ABSTRACT

Revenue service for Calgary’s $1.4 Billion West LRT project was achieved on December 10, 2012, only five years after City Council approval to proceed with the project. The success in achieving this milestone was largely due to effective planning by the Owner and implementation of a design-build model for fast track delivery of the core components, these included a new 5 mile line with elevated, tunneled, trench and at-grade guideway, 6 passenger stations, 11 substations and utility buildings, a new highway overpass and 2 new park and ride facilities. Award of the design-build contract to SNC-Lavalin Constructors Pacific (SLCP) was made in November 2009, with a 37 month design and construction schedule utilizing a combination of prescriptive and performance specifications to facilitate integration with the existing LRT system while also allowing some innovation where appropriate. This paper will present the Owner’s rationale for proceeding with design-build delivery and how public and organizational considerations were addressed. This paper will also present an overview on some key lessons learned from the City of Calgary’s perspective.
INTRODUCTION

In November 2007, City Council approved the alignment and funding for Calgary’s West Light Rail Transit (WLRT) project to serve communities in west Calgary. The Council decision also addressed a project completion date of December 2012, coinciding with a timeline that kept the overall $1.4 Billion program budget within a schedule for available provincial funding and is considered a success by every metric. The most significant of which is meeting both internal and external stakeholder expectations. The five mile (8km) extension of Calgary’s C-Train Light Rail Transit (LRT) system opened exactly on schedule on December 10, 2012 after an unprecedented five year fast-track design build project delivery period. This paper presents the Owner’s rationale for proceeding with design-build delivery and how public and organizational considerations were addressed. This paper will also present an overview on how the project was planned and executed and finally, some key lessons learned from an Owner’s perspective.

PROJECT HISTORY AND BACKGROUND

Calgary’s WLRT project is the most recent extension of Calgary’s LRT system that originally commenced operation in 1981 with service from downtown to south Calgary. Since that time, extensions were added to the south line, and new lines were added to the northwest and northeast areas. Based on ridership, it is widely regarded as one of the most successful LRT systems in the world. The system currently carries over 350,000 passengers per weekday (Calgary Transit Service Design Division, 2013) with annual ridership over 102 million, more than any other light rail system in North America.

In November 2007, City Council approved the alignment and funding for Calgary’s WLRT project to serve communities in southwest Calgary. The Council decision also set a project completion date of December 2012, coinciding with a timeline that kept the overall program budget within a schedule for available Provincial funding. In early 2008, The City of Calgary (The City) engaged Hatch Mott MacDonald (HMM) as their Owner’s Engineer and formed an integrated Owner/Owner’s Engineer team tasked with procurement and implementation of the project.
The alignment of the WLRT line (presented on page 2) connects to the existing LRT system near the downtown core on 7th Avenue at 11th Street SW, and continues west converging onto Bow Trail, to 33rd Street where it traverses adjacent to Westbrook Mall, south to 17th Avenue and then west along 17th Avenue to the terminus at 69th Street SW. This alignment features a combination of elevated, tunneled, trenched and at-grade guideways and stations.

**Benefits to Society**

The major benefits to society resulting from the WLRT project include:

- Provision of a rapid, convenient, economical and safe mode of public transportation for approximately 44,000 people per day from the western quadrant to the downtown core of the City, with a travel time of 13 minutes.

- Diversion of up to 7,300 automobile trips per day from Calgary roads equating to annual environmental emissions reduction of 3,600 tons of carbon dioxide, 210 tonnes of carbon monoxide, 14 tons of nitrogen oxides and 28 tons of volatile organic compounds. In addition, the design and construction of the four-storey transit oriented development building at Westbrook Station complies with LEED Gold environmental standards.

- Reduction in travel time for all travelers between the downtown core and west Calgary.

- Refurbishment of a significant portion of the infrastructure (roadways, utilities, landscaping, etc.) within the general area of the LRT alignment.

- Refurbishment of the Westbrook mall area resulting from the transit-oriented development provided by this project. Development in the area will provide added local services to the public.

- Construction of a new high school in the west Calgary area.
**Milestone Schedule for Successful Project**

The December 2012 target completion date required delivery, within a five-year period, of the largest capital infrastructure project in The City’s history. This represented an unprecedented project delivery schedule. It was therefore necessary to develop a project implementation schedule with a series of clearly defined and measurable milestones that became the primary project driver (see below for milestone schedule). Project success was consequently distilled down to a focused process of achieving each of these successive milestones regardless of the effort required. This project management strategy, together with innovative organization and planning, was key to the successful delivery of the WLRT project.

**PROCUREMENT PHASE**

The project schedule presented a significant challenge and required implementation of a number of planning, organizational and procurement initiatives including the following:

**Fast-track Delivery:** To achieve the December 2012 completion date, a fast-track project delivery strategy for the new LRT line was required whereby detailed design would be carried out concurrent with construction under a design-build (DB) project delivery model. Successful implementation of DB project delivery depends on a number of factors of which clear scope definition to allow for accurate costing and detail design by the DB contractor is key to achieving a high degree of cost and schedule certainty. On the WLRT project, this was achieved by preparing a request for proposal (RFP) package that defined the work via a series of concept drawings and a combination of both prescriptive specifications for Owner “must have” requirements, and performance specifications that would enable the project to benefit from contractor innovation where appropriate. To further accelerate the overall project schedule, this scope definition and preliminary design process was carried out in parallel with a number of iterative engagement processes addressing both public and internal stakeholders. It is believed that the fast-track delivery of this project by the DB approach advanced the schedule by at least one year as compared to the traditional design-bid-build approach.

**Integrated Project Team:** The City created a separate City group, the WLRT Project Office to direct the project. This group was supported by and integrated with HMM and their team of subconsultant specialists who served as the Owner’s Engineer. The Owner’s Engineer focused on design production and RFP development while The City team functioned as enablers within the City, developing buy-in from other City...
departments and groups, and facilitating the way for timely reference design development. This integrated project team approach had never previously been done by The City and saved significant overall project time.

**Accelerated Preliminary Design:** This intensive multi-disciplinary engineering and architectural design effort required the completion of preliminary design for a highly complex work scope within a compressed nine-month period. These included: Request for Qualifications documents; preliminary design drawings; prescriptive and performance specifications; preliminary schedule and construction cost estimates; updated LRT design guidelines; RFP documents; proponent submission evaluations and public engagement exhibits.

**Land Acquisition:** In early 2008 the WLRT Office began an intensive 18-month process of negotiation, acquisition and possession of approximately 50 properties including residential, commercial and railway right-of-way required to be concluded in time for commencement of construction of the project. The early identification and acquisition of properties under a “get it right the first time” approach was key to advancing the project schedule. Following this 18-month period, no further land acquisition was required.

**Enabling Works Projects:** A number of enabling works projects were implemented prior to commencement of the main LRT construction works. These included removal and relocation of acquired residential and commercial buildings, modifications to the TELUS World of Science building and parking lot, reconfiguration of Shaganappi Point Golf Course, relocation of high school playing fields, removal or relocation of commercial signage, raising of major overhead transmission lines, and clearing of the areas required for LRT construction.

**Segregation of the WLRT from the Existing Operations and Control Centre (OCC):** The WLRT office recognized that as with any new LRT line, a significant risk existed with integration of the new system into the existing OCC. The decision was made to carry out comprehensive testing and commissioning of the new system.
as a stand-alone activity separate from integration into the OCC. The project team designed a separate OCC integration plan to be implemented progressively in parallel with testing and commissioning of the project, thereby eliminating the twin risks of integration delay and change.

**Public Engagement:** The public engagement process was based on The City’s *Engage!* policy and framework commencing with development of a Public Engagement Plan. Community Advisory Committees were established to have input into key project elements such as station design, urban design, traffic, parking and noise attenuation. More than 115 meetings were held with community members resulting in changes to the vertical alignment at two locations, modification of the original design of all six LRT stations, influence on the urban design at each of the stations and identification of a number of residential areas that warranted noise attenuation.

**Internal Stakeholder Engagement:** A comprehensive process was implemented whereby stakeholder City departments were engaged to identify and address concerns about how their respective operations would perform during both construction and operation of the new line. This included City business units such as Calgary Transit, Roads, Water Resources, Parks, Transportation Planning, Community & Neighborhood Services, Land Use Planning & Policy and others.

**Design-Build Contractor Procurement:** At the time of procurement, the project team was challenged with creating a competitive bidding process and attracting qualified proponents in a busy industry. To address this challenge several initiatives were actioned. Industry bulletins were issued to keep the wider industry informed and updated on the WLRT project. A Fairness Advisor was hired for the proposal process to ensure the procurement process was open and fair to all proponents. A new DB agreement for The City was created. These and other related actions resulted in a clearly successful procurement process with competitive market related pricing, award of a contract to a well-qualified contractor and no legal challenges to the outcome by unsuccessful proponents.

**IMPLEMENTATION PHASE**
In addition to the measures described above to address the schedule requirements of this project, successful delivery was founded on the establishment and effective implementation of a strong and clear project management approach. Key elements of this approach included the following:

**Project Implementation:** The City awarded a design-build agreement (DBA) to the successful proponent, SNC-Lavalin Constructors Pacific (SLCP), in November 2009. The DBA required work to be substantially performed by end of August 2012 and final completion by end of November 2012 in time for The City’s planned revenue service date in mid-December 2012. SLCP as the DB Contractor (DBC) and their local specialist partners were organized into four 50/50 joint ventures each responsible for separate components of the work. The DBC was responsible for all detailed design and construction as well as for project management, construction management, coordination of third-parties (i.e. franchise utilities), quality management, environmental management, health and safety management, traffic management during construction, and sub-system integration, project testing and commissioning.

**Effective Project Scheduling:** Immediately upon contract award in late 2009 the DBC mobilized their designers and commenced work on detailed design. Mobilization of construction forces commenced in early 2010 and construction, testing and commissioning was completed over the following three-year construction period. Correct staging of the work was critical to maintaining schedule. For example, work fronts were opened up concurrently along the entire alignment; utilities that conflicted with trenched or tunneled guideways were relocated before any significant excavation could commence. In other cases, roads were detoured and existing traffic lanes closed to allow for guideway and structures to be constructed. In very general terms, the construction focus in 2010 was on civil works (utilities, earthworks, concrete structures, guideway and roadworks). In 2011 the focus continued on civil works but also addressed construction of fixed facilities (stations, sub-stations, utility rooms) and trackwork. In 2012, the focus continued on trackwork but also addressed traction power and the overhead catenary systems, signals and communications and finally testing and commissioning of the LRT system. Through effective schedule implementation and control, the project overcame a number of construction challenges in the drive to maintain schedule. This required an average of 100,000 manhours per month with a monthly peak of 162,800 manhours in 2011.

**Risk Allocation:** Through a risk management process that included a series of risk workshops, the project team identified a number of significant risks that needed to be addressed. This required profiling of the risks and allocation to the party best equipped to manage the risk. In this way a number of risks were either retained by The City to manage or allocated to the contractor. For example, a number of environmentally impacted areas were identified during the environmental assessment. Under the risk allocation process The City retained...
the cost for transportation, disposal and treatment of the actual encountered contaminated soil volume as required at a licensed landfill. Another example was that of the risk of dealing with private franchise utility companies. Under the risk allocation profile, The City retained the risk of any critical path schedule delays to relocation of these utilities beyond a four-month period, providing the contractor with a level of confidence for costing of the work. Risks associated with other issues such as obtaining building permits, weather, identification of conflicting utilities and site investigations were assigned to, and priced by, the contractor.

**Quality Management:** A key innovation in the DB delivery of the project was the development of a new DB Agreement and procurement process that is expected to serve as The City’s model for future DB projects. In addition to meeting the schedule and budget requirements, the Agreement addressed quality issues that were of concern to The City based on their experience on previous DB transportation projects. The new DB Agreement as well as the project management process that included a structured quality audit process carried out by the Owner’s Engineer team resulted in the quality end product that The City desired.

**Preliminary Cost Estimating and Scheduling:** Implicit to effective project management is the need to manage scope, cost, schedule and quality. The project team developed detailed preliminary schedule and cost estimates that were used to control development of both scope and quality to procure a project within the approved budget and schedule. Due to a combination of the effectiveness of this schedule and cost control process and a favourable bidding environment, the contract was awarded for a lump sum fixed price value in line with the estimates developed by the project team.
Project Controls: A pre-requisite for effective project management is the ability to monitor and control various elements such as document management, cost control and change management. On the West LRT project, document control was achieved by use of a project extranet site where all official documentation between contracted parties was formally transmitted, logged and tracked. In total over 5,000 document packages were transmitted and processed via this system in addition to the many avenues of informal transmitting of information. A rigorous cost and change control process was implemented whereby Owner contemplated changes, contractor notice of changes and change orders were rigorously managed. This process resulted in contract changes being maintained to well within comparable industry limits.

Communications: Projects of multi-year duration require a thorough and comprehensive communications plan to keep both internal and external stakeholders apprised of project progress and issues. Neglect of this aspect can result in significant stakeholder challenges to the project that have potential for serious disruption. For the West LRT project The City was particularly sensitive to keeping the public (their major stakeholder) informed. This was achieved primarily by the use of a high quality, informative project website that was updated on a weekly basis with current project notifications, photos, videos and traffic alerts. This was supplemented by regular distribution of project update flyers delivered to residential and commercial property owners along the alignment. A philosophy of providing high quality, accurate and credible information and updates together with a commitment of responsiveness to public complaints resulted in a very successful project-public alignment process. Evidence of this was the positive coverage of the project by local Calgary media.

Partnering to Success: A major contributor to the success of the project, apart from the planning, organizing and procurement strategies carried out by all project participants, lay with the willingness of all parties to partner for the success of the project. Contracted parties recognized that partnering, communication and alignment were crucial to the delivery of such a complex project within an aggressive schedule. This created a culture of respect and cooperation between parties that helped maintain focus and overcame many challenges both technically and contractually. The partnering process included development of a partnering charter, facilitated partnering sessions, and informal alignment meetings.

Project Handover: The original DBA substantial performance and final
completion dates were respectively August 31, 2012 and November 30, 2012 to allow for a December 10, 2012 revenue service date (a non contractual date) An extension of time resulted in the substantial performance and final completion dates extending by 60 days thereby resulting in final completion occurring after the planned revenue service date. Under the prevailing commitment to partnering the contracted parties agreed that the revenue service date of December 10, 2012 was attainable and committed to achieving this date as the win-win project outcome. This however presented a number of challenges in terms of asset handover from DBC to Calgary Transit requiring a very detailed planned and coordinated staging process from a construction site on October 30th to an operating service on December 10th.

LESSONS LEARNED FROM AN OWNER’S PERSPECTIVE

A number of lessons learned arose from the WLRT project. The following are the top three coming from The City of Calgary’s perspective:

1. Significant effort on developing clear documents, regardless of contracting strategy, pays dividends towards the end of the project.

The City’s West LRT Office and HMM (as Owner’s Engineer) worked intensively through 2008 and early 2009 to produce the technical Project Requirements. As with all design efforts, there is an iterative component to the development of quality design documents, and the process is complicated when multiple disciplines, and public stakeholders, are involved concurrently. Rather than halt the refinement and clarification process as early as possible, the decision instead was made to work continuously until such time as the documents were required for commercial release in the RFP process. This strategy contrasts with the approach chosen by many municipalities who regard the DB approach as an opportunity to economize on upfront document development costs.

The extra efforts expended on developing clear documents that effectively captured realistic project requirements that met the expectations of The City’s internal and external stakeholders was of tremendous assistance to all parties in the West LRT project. Particularly towards the end of the construction phase in 2012, as the revenue service date loomed, the forethought embodied in the documents kept contractual disputes to a minimum, reduced surprises and assisted in maintaining alignment of the many parties involved. This alignment translated into proper focus on key milestones and deliverables, which collectively supported the achievement of revenue service on the scheduled date, established five years earlier, of December 10, 2012.

2. Keeping a common vision of “success” that is closely aligned with the broader public’s expectations, assists in avoiding trivial disputes which are not in the greater interests of the project.

While there are inevitably disputes and differences of opinion that arise in a large, urban construction project, it was crucial that the team members of the WLRT project maintained a focus on the ultimate deliverable of the endeavour, namely LRT service for the residents and businesses of southwest Calgary. As can be expected, outside of the immediate project participants, the public and media did not distinguish between the roles of designers, contractors, the Owner’s Engineer, project manager and politicians. The public, and the provincial government of Alberta, expected the team to deliver a quality end product on time and on budget.
Keeping this in mind helped the project parties to not lose sight of what the ultimate end user, the transit patron, expected, and this proved to be helpful in identifying, clarifying and resolving minor disputes in a timely manner, to the betterment of the project.

3. Avoiding a complete “turnkey” contracting approach allowed the Parties to focus on their areas of strength and expertise, and converge on a successful finished product which exceeded stakeholder expectations. Rather than attempting to create a single all-inclusive contract that addressed all facets of the project, the Owner’s team consistently examined the appropriate party who could best handle the risks associated with a particular scope of work. While this created multiple contracts rather than a single turnkey approach, it allowed the successful proponents to work in their areas of strength without an excessive number of variables beyond their control impacting their work. This translated into reduced claims around interface conditions, provided certainty for the City’s internal stakeholders, including Calgary Transit, and avoided precious time being lost in learning technical intricacies outside of a particular contractors’ expertise. Combined with the integrative role of the Owner’s Engineer and City Project Office, this approach allowed the overall WLRT programme to deliver timely results using a major DB contract supported by a number of peripheral contracts.

CONCLUSIONS

The West LRT project, the largest in The City of Calgary’s history, is considered a successful project because stakeholder expectations, both internal and external, were met. The ambitious timeline of the project made it a challenge to weave together the overlapping procurement, design and construction phases and ensure that all parties were treated fairly and respectfully. The project’s success required high levels of mutual trust, to
allow the team to work “above” the Contract, and make use of the Contract for clarification when disputes arose, but not as a prescriptive tool for managing all the daily interactions of the team members. The use of a well integrated Owner’s team, together with a competent Design-Builder, and a commitment to remain focused on the ultimate delivery of quality LRT service in southwest Calgary for the daily transit user resulted in a successful project completion, and continued strong support for additional major transit projects in The City of Calgary.

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City of Calgary’s West LRT Project
Use of Design-Build for Fast Track Delivery

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Project Overview

- 5 mile extension
- $1.4 billion project cost
- Combination of elevated, tunnel, trench and at grade guideway
- 6 new stations
- 5 year fast track delivery schedule
  - 2 year public consultation, reference design and procurement
  - 3 year construction and T & C

Alignment

- View westward from connection to existing LRT system

Social & Economic Benefits

- Expected ridership of 44,000/day
- Reduction in approx. 7,300 vehicles/day
- Annual reduction in:
  - 3,600 tons of CO₂
  - 210 tons of CO
  - 14 tons of nitrogen oxides
  - 28 tons of volatile organics

Project Challenges

- Largest infrastructure project in Calgary
- Unprecedented 60 month schedule
- Relative lack of design-build experience
- Stakeholder engagement

Project Success

- On time and on budget delivery
- Integrated Owner’s team
- Partnering Culture
- Satisfied Stakeholders
Lesson 1 – Clear Documents

Lesson 2 – Common Vision of Success

Lesson 3 – Keep People Working at their Strengths

The Goal: Meeting Commitments – Delivering Transit

The Virtuous Cycle

A major project, successfully delivered, creates trust and momentum for public transit

Questions?