

Pilon, Janet

Subject: Auditor General LRT program review
Attachments: OFH-LRT-AG-andAppxA-D.pdf

From: paulslater
Sent: March-21-17 10:23 PM
To: Office of the Mayor; Ferguson, Lloyd
Cc: Whitehead, Terry; clerk@hamilton.ca
Subject: Auditor General LRT program review

See files attached to this message (sent from GoodReader)

To:
Mayor Fred Eisenberger and,
Councillor Lloyd Ferguson (Ward 12, Ancaster)

Cc:
Office of the City Clerk (Correspondence re: 28-Mar-2017 GIC)
Councillor Terry Whitehead (Ward 8, West Mountain)

Find attached, my letter regarding support for Councillor Whitehead's Motion seeking an audit of the LRT program by the Auditor General of Ontario.

Yours sincerely,
Paul Slater
Hamilton (Ancaster) resident

Sent from my iPadPro

Our Future Hamilton - needs an LRT review by the Auditor General by Paul Slater, Hamilton, ON. Dated: 2017-03-20

Dear Mayor Fred Eisenberger and Councillor Lloyd Ferguson

I believe that there is a need to change the way we do things within city hall; our future depends upon it. This is the era of the innovation and knowledge driven economy. Do we want our city facing possible bankruptcy or to be a prosperous intelligent community?

As a start, as my city representatives, I ask that you both support Councillor Terry Whitehead's motion seeking an audit of the LRT program by the Auditor General of Ontario [A]. The reasons why are presented below and within the four accompanying appendices.

People and Culture

The LRT Office will have 23 staff [PED16210 Appx A] dedicated to helping the Government of Ontario spend the \$1-billion Capex acquisition monies but, zero staff dedicated to the mitigation of the potential \$2-billion Opex sustainment i.e. operations, maintenance (O&M) and support costs.

It has been 22 months since the \$1-billion Capex funding announcement. During this short time, due to the lack of an Asset Management-Sustainment Practice focus, early decision-making has left the Hamilton LRT B-Line program as a \$3-billion life-cycle asset burden instead of an approximate \$1.95-billion life-cycle economic asset!

I have offered my guidance to the City of Hamilton (CoH) and Metrolinx / Government of Ontario [see Appx A thru D attached] without any response to my 'free' advice. I agree with Councillor Whitehead that we desperately need an outsider's viewpoint on Hamilton LRT; a viewpoint that will be listened to.

The Auditor General's team will:

- i) not be awestruck by a \$1-billion Capex gift.
Noteworthy, the technically astute know that Capex comes with an additional Opex commitment. In this case, the estimated \$2-billion has been unaddressed.
- ii) not be politically motivated.
- iii) not be tainted by any cosy relationship with industry behemoths, who are perhaps offering incentives to proceed without doing due diligence.
- iv) be able to assemble impartial experts to work the problems and provide good advice.

The following are sample questions that I would like the Auditor General to answer:

1. The lack of Early-AM Supportability Analysis

As addressed in my previous OFH submissions [Appx A, B & C] [1] the first key good decision is to do Early-AM Supportability Analysis. The integrated product team i.e. LRT Office, does not have any knowledgeable Support Solution Managers or Early-AM Specialists on the team.

Auditor General questions

- 1.1 Sustainment represents approx 2/3 of an asset's Life Cycle Costs (LCC), should the LRT Office staffing mix be changed to reflect the Acquisition - Sustainment tasking requirements?
- 1.2 Given that this is the age of the knowledge driven economy, is Metrolinx / the Government of Ontario justified in allowing 14.6% waste of provincial infrastructure monies?

- 1.3 If Metrolinx / the Government of Ontario allocates all its \$15-billion GTHA transit fund to Capex, who is picking up the resulting \$30-billion asset through-life Opex bill? and,
1.4 how could this impact funding commitments to Hamilton LRT?

2. Operations, Maintenance and Support costs

Beginning with the announcement of Hamilton's LRT project, the Design-Build-Finance-Operate-Maintain (DBFOM) model has been assumed as the delivery of the Hamilton LRT.

Auditor General questions

- 2.1 If an Operator and/or Maintainer is in breach of contract and refuses to continue without increased payment or goes into bankruptcy e.g. due to poor ridership revenue or transit type technological obsolescence, what options will the CoH have with the resulting 'white elephant' LRT assets?
2.2 Will the Government of Ontario be responsible for LRT tare-down costs?

3. Analysis of Alternatives (re: Affordability)

I believe a 'Driverless' BRT # [hash] comprising of Qty-4 Bus Rapid Transit lines (i.e. BLAST network Lines A, B and two extended split-S lines) developed under an Asset Management-Sustainment Practice run program would currently come in cheaper and complete in the same 2024 timeline than the Metrolinx-Hamilton LRT Office led \$1-billion Capex and unaddressed \$2-billion Opex 3/4 (McMaster Univ to Queenston Circle) LRT B-Line program.

Auditor General questions

- 3.1 Should more affordable 'Driverless' technologies be risked within the current program(s)?
3.2 Can the LRT B-Line allocated \$1-billion be re-allocated to an equivalent Qty-4 Line BRT#?
3.3 How do we best futureproof our transit infrastructure investment(s)?

Recommendation 1

The City of Hamilton should request an audit of the LRT program by the Auditor General of Ontario.

Recommendation 2

The City of Hamilton should provide the Auditor General of Ontario with this document as sample evidence of a citizen's concern.

Appendices:

Appx A: Our Future Hamilton - must resolve Technical Debt, by Paul Slater, submitted 2017-01-23.

Appx B: Our Future Hamilton - needs Early-AM Supportability Analysis, by Paul Slater, submitted 2016-10-06.

Appx C: Our Future Hamilton - starting off right, by Paul Slater, submitted 2016-03-20.

Appx D: Our Future Ontario (hangs on good Asset Management-Sustainment Practice!), by Paul Slater, dated 2016-07-13 and submitted to Hon. Bob Chiarelli, Minister of Infrastructure.

Reference and Websites:

[A] Hamilton Spectator, Mar 15, 2017, DRESCHER: Whitehead calls for audit of Hamilton LRT project
www.thespec.com

[1] Our Future Hamilton: Communities in Conversation
www.hamilton.ca/ourfuturehamilton

Appx A

Our Future Hamilton - must resolve Technical Debt by Paul Slater, Dated: 2017-01-24

Resident of: Hamilton, ON.

Occupation: Sustainment Specialist

Vision 2040

The entity 'George Hamilton' is becoming more intelligent and caring. A ---- See [1]

Dear Mr. Andrew Hope, Director, Hamilton LRT Capital Projects Group, Metrolinx

I would like to thank you for our conversation on Wednesday, January 18th at McMaster Innovation Park, Atrium. If you recall, my concern is the lack of good decision-making based on affordability, practiced by the Public Service, in this new era of mega infrastructure spending. I also worry about the possibility of the Provincial Government downloading the unaddressed \$2 billion of LRT B-Line life-cycle operations, maintenance and support costs on the City of Hamilton (CoH).

You stated that Metrolinx is being cautious with the \$1B Capex Hamilton LRT B-Line project with the non-decision on 'Driverless' Light Rail Vehicles (LRV), due to schedule and the technological development risk. And, that the operations, maintenance and storage facility (OMSF) design is proceeding with only the requirement input of a 30m or 40m vehicle length envelope. I believe that this is unacceptable in today's knowledge-driven economy.

Robotization (i.e. Robots and Artificial Intelligence) is going to offer unprecedented savings on manpower going forward to the 'un-work' economy. Recent press releases by Tesla, Uber, and Ford tell us that sales of autonomous cars will be a common occurrence in the 4-8 year timeframe. Driverless LRV's will be a simpler problem than autonomous cars, given that they run on rails.

The Hamilton LRT B-Line has an 8 year window to design-in Driverless LRV (thru FY2024). Is being cautious worth hundreds of millions in lost savings? Understanding the exponential function on growth, I would say that this is not justifiable. The technical engineering astute understand that technological developments are exponential in nature. The naive perceive technological growth as linear (for the exponential growth perspective see [A]). Noteworthy, humankind is at the knee of the exponential curve on the robotization graph.

Technical Debt

Due to the lack of logistics engineering process; Canadian cities are support solution blind due to the inherent flaws of following a systems engineering only acquisition process; making decisions without fully considering life-cycle sustainment e.g. Early-AM Supportability Analysis, sustaining resets and technology insertion on whole life cycle costs (LCC).

I would like to offer some further guidance to the Hamilton LRT Office team.

I have 30+ years experience in the Aerospace and Defence (A&D) industry. As the internet of things comes into play in 'smart infrastructure' investments and municipal systems become

more complex, the life cycle cost ratios in the public sector will match those of A&D. LCC's ratios quoted below reflect the high-tech A&D industry.

Physical Asset Management 101 - Analysis of Alternatives

Facts

- * Sustainment costs, or Opex, typically represent 66% of an asset's whole LCC.
- * Ops labour costs (i.e. compensation for employees) typically represent 50% of Opex, hence
 - * Acquisition costs, or Capex = Operations labour costs (i.e. Drivers + Admin staff pay).

Sticking to generalizations

- * Let's say Ops operator labour is 2/3 and Ops support labour is 1/3 of total Ops labour costs.
- * 40 \$4M LRV's will need \$1M upgrade to Driverless & \$10M of infrastructure black boxes.
- * Let's assume 2 to 3 technology insertions over the 30 yr asset life - the 1st being Driverless.

Then, by calc

Driver compensation is \$1B x 0.666 (Drivers pay) = \$666M

Driverless LRV Upgrade is \$40M + 10M smart infrastructure = a \$50M technology insertion

Going 'Driverless' is a \$666M-50M = \$616M saving or, \$20.5M/yr in annual Opex savings

Further opportunity (from going 'Driverless')

A partnership with a locomotive OEM should be explored. Selling Driverless LRV Upgrades to the 40+ cities operating LRT globally will be a prosperity game changer for our city. We have research institutions, skilled labour, steel, vacant land and a tri-transportation network to offer!

People and Culture

Today's 'business-as-usual' needs to be improved upon with such large infrastructure funding sums at stake in Ontario. City hall desperately needs an improved in-house technical capability for future success. Human Resources must hire more strategically going forward if we are to become an Intelligent Community. The Government of Canada and the Government of Ontario plan respective 12 year \$180 billion and \$183 billion infrastructure funding. The Public Services, as outlined on this LRT B-Line program, are going to over pay for physical assets with current practices. Without change, the Canadian public will get much less than the expected municipal infrastructure, we so desperately need, over the next 12 years.

Recommendation 1 - repeat [2]

City Staff and Councillors should address the lack of modern-day Asset Management-Sustainment Practice experience within the Hamilton LRT Office.

Recommendation 2

The Economic Development Dept. should look for a LRV OEM willing to locate in Hamilton, ON. Set-up of a Driverless LRV Design Office with a production facility to follow is the goal.

Reference and Websites:

[1] Our Future Hamilton - needs Early-AM Supportability Analysis, by Paul Slater, submitted 2016-10-06.

[2] Our Future Hamilton - starting off right, by Paul Slater, submitted 2016-03-20.

[A] Free on-line book, Chapter 3: Exponential Growth - by Frederico Pistono, Nov2012

www.robotswillstealyourjob.com

Appx B

Our Future Hamilton - needs Early-AM Supportability Analysis by Paul Slater, Dated: 2016-10-06

Resident of: Hamilton, ON.

Occupation: Sustainment Specialist

Vision 2040

The entity 'George Hamilton' is becoming more intelligent and caring. A whole-of-government strategic approach based on Asset Management-Sustainment Practice with Information Interoperability has made Hamilton, Ontario, the model of affordability and through-life finance. This prosperous community of communities is a Smart Sustainable City, one which provides a quality of life for all its citizens that is second to none. The wealth generated by the City of Hamilton is distributed evenly among its residents.

Dear Mr. Peter Olak, LRT Senior Project Manager

I would like to thank you for our conversation on Monday, September 12th at McMaster Innovation Park, Atrium. If you recall, my concern is the poor standard of Asset Management (AM) practice employed by the public service in this new era of mega infrastructure spending. I also worry about the possibility of the Provincial Government downloading the \$2.4 billion of lower city LRT lifecycle operations and maintenance (O&M) costs on the city.

You stated that the \$1.2 billion Capex LRT project is following standard practice, with decisions on the OMF and Driver-v's-Driverless to come later in the process. I believe that this is unacceptable in today's knowledge-drive economy. The Government of Ontario is giving up on hundreds of millions of dollars in potential Opex support costs savings. Today's public service business-as-usual needs to be improved upon with such large funding sums at stake.

I would like to draw your attention to 'Our Future Hamilton - is a Smart Sustainable City' and 'Our Future Hamilton - starting off right' my Communities in Conversation [A] submissions [1][2].

Physical Asset Management 101 - Influencing the design:

* 14.66% savings of the asset Life Cycle Costs via Early-AM Supportability Analysis practice.

Hence, the potential lost to the City of Hamilton, based on generalizations, \$527.8 million or \$17.6 million per year in Opex savings for the City's B-Line and lower city part A-Line LRT from FY2020-2045.

Noteworthy, for this amount of savings, Asset Management-Sustainment Practice personnel must be at the table prior to any commencement of LRT design. As you pointed out this is not happening with LRT in Ontario. Hence, we are in the position of 'fait accompli' with potential design influenced O&M savings on the LRT B-Line and lower city part A-Line.

LRT B-Line - Fait accompli

Time to move on with some intelligence.

The opportunity

Let's do it right from the start with our prosperity 'game changer' - LRT A-Line (Inclinator/Lift to Airport mountain section) and the 'crown jewel' - Airport Employment Growth District (AEGD).

With the dawn of the Internet of Things, all large municipal infrastructure projects of tomorrow will be more complex and have a substantial amount of embedded technology spend on control systems, connectivity and customer experience. Knowing how to bring together automation and cyber-physical systems, manned-unmanned teaming and municipal infrastructure asset management skills is crucial to avoiding cost and time overruns. Front-end analysis is necessary for the 'Smart Infrastructure' unknowns so that 'Will cost - Should cost' estimates are closer to the truth; aiding effective reliability trade-offs, better decision-making and allocation of funds.

People and Culture

Both the Government of Canada and Government of Ontario are tying their respective 10 year \$120 billion and \$137 billion municipal infrastructure program handouts to AM practice [B] [C]. If they wish to maximize cost savings then they should be supportive of a city that wishes to i) demonstrate an evolved AM culture, ii) be the leader in affordability and through-life finance and, iii) become the pilot 'Smart Infrastructure' development location of choice.

Action

With regards to LRT A-Line, Metrolinx / Infrastructure Ontario and Infrastructure Canada must be notified ASAP of our desire to lead with Early-AM Supportability Analysis development.

Recommendation 1

The City of Hamilton should approach both the Government of Canada and Government of Ontario for LRT A-Line Early-AM Supportability Analysis infrastructure funding.

Endnote

With demonstrated Early-AM Supportability Analysis over the next 10 years of infrastructure funding; both the Federal and Provincial Governments will be willing to invest tax payers dollars in Hamilton, Ontario, because of our 'Will cost - Should cost' estimates, life cycle cost savings and enduring fiscal responsibility.

Reference and Websites:

[2] Our Future Hamilton - starting off right by Paul Slater, submitted 2016-03-20.

[1] Our Future Hamilton - is a Smart Sustainable City (inc. Hamilton 2040) by Paul Slater, submitted 2015-08-25.

[C] Infrastructure Canada

<https://www.canada.ca/en/office-infrastructure.html>

[B] Metrolinx - The Big Move: Planning

www.metrolinx.com/en/regionalplanning/projectevaluation/planningdesignandengineering/planning_design_engineering.aspx#hamilton

[A] Our Future Hamilton: Communities in Conversation

www.hamilton.ca/ourfuturehamilton

Our Future Hamilton - starting off right

by Paul Slater, Dated: 2016-03-20

Resident of: Hamilton, ON.

Occupation: Sustainment Specialist

Dear Mr. Paul Johnson, Director, LRT Project Coordination

I was looking through the 2016 Committee and Council Meeting Calendar for some 2016-2025 Strategic (Asset Management) Planning information and happened to come across the General Issues Committee meeting on Tuesday, March 22nd. I opened up the Light Rail Transit (LRT) Office and Administration Budget (PED16073) document which includes the Hamilton dedicated staff and primary support positions list (Appx. A) with anticipation. My reaction? I thought to myself "Oh my gosh - there is no 'Sustainment Practice' person on the 12+4 staffed LRT Office team, currently the biggest Capex program in the City of Hamilton. So much for talking up 'Asset Management' at all levels of government!"

I would like to draw your attention to 'Our Future Hamilton - is a Smart Sustainable City' my Communities in Conversation submission. See pages 4 & 5 [1]:

Physical Asset Management 101

Facts

- * Sustainment costs, or Opex, typically represent 66% of an assets whole Life Cycle Costs.
- * Post-design, typically 66% of the sustainment costs are locked in i.e. inherent to the design.

Influencing the design - the maximum potential from good 'Sustainment Practice' is:

- * 14.66% savings of the asset Life Cycle Costs via Early-AM Supportability Analysis practice.

Hence, the opportunity in the City of Hamilton (CoH), sticking to generalizations - 17.6 million dollars per year in Opex savings for the City's B-Line & part A-Line LRT; \$1.2 billion Capex program from FY2020-2045.

To restate the key point here - For this amount of savings, Asset Management-Sustainment Practice (AM-SP) personnel must be at the table prior to any commencement of LRT design. Not having AM-SP representation on any LRT Office team the Government of Ontario is giving up on hundreds of millions of dollars in future potential Opex support costs savings.

You may say:

1. It's not future CoH tax dollars that's being wasted - why should we care?

Comment - As provincial tax payers we should all care - potentially, hundreds of millions of future Ontario tax dollars down the drain!

2. Our Senior Program Managers will also think about sustainment issues - we are OK

Comment - The US Army, US Navy and US Air Force are three of the biggest asset owning organizations in the world. Note, an army forward operating base is not much different than a small municipality. The US military are the best at what they do however, in 2009, due to

constant lack of overthought and huge cost overruns; the Department of Defence mandated that all major acquisition Program Managers shall have, as a number two, a sustainment Product Support [Solution] Manager to keep his/her focus on the 66% in-service life cycle costs [B]. In Canada, a recent PricewaterhouseCoopers report [C] concluded 'that both Public Services and Procurement (formerly PWGSC) and National Defence don't have in-house staff and expertise to understand technical matters that contribute to higher project costs'. I have no doubt that the Government of Ontario and the City of Hamilton are in this same position.

The opportunity

A wise forward thinking CoH would say to Metrolinx / Infrastructure Ontario - with AM-SP expertise we can help you identify up to \$18 million dollars in annual operating and support costs savings. Let us both share in that saving with a Performance-Based Sustainment 50-50 contract. The Government of Ontario could save up to \$9M per year while contributing \$9M per year to a proposed Smart Sustainable Hamilton initiative [1]. A win-win situation.

People and Culture

Both the Government of Canada and Government of Ontario are tying their municipal infrastructure funding awards to demonstrated Asset Management (AM) practice. The City of Hamilton should therefore base its SP2016-2025 staffing and culture initiatives on AM practice; if it wishes to maximize its successes in the respective 60 billion and 130 billion dollar infrastructure program handouts.

Action

With regards to Infrastructure Asset Management, Metrolinx / Infrastructure Ontario must be held accountable - to practice what they preach.

Recommendation 1

The City of Hamilton must take the lead and request the investment of an Asset Management-Sustainment Practice capability on the Hamilton LRT Office team. This Tuesday's General Issues Committee approval should be deferred until further negotiations can take place.

2016-2025 Strategic (Asset Management) Planning.

Recommendation 2

Over the coming months the City Manager should ask the right AM-SP questions of our other major programs i.e. WHD and AEGD. And beyond, the same AM-SP questions should be reviewed against all aspects of City's operations in our much needed transformation.

Reference and Websites:

[3] HamiltonON-2040 (includes Vision 2040) by Paul Slater, reformatted 2016-02-29.

[2] Our Future Hamilton - the need to be realistic! by Paul Slater, submitted 2016-01-27.

[1] Our Future Hamilton - is a Smart Sustainable City (inc. Hamilton 2040) by Paul Slater, submitted 2015-08-25.

[C] The Canadian Press - perverse incentives: for industry to increase costs
<http://ipolitics.ca/2016/03/13/perverse-incentives-leaked-report-blasts-federal-contracting-regime/>

[B] Sec 805 of FY10 NDAA (Public Law 111-84) Oct 09 - Mandated PSMs

<http://www.gao.gov/assets/670/662809.pdf>

[A] Metrolinx - The Big Move: Planning

http://www.metrolinx.com/en/regionalplanning/projectevaluation/planningdesignandengineering/planning_design_engineering.aspx#hamilton

Our Future Ontario (hangs on good Asset Management-Sustainment Practice!) **by Paul Slater, Hamilton, Ontario. Dated 2016-07-13**

Background

The province's Infrastructure for Jobs and Prosperity Act, 2015, was proclaimed on May 1, 2016. As a result, a potential Municipal Asset Management Planning Regulation Discussion Paper has been released for comment. It is intended to establish a standard format for municipal asset management plans that builds upon the important work undertaken to date [A].

Feedback Summary

The Government of Ontario is tying its municipal infrastructure funding awards to demonstrated Asset Management (AM) practice; if Infrastructure Ontario wishes to maximize its successes in its respective 137 billion dollar infrastructure program handouts, while achieving substantial savings, then front-end Early-AM supportability analysis must be stressed and incorporated, not the current poor after-commissioning AM practice status quo.

It is evident that the Government of Ontario does not yet know what good AM is, hence any regulation should be postponed for a couple of years. In the meantime, a training needs assessment should be developed and an Ontario-wide advanced AM training program introduced.

Asset Management-Sustainment Practice, with Information Interoperability, is foundational to Smart Sustainable Cities or Communities implementation. A primary goal for the Government of Ontario should be to become a Smart Sustainable Province. The predicted global smart city marketplace, valued at \$1.565 trillion dollars by 2020, could be the driver of Ontario jobs and prosperity.

Our Future Ontario - Vision 2045

The entity 'Sandfield Macdonald' is part of the 'Oh Canada' superintelligence cognitive computing grid. A whole-of-government strategic approach based on Asset Management-Sustainment Practice has made Ontario the model of affordability and through-life finance. We are a Smart Sustainable Province. Ontario is the most cyber-visited region in the world - our way of life is envied around the globe.

People and Culture

Asset Management practitioners have to have an understanding of modern day 'Smart Infrastructure', otherwise their contributions will not generate the maximum value from the huge investments we are about to commit to Municipal Infrastructure. An 'Asset Lifecycle' and 'Smart Sustainable' learning culture is key to success as a province.

Clarification - Do not get confused between the words

Sustainable or Sustainability - the resource is not depleted or permanently damaged

Sustainment - lifecycle Reliability, Maintenance and physical Asset Management practice driven by 'value'

Firstly, it is encouraging to hear that the Provincial Government wishes to improve current AM practice and understands that municipal asset management planning is not a stand-alone process - It must be integrated with other municipal financial and planning processes and important provincial initiatives. I look forward to the development of the Municipal Asset Management discipline and hearing of special initiatives for our prosperity.

1. A major flaw in the Discussion Paper overview statement

"At the very core of public sector asset management are two fundamental considerations: providing satisfactory levels of service to the public, and ensuring the sustainability of infrastructure assets over the long term."

The Designers dream - perverse incentives! The lack of cost control in the core fundamental considerations, encouraging over-design - the Construction companies / Original Equipment Manufacturers (OEM) / Primes will love the Provincial Government. Huge profits for a few well connected businesses is not the way to stimulate job creation and prosperity. And unfortunately, municipalities will be left with excessive Operations and Maintenance (O&M) bills to pay for years thereafter.

Clearly, there is much work to do to ensure that municipal asset management planning advances across Ontario. The two fundamental considerations are admirable however, the primary core fundamental should be: i) to reduce life cycle costs; [written as the 1st of the 3 core fundamentals].

Recommendation 1

The core fundamentals will be adjusted accordingly to three, adding i) to reduce life cycle costs;

Physical Asset Management 101

Facts

- * Sustainment costs, or Opex, typically represent 66% of an asset's whole Life Cycle Cost (LCC).
- * Post-design, typically 66% of the sustainment costs are locked in i.e. inherent to the design.

Sticking to generalizations. Let's say reliability and maintenance practitioners can achieve 33% improvements in O&M e.g. via LORA and RCM, which would be outstanding - World-class or Maintenance Excellence status.

Then, the options are:

- * Acceptance as-is of the designer's efforts post commissioning - 0% O&M savings.
- * 7.33% savings of the asset LCC via Overall Equipment Effectiveness (OEE) improvements post commissioning.
- 14.66% savings of the asset LCC via Early-AM Supportability Analysis (SA) practice, hence
- * 22% savings of the asset LCC via combined Early-AM SA & OEE 'Affordable Sustainment' practice.

We are currently blessed - both our Provincial and Federal Governments have seen the light and have committed sustainable funding to our much needed infrastructure. 137 billion dollars over 10 years [B] and 120 billion over 10 years [C] respectively. I am going to make the assumption that with an Ontario to Canada population of 38.6% our Federal share, of hopefully \$46.32 billion, will be mostly be invested in 'Smart Infrastructure'.

Assuming funding is allocated equally to Capex and Opex requests, then the potential savings on the total infrastructure monies is 22% of \$137 + 46.32 billion = \$40.33 billion, which can be re-invested, hence the ability to spread the funding awards across all 444 municipalities of Ontario.

With \$133 billion worth of municipal infrastructure assets in the province, there is also the potential for Sustainment OEE improvements. 7.33% of \$133 billion = \$9.75 billion, a further potential savings bonus.

Noteworthy

The Early-AM SA opportunity mentioned above requires getting a Support Solution Team (SST) in place prior to any acquisition, or Capex feasibility study. The SST will work with the Construction companies / OEM's / Primes to ensure lowest life cycle cost and will generate the predicted O&M cost data to keep them honest.

The Federal example of perverse incentives [1] driving current standard practice of limited front-end analysis and only transitioning acquisition (Capex) projects information to sustainment (Opex) programs post-commissioning, hence loading unnecessary operations and maintenance costs onto the 'End User'

municipalities, has to end. The status quo of standard post-commissioning AM practice within the public service industries has to be broken if Ontario is to become the world leader in sustainable development.

Recommendation 2

The Government of Ontario shall demand that Infrastructure Ontario entices all 'End User' municipalities to move to affordable sustainment and operational excellence practice i.e. whole lifecycle Asset Management-Sustainment Practice, with Information Interoperability.

Look on most university websites for available courses on engineering and you will often find Systems Engineering (Acquisition a.k.a. Capex practices) and all its component disciplines; however, you will rarely find its twin, Logistics Engineering (Sustainment a.k.a. Opex practices or advanced physical AM).

Recommendation 3

The Government of Ontario must delay any proposed regulation for a minimum of two years until a Training Needs Assessment is conducted and adequate education on good whole lifecycle Asset Management-Sustainment Practice is available province-wide.

2. Question# 3 * How could asset management plans best be integrated with other planning, policies and processes, including budgets in particular?

Our Future Ontario - is a Smart Sustainable Province

The transition to Smart Sustainable Cities or Communities is a socio-economic imperative for Ontario. Our municipalities must be built on technical innovation and new approaches to city-management.

Over 17 years ago (Aug-1998), I was one of only a dozen who submitted to the Federal Government's Blue Ribbon Panel which was mandated to determine how Canada could lead the world in Smart Communities development. Also, having distributed education material outlining the concept to many Ontario municipalities thereafter, I like to think that I was an influence in the Provincial Government decision to attempt the creation of 50 Smart Sustainable Communities across Ontario i.e. the Connect Ontario and GeoSmart initiative.

Internationally, the Smart Sustainable Cities or Communities (SSC) dream has been given a boost with the release of standards: ISO 55000, Asset Management, the UK BSI PAS 181, Smart city framework and ISO 37120, Sustainable development of communities, in 2014. China is planning 500 smart cities, India 100 smart cities. The EU and the US have Smart Cities Initiatives. Singapore and Malta currently have the primary goal of becoming a Smart / Intelligent Nation.

Recently, on 19 May 2016, the International Telecommunication Union in collaboration with the United Nations Economic Commission for Europe launched 'United for Smart Sustainable Cities' (U4SSC). The project U4SSC is being implemented in 56 selected countries in Europe, Central Asia and North America [2].

A Smart Sustainable Province initiative

'Smart Infrastructure' i.e. the Internet of Things (IoT), is the current game-changer in town. We cannot allow the financial wizards to regurgitate past old technology examples and extrapolate what the future sustainment costs are going to be. We need technical expertise. A knowledgeable breed of 'Sustainers' who can determine the LCC using predictive tools e.g. level of repair analysis (LORA), Reliability-Centered Maintenance (RCM) & spares optimization, so that 'Will cost - Should cost' estimates are closer to the truth; aiding effective reliability trade-offs, better decision-making and allocation of funds. For example, within the next 5-15 years, when most of the 'Metrolinx - The Big Move' [D] programs are to complete, driverless trains, LRT, buses and taxi-cars will be the norm. What effects on manpower and the operations expenses (Opex) is this driverless world going to mean? Only good Early-AM supportability analysis can tell us this.

You may say, we tried the 'Smart' approach with the Connect Ontario and GeoSmart initiative 15 years ago with limited success. My rebuttal to that would be - the Government of Ontario should have listened back then to the 'Sustainment Practice' argument and also not stifled innovation with conditions. This should be a lesson-learned for any proposed Municipal AM Planning regulation. We lost the advantage of a 15 year head start. We now need to double our efforts to get back in the smart cities game and become a front runner - Our prosperity depends on it.

Forecasts from Frost & Sullivan suggest the global smart city market will be valued at \$1.565 trillion in 2020. Some 23 billion connected devices will be in use by 2020 globally within these smart cities [3].

Recommendation 4

Ontario's overall Jobs and Prosperity strategy shall be to i) become a Smart Sustainable Province and, ii) target the Smart Cities marketplace.

3. Further - A general observation

From the respective Discussion Paper, I get the impression that the Provincial Government equates AM to municipal infrastructure only.

Health and education are two of the largest drains on the Provincial Government finances [B]. The same Asset Management-Sustainment Practice with Information Interoperability framework should be applied to all public sector footprints.

For example

Again, assuming funding is allocated equally to Capex and Opex requests, then:

* annual Health Care and Social Services expenses - 22% of \$62 billion = \$13.64 billion in potential saving, which can be re-invested. Likewise,

* annual Education and Training expenses - 22% of \$53 billion = \$11.66 billion in potential savings.

There needs to be a whole-of-government approach to advanced physical AM for our future prosperity.

Recommendation 5

The Government of Ontario should study and report on the potential of a new integrated approach - A government-wide, cross-ministries, Asset Management System introduction.

Endnote

As outlined above, there is no shortage of monies for building 'Our Future Ontario' if we adopt an Asset Management-Sustainment Practice culture throughout government. The savings can be substantial. Only political will and good leadership is required - What happens next is up to you.

Reference and Websites:

[A] Municipal Asset Management Planning Regulation Discussion Paper
www.ontario.ca

[B] Ontario Ministry of Finance
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[C] Department of Finance, Canada
www.fin.gc.ca

[D] Metrolinx - The Big Move
<http://www.metrolinx.com/thebigmove/en/default.aspx>

[1] The Canadian Press - perverse incentives: for industry to increase costs
<http://ipolitics.ca/2016/03/13/perverse-incentives-leaked-report-blasts-federal-contracting-regime/>

[2] United for Smart Sustainable Cities
<http://itu.int/go/U4SSC>

[3] Frost & Sullivan
ww2.frost.com