

Infrastructure Management for Tren Urbano
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Executive Summary:

A. Research Objectives

The purpose of this research is to investigate the infrastructure management strategies necessary for the successful long-term operation of a modern urban rail transit system and to recommend a strategy for effective infrastructure management of Tren Urbano (See Appendix A for definitions used in this study). It is my objective to investigate how infrastructure management can be successfully utilized in an urban rail transit system, particularly with newly constructed systems, in which the problems associated with infrastructure neglect have yet to be noticed, yet can be affordably managed.

The problem being defined is two-fold in nature. First, infrastructure deterioration is requiring increased expenditures just to maintain current levels of performance, and can be aided by effective infrastructure management. Second, long-term planning, in the form of life-cycle-costing and integration of design and construction with operation, can greatly enhance service lives and decrease life cycle costs, but has not been in practice in many situations.

B. Motivation

Tren Urbano, San Juan's first modern urban rail transit system, will open for traffic in November 2001. At this time, all of the pieces must be in place to effectively operate the system. As this is a newly constructed system, there is much that can be done to ensure that all infrastructure assets are effectively managed, and there is great opportunity to test the hypothesis that an IMS can be of great benefit to a newly constructed facility.

Typically, infrastructure elements deteriorate at rates that are imperceptible to owners, except when measured in units of years or even decades. As a result, there is a mistaken impression that regular inspection and preventive maintenance is unnecessary, or perhaps not cost-effective.

As our nation's infrastructure deteriorates and we are faced with an increasing stock of substandard bridges, roads, buildings, and transit facilities - all vying for limited maintenance and replacement resources - there is an urgent need to find ways to stretch these limited resources to their fullest. The concept of infrastructure portfolio management has arisen from this need, and is being used to assist owners of infrastructure in managing their assets under capital constraints. This summary will present the research work done to investigate how infrastructure management has been and can be performed by urban rail transit agencies in order to provide recommendations to the executives, operators and managers of Tren Urbano in San Juan, Puerto Rico.

C. Research Methodology

This research is being performed from the bottom up. Three distinct levels have been identified in order to evaluate and recommend an effective infrastructure management strategy. The first level involves investigating the various systems and tasks necessary to carry out effective infrastructure management and the tools available to carry out these functions from an operator's perspective. The second level will be to study how these tasks interrelate to one another and how the various personnel must contribute to the success of the strategy. Finally, the third level will be to investigate how infrastructure management fits into the strategic plan of an urban rail transit agency and how the previous two levels of tasks can be organized and managed to achieve effective infrastructure management (See Appendix B for a more detailed discussion of these three levels of stratification).

The objectives that I have proposed to reach with this research will be, and has been, accomplished through three stages. First, an extensive collection of data and information must be collected in order to both fully understand the problems facing urban rail transit agencies and to determine possible courses of action. A literature search was first performed in order to determine how extensively the professional community has addressed this issue. This literature search has led to a wide variety of information pertaining to such issues as bridge management, bridge inspection and maintenance,

infrastructure management for municipalities, transit agency organization, etc. Then a survey was developed and sent to twenty major urban rail transit agencies in both North and South America. This survey was intended to determine the practices, policies, and sophistication of the agencies with respect to infrastructure asset management. It included questions of general demographics, infrastructure inventory, inspection practices, and infrastructure management. The prime intent was to determine both the perceptions of need versus cost for infrastructure management and the current practices or future plans for infrastructure management in their transit agency. (See Appendix C for a copy of the survey and attached documentation and results.) Additionally, a great deal of correspondence with professionals in transit agencies, government, private sector firms, and academics has occurred to gauge the reasonableness of the research assumptions and findings.

Second, once all of this data has been collected, it will be imperative to sort and analyze the data in order to coherently deal with the information contained therein. By studying the attitudes and assumptions of currently used infrastructure management polices and by utilizing the knowledge of the contacted professionals, a framework for dealing with all of the information will be formed.

Finally, all of this data collection and analysis will lead to several choices or paths of action that could be recommended to Tren Urbano. These differing scenarios must be tested against the specific needs and factors of the situation in San Juan in order to come to any viable recommendations that can be made to the staff of Tren Urbano.

D. Findings to Date and Implications for the San Juan Metropolitan Area

The status of this project is in varying stages of completion at the current time. The literature search is an on-going process that continues to yield useful information as time permits. Additionally, correspondence with various experts in the field of infrastructure management continues as new information is found or needed. These two aspects of the research, though not as heavily required as in the beginning of the research, continue

when necessary. The survey results have been received from 6 of the 20 agencies targeted, and further follow-up should yield more respondents very soon. A brief summary of the current results from all literature searches, correspondence, and survey respondents will be given below.

Since the 1960's, public owners of infrastructure have been utilizing computer technology in order to help them manage their assets. At first, pavement management systems were implemented to track condition of a pavement inventory. This concept was soon used to manage an inventory of bridges, and more recently, these systems are being utilized to manage all types of infrastructure assets, including transit facilities. Many systems both similar and dissimilar to Tren Urbano have begun implementing systems to assist in both their operational and managerial tasks, and to aid in the capital programming aspect of their agencies.

While it is good to see that transit agencies are beginning to see the relative benefits of performing infrastructure management, it is seen through this research that a distinct duplication of effort is occurring at every transit agency, and very different approaches have been taken in developing an infrastructure management system. Additionally, the biggest lesson that is being learned in the industry is that long-term planning of infrastructure management is not nearly as effective if done after design and construction are complete (See Figure 1 for a graphical depiction of this principle).

Those agencies that have begun to implement preventive and predictive maintenance programs are discovering how difficult it can be to do this after years of operation. In some instances, the transit agency does not even have an accurate inventory of their infrastructure assets. In short, by thinking of the long term effects of design, construction, and operations decisions on the service levels of their infrastructure, agencies can achieve longer service lives, lower life cycle costs, and less headaches than by thinking of infrastructure deterioration only after it has begun to have noticeable effect on the level of service.

Most of the transit agencies that have responded to the survey have recommended the implementation of an infrastructure management system at the outset of service of any new transit system. Currently, this is the fundamental finding of this research to date. Infrastructure can be best managed over its life cycle by starting from the outset of the service life and planning for the entire service life using life cycle costing methods to maximize returns on investment in infrastructure.

E. Work Plan for the Remainder of the Project

To complete this work, several more tasks must be accomplished, and analysis of the collected data must be completed. Most notably, the survey needs to be completed and analyzed fully. More responses are expected in soon and once they are all returned, the opportunity to scrutinize them to look for trends and other pertinent information will be available.

There are also some experts in the field that still need to be interviewed in order to understand their opinions and practices on how to best implement and maintain a system of infrastructure management.

Additionally, I am working on developing a framework for infrastructure management that can assist transit owners in implementing a management system for infrastructure (See Appendix D for a brief discussion). This framework is in its infancy, but will hopefully develop into a useful tool.

Finally, my work will be done when I fully integrate the knowledge that I have gained while working on this project into one concise document indicating the state-of-the-art in infrastructure management for transit. Much work needs to be done to bring all of this knowledge, in the form of conversations, papers, and experience, together.



Figure 1

