

**An Innovative Process for the Development of the
New City of Calgary
Road Construction Specifications – A Case Study**

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Abstract

In 2009 the City of Calgary commissioned EBA, A Tetra Tech Company (EBA) to undertake a comprehensive review of the City's standard specifications for road and other surface works construction. A process was developed that would incorporate input from a wide spectrum of stakeholders, and build consensus within the contracting and development industries as well as with City technical and administrative groups.

The initial step in this process was a half day project kick off meeting, bringing together a large number of people from across the various stakeholder groups. As part of this effort, working groups were tasked with discussing and reporting back on three fundamental questions. What do we want the specifications to achieve? What level of responsibility (and risk) should be with the Contractor, Owner and Developer for quality? And, how do we balance initial cost with generational accountability?

The outcomes served to provide the review team with five guiding principles for the ultimate delivery of enhanced specifications, including;

- 1) Improved Clarity – As specifications evolve over time often revisions are made to address previous issues and new technologies. The revised specifications are presented in a clear and concise manner.
- 2) State-of-the-Industry Material and Construction Quality Standards – Provide the most recent recognized quality standards that will satisfy the expectations of Calgary taxpayers.
- 3) Clearly Defined Roles and Focusing the Responsibility for Quality on Contractors and Suppliers – Provide the means to enable Contractors and Suppliers to “take ownership” of their processes.
- 4) Delivering Cost-Effective and Sustainable Infrastructure - Consistent with the City's Plan-It and Triple Bottom Line direction, all aspects of project delivery must have the underlying principal to provide safe, reliable and sustainable infrastructure.
- 5) Fair and Equitable Resolution Process - Consistency, simplicity, risk management, and fair and equitable dispute resolution principals are essential to meeting industry objectives.

Over a period of 18 months an interactive process including, draft specification development, presentation to, and soliciting of input from, various industry stakeholder groups, developing consensus and incorporating input, was used to arrive at a solution that had “buy in” from all parties.

This paper describes in detail the process and final outcomes of this innovative approach to specification development. It will also highlight some of the technical aspects that will provide the citizens of Calgary with sustainable, quality surface works construction for decades to come.

1 Introduction

In 2009 the City of Calgary commissioned EBA, A Tetra Tech Company (EBA) to undertake a comprehensive review of the City's standard specifications for road and other surface works construction. A process was developed that would incorporate input from a wide spectrum of stakeholders, and build consensus within the contracting and development industries as well as with City technical and administrative groups.

This paper describes the process adopted for the specification review and the technical highlights incorporated into the revised specifications.

2 Background

2.1 City's Reason for the Specification Review

The City of Calgary Standard Specification for Road Construction has been updated a number of times over the past years. The objective of this project was to assess The City of Calgary current versions and provide new conceptual specifications that recognizes and implements the most current industry standards and procedures, as well as the corporate goals of the City. The proposed specifications would need to be presented to the Urban Development Institute (UDI) and other major stakeholders. Stakeholders review and approval would result in delivery to The City of Calgary of cost-effective and extended life cycle transportation infrastructure.

The City of Calgary has, and continues to experience significant growth. In fact, an average of 270 lane-km (or 2.5%) of new roadway infrastructure is being added every year. Rehabilitation requirements are typically every 12 years for major roads, 17 years for collectors and 25 years for local roadways. The opportunity to improve the delivery of new roadway infrastructure, and potentially extend the service life of pavements represents a significant benefit to the citizens of Calgary.

2.2 City Corporate Mandates

The City of Calgary has several mandates which serve to provide guidance to business units operating in various areas. Relative to the specification review initiative, the following were considered applicable:

- Corporate Goals
 - i) Deliver quality public service to Calgarians.
- Business Unit Goals (Transportation Department)
 - i) Develop activity based plans and measures for Road Service Excellence.
 - ii) Align design, construction, operations, and management procedures to support the Transportation Department policy and planning initiatives.

2.2.1 Plan It Calgary / Calgary Transportation Plan

Plan It Calgary involved the engagement of over 6,000 Calgarians and conducted an extensive amount of research during the two year process.

On September 28, 2009 City Council approved a new Municipal Development Plan (MDP) and Calgary Transportation Plan (CTP) that were created through the Plan It Calgary process. These plans describe the vision for a long-term pattern of growth and development in Calgary over the next 60 years and provide policies that will start to create that form of city over the next 30 years. These policies will guide decisions that will continue to integrate social, economic and environmental objectives.



With regards to the specification review process the following goals were considered applicable:

Transportation Goal #6: Advance environmental sustainability. The transportation system should be planned, designed, operated and maintained to reduce the impact of travel on the environment by curbing land consumption, protecting air and water quality and reducing energy consumption and greenhouse gas emissions.

Transportation Goal #7: Ensure transportation infrastructure is well managed. Sound management of all transportation infrastructures will promote efficiency, infrastructure preservation and value, safety and a healthy environment.

Related policies include:

- Ongoing operating and maintenance costs must be considered in the approval process for transportation infrastructure projects.
- New funding sources should be identified and pursued to fund both transportation capital and operating costs.
- The capacity and life-cycle of existing transportation infrastructure should be optimized before investing in new infrastructure in existing areas.
- The infrastructure and implementation strategies identified in the CTP should be reviewed and prioritized within the context of The City's current and future financial capacities.

In the area of infrastructure management, the primary objective is to use best infrastructure management practices to keep Calgary's transportation infrastructure safe and reliable, and minimize future expenditures by optimizing the life-cycle of existing and future facilities.

To accomplish this overall objective, the following efforts are considered:

- A life-cycle costing and management program should be used to optimize the recommendations for infrastructure investment, which should be aimed at improving the overall condition of the transportation infrastructure and minimizing the overall life-cycle cost, and the impact on the natural environment.
- Environmental best practices must be incorporated into all infrastructure management activities to minimize impact on the environment and integrated green infrastructure.

The concept of sustainability is defined as “Meeting the needs of the present without compromising the ability of future generations to meet their own needs”. It includes environmental, economic and social sustainability. Sustainability is defined by the 11 Sustainability Principles for Land Use and Mobility, approved by Calgary City Council on Jan. 8, 2007”.

2.2.2 Triple Bottom Line Policy

Consistent with the Plan It Calgary approach is the policy of Triple Bottom Line. The Triple Bottom Line is an approach to decision making that considers economic, social and environmental issues in a comprehensive, systematic and integrated way.

The Triple Bottom Line has been adopted by many organizations in both the public and private sector. It is a departure from making decisions based solely on the financial bottom-line. It also reflects a greater awareness of the impacts of our decisions on the environment, society and the external economy - and how those impacts are related.

3 Specification Development Process Overview

3.1 Project Initialization Focus Group Meeting

To initiate the specification review project, a focus group meeting was held November 9th, 2009. Over 40 representatives of the City, industry, developer representatives, facilitators, along with the project team participated. After introductions, a City presentation on the objectives of the exercise and a review of specification concepts, the group separated into three working groups. Each group was tasked with addressing one question related to the review. The following sections provide a summary of the results of this exercise.

Question 1: What do we want these specifications to achieve?

Discussion Outcome Summary: The discussion started with the scenario of if no specifications existed, the group agreed that clear specifications were necessary. We should move away from the current ‘cookie cutter’ methodology to allow for more development/neighborhood appropriate models and specifications that consider revenue potential as well. The specifications need to take into account initiatives such as Plan It and Triple Bottom Line but be acceptable to the main stakeholders as well.

Notes:

- Clarity
- Consistency and sustainability with City policy (Triple bottom line)
- What we want to achieve is not ‘cookie cutter’
- Not only UDI projects (scope)
- Maximum flexibility and minimize constraints
- Appropriate products and consistency in quality

- Flexibility of approvals outside standard specifications
- Balance between long and short term goals. (upfront cost savings cancelled out by future City maintenance)

Question 2: What level of responsibility should be with Contractor, Owner and Developer for quality?

Discussion Outcome Summary: The group wanted to ensure the specifications created a focus on safe, reliable, well maintained and sustainable innovations whilst ensuring that costs incurred by all parties were kept at a reasonable level. There was a feeling that reviewing current practice to identify unnecessary tasks/fees could free up resources to be better dedicated to improving quality, in particular for the developers.

They discussed the potential for varying Construction Completion Certificate (CCC) and Final Acceptance Certificate (FAC) timescales, but the feeling was that extending these too far would create a window of opportunity whereby companies could potentially declare bankruptcy to get out of CCC/FAC obligations. A suggestion was made that rather than fixes be required to receive CCC, they be noted as required repairs at the FAC stage and then this inspection becomes the main focus for repairs. This would reduce construction frequency and disruption for residents and may be more cost effective in the long run.

Notes:

- Think outside the box, Materials, Products, Processes
- Manage the risk outside of maintenance/ warranty period
- Safe Innovations
- “Hybrid” specifications for Contractors, to allow more flexibility
- Contractors and Consultants have the increased responsibility to ensure safety and compliance.
- Designs should conform to warranty periods, better products, better materials at install, trust and integrity
- Review ‘doing things because we always have’ – there are savings that could be found in removing some of these items.
- “One size does not fit all”.

Question 3: Balancing initial cost with generational accountability?

Discussion Outcome Summary:

- What is long term?
- Do what’s right for future generations.

- Common Themes: Cost, Quality, Time
- Top Priorities Agreed: Citizen - Quality, City - Cost / Quality, UDI - Cost

Notes:

UDI Goals:

- Initial cost/affordability, marketplace, consistency of application of policy
- Innovation , cost effective design and performance
- City policy regarding acceptance, needs to be consistent

City Goals:

- Lower O & M costs and lower taxes
- Provide safe, functional/effective transportation network for citizens
- Consistency of standards/ Equality
- Meet national standards/specifications/legislation/policies
- Public education on projects why things are being done a certain way
- Latest technology to be used in design

Citizen Goals:

- Emphasis on quality
- Lower taxes – long term
- Inconvenience of construction. Get it right the 1st time
- Expect good quality road network

3.2 Guiding Principals

The Focus Group Meeting and subsequent discussions with City personnel representing various levels, served to provide the review team with five guiding principles for the ultimate delivery of enhanced specifications, including;

- 1) **Improved Clarity** – As specifications evolve over time often revisions are made to address previous issues and new technologies. The revised specifications must be presented in a clear and concise manner.

- 2) **State-of-the-Industry Material and Construction Quality Standards** – Provide the most recent recognized quality standards that will satisfy the expectations of Calgary taxpayers.
- 3) **Clearly Defined Roles and Focusing the Responsibility for Quality on Contractors and Suppliers** – Provide the means to enable Contractors and Suppliers to “take ownership” of their processes.
- 4) **Delivering Cost-Effective and Sustainable Infrastructure** - Consistent with the City’s Plan-It and Triple Bottom Line direction, all aspects of project delivery must have the underlying principal to provide safe, reliable and sustainable infrastructure.
- 5) **Fair and Equitable Resolution Process** - Consistency, simplicity, risk management, and fair and equitable dispute resolution principals are essential to meeting industry objectives.

3.3 Consensus Building

Over a period of 18 months an interactive process including, draft specification development, presentation to, and soliciting of input from, various industry stakeholder groups, developing consensus and incorporating input, was used to arrive at a solution that had “buy in” from all parties. Stakeholder groups and their perspective were generally as follows.

- **City Administration** – Generally responsible for fulfilling the City’s “corporate” objectives described in previous sections. A focus on sustainable infrastructure, not only in terms of new construction, but with regards to preservation of existing infrastructure elements, was key.
- **City Materials & Research** – This group represented the “ownership” of the new specifications, as this was, and continues to be an important role of this group. Focus areas included state-of-the-industry technical standards as well as sound quality management practices. This group also represented, along with EBA, the working group responsible for ultimate delivery of the new specifications.
- **Urban Development Institute (UDI)** – This group is charged with representing the vast majority of those companies involved in new residential construction in Calgary. The Institute’s activities focus on promoting wise, efficient and productive urban growth. This group’s input provided accountability for “value for money”, and challenged the delivery group to justify the cost-benefit of technical and quality management aspects of the specifications.
- **Alberta Roadbuilders and Heavy Construction Association (ARHCA)** - This group represents the construction industry responsible for the delivery of surface infrastructure works. Their input was valuable in weighing the true economic consequences of proposed specification changes such that any benefit could be accurately assessed in terms of resulting cost increases or savings. Representing a broad range of contractors, it was the responsibility of this group to provide a consensus regarding issues to maintain a constant focus for the overall group.

- Alberta Ready-Mixed Concrete Association (ARMCA) and the Cement Association of Canada (CAC)** – ARMCA represents over 90% of the concrete producers in Alberta and promotes the ready-mixed concrete industry as well as state-of-industry concrete technology. There have been several concerns over The City of Calgary Standard Specification for Road Construction with respect to current concrete technology and national standards. Portland cement concrete (PCC) specified by The City was not consistent with the current Canadian Standard Association (CSA) specification for concrete materials and methods of concrete construction and concrete practices. It was felt that the concrete specified by The City was potentially of lower quality than concrete supplied for Alberta Transportation projects, the City of Calgary Transportation Infrastructure projects and commercial projects in Calgary. A significant percentage of concrete sidewalk failures in new subdivisions at FAC stage was a source of frustration for developers and was frequently voiced by UDI. The Cement Association of Canada (CAC) had similar concerns.

During the review process over ten face-to-face meetings were held between the project delivery team and various stakeholders. In addition, correspondence (both verbal and written) was ongoing between all parties which ultimately resulted in a general consensus. As a result, the revised specifications were issued by the City of Calgary Roads, as the 2012 Standard Specifications for Road Construction.

4 Technical Highlights

4.1 Portland Cement Concrete (PCC)

All cast-in-place concrete works were to be performed with the current CSA standards for cementitious materials (A3000), concrete materials and Methods of Concrete Construction (A23.1) and Test Methods and Standard Practices for Concrete (A23.2). ASTM standards were only applied when specified by CSA. Section 310.00.00, Portland Cement Concrete formed the basis for the development of Section 311.00.00 – Concrete Sidewalk, Curb and Gutter, Section 312.00.00 – Portland Cement Concrete Pavement with the new section on Concrete Overlay, Section 315.00.00 – Architectural Pavements, and Section 316.00.00 – Noise Barriers. The premise of the changes and additions in the specification was to specify durable concrete with an extended service life and the terminology reflected state-of-art concrete technology. The most significant changes are outlined below.

- The reference to class “A” and class “B” concrete and overlay concrete has been replaced with the CSA exposure class C-2 concrete, non-structurally reinforced and exposed to chlorides and freezing and thawing cycles. The strength requirements were increased for durability but the reference to minimum cement contents in the old specifications was removed. Fly ash addition/replacement to Portland cement was not allowed in the old specifications but was permitted in the new guidelines as its



advantages in improving long-term durability and strength development are widely recognized.

- The aggregate properties were clearly specified and consistent with the CSA durability requirements for concrete aggregate.
- A shift from the prescriptive mix design including cement content, water to cementing materials ratio (w/cm) and air content adjustments to strength, to a performance oriented process resulted in the detailed submission requirements prior to the construction season for review and acceptance. Similarly, all references to the producer's concrete batching proportioning and mixing were removed.
- The roles of quality control, quality assurance and the verification process were clearly defined.

4.2 PCC Surface Works

Portland cement surface works were divided into two sections; Section 311.00.00 Concrete Sidewalks, Curbs and Gutters and Section 312.00.00 Portland Cement Concrete Pavement with a new section on concrete overlay for pavement rehabilitation. The most significant changes are highlighted below.

- Mix properties and performance characteristics of concrete were clearly defined and consistent with Section 310.00.00 and the durability requirements. Hot weather requirements were consistent with the CSA temperature ranges.
- Some of the proposed changes on how to evaluate failures of sidewalks, curbs and gutters were accepted.
- The concrete mix performance characteristics of the concrete pavement and the concrete overlays were based on the flexural strength rather than compressive strength.
- Detailed references to concrete mixing, paving equipment, and paving operations were removed.



4.3 Granular Materials

Granular materials requirements, contained in Section 303.00.00 generally focused on the materials actually being produced and incorporated into City projects. Changes included the following.

- Updated property requirements to reflect current supply and previous City research.
- Reducing the number of products and altering the gradation requirements to be consistent with Alberta Transportation requirements, thereby reducing the number of stockpiles required.

- Clarifying the Quality Control (QC) testing requirements and submission expectations.

4.4 Asphalt Binder

The specification review enabled the transition to the Superpave Performance Grade (PG) system. AASHTO M320 was established as the standard for asphalt binder materials. The following highlights the new specification.

- Guidelines for binder selection were incorporated based on roadway classification, traffic loading, transit bus traffic and the presence of signalized intersections.
- In response to industry feedback, the number of binder grades was reduced to three; PG 58-31, PG 64-34, and PG 70-31.

4.5 Asphalt Concrete

Four standalone asphalt concrete sections were developed for Asphalt Concrete – Superpave, Asphalt Concrete – Marshall, Stone Matrix Asphalt (SMA) and Bridge Mastic Asphalt. The intent was to position the City to fully adopt the Superpave system in the near future. Significant changes are described as follows.

- Consideration of Warm Mix Technology (WMA) on a project-by-project basis (Contractor proposal submission required).
- The most current technical requirements were adopted for all mix types.



- Compaction as a percent of Maximum Relative Density and a minimum Tensile Strength Ratio (TSR) requirement was adopted for all mix types, where the City had no requirement for moisture susceptibility previously.
- Standalone Sections for Materials, Execution, QC/QA, Acceptance Parameters, etc.
- End Product Specification (EPS) based philosophy was adopted for all projects.
- To address the issue of balancing the Quality Assurance (QA) effort with the size of the project a tiered system was developed including two Project Categories (one for larger Capital Works projects with statistical based acceptance and one for subdivision as well as smaller projects, QC based with QA audit).
- Revised production tolerances (generally less stringent) and criteria for JMF revision and QC reporting.

- Simplified “Execution” section, reflecting EPS philosophy.
- Appeal testing protocols for all parameters subject to payment adjustment.
- Payment adjustments were adopted for asphalt content, compaction, air voids, thickness, and in some cases smoothness. In some cases the adjustments were different for lower lift and upper lift to reflect the relative consequences of noncompliance.



4.6 Pavement Design

Previous City specifications included standards for the design of pavement structures which were generally a blend of Asphalt Institute and layer equivalency factors. The revised standards were primarily based on the AASHTO 1993 Design Guide. Highlights of the new specification include the following.

- To reduce costs, without sacrificing performance, minimum standard pavement sections were developed for Local roadways, Major Collectors (with transit bus traffic) and Minor Collectors (without transit bus traffic).
- The previously specified 15-year design life was revised to 20 years for Industrial roadways and 30 years for Major roadways.
- Requirements were included for characterizing subgrade support conditions.
- Traffic inputs were clarified including Load Equivalency Factors for cars, single unit trucks, tractor trailer units and transit buses.
- Layer Coefficients were stipulated for asphalt concrete with polymer modified asphalt, asphalt concrete without modified binder, Full Depth Reclamation (FDR), Cold In-place Recycling (CIR), granular base and granular sub-base.



5 Closure

This paper has described in detail the processes and final outcomes of this innovative approach to specification development. It also highlights some of the technical aspects that will provide the citizens of Calgary with sustainable, quality surface works construction for decades to come.