

Why is so much emphasis placed on *Design* and *Construction*, and not *Asset Management*?

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Defining a Research Agenda for AEC Process/Product Development in 2000 and Beyond

*The United States spends an enormous amount of money annually to replace or repair deteriorated equipment, machines and other components of the infrastructure. In the next several decades, a significant percentage of the country's transportation, communications, environmental, and power system infrastructure, as well as public buildings and facilities, will have to be renewed or replaced.*¹

North America has an established “built environment” of buildings and constructed infrastructure with a value of more than \$20 trillion (at this point the number is significant, frightening and difficult to prove – much like the combined national and regional governmental debts). As such, the operation, maintenance, repairs, and eventual renewal of this built environment represents a major, rapidly growing cost to Canada and the USA.

The Federal Facilities Council² recommends maintenance and repair expenditures of 2-4% of the “Capital Replacement Value” of constructed facilities per year; -- equaling approximately \$0.4 trillion per year in North America). In addition, most construction components or systems *only* have service lives ranging from 5 to 50 years; thereby necessitating rehabilitation or renewal expenditures equaling \$1.0 trillion each year, on average. Therefore, the maintenance, repair and renewal market represents a significant portion of the construction industry, as well as significant expenditures to owners and operators of facilities. A recent review of Statistics Canada construction expenditures by municipalities has shown that close to \$80 billion is spent on construction every year; significantly less than the “maintenance expenditures”.

Not only are we *not* spending enough on maintenance and repair, we are accumulating a repair and replacement deficit for Canadian public infrastructure, estimated at \$44 billion in 1995³ (All these numbers can be multiplied conservatively by 10 to reflect the USA construction economy).

¹ *Research Agenda for Test Methods and Models to Simulate the Accelerated Aging of Infrastructure Materials*, Board on Infrastructure and the Constructed Environment, National Research Council, National Academy Press, Washington, D.C., 1999

² *Budgeting for Facilities Maintenance and Repair Activities, Standing Committee on Operations and Maintenance*, National Research Council, National Academy Press, Washington, D.C., 1996.

³ *Report on the State of Municipal Infrastructure*, Federation of Canadian Municipalities, 1995.

To make matters worse, in the authors' view, too much emphasis has been placed on new construction for the past three decades, all to the detriment of maintaining the existing facilities. As a result, organizations may have more facilities than they can afford to maintain; and in many instances, they may be unaware of this situation and their serious predicament.

Maintenance is “boring”, design and construction are “sexy”

No Politician has ever had a pot-hole contract ‘ribbon cutting’ ceremony

[unknown Director of Public Works]

In addition, many buildings are run inefficiently due to poor monitoring and control systems, water and road networks are deteriorating faster than they can be replaced and the overall condition of the nation's bridges remains unknown, and hazardous. A lack of knowledge of the condition of the built environment often means that the scarce resources that are available for maintenance and repair are used inefficiently or inappropriately. These problems affect everyone through increased health and safety risks, reduced economic competitiveness, inefficient maintenance strategies, the reduction in value of a nation's built assets and a need for increasing funding to maintain the built environment. In some cases, this overall inefficiency will actually create the need for “new” buildings and constructed infrastructure, even when suitable facilities already exist or can be modified.

Asset managers and facility managers are responsible for managing this substantial amount of maintenance and repair work. It is their responsibility to optimize their expenditures and to maximize the value of the asset over its life cycle. In many instances, the design and construction costs are small compared to both the asset management costs and a building's life cycle cost; thus making the asset managers and the property managers major players in the construction game. Asset and property managers are faced with many difficult decisions regarding when and how to repair their existing building stock cost-effectively. They have few tools, either literature or intelligent computer software, to assist them in the decision-making process.

Aggravating this situation, economic trends suggest that the next ten years will be ones of decreased revenues and dwindling profit margins. Some major property owners in North America such as Public Works and Government Services Canada have forecast reductions in operating and maintenance budgets. In addition, premature deterioration is appearing in many “newer” construction products and many conventional construction solutions and products are failing for little-understood reasons. Further complicating the asset manager's headaches are perennial construction problems such as the fragmented and conservative nature of the industry, the limited financial resources for research and poor technology transfer to building practitioners. All these factors combine to add more stress to an asset manager's task of maintaining assets at acceptable levels over a building's service life.

Hey, Asset Management is “sexy”!

As indicated above, there is a significant demand for proper asset management strategies and techniques; however, there are few tools currently available. However, information technologies can assist many facets of the problems:

The author presents his five “Whats” of asset management:

- What do you own?
- What is it worth?
- What is its condition?
- What is the maintenance backlog?
- What will you fix first?

Typically most organizations fare well for the first question, then may fail miserably on the remaining four questions. Or, there might be a scattering of responses depending on the discipline domain (i.e. roadways, bridges, parks, buried, buildings).

Research Agenda

Information and communication technologies now allow asset managers to be more efficient in the way they manage their facilities. More specifically, technologies such as product modeling and data warehousing will permit the storage of data concerning facilities and will be able to translate these data into useable information and knowledge.

- **What do you own?**

Relational and object-oriented database technology combined with Geographical Information Systems (GIS) will provide an accurate picture of the extent of a portfolio.

- **What is it worth?**

Life cycle analysis, economic modeling, and trending will calculate both coarse and accurate values of generic types of construction.

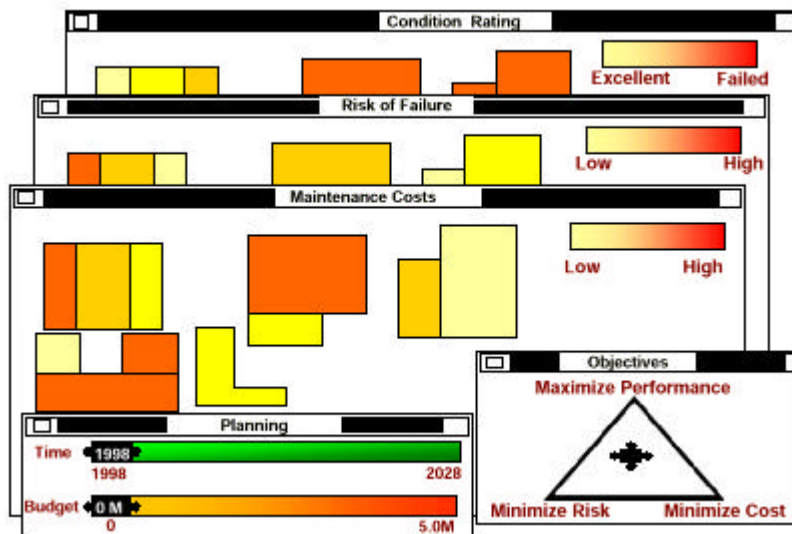
- **What is its condition?**

Engineered Management Systems, as proposed by the US Army Corps of Engineers, or financial models as proposed by the National Association of College and University Business Officers can be used to establish the technical condition or the financial backlog of the asset, respectively.

- **What is the maintenance backlog?**

- Trending, data warehousing, and object-oriented databases will allow the managers to calculate both the current backlog of deferred maintenance, in addition to the projected levels of maintenance in the future.

- **What will you fix first?**
- Decision-support tools such as those suggested in the Building Envelope Life Cycle Asset Management Project⁴ could provide standard interfaces for asset managers



Conclusions

Asset Management is a significant portion of the funds expended on construction each year. Investigation of the field to date has found a limited number of applications for decision-making in the domain of asset management, and did not find any comprehensive solution that addresses the current and future needs for investment planning for facility engineers and managers.

An agenda of research in the field of asset management should include the following:

- Seamless data integration is difficult to achieve, but an essential feature of the software environment for a domain such as asset management.
- Currently available tools require enhancement and standardization to meet investment planning needs.
- Any software development should be done in partnership with software companies.
- There is no central repository or source for information for the domain of infrastructure planning.
- There is a need to share experience and “best practices” regarding infrastructure planning.
- Life cycle analysis and long-term service life prediction form an integral part of the asset management of municipal infrastructure.

⁴ Effective Decision-Making Tools for Roofing Maintenance Management, *First International Conference on New Information Technologies in Civil Engineering*, Montreal, Oct 1998, pp.425-436.