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Planning Analytics for Asset Lifecycle Management (PALM)

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City agencies need to co-ordinate the planning and management of assets to improve the quality of service to its citizens

- City agencies are under tremendous pressure to provide improved quality of service to its citizens.
- Cities need an innovative approach to managing aging assets. Specifically agencies are very concerned that because of the budget shortfalls they are delaying the replace, rehab and repair decisions that will eventually result in:
  - a big bump in failure of assets
  - increase in average age of assets
  - lower quality of service
- PALM takes an innovative approach to cross agency planning by bringing together the concept of total lifecycle management of city infrastructure using descriptive, predictive and prescriptive analytics. PALM leverages three pillars:
  - **Asset Performance Analysis** – Cross-agency predictive & quantitative analysis of current performance of city infrastructure; Scoring framework to enable identifying low performing assets
  - **Strategic Needs Assessment** – Identify short (1-5 years) and long (10 – 100 year) term investment candidates across all city assets; Perform sustainability analysis
  - **Investment Planning** – Perform cross agency comprehensive planning for optimal operation and capital management

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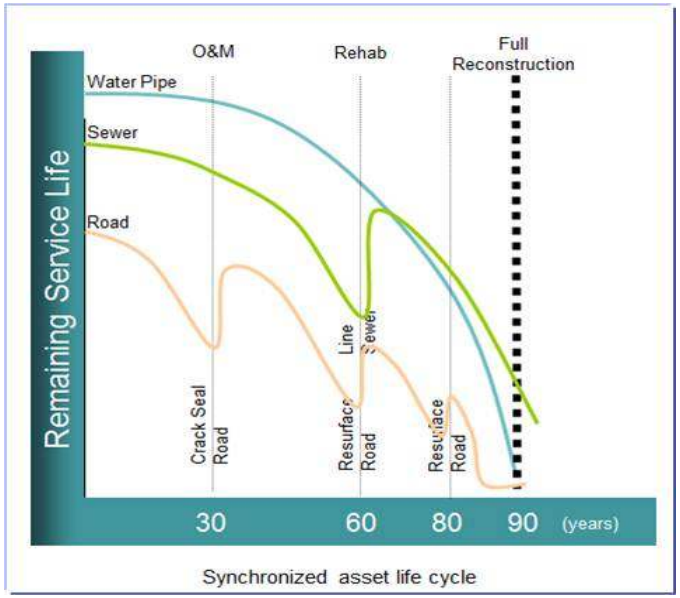
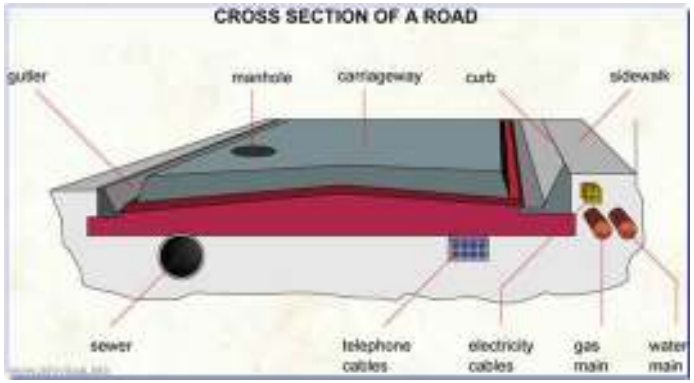
Key goals of Coordinated Capital Planning

Goals: Enable a cross agency / asset investment planning by predicting, prescribing, coordinating and acting as a unified entity.

- What is the remaining service life of road, water, storm sewer etc. at each block of road?
- What are my prescription options: pave the road in 2012 vs. full reconstruction in 2017? Reline the pipe in 2013 vs. replace in 2018
- Can I synchronize the prescriptions so we only dig once
- Maximize "gain in service life / $ spent"





Road **Water** **Sanitary / Storm** **Ponds** **Bike Paths** **Signs** **Pavement** **Buildings**

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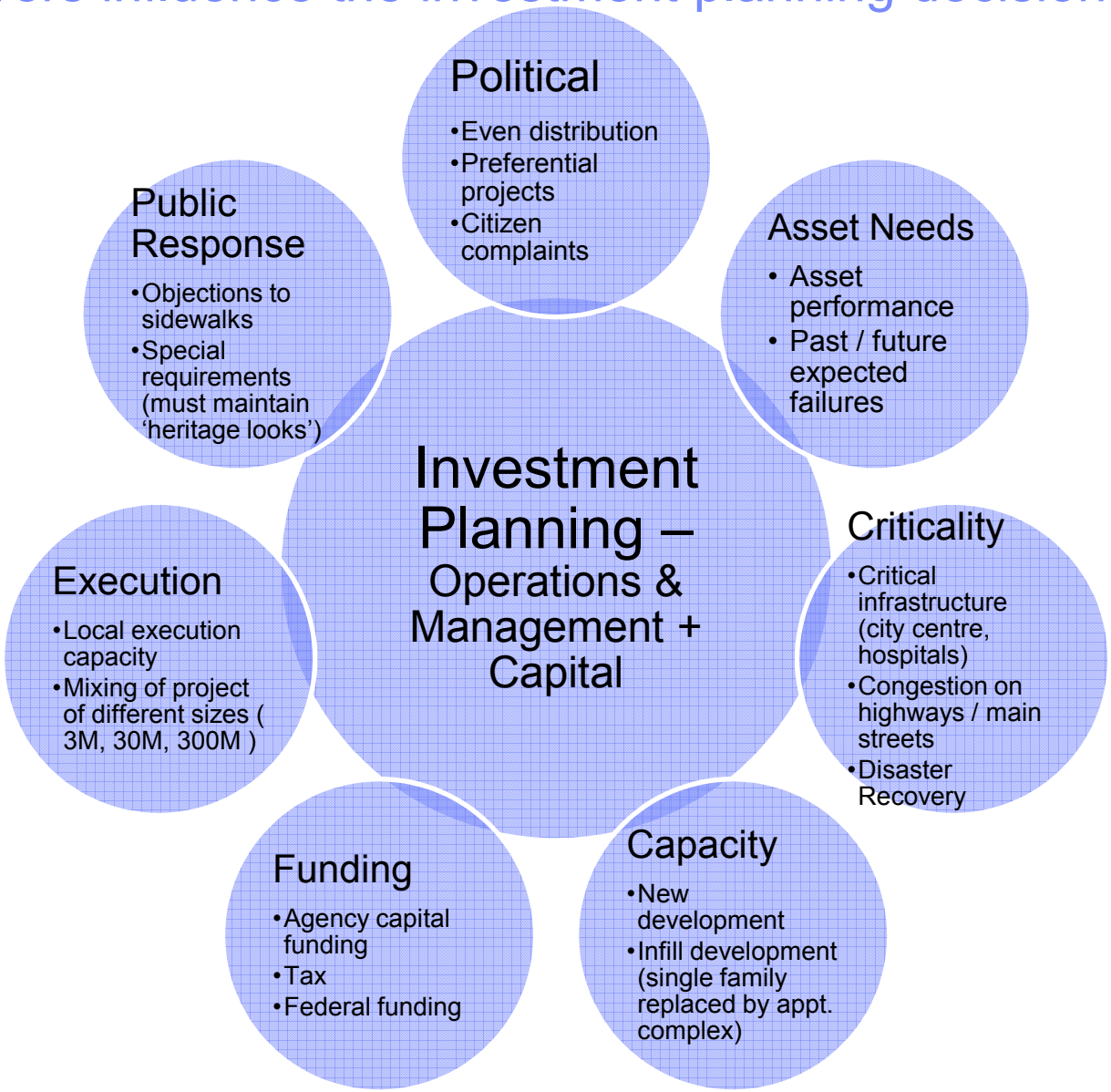
Multiple drivers influence the investment planning decisions



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PALM won the prestigious AMO (Associations of Municipalities of Ontario) award for most innovative use of federal gas tax money in a public-private partnership

City awarded for partnership with IBM

The city's partnership with IBM to improve the management of Cambridge's infrastructure has captured provincial attention.

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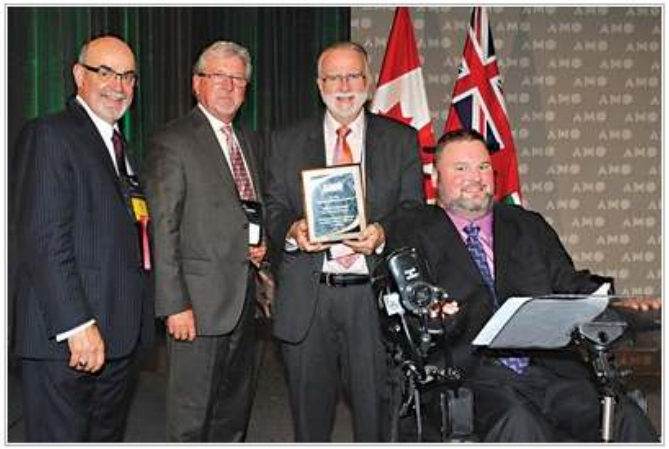

left to right
(left to right) Gary McNamara, president of AMO; Rudi Loepp, public sector industry solutions executive for IBM; Cambridge Mayor Doug Craig; and Steven Fletcher, Canada's Minister of State-Transport, were part of the award ceremony Monday in Ottawa.

The city's partnership with IBM to improve the management of Cambridge's infrastructure has captured provincial attention.

Cambridge was awarded the Association of Municipalities of Ontario Gas Tax Capacity Building Award for the innovative public/private partnership.

Steven Fletcher, Minister of State for Transport; and Gary McNamara, president of AMO; presented the award to Cambridge Mayor Doug Craig at the association's annual conference in Ottawa last Monday.

Honoured for its use of a specialized system know as PALM?(Planning Analytics for Asset Life-Cycle Management), it was built in Cambridge, in collaboration with IBM. It brings together information from multiple departments within the city and makes it accessible to crews in the field through mobile devices, to expedite repairs and maximize the life span of the city's infrastructure. The city can gather growth management, infrastructure conditions and utility data from PALM to better co-ordinate renewal projects.

Cambridge invested $150,000 from Canada's Gas Tax Fund into the innovative project. It's expected that the PALM system will save the City $100,000 per year in staff time spent on capital plan forecasting. In addition, Cambridge expects to save on costs related to project coordination and enjoy the benefits of long-term, sustainable asset management – City of Cambridge

Cambridge's PALM system demonstrates an exceptionally innovative use of Canada's Gas Tax Fund that will provide long-term benefits to both the community and municipalities across the province- Gary McNamara, AMO President

We need to find more efficient ways to analyze data, anticipate problems and co-ordinate resources and this system helps us do that – Mike Hausser, Director of Asset Management, City of Cambridge

http://news.ca.msn.com/ontario/cambridge/city-awarded-for-partnership-with-ibm

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PALM has five modules that enable analytics based cross agency planning

	Infrastructure Profile	Predictive Performance Analysis	Needs Assessment	Project Identification	Investment Planning
What does it do?	Describe historical assessment of assets using key performance indicators	Predict future failures, expected costs and expected service life for assets	Analyze KPIs to assign a health index score and identify potential prescription options	Identify projects across agencies for future capital investment	Optimize investment allocation to maximize the service life extension & service level improvement
How does it do it?	Coalesce asset management, GIS and other data sources into a unified correlated information hub	Evaluate historical KPIs to predict the future events and their financial impact	Calculate unified health index using predictive and historical KPI values in an analytical framework	Apply business policy by traversing a multi-layer tree composed of multi-asset needs	Plan funding assignment to candidate projects by satisfying complex business constraints
What is the scope of analysis?	Multi- Asset Analysis	Single Asset Analysis	Single Asset Analysis	Multi- Asset Analysis	Multi- Asset Analysis
What are the key outputs?	Historical KPIs across all asset classes	Mean residual life, failure probability, expected future cost	Temporal view of prescriptions; Cost , service life extension & service level improvement	Block level prescription across all asset classes	Executable projects, funding sources, execution year
What type of analytics is used?	Spatial correlation, multi-layer querying, business intelligence	Predictive analytics	Predictive analytics, analytical framework	Business rules management system	Prescriptive analytics

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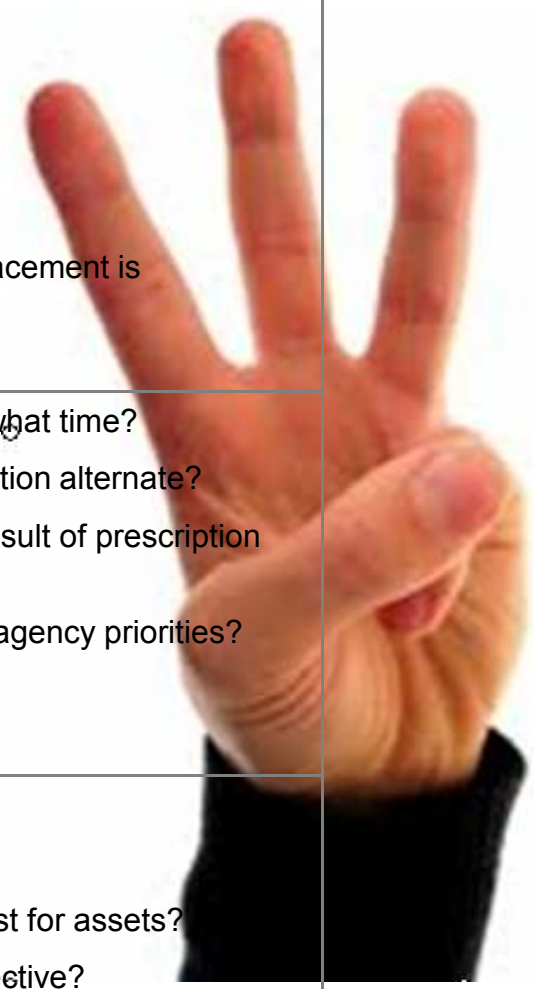
PALM addresses innovation at three core phases of asset lifecycle management

Performance Analysis	▪ What is the current and expected future condition of assets? ▪ What assets that are impacting the quality of service to citizens? ▪ When was the asset constructed / rehabilitated / replaced? ▪ Where is the asset / component in its lifecycle? ▪ What is asset's theoretical lifecycle? ▪ What is the estimated residual life until rehabilitation and / or replacement is necessary? ▪ Is the asset technically or commercially obsolete?
Strategic Needs Assessment	▪ What alternate prescriptions can be applied to the assets and at what time? ▪ What is the expected performance improvement for each prescription alternate? ▪ What is the future expected O&M cost / savings for assets as a result of prescription application by time horizon? ▪ What are the capital plan candidates 1,3, 5, 10, 30 year by cross agency priorities? ▪ Is the future plan sustainable? What is the revenue gap? ▪ How can end-of-life of assets be synchronized?
Investment Planning	▪ What is the optimal capital plan given the future needs? ▪ What assets are good candidates for O&M ▪ Given the expected future O&M cost, what is the total lifecycle cost for assets? ▪ Run alternate planning scenarios based on different strategic objective? ▪ Perform a cross-agency asset planning analysis



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Planning Analytics for Asset Lifecycle Management (PALM)

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PALM incorporates use cases for decision support across the complete lifecycle of the asset

Performance Analysis

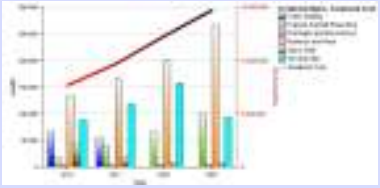
Infrastructure profile

Predictive performance analysis

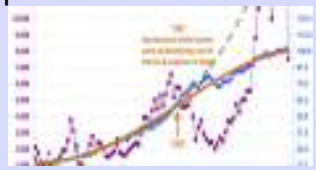
Performance scoring

Strategic Needs & Sustainability Analysis

Asset needs analysis



Sustainability & rate case optimization

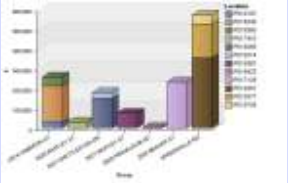


Cross agency project identification

Investment Planning

Operations & management planning

Agency capital planning



Integrated multi-agency planning

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Enterprise dashboard is built on IOC platform enabling quick and seamless deployment and customization

Spatial infrastructure profile of complete city assets: Road, Water, Storm, Sewer, Ponds, Parking Lots, Street Lights etc..

Predicting failure probability, mean residual life, expected failure in next year etc. for assets

Prescribing treatments for assets; Performing sustainability analysis

Performing cross-agency investment planning: Funding constraints, multi-year planning, multiple objectives

Value proposition of PALM

	Short Term	Long Term
Multiple Agencies	○ Cross-agency infrastructure analysis ○ Multi-agency / asset risk analysis ○ Cross agency project identification ○ 'Best value for money' project analysis and categorization	○ Cross agency capital project identification for long term ○ Integrated investment planning across agencies ○ Integrated project identification for 5, 10, 30 years
Single Agency	○ Current risk profiling of complete infrastructure ○ Macro & micro level failure prediction ○ Asset health scoring ○ Prescription identification ○ Quantitative investment planning with 'color of money' constraints and multi-objective analysis	○ Long horizon failure prediction of assets ○ Asset deterioration curves ○ Sustainability analysis ○ Rate case optimization ○ Long term analysis to identify 5, 10, 30 year projects

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A broad set of users are an ideal target for PALM

- City mayor / city council
  - Mayor's office of capital projects / sustainability center

- City agencies / departments
  - Department of Transportation
  - Department of Public Works
  - Department of Planning
  - Waterworks Department
  - Building Management
  - Other agencies owning / managing assets

- City department managing multiple agencies
- Semi-Private / Private agencies
- Engineering companies making business case for infrastructure investment

Note: The set of users depend on how the city departments are organized including roles and responsibilities. The set of target users for each city will be a function of the roles & responsibilities

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Thank You!

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