate. The purpose of these meetings was to discuss technical issues and approaches that were being used in the design, construction package scope, and schedule as well as other technical discipline issues.

Additional task forces were constituted as necessary to deal with issues that emerged throughout the project, such as Document Control/IT, Environmental or Construction Support Services.

Interface during Construction: The design team interfaced with the construction staff in several ways during the construction phase. This interface was referred to as the Design Construction Support Services, and included responding to Requests for Information (RFI), conducting shop drawing reviews, preparing revised designs to respond to changed conditions (Field Change Memos) or issuing design revisions (Design Change Notice), and providing design assistance for resolving Non Conformance Report (NCR) issues. The design staff was available for field reviews to review progress, clarify the plans and specifications, and answer questions regarding the construction documents. Field staff provided by the design team reviewed construction activities and quality control reports to confirm that the project was constructed in general conformance with the plans and specifications. Additionally, the design team prepared the record drawings based on red-line drawings provided by STC.

Risk Management

By the very nature of the P3 process, risk management was critical to the success of the project. Specifically, the major features of the NEST design process that had significant risk implications were:

- Timely completion of designs that met the timelines adopted in the integrated design and construction schedule
- Obtaining AT approval on design packages to allow for construction to proceed
- Obtaining applicable approvals from external agencies
- Completing standardized, technically complete, and constructible design packages while utilizing over 70 project team members within multiple offices across North America

To manage these risks, the project management team implemented a rigorous risk management approach that involved the creation and implementation of a comprehensive risk management plan. The plan outlined the framework through which risks would be identified, analyzed, mitigated, and controlled. Complementing the risk management plan were the communication processes that were put in place between the design and construction teams and other stakeholders as well the approach to open and innovative thinking as described throughout this document.

One of the greater risks on the project was obtaining the necessary regulatory and stakeholder approvals on the wetland compensation and drainage plans and designs within a timeframe that allowed for appropriate construction sequencing within the project schedule. Due to the process developed and spearheaded by the design team and participated in by the stakeholders, the review processes were shortened and the resulting drainage plan met the requirements for wetland compensation as well as those of

the City of Calgary. The diligence placed on risk management by the design management team played a critical role to the on time, on budget delivery of this complex scope of work.

Design and Quality Management

The NEST Quality Management System (QMS) was consistent with all of the requirements of ISO 9001- 2000 Standards, and included both internal and external audits for compliance.

A comprehensive design review process was programmed into the schedule to allow STC, STG, and operations and maintenance (O&M) reviews ahead of any formal submission to AT. Further time was scheduled to address comments and observations of AT's review resources, following a fixed review period of five days (written into the DBFO contract). Numerous steps, including partnering and over-the-shoulder sessions between the various parties involved, were implemented to ensure that all levels of review were completed, issues addressed and implemented within the planned schedule constraints of the project.

Bridge structures had a further level of review due to the project's requirement to have all structural design reviewed by an independent design reviewer. Independent professional engineers (not at all associated with the project) were engaged by the design-build team to conduct reviews of structural design inputs, and to attest to the completeness, integrity and accuracy of all aspects of the engineering drawings and construction specifications. Designs for works outside of the core "transportation" and "buffer" components of the TUC were further subjected to a Ministerial Consent application and approval process by Alberta Infrastructure.

The project also had a rigorous construction quality assurance process in place to ensure the construction was completed in general conformance with the plans and specifications. Although the contractor was ultimately responsible for carrying out the quality assurance process, the process was complemented by construction oversight representatives from the design team acting on behalf of the engineers of record, representatives acting on behalf of Alberta Transportation and representatives acting on behalf of STG.

Co-ordination with agencies and local jurisdictions

The design effort required coordination with Provincial and Federal agencies and other local jurisdictions including the City of Calgary, Municipal District of Rockyview, and numerous utility companies. environmental permitting and cultural resource issues involved coordinating with various public agencies depending upon the specific circumstances.

Partnership and community inclusion

This high-profile project required effective communications and engagement with external partners and the effected community. Partnership was extended beyond the P3 team and AT to include other stakeholders including the City of Calgary and M.D. of Rocky View. The design concept was introduced to the local MLA with full endorsement before the mass mail out of 2,000 information brochures to local residents. Information brochures were made available at each of the stakeholders' locations for the general public's convenience. As well, a dedicated project phone line and website allowed easy public access to information and the chance to make inquiries about the project.

A focus on communication

With over 70 project staff in AECOM offices across Canada and the United States, the ability to communicate and coordinate was pivotal to the success of the NEST project. To ensure complete team understanding and convergence on the appropriate designs, the

management team employed a wide spectrum of communications tools including face time (home and away trips), videoconferencing, teleconferencing, e-mail, courier, snail mail and document control software. A process for communications management including a detailed communications management plan was established and implemented to ensure timely and appropriate generation, collection, dissemination, storage and ultimate disposition of project information.

Aggressive project timeline

The aggressive, compressed design build schedule required superior project management skills at every step. To achieve the set construction completion date for the project, design had to occur concurrently with construction, leaving little room for redesign or hold-ups. To keep construction advancing, AECOM developed and implemented a design deliverable management program, including a fully integrated design and construction schedule that allowed AECOM and other key players to complete the project on schedule.

Throughout the NEST project, multiple levels of reviews were conducted including constructability and technical compliance reviews by STC, STG, and AT as well as several compliance reviews. Additional reviews by third party stakeholders such as regulatory bodies and utility companies were conducted, all contributing to the need for a focus on schedule control and effective communication and collaboration.

4. Environmental impact

Wetlands planning

During the planning, design and construction of NEST, AECOM had to consider several environmental factors, including over 250 wetlands, ranging from small to large, and permanent ponds, some of which contain rare plant species. The project involved preservation of numerous existing wetlands and creation of habitats to compensate for losses related to the project in keeping with Alberta and Calgary wetland conservation policy. The NEST mainline roadway and its associated interchanges and borrow areas impacted a total area of 78 ha and another 66.3 ha of adjacent, functional upland habitat. Impacts related to construction totalled 3.35 ha of wetland and 9.15 ha of adjacent, functional upland habitat.

Compensation ratios were determined for each wetland based on its existing condition and setting. Discussions with Alberta Environment during the preparation of the Environmental Impact Assessment concluded that an average compensation ratio of about 1.3 would be applied to the impacted wetlands, resulting in the need for 164.9 ha of compensation area.

AECOM provided hydrological modeling and environmental design for 10 ponds and more than 80 wetlands, evaporative basins and infiltration areas. Regional limitations in acceptable runoff volumes required a Low Impact Development (LID) approach to the overall freeway project. This required extensive application of shallow infiltration and evapotranspiration techniques.

Wetlands that had to be drained and cleared were identified in the planning stage of the project. All wetlands loss had to be compensated (a cost to Stoney Trail Group), so wetland draining, infilling and disturbance was minimized. Although some wetlands were removed entirely, others were

only partially filled, and these required special measures to protect them from accidental infilling, release of sediments and contamination from hazardous materials.

The ECO Plan for the NEST project included the following measures that had to be taken by AECOM to reduce the impact on wetlands:

- Clearing limits within wetlands must be carefully adhered to, to avoid accidental infilling. If in doubt, clarify with a site foreman before initiating work.
- Refuelling and maintenance is to be done at central staging area, 100 m from any waterbody.
- Spill pans and other spill prevention measures outlined in the ECO Plan must be used at refueling and maintenance areas.
- Equipment working within 10 m of a waterbody should first be inspected to ensure there are no leaks and that it is clean of fuels and oils. Any equipment from the US must be washed and clean of any grease, fuel or oil before working in water to avoid transfer of diseases.
- Installation of erosion protection measures (e.g., silt fencing) around the areas of the wetland to be left undisturbed.
- Directing water pump-out outlets over vegetated areas, and never directly into adjacent wetlands.
- All topsoils must be stripped and stockpiled separately from subsoils. Wetland soils must be stockpiled separately from other soils. Stockpile sites should be mapped at the time they are created, and the maps held by the Construction and Environmental Managers.
- Sediment-laden waters must not be allowed to run-off into waterbodies – stop work, consult with site foreman to identify appropriate erosion control measures.

Wetland work is permitted under an Alberta Water Act approval. All of the conditions outlined by the Alberta Water Act were implemented and strictly adhered to.

Drainage

As previously described, AECOM provided hydrological modeling and environmental design for 10 ponds and over 80 wetlands, evaporative basins and infiltration areas. Shallow infiltration and evapotranspiration techniques were applied to ensure drainage met standards without adversely impacting the surrounding wetlands. Regional limitations in acceptable runoff volumes require a Low Impact Development (LID) approach to the overall freeway project.

The flat topography and clay soils in the NEST construction area result in a combination of non-existent to poor drainage and numerous existing wetlands. As a result the drainage and ecological issues posed significant constraints for highway construction.

The design of the stormwater storage facilities will also include provision for the operation and maintenance activities associated with the facility. The activities that will were considered include:

- Floating debris removal
- Sediment depth monitoring and removal
- Hazardous spill containment and removal/ remediation
- Algal treatment events
- Service vehicle access to and into all sediment forebays
- Emergency vehicle access to all permanent water bodies
- Preventing freezing of inlet and outlet piping during the winter months
- The operations of the stormwater storage facilities will need to be included into the emergency spill procedures

5. Social and economic benefits

According to the Alberta government, Deerfoot Trail is the heaviest traveled road in the entire Province of Alberta, with an estimated 30,000 to 40,000 vehicles expected to use the new ring road each day. Under the P3 financing model, the road was finished and open to traffic on schedule in the fall of 2009, two years earlier than would have been possible with conventional delivery.

The NEST roadway system will act as an integral component of Calgary's ring road as well as the province's overall transportation network. The new Ring Road will help alleviate inner-city congestion and allow for goods and people to move more freely throughout the city. It will also enhance mobility for Calgarians by relieving traffic pressure on other local roads and will accommodate traffic demands from the development of new communities in the Northern quadrant of the city.

Inter-provincial transportation will benefit as NEST provides an effective link between both Highway 1 and Highway 2. Additionally, NEST will contribute to more efficient movement of goods across the province, as the trucking route now bypasses travel through the city.

NEST will also alleviate some of the traffic congestion on Deerfoot Trail, the busiest road in Alberta with over 160,000 vehicle trips a day on some sections. Reduction of congestion on roads such as Deerfoot Trail, equates to a reduction in green house gas emissions from reduced idling time. Calgary and inter-provincial commuters will benefit from fewer collisions as a result of a safer, more efficient highway.

The northeast portion of the ring road increases the potential for development in surrounding areas which now have better access to the rest of the city. Furthermore, there is potential for communities surrounding the ring road to see an increase in property value from shorter commute times, and general access to the city.

Major interchanges along the northeast route including, Metis Trail (which serves as an alternate link to the CrossIron Mills shopping area north of the city), Country Hills Boulevard, McKnight Boulevard, and 16 Avenue NE (Highway 1), will also greatly benefit residents of northeast communities, as well as those individuals travelling to and from the northeast portion of the city. The project design drastically reduced the number of conflict points from a typical cross-road intersection as collisions are confined to sideswipe type with much lower injury severity as compared to T-bone or head-on type.

Mayor Dave Bronconnier agrees that "the residents of north Calgary will enjoy a great benefit as a result of this portion of the ring road, not to mention the huge impact it will provide our transportation and logistics industries in moving their products more quickly and efficiently."

6. Meeting and exceeding owner's/ client's needs

As the largest transportation contract ever awarded by Alberta Transportation at the time of award, the NEST project was a very large scale undertaking that offered significant schedule and cost savings. The project has been recognized for a number of awards to date including:

- 2009 Minister's Award of Excellence for Process Innovation" – Alberta's Ministry of Transportation
- Alberta Construction Magazine: Major Civil Project Winner for 2009
- 2011 Consulting Engineers of Alberta Award of Excellence, Transportation Infrastructure

Proven Project Management Results:

Time Savings: The P3 model was a successful time savings venue, creating a competitive bidding environment for the NEST project. Because of this design-build-finance-operate model and the partnerships established at the beginning of the project, NEST was completed much quicker and at a lower cost than the Northwest portion of Stoney Trail.

Cost Savings: The large scale of AT P3's has provided opportunities for economies of scale not found in conventional Design Bid Build models. Detail standardization, mass haul balancing, and large scale supply subcontracts all contribute to "value for money" in considering the business case.

Risk Reduction: The project design drastically reduced the number of conflict points from a typical cross-road intersection as collisions are confined to sideswipe type with much lower injury severity as compared to T-bone or head-on type.

Cumulative Benefit: NEST creates a cumulative benefit for Calgary commuters, reducing commute time by lessening traffic on other Calgary corridors; for inter-provincial travelers – both people and goods, as the can now travel; the environment as there will be less emissions produced from idling cars on busy road-ways; as well as the owner, enabling AT to have their project quickly completed and competitively funded.

Design Breakthrough: The innovative approach developed to obtain the necessary approvals for the wetland compensations and drainage plans and designs, design modifications to the bridge structures, and integrated project management approach all supported the concurrent design and construction methodology adopted allowing for the project to be completed on time and on budget.

Transferability: The success of the P3 model paired with the concurrent design build concept of this project, have given the Province of Alberta and Alberta Transportation a unique way to fund and quickly complete future large-scale projects. NEST will not only act as a successful case study for transportation projects, but the project management and funding partnerships formed can also be applied to other construction-based, Provincially driven projects in the future.