

**Procurement Strategies for Long-Term Control, Operation and Maintenance
of Tren Urbano**

by

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Abstract

Tren Urbano, the new rail system currently under construction in the San Juan Metropolitan Area in Puerto Rico is expected to open by July 2001. The system was procured with a combination of a System and Test Track Turnkey (STTT) contract, and six design-build Alignment Section Contracts (ASCs).

The STTT contract requires the contractor to provide among other things, vehicles, systems, an operations control center, as well as at least five years of operation and maintenance (O & M). The Puerto Rico Highways and Transportation Authority (PRHTA) has the option to renew the O & M contract for another five years.

This thesis presents procurement strategies for control, operation and maintenance of the Tren Urbano system beyond the first five years of O & M. Issues that will influence the procurement decision-making process are discussed and analyzed.

Five possible O & M alternatives are examined in this thesis. Their merits and demerits are weighed, and strategies for preparing for each alternative are devised. Requirements for the successful implementation of each strategy are presented. In addition, the thesis examines the actions that have to be taken in order to monitor and assess the performance of the contractor and the system, if the long-term procurement decision is not made before the start of Revenue Service. Metrics and methods of evaluation are presented.

The thesis attempts to synthesize the strategies for the five alternatives into one major strategy for consideration by the PRHTA. A proposal is made on when to make the long-term procurement decision and how to arrive at the optimal decision. Finally, some realistic scenarios are simulated, and the recommendations for dealing with these scenarios are offered.

The principles underlying the procurement strategies presented in this thesis apply to public agencies in various areas of industry. It is intended that this thesis will serve as an impetus for more research into long-term strategic planning in the public sector.

Thesis Supervisor: John B. Miller

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Chapter 1

Background, Purpose and Outline of Study

1.1 Introduction: Procurement of Tren Urbano

Tren Urbano is a rail transit system currently under construction in the San Juan Metropolitan Area of Puerto Rico. Phase I of the project, a 17.2 kilometer line linking Bayamón with Santurce via Guayanabo, Río Piedras and Hato Ray, will have 14 stations and a vehicle maintenance and storage depot.¹ The system is scheduled to open for use in July 2001.

In August 1994, the Puerto Rican Highway and Transportation Authority (herein after referred to simply as “The ACT” or “The Authority”), appointed four firms: Daniel Mann, Johnson & Mendenhall; Frederic R. Harris, Inc.; and Eduardo Molinari y Asociados and Barrett & Hale as General Management Architecture and Engineering Consultant. Known collectively as GMAEC Tren Urbano, this group carried out preliminary design to a point where the ACT could use a split/hybrid turnkey² and six separate design-build methods of delivery for the design, construction, and operation and maintenance (O & M) of the system. The split/hybrid turnkey delivery method – which, in part, is the focus of this thesis – is referred to by the ACT as the Systems and Test Track Turnkey (STTT) contract.

Under the terms of the STTT contract, the contractor, Siemens Transportation Partnership Puerto Rico, S.E., is to provide for a periodic fixed fee, 2.5km of track, two stations, yards and shops, vehicles, systems, coordination for the six civil design-build packages, as well as the first

¹ Colón de Armas, Carlos A. and Bruce H. Goluman. “Tren Urbano: A New Era in Transit Finance” in *Puerto Rico Business Review*. Government Development Bank for Puerto Rico. Vol. 21 No. 3. July-Aug-Sept. 1996.

² The term “turnkey” as used by the Authority is slightly different from the classical definition of turnkey. In the classical sense, a turnkey contractor is an entity that performs the design, construction, and construction financing of the project, with payment made at the completion of the project (when the contractor turns over the “key”). In the case of Tren Urbano, the contractor does not pre-finance the project, and will receive periodic fixed payments during the construction and operation of phases of the project.

five years of operations and maintenance. The ACT has an option to renew the contract for another five-year period, beginning in July 2006.

As of the time of writing this thesis, all six design-build packages or "Alignment Section Contracts" had been awarded to various bidders. The first phase of the Tren Urbano project costs over \$1 billion.³ Several extensions are planned in future phases of the project.

1.2 Goals and Objectives

The purpose of this research is to analyze and develop strategic alternatives for the continued control, operations and maintenance of the Tren Urbano transit system after the expiration of the 5-year operations and maintenance period currently awarded to Siemens Transportation Partnership. The thesis considers, examines, and develops alternative approaches which the ACT may follow in order to be in the best position to take a decision on the future operation of the Tren Urbano transit system which will be in the system's, as well as in Puerto Rico's best interest.

It is a goal of this thesis to analyze and recommend necessary requirements for preparation for each of the alternative approaches available to the Authority. Among other goals, this thesis hopes to identify the metrics for evaluation of the performance of the Tren Urbano system, prior to making a decision on its future. In addition, the personnel and data/information requirements will be examined, with an eye toward making specific recommendations to the Authority.

³ Pesquera, Carlos I. and Sergio L. González. "Tren Urbano on Track to Relieve Congestion" in *Railway Gazette International*. January 1996.

It is intended that this thesis will help the Authority to attain its overall goal of owning a transit system which is efficient to operate and maintain, with high quality of service, good ridership, and maximum revenue collection.

1.3 Background Motivation

In awarding the contract for the Tren Urbano transit system, the Puerto Rico Highways Authority, upon the recommendations of various consultants, adopted the Design-Build-Operate (DBO) system of procurement. This was done for a number of reasons. First, the Authority felt that DBO, as compared with the traditional system, would result in cost savings. In addition, it would be more efficient for a project of such magnitude and scope. Furthermore, DBO was a necessity in Puerto Rico, given the lack of expertise in the area of transit system design and operation. Finally, it was argued that the DBO system would avoid fragmentation of the project and hence provide a single point of accountability.⁴

The Tren Urbano project is the first transportation project in Puerto Rico to be awarded using the Design-Build-Operate (DBO) system of delivery. It is expected, therefore, that as the project enters the operations and maintenance phase, the Authority will face certain critical issues. One of these issues is the decision on the control and operation of the system beyond the time period specified in the contract with Siemens. There is the need for the Authority to be adequately prepared and informed so that the best decision can be made in this regard.

At the end of the five-year operations and maintenance period currently awarded to Siemens, the Authority could be faced with a number of possibilities, as far as the control and operation of the system is concerned. It will only be prudent that decisions on the future of Tren Urbano be reached well before 2006, so as to ensure a smooth transition between the various phases of the Operations and Maintenance schedule. To be able to exercise the best option for Tren Urbano, the Authority should attempt to address a number of questions during the early operations phase:

⁴ Puerto Rico Department of Transportation and Public Works, "Tren Urbano Industry Outreach Seminar Presentation Materials" (Orientation Seminar held for potential bidders/contractors, San Juan, Puerto Rico, May 15-17 1995).

- What information should be acquired by Tren Urbano on the operations and maintenance of the transit system?
- What kind of personnel should Tren Urbano acquire to observe and evaluate the transit system in the course of the first three or four years of operation?
- What data should the Authority collect so as to be able to make a good assessment of the operations and maintenance portion of the DBO?
- How should the Authority conduct their assessment in a manner that is fair to Siemens and to potential bidders?
- What should be the metrics by which the performance of Siemens is evaluated?
- When is the optimal time to make a decision for long-term operation?

These are just a few of the issues that the Authority will have to address as soon as possible. The earlier it begins to prepare itself for the future, the better position it will be in to make a decision in the system's best interest.

As a pre-requisite to placing itself in the best position to make the correct decision on Tren Urbano, the ACT will have to engage in careful strategic planning and management. There is the need for the Authority to 'simulate' the future on paper so as to be able to examine some future consequences in the present. Such planning will encourage the development and evaluation of a significant number of alternate courses of action. Furthermore, a strategic plan will provide a framework for decision making. Thus, it is likely to stimulate the ACT to discharge its duties in a more effective manner. Furthermore, strategic planning for the future of Tren Urbano will prevent "off-the-cuff" decisions.⁵ The need for planning for and anticipating events and outcomes in the future cannot be overstressed. It is against this background that this research is being conducted.

⁵ Holloway, Clark. Strategic Planning. Chicago: Nelson-Hall, Inc. 1986.

1.4 Outline of Study

This study is divided into four parts. Chapter 2 looks at the possible outcomes and available alternatives for the ACT, in regards to long-term procurement of operations and maintenance of Tren Urbano. Each possible option is thoroughly examined, with its advantages and disadvantages objectively discussed. A strategy is then formulated for each of the alternatives available to the ACT.

Chapter 3 tackles the issue of how to monitor and assess the performance of the incumbent operator, as a necessary step to making a decision regarding the direction of the Tren Urbano project. Among issues analyzed are personnel requirements, data needed, as well as methods of monitoring and assessing system and contractor performance.

In Chapter 4, an attempt has been made to amalgamate the various strategies outlined in Chapter 2, and methods of monitoring described in Chapter 3 into one major strategy for the Authority. In addition, a discussion on the optimal decision time is presented. The chapter concludes with the analysis of a proposed approach for arriving at a decision on the future long term operation and maintenance of Tren Urbano.

Finally, a variety of realistic scenarios, as well as recommended actions, are presented in Chapter 5. This chapter ends with some general remarks on strategy formulation and implementation for the future O & M procurement, and the general application of these strategies to decision-making in the public sector.

Chapter 2

Analysis of Possible Scenarios

2.1 Probable Outcomes

Although Tren Urbano will not open till 2001, it is imperative, for purposes of good planning, to consider now some of the critical issues that the Puerto Rico Highways and Transportation Authority will face, with respect to making a decision on the future control, operation and maintenance of the system. In spite of the fact that it is almost impossible to predict exactly what will happen in the future, it is safe to say that a good anticipation of some of the possible outcomes will help the Authority to make a decision on who operates and maintains Tren Urbano in the future. Besides, if the ACT prepares adequately for each of the different eventualities, it will be in a better position to make the correct decision regarding the future direction of Tren Urbano.

The importance of the ACT's readiness and preparedness to confront various eventualities cannot be over-emphasized. The Authority needs to place itself in such a position that whatever decision is taken regarding the future control and operation of Tren Urbano will be in the system's best interest, and at the same time, will best serve Puerto Rico's interests. Additionally, the Authority needs to guard against the possibility of having very limited options when the time comes to make a decision on the future of the system. It is against this background that the ACT must take some actions in anticipation of the possible scenarios that could evolve as the time to decide on the future of Tren Urbano approaches. As shown in Figure 2.1, the ability to impact cost and to influence major decisions increases with an increase in the

amount of time available to make those decisions.⁶ Thus mapping out a good management strategy presently will not only reduce the cost of future actions, but also will present the ACT with a good time frame within which to take the necessary actions that will help prepare for the future.

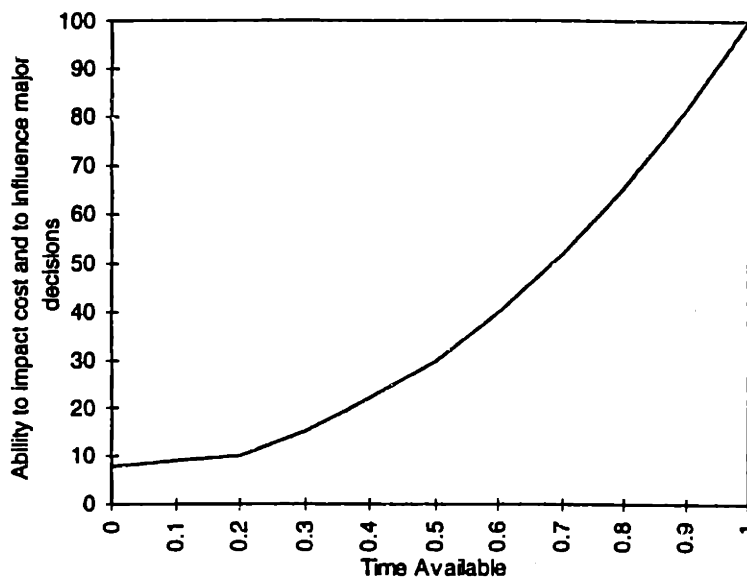


Figure 2.1: Ability to influence decision versus time available to make decision

Five major scenarios for the future control and operations of Tren Urbano will be examined here. These scenarios are listed in the table below.

SCENARIO	ACT ACTION
1	Take-Over
2	Re-compete
3	Renewal for 5 more years
4	Re-negotiate in 2006 for longer term
5	Early Re-negotiation and Extension

Table 2.1: Possible Outcomes

⁶ Course lecture notes. *Innovative Contract Strategies in the Public and Private Sectors*. Massachusetts Institute of Technology. Spring 1997.

2.1.1 Definitions

Take-over: The take-over option is defined here as the ACT assuming direct responsibility for the day-to-day administration, operation and maintenance of the system in 2006 or 2011, upon the expiration of the STTT contract with Siemens Transportation Partnership. The Authority may take direct responsibility for all aspects of the system or may contract out certain portions of it.

Re-compete: This scenario is defined in this thesis to be the case where the Authority decides to invite bids from all interested operators and then awards the operating and maintenance of the system to a deserving contractor for a specified length of time.

Renewal for 5 more years: This is where the ACT simply exercises the renewal option in the present contract with Siemens for a new five-year term. This scenario will arise if the Authority is satisfied with the performance of Siemens, and/or if the ACT feels that the five-year time frame is too short to adequately prepare itself for the other scenarios.

Re-negotiation in 2006 for a longer term: In this scenario, the ACT and the contractor enter into a long-term Operations and Maintenance Contract which will be in effect when the current contract expires in 2006. This option is made possible by the new Internal Revenue Service Regulation that permits state and local government agencies to sign long-term management contracts with private sector agencies without giving up the benefit of tax-exempt financing.⁷

⁷ "Final IRS Bond Regulations Open Long-Term Window For Service Contracts." *Public Works Financing*. Vol. 103. January 1997.

Early Re-negotiation and Extension: This is defined as the option where the ACT immediately enters into negotiation with Siemens, with the two parties signing a long-term contract within the next year or two that will replace the current 5-year contract. As will be discussed in the Section 2.2 of this chapter, this option will give the incumbent contractor a long-range perspective, which could be beneficial to both the ACT and Siemens.

2.2 Discussion of the Scenarios

Without a doubt, the take-over scenario is the most difficult that the ACT might face, given (a) its (ACT's) lack of experience in rail transit operations, (b) the short five-year period within which it has to organize its take-over activities, and (c) the fact that the take-over scenario is the most complex because it involves the hiring and training of management, operations and maintenance personnel, and the award of contracts for suppliers of equipment and services. Thus, a lot of energy should be spent on the take-over strategy. As a matter of fact, if the ACT prepares adequately for the take-over scenario, other scenarios should be relatively easy to deal with.

The idea behind the take-over strategy is to put the ACT in a very strong position, so that they will not have their hands tied behind them whenever it comes to negotiating with the incumbent contractor on the future administration and operation of the system. Ideally, the ACT would want to be placed in a state where it will have the capability of taking over by the fifth year of the Operations and Maintenance period, and can say to the incumbent contractor or potential bidders that "we can take over, but we would like a private entity to run it." This situation would place the ACT in an advantageous position -- the incumbent contractor, as well as potential bidders, will be forced to think again if they have any intention of foisting some

conditions on the ACT, with the notion that the Authority will be forced to accept those conditions, just because it cannot run the system on its own.

The take-over strategy is motivated by two main drivers, the first being the need for the ACT to be risk-averse by preparing for the worst-case scenario, the other being the ACT's desire to be in a highly favorable position in all future negotiations concerning the operation of the system. The worst-case scenario is where the Authority is forced to oversee the day-to-day administration, operations and maintenance of the system against its desire. This scenario can be brought about by a number of factors. For instance, if it is determined that the incumbent operator is not performing adequately in accordance with the standards set forth in the contract, and if the ACT does not find any private operators whom it deems capable of running Tren Urbano, then it will have no other alternative than to run the system on its own.

Before a take-over plan is considered, the ACT must address some questions: Assuming that it runs the system operation, will it be able to at least maintain (or even exceed) the high performance standards that were set in the O & M contract for the private operator? Will the Authority have adequate personnel who will be able to direct a take-over bid? Will the ACT be in a position to carry out the training of new personnel in an expeditious manner, should the take-over scenario materialize? Most importantly, how will the Authority position itself in such a way that it can prepare for a take-over, and yet, at the same time, not interfere with or hinder the work of the current contractor? These are just a few of the issues that the ACT has to grapple with as a take-over strategy is being formulated. Before a pragmatic take-over strategy can be realized, these issues have to be addressed.

Given the fact that the ACT has never administered a project as immense as Tren Urbano, it goes without saying that the Authority will have to invest a lot of time and energy into the

formulation of a take-over strategy. A considerable amount of resources will be needed if the Authority is to acquire and train personnel who will lead a take-over bid.

Like any endeavor, the take-over option has its merits and demerits. The main advantage is that it ensures that the ACT and the government of Puerto Rico have direct control of the project. Operation and Maintenance of the system will be in local hands. On the other hand, the fact that a take-over bid, especially one after just five years of operations and maintenance, will require the total cooperation from the current contractor, makes this option a laborious undertaking. For direct take-over to be possible, the Authority must be absolutely certain that it has the requisite material resources, as well as the necessary skilled personnel to assume direct control of the system.

The process of re-competing, though it sounds simple and straightforward, can be challenging and tedious. It is necessary to identify the possible events that can lead to this scenario, and to explain the need for preparation for this scenario.

The ACT will find re-competing a viable and necessary option if :

- (i) the Authority decides not to exercise the renewal option for the incumbent contractor, having determined that the incumbent contractor has not performed satisfactorily in accordance with the standards set forth in Operations and Maintenance Contract, AND having been thoroughly convinced that the incumbent contractor will be incapable of, or does not show the desire to, improve on his performance.
- (ii) the incumbent contractor performs satisfactorily during the first five years of the O & M period, but demonstrates clearly that it is unable or unwilling to continue operating the system.
- (iii) the Authority determines that there are other potential operators on the market who are capable of running the system (a) more efficiently, (b) at lower cost, (c) at a higher

standard, (d) in a manner more satisfactory to the Authority, in the political, social and economic sense, or (e) with a combination of any or all four of the previous factors listed.

(iv) the ACT and Siemens come to an amicable settlement, where both parties agree to end their contractual relationship.

(v) the Authority decides to exercise its right to terminate Siemens before the expiration of the current contract for any reason (for example, gross violation of Puerto Rican and federal laws by the contractor).

Preparation for this scenario is motivated by the need to ensure that there is adequate competition to drive down the cost of awarding a new O & M contract, if it turns out that the incumbent is unable to adequately meet the ACT's goals in the first five years of O & M. Furthermore, preparing for this scenario could arm the Authority with one more strategic "weapon" so that when the time comes for re-negotiation, the ACT will be in a strong position and will therefore not have its arms twisted by the incumbent contractor.

In order to prepare for this scenario, the Authority will have to re-examine the procurement process it undertook for the award of the STTT contract, with a view to making the necessary changes that would encourage more vendor interests in the process. So as to incorporate lessons learned from the STTT procurement procedure, there will be the need to formulate a new procurement strategy. While an assessment of the STTT contract is beyond the scope of this thesis, it is nonetheless pertinent to discuss some of the issues relating to the procurement methodology for the STTT contract, for the purposes of revising strategies for the re-bidding and re-awarding of the O & M phase of Tren Urbano.

It is worth noting that the procurement process that led to the award of the STTT contract was very lengthy and elaborate. This was due to the Design-Build-Operate (DBO) format of the contract. Among some of the issues that had to be considered were time constraints, flexibility for design and construction changes, pre-construction service needs, design interaction between the ACT and the contractor⁸, responsibility for the design-construction and the construction-operation interfaces⁹, and financing for the DBO venture, among others. These project drivers, in addition to the fact that there were no transit precedents to consult during the formulation of the DBO procurement scheme¹⁰, contributed to the complexity of the procurement strategy and the Authority's adoption of a procurement process eventually leading to the award of the STTT contract to the Siemens Partnership. Because the re-bidding process will involve only issues pertaining to operations and maintenance, and not to design and construction, it should be expected that the adoption of a procurement strategy for re-competing will be less cumbersome and demanding. Additionally, the current contract will serve as a good precedent and will therefore enhance the drafting process for the re-competing strategy.

Before closing out the discussion on re-competing, it is worth looking at its merits and demerits. As has been mentioned earlier, re-competing would encourage competition, and hence may lead to the award of the O & M contract to the low-cost bidder. Additionally, it may provide a good incentive for the incumbent operator to perform well, so as to be re-considered for a second five-year term, if he is interested. Knowing that the Authority is prepared to hire other interested operators could force the current operator to put on "good behavior" if the current operator wants to be re-hired upon the expiration of the STTT contract.

⁸ Gordon, Christopher M.: "Choosing Appropriate Construction Contracting Method." *Journal of Construction Engineering and Management*. ASCE. Vol. 120 No. 1 March 1994.

⁹ GMAEC. Tren Urbano Program Consultants: "Procurement Strategy Paper." December 5, 1994.

¹⁰ GMAEC. Tren Urbano Program Consultants: "Discussion Draft of Procurement Strategy Paper." October 29, 1994.

Another advantage of the re-compete strategy is that it provides the easiest way out for Siemens, should they decide that they are uninterested or unwilling to carry out further O & M. If that is actually the case, and if in the opinion of the ACT exercising the renewal option would not be beneficial, then Siemens and the ACT can come to an amicable settlement, which will allow the ACT to proceed with its procurement plan for the award of a new contract. In this circumstance, this scenario is unlikely to lead to animosity between owner and contractor. Hence the transition from one operator to another is likely to be smooth.

The primary demerit of this strategy is the fact that it is based mainly on the market. The availability of an appropriate contractor/operator is not totally assured. Therefore, it is possible that there may not be adequate competition. Furthermore, if the current operator has an interest in carrying out future O & M, then re-competing may be viewed as a sign of lack of confidence in the incumbent operator, possibly resulting in strained ACT-contractor relationships, and culminating in some negative effects on the project.

To re-compete will require substantial commitment of the ACT's resources (particularly money and time), which makes this option an expensive endeavor. It is essential that the Authority is aware of this.

The renewal scenario is probably the most straightforward of the five presented in this chapter. Nevertheless, there are still a number of issues that have to be dealt with by the Authority before it exercises this option.

The ACT is likely to use the option to renew the O & M contract for 5 more years in the following situations:

- (i) Siemens performs satisfactorily during the first five years of O & M;
- (ii) The ACT determines that five years is too short a time period to adequately prepare for the other scenarios, and that it needs a longer time period within which to make a

decision on who will permanently control Tren Urbano O & M. Renewal is hence the most feasible option;

(iii) The Authority projects that it will be in a position to ably take-over the operations and maintenance of Tren Urbano after a second five-year contract has expired in 2011. In that case, renewal would be the best option under the circumstance.

(iv) The O &M contract is not very favorable to Siemens. It is clear that the Siemens is losing money; however the Authority's costs will rise dramatically if take-over occurs in Year 6 of the O & M period. Thus the ACT is in a win-lose situation.

For purposes of comparison with the strategies for the other scenarios, an examination of the advantages and disadvantages of the renewal strategy is in order. One clear advantage is that this option presents the Authority with the opportunity of assessing the contractor's performance in the course of the first five years of O & M. The ACT can therefore have an idea of what aspects of the system are up to standards and what aspects will need to be improved or changed in the contract. Another advantage is that since the first five years of O & M may not be adequate for a fair assessment of contractor performance, a second five-year term will provide the ACT with a fairer basis for judgment of how successful the contractor or the system is performing. Adding a second five-year term provides the opportunity for the acquisition of more O & M performance data. Furthermore, it provides a longer timeline for technology transfer into the island of Puerto Rico, which increases the likelihood of having local resident transit operation expertise on the island in the near future. Finally, with risk assessment and management being among the key concerns of the ACT¹¹, the renewal strategy ensures that project performance risk is reduced when the contract is awarded in five-year segments.

¹¹ GMAEC. Tren Urbano Program Consultants: "Vendor Outreach White Paper." March 6, 1995.

The main disadvantage of the five-year renewal option is that it may not motivate the contractor to act in the Authority's long-term interest, especially if the contractor does not envisage being a part of the Authority's long-range plans. Besides, another short five-year term could breed distrust between the ACT and the contractor; the contractor may feel the ACT does not have enough confidence in him to award a longer-term contract. Furthermore, if the contractor is not very interested in a second five-year term, but is bound to continue with O & M for another five years, the relationship between the Authority and the contractor could be strained, resulting in an atmosphere of animosity, which will hinder the smooth running of Tren Urbano.

At the time the STTT contract was drafted, the ACT was unable to contract the operations and maintenance of Tren Urbano for a period longer than five years. This was due to an Internal Revenue Service (IRS) regulation which prohibited state and local governments from signing long-term management contracts with private operators without forfeiting the benefits of tax-exempt financing.¹² On January 10, 1997, the IRS released final private activity bond regulations and revenue procedures that will permit state and local governments to sign long-term contracts with private sector agencies without losing the privilege of tax-exempt financing.¹³ Under the new regulation, private entities may manage certain state or local facilities under contracts with terms of up to 20 years¹⁴ if at least eighty (80) percent of the compensation is fixed. The terms and restrictions of the provision are described in Table 2.2. The new procedure takes effect for management contracts entered into, materially modified, or extended after May 16, 1997.

¹² In some states, project-specific enabling laws could be passed to allow municipalities to enter into long-term public-private agreements for sharing risks. For example, California and Florida have passed statewide legislation allowing municipalities to sign long-term management contracts. The contract for the Hudson-Bergen Light Rail Project was made possible by a project-specific law approved by the New Jersey state legislature.

¹³ "Final IRS Bond_Regulations Open Long-Term Window For Service Contracts." *Public Works Financing*. Vol. 103. January 1997.

¹⁴ Federal Register: Rules and Regulations. Vol. 62, No. 11. Thursday January 16, 1997.

Duration of contract in years	Type of Annual Compensation	Maximum useful life of project at end of contract
10	At least 80% is periodic fixed fee	80%
15	At least 95% is periodic fixed fee	80%
20	At least 80% is periodic fixed fee	80%

Table 2.2: Summary of new rules for long-term contracts

The new IRS regulations present the ACT and the current operator with the opportunity of considering the option of re-negotiating a new contract for a term longer than five years, upon the expiration of the current STTT contract. There are several drivers that will motivate the signing of a long-term contract. First, a long-term contract gives the operator a vote of confidence and trust, as well as a good sense of security on the project. This, in turn, ensures that the contractor has a long-term perspective in terms of operations procedures and maintenance cycles. Thus, this scenario will very likely provide an incentive for the contractor to act in the ACT's long-term interest. Additionally, a long-term contract provides a fairer basis for assessment of contractor performance, due to the fact that more data on O & M will become available to the Authority in the longer time frame. From an economic standpoint, this scenario could result in net savings for the ACT, since there are costs involved in renewing or re-competing the contract every 5 years. From a political perspective, this option will help allay any fears the contractor may have about uncertainty in the future political situation in Puerto Rico and its influence on the award of future contracts. Furthermore, this option would be

helpful to the future expansion of Tren Urbano, in view of the fact that there will be a fewer number of players, reduced bureaucracy, and an easier negotiation process, among others.

There could be potential problems with the re-negotiation strategy. One is the lack of competition. It would be difficult for the Authority to justify its price since negotiation is done with only one operator, and the price is not determined by the market. Besides, it would be difficult to verify the probity of the re-negotiation process. Additionally, should negotiations become difficult, it may not be easy for the ACT to retreat in favor of another alternative. The process itself may drag on for a long time, which can affect the ACT's timeline for other phases of the Tren Urbano project. Furthermore, the re-negotiation option may not allow for any independent checks on the process, which may not go down well with potential vendors or the public. Another problem is the increase in project risks. A longer timeline means the ACT has put more trust in the contractor. Consequently, the contract performance risks which the ACT faces are greater.

Early re-negotiation and extension also involves the signing of a long-term O & M contract between the ACT and Siemens. In this scenario, however, a contract is signed within the next year or two to replace the current five-year O & M contract. The idea behind exercising the early re-negotiation and extension option is to immediately take advantage of the new IRS provisions for long-term contracts. Considering the frequency with which government regulations are modified, it is not inconceivable that this option may not be available to the Authority at the time the present O & M contract expires. Thus, if the Authority and the contractor are both willing and able to enter into a long-term agreement immediately, there may be no need for waiting till the expiration of the current contract.

Early re-negotiation and extension can reduce political risks associated with the project. By awarding a long-term contract now, political interference in the system is limited -- future

governments and political powers who have the intention of serving certain interests, will not be able to meddle with day-to-day operations decisions. The contractor, for his part, having been given a long-range perspective, does not have to worry much about uncertainty in the political climate in Puerto Rico.

The early re-negotiation and extension option will present the opportunity for both the contractor and the ACT to review each other's long-term interests. This option can potentially eliminate or at least curtail any counter-productive short-term behavior on the part of the contractor. It could also increase the trust between owner and contractor, which in turn could encourage a fiduciary relationship, a necessary element for the success of Tren Urbano.

Awarding a long-term contract now will save the ACT from worrying (at least in the near future) about the who runs the system when the present O & M contract expires in 2006. The Authority will then be able to focus its limited human and material resources on effective contract administration and contractor and system monitoring while Tren Urbano is operating.

It is prudent to realize that, like the other scenarios, early re-negotiation and extension has a few drawbacks. As mentioned during the discussion and analysis of Scenario 4, the Authority will face bigger project risks. Not unlike other government agencies, the ACT is highly risk-averse. Therefore, before this option can be exercised, a reliable risk mitigation plan has to be devised.

The major handicap of this option is that the ACT will not have the opportunity of monitoring and assessing the performance of the contractor and the system before the signing of a long-term contract. In other words, the Authority forfeits the five-year trial period during which all the kinks in the system operation can be identified and fixed before a decision is reached on Tren Urbano long-run operation and maintenance.

Early re-negotiation will do away with competition. Vendors who could provide better prices are automatically eliminated. Thus, after negotiation, the ACT is not assured that it would be paying the best price on the market.

The scenarios listed in Table 2.1 and described above are by no means exhaustive. In fact, it is possible that there could be slight modifications in any or all of them. For example, there is a possibility that instead of renewing the contract with the entire Siemens joint venture team, the ACT will let the parent company out of the contract and enter into a new 5-year contract with just Alternate Concept Inc., the Operations and Maintenance specialists of the Siemens consortium.

It is worth noting at this point that, for the sake of clarity, the five scenarios described are discussed individually, as if they are isolated and independent. In reality, the Authority could opt for a hybrid of two or more of these scenarios. For instance, a possible outcome is renewal of the contract with Siemens in 2006 for 10 more years, and take-over in 2016. Another possibility is early re-negotiation and extension of the Siemens contract for 15 years, say, with an ACT take-over occurring in 2016. The combinations are countless.

In the remaining subsections of this chapter, the strategy for preparation for the five major probable outcomes mentioned above, along with some possible variations, will be examined in detail.

2.3 Strategy Formulation

2.3.1 Scenario 1: Take-over

The take-over option is a very formidable challenge for the ACT. It requires very shrewd planning and forecasting on the part of the Authority. The ACT will be required to make some major organizational changes which will involve its human and material resources.

The take-over requirements can be broadly divided into four categories, as shown in Figure 2.2 on the next page. The categories are (i) Deliverable Documents, (ii) Management and Other Personnel, (iii) Data Collection/Information Verification, and (iv) Supplies. It must be noted that these requirements are supplementary to one another. Therefore each requirement on its own will not be acceptable as a complete take-over strategy.

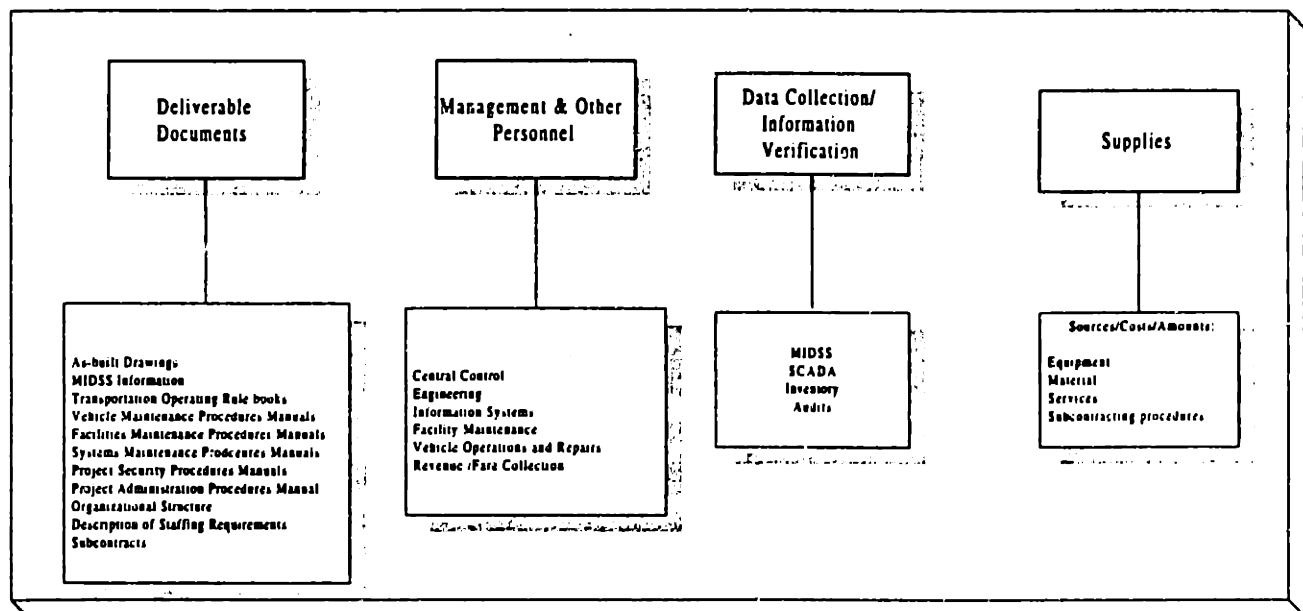


Figure 2.2: Take-over Requirements

Deliverable documents include those documents in which have been recorded all the pertinent information regarding the administration, and operation and maintenance of the

system. During the first five years of the Operations and Maintenance period, it would be easy for the Authority to keep itself abreast with the workings of the system if it ensures that all deliverable documents are submitted by the contractor on time and are accurate in content. The most important of the deliverable documents are the as-built drawings, as they describe the location, size, and scope of all the physical components of the system. With the as-built drawings in its hands, the ACT should become very familiar with such details of the system configuration as the number and location of fixtures, controls, emergency switches, and even location of expansion joints, among others. Take-over will be made smoother if there are personnel at the ACT who are well-versed in the physical installation of the system as built. The converse is true: it would be extremely difficult, practically unfeasible, and plainly unwise to take control of the operation of a system whose as-built drawings are either incomplete or inaccurate. The importance of the as-built drawings, thus, cannot be over-emphasized.

Among other deliverable documents, the information supplied by the contract through the Management Information and Decision Support System (MIDSS) is also very essential. Since the MIDSS gathers information from all data collection and transmission systems, it stores records on all train control information, revenue collection information, and the Supervisory, Control, and Data Acquisition (SCADA) system¹⁵, in addition to maintenance reporting systems, inventory and personnel system. The current O & M contract requires that the MIDSS be programmed to generate daily and monthly counts and to perform all calculations. Furthermore, the Authority is to have real-time access to all elements of the MIDSS, through a network connection.¹⁶

¹⁵ The SCADA System is an inter-related system of components used to electronically monitor, supervise, control and operate all of the remotely controlled equipment on the Project.

¹⁶ STTT Contract: Special Provisions - O&M, Article 2.3.4.

The MIDSS alone is a single source of an enormous amount of information which the Authority will need to have before a take-over bid can be successful. Here again, the ACT has to ensure that the information from the MIDSS is frequently updated and is accurate at all times.

The ACT has to ensure that it has regularly updated copies of the Transportation Operating Rule books.¹⁷ With these, ACT personnel can be brought up to speed on operations procedures and organizational issues like the operations reporting structure, procedures for scheduling operators, terminal speed operations, train control operations, emergency and vehicle failure procedures, and any abnormal operations procedures.

The Vehicle Maintenance Procedures Manuals, Facilities Maintenance Procedures Manuals, as well as the Systems Maintenance Procedures Manuals will help the ACT gain a knowledge of maintenance procedures like track inspection, track maintenance, mainline structure inspection, station and right-of-way inspection, train control equipment testing, inspection and maintenance procedures, communications equipment testing, inspection, revenue vehicle cleaning, preventive and corrective maintenance, and major car overhauls. With these documents, the ACT will not only be able to determine how the contractor carries out his maintenance plan, but also will gain a knowledge of the frequency and scope of the maintenance activities, as well as the current conditions of the vehicles, facilities, and other system components.

Project Security Policy and Procedures Manuals should also be collected and thoroughly studied. From these manuals, the Authority will be in a position to acquaint itself with the safety arrangements for each aspect of the project. Additionally, the ACT should be able to learn more about the requisite level for maintenance of safety and security on the entire system.

Another important set of documents is the Project Administration Policy and Procedure Manuals which detail management issues such as payroll, personnel and human resources,

¹⁷ Information from interview with Ann Herzenberg, Deputy Director of Operations at the Massachusetts Bay Transit Authority (MBTA).

procurement, safety and risk management, operations planning and engineering, accounting and budgeting, customer service and revenue collection. Even if the ACT decides to adopt different administrative policies and procedures, these documents can still serve as a useful tool by providing the ACT with ball-park figures on administrative requirements.

It is highly significant that the Authority be aware of the organizational structure needed and maintained for the day-to-day operation of Tren Urbano. For this reason, the ACT must obtain documents from the contractor describing the executive and administrative structure, departments, positions or job titles within each department, the relationship between various departments and the “chain of command” in the organizational structure.¹⁸ Furthermore, the Authority must acquire and study documents describing the staffing requirements and detailing the educational qualifications and work experience requirements for each position, as well as the hours of work for each shift for each position, and the total number of hours worked per week for each position in the organizational structure.

It is in the ACT’s interest to know what kind of contracts Siemens has signed with its various subcontractors and suppliers. To this end, it would be advisable for the Authority to obtain updated copies of all subcontractor and supplier agreements that the incumbent contractor has signed with other parties. The acquisition of these documents will serve three purposes: First, it will enable the Authority to get an idea of how many and what kind of subcontractors are participating in the project. This could be an indicator of the number and types of subcontractors whose services the Authority might need in the event of a take-over. Second, the acquisition of subcontracts will aid in determining the scope of participation of the various subcontractors and suppliers. Finally, having a good knowledge of the subcontracts will be advantageous to the Authority, should it decide to negotiate deals with some of Siemens’

¹⁸ Information from Ann Herzenberg, MBTA and from STTT Contract: Technical Provisions - Operations and Maintenance, Section 17020.

subcontractors and suppliers, or should the Authority choose to assume the buyer's position in the current subcontracts at the time of take-over.

The take-over strategy requires some key Management Personnel who will observe the performance of the system during the first five years of the O & M period. During this time the personnel will learn more about how the system works, with a view to running it if the need ever arises. The personnel should be thoroughly knowledgeable in various aspects of the system. It is recommended that during the first five years of the O & M period, the ACT delegate managers to be in charge of the main elements of the system: Central Control, Engineering, Information Systems, Facility Maintenance, Vehicle Operations and Repairs, Revenue/Fare Collection and Human Resources. All the managers report to an Associate Director, who in turn reports to the Executive Director of the Tren Urbano Office.

The Engineering Manager's responsibilities should include the oversight of construction-operation interface and the transition between the two phases, as well as the observance of work done by professional service (architectural, civil, mechanical, electrical, and structural) consultants in connection with O & M. The Central Control Manager is the person responsible for the communications equipment, power distribution, train controls, and traction power, among others. The Information Systems Manager will be in charge of the computer systems, all data collection and information processing, including but not limited to the MIDSS and the SCADA systems. The responsibilities of the Facility Maintenance Manager shall cover all the fixed facilities: stations, railway equipment, booths, and yard and shops; whilst the Vehicle Operation and Repairs Manager will be in charge of the operation and maintenance of the fleet of cars. Matters relating to Revenue collection and fares shall be delegated to the Revenue & Fare Collection Manager. The Human Resources Manager shall observe hiring and training

practices for the Operations and Maintenance staff. The recommended organizational structure for the Management Personnel is summarized in Figure 2.3.

The take-over scheme requires effective monitoring of not only the system elements, but also the contractor's role and performance in the operations and maintenance phase of Tren Urbano. Monitoring of contractor performance will be examined in detail in the next chapter of this thesis.

Data collection of information on the system-wide elements will enable the Authority to keep abreast with all operational issues pertaining to the day-to-day administration of the system. In fact, it is the best way the personnel of the ACT can learn about the system while it is operational and in private hands. The principal tools that can be used to gather data on the system include the Management Information and Decision Support Systems (MIDSS), the Supervisory, Control and Data Acquisition (SCADA) system and the inventory system. ACT personnel will have to be conversant with the control and operation of these systems. For effective and successful monitoring to be carried out, it is highly recommended that the Authority undertake frequent inspection of the tracks, stations, and other system facilities. Additionally, auditing of the O & M procedures, all submittals, and reporting systems will enhance the ACT's position to take-over.

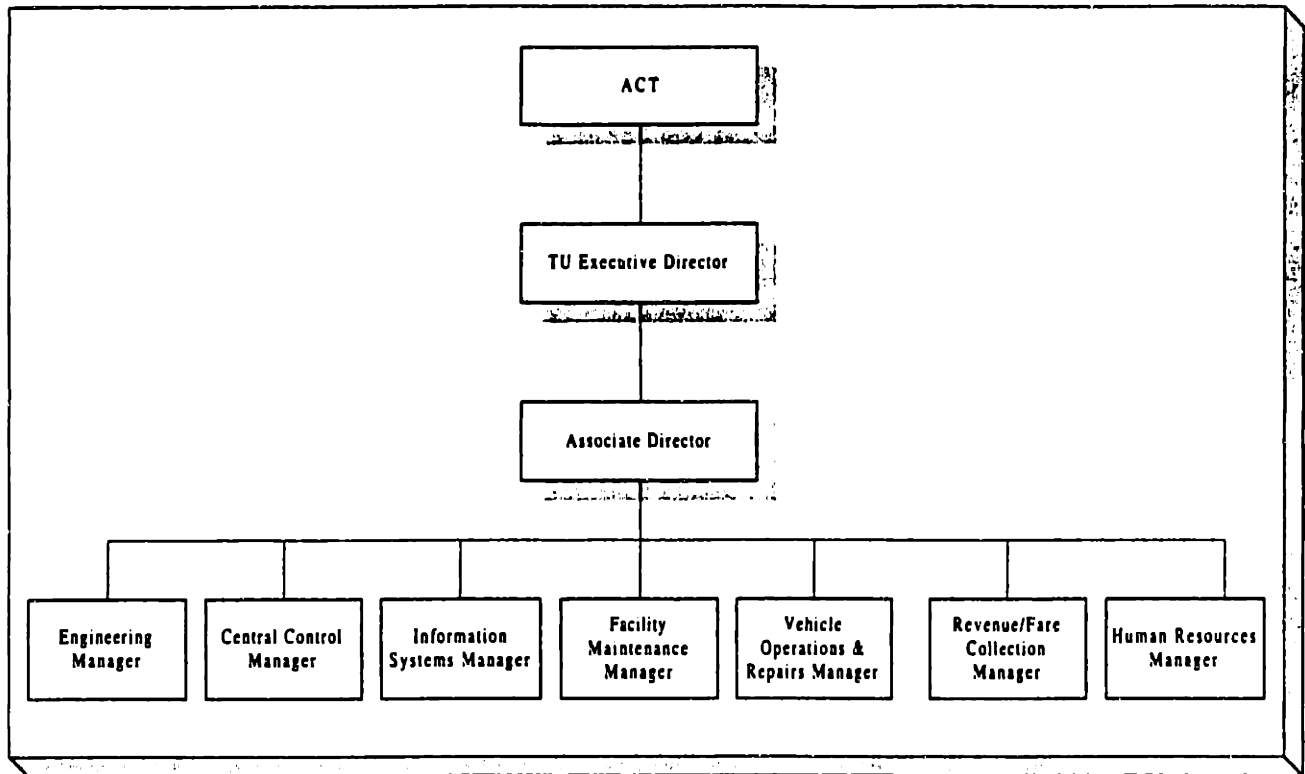


Figure 2.3: Recommended Organizational Chart for Take-Over Team

A key issue in the take-over plan is the determination of how the ACT obtains supplies of equipment and materials. Before the time of take-over, the Authority must be able to determine the sources, costs, and amounts of all supplies needed. The rate of supply ought to be determined as well. Potential suppliers and subcontractors have to be identified. Subcontracting procedures have to be firmly established so that if the take-over scenario actually materializes, procurement decisions will be made expeditiously and transparently, under little or no time pressure.

It must be remarked that the take-over requirements discussed in this subsection are not to be viewed as a checklist of “do’s and don’ts” or as a “shopping list.” Rather, they should be regarded as pieces of a jigsaw puzzle that can be fitted together within a particular time frame.

For the take-over strategy to work, it is best to set a time table of the sequence of actions that are required. A recommended time table for a take-over bid is presented in Figure 2.4.

The take-over preparation process will depend, to an extent, on the relationship between the ACT and Siemens. An arrangement will have to be made to ensure a smooth process, which is devoid of animosity and distrust.

ID	Task Name	1999		2000		2001		2002		2003		2004		2005		2006	
		Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul
1	Identify Management and Monitoring Personnel	█															
2	Review Operator's Organizational Structure	█	█	█	█												
3	Review Description of Staffing Requirements	█	█	█	█												
4	Review Transportation Operation Rule books			█	█												
5	Review Vehicle Maintenance Procedures Manuals			█	█												
6	Review Systems Maintenance Procedures Manuals			█	█												
7	Review Project Security Procedures Manuals			█	█												
8	Review Subcontractors and Suppliers' Agreements			█	█												
9	Review As-built drawings of system					█											
10	MIDSS Updates					█	█	█	█	█	█	█	█	█	█	█	█
41	SCADA Updates					█	█	█	█	█	█	█	█	█	█	█	█
72	Check Inventories					█		█		█		█		█		█	
84	Audits							█		█		█		█		█	
90	Decision Time: Taking over or not?											█	█	█	█	█	█
91	Hiring of O & M Staff											█	█	█	█	█	█
92	Develop Maintenance Plan													█	█	█	█
93	Training of Personnel														█	█	█
94	Establish Material Supply Process														█	█	█

Figure 2.4: Proposed Time Table for Take-Over Scenario

2.3.2 Scenario 2: Re-compete

In formulating a re-competing strategy, three major factors need to be seriously considered. These are (i) the availability of appropriate and qualified transit operators, (ii) the current and future states of the market for transit operators, and (iii) the relative size (in terms of scope, cost

and duration) of the Operation and Maintenance contract. It is obviously impossible for the ACT to send out a Request for Proposals (RFP) or Request for Qualifications (RFQ) if there are no potential bidders. The ACT will therefore have to approach this strategy very cautiously.

While there is currently little or no local resident operations expertise in the Commonwealth of Puerto Rico, there certainly are a number of appropriate U.S. and international firms that can take the responsibility of operating and maintaining Tren Urbano. Examples of such firms include ABB Matra, Bombardier, Metrovias, AEG Transportation, and GEC Alsthom Transportation. That there will be enough firms to ably run the system is therefore unquestionable. Whether there will be enough operators available who will be willing to run the system is the issue that has to be addressed. It is also possible, though not highly probable, that there could be enough local expertise in O & M by the time the first five years of operations have elapsed to trigger the formation a local firm to compete independently for the O & M contract in 2006, or to form a joint venture or a consortium with one or more interested bidders.

Current trends in procurement seem to encourage more private sector participation in the operation of public transit services. The Federal Government has been encouraging more and more public agencies to consider private sector involvement in the delivery of services.¹⁹ If the trend continues, it should be expected that there will be some competition in the O & M market.

The size of the O & M contract package is a key ingredient in the re-competing scenario. Generally, it is very difficult to attract a large number of bidders to compete for a large-scale project. This is due to the difficulty which many small contractors face in securing bonds. When the project is too small, large firms find it unattractive to bid. Against this background, it is very important for the Authority to thoroughly examine the extent of the O & M contract. The STTT procurement did not attract as many bidders as was envisaged. One reason may have

¹⁹ Thomas, Edward L. FTA Turnkey Demonstration Projects. Lecture delivered at MIT-UPR Conference in San Juan , Puerto Rico. January , 1997.

been that the large size of the project was a deterrent to many potential bidders.²⁰ Unlike the STTT, the O & M procurement should attract more bidders, considering the fact that the project is smaller in scope.

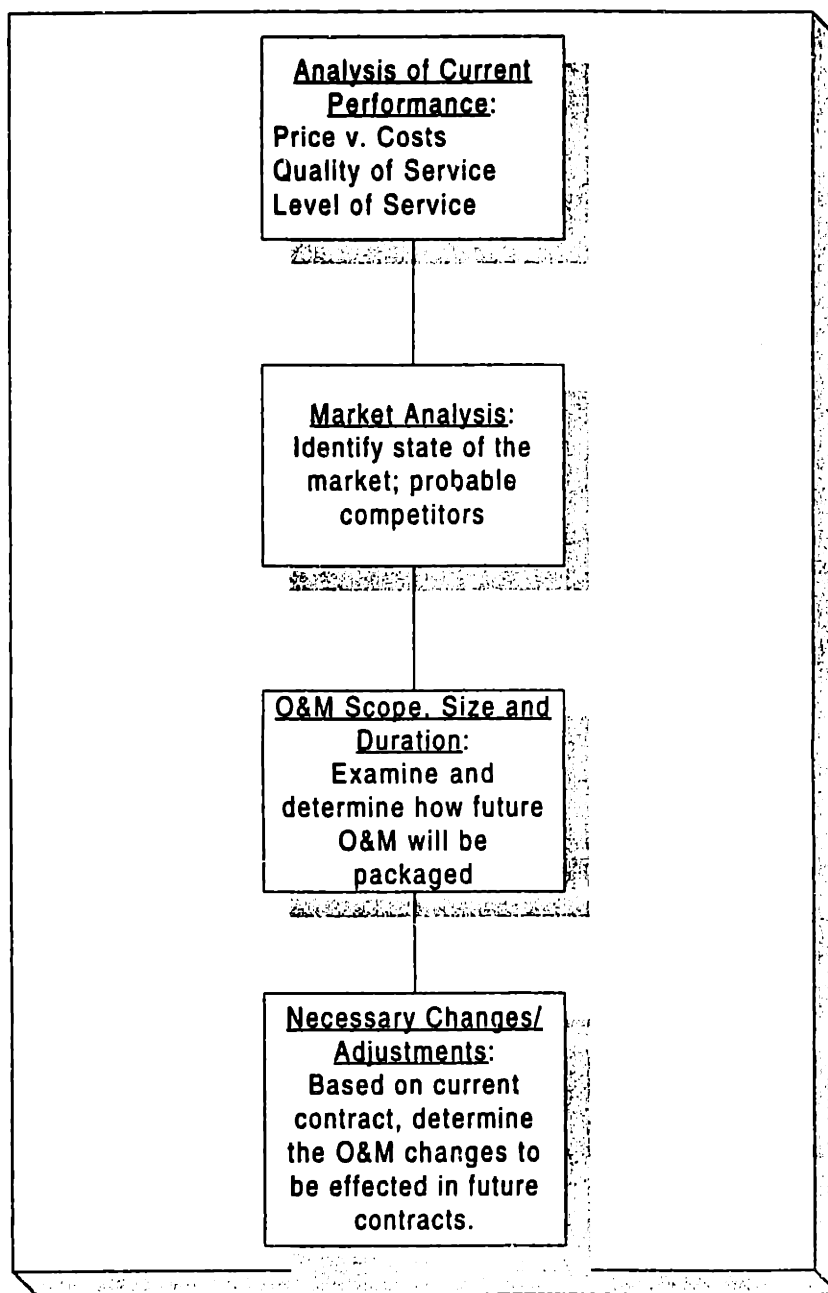


Figure 2.5: Requirements for Preparing for the Re-competing scenario

²⁰ Information from Randy Altschuler, GMAEC: Tren Urbano Program Consultants.

Figure 2.5 shows the set of actions required for the ACT to prepare for the re-competing scenario. As part of its strategy, the Authority will first of all have to assess carefully the performance of the system. This entails a profitability analysis, where the Authority has to determine how O & M costs match or vary from the price that is being paid to the current contractor. If it is clear that the ACT is realizing significant losses, despite the fact that it is possible to obtain a lower price from a more competitive operator, then it is best to go ahead and re-compete the O & M contract.

An analysis of service quality also needs to be performed. Perhaps, as a way of driving down costs, the ACT may decide that it no longer wants to pay for a very high quality service, and hence may be willing to scale down the operation of the system.

As part of the analysis of the current performance of the system, the ACT should take a look at the level of service. This includes an assessment of the frequency of service, hours of operation, and level of ridership. Perhaps a re-organization of service levels and/or hours could drive down costs and increase system performance.

A key requirement of the re-compete strategy is for the Authority to constantly watch the market to determine if there are enough competitors to warrant the initiation of a bidding process. The number of available competitors will also determine how much time, money and effort should be placed in the bidding process, how many steps the bidding process will involve, what award method should be used (for example lowest price, or 'best value'), and the flexibility for negotiating a final price with the bid winner.

Analysis of the contractor market involves the consideration of ways to increase the number of competitors involved in the bidding process. That is to say the ACT should be thinking of how to provide incentives or motivation for potential operators to participate in the bidding for the O & M. To this end, an evaluation of the STTT procurement process would be useful. It

would provide the Authority with an idea of the areas that need to be improved in order to enhance competition during future procurements. An in-depth analysis of the STTT procurement process is beyond the scope of this thesis.

To re-compete the project, a decision has to be made on the scope of a future O & M contract. In other words, the Authority will have to decide exactly what portion of the project should be contracted out. For instance, it is possible to contract out O & M, while the ACT retains the right to purchase vehicles, supplies, and equipment. In this framework, the operator is more or less a leasee and is only engaged in day-to-day operations and maintenance issues. Another possibility is for the Authority to contract out all aspects of the system – supplies, equipment purchase, communications, train controls, and all operations and maintenance. The extent of the work will influence the number and type of competitors, if and when re-competing becomes necessary.

The cost and financing of the Operations and Maintenance are also a major concern. The ACT projected in 1994 that O & M costs will be about \$27 Million per annum, once the line is opened.²¹ When the system starts operating in 2001, O & M costs have to be tracked to find out how close they are to the estimates, and to determine how the costs can be reduced without sacrificing quality. Low O & M costs will tend to attract more competition.

The duration of the contract is an important consideration. There are some operators who would be attracted by a long-term contract, since a longer time period will not only give them a greater chance to at least break even economically, but also will provide them with a greater sense of “job security.” From the ACT’s perspective, a long-term contract could be beneficial. It provides Tren Urbano with an excellent opportunity to increase technical capabilities.

²¹ GMAEC. Tren Urbano Program Consultants: “Discussion Draft of Procurement Strategy Paper.” October 29, 1994.

Additionally, a long-term contract will inevitably include several cycles of preventive maintenance and system rehabilitation for which the contractor will be responsible.

A case can be made for a short-term contract. It can be argued that a short-term contract reduces the contract performance risk which the ACT bears. Besides, it gives the ACT a better chance to salvage the system from a contractor who is not performing up to satisfactory standard. From a contractor's point of view, a short-term contract will not require as much human and material resources as would a long-term contract. Furthermore, the contractor is not committed to a long-range maintenance schedule, which drives up O & M costs. An optimum contract duration, incorporating all the factors discussed above, will have to be determined by the Authority.

Like any project, it should be expected that when the operation of Tren Urbano gets underway, some unforeseen situations or events may arise which may necessitate some O & M changes in the current contract. It should be envisaged that at the end of the five-year contract, there will be some changes and/or adjustments that have to be incorporated in a future contract (and hence in the procurement process). Examples of possible changes are performance standards, specified maintenance procedures and cycles, and safety and security measures. When Tren Urbano opens for revenue service, it should be the responsibility of the ACT to determine all the changes and to effect them in a future contract.

As part of the re-competing preparation strategy, it is important to establish a plan of actions which the Authority will undertake not only before the decision on re-competing is reached, but also after the decision is made. A recommended schedule of actions is shown in Figure 2.6 below.

ID	Task Name	2001		2002		2003		2004		2005		2006	
		Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul
1	Market Analysis												
2	O&M Changes/Adjustments												
3	Decision: Re-compete or not?												
4	Decision: Contract Scope and Duration												
5	Vendor Outreach												
6	RFQ												
7	RFP												
8	Shortlisting of Contractors												
9	Final Proposals												
10	Selection of Contractor												
11	Final Negotiations												
12	Contractor Begins Work												

Figure 2.6: Recommended Time Table for Re-competing

The time table considers all the steps that need to be taken once it has been decided to re-compete the O & M contract. The immediate step after the re-compete decision is to embark on a vendor outreach, as was done in the course of the procurement of the STTT. The objectives of a vendor outreach are (i) to ensure that as many potential bidders as possible are informed of the Authority's decision to re-compete, and are knowledgeable of the Tren Urbano system; (ii) to encourage participation in the procurement process; and (iii) to obtain some useful input from the vendor community. Vendor Outreach involves announcements, advertisements, and holding information sessions for potential bidders.

During the vendor outreach, the ACT should prepare itself to address some likely questions that may be posed by potential vendors: Why is the Authority not renewing the Siemens' contract? Is it because the ACT is tough to work for? Or is it because Siemens was making too much losses? If so, how will the potential vendors be assured that they would not find themselves in the same predicament? Are the ACT's expectations of the operators (and of Tren Urbano) very realistic? In re-competing, these are some of the public relations risks that the ACT may face.

As was done during the STTT procurement, potential operators would be given a time frame within which to submit a Letter of Interest to Participate. A Request for Qualification (RFQ), and later, a Request for Proposals (RFP) will be issued. After all the proposals are thoroughly studied, a short-list of candidate contractors can be made. Following that, the Authority may request the short-listed firms to make all necessary modifications and to submit final proposals, after which the contract would be awarded to the contractor with the lowest responsible bid. From then, the ACT can negotiate final price and terms with the winning contractor. The timeline should be such that the winning contractor has at least 6 months between the time of award and the expiration of the current O & M contract with Siemens.

If one considers that five years is not a very long time for the ACT to be prepared to take over direct control and O & M, and if one considers that a future O & M contract will not be as complex as the present STTT contract, one can conclude that the re-compete strategy is worth pursuing.

2.3.3 Scenario 3: Renewal for 5 more years

Under this scenario, the ACT simply exercises the option provision in the STTT contract by simply extending the O & M contract with Siemens for another 5 years.

For the renewal option the strategy is three-fold: the ACT will monitor all aspects of the system, identify successful and problematic areas, and then initiate changes before a new five-year term is awarded to the incumbent contractor. The steps are summarized in Figure 2.7 below.

Monitoring of the system and contractor performance is discussed in detail in Chapter 3 of this thesis. In this subsection, all discussion on monitoring will focus on the aspects pertinent to the ACT's strategy for preparing for the five-year renewal option.

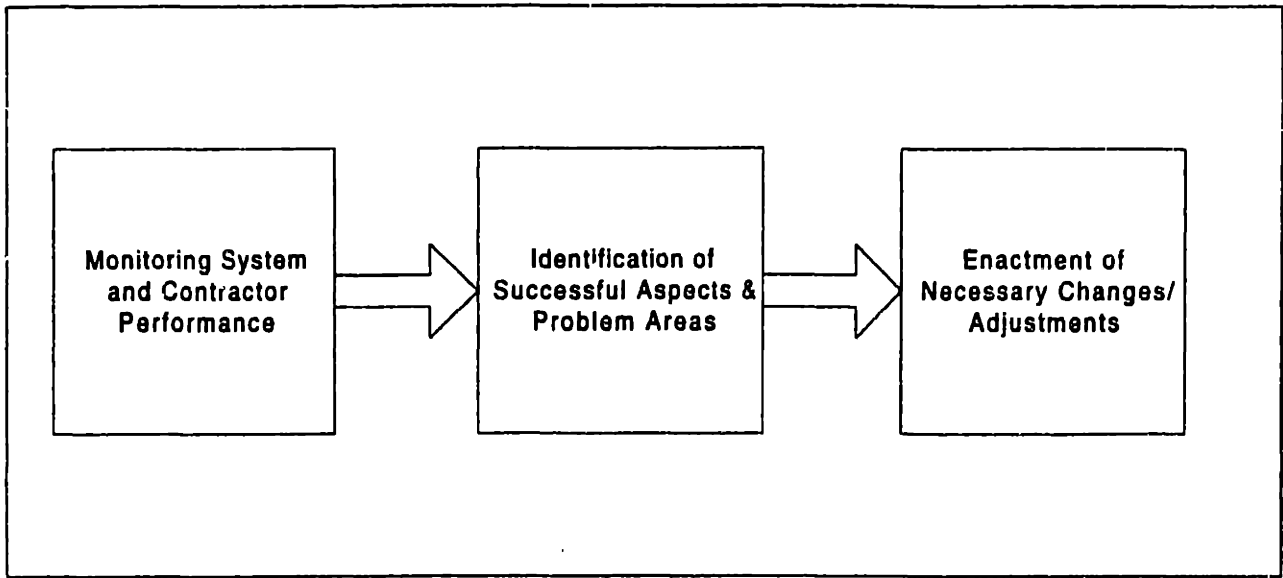


Figure 2.7: Preparation for STTT Contract Renewal

It is important that before a decision is made about renewal of the contract, the Authority is familiar with how Siemens is running the system. To this end, the Authority will have to closely observe the contractor's administrative, operations, and maintenance procedures, with a view to ensuring that these procedures are making the system highly successful overall.

The system elements whose performance has to be monitored include vehicles, train control, communications, operations control, and maintenance facilities. The Authority must observe closely how these system components function so that it will be in a position to determine whether or not the system is performing up to the expected standards. The performance of the contractor should be closely watched as well, using the performance indicators and standards set forth in the STTT contract. Some of these indicators include On-time Performance, Missed Trips, Fleet-wide Mean Distance Between Failures, and Level of Cleanliness, among others. (Please refer to Chapter 3 for details on performance indicators and standards.)

It should be emphasized that monitoring the performance of the contractor and the level of operation of the system is not an end in itself. The Authority will benefit more if, in the course

of monitoring, problem areas are addressed before (if possible) or during the process of contract renewal. In addition, those aspects of the contractor's work or the system's operation that have been successful need to be identified, so that the Authority can make the requisite arrangements to consolidate these successes achieved. It is highly possible that some of the expectations of the system may not be realistically met or may be exceeded (i.e. some standards may be too high or too low). Monitoring of the first few years of O & M gives the Authority the opportunity to reassess its standards and expectations.

It should be expected that during the first few years of O & M, there may be a few problem areas that would need to be addressed before contract renewal is initiated. A list of possible changes or adjustments is shown in Table 2.3. This list is by no means exhaustive, since it is impossible to predict exactly what will happen when Tren Urbano opens.

POSSIBLE AREAS OF CONCERN
Technology Transfer
Fare Collection
Safety and Security
Community Relations and Public Information
Marketing
Relationship between contractor and subcontractors
Future Expansion

Table 2.3: Areas in which changes will likely be made

It is possible - and even probable - that Tren Urbano will expand even before the expiration of the contract period with Siemens (The Minillas extension, for example, could get underway

before 2006). Should this happen, there may be the need to extend the contract with Siemens, without re-competing it. The ACT needs to be aware of the ramifications of future Tren Urbano expansion on the current STTT contract, so action can be taken accordingly.

Renewal for five years is probably the easiest option for the Authority. It should be pointed out, however, that the contract renewal process cannot be taken for granted, as it requires close monitoring of the contractor, the entire system, and even the Authority's structure.

2.3.4 Scenario 4: Re-negotiate in 2006 for a longer term

The strategy for an extended contract in 2006 is very similar to the case where the contract is renewed for 5 more years. All the necessary steps for contract renewal are applicable to the case of long-term contract negotiation. However, for a long-term contract, one more step is highly crucial: that of risk management and allocation. The requisite actions for a strategy for this scenario are shown in the diagram of Figure 2.8. Since the strategy is similar to the strategy for renewal, discussion here will only focus on the main difference, which is risk.

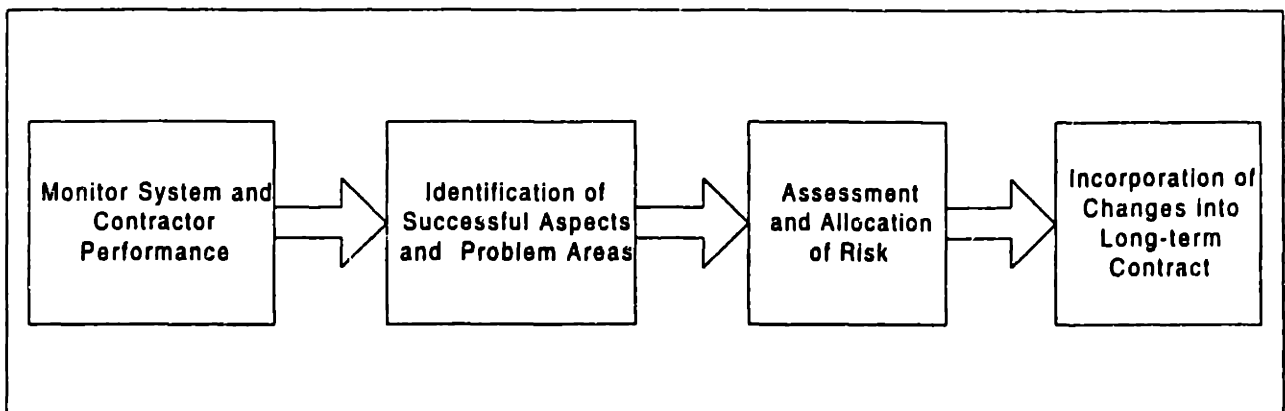


Figure 2.8: Necessary steps for signing long-term contract in 2006

If a long-term contract is awarded, there will be greater risks associated with the project. A risk mitigation plan, therefore, has to be devised. The financial risk of a project can, in extreme cases, be shifted solely to the owner or to the contractor, or more desirably, shared by both. A balancing of the risk should be sought between the owner and the contractor in order to utilize the incentive value of bearing risk while minimizing a contingency charged for accepting the risk.²²

Before deciding on how much risk each party to a re-negotiated contract will bear, it is worth examining all the common risks associated with a long-term contract. For a project of this nature, there are very obvious financial risks. The ACT is depending on multiple sources of funding: federal, state, and local.²³ Any change in the level or regularity of funding poses serious risks to both the contractor and the ACT. To help mitigate this risk, the federal government has offered to provide a Full Funding Agreement which fixes the multi-year term for each party's share.²⁴

Revenue risk is highly critical. When the Tren Urbano concept was implemented, it was projected by the Department of Transportation and Public Works (DTPW) that during O & M, ridership would increase yearly to an estimated 115,000 travelers per day by 2010, i.e. nine years after the system operations get underway.²⁵ Now, the amount of revenue from operations is a function of the level of ridership. Therefore, if ridership levels fall below expectations, revenues will drop. Consequently, the ACT may have to increase the subsidy²⁶ it pays out to the contractor. (Please refer to Figure 2.9).

²² Levitt, R. E., Ashley, D. B., and Logcher, R.D. "Allocation of risk and incentive in construction." *Journal of the Construction Division*, American Society of Civil Engineers. September 1980.

²³ Information supplied by Dr. Carlos Colón de Armas, Deputy Executive Director, ACT Department of Transportation and Public Works.

²⁴ GMAEC Tren Urbano Program Consultants. "Procurement Strategy Paper." December 5, 1994.

²⁵ Pesquera, Carlos I. Secretary, Department of Transportation and Public Works. Lecture delivered at MIT-UPR Conference in San Juan, Puerto Rico. January, 1997.

²⁶ Here, the term "subsidy" refers to the difference between the total revenues from fare collection and the Base Compensation which the ACT pays to the contractor for services rendered.

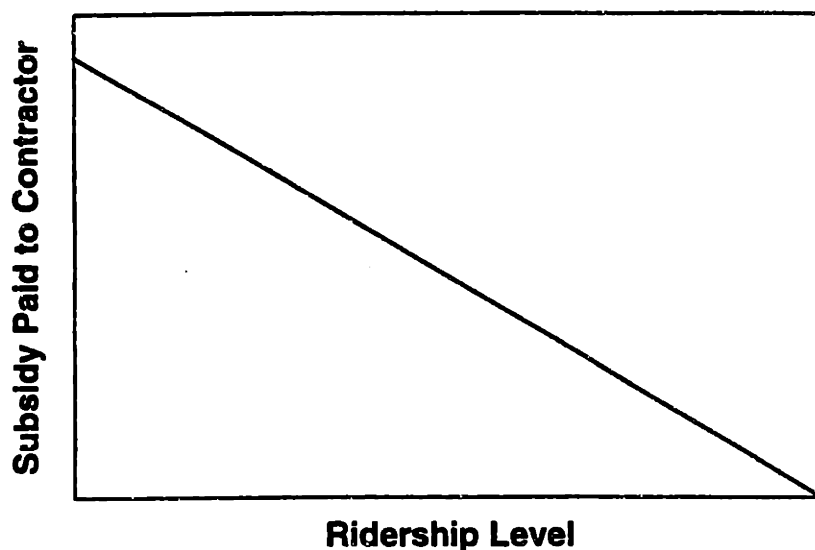


Figure 2.9: Graph showing variation of Subsidy Payments with Ridership Levels

As per the present contract, the contractor is paid a bonus equal to \$0.15 per patron if the actual ridership exceeds the ACT's incentive projection for total ridership in a given year.²⁷ This amounts to some form of a profit-sharing scheme between the owner and the contractor. However, as can be seen from Figure 2.10, the contractor does not share losses with the owner when the ridership (and hence revenue) falls below the incentive projection. With the signing of a long-term contract, a risk-sharing model or framework has to be worked out, as far as operation revenue is concerned. While it can be argued that the ACT, as owner, should bear all the revenue risk, it is recognized that the future is unpredictable, and hence any operator must be willing to assume a reasonable amount of revenue-related risk. Against this background, it is recommended that, provided the IRS minimum requirement of 80% periodic fixed compensation is met, the Authority and the operator share any losses that would be incurred as a result of a decrease in the level of ridership.

²⁷ STTT Contract: Special Provisions - O&M, Article 4.5.

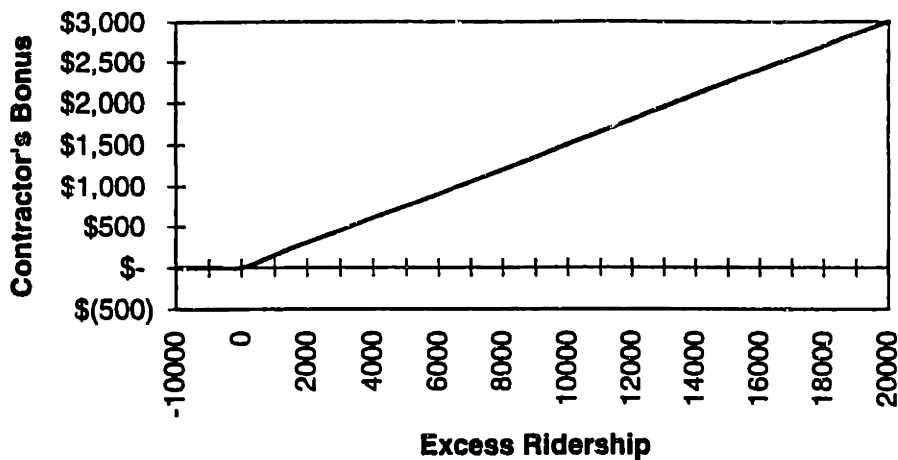


Figure 2.10: Relationship between Contractor's Bonus and Excess Ridership.²⁸

Performance risk has to be controlled, although it is especially difficult to do so under a long-term contract. Under the terms of the current STTT contract, the contractor is required to deliver a Performance Security of \$10 million in the form of a surety bond, cash deposit, or an irrevocable letter of credit before the issuance of the Certificate of Final Acceptance (CFA) by the Authority and before the commencement of Pre-Revenue Service. The Performance Security is to be maintained in effect and held by the Authority until the O & M contract expires or is terminated.²⁹ With a long-term contract, the ACT should demand a greater amount of performance security from the operator.

As has been provided in the current STTT contract, the ACT can shift some operational risks in a long-term contract to the operator through the use of performance standards and specifications (which include penalties and incentives). It must be realized, however, that the penalties do not apply if the contractor is losing money. The performance standards may need to be reviewed when the system comes into operation, but before the long-term contract is awarded.

²⁸ Note that if ridership falls below incentive projections, Contractor's bonus is not negative.

²⁹ STTT Contract. Special Provisions - O & M. Article 10.2

To assure a smooth and timely procurement process, the long-term contract strategy should be implemented over the time period available before a decision on the future operation of Tren Urbano is reached. A recommended schedule is presented in Figure 2.11 on the next page. The schedule begins in 1999, two years before the expected commencement of system operations. The reason behind this is to provide adequate time for a management and monitoring team to be assembled, and for the ACT to obtain all deliverable documents like As-built drawings, Transportation Operation Rule books, and Systems Maintenance Policy and Procedures Manuals.

When the system becomes operational, the monitoring personnel will obtain O &M data, on a regular basis, from the MIDSS and the SCADA systems, as well as from the inventories, audits and other forms of monitoring. Using the data available, the ACT will then identify all problem areas, with a view to making the corrections that can be made as operations continue. Those corrections that cannot be made immediately should be earmarked for the future. In the meantime, the Authority should begin the risk assessment process, even before a decision is made on whether or not to award a long-term contract.

If the ACT decides on a long-term contract, a decision will have to be made on the length of the contract. It should be realized that the longer the contract period, the more risk there will be in the procurement. The important question is: considering all factors, what is the optimal contract period: ten, fifteen, or twenty? It is for the ACT to determine which time period serves the system best economically, socially, and politically. It is highly recommended that when the decision on the contract length is made, the Authority invite proposals from the contractor. The reason for a Request for Proposal is for the ACT to have a fair idea of what the operator expects in a long-term contract. More importantly, an RFP would enhance dialogue between owner and contractor, and would thus avoid making the procurement process a one-sided affair.

ID	Task Name	1999		2000		2001		2002		2003		2004		2005		2006	
		Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul
1	Identify Management and Monitoring Personnel	█															
2	Obtain Deliverable Documents	█		█													
3	MIDSS Updates					█	█	█	█	█	█	█	█	█	█	█	█
34	SCADA Updates					█	█	█	█	█	█	█	█	█	█	█	█
65	Check Inventories					█		█		█		█		█		█	
77	Audits							█		█		█		█		█	
83	Other Monitoring									█	█	█	█	█	█		
90	Identification of Problem Areas					█		█		█		█		█			
91	Risk Assessment and Allocation									█		█		█			
92	Decision: Long-term or not?									█		█		█			
93	Decision: Length of contract									█		█		█			
94	Proposals from Contractor														█		
95	Incorporation of changes into contract draft														█		
96	Contract Negotiations																█
97	Signing of Contract																█
98	Begin Long-term O&M																█

Figure 2.11: Time Table for Re-negotiation of Long-Term Contract in 2006

Upon reviewing the operator’s proposals, the ACT should then incorporate all necessary changes into a draft long-term contract, which can then be reviewed by the contractor. Formal negotiations can proceed thereupon, with a new contract coming into effect by the time the current STTT contract expires.

The option to re-negotiate in 2006 for a long-term contract is one that depends on how the first five years of O & M go. In this regard, the option lends itself to high scrutiny by the ACT, hence its viability.

2.3.5 Scenario 5: Early Re-negotiation and Extension

The key strategy for this option is the identification, assessment, and allocation of risk. Early re-negotiation and extension involves the same risks discussed in the analysis of Scenario 4. Project completion and cost overrun risks are additional risks in this scenario, since construction would still be in progress if the ACT decided to give Siemens an early extension. To help assuage these risks, the Authority should require high value Performance Security, Compliance Bonds, and Contractor's Risk Insurance. As further protection against cost overruns, it is advisable for the Authority to demand that a separate Letter of Credit for a specified amount be set aside. All the bonds should be on the account of the operator and must be supported by joint and several parent company guarantees.

While risk assessment is being carried out, a decision on the length of the new contract has to be made. All the factors discussed under Scenario 4 hold true for the early re-negotiation and extension option. Additionally, there may be the need to make some modifications to the current contract to bring it in line with the newly proposed O & M timeline. A draft proposal of the contract could be sent to the contractor for review and comment. Upon receiving feedback from the contractor, the ACT should be ready to begin negotiations with Siemens on all proposed amendments. (Please see Figure 2.12 for a summary of necessary actions for early re-negotiation).

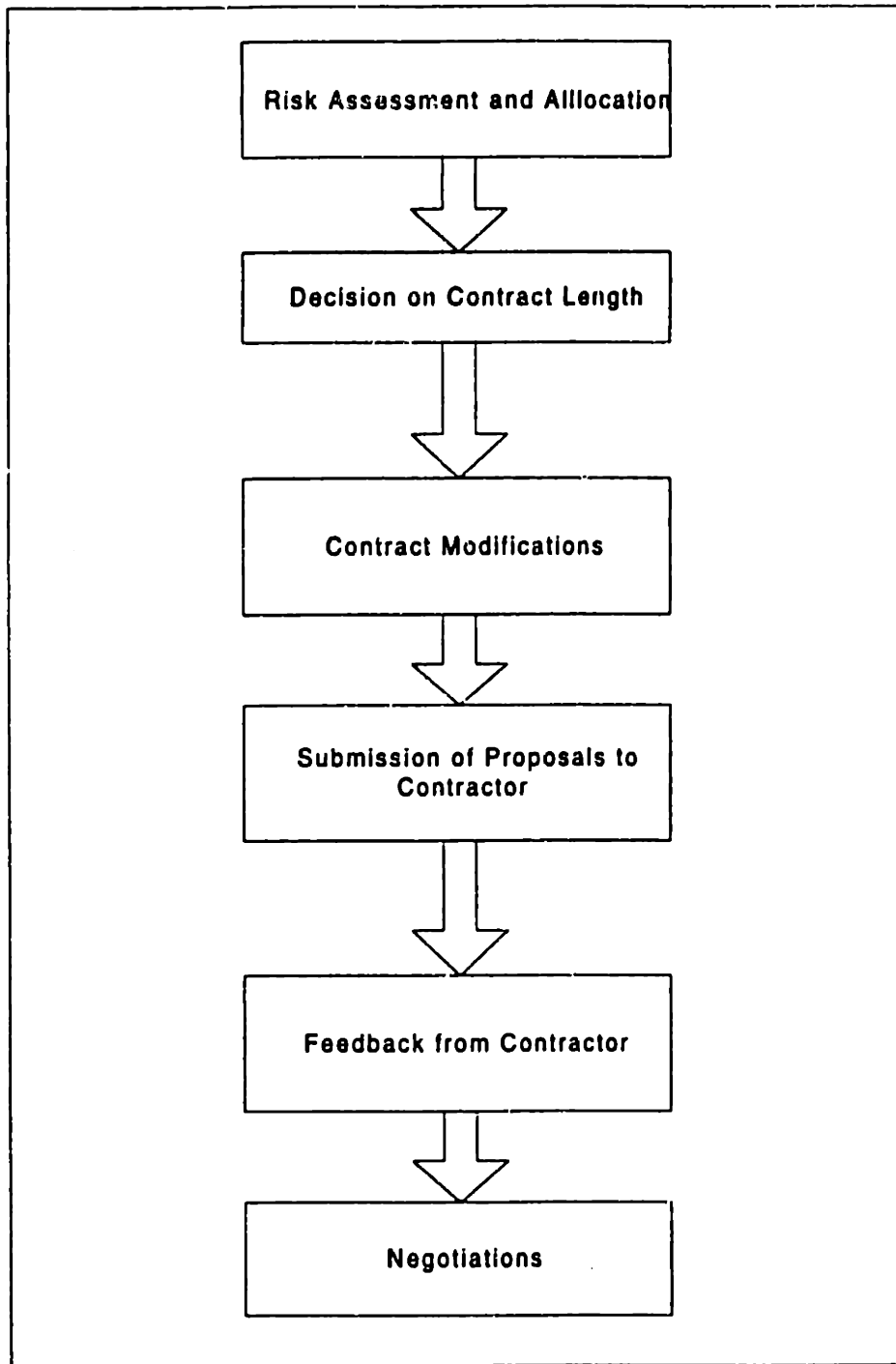


Figure 2.12: Necessary procedures for Early Re-negotiation and Extension

Chapter 3

Monitoring and Assessment of Contractor and System Performance

3.1 Introduction

In Chapter 2, five probable scenarios for operations and maintenance of Tren Urbano were analyzed. Strategies for preparing for each of the scenarios were outlined. With the exception of the fifth scenario (i.e. Early Re-negotiation and Extension), the strategies for each of the options have one common requirement: monitoring and assessment of the performance of the operator and of the system as a whole. Any decision made on future procurement of O & M after the start of system operations in 2001 will have to depend, to a large extent, on the assessment of the first few years of O & M.

In order to be in a position to determine the level of performance of Tren Urbano, the ACT will need to adopt a monitoring plan. The plan, which should not be limited to mere contract administration, must include the establishment of metrics for system and contractor performance evaluation, development of strategies for collection of information on performance indicators, and the selection of methods for interpretation and assessment of the information gathered. Since the ACT has already set some performance standards for the contractor and for the system in the STTT contract, the procedures and policies of the monitoring plan have to be consistent with the provisions on performance as laid out in the STTT contract. Such an arrangement ensures that there is no disparity between the monitoring plan and the contract, as regards the Authority's expectations of the contractor's output.

This chapter examines and evaluates the monitoring methods available to the ACT, how effectively the ACT can use these methods, and how to assess the performance of the overall Tren Urbano system, and of the system operator in particular. The next subsection is devoted to justification of the need for an ACT Monitoring Program, whilst the rest of the chapter focuses on various aspects of monitoring and evaluating the system and contractor performance.

3.2 Aims and Objectives of Monitoring Program

Monitoring of Tren Urbano will serve the following purposes:

- (i) Enable the Authority to be abreast of O & M progress and performance. This will help the Authority decide if and when some operational or policy changes are necessary either immediately or upon the expiration of the five-year O & M contract.
- (ii) Serve as a tool for Quality Control and Quality Assurance. By closely monitoring the O & M phase, the Authority will be more capable of ensuring that the operator's service is of the quality desired by the Authority. Substandard performance in any aspect of the project delivery can be noticed; the operator will then be instructed to make the necessary adjustments which will bring the service to the ACT's expected level of quality.
- (iii) Assist the ACT in enforcing all O & M contract provisions. A monitoring program forces the contractor to check himself against breach of contract.
- (iv) Serve to ensure that the contractor is in compliance with all rules and regulations of the Federal Transit Administration (FTA). In particular, vehicle and passenger safety regulations are key elements which have to be strictly enforced. Monitoring the system will enable the ACT to detect any and all violations of FTA rules.

- (v) Help to determine if the O & M information supplied by the contractor is accurate. In addition, it can check the effectiveness of the contractor's reporting system.
- (vi) Help the Authority to make future O & M decisions. The ACT will be in a better position to determine whether to renew the contract with Siemens, to re-compete, or to take over.
- (vii) Can be of help to the Authority, when the time comes to making decisions on the future expansion of the system. For future phases, it is hoped that the procurement will be enhanced by the experience gained by the ACT and the GMAEC from the procurement of Phase I, which includes the O & M period.
- (viii) Adequately prepare the Authority to address general administrative, social, and political issues relating to Tren Urbano in particular, or to the transportation sector in general.

3.3 Monitoring Personnel

A key step in the Monitoring plan is to assemble a monitoring team. This comprises the management and staff who will actually observe the performance of various elements of the Tren Urbano system. Essentially, the monitoring team will carry out three functions: (a) Quality Control/Assurance Personnel, (b) Performance Evaluators, and (c) "Apprentices" (to a small extent). As a Quality Control/Assurance team, the monitoring personnel will inspect the various aspects of the O & M to provide control over the operations of the system so as to ensure that the desired level of quality is achieved and maintained in accordance with the applicable standards or specifications. As Performance Evaluators, the monitoring personnel's responsibilities will be: (a) to examine and review the methods and output of the contractor, and of the system in

general, and (b) to provide the Authority with information on the degree of success of the system, the level of performance of the operator, areas that need improvement, and what kind of adjustments, if any, the Authority can make to enhance performance of the system. As apprentices, the monitoring personnel will observe how the system is run, with a view to gaining some knowledge on transit operations. This could be of help to the Authority in the future.

For monitoring to be effective, it is advisable to divide the responsibilities into specified categories, with personnel being assigned tasks in each category.³⁰ The Monitoring personnel requirements are shown in Table 3.1 below.³¹

Responsibilities for Monitoring Personnel
Engineering
Central Control
Information/Data Collection
Facilities
Vehicle Operations
Accounting
Technology Transfer
Audits & Inventories

Table 3.1: Areas of responsibility for Monitoring Personnel

Engineering Personnel should be responsible for observing and assessing the architectural, civil, mechanical, electrical, and structural components of the system. The responsibilities of the Central Control personnel should comprise observance and appraisal of all work related to train controls, power, and communications equipment and personnel. Information/Data Collection personnel should be assigned the duty of acquiring, verifying, and analyzing the system data and checking on the operator's reporting system. Facilities Personnel will be in charge of the permanent and temporary infrastructure: stations, railway equipment, booths, and yard and shops, among others. All aspects of monitoring relating to the running and repair of vehicles in the fleet should be under the jurisdiction of the Vehicle Operations staff. The Accounting

³⁰ Adapted from the ACT's Guideline for Evaluation of STTT Contractors.

³¹ Information supplied in part by Ann Herzenberg, MBTA.

Personnel will monitor O & M costs, ridership, and revenue collection, while the Technology Transfer staff will monitor the contractor's (and the ACT's) Technology Transfer Program. Audits and Inventories Personnel should be responsible for bookkeeping verification of transactions, operations, expenditure, revenues, and taxes.

It should be noted that some of the duties of the various monitoring personnel are not totally independent. As a matter of fact, it is more effective if the different divisions collaborate as a team. Such an arrangement will enable the personnel to complement each other's work and to consolidate the work of the Monitoring team.

3.4 Data Collection

In order to be in a good position to evaluate the performance of Tren Urbano, the ACT must acquire relevant information on the system in the course of monitoring the O & M phase. To be able to exercise the best option for Tren Urbano, the Authority should attempt to address a number of questions regarding the operations phase:

- What information should Tren Urbano acquire to observe and evaluate the transit system?
- What kind of data should the Authority collect so as to be able to make a good assessment of how the contractor is managing the operations and maintenance portion of the Design-Build-Operate contract?

These are just two of the many O & M questions that the Authority will have to address as soon as possible. The earlier it addresses these issues, the more effective the monitoring of the system will be. It is against this background that data collection must be regarded as an important role player in monitoring the system and its operator.

In a public-owned, privately-operated service, the level of monitoring and evaluation of the operator's performance, or of the service will depend on the quality of information or data that the owner acquires. Quality is a function of both the amount of relevant information and its accuracy³².

There are various sources and types of information that the ACT can acquire in the course of monitoring the O & M phase of the project. Table 3.2 below shows a listing of the pertinent information that can be obtained while monitoring the Tren Urbano system. It must be noted that the ACT does not necessarily need to gather data on all the types of information listed here before a decision on the future of the system can be made.

Essential Information	Non-critical information
O & M Procedures	Train Headways
On-time Performance	Hiring & Training Procedure
Train Accidents	Injuries
Missed Trips	Response time to failures
Revenue Collection Information	Response time to inquiries and complaints
Train control	Technology Transfer Plan
SCADA System	Subcontracts
Turnstile count: Ridership levels	Security: thefts, vandalism, etc.
Maintenance schedules and cycles for system components	Cleaning cycles of vehicles, stations and other facilities
Inventory	Organizational structure
Budget	Staffing Requirements
Failure Rates: vehicle, power, air conditioning, turnstiles, fare vending machines, station elevators	Availability of timetables, maps and other service information
Operating Costs	Payroll
Sources and Costs of Materials & Supplies	Customer Relations

Table 3.2: Types of information that can be gathered whilst ACT monitors Tren Urbano

³² Halvorsen, R.D., Y. Panayotidis, M. Bucciarelli, and N.H.M. Wilson; Monitoring the Performance of Private Service Contractors. UMTA-MA-11-0049-91-1 (Washington, D.C: Report prepared for the Office of Technical Assistance and Safety, February 1992)

The information types can be classified into two broad categories: essential and non-critical. The essential information is defined here as the kind of information that cannot be overlooked if the Authority is to make an assessment of the system. The non-critical information is defined as the kind of information which will be of help, but without which the Authority can still make a reasonable assessment of system and operator performance.

Considering that gathering a large information data base will only make an assessment of the contractor more difficult, and bearing in mind the cost implications of collecting a great amount of information, it is proposed that the Authority limit its data collection efforts to the essential information listed in Table 3.2. Such a range of information should be ample for an assessment of the contractor, provided the information gathered is reliable.

3.4.1 Role of the MIDSS

To help keep track of information, the STTT contract requires the contractor to develop, use, and maintain computerized Management Information and Decision Support Systems (MIDSS). The MIDSS is to be programmed to “generate daily and monthly counts, to perform calculations, and to acquire all necessary information and reports.”³³

Probably the largest source of information available to the Authority, the MIDSS puts together information from the train control, turnstile counts, revenue collection, SCADA, maintenance reporting system, payroll, inventory, and personnel, among others. It could potentially be one of the most effective means of gathering O & M information on a daily, weekly, or monthly basis. By having a network connection to the MIDSS, the Authority can collect data, reports, and other information in a relatively short time. In addition, by providing

³³ STTT Contract: Special Provisions - O & M, Article 2.3.4

the Authority with the ability to generate its own reports and analyses based on data from the transportation operating, maintenance, administration and security systems, the MIDSS gives the Authority some flexibility to organize the data it receives in the course of monitoring O & M.

Provided the information supplied to the ACT is accurate, the MIDSS can serve as a useful performance management report tool which will help in the ACT's review of the system and its decision-making process. Up-to-date information on performance indicator levels and trends can be obtained and then compared with the ACT's set standards or with other transit operation levels and trends.

From an economic perspective, the MIDSS helps to save some money, since the Authority focuses less resources on gathering information and instead, only has to focus on ascertaining the veracity and accuracy of the information provided by the contractor. Furthermore, the network connection between the ACT and the contractor enables both parties to obtain information from the same source. That way, duplication of efforts is avoided.

3.5 Important Issues to Consider

There are some issues which the Authority has to address before monitoring begins in earnest. There are others that have to be dealt with as O & M progresses, and there are still others that can only be taken care of at the end of the five-year O & M period.

A key question that has to be answered is: when is the best time to begin monitoring of the system and the contractor? Most transit system monitoring begins after the start of O & M, simply because the design and construction phases are totally separate from the operations and maintenance phase. This is due to the fact that the systems are procured using traditional approach to procurement where the designer, the builder, and the operator are three different

entities.³⁴ With the application of a turnkey form of procurement for Tren Urbano, the same entity owes the ACT the responsibility of ensuring a smooth interface between the design and construction phases and the operations and maintenance period. Thus the Authority can begin to monitor the system before the start of O & M.

Pre-O&M monitoring entails review of the plans and procedures, as well as of relevant documents. The rationale behind the review process is to keep the ACT abreast of the contractor's operations methods, solutions, procedures and policies, and to ensure that the contractor's policies and procedures will be understandable and acceptable to the Authority in the event that any one of the five scenarios is followed. The content and format of the contractor's documents will have a profound effect on those operators who follow, and it is in the Authority's interest to be a constructive, helpful participant in the generation by Siemens of project-wide information systems.

Submittals that have to be reviewed include As-built drawings, O & M plans and procedures, Revenue Vehicle Maintenance Policy and Procedures Manuals, Transportation Operating Rule books, Maintenance Policy and Procedures Manuals, Budget, Hiring and Training Plan, and Equipment, Materials, Supplies and Services Procurement List.³⁵

Considering the number of submittals required and allowing for the review process and possible re-submittal, it is recommended that Pre-O&M monitoring begin at least 2 years before the Tren Urbano gets into operation. January 1999 is an appropriate time. Indeed, it may be wise to begin this process now, by receiving, evaluating and accepting outlines and formats for project documentation from Siemens.

³⁴ Information from interview with Mr. Joe Ferretti, Operations Manager, Alternate Concepts Inc., partner in Siemens consortium.

³⁵ STTT Contract: Technical Provisions: O & M, Section 17020

Pre-Revenue Service Testing should also be monitored so that if the Authority observes any kinks in the system, it can take appropriate action to ensure that all problems are remedied. Pre-Revenue Service monitoring can make a significant impact on the system performance during Revenue Service. This point is best illustrated with an example. The Manchester Metrolink in the United Kingdom, which became operational in 1992, had a Pre-Revenue Service of less than 21 days. However the owner, the Greater Manchester Passenger Transport Executive (GMPTE), monitored the Pre-Revenue Service Period, and with the cooperation of the operator, was able to adjust how the operator runs his timetables, deals with emergencies, and at the same time bed down the individual disciplines in his team.³⁶

Once the O & M period begins, monitoring has to focus on a greater number of issues. The service quality is a primary concern. Among other things, the ACT Monitoring personnel would want to constantly verify if: (i) the trains are arriving at and departing from stations on time, (ii) the vehicles are not over-crowded, (iii) the vehicles run smoothly without frequent breakdowns or power failures, (iv) the stations are well maintained, (v) there is high personal safety and security on trains and around stations, and (vi) customer service is given a high priority.

Of primary concern are O & M costs. In the course of monitoring, a distinction has to be made between price (the amount of money that the Authority pays out as reimbursement) and cost (the contractor's expenses).³⁷ The Authority must ascertain that the operator is incurring the costs that he is reporting and must ensure that cost overruns are minimized.³⁸ It must be pointed out that monitoring prices and costs does not necessarily mean the Authority should look to suppress every opportunity the operator has of making profit. After all, in participating in the procurement of Tren Urbano, the operator intends and expects to make some profit. The

³⁶ Black, Eric: "Metrolink Moves Manchester: Building the Network" in *Railway Gazette International*. November 1991.

³⁷ Barrie, D.S., and B. C. Paulson: Professional Construction Management. 2nd ed. New, York., NY: McGraw-Hill! Book Co.1984.

³⁸ Gilbreath, R. D. Managing Construction Contracts. New York, NY: John Wiley and Sons. 1983.

purpose of monitoring prices and costs should be to ascertain the veracity of the operator's transactions and the accuracy of his reports.

The level of service is an important performance parameter and hence should be given considerable attention by the ACT Monitoring Personnel. The term "level of service" refers to headways, hours of operation, days of operation, and the number of cars on a train during specified periods of the day or week. It will be necessary to determine if the stipulated weekday and weekend headways are realistic. Conceivably, there could be a need to increase or decrease headways at certain times of the day in direct response to ridership demands. An example will best illustrate this point. The ACT-stipulated headway for 6:30am to 8:30am on weekdays is four minutes, as provided in the STTT contract.³⁹ For the period between 8:30am and 10:00am on weekdays, the stipulated headway is 8 minutes. If on opening Tren Urbano the ACT realizes that a four-minute headway is suitable for the rush-hour passengers, and that the rush hour ridership does not decline till after 9:00 am, then there will be the need to assign a four-minute headway to the period between 8:30 am and 9:00pm.

In the current contract, the operating hours for Tren Urbano have been set from 5:00 am till 01:00 am. The ACT ought to monitor and analyze the system patronage during these hours. If late night ridership levels are extremely low, so that the 20 hours-per-day operations periods cannot be justified economically, then the Authority will have to reduce the hours of operation. On the other hand, if the ACT's Monitoring Personnel have cause to believe that a 24 hours-per-day operations period will be economically feasible, then they can recommend that the ACT management give its approval for the train lines to run at all times of the day. The number of cars per train at specified periods can also be adjusted based on observed trends in system patronage.

³⁹ STTT Contract: Technical Provisions, Section 17000.

Ridership level depends in part on public perception of a transit system. Against this background, the Authority must address the issue of how to monitor the manner in which the contractor handles community relations. Of particular importance is the development of constructive working relationships with community groups and leaders. While this may be a thorny issue, it would be very naïve to not realize that community group leaders do have some influence on how individuals from each community perceive Tren Urbano (and hence, its ridership). Factors that influence community relations include the condition in which service property is maintained in a particular community: i.e. right-of-way landscaping, exterior appearance of vehicles, stations, parking facilities, guideways, and maintenance and storage facilities; noise impacts in residential areas⁴⁰; ease of transfer from one mode of transport to another (e.g. from Tren Urbano to Públicos)⁴¹; and the effect of a future fare integration policy on various communities.

It is essential that the issues identified in this subsection be dealt with as O & M proceeds. As monitoring of the system occurs, any problems that can be fixed immediately should be fixed. Those that require solutions at a later date should be earmarked and the corrections made at the appropriate time. It must be noted that with a procurement system as unique as Tren Urbano's, some unforeseen circumstances may arise during O & M. It is the owner's responsibility to rectify anomalies to the best of his ability, and in the system's best interest.

⁴⁰ STTT Contract: Special Provisions - O & M, Article 2.C.1.

⁴¹ Amador, María: "Integrating the Públicos into the Tren Urbano System." Lecture delivered in Cambridge, Massachusetts to MIT Tren Urbano Research group. April 1997.

3.6 Performance Standards and Indicators

For monitoring to be successful, it is necessary to determine the metrics by which the performance of the Tren Urbano system and its operator would be evaluated. As in the case of most transit systems, performance indicators and performance standards will be used to capture certain aspects of operator and system performance.

For the sake of clarity, a performance indicator is defined in this thesis as a measure by which the efficiency and/or effectiveness of a transit system can be estimated. Indicators are generally clear, specific, and measurable.

The term “Performance standards” is defined in this thesis as targets assigned to performance indicators to promote efficient and effective performance of the transit system.⁴² They provide the managers of system with a basis for assessing system performance as revealed by performance indicators.

Pre-determined standards have been incorporated in the STTT contract. This enables the ACT to link operator performance with overall system performance, and thus provides the ACT with a mechanism for monitoring and evaluating the success of the contractor during the O & M period. Furthermore, pre-determined standards give the contractor an idea of what the owner expects of him.⁴³

For purposes of monitoring Tren Urbano some performance indicators and standards, as per STTT contract provisions, have been identified. Some of the performance indicators are quantitative while others are qualitative. The quantitative performance indicators and standards are listed in Table 3.3 below. Upon examination of the indicators and standards, one observes that the ACT has very high expectations for Tren Urbano as far as system performance is

⁴² Regional Public Transportation Authority, Maricopa County, Arizona: Developing a Performance Management System for Transit Services. Report Published for the U.S. Department of Transportation. January, 1989.

⁴³ Hayes, Edward C.: “Contracting for Services,” in Privatization: The Provision of Public Services by the Private Sector, ed. Roger L. Kemp. McFarland & Company, Inc. Jefferson, North Carolina. 1991.

concerned. The standards were arrived at after comparison of performance statistics from various major transit systems around the United States, and after incorporating the fact that Tren Urbano is new and will be run by a private operator, who will be held to a higher standard.⁴⁴

	Performance Indicator	Performance Standard
1	On-Time Performance	98.5%
2	Missed Trips	At most 30 per month
3	Accidents/Injuries	None
4	MDBF ⁴⁵ (Fleet-wide)	60,000 km
5	MDBF (Air Conditioning Systems)	120,000 km
6	Vehicle Cleanliness/Cleaning cycle	Daily interior cleaning and graffiti removal; Exterior cleaning every 5 days
7	Mean Hours between failure for station elevators and escalators	350 hours
8	Facilities Preventive Maintenance	Based on "approved standards"
9	Station Cleanliness/Cleaning cycle	Spills cleaned within 30 minutes of occurrence; no overflowing trash, etc.
10	Mean transactions between turnstile failures	20,000 cycles
11	Customer Service	Phone answered within 5 rings; Response to inquiries and complaints within 3 days
12	Response time to service-impacting failure	Minimum ⁴⁶ of 30 minutes.
13	Availability of Timetables, maps, schedules, etc.	At all times during operating hours
14	Ridership counts	Varies: depends on ACT projections
15	O&M Costs and Revenue	Based on ACT-approved contractor projections

Table 3.3: List of Tren Urbano Performance Indicators and Standards

⁴⁴ Information from interview with Howey Morris, Tren Urbano Consultant.

⁴⁵ MDBF = Mean Distance Between Failures

⁴⁶ This is an obvious error in the contract (Technical Provisions- O & M, Section 17010). It should read: "Maximum Response Time."

The qualitative performance indicators which are relevant to Tren Urbano include the level of technology transfer, safety and security, community feedback, and level of participation, among others. While these indicators can give an idea of the operator's level of performance, they are rather subjective and consequently depend on how ACT Monitoring Personnel interpret them.

As O & M proceeds, the ACT Monitoring Personnel should collect data on the performance indicators and compare them with the standards. Most of the information on the quantitative indicators can be obtained through the MIDSS. There are certain kinds of data on some of the indicators (for example the availability of timetables, maps, schedules, etc.) which may have to be obtained directly by the Authority.

The role of performance standards in the monitoring and assessment of Tren Urbano should not be over-stressed, as the performance standards serve as no more than a guide for the Authority to assess system performance. Performance evaluation and any decision-making process on the future procurement of O & M which focus solely on the relationship between and indicator and its standards will subvert the idea of effective management and control of Tren Urbano.

3.7 Methods of Monitoring

Having identified the personnel requirements, the issues to be addressed, the starting time and the information needed for monitoring, the next question is: what kind of monitoring is required for Tren Urbano?

To monitor the operator and the entire system, it is recommended that the Authority use a combination of five methods, depending on when monitoring is being done and what information is being checked: (a) directly overseeing the information/data collection process, (b) randomly cross-checking the information provided by the contractor by collecting an independent set of representative data, (c) auditing the contractor's records on a regular or irregular basis, (d) checking the system's inventories periodically, and (e) conducting periodic surveys of Tren Urbano riders.

Direct oversight by the Authority is recommended only during Pre-Revenue Testing and during the first few months (twelve, say) of Revenue Service. The use of this method will ensure that the reporting system of the contractor not only complies with the provisions of the contract, but also is compatible with the Authority's Management Information System. In addition, direct oversight at the beginning of O & M presents the Authority with an early opportunity of making necessary corrections and adjustments to system operations or to the data collection process if the need arises. Direct oversight can be carried out by having the ACT Monitoring Personnel work in positions where they will be able to directly observe the performance of the contractor and of the system and, at the same time, track the data collection and information systems. Specifically, the ACT can deploy some officers to check some of the turnstile counts, revenue collection information, on-time performance, missed trips, and failure rates, etc. and then compare them with what the contractor is reporting. They will also check if – and how frequently – information is being recorded accurately. This method of monitoring is costly, considering the fact that it involves deployment of personnel and material resources. The Authority should exercise caution when directly overseeing the information/data collection process. It would not be beneficial if the ACT gives the impression of “policing” the contractor.

The contractor could be put in an uncomfortable situation with the Authority constantly overseeing his every move. This can potentially breed distrust between owner and contractor.

Once the start-up kinks have been fixed and the Authority and the operator have become accustomed to routine system operation, direct oversight can be ceased. Monitoring will now be done by the last four of the five methods mentioned above.

Random checking can be carried out in two ways: (i) selecting random stations and/or trips and observing the contractor's performance and data collection at regular intervals, every month, say; or (ii) observing the data collection process at irregular intervals. It must be realized that, regardless of the method employed, there could be statistical errors if the sample size or range of the data that is gathered or frequency of data collection is not high enough.⁴⁷ This would render the method ineffective. This method of monitoring poses little threat to the integrity of the contractor and hence may avert a situation of distrust. The method is applied fairly successfully in Buenos Aires by the owner, SBASE ('Subte') to monitor the transit system operations contracted out to the Metrovias consortium.⁴⁸

Random checking is best exercised for the verification of data that can be visually observed. Examples are turnstile counts, on-time performance, missed trips, and train accidents.

To ascertain the veracity of data supplied by the contractor that cannot be visually observed, auditing is the most appropriate method to employ. The Authority can audit the contractor's record on a regular or irregular basis, with or without serving notice to the contractor. This can be done directly or through the services of an audit firm hired by the Authority. Information that has to be audited includes O & M budgets, operator's accounting system, costs and revenue, and volumes, sources and costs of equipment, materials, supplies and services. Auditing provides

⁴⁷ Casley, Dennis J.: The Collection, Analysis, and Use of Monitoring and Evaluation Data. Baltimore, Maryland: The Johns Hopkins University Press. 1988.

⁴⁸ MacKay, Ron: Alternate Concepts, Inc. Partners in Siemens Transportation Partnership. Presentation at MIT-UPR conference in San Juan, Puerto Rico. January 1997.

the ACT with a high level of confidence on the degree of accuracy of the contractor's records. Furthermore, with the knowledge that his records can be audited at any time, the contractor is motivated to perform better, and to keep records in a transparent manner.

In order to be abreast of the state of all service property and inventory levels, it is advisable for the ACT to carry out periodic inventory checks. These checks will provide the ACT with an idea of the trend of usage of equipment, vehicles and facilities, their rate of wear and replacement, maintenance cycles, and, possibly, life spans.

Ridership surveys, if well-conducted, can be a very effective means of assessing not only the contractor's performance but also the accuracy of his data collection. The STTT contract does, in fact, stipulate that the contractor, or his consultant, perform ridership surveys at the conclusion of each Service year to determine general public perceptions concerning the quality and efficiency of the services provided by Tren Urbano, its desirability, and any deficiencies in services⁴⁹. It is still important for the Authority to conduct its own surveys on a periodic basis along various alignment sections, at various stations, and even during community forums so that the results can be compared with the contractor's information. The survey could be used to obtain information on ridership levels, service quality, level of service, customer service, fare integration policies, inter-modal transport, community relations, general perceptions of the public, and suggestions for improvements. It must be stressed that any surveys that are conducted must include statistically valid samples of both patrons and non-patrons.

⁴⁹ STTT Contract: Special Provisions: O & M, Article 2.3.8.4.

ID	Task Name	1999		2000		2001		2002		2003		2004		2005		2006	
		Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul
1	Assemble Monitoring Personnel	█	█														
2	Review of Documents, Plans and Procedures	█	█	█	█												
3	Direct Oversight of Data Collection					█	█										
4	Random Checking							█		█		█		█		█	
14	Auditing							█		█		█		█		█	
20	Inventory Checks					█		█		█		█		█		█	
32	ACT-conducted Rider Surveys							█		█		█		█		█	

Figure 3.1: Recommended Monitoring Schedule

From the foregoing discussion, it is evident that no single method of monitoring is adequate. Rather, a combination of all five techniques will produce the best results. A time table, like that of Figure 3.1 above, which combines the five methods discussed, will give a clearer picture of the monitoring program. It is advisable to determine in advance when and how often to use a particular method of monitoring.

3.8 Assessment of Performance

As the ACT monitors the operations of Tren Urbano, it has to periodically make appraisals in order to determine how the system and the operator are performing, how close their performance is to the ACT's expectations, what improvements the operator and/or the ACT can make to enhance performance, and what to do about the future operations of Tren Urbano.

Basically, two methods can be used to evaluate the system. The first is by making a comparison of the data gathered on the contractor's performance with the standards set by the ACT in the STTT contract. If the data indicates that the contractor's performance equals or exceeds the set standards, then interpretation is straightforward: the contractor is operating the system very well. On the other hand, if the data reveals that the contractor is performing below the set standards, the Authority should be cautious in drawing a conclusion. The reason for the

difference could be because some of the performance standards may be too high and hence are not realistically attainable, or because the operator's performance is substandard. Good engineering judgment should be used in making a performance evaluation based on pre-determined standards.

The second method of assessment is comparing performance data collected with those of other major transit systems in the United States and similar systems abroad. Again, caution should be exercised since different systems have different definitions for various performance indicators. For example, On-Time Performance (OTP) is defined by Tren Urbano as arrival (a) less than one minute prior to scheduled time, (b) more than the lesser of (i) three minutes, and (ii) one-half of the headway on which the train is scheduled to operate, after the scheduled time. In the case of the Manchester Metrolink Light Rail in the United Kingdom, OTP is defined as arrival (a) less than two minutes prior to scheduled time, or (b) more than two minutes after the scheduled time.⁵⁰ For the New York Subway, the definition of OTP is similar to the Manchester Metrolink.⁵¹ Thus a 96% OTP in San Juan does not necessarily correspond to 96% in New York or Manchester. It is still advisable, nevertheless, to compare Tren Urbano data with national trends, even if only for obtaining a general idea of where Tren Urbano stands, relative to other transit systems.

With a fair evaluation of the contractor, the Authority should be in a position to make a decision on the future direction of Tren Urbano.

⁵⁰ Armitage, Richard: "Tunnel Vision: Manchester Metrolink." *Global Transport*. Winter 1995.

⁵¹ Nakanishi, Yuko J: Region II University Transportation Research Center. Presentation to MIT-UPR New York City Transit Tour. March 1997.

3.9 Summary

Monitoring of the contractor and system performance is a pre-requisite to making a decision on the future direction of Tren Urbano (except in the case where a long-term contract is awarded before the scheduled commencement of O & M in 2001). It is important for those monitoring the contractor to realize that there are different “correct” ways to carry it out. Several factors can contribute to the success or failure of the transit operations management. In order to save time and effort and to avoid a situation of constantly “policing” the incumbent contractor, monitoring should focus on six main success/failure contributors:⁵²

- Financial efficiency: cost-effectiveness and maximization of revenue
- Operating and Maintenance Levels of Equipment, facilities and systems
- Effective policies and procedures
- Financial efficiency: cost-effectiveness and maximization of revenue
- Quality of personnel
- Workable plans and schedules.

Finally, it must be pointed out that monitoring the contractor on a micro level – where every procedure is vetted – will not be as useful as monitoring on a periodic basis.

⁵² Information from Anne Bickford, former Deputy Director of Operations, MBTA. Currently with Alternate Concepts, Inc.

Chapter 4

Combined Strategy for All Scenarios

4.1 Introduction

Thus far, strategies for preparing for several O & M management situations have been outlined and discussed. In addition, the requirements and methods for evaluating the performance of the operator have also been analyzed. While each strategy on its own can be pursued independently, it is prudent, for purposes of good organization and to avoid duplication of efforts, to synthesize these strategies into a composite strategy which the Authority can work with. This chapter aims to tie together all the strategies involved in making a management decision on the future control, operation and maintenance of Tren Urbano.

4.2 Personnel Requirements

Regardless of what direction the future operation and maintenance of Tren Urbano heads, the ACT will need some key personnel who will assist the Authority in preparation for any of the outcomes outlined in the preceding chapters. Knowledgeable personnel have to observe, examine, and evaluate various aspects of Tren Urbano as construction and operation and maintenance proceed. These personnel should not only be in a position to keep established acceptable forms of project documentation, and to judge the performance of the operator, but also should be able to manage the different components of the system which they are overseeing, in the event of a take-over.

The key personnel requirements for a combined strategy can be divided into two tiers. The first level comprises a core of three highly qualified experts who will be in charge of Operations, Maintenance, and Finance, respectively (Please see Figure 4.1 below).⁵³ It is recommended that these three experts have many years of experience in transit operation, maintenance, and general administration in the United States and, preferably, in other countries. Their duties would be to direct the second tier personnel on the relevant information to be gathered during O & M, and how to store the information. In addition, the first tier personnel will provide technical and professional advice to the Authority on the requirements for any alternative that the ACT wants to choose. Since the take-over option is the most complex, these personnel should be prepared to assist the ACT in starting up an entity to run the system in the event that the ACT actually takes it over. The first tier personnel must therefore: (a) understand the organizational characteristics of the system, (b) be able to respond to unpredictable events, (c) be capable of effectively measuring success, and (d) be very objective and realistic about the contractor's performance, as well as the ACT's expectations and capabilities.⁵⁴

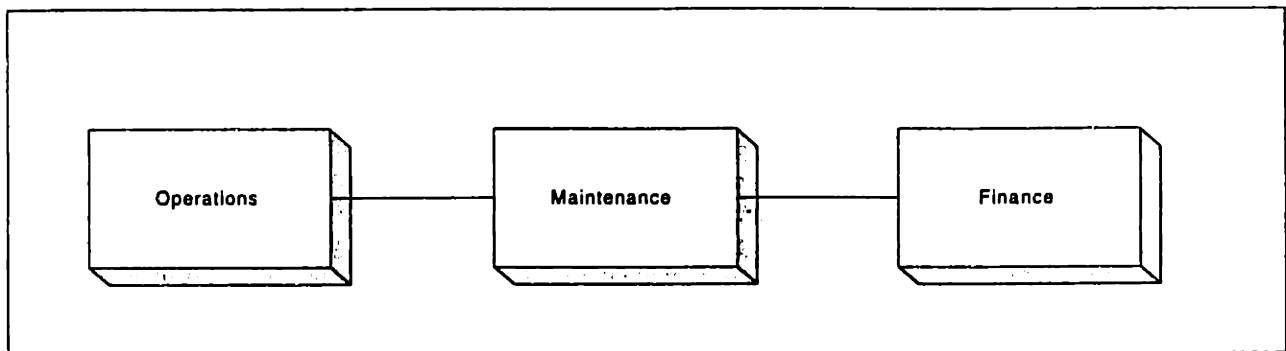


Figure 4.1: Personnel Requirements for Implementation of Common Strategy – First Tier

⁵³ Based, in part, on information from Anne Bickford and Ann Herzenberg, MBTA.

⁵⁴ Information from Anne Bickford and Larry Gould, New York Transit Authority.

As for the second tier personnel, they will be responsible for handling the finer details of O & M issues, as the decision time approaches. However, hiring them will depend on whether or not the Authority feels it has adequate personnel to handle the duties of personnel who will be involved in helping to make the decision on future O & M. Their requisite areas of responsibility are summarized in Figure 4.2 below.⁵⁵ A detailed discussion of the second tier personnel requirements follows.

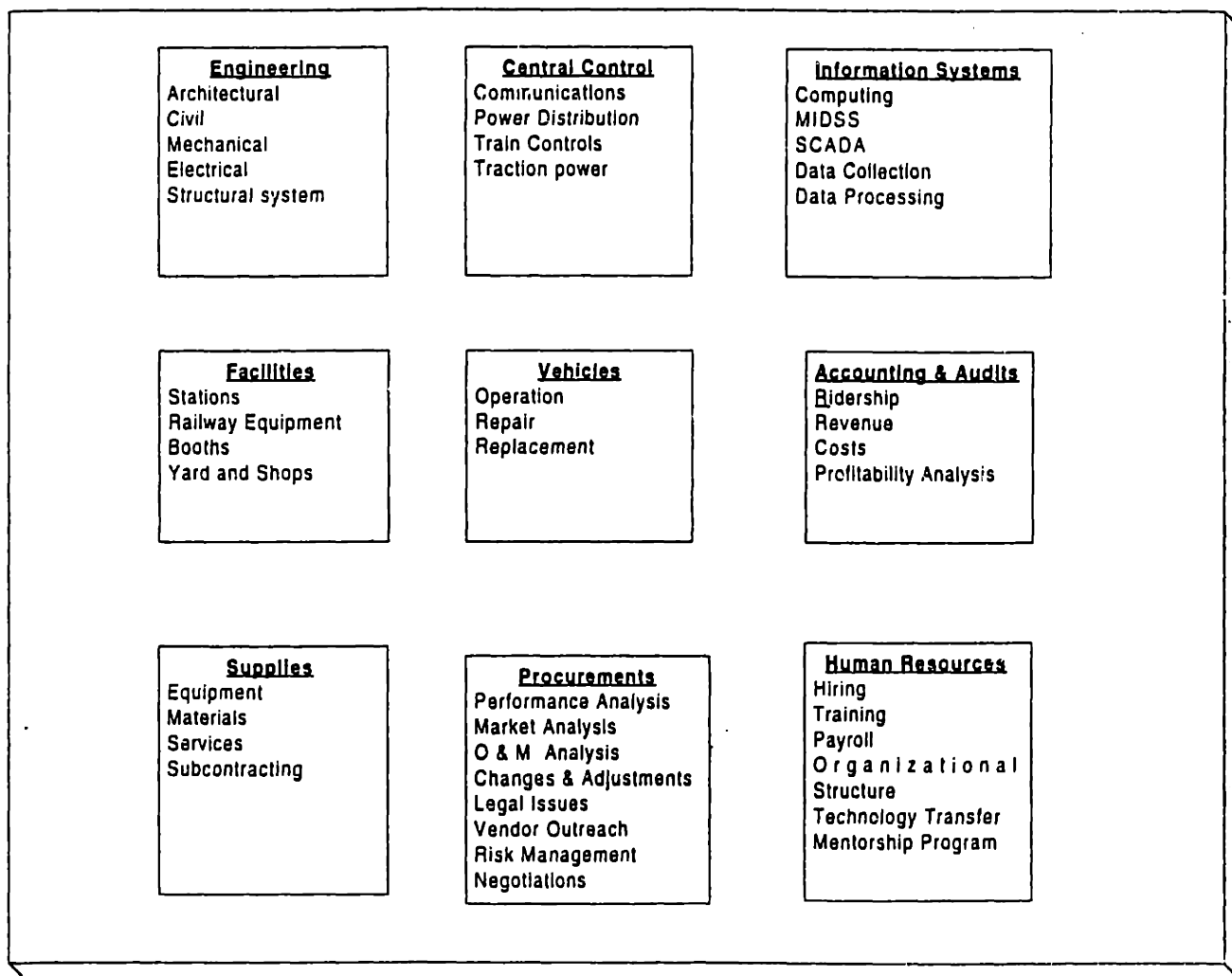


Figure 4.2: Personnel Requirements for Implementation of Common Strategy – Second Tier

⁵⁵ Some of the information was obtained from Ann Herzenberg, MBTA; Howey Morris, Tren Urbano Consultant; the STTT Contract: Technical Provisions - O&M; and the Puerto Rico Highways and Transportation Authority's Guideline for Evaluation of the STTT Contractors.

The second tier personnel, should they be needed, will observe, learn from, and evaluate O & M procedures as the system is in operation. They will prepare the necessary documents and store any relevant information. Should the ACT deem it necessary to take over the operation of the system, the same personnel should be in a position to provide supervision in the area of operation that they have been overseeing. If the Authority chooses to renew the contract for another five years, the personnel will help to identify the strengths and weaknesses of various elements of O & M. In addition, if the decision is to offer a long-term contract to the operator, the personnel will be capable of describing issues that have to be considered, identifying areas of uncertainty, and pinning down areas of risks in the various components of the system.

The Engineering staff will observe all aspects of the project relating to the architectural, structural, civil, electrical, and mechanical functions of the system, as well as all other professional services rendered during the Pre-Revenue Service and the Revenue Service Period. They will document the procedures involved in all work relating to their domain. In addition, they will report to the Authority any and all anomalies in the engineering systems as O & M proceeds. If the Authority chooses to take-over O & M, the Engineering staff must be capable of assuming direct control of Tren Urbano's engineering systems and of training more personnel to help run the system. It should be able to advise the Authority on whether any portion of the engineering work may have to be contracted out. As far as other scenarios are concerned, the engineering staff should be able to evaluate the performance of the system and of the contractor, provide expert advise to the ACT on which areas need to be improved, determine what kinds of adjustments are needed, and determine what kinds of standards the ACT should set in the future for the engineering systems.

Central control personnel form an integral part of transit operations. As such, personnel overseeing this area of operations have an important responsibility in observing and evaluating the train controls and communication systems. The combined strategy requires the central control staff to be conversant with how to manually and automatically operate the control centers. They should be familiar with any problems in the system. Furthermore, they should provide the Authority with advice on any necessary changes in the future. Of high importance is the documentation process. The staff should ensure that control and communications policies and methods are well-documented so that whoever takes over the operation of the system, with little training, will understand how it works.

Information Systems personnel will acquire operations information while the private operator is running the system. If the Authority takes over, their role will change. They will be the ones providing the information to the Authority. Either way, they will have to be capable of managing information systems and databases. It is for the Information Systems personnel to ensure that the MIDSS and the SCADA systems perform satisfactorily. Additionally, they have to make recommendations on upgrades, or ways to enhance information reporting. When the time comes to make a decision, the Information Systems personnel should be able to provide assistance to the ACT, since they will have had several opportunities of analyzing O & M data.

Personnel in charge of facilities will observe how railway equipment, stations, booths, and yard and shops are maintained. They will appraise the conditions of these facilities and recommend any modifications of facility maintenance policies and procedures to the Authority. Additionally, they should be knowledgeable of the maintenance cycles of the fixed facilities. Also, if there is an ACT take-over, the staff should be ready to manage the fixed facilities.

Staff members in charge of observing vehicle operation should familiarize themselves with not only how the vehicles are manually and automatically operated, but also with their cleaning,

repair, and replacement schedules. They will be able to provide some input on evaluation of vehicle operations when the time comes to assess the contractor's performance or to determine what action the Authority should take regarding the future of O & M. If take-over is necessary, staff in charge of vehicles will be responsible for managing operations and repairs, as described in the take-over strategy formulation in Chapter 2.

Accounting and Auditing Personnel will play various roles in anticipation of all the major scenarios outlined earlier. When O & M gets underway, they will be in charge of checking the operator's accounting system which includes costs, ridership counts, revenue collection, and profitability analyses. Through this function, they will be able to counsel the Authority on ridership and revenue maximization, as well as on necessary cutbacks on operating costs. They can also help evaluate price/cost proposals of potential operators, if the Authority decides to re-compete the O & M contract. Should take-over occur, they should be ready to take charge of the accounting system.

The responsibilities of Supplies staff members include overseeing the contractor's material, equipment, and services stream, storing information on costs, volumes, and sources of supplies and services, as well as of subcontracting procedures and policies, with a view to assuming the role of supplies and equipment managers if the need arises. They could also look into the possibility of assuming the buyer's role in Siemens' contract, in the event of a take-over. As far as other scenarios are concerned, they must be in a position to advise the Authority based on their observation and their knowledge of the supply process.

One of the most important personnel requirements in the combined strategy is the Procurement personnel who will more or less assist in directing the future procurement of Tren Urbano O & M. During the first few years of O & M, they will perform analyses of the incumbent operator's performance, so as to determine whether or not to exercise the five-year

option to renew, or to offer the operator a long-term contract. They will also study the feasibility of re-competing by performing a market analysis. If the ACT chooses to re-compete the O & M contract, the Procurement personnel should be responsible for vendor outreach and for preparation of Requests For Proposals (RFPs) and/or Invitations To Bid (ITBs). The Procurement staff members will perform risk analysis to determine the allocation of risks in a long-term O & M agreement. Additionally, they will determine what kinds of changes or adjustments need to be made in the current or future O & M contract. Furthermore, the Procurement Personnel will deal with legal issues relating to contracting under any of the procurement alternatives available to the Authority. Finally, they will be responsible for negotiating any future contracts or subcontracts (if necessary).

The responsibilities and duties of the Human Resource staff are diverse. These officers will observe, document, and appraise hiring and training procedures during O & M. They will also observe and evaluate the level of success of the Technology Transfer and Mentorship Programs. They should determine the extent of involvement of local expertise in O & M procedures. In effect, they should be in a position to inform the ACT on whether, in their estimate, there is enough local expertise to warrant a take-over or some other procurement arrangement that might require a high number of local professionals. Additionally, the Human Resource staff should be ready to assume responsibility for personnel recruitment and training, in case the Authority does take over O & M.

Figures 4.3 and 4.4 show one possible timing for the hiring of first and second tier employees. A senior maintenance manager would be hired now to work with Siemens in approving content and format of project documentation. The other two key managers would be hired prior to the decision period. As mentioned earlier, Tier Two personnel may or may not be needed.

ID	Task Name	1998		1999		2000		2001		2002		2003		2004		2005		2006	
		Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul
1	Maintenance																		
2	Operations																		
3	Finance																		

Figure 4.3: Hiring Dates for Tier One Employees

ID	Task Name	2003		2004		2005		2006	
		Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul
1	Engineering								
2	Central Control								
3	Information Systems								
4	Facilities								
5	Vehicles								
6	Accounting & Audits								
7	Supplies								
8	Procurements								
9	Human Resources								

Figure 4.4: Hiring Dates for Tier Two Employees (If necessary)

4.3 Choosing the Optimal Decision Time

In drawing up a composite strategy for possible scenarios, an important consideration is when to actually make a decision on how to procure the long-term operations and maintenance of Tren Urbano. Basically there are two different time periods to consider. The first period is for the case where the Authority considers awarding a long-term contract to Siemens Partnership, before the start of O & M in 2001. The other period applies to all the remaining scenarios (where a decision on long-term control, operation and maintenance is made after the start of the initial O & M phase of the project). Regardless of which time period is considered, several factors can influence the timing of the decision.

The ACT should consider early re-negotiation and extension as soon as practicable. One reason for this is to provide an adequate time frame within which the owner and the contractor can deliberate on, assess, and negotiate conditions of a long-term contract. Another reason is to provide an incentive for the contractor to place his long-term interest in the project in the course of the design and construction periods.⁵⁶ If the ACT and Siemens sign a long-term contract very early, there would still be adequate time for the contractor to incorporate some positive long-term strategies in the design and construction process. Thus the contractor may spend more resources up-front to put in place a high quality system by the time the O & M phase comes around. From a legal perspective, an early decision will provide enough time for all legal hurdles to be cleared before O & M formally begins. Furthermore, from a management standpoint, making an early decision will allow enough time for the Authority to formulate plans on the extent of its involvement in the monitoring and administration of the O & M contract.

In the light of the factors mentioned in the foregoing discussions, it is recommended that Early Re-negotiation and Extension be considered between now and January 1999, a time frame of nearly 27 months. Such a period is long enough for the Authority to conduct all the requisite feasibility studies and analyses before exercising the Early Re-negotiation and Extension procurement option.

To be able to decide on the optimal decision time for the remaining scenarios, one has to take into account the time frame available, as well as other factors that could determine the decision time (for example contract provisions, adequacy of information on system performance, etc.).

If the ACT does not select the early re-negotiation option, then it has to prepare for other scenarios while O & M activities proceed for the first five years. The Authority has to observe

⁵⁶ Construction Industry Institute: Impact of Various Construction Contract Types and Clauses on Project Performance. Publication 5-1. 1986. Austin, Texas.

and then evaluate the first five years of operation and maintenance, before a decision on the long-term direction of Tren Urbano is reached. Needless to say, the decision on whether to renew the contract with Siemens Transportation has to be made before the end of the fifth year of Revenue Service. Now, the STTT contract specifies that, if the ACT decides to renew the contract with the incumbent contractor, then it should give notice to the contractor "at least three hundred and sixty-five (365) days prior to the end of the fifth Service Year."⁵⁷ Thus, in effect the ACT has four years after the start of Tren Urbano operations to inform the contractor of its decision. However, for purposes of sound planning it is better if the decision is made before the end of the fourth Service Year. Some allowance has to be made so that should the Authority decide to discontinue its relationship with Siemens, there will be adequate time, (a) if re-competing is the desired option: to send out a Request For Proposals or an Invitation to Bid, to receive and review bids from potential vendors, to negotiate with a new operator, and to ensure a smooth transition to a new operator, or (b) if the ACT desires to take over O & M: to hire and train the needed personnel, to engage the services of appropriate subcontractors and supplies, and to coordinate the transfer of operations control from Siemens to the Authority. Even if the ACT exercises the option to renew, it would still be beneficial to make the decision early enough. The rationale is to provide adequate time for any adjustments in policies and procedures that may be needed before the second five-year term begins.

Although it would be good to make a decision early, it would also be desirable to make it late enough to accommodate for the fact that the ACT will need some time within which to monitor the contractor, gather ample information, and assess the contractor's O & M performance before deciding on what to do about the next phase of O & M. In general, before an owner makes a decision on procurement, he will need adequate time for an "apples-to-apples" comparison of the benefits, costs, and risks associated with each of the possible alternatives

⁵⁷ STTT Contract: Special Provisions - O & M, Article 2.11.

available.⁵⁸ This principle is certainly applicable to the ACT, which as a public owner is held accountable by the taxpayers for all decisions relating to public services. It is apparent, thus, that an optimal decision time has to be sought, with the decision made at a time which is considered neither too early nor too late.

Considering the time frame required for the monitoring and assessment of contractor performance, and considering the STTT contract provisions, it would be best if the ACT decided on which procurement option to adopt for Tren Urbano O &M between January 2004 and June 2005. The eighteen-month period gives sufficient time for the necessary preparatory actions to be taken before a decision is made. It also allows a one-year “transition period,” in case the Authority takes a decision which would entail a change in operators.

Time Period	ACT Action
September 1997- January 1999	Consider Early Re-negotiation
January 1999 - January 2004	Initial Monitoring of Contractor and Entire TU System
January 2004 - June 2005	Decision on Procurement of future O & M
June 2005 - June 2006	Transition Period

Table 4.1: Timeline available for deciding on procurement of future O & M.

The optimal time schedule for ACT’s future O & M procurement involves four key actions: (i) early re-negotiation, (ii) monitoring of the first few years of O & M, (iii) making a decision on the future control, operation and maintenance, and (iv) allowing for a transition period between the two phases of O & M. The actions are summarized in Table 4.1 above.

It should be noted that Table 4.1 considers all the five possible alternatives discussed throughout this thesis. Obviously, if the Early Re-negotiation option is chosen, then there will be no need for a decision time in 2004, or a transition period. Also, monitoring strategies would, in all likelihood, change as a result of the award of a long-term contract.

⁵⁸ Scully, Larry J. and Lisa A. Cole: “Making the Decision” in Privatization: The Provision of Public Services by the Private Sector, ed. Roger L. Kemp. McFarland & Company Inc. Jefferson, North Carolina. 1991.

Before closing out the discussion on the optimal time to make a future procurement decision, a note of caution would be in order. It would be naïve to not consider the fact that the timing of any decision which is unfavorable to the incumbent contractor could have some unpleasant implications. The ACT must therefore be very cautious about when to make an unfavorable announcement to the contractor. Making such an announcement too early could lead to a long transition period, during which time the contractor may put on counter-productive behavior. A late “unfavorable announcement” would not give the new operator enough time to prepare its personnel and resources for the commencement of a new O & M phase.

4.4 Planning a Complete Time Schedule

Determination of the optimal time range within which to make a decision regarding the future of Tren Urbano operations should not be viewed as an end in itself. Rather, it is a means to an end, as it serves as a benchmark around which all other necessary activities can be planned. The combined strategy would not be complete without a comprehensive time table or schedule of planned ACT strategies. The rationale behind the time schedule is the need for the ACT to maintain a keen foresight for the future -- planning early encourages better preparation for expected outcomes. Moreover, drawing up a complete time table impels the Authority to make contingency plans, should unexpected events rear up.⁵⁹

A suggested time schedule is shown in Figure 4.5 on the next page. Upon examination of the schedule, one will find that the Early Re-negotiation and Extension alternative has not been included. The reason for this deliberate omission is that unlike the other four alternatives, early

⁵⁹ Ritz, George J. Total Construction Project Management. New York, NY: McGraw-Hill, Inc. 1994.

re-negotiation does not significantly determine or affect ACT activities between 2001 and 2006. In fact, Early Re-negotiation will drive the Authority to focus mainly on contract administration.

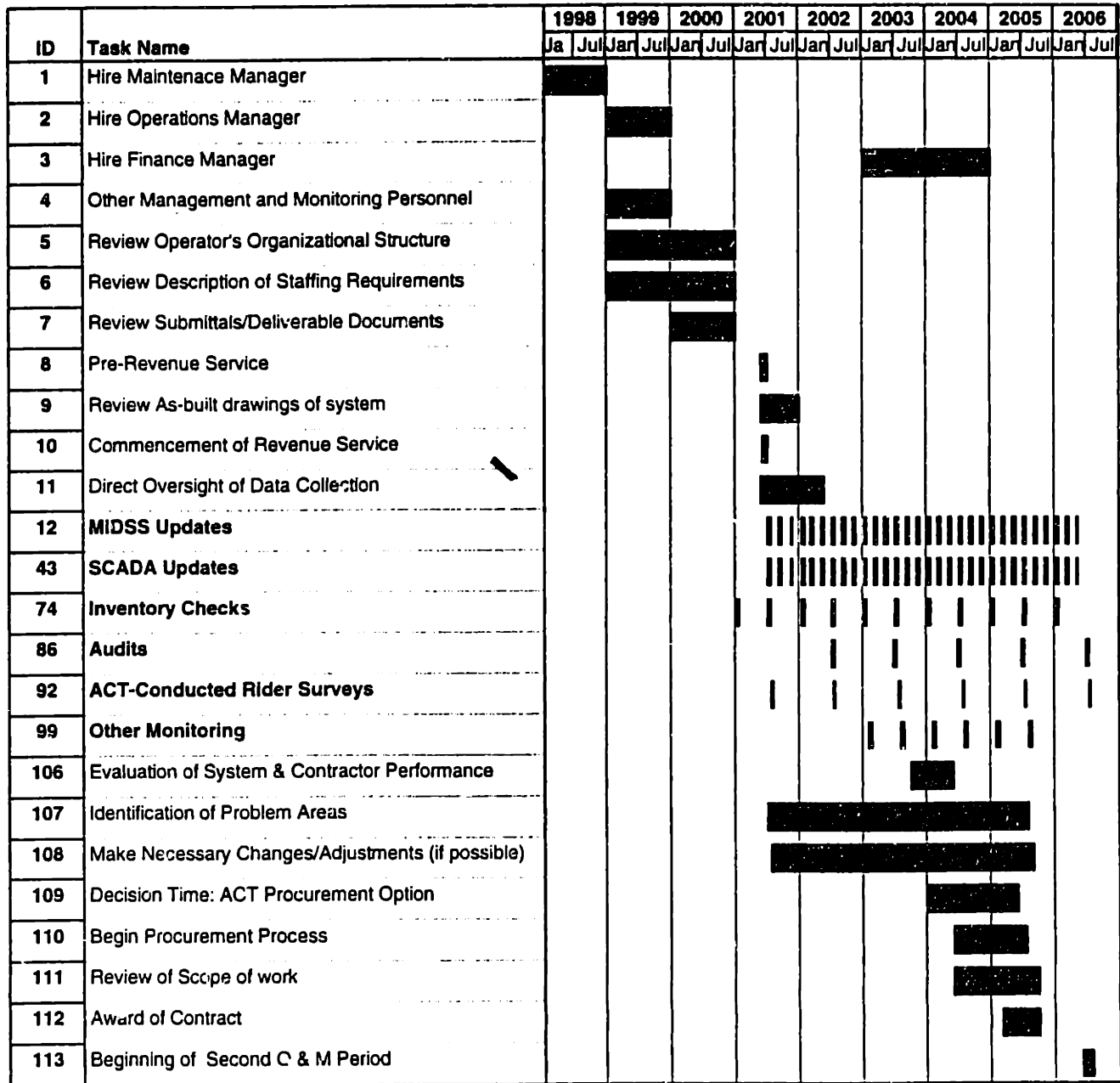


Figure 4.5: Proposed complete schedule for the combined strategy

The suggested time schedule begins with the identification of management and monitoring personnel. Given that this is an elaborate process requiring recruitment and training of staff, it requires a significant amount of time.

Between now and 1999, the Authority should hire experienced maintenance and operating managers to assist (and not obstruct) Siemens with the development of the format and content of project documentation, such that as construction is completed and operation begins, information systems are such that all five scenarios can be chosen by the ACT.

Between January 1999 and January 2001, the Authority must review the operator's organizational structure, as well as the staffing requirements and all submittals and deliverable documents. If any of the submittals are unsatisfactory in terms of content or detail, the Authority should require the contractor to submit revised and improved versions.

Pre-Revenue Service is expected to commence sometime around May 2001.⁶⁰ During this time, a few tasks need to be performed. It is suggested that the Authority review the complete as-built drawings of the system and compare them with what has actually been installed. This is a very important responsibility, since acquisition and understanding of the as-built drawings is a significant factor in the preparation for taking over operations or for re-competing.

As part of the combined strategy, it is proposed that at the commencement of Pre-Revenue Service, the Monitoring Personnel of the Authority should become involved in directly overseeing the contractor's data collection/information acquisition process for a year, by which time it is anticipated that all start-up kinks should have been fixed. Monitoring can then take the form of random checks, audits, review of MIDSS and SCADA system reports, among ACT-conducted rider surveys, among others. Evaluation of the system and contractor performance

⁶⁰ STTT Contract: Special Provisions - O & M, Article 2.4.

(for the purpose of making a decision on future procurement) should be done between September 2003 and July 2004, with a final decision arrived at no later than June 2005.

While monitoring takes place, problem areas should be identified and necessary adjustments made immediately, if they are not cardinal. If the ACT decides not to renew, then a new procurement process has to be initiated by July 2005, at the very latest. Preparing for take-over (either by the ACT or by a new contractor) will require at least one year. With this time schedule, the second phase of O & M should commence by July 2006.

4.5 A Proposed Approach

This chapter has attempted to bring together all the strategies required for the Authority to prepare to make a decision regarding the future control, operation and maintenance of Tren Urbano. Although it is laudable to put together a common strategy, it must be realized that each strategic alternative will still be analyzed individually. Thus, there is the need for a sequential approach to arriving at a decision regarding a future O & M contract. A sequence of steps for making the procurement decision is proposed. A breakdown of the sequential approach will now follow. (Please see the flowchart in Figure 4.6 below for a summary of the required steps).

Among the five major alternatives discussed throughout this thesis, the only option that can be considered at this time is the Early Re-negotiation and Extension option. The question the ACT wants to ask itself is: "Are we willing to re-negotiate early and to award a long-term contract now?" If the Authority is not in favor of re-negotiating now, then it can turn its immediate attention to monitoring the contractor. If the ACT desires to re-negotiate now, then it has to ascertain whether or not the contractor wants to enter into a long-term arrangement. Should the contractor express the interest in entering into a long-term contract, the ACT will

then have to carry out risk assessment and allocation, decide on the length of the contract, make modifications, and then submit proposals to the contractor, following which negotiations will be held, culminating in the signing of a long-term O & M contract. If the incumbent contractor is unwilling to sign a long-term contract, then the ACT moves to its next step -- monitoring of the contractor during the first few years of the initial five-year O & M term.

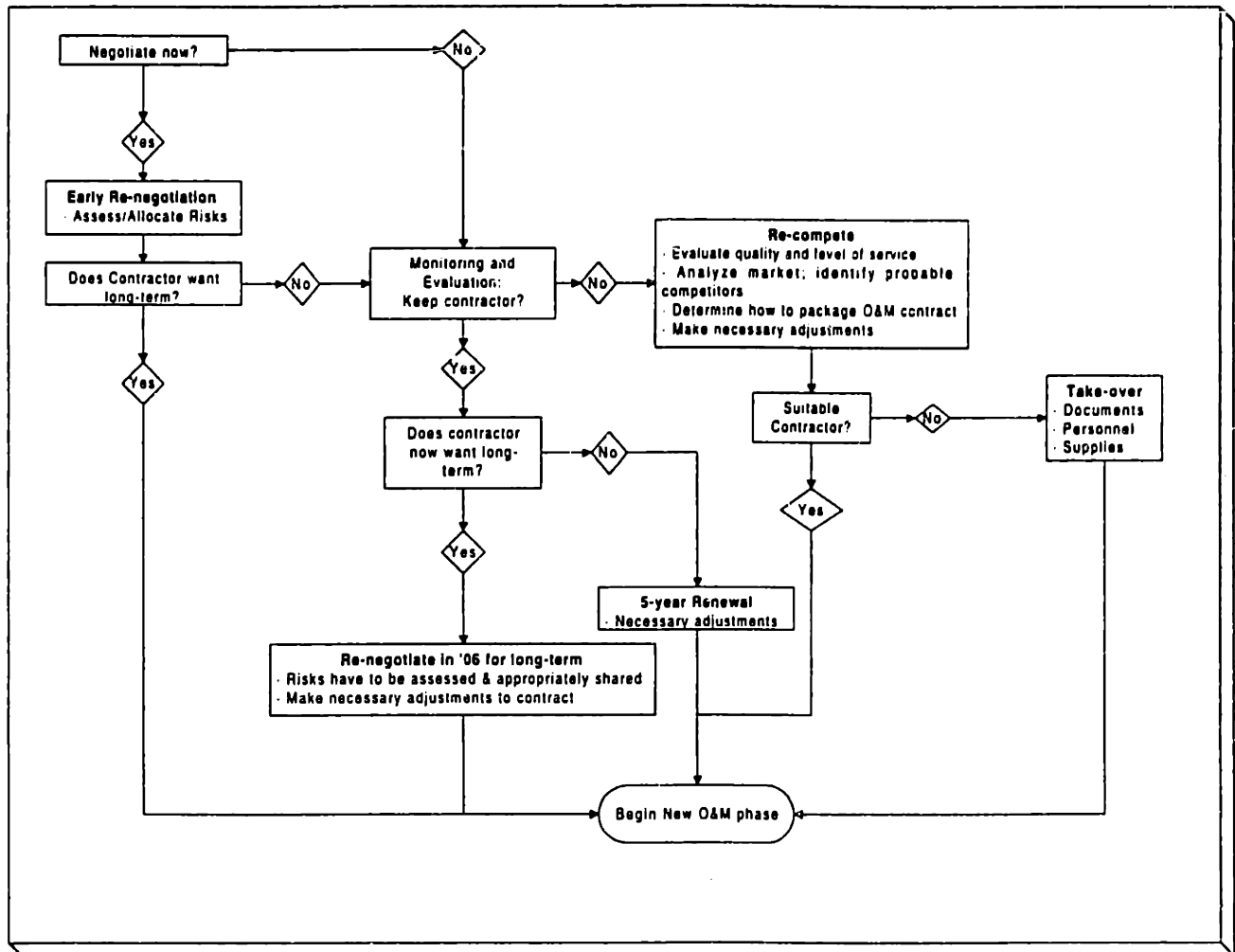


Figure 4.6: Flowchart for O & M Procurement decisions

Based on its evaluation of the contractor after monitoring O & M, the ACT has to decide whether or not to keep the contractor. If the contractor is performing well, then the ACT would want to retain his services. Otherwise, the ACT will have to consider re-competing or take-over.

If the Authority re-competes and finds a suitable contractor, then that contractor can be awarded a new O & M contract, the duration of which will be set by the Authority.

In the event that the ACT chooses to keep the contractor, the contractor may still be unwilling to enter into a long-term agreement, in which case the ACT should exercise the five-year renewal option. Should the contractor and the ACT both express the desire for a long-term contract, both parties must then negotiate the price, duration, and scope of work, and then make the necessary adjustments, following which a new long-term agreement can be signed.

If after electing not to keep the incumbent operator, the Authority does not find a vendor it believes is suitably qualified, then the Authority will have to consider directly taking over O & M. The take-over preparation tasks such as recruitment and training of personnel, establishment of material, equipment and supply stream, and subcontracting of services (if necessary), will then have to be performed.

It will be observed from the flowchart that the take-over option is earmarked as the last resort. This is because in reality, this option is very difficult to exercise within the first five years of operation. This does not in any way imply the Authority should not prepare for this possibility. From a tactical viewpoint, it is prudent to prepare for it and to exercise this option as a trump card.

Chapter 5

Conclusions and Recommendations

5.1 Chapter Overview

In Chapters 2-4, an attempt was made to answer three basic strategy formulation questions with particular reference to the future control, operation and maintenance of the Tren Urbano system:⁶¹

1. What position does the ACT find itself in? (Current O & M)
2. Where does the ACT want to be? (Future O &M)
3. How does the ACT get where it wants to be? (How to procure future O & M)

The previous chapters have thus focused on the processes involved in the development of optimal strategic alternatives for Tren Urbano, and in formulating a comprehensive “master strategy” for the future procurement of operations and maintenance. In this chapter, specific circumstances and actions will be considered. A variety of situations which could realistically arise when Tren Urban opens, is presented. Recommendations are made on what decisions the ACT can or should take in the face of the prevailing conditions presented.

Finally, this chapter concludes with some general remarks about strategy formulation for the future O & M procurement, its implementation, and its general applicability to delivery of public projects.

⁶¹ Strategy questions adapted from Higgins, James M. Strategy: Formulation, Interpretation, and Control. New York: CBS College Publishing. 1985.

5.2 Recommendations For Some Realistic Scenarios

As was mentioned in Chapter 2, the Authority could face a myriad of events and possible outcomes as far as the operation and maintenance phase of the project is concerned. While it would be impossible to specify every event and its possible outcome, a number of realistic scenarios can be envisaged. It is worth taking a detailed look at some of these scenarios.

It must be pointed out that the recommendations that follow are based on the assumption that the Authority has adopted most or all of the procurement strategies outlined in Chapters 2 - 4.

5.2.1 High Ridership, High Revenues, High Profits

It is likely that most of the Authority's decisions will be based on costs,⁶² level of service and the quality of service, since these are three of the prominent drivers that determine the success or failure of most transit systems.⁶³ If the ridership level is higher than projected, revenues would be high, and assuming costs are kept relatively low, high profits could be realized. (Please see Figure 5.1 below). Ideally, this is one of the circumstances the Authority would like to find itself in.

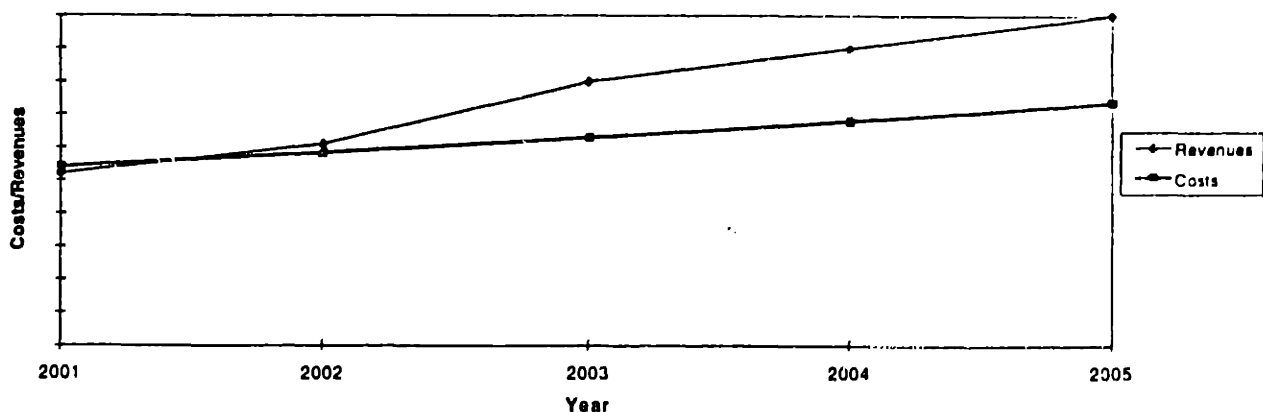


Figure 5.1: Hypothetical Projection of Revenues and Costs - High Profitability

⁶² In this chapter, the term "costs" refers specifically to operating costs only, and not to capital costs.

⁶³ Fielding, Gordon J. Managing Public Transit Strategically. San Francisco: Jossey-Bass, Inc. 1987.

Under these conditions, it is best for the Authority to keep the incumbent operator. Consequently, the ACT can either exercise the option to renew for another five -year term, or can re-negotiate for a long-term contract which will come into effect in 2006. Take-over will be an option only if the Authority is very certain that it can make profits at least equal to the amounts realized by the incumbent operator.

Whatever alternative the Authority chooses should aim at consolidating the gains that have to be made in the first few years. Furthermore, any O & M changes should be geared toward increasing profits without much sacrifice on quality. It is possible, for instance, to increase the level of service, if projections indicate that a demand exists for increased hours of operation and/or reduced headways. In any case, the Authority will do well not to interfere with any positive factors that could be leading to the high revenues and high profitability.

5.2.2 High Costs, Operator Incurring Losses, ACT May Lose More Upon Take-Over

Though not desirable, it is not inconceivable that after a few years of O & M, operating revenues would be substantially lower than costs (hence losses would be incurred), as demonstrated in the graph of Figure 5.2. If the ACT, after conducting some analyses, determines that taking over would result in significantly greater losses than the operator is realizing, then the best option would be to renew the contract for another five years.

The approach the ACT should take under this circumstance is to attempt to break even, if possible. Otherwise, losses will have to be kept to a minimum. Thus, there may be the need for some operational cutbacks in level of service⁶⁴ or, possibly, in the quality of service. There may also be the need to increase the amount of subsidy being paid to the operator, as a way of

⁶⁴ GMAEC. Tren Urbano Program Consultants: Procurement Strategy Paper. December 5, 1994.

providing an incentive for him to stay on the job. In any event, ACT actions should at least ensure that an increase in the losses incurred is prevented.

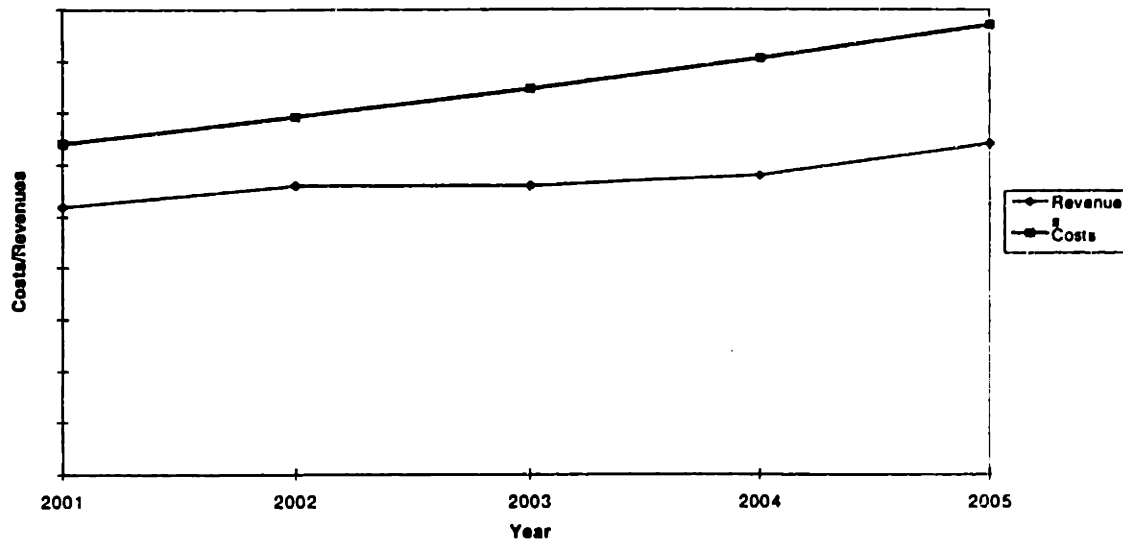


Figure 5.2: Hypothetical Projection of Revenues and Costs - Losses Incurred

5.2.3 High Revenue, High Costs, Profitable but Operator Causing Cost Overruns

A possible scenario is where ridership and revenues are high, and some profit is made; however full profit potential is not realized due to high cost overruns by the operator. The recommended course of action for the ACT should be to re-compete, in the hope that a contractor whose operating expenses would be lower may be found.

In this scenario, the Authority may still need to undertake some cutbacks so as to further reduce costs. Another alternative would be for the Authority to take over O & M, if it is in a position to do so at a lower cost than that of the incumbent contractor.

5.2.4 High Ridership, High Costs, Little or No Profits

This scenario is similar to the one just discussed in Subsection 5.2.3 above. In this case, however, the high costs are not necessarily attributable to contractor costs overruns, but to other factors beyond the control of the operator. Here the Authority has three options. First, it can renew the contract if it determines that it would be almost difficult to drive down costs without making a significant compromise on the service level or quality. Alternatively, the ACT could re-negotiate with the operator for a long-term contract, with the expectation that economies of scale would result in a reduction in costs in future years. If in the view of the ACT it would be possible to obtain a vendor who can run the system at a cheaper expense, then the ACT can choose the third option – re-competing the next phase of O & M.

5.2.5 Low Ridership, Low Costs, With Losses

Should a situation arise where ridership levels are significantly lower than expected, and O & M costs are quite low, and with no profits being realized, then the ACT must take actions aimed at encouraging an increase in ridership (and hence operating revenue) while maintaining the low costs. To this end, it is recommended that renewal of the contract be considered, perhaps with an increased – but conditional – base compensation given to the operator, while the Authority and the operator intensify their service promotion, marketing and public relations/information efforts aimed at encouraging more riders. Some cutbacks may have to be done, particularly in the hours of operation, if the Authority determines there is not enough demand for a 20-hour per day operating schedule.

Re-negotiation for a long-term is also plausible in this circumstance, although the issue of revenue risks may have to be tackled by both owner and contractor. Perhaps a revenue (and

loss) sharing scheme will have to be devised so as to drive the operator to increase his efforts at capturing more riders.

5.2.6 High Profitability But Operator Not in Favor with Long-Term Contract

There could possibly be a situation where the incumbent operator is making profits, but is unwilling to commit to a long-term contract. In such a case, the Authority has at least three options: renew with the incumbent, take-over, or re-compete. Perhaps the best choice under this circumstance would be to exercise the five-year renewal option, as a means for the Authority to buy time for preparation for a possible take-over in 2006, if feasible, or to re-compete and award a long-term contract to the deserving bidder, if the market conditions permit.

5.2.7 Low Profitability But Operator in Favor of Long-Term Contract

Towards the end of the first five years of O & M, the ACT will perform an appraisal of the contractor's performance so as to decide on the next step to take with respect to awarding a new O & M contract term. Provided the ACT is satisfied with the incumbent contractor's performance, then in the event that the operator expresses his willingness to enter into a long-term contract in spite of low profitability during the first phase of the O & M period, it is recommended that the ACT and the operator enter into a long-term arrangement, unless the ACT foresees being able to directly take over the operation of Tren Urbano in the near future.

It must be stressed that "low profitability" to the ACT may have a different meaning for the operator, who may adopt certain cost-saving measures, unbeknownst to the owner, in order to increase his profit margin.⁶⁵ It is important for the ACT to be aware of this so that in the

⁶⁵ Maher, R. "Complex problems with separate contracting systems." *Journal of the Construction Division, ASCE*. Vol. 105 no. 2. 1979.

negotiations for a long-term contract, it can scrupulously address the issues of costs, prices, revenues, and profitability.

5.3 General Remarks

First, a note of caution: the strategies suggested here are not be taken as “complete” in themselves; they form just a small piece of the whole Tren Urbano project. There are several other factors that can determine the future of Tren Urbano. It is hoped, nonetheless, that this piece is given due consideration.

Before concluding this thesis, a few general but pertinent remarks are in order.

5.3.1 Importance of Strategic Planning

The rationale behind the formulation of procurement strategies for Tren Urbano’s long-term future is to guard the ACT against being overtaken by any turn of events in the future. It is hoped that by putting some thought into future possibilities, the ACT will be placed in a vintage position to make the best decision regarding the future direction of Tren Urbano, in the interest of the system and the Commonwealth at large.

The significance of strategic planning in the Tren Urbano project (and in the any organization in general) cannot be overstated. As pointed out by Holloway, “the value of strategic planning is that it both simulates and stimulates.”⁶⁶ This thesis has attempted to show this concept from both a hypothetical standpoint and a practical perspective.

Given that the future is impossible to predict, it is essential for an organization – public or private – to set a goal of having as many alternatives as possible in order to be able to face

⁶⁶ Holloway, Clark. Strategic Planning. Chicago: Nelson-Hall, Inc. 1986.

foreseen and, more importantly, unforeseen circumstances in the future. In pursuance of this goal, it is recommended that the Authority consider the proposed preparatory and anticipatory actions outlined and reviewed in this thesis.

5.3.2 Early Participation in Documentation Process

The importance of project documentation⁶⁷ has been discussed. Nonetheless, it is important to reiterate that the ACT should participate very early in the process of developing the format and content of project-wide documents in order to influence how project information is stored. This way, the ACT will always have a high level of knowledge of the system, regardless of what the O & M procurement outcome is.

5.3.3 Need for Transparency

Like most other public agencies, the ACT is accountable to the tax payers. Thus, it could be subjected to intense scrutiny by various individuals or groups of the populace,⁶⁷ including contractors who may have a vested interest in how the O & M phase goes. As such it must be stressed that in undertaking the strategies proposed, the ACT should be as transparent as possible, without compromising on confidentiality.

Keeping its activities transparent could promote trust between the Authority and the incumbent contractor, and between the Authority and any potential vendors. If the Authority informs the incumbent contractor of how it intends to approach future procurement, it could even prompt the contractor to make known his long-range intentions and expectations – and that could give the Authority a clearer picture of its planning horizon.

⁶⁷ Pirie, J. David. "Private/Public Partnership." Paper presented at Conference on Public/Private Partnering. Moncton, New Brunswick: Strait Crossing, Inc. March 29, 1994.

5.3.4 Absence of 'Formulae'

The strategies presented in this thesis are meant to provoke the ACT to ponder the future of Tren Urbano while the construction is in its early stages. It must be emphasized that these procurement strategies are not to be viewed as derived formulae or as recipes obtained from a cookbook. Instead, they merely serve as guidelines to help the Authority in its strategic planning process. While it is recommended that the Authority make every effort to execute these strategies, the application of engineering judgment and experience in making procurement decisions should not be overlooked.

5.3.5 External Factors

It is a well-known fact that sometimes there are factors external to a project which may influence the direction of a procurement process.⁶⁸ To lose sight of this fact would be tantamount to unwillingness to face reality. As far as Tren Urbano is concerned, the cardinal external factor that could influence any of the strategies is politics. Although this is a delicate issue, it is nonetheless important to recognize that politics can influence the type of decisions and the timing of the decisions regarding the future of O &M of Tren Urbano.

5.3.6 Implementation of Proposals

It is essential to realize that the formulation of the strategy is not an end in itself, but just a means for planning which the Authority can use to achieve one of its main goals – the procurement of a high quality, user-friendly, and efficient transit system for the people of the

⁶⁸ Gordon, Christopher M. "Choosing Appropriate Construction Contracting Method." *Journal of Construction Engineering and Management*. American Society of Civil Engineers. Vol. 120 No. 1. March 1994.

San Juan Metropolitan Area.⁶⁹ It must be noted that the most elegantly conceived, most precisely articulated strategy is virtually worthless unless it is implemented successfully.⁷⁰ It is hoped that the strategies proposed would be considered and implemented now by the Authority, to more meaningfully impact a decision in the future.

5.3.7 A Final Word

Although this thesis has focused mainly on providing strategies for the Puerto Rican Highway and Transportation Authority, the underlying principles surrounding the formulation of the procurement strategies do very well apply to most public agencies involved in making decisions regarding the delivery of public projects by private entities. This certainly includes the energy, defense, transportation, construction, and aviation, among other industries in the public sector. Procurement strategies in all these areas must seek to produce optimal results for the general public.

In the coming years, as more and more public agencies consider the contracting of public service to private operators, there will be the need to use some cases as a benchmark for reference. It is fervently hoped that the experiences, both positive and negative, of the operation and maintenance contract procurement process of the Tren Urbano project will serve as a guide for all public sector agencies in various industries.

Finally it is fitting to conclude this thesis with this quote:

Most battles are won – or lost -- before they are engaged, by men who take no part in them; by their strategists.

-- K von. Clausewitz

⁶⁹ STTT Contract: Special Provisions - O & M, Article 1.1.

⁷⁰ Higgins, James M. Strategy: Formulations, Implementation, and Control. New York: CBS College Publishing. 1985.

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