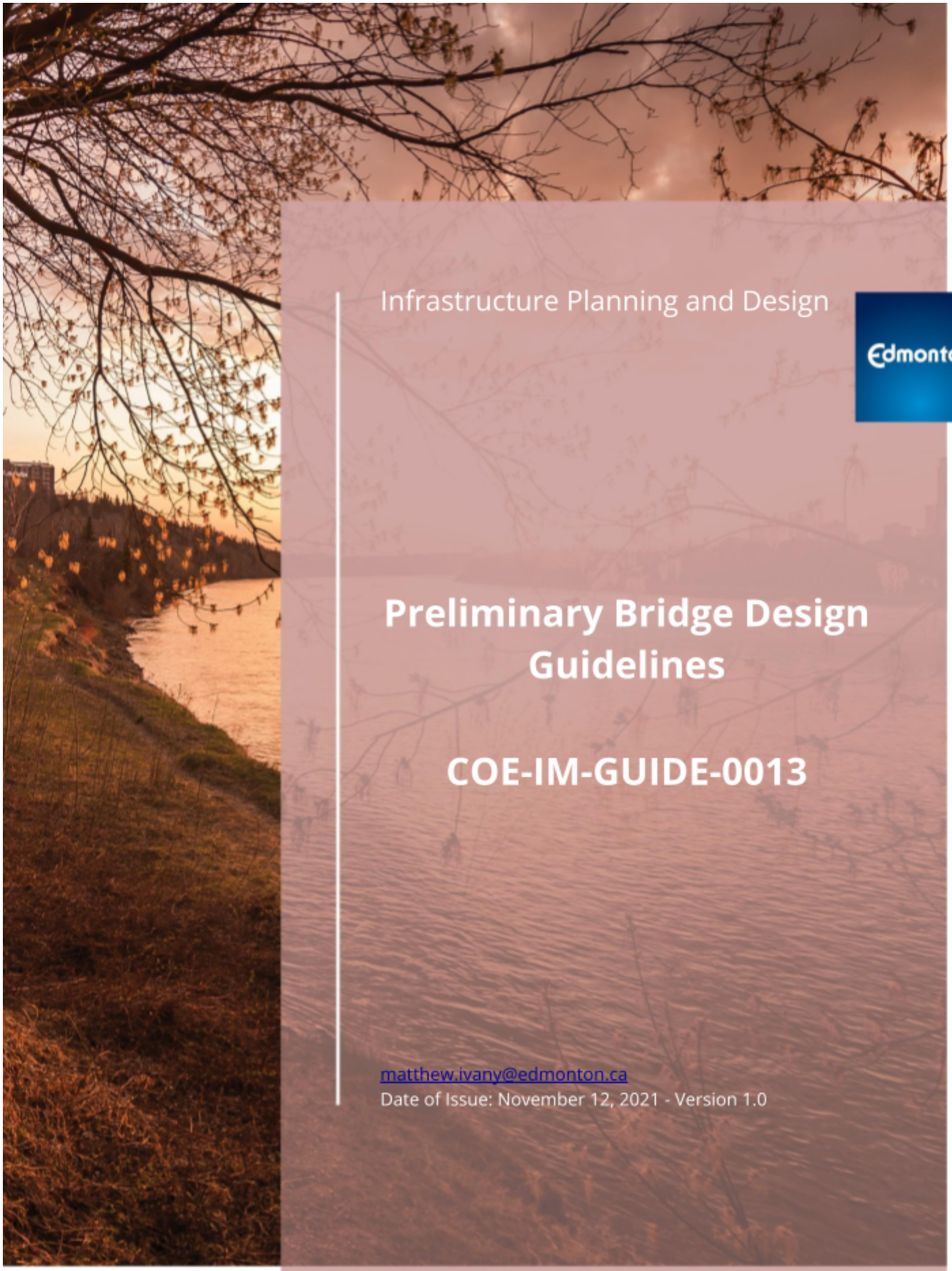

Infrastructure Planning and Design

Edmonton

Preliminary Bridge Design Guidelines

COE-IM-GUIDE-0013

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Disclaimer

This volume was developed for establishing guidelines for the City of Edmonton's expectations in the design and construction of structural preliminary design drawings. Care has been taken to confirm the accuracy of the information contained herein. The views expressed herein do not necessarily represent those of any individual contributor. Structural and related asset design continually evolves, and practices change and improve over time, so it is necessary to regularly consult relevant technical standards, codes, and other publications rather than relying on this publication exclusively. The City of Edmonton, authors, and members of the review committee, want to convey that this document does not constitute a project-specific design. As such, no part of this guideline alleviates the responsibility of the professionals retained to design and construct specific projects from taking full responsibility and authenticating their designs as required in accordance with APEGA, AAA, Alberta Building Code, and any other statutory or safety requirements.

Any Standard Drawings, Details, or specifications are provided to convey the City's typically ideal general arrangement and requirements. Representations may not be to scale, they may be substantially schematic in nature and/or require further elaboration and development. As such those documents are not suitable for integration into a specific implementation without review and modification and are only intended for use by a competent designer exercising professional judgment. The designer shall modify and supplement as necessary to provide a complete, properly functioning design that conforms in all respects to the City's functional requirements. When actualized in a particular implementation it is the designer's responsibility to ensure the size, location, and spacing of all elements, and all components/specifications, are suitable and safe for the use and location intended, and any applicable code, legislative, and authority requirements are adhered to. In addition, any accessibility, operational and maintenance requirements must be met. Deviations from the represented nominal design parameters, questions of intent or accuracy, or any other apparent conflicts, shall be reconciled with an appropriate City representative. Finally, when employing any aspect of these documents, the ultimately responsible professional designer shall remove any authentication of the original author(s), note any provenance as appropriate, and apply their own authentication as required.

VER	Date	Revision Summary
01	2021-11-12	Original Issue

Printed or downloaded copies of this document are not controlled and may not be the current version.

ACKNOWLEDGEMENTS

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Thank you to all the reviewers who took the time to provide input into these guidelines.

***Professional Work Product (PWP)* Responsibility Matrix**		
***Authenticator* (Seal)**	***Validator* (Permit)**	**Section(s)**
PROFESSIONAL ENGINEER ALBERTA MATTHEW IVANY 2021-Nov-12 ID: 101421	**PERMIT TO PRACTICE** **CITY OF EDMONTON** RM SIGNATURE: Natalie Lazurko RM APEGA ID #: 93519 DATE: 2021-Dec-01 **PERMIT NUMBER: P005038** The Association of Professional Engineers and Geoscientists of Alberta (APEGA)	**All**

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1.0 INTRODUCTION

Bridge Structure Preliminary Design Report serves the dual purpose of documenting the decision-making process used to arrive at a recommendation on what type of structure (or rehabilitation methodology) should be carried forward to detailed design, and assembling all information required for the Consultant to complete detailed design.

This document includes the requirements to formalize Design Checkpoint 3 (preliminary engineering) and facilitate project handover from Checkpoint 3 to Checkpoint 4 (detailed design and construction) as per the City of Edmonton's PDDM (Project Development and Delivery Model).

The City of Edmonton follows the Project Development and Delivery Model (PDDM) process to enhance infrastructure project oversight. This process operates within a develop/deliver model approach where teams work together through all stages of the project with leadership of the project changing through phases of Develop and Deliver. This model involves 5 checkpoints with the leadership handover occurring at Checkpoint 3 which is typically the transition between the end of preliminary design and beginning of detailed design.

In order to ensure an efficient Checkpoint 3 handover, the design guidelines herein will provide consistency for bridge projects ensuring information expected by the Deliver team is provided by the Develop team. Integrating these guidelines to all bridge projects will also provide reliability and efficiency within the PDDM process.

1.1 City of Edmonton Bridge Project Classification Type

The City of Edmonton uses a classification process to identify project types as shown below in **Table 1.1 -Bridge Project Classification Type**. Report requirements vary by scope and type of project as shown in **Table 3.1 - Report Requirements by Classification**.

Table 1.1 Bridge Project Classification Type

Level 1 - SMALL	➢ Low complexity ➢ Few stakeholders ➢ No major constraints ➢ Low level of risk ➢ No public engagement ➢ LIttle to no land acquisition	➢ resurfacing with minor concrete work on bridge or approaches; requires only limited lane closures to complete work ➢ small span length with low capital cost (less than $5M)
Level 2 - MEDIUM	➢ Medium in size and scope ➢ Medium complexity ➢ Many stakeholders – internal & external ➢ Minor or few major constraints ➢ Medium level of risk ➢ Limited external engagement	➢ rehab requiring partial closures of bridge structure; original bridge superstructure and substructure retained ➢ pedestrian creek bridges ➢ non-bridge size culvert replacement ➢ all other bridges not fitting into small or large
Level 3 - LARGE	➢ Large in size and scope ➢ High complexity ➢ Many stakeholders – internal & external ➢ Potential involvement of partners ➢ Major constraints ➢ High level of risk ➢ Potential for political involvement ➢ Substantial external engagement	- replacement of bridge superstructure or full bridge replacement requiring full closure and substantial detours/temporary roads - pedestrian river bridges - any water crossing bridges or any bridge over a freeway or railway grade separations

2.0 Bridge Structure Preliminary Design Report

The Bridge Structure Preliminary Design Report will: identify the design criteria for the project; identify, document and describe key constraints; present multiple alternatives that meet the project requirements; evaluate the alternatives for constructability, schedule, cost, operations and maintenance, risks; and provide a recommendation for detailed design. The Report is supported by reference studies, cost-estimates, and Preliminary Design Drawings. Upon acceptance of the Preliminary Design Report, a design brief is prepared for the selected option, prior to commencing detailed design.

In general, the Preliminary Design Report should include the following sections:

1. **Executive Summary**

2. **Introduction**
   - include a discussion on background studies or information referenced in the completion of this report.
   - include the objectives for project, which will guide option development and evaluation criteria

3. **Background**
   - description of existing structure, history, etc.
   - outline of key findings from previous studies or reports, including summary of information obtained from the City Bridge Files, such as condition assessments, previous rehabilitations, planning studies, etc.

4. **Design Standards and Criteria**
   This will establish the key criteria, considerations and constraints for the project and may include some, or all, of the following:
   - **Design Criteria** including design standards and references for:.
     - **Site Specific Considerations**
     - **Aesthetics**
     - **Users** including identification of traffic, laning configuration, active mode routes and/or pedestrian walkways
     - **Roadway**
       - Design Standards and Criteria
       - Geometric constraints and geometry (Clearances, lengths, widths, etc)
       - Roadway width and Sidewalk/SUP widths
       - Vertical Alignment
       - Horizontal Alignment
     - **Bridge** Design Standards and Criteria
       - Design Loading
       - Barriers and Railings
       - Preliminary Bridge Cross Section - developed and confirmed with City roadway engineers
       - Design standards or criteria changes or addition referencing the *City of Edmonton Bridge Structure Design Criteria* in **Appendix D**
     - **Drainage**
       - Design Standards and Criteria
     - **Lighting**
       - Design Standards and Criteria
     - **Landscaping/Art Requirements (if required)**

- Percent for Art City Policy
- Landscape Design and Construction Standards

5. **Constraints and Controlling Factors**

Identify factors that influence/control the design and identify major risk for the project with mitigation strategies. This will include, but not be limited to the following:

- **Site Specific Considerations**
  - This can include the findings from any site visits or investigations
- **Utilities**
- **Land and Right of Way**
- **Geotechnical**
  - Summary of geotechnical conditions and recommendations of geotechnical investigation.
- **Hydrotechnical**
  - Summary of hydrotechnical investigation and recommendations.
- **Environmental**
  - Enviso Checklist and summary of permit/approval requirement and timelines (F-018 Environmental Permit Approval Checklist)
  - EIA and/ or SLS, if required
  - ESA, if required
  - Summary of any or environmental investigations
  - Possible tree removals
- **Historical Resources**
  - HRIA/SOJ/Archaeological Requirements
- **Summary of Identified Agreement/Permit Requirements**
  - Summary of all permits required (Environmental, Historical Resources, Land Acquisition/Easements, Utility, Rail, High Pressure Pipelines, Altalink, Development Permits, etc.)
- **Constructability Constraints**
  - Access and Laydown
  - Detour requirements, road closures, adjacent project coordination, or construction staging requirements
  - removal or relocation of existing utilities
- Other items of key consideration for the development of the bridge structure alternatives, including lighting and drainage may also be included such as preliminary design of drainage and lighting.

6. **Bridge Structure (New, Replacement, Rehabilitation, etc.) Alternatives**

The section will present the bridge alternatives developed to meet the design constraints and controlling factors, and achieve the City's objectives.

For some projects where a significant number of alternatives may be viable, a high-level screening and evaluation may be completed and documented to reduce the number of alternatives to the three preferred alternatives best suited for a further more detailed evaluation.

Each alternative should be developed to a necessary level of detail to facilitate an informed evaluation of options. This section will include a discussion on bridge articulation and load paths, constructability considerations, design and construction schedule, maintenance and operation including Service life prediction and maintenance projection for major replaceable components, life cycle cost analysis, and capital cost estimate. Major risks should be identified, as well as any special studies which may be required (e.g. wind studies). Any required design exceptions shall be identified, with supporting justification.

Drawings/sketches of the three alternatives shall be developed and included as an Appendix.

7. **Evaluation**

The evaluation will consider a comparison of the alternatives and may include some or all of the following criteria:

- Constructability
  - Construction Schedule
  - Staging
  - Risks (geotechnical, material procurement, permitting requirements, etc.)
- Maintenance, Operation and Inspection
  - Life Cycle Costing (50 years)
  - As a rule of thumb, in general, 1% maintenance cost per year with 5 year minor intervention completed internally by Infrastructure Maintenance, and a major rehabilitation every 25 years.
- Capital Construction Costs
- Site suitability and Aesthetics
- Environmental Impact
- Impact and Benefits to Users
  - Level of Service, Detours Traffic/Pedestrian/active modes
- Others are required

The evaluation section should include:

- Detailed description of each of the established criteria and how each option will be compared against the others.
- Detailed description of the weighting system.
- Each option to be weighted for each criteria with explanation of why the weighting was chosen.

8. **Interim Maintenance Requirements**

If the project will not move into detailed design and construction in the short term, identify all interim maintenance and repair items required to keep the structure safe and serviceable. Interim work shall identify cost and schedule.

9. **Recommendation**

Further, the preliminary design shall include and consider the following:

Background information shall be referenced and summarized in the report and included in the Appendices. Background information may include: Reference Drawings, previous reports and studies for the site.

Supporting studies shall be referenced and summarized in the report and included in the Appendix. Reference studies may include: Geotechnical Investigation and Recommendation, Hydrotech Investigation and Recommendations, Environmental Reports, Architectural, Landscape, etc.

Schedule: Project schedule shall be presented considering duration for detailed design and tendering in addition to construction schedule to provide necessary information for planning of delivery. The schedule shall have appropriate durations for the identified tasks, identify critical path and highlight potential risks and mitigations that can be considered.

Procurement Recommendations: When identified in the Description of Work, procurement recommendations shall be discussed. As an example, when CCGC is identified the Consultant shall identify procurement risks and potential early work opportunities to meet City objectives. Specialized procurement such as CCGC is typically identified in the Description of Work.

Cost-Estimate: Cost-estimates shall be considered Class 3 estimates with an accuracy expectation of -20% to +30%. It is expected that Consultants will consider all relevant resources in developing cost-estimates including Unit Price Average Reports, recent tender results, and input from industry, with description for the basis of estimate. Cost-estimates shall be presented in a unit price format appropriate for the level of detail and contingency. Costs shall be broken down for Growth and Renewal costs. Refer to **Appendix D** for an example cost-estimate and the City of Edmonton White Paper *Understanding Growth & Renewal*.

City Cost Assumptions: The City of Edmonton has several internal services that are delivered as part of a project including traffic, survey, internal costs, transit detours, other services (5-15% cost total based on scope of project). These costs should be accounted for in your estimate.

Appendix List: The items appended to the report will vary, depending on project demands but may include some or all of the following:

- Engagement Materials such as *Stakeholder Engagement Summary*
- Pedestrian and Traffic Accommodation materials
- Technical sub-consultant memos including Hydrotechnical, Geotechnical, and Environmental
- Workshops summaries such as a *Design Workshop Summary*
- Load-Evaluation (if required for rehabilitation projects)
- Cost-Estimates
- Drawings

2.1 Report Requirements by Classification

Minor rehab/major maintenance type work as identified in Level 1 - Small, specifically for overpass/interchange projects where permits are typically not required/applicable, a project can directly enter into detailed design. However, if it requires PEP or other permitting issues specifically over river bridges or creek/park bridges, some preliminary design will be applicable.

Specific items required in the Preliminary Design Report shall also be as established in the specific project *Description of Work*.

Table 2.1 - Typical Report Requirements by Classification

Preliminary Design Table of Contents	Level 1 - Small	Level 2 - Medium	Level 3 - Large
1.0 Executive Summary	○	◑	●
2.0 Introduction	●	●	●
3.0 Background	●	●	●
4.0 Design Standards and Criteria	◑	◑	●
• Site Specific Considerations	●	●	●
• Aesthetics	○	◑	●
• Users including identification of traffic, laning configuration, active mode routes and/or pedestrian walkways	○	◑	●
• Roadway Design Standards and Criteria	◑	●	●
• Geometric constraints and geometry	○	◑	●
• Roadway width and Sidewalk/SUP widths	◑	●	●
• Vertical Alignment	○	◑	●
• Horizontal Alignment	○	◑	●
• Bridge Design Standards and Criteria	●	●	●
• Design Loading	●	●	●
• Barriers and Railings	○	◑	●
• Preliminary Bridge Cross Section	○	◑	●
• Design standards	●	●	●
• Landscaping/Art Requirements (if required)	○	◑	●
• Percent for Art City Policy	○	◑	●
5.0 Constraints and Controlling Factors	●	●	●
• Site Specific Considerations	●	●	●

• Utilities	●	●	●
• Land and Right of Way	○	◑	●
• Geotechnical	◑	●	●
• Hydrotechnical	◑	◑	●
• Environmental	◑	●	●
• Historical Resources	◑	◑	●
• Summary of Identified Agreement/Permit Requirements	◑	●	●
• Constructability Constraints	◑	●	●
6.0 Bridge Structure (New, Replacement, Rehabilitation, etc.) Alternatives (where applicable)	○	◑	●
7.0 Evaluation	◑	◑	●
8.0 Interim Maintenance Requirements	○	◑	●
9.0 Recommendation	●	●	●

● - required

○ - not required

◑ - sometimes required

3.0 Bridge Structure Preliminary Design Drawings

Bridge Structure Preliminary Drawings will be developed for all alternatives presented in the Preliminary Design Report.

3.1 Drawing Content

Drawings shall include: Bridge Structure Preliminary Design Drawings, Traffic Accommodation Drawing (if required) and renderings (if required).

The content of the drawings should reflect the recommended option from the preliminary design report/rehabilitation strategy. Key items that shall be included as appropriate for the bridge include:

Prelim Report Drawing List (for report appendices):

1. Site Plan (Overall, larger scale)
    - Roadway Connections
    - Profile
2. Bridge Alternatives(up to 3 alternatives typically) (plan/profile/elevations/x-section)
3. Details - Design Exceptions, Site Specific Requirements, Non-standard elements, Non-conventional pier arrangements, architectural features
4. Renderings (Optional, Context specific)

Recommended Prelim Design Option Drawing (for signing):

1 - General Arrangement including Plan and Profile
2 - Cross-section and Details

- General Information
    - Road names
    - Property lines
    - Roadway information including, but not limited to curb faces, edge of asphalt, shared use paths, sidewalk / crosswalk, barriers, bus stops /pads, intersections, lane lines, shoulder widths, lane widths, major earth work limits
    - Civil Works required for tie-in to existing infrastructure and limit of construction
    - Existing Utilities (High Pressure Pipelines, Altalink/other power transmission lines, etc).
    - New/Proposed Utilities
    - Existing and Proposed signals
    - Land (existing and required property lines shown)
    - Potential Tree Impacts (conceptual/clouded/noted)
    - Drainage locations
    - Lighting locations

- Plan, Profile and Section including the following structural information
    - Structure depth and clearance
    - Bridge articulation
    - Cross-section of structure
    - Shy distance
    - Retaining walls / MSE walls
    - Foundations
    - Abutments
    - Piers
    - Superstructure with proposed girder and joint types
    - Barriers and approach rail

  - Wearing surface
  - Pier type and protection (if required)
  - Headslope
  - Drainage Locations including Trough Drains if required

- General Notes
  - Design and posted speed
    - *Note: for Design Speed = Posted Speed (50 km/hr and lower), specify that offsets, horizontal & vertical alignment, and intersection sightlines utilize a design speed of posted + 10 km/h*
  - Match lines and adjacent sheet names
  - Specific notes as required

Traffic Accommodation Drawing:

- Construction Staging and Traffic Accommodation Drawing
  - Access widths, modifications, and closures
  - Laydown areas
  - Staging requirements
  - Land owner / lot information

4.0 Submissions

Submissions shall include 90% and Final Submissions, unless otherwise modified in the ***Description of Work***.

4.1 Developing Preliminary Design Alternatives

During the development of the preliminary design, it is expected that the Consultant will keep the City informed of project status and alternatives considered in development. Specific design process requirements such as Workshops may be identified in the ***Description of Work***, however in general the following should be considered and documented during preliminary design development:

- Evaluation Criteria developed with City
- Workshop to evaluate alternatives
- VE Session

4.2 90% Submission

The submission is substantially complete and ready for City review. The supporting reports and studies shall be included as *Draft* submissions. Drawings will be complete and submitted as *Draft*.

- Design Criteria and Constraints are substantially completed
- Alternatives have been identified and descriptions provided, with narratives related to the evaluation criteria. Any design exceptions should be identified.
- Evaluation Criteria and weighting is completed
- Supporting reports and studies should be included as Draft.
- Cost-estimates are completed and included
- Drawings shall be included as a draft.
- Recommendation is provided.

90% Drawings are sent for external review by other City Departments and Utilities.

A Comment Log shall be used to track City Reviewer comments, and resolution. The Comment Log shall include at a minimum the listed City reviewers, comments, and consultants response, and shall be developed and maintained by the Consultant. An example is included in **Appendix C**.

4.3 Final Submission

The final report including all supporting reports and studies are completed, and authenticated as per APEGA requirements. The report shall include the final drawings.

The completed comment log shall be submitted with the Final Submission.

The drawings for the recommended option shall be sealed and provided as an additional deliverable in a format acceptable to the City of Edmonton.

4.4 Design Brief

Following the City acceptance of the Preliminary Design Report, the Consultant shall prepare a Design Brief prior to commencement of Detailed Design (example shown in **Appendix B**).

5.0 Bridge Structure Design Criteria

The standards for Bridge Structure Design Criteria shall use the most recent version of the Alberta Transportation Bridge Structure Design Criteria, with any proposed design exceptions being included in the preliminary design report and Design Brief.

5.1 Bridge Barriers/Rails

Bridge Barriers/Rails historically have been a challenging aspect of design, though not usually in a technical nature. The bridge designer has to balance real safety vs the public perception of safety and will need to balance the context of the area when choosing an appropriate barrier/rail combination. Notwithstanding code requirements, designers must consider other elements in their design such as historical context, aesthetics, adjacent road uses, amount of active mode activity, appropriate materials, public input, and other architectural requirements.

Various literature would suggest that if a dedicated sidewalk/pedestrian facility is only provided on one side of the roadway with clear signage that this facility shall be used by active modes and that the vehicular travelway use is not permitted then a traffic barrier is acceptable on the non-pedestrian facility side. That is typically appropriate within a highway design context, however within City of Edmonton limits, unless granted a design exception, barriers and rails shall be designed assuming that cyclists and active modes can use the vehicle travel way.

Guidance on requirements for appropriate barrier and railing requirements can be found in the latest version of the Canadian Highway Bridge Code and the Transportation Association of Geometric Design Guide for Canadian Roads.

6.0 References

Alberta Transportation Bridge Conceptual Design Guidelines:
https://open.alberta.ca/publications/bridge-conceptual-design-guidelines-version-3-0

Alberta Transportation Bridge Structure Design Criteria:
https://open.alberta.ca/publications/bridge-structures-design-criteria-version-8-1

Engineering Drafting Guidelines for Highway and Bridge Projects Version 2.1 - Alberta Transportation:
https://open.alberta.ca/publications/engineering-drafting-guidelines-for-highway-and-bridge-projects-version-2-1

City of Edmonton - Complete Streets Design and Construction Standards (Version 04 - Oct 22 2021):
https://www.edmonton.ca/sites/default/files/public-files/documents/PDF/CompleteStreets_DesignStandards_2021.pdf

CSA Group - S6:19 - Canadian Highway Bridge Design Code (Revised September 2021)

Appendix A
DRAWINGS STANDARDS

Drawing Standards shall meet City Standards including:

- Title block
- 1:1000 D size (22”x34”) border (scale can vary based on scope of project)
- North arrow
- Scale bar
- Date
- Plan name
- Limits defined by road names
- Bridge number
- City of Edmonton logo and department name
- Designer / drafter first name and initial of last name
- Engineer stamp
- Key plan
- Signing block

Drawings shall meet the City Standards for Naming Plans

- For avenues and streets, use the first digit the facility type in lower case and follow by the avenue or street number
  - A for avenues
  - S for streets
  - For example:
    - 137 Avenue use A137
    - 127 Street use S127
- For named roads, the first four letters of the facility name are to be used for the plan name. Where the facility name consists of multiple names, the first two letters of the first two names will be used. For example:
  - Whitemud Drive use WHIT
  - Queen Elizabeth Park Road use QUEL
  - Argyll Road use ARGY
- Followed by a “P”and the two digits of the year the plan is initiated, and the project number assignment for the location
  - P191, P201, etc.
- Followed two digit sequential numbering of plans on that corridor in that year starting at S01
  - consecutively numbered from west to east and from south to north – in the direction of increasing northings and eastings
  - Where a project has a major change in bearing, consecutive plans may violate the above numbering to maintain the overall direction
- Example of a prelim plan name initiated in 2020 for Wellington Bridge on 102 Ave: “A102 P201 S01”
- The bridge name and number should be included in the title block (B___)
- New bridges to be assigned bridge number from Infrastructure Maintenance group

Presentation Conventions shall consider the following:

Drawing Looks

- Existing conditions – thin grey or black lines
- Proposed improvements – thick colour lines

- Future stages – thick colour lines in the background and transparent
- Improvements by others – monochrome (colour 11)

Drawing Layout shall consider the following

- Plans should be prepared with north to the top of the page or to the right hand side. When it is not possible to orientate North towards the top, the drawing should be oriented in an easterly direction.
- Center improvements on sheet
- Intersections should be completely on one plan. Avoid placing intersections on match lines.
- Scale full size plans at 1:1000
- Where plan detail is dense, use inserts
- Key plans should be 10% of the sheet size
- Match lines will be shown and include text that references the adjoining plans for continuation

Element placement:

- North Arrow in upper right
- Key Plan in upper right and oriented with north to the top of the plan. The key plan shall be consistent in size, location and orientation throughout the plan series.
- Legends, and general notes, on the right where possible

Profile preparation:

- Where drawing is plan/profile
- Profile below the plan view
- Profile stationing aligns with plan stationing
- Profile covers stationing between match lines at minimum
- Lines should be plotted in sync with centerline chainage
- Note chainage at intersecting roadways, railroads, and water crossings
- Label all profiles
- Distinguish concurrent profiles by colour, line style, and weight
- Profiles should be drawn at 10:1 (may be adjusted for clarity)

Slope and Batters:
Slopes and Batters will be shown as per Alberta Transportation guidelines found at
Engineering Drafting Guidelines for Highway and Bridge Projects Version 2.1 - Alberta Transportation. (Page 19)

Cross slopes:

- Concrete walks, boulevards, and asphalt slopes expressed in %
- Rural ditching slopes as a ratio of horizontal distance per metre of elevation

Rules of thumb:

- Reduce cluttered appearance, enhance readability
- Include photos of existing conditions (max four per sheet)
- Draw to scale (including cross sections)
- Prior to sharing a plan, plot & review plan as if you were looking at the plan for the first time and ensure clarity of information shown
- Spell check
- Ask questions and get other opinion where unsure of clarity or layout

Text:

- Double check notes and dimensions, they govern over discrepancies with line work
- Use complete words, avoid abbreviating
- Text should be readable from the front or the right (westerly). If the plan is orientated with north to the right of the page text should be readable from the front or the left (northerly)
- Notes to be within match lines and outside the roadwork
- Align notes vertically
- Place leader lines at a uniform angle
- Notes written in uppercase
- Eliminate text over text by moving or deleting text

Text styles:

- Facility names
- True type font ERAS BOLD
- 4.0mm plotted on 22" x 34" sheets
- Notes
- True type font ERAS DEMI
- 2.5mm plotted on 22" x 34" sheets
- Cadastral information
- True type font ARIAL NARROW
- 2.5mm plotted on 22" x 34" sheets
- Line spacing will be "0"concecutive notes will be separated by two line spaces for clarity

Appendix B
DESIGN PROJECT BRIEF

DESIGN PROJECT BRIEF

Provide a general description of the recommended option for Detailed Design.

The following table summarizes the design brief.

ITEM	REV	DESCRIPTION
Design Codes and References:		• CAN/CSA-S6 (current edition) • *List all other design references*
General:		• Span No. and Length • Horizontal Alignment • Vertical Alignment • AADT/year • Design Speed • Cross-Section (Crown or Superelevation) • Skew • Lane Width and Clear Roadway • Bridge Width • Clearance under the bridge (freeboard and minimum soffit or vertical roadway clearances) • Bridge-rail type • Approach guardrail type • Railway Info (If applicable)
Design Parameters:		• Live Load • Pedestrian Load • Dead Load

		• Roadway Class • Traffic Volume • Wind Load • Temperature Range • Earth Pressure • Ice Loads • Earthquake • Geotechnical Features • Durability Considerations (Splash Zone, etc)
Structural Materials		• Cast-in-Place Concrete • Precast Concrete • Reinforcing Steel • Prestressing Steel • Post-Tensioning Steel • Structural Steel • Other Materials
Abutments		• Type • Foundation • Details (backwalls, wingwalls, roof slab, approach slab, shear blocks, sleeper slab) • Finish and Appearance • Inspection Access • Drain Troughs • Special Features • Crash walls • Additional Comments

Piers		• Type • Foundation • Details (Pile Cap/Footing, Elevation, thickness) • Nose Plates • Finish and Appearance • Special Features • Bracing • Crash walls • Additional Comments
Bearings		• Type • Expansion • Fixed • Durability / Corrosion protection • Special Features
Girders		• Method of Analysis • Girder Type • Girder Number and Spacing • Continuity • Transverse Connectivity • Diaphragms • Finish • Special Features • Additional Comments
Deck		• Thickness • Width • Haunches

		• Crown or Superelevation • Wearing Surface • Curbs • Sidewalks/Active Modes Connections • Barriers • Railings • Median • Deck Drains • Utilities • Special Features • ACP Weep Drains • Utilities Provisions
Joints:		• Type • Location • Special Features
Retaining Walls:		• Location and wall type: • Interaction at Bridge Abutments • Drainage • Component features and specifications: • Length • Maximum Height • Special Features • Finishes
Preliminary List of Drawings		•
Unresolved Items		•

Appendix C

EXAMPLE COMMENT LOG

Reviewers: Reviewer Ex (RE)

Item	Document Reviewed	Pg/Dwg	Section	Comment/Question	By	Response
1	Preliminary Design Report	Pg. 1-1	1	There is no mention of design objectives. Please review the DOW and include the objectives in the introduction	RE	The design objectives from the DOW, including Functional, Safe, Accessible and Welcoming have been included
2	Preliminary Design Drawings	Dwg S01	Elevation	show profile information	RE	vertical curve information and stationing has been added
3						

Appendix D
COST-ESTIMATING

Included in this appendix are:

- Example cost-estimate prepared to the expected level of detail
- *Understanding Growth & Renewal* White Paper
- Basis of Estimates
- Life Cycle Cost Analysis

Lifecycle Management

Understanding Growth & Renewal

White Paper with Examples to Help in Project Development

Purpose

To ensure, throughout a project's development, that expectations for Renewal funding are met, it is important to be consistent and transparent about how we classify Renewal actions vs Growth actions. Our commitments to Council with respect to the Renewal budget are built on the fundamental assumption that funding for Renewal is spent on Renewal.

This paper is crafted to help determine which components of Renewal projects would be considered Renewal actions versus Growth actions, providing consistency in how Growth is applied to projects, and providing clarity for Council and staff in understanding the costs of Growth and Renewal. This enables the City to appropriately report on, and plan for the Growth of City assets in the delivery of service to citizens, as well as appropriately manage the resources put towards Growth actions.

What is Growth vs Renewal?

Put simply, Growth is any action that increases or adds to the intended Level of Service of an asset. Renewal is any action to an asset that extends its expected life AND restores an asset to its intended Level of Service. These definitions are true regardless of the trigger for the action, so whether or not the action is responding to a lifecycle event, a legislated action, or an asset failure, the difference between what is Growth and Renewal is the same.

Funding of Growth vs Renewal

Though the definitions are quite succinct, rules around funding require a bit more nuance. There is not a one to one relationship between Renewal funding and Renewal actions. Use of Renewal funds for actions that are defined as Growth are allowed under certain circumstances. It is important to recognize that there is a difference between what an action is (Growth vs Renewal) and how it is funded. The following are what is considered acceptable uses of Renewal funding for Growth actions:

Table 1: Renewal Funded Growth Action Exceptions

1	Complying with Provincial or Federal legislative or regulatory mandatory requirements (this does not apply to requirements that can be "grandfathered"). Legislated requirements that require brand new assets or extensive upgrades to existing assets should be considered as a growth ask of Council.
2	Complying with a legal court ordered action. Similar to above, requirements that require brand new assets or extensive upgrades to existing assets should be considered as a growth ask of Council.
3	Specific instances where Council has agreed to use Renewal funding for Growth, the only current (Sept 2019) example of which is the Energy Retrofit Program in the Facility Renewal program.
4	Contribution toward Growth actions in circumstances where Renewal was already planned, and the Growth actions result in replacing or reducing the assets planned for Renewal at less capital or operating burden to the City.
5	Creation or upgrade of assets to support an existing asset in achieving its intended life or level of service (ie support of better, more effective/efficient design).

Important Notes:

- It is important to recognize that the difference between Growth and Renewal is not based on funding type, though some types of funding do have rules surrounding its use.
- An action to replace an asset mid-life with a new asset (not because of the expected lifecycle replacement requires it, but because a new asset is required) is not considered a Renewal Action, nor would it be considered a Renewal Funded Growth Action Exception
- Any Growth actions, outside of the items listed within Table 1 can be funded through the Growth allocation built into a Renewal Composite (other controls, however, may be in place for the use of these funds)

Table 2: Definitions

Term	Definition
Renewal Actions	Investment in existing infrastructure assets to restore the asset to its former condition and may extend its service life. Capital investment in Renewal extends the period of service potential but does not change the replacement value, and therefore does not increase the size of the infrastructure asset portfolio. Renewal includes rehabilitation and replacement: ● Rehabilitation: The action of restoring or replacing parts or components of an infrastructure asset to a former condition or status. Generally involves repairing the asset to deliver its original Level of Service without resorting to significant upgrading or Renewal, using available techniques and standards. ● Replacement - The action of replacing an infrastructure asset so as to provide similar, or an agreed alternative, Level of Service.
Growth Actions	Investment in the upgrade of existing infrastructure assets or development of new infrastructure assets (created or acquired), which increase the value of the overall portfolio of assets. These actions increase or add to the intended Level of Service provided by the City's portfolio of infrastructure assets.
Replacement Value	The cost of total replacement of an existing asset in today's dollars, including assets that replicate what is in existence with the most cost effective asset providing an equivalent Level of Service. Replacement value considers the cost to replace an obsolete asset with its modern equivalent, and the cost to meet current legislative or regulatory requirements.
Modern Equivalent Asset	An asset which provides similar function and equivalent Level of Service to the asset being renewed, but which is constructed or made using current materials and techniques. Modern Equivalent Assets are used when the type of asset to be renewed is no longer being manufactured, or is cost prohibitive to reproduce. A simple example is the Renewal of flooring in a facility where the previous flooring material was made from Vinyl Asbestos Tile. As this type of tile is no longer produced, Vinyl Composition Tile, which provides a similar Level of Service, is used as its modern equivalent.
Level of Service	The parameter or combination of parameters that reflect socio-cultural, financial/economic and environmental outcomes that the organization delivers. They describe the outputs or objectives that the City intends to deliver; includes measures at the corporate, stakeholder, and asset operator levels of the organization. They are the composite indicators such as quality, quantity, reliability, responsiveness, safety and cost, for a particular activity or service area against which service performance may be measured.
Maintenance	All actions necessary, excluding Renewal actions, to address deterioration of an asset to preserve its condition and achieve its expected useful life. Maintenance does not increase the Level of Service of the asset or increase its service life, rather it slows down deterioration and delays when Renewal actions are necessary. Within the City of Edmonton context, maintenance actions are not capitalized, and should be proactively built into operating budgets.

Calculation of Growth vs Renewal Within Renewal Composites

Within Renewal Composites, a Growth component is identified to accommodate some of the required Growth as a result of a Renewal project. This is represented as a percentage of the Composite value, and the percentage can vary between Composites.
The calculation of Growth component value is calculated using whole project costs (design, construction, commissioning, etc), and is calculated as follows:

$$\text{\% Growth} = \frac{\text{Growth Funded Action Costs}}{\text{Total Project Cost}}$$

(Renewal Action Costs + Growth Action Costs)

In reference to the above formula, the following describes the components of the formula:

Table 3: Formula Definitions

Component	Definition
Total Project Cost	The total cost to implement a project. In the context of a Renewal project, this includes the costs of all Renewal Actions and Growth Actions
Renewal Funded Action Costs	Costs related to Renewal Actions as defined in Table 2 as well as any applicable Renewal Funded Growth Action exceptions as defined in Table 1.
Growth Funded Action Costs	Costs related to Growth Actions as defined in Table 2. The sum total of these costs include the difference in cost to upgrade existing assets, and the value of the new assets being developed as part of the project.

Growth Component of Renewal Fictional Project Examples

While the Growth component is calculated at the Composite level, the formula can be used to help Project Managers understand the impacts of Growth at a project level. Additionally, an approved project may have an agreed to percentage of Growth built into the project approval. To demonstrate the use of the formula at the project level, examples are provided in the following pages. Please note, these are fictional scenarios and do not reflect real world costs.

Open Space Example #1

A ten year old parking lot ($500,000) is in F condition, well in advance of its planned life of 25 years. An assessment of the parking lot has determined that the parking lot was developed without a storm sewer, resulting in standing water sitting on the surface, causing the premature deterioration. Any Renewal of the parking lot without appropriate drainage will result in a reduced lifecycle of the asset. The recommended solution is to rebuild the parking lot with a new storm sewer ($1,000,000).

Fund	Items	Justification	Budget
Renewal Funded	Renewal Actions		
	Parking Lot Renewal	Replacement of the asset with its modern equivalent	$500,000
	Renewal Funded Growth Actions (Table 1)		
	Storm Sewer	New asset to support the achievement of the base asset's expected lifecycle and/or level of service. (Exception 5)	$1,000,000
Total Renewal Funded Actions			$1,500,000
Growth Funded	Growth Actions		
Total Growth Funded Actions			$0
Total Project Cost			**$1,500,000**

$$\textbf{\% Growth} = \frac{\text{Growth Action Costs}}{\text{Total Project Cost}} = \frac{\$0}{\$1{,}500{,}000} = \textbf{0\%}$$

Open Space Example #2

An 80 m long gravel trail (replacement value $24,000) connecting a neighbourhood with the river valley needs to be replaced due to ongoing erosion issues. At the same time the upper portion of the trail needs to be rerouted due to right-of-way conflicts, resulting in trail lengthening by 10 m ($3,000). The decision is made that in order to reduce the erosion potential on this important trail connection, the grade of the lower trail portion will be reduced, resulting in trail lengthening by 20 m ($6,000) and the entire trail will be paved (added cost of $22,000).

Fund	Items	Justification	Budget
Renewal Funded	Renewal Actions		
	Gravel Trail Replacement	Replacement of the asset with its modern equivalent	$24,000
Total Renewal Funded Actions			$24,000
Growth Funded	Growth Actions		
	Trail Extension by 30 m 10m right of way ($3,000) + 20m grade lowering ($6,000)	Expansion of asset	$9,000
	Upgrade to Asphalt	Increased Level of Service and increased asset value	$22,000
Total Growth Funded Actions			$31,000
Total Project Cost			**$55,000**

$$\textbf{\% Growth} = \frac{\text{Growth Action Costs}}{\text{Total Project Cost}} = \frac{\$31,000}{\$55,000} = \textbf{56.3\%}$$

Open Space Example #3

A playground (funded under the Neighbourhood Park Development Program) is approaching the end of its useful lifespan and needs to be replaced. A new playground, with similar Levels of Service, would cost $470,000. However, the design of this playground requires upgrades to be compliant with current CSA standards ($150,000).

Fund	Items	Justification	Budget
Renewal Funded	Renewal Actions		
	Playground replacement	Replacement of the asset with its modern equivalent	$470,000
	Renewal Funded Growth Actions (Table 1)		
	Upgrades to comply with CSA standards	Legislated requirement as a result of replacing the asset	$150,000
Total Renewal Funded Actions			$620,000
Growth Funded	Growth Actions		
Total Growth Funded Actions			
Total Project Cost			**$620,000**

$$\textbf{\% Growth} = \frac{\text{Growth Action Costs}}{\text{Total Project Cost}} = \frac{\$0}{\$620{,}000} = \textbf{0\%}$$

Note that the source of funding does not determine which actions are Renewal or Growth

Facilities Example #1

A water filtration system in a facility is at the end of its life and requires Renewal. The original asset installed was a "middle of the line" model of its day, however this technology is not available anymore, so it will need to be replaced with a modern equivalent "middle of the line" filtration system ($125,000). Installation of the filtration system will require modifications to the filtration room including ventilation system upgrades, piping relocations, and doorway widening ($75,000). Updates to the Alberta Building Code requires a larger separation between the filtration system and the electrical service, which will require electrical modifications ($50,000) to comply with the code change for a total base replacement value of $250,000. As part of the project, the modified electrical service will be extended to support another piece of equipment elsewhere in the facility ($15,000). The City of Edmonton operational standards require that water filtration systems filter to a higher standard than the legislated requirements, which is greater than the specified output of the "middle of the line" filtration system. This operational standard will require the "middle of the line" filtration system to be replaced with a "top of the line" replacement.

Fund	Items	Justification	Budget
Renewal Funded	Renewal Actions		
	Filtration system	Replacement of the asset with its modern equivalent	$125,000
	Ventilation system modifications, piping relocation, and doorway relocation	Connected assets requiring modification to implement the replacement of the asset	$75,000
	Renewal Funded Growth Actions (Table 1)		
	Electrical modification	Legislated requirement as a result of replacing the asset (Exception 1)	$50,000
Total Renewal Funded Actions			$250,000
Growth Funded	Growth Actions		
	Extension of electrical	Electrical upgrades are not required as part of the Renewal and add new assets and an increased level of service to the facility	$15,000
	Upgrade to "Top of the Line" System	New asset specifications are enhanced beyond the modern equivalent Levels of Service and are not imposed on the City through legislation or regulation	$50,000
Total Growth Funded Actions			$65,000
Total Project Cost			**$315,000**

$$\textbf{\% Growth} = \frac{\text{Growth Action Costs}}{\text{Total Project Cost}} = \frac{\$65{,}000}{\$315{,}000} = \textbf{20.6\%}$$

Facilities Example #2

A facility at the Waste Management site is at its end of life and requires replacement. The existing facility is a pre-engineered structure with simple electrical and mechanical systems ($3,000,000). The replacement facility will be of a similar design with similar electrical and mechanical systems, however, the replacement facility ($3,750,000) will be 25% larger than the existing facility. Additionally, the design of the new facility will require an additional access road to the rear of the facility ($1,000,000). The process equipment inside the facility ($2,500,000) is aged, not yet at the end of life, however, because the facility housing the equipment is being replaced, the equipment will need to be relocated, and reinstalled. The cost to reinstall this equipment is more than the depreciated value of the assets, making the reinstallation cost prohibitive, therefore, replacement is the best solution. Replacement process equipment selected for the replacement facility ($4,000,000) is larger, faster, and accommodates more waste. The existing equipment can be sold to other waste management organizations and be used to fund a portion of the cost of the replacement process equipment.

Fund	Items	Justification	Budget
Renewal Funded	Renewal Actions		
	Pre-engineered Facility	Replacement of the asset with its modern equivalent	$3,000,000
	Process Equipment	Replacement of the asset with its modern equivalent	$2,500,000
Total Renewal Funded Actions			$5,500,000
Growth Funded	Growth Actions		
	25% Increase to Facility	New asset specifications are enhanced beyond the modern equivalent Levels of Service and are not legislated by a higher authority	$750,000
	Access Road	New asset to support in increase to the assets Level of Service	$1,000,000
	Process Equipment Upgrade	New asset specifications are enhanced beyond the modern equivalent Levels of Service and are not imposed on the City through legislation or regulation	$1,500,000
Total Growth Funded Actions			$3,250,000
Total Project Cost			**$8,750,000**

$$\textbf{\% Growth} = \frac{\text{Growth Action Costs}}{\text{Total Project Cost}} = \frac{\$3{,}250{,}000}{\$8{,}750{,}000} = \textbf{37.1\%}$$

Note: The funds acquired through the sale of the existing process equipment provide an additional source of funding to the project, however, does not apply to the calculation of Growth as Growth calculations are based on replacement value as a measure of service.

Roads Example #1

A 1 km section of goods movement roadway is up for rehabilitation and requires Renewal. The current road design includes a four lane road ($3,000,000) with 1.5 m boulevard sidewalks on both sides ($225,000 + $225,000) and was constructed to the appropriate standards of the day. City design standards have evolved and the geometric requirements for users have changed. The current City of Edmonton Complete Streets Design and Construction Standards (CSDCS) indicates a requirement for 3.0 m asphalt boulevard shared use paths along both sides of the roadway. Due to space requirements, only one side can accommodate the 3.0 m shared use path ($270,000), while the other side will receive a 1.8 m boulevard sidewalk ($230,000).

Fund	Items	Justification	Budget
Renewal Funded	Renewal Actions		
	Roadway Renewal	Replacement of the asset with its modern equivalent	$3,000,000
	Sidewalk Renewal	Replacement of the asset with its modern equivalent (Cost applied toward a different, upgraded asset fulfilling a similar function)	$450,000
Total Renewal Funded Actions			$3,450,000
Growth Funded	Growth Actions		
	Upgrade Sidewalk from 1.5m to 1.8m Standard	Dimensions of the new asset are larger than the than the asset being replaced, increasing its intended Level of Service (increase of 0.3 m to width)	$5,000
	Upgrade Sidewalk from 1.5m to 3.0m Shared Use Path	New asset dimensions and specifications are enhanced beyond the modern equivalent Levels of Service (change to 3.0 m of asphalt material)	$45,000
Total Growth Funded Actions			$50,000
Total Project Cost			**$3,500,000**

$$\textbf{\% Growth} = \frac{\text{Growth Action Costs}}{\text{Total Project Cost}} = \frac{\$50{,}000}{\$3{,}500{,}000} = \textbf{1.4\%}$$

Roads Example #2

The existing 1.12 km of arterial road has 2 x 2.7 m lanes and 2 x 2.8 m lanes (+gutter width) ($3,360,000), and is a bus route. Modern vehicles have grown, and buses require a minimum of 3.2 m lanes, which is still less than the City's current standard of 3.5 to 3.7 m lane widths for arterial roads. The existing roadway also has fully mature trees on both sides of the road. Due to condition, the road requires full reconstruction, and through full reconstruction, the roadway will be widened to four 3.2 m lanes ($4,368,000). As part of the scoping of this project, an assessment of the boulevard trees was undertaken to understand the impact of the construction on the trees. It was determined the trees will be impacted by the road reconstruction, even if no changes to the roadway geometry were made, so will need to be relocated ($150,000).

Fund	Items	Justification	Budget
Renewal Funded	Renewal Actions		
	Roadway Renewal	Replacement of the asset with its modern equivalent	$3,360,000
	Tree Relocation	Replacement of the asset with its modern equivalent (Cost applied toward a different, upgraded asset fulfilling a similar function)	$150,000
Total Renewal Funded Actions			$3,510,000
Growth Funded	Growth Actions		
	Upgraded Roadway Width	Dimensions of the new asset are larger than the asset being replaced, increasing its intended Level of Service (increase of 0.5 m to width of each lane)	$1,009,000
Total Growth Funded Actions			$1,009,000
Total Project Cost			**$4,519,000**

$$\textbf{\% Growth} = \frac{\text{Growth Action Costs}}{\text{Total Project Cost}} = \frac{\$1{,}009{,}000}{\$4{,}519{,}000} = \textbf{22.3\%}$$

Roads Example #3

A goods movement roadway ($3,500,000) is programmed for reconstruction. The original asset was constructed to the appropriate standards of the day, however city design standards have evolved and the geometric requirements for users have evolved. The existing lane widths are wider than current target value and ranges identified in the City of Edmonton Complete Streets Design and Construction Standards (CSDCS) but still within national guidelines for roadway design. The cost to replace the curb line itself would be considered a "wash" but changing the curbline will require all the drainage infrastructure ($225,000) to be replaced. The drainage infrastructure is in good to fair condition with 20 more years of life expectancy.

Fund	Items	Justification	Budget
Renewal Funded	Renewal Actions		
	Roadway Renewal	Replacement of the asset with its modern equivalent	$3,500,000
Total Renewal Funded Actions			$3,500,000
Growth Funded	Growth Actions		
	Drainage Infrastructure Replacement	Replacement of existing infrastructure prior to end of life to accommodate a change in Level of Service not mandated by legislation	$225,000
Total Growth Funded Actions			$225,000
Total Project Cost			**$3,725,000**

$$\textbf{\% Growth} = \frac{\text{Growth Action Costs}}{\text{Total Project Cost}} = \frac{\$225{,}000}{\$3{,}725{,}000} = \textbf{6.0\%}$$

Neighborhoods Example #1

A diagonal road at 120 Avenue and 92 Street in Alberta Avenue has been identified for neighbourhood Renewal ($500,000). Upon further analysis it is concluded that the road is redundant, and can be closed to create a larger park space for the community. The road was originally identified to be reconstructed, so if the road base is simply removed and restored to grass it will be at a lower cost ($300,000).

Fund	Items	Justification	Budget
Renewal Funded	Renewal Actions		
	Roadway Renewal	The cost for the replacement of the asset with its modern equivalent would be $500,000, however, an alternative solution is used which results in a reduced replacement value	$0
	Renewal Funded Growth Actions (Table 1)		
	Roadway Renewal and Naturalization	New asset, replacing the removed asset, providing a different function or Level of Service (Exception 4)	$300,000
Total Renewal Funded Actions			$300,000
Growth Funded	Growth Actions		
Total Growth Funded Actions			$0
Total Project Cost			

$$\textbf{\% Growth} = \frac{\text{Growth Action Costs}}{\text{Total Project Cost}} = \frac{\$0}{\$300{,}000} = \textbf{0\%}$$

While the above example indicates these actions would be considered Growth through the creation of new assets and change in Level of Service, funding for these actions may be provided through a Renewal Composite as the cost for renewing the existing asset was planned for and prioritized within the Renewal Composite.

Neighborhoods Example #2

As part of a neighborhood Renewal ($4,800,000), a bike route is being developed along 1 km of roadway. A two-way protected bike lane has been selected as the preferred facility type. The design for the protected bike lane utilizes a new concrete median and flexi posts, ($100,000) to be placed within the roadway following Renewal of the road.

Fund	Items	Justification	Budget
Renewal Funded	Renewal Actions		
	Roadway Renewal	Replacement of the asset with its modern equivalent	$4,800,000
Total Renewal Funded Actions			$4,800,000
Growth Funded	Growth Actions		
	New Bike Lane	New asset adding or increasing Levels of Service	$100,000
Total Growth Funded Actions			$100,000
Total Project Cost			**$4,900,000**

$$\textbf{\% Growth} = \frac{\text{Growth Action Costs}}{\text{Total Project Cost}} = \frac{\$100{,}000}{\$4{,}900{,}000} = \textbf{2.0\%}$$

Cost Estimate

Client: The City of Edmonton
Project: Mystery Bridge Replacement
Road: Yellow Brick Road
Subject: Option 1: Single Span Steel Girder
49m Single Span Haunched Steel I-Girder (Semi-Integral)

Date Submitted: 05-Mar-21
Tender Date: TBD
Completion Date: TBD

No. of Structures: 1
Length (m): 64
Width (m): 23.8
Area (m^2): 1520

						Growth and Renewal Costs				
						Percent		Cost		
Item	Bid Item Description	Estimated Quantity	Units	Estimated Unit Price	Estimated Cost	Renewal	Growth	Renewal	Growth	Notes
1	Mobilization and Demobilization	1	LS	$ 793,200	$ 793,000	100%	0%	$ 793,000	$ -	These items assumed to be the same if project was renewal only.
2	Traffic Accommodation	1	LS	$ 175,000	$ 175,000	100%	0%	$ 175,000	$ -	
3	Removal of Bridge Structure	1	LS	$ 264,000	$ 264,000	100%	0%	$ 264,000	$ -	
4	Excavation - Structural	1	LS	$ 50,000	$ 50,000	69%	31%	$ 34,500	$ 15,500	The proposed new bridge width is 23.78m which is 31% wider than the existing bridge width of 16.31m. Growth cost for the new bridge is assumed to 31% of the total cost.
5	Backfill - Crushed Granular	1	LS	$ 80,000	$ 80,000	69%	31%	$ 55,200	$ 24,800	
6	Excavation	4,900	m^3	$ 25	$ 123,000	69%	31%	$ 84,870	$ 38,130	
7	Backfill	11,260	t	$ 20	$ 225,000	69%	31%	$ 155,250	$ 69,750	
8	Concrete - Pile	795	m^3	$ 500	$ 398,000	69%	31%	$ 274,620	$ 123,380	
9	Drill Rig Set-up (Drilled Piles)	18	each	$ 8,000	$ 144,000	69%	31%	$ 99,360	$ 44,640	
10	Pile Installation (Drilled Piles)	450	m	$ 700	$ 315,000	69%	31%	$ 217,350	$ 97,650	
11	Concrete - Class C	296	m^3	$ 1,500	$ 444,000	69%	31%	$ 306,360	$ 137,640	
12	Concrete - Class HPC	444	m^3	$ 2,000	$ 888,000	69%	31%	$ 612,720	$ 275,280	
13	Plain Reinforcing Steel - Supply	134,000	kg	$ 1.50	$ 201,000	69%	31%	$ 138,690	$ 62,310	
14	Stainless Reinforcing Steel - Supply	68,000	kg	$ 8.00	$ 544,000	69%	31%	$ 375,360	$ 168,640	
15	Reinforcing Steel - Place	202,000	kg	$ 1.25	$ 253,000	69%	31%	$ 174,570	$ 78,430	
16	Supply and Delivery of Bearings	1	LS	$ 111,333	$ 111,000	69%	31%	$ 76,590	$ 34,410	
17	Installation of Bearings	1	LS	$ 19,200	$ 19,000	69%	31%	$ 13,110	$ 5,890	
18	Supply of Steel Girders	1	LS	$ 1,757,000	$ 1,757,000	69%	31%	$ 1,212,330	$ 544,670	
19	Delivery of Girders	1	LS	$ 193,000	$ 193,000	69%	31%	$ 133,170	$ 59,830	
20	Erection of Girders	1	LS	$ 458,000	$ 458,000	69%	31%	$ 316,020	$ 141,980	
21	Aesthetic Pedestrian Handrail	1	LS	$ 200,000	$ 200,000	69%	31%	$ 138,000	$ 62,000	
22	Miscellaneous Iron	1	LS	$ 10,000	$ 10,000	69%	31%	$ 6,900	$ 3,100	
23	Deck Waterproofing	1,540	m^2	$ 75	$ 116,000	69%	31%	$ 80,040	$ 35,960	
24	Asphaltic Concrete Pavement	190	t	$ 230	$ 44,000	69%	31%	$ 30,360	$ 13,640	
25	Drainage	1	LS	$ 30,000	$ 30,000	100%	0%	$ 30,000	$ -	Assumed renewal only as these upgrades would need to be made for renewal only
26	Roadworks	1	LS	$ 250,000	$ 250,000	100%	0%	$ 250,000	$ -	
27	Street Lighting - Decorative	1	LS	$ 90,000	$ 90,000	69%	31%	$ 62,100	$ 27,900	Assumed decorative lighting part of growth
28	Vegetation and Tree Clearing	1	LS	$ 300,000	$ 300,000	69%	31%	$ 207,000	$ 93,000	Additional tree clearing and landscaping needed for wider bridge
29	Landscaping	1	LS	$ 250,000	$ 250,000	69%	31%	$ 172,500	$ 77,500	
				Estimated Tender Cost Total	**$ 8,725,000**			**$ 6,488,970**	**$ 2,236,030**	
				Estimated Unit Cost ($/$m^2$)	**$ 5,740**					
				Contingency (20%)	$ 1,745,000			$ 1,298,000	$ 447,000	20% Contingency
				Aesthetic Additions (10%)	$ 873,000			$ -	$ 873,000	Aesthetics 100% Growth
				Engineering (15%)	$ 1,309,000			$ 1,178,100	$ 130,900	Engineering assumed 90% renewal
				Estimated Project Cost Total	**$ 12,652,000**			**$ 8,965,070**	**$ 3,686,930**	
								71%	29%	

REMARKS:

1. Estimate based on 2021 dollars
2. Estimate is exclusive of GST
3. Estimate is accurate to -20% / +30%
4. 20% Contingency
5. 10% Aesthetic Additions to include items that may be incorporated during detailed design, such as seating areas, architectural features on or off the bridge (dependent on chosen bridge option)

OPTION 2A

COST ESTIMATE TYPE: B
PROJECT: City of Edmonton - Bridge Rehabilitation
BRIDGE: Mystery Bridge

High Performance Concrete (HPC) Overlay **DATE:** June 2019

Description of Item	Unit	Quantity	Engineer's Estimate	
			Unit Price	Total Price
Mobilization (10%) Bridge	LS	1	$ 177,322.00	$ 177,320.00
Traffic Accommodation	LS	1	$ 150,000.00	$ 150,000.00
Approach Repairs	LS	1	$ 20,000.00	$ 20,000.00
Abutment Partial Depth Repairs (pier, abutments, wingwalls)	m2	22	$ 1,200.00	$ 26,400.00
Epoxy Crack Injection (pier, abutments)	m	40	$ 550.00	$ 22,000.00
Sealers	LS	1	$ 40,000.00	$ 40,000.00
ACP- Milling	LS	1	$ 50,000.00	$ 50,000.00
ACP-Placement	tonne	375	$ 415.00	$ 155,630.00
Curb and Gutter Replacement	m	120	$ 315.00	$ 37,800.00
Sidewalk Replacement	m	60	$ 660.00	$ 39,600.00
Girder Repairs	LS	1	$ 34,000.00	$ 34,000.00
Supply and Installation of Bearing Pads	LS	1	$ 107,250.00	$ 107,250.00
Bearing Plate Repairs	LS	1	$ 30,000.00	$ 30,000.00
Supply and Install of Expansion Joints	LS	1	$ 250,000.00	$ 250,000.00
Deck Milling (removals)	m2	2,700	$ 70.00	$ 189,000.00
Concrete - Fiber Reinforced Class HPC	m3	160	$ 2,600.00	$ 416,000.00
Concrete - Median	m3	28	$ 2,000.00	$ 56,000.00
Concrete Barrier Repairs	LS	1	$ 70,000.00	$ 70,000.00
Pedestrian / Cyclist Handrail	m	82	$ 970.00	$ 79,540.00
TOTAL ESTIMATED EXPENDITURES				**$ 1,950,540**

CONTRACT ESTIMATE	$ 1,950,540
CONTINGENCY @ 20%	$ 390,108
ENGINEERING @ 15%	$ 292,581
CONSTRUCTION CONSULTANT@ 3%	$ 58,516
INTERNAL CITY SERVICES @ 30%	$ 585,162
TOTAL	**$ 3,276,907**

OPTION 2B

COST ESTIMATE TYPE: B
PROJECT: City of Edmonton - Bridge Rehabilitation
BRIDGE: Mystery Bridge

Polyester Polymer Concrete (PPC) Overlay **DATE:** June 2019

Description of Item	Unit	Quantity	Engineer's Estimate	
			Unit Price	Total Price
Mobilization (10%) Bridge	LS	1	$ 471,122.00	$ 471,120.00
Traffic Accommodation	LS	1	$ 50,000.00	$ 50,000.00
Approach Repairs	LS	1	$ 20,000.00	$ 20,000.00
Abutment Partial Depth Repairs (pier, abutments, wingwalls)	m2	22	$ 1,200.00	$ 26,400.00
Epoxy Crack Injection (pier, abutments)	m	40	$ 550.00	$ 22,000.00
Sealers	LS	1	$ 40,000.00	$ 40,000.00
ACP- Milling	LS	1	$ 50,000.00	$ 50,000.00
ACP-Placement	tonne	375	$ 415.00	$ 155,630.00
Curb and Gutter Replacement	m	120	$ 315.00	$ 37,800.00
Sidewalk Replacement	m	60	$ 660.00	$ 39,600.00
Girder Repairs	LS	1	$ 34,000.00	$ 34,000.00
Supply and Installation of Bearing Pads	LS	1	$ 107,250.00	$ 107,250.00
Bearing Plate Repairs	LS	1	$ 30,000.00	$ 30,000.00
Supply and Install of Expansion Joints	LS	1	$ 250,000.00	$ 250,000.00
Deck Milling (removals)	m2	2,700	$ 70.00	$ 189,000.00
Concrete - PPC	m2	2,700	$ 1,300.00	$ 3,510,000.00
Concrete Barrier Repairs	LS	1	$ 70,000.00	$ 70,000.00
Pedestrian / Cyclist Handrail	m	82	$ 970.00	$ 79,540.00
TOTAL ESTIMATED EXPENDITURES				**$ 5,182,340**

CONTRACT ESTIMATE	$ 5,182,340
CONTINGENCY @ 20%	$ 1,036,468
ENGINEERING @ 15%	$ 777,351
CONSTRUCTION CONSULTANT@ 3%	$ 155,470
INTERNAL CITY SERVICES @ 30%	$ 1,554,702
TOTAL	**$ 8,706,331**

OPTION 3

COST ESTIMATE TYPE: B
PROJECT: City of Edmonton - Bridge Rehabilitation
BRIDGE: Mystery Bridge

Reinforced HPC deck

DATE: June 2019

Description of Item	Unit	Quantity	Engineer's Estimate	
			Unit Price	Total Price
Mobilization (10%) Bridge	LS	1	$ 489,046.50	$ 489,050.00
Traffic Accommodation	LS	1	$ 200,000.00	$ 200,000.00
Abutment Partial Depth Repairs (pier, abutments, wingwalls)	m2	22	$ 1,200.00	$ 26,400.00
Epoxy Crack Injection (pier, abutments)	m	40	$ 550.00	$ 22,000.00
Sealers	LS	1	$ 40,000.00	$ 40,000.00
ACP- Milling	LS	1	$ 50,000.00	$ 50,000.00
ACP-Placement	tonne	375	$ 415.00	$ 155,625.00
Curb and Gutter Replacement	m	120	$ 315.00	$ 37,800.00
Concrete Sidewalk	m	60	$ 660.00	$ 39,600.00
Girder Repairs	LS	1	$ 34,000.00	$ 34,000.00
Supply and Installation of Bearing Pads	LS	1	$ 429,000.00	$ 429,000.00
Bearing Plate Repairs	LS	1	$ 95,000.00	$ 95,000.00
Abutment Excavation and backfill	LS	1	$ 80,000.00	$ 80,000.00
Concrete - Approach slab	m3	180	$ 2,500.00	$ 450,000.00
SS Rebar - Supply and Place	kg	27,500	$ 11.00	$ 302,500.00
Concrete - Approach Barriers	m3	20	$ 2,500.00	$ 50,000.00
Deck Milling (removals)	m2	2,700	$ 70.00	$ 189,000.00
Bridge Removals (removals)	LS	1	$ 600,000.00	$ 600,000.00
Concrete - Class HPC	m3	385	$ 2,500.00	$ 962,500.00
SS Rebar - Supply and Place	kg	70,000	$ 11.00	$ 770,000.00
Concrete - Deck Barriers	m3	60	$ 2,500.00	$ 150,000.00
Rebar - Supply and Place - Deck barriers	kg	6,500	$ 11.00	$ 71,500.00
Concrete - Median	m3	28	$ 2,000.00	$ 56,000.00
Pedestrian / Cyclist Handrail	m	82	$ 970.00	$ 79,540.00
TOTAL ESTIMATED EXPENDITURES				**$ 5,379,515**

CONTRACT ESTIMATE	$ 5,379,515
CONTINGENCY @ 20%	$ 1,075,903
ENGINEERING @ 15%	$ 806,927
CONSTRUCTION CONSULTANT@ 3%	$ 161,385
INTERNAL CITY SERVICES @ 30%	$ 1,613,855
TOTAL	**$ 9,037,585**

OPTION 3

COST ESTIMATE TYPE: B
PROJECT: City of Edmonton - Bridge Rehabilitation
BRIDGE: Mystery Bridge

Reinforced HPC deck

DATE: June 2019

Description of Item	Unit	Quantity	Engineer's Estimate	
			Unit Price	Total Price
Mobilization and Demobilization - 10% of estimate	LS	1	$ 1,024,769	$ 1,024,770.00
Traffic Accommodation for Bridge Construction	LS	1	$ 250,000	$ 250,000.00
Demolition	LS	1	$ 1,000,000	$ 1,000,000.00
Excavation& Backfill	LS	1	$ 80,000	$ 80,000.00
Concrete - Class C	m3	90	$ 2,000	$ 180,000.00
Concrete - Class HPC	m3	500	$ 2,500	$ 1,250,000.00
Plain Reinforcing Steel - Supply	kg	3,000	$ 2.10	$ 6,300.00
Stainless Reinforcing Steel - Supply	kg	110,000	$ 9.10	$ 1,001,000.00
Reinforcing Steel - Place	kg	113,000	$ 1.90	$ 214,700.00
Supply of Structural Steel Girders and Associated Material	LS	1	$ 4,150,000	$ 4,150,000.00
Delivery of Girders	LS	1	$ 290,000	$ 290,000.00
Erection of Girders	LS	1	$ 1,000,000	$ 1,000,000.00
Supply and Delivery of Bearings	LS	1	$ 190,000	$ 190,000.00
Installation of Bearings	LS	1	$ 75,000	$ 75,000.00
Pedestrian Handrail - Supply and Install	m	82	$ 970	$ 79,540.00
Miscellaneous Iron	LS	1	$ 10,000	$ 10,000.00
Deck Waterproofing	m2	2,800	$ 75	$ 210,000.00
Asphaltic Concrete Pavement	t	520	$ 320	$ 166,400.00
Abutment Partial Depth Repairs (pier, abutments, wingwalls)	m2	25	$ 1,200.00	$ 30,000.00
Epoxy Crack Injection (pier, abutments)	m	45	$ 550.00	$ 24,750.00
Sealers	LS	1	$ 40,000.00	$ 40,000.00
TOTAL ESTIMATED EXPENDITURES				**$ 11,272,460**

CONTRACT ESTIMATE	$ 11,272,460
CONTINGENCY @ 20%	$ 2,254,492
ENGINEERING @ 15%	$ 1,690,869
CONSTRUCTION CONSULTANT@ 3%	$ 338,174
INTERNAL CITY SERVICES @ 30%	$ 3,381,738
TOTAL	**$ 18,937,733**

Discount Rate:	0	
Analysis Period:	60	years
Starting Year:	2,020	

REVISION DATE: **June 2019**

Notes: *Cost estimates are* ***Class 'B' accuracy [+/- 25%].***
Life Cycle Cost Estimates exclude contingency

Year from baseline	***0***	***5***	***10***	***15***	***20***	***25***	***30***	***35***	***40***	***45***	***50***	***55***	***60***	***EXPENDITURE (current dollars)***	***NET PRESENT VALUE***	***DIFFERENCE***	***% DIFFERENCE***
Year	***2,020***	***2,025***	***2,030***	***2,035***	***2,040***	***2,045***	***2,050***	***2,055***	***2,060***	***2,065***	***2,070***	***2,075***	***2,080***				
Mystery Bridge																	
Option 1																	
Do minimum																	
Replace Expansion Joint Seal	114,000													$114,000.00	$114,000.00		
Superstructure Replacement																	
10 Years - Replacement			11,272,460											$11,272,460.00	$7,615,270.07		
Repairs/Rehabilitation Every 20 Years																	
30 Years - Top Lift of ACP							279,200							$279,200.00	$86,082.57		
Repairs/Rehabilitation Every 40 Years																	
50 Years - Full Wearing Surface Replacement & Bearings											838,400			$838,400.00	$117,973.46		
														$12,504,060.00	**$7,933,326.10**		
Option 2A																	
Initial Rehabilitation - Fibre-Reinforced HPC Overylay	1,950,540													$1,950,540.00	$1,950,540.00		
First Cycle of Repairs/Rehabilitation																	
20 Years - Rehabilitation					1,950,540									$1,950,540.00	$890,200.99		
Second Cycle of Repairs /Rehabilitation																	
40 Years - Replacement								15,000,000						$15,000,000.00	$3,801,232.06		
														$18,901,080.00	**$6,641,973.05**	**$1,291,353.04**	**19.44%**
Option 2B																	
Initial Rehabilitation - PPC Overlay	5,182,340													$5,182,340.00	$5,182,340.00		
Seal Replacement																	
15 Years - Rehabilitation				114,000						114,000				$228,000.00	$82,816.77		
First Cycle of Repairs/Rehabilitation																	
30 Years - Rehabilitation							5,182,340							$5,182,340.00	$1,597,812.17		
Second Cycle of Repairs /Rehabilitation																	
60 Years - Replacement												15,000,000		$15,000,000.00	$1,734,832.69		
														$25,592,680.00	**$8,597,801.63**	**$664,475.53**	**-7.73%**
Option 3																	
Initial Rehabilitation - New Reinforced Concrete Deck	5,379,515													$5,379,515.00	$5,379,515.00		
First Cycle of Repairs/Rehabilitation and Bearing Replacement																	
40 Years - Rehabilitation								1,918,290						$1,918,290.00	$486,124.36		
Second Cycle of Repairs /Rehabilitation																	
60 Years - Replacement												15,000,000		$15,000,000.00	$1,734,832.69		
														$22,297,805.00	**$7,600,472.06**	**$332,854.04**	**4.38%**
Option 4																	
Superstructure Replacement	11,272,460													$11,272,460.00	$11,272,460.00		
Repairs/Rehabilitation Every 20 Years																	
20 Years - Top Lift of ACP					279,200								279,200	$558,400.00	$153,964.10		
Repairs/Rehabilitation Every 40 Years																	
40 Years - Full Wearing Surface Replacement & Bearings									838,400					$838,400.00	$174,629.54		
														$12,669,260.00	**$11,601,053.63**	**$6,221,538.63**	**-53.63%**

Future Rehabilitation Costs

Option 2A, 2B, and 3						
Item	**Quantity**	**Unit**	**Rate**	**Cost**		
Expansion Joints Seal Replacement					**$ 114,000**	
Strip Seal	76	m	$ 1,500	$ 114,000		
Expansion Joints Full Replacement					**$ 250,000**	
Supply and Delivery - Strip Seal	76	m	$ 2,200	$ 167,200		AT UPA - $2176 for 2017 - Total Replacement UPA - $3247
Installation	76	m	$ 1,089	$ 82,764		AT UPA - $575 for 2017 - increased to
Elastomeric Bearing Replacement					**$ 325,000**	
50 Bearings Total	50	ea	$ 6,500	$ 325,000		From Cost Estimate for Elastomeric Bearings
Complete Replacement					**$ 15,000,000**	
	2500	ea	$ 6,000	$ 15,000,000		From Cost Estimate for Elastomeric Bearings
Option 4						
Item	**Quantity**	**Unit**	**Rate**	**Cost**		
Wearing Surface Replacement (Top Lift Only)					**$ 279,200**	
Surface removal	2800	m2	$ 70	$ 196,000		AT UPA $68.91 for 2019
ACP	260	tonne	$ 320	$ 83,200		AT UPA $317.48 for 2019
Replacement of Waterproofing System & Wearing Surface					**$ 656,400**	
Surface Removal	2800	m2	$ 70	$ 196,000		AT UPA $68.91 for 2019
Sandblasting	2800	m2	$ 30	$ 84,000		AT UPA $31 for 2019
ACP	520	tonne	$ 320	$ 166,400		AT UPA $317.48 for 2019
Waterproofing	2800	m2	$ 75	$ 210,000		AT UPA $73.56 for 2019
Abutment Bearing Replacement					**$ 182,000**	
14 Bearings per Abutment - 2 Abutments	28	ea	$ 6,500	$ 182,000		From Cost Estimate for Elastomeric Bearings

Table C2.1
Typical service life of components
(See Clause C2.3.1.)

Component	Service life, years
Asphaltic concrete pavement	15–20
Hot applied rubberized waterproofing membrane	25–30
Concrete overlays with waterproofing	30
Steel coating systems	10–20
Timber wearing surfaces	5–10
Expansion joints	15–30
Expansion joint seals	5–15
Bearings under expansion or fixed joints	25–40