RÉSEAU ÉLECTRIQUE MÉTROPOLITAIN (REM) PROJECT

MONTREAL, QUEBEC

PRELIMINARY DESIGN & COST ESTIMATE GAP ANALYSIS

FINAL REPORT

June 23, 2017

Hanscomb

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PROJECT NUMBER: Ott-5337

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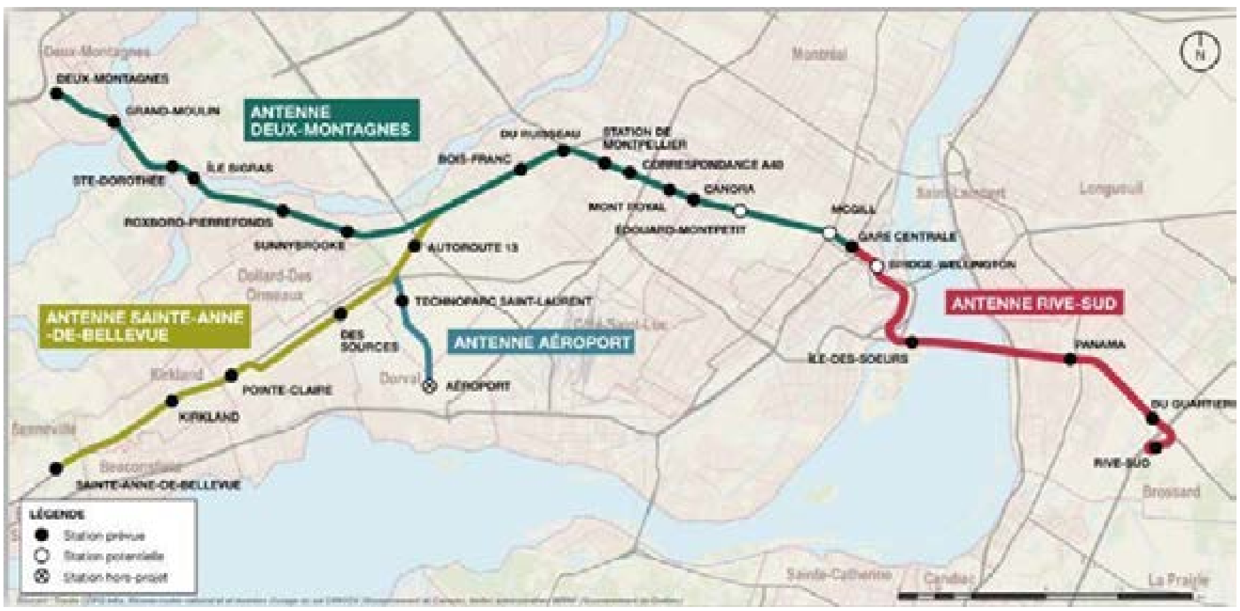
1.0 Preface Project Description

1.1 Overview of the project

The Réseau Électrique Métropolitain (REM) is 67km rapid transit system for the Greater Montreal area that would link several suburbswith Downtown Montreal via the Central Station. The REM includes 4 segments or branches namely: Deux-Montagnes (29.8 km), Rive-Sud (16.1 km), Sainte-Anne-de-Bellevue (16.5 km) and Montreal Airport (4.6 km). There will be a total of 27 stations (6 underground, 7 elevated and 14 surface) with Wi-Fi connection on the entire network. The system will be electric and fully automated. Traction power will be supplied using overhead catenary system. The stations will include an approximate 80m-long platforms, elevators, escalators, platform screen doors and will be integrated with existing transit networks and feeder buses. Park-and-ride facilities and bus terminals will be provided in some stations.

1.1.1 Project Network Map:



1.2 Deux-Montagnes Segment

1.2.1 Project Scope

- Implementation of approximately 32 km of new double track of which 5 km is in the interior Mont-Royal tunnel. The existing tracks and facilities will be replaced
- Conversion of existing 11 train stations along the REM including redevelopment of bus terminus, Park-and-ride parking stations, loading area, access roads for pedestrian and cyclist as well as other site development

1.0 Preface Project Description

1.2 Deux-Montagnes Segment (Cont.)

1.2.1 Project Scope (Cont.)

- Demolition or dismantling of all infrastructure or all systems particularly the existing train station platforms, signalisation system, the existing tracks and equipments as well as the existing traction power supply
- Construction of a new connecting station between the REM and the Mascouche train line
- Building of new overpasses to replace 13 at-grade crossings including the construction of an elevated track approximately 2.3 km long between the stations Sunnybrooke and Ile-Bigras, and redevelopment of the connecting roads affected.
- Closure of 2 at-grade crossings including the redevelopment of connecting roads affected.
- Construction of 2 new bridges for pedestrian and cyclists above the REM tracks
- Construction of a tiered railroad crossing (grade separation) at the west junction between the segment Sainte-Anne-de-Bellevue and segment Deux-Montagnes
- Doubling of the 4 railway bridges spanning along the rivière des Mille-iles and rivière des Prairies
- Doubling of the 2 railway overpass spanning along the roads of Bord-de-l'eau and Oka
- Doubling of a railway overpass spanning along the pedestrian path of Bois-de-Liesse Parc Nature
- Improvements to the security measures in the Mont-Royal tunnel including the construction of an evacuation and ventilation shaft.
- Conversion of the existing track power supply from 25 kV AC to 1500V DC
- Transformation of the existing maintenance facility at Saint-Eustache in adding a storage area, light maintenance workshop, train inspection system and a maintenance workshop for infrastructure, and a train command post.
- Construction of layover train storage facilities at the end of track line for the Mascouche trains, including 4 tail tracks
- Alignment of the track platform according to the new track lines and profiles
- Installation of new fencing along the railway right of way and other areas as required
- Reconstruction of the entire drainage system along the track lines, in trenches or in pipes and construction of station drainages
- Relocation or protection of technical urban networks in conflict
- Connecting to the existing technical urban networks as needed
- Make good existing infrastructures that are to be retained including bridges, roadways, lightings, signalisations, markings and buildings as per document A079.

1.0 Preface Project Description

1.2 Deux-Montagnes Segment (Cont.)

1.2.2 Stations (14)

- McGill
  - Underground station, platform type: no info available
- Edouart-Montpetit
  - Underground station, platform type: no info available
- Canora
  - Surface station, lateral platform
  - Bike stalls (100), Temp. Parking stalls (7)
- Mont-Royal
  - Surface station, lateral platform
  - Bike stalls (60), Temp. Parking stalls (8)
- Correspondance A40
  - Surface station, Central platform
  - Bike stalls (20), Temp. Parking stalls (6)
- Montpellier
  - Surface station, lateral platform
  - Bike stalls (6), Temp. Parking stalls (9)
- Du Ruisseau
  - Surface station, lateral platform
  - Bike stalls (45), Temp. Parking stalls (10), Park-and Ride (1060)
- Bois-Franc
  - Surface station, lateral platform
  - Bike stalls (80), Temp. Parking stalls (14), Park-and Ride (740)
- Sunny Brooke
  - Surface station, lateral platform
  - Bike stalls (30), Temp. Parking stalls (14), Park-and Ride (400)
- Roxboro-Pierrefonds
  - Elevated station, lateral platform
  - Bike stalls (50), Temp. Parking stalls (14), Park-and Ride (1040)
- Ile-Bigras
  - Surface station, lateral platform
  - Bike stalls (20), Temp. Parking stalls (2), Park-and Ride (45)
- Sainte-Dorothée
  - Surface station, lateral platform
  - Bike stalls (45), Temp. Parking stalls (8), Park-and Ride (975)

1.0 Preface Project Description

1.2 Deux-Montagnes Segment (Cont.)

1.2.2 Stations (14) (Cont.)

- Grand-Moulin
  - Surfacestation, lateral platform
  - Bike stalls (44), Temp. Parking stalls (6), Park-and Ride (230)
- Deux-Montagnes
  - Surfacestation, lateral platform
  - Bike stalls (10), Temp. Parking stalls (16), Park-and Ride (1160)

1.3 Rive-Sud Segment

1.3.1 Scope of Work

- The Segment Rive-Sud is divided into 3 sections:

Within the City of Montreal

- Construction of approximately 5 km of new double tracks including a power traction system of 1500V DC
- Construction of a new station at the interior of the Gare Central
- Demolition of a part of the existing structure at the south of the Gare Central for to construct in this structure the exit tunnel portal and the track of the REM within the Griffintown sector in order to access the Gare Central station
- Construction of a tunnel approximately 2.5 km completed in part rock and part covered trench, including 2 evacuation and ventilation ancillary structures between William street and business park of Pointe-Saint-Charles near the Mel's Studios
- Construction of an access to the existing service centre in the business park sector of the Ponte-Saint-Charles completed in trenches and short tunnels
- Construction of an elevated structure supporting the tracks approximately 1 km overhead the channel of the Saint-Laurent river between Montreal island and Nun's island.
- Construction of a station in the central median of Autoroute 10 on Nun's Island, including bus terminus, loading area, road access for pedestrians and cyclists as well as other site development
- Redevelopment of the local road networks in the Griffintown and Marc-Cantin sector
- Installation of fencing along the railway right-of-way and other site right-of-way as required
- Implementation of drainage system in the tracks and stations
- Relocation or protection of technical urban network in conflict
- Connecting to the existing technical urban networks as required

1.0 Preface Project Description

1.3 Rive-Sud Segment

1.3.1 Scope of Work (Cont.)

Within the New Saint Lawrence Bridge

- The works in the surroundingsof the New Saint-Lawrence Bridge, including the Nun's island, on the New Saint-Lawrence Bridge as well as the Rive-Sud up to the property limit of Infrastructure Canada is listed as under the area of responsibility of Infrastructure Canada. For reference, this sector is limited by the chainages 204+700 to 209+700 from the project reference. All works situated in the interior of this sector must be accomplished according to present particular requirements as well as according to the contents of all agreement with the pertinent parties.

Along Autoroute 10on the Rive-Sud

- Construction of approximately 6 km of new double track at grade in the central median of Autoroute 10including a traction power system of 1500V DC
- Modification to the bridge overpass foundations of Pelletier Boulevardover the Autoroute 10
- Construction of the Panama Station
- Extension of the existing pedestrian tunnelwestward under the off-ramp of Autoroute10 towards Taschereau Boulevard
- Construction of Panama busterminus, an undergroundPark-and-ride parking stations, a loading area, road access for pedestrians and cyclists as well as other site development
- Split-off from Autoroute10 approximately 1 km in two directions from the sector in Du Quartier Station
- Construction of the Du Quartier Station and a pedestrian bridge over the Autoroute 10in connection with future development
- Construction of an elevated structure supporting the tracks over Autorooute 10, approximately 1 km to access the Rive-Sud Station
- Construction of the Rive-Sud station in the South Quadrantof the Autoroute10/Autoroute 30 interchange
- Construction of a Rive-Sud bus terminus,a park-and-ride parking stations, loading area, road access for pedestrians and cyclists as well as other site development
- Construction of a road access via Autoroute 10 including the construction of an overpass on the Gobeil ascent.
- Construction of a workshop and storage adjoining the Rive-Sud Station including a storage area, train wash equipment, light-weight maintenance as well as train inspection system
- Installation of fencing along the railway right-of-way and other site as required

1.0 Preface Project Description

1.3 Rive-Sud Segment

1.3.1 Scope of Work (Cont.)

- Implementation of drainage system in the tracks and stations
- Connecting to the existing technical urban networks as required

1.3.2 Stations (6)

- Gare Centrale
  - Underground station, Central platform
- Bassin Peel
  - Underground station, platform type: no info available
- Ile-des-Soeurs
  - Surface station, lateral platform
  - Bike stalls (100), Temp. Parking stalls (38), Park and ride (700)
- Panama
  - Surface station, lateral platform
  - Bike stalls (200), Temp. Parking stalls (7)
- Du Quartier
  - Surface station, Central platform
  - Bike stalls (74), Temp. Parking stalls (6)
- Rive Sud
  - Elevated station, lateral platform
  - Bike stalls (50), Temp. Parking stalls (26), Park and ride (3000)

1.4 Sainte-Anne-de-Bellevue Segment

1.4.1 Scope of Work

- Construction of approximately 17km of new track including the track power system of 1500V DC, primarily on elevated structure, of which 6 km is at the interior of the existing Doney spur right-of-way and comprising of 3 highway crossings
- Dismantling of existing railway equipments from the Doney Spur including the demolition of a railway overpass over the Autoroute 40.
- Construction of Autoroute 13, Des Sources, Pointe-Clair, Kirkland and Sainte-Anne-de Bellevue Stations including bus terminus, park-and-ride stalls, loading area, road access for pedestrians and cyclists as well as other site development
- Construction of an on-grade railway crossing at the Airport junction on the Sainte-Anne-de-Bellevue segment
- Installation of fencing along the site right-of-way or where required
- Implementation of drainage system along tracks and stations

1.0 Preface Project Description

1.4 Sainte-Anne-de-Bellevue Segment

1.4.1 Scope of Work (Cont.)

- Connecting to the existing technical urban networks as required

1.4.2 Stations (5)

- Autoroute 13
  - Elevated station, lateral platform
  - Bike stalls (20), Temp. Parking stalls (6), Park-and Ride (500)
- Des Sources
  - Elevated station, lateral platform
  - Bike stalls (20), Temp. Parking stalls (6), Park-and Ride (500)
- Pointe-Claire
  - Elevated station, lateral platform
  - Bike stalls (50), Temp. Parking stalls (14), Park-and Ride (700)
- Kirkland
  - Elevated station, lateral platform
  - Bike stalls (25), Temp. Parking stalls (6), Park-and Ride (500)
- Sainte-Anne-Bellevue
  - Elevated station, lateral platform
  - Bike stalls (20), Temp. Parking stalls (26), Park-and Ride (200)

1.5 Aéroport Segment

1.5.1 Scope of Work

- Construction of the elevated structure, approximately 1 km between the Airport Junction and tunnel entrance, including traction power system of 1500V DC
- Construction of an underground station Technoparc, development of loading area along the street, development of road access for pedestrian and cyclists as well as other site development
- Redevelopment of the road network for the riverside properties
- Construction of a tunnel approximately 3 km under the airport runway and in the Technoparc Saint-Laurent including the trench transition
- Construction of a ventilation shaft at the north of tunnel
- Installation of fencing along the site right-of-way or where required
- Implementation of drainage system along the tracks and stations
- Relocation or protection of technical urban networks in conflict
- Connecting to the existing technical urban networks as required

1.0 Preface Project Description

1.5 Aéroport Segment

1.5.1 Scope of Work (Cont.)

Note: The work within the surroundings of the Montreal Airport (Airport station and related auxiliary structures) is listed under the areas of responsibility of the Montreal Airport. The Project Co must accomplish the work according to the requirements contained in all agreement with third party and with the Montreal Airport.

1.5.2 Stations (2)

- Technoparc Saint-Laurent
  - Underground station, lateral platform
  - Bike stalls (20), Temp. Parking stalls (6)
- Aéroport
  - Underground station, Central platform – by others
  - Park and ride – by others

20(1)(b):

20(1)(c), 20(1)(d)

13(1)(c):

20(1)(b):

[redacted]

1.0 Preface Project Description

13(1)(c):

[redacted]

20(1)(b):

20(1)(c), 20(1)(d)

1.0 Preface Project Description

20(1)(b):
20(1)(c), 20(1)(d)

13(1)(c):

[redacted]

1.0 Preface Project Description

13(1)(c):

1.6 Project Phasing (Cont.)

18(a)(b)

Below is the latest contractual dates and project schedule as per Schedule 2 Rev BC:

20(1)(b):

20(1)(c), 20(1)(d)

Activity/Phase	Contractual Dates
[redacted]	[redacted] 18(a)(b)

2.0 Hanscomb Roles & Responsibilities

2.1 Hanscomb Scope:

As per the Services Request form, Hanscomb's scope is as follows:

To complete an independent due diligence review and assessment of the Project's existing indicative design and cost estimates provided by CDPQ Infra and its advisors. The design and cost estimates due diligence review will be for the full lifecycle of the Project and include:

- Capital costs, civil works,
- Operations, maintenance, lifecycle/rehabilitation;
- Utilities, displacement,
- Site remediation/environmental contamination remediation
- Electrical works
- Supply of rolling stock,
- Control systems,
- SPV and development/administrative costs;
- Contingencies, and
- Project risks

To comment on the reasonableness and level of accuracy, assumptions, potential risks and explain any gaps in the design and cost estimates. The gap analysis will identify and recommend areas for further analysis and include a description and prioritization of next steps and activities requiredto fill these gaps. Hanscomb will also provide an assessment of:

- Potential issues/oversights in the indicative design,
- Volatility/sensitivity of cost components over the lifecycle of the assets; and
- The alignment/reasonableness of the project schedule with the proposed design.

Hanscomb is not to re-create the cost estimate; rather is expected to complete a detailed due diligence review and analysis of the existing indicative design and cost estimates, comment on their reasonableness and level of accuracy, and explain why any gaps in the design and cost estimates.

Throughout the course of the analysis phase of this assignment, Hanscomb will also provide ad-hoc advice to PPP Canada on matters related to design, engineering and cost analysis as requested.

2.0 Hanscomb Roles & Responsibilities

2.2 Expected Deliverables:

1st Deliverable: April 26, 2017

- First Draft – Preliminary Draft Design and Costing Review Report

2nd Deliverable: May 3, 2017

- Second Draft – Penultimate Design and Costing Review Report

3rd Deliverable: May 10, 2017

- Final Draft – Final Design and Costing Review Report

Note: The final draft deliverable date was moved to accommodate a meeting with CDPQ on May 11, 2017 and include additional time to review new documentation received after the meeting.

If Requested:

- A presentation of the Design and Costing Review Report Highlighting key findings

Note:

2.3 Exclusions

Our current exclusions of our review of the costing work provided by CDPQ are as follows:

Any cost associated with necessary agreements between the government of Canada and its agencies and the province of Quebec and its agencies.

We have not allocated or determined any costs for any government agency to cover any of their individual staff time associated with this project.

2.3 Methodology:

Our current methodology is to review and access all Hard and Soft costs as provided by PPP Canada. Our approach is to determine if the various material schedules follow a logical path and that the proposed unit rates reflect the general descriptions of the intended work.

We are also reviewing how this information in the details of the material and cost schedules are incorporated into the project total cost summaries. In addition, review and determine the rational of the project risk allowances and project specific contingencies.

We are also reviewing how this information in the details of the material and cost schedules are incorporated into the project total cost summaries. In addition, review and determine the rational of the project risk allowances and project specific contingencies.

2.0 Hanscomb Roles & Responsibilities

2.3 Methodology (Cont.):

The goal within the first deliverable is to develop a total project cost summary that can be followed for the duration of our assignment on this project. This will enable Hanscomb and the consultants to ensure that the project has complete cost coverage of all aspects of the project including specific contingencies to cover the projects current and future risks.

The project will continue to advance in engineering design over the next eight months. We have anticipated that some of the proposed work items may not advance to the point where the consultant team has provided their supporting cost details. We believe that the best approach is to identify any of these areas and work with the consultant team to determine an appropriated amount of funds to cover the specific areas of concern. As the project information improves these assessments will be updated and the cost allocations will be revisited and the costs adjusted to reflect the newly developed information.

2.3.1 Project Cost Planning & Control Services Scope of Work Outline

<u>**Introduction**</u>

The key objectives of capital cost planning and control for any construction project are:

- to keep expenditures within the amount allocated for each of the various elements or segments of the project
- to achieve the best value for each dollar spent
- to achieve a balanced expenditure between the various elements or segments of the project.

In order to achieve these objectives a systematic form of cost control must be established. Effective cost planning and control systems are integrated into and operate within the total project management structure.Any cost planning and control system, for whatever purpose, embodies the following principles:

- there must be a frame of reference containing a realistic first estimate of the project and a plan of how this will be spent
- there must be a control mechanism that allows feedback or checking of the original cost plan as the project proceeds
- there must be a clearly defined procedure for taking remedial action as the project proceeds.

2.0 Hanscomb Roles & Responsibilities

2.3 Methodology (Cont.):

The Cost Planning & Control Process

Participating as active members of the design team, Hanscomb's cost planners will begin by establishing a "cost plan" for the project which will be subdivided into elements or functional components, using the elemental cost estimating format prepared by the Canadian Institute of Quantity Surveyors (C.I.Q.S.). While these are 'elements' only loosely related to the traditional trade based estimating format used generally within the construction industry, there are distinct advantages in having this form of breakdown during the design stage. The subdivisions used in elemental estimates are immediately recognizable as design and functional components of the structure. Furthermore, there is a direct relationship between estimates of similar or even different structures, regardless of design and specification approach, which permits meaningful cost comparisons and analysis.

Once approved by the owner, the cost plan will set out the total cost limits for the project and will be subdivided into meaningful sections, each with its own cost and outline specifications stated. The cost plan will provide the frame of reference required as the first principle of an effective cost control system.

As the design proceeds, construction cost estimates will be prepared/reviewed at each milestone. These estimates will be based on the latest available design information completed to the highest level of detail commensurate with the submission documents for each stage. When complete, estimates will be reconciled with the Owner's approved budget. Should cost problems be identified, cost reduction strategies will be proposed for the Owner's approval. In this manner, the owner and design team will address cost problems in the most effective manner - as they are identified. This continuous cost checking and remedial action (the second and third principles of effective cost control) will be an integral part of the project design process.

Larger projects where the design and construction work is sequenced in a series of packages and stages, regular project Budget Status Reporting becomes a necessary control tool. Budget Status Reports are generated each month from a continuously updated database that includes such items as the original budget, owner approved changes, revised budget, latest estimate or contract value, contemplated changes, committed costs, contingency status, cashflows, etc. When combined with project schedules, the Budget Status Reports can also provide management timely comparisons of actual to forecast performance for each component and at every stage of the work. Each report can be customized to show varying levels of detail as required by various levels of management to monitor performance, identify problems and take the appropriate action.

2.0 Hanscomb Roles & Responsibilities

2.3 Methodology (Cont.):

Cost Planning Risk Management

In any estimate there is the potential for variation. In construction cost planning variations can be attributed to three primary sources:

- Incomplete, incorrect or misinterpreted design information;
- Cost escalation;
- Changes during construction.

The major objective of any construction cost plan is to arrive at a realistic and achievable 'bottom line', a total that an owner or manager can confidently carry into his project pro formas. The problem, then, is to address the risk of estimating variations within the cost plan, above the bottom line. The solution is to identify a contingency sum to absorb the costs of estimating variations without affecting the total.

The effective use of contingencies in construction cost planning requires a clear understanding of estimating risks in both a project specific and general construction market sense. The appropriate level of contingency is dependent on the amount of information available, knowledge of the design team's methods and philosophy, the timing of estimate preparation relative to the project design and construction schedule, and the anticipated complexity of the actual construction work.

Contingency assessment for a construction estimate is therefore divided into three distinct categories:

- Design and Pricing Contingency
- Escalation Contingency
- Post Contract (Change Orders) Contingency

The amount of total contingency carried will obviously vary dependent on project type and its point of progression through each stage of the design process, but the overall goal remains constant - to provide a realistic estimate of construction cost with a fixed and reliable bottom line.

Design and Pricing Contingency

The accuracy and detail of design information available to the construction cost planner will directly affect the precision of the completed estimate. It stands to reason that the better the information, the better the result. Unfortunately, it is almost always impractical to wait until the design is complete to undertake an estimate of its cost.

2.0 Hanscomb Roles & Responsibilities

2.3 Methodology (Cont.):

Months or even years of work may be required to bring a project to this stage only to find out that the whole venture is unaffordable. Cost Plans prepared at any stage during the design risk variation due to incomplete design information. The design and pricing contingency is applied to cushion the bottom line against these risks.

<u>It is important to note that the design and pricing contingency is not intended to accommodate program (scope) changes.</u> Changes to the owner's stated project requirements would necessarily result in corresponding adjustments to the budget.

<u>Escalation Contingency</u>
Within the construction industry, cost information is most readily available in current dollar terms. Contractors and suppliers can best provide cost information based on their current labour and material costs, volume of work, bidding conditions, type and size of project, expected construction duration, etc., all of which are known quantities today, but are subject to sporadic and sometimes unforeseeable changes in the future. It's no accident that contractors place time limitations on their bids.

It makes sense for construction cost planners to use the most accurate cost information available. In doing so, however, they produce estimates that reflect current market or bidding conditions. Where the design is incomplete or the actual construction start is to be delayed, there is the risk of cost increases due to escalation likely to occur between the time of estimate preparation and the commencement of work. The escalation contingency is applied to absorb any erosion in the buying power of the construction dollar during this interval.

Generally, it is assumed that cost escalation likely to occur during construction is included in the unit rates used to calculate the construction cost. For example, a painting contractor preparing a bid will take into account the timing of his work that may not commence until the project has been under construction for several months. He will make allowances for any expected labour and material cost increase during construction. However for megaprojects, or work undertaken over a protracted period of time, it may be necessary to consider other methods of estimating cost escalation during construction.

2.0 Hanscomb Roles & Responsibilities

2.3 Methodology (Cont.):

Post Contract (Change Order) Contingency

After the design is complete, the contract awarded and construction started, there will still be cost increases prior to the final accounting. Changes to the work will in all probability result in additional cost to the owner. Generally there are six reasons giving rise to changes in the work:

- Unforeseen conditions;
- Code changes applied retroactively;
- Minor co-ordination errors in drawings and specifications;
- Contractor proposed changes (usually credits);
- Owner requested changes;
- Errors and omissions

To the extent that changes result from unforeseen conditions, code changes or minor co-ordination difficulties, their correction will not usually materially affect the finished work, only the cost. The post contract contingency provides a fund to address these issues.

As previously discussed, owner requested changes that have the effect of changing the stated project requirements should be funded through amendment to the budget.

Contingency Amounts

Although the amount of contingency appropriate for a particular estimate will vary from project to project there are some general guidelines to follow. The contingency should reflect the type of project, it’s relative complexity, geographic location, current and anticipated market or bidding conditions, amount of design information available, printed or oral, the estimator’s experience and familiarity with the design team etc. and represent a consigns of all parties to the project.

The Design and Pricing Contingency will be highest at the beginning of the design stage when the amount of information available to the cost planner is minimal. As the design proceeds, and decisions regarding the project’s massing and materials are made the requirement for this contingency will reduce. At time of bid, when the documentation is 100% complete, there should be no further need of this contingency. For most new projects at the programming stage a design and pricing contingency of 10 - 20% should be adequate. The amount by which the contingency is reduced as the design advances must directly correspond to an increase in accuracy and detail of design information. Often, decisions to reduce the design and contingency too soon in the design process do not solve cost problems, just postpone them.

The Escalation Contingency will address anticipated changes in construction costs due to fluctuations in market conditions during the interval between cost plan preparation and project bid.

2.0 Hanscomb Roles & Responsibilities

2.3 Methodology (Cont.):

Forecasting construction cost escalation rates is a complex undertaking requiring careful assessment of a continually changing construction market. As these changes are, at best, difficult to predict, the escalation contingency should be monitored regularly and adjusted as required.

Finally, the determination of the Post Contingency (Change Order) Contingency must take into account the expected degree of difficulty to be encountered on site. Generally, renovation work presents more problems during construction than new work.

Contingency Guidelines for New Construction

	Pre-Schematic Design	Schematic Design	Design Develop-ment	Contract Documents	Tender & Award
Design	10 to 20%	7.5 to 10%	5 to 7.5%	1 to 5%	0 to 1%
Escalation	As required by prevailing market conditions				
Post Contract	Generally 1.5 to 3% for new infrastructure construction				

Careful and realistic contingency assessment is fundamental to the construction cost planning process. Properly used, contingencies afford owners and design professionals alike a measure of flexibility with a project budget to effectively manage project costs during design and construction.

Cost Planning & Control Activities

The following is a description of the construction cost planning and control activities that can be undertaken during the design and construction stages of any project to ensure the project budget is properly developed and respected. These activities apply to all work included within the mandate of the Project Control Specialist.

2.0 Hanscomb Roles & Responsibilities

2.3 Methodology (Cont.):

Order of Magnitude Phase

- assist design team throughout the masterplanning/functional programming phase in capital and life-cycle cost evaluation of required function criteria.
- recommend appropriate design, escalation and post contract (construction stage) contingencies for construction cost estimating risk management
- prepare Draft Order of Magnitude Estimate based on documentation available at completion of masterplanning/functional programming stage
- reconcile with approved budget and assist design team in preparation of cost reduction strategies as required
- prepare final Order of Magnitude Estimate incorporating all approved changes
- **Note**: often, the completed and approved Masterplan/Functional Area Estimate is adopted by the owner as the official Project Budget and is used as the baseline for all future cost control on the project.

Schematic Design Phase

- assist design team throughout the schematic design phase in capital and life-cycle cost evaluation of massing schemes, layouts, alternative systems and components, etc.
- review and recommend appropriate design, escalation and post contract (construction stage) contingencies for ongoing construction cost estimating risk management

The outline below is our Typical Methodology. However, on this project, the successful proponent team would follow this methodology internally.

Design Development Phase

- assist design team throughout the design development phase in capital and life-cycle cost evaluation of building materials and components, etc.
- review and recommend appropriate design, escalation and post contract (construction stage) contingencies for ongoing construction cost estimating risk management
- prepare Draft Cost Plan based on documentation available at completion of design development stage
- reconcile with approved budget and assist design team in preparation of cost reduction strategies as required
- prepare final Cost Plan incorporating all approved changes

2.0 Hanscomb Roles & Responsibilities

2.3 Methodology (Cont.):

Construction and Tender Documents and Tendering Phase

- assist design team throughout the construction and tender documents and tendering phase in capital and life-cycle cost evaluation of building materials and components, etc.
- review and recommend appropriate design, escalation and post contract (construction stage) contingencies for ongoing construction cost estimating risk management
- prepare Cost Checks at 30%, 60% and 90% completion milestones (or as required to suit specific project requirements) based on documentation available at that point
- reconcile each Cost Check with approved budget and assist design team in preparation of cost reduction strategies as required
- prepare final version of each Cost Check incorporating all approved changes
- prepare Pre-Tender Estimate based on tender documents
- review addenda issued during tender period and adjust Pre-Tender Estimate as required
- assist design team in tender review and negotiations leading up to award of contract

Construction and Post Construction Phase

- review and evaluate contractor's application for progress payments and recommend amounts payable
- review and recommend appropriate, escalation and post contract (construction stage) contingencies for ongoing construction cost estimating risk management
- review, evaluate and assist in the negotiation and settlement of contractor's submissions for additional money in relation to change orders, field instructions, etc.
- prepare final account for settlement with contractor upon completion of construction work
- coordinate with other consultants and include costs for work items outside of the Architect's mandate in estimates and reports as deemed appropriate by the Owner and Architect

General

- continuously monitor and advise team of current and expected future construction market conditions which may affect construction costs
- prepare construction escalation forecasts and update quarterly for use with all estimates
- coordinate with, and provide information to, scheduling and value management participate in presentation of cost estimates, reconciliations, cost reduction strategies, etc. to Owner as required
- Follow the detailed milestone steps for the preparation of each deliverable as outlined within our preliminary work plan level of effort

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13(1)(c): 18(a)(b)

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13(1)(c), 18(a)(b)

Strictly Private and Confidential

Analysis of Canada's Potential Participation in the REM

July 6, 2017

Blair Franklin

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Table of Contents

13(1)(c):

[redacted]

Executive Summary

18(a)(b)

13(1)(c):

Executive Summary

- Blair Frankln was retained by PPP Canada to provide advice and assist Canada in evaluating the project proposal from CDPQ regarding the REM in the Greater Montréal area

[redacted]

[redacted]

13(1)(c): 18(a)(b)

Introduction

18(a)(b)

13(1)(c):

Introduction

- Blair Franklin was engaged by PPP Canada on April 11, 2017 with respect to RFP PPP-042. Blair Franklin understands that the primary purpose of the engagement is to provide advice and assist Canada in evaluating its potential financial investment in the Réseau électrique metropolitan ("REM" or the "Project") in the Greater Montréal area

[redacted]

Scope of Review, Assumptions and Limitations

13(1)(c):

Scope of Review

- Blair Franklin has relied on both public and non-public information related to the REM, including the following:
  1. Public documents related to the REM including but not limited to project brochures or overviews, technical briefings, financial information notes, agreements and other material documents

[redacted]

- Blair Franklin has not independently verified any of the assumptions contained in the information provided by PPP Canada, their representatives or publicly disclosed by CDPQ

18(a)(b)

(1) In discussions with CDPQ, there been little to no indication of flexibility with respect to potential changes in the structure

Assumptions, Limitations and Conditions

- In conducting its analysis, Blair Franklin has:
  - Relied upon, without independent verification, the completeness, accuracy and fair representation of all information related to the Project that was provided to Blair Franklin by PPP Canada and their representatives or is publicly available
  - Based its analysis on prevailing market conditions
  - Acted under the assumption that there has been no material change in facts / circumstances of the information provided or otherwise available to Blair Franklin
- Analysis is at the date hereof
- We note that the preparation of this analysis is a complex process, and as such, all elements of Blair Franklin's analysis must be considered collectively
- This report is preliminary, subject to change and solely for the use of Canada and its representatives

All amounts are in CAD, unless otherwise stated

All references to years are calendar years, unless otherwise stated

Overview of the REM

18(a)(b)

13(1)(c):

Overview of the REM

- The REM will be a fully automated, electric light rail transit system ("LRT") comprised of 67 kilometres of dedicated rail lines including four branches connecting downtown Montréal, the South Shore, the West Island, the North Shore and Pierre-Elliott Trudeau Airport
  - It is anticipated that 50% of the tracks of the REM will occupy existing rail corridors and 30% will follow existing highways
  - Project will result in two new high-frequency public transit service lines to key employment hubs

18(a)(b)

- Once completed, it is anticipated that the REM will be the fourth largest automated transportation system in the world
  - The REM also represents the largest public transportation infrastructure investment for the region since the Montréal metro (inaugurated in 1966)
  - Implementation of the REM is underway with estimated operation of the first trains in 2020

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18(a)(b)

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13(1)(c):

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18(a)(b)

18(a)(b) 13(1)(c):

[redacted]

13(1)(c):

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Blair Franklin

18(a)(b)

18(a)(b)

13(1)(c):

[redacted]

13(1)(c):

[redacted]

18(a)(b)

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18(a)(b) 13(1)(c):

[redacted]

(1) Adjusted for a 50-year term
(2) Passenger kilometres assumption for the year beginning June 2024

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13(1)(c), 18(a)(b)

Requested Participation of Canada in the Réseau Électrique Métropolitain (REM) – Briefing Note

Introduction

18(a)(b)

Blair Franklin was retained by PPP CanadaInc. on April 11, 2017 to (i) review materials available on the REM Project (the “Project”), (ii) perform a valuation analysis of the requested participation of the Government of Canada (“GoC”) in the Project (“GoC Participation”) [redacted] 18(a)(b)

18(a)(b)

[redacted]

13(1)(c), 18(a)(b)

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13(1)(c), 18(a)(b)

[redacted]

RÉSEAU ÉLECTRIQUE MÉTROPOLITAIN (REM) PROJECT

MONTREAL, QUEBEC

PRELIMINARY DESIGN & COST ESTIMATE GAP ANALYSIS

FINAL REPORT

June 6, 2017

Hanscomb

RÉSEAU ÉLECTRIQUE MÉTROPOLITAIN (REM) PROJECT

MONTREAL, QUEBEC

PRELIMINARY DESIGN & COST ESTIMATE GAP ANALYSIS

FINAL REPORT

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June 6, 2017

PROJECT NUMBER: Ott-5337

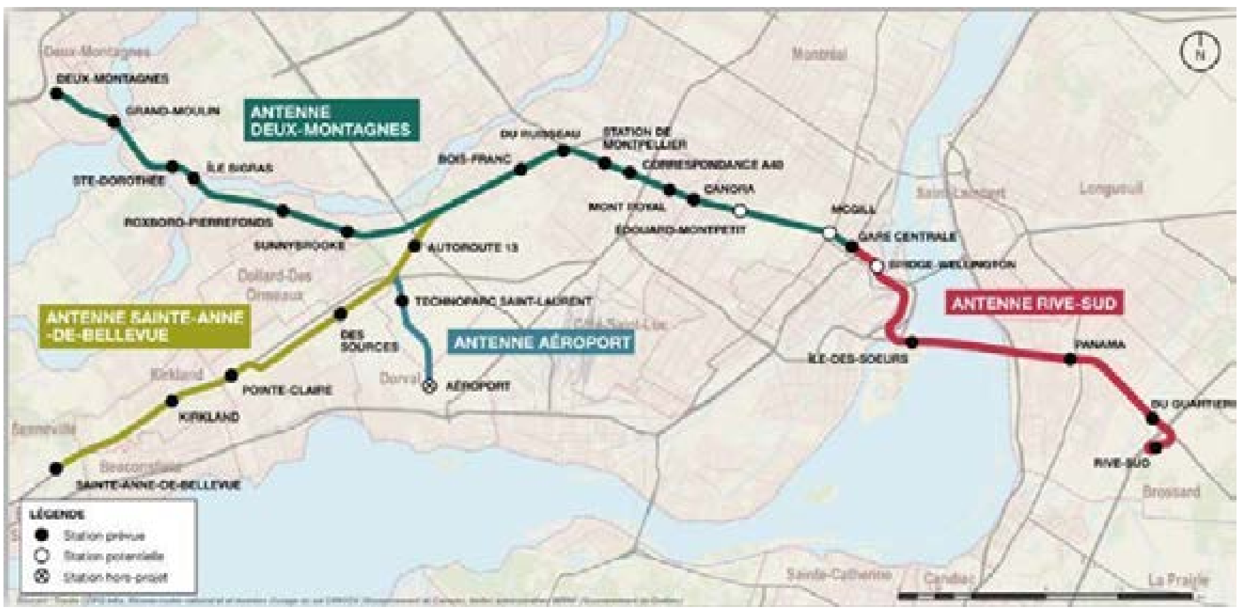
TABLE OF CONTENTS

1.0 Preface Project Description

1.1 Overview of the project

The Réseau Électrique Métropolitain (REM) is 67km rapid transit system for the Greater Montreal area that would link several suburbswith Downtown Montreal via the Central Station. The REM includes 4 segments or branches namely: Deux-Montagnes (29.8 km), Rive-Sud (16.1 km), Sainte-Anne-de-Bellevue (16.5 km) and Montreal Airport (4.6 km). There will be a total of 27 stations (6 underground, 7 elevated and 14 surface) with Wi-Fi connection on the entire network. The system will be electric and fully automated. Traction power will be supplied using overhead catenary system. The stations will include an approximate 80m-long platforms, elevators, escalators, platform screen doors and will be integrated with existing transit networks and feeder buses. Park-and-ride facilities and bus terminals will be provided in some stations.

1.1.1 Project Network Map:



1.2 Deux-Montagnes Segment

1.2.1 Project Scope

- Implementation of approximately 32 km of new double track of which 5 km is in the interior Mont-Royal tunnel. The existing tracks and facilities will be replaced
- Conversion of existing 11 train stations along the REM including redevelopment of bus terminus, Park-and-ride parking stations, loading area, access roads for pedestrian and cyclist as well as other site development

1.0 Preface Project Description

1.2 Deux-Montagnes Segment (Cont.)

1.2.1 Project Scope (Cont.)

- Demolition or dismantling of all infrastructure or all systems particularly the existing train station platforms, signalisation system, the existing tracks and equipments as well as the existing traction power supply
- Construction of a new connecting station between the REM and the Mascouche train line
- Building of new overpasses to replace 13 at-grade crossings including the construction of an elevated track approximately 2.3 km long between the stations Sunnybrooke and Ile-Bigras, and redevelopment of the connecting roads affected.
- Closure of 2 at-grade crossings including the redevelopment of connecting roads affected.
- Construction of 2 new bridges for pedestrian and cyclists above the REM tracks
- Construction of a tiered railroad crossing (grade separation) at the west junction between the segment Sainte-Anne-de-Bellevue and segment Deux-Montagnes
- Doubling of the 4 railway bridges spanning along the rivière des Mille-iles and rivière des Prairies
- Doubling of the 2 railway overpass spanning along the roads of Bord-de-l'eau and Oka
- Doubling of a railway overpass spanning along the pedestrian path of Bois-de-Liesse Parc Nature
- Improvements to the security measures in the Mont-Royal tunnel including the construction of an evacuation and ventilation shaft.
- Conversion of the existing track power supply from 25 kV AC to 1500V DC
- Transformation of the existing maintenance facility at Saint-Eustache in adding a storage area, light maintenance workshop, train inspection system and a maintenance workshop for infrastructure, and a train command post.
- Construction of new facilities at the end of track line for the Mascouche trains, particularly the technical facilities and 4 tail tracks
- Alignment of the track platform according to the new track lines and profiles
- Installation of new fencing along the railway right of way and other areas as required
- Reconstruction of the entire drainage system along the track lines, in trenches or in pipes and construction of station drainages
- Relocation or protection of technical urban networks in conflict
- Connecting to the existing technical urban networks as needed
- Make good all existing infrastructures that are to be retained including bridges, roadways, lightings, signalisations, markings and buildings as per document A079.

1.0 Preface Project Description

1.2 Deux-Montagnes Segment (Cont.)

1.2.2 Stations (14)

- McGill
  - Underground station, platform type: no info available
- Edouart-Montpetit
  - Underground station, platform type: no info available
- Canora
  - Surface station, lateral platform
  - Bike stalls (100), Temp. Parking stalls (7)
- Mont-Royal
  - Surface station, lateral platform
  - Bike stalls (60), Temp. Parking stalls (8)
- Correspondance A40
  - Surface station, Central platform
  - Bike stalls (20), Temp. Parking stalls (6)
- Montpellier
  - Surface station, lateral platform
  - Bike stalls (6), Temp. Parking stalls (9)
- Du Ruisseau
  - Surface station, lateral platform
  - Bike stalls (45), Temp. Parking stalls (10), Park-and Ride (1060)
- Bois-Franc
  - Surface station, lateral platform
  - Bike stalls (80), Temp. Parking stalls (14), Park-and Ride (740)
- Sunny Brooke
  - Surface station, lateral platform
  - Bike stalls (30), Temp. Parking stalls (14), Park-and Ride (400)
- Roxboro-Pierrefonds
  - Elevated station, lateral platform
  - Bike stalls (50), Temp. Parking stalls (14), Park-and Ride (1040)
- Ile-Bigras
  - Surface station, lateral platform
  - Bike stalls (20), Temp. Parking stalls (2), Park-and Ride (45)
- Sainte-Dorothée
  - Surface station, lateral platform
  - Bike stalls (45), Temp. Parking stalls (8), Park-and Ride (975)

1.0 Preface Project Description

1.2 Deux-Montagnes Segment (Cont.)

1.2.2 Stations (14) (Cont.)

- Grand-Moulin
  - Surfacestation, lateral platform
  - Bike stalls (44), Temp. Parking stalls (6), Park-and Ride (230)
- Deux-Montagnes
  - Surfacestation, lateral platform
  - Bike stalls (10), Temp. Parking stalls (16), Park-and Ride (1160)

1.3 Rive-Sud Segment

1.3.1 Scope of Work

- The Segment Rive-Sud is divided into 3 sections:

  <u>Within the City of Montreal</u>

- Construction of approximately 5 km of new double tracks including a power traction system of 1500V DC
- Construction of a new station at the interior of the Gare Central
- Demolition of a part of the existing structure at the south of the Gare Central for to construct in this structure the exit tunnel portal and the track of the REM within the Griffintown sector in order to access the Gare Central station
- Construction of a tunnel approximately 2.5 km completed in part rock and part covered trench, including 2 evacuation and ventilation ancillary structures between William street and business park of Pointe-Saint-Charles near the Mel's Studios
- Construction of an access to the existing service centre in the business park sector of the Ponte-Saint-Charles completed in trenches and short tunnels
- Construction of an elevated structure supporting the tracks approximately 1 km overhead the channel of the Saint-Laurent river between Montreal island and Nun's island.
- Construction of a station in the central median of Autoroute 10 on Nun's Island, including bus terminus, loading area, road access for pedestrians and cyclists as well as other site development
- Redevelopment of the local road networks in the Griffintown and Marc-Cantin sector
- Installation of fencing along the railway right-of-way and other site right-of-way as required
- Implementation of drainage system in the tracks and stations
- Relocation or protection of technical urban network in conflict
- Connecting to the existing technical urban networks as required

1.0 Preface Project Description

1.3 Rive-Sud Segment

1.3.1 Scope of Work (Cont.)

Within the New Saint Lawrence Bridge

- The works in the surroundingsof the New Saint-Lawrence Bridge, including the Nun's island, on the New Saint-Lawrence Bridge as well as the Rive-Sud up to the property limit of Infrastructure Canada is listed as under the area of responsibility of Infrastructure Canada. For reference, this sector is limited by the chainages 204+700 to 209+700 from the project reference. All works situated in the interior of this sector must be accomplished according to present particular requirements as well as according to the contents of all agreement with the pertinent parties.

Along Autoroute 10on the Rive-Sud

- Construction of approximately 6 km of new double track at grade in the central median of Autoroute 10including a traction power system of 1500V DC
- Modification to the bridge overpass foundations of Pelletier Boulevardover the Autoroute 10
- Construction of the Panama Station
- Extension of the existing pedestrian tunnelwestward under the off-ramp of Autoroute10 towards Taschereau Boulevard
- Construction of Panama busterminus, an undergroundPark-and-ride parking stations, a loading area, road access for pedestrians and cyclists as well as other site development
- Split-off from Autoroute10 approximately 1 km in two directions from the sector in Du Quartier Station
- Construction of the Du Quartier Station and a pedestrian bridge over the Autoroute 10in connection with future development
- Construction of an elevated structure supporting the tracks over Autorooute 10, approximately 1 km to access the Rive-Sud Station
- Construction of the Rive-Sud station in the South Quadrantof the Autoroute10/Autoroute 30 interchange
- Construction of a Rive-Sud bus terminus,a park-and-ride parking stations, loading area, road access for pedestrians and cyclists as well as other site development
- Construction of a road access via Autoroute 10 including the construction of an overpass on the Gobeil ascent.
- Construction of a workshop and storage adjoining the Rive-Sud Station including a storage area, train wash equipment, light-weight maintenance as well as train inspection system
- Installation of fencing along the railway right-of-way and other site as required

1.0 Preface Project Description

1.3 Rive-Sud Segment

1.3.1 Scope of Work (Cont.)

- Implementation of drainage system in the tracks and stations
- Connecting to the existing technical urban networks as required

1.3.2 Stations (6)

- Gare Centrale
  - Underground station, Central platform
- Bassin Peel
  - Underground station, platform type: no info available
- Ile-des-Soeurs
  - Surface station, lateral platform
  - Bike stalls (100), Temp. Parking stalls (38), Park and ride (700)
- Panama
  - Surface station, lateral platform
  - Bike stalls (200), Temp. Parking stalls (7)
- Du Quartier
  - Surface station, Central platform
  - Bike stalls (74), Temp. Parking stalls (6)
- Rive Sud
  - Elevated station, lateral platform
  - Bike stalls (50), Temp. Parking stalls (26), Park and ride (3000)

1.4 Sainte-Anne-de-Bellevue Segment

1.4.1 Scope of Work

- Construction of approximately 17km of new track including the track power system of 1500V DC, primarily on elevated structure, of which 6 km is at the interior of the existing Doney spur right-of-way and comprising of 3 highway crossings
- Dismantling of existing railway equipments from the Doney Spur including the demolition of a railway overpass over the Autoroute 40.
- Construction of Autoroute 13, Des Sources, Pointe-Clair, Kirkland and Sainte-Anne-de Bellevue Stations including bus terminus, park-and-ride stalls, loading area, road access for pedestrians and cyclists as well as other site development
- Construction of an on-grade railway crossing at the Airport junction on the Sainte-Anne-de-Bellevue segment
- Installation of fencing along the site right-of-way or where required
- Implementation of drainage system along tracks and stations

1.0 Preface Project Description

1.4 Sainte-Anne-de-Bellevue Segment

1.4.1 Scope of Work (Cont.)

- Connecting to the existing technical urban networks as required

1.4.2 Stations (5)

- Autoroute 13
  - Elevated station, lateral platform
  - Bike stalls (20), Temp. Parking stalls (6), Park-and Ride (500)
- Des Sources
  - Elevated station, lateral platform
  - Bike stalls (20), Temp. Parking stalls (6), Park-and Ride (500)
- Pointe-Claire
  - Elevated station, lateral platform
  - Bike stalls (50), Temp. Parking stalls (14), Park-and Ride (700)
- Kirkland
  - Elevated station, lateral platform
  - Bike stalls (25), Temp. Parking stalls (6), Park-and Ride (500)
- Sainte-Anne-Bellevue
  - Elevated station, lateral platform
  - Bike stalls (20), Temp. Parking stalls (26), Park-and Ride (200)

1.5 Aéroport Segment

1.5.1 Scope of Work

- Construction of the elevated structure, approximately 1 km between the Airport Junction and tunnel entrance, including traction power system of 1500V DC
- Construction of an undergroundstation Technoparc, development of loading area along the street, development of road access for pedestrian and cyclists as well as other site development
- Redevelopment of the road network for the riverside properties
- Construction of a tunnel approximately 3 km under the airport runway and in the Technoparc Saint-Laurent including the trench transition
- Construction of a ventilation shaft at the north of tunnel
- Installation of fencing along the site right-of-way or where required
- Implementation of drainage system along the tracks and stations
- Relocation or protection of technical urban networks in conflict
- Connecting to the existing technical urban networks as required

1.0 Preface Project Description

1.5 Aéroport Segment

1.5.1 Scope of Work (Cont.)

Note: The work within the surroundings of the Montreal Airport (Airport station and related auxiliary structures) is listed under the areas of responsibility of the Montreal Airport. The Project Co must accomplish the work according to the requirements contained in all agreement with third party and with the Montreal Airport.

1.5.2 Stations (2)

- Technoparc Saint-Laurent
  - Underground station, lateral platform
  - Bike stalls (20), Temp. Parking stalls (6)
- Aéroport
  - Underground station, Central platform – by others
  - Park and ride – by others

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20(1)(c), 20(1)(d)

13(1)(c):

13(1)(c):

1.0 Preface Project Description

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20(1)(b):

20(1)(c), 20(1)(d)

1.0 Preface Project Description

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20(1)(b):
20(1)(c), 20(1)(d)
13(1)(c):

1.0 Preface Project Description

13(1)(c):

1.6 Project Phasing (Cont.)

18(a)(b)

Below is the latest contractual dates and project schedule as per Schedule 2 Rev BC:

20(1)(b):

20(1)(c), 20(1)(d)

Activity/Phase	Contractual Dates
[redacted]	[redacted] 18(a)(b)

2.0 Hanscomb Roles & Responsibilities

2.1 Hanscomb Scope:

As per the Services Request form, Hanscomb's scope is as follows:

To complete an independent due diligence review and assessment of the Project's existing indicative design and cost estimates provided by CDPQ Infra and its advisors. The design and cost estimates due diligence review will be for the full lifecycle of the Project and include:

- Capital costs, civil works,
- Operations, maintenance, lifecycle/rehabilitation;
- Utilities, displacement,
- Site remediation/environmental contamination remediation
- Electrical works
- Supply of rolling stock,
- Control systems,
- SPV and development/administrative costs;
- Contingencies, and
- Project risks

To comment on the reasonableness and level of accuracy, assumptions, potential risks and explain any gaps in the design and cost estimates. The gap analysis will identify and recommend areas for further analysis and include a description and prioritization of next steps and activities requiredto fill these gaps. Hanscomb will also provide an assessment of:

- Potential issues/oversights in the indicative design,
- Volatility/sensitivity of cost components over the lifecycle of the assets; and
- The alignment/reasonableness of the project schedule with the proposed design.

Hanscomb is not to re-create the cost estimate; rather is expected to complete a detailed due diligence review and analysis of the existing indicative design and cost estimates, comment on their reasonableness and level of accuracy, and explain why any gaps in the design and cost estimates.

Throughout the course of the analysis phase of this assignment, Hanscomb will also provide ad-hoc advice to PPP Canada on matters related to design, engineering and cost analysis as requested.

2.0 Hanscomb Roles & Responsibilities

2.2 Expected Deliverables:

1st Deliverable: April 26, 2017

- First Draft – Preliminary Draft Design and Costing Review Report

2nd Deliverable: May 3, 2017

- Second Draft – Penultimate Design and Costing Review Report

3rd Deliverable: May 10, 2017

- Final Draft – Final Design and Costing Review Report

Note: The final draft deliverable date was moved to accommodate a meeting with CDPQ on May 11, 2017 and include additional time to review new documentation received after the meeting.

If Requested:

- A presentation of the Design and Costing Review Report Highlighting key findings

Note:

2.3 Exclusions

Our current exclusions of our review of the costing work provided by CDPQ are as follows:

Any cost associated with necessary agreements between the government of Canada and its agencies and the province of Quebec and its agencies.

We have not allocated or determined any costs for any government agency to cover any of their individual staff time associated with this project.

2.3 Methodology:

Our current methodology is to review and access all Hard and Soft costs as provided by PPP Canada. Our approach is to determine if the various material schedules follow a logical path and that the proposed unit rates reflect the general descriptions of the intended work.

We are also reviewing how this information in the details of the material and cost schedules are incorporated into the project total cost summaries. In addition, review and determine the rational of the project risk allowances and project specific contingencies.

We are also reviewing how this information in the details of the material and cost schedules are incorporated into the project total cost summaries. In addition, review and determine the rational of the project risk allowances and project specific contingencies.

2.0 Hanscomb Roles & Responsibilities

2.3 Methodology (Cont.):

The goal within the first deliverable is to develop a total project cost summary that can be followed for the duration of our assignment on this project. This will enable Hanscomb and the consultants to ensure that the project has complete cost coverage of all aspects of the project including specific contingencies to cover the projects current and future risks.

The project will continue to advance in engineering design over the next eight months. We have anticipated that some of the proposed work items may not advance to the point where the consultant team has provided their supporting cost details. We believe that the best approach is to identify any of these areas and work with the consultant team to determine an appropriated amount of funds to cover the specific areas of concern. As the project information improves these assessments will be updated and the cost allocations will be revisited and the costs adjusted to reflect the newly developed information.

2.3.1 Project Cost Planning & Control Services Scope of Work Outline

<u>**Introduction**</u>

The key objectives of capital cost planning and control for any construction project are:

- to keep expenditures within the amount allocated for each of the various elements or segments of the project
- to achieve the best value for each dollar spent
- to achieve a balanced expenditure between the various elements or segments of the project.

In order to achieve these objectives a systematic form of cost control must be established. Effective cost planning and control systems are integrated into and operate within the total project management structure.Any cost planning and control system, for whatever purpose, embodies the following principles:

- there must be a frame of reference containing a realistic first estimate of the project and a plan of how this will be spent
- there must be a control mechanism that allows feedback or checking of the original cost plan as the project proceeds
- there must be a clearly defined procedure for taking remedial action as the project proceeds.

2.0 Hanscomb Roles & Responsibilities

2.3 Methodology (Cont.):

The Cost Planning & Control Process

Participating as active members of the design team, Hanscomb's cost planners will begin by establishing a "cost plan" for the project which will be subdivided into elements or functional components, using the elemental cost estimating format prepared by the Canadian Institute of Quantity Surveyors (C.I.Q.S.). While these are 'elements' only loosely related to the traditional trade based estimating format used generally within the construction industry, there are distinct advantages in having this form of breakdown during the design stage. The subdivisions used in elemental estimates are immediately recognizable as design and functional components of the structure. Furthermore, there is a direct relationship between estimates of similar or even different structures, regardless of design and specification approach, which permits meaningful cost comparisons and analysis.

Once approved by the owner, the cost plan will set out the total cost limits for the project and will be subdivided into meaningful sections, each with its own cost and outline specifications stated. The cost plan will provide the frame of reference required as the first principle of an effective cost control system.

As the design proceeds, construction cost estimates will be prepared/reviewed at each milestone. These estimates will be based on the latest available design information completed to the highest level of detail commensurate with the submission documents for each stage. When complete, estimates will be reconciled with the Owner's approved budget. Should cost problems be identified, cost reduction strategies will be proposed for the Owner's approval. In this manner, the owner and design team will address cost problems in the most effective manner - as they are identified. This continuous cost checking and remedial action (the second and third principles of effective cost control) will be an integral part of the project design process.

Larger projects where the design and construction work is sequenced in a series of packages and stages, regular project Budget Status Reporting becomes a necessary control tool. Budget Status Reports are generated each month from a continuously updated database that includes such items as the original budget, owner approved changes, revised budget, latest estimate or contract value, contemplated changes, committed costs, contingency status, cashflows, etc. When combined with project schedules, the Budget Status Reports can also provide management timely comparisons of actual to forecast performance for each component and at every stage of the work. Each report can be customized to show varying levels of detail as required by various levels of management to monitor performance, identify problems and take the appropriate action.

2.0 Hanscomb Roles & Responsibilities

2.3 Methodology (Cont.):

Cost Planning Risk Management

In any estimate there is the potential for variation. In construction cost planning variations can be attributed to three primary sources:

- Incomplete, incorrect or misinterpreted design information;
- Cost escalation;
- Changes during construction.

The major objective of any construction cost plan is to arrive at a realistic and achievable 'bottom line', a total that an owner or manager can confidently carry into his project pro formas. The problem, then, is to address the risk of estimating variations within the cost plan, above the bottom line. The solution is to identify a contingency sum to absorb the costs of estimating variations without affecting the total.

The effective use of contingencies in construction cost planning requires a clear understanding of estimating risks in both a project specific and general construction market sense. The appropriate level of contingency is dependent on the amount of information available, knowledge of the design team's methods and philosophy, the timing of estimate preparation relative to the project design and construction schedule, and the anticipated complexity of the actual construction work.

Contingency assessment for a construction estimate is therefore divided into three distinct categories:

- Design and Pricing Contingency
- Escalation Contingency
- Post Contract (Change Orders) Contingency

The amount of total contingency carried will obviously vary dependent on project type and its point of progression through each stage of the design process, but the overall goal remains constant - to provide a realistic estimate of construction cost with a fixed and reliable bottom line.

Design and Pricing Contingency

The accuracy and detail of design information available to the construction cost planner will directly affect the precision of the completed estimate. It stands to reason that the better the information, the better the result. Unfortunately, it is almost always impractical to wait until the design is complete to undertake an estimate of its cost.

2.0 Hanscomb Roles & Responsibilities

2.3 Methodology (Cont.):

Months or even years of work may be required to bring a project to this stage only to find out that the whole venture is unaffordable. Cost Plans prepared at any stage during the design risk variation due to incomplete design information. The design and pricing contingency is applied to cushion the bottom line against these risks.

It is important to note that the design and pricing contingency is not intended to accommodate program (scope) changes. Changes to the owner's stated project requirements would necessarily result in corresponding adjustments to the budget.

Escalation Contingency

Within the construction industry, cost information is most readily available in current dollar terms. Contractors and suppliers can best provide cost information based on their current labour and material costs, volume of work, bidding conditions, type and size of project, expected construction duration, etc., all of which are known quantities today, but are subject to sporadic and sometimes unforeseeable changes in the future. It's no accident that contractors place time limitations on their bids.

It makes sense for construction cost planners to use the most accurate cost information available. In doing so, however, they produce estimates that reflect current market or bidding conditions. Where the design is incomplete or the actual construction start is to be delayed, there is the risk of cost increases due to escalation likely to occur between the time of estimate preparation and the commencement of work. The escalation contingency is applied to absorb any erosion in the buying power of the construction dollar during this interval.

Generally, it is assumed that cost escalation likely to occur during construction is included in the unit rates used to calculate the construction cost. For example, a painting contractor preparing a bid will take into account the timing of his work that may not commence until the project has been under construction for several months. He will make allowances for any expected labour and material cost increase during construction. However for megaprojects, or work undertaken over a protracted period of time, it may be necessary to consider other methods of estimating cost escalation during construction.

2.0 Hanscomb Roles & Responsibilities

2.3 Methodology (Cont.):

Post Contract (Change Order) Contingency

After the design is complete, the contract awarded and construction started, there will still be cost increases prior to the final accounting. Changes to the work will in all probability result in additional cost to the owner. Generally there are six reasons giving rise to changes in the work:

- Unforeseen conditions;
- Code changes applied retroactively;
- Minor co-ordination errors in drawings and specifications;
- Contractor proposed changes (usually credits);
- Owner requested changes;
- Errors and omissions

To the extent that changes result from unforeseen conditions, code changes or minor co-ordination difficulties, their correction will not usually materially affect the finished work, only the cost. The post contract contingency provides a fund to address these issues.

As previously discussed, owner requested changes that have the effect of changing the stated project requirements should be funded through amendment to the budget.

Contingency Amounts

Although the amount of contingency appropriate for a particular estimate will vary from project to project there are some general guidelines to follow. The contingency should reflect the type of project, it's relative complexity, geographic location, current and anticipated market or bidding conditions, amount of design information available, printed or oral, the estimator's experience and familiarity with the design team etc. and represent a consigns of all parties to the project.

The Design and Pricing Contingency will be highest at the beginning of the design stage when the amount of information available to the cost planner is minimal. As the design proceeds, and decisions regarding the project's massing and materials are made the requirement for this contingency will reduce. At time of bid, when the documentation is 100% complete, there should be no further need of this contingency. For most new projects at the programming stage a design and pricing contingency of 10 - 20% should be adequate. The amount by which the contingency is reduced as the design advances must directly correspond to an increase in accuracy and detail of design information. Often, decisions to reduce the design and contingency too soon in the design process do not solve cost problems, just postpone them.

The Escalation Contingency will address anticipated changes in construction costs due to fluctuations in market conditions during the interval between cost plan preparation and project bid.

2.0 Hanscomb Roles & Responsibilities

2.3 Methodology (Cont.):

Forecasting construction cost escalation rates is a complex undertaking requiring careful assessment of a continually changing construction market. As these changes are, at best, difficult to predict, the escalation contingency should be monitored regularly and adjusted as required.

Finally, the determination of the Post Contingency (Change Order) Contingency must take into account the expected degree of difficulty to be encountered on site. Generally, renovation work presents more problems during construction than new work.

Contingency Guidelines for New Construction

	Pre-Schematic Design	Schematic Design	Design Develop-ment	Contract Documents	Tender & Award
Design	10 to 20%	7.5 to 10%	5 to 7.5%	1 to 5%	0 to 1%
Escalation	As required by prevailing market conditions				
Post Contract	Generally 1.5 to 3% for new infrastructure construction				

Careful and realistic contingency assessment is fundamental to the construction cost planning process. Properly used, contingencies afford owners and design professionals alike a measure of flexibility with a project budget to effectively manage project costs during design and construction.

Cost Planning & Control Activities

The following is a description of the construction cost planning and control activities that can be undertaken during the design and construction stages of any project to ensure the project budget is properly developed and respected. These activities apply to all work included within the mandate of the Project Control Specialist.

2.0 Hanscomb Roles & Responsibilities

2.3 Methodology (Cont.):

Order of Magnitude Phase

- assist design team throughout the masterplanning/functional programming phase in capital and life-cycle cost evaluation of required function criteria.
- recommend appropriate design, escalation and post contract (construction stage) contingencies for construction cost estimating risk management
- prepare Draft Order of Magnitude Estimate based on documentation available at completion of masterplanning/functional programming stage
- reconcile with approved budget and assist design team in preparation of cost reduction strategies as required
- prepare final Order of Magnitude Estimate incorporating all approved changes
- **Note**: often, the completed and approved Masterplan/Functional Area Estimate is adopted by the owner as the official Project Budget and is used as the baseline for all future cost control on the project.

Schematic Design Phase

- assist design team throughout the schematic design phase in capital and life-cycle cost evaluation of massing schemes, layouts, alternative systems and components, etc.
- review and recommend appropriate design, escalation and post contract (construction stage) contingencies for ongoing construction cost estimating risk management

The outline below is our Typical Methodology. However, on this project, the successful proponent team would follow this methodology internally.

Design Development Phase

- assist design team throughout the design development phase in capital and life-cycle cost evaluation of building materials and components, etc.
- review and recommend appropriate design, escalation and post contract (construction stage) contingencies for ongoing construction cost estimating risk management
- prepare Draft Cost Plan based on documentation available at completion of design development stage
- reconcile with approved budget and assist design team in preparation of cost reduction strategies as required
- prepare final Cost Plan incorporating all approved changes

2.0 Hanscomb Roles & Responsibilities

2.3 Methodology (Cont.):

Construction and Tender Documents and Tendering Phase

- assist design team throughout the construction and tender documents and tendering phase in capital and life-cycle cost evaluation of building materials and components, etc.
- review and recommend appropriate design, escalation and post contract (construction stage) contingencies for ongoing construction cost estimating risk management
- prepare Cost Checks at 30%, 60% and 90% completion milestones (or as required to suit specific project requirements) based on documentation available at that point
- reconcile each Cost Check with approved budget and assist design team in preparation of cost reduction strategies as required
- prepare final version of each Cost Check incorporating all approved changes
- prepare Pre-Tender Estimate based on tender documents
- review addenda issued during tender period and adjust Pre-Tender Estimate as required
- assist design team in tender review and negotiations leading up to award of contract

Construction and Post Construction Phase

- review and evaluate contractor's application for progress payments and recommend amounts payable
- review and recommend appropriate, escalation and post contract (construction stage) contingencies for ongoing construction cost estimating risk management
- review, evaluate and assist in the negotiation and settlement of contractor's submissions for additional money in relation to change orders, field instructions, etc.
- prepare final account for settlement with contractor upon completion of construction work
- coordinate with other consultants and include costs for work items outside of the Architect's mandate in estimates and reports as deemed appropriate by the Owner and Architect

General

- continuously monitor and advise team of current and expected future construction market conditions which may affect construction costs
- prepare construction escalation forecasts and update quarterly for use with all estimates
- coordinate with, and provide information to, scheduling and value management participate in presentation of cost estimates, reconciliations, cost reduction strategies, etc. to Owner as required
- Follow the detailed milestone steps for the preparation of each deliverable as outlined within our preliminary work plan level of effort

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RÉSEAU ÉLECTRIQUE MÉTROPOLITAIN (REM) PROJECT

MONTREAL, QUEBEC

PRELIMINARY DESIGN & COST ESTIMATE GAP ANALYSIS

FINAL REPORT

May 31, 2017

RÉSEAU ÉLECTRIQUE MÉTROPOLITAIN (REM) PROJECT

MONTREAL, QUEBEC

PRELIMINARY DESIGN & COST ESTIMATE GAP ANALYSIS

FINAL REPORT

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May 31, 2017

PROJECT NUMBER: Ott-5337

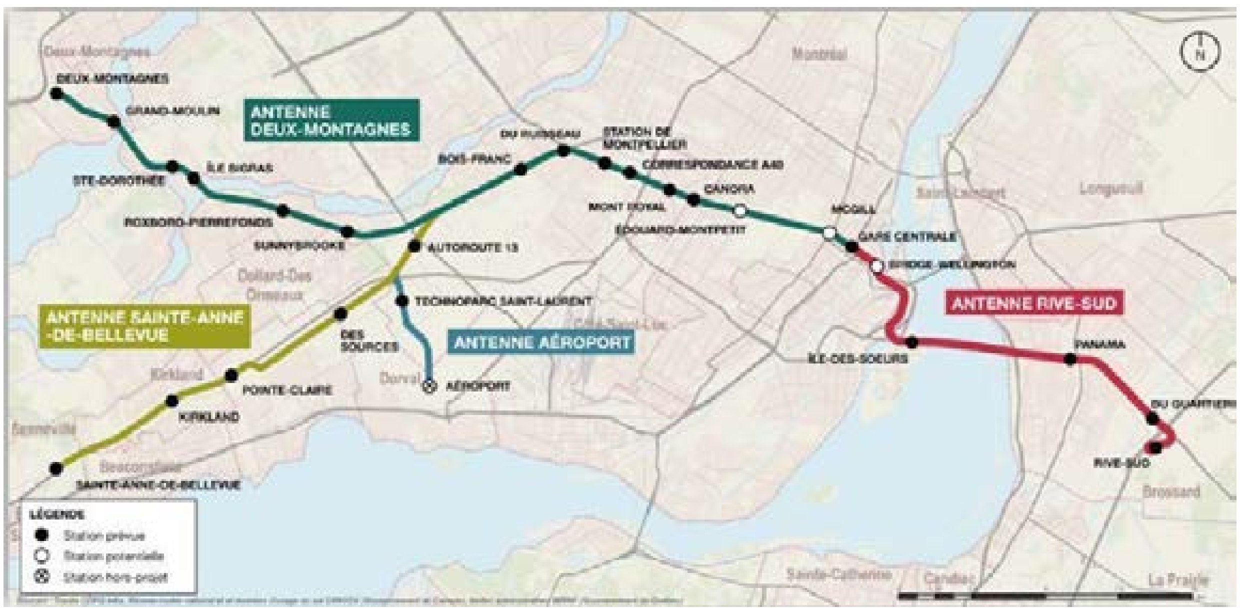
TABLE OF CONTENTS

1.0 Preface Project Description

1.1 Overview of the project

The Réseau Électrique Métropolitain (REM) is 67km rapid transit system for the Greater Montreal area that would link several suburbswith Downtown Montreal via the Central Station. The REM includes 4 segments or branches namely: Deux-Montagnes (29.8 km), Rive-Sud (16.1 km), Sainte-Anne-de-Bellevue (16.5 km) and Montreal Airport (4.6 km). There will be a total of 27 stations (6 underground, 7 elevated and 14 surface) with Wi-Fi connection on the entire network. The system will be electric and fully automated. Traction power will be supplied using overhead catenary system. The stations will include an approximate 80m-long platforms, elevators, escalators, platform screen doors and will be integrated with existing transit networks and feeder buses. Park-and-ride facilities and bus terminals will be provided in some stations.

1.1.1 Project Network Map:



1.2 Deux-Montagnes Segment

1.2.1 Project Scope

- Implementation of approximately 32 km of new double track of which 5 km is in the interior Mont-Royal tunnel. The existing tracks and facilities will be replaced
- Conversion of existing 11 train stations along the REM including redevelopment of bus terminus, Park-and-ride parking stations, loading area, access roads for pedestrian and cyclist as well as other site development

1.0 Preface Project Description

1.2 Deux-Montagnes Segment (Cont.)

1.2.1 Project Scope (Cont.)

- Demolition or dismantling of all infrastructure or all systems particularly the existing train station platforms, signalisation system, the existing tracks and equipments as well as the existing traction power supply
- Construction of a new connecting station between the REM and the Mascouche train line
- Building of new overpasses to replace 13 at-grade crossings including the construction of an elevated track approximately 2.3 km long between the stations Sunnybrooke and Ile-Bigras, and redevelopment of the connecting roads affected.
- Closure of 2 at-grade crossings including the redevelopment of connecting roads affected.
- Construction of 2 new bridges for pedestrian and cyclists above the REM tracks
- Construction of a tiered railroad crossing (grade separation) at the west junction between the segment Sainte-Anne-de-Bellevue and segment Deux-Montagnes
- Doubling of the 4 railway bridges spanning along the rivière des Mille-iles and rivière des Prairies
- Doubling of the 2 railway overpass spanning along the roads of Bord-de-l'eau and Oka
- Doubling of a railway overpass spanning along the pedestrian path of Bois-de-Liesse Parc Nature
- Improvements to the security measures in the Mont-Royal tunnel including the construction of an evacuation and ventilation shaft.
- Conversion of the existing track power supply from 25 kV AC to 1500V DC
- Transformation of the existing maintenance facility at Saint-Eustache in adding a storage area, light maintenance workshop, train inspection system and a maintenance workshop for infrastructure, and a train command post.
- Construction of new facilities at the end of track line for the Mascouche trains, particularly the technical facilities and 4 tail tracks
- Alignment of the track platform according to the new track lines and profiles
- Installation of new fencing along the railway right of way and other areas as required
- Reconstruction of the entire drainage system along the track lines, in trenches or in pipes and construction of station drainages
- Relocation or protection of technical urban networks in conflict
- Connecting to the existing technical urban networks as needed
- Make good all existing infrastructures that are to be retained including bridges, roadways, lightings, signalisations, markings and buildings as per document A079.

1.0 Preface Project Description

1.2 Deux-Montagnes Segment (Cont.)

1.2.2 Stations (14)

- McGill
  - Underground station, platform type: no info available
- Edouart-Montpetit
  - Underground station, platform type: no info available
- Canora
  - Surface station, lateral platform
  - Bike stalls (100), Temp. Parking stalls (7)
- Mont-Royal
  - Surface station, lateral platform
  - Bike stalls (60), Temp. Parking stalls (8)
- Correspondance A40
  - Surface station, Central platform
  - Bike stalls (20), Temp. Parking stalls (6)
- Montpellier
  - Surface station, lateral platform
  - Bike stalls (6), Temp. Parking stalls (9)
- Du Ruisseau
  - Surface station, lateral platform
  - Bike stalls (45), Temp. Parking stalls (10), Park-and Ride (1060)
- Bois-Franc
  - Surface station, lateral platform
  - Bike stalls (80), Temp. Parking stalls (14), Park-and Ride (740)
- Sunny Brooke
  - Surface station, lateral platform
  - Bike stalls (30), Temp. Parking stalls (14), Park-and Ride (400)
- Roxboro-Pierrefonds
  - Elevated station, lateral platform
  - Bike stalls (50), Temp. Parking stalls (14), Park-and Ride (1040)
- Ile-Bigras
  - Surface station, lateral platform
  - Bike stalls (20), Temp. Parking stalls (2), Park-and Ride (45)
- Sainte-Dorothée
  - Surface station, lateral platform
  - Bike stalls (45), Temp. Parking stalls (8), Park-and Ride (975)

1.0 Preface Project Description

1.2 Deux-Montagnes Segment (Cont.)

1.2.2 Stations (14) (Cont.)

- Grand-Moulin
  - Surface station, lateral platform
  - Bike stalls (44), Temp. Parking stalls (6), Park-and Ride (230)
- Deux-Montagnes
  - Surface station, lateral platform
  - Bike stalls (10), Temp. Parking stalls (16), Park-and Ride (1160)

1.3 Rive-Sud Segment

1.3.1 Scope of Work

- The Segment Rive-Sud is divided into 3 sections:

  <u>Within the City of Montreal</u>
- Construction of approximately 5 km of new double tracks including a power traction system of 1500V DC
- Construction of a new station at the interior of the Gare Central
- Demolition of a part of the existing structure at the south of the Gare Central for to construct in this structure the exit tunnel portal and the track of the REM within the Griffintown sector in order to access the Gare Central station
- Construction of a tunnel approximately 2.5 km completed in part rock and part covered trench, including 2 evacuation and ventilation ancillary structures between William street and business park of Pointe-Saint-Charles near the Mel's Studios
- Construction of an access to the existing service centre in the business park sector of the Ponte-Saint-Charles completed in trenches and short tunnels
- Construction of an elevated structure supporting the tracks approximately 1 km overhead the channel of the Saint-Laurent river between Montreal island and Nun's island.
- Construction of a station in the central median of Autoroute 10 on Nun's Island, including bus terminus, loading area, road access for pedestrians and cyclists as well as other site development
- Redevelopment of the local road networks in the Griffintown and Marc-Cantin sector
- Installation of fencing along the railway right-of-way and other site right-of-way as required
- Implementation of drainage system in the tracks and stations
- Relocation or protection of technical urban network in conflict
- Connecting to the existing technical urban networks as required

1.0 Preface Project Description

1.3 Rive-Sud Segment

1.3.1 Scope of Work (Cont.)

Within the New Saint Lawrence Bridge

- The works in the surroundingsof the New Saint-Lawrence Bridge, including the Nun's island, on the New Saint-Lawrence Bridge as well as the Rive-Sud up to the property limit of Infrastructure Canada is listed as under the area of responsibility of Infrastructure Canada. For reference, this sector is limited by the chainages 204+700 to 209+700 from the project reference. All works situated in the interior of this sector must be accomplished according to present particular requirements as well as according to the contents of all agreement with the pertinent parties.

Along Autoroute 10on the Rive-Sud

- Construction of approximately 6 km of new double track at grade in the central median of Autoroute 10including a traction power system of 1500V DC
- Modification to the bridge overpass foundations of Pelletier Boulevardover the Autoroute 10
- Construction of the Panama Station
- Extension of the existing pedestrian tunnelwestward under the off-ramp of Autoroute10 towards Taschereau Boulevard
- Construction of Panama busterminus, an undergroundPark-and-ride parking stations, a loading area, road access for pedestrians and cyclists as well as other site development
- Split-off from Autoroute10 approximately 1 km in two directions from the sector in Du Quartier Station
- Construction of the Du Quartier Station and a pedestrian bridge over the Autoroute 10in connection with future development
- Construction of an elevated structure supporting the tracks over Autorooute 10, approximately 1 km to access the Rive-Sud Station
- Construction of the Rive-Sud station in the South Quadrantof the Autoroute10/Autoroute 30 interchange
- Construction of a Rive-Sud bus terminus,a park-and-ride parking stations, loading area, road access for pedestrians and cyclists as well as other site development
- Construction of a road access via Autoroute 10 including the construction of an overpass on the Gobeil ascent.
- Construction of a workshop and storage adjoining the Rive-Sud Station including a storage area, train wash equipment, light-weight maintenance as well as train inspection system
- Installation of fencing along the railway right-of-way and other site as required

1.0 Preface Project Description

1.3 Rive-Sud Segment

1.3.1 Scope of Work (Cont.)

- Implementation of drainage system in the tracks and stations
- Connecting to the existing technical urban networks as required

1.3.2 Stations (6)

- Gare Centrale
  - Underground station, Central platform
- Bassin Peel
  - Underground station, platform type: no info available
- Ile-des-Soeurs
  - Surface station, lateral platform
  - Bike stalls (100), Temp. Parking stalls (38), Park and ride (700)
- Panama
  - Surface station, lateral platform
  - Bike stalls (200), Temp. Parking stalls (7)
- Du Quartier
  - Surface station, Central platform
  - Bike stalls (74), Temp. Parking stalls (6)
- Rive Sud
  - Elevated station, lateral platform
  - Bike stalls (50), Temp. Parking stalls (26), Park and ride (3000)

1.4 Sainte-Anne-de-Bellevue Segment

1.4.1 Scope of Work

- Construction of approximately 17km of new track including the track power system of 1500V DC, primarily on elevated structure, of which 6 km is at the interior of the existing Doney spur right-of-way and comprising of 3 highway crossings
- Dismantling of existing railway equipments from the Doney Spur including the demolition of a railway overpass over the Autoroute 40.
- Construction of Autoroute 13, Des Sources, Pointe-Clair, Kirkland and Sainte-Anne-de Bellevue Stations including bus terminus,park-and-ride stalls, loading area, road access for pedestrians and cyclists as well as other site development
- Construction of an on-grade railway crossing at the Airport junction on the Sainte-Anne-de-Bellevue segment
- Installation of fencing along the site right-of-way or where required
- Implementation of drainage system along tracks and stations

1.0 Preface Project Description

1.4 Sainte-Anne-de-Bellevue Segment

1.4.1 Scope of Work (Cont.)

- Connecting to the existing technical urban networks as required

1.4.2 Stations (5)

- Autoroute 13
  - Elevated station, lateral platform
  - Bike stalls (20), Temp. Parking stalls (6), Park-and Ride (500)
- Des Sources
  - Elevated station, lateral platform
  - Bike stalls (20), Temp. Parking stalls (6), Park-and Ride (500)
- Pointe-Claire
  - Elevated station, lateral platform
  - Bike stalls (50), Temp. Parking stalls (14), Park-and Ride (700)
- Kirkland
  - Elevated station, lateral platform
  - Bike stalls (25), Temp. Parking stalls (6), Park-and Ride (500)
- Sainte-Anne-Bellevue
  - Elevated station, lateral platform
  - Bike stalls (20), Temp. Parking stalls (26), Park-and Ride (200)

1.5 Aéroport Segment

1.5.1 Scope of Work

- Construction of the elevated structure, approximately 1 km between the Airport Junction and tunnel entrance, including traction power system of 1500V DC
- Construction of an undergroundstation Technoparc, development of loading area along the street, development of road access for pedestrian and cyclists as well as other site development
- Redevelopment of the road network for the riverside properties
- Construction of a tunnel approximately 3 km under the airport runway and in the Technoparc Saint-Laurent including the trench transition
- Construction of a ventilation shaft at the north of tunnel
- Installation of fencing along the site right-of-way or where required
- Implementation of drainage system along the tracks and stations
- Relocation or protection of technical urban networks in conflict
- Connecting to the existing technical urban networks as required

1.0 Preface Project Description

1.5 Aéroport Segment

1.5.1 Scope of Work (Cont.)

Note: The work within the surroundings of the Montreal Airport (Airport station and related auxiliary structures) is listed under the areas of responsibility of the Montreal Airport. The Project Co must accomplish the work according to the requirements contained in all agreement with third party and with the Montreal Airport.

1.5.2 Stations (2)

- Technoparc Saint-Laurent
  - Underground station, lateral platform
  - Bike stalls (20), Temp. Parking stalls (6)
- Aéroport
  - Underground station, Central platform – by others
  - Park and ride – by others
  - [redacted]

20(1)(b):
20(1)(c), 20(1)(d)

13(1)(c):

1.0 Preface Project Description

13(1)(c):

20(1)(b):

20(1)(c), 20(1)(d)

[redacted]

1.0 Preface Project Description

20(1)(b):

[redacted]

20(1)(c), 20(1)(d)

13(1)(c):

1.0 Preface Project Description

13(1)(c):

1.6 Project Phasing (Cont.)

18(a)(b)

Below is the latest contractual dates and project schedule as per Schedule 2 Rev BC:

20(1)(b):

20(1)(c), 20(1)(d)

Activity/Phase	Contractual Dates
[redacted]	[redacted]

18(a)(b)

2.0 Hanscomb Roles & Responsibilities

2.1 Hanscomb Scope:

As per the Services Request form, Hanscomb's scope is as follows:

To complete an independent due diligence review and assessment of the Project's existing indicative design and cost estimates provided by CDPQ Infra and its advisors. The design and cost estimates due diligence review will be for the full lifecycle of the Project and include:

- Capital costs, civil works,
- Operations, maintenance, lifecycle/rehabilitation;
- Utilities, displacement,
- Site remediation/environmental contamination remediation
- Electrical works
- Supply of rolling stock,
- Control systems,
- SPV and development/administrative costs;
- Contingencies, and
- Project risks

To comment on the reasonableness and level of accuracy, assumptions, potential risks and explain any gaps in the design and cost estimates. The gap analysis will identify and recommend areas for further analysis and include a description and prioritization of next steps and activities requiredto fill these gaps. Hanscomb will also provide an assessment of:

- Potential issues/oversights in the indicative design,
- Volatility/sensitivity of cost components over the lifecycle of the assets; and
- The alignment/reasonableness of the project schedule with the proposed design.

Hanscomb is not to re-create the cost estimate; rather is expected to complete a detailed due diligence review and analysis of the existing indicative design and cost estimates, comment on their reasonableness and level of accuracy, and explain why any gaps in the design and cost estimates.

Throughout the course of the analysis phase of this assignment, Hanscomb will also provide ad-hoc advice to PPP Canada on matters related to design, engineering and cost analysis as requested.

2.0 Hanscomb Roles & Responsibilities

2.2 Expected Deliverables:

1st Deliverable: April 26, 2017

- First Draft – Preliminary Draft Design and Costing Review Report

2nd Deliverable: May 3, 2017

- Second Draft – Penultimate Design and Costing Review Report

3rd Deliverable: May 10, 2017

- Final Draft – Final Design and Costing Review Report

Note: The final draft deliverable date was moved to accommodate a meeting with CDPQ on May 11, 2017 and include additional time to review new documentation received after the meeting.

If Requested:

- A presentation of the Design and Costing Review Report Highlighting key findings

Note:

2.3 Exclusions

Our current exclusions of our review of the costing work provided by CDPQ are as follows:

Any cost associated with necessary agreements between the government of Canada and its agencies and the province of Quebec and its agencies.

We have not allocated or determined any costs for any government agency to cover any of their individual staff time associated with this project.

2.3 Methodology:

Our current methodology is to review and access all Hard and Soft costs as provided by PPP Canada. Our approach is to determine if the various material schedules follow a logical path and that the proposed unit rates reflect the general descriptions of the intended work.

We are also reviewing how this information in the details of the material and cost schedules are incorporated into the project total cost summaries. In addition, review and determine the rational of the project risk allowances and project specific contingencies.

We are also reviewing how this information in the details of the material and cost schedules are incorporated into the project total cost summaries. In addition, review and determine the rational of the project risk allowances and project specific contingencies.

2.0 Hanscomb Roles & Responsibilities

2.3 Methodology (Cont.):

The goal within the first deliverable is to develop a total project cost summary that can be followed for the duration of our assignment on this project. This will enable Hanscomb and the consultants to ensure that the project has complete cost coverage of all aspects of the project including specific contingencies to cover the projects current and future risks.

The project will continue to advance in engineering design over the next eight months. We have anticipated that some of the proposed work items may not advance to the point where the consultant team has provided their supporting cost details. We believe that the best approach is to identify any of these areas and work with the consultant team to determine an appropriated amount of funds to cover the specific areas of concern. As the project information improves these assessments will be updated and the cost allocations will be revisited and the costs adjusted to reflect the newly developed information.

2.3.1 Project Cost Planning & Control Services Scope of Work Outline

Introduction

The key objectives of capital cost planning and control for any construction project are:

- to keep expenditures within the amount allocated for each of the various elements or segments of the project
- to achieve the best value for each dollar spent
- to achieve a balanced expenditure between the various elements or segments of the project.

In order to achieve these objectives a systematic form of cost control must be established. Effective cost planning and control systems are integrated into and operate within the total project management structure.Any cost planning and control system, for whatever purpose, embodies the following principles:

- there must be a frame of reference containing a realistic first estimate of the project and a plan of how this will be spent
- there must be a control mechanism that allows feedback or checking of the original cost plan as the project proceeds
- there must be a clearly defined procedure for taking remedial action as the project proceeds.

2.0 Hanscomb Roles & Responsibilities

2.3 Methodology (Cont.):

The Cost Planning & Control Process

Participating as active members of the design team, Hanscomb's cost planners will begin by establishing a "cost plan" for the project which will be subdivided into elements or functional components, using the elemental cost estimating format prepared by the Canadian Institute of Quantity Surveyors (C.I.Q.S.). While these are 'elements' only loosely related to the traditional trade based estimating format used generally within the construction industry, there are distinct advantages in having this form of breakdown during the design stage. The subdivisions used in elemental estimates are immediately recognizable as design and functional components of the structure. Furthermore, there is a direct relationship between estimates of similar or even different structures, regardless of design and specification approach, which permits meaningful cost comparisons and analysis.

Once approved by the owner, the cost plan will set out the total cost limits for the project and will be subdivided into meaningful sections, each with its own cost and outline specifications stated. The cost plan will provide the frame of reference required as the first principle of an effective cost control system.

As the design proceeds, construction cost estimates will be prepared/reviewed at each milestone. These estimates will be based on the latest available design information completed to the highest level of detail commensurate with the submission documents for each stage. When complete, estimates will be reconciled with the Owner's approved budget. Should cost problems be identified, cost reduction strategies will be proposed for the Owner's approval. In this manner, the owner and design team will address cost problems in the most effective manner - as they are identified. This continuous cost checking and remedial action (the second and third principles of effective cost control) will be an integral part of the project design process.

Larger projects where the design and construction work is sequenced in a series of packages and stages, regular project Budget Status Reporting becomes a necessary control tool. Budget Status Reports are generated each month from a continuously updated database that includes such items as the original budget, owner approved changes, revised budget, latest estimate or contract value, contemplated changes, committed costs, contingency status, cashflows, etc. When combined with project schedules, the Budget Status Reports can also provide management timely comparisons of actual to forecast performance for each component and at every stage of the work. Each report can be customized to show varying levels of detail as required by various levels of management to monitor performance, identify problems and take the appropriate action.

2.0 Hanscomb Roles & Responsibilities

2.3 Methodology (Cont.):

Cost Planning Risk Management

In any estimate there is the potential for variation. In construction cost planning variations can be attributed to three primary sources:

- Incomplete, incorrect or misinterpreted design information;
- Cost escalation;
- Changes during construction.

The major objective of any construction cost plan is to arrive at a realistic and achievable 'bottom line', a total that an owner or manager can confidently carry into his project pro formas. The problem, then, is to address the risk of estimating variations within the cost plan, above the bottom line. The solution is to identify a contingency sum to absorb the costs of estimating variations without affecting the total.

The effective use of contingencies in construction cost planning requires a clear understanding of estimating risks in both a project specific and general construction market sense. The appropriate level of contingency is dependent on the amount of information available, knowledge of the design team's methods and philosophy, the timing of estimate preparation relative to the project design and construction schedule, and the anticipated complexity of the actual construction work.

Contingency assessment for a construction estimate is therefore divided into three distinct categories:

- Design and Pricing Contingency
- Escalation Contingency
- Post Contract (Change Orders) Contingency

The amount of total contingency carried will obviously vary dependent on project type and its point of progression through each stage of the design process, but the overall goal remains constant - to provide a realistic estimate of construction cost with a fixed and reliable bottom line.

Design and Pricing Contingency

The accuracy and detail of design information available to the construction cost planner will directly affect the precision of the completed estimate. It stands to reason that the better the information, the better the result. Unfortunately, it is almost always impractical to wait until the design is complete to undertake an estimate of its cost.

2.0 Hanscomb Roles & Responsibilities

2.3 Methodology (Cont.):

Months or even years of work may be required to bring a project to this stage only to find out that the whole venture is unaffordable. Cost Plans prepared at any stage during the design risk variation due to incomplete design information. The design and pricing contingency is applied to cushion the bottom line against these risks.

It is important to note that the design and pricing contingency is not intended to accommodate program (scope) changes. Changes to the owner's stated project requirements would necessarily result in corresponding adjustments to the budget.

Escalation Contingency

Within the construction industry, cost information is most readily available in current dollar terms. Contractors and suppliers can best provide cost information based on their current labour and material costs, volume of work, bidding conditions, type and size of project, expected construction duration, etc., all of which are known quantities today, but are subject to sporadic and sometimes unforeseeable changes in the future. It's no accident that contractors place time limitations on their bids.

It makes sense for construction cost planners to use the most accurate cost information available. In doing so, however, they produce estimates that reflect current market or bidding conditions. Where the design is incomplete or the actual construction start is to be delayed, there is the risk of cost increases due to escalation likely to occur between the time of estimate preparation and the commencement of work. The escalation contingency is applied to absorb any erosion in the buying power of the construction dollar during this interval.

Generally, it is assumed that cost escalation likely to occur during construction is included in the unit rates used to calculate the construction cost. For example, a painting contractor preparing a bid will take into account the timing of his work that may not commence until the project has been under construction for several months. He will make allowances for any expected labour and material cost increase during construction. However for megaprojects, or work undertaken over a protracted period of time, it may be necessary to consider other methods of estimating cost escalation during construction.

2.0 Hanscomb Roles & Responsibilities

2.3 Methodology (Cont.):

Post Contract (Change Order) Contingency

After the design is complete, the contract awarded and construction started, there will still be cost increases prior to the final accounting. Changes to the work will in all probability result in additional cost to the owner. Generally there are six reasons giving rise to changes in the work:

- Unforeseen conditions;
- Code changes applied retroactively;
- Minor co-ordination errors in drawings and specifications;
- Contractor proposed changes (usually credits);
- Owner requested changes;
- Errors and omissions

To the extent that changes result from unforeseen conditions, code changes or minor co-ordination difficulties, their correction will not usually materially affect the finished work, only the cost. The post contract contingency provides a fund to address these issues.

As previously discussed, owner requested changes that have the effect of changing the stated project requirements should be funded through amendment to the budget.

Contingency Amounts

Although the amount of contingency appropriate for a particular estimate will vary from project to project there are some general guidelines to follow. The contingency should reflect the type of project, it's relative complexity, geographic location, current and anticipated market or bidding conditions, amount of design information available, printed or oral, the estimator's experience and familiarity with the design team etc. and represent a consigns of all parties to the project.

The Design and Pricing Contingency will be highest at the beginning of the design stage when the amount of information available to the cost planner is minimal. As the design proceeds, and decisions regarding the project's massing and materials are made the requirement for this contingency will reduce. At time of bid, when the documentation is 100% complete, there should be no further need of this contingency. For most new projects at the programming stage a design and pricing contingency of 10 - 20% should be adequate. The amount by which the contingency is reduced as the design advances must directly correspond to an increase in accuracy and detail of design information. Often, decisions to reduce the design and contingency too soon in the design process do not solve cost problems, just postpone them.

The Escalation Contingency will address anticipated changes in construction costs due to fluctuations in market conditions during the interval between cost plan preparation and project bid.

2.0 Hanscomb Roles & Responsibilities

2.3 Methodology (Cont.):

Forecasting construction cost escalation rates is a complex undertaking requiring careful assessment of a continually changing construction market. As these changes are, at best, difficult to predict, the escalation contingency should be monitored regularly and adjusted as required.

Finally, the determination of the Post Contingency (Change Order) Contingency must take into account the expected degree of difficulty to be encountered on site. Generally, renovation work presents more problems during construction than new work.

Contingency Guidelines for New Construction

	Pre-Schematic Design	Schematic Design	Design Develop-ment	Contract Documents	Tender & Award
Design	10 to 20%	7.5 to 10%	5 to 7.5%	1 to 5%	0 to 1%
Escalation	As required by prevailing market conditions				
Post Contract	Generally 1.5 to 3% for new infrastructure construction				

Careful and realistic contingency assessment is fundamental to the construction cost planning process. Properly used, contingencies afford owners and design professionals alike a measure of flexibility with a project budget to effectively manage project costs during design and construction.

Cost Planning & Control Activities

The following is a description of the construction cost planning and control activities that can be undertaken during the design and construction stages of any project to ensure the project budget is properly developed and respected. These activities apply to all work included within the mandate of the Project Control Specialist.

2.0 Hanscomb Roles & Responsibilities

2.3 Methodology (Cont.):

Order of Magnitude Phase

- assist design team throughout the masterplanning/functional programming phase in capital and life-cycle cost evaluation of required function criteria.
- recommend appropriate design, escalation and post contract (construction stage) contingencies for construction cost estimating risk management
- prepare Draft Order of Magnitude Estimate based on documentation available at completion of masterplanning/functional programming stage
- reconcile with approved budget and assist design team in preparation of cost reduction strategies as required
- prepare final Order of Magnitude Estimate incorporating all approved changes
- **Note**: often, the completed and approved Masterplan/Functional Area Estimate is adopted by the owner as the official Project Budget and is used as the baseline for all future cost control on the project.

Schematic Design Phase

- assist design team throughout the schematic design phase in capital and life-cycle cost evaluation of massing schemes, layouts, alternative systems and components, etc.
- review and recommend appropriate design, escalation and post contract (construction stage) contingencies for ongoing construction cost estimating risk management

The outline below is our Typical Methodology. However, on this project, the successful proponent team would follow this methodology internally.

Design Development Phase

- assist design team throughout the design development phase in capital and life-cycle cost evaluation of building materials and components, etc.
- review and recommend appropriate design, escalation and post contract (construction stage) contingencies for ongoing construction cost estimating risk management
- prepare Draft Cost Plan based on documentation available at completion of design development stage
- reconcile with approved budget and assist design team in preparation of cost reduction strategies as required
- prepare final Cost Plan incorporating all approved changes

2.0 Hanscomb Roles & Responsibilities

2.3 Methodology (Cont.):

Construction and Tender Documents and Tendering Phase

- assist design team throughout the construction and tender documents and tendering phase in capital and life-cycle cost evaluation of building materials and components, etc.
- review and recommend appropriate design, escalation and post contract (construction stage) contingencies for ongoing construction cost estimating risk management
- prepare Cost Checks at 30%, 60% and 90% completion milestones (or as required to suit specific project requirements) based on documentation available at that point
- reconcile each Cost Check with approved budget and assist design team in preparation of cost reduction strategies as required
- prepare final version of each Cost Check incorporating all approved changes
- prepare Pre-Tender Estimate based on tender documents
- review addenda issued during tender period and adjust Pre-Tender Estimate as required
- assist design team in tender review and negotiations leading up to award of contract

Construction and Post Construction Phase

- review and evaluate contractor’s application for progress payments and recommend amounts payable
- review and recommend appropriate, escalation and post contract (construction stage) contingencies for ongoing construction cost estimating risk management
- review, evaluate and assist in the negotiation and settlement of contractor’s submissions for additional money in relation to change orders, field instructions, etc.
- prepare final account for settlement with contractor upon completion of construction work
- coordinate with other consultants and include costs for work items outside of the Architect’s mandate in estimates and reports as deemed appropriate by the Owner and Architect

General

- continuously monitor and advise team of current and expected future construction market conditions which may affect construction costs
- prepare construction escalation forecasts and update quarterly for use with all estimates
- coordinate with, and provide information to, scheduling and value management participate in presentation of cost estimates, reconciliations, cost reduction strategies, etc. to Owner as required
- Follow the detailed milestone steps for the preparation of each deliverable as outlined within our preliminary work plan level of effort

[redacted]

13(1)(c), 18(a)(b)

[redacted]

13(1)(c), 18(a)(b)

[redacted]

13(1)(c), 18(a)(b)

[redacted]

13(1)(c), 18(a)(b)

[redacted]

13(1)(c), 18(a)(b)

[redacted]

13(1)(c), 18(a)(b)

[redacted]

13(1)(c), 18(a)(b)

[redacted]

13(1)(c), 18(a)(b)

[redacted]

13(1)(c), 18(a)(b)

[redacted]

13(1)(c), 18(a)(b)

[redacted]

13(1)(c), 18(a)(b)

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13(1)(c), 18(a)(b)

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13(1)(c), 18(a)(b)

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13(1)(c), 18(a)(b)

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13(1)(c), 18(a)(b)

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13(1)(c), 18(a)(b)

[redacted]

13(1)(c), 18(a)(b)

[redacted]

13(1)(c), 18(a)(b)

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13(1)(c), 18(a)(b)

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13(1)(c), 18(a)(b)

13(1)(c):

Initial Assessment: Réseau Électrique Métropolitain (REM) Project

18(a)(b)

- **Overview:** The REM Project (the Project) will be procured using the CDPQ Infra model (where CDPQ Infra is responsible for the planning, development and delivery of the project as well as participating as an equity investor). [redacted]

18(a)(b)

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18(a)(b)

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REM | Analysis To Date

Deputy Minister Advisory– 2017.02.01

Presentation Outline

- Project Overview
- Financial Structure
- Costs
- Revenues
- Returns
- Next Steps

PROJECT OVERVIEW

System Map


DEUX-MONTAGNES
GRAND-MOULIN
SAINTE-DOROTHÉE
ÎLE-BIGRAS
ROXBORO-PIERREFONDS
SUNNYBROOKE
BOIS-FRANC
DU RUISSEAU
MONTPELLIER
CORRESPONDANCE A40
MONT-ROYAL
CANORA
ÉDOUARD-MONTPETIT
McGILL
BONAVENTURE GARE CENTRALE
BASSIN PEEL
ÎLE-DES-SOEURS
PANAMA
CHEVRIER
DU QUARTIER
RIVE-SUD
SAINTE-ANNE-DE-BELLEVUE
KIRKLAND
POINTE-CLAIRE
DES SOURCES
AUTOROUTE 13
TECHNOPARC MONTRÉAL
MONTRÉAL-TRUDEAU AIRPORT
DIRECTION VAUDREUIL-HUDSON
DIRECTION BLAINVILLE-SAINT-JÉRÔME
DIRECTION REPENTIGNY MASCOUCHE
DIRECTION MONT-SAINT-HILAIRE
DIRECTION CANDIAC
MONTMORENCY
DE LA CONCORDE
SAINT-MICHEL
HONORÉ-BEAUGRAND
CÔTE-VERTU
BERRI-UQAM
LONGUEUIL-UNIVERSITÉ-DE-SHERBROOKE
SNOWDON
ANGRIGNON
LEGEND
REM
Planned station
Potential station
Intermodal station
Metro station
Commuter train line

Project Description

- Electric, fully automated light rail (LRT) network
  - 67 kilometres of twinned tracks with 27 stations
  - Initial fleet of approx. 200 electric powered rolling stock
  - Below, above and at grade routes
- Integrated network linking downtown Montreal, South Shore, West Island, North Shore and the airport
  - LRT over New Champlain Bridge Corridor to South shore and airport to west
  - Integration of network & feeder buses and connection to other metro lines

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ANALYSIS: External Advisor

- PPP Canada is engaging an Engineering & Costing firm to develop an independent Class D cost estimate of construction and operating costs using available information
  - Review CDPQ Design & Costing work to date (**Annexed**)
  - Serve as an on-going resource

13(1)(c):

- Engage/Complete: approx. 3 wks./2-6 wks.

[redacted]

18(a)(b)

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ANALYSIS: External Advisor

- PPP Canada is engaging a Forecasting firm to: (**Annexed**)
  - Review forecasting work done by CDPQ
  - Advise on potential correction factors to apply to CDPQ forecast
  - Serve as an on-going resource
- Engage/Complete: approx. 3 wks./2-4 wks.

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Réseau Electrique Métropolitain (REM)

Project Summary and Analysis

This paper is intended to provide PPP Canada management with a summary and analysis of the REM project, and is based on previously shared information and recent public sources. It is provided with a view towards identifying what would be needed to develop a more comprehensive approach to analyzing federal interests in the project.

It starts with a description of the project itself, the scope and location of the system. It then describes the proponent and the procurement model, the key terms of the recently-issued Request for Qualifications, and the budget and necessary approvals for the project. It then presents an analysis of the main issues that may affect the project, such as risk transfer, governance and integration with existing transit fares and systems, and outlines next steps.

I. Project description and scope

The project is proposed to be a major new automated rapid transit system linking the City of Montreal with surrounding suburban areas to the north, south and west. It was originally conceived as two separate LRT projects, one connecting the south shore to the downtown over the new bridge on the St. Lawrence, and another connecting downtown to the Montreal-Trudeau Airport and the west island. Now it is conceived as one system with several lines, connecting the south shore to downtown, the airport, and Sainte-Anne de Bellevue on the west island, with a branch to Deux Montagnes to the north.

The scope of the project includes 67 kilometres of double track, 24 stations, nine bus terminals, and 13 parking facilities. Several tunnels are required, 3 km on the south shore branch and 2.5 km in the west. 20 hour/day, 7 days/week operations are planned, with three minute headways during peak hours, and up to 12 minute headways in off-peak hours. The project includes the acquisition, operations and maintenance of 200+ vehicles.

The technology chosen is light rail transit (LRT), and much like Vancouver's SkyTrain system, it is to be an automated, driverless system, fully separated from traffic.

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13(1)(c), 18(a)(b)

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REM | Additional Scenarios

Deputy Minister Advisory– 2017.02.08

Context

13(1)(c):

- In response to analysis presented on 2017.02.01, the DM Advisory group expressed interest in additional sensitivity scenarios

18(a)(b)

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18(a)(b)

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REM | Preliminary Advisor Observations

Deputy Minister Advisory– 2017.05.15

Updated 2017.05.09

Presentation Outline

18(a)(b)

- Updates on engagement of consultants
  - Design and Costing (Hanscomb)
  - Ridership (HDR)
  - Investment Bank (Blair Franklin)

13(1)(c):

[redacted] 18(a)(b)

Design and Costing

Status

- Hanscomb has:
  - reviewed available design & costing related materials
  - met with CDQPI's design & costing team – May 11th
  - met with investment banking advisory team with a focus on information sharing and coordinating deliverables
- Draft reportin production – May
- Final deliverable – Beginning of June

13(1)(c), 18(a)(b)

13(1)(c), 18(a)(b)

Status

- HDR has:
  - Reviewed all publicly available ridership related reports and data
  - met with CDQPI's ridership forecasting team – May 5th
  - reviewed supplementary ridership information provided by SDG
  - met with investment banking consultant team
- Draft reportin production – May
- Final deliverable – Beginning of June

13(1)(c), 18(a)(b)

13(1)(c), 18(a)(b)

Status

- Blair Franklin has:
  - Reviewed all available project documentation related to the financial and commercial structure of the project
  - Met with CDPQI's financial team – May 12th
  - Liaised other consultant teams to share information and coordinate deliverables
- Draft reportin production – May
- Final deliverable – Beginning of June

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Final Report

Due Diligence Review of the Ridership Forecast for the Réseau Électrique Métropolitain Project

PPP Canada

Ottawa, ON

July 12, 2017

Contents

Figures

Tables

Executive Summary

HDR has conducted a review of the ridership forecasts provided for the Réseau Électrique Métropolitaine (REM), an intended network of light-rail lines covering the Montréal metropolitan area. These forecasts were documented in the February 2017 Réseau Électrique Métropolitain (REM) | REM Forecasting Report ("the forecasting report") prepared by Steer Davies Gleave (SDG) for CPDQ Infrastructure Inc, and in supporting reports, files and responses to our queries. The review, based on the parameters, comparisons and outputs described in the forecasting report, has incorporated an assessment of (a) the reasonableness and applicability of the modelling approach and methodology; (b) the reasonableness and accuracy of the inputs and assumptions; and (c) the resulting dependability of the ridership forecasts. It has not included a direct review of the modelling files and we have assumed that the numbers contained in the report represent an accurate transcription of the output of the model that was run according to the described methodology. This report focuses on providing an assessment of the reasonability of the ridership forecasts projected in the REM study and the extent to which these may be impacted by input and processing assumptions.

18(a)(b)

A summary of the resulting findings and observations is included below:

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18(a)(b)

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1. Introduction

HDR has been requested by PPP Canada to provide an independent opinion on the accuracy and quality of the ridership forecasts provided for the Réseau Électrique Métropolitaine (REM), an intended network of light-rail lines covering the Montréal metropolitan area. This review is based primarily on the information contained in the February 2017 Réseau Électrique Métropolitain (REM) | REM Forecasting Report ("the forecasting report") prepared by Steer Davies Gleave (SDG) for CPDQ Infrastructure Inc. Supporting information, including a description of input and calibration data and the stated preference survey (in the data collection report) and additional spreadsheets containing breakdowns of land use and demand, was also requested and reviewed. However, the scope of the review does not include direct analysis of modelling files—the assessment of the model is based on the parameters, comparisons and outputs described in the forecasting report.

In summary, HDR has undertaken to review:

- The reasonableness and applicability of the modelling approach and methodology
- The reasonableness and accuracy of the inputs and assumptions
- The resulting dependability of the ridership forecasts

Each of these is assessed in a separate section of this report.

This report does not evaluate other aspects that may influence the decision to construct the REM network, such as technical feasibility, environmental impacts, or project cost, and focuses only on providing an assessment of the reasonability of the ridership forecasts projected in the forecasting report and the extent to which these may be impacted by input and processing assumptions.

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