OFFICE OF THE
City Auditor

23rd Avenue & Gateway Boulevard Interchange Project Review

September 3, 2008

THE CITY OF Edmonton

The Office of the City Auditor conducted this project in accordance with the *International Standards for the Professional Practice of Internal Auditing*

23rd Avenue & Gateway Boulevard Interchange Project Review

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23rd Avenue & Gateway Boulevard Interchange Project Review

Summary for City Council

The City Manager requested that the Office of the City Auditor (OCA) review the process that was followed for the 23rd Avenue and Gateway Boulevard Interchange Project (the 23rd Avenue project). This review is included in the Office of the City Auditor's (OCA) 2008 work plan, approved by City Council. Our overall objective was to identify areas of improvement in the planning, design, tendering and contract award processes for future major/complex projects. To achieve our objective, we sought to answer three basic questions:

- What are the reasons for the cost increase from $75 to $261 million?
- What are the causes of the delay in project completion from 2006 to 2011?
- Did the City exercise due diligence as project owner in managing the project?

Council is the City's governing body and approves funding for capital projects such as the 23rd Avenue project. The City Manager is responsible for recommending initiatives and managing approved capital programs in an efficient, effective and economical manner.

Guidance for managing capital projects comes from a variety of sources. The Project Management Institute provides general guidance that can be used for all types of projects and identifies specific knowledge areas required for effective project management. Administrative Directive A1424A, *Project Management for Projects (November 1999)* provides a corporate-wide, professionally accepted framework for managing City projects. The Transportation Department Project Management Manual (2006) provides basic guidance for transportation projects.

Our review included the assessment of project documentation maintained in manual and electronic files, area structure plans, Transportation and Public Works Committee and Council reports, and interviews with City staff and representatives from the consulting, engineering and construction industries.

The purpose of this summary is to highlight areas requiring improvement by the Administration and any direction that Council may need to provide to Administration in order to fulfill its governance and oversight role. A full report outlining the detailed results of our review follows.

What are the reasons for the cost increase from $75 to $261 million?

The 23rd Avenue project cost increased by $186 million from $75 million in 2003 to $261 million in 2007. The following table summarizes the reasons for the cost increase.

Table 1
Cost Increases

Reasons for Cost Increase	Amount (millions)	Comments
Cost Escalation	$86	The original estimate was stated in 2003 dollars rather than year-of-expenditure dollars. Project completion is now scheduled for 2011. This amount is based on heavy construction industry escalation factors.
Industry at Capacity	$55	At the time of tender there were other significant opportunities for contractors across the province. Only two contractors submitted bids for the 23rd Avenue project.
Design Changes and Underestimates	$45	In addition to design changes, the engineering consultant hired for the design phase identified "significant deficiencies" in the concept plan estimates.
Total Increase	**$186**	

What are the causes of the delay in project completion from 2006 to 2011?

The plan prepared at the conclusion of the concept planning phase indicated construction of the 23rd Avenue project was to be completed in 2006. Following the award of the construction contract it was communicated that construction would be complete in 2011, approximately 60 months later than planned. The following table identifies the delays or lapsed time between the planned and actual completion of each phase of the project.

Table 2
Project Delays
(Planned to Actual Schedule)

Phase	Months	Comments
Strategic Planning	--	A specific strategic plan was not prepared and executed. This may have resulted in lost opportunities such as early land acquisition.
Concept Planning	9	The Transportation and Public Works Committee extended the non-statutory hearings by 3 months. Project documentation does not indicate the reasons for other delays. Resourcing issues experienced by Transportation and the complexity of the project also impacted the schedule.

Phase	Months	Comments
Preliminary/Detailed Design Phases	24	Rework of the plan was required due to "significant deficiencies" in the concept plan. Land acquisition was extended due to the desire to avoid the risk of claims against the City after project completion. Unplanned work for pipeline relocation and protection was required.
Tendering & Contract Award	6	Tender packages were not ready when planned, 9 addenda were issued and the approval process took longer than planned.
Construction	24	The construction period extended from 2 to 3 years. (12 months) Early communication on the construction period did not include final asphalt overlay to the Gateway Boulevard/Calgary Trail corridor. (12 months)
Total Number of Months	**63**	

Did the City exercise due diligence as project owner in managing the project?

The above results are a reflection of the project management practices applied for the 23rd Avenue project. Our observations are summarized into four themes: guidance, resources, communications and project management practices.

General guidance to facilitate effective planning, management, integration and control of projects is available at various levels: The Project Management Institute, corporately for the City and departmentally for transportation infrastructure projects. Our high level review of the departmental manual revealed areas that require review and enhancement. The project plan included some guidance for project management but did not include sufficient details to effectively manage the 23rd Avenue project.

Resource issues in the Transportation Planning area have been identified as far back as 1995. A junior staff member was assigned project management duties for the 23rd Avenue project during the planning phase. We also noted the department does not have cost estimating expertise and relies on consultants for this function. Without this expertise, the City cannot effectively verify the accuracy of project estimates.

Project communications were not completely effective resulting in attention being diverted from project work and creating some degree of uncertainty among team members. A number of reports were requested/provided to Transportation and Public Works Committee/Council, effectively shifting Council from a strategic to a detailed project focus. Communication from engineering consultants also indicated that the "health of the partnership" had been tested by uncertainty and the time it took to resolve issues.

Project ownership was transferred between branches and project managers as the 23rd Avenue project progressed. Project management roles, responsibilities and accountabilities were not clearly defined and the City relied on the engineering consultant to manage key activities. We also noted that learnings from similar projects were not captured and shared to facilitate continuous improvement. This impacted the quality of project outcomes.

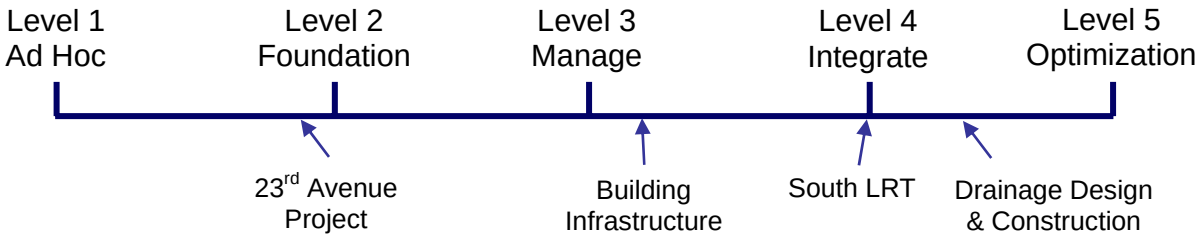
Project Management Maturity Assessment

At the conclusion of our review we assessed the project management practices for the 23rd Avenue project using the maturity model developed by the Project Management Institute. The model represents best practice for any major project. The following table outlines the five maturity levels. The full model is included in Section 5.3.7 of this report. At the bottom of the table is our assessment of the 23rd Avenue project as well as our preliminary assessment of other organizational units in the City.

Table 3
Project Management Maturity Model
(Project Management Institute)

Level 1	Level 2	Level 3	Level 4	Level 5
No formal, consistent process	Consistent, basic approach	Consistent, comprehensive approach	Project portfolio management is institutionalized and integrated into the organization's business planning process	Project-centered organization with an established approach to continuous improvement of project management practices

OCA's Assessment of City Project Management Practices



Best practice research and some project management practices within the City demonstrate the potential for significant benefits from moving towards a project-centered/project portfolio management environment (Level 5). These opportunities

would significantly enhance the City of Edmonton's ability to deliver projects with predictability, consistency, and success.

We have made nine recommendations to enhance the City's project management, cost estimating, scheduling, resourcing and communication practices. These recommendations as well as the Administration's action plans are summarized in Section 6 of this report.

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23rd Avenue & Gateway Boulevard Interchange Project Review

1. Introduction

The City Manager requested that the Office of the City Auditor (OCA) review the process that was followed for the 23rd Avenue and Gateway Boulevard Interchange Project (the 23rd Avenue project). At that time, the main construction contract had just been awarded, with the total project cost increasing from the 2003 estimate of $75 million to $261 million in 2007. The City Manager requested that we evaluate any conditions that may have hindered progress, including the reasonableness of project timelines and the approval and tendering processes.

The review of the 23rd Avenue project is included in the OCA's 2008 work plan that was approved by City Council. Our overall objective was to identify areas of improvement in the planning, design, tendering and contract award processes for future large/complex projects.

2. Background

2.1. Project Management

The Project Management Institute identifies specific knowledge areas for effective project management. These include: scope, quality, time, cost, information/ communication, contract/procurement, human resource, risk and integration management.

Administrative Directive A1424A, *Project Management for Projects (November 1999)* provides a corporate-wide, professionally accepted framework for managing the scope, quality, time, cost, risk and human resources of corporate projects. The policy also provides guidelines to establish clear lines of accountability and responsibility for project management decisions and for achieving project objectives and deliverables.

The Transportation Department Project Management Manual (2006) provides basic guidance for transportation projects. Responsibility for managing the strategic and conceptual planning phases of projects is assigned to the Transportation Planning Branch. Responsibility is then transferred to the Streets Engineering Branch for the preliminary and detailed design phases and the construction phase.

2.2. 23rd Avenue Project Background

In the early 1980's, the area south of 23rd Avenue and east of Gateway Boulevard was primarily zoned for industrial use. During the 1990s, a series of events took place that accelerated development in the area and placed pressure on the City to address the rapidly evolving transportation needs.

- In 1994, the City of Edmonton, Province of Alberta and CP Rail entered into a series of agreements for the transfer of land among the parties.
- In 1996, part of the land was rezoned for commercial use to accommodate the first phase of the proposed South Edmonton Common development. Full development was expected to be reached in about 25 years (2020).
- In 1998, additional land was designated for commercial use for the South Edmonton Common development. Subsequently, in 2004, the expected time frame for full development was significantly reduced to 2010.
- In 1999, the Transportation Master Plan was approved by City Council.

In September 2003, Council approved the concept plan for the 23rd Avenue project. The estimated cost for the project was $75 million, with construction to be complete by the end of 2006. Subsequently, design and pricing changes brought the estimated cost to approximately $130 million.

In August 2007, following the review of construction bids received, Council approved an additional capital budget of $130 million, bringing the total 23rd Avenue project cost estimate to $261 million. Subsequently, planned construction completion was reported to be in 2011.

Figure 1 illustrates what the 23rd Avenue project will look like when it is complete. It includes five bridges: two over Gateway Boulevard and Calgary Trail, two over the CP Rail tracks at 23rd Avenue and a flyover at 19th Avenue.

Figure 1
Artist Rendering of 23rd Avenue & Gateway Boulevard Interchange (looking south)

Source: **23rd Avenue Interchange project** website

3. Objectives

The primary objectives of this review were to evaluate the effectiveness of the project management process including the interaction with other corporate processes, determine the reasons for cost increases and any project delays, and identify learnings and areas of improvement for future projects.

4. Scope and Methodology

4.1. Audit Scope

The audit scope included the strategic planning, concept planning, preliminary and detailed design and the tendering and contract award phases for the 23rd Avenue project. We did not include review of construction activity in the scope of our audit.

4.2. Methodology

We developed audit programs that identified the steps necessary to gather sufficient support to address the audit objectives. We obtained information through the review of project documentation maintained in manual and electronic files, area structure plans,

Transportation and Public Works Committee and Council reports, and from interviews with:

- City staff from:
  - Transportation Department
  - Policy and Planning Branch, Planning and Development Department
  - Law and Materials Management Branches, Corporate Services Department
  - Economic Trends/External Research, Office of the Deputy City Manager
  - South Light Rail Transit Office
  - Drainage Branch, Asset Management and Public Works Department
  - Project Management and Construction Branch, Capital Construction Department
- Representatives from:
  - Alberta Transportation and the City of Calgary
  - Local consulting and construction firms familiar with the 23rd Avenue project
  - The Consulting Engineers of Alberta, Edmonton Construction Association, and the Alberta Roadbuilders & Heavy Construction Association

We also reviewed best practice materials developed by the Project Management Institute and the Association for the Advancement of Cost Engineering.

5. Observations and Analysis

We have grouped our observations and analysis as responses to three basic questions:

- What are the reasons for the cost increase from $75 to $261 million? (section 5.1)
- What are the causes of the delay in project completion from 2006 to 2011? (section 5.2)
- Did the City exercise due diligence as project owner in managing the project? (section 5.3)

The opinions and recommendations contained in this report are generally applicable to large and complex projects.

5.1. What are the reasons for the cost increase from $75 to $261 million?

5.1.1. Project Cost Summary

In September 2003, Council approved the concept plan for the 23rd Avenue project with an estimated cost of $75 million. Table 4 highlights the estimated total interchange costs

of the 23rd Avenue project at key points through to the construction contract award in September 2007.

Table 4
Project Cost Summary
(Millions of dollars)

Item	Concept Plan September 2003	Preliminary Design October 2004	Detailed Design October 2006	2007 Award* September 2007
Bridges & Retaining Walls	$13	$25	$31	$93
Roadwork and Traffic Operations	24	37	52	100
Drainage System				
▪ Roadway Drainage	6	6	7	12
▪ Storm/Storage Tunnel	7	8	8	8
Pipeline & Utility Protection	4	11	16	16
Land Acquisition	2	6	6	6
Engineering & Administration	17	11	14	15
Subtotal (excluding GST)	**$73**	**$104**	**$134**	**$250**
GST (included in Oct. 2006 subtotal)	$2	$3	GST included	$11
Total (including GST)	**$75**	**$107**	**$134**	**$261**

* Total project cost estimated after award of the main construction contract

The cost estimates in 2003, 2004 and 2006 were reported in constant dollars in the year of estimate, not in forecast year-of-expenditure dollars. Since the projected costs were not escalated to the years in which construction was scheduled, the total project costs were understated. The estimates for GST in 2003 and 2004 are net of the rebate the City receives, while the 2007 estimate includes the future GST payments to vendors.

The benefit-cost ratio for the 23rd Avenue project was not updated when Council approved the additional $130 million, bringing the current capital budget estimate for the entire project to $261 million. We included a case study of the 23rd Avenue project in our 2006 audit of the Transportation Planning Branch. One of our conclusions from that case study was:

> The Transportation Planning Branch has a methodology, but does not have a formal process to initiate a benefit-cost analysis. Lack of such a process limits City Council's ability to make effective choices relating to prioritizing transportation projects as circumstances change.

The benefit-cost ratios included in the 2006 case study noted that at $75 million the benefit-cost ratio was 3.0 while at $125 million (the estimate at the time of the case study) the ratio was reduced to 1.6. As the benefit-cost ratio decreases the economic benefits associated with reductions in accident rates and travel times are less favorable. The department did not update the benefit-cost ratio prior to recommending to Council that the 23rd Avenue project not proceed when the expected cost rose to $261 million.

OCA Opinion

Not reporting project costs in year-of-expenditure dollars can result in understated project costs – especially in times of high market volatility. In our opinion, decision makers are unable to make fully informed decisions when costs are understated and timely benefit-cost analyses are not provided.

(Recommendations 2, 4 & 6)

5.1.2. Cost Increase

Between September 2003 and September 2007, total project cost forecasts increased by $186 million. The current total project cost forecast of $261 million was prepared when the construction contract was awarded.

Table 5 summarizes changes in cost estimates for major project components to the following categories:

- **Cost Escalation** associated with annual inflationary pressures and limited availability of materials such as concrete, asphalt and steel.
- **Other Changes** such as design changes, quantity underestimation, unforeseen conditions, and heavy construction industry capacity.

Table 5
Project Cost Increase
(Millions of dollars)

Project Component	Concept Plan September 2003	Cost Escalation	Other Changes	2007 Award* September 2007
Bridges & Retaining Walls	$13	$30	$50	$93
Roadwork and Traffic Operations	24	44	32	100
Drainage System				
▪ Roadway Drainage	6	6	--	12
▪ Storm/Storage Tunnel	7	1	--	8
Pipeline & Utility Protection	4	--	12	16
Land Acquisition	2	--	4	6
Engineering & Administration	17	--	(2)	15
Total (excluding GST)	**$73**	**$81**	**$96**	**$250**
GST	$2	5	4	$11
Total (including GST)	**$75**	**$86**	**$100**	**$261**

* Total project cost estimated after award of the main construction contract

Cost Escalation of $86 million is made up of:

- Rapidly escalating costs of concrete, asphalt, backfill material, and steel.
- Annual heavy construction industry cost escalation, which ranged from a low of 7% in 2003 to a high of 20% in 2005, then decreased slightly to 17% and 18% in 2006 and 2007 respectively.

Other Changes of $100 million is made up of:

- $55 million, which reflects the limited competition and the construction industry being at capacity.
- Design changes as the project evolved, resulting in costs increasing by $22 million. In addition, quantity underestimates added an additional $23 million.

  Significant changes included realignment of the 23rd Avenue interchange, replacing and relocating pipelines under roadways, more extensive use of retaining walls, addition of an auxiliary lane, an extra lane on the north and south bridge structures (23rd Avenue bridges) and the final design of the 19th Avenue flyover. During land negotiations, the City agreed to relocate pipelines that ran under the northwest corner of South Edmonton Common land, increasing the project costs further.

OCA Opinion

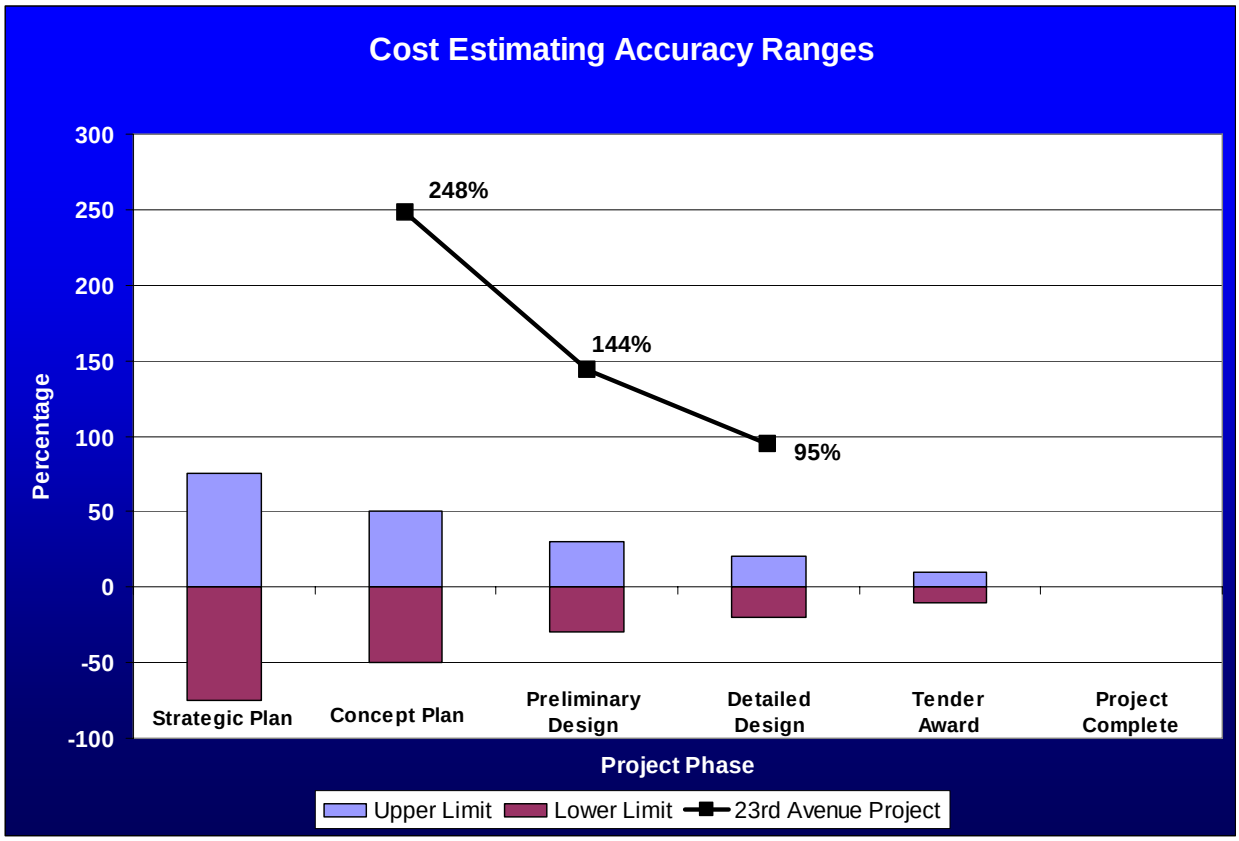
Based on our analysis, the majority of the increase in cost ($141 million of $186 million) is a result of cost escalation and the construction industry being at capacity. Reporting in year-of-expenditure dollars would have resulted in less of an increase; however, the increase resulting from recent market volatility could not have been predicted in 2003.

(Rec*ommendations 2 & 6*)

5.1.3. Cost Estimating Process

In our 1998 *Cost Estimating Audit*, the City developed its expectation to have at least 80% of its project cost estimates fall within specified levels of accuracy at each major project phase (strategic planning, conceptual planning, preliminary design, detailed design, and contract award). As a result of that audit, the City analyzed internal data and adopted prescribed accuracy levels (± %) for each project phase for different types of infrastructure. Chart 1 illustrates the cost estimating accuracy for the 23rd Avenue project relative to the City's standard accuracy ranges.

Chart 1



The ± percentage expressed for each project phase in the above chart is the ratio of the difference between the final project cost and the estimate at the end of each phase expressed as a percentage of the estimate. For the purposes of this report, we have assumed that the final project cost will equal the estimate at tender award.

The accuracy of cost estimates for the 23rd Avenue project fall significantly outside the expected ranges even though the consulting contract documents specify tighter ranges as expected outcomes of the design phases. The City's standard consulting service agreements do not have effective provisions to hold consultants responsible for not achieving the expected cost estimating accuracy ranges.

Through our review of detailed costs for this and similar projects, we observed that the Department does not use a standard method of categorizing costs, limiting the ability to compare costs between projects or even between project phases of the same project.

- Only 50 of the 327 line items identified in the tender documents for this project could be compared with preliminary design estimates.
- In total, 71 line items could be compared with those of other interchange projects.
- Differences between the pre-tender estimate and bid prices for the 327 individual line items in the construction contract were as high as 1,273%, with 107 items having a difference greater than 100%.

- Our comparison of the bids received from the two construction companies revealed significant differences in the unit costs quoted for individual line items. 130 of the 327 items had differences greater than 100% between the bids with the greatest difference being 1,188%.

Transportation's cost estimating methodology is primarily based on historical costs of roadway projects. The Department has limited experience with pricing for bridge structures. Transportation does not have cost estimating expertise and relied on estimates prepared by the engineering consultants. The engineering consultants based their estimates on a combination of data obtained from Transportation for roadway projects, data from bridge structure projects they were involved with, and discussions with the construction industry. Project documentation shows that Transportation reviewed the estimates, but does not indicate the extent or thoroughness of those reviews, nor were there any sign-off documents to show Transportation's agreement with and approval of the estimates.

Transportation captures current costs, but doesn't do any regular trending analysis. They do not share data with the City's Chief Economist to develop better project cost forecasting models.

Our research shows that cost estimating challenges are also being experienced by other government organizations. Several organizations have developed tools and methodologies to address these challenges. For example, British Columbia,[1] New Jersey,[2] Washington,[3] Ohio,[4] and Queensland Australia[5] have developed comprehensive models, tools, and methodologies for cost estimating, benefit/cost calculations, cost estimate validation process, etc.

The contingencies included in the concept plan and preliminary design estimates were calculated using percentages of total construction cost ranging from 5% to 25%. The detailed design estimate included a 10% contingency for unforeseen elements. These contingencies did not include an allowance for risks identified in the preliminary design phase. The risk consultant estimated that the costs of identified project risks ranged from $8 million to $25 million, depending on the degree to which they were resolved. The final risk report identified a number of risks that had not yet been addressed. There is no documentation demonstrating that those risks have been resolved and an allowance is not included in the 2007 cost estimate.

The contingency amount included in the 23rd Avenue project construction contract is significantly lower than the amount that is normally included in construction contracts.

[1] http://www.th.gov.bc.ca/Publications/repopubs.htm
[2] http://www.state.nj.us/transportation/eng/CCEPM/
[3] http://wsdot.wa.gov/BIZ/CONSTRUCTION/constructioncosts.cfm
[4] http://www.dot.state.oh.us/CONTRACT/estimating/
[5] http://www.mainroads.qld.gov.au/web/partnersCR.nsf/DOCINDEX/Technical+Reference+Centre?OpenDocument

OCA Opinion

In our opinion, the lack of a consistent method of categorizing costs reduces the ability to effectively forecast project costs and use learnings from a project to improve future performance. Further, not having cost estimating expertise limits the department's ability to conduct an effective review of cost estimates prior to acceptance.

The current cost estimating methodology is not effective for large/complex projects. Transportation should research practices being implemented in other jurisdictions and adopt best practices to enhance cost estimating effectiveness.

Based on our review, the methodology used to determine contingency requirements was incomplete and may result in over-expenditure as the project proceeds.

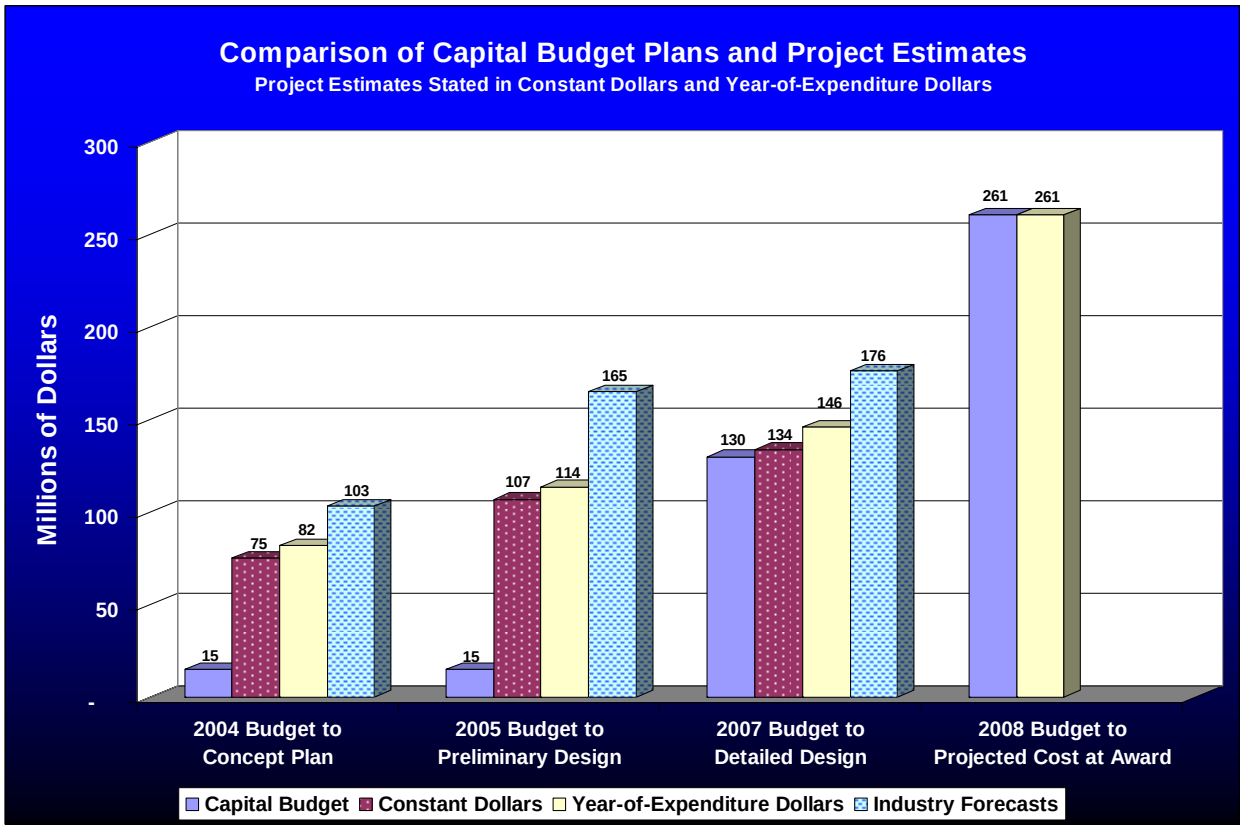
(Recommendation 5)

5.1.4. Capital Priorities Plan/Budget Process

At the time funding was approved for the 23rd Avenue project all City Departments prepare and submit capital priorities plan/budget requests (capital budget) for consideration in July of each year. From those Departmental submissions, the City prepared its capital projects list to be included in its annual capital budget submission to Council. The capital and operating budgets are then formally presented to and discussed by Council in December.

The 23rd Avenue project estimates discussed in the previous section were prepared at the conclusion of each project phase in the fall of 2003, 2004 and 2006. The Department did not advise Council of these revised budget estimates during capital budget presentations and discussions for budget years 2004, 2005, and 2007. Chart 2 shows the approved budget, project cost estimates as prepared, project cost estimates if they had included cost escalation forecasts available at that time, and project cost estimates adjusted for actual annual cost escalations experienced by the heavy construction industry.

Chart 2



The chart shows that the capital budgets did not reflect the project cost estimates (constant dollars) for the 23rd Avenue project. For example, the 2004 capital budget was approved at $15 million[6] while the estimated cost was $75 million, an understatement of $60 million. The 2005 budget was understated by $92 million while the 2007 budget was only slightly lower than the project estimate.

As noted in section 5.1.1 project cost estimates are stated in constant dollars in the year they are prepared. Applying the cost escalation rates included in budget guidelines increases the difference between the capital budget and the project estimates restated in year-of-expenditure dollars. Using these escalation rates the 2004, 2005 and 2007 capital budgets were understated by $67, $99 and $16 million respectively.

Our comparison of escalation rates used for budget purposes to historical and forecast escalation rates obtained from the heavy construction industry show significant differences. The fourth bar in each group (Industry Forecast) reflects the project cost estimates when industry-specific escalation rates are applied.

For 2008, we have assumed that future cost escalation is included in the contractors bid and is therefore in the project budget. However, the $261 million does not include

[6] The $15 million was approved to start design work, acquire land and for the design and construction of the storm drainage tunnel.

concept planning costs of approximately $600,000, which were funded from composite program xx-66-1910, Planning Studies.

Cost Recovery

In June 2003, Council approved the 2004 Business Plan and Budget Guidelines that identified $74 million of Tax-Supported Debt and $4 million of developer/partnership funding for the 23rd Avenue project. The Preliminary Design Report finalized in January 2005 provides a summary of expected cash contribution from external parties. Table 6 presents an overview of these expected cash contributions and an updated estimate based on signed agreements.

Table 6
Project Cost Recovery Estimates
(Millions of dollars)

External Party	2004 Estimate	2007 Estimate
CPR	$3	$5
ATCO	$2	$7
Other pipeline companies ▪ Imperial Oil Limited ▪ BP Canada Energy Resources Company ▪ Pembina Pipeline Corporation	$1	$0
South Edmonton Common (SEC)	$7	$0*
TOTAL	**$13**	**$12**

*As part of the agreement for the parcel of land required for the 19th Avenue flyover, the City agreed to pay all construction costs.

The budget documents approved by Council do not include the cost recoveries identified in the 2004 Budget Guidelines, the 2005 Preliminary Design report, or signed agreements.

OCA Opinion

Based on our review, information presented in the project budgets does not accurately reflect forecast project costs or expected recoveries. This is due in part to budget guidelines not reflecting the cost escalation experienced in the heavy construction industry, resulting in understated costs.

In our opinion, departments should provide Council with the most current cost estimates and cost recovery data available for major projects prior to budget deliberations to ensure they are making fully informed decisions. This was not the case for the 23rd Avenue project.

(Recommendations 2, 4, 5 & 6)

5.2. What are the causes of the delay in project completion from 2006 to 2011?

5.2.1. Project Phases

The project construction life-cycle can be broken down into five phases. The following is a brief description of the objectives and outputs for each phase.

- **Strategic Planning** – Identifying infrastructure needs and prioritizing transportation projects that support and enhance the City's infrastructure needs. Outputs include the Transportation Master Plan and Capital Priorities Plan.
- **Concept Planning** – Developing a needs statement, completing technical analyses, generating and evaluating alternate solutions, and recommending the best solution. The output for this phase is a concept plan and report that is forwarded to Council for approval and provided as input to the Capital Priorities Plan/Budget process.
- **Preliminary and Detailed Design** – Developing a preliminary design that ensures the feasibility of the recommended solution, and facilitates addressing issues and evaluating and refining costs. The detailed design includes preparing a facility design, including detailed specifications to facilitate construction. Outputs include engineering plans, a report, contract plans and specifications, and a pre-tender cost estimate.
- **Tender and Contract Award** – Developing documents to support the chosen go-to-market strategy, customizing formal contract documents, and establishing the framework for evaluating bid submissions. The output is the contract award to the best-evaluated bidder.
- **Construction** – Building of the facility according to plans and specifications within budget and schedule. The output is a functional facility (e.g., road or bridge). We did not include a review of this phase in our scope since construction is not complete.

We used the project schedule prepared at the end of the Concept Planning phase as the planned schedule (Plan). By comparing the planned schedule to the actual schedule we determined the delay resulting from each of the project phases.

5.2.2. Strategic Planning

Strategic Planning	Concept Planning	Preliminary and Detailed Design	Tender and Contract Award	Construction
Plan – n/a **Actual 1994-1999**	Plan 2001-2003 Actual 1999-2003	Plan 2004-2005 Actual 2004-2007	Plan 2005 Actual 2006-2007	Plan 2005-2006 Actual 2008-2011

A specific strategic plan was not prepared and executed. This may have resulted in lost opportunities such as early land acquisition since a number of documented events took place that forecast infrastructure requirements. Table 7 highlights the years in which information related to the requirements for the 23rd Avenue project were identified.

Table 7

Strategic Planning	1994	1995	1996	1997	1998	1999
CP Rail Relocation	a					
Traffic Impact Assessment and ASP Identify Ultimate Configuration			b			
South Edmonton Common Phase 2 ASP					c	
Transportation Master Plan						d

The following information contained in these documents provides strategic insight into the need for the 23rd Avenue project in the years prior to concept planning.

Note a: The need for some type of access at 19th Avenue was communicated in the City's commitment when CP Rail relocated its tracks in 1994.

Note b: The1996 Transportation Impact Assessment completed for CP Rail concluded that grade-separated interchanges would ultimately be required at both 23rd Avenue and 19th Avenue if full commercial development took place. The assessment also identified the need to widen 23rd Avenue from four lanes to six lanes.

The 1996 Area Structure Plan (ASP) Bylaw for phase 1 of South Edmonton Common identified the need for an interchange at 23rd Avenue, access requirements at 19th Avenue, contamination from oil and gas pipeline leaks, and the need to upgrade the pipelines.

Note c: The 1998 Area Structure Plan (ASP) Bylaw for phase 2 of South Edmonton Common identified the need for additional lanes on 23rd Avenue, two left turn lanes off Calgary Trail to 23rd Avenue eastbound, and a grade-separated left turn in and no left turn out at 19th Avenue.

Note d: The first document committing the City to a course of action was the 1999 Transportation Master Plan. The plan identified the need to develop Gateway Boulevard/Calgary Trail to full free-flow standard with strict access control.

The documents identified in notes a, b and c communicated broad-based concepts regarding land use south of 23rd Avenue and east of Gateway Boulevard. We were advised by the Law Branch that these documents did not commit the City to a course of action for the adjacent roadway network.

A case study of the 23rd Avenue project included in our 2006 Transportation Planning Branch audit report included three learnings related to the City's strategic process:

> When the zoning changed from industrial to commercial use, the City was exposed to significant risks associated with this corporate project. The 23rd Avenue project presented the City with significant development opportunities but also corresponding transportation challenges. An integrated approach did not exist to manage corporate projects, risks and optimize the City's interests.

The pace of South Edmonton Common development accelerated at a rate exceeding the City's capacity to plan for a major interchange at 23 Avenue. The City needed to manage and control the pace of development (planned growth) to mitigate the impacts on the transportation system.

The Transportation Master Plan did not incorporate a means to effectively respond to emerging corporate projects and their impact on other transportation projects. The Transportation Master Plan provided strategic direction regarding the need for free flowing roads, but did not provide a means to compare this project's needs against other transportation projects within the City.

We reviewed Transportation's responses to area structure and neighbourhood structure plan proposals for the years 2004 through 2007 which show increased input on the impact of the development on the surrounding transportation infrastructure. Transportation advised us that they also have more opportunity to address Council when planning bylaws are put forward for approval.

OCA Opinion

In our opinion, the improvements in the responses to structure plans and other actions described by Transportation management appear to address the deficiencies related to identifying and tracking the impact of area structure plan proposals on the surrounding infrastructure.

Continued efforts to provide Council with the full impact of development requests on the surrounding infrastructure (e.g., roads, drainage, etc.) enhances their ability to make informed decisions. Documenting the impacts also enhances Transportation's ownership role by capturing historical information that improves the project planning process.

5.2.3. Concept Planning

Strategic Planning	**Concept Planning**	Preliminary and Detailed Design	Tender and Contract Award	Construction
Plan – n/a Actual 1994-1999	**Plan 2001-2003 (1st Quarter)** **Actual 1999-2003 (4th Quarter)**	Plan 2004-2005 Actual 2004-2007	Plan 2005 Actual 2006-2007	Plan 2005-2006 Actual 2008-2011

Overall, there was a nine-month period between the planned and actual completion of concept planning for the 23rd Avenue project.

The Transportation Planning Branch has experienced resource issues over the last 13 years.[7] The risks associated with this issue have been documented in various risk analyses by both our office and the Transportation Department.

Table 8 sets out the timeline for the planned and actual concept planning phase and identifies when key events impacting the 23rd Avenue project took place (see table notes).

Table 8

Concept Planning	Prior Years	Year/Quarter							
		2002				2003			
		1	2	3	4	1	2	3	4
Planned Schedule	**December 2001**								
Actual Schedule									
▪ Feasibility Planning	**1999 – 2001 a**								
▪ Concept Planning		**b**					**c**		**d**

Note a: In 1999 Transportation Planning made enquiries about the cost of some properties when preparing a feasibility plan for the 23rd Avenue interchange.

Note b: As a result of staff turnover, in 2002 a junior staff member working to obtain his professional engineering designation was assigned as the City's project manager for the 23rd Avenue project. To compensate for the inexperience, the Department established a Senior Advisory Council to provide guidance and asked the project's consulting engineers to provide mentoring. An Advisory Council member advised us that they met a number of times and provided input to the project manager. Documentation was not maintained to demonstrate the amount of guidance or mentoring provided or its impact on effectively completing the concept plan.

In 2002, following a limited competition conducted by the Department, the consulting engineering firm hired for concept planning assigned an experienced engineer as a co-project manager. At the conclusion of a two day workshop that was conducted at the start of the concept planning phase ("Partnering: A New Way of Working Effectively – Together"), the co-project manager wrote, "…I sensed, during the wrap-up yesterday, that the participants… [both City and Consultants] …are somewhat apprehensive and daunted by the challenge that this study represents. I share this feeling, but am confident that we have the necessary (and best) resources to tackle the job."

[7] Outlined in: Transportation Planning Branch Audit (1995), Transportation Planning Branch Follow-up Audit (1998), Enterprise Risk Management Pilot Project (2003/2004), Business Objectives Review (2004), Major Projects Planning Risk Assessment (2005), Transportation Planning Branch Audit (2006)

Note c: The Department and the consultant presented a report recommending approval of the Concept Plan to Transportation and Public Works Committee on June 24, 2003. At that meeting, the Transportation and Public Works Committee approved a motion that non-statutory public hearings remain open until September 16, 2003, effectively delaying the 23rd Avenue project by three months.

When Council approved the concept plan on September 23, 2003, they passed a motion requesting information on how the 23rd Avenue project could be expedited. This resulted in accelerating the construction of the storm sewer tunnel from 34th Avenue to South Edmonton Common.

Note d: The Final Concept Planning report dated December 2003 indicates that the concept planning phase completion was delayed due to the extension for public hearings.

Reasons for project delays other than the extension for non-statutory public hearings were not in the project documentation.

5.2.4. Preliminary and Detailed Design

Strategic Planning	Concept Planning	**Preliminary and Detailed Design**	Tender and Contract Award	Construction
Plan – n/a Actual 1994-1999	Plan 2001-2003 Actual 1999-2003	**Plan 2004-2005** **Actual 2004-2007**	Plan 2005 Actual 2006-2007	Plan 2005-2006 Actual 2008-2011

Overall, there was a 24-month period between the planned and actual completion of the preliminary and detailed design phases for the 23rd Avenue project.

Responsibility for managing the 23rd Avenue project was passed from the Transportation Planning Branch to the Streets Engineering Branch for design work. At that time, the Streets Engineering Branch assigned an experienced Professional Engineer as the City's Project Manager. The Project Manager was not assigned full time[8] to the 23rd Avenue project and did not have dedicated staff reporting to him in a support role. In addition, the Department also contracted with a different engineering consulting firm to carry out the design work.

The contracted firm communicated concerns over the completeness and accuracy of the functional planning work (completed in the concept planning phase) on several occasions to the City's Project Manager, including the following:

- October 21, 2004 – "Upon detailed review of the concept planning information, it was determined that there were some significant deficiencies in the material, namely…"

[8] In 2005; 62% of the project manager's available time was planned for this project.

- January 26, 2006 – "As our review of the functional planning progressed, it became clear that several issues required significant efforts to create a functional plan that was suitable for proceeding to preliminary design."

The consulting engineering company that was hired for the preliminary and detailed design phases identified a nine to ten-week delay in the 23rd Avenue project because they needed to: 1) re-develop a functional plan (the 23rd Avenue project was larger and more complex than anticipated) and 2) redesign the interchange alignment.

Table 9 sets out the timeline for the planned and actual design phase and identifies when key events impacting the 23rd Avenue project took place.

Table 9

Preliminary and Detailed Design	Year/Quarter															
	2004				2005				2006				2007			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Planned Schedule																
▪ Preliminary Design																
▪ Detailed Design																
Actual Schedule																
▪ Preliminary Design	**a**															
▪ Detailed Design										**a**		**a**	**b**	**c**		
▪ Land negotiations and acquisition	**d**							**d**		**d**		**d**		**d**		

Note a: **Professional Services Contract** - In January 2004, Council approved a contract for professional engineering services for the design and construction of the interchange. In June 2006, an additional $6 million was approved for the professional engineering services contract, doubling the original contract from $6 million to $12 million.

Significant changes between the concept plan and the final design included realignment of the 23rd Avenue interchange eastward, replacing and relocating nine pipelines, more extensive use of retaining walls, addition of an auxiliary lane between 23rd and 34th Avenue, an extra lane on the north/southbound bridge structures, and the 19th Avenue connection being built as a flyover rather than an underpass.

Council approved an additional $2 million in October 2006 for engineering services for pipeline relocation, increasing the contract for engineering services to $14 million.

The 2001 *South Edmonton Pipeline Relocation Study* used to develop the Concept Plan did not identify pipeline upgrade or environmental concerns and recommended minimal actions for pipeline protection. This report did not reference the 1996 amendment to the Edmonton Research and Development Park area structure plan (Bylaw 11278), which identified environmental

contamination issues and pipeline companies' concerns related to the condition and protection of their pipelines.

Note b: **Alternate Interchange Designs** - Alternate interchange designs were not fully explored in the concept planning phase. Instead, alternative designs continued to be explored until the City went to the market to pre-qualify potential construction contractors:

- Diverging Diamond Interchange Concept Analysis – April/May 2006,
- Freehand sketch of new 19th Avenue exit ramp and overpass – May/June 2006,
- Evaluation of at-grade Options – September/October 2006, and
- Redesign of 19th Avenue Exit & Overpass – Late 2006/Early 2007.

Note c: **Justification for Extension of Services** - In May 2007, the City's Project Manager documented the reason for the increase in engineering fees. The following is a quote from the document:

> Justification for extension of services – As this project progressed; it became apparent that several issues needed more work than was identified in the concept planning study. They included: the pipeline conflicts, extensive retaining walls, extensive land issues, contaminated soil and varying soil conditions. Additionally, increasing project costs, political pressure to reduce those costs (and justify the project), extended design and construction schedule, added to the overall work required. Also items such as construction survey and materials testing were added to the overall scope of work. These factors and more lead to the increased fee requirements for the consultant to complete the project.

Note d: **Land Negotiation and Acquisition** - The Department initiated the process to acquire the land required for the interchange early in 2004, after Council approved the concept plan. In November 2005, it presented a status report to Transportation and Public Works Committee. In May 2006, Council authorized the Administration to take all steps required by the *Expropriations Act* to expropriate one of the properties. In June 2006, Transportation and Public Works Committee passed a motion to conclude negotiations and finalize a Memorandum of Agreement with South Edmonton Common. The final agreement was signed in February 2007.

Extensive effort was required to obtain the property required for the 19th Avenue flyover.

- Negotiations were complicated by the City's desire to eliminate the risk of claim against the City following completion of construction due to loss of land value (Municipal Government Act section 534).
- The City entered into negotiations with pipeline companies regarding relocating and upgrading of the pipelines located under South Edmonton

Common land. The City coordinated and contracted out relocation work and was responsible for all relocation costs, with the exception of a portion of the costs which were recovered through the terms of a franchise agreement.

The design of the 19th Avenue access to South Edmonton Common was a factor in land negotiations. In order to be prepared to proceed with the 23rd Avenue project when negotiations were complete, Transportation maintained two sets of plans – an overpass and an underpass. The City continued to consider the underpass design even though safety concerns were identified with the underpass design.

OCA Opinion

Based on our review, the application of the concept planning process was not effective in delivering quality outcomes, resulting in rework, delays, and higher costs.

For major and/or complex projects, the City should assign an experienced project manager for the duration of the project to minimize risks such as poor quality plans, project delays, and ineffective project management.

While we agree that the City avoided significant potential costs associated with claims under the MGA, we estimate that the costs of relocating pipelines and cost escalation due to delays actually exceed the costs the City would have borne if it had acquired the land earlier. Application of the City's Enterprise Risk Management (ERM) model[9] should have been adopted to systematically evaluate and quantify this corporate risk.

In our recent review of the Land and Buildings Branch, we stated that "Longer-term land requirements are not being identified consistently …" and concluded that "This can result in delays in capital projects, higher cost…" The Administration agreed with our recommendation to develop a long-term strategy for procuring land.

(Recommendations 3 & 8)

5.2.5. Tender and Contract Award

Strategic Planning	Concept Planning	Preliminary and Detailed Design	**Tender and Contract Award**	Construction
Plan – n/a Actual 1994-1999	Plan 2001-2003 Actual 1999-2003	Plan 2004-2005 Actual 2004-2007	**Plan 2005** **Actual 2006-2007**	Plan 2005-2006 Actual 2008-2011

The 23rd Avenue project schedule that was prepared during concept planning identified tendering taking place the last quarter of 2004 with construction starting early 2005. The planning and design phases took approximately two years longer than planned, resulting in this phase actually starting in the fourth quarter of 2006.

[9] The City's Enterprise Risk Management model is available under resource materials at www.edmonton.ca/auditor

Overall, tendering and contract award took six months longer than planned. Extending the construction phase accounts for the remaining 24 months required for project completion.

Table 10 sets out the timeline for the planned and actual tendering, contract award and construction phases, and identifies when key events impacting the 23rd Avenue project occurred.

Table 10

Tender and Contract Award	Prior Years	Year/Quarter								Future Years
		2006				2007				
		1	2	3	4	1	2	3	4	
Planned Schedule										
▪ Tender	**Q4, 2004**									
▪ Construction	**2005**									
Actual Schedule										
▪ Tender				**a**	**b**	**c**				
▪ Construction								**d**		**2008 – 2011 e**

Note a: Transportation advised us that prior to tendering for construction, they talked with contractors to generate interest in the 23rd Avenue project and reviewed market conditions to determine the most opportune time to go to market.

Note b: The City pre-qualified the four vendors who showed interest in bidding on the 23rd Avenue project. While the vendors were quite varied in size and experience with this type of project, the evaluations had them rated within five points of each other on a 100-point scale. Only two of the four vendors submitted bids.

Note c: The tender release was delayed by one month because the tender package, which includes detailed plans and specifications, was not ready. After the tender was released, nine addenda were processed. Some of the addenda related to lowering risk assignments to the successful contractor and increasing the time allowed for construction of the interchange from two to three years. Delays resulted in loss of a construction season.

Note d: The construction contract includes approximately $3 million for bonus payments for vendor performance. These items are not direct costs, but rather penalties/rewards based on vendor performance.

Due to a conflict in wording between the City's standard conditions and the special conditions prepared by the engineering consultant, the City agreed to pay additional costs for the contractor to perform the duties of the prime contractor related to health and safety issues. There was no evidence to

indicate the City reviewed the special conditions prior to including them in the tender document.

Note e: The Department originally had a separate project for a final pavement overlay to be applied to the Calgary Trail/Gateway Boulevard corridor from south of 23rd Avenue to 34th Avenue after construction of the interchange was complete. The completion date of 2011 includes applying the final pavement overlay.

Contract Procurement

Generally, tendering and awarding of contracts were handled in accordance with City procedures. The only noted exception was with three contracts where work started before contract documents were in place. The exceptions were for consulting agreements that were low risk to the City.

We met with representatives from the construction and consulting engineering industries to obtain insight into their relations with the City. During the meetings, they identified a number of potential improvements to current practices regarding risk sharing (e.g., weather delays, volatile market conditions), facilitating construction (e.g., traffic flow, noise bylaw exemptions), and using strategic or innovative tendering methods.

In 2007, the Administration undertook a review of alternative tendering types to address volatile market conditions. The results of the review address several of the items raised by the construction industry. Some of the industry suggestions that were not addressed in the review include:

- Discussion with the construction industry during the design process to improve constructability and determine the most appropriate contracting method. Alternatively, hire a construction contractor early in the design process to help improve constructability.
- The City accepting market volatility risk (e.g., cost of concrete, fuel cost) rather than assigning full risk to contractors.
- Reconsider the City's position of maintaining traffic flow at the expense of lost productivity.
- Consider including some flexibility in meeting deadlines for things such as weather delays.

OCA Opinion

In our opinion, application of the pre-qualification process was not fully effective.

Based on our review the tender/contract documents should be reviewed and modified in the areas of risk sharing framework, reward/penalty clauses, supplementary conditions, and clauses that enable consistent delivery of high quality outputs.

We estimate that the one-year delay in the start of construction from 2007 to 2008 increased the 23rd Avenue project costs by approximately $20 million.

(Recommendation 9)

5.3. Did the City exercise due diligence as project owner in managing the project?

5.3.1. City Expectations

One of the key purposes of Administrative Directive A1424A, *Project Management for Projects (1999)* is to:

> Establish clear lines of accountability/responsibility for project management decisions and the achievement of project objectives and deliverables. Clear lines of accountability/responsibility are required to facilitate optimal decision making, minimize misunderstandings and delays, and understand the cause of problems as they may arise.

Establishing a standard of care (due diligence) by a project owner ensures balance between the competing demands for quality, scope, time and cost through effective project management and demonstrated project ownership.

5.3.2. Project Management Manuals

Administrative Directive A1424A requires that departments develop a project management framework and procedures to set out basic expectations/standards and that a project management manual be developed for each project at the same time that the project plan is developed. This manual is intended to thoroughly describe the project management functions and include procedures for documentation, filing, and circulation of project forms, progress reporting, performance management tracking, and cost and schedule controls.

The Transportation department last updated its project management manual in 2006. This manual sets out the basic expectations for managing projects, including cost estimating accuracy, but not cost estimating tools, methodologies and cost estimating verification processes. We noted that the updated manual does not require that risk

management activities be completed until the construction phase and does not define the level of effort that should be expended on planning and design activities. A project management manual for the 23rd Avenue/Gateway Boulevard project was not developed by the Project Manager as required by the Directive.

The following best practices employed by other organizational units within the Corporation result in enhanced project management capabilities.

- The Drainage Design and Construction Section's systems and procedures are developed to the ISO 9001 Quality Management System standard. This Section has been regularly audited over the past 11 years by independent, outside organizations to ensure that its quality management practices comply with the ISO 9001 quality standards. This manual extensively documents the role of the Project Manager.
- The project control management manual developed for the South LRT project clearly articulates the responsibilities of the City's LRT Project Office and the Managing Consultant. Under the oversight of the LRT Project Office the managing consultant coordinates the design and construction activities, acts as the owner's representative by providing the required project management services, and provides regular and extensive project reporting to the City.

OCA Opinion

Transportation should review the project management frameworks used by the Drainage Branch and South LRT Office to gain an understanding of the ways in which other organizational units within the City are applying project management best practices. This insight would provide the necessary knowledge to move Transportation's project management processes and procedures toward best practices.

Based on our review, the Transportation Department needs to review and update its project management manual to ensure that it includes sufficient detail regarding project management knowledge areas and that it provides sufficient guidance for the effective and efficient delivery of projects.

As required by the Administrative Directive, detailed project management manuals need to be developed for each large/complex project to ensure that the assigned team clearly understands the requirements associated with successful project outcomes.

In our opinion, effective project management would have ensured that required processes were developed and applied.

(Recommendation 1)

5.3.3. Project Resourcing / Level of Effort

Administrative Directive A1424A requires that a project manager be appointed and that a project team commensurate with the size and complexity of the project be established. Project management processes are to be based on project management principles to ensure control over the core functions of scope, quality, time and cost throughout the project life cycle. The procedures note that a performance management tracking system should be established to monitor and report cost, time and quality objectives in relation to expectations.

Effective project management as described by the Project Management Institute requires that project managers demonstrate skills and expertise to address the following specific knowledge areas: scope management, quality management, time management, cost management, information/communication management, contract/procurement management, human resource management, risk management, and project management integration.

In the concept planning phase, the individual assigned to manage the 23rd Avenue project was relatively new to the engineering field. In addition to his role as project manager, he was assigned the duties of maintaining traffic information relative to the 23rd Avenue project. A support structure was put in place to mentor the individual (Senior Advisory Review Council), however, documentation demonstrating its effectiveness was not maintained and the individual has left the employ of the City. As noted previously, the Transportation Planning Branch has experienced resource issues over the last 13 years. This may have impacted the quality of the project management, which in turn may have contributed to the problems observed with the concept plan.

The Association for the Advancement of Cost Engineering recommends that 10% to 40% of total project engineering costs be committed to concept planning.[10] This level of effort is typically associated with budget, authorization and project control. Based on simplified calculations, we estimate that effort applied to the concept planning phase for the 23rd Avenue project was approximately 4%. The level of effort put into project planning is ultimately reflected in the degree of completeness of the project design. (e.g., the 23rd Avenue project concept plan identified the need for 5,400 sq. meters of retaining wall. This was revised to 19,700 sq. meters in the preliminary design.)

Streets Engineering Branch had the responsibility for managing the 23rd Avenue project during the design phase (preliminary design followed by detailed design). The individual designated as the project manager during the design phases had more than 10 years of experience in the engineering field. Time records show that this individual also worked on other projects while managing the 23rd Avenue project. We were able to determine

[10] Association for the Advancement of Cost Engineering (AACE) International Recommended Practice No. 17R-97 Cost Estimate Classification System – TCM Framework: 7.3 – Cost Estimating and Budgeting (2003).

that some support was assigned to the 23rd Avenue project; however, documentation tracking the level of support was not maintained.

We met with representatives from the construction and consulting engineering industries to obtain insight into project manager skills and experience requirements and to understand their relations with the City. They identified the skills and expertise of an effective project manager as including (but not limited to): knowledge in the discipline of project management, design and construction expertise, operations knowledge, contract management, and working as a part of a team. Some industry representatives also indicated that they believe that the City needs to have closer relationships with the engineering consultants to ensure effective project management integration. We also noted that in the City's Dialogue sessions in previous years the Consulting Engineers of Alberta identified the following desires:

- Putting City staff into planning teams to manage project scope.
- More active partnering; not in attending meetings but in active practice.
- Ensuring continuity on design teams throughout the project planning process.

The following practices employed by other organizational units within the City result in enhanced project management capabilities:

- The South LRT project team consists of a comprehensive team of dedicated City staff, a Managing Consultant, Unit Prime/Specialists Sub-consultants, and the Construction Contractors, sub-contractors and suppliers.
- In the Drainage Branch, every project has an assigned Project Manager with acquired knowledge in the discipline of Project Management. The typical team (in accordance with ISO Procedures) under the Project Manager includes a resident engineer, draftsperson, inspector, constructor, designer, estimator, surveyor and a scheduler.
- Program Managers in the Project Management and Construction Branch (buildings infrastructure) are aligned with business specialties including recreational facilities, community services, Fire/EMS, Transportation, and Civic Buildings. Each Program Manager has assigned support staff.

In 2001, the City developed a training program entitled "A Corporate Overview on the City of Edmonton's Approach to Project Management." This short introductory project management course was conducted only once for a target audience.

OCA Opinion

In our opinion, experienced, dedicated resources (either in-house or contract), need to be assigned as the City's representative (owner's agent) for the duration of a large/complex project as it evolves from concept planning to preliminary design to detailed design and construction.

We also believe that the City Manager should develop and implement a more comprehensive training program for project managers to learn how to effectively apply the nine knowledge areas of the project management discipline.

(Recommendations 1 & 8)

5.3.4. Communications

The City must ensure that all major stakeholders are kept informed throughout each project. Effective communication is key to successful project management integration and to maintaining open and trusting relationships. Effective communication requires that:

- Issues be identified and discussed early in the process and successfully resolved in a timely manner.
- Community acceptance be obtained and a plan be developed to get input at the right times.
- Comprehensive communications be maintained to increase buy-in for all stakeholders.

In the interviews we conducted during our Governance Review in 2007, Councillors expressed frustration that they did not receive all relevant information from the Administration. One aspect of the information provided to Councillors should be a history of the topic and how it has been, or is, contributing to Council's understanding and decision-making. Complete disclosure of the "life cycle" of an issue provides important context for considering progress and allows Council and/or its Committees to determine when they have received sufficient information to reach a decision on a topic. Similar concerns were identified by some Councillors at the start of our review of this project.

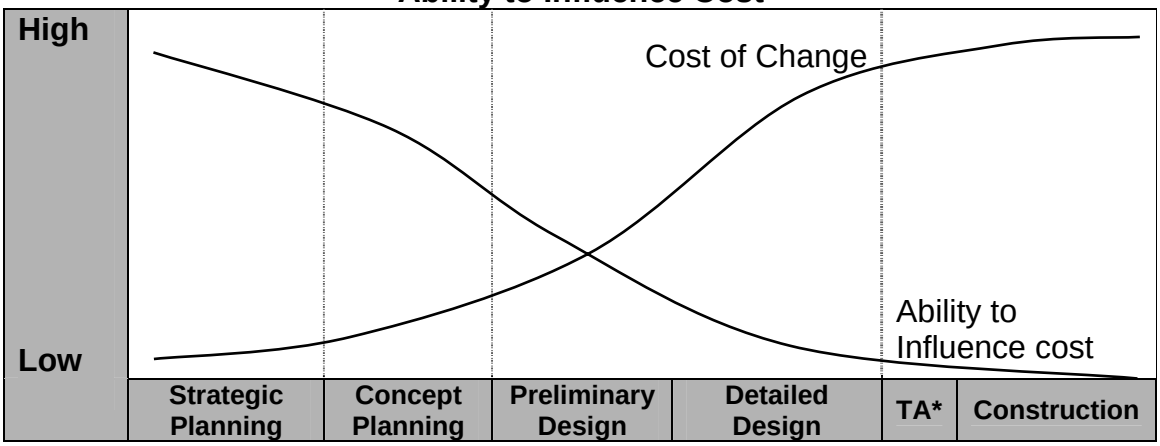
A two-day facilitated partnering session was held at the beginning of concept planning that involved several stakeholders. Key outputs included a Partnering Charter, early action items, identification of project goals, and means of measuring accountability. A similar session also took place upon the initiation of the design phase, which involved a different group of stakeholders.

The design consulting engineering firm identified concerns with communication with the City relating to the concept plan, scope of work, duration of the project and the approval

process. In October 2006, the firm indicated that the health of the partnership remained very good, but had been tested by the uncertainty of the future of the 23rd Avenue project and the number of issues that were not being resolved in a timely manner.

Diagram 1 illustrates the importance of comprehensive communication in the planning phases. As a project progresses through the various project management phases, the ability to influence cost diminishes significantly, and the cost of a design change increases costs significantly. Exploring new information beyond the preliminary design phase is increasingly expensive and less cost effective.

Diagram 1
Ability to Influence Cost



*TA – Tender and Award

The OCA reviewed 23 reports prepared for the Transportation and Public Works Committee/Council that were related to traffic, design and funding. Nine of the reports were prepared following completion of the preliminary design phase. The 23rd Avenue project records did not make reference to these reports or their impact on the 23rd Avenue overall project schedule or cost.

A case study of the 23rd Avenue project included in our 2006 Transportation Planning Branch audit report provided the following learning:

> In response to increased public awareness regarding increases in congestion, the governing bodies requested more information about the development and its impacts on transportation. Several detailed reports were prepared and presented to Transportation and Public Works Committee and Council in response to these requests. The effect was a shift from a strategic focus for the governing bodies to a detailed project focus.

During our interviews with members of Council in 2007 as part of the Governance Review, some Councillors advised us that there are times when Council moves from a governing role to one where they micro-manage the Administration. Sometimes this switch in roles may be seen as inappropriately directing Administration staff. Councillors

also indicated that an open and transparent political process takes time and sometimes inefficiencies must be endured.

At the end of preliminary design, Council received a report outlining design alternatives that were not fully explored or documented in the Concept Plan. Alternate interchange designs then continued to be examined further during the detailed design phase. As mentioned previously, by this point in the process, there is very little opportunity to influence project costs or outcomes. Effort expended in pursuing alternative designs at this stage is essentially rework.

OCA Opinion

In our opinion, project communication was not effective resulting in attention being diverted from project work and creating some degree of uncertainty among team members due to reports continually being presented to the Transportation and Public Works Committee/Council. Effective project scheduling should consider the political environment and include the necessary time for informed decision-making.

By providing Council with information that is or can be perceived as incomplete or inaccurate, the Administration is leading Council to question previous decisions.

Comprehensive communication needs to take place early in the project to minimize the risk of Council "micro-managing" and to ensure that no time is wasted revisiting design decisions.

Quantitative methods, similar to the one utilized by the South LRT project team, should be used to periodically assess the health of project partnerships.

(Recommendations 2 & 6)

5.3.5. Approval and Reporting for Major Projects

Approval of capital projects is the responsibility of Council while the City Manager is responsible for recommending and managing capital projects. Administrative Directive A1424A, *Project Management for Projects* provides a corporate-wide, professionally accepted framework for managing City projects but does not set out the requirements for approval and transparent reporting for capital projects or how the project management process aligns with the budget process.

For the 23rd Avenue project a number of reports were prepared for the Transportation and Public Works Committee/Council in addition to those required for approval of the concept plan and budget. We also found a number of documents on file that were prepared or reviewed by the 23rd Avenue project team in response to requests received from various stakeholders. Further, management advised us they responded to requests received from individual Members of Council, creating uncertainty around the project as a whole.

Major projects such as the 23rd Avenue project have a significant draw on funding availability. A clearly defined process for project approval and monitoring is required to mitigate risks such as over-commitment of budget and tension among stakeholders due to misunderstanding or lack of information. In addition, any change in scope, scheduling and cost can significantly impact the City's ability to effectively prioritize and fund competing capital projects.

OCA Opinion

In our opinion, clear corporate guidance on approval and performance reporting for major projects is required to improve the effectiveness of project management including planning, approval, monitoring, evaluation and accountability. Corporate guidance for performance reporting should be based on guidance set out in the Project Management Institute body of knowledge and recognize the different information needs of all stakeholders including Council, Senior Management and Project Managers.

(Recommendation 1, 6 & 7)

5.3.6. Process Ownership

The City must retain full accountability throughout the life of a project by:

- Ensuring that the City's interests are protected;
- Providing strong technical leadership over capital project development during planning, design and construction;
- Ensuring compliance with corporate policy, directives, procedures, manuals, practices, and professional engineering standards; and
- Ensuring that project costs are disclosed and managed appropriately.

Achieving this level of accountability requires that all projects be resourced at an appropriate level (in-house or purchased externally). Large and/or complex projects require a full time project manager (owner's agent) and support staff with sufficient expertise, authority, and accountability to deliver products in accordance with best practice associated with infrastructure planning and design processes, including:

- **Road safety audit** – a process to ensure that operational road safety experience is applied during the design and construction process to minimize the number and severity of accidents.
- **Risk management** – a process employed to understand, manage and communicate risk that can lead to cost, schedule and performance issues.
- **Value engineering** – a problem-solving tool that can reduce costs while maintaining or improving performance and quality requirements. It is a function-oriented,

systematic team approach to providing value in a product or service by decreasing costs, increasing profits and improving quality.

- **Constructability review** – the optimum use of construction knowledge and experience in planning, design, procurement, and field operations to more efficiently and effectively achieving overall project objectives.
- **Traffic impact assessment** – an analysis that indicates the effect of the proposed development on the existing and proposed roadway network in terms of additional traffic and suggests roadway improvements necessary to accommodate the development.
- **Cost estimating** – the process of assembling and predicting the costs of a project. It encompasses the economic evaluation, project investment cost and predicting and forecasting of future trends and costs.
- **Records management** – a field of management responsible for the efficient and systematic control of the creation, receipt, maintenance, use and disposition of records.

Our review of these processes in this project indicated that they were organized and managed by the consultants, not by the Transportation department. In most cases, there was no documentation that processes were conducted in accordance with best practice methodologies. In addition, there was no documentation demonstrating that the final results (including required follow-up) were acted upon. Final process results and outcomes were not formally signed-off by the City as the project owner. For example, in 2006 a third road safety audit report was issued by a traffic and safety management consultant that was hired by the design consultant contracted by the City for the 23rd Avenue project. The report identified 11 issues that were outstanding/unresolved from prior reports and 33 new safety issues with suggested solutions. There was no response provided by the City as required by best practice.

Application of these best practices requires that the owner demonstrate ownership of these processes and the results through its project manager. In this project, the City delegated this scope of work to consultants, with no formal accountability for achieving the intended results. Effective implementation of these best practices requires detailed understanding of each process, incorporating the processes into the protocols for managing projects, and ensuring the intended outcomes are tracked and achieved.

OCA Opinion

Based on our review the City did not demonstrate that it fully owned the processes undertaken during the planning and design phases for the 23rd Avenue project or that best practices were followed.

In our opinion, as a responsible owner, the City needs to manage all processes and follow best practice to ensure expected outcomes are acted upon, thereby ensuring the delivery of a more cost-effective capital project.

(Recommendations 1, 3, 5 & 8)

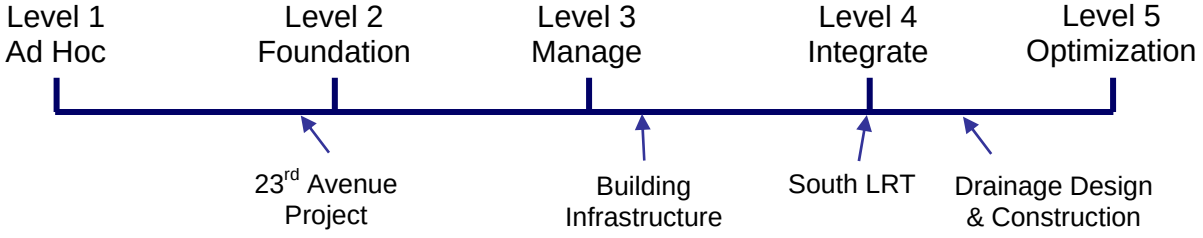
5.3.7. Project Management Maturity Assessment

We assessed the project management practices for the 23rd Avenue project using the maturity model developed by the Project Management Institute. The model represents best practices for any major project. Table 11 provides the characteristic for each maturity level and our assessment of the 23rd Avenue project as well as our assessment of other organizational units in the City.

Table 11
Project Management Maturity Model
(Project Management Institute)

Level 1	Level 2	Level 3	Level 4	Level 5
No formal, consistent process Key Characteristics ▪ Many incomplete, informal approaches ▪ Highly dependent on Project Manager ▪ Project outcomes unpredictable ▪ Little organizational support for project management ▪ Lessons learned are not gathered and passed on to other projects	Consistent, basic approach Key Characteristics ▪ Managed support for project management ▪ Repeatable processes are applied to basic project management steps ▪ Project outcomes are more predictable ▪ Use of common tools and techniques for key project management processes	Consistent, comprehensive approach Key Characteristics ▪ Senior management support for project management ▪ Organization can efficiently plan, manage, integrate and control single projects ▪ Repository of previous project experience is maintained and utilized ▪ Team members and project managers are trained in project management ▪ Consistent use of tools and techniques for project management processes	Project portfolio management is institutionalized and integrated into the organization's business planning process Key Characteristics ▪ Active senior management support for integration of business planning and project execution ▪ Organization can efficiently plan, manage, integrate and control multiple projects ▪ Database of previous project data is maintained and utilized	Project-centered organization with an established approach to continuous improvement of project management practices Key Characteristics ▪ Project management environment improvement is actively encouraged ▪ Flexible, project-centred organizational structure ▪ Career program for project managers ▪ Project management training is a key component in staff development

OCA's Assessment of Project Management Practices:



OCA Opinion

Transportation management advised us that the project management practice used for the 23rd Avenue project is the same as those used for other interchange projects they consider to be successful. Best practice research and some project management practices within the City demonstrate the potential for significant benefits by moving towards a project-centered/project portfolio management environment. These opportunities would significantly enhance the City of Edmonton's ability to deliver large/complex projects with predictability, consistency, and success.

A first step in this regard is implementing an enhanced corporate project management framework within the context of the newly created Capital Construction Department and the ongoing organizational changes that are being contemplated by Management.

(Recommendations 1, 5 & 8)

6. Recommendations

We believe that the following recommendations and management action plans address the issues identified in section 5 of this report. Implementing these recommendations will enhance the City's ownership and project management abilities, thereby improving cost estimating and scheduling practices and ensuring that large and complex projects are managed effectively, efficiently and economically.

Recommendation 1 *(Sections 5.3.2, 5.3.3, 5.3.5, 5.3.6 & 5.3.7)*

The OCA recommends that the City Manager explore alternate project management delivery strategies to improve the effectiveness of project delivery. This includes:

a. Establishing a project management office,

b. Developing best practice project management and cost estimating manuals,

c. Training in the discipline of project management,

d. Defining project appropriate level of planning and engineering standards, and

e. Appropriate monitoring and sign-off.

Management Response and Action Plan

a. **Accepted with Modification**: – The possibility of a project management office that would manage a major project from concept through construction has been considered. However, in a municipal government structure the expertise and recourses are limited and Administration does not intend to develop an office of that nature. In the fall of 2007, the City Manager established a new Administration Committee, consisting of the City Manager, General Manager of Transportation, General Manager of Asset Management and Public Works, one other General Manager as the case may determine, and the Branch Manager of Finance to

review major and significant capital projects and costs implications. This committee has met on several occasions to give guidance and direction on these projects. Further, in February 2008, the City Manager announced a corporate restructuring, which included the establishment a Capital Construction Department. This department is now the centre of all project management and is in essence a project management office. The General Manager has responsibility for managing all capital projects. The internal Committee has been amended based on the new corporate structure and now includes the Chief Financial Officer and Treasurer. Capital Construction Department staff will be involved in the development of projects from concept through to construction, but may not necessarily be the lead during the concept phases.

Implementation Date: Implemented
Responsible Party: General Manager, Capital Construction Department

b. **Accepted**: – Administration will continue to identify the best project management methods to match the unique needs for each capital project.
Project Management Manual, updated in 2006 & other items, will be reviewed.
Administration will develop cost estimating manuals.

Implementation Date: End of 2009
Responsible Party: General Manager, Capital Construction Department

c. **Accepted**: – Administration will ensure that appropriate project management training is provided to persons who are responsible for the planning & execution of capital projects. The City has established project managing training in 2001, with a new curriculum being developed in 2008, launched in August 2008. This is a 33 day course.

Implementation Date: Implemented
Responsible Party: General Managers, Capital Construction Department, Transportation Department and Corporate Services

d. **Accepted**: – Administration will provide the proper level of resources in quantity & quality to match the level of effort necessary to plan & execute each capital project.

Implementation Date: Implemented
Responsible Party: General Managers, Capital Construction Department & Transportation Department

e. **Accepted**: – Administration will develop a process to define the formal handover point between Departments when accountability for actual construction begins. This point varies depending on the construction delivery method chosen for each capital project. This hand-off is made easier by the use of the PACMAN software, implemented in October 2007.

Implementation Date: End of 2009
Responsible Party: General Managers, Capital Construction Department & Transportation Department, and other General Managers as the circumstances require.

Recommendation 2 *(Sections 5.1.1, 5.1.2, 5.1.4 & 5.3.4)*

The OCA recommends that the City Manager ensure that upon initiation of concept planning, the assigned project manager develop a comprehensive communication plan for all stages of the project to ensure that:

a. All participants are informed in a timely manner on matters that affect their contribution to project success, and

b. If partnerships are used, formal quantitative tools are implemented to evaluate the "health of a partnership" on a regular basis throughout each project.

Management Response and Action Plan

a. **Accepted**: – Administration will ensure that significant impacts are communicated to the appropriate participants who contributed to the impact or could be affected by it. It is important to provide sufficient advance notice to enable those participants to make changes or confirm their decisions.

Implementation Date: Implemented
Responsible Party: General Managers, Capital Construction Department & Transportation Department

b. Administration has used qualitative tools and process in the past, however, will develop a quantitative tools & process to evaluate the "health of the partnership" among the participants in the planning & execution of capital projects.

Implementation Date: End of 2009
Responsible Party: General Managers, Capital Construction Department & Transportation Department

Recommendation 3 *(Sections 5.2.3/5.2.4 & 5.3.6)*

The OCA recommends that the City Manager ensure that project managers as "project owners":

a. Formally manage key processes, such as road safety audits, risk assessments, etc. to ensure that intended outcomes are complete and accurate, and

b. Utilize the City's enterprise risk management process to assess risks not normally associated with the type of project being managed.

Management Response and Action Plan

a. **Accepted**: – Administration has developed process for a formal accounting & sign-off of each critical audit, program, activity, etc to ensure the intended outcomes are achieved prior to handover to the next person who assumes responsibility for the capital project. It is not possible to retain the same team for the entire duration of long-term projects.

   Implementation Date: Completed
   Responsible Party: General Managers, Capital Construction Department & Transportation Department

b. **Accepted**: – Administration will use an internal resource or consultant that is separate from any other aspect of a project to conduct risk management assessments in compliance with the City's enterprise risk management process.

   Implementation Date: Implemented
   Responsible Party: General Managers, Capital Construction Department & Transportation Department

Recommendation 4 *(Section 5.1.1 & 5.1.4)*

The OCA recommends that the City Manager ensure that benefit-cost ratios for planned projects are recalculated when there are significant changes to expected costs and/or benefits prior to awarding construction contracts.

Management Response and Action Plan

Accepted: – On major projects, Administration will provide participants with updates to the benefit-cost ratios for capital projects when significant changes occur until a contract for construction has been awarded.

The final report from Administration did not recommend proceeding with the 23 Avenue Interchange based on the increased costs.

Implementation Date: Implemented
Responsible Party: General Managers, Capital Construction Department & Transportation Department

Recommendation 5 *(Sections 5.1.3, 5.1.4, 5.3.6 & 5.3.7)*

The OCA recommends that the City Manager ensure that costing models and quality assurance processes for major and/or complex projects are enhanced by:

a. Working with the Chief Economist and Materials Management to develop appropriate escalation factors,

b. Reengineering cost estimating tools and methodologies to facilitate effective trend analysis, project cost forecasting and cost estimate validation,

c. Acquiring cost estimating expertise to ensure cost estimates are as accurate and complete as possible for each phase of a project,

d. Incorporating appropriate contingency amounts for both construction and identified risk elements, and

e. Developing appropriate quality standards and utilizing sign-offs at the end of each project phase (go/no-go decision points) to reduce the likelihood of rework.

Management Response and Action Plan

a. **Accepted**: – Materials Management will develop the following information related to cost escalation factors:

- Materials Management construction tendering report. This report will be released annually commencing in August 2008 and will provide an annual review of tendering activity for the previous year. The report will capture tendering data analytics and trending information related to number of bids received on construction tenders, comparisons of pre-tender cost estimates to awarded contract values and additional tendering and local construction market activity information.
- Periodic industry sounding surveys to solicit cost escalation estimates used by major contractors in preparing bids for City and other tenders.
- Periodic cost escalation factor benchmarking surveys for other major Alberta public sector owners including Alberta Transportation, Alberta Infrastructure, University of Alberta, Alberta Health Services, City of Calgary, etc.

This information will be provided to the Chief Economist and all relevant Departments to assist in projecting cost escalation factors for use in capital budget development and project planning.

Implementation Date: In Progress
Responsible Party: Corporate Services, Materials Management

Management Response and Action Plan

b. **Accepted**: – In October 2007, Administration implemented new software (PACMAN) to for project management. This tool has provided improvements in cost estimating tools & methodologies. Administration will continue to work on a continuous improvement model and will continue to review and adapt this tool and other processes, as necessary.

   Implementation Date: Implemented
   Responsible Party: General Managers, Capital Construction Department & Transportation Department

c. **Accepted**: – In conjunction with the action described in the previous paragraph, Administration continues to identify the staffing requirements in the appropriate budgets to match expertise with the improvements in cost estimating tools & methodologies.

   Implementation Date: Implemented
   Responsible Party: General Managers, Capital Construction Department & Transportation Department

d. **Accepted**: – Administration has incorporated appropriate contingency for risks associated with construction & unusual elements in major capital projects by using a model developed by the University of Alberta that has been successful on several City projects.

   Implementation Date: Implemented
   Responsible Party: General Managers, Capital Construction Department & Transportation Department

e. **Accepted**: – Administration is developing a process to ensure that there is a record of sign-off for compliance at the end of critical points in projects.

   Implementation Date: December 2009
   Responsible Party: General Manager, Capital Construction Department

Recommendation 6 *(Sections 5.1.1, 5.1.2, 5.1.4, 5.3.4 & 5.3.5)*

The OCA recommends that the Chief Financial Officer ensure that the capital priorities planning/budgeting process is adjusted to incorporate the following principles:

a. Budgets should reflect current total project cost estimates in forecast year-of-expenditure dollars and include expected cost recoveries, and

b. Significant changes to project estimates that occur after budget preparation should be communicated to Council prior to specific budget deliberations and approval.

Management Response and Action Plan

a. **Accepted**: – Several changes to the capital budget process have been or are in the process of being implemented to address accurately reflecting project budgets.

- A review of the capital budget process was completed in 2006 and resulted in development of a transition plan to implement multi-year capital budgeting that coincides with the Council term. Phase-in of multi-year capital budgeting started with a two year capital budget for 2007 and 2008 and work is currently underway on development of a three year capital budget for 2009-11. One benefit of multi-year capital budgeting is that it provides a better timeframe to plan and execute projects.
- The capital budget guidelines provided to departments for 2009-11 include a section that directs departments to apply cost escalations to their projects using cost escalation forecasts provided by the City's Economic Trends Research unit for each of the three years. Capital budget instructions for future years will include specific direction that budgets should reflect current total project cost estimates in forecast year-of-expenditure dollars and include expected cost recoveries.
- A Preliminary 10-Year Capital Investment Agenda for 2008-2017 was presented to Council in July 2008. Cost escalations for 2008-2017 provided by the City's Economic Trends Research unit were applied to the majority of projects included in the Preliminary 10-Year Capital Investment Agenda. The 10-Year Capital Investment Agenda provides a longer term planning horizon that facilitates better planning and integration of project sequencing, staging and execution. The 10-Year Capital Investment Agenda budgets will be updated on a periodic basis to reflect current costing information and forecasts and will be used to guide development of the three capital budgets.

b. **Accepted**: – A review is underway to establish a reporting mechanism in 2009 of significant changes to project estimates that occur after budget approval by Council.

Implementation Date: In Progress
Responsible Party: Finance and Treasury Department**:**

Recommendation 7 *(Section 5.3.5)*

The OCA recommends that the City Manager ensure that a corporate process is documented and formalized:

a. That sets out the responsibilities of all stakeholders for approval of capital projects and any subsequent changes, and

b. That sets out performance reporting requirements that address the needs of all stakeholders and assists Council in maintaining a strategic focus on project outcomes.

Management Response and Action Plan

Accepted: – By early in 2009, City Manager, working with the City Auditor and Administration, will review the City Administration Bylaw, City Policies and Administrative Directives and bring any necessary amendments or recommendations for new policies to Council to clarify the roles and responsibilities of all stakeholders in the capital project approval process and to determine an acceptable performance reporting mechanism.

Implementation Date: March 2009
Responsible Party: City Manager

Recommendation 8 *(Sections 5.2.3/5.2.4, 5.3.3, 5.3.6 & 5.3.7)*

The OCA recommends that the City Manager ensures continuity of project teams assigned to large/complex projects to minimize the risk of knowledge loss. The team comprised of:

a. An experienced project manager/owner's representative with sufficient responsibility and authority to effectively and efficiently manage the project, and

b. The appropriate number of support staff to satisfy the knowledge area requirements defined by the Project Management Institute.

Management Response and Action Plan

Accepted: – It is not possible to retain the same persons on long-term capital projects given the flow of responsibility across Departments during each stage, the shift in expertise needed in planning stages versus construction management & the natural migration of employees for various reasons. Having an overlap strategy & a formal handover point including sign-off will ensure that continuity is maintained.

Implementation Date: End of 2009
Responsible Party: City Manager

Recommendation 9 *(Section 5.2.5)*

The OCA recommends that the General Manager of Corporate Services, in consultation with the Transportation Department, review the tendering/contract processes and documents used for large/complex projects to ensure that risks are apportioned appropriately and that best industry practices are incorporated.

Management Response and Action Plan

Accepted: – a) Significant changes have been made to the City's standard construction tendering/contract documents to adjust risk allocations (such as material cost escalation, geo tests, utilities, fuel) between the City and construction contractors in the current market environment. These changes will be introduced within the City's 2008 update to its standard documents to be released in August 2008. Ongoing reviews of the City's standard construction tendering/contract documents will continue to take place at least annually.

b) Industry dialogue sessions are held regularly with industry associations including the Edmonton Construction Association (ECA), Alberta Roadbuilders and Heavy Construction Association (ARHCA), Consulting Engineers of Alberta (CEA) and Alberta Architects Association (AAA). These sessions will continue to be held at least semi-annually on general topics to solicit feedback on City practices and to seek suggestions for improvement related to the City's project delivery methods and tendering/contract management processes. This information will be considered in order to increase marketplace interest and competition on City work and to seek best value outcomes in the City's Capital works programs.

c) In conjunction with the Transportation or Capital Construction Departments, continue to engage in direct discussions with major City contractors on topics related to both general City practices as well as to seek specific input on project delivery strategies for proposed large/complex projects that are expected to be tendered in the future. These discussions have been ongoing for the last 8 years and are in order to strengthen relationships with the City's key contractors.

d) Meet periodically with other major public sector owners to compare standard construction tendering processes and documents in order to share the City's leading practices and to increase awareness of industry best practices being used by peer organizations for possible implementation at the City.

Implementation Date: In Progress
Responsible Party: Corporate Services, Materials Management/Law

The OCA thanks the management and staff of the Transportation Department as well as staff in other departments that assisted us with this project for their cooperation and support. We would also like to thank the consulting and construction professionals who met with us for taking time to provide their perspective on City processes and best practice methodologies.

The 23rd Avenue & Gateway Boulevard Interchange Project Review team consisted of:

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