CIS-TRM Town Hall Meeting Summary – Phase II

Discussion A: CIS Short/Medium Term Technology Development Needs

Research & Development (R&D):

- Deterioration Data:
  - The reality of aging Infrastructure may be better demonstrated through the use of qualified Deterioration Curves. These can be used to generally assist personnel for better decision-making. We can look into their applicability to small systems.
  - Proof of deterioration factors should also be provided.
  - Understand deterioration and service life (ex. failure mechanism). Develop more predictive tools.

- Monitoring (ex. quality of water in distribution systems) and what to monitor (ex. performance of new materials) should be determined.

- Help coordinate interventions between utilities.

- Evaluate the ruggedness/robustness of technology.

- Continued development of CALIBRATED NETWORK models assessment to support decision makers and address issues of reliability.

- Ensure there is dedicated research & development (R&D):
  - Evaluations of projects by expert groups using technologies and dissemination should be ongoing.
  - Establish a permanent Infrastructure Program of pilot projects, demonstrations and technologies.

- Tools that can determine the residual life of infrastructures.

- Tools that evaluate the performance of new technologies.

- Tools for consumers to understand the cost of usage.

- Tools to evaluate the impact of rehabilitation on residual life.

- Calculations on the life cycle of the work.

- More research should be done on "Non-man" entry technologies (ex. A sewer system without manholes. Maintenance is accomplished by robotics, remote control, etc.)

- Develop technologies in multiple disciplines.

- Develop infrastructure protection systems.

- Executive management systems already exist, but more R&D should be done in order to optimize the usefulness of tools they provide. As well, refine them to better accommodate the industry's needs.

- Tie research with the commercialization network.

- Databank of past problems/failures and solutions so that we don't make the same mistakes again and we don't need to "reinvent the wheel".

- Create a GIS/database of inventory. Create a Best Practices Directory with "universal" access.

Knowledge & Exposure:

- Better identify the community's needs.

- Create visualizations of the interesting aspects of infrastructure to better educate users (ex. Virtual tours of infrastructure).

- Influence "externalities" on infrastructure.

- Promote integration of clean and non-polluting technologies.

- Quantify the benefits of interventions (social, economical) that decision-makers are accountable for.

- Market studies to help promote R&D.

- Increase the fundamental understanding of materials.

- Industry connection:
    - Life expectancy maintenance must be enforced. For example, important facts about the impacts of increased maintenance dollars on life expectancy should be collected. We should also generate "improvement curves". Most importantly, share knowledge/information with "trust".

  - Create and investigate an environment where we can share ownership (ex. Technology that assesses and allows exchange of information).
  - Employ a risk-sharing mechanism. Do not fear failure.
  - Have a promotion/communication system between academia, researchers and owners.
  - Ensure all participants are included in the delivery of good systems.

- Educate the public on asset management and legislative requirements. Give them a better understanding of technical needs. Let them know the condition of our infrastructure and the need for standardization.

- Need better knowledge of the harmful consequences of poor water quality. Provide information, such as measurements.

- Review the curriculum – "MBA-Infrastructure".

- At the political level, provide education on asset management.

- Mobilize public/political opinion.

- Develop new demonstration projects to showcase capacities in order to accept new technologies.

- Encourage cooperative efforts, such as a Canadian owned consortium. Industry + Government => Delivery of Services.

- Incorporate future needs/requests.

- Implement web-based systems for information about infrastructure.

- Generate and circulate information/data that feeds policy papers.

- Knowledge of networks – 2 levels: 1) preliminary; 2) in-depth.

- Quantify the "sustainable" level of infrastructure. Demonstrate how infrastructure is actually needed and define demand management.

- Identify and understand the value/benefits (real costs) associated with CIS assets. People are more willing to spend when they know what is to gain from their investments. It is only a question of sustainability. Hence, we must deliver the on-going message of the importance of sustainable development via P.R. campaigns, giving rise to cultural shifts.

- Understand who the players are and the technologies that can be adapted by different players.

Innovation & Improvements:

- Acknowledge the cultural shift to adopt new technology, such as materials, and improve their application techniques.
- Define the measures to be taken to develop better tools.
- Define technological “counter-performance”.
- Adapt technologies from other sectors.
- Tools that allow more collaboration in execution (non-linear).
- Invent technologies that are self-contained. “It has to make itself work”. As well, use materials that last longer and design for durability for these self-contained systems.
- Deal with "variables" (change).
- Real-time tools for measuring the condition and performance of the infrastructure.
- Technologies that can adapt to climate conditions during maintenance, rehabilitation and construction.
- Technologies and management tools adaptable to small urban areas.
- Develop IT to address the barriers to implementation: the legacy of past decisions and adapting new approaches to stay ahead of wave.
- Address the issue of lack of redundancies in "critical" components.
- Determine optimal preventive and corrective interventions to be included in the decision-making process (ex. maintenance, life cycle scales).
- Auscultation tools, underground in particular.

Human Resources:

- Train human resources to deal with drinking water. Enforce a new provincial regulation => need for training.

- Build up more qualified labour through training, developing more partnerships, performing more applicable research, and emphasizing the value of engineering (ex. certification).

- Praise HR competency in technological innovations.

- Adapt modern tools for practical training (of professionals and practitioners). Get manufacturers of infrastructure technology involved.

Structuring & Standardization:

- Standardized data repositories about what's available in the market.

- Adapt standards (LC Analysis) to regional climatic conditions & soil.

- Standardize the methods of economic analysis of projects. This may be accomplished through building an Expert system model, made available to any user. There should be a consensus on input values, multi-objective criteria, data organization, completeness, availability, "integration" of different types of infrastructure, and should progress from project to program planning.

- Compose a decision model based on the present (hierarchical) reality and upgrade it to a systematic model.

- Move toward grade specifications.

- Planning procurement: establish a priority plan and upgrade local standards.

- Ensure tools respond to the broadest possible legislative and administrative framework.

- Establish standard industry terminology and their definitions.

- Define the concept of performance depending on the type of work. Also define the non-performance penalty criteria.

- Liability is becoming a major concern. We must reduce liability through implementing quality management systems and/or standards.

- Define the minimum and compulsory infrastructure upkeep and maintenance standards.

- Enforce laws on municipalities to use new technologies.

- Define the essential points of the infrastructure diagnosis.

Management & Finance:

- Allocate a percentage of money towards innovation (R&D).

- New funding mechanisms to foster development of new technologies/processes. Explore and implement (ex. Green fund). All possible funding sources should be studied.

- Allow capital investment with broadbands.

- Consider exporting our technologies.

- Emergency management tools.

- Data management.

- Quality control and competencies.

- Work on low bid procurement. Adopt and accept LC procurement.

- Perform activity-based costing (which takes us through processing => understanding the issue => integration of finance with engineering). Create a sustainability model for infrastructure.

- In terms of LCC, find out what the "real" user cost/value is.

- Generate decision-based LCC and determine the cost of non-adoption.

- Assess the entire cost and perform a life cycle analysis. Link these to the decision model process; address social, environmental and economical issues.

- In view of the process issue, there should be an integration of Capital Operation Budgets, Life Cycle Costs (LCC) and maintenance planning. The main challenge is to incorporate "other" costs.

- Evaluate and improve the cost-effectiveness of building and materials.

- Make this a free market (ex. P3 Initiatives and others).
- Marketing management tools: promote infrastructures with regard to other needs.
- Cost characterization protocol.
- Infrastructure management & funding – What are the "Carrots & Sticks?"
- Pool resources of small communities to increase purchasing power.

Discussion B: CIS Technology Challenges to Meet Needs

These are items chosen from Discussion A that Town Hall Meeting participants identified to be top priorities. Each item has been expanded in discussion to identify the barriers as well as technical solutions.

- **Uniform/Standardized Methods of Economic Analysis**

  - Define objectives and the perspective.
  - Develop performance measures. Define, quantify, distinguish comparisons & trade-offs, and identify social and economic benefits (ex. BC cost benefit assessment manual). Another challenge is to create a process to determine "value" of measures. We should develop a "skeleton tool" that can be customized, and make it relatively simplistic and transparent (See AB Infrastructure - data collection).
  - Data collection (private and/or centralized). There exist various levels of sophistication, based on available data (Top down approach).
  - Including a "sensitivity" of model with bounds and subjectivity.
  - Deriving output: Defining the best return on investment (ROI).
  - Determining the needs pertaining to inventory, function & interrelations.
  - Gathering information on funding mechanisms.
  - Answering the question: Should we perform full cost accounting or not? (Ex. Training)

- **Infrastructure Management and Funding [Carrots & Sticks]**

  - Demand management tools.
  - Identifying life cycle management benefits (ex. New Zealand).
  - Acquiring technologies to measure demand and manage it.

- Developing “User-pay” technologies where their objective is to measure the use of service and costing it.
- Maintaining focus on "standardized" technologies.
- Encourage "innovations".
- Acquiring cost saving information through comparing technologies, service lives, etc.
- Liability: use as an accounting tool
- Vulnerabilities of infrastructure management and funding.
- Can we learn from others?

- **Acquiring Knowledge of the Condition of Infrastructure**
  BARRIERS: Budgets and diagnostic costs
  - Non-destructive diagnostic tools.
  - Tools for networks and projects.
  - Reliability of information.
  - Involvement of Public Works => knowledge
  - Appropriate indicators.
  - Accessibility and popularization
  - Information update
  - Knowledge through technological surveillance
  - Compulsory declaration by the owner of the work – What form?
  - Identify and understand the problems “to be inspected”.
  - Prioritization of inspection
  - Frequency of inspection
  - Common standardized performance indexes.

- Know the construction and maintenance history, etc.
- Recommend courses for elected officials.
- Manpower training: specialized and technical depending on the technologies; certification and continuing education.
- Form taken by information management?
- Integration of analytical results into a master plan
- Standardization/formulation of status report.
- Publication of results, such as benefits of methods.
- Task empowerment at all levels => coordinator (Federal/Provincial/Municipal)
- How much time is required to execute measures?
- Obtain information from experienced employees – "corporate memory" – interdepartmental cooperation.
- Definition of new technologies – inventory.

- **Tools to Determine Residual Life (ex. Deterioration Curves and Improvement Curves)**
  BARRIER: The difficulty of determining Residual Life lies in the complexity of systems: pressurized structures (ex. aqueducts), various materials, etc.

  - Define "Residual Life"; definition based on the industry of the intervention and the type of structure, function and performance.
  - Integrate into the master plan.
  - Generate deterioration models and comparative data for materials and structures.
  - Knowledge of materials
  - Infrastructure use – forecasting tools. Calibrate forecast simulations (reliability) and validate at the time of the forecast.

- Operations training.
- Tools that consider the reduced data history.
- Maintain consistency of data over time.
- Gearing analysis to different levels of decision-making.
- Developing risk and/or decision models.
- Developing inexpensive and reliable (calibrated) tools.
- Designing/Constructing in-place technologies (ex. liner for sewers).
- Costing the technologies.
- Non-destructive testing (NDT) or condition rating.
- Continuous monitoring technology (ex. sensors that are inexpensive).
- Sharing a "common language" & establishing common procedures.
- Generate costing models and investment models.
- Collecting "field" performance data for rehabilitation technologies.
- Reliability of systems: objective, repetitive, recognized or standardized.
- Recognized practices.
- High-performance tools (network level).
- Knowledge of the parameters that influence the life cycle.
- Use of results:
    - How in the decision-making process?
    - Optimal intervention time.
- Paradigm shift of the low tolerance level for failure:
    - The steps needed to "share risk".
    - How to measure risk aversion
    - Demonstration projects
    - The "value" of risk

- **Calculations of the Useful Life of the Work**
  BARRIERS: change the culture and accounting – all levels
  - Permanence of decision-makers

  - Define useful life
  - Establish the service levels.
  - Quantification of the effects of interventions.
  - Quantify the costs/scenarios and forecast.
  - Decisions: short-term versus long-term
  - Quality versus Cost; analytical tools
  - Optimization of use of technologies, products and materials.
  - Define economic parameters.
  - Account for standardized services
  - Incentives
  - Establish the residual value
  - Relate the robustness of decisions to the sensitivity of the parameters- “risk analysis”
  - Maintenance cost trend models
  - Expectations in terms of unrealistic times and financing for short-term projects.
  - Cyclical industry.

- **LCC - Real Cost/Value**

  - What are costs?
  - Define these costs, including discount rates.

- The challenge is measuring the life of assets, and costs over life of assets. There's also a challenge in measuring the database.
- Costs influenced by "level of service".

- Educating the public that infrastructure has a life cycle.

- National Action Plan Information:
  - New "sustainable" funding ("rate structures") models. Be aware of the "burden" on the municipality and provide alternative service delivery mechanisms (evaluations).
  - Developing planning tools that provide integrated, adopted infrastructure asset management.
  - Managing inventory
  - Establishing processes for ROI.
  * "Recognize"/reflect instead of include
  - Strengthening institutions via: education and training; communication; corporate structures; knowledge; governance; and, interactions (ex. between partnerships).
  - Need "stakeholders" (ex. Lobby) group
  - To continue moving, we must plan forward.

- **Identifying, Understanding and Communicating the Real Costs/Benefits/Value of CIS Assets:**
  BARRIER: Deliver an on-going message.

  - In order to overcome the frustration of abstract costs, we should develop standardized methods of accounting and standardized formats/templates.

  - Public apathy is taken for granted. We should make an initiative to report the asset value to the public and get them involved in the decision-making process. "Tell them where their money is being put to use". Ex. Show the depreciation rate.
  - Public accounting methodology in Legislation must be employed. To deal with this issue, we should devote a "Body" to deal with the legislation and deal with other invention models.

  - Assess the state (the value) of infrastructure with technological tools. There's also the need for tools that can assess an Holistic Model.

  - There's no incentive (ex. Rewards, benefits) for the public to adopt a policy. To demonstrate to them the benefits associated with new policies, we can have the insurance sector track failures and costs

associated versus LCA. Furthermore, we can track successes, perform benchmarking, and revise accounting methods.

- Establishing a level of service

- **Quantification of the Benefits of Intervention**
  BARRIER: Encourage all stakeholders to provide information

  - Case studies: projects and "management methods".
  - Define life cycle and the impact on life cycle.
  - "Simplification"
  - Identify performance indicators
  - Identify interventions at different points in the life cycle.
  - Benefits associated with money (even environmental).
  - Short-term and long-term cost/benefit studies.
  - Incentives to evaluate the social costs/benefits. The type of incentive depends on the analysis level and is defined by the party requesting the information.
  - List benefits by forecasting (before) and/or evaluating (after) and report.
  - Establish regionalized costs of intervention techniques.
  - Establish the impacts of non-intervention
  - "Qualify" the results.

- **Tools to Evaluate the Performance of New Technologies**

  - Look for "old" technologies elsewhere and compare existing technologies.
  - Comparison of performance in similar situations.
  - Accelerated tests

- Define utilization parameters.
- Reliable and certified tools.
- Beta site to evaluate – experimental sites for pilot projects.
- Government bodies providing sites for pilot projects.
- Emphasis on "Made in Canada" technologies.
- Monitoring of pilot projects (programs).
- Funding related to risk sharing.
- Technology life cycle analysis.
- Multidisciplinary analysis
- CITAC/SATI
- Overall cost of the technology versus conventional technology.

- **Education in the Political/Public Level Regarding Asset Management**

  - It is not a perceived priority for the public. Hence, we need a National academy with a sustainable mandate. They must target the message to the audience and the spokespersons. We need to place engineers in leadership positions.
  - Sometimes, it's difficult to have fully informed decisions. To resolve that problem, we can use systems that provide costing options and use simple analogies, like car maintenances, to describe situations.
  - There's a lack of integration in decision-making. Tools should be employed to perform the integration and decisions should be prioritized.

    Ex. Certification Program:
    - Tie criteria to funding
    - Automated trigger(s)
    - Program funding; dedicated reserves

    Furthermore, an inventory of materials and/or innovative methods for replacement and rehabilitation (aimed at optimizing durability) can be maintained. Lastly, integrate multi-discipline databases and their applications.

- **Sharing Knowledge**

BARRIERS: Dissemination of industrial secrets;
- Difficulty of opening mind to bad experiences;
- "Blind confidence" in unproven technologies.

- Ownership of information
- Sharing at all levels.
- Dissemination of knowledge.
- "Experience" with the monitored result.
- Knowledge of errors and how to avoid them.
- Neutral validation of case studies.
- Knowledge sharing tools, such as websites.
- Distinction:
  - Continuing education;
  - Post-secondary education
  - Technical learning.
- General incentives for training in sharing.
- Quality of information
- Cooperation between disciplines involved.
- Send the information to whom?

Low Bid Procurement: Adopt Life Cycle Principles for Procurement

- Low bid-procurement is always open to misuse and abuse. So we must develop a method that includes innovation in the bid procurement.
- Risks can be accommodated by life cycle approach principles.
- Industry is not always willing to pay for the price of innovation of materials or processes. Hence, we should encourage quality, durability and longevity in design. Tools that quantify value and demonstrate benefits may give the industry a better idea of the advantages of innovation.

- A set (fixed) capital is restrictive. Some solutions are: to show all demonstration project(s) based on a different procurement model; investigate (ex. carbon based modeling); and, develop new delivering models.

- **Planning procurement: to establish a prioritization of processes/systems**

  - Insufficient human resource competencies at some community levels: Develop a model of planning and technicalities to generate assistance (Ex. Mentoring).

  - More knowledge about the inventory of CIS.

  - Improve the reliability of numbers.

  - Turnover of consultants pertaining to bid procurement.

General Conclusions/Recommendations

1. Dissemination of TRM to Federal, Provincial/Territorial and Municipal involvement.

2. Include other stakeholders (ex. finance, insurance) in the CIS-TRM project.

3. Bring infrastructure to the public eye and promote the value of infrastructure in an appealing and interesting manner to the general public (ex. "The story of infrastructure").

4. Civil Infrastructures are in many ways the healthcare system of "communities".

5. Track historical patterns of funding (ex. % spent on repairs versus new versus maintenance)

6. Life Cycle => Funding

7. Responsibility => Accountability

8. Discuss the Information Cycle Process

9. Possibly get the Marine Transportation Sector involved.

10. Railway/moving people; remote communities.

11. Link TRM with other initiatives (ex. Transport Canada) and find out the barriers and technological means to resolve it.

12. Explore the Innovative Spectrum.

13. Reserve money annually to put the plan into action.

14. Promote efforts, disseminate information (educate the population and reeducate practitioners).

15. Subsidies related to knowledge of the condition (incentives accompanied by tools).

16. Harmonize.

17. Dedicated underground networks.

18. Favour technologies that protect the environment.

19. Study GASB 34 and its application.

20. Investment in infrastructures.

21. Federal investments with: Engine => Ottawa
Distances => Provinces
Actions => Cities

22. Public awareness of the importance of infrastructures.

23. Involvement of journalists.

24. Future programs: structured so that the work is spread over several years.

25. Evolution of society; insurance, litigation, etc.