MIT Research Program on Tren Urbano

Research Summary for January Encuentro
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Analysis of Alternative Tren Urbano Service Plans: Incorporating the Feeder Bus System and Maximizing System Benefits

Objective:

The objective of this research is to determine what Tren Urbano service plans will maximize overall public transportation rider satisfaction and how changes to the existing service plan will affect cost. Attention will be paid to what level of service should be provided during the different periods of the day and how the operations plan will support and be supported by the feeder bus system.

There are two aspects of the Tren Urbano service plan that might be modified: headways and train lengths. A set of alternative service plans which attempt to address concerns about the existing service plan will be developed. In order to evaluate and compare these alternative service plans, measures of cost and rider satisfaction will be developed and estimated for alternative headway and train length combinations. Finally, plans that effectively address concerns about the existing service plan at a reasonable cost to the bus and rail systems will be identified and suggested as alternative service plans for Tren Urbano.

Motivation:

In order to justify spending $1.67 billion on Tren Urbano, it is important that the benefits to the public are maximized. There are several guiding principles that should be considered when designing service plans that attempt to incorporate a feeder bus system and maximize system benefits:

- At high-volume transfer locations like Sagrado Corazón, Piñero, and Cupey, bus and rail time-tables should be coordinated to reduce passenger waiting times.

- A new rail system should provide a service that is perceived as an improvement over existing public transportation services, and so travel times should be shorter and frequencies should be higher than when there was just a bus system.

- High quality evening, midday, and weekend service is important because ridership during these times is likely to be significant. Furthermore, first-time users of Tren Urbano will be on the system at these times, and so it is important that they get a good first impression.

- Throughput capacity should be high enough to satisfy passenger demands throughout the day and prevent crowding on the trains.

The existing service plan:

	Headways	Cars
5:00-6:00	12	4
6:00-6:30	8	4
6:30-8:30	4	4
8:30-10:00	8	4
10:00-3:00	12	4
3:00-3:30	8	4
3:30-6:00	4	4
6:00-8:00	8	4
8:00-9:00	12	4
9:00-1:00	12	2
Weekends	12	2

Source: PRHTA Operations and Maintenance Contract June 1996

Concerns with the existing service plan:

4-minute headways during the peak periods may be needed to accommodate future demand, but they may not be optimal for rail-to-bus and bus-to-rail transfers, given that buses will run on 5, 10, 15, and 20-minute headways when the Tren Urbano Bus Feeder System is introduced. 5-minute headways during the peak periods may be preferable.

12-minute headways during the middle of the day provide a frequency that is worse than what is currently available with the bus-only system. Metrobús I currently has 6-7 minute headways along the Río Piedras-Hato Rey-Santurce-Old San Juan corridor throughout the day, but it will not run south of Sagrado Corazón when Tren Urbano starts. This suggests that 5 or 6-minute headways during the midday period might be preferable.

Having three service frequencies also introduces a degree of complexity to the system that might not be necessary. It might be preferable to covert those periods with 8-minute headways into periods with 5 or 10-minute headways.

12-minute headways during the evening periods may contribute to a feeling that Tren Urbano stations are deserted and unsafe. 10-minute headways might be preferable.

12-minute headways during the weekends may not provide a high enough level-of-service for those people who might be interested in using the train for recreational purposes. 10-minute headways might be preferable.

Progress:

Tasks 1 and 2 have been started, and Tasks 3 and 4 will be undertaken in the spring.

Task 1 – Gather Background Information

New Starts

The purpose of gathering information from new starts is to determine what strategies are being used to coordinate new rail service with a preexisting bus service, how ridership might vary throughout the day, and how a city's overall public transportation usage is affected by the introduction of a new rail system. The answers to these questions have implications for how successful Tren Urbano's service plan will be in its first year. The following rail systems are some systems from which information is being gathered:

- Salt Lake City's TRAX – Opened in 1999
- Dallas' DART – Opened in 1996
- Denver's LRT – Opened in 1994
- St. Louis's Metrolink – Opened in 1993
- Miami-Dade's Metrolink – Opened in 1984

Previous Tren Urbano Research

The purpose of reviewing the research done by students previously involved in the Tren Urbano program is to be able to build upon their work. This research is the natural continuation of the following two master's theses:

- "The Intermodal Connection: Integrating New Rail Lines With Existing Transit Service" by Jason Lee
- "Strategic Transit Service Planning In The Santurce/Old San Juan Corridor" by Elton Lin

Non-Tren Urbano Research

The purpose of reviewing the research done by students in the field of transit operations is to be able to build upon the models they have developed for estimating the costs of such things as splitting cars. One such thesis is:

- "Operation of Five-Car Trains on the MBTA Red Line" by Robert Antonisse

Operations and Maintenance Plan

The purpose of reviewing the operations and maintenance plan is that it will provide the basis from which alternative service plans and their service statistics will be derived.

Systems and Test Track Turnkey Contract

The purpose of reviewing the contract is to determine the limits to how much the operations and maintenance plan can be modified. The Base Compensation formula will not have to be modified as long as the number of revenue service vehicle kilometers is within the 15% of what is provided by the existing service plan. The Base Compensation will be calculated using unit prices for revenue service train hours and revenue service vehicle kilometers.

Multisystems Feeder Bus System Plan

The purpose of reviewing this document, when viewed together with the existing Tren Urbano service plan, is to provide a basis from which to compare the quality of service provided by different forms of the bus-rail transportation system.

AMA/Metróbus Schedule and Route Map

The purpose of reviewing this document is to determine how the existing Tren Urbano and Bus Feeder System plans will affect the quality of transit service provided in San Juan and whether alternative service plans can provide any additional benefits.

Task 2 – Develop Alternative Service Plans

Developed the following group of alternative operation plans for weekdays:

Alternative Plan	A	B	C	D	E
Characteristics	10-minute headway maximum	5-minute headway minimum	8-minute headways to 10-minute headways	5-minute headways and split cars at midday	8-minute headways to 5-minute headways

Alternatives for weekend service:

X	Y
12-minute headways	10-minute headways

Service Statistics of existing service plan:

Weekdays

Round Trips/Day:	142
Train Kilometers/Day:	5925
Trains Needed/Day:	26
Car Hours/Day:	703
Split Trains at Midday	0

Weekends

Round Trips/Day:	101
Train Kilometers/Day:	3434
Trains Needed/Day	6
Car Hours/Day:	246

Task 3 – Develop Models for Evaluating Alternative Service Plans

Calculate Service Statistics for Alternative Service Plans

Determine Unit Costs

Will include items such as labor, vehicle maintenance, track maintenance, power, and splitting.

Develop Cost Model

Will be based on the unit costs and the service statistics gathered for each alternative service plan

Develop Satisfaction Model

Will be based on ridership estimates and characteristics of the service plan that will determine measures of satisfaction like crowding and average waiting time

Task 4 – Implement Models

Evaluate the different alternatives with the models and choose the plans among them that have the greatest chance of maximizing benefits.