



**Office of the Auditor General: Audit of Light Rail
Transit Planning and Change Management –
Interim Report, Tabled at Audit Committee –
December 1, 2016**

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Acknowledgments

The team responsible for this audit, comprised of Ted Pender, Austin Jenkins and Dana Mersich, under the supervision of Ken Hughes and the direction of Ed Miner, would like to thank those individuals who contributed to this project, and particularly, those who provided insights and comments as part of this audit.

Original signed by:

Auditor General

Executive Summary

Purpose

This provides an interim report for the Audit of Light Rail Transit Planning and Change Management. This audit examined the operational plans, risk and change management processes for City's transition from operating a primarily bus system to operating the combined bus and rail network.

Rationale

The Light Rail Transit (LRT) project is a key part of the Transportation Master plan and aims to make it more attractive and easier for residents and visitors to move through the city of Ottawa using transit. Phase 1 of Ottawa's LRT system is called the Confederation Line. This \$2.1 billion project includes financial contributions from the provincial and federal governments.

As of May and June 2016, the time of our fieldwork, construction of the Confederation Line was underway, and the Line is intended to start full revenue service in the spring of 2018. The City of Ottawa has retained the Rideau Transit Group (RTG) to work on this project as part of a public-private partnership. RTG is a consortium of Canadian and international companies that is currently working closely with the City's Rail Implementation Office (RIO) and Transit Service. Within the City, RIO is the lead on the project and oversees project planning for the overall design, engineering, construction and commissioning of the Confederation Line. RTG will design and build the Confederation Line and maintain it until 2048. OC Transpo (OCT) will operate the LRT system, together with the existing O-Train (Trillium Line) and the bus network.

Many customer-facing and internal systems will undergo significant changes so that the City can operate the new light rail system. The ability to achieve a successful transition from a bus system to a combined bus and rail network requires complete transition plans; an effective governance structure to manage critical risks related to achieving planned targets and successful transition; and a consistent understanding of key elements of system acceptance.

This audit is intended to give City Council assurance that that these processes and structures are in place and working effectively to achieve a successful transition in 2018. The audit team included a Subject Matter Expert (SME) in order to better understand the risk associated with this transition. He has 40 years of experience in

bus and rail public transit operations, including being responsible for the operation and maintenance of three North American light rail systems.

Findings

The following are preliminary findings and relate to planning and change management conditions from the time of OCT's Operational Risk Management session in 2015 to the time of the audit in May and June 2016.

At this time, it is not possible to conclude on the audit objectives as several key parts of the transition plans will be further developed in late 2016 and early 2017. Our SME reviewed the timing for these components and deemed it to be reasonable and in line with industry norms. We will perform a second phase of audit fieldwork to verify that key items are completed as expected.

1. The City's plans to transition from operating the bus network to operating the combined bus and rail network

- a. **Planning:** We found OCT's project planning for On Track 2018, its program to adjust to the new system and the related construction, to be thorough. Key planning elements have been identified and addressed to effectively integrate the Confederation Line into OCT's service delivery model and meet the Revenue Service Availability date. In developing the plan, OCT has considered and continues to draw upon information from six comparable rail systems and the advice of two recognized industry experts. Applicable senior management staff from OCT and RIO and the industry experts have also provided input on operational risks relevant to the transition. OCT management indicates that the operational risk themes and action items will be embedded in their new "Rail Activation Management Program" (RAMP) which will be launched in January 2017.
- b. **Communication plan:** We found OCT's proposed communication strategy to be detailed covering all aspects of the changes affecting customers and other stakeholders that are coming in 2018. The strategy provides a comprehensive approach to familiarizing users with the benefits of the new multi-modal network in order to enhance customer satisfaction.
- c. **Protocol for Revenue Service Availability date:** We established that a detailed and approved structure is in place which describes the process for RIO to request a delay to the Revenue Service Availability date, should it be required. Also, a group drawn from RTG, RIO and OCT, and other key

stakeholders and contributors on the project has been established to manage and coordinate key issues that need to be addressed at the end of the project.

2. Effectiveness of the governance structure to identify and manage critical risks related to achieving planned targets and successful transition

- a. **Vehicle delivery:** Based on our observations to date, the transition to an integrated Bus/Train Rapid Transit system should not be impacted by vehicle delivery delays. While supply chain issues and the training requirements for new staff initially caused RTG to fall behind their production schedule for the vehicles, trained staff have been brought in and oversight increased. RTG is monitoring the progress closely and recently submitted a revised schedule in their monthly update to RIO in May 2016 showing that they will be on schedule for the delivery of the final vehicle. RTG also has contingency plans to deal with delays.
- b. **Training facility:** Based on our observations to date, the driver training program should not be impacted by the train simulator acquisition and/or training facility construction. A Request for Proposal for the simulator was issued in June 2016 and OCT has a detailed procedure to minimize the risk of delay in selecting a quality vendor. The new facility for training operators is an extension of an existing OCT building whose construction will take place outside of current operations therefore having no impact on staff. While OCT's timeline for building the training facility is aggressive, it may not be unrealistic considering the advance research and planning that has been done. Also, OCT's Chief Safety Officer has previous experience in implementing a new training simulator for another system which provides additional confidence in the prospects for success.
- c. **Train Control system:** Based on our observations to date, the transition to an integrated Bus/Train Rapid Transit system should not be affected by delays in getting the Thales Communication-Based Train Control (CBTC) system functioning. The CBTC system being used for the Ottawa LRT is the latest version, and this represents its first integration with this kind of car. However, the Thales CBTC system is a proven product in use in other systems around the world. Our SME believes that after the "normal" integration challenges that occur during every rail system start-up, the CBTC will function at a level that can deliver the service that is promised.
- d. **Maintenance and Storage Facility (MSF) and Control Room:** Based on our observations to date, the transition to an integrated Bus/Train Rapid Transit system should not be affected by delays in the construction of the

MSF and control room. As of April 2016, construction of some parts of the MSF and yard control room was three months behind schedule. The understanding of RIO management is that these outstanding items meet the criteria for “minor deficiencies” under the Project Agreement (PA) with respect to the milestone for MSF completion. RTG is currently working 6 days per week and is still aiming for test track readiness in the fall of 2016. In addition to the above-noted items, some aspects of the MSF construction cannot begin until the use of the space for vehicle assembly is complete. Consequently, this work will be performed in 2018.

3. Understanding of key elements related to system acceptance

- a. **Common definition of the 12-day Trial Running period:** During our planning work in April 2016, we noted inconsistencies in the interpretation of the definition of the 12-day Trial Running period between stakeholders. We expect that a common understanding will be established as management indicated they began discussions on all the elements of the 12-day Trial Running period in May 2016. This is sufficiently in advance of its scheduled occurrence in April 2018.
- b. **Process for resolving disagreements related to “Minor Deficiencies”:** We found that the Project Agreement clearly defines the role of an Independent Certifier which is needed for situations where stakeholders may disagree on whether an RTG defect is considered a minor deficiency. The Independent Certifier makes the final decision on these matters.
- c. **Clarity of transfer of responsibilities at critical project juncture:** There is a clear “handoff” process for the transfer of responsibilities between parties. There will be only one handoff to the City which will take place on the Revenue Service Availability date. According to our SME this makes the risk due to complexity low. By the end of 2016, RIO is expected to develop a comprehensive close-out schedule which outlines in detail elements to be met prior to acceptance.

Conclusion

Based on our work performed in May and June 2016, we did not identify any areas of high risk or gaps for the City related to the planning and change management of the LRT project. On the whole, our interim conclusion is that the planning for the transition to a bus and LRT network is thorough and well managed and an effective governance structure is in place. In addition there are strong financial incentives built into the

Project Agreement for RTG to avoid schedule delays and achieve the May 2018 Revenue Service Availability date. As it is early in the process, there is opportunity for time lost in delivery of certain elements of the PA to be recouped. In the opinion of our SME, OCT is ahead of where most rail systems are at this point in the start-up of a new system.

While at this point in the project it is impossible to guarantee that the transition to a combined BRT/LRT network will go smoothly, there was nothing we observed that we believe should have been in place that was not. That said there were a number of audit questions that were unable to be answered during this phase of fieldwork which will be addressed during the second phase of the audit.

We will be able to provide a final opinion once we have completed the recommended outstanding audit work in early 2017. During the second phase of this audit we will examine components related to the Communication Strategy, protocol for Revenue Service Availability, the vehicle and facility construction, the Thales CBTC integration, the close out schedule, and the Trial Running Test Plan. These components of the project are scheduled to be completed between summer 2016 and Q1 2017.

Management Response

Management agrees with the findings of the interim audit report, which confirm the robust and comprehensive program that has been put in place to manage the transition to a multi-modal operation.

Construction of the Confederation Line and planning for the transition to a new combined transit system is a complex, integrated project that has continued to advance since the conclusion of the audit fieldwork in May to June 2016.

In examining the originally recommended service, a key enhancement identified by Transit Services was the addition of a rail operator training facility and simulator. This project allows for a leading edge approach to training rail operators including the use of a simulator that assists operators to learn both how to operate the train and to fully understand the right-of-way setting. Following the development of a project charter and workplan, the training facility project is moving forward. Currently, the procurement process is complete and construction activities are well underway for the new facility and development of the simulator. It is anticipated that the simulator will be operational by Q3 2017.

The corporate re-organization also resulted in the formation of a new Transportation Services Department that includes O-Train Construction (formerly called the Rail

Implementation Office (RIO)) and Transit Services both reporting to the General Manager of the Transportation Services Department. This alignment brings the construction team and operations team together, allowing for enhanced coordination, integration and improving the transfer of the project from construction to operations.

The detailed section of this report is available in English only and may be translated in whole or in part upon request. For more information, please contact Ines Santoro at 613-580-2424, extension 26052.

La section détaillée de ce rapport n'existe qu'en anglais et pourrait être traduite en partie ou en totalité sur demande. Renseignements : Ines Santoro, 613-580-2424, poste 26052.

Detailed Audit Report

Audit of Light Rail Transit Planning and Change Management – Interim Report

Introduction

The Audit of Light Rail Transit Planning and Change Management was included in the 2016 Audit Plan of the Office of the Auditor General, approved by Council on December 9, 2015.

Background and Context

In November of 2008, Ottawa City Council approved a Transportation Master Plan laying the foundation for Ottawa's light rail transit (LRT) project. Over the next four years, all of the other pieces were put in place, culminating with the awarding of the \$2.1-billion project for the phase 1 of Ottawa's LRT system called the Confederation Line in February 2013.

The Confederation Line will be a significant part of OC Transpo's integrated transit network. It will connect to the existing Bus Rapid Transitway at Tunney's Pasture Station in the west and Blair Road in the east, and to the O-Train at Bayview Station. It includes a 2.5-km downtown tunnel. There will be thirteen stations on the 12.5-kilometre route. Three stations will be located underground in a downtown tunnel. A fourth underground station will be located at St. Laurent.

To build the Confederation Line, the City of Ottawa retained a public-private partnership team, the Rideau Transit Group (RTG). The project includes financial commitments from the provincial and federal governments. RTG is consortium of Canadian and international companies that is currently working closely with the City of Ottawa's Rail

Implementation Office (RIO) and Transit Services. RTG will design and build the Confederation Line and maintain it until 2048.

Construction of the Confederation Line is currently underway, and the Confederation Line is planned to begin full revenue service beginning the spring of 2018.

The Confederation Line combines the alternative financing and procurement and design, build, finance, maintain models with the goals of limiting financial risks to the City of Ottawa and ensuring the on-time construction of a quality project. This approach transfers financial, schedule and quality risks to private sector partners as condition of contract.

The model means that RTG provides a fixed cost not only for the initial build, but also for 30 years of maintenance. This model should result in:

- Five years of construction with financial incentives tied to on-time completion
- A quality build – since the constructor will also be tasked to maintain the system
- Strong motivation for quality maintenance of the system over the long-term

Within the City, the RIO is the lead on the O-Train Confederation Line project. RIO's project plans to oversee the overall design, engineering, construction and commissioning of the Confederation Line include:

- Ensuring technical compliance with Project Agreement requirements including review of contractor design submissions, construction activities, vehicle requirements, systems, testing and commissioning
- Contract and construction management support
- Project scope, cost and schedule
- Coordinating with Corporate Communications
- Engagement and outreach with stakeholders
- Administering the Project Agreement during the construction term
- Change Management
- Risk Management
- Quality Management
- Safety Management

OC Transpo will operate the LRT system when it comes on-line, together with the existing O-Train (Trillium Line) and the bus network.

Many customer-facing and internal systems will undergo significant changes so that the City can operate the new light rail system. OC Transpo's program to adjust to the new

system and the related construction is referred to as “On Track 2018”. The objective of “On Track 2018” is to transition OC Transpo in a planned, stepped approach to a multi-modal service. It consists of 25 projects:

1. Trains and Systems
2. Control Centre
3. IT Strategy
4. Bus Service Delivery Model
5. Regulations and Support Documentation
6. Business Processes
7. Opportunities and Gaps
8. Training Strategy
9. Fare Control
10. Contract Management
11. Relationship Model with Rideau Transit Maintenance (RTM)
12. Station Design
13. OC Transpo Spaces
14. System Branding Approach
15. Retail Space
16. Customer Journey
17. Organizational Structure
18. Regulatory Framework
19. Staffing
20. Recruitment
21. Labour Relations
22. Collective Agreements
23. Customer Readiness (“18 Minus 18”)
24. Internal Communications
25. Change Management

This audit is important because it provides assurance to Council that OCTranspo is adequately prepared for this important and momentous transition.

Since audit fieldwork in May and June 2016, RIO now reports to the General Manager of a newly formed Transportation Services Department so the construction team and operations team are now both under one roof.

Audit objectives and criteria

The primary objective of the audit is to ensure that the City is prepared to successfully transition from operating a primarily bus system to operating the combined bus and rail network.

As part of the review and analysis the audit team utilized the services of a subject matter expert (SME) to gain insight into the risks related to transitioning from a bus network to the introduction of light rail. The SME recently retired as Assistant General Manager of Rail Operations for a major American transportation district. He has 40 years of experience in bus and rail public transit operations, including being responsible for the operation and maintenance of three North American light rail systems. He currently provides operational consultation services to other major American cities and participates in numerous peer review panels.

During the preliminary survey stage of the audit work, the most significant elements of “On Track 2018” were examined through documentation review, interviews with senior managers and the opinion of the SME.

The following audit objectives were arrived at based on this examination:

1. Assess the completeness of City plans to transition from operating the bus network to operating the combined bus and rail network.
2. Assess the effectiveness of the governance structure to identify and manage critical risks related to achieving planned targets and successful transition.
3. Assess whether the key elements related to system acceptance are consistently understood.

The potential impacts of these elements on the successful transition to a combined bus and rail system were then considered from a risk perspective. Elements of “On Track 2018” that were deemed higher risk were the basis for developing the specific criteria for conducting the audit work. The audit criteria have been organized according to lines of enquiry and, taken together, address the entirety of the stated audit objectives. Refer to Appendix A for the identification of audit criteria.

Scope

The scope of this engagement extends to City of Ottawa, OCTranspo and RIO documentation and communication that are relevant to the objective of the audit. Aspects of the LRT project that were deemed out of the scope of this audit include:

- Construction and civil works, including items such as pre-existing site conditions and sinkholes
- Safety and legislative requirements (these are the subject of a future audit)
- Cost of operations and maintenance

Through the audit plan work, many elements of “On Track 2018” were deemed to be low risk based on interviews, documentation review and the opinion of the SME that these matters were well in hand. Others were deemed low risk where the task had already been completed and will not reoccur in the life of the current project or the audit team was satisfied that the inherent risks were low. Consequently they were not part of the currently proposed scope of the audit. However, if additional information comes to light in the conduct of the audit work the Office of the Auditor General may deem it necessary to conduct additional work in these areas.

The time period under examination extends from the time of OCT’s Operational Risk Management session in 2015 to the time of the audit in May and June 2016.

Audit Approach and Methodology

Our audit approach included examination of relevant policies, procedures, reports and other documentation. We conducted numerous interviews with Senior Managers responsible for the delivery of the LRT Project, including managers from both the RIO and OCT. We also participated in site visits to the Maintenance and Storage Facility and an active LRT construction area. Extensive documentation review was also performed.

During our review in May and June 2016, it was noted that there are several key elements of the plans and the risk mitigation strategy were scheduled to be further developed/elaborated later in 2016 and early 2017. Based on this observation and the status of the project in its life cycle, in our opinion it was not possible to conclude on the audit objective at that time and as such, we have prepared this interim report

The audit timelines are as follows:

Planning	April-May 2016
Fieldwork	May-June 2016
Interim Reporting	December 2016
Second phase of Fieldwork	January-February 2017
Final Reporting	

All work performed conforms to the City of Ottawa's Audit Standards.

Audit Observations and Recommendations

Audit Objective #1

Assess the completeness of City plans to transition from operating the bus network to operating the combined bus and rail network.

Planning for *On Track 2018*

The planning for *On Track 2018* should be comprehensive and sufficient to ensure key planning elements are identified and addressed to effectively integrate the Confederation Line into OCT's service delivery model and meet the Revenue Service Availability date. We found that to be the case.

OCT's project planning for *On Track 2018* is extremely thorough and has been broken down into 25 specific sub-projects. Each sub-project is led by a specified individual and has a detailed project charter that identifies key roles and responsibilities.

Documentation for each sub-project also includes detailed timelines and descriptions of risks and accompanying mitigation plans. As well, for every key decision point related to the LRT, OCT considers relevant information from six comparable rail systems: Edmonton, Calgary, Montreal, Boston, Vancouver and Toronto.

Two recognized industry experts were brought on board early by OCT and were used both for independent advice at the beginning of the project for the development of the plan, as well as for ongoing consultation and advisory purposes. One expert has 40 years of public and private sector experience as a transit agency manager and consultant on service delivery for rail, including involvement in several major U.S. regions related to rail system activation and start-up support advisory services for major P3 light rail initiatives. The second industry expert has over 30 years of public and private sector experience as a transit agency manager and consultant, including the oversight of the largest U.S. light rail system and safety reviews of two major North American transit systems.

OCT hosted an operational risk management session in 2015 to identify risks relevant to the transition from build to operations of the Confederation Line. All relevant senior management staff from OCT and RIO were involved, as well as the aforementioned industry experts. This resulted in a list of 10 major risk themes for which detailed mitigation strategies, staff responsible, and scheduled action items were identified. The list is reviewed and followed-up on at quarterly senior management meetings.

OCT management indicates that going forward, the risk themes and action items will be embedded in their new “Rail Activation Management Program” which will be launched January 1, 2017. The Rail Activation Management Program (RAMP) will be used to transition from the build phase, to integrated testing and commissioning and safety certification ahead of the start of revenue service. RAMP is intended to tie together all critical activities and provide an enhanced level of coordination between project elements in order to ensure a safe, reliable and on-time start of revenue service. RAMP will include tracking and reporting on all critical activities, identification and management of issues and risks, and a structured internal and external communication program.

While the program details are to be determined in the coming months, RAMP will include frequent (e.g. weekly) reporting to the Transportation Services RAMP program management team on project issues and risks, including operational risks, in the lead-up to revenue service. Details regarding RAMP’s member composition and reporting structure will also be mapped out over the next few months.

Communication Strategy

The 2018 Bus Network Report and the proposed Communication Strategy should provide a comprehensive approach to familiarizing users with the benefits of the new multi-modal network, and enhance customer satisfaction. We found that to be the case.

With the opening of the Confederation Line in 2018, bus routes will operate at the same frequency, over the same hours along the same streets serving the same stops as today in Ottawa’s communities and then connect to the LRT at one of 13 stations along the line. Bus routes that today operate on the Transitway between Blair and Tunney’s Pasture stations and through the downtown will be replaced by light rail service. Routes designated as “Express” will be replaced by new Connexion routes, which will connect customers’ home locations to the Confederation Line. Therefore in general terms, less communication efforts are required than if there were to be a major redesign of the network.

Recommended changes to the OCT fare structure were subject to public consultation and were approved by Committee and Council in June 2016. With the opening of the Confederation Line, because there will no longer be express routes and it was impractical to continue to collect premium fares, it was decided to remove the current premium fares for existing express routes. This change resulted in increases to other fares in order to ensure that overall fare revenue is consistent and aligned with the City’s Long Term Affordability Plan for Transit. Our SME is supportive of OCT changing the fare structure effective January 2017 as opposed to a later date. OCT has many

complex elements to address in the coming months and getting this fare structure change behind them will allow them to focus on other issues as they arise.

The “18 Minus 18” program will be the way that OCT will provide customers and other stakeholders with information about all aspects of the changes that are coming in 2018. The documentation supporting the program is comprehensive, and OCT has engaged marketing professionals to assist with the communication to the public.

Protocol to move the Revenue Service Availability date

An approved protocol should be in place to move the Revenue Service Availability date if necessary. We found that to be the case.

A detailed and approved structure is in place describing the process and the governing bodies involved, should RIO be required to request a delay to the Revenue Service Availability date. As well, an “Integrated Close-out Meeting Group” is in place to manage and coordinate close-out issues. It includes representatives from the engineering joint venture, construction group, RTG, RTM, OCT, Light Rail Vehicle, Systems and Operations Integration Branch Civil Design and Construction Branch, and the Project Management Branch.

Summary of observations for Audit Objective #1:

Based on the above-noted observations and the current status of the LRT project, we have not identified any apparent gaps in the planning or communication processes in place or likely significant negative effects. However, numerous audit questions were unable to be answered during this phase of fieldwork. This is attributable to the fact that the project has not yet reached the point at which the required work is due to be completed. The scheduling of these items was reviewed by our SME and deemed to be reasonable and in line with industry norms. In order to obtain adequate and sufficient evidence to provide an opinion on the achievement of the audit objective, it will be necessary to investigate these items in late 2016 or early 2017.

During the second phase of audit fieldwork we will verify that the following have been completed, or are on schedule to be completed, as expected:

- Summer 2016: The Terms of Reference and membership for the Integrated Closeout meeting group are expected to be finalized
- Late 2016: The Integrated Closeout meeting group scheduled to complete the “Integrated Close-out Schedule Basis Chart”
- December 2016: The Integrated Closeout meeting group is expected to bring the Go/No-Go list to the Executive Steering Committee for approval

- February 2017: “18 Minus 18” communications program report is scheduled to be tabled at the Transit Commission meeting
- Early 2017: OCT is planning to brief all Councillors on the service plan
- Q1 2017: The mitigation plan for a failure to meet the vehicle delivery date and overall project schedule is due
- Q2 2017: The development of an overall delay strategy plan (operational, technical, communication) is due

Audit Objective #2

Assess the effectiveness of the governance structure to identify and manage critical risks related to achieving planned targets and successful transition.

Impact of any Vehicle Delivery delays

The transition to an integrated Bus/Train Rapid Transit system should not be impacted by vehicle delivery delays. Based on our observations to date, we found this to be the case.

The vehicles are being assembled in Ottawa at the Maintenance and Storage Facility (MSF) assembly plant by Alstom, a supplier to RTG. During creation of the assembly floor within the MSF, supply chain issues and the training requirements for new staff initially caused RTG to fall behind their production schedule. In response, Alstom has increased the number of trained staff and brought in a new production manager. RTG has also recently assigned an individual with the specific task of providing more oversight of vehicle construction with Alstom. Alstom has developed a recovery plan and is currently on track with that plan. RTG has contingency plans in place, including double-shifting and providing production at another facility, to deal with delays. RIO staff indicate that they believe that the new assembly schedule is aggressive, and they plan to closely monitor the situation.

Regular communication and status updates between RIO and Alstom take place in the form of Vehicle Final Design Review meetings, and there are regular internal Vehicle Working Group meetings that review the status of issues.

RTG issues monthly schedule updates to RIO and recently submitted their revised schedule for May 2016, showing a full catch up to the original scheduled delivery of the final vehicle. RTG management indicate that they believe that the schedule is achievable and that they have adequate staff on the production line monitoring progress daily.

A significant factor reducing the risk for the City of significant schedule delays is the fact that RTG has a strong financial incentive to achieve the target opening date: In addition to a \$1.0M one-time penalty for missing the May 2018 Revenue Service Availability date, RTG would be forgoing an estimated \$4.6M in monthly maintenance revenues and would internally incur an estimated \$0.8M per month in office costs.

Impact of any Training Facility delays

The driver training program should not be impacted by the train simulator acquisition and/or training facility construction. Based on our observations to date, we found this to be the case.

One element of *On Track 2018* that is being delivered exclusively by OCT with no involvement from RIO is a new facility specifically for training operators on a train simulator. Operators need to learn to both operate the train and to fully understand the right-of-way operating environment. The simulator assists in both and allows construction activities to continue with minimal interruption from moving trains.

This new training facility consists of two main components. The first component is the physical space, which will be an extension on an existing OCT building. The second is the specialized train simulator, which will be housed within this space.

The training facility is not critical to the LRT system although the need to schedule access to the rail line may be reduced if operators are able to complete some portion of their training on the simulator. The challenge relates to the impact on access to the rail line as segments of the line become operational. If the training facility is not available as scheduled, then driver training will be limited to the rail line. Note that the system will be heavily booked for system testing and other activities. Further, when actual training access is granted for such mainline training, it will be done over a line that is not fully certified for "normal" operation.

Construction-testing-coordination plans can be implemented to allow line-sharing by scheduling activities at different times. These types of plans are common in rail line start-ups. However, if access to the rail line is required for training purposes, there is a risk of the construction schedule being impacted. Conversely, training delivery will be impacted if the construction activity is late. Some operators could end up having limited "over-the-road" (or simulated) experience before revenue service commences if the construction activity is late. Having a functional training facility means operators will need less time operating trains on the actual mainline to become fully competent.

The building extension will be standard construction, further simplified by the fact that a recent renovation of the existing building included provisions (power, data, etc.) for the extension, which was foreseen at that time. The construction will take place outside of current operations and have no impact on staff, making the coordination of construction activities relatively straightforward.

A Request for Information process was completed in December 2015 in order to ensure industry alignment and bring clarity to needs and schedule expectations. A Request for Proposal for the simulator was then issued via an on-line bidding service on June 9, 2016. OCT has mapped out detailed timelines for evaluations and selection of a quality vendor in order to minimize the risk of delay.

According to our SME, Denver's simulator took more than 18 months to be delivered and placed into actual service as a training tool once the contract was awarded. His opinion is that while OCT's timeline is aggressive, it may not be unrealistic considering the advance research and planning that has been done. OCT's Chief Safety Officer was also previously responsible for the implementation of a new training simulator for another system (Vancouver), and this experience provides additional confidence in the prospects for success.

Impact of any Communication-Based Train Control system delays

The transition to an integrated Bus/Train Rapid Transit system should not be impacted by delays in achieving functionality of the Thales Communication-Based Train Control (CBTC) system. Based on our observations to date, we found this to be the case.

The latest version of the Thales CBTC system is being used for the Ottawa LRT and this will represent its first integration with this kind of car. Mitigating this inherent risk of being the first is that there will be cab signals and limited wayside fixed signals in place in the event that the CBTC malfunctions. The LRT project has not yet reached the phase where system integration with CBTC has begun.

As noted above, RTG has a strong financial incentive to successfully achieve CBTC functionality in time to meet the target opening date. Additionally, the Thales CBTC system is a proven product, in use in systems around the world. The SME believes that after the "normal" integration challenges that occur during every rail system start-up, the CBTC will function at a level that can deliver the service that is promised.

Impact of any Maintenance and Storage Facility and Control Room delays

The transition to an integrated Bus/Train Rapid Transit system should not be impacted by delays in the construction of the MSF and control room. Based on our observations to date, we found this to be the case.

The construction of some elements of the MSF and yard control room is three months behind schedule as of April 2016. Some elements of the project are on track, while others have experienced slippage. RIO is closely monitoring the outstanding items and has come to an agreement with RTG regarding which would be “deferred items” at the time of substantial completion of the MSF. The understanding of RIO management is that the outstanding items meet the criteria for “minor deficiencies” under the project agreement with respect to the milestone for MSF completion. As well, RIO has asked RTG to confirm in writing that any delays related to the MSF would not impact the vehicle testing schedule. RIO is comfortable with the response received, as well as with the openness of communication with the contractor. RTG is currently working 6 days per week and is still aiming for test track readiness in fall 2016.

In addition to the above-noted items, some aspects of the MSF construction cannot begin until the use of the space for vehicle assembly has been completed. Consequently, this work will be performed in 2018.

As noted above, RTG has a strong financial incentive to complete the construction work necessary to ensure that the transition to an integrated Bus/Train Rapid Transit system is achieved by the scheduled opening date.

Summary of observations for Audit Objective #2:

There are strong financial incentives built into the Project Agreement for RTG to avoid schedule delays and achieve the May 2018 Revenue Service Availability date. Additionally, it is early in the process and there is opportunity for time lost in delivery of certain elements of the PA to be recouped.

Based on the above-noted observations and the current status of the LRT project, we have not identified any apparent gaps in the governance structure in place or likely significant negative effects. However, numerous audit questions were unable to be answered during this phase of fieldwork. This is attributable to the fact that the project had not yet reached the point at which the required work was due to be completed. The scheduling of these items was reviewed by our SME and deemed to be reasonable and in line with industry norms. In order to obtain adequate and sufficient evidence to

provide an opinion on the achievement of the audit objective, it will be necessary to investigate these items in late 2016 or early 2017.

During the second phase of audit fieldwork we will verify that the following have been completed as expected:

- Ongoing: RIO plans to very closely monitor the vehicle delivery schedule, and will request an additional recovery plan if slippage is observed
- Q2 2016: Document is due that maps out of the top 10 integration issues and overlays these expectations with the schedule
- July 2016: RFP for simulator closes and training centre construction project is expected to go out to tender
- August 2016: OCT is scheduled to kick off its simulator and training facility project
- Late 2016: Working group to address Thales CBTC integration is scheduled to begin activities
- Late 2016: Several significant items on the MSF construction are scheduled to be completed.
- January 2017: Vehicle integration with CBTC is scheduled to commence
- Q1 2017: The “Mitigation Plan for failure to meet vehicle delivery and overall project schedule” is due

Audit Objective #3:

Assess whether the key elements related to system acceptance are consistently understood.

Definition of the 12-day Trial Running period

A common understanding among stakeholders of the details of the 12-day Trial Running period should be established at an appropriate point in the project timeline. We expect that this will be the case.

The 12-day Trial Running period is scheduled to take place in April 2018. As of April 2016, inconsistencies in interpretation of the definition of the 12-Day Trial Running period between stakeholders were noted during interviews, and many individuals said that it was not well-defined. RIO recently received and is reviewing and collecting comments on the Trial Running Test Plan. Management indicated that the Integrated Closeout Working Group commenced discussions on the all the elements of the 12-day Trial Running period in May 2016. In the opinion of our SME, the timing is sufficiently in advance of its scheduled occurrence.

Process for resolving disagreements related to “Minor Deficiencies”

A process should be in place to manage any situations where stakeholders do not agree on whether a defect meets the Project Agreement definition of “Minor Deficiencies” with respect to the acceptability of RTG work. We found this to be the case.

An Independent Certifier will decide where there is a disagreement on whether a defect is a “Minor Deficiency”. The role of the Independent Certifier is defined clearly in the Project Agreement. He or she is independent of both parties and must be agreed to by both parties. As part of the acceptance process, the Independent Certifier prepares the list of “Minor Deficiencies” before the Substantial Completion Certificate is issued. The decision by the Independent Certifier on which defects constitute “Minor Deficiencies” is final. There is no further dispute resolution process and the process is exempt from the arbitration process that applies to the rest of the project.

Transfer of responsibilities at critical project junctures

There should be a clear “handoff” process for transfer of responsibilities between parties at critical project junctures. We found that to be the case.

There will be only one handoff to the city, which is expected to take place on the Revenue Service Availability date. Consequently, according to our SME the risk due to complexity is very low.

In the Commissioning and Completion section of the Project Agreement, the processes for Milestone Acceptance Certification, Substantial Completion Certification, and Revenue Service Availability Certification are described. This is supplemented with Schedule 14 to the Program Agreement, Commissioning, which addresses Acceptance.

The RIO Integrated Closeout working group is developing a comprehensive Integrated Close-out Schedule detailing the seven elements which must be met prior to Acceptance. This schedule is expected to be completed by the end of 2016.

Summary of observations for Audit Objective #3:

Based on the above-noted observations and the current status of the LRT project, we have not identified any apparent gaps in the consistency of the understanding of the key elements related to system acceptance. However, numerous audit questions were unable to be answered during this phase of fieldwork. This is attributable to the fact that the project had not yet reached the point at which the required work was due to be completed. The scheduling of these items was reviewed by our SME and deemed to be reasonable and in line with industry norms. In order to obtain adequate and sufficient

evidence to provide an opinion on the achievement of the audit objective, it will be necessary to investigate these items in late 2016 or early 2017.

During the second phase of audit fieldwork we will verify that the following have been completed as expected:

- Late 2016: The Integrated Close-out Schedule detailing the seven elements which must be met prior to Acceptance including a detailed plan to address the sharing of the track by the T&C group and the Operator Training is expected to be delivered by the T&C Steering committee
- Late 2016: The Trial Running Test Plan will be formally discussed and ultimately adopted at the Integrated Close Out meeting

Conclusion

Based on our work performed in May and June 2016, we did not identify any areas of high risk for the City related to the planning and change management of the LRT project. We stress that we were not able to fully address the audit objectives at this time due to numerous key tasks planned to be completed at a later date. In order to be in a position to present a conclusion on the audit objective, further audit fieldwork needs to be completed at a later stage in the project timeline. Consequently, we will perform a second phase of audit fieldwork to verify that key items are completed as expected.

On the whole, our interim conclusion is that the LRT project planning is thorough and well managed and an effective governance structure is in place. In the opinion of our SME, OCT is ahead of where most rail systems are at this point in the start-up of a new system. While at this point in the project it is impossible to guarantee that the transition to a combined BRT/LRT network will go smoothly, there was nothing we observed that we believe should have been in place at this point in the project that was not.

We will be able to provide a final opinion once we have completed the recommended outstanding audit work in early 2017.

Appendix A: Audit Objectives and Criteria

Audit Objectives and Criteria

Audit Objective #1: Assess the completeness of City plans to transition from operating the BRT network to operating the combined BRT/LRT network.	
1.1	Planning for On Track 2018 is comprehensive and sufficient.
1.2	The Communication Strategy is comprehensive and will enhance customer satisfaction.
1.3	A protocol exists to move the Revenue Service Availability date.
Audit Objective #2: Assess the effectiveness of the governance structure to identify and manage critical risks related to achieving planned targets and successful transition.	
2.1	Any delays in vehicle delivery will not impact the Revenue Service Availability date.
2.2	Any delays related to the training facility will not impact the Revenue Service Availability date.
2.3	Any delays related to Communication-Based Train Control system will not impact the Revenue Service Availability date.
2.4	Any delays related to the construction of the Maintenance and Storage Facility and Control Room will not impact the Revenue Service Availability date.
Audit Objective #3: Assess whether the key elements related to system acceptance are consistently understood.	
3.1	A common definition of the 12-day Trial Running period is being established.
3.2	A process for resolving disagreements related to “Minor Deficiencies” is in place.
3.3	The transfer of responsibilities at critical project junctures is clear.