Los Angeles County Metropolitan Transportation Authority

ARTHUR ANDERSEN

FINAL REPORT OF RECOMMENDATIONS

FOR

CONTRACT NO. LST-135-95

VOLUME B
PART I

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Chapters included in this Part I

CHAPTER I

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INTRODUCTION TO VOLUME B

CONSTRUCTION MANAGEMENT FUNCTIONS REVIEWED BY ARTHUR ANDERSEN

Arthur Andersen grouped the scope of service provided by the MTA related to its Rail Transit Program into sixteen functional areas. This chapter identifies those functions and their subparts and describes the structure of our functional reviews documented in later chapters. For each function, the following chapters **(Chapters II to XVII)** set forth:

1. The Nature and Objectives of the Function
2. Issues of the Function
3. Findings Regarding the Function
4. Implications of Our Findings
5. Recommendations based on our findings

The following Sixteen Functions were determined to encompass the scope of the MTA's Construction Division related to its Rail Transit Program:

1. **Engineering [Chapter II]**

2. **Real Estate [Chapter III]**

3. **Cost Estimating [Chapter IV]**

4. **Contract Awards [Chapter V]**

   additionally included areas:

   - Constructability Analysis
   - Review of Bid/Contract Documents
   - Pre-Construction Services

5. **Contract Administration [Chapter VI]**

   additionally included areas:

   - Contract Management
   - Document Control
   - Contract Close-out

6. **Billings and Payment Applications [Chapter VII]**

7. **Resident Engineer [Chapter VIII]**

   additionally included areas:

   - Construction & Systems Contract Management
   - Environmental
   - Geotechnical Services
   - Third Party Coordination
   - Surveys
   - Testing and Start-up

8. **Change Orders and Claims [Chapter IX]**

   additionally included areas:

   - Change Control
   - Claims Analysis

9. **Project Control - Schedule [Chapter X]**

10. **Project Control - Cost (Cost Control) [Chapter XI]**

11. **Project Control - Reporting and Management Reporting [Chapter XII]**

12. **Safety [Chapter XIII]**

    additionally included areas:

    - System Safety & Assurance
    - Safety Certification
    - Construction Safety

13. **Quality Assurance and Quality Control [Chapter XIV]**

14. **Public Affairs [Chapter XV]**

15. **Risk Management [Chapter XVI]**

16. **Human Resources [Chapter XVII]**

CHAPTER II
Volume B

ENGINEERING

1.0 Nature of the Function

The Engineering function creates an overall design for a rail construction project. A multitude of technical disciplines comprise the Engineering function for a rail project including architectural, structural, civil, electrical, mechanical, and environmental engineering. Engineers (or designers, as they are sometimes referred) translate the vision for a rail transportation system into a constructable design.

2.0 Issues of the Function

Rail construction project have specific phases. These phases include early planning (Conceptual Design), preliminary design completion (Preliminary Engineering), design finalization (Detailed Design) and physical construction and systems installation (Construction). As is the case for other disciplines, Engineering function objectives and success factors change throughout these phases:

Conceptual Design

Conceptual designs are the rough interpretations of a rail system aimed at satisfying some perceived transportation need. They specify: (1) the alignment which is sometimes referred to as the "Preferred Alternative", tracing the route for the rail system; (2) the mode such as heavy rail or light rail, surface rail or subway; (3) the number and location of stations; (4) targeted costs for the system and (5) other basic systems parameters such as aesthetics and special features.

Conceptual designs offer the most value when they faithfully and realistically reflect the transportation needs being addressed. Valid conceptual designs specify a viable rail system from the standpoint of technology, constructability, operability, maintainability and estimated cost. In this way, the conceptual design process benefits greatly from the experiences gained from previous rail construction projects. Therefore, conceptual designs are best served when planners utilize engineering and estimating resources of past MTA projects.

Conversely, conceptual designs that fail to address perceived transportation needs or make little use of existing know-how at best offer limited value to the rail project and, at worst, threaten serious consequences for the entire construction program. Poor conceptual designs may require costly engineering rework during the Preliminary Engineering phase. Poor conceptual designs mated with a premature and politically motivated project adoption process introduce numerous risks to the future rail construction project. These risks include unrealistic budgets, a lack of sufficient cost control mechanisms and a loss of program credibility. By committing to underdeveloped plans with unrealistic budgets, the project becomes a constant management struggle and threatens the MTA's credibility in the eyes of citizens and funding sources.

Preliminary Engineering

Preliminary Engineering takes the rail project design from the conceptual level to a 30% level of completion. The engineering function specifies in greater detail the overall track alignment, dimensional shape and orientation of stations, fundamental systems requirements and other attributes of the rail line. Engineers determine environmental impacts and environmental mitigation strategies during Preliminary Engineering as a basis for receiving funds. This phase of the design is also when the entire rail project is partitioned into specific design elements or contract units. Contract units typically segregate along specific station, tunnel and systems contracts, though, certain contracts may contain a section of tunnel along with a station.

Guided by past experience, the MTA has piloted a Project Adoption process which delays all budget commitments and funding efforts until the conclusion of Preliminary Engineering. With this process, Preliminary Engineering takes on a more significant role in the overall success of the project.

The MTA, through its Construction Engineering function, drafts an agreement with the EMC to perform all Preliminary Engineering work. MTA engineers perform regular reviews of the design work and monitor design fees incurred. At the conclusion of Preliminary Engineering, the MTA reviews the design, as well as the overall project budget and master schedule developed in this phase. The Project Adoption process proceeds with budget and funding commitments based on the Preliminary Design.

Properly executed Preliminary Engineering will provide for a fully-sorted design, as well as a realistic project budget incorporating contingencies based on risk factor analysis. Project budget and funding commitments based on the knowledge gained during Preliminary Engineering posture the rail

construction project for success. Commitments made without benefit of Preliminary Engineering information, or MTA-mandated changes to the design occurring after Preliminary Engineering jeopardize the success of the project and potentially the rail construction program in its entirety.

Detailed Design

The Engineering function reaches full mobilization at the start of Detailed Design. During this phase, the preliminary design is layered with increasing levels of detail. Each of the engineering disciplines contribute to sets of engineering drawings that, in composite, form the design for a particular construction or installation contract.

Successful designs are those that satisfy the following three primary objectives to: (1) meet the intent and specification of preliminary designs; (2) prove constructable at the targeted cost; and (3) limit the risk of contract changes during construction. The MTA relies on the specialized expertise of EMC engineers as well as Section Designers (smaller design firms subcontracting to the EMC) to perform detailed design work. The MTA, again through the Construction Engineering function, executes a Project Implementation Plan (PIP) contract with the EMC to supply design services and management oversight of Section Design firms. The scope of the PIP defines the elements of the rail project to be designed and specifies the level of involvement by engineering discipline and work package (e.g., set of drawings) for the EMC and Section Designers (to be selected later). The budget and master schedule parameters adopted during Preliminary Engineering govern the PIP budget and schedule.

The MTA Construction Engineering function is charged with overseeing the Detailed Design effort. The result of effective management is the achievement of the three primary objectives listed above, with the addition of design cost containment. These objectives are easier to attain when the preliminary design is robust, the scope and baseline for the PIP are clearly delineated, the MTA Construction Engineering function possesses suitable familiarity with design concepts and past lessons, and most of all, when the design parameters remain stable.

The MTA achieves excellence in design by developing quality preliminary plans and retaining the best engineering talent available. Well-defined Project Implementation Plans are crafted from rail design experience, as well as a critical eye toward design cost containment. Yet these factors alone will not

guarantee success as long as the MTA, through Board- or staff-mandates, alters the rail project design in mid-course.

Construction

The Engineering function is active during the construction phase to: (1) review questions and comments submitted by contractors, the CM and other sources; (2) provide design solutions to required construction and installation contract changes; (3) glean "lessons learned" from designs presently under construction, and (4) review and approve required contractor submittals (e.g., shop drawings). While the accumulation of lessons learned is an important endeavor for an MTA program with substantial rail construction ahead, the MTA should strive for a reduced Engineering function involvement during construction. A minimal requirement for design services during construction is a prime indicator of design process quality.

Submittals are generally contracted requirements of the contractor and include shop drawings and Contract Document Requirements Lists. As construction proceeds, the contractor may issue submittals and Requests for Information (RFIs). Submittals are a contractor's proposed alternative for some construction method, material or design specified in the contract. RFIs are contractor requests for clarification regarding drawings or specifications. The EMC reviews submittals and RFIs and recommends a course of action, which may include issuing a change to the contract. For those potential contract changes having significant cost impacts, the MTA becomes involved through its Change Control Board mechanism (see separate section).

Effective management of design services during construction ensures that unwarranted design-related changes are not approved. Because the cost impacts of a change escalate substantially during construction (see separate Cost Control discussion), the MTA must limit design-related changes. A well-managed design process creating thorough contracts is the MTA's chief tool for avoiding design changes. Lacking this, any control mechanism will have limited effect on escalating construction costs.

It should be stressed that "design process" as referred to in this section entails more than the actions of the MTA Construction Engineering function, the EMC and Section Designers. The design process is also characterized by MTA Board, management and staff directives.

Principal Engineering Function Issues

The findings, implications and recommendations presented in this and other sections of our report focus on what we believe to be principal engineering issues facing rail construction projects. In summary, they are:

1. Organizational Roles and Responsibilities: The effectiveness of engineering for design and construction is influenced by the type of organization utilized by the MTA as well as assignment of responsibilities between MTA staff and consultants
2. Coordination of Engineering Disciplines: Perhaps no other function involved with rail construction demands the variety of technical expertise as the engineering function. MTA engineering, both within the project team and across the function as a whole, must coordinate station, tunnel and systems design oversight efforts for an integrated rail construction project
3. Lessons Learned: Incorporating the lessons of the past is a centerpiece of continuous improvement. A rail construction program as expansive as the MTA's benefits significantly from the diligent application of past experience to new designs
4. Control of Design-related Costs: A management objective of the MTA Construction Engineering function is to contain design-related costs, which include the cost of design services as well as the cost impacts of design-related construction contract changes. This issue is discussed in the Cost Control section of the report and will not be treated in this section

One other critical aspect of the Engineering function omitted from the issues above is the quality of design from a technical standpoint. To completely address this, and to provide a full assessment of the MTA rail construction design process, would require a separate study encompassing these engineering aspects beyond the scope of this report and, therefore, is not discussed in this section.

3.0 Findings, Implications and Recommendations Regarding the Function

3.1 Organizational Roles and Responsibilities

During the project design phase, the overall responsibility to perform the tasks associated with Engineering resides with the EMC. The MTA is responsible for the oversight of the EMC as they perform the tasks associated with Engineering during design. This oversight is accomplished through

detailed review of EMC submittals, audits of EMC time charges, close daily interface with EMC functional design leads, Project Managers and Project Unit Managers, and by controlling the fee paid to the EMC through the performance report card mechanism.

The following summarizes the major responsibilities performed by the EMC, in priority order as it relates to Engineering:

1. Develop technical criteria and standards to serve as an engineering baseline to which all disciplines including architectural, civil, electrical, mechanical and others will design
2. Perform all preliminary design efforts for the rail system to the 30% design level
3. Solicit the participation of candidate Section Design subcontractors during detailed design. Provide an initial evaluation of Section Designer candidate credentials and assist the MTA in the selection of qualified firms
4. Manage the efforts of subcontracted Section Designers throughout detailed design. Monitor the progress and ensure the quality of Section Designer products. Assist Section Designers by interpreting design criteria whenever required
5. Perform design Quality Audits of all EMC- and Section Designer-generated work for conformity to the design criteria (Please refer to Chapter XIV - Quality)
6. Support the construction of the rail project by reviewing and responding to Contractor submittals. Develop design solutions for required changes to construction contracts
7. Maintain a Lessons Learned program to incorporate improvements and other changes experienced on prior contracts into the design of future contracts

The following summarizes the major responsibilities performed by the MTA, in priority order as it relates to Engineering:

1. Develop and negotiate Project Implementation Plans along with the EMC to serve as a contractual scope of work for rendering specific design services
2. Perform a detailed review of EMC submittals at the 60%, 85% and 100% design levels to judge the progress and quality of contract designs. Review designs to ensure that approved comments are consistently incorporated
3. Review the progress of EMC and Section Designer efforts. Apply the Earned Value measurement system for determining cost and schedule progress for designs

4. Consolidate and classify all submittal comments originating from utilities, municipalities, community interests and from within all MTA functions concerned. Make final determinations on the inclusion or exclusion of design alterations proposed by submittals
5. Maintain close working relationships with EMC Project Unit Managers responsible for the overall design of specific contracts
6. Perform independent value engineering analysis to identify areas of design improvement and cost reduction
7. Review the progress of EMC and Section Designer efforts. Apply the Earned Value measurement system for determining cost and schedule progress for designs
8. Review EMC hourly charges and overhead rates
9. Grade the performance of the EMC on a variety of measures including design progress, quality of designs, ability to manage Section Designer efforts and responsiveness to Request for Information submittals

Recommendations for Organizational Roles and Responsibilities

Engineering is a function that is performed by the EMC. The EMC is responsible for developing preliminary designs of rail transportation projects to the 30% design stage, for completing certain elements of the final design , for managing Section Designers and for providing design support during construction.

The MTA oversees the Engineering function by maintaining a close working interaction with EMC design leads, Project Managers and Project Unit Managers. The MTA also maintains a primary role in reviewing designer submittals and recommending a course of action with respect to design additions and deletions. The MTA provides further oversight of the Engineering function by defining the scope of design services (through the Project Implementation Plan), reviewing EMC and Section Designer time charges and through the performance report card mechanism of the EMC professional services contract.

A significant rail construction design effort remains for the MTA to realize its 20-year plan. We do not believe the MTA has the need or the capacity to staff a sufficient internal engineering function with the level of skills and expertise required to perform this level of design work. Due to the impacts of design on total project and program costs, the MTA is best served by utilizing the highest quality technical skills available in the market, namely through design consultants.

Based on the status of the rail construction program, as well as the long-term contract with the EMC to provide design services, we believe the current structure of assignments for the Engineering function between the MTA and the EMC is a preferred structure. Therefore, **we recommend that the MTA not assume any additional tasks from the EMC related to Engineering**. The MTA should continue to require the EMC to perform their activities related to Engineering, while they continue to be assigned the oversight function.

With these recommendations, we believe the MTA will obtain the following benefits:

1. Qualified Personnel: An ability to mandate qualified personnel are provided and available for this function. This is particularly valuable for the specialized disciplines of electrical, mechanical and structural engineering
2. Better Management Communications: Fewer MTA staff personnel responsible for managing contract designs will provide for more effective knowledge sharing among a manageable-sized group, and allow MTA Engineers, in their oversight role, to focus on the important issues
3. Staffing Flexibility: Less MTA staff limitations as Engineering demands increase (particularly during peak design submittal periods) compared to if the MTA were to take this function in-house. Use of Section Designers will also facilitate the achievement of DBE/WBE goals

Coordination of Engineering Disciplines

Engineering Contract Assignments

The MTA Construction Division, through its adopted "Projectized Matrix", assign dedicated resources to project teams. Facilities Engineering Managers are assigned responsibility for two to three station and tunnel contracts, while Systems Engineering Managers handle as many as five contracts.

An attempt was made on the MRL - Segment 2 project to stagger facilities contract responsibilities. That is, a Facilities Engineering Manager would have responsibility for contracts at an early stage of design (say, between 30% Preliminary and 60% In-process design) and one to two contracts in a later design stage (perhaps at the 85% Pre-final or 100% Final level). A goal of this arrangement was to facilitate the feedback of lessons learned during advanced designs to those in an earlier stage. Due to the transfer of

project responsibility from the RTD to the LACTC, many current MTA Engineering Managers did not assume responsibilities for specific contracts until in-process or pre-final design stages.

Contract Team Meetings

Cross-discipline contract teams were also utilized by the Segment 2 project team. Contract teams grouped engineering, construction, project controls, contract administration, public affairs and third party representatives into a focused contract-responsible team. During design, the Engineering Manager served as the lead contract responsibility. Once the contract progressed to construction, the team lead would transfer to the MTA Construction Manager. Near close-out, with heavy administrative "clean-up" requirements, contract lead responsibility would shift to the team contract administrator.

During design and early construction phase of Segment 2, contract leads would meet regularly to discuss issues facing the contract. This practice was not sustained in many cases after construction began, and has become an even less-used management tool for the current Red Line project team.

Design submittals for facilities contracts occur for specific milestones throughout the design process. In-process, Pre-final and Final design submittals are described in the table below:

Design Submittal	Design %	Design Requirements Reviewed
In-process	60%	• Civil, Structural, Architectural design • Electrical/Mechanical design • Draft specifications and design calculations • Final traffic plans • Utility relocation agreements • Facilities maintenance
Pre-final	85%	• Incorporation of all submittal comments • Coordination between engineering disciplines, facilities and systems • Complete drawing and specification documentation
Final	100%	• Incorporation of all submittal comments, Lessons Learned, etc.

Designer submittal documents (including drawings, specifications and other support) are distributed widely within the MTA, the EMC, local municipalities, utilities and other third parties for review and comment. All comments are due within two weeks of the designer's submittal. The MTA Facilities

Engineer is responsible for collecting and classifying all submittal comments with the exception of those originating within the EMC.

MTA Systems Engineering Managers are also required to submit their comments to the Facilities Engineering Manager. In some instances, comments from Systems Engineering Managers have been minimal or no comments made regarding the facility design.

Because many systems aspects of the MTA rail construction effort are common to more than one active project (i.e., "systemwide"), certain MTA Engineering Managers are not assigned to a project. Systemwide contract leads and other functional engineering support remain independent of the project team Engineering Managers, and are not present in many cases for project engineering team meetings discussing technical issues for project-specific contracts. In addition, MTA systemwide and functional engineering support managers interface with EMC systems engineering disciplines who, themselves, remain independent of specific project design efforts within the EMC organization. In our interview, we have noted concerns from other project-assigned managers that functional systems engineering lacks sufficient responsiveness to a particular project's needs.

Implications of Coordination of Engineering Disciplines

With responsibilities for essentially three major contracts, the MTA project team Engineering Managers are able to maximize their oversight capabilities throughout the design effort. Reducing the number of contract assignments, with a corresponding increase in the number of project-assigned Engineering Managers, will create a cumbersome management structure impeding communication. Three to four Facilities Engineering Managers, roughly the same number of project-assigned Systems Engineering Managers and the Deputy Project Manager for Engineering comprise a manageable engineering team to freely discuss project design issues.

Since particular MRL - Segment 2 Facilities Engineers did not receive contract responsibility until in-process or pre-final design stages, their ability to manage the design effort was limited. This situation, to a greater degree, has been rectified for Segment 3 - North Hollywood and Pasadena Blue Line efforts.

In all, the contract team approach established for MRL - Segment 2 represented an innovative management technique for sharing contract information across a variety of functional perspectives.

Because of the highly-leveraged nature of an MTA project team, efficient mechanisms for communicating the issues regarding a contract to all disciplines greatly assist the MTA in its oversight role. We believe the Red Line project team managers will negatively impact their oversight capabilities by not utilizing a contract team meeting approach.

To a large extent, a rail transportation system is a truly integrated system. Very few elements exist in isolation. In particular, systems aspects have ramifications to the design of facilities (stations, tunnels and other structures) and the converse is also true. Throughout much of the Red Line Segment 2 design process, an organizational separation existed between systems engineering and project-specific engineering (facilities, most notably). Breakdowns in communication between systems engineering disciplines and facilities engineering disciplines have contributed to an excess of design-related changes both before and during construction.

The current MTA Red Line project team has introduced certain measures to improve coordination between the various systemwide and project-focused engineering efforts. An example includes requiring systemwide designers to physically relocate near project team designers.

Recommendations for the Coordination of Engineering Disciplines

We recommend that the MTA increase the number of Systems Engineering Managers which are assigned to specific project teams. In this way, all engineering disciplines will be represented in team meetings, will be equally required to provide submittal comments and will have the same dedication and sense of urgency to project needs.

The MTA should strive to achieve continuity of contract assignments for Engineering Managers. These assignments should be in effect at the earliest possible time, namely during Preliminary Engineering when contract units are defined. In this way, an Engineering Manager has the full perspective of issues arising for a contract as a guide to decision-making during final design and construction phases.

As it relates to contract oversight, **we recommend that the MTA Red Line project reestablish regular contract team meetings.** Multi-functional knowledge sharing focused on specific contracts is an

essential ingredient to effective oversight. Reliance on dated reporting or multiple one-on-one discussions is an ineffective and inefficient alternative.

We also recommend that the appropriate systemwide and functional engineering managers be required to attend as many project engineering meetings as possible, particularly during peak design through the final submittal for the majority of contracts. The MTA should require the full participation of systemwide engineering managers throughout the submittal process for all major contracts and should establish this involvement as a principal performance measure.

With these recommendations, we believe the MTA will obtain the following benefits:

1. Better Engineering Communication: An appropriately-sized engineering function within the project team offers an enhanced ability to identify and communicate issues regarding specific contracts
2. Better Contract Knowledge: Engineers involved in the early stages of Preliminary Engineering will have a depth of experience with a contract to truly appreciate risks and design issues. Multi-functional contract teams ensure that all disciplines are aware of any issue pertaining to that contract
3. Superior Design Coordination: A systemwide engineering function that effectively integrates with and participates in project-focused design efforts reduces the risks of incompatible designs, engineering rework and construction changes

Lessons Learned

As originally drafted in 1992, the long-term EMC contract omitted the requirement to develop a Lessons Learned program for incorporating past experience into future designs. A subsequent change to the EMC contract authorized a study of Segment 1 contracts for applicable improvements to Segment 2 facilities and systems. However, significant design work had already been performed on many facilities. Consequently, changes originating from the Lessons Learned program were not incorporated into a typical Segment 2 station contract until the 85% (pre-final) design stage. Changes continued to flow to contracts after award and well into construction.

The MTA Board requested an independent study of the Lessons Learned program to verify its effectiveness. Design changes required for two station contracts on the Wilshire corridor were studied for their applicability to stations in design for Segment 3 - North Hollywood about to enter the

bid/award phase. A total of thirty-three changes were found to be relevant changes, implying that they would be required for North Hollywood stations as well. The independent review showed that of the thirty-three applicable Lessons Learned, thirty-two were incorporated into the original design documents.

Implications of Lessons Learned

Due to the delay in establishing a Lessons Learned program caused by a failure to establish such a program for Segment 1 prior to its transfer to the RCC, Lessons Learned changes for many Segment 2 contracts arrived late in the design process (at or beyond the 85% design stage) significantly driving up the cost of design, or after contract award, necessitating a change to the construction contract, for an even larger cost increase. By failing to incorporate a change in the bid package initially or through amendment, the MTA loses the benefit of bidding to reduce the cost of the modification. Once construction is underway, changes have a potentially complex interplay with ongoing activities. An owner such as the MTA will have difficulty quantifying the true effects of the change to the contractor. The contractor has a negotiating advantage when accepting Lessons Learned contracts after physical work has commenced. In fact, the change may require significant construction rework that may have been avoided otherwise.

If the results of the independent audit on Segment 3 - North Hollywood are consistent for the remaining projects, the volume and cost of design-related changes should trend noticeably downward. However, the continued success of Lessons Learned will depend on the MTA's diligent review and enforcement of EMC requirements.

Recommendations for Lessons Learned

We believe the Lessons Learned program is essential to the improvement in overall design for the MTA rail construction program and to controlling and reducing costs. The spirit of the Lessons Learned program represents the chief benefit of retaining a single design organization such as the EMC. Lessons Learned must be considered a formalized program for capturing all value engineering and design standardization improvements gained from deepening experience as the MTA rail construction program matures.

In addition, we believe that stronger coordination between the MTA systemwide and project-specific engineering functions will be required to ensure that design changes are consistently applied to every affected contract as soon as possible.

With these recommendations, we believe the MTA will obtain the following benefits:

1. Better Designs: Lessons from design, construction, operations and maintenance, properly tracked and integrated, lead to better all-around designs that offer superior quality, aesthetics, operability and maintainability at a lower total cost
2. Better Cost Control: By capitalizing on past lessons and infusing continuous improvement into the entire rail construction effort, the MTA can ultimately achieve lower total costs as design-related changes are minimized and design uniformity increases

CHAPTER III
Volume B

REAL ESTATE

1.0 Nature of the Function

The goal of the real estate function is to ensure that necessary property is obtained in a timely and cost effective manner in order to facilitate rail construction activities. This function involves identification of properties for acquisition, determination of the nature of that acquisition (e.g. full-take or easement), negotiations with affected property owners and, if necessary, relocation of occupants. Both state and federal regulations provide requirements for these activities.

The real estate function is primarily performed by the MTA Real Estate Department with assistance from the EMC. During preliminary engineering, the EMC identifies specific parcels of land to acquire, the nature of those acquisitions and the dates by which property must be acquired. This information is reviewed by the MTA and is incorporated into the overall project budget and schedule. The MTA is responsible for conducting negotiations, acquiring identified properties and performing any necessary relocations.

2.0 Issues of the Function

Currently, the Real Estate function is designed to achieve the MTA's objectives that:

1. Properties are acquired in a cost effective and timely manner
2. Acquired properties are sufficiently maintained to allow commencement of construction activities
3. Acquisition and relocation activities are conducted in compliance with applicable federal and state guidelines

3.0 Findings Regarding the Function

The following summarizes the major duties currently being performed by the EMC:

1. Identification during the design phase of properties requiring acquisition
2. Identification of the type of acquisition required to facilitate construction activities
3. Determination of the date by which acquisition must be completed to prevent any construction delays

The following summarizes the major duties currently being performed by the MTA:

1. Approval of property acquisitions as identified by the EMC
2. Coordination and review of third party appraisals to determine acquisition costs and just compensation to be paid to property owners
3. Negotiations with owners for the acquisition of properties
4. Relocation of occupants
5. Maintenance of acquired properties to allow construction activities to begin on their scheduled dates
6. Perform environmental assessments of properties to be acquired through the use of consultants

Exhibit 1 summarizes the major activities and time frames associated with the acquisitions of real property.

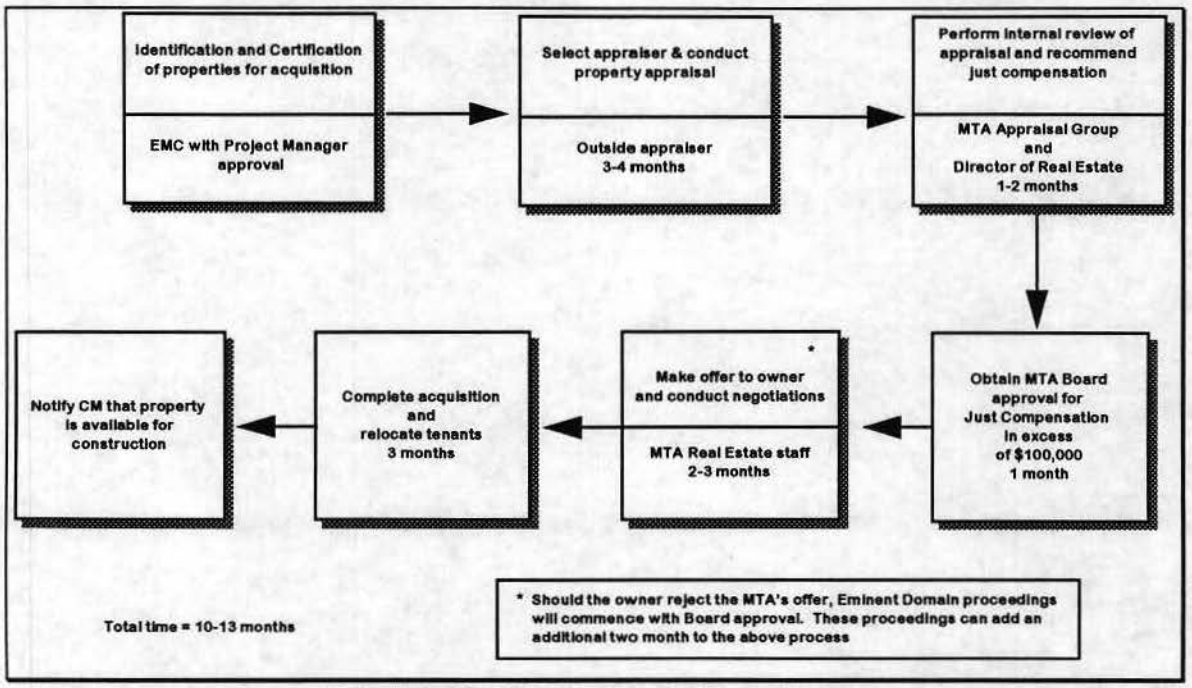


Exhibit 1 Real Estate Acquisitions Process

As demonstrated by Exhibit 1, the acquisition process is typically quite lengthy, 10-13 months, and any additional delays can adversely impact construction schedules.

Appraisal

Subsequent to EMC property identification and MTA Project Manager approval, the real estate function must appraise a property's value. The MTA uses appraisals to determine "Just Compensation" for current owners. Generally, appraisals are performed by independent fee appraisers and are reviewed by MTA staff. All appraisals, including those internally performed, must comply with federal and state regulations in addition to MTA guidelines.

MTA review of appraisal reports, which are also governed by state and federal regulations, is a lengthy process. Verifying data, evaluating the appraisers' assumptions and determining the accuracy of appraisals are all time consuming tasks but are essential to an effective acquisition program.

Personnel limitations within the Real Estate Appraisal group have compounded the challenge of meeting the appraisal schedule. The Appraisal Section of the MTA's Real Estate Department has

six authorized positions consisting of a Manager, four Senior Real Estate Appraisal Officers and one Real Estate Assistant. However, only two of the Senior Real Estate Appraisal Officer positions are currently filled. The Real Estate group has sought to mitigate the impact of these limitations through creative schedule management and the use of consultants, but some delay is unavoidable.

Property Certification

Due to the length of time involved in an acquisition, property certification is often required before design work is sufficiently advanced. Subsequent design changes may therefore necessitate recertification. Additionally, Board initiated and technical changes resulting in non-use of previously certified property, revision of take vs. easement decisions and new use or space requirements can also necessitate recertification.

Our interviews indicated that this occurs on a fairly regular basis, at times as many as one in three properties have required recertification. Depending on circumstances, additional appraisals must be solicited, performed and reviewed. Therefore, recertification can result in added appraisal costs as well an otherwise unnecessary use of limited appraisal staff time.

Board Involvement

The MTA Board of Directors plays an active role in the Real Estate Acquisition process. Board approval is required for the acquisition of any property with a "Just Compensation Level" above $100,000. Additional Board approval is required if the negotiated acquisition price (referred to as administrative settlement) exceeds the Board authorized "Just Compensation" amount by 10% or more.

If the property owner rejects the MTA's offer, acquisition must be accomplished through Eminent Domain proceedings. These proceedings also require the authorization of the MTA Board. Additionally, settlement of any litigation resulting from the acquisition must also be approved by the MTA's Board of Directors.

Consequently, these procedures can and have led to specific properties requiring the Board's attention on three separate occasions: (1) approval of just compensation; (2) review and

approval or rejection of administrative award and (3) approval of Eminent Domain proceedings. These proceedings can consume significant amounts of Board time on a single property and lead to potential delays. Because they are required to approve any administrative settlement that exceeds the original authorization by ten-percent or more, the Board may be required to expend their valuable time to approve an expenditure of an immaterial amount of money.

Budget and Forecasting

As of January 1995, forecasted real estate costs for MRL - Segment 2 were in excess of their original budget by approximately $11,000,000 or 14 percent. Although no specific contingency is allocated to Real Estate, using the overall project contingency of ten-percent of budgeted costs as a guide, Real Estate Operations will exceed budgeted costs plus contingency by slightly over $3 million dollars. This overrun has been primarily caused by higher-than-expected property acquisition costs.

Property Maintenance

Upon successfully acquiring a parcel of real estate, the MTA's Real Estate Property Management Group is responsible for its maintenance. This includes keeping the property free from debris and protecting it from vandals, etc. In certain instances these responsibilities have not been met, angering local citizens and requiring the use of CM and contractor personnel to perform property management duties.

Organizational Reporting

Although the real estate function represents a significant portion of rail construction activities, the Real Estate Group does not report to the MTA Project Manager. Instead, the Director of Real Estate reports to the Deputy CAO for General Services with the Administrative Division. Given the significance of real estate acquisitions to the construction budget and schedule, it is essential that there be open communication between these groups and an understanding of each others needs.

4.0 Implications of Our Findings

Delays in real estate acquisitions can adversely impact construction management's efforts to acquire property in a timely and cost effective manner. As property acquisitions require a lead time of a year or more, it is essential that the Real Estate group work closely with the Construction Division project team and begin its acquisition process as soon as property to be acquired is identified by the EMC. Recertifications motivated by changes in owner's preferences or premature design specifications can create significant scheduling issues and stretch "thinly-spread" Real Estate resources to a breaking point.

Real estate costs are by nature volatile. Therefore, budgets and contingencies must be carefully monitored, updated and revised as conditions warrant. Right-of-way property is typically acquired in a piece-meal fashion. Therefore, real estate contingencies are managed at the lowest level of detail to avoid budget overruns.

Finally, the importance of adequately managing acquired properties must not be overlooked. Well maintained properties reduce the chances of injury and promote a positive image of the MTA among local citizens. Additionally, effective property management will ensure that acquired properties are available for construction activities to begin on their scheduled dates.

5.0 Recommendations for this Function

We recommend that the MTA retain the current organizational reporting relationships as it relates to the Real Estate Function to maintain responsiveness to the Construction Division's needs and control costs. Although the Real Estate Department plays a critical role in the success of the Construction unit, we believe any change in reporting relationships would undermine its effectiveness and increase the cost of providing services. These assumptions are predicated on the fact that the Construction Division uses about 50-60% the total hours expended by the Real Estate Department. Additionally, because the Real Estate Department has many functions (appraisal, acquisition, relocation, etc.) any splitting of the department would result in duplicated positions and a potential under utilization of resources. However, in recognition of the importance of real estate to construction activities, we recommend that the office of the

Chief Executive Officer implement a new approach to providing Real Estate services to the Construction Division.

We recommend that the Real Estate Department form a "contract" or "letter of agreement" defining that nature of the relationship between Real Estate and the Construction Division. In acquiring this service, the Construction Division will want to define or describe the following:

- Services to be provided, including the level of quality and responsiveness
- Length of service - typically one year, with renewal coinciding with the annual budget process
- Cost of service
- Skills and experience required of the specific service provider
- Right to approve and accept specific individuals who will provide the service selected based on the above criteria
- Cancellation Policy
- Options to Procure additional services during the contract period
- Specific performance measures to be used to measure the level of satisfaction with services provided
- Right to evaluate Real Estate department personnel assigned to the Construction Division and significantly influence their annual review

In its agreement with the Construction Division, the Real Estate function should also specify the following :

- Services to be provided, including the level of quality and responsiveness
- Length of service - typically one year with renewal to coincide with the annual budget process
- Price of service
- Skills and experience required of the specific service provider
- Cancellation Policy
- Options to provide additional services during the contract period
- Support Requirements to be provided by the internal customer (e.g. office space, secretarial support, telephone and fax service)

- Specific feed back based on agreed upon performance measures at agreed upon time intervals
- Opportunity to earn "bonus" dollars based on meeting and/or exceeding the internal customer's expectations as defined by agreed upon performance measures

This "contract" will provide a framework for Real Estate services to be provided to the Construction Division. In specifying each organization's roles and responsibilities, as well as providing performance measures, the delivery of real estate services to the Construction Division will be improved. The "contract" should be signed by both parties and subsequent disputes should be resolved be the CEO or COO, as appropriate. This approach has been used with success by other authorities and companies in other industries and offers a unique way to foster a spirit of cooperation and teamwork between internal service providers and customers.

In order to achieve its cost and schedule objectives, the MTA should fill the remaining two authorized but vacant Senior Real Estate Appraisal Officer positions. As discussed earlier in this section, much of the work associated with appraisal reviews is time consuming but is vital to successful acquisition efforts. Filling its current vacancies represents the most viable means for the MTA to ensure that property is acquired in a timely cost effective manner.

To control costs, project contingency for real estate acquisition should be specifically identified and incorporated into management reports. By explicitly identifying these amounts, management will increase awareness of budgetary constraints and effectiveness of cost controls. Exception reporting regarding real estate transactions should be highlighted within the Board's progress reports.

To reduce the possibility of schedule delays, the MTA should reexamine the level of Board involvement required for Real Estate acquisitions. As discussed earlier, a single property can require the Board's attention on several occasions. Additionally, these procedures may require that the Board authorize additional expenditures of immaterial amounts. The current arrangement does not represent an effective or efficient use of Board time.

To reduce the possibility of schedule delays and free up Board time, we recommend that the Real Estate and Joint Development Committee of the Board of Directors be delegated the authority to approve additional compensation to property owners at a level not to exceed

twenty-percent of the original level of Board authorized Just Compensation. Additionally, this Committee should be available to meet on a bi-weekly basis should real estate acquisition needs so dictate. This will reduce the amount of total Board Member involvement in real estate acquisitions while still providing an appropriate level of control.

CHAPTER IV
Volume B

COST ESTIMATING

1.0 Nature of the Function

Cost Estimating predicts the cost of construction activities. To support planning, Cost Estimating establishes a likely total project cost to construct the proposed rail system. During design, Cost Estimating allows engineers and managers to determine if a design is constructable to the targeted cost. Once construction activities begin, the Cost Estimating function supports the change process by providing fair cost estimates of proposed changes and assists in the negotiations with contractors. In the final analysis, the difference between the estimate and the fully-realized total cost validates the effectiveness of the Cost Estimating function.

Cost Estimating for design is a function that is performed by the EMC. The EMC is responsible for establishing contract cost estimates at each design submittal milestone and for developing Rough Order of Magnitude estimates for design-related contract changes. Likewise, Cost Estimating for construction contract changes is a function that is performed by the CM. The CM is responsible for developing Fair Cost Estimates to facilitate resolution of disputes through the Change Order and Claim process.

1.1 Cost Estimating During Design

The Design Cost Estimating function supports the design of station, tunnel, systems or other contracts for construction or installation. The information provided by the Design Cost Estimating function predicts the likelihood that a design will meet its targeted cost of construction. Design engineers from both the EMC and Section Designers, as well as MTA Facilities and Systems Engineering Managers, use Design Cost Estimating figures as one basis for making sound design decisions.

Cost Estimators reside within the MTA and EMC and utilize a frequently updated database detailing equipment costs, labor rates and other charges for all construction disciplines employed throughout the project. In this way, Cost Estimators can examine a design and compile an estimate to construct the design, in the same manner that a potential construction contractor would assemble a bid.

1.2 Cost Estimating During Construction

The Construction Cost Estimating function primarily supports the field operations (CM Resident Engineering office) by analyzing contract change notice costs in support of the Change Order and Claim process. The Construction Cost Estimating function supports the accurate development of cost forecasts by gauging the magnitude of potential claims impacts through this forecasting process.

Estimators utilize the same database employed during design, as well as other discipline-specific data. For a sufficiently detailed change description, this information allows total cost estimates to be assembled from baseline work elements required for negotiations with the contractor.

2.0 Issues of the Function

2.1 Fundamental Concepts

Cost Estimating is a valuable tool for the effective management of a rail construction project. It enables managers to make informed decisions about the status of designs as they progress through key milestones. As a cost control mechanism, Cost Estimating allows the MTA to: (1) determine the likelihood that contracts will be awarded to bidders within a targeted cost, (2) plan and develop conceptual designs to predetermined cost targets and (3) effectively negotiate the cost of changes to construction contracts.

2.2 Cost Estimating for Rail Construction Project Phases

Rail construction project have specific phases. These phases include early planning (Conceptual Design), preliminary design completion (Preliminary Engineering), design finalization (Detailed Design), contract bid and award (Bid Evaluation and Contract Award) and physical construction and systems installation (Construction). The effectiveness of Cost Estimating is determined by a variety of factors occurring along each phase:

<u>Conceptual Design and Preliminary Engineering</u>

Cost Estimating can assist the development of conceptual and preliminary designs by supplying cost information for planning purposes. Accurate cost estimates allow planners to quickly determine the

feasibility of an alignment and system configuration. This prevents unnecessary planning efforts and greatly facilitates preliminary engineering work.

The effectiveness of Cost Estimating during Conceptual Design and Preliminary Engineering is limited by the accuracy of estimate data in databases, as well as the skill and experience of Cost Estimators. Utilizing knowledge gained from past rail construction projects is one effective way to ensure that estimates incorporate real-world conditions. The value of Cost Estimating information is ultimately governed by the decision-makers who receive it. If political priorities dominate the project approval process, cost estimates will have limited value in determining the appropriate budget for a rail construction project.

Experiences gained through the course of managing prior rail construction projects has led the MTA Construction Division to establish an alternative Project Adoption process. Recognizing that the validity of a committed budget depends on how well the MTA understands the project scope and risks, this Project Adoption process attempts to defer budget commitments until the conclusion of Preliminary Engineering. With this policy, cost estimation may play a greater role in establishing the overall project contingency and budget.

For cost estimation to support Project Adoption, the MTA should apply the same data, methods and resources throughout Preliminary Engineering that they will utilize during design and construction. To be of most value to Project Adoptions, cost estimation must provide the MTA an accurate assessment of total project costs, including an established contingency that is based firmly on risk analysis.

Detailed Design

During detailed design, EMC and MTA cost estimators provide the project team complete estimates for each submittal milestone. For each station, tunnel, systems or other contract, design submittal milestones occur, in general, at the In-process (60% design completion), the Pre-final (85% design completion) and the Final (100% design completion) stages. Once designers provide submittal drawings, cost estimators perform a detailed cost accumulation of every element drawn. This process is known as a "full take-off" estimate, and is intended to closely mimic the process a contractor would use to establish his bid.

Quality cost estimates during design allow designers and project management to make informed decisions about design direction. Accurate estimates can assure the MTA that the individual contract designs (e.g., a station) are engineered to the targeted cost of construction. Responsive cost estimates allow project management to perform cost/benefit trade-offs and mitigate cost issues.

For cost estimates to be truly reliable, they must accurately cost the design in its current and anticipated form, as well as cost all identified risks to the construction of the design. Accurate costing from design drawings requires an accurate cost database, skilled drawing interpretation, and thoroughness. Digitization and CADD applications can help ensure that all drawing elements are incorporated in the estimate. In this respect, quality cost estimates are dependent upon the quality of design documents in place. Risk identification and costing requires a measure of skill and experience with the construction of similar designs, and a "feel" for what may be unique to a particular design or site. Failure to consider interactions between construction contracts or an incomplete understanding of site conditions all contribute to poor risk identification and costing.

Timeliness is another aspect of cost estimation that determines its usefulness during design. By providing accurate cost estimates in a timely manner, decision-makers within the MTA and the EMC may better judge design direction and assess alternatives. "What if" analyses often rely more on timing than absolute accuracy. Estimators with a predisposition to performing full-take offs may display reluctance to offer "back of the envelope" estimating in support of design options.

Bid Evaluation and Contract Award

Prior to opening competitive bids for construction and procure/install contracts, Cost Estimating is responsible for generating a final Engineer's Estimate representing the best guess at the final award price. The Engineer's Estimate includes a full take-off of the design in its final form, the latest market information on construction costs and even the bid climate. The Engineer's Estimate establishes a baseline for evaluating each bid. It also serves as a confirmation of the validity of estimate assumptions used throughout the design.

After bids are received, the role of Cost Estimating is to perform a detailed comparison of all bid submittals. Because MTA construction and procure/install contracts are awarded through an RFP process, cost estimators are ultimately limited to supporting the selection of the low-priced bid or offering an assessment of why the low-priced bid is a non-responsive or unrealistic bid.

Cost estimators properly support the Bid/Award process by generating a reliable Engineer's Estimate baseline and thoroughly evaluating bids. Ultimately, the MTA wishes to make a selection to minimize total costs for the contract. Total costs include the fixed-price award value and the cost of changes. Therefore, cost estimators must perform appropriate due diligence to ensure that the lowest responsive bidder is also the most likely choice to minimize total construction costs.

As part of the overall bidding strategy, contractors attempt to build in the highest possible profit while remaining the low priced bidder. To achieve this, contractors may "front load" the bid by over-costing early work steps and under-costing later work steps to gain a cash flow edge. In other cases, contractors may recognize an ambiguity (i.e., a weakness) in the design and transfer extra costs to affected work steps in order to achieve maximum payment for changes during construction. When evaluating bids, cost estimators must be able to recognize these and other tactics.

Construction

Cost estimation during construction establishes cost estimates for construction or procure/install contract changes to assist the MTA in achieving the lowest cost settlements with contractors. To fully support the control of construction costs, estimators must prepare accurate, timely and complete estimates. Estimates must also be generated independently of contractor influence, and must be positioned to "drive the best deal" on the behalf of the MTA.

When a change is initiated in the field, a Rough Order of Magnitude (ROM) estimate is prepared by the Resident Engineer (for the majority of construction-related changes) or the EMC (for design-related changes). The ROM is intended only as an alert to a potential change and identification of probable level of approval required. CM estimators subsequently develop a Fair Cost Estimate (FCE) to serve as the basis for negotiations with the contractor. The contractor is also responsible for submitting a proposed price in advance of formal negotiations.

ROM estimates with reasonable accuracy offer a forecasting benefit by alerting project management to the magnitude of potential construction contract changes. Accuracy is more important for the FCE because this estimate establishes the MTA's negotiating position. FCEs that fully incorporate the scope of the change, including only the additional manpower, materials, equipment and other costs the contractor must incur, will greatly facilitate settlements which minimize MTA costs. On the other hand,

estimates that incorporate more than the contractor's true incremental change requirements, or are not prepared independently of contractor proposals will reward the contractor excessively at the MTA's expense.

2.3 Principal Cost Estimating Issues

The findings, implications and recommendations highlighted in the text to follow focus on what we believe to be the primary Cost Estimating issues facing the MTA for rail construction projects. These issues can be summarized as follows:

1. Organizational Roles and Responsibilities: The effectiveness of cost estimating for design and construction is influenced by the type of organization utilized by the MTA as well as assignment of responsibilities between MTA staff and consultants
2. Use of Cost Estimating Resources During Conceptual Design: Appropriate use of cost estimating resources during Conceptual Design will allow the MTA to capitalize on prior experience throughout the planning process
3. Timeliness of Cost Estimating During Design: Timely cost estimates provide MTA managers ample opportunity to analyze alternatives and direct the course of designs to ensure target construction costs will be met
4. Cost Estimating for the Final Design Submittal: Cost estimates generated at the 100% design stage allow the MTA and designers to assess, for one last time, the cost position of a design and to provide guidance for incorporating late-arriving submittal comments
5. MTA Estimating Support During Construction: The degree to which the MTA can be assured of valid Fair Cost Estimates and the ability of FCEs to support change negotiations with contractors determines in large measure the MTA's cost control capability during construction.

3.0 Organizational Roles and Responsibilities

3.1 Findings Regarding Organizational Roles and Responsibilities

During the project design phase, the overall responsibility to perform the tasks associated with Cost Estimating resides with the EMC. The MTA is responsible for the oversight of the EMC as they perform the tasks associated with Cost Estimating during design. This oversight is accomplished through

detailed review of EMC Cost Estimating work throughout the design process, and by utilizing full comment authority on EMC Cost Estimating work products.

The following summarizes the major responsibilities performed by the EMC, in priority order as it relates to Cost Estimating:

1. Build and maintain a current database of equipment cost and labor rates for all architectural, civil, electrical, mechanical, and other disciplines encountered on all construction and systems contracts comprising the project
2. Provide cost estimates, including full take-offs, to support each design submittal review
3. Provide an analysis, when requested, of Contractor's Cost Proposals resulting from proposed changes
4. Assign Rough Order of Magnitude estimates to all design-related construction contract change requests and change notices

The overall responsibility to perform the tasks associated with Cost Estimating for design resides with the EMC. The MTA is responsible for the oversight of the EMC as they perform the tasks associated with Cost Estimating. In practice, the MTA exercises detailed review and comment authority over the EMC throughout the course of Cost Estimating efforts for design.

The following summarizes the major responsibilities performed by the CM organization, in priority order as it relates to Cost Estimating:

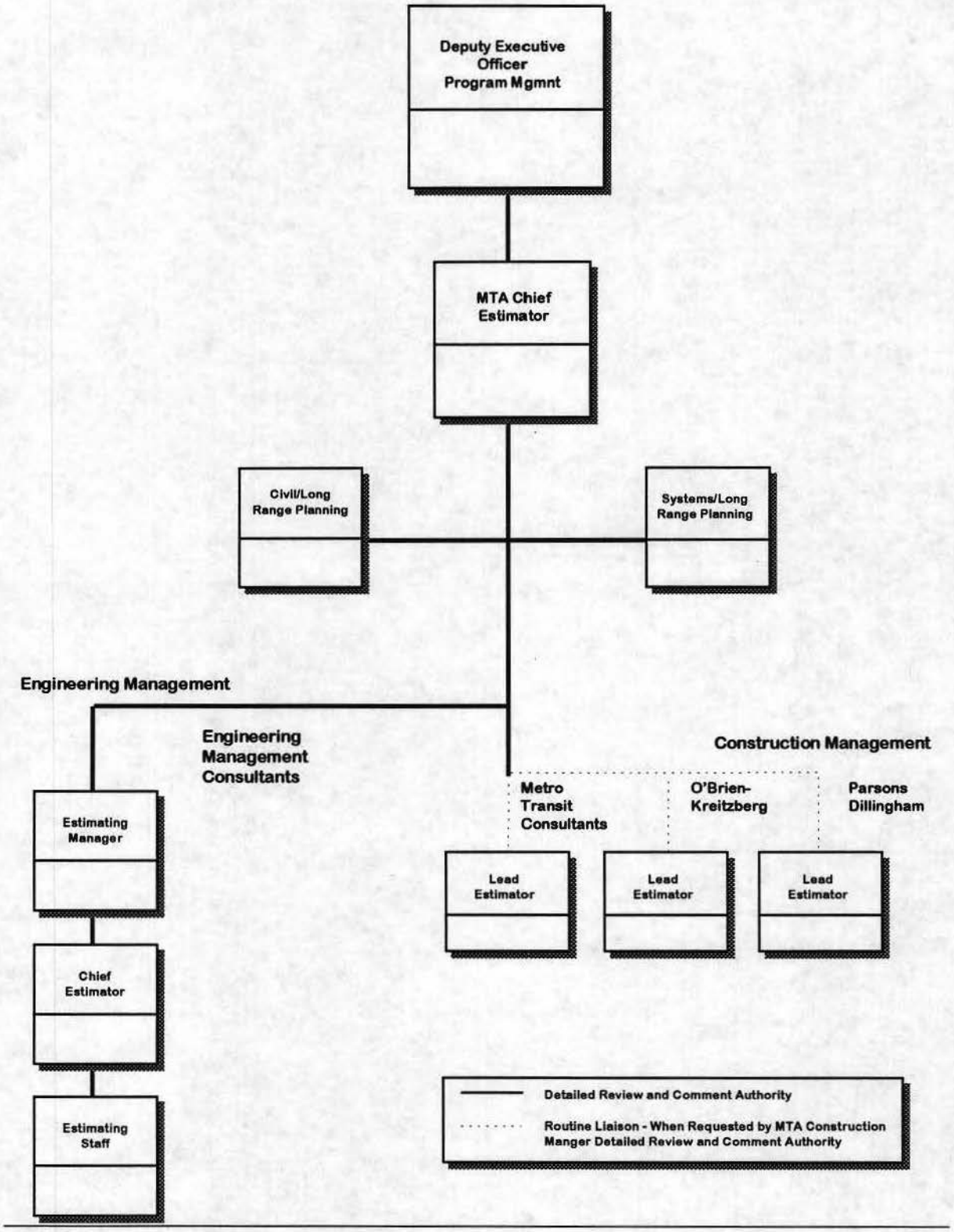
1. Build and maintain a current database of equipment cost and labor rates for all construction disciplines encountered on all construction and systems contracts comprising the project
2. Provide cost estimates, including quality take-offs, to support the contract change negotiation process. Provide Fair Cost Estimates for contract changes
3. Provide an analysis of Contractor's Cost Proposals resulting from proposed changes
4. Quantify and define the scope of change notices
5. Establish the appropriate Basis of Payment (Bid Unit, Lump Sum or Extra) for an approved contract change

The overall responsibility to perform the tasks associated with Cost Estimating for construction resides with the CM. The MTA is responsible for the oversight of the CM as they perform the tasks associated with Cost Estimating. In practice, the MTA performs the role of routine liaison with the CM throughout the course of the majority of Cost Estimating efforts. The MTA Estimators provide assistance to CM Estimators in researching and developing Fair Cost Estimates on an as-required basis only.

The MTA has proposed a reorganization plan for the Cost Estimating function. This plan recommended the consolidation of CM cost estimating functions within the MTA Estimating organization, and an amendment to the CM scope of services eliminating the requirement to supply a Cost Estimating function. This proposal was put forth in an effort to establish tighter MTA control of cost estimating and negotiating for construction contract changes, as well as to reduce overhead costs.

Exhibit 1 depicts the current organization structure and relationships for the Cost Estimating function.

Exhibit 1. Current Cost Estimating Organization



It should be noted that the MTA Chief Cost Estimator, with considerable rail construction experience, has expressed his plans to retire within a year.

3.2 Implications of Organizational Roles and Responsibilities

Currently, the MTA has a strong, oversight involvement in the creation of cost estimates during design, while having only a weak administrative involvement in estimating during construction. Please refer to Section 7.0, **MTA Estimating Support for Construction** below for a discussion on construction-related estimating.

Cost estimating for a rail construction project is a highly specialized endeavor. Apart from reliable data, cost estimating benefits most from an experienced eye. With the imminent loss of their Chief Cost Estimator, the MTA will have a significant skills gap to address before taking on a more active oversight role in all aspects of cost estimating.

3.3 Recommendations for Organizational Roles and Responsibilities

We recommend the MTA retain its current organization structure with respect to Cost Estimating. We believe the current organizational structures and relationships in place today are appropriate for the performance and oversight of Cost Estimating activities. In addition, we do not advocate a change in the scope of services provided by the EMC or a CM with respect to Cost Estimating. Rather, we believe that the EMC and the CM should retain their current responsibilities as they relate to Cost Estimating for design and construction. However, we advocate a stronger and more active role for the MTA with respect to Cost Estimating. Please refer to Chapter 7.0, **MTA Estimating Support During Construction** for further details.

To achieve a more active cost estimation oversight, the MTA should recruit an experienced Senior Estimator to eventually replace the retiring Chief Cost Estimator. The MTA should also add an additional estimator for the increased oversight responsibility. To solidify the oversight of construction-related estimating, the MTA must also bolstered the Construction Division Contracts Administration function. See the chapter on Contracts Administration for additional details.

With these recommendations, we believe the MTA will obtain the following benefits:

1. Qualified Personnel: An ability to mandate qualified personnel are provided and available for this function. This is particularly valuable for the specialized disciplines of electrical, mechanical and structural estimating
2. Timeliness: Flexibility to have Change Order and Claim estimate information evaluated in a timely and cost effective manner
3. Staffing Flexibility: Less MTA staff limitations as Cost Estimating demands increase (particularly during peak design submittal periods as well as for peak construction through close-out) compared to if the MTA were to take this function in-house
4. Improved Cost Control: A stronger MTA oversight of cost estimates will provide a higher measure of cost control, justifying the additional investment in MTA Cost Estimating resources

Please refer to Section 7.0, **MTA Estimating Support During Construction** for additional recommendations and benefits related to an increased MTA Estimating involvement.

4.0 Use of Cost Estimating Resources During Conceptual Design

4.1 Findings Regarding Use of Cost Estimating Resources During Conceptual Design

During the conceptual design of the MRL - Segment 2 project, Planning and Programming chose to utilize a separate design consultant with its own estimating capability. MTA (then RCC) and EMC (then MRTC) cost estimating groups were not involved in establishing conceptual cost estimates.

4.2 Implications of Use of Cost Estimating Resources During Conceptual Design

By not using RCC and MRTC cost estimating resources throughout conceptual design, much of the estimating experience gained from MRL - Segment 1 was not incorporated into the budget development process for Segment 2. Opportunities for establishing realistic project contingencies based on an appropriate risk-factor analysis were limited substantially (see the Project Contingency section of the Cost Control chapter for additional details and recommendations).

4.3 Recommendations for Use of Cost Estimating Resources During Conceptual Design

We strongly recommend the use of MTA Cost Estimating resources as part of an overall Project Adoption process in the manner established for the Pasadena Line and MRL - Segment 3. In this way, the full benefits of past experiences can provide the most realistic cost estimates for planning and preliminary design.

With this recommendation, we believe the MTA will obtain the following benefits:

1. Realistic Budgets: Conceptual and preliminary designs that make use of the cost experience gained from the construction of very similar systems within the same city will lay the groundwork for more realistic budgets and contingencies
2. Growing Knowledge Base: An active MTA Cost Estimating participation in conceptual and preliminary project designs will allow the function to gain more knowledge about the project at an early stage

5.0 Timeliness of Cost Estimating During Design

5.1 Findings Regarding Timeliness of Cost Estimating During Design

Three significant design submittals typically occur from the time a contract concludes preliminary engineering (up to 30% design completion) to its release for bid. These three submittals are the In-process, Pre-final and Final. The table on the following page depicts the designer's typical requirements for each submittal:

Design Submittal	Design %	Design Requirements
In-process	60%	• Civil, Structural, Architectural design • Electrical/Mechanical design • Draft specifications and design calculations • Final traffic plans • Utility relocation agreements • Facilities maintenance
Pre-final	85%	• Incorporation of all submittal comments • Coordination between engineering disciplines, facilities and systems • Complete drawing and specification documentation
Final	100%	• Incorporation of all submittal comments, Lessons Learned, etc.

The formal submittal process spans approximately four weeks for each design milestone. The designer produces and distributes submittal documentation for comments by all design disciplines, MTA project team functions (engineering, construction, contracts, etc.), MTA Operations and affected municipalities. All comments for a given contract are due within three weeks of submittal distribution.

The MTA Engineering Manager with primary responsibility for the contract consolidates and classifies all comments. One week after final comments are due (four weeks after the designer's submittal) the MTA holds a Design Review Meeting to discuss the status of the design. A multi-organizational, multi-disciplined group judges the merits of specific submittal comments. The EMC, in conjunction with the responsible MTA Engineering Manager establish action steps to address valid comments.

Throughout the submittal process, MTA and EMC estimators prepare a full take-off estimate of the design as it currently exists. "Full take-off" in this case implies an estimating process that mimics the process employed by a contractor to create a bid. This creates a very robust cost estimate at each submittal, but requires additional estimating time. The time to complete a design submittal cost estimate has typically averaged nearly six weeks. Consequently the Design Review Meeting is conducted without benefit of the updated cost estimate. Exhibit 3 illustrates the submittal timeline of events.

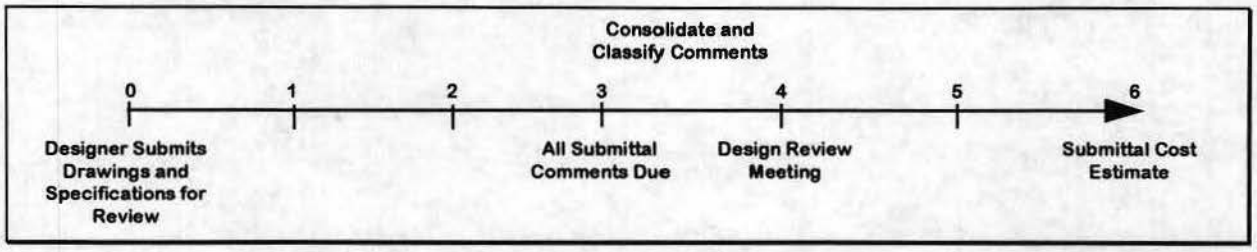


Exhibit 3

5.2 Implications of Timeliness of Cost Estimating During Design

The Design Review Meeting culminates a submittal process yielding feedback from a variety of disciplines, organizations and municipalities. The fundamental goals of specific tunnel, station or systems contract design work is evaluated and redirected. Substantive design refinements occur as a result of submittal comments and Design Review Meeting outcomes. Please refer to Section 8.0, **History of Major Segment 2 Contract Cost Estimate** for a series of examples illustrating the nature of changes that occurred during the Segment 2 design process.

The submittal process is not taking full advantage of cost estimate information whenever full take-offs require six weeks to complete. Participants of the Design Review Meeting do not benefit from cost estimates when discussing the merits of submittal comments or the appropriate design course to take. Engineering decisions regarding alternative locations for ventilation shafts, added entrances or relocated utilities, to name a few examples, require estimate support for a proper cost-benefit analysis. Without cost estimates, Design Review participants may elect to proceed with design alterations or additions based on false assumptions about the likely cost to construct the design in its current form. Discretionary items may be accepted when the station design already exceeds target cost. In other instances, Design Review participants may not be alerted to over-costly designs.

5.3 Recommendations for Timeliness of Cost Estimating During Design

We recommend that MTA cost estimators assure that estimates are prepared in advance of the Design Review Submittal. This can be achieved by either streamlining the full take-off procedures for the In-process and Pre-final estimates and/or by starting the estimating cycle two weeks before the designer is to distribute submittal documentation. Generally, a full market-price adjusted estimate to the level of

the Engineer's Estimate is not required for engineering trade-off discussions. However, through a continuous improvement approach, submittal estimates can approximate full take-off quality with a decreasing time requirement. Closely-approximated estimates arriving in time to support or refute design decisions are more valuable than extremely precise take-offs received after the fact. Therefore, we recommend that MTA estimators place a priority on timely (though accurate) support of design submittal discussions versus market-price precision, particularly for the In-process and Pre-final milestones.

The MTA should continue to investigate ways of utilizing CADD capabilities as one way to streamline estimation. While full take-offs from CADD drawings may not be practical or cost effective, additional steps to perform partial take-offs may be possible.

With these recommendations, we believe the MTA will obtain the following benefits:

1. Better Cost Control: With timely estimates to support the design submittal process, the MTA will be able to perform more effective cost/benefit trade-offs to control cost. Cost control affected early in the design process has a far greater impact on total cost savings during construction
2. Lower Costs: A streamlined estimating process will reduce some MTA expenditures on submittal estimating requirements

6.0 Cost Estimating for the Final Design Submittal

6.1 Findings Regarding Cost Estimating for the Final Design Submittal

As described above, cost estimates are created for each design submittal. At the conclusion of design, estimators prepare a separate estimate, known as the Engineer's Estimate, to closely approximate bidding expectations. The Engineer's Estimate is the best and final estimate prepared from a full take-off (in the manner that contractors will prepare their bid) and incorporating all known economic influences. Based on the degree of accuracy displayed by the Engineer's Estimate, along with its proximity to the final design submittal estimate, current Red Line project managers have questioned the need for a final design estimate to support the final submittal.

Based on the past experiences of MRL - Segment 2 station and tunnel contracts, cost estimates were modified significantly from the final design submittal to the Engineer's Estimate. While a portion of the change may be attributed to refined market-based information, addition changes are most likely the result of actual changes to the design. Please refer to Chapter 8.0, **History of Major Segment 2 Contract Cost Estimates** for a series of examples illustrating the nature of changes that occurred during the Segment 2 design process.

6.2 Implications of Cost Estimating for the Final Design Submittal

The histories of Segment 2 facilities estimates indicates that design decisions are still being made by the MTA after the final (100%) submittal. A likely source of changes are the numerous submittal comments incorporated into the design either before the bid package is release to qualified bidders or afterward by amendment to the RFP. In fact, the majority of Third Party comments do not arrive until after the final design review. By eliminating the cost estimate for the final submittal, valuable information will be lost to the MTA and its designers. Their ability to perform cost/benefit assessments of these late-issued submittal comments will be diminished. From the discussion on timeliness of cost estimates presented above, the value of cost estimates available to support the submittal process (including the final design submittal) is clear.

The final submittal cost estimate highlights the effects of design changes applied since the Pre-final review. In this sense, the final submittal estimate presents one last opportunity to adjust the design to hit target costs. The final estimate allows the MTA project team to make intelligent decisions regarding the incorporation of specific submittal comments. By eliminating the final estimate, discretionary submittal comments may be added to a design already likely to exceed targeted cost.

The Timberline estimating and Primavera scheduling software systems are linked to provide the MTA with resource-loaded cash flow projections whenever an estimate is revised. By eliminating the final design estimate, cash flow planning will not be revised beyond its pre-final submittal state.

6.3 Recommendations for Cost Estimating for the Final Design Submittal

We recommend that the MTA retain the final design cost estimate. Again, the MTA estimating function should place a higher priority on the timeliness of final submittal cost estimate figures rather than maximum accuracy (see Section 5.3, Recommendations Timeliness of Cost Estimate above). The

MTA estimating function must also ensure that sites are properly examined in the course of developing an estimate.

With this recommendation, we believe the MTA will obtain the following benefits:

1. Better Cost Control: The final design estimate will provide the MTA additional management information on the status of a contract prior to releasing the RFP. Better information will provide a firm basis for the MTA to decide on the inclusion or exclusion of late submittal comments
2. Better Cash Flow Planning: Cash flow plans refined through the final design estimate will provide MTA project management with a clearer picture of the likely cash-flow demands of the contract once construction proceeds

7.0 MTA Estimating Support During Construction

7.1 Findings Regarding MTA Estimating Support During Construction

MTA cost estimators work closely with EMC estimating staff to produce design review estimates. During construction, however, the MTA estimators generally do not get involved in the preparation of Rough Order of Magnitude (ROM) estimates or more refined Fair Cost Estimates (FCEs) to support the construction contract change process (see Chapter IX, Volume B - Change Orders and Claims for additional background on this topic). MTA estimators also do not participate in the negotiation of changes with the construction contractor.

Based on a trend observed of final negotiated costs of design-driven changes exceeding the ROM estimates the MTA Chief Cost Estimator has enacted the following policy:

1. ROM estimates will be set by consensus of the MTA Chief Cost Estimator, the EMC Manager of Estimating and the CM Chief Estimator. Where consensus is not reached, the MTA Chief Cost Estimator will have final determination
2. The ROM will be initially set by the EMC Manager of Estimating prior to establishing a consensus. The final ROM will be set prior to divulging figures to the Change Control Board

3. Estimators will continue to express ROMs as a range, though a tighter range than previously allowed

7.2 Implications of MTA Estimating Support During Construction

The ROM figures generated in response to a potential construction contract change serve only to provide a very early assessment of the cost to the MTA. According to the MTA Chief Estimator, the ROM is used to alert the Change Control Boards, Configuration Management group and others that a change is in the works. Consequently, the ROM does not have to be extremely precise to perform its role. Nonetheless, as the analysis above shows, the ROM figures do tend to understate the eventual costs of a change by a noticeable margin. This may raise change control issues for changes at the approval threshold of involving the MTA (above $50,000 in estimated cost). If a change is significantly undervalued at the ROM and issued to the contractor without MTA involvement, the final settled amount may have merited MTA involvement via the Change Control Board.

Another implication with respect to understated ROMs for design-related changes is the inherent organizational tension this produces between the CM and EMC. The CM may conclude that the EMC is understating estimates for construction changes in order to limit their liability and to call into question the CM's own ability to negotiate settlements. Without commenting on the merit of this argument, the MTA's interests are not served with tensions such as these.

7.3 Recommendations for MTA Estimating Support During Construction

We believe the MTA should serve a greater role in estimating support during construction. Without some level of involvement in estimating contract changes during construction, the MTA is not exercising appropriate control over the cost of changes. Therefore, **we recommend that the MTA authorize and require the MTA Chief Estimator to review and approve all ROM and FCE estimates for changes likely to exceed $50,000.** To supplement the involvement of MTA estimators, **we recommend a strengthened MTA contract administration function (see Chapter VI, Volume B - Contract Administration for additional details).**

We concur with the actions of the MTA Chief Estimator to review all design-related Rough Order of Magnitude estimates and acknowledge the initiative this represents to actively control project costs. Particularly after construction begins, design-related changes can have material impacts on the allocated

contingency, and proper review is essential to effective cost control. **We recommend that all design-related Rough Order of Magnitude estimates be approved by the MTA Chief Estimator.**

While we recognize that negotiating a final settlement with the contractor for a change is an important responsibility of the CM (particularly of the Resident Engineer, supported by CM Estimators and Project Control Engineers), we also believe the MTA Cost Estimating function should be authorized and required to participate in the negotiation of significant changes.

However, we believe that the EMC and the CM should retain their current responsibilities as they relate to estimating support during construction. We are not advocating a change in the scope of services to be provided by the EMC or any CM with respect to these specific responsibilities. Rather, we recommend a stronger and more active role for the MTA with respect to this function.

With these recommendations, we believe the MTA will obtain the following benefits:

1. Qualified Personnel: An ability to mandate qualified personnel are provided and available for this function. This is particularly valuable for the specialized disciplines of electrical, mechanical and structural estimating
2. Timeliness: Flexibility to have Change Order and Claim estimate information evaluated in a timely and cost effective manner
3. Staffing Flexibility: Less MTA staff limitations as Cost Estimating demands increase (particularly during peak design submittal periods as well as for peak construction through close-out) compared to if the MTA were to take this function in-house
4. Improved Cost Control Oversight: An MTA estimating involvement in preparation of ROM, FCEs as well as negotiated settlements for construction contract changes will assure that the best interests of the MTA as owner are always served
5. Better Cost Control: This system of checks and balances provides a flexible and desired level of control over the process that could be increased or decreased as MTA management desired through assignment of technical evaluators or additional qualified staff. Also, a consistent involvement by MTA estimators from project design through construction will assure that experiences from the design process are effectively and consistently applied to the estimating and negotiating of changes

during construction. The MTA's position in negotiations with the contractor are correspondingly strengthened

8.0 History of Major Segment 2 Contract Cost Estimates

The following appendix describes the amount and nature of cost estimate changes for four representative MRL - Segment 2 facilities contracts.

Contract B-252: Vermont/Santa Monica Station

Stage	Estimate	Change in Dollars	Percentage Change
Conceptual Estimate	$45,814,000	N/A	N/A
30% Estimate	$38,432,000	($7,382,000)	(16%)
60% Estimate	$53,052,000	$14,620,000	38%
85% Estimate	$59,174,000	$6,122,000	12%
100% Estimate	$59,980,000	$806,000	1%
Engineer's Estimate	$59,864,000	($116,000)	(.2%)
Award Value	$50,879,000	($8,985,000)	(15%)

At conceptual design, costs for contract B-252 were estimated to be $45,814,000. At this point, station length was 878 feet. For the 60% estimate (no reconciliation for 30% has been provided) station length was increased to 903 feet and total costs were estimated to be $53,052,000. This increase was comprised of three components: (1) increased station length ($700,000), (2) shaft extensions ($3,450,000) and finishes ($3,088,000).

From the 60% to 85% estimate, costs increased by $6,122,000 to $59,174 ,000, an increase of approximately 12%. Station length was reduced from 903 feet to 889 feet. The cost increases were primarily caused by a change in escalation percentage ($1,367,000), increased finishes ($1,877,000), Transit Enhancement Option 1 ($2,302,000), a schedule change ($673,000) and cost adjustments based on quantity and price take-off ($806,000). These increases were partially offset by decreases due to reduced length ($392,000) and other schedule and design changes ($1,476,000). This estimate was revised and issued three times.

The 100% (final) estimate was $59,980,000. No reconciliation was given for this $806,000 increase. Total cost at the Engineer's Estimate was $59,864,000.

Changes After Award

Per the December 1994 PMSR, contract B-252 is 12% complete. Total changes to contract B-252 amounted to $122,000 as of March 1995. The majority of costs are due to work scope changes ($87,986) with the remainder comprised of differing site conditions ($27,633) and contract options ($6,815).

Contract B-241: Vermont/Beverly Station

Stage	Estimate	Change in Dollars	Percentage Change
Conceptual Estimate	$40,012,000	N/A	N/A
30% Estimate	$34,304,000	($5,708,000)	(14%)
60% Estimate	$45,969,000	$11,665,000	34%
85% Estimate	$55,041,000	$9,072,000	20%
100% Estimate	$51,358,000	($3,683,000)	(7)%
Engineer's Estimate	$47,950,000	($3,408,000)	(7)%
Award Value	$40,958,000	($6,992,000)	(15%)

At the conceptual phase, the original budget for contract 241 was set at approximately $40,000,000 with a station length of 573 feet. As of the 60% estimate (no reconciliation is available for the 30% estimate), station length was increased to 594 feet and total cost was estimated to be $45,969,000. This increase was attributable to increased finish ($1,069,000), engineering and shop drawing costs ($377,000), quality control ($905,000), increased station depth (10 ft. with an associated cost of $1,954,000), shaft increases ($1,038,000) and a station and foot print increase($641,000). Additionally, a $1,034,000 increase due to contaminated soils was added. These cost were reduced by an escalation adjustment of ($321,000).

At the 85% stage, costs had increased to $51,136,000 while station length remained at 594 feet. The majority of this increase was comprised of detailed emergency exits work ($1,913,000), electrical costs ($723,000), additional dewatering treatment ($642,000), miscellaneous quantity and cost adjustments ($299,000), schedule changes ($225,000), metals ($208,000), station/tunnel connections ($125,000) and irrigation and landscaping charges ($107,000). The remaining increase was due to several miscellaneous

items such as utilities, walkways and demolition whose values in the individual did not exceed $100,000.

The above estimate (85%) was re-issued twice. On the first re-issue, costs increased an additional $2,088,000 due to increased foot print to provide for the "Great Space" design ($1,780,000) and increased finishes ($308,000). On the second re-issue, station length grew to 607 feet resulting in a further increase of $598,000. Additionally, an enhanced entrance/plaza added $2,419,000 to the estimate with schedule changes adding $178,000. A $2,123,000 reduction attributed to miscellaneous cost adjustments was also incorporated in the second revision resulting in a pre-final (85%) estimate of $55,041,000.

The final estimate for contract 241 was $51,358,000. This decrease was caused by reductions due to negative escalation ($991,000), takeoff quantity and price reductions ($1,815,000) and a schedule adjustment ($877,000).

Changes After Award

As of December, contract B-241 was 22% complete. Three change notices totaling $50,000 due to differing site conditions had been executed as of March 1995 for this contract. One change notice with no cost was executed based on design changes. No other change notices were executed.

Contract B-261: Vermont/Sunset Station

Stage	Estimate	Change in Dollars	Percentage Change
Conceptual Estimate	$45,549,000	N/A	N/A
30% Estimate	$36,679,000	($8,870,000)	(19%)
60% Estimate	$64,000,000	$27,321,000	74%
85% Estimate	$58,438,000	($5,562,000)	(9%)
100% Estimate	$53,742,000	($4,696,000)	(8%)
Engineer's Estimate	$47,819,000	($5,923,000)	(11)%
Award Value	$44,967,000	($2,852,000)	(6%)

The conceptual stage cost estimate for contract B-261 was $45,549,000. As of the 60% estimate, costs has increased to $64,000,000 (no estimate information for 30% or station length was given). Contributing to the above increase were the following: entry ($6,003,000); plaza ($5,450,000); station foot print increase

with resulting increases in rebar, concrete, excavation and elevators ($2,730,000), shaft rework to side streets ($2,500,000), construction duration of B-251 ($569,000), escalation caused by B-251 interface ($751,000), demolition costs ($228,000) and HDPE/Bentonite costs ($220,000).

At the pre-final (85%) estimate, costs decreased to $58,438,000. This decrease was attributable to a negative escalation adjustment of ($2,500,000) miscellaneous quantity and price reductions ($1,381,000), and plaza design takeoff adjustments ($1,681,000). Again, no detail regarding station length was provided.

Final (100%) estimated cost was set at $53,742,000. The decrease from the previous estimate was primarily due to a deleted design allowance ($4,828,000), reduced escalation costs ($913,000) and a reduction in concrete prices ($550,000). Further reductions totaling $204,000 were attributed to metal and miscellaneous adjustments.

Changes After Award:

Per the December PMSR, contract B-261 is 13% complete. As of March 1995, one "owner originated terms and conditions" change had been executed. This change reduced costs by $50,000.

Contract B281: Hollywood/Vine Station and Crossover

Stage	Estimate	Change in Dollars	Percentage Change
Conceptual Estimate	$48,437,000	N/A	N/A
30% Estimate	$40,012,000	(8,425,000)	(17%)
60% Estimate	$64,106,000	$24,094,000	60%
85% Estimate	$64,624,000	($518,000)	(1%)
100% Estimate	$60,000,000	($4,624,000)	(7%)
Engineer's Estimate	$56,469,000	($3,531,000)	(6%)
Award Value	$49,287,000	($7,182,000)	(13%)

From conceptual to the 60% stage, costs increased from $48,437,000 to $64,106,000, a change of $15,669,000 or 32%. This change is attributable to the following: a 34% increase in station area ($4,840,000), BRS/UPE costs ($3,315,000), excavation support ($2,421,000), "Walk of Stars" protection

($2,010,000), increases in station width, depth, height and thickness ($3,028,000) and miscellaneous cost adjustments ($55,000).

As of the initial 85% estimate, costs totaled $65,884,000. The change in estimate was caused by the following: additional finishes ($2,465,000), schedule change costs (including escalation) ($2,353,000), additional HDPE cost ($185,000) and miscellaneous takeoff quantity and price adjustments ($98,000). These increases were partially offset by station area and structural change reductions ($2,638,000) and cost reductions made to "walk of the stars" protection ($685,000). This estimate was revised and reissued to reflect cost savings of $1,260,000 from reduced wall thickness and schedule changes. Revised 85% estimate totaled $64,624,000.

Changes After Award

This contract is in a very early construction phase. Consequently, few changes have been enacted.

CHAPTER V
Volume B

CONTRACT AWARDS

1.0 Nature of the Function

Contract Awards is the process of contractually obtaining a contractor or professional service provider (consultant) through a formal selection process to perform for the MTA, a specific scope of work at a fair and reasonable price. The current function of Contract Awards operates to achieve the MTA's objective of Procurement Management - to establish standards and guidelines for the procurement process to ensure that:

1. Services and equipment are obtained efficiently and in compliance with provisions of applicable MTA policies and local, state and federal requirements
2. Construction contracts are obtained to complete the project on schedule, within budget, safety and in accordance with plans, specifications, MTA policies and local, state and federal requirements.

1.1 Organizational Structure

The current Construction Contracts group consists of:

- Director of Contracts
- Contracts Managers for the construction/system contracts of each Metro Transit Line (MGL, MRL, etc.)
- Contracts Mangers for Professional Services contracts and Systemwide contracts
- Contract Administrators for both construction/system contracts and professional service provider contracts.

The construction/system contracts Contract Managers and their Contract Administrators report directly through to the Project Mangers (solid line) and indirectly to the Director of Contracts within the Construction unit (dotted line). The Professional Service Provider Contract Administrators and the Systemwide Contract Administrators report directly to the Director of Contracts in the Construction unit (solid line). This structure is reflected in Exhibit 1.

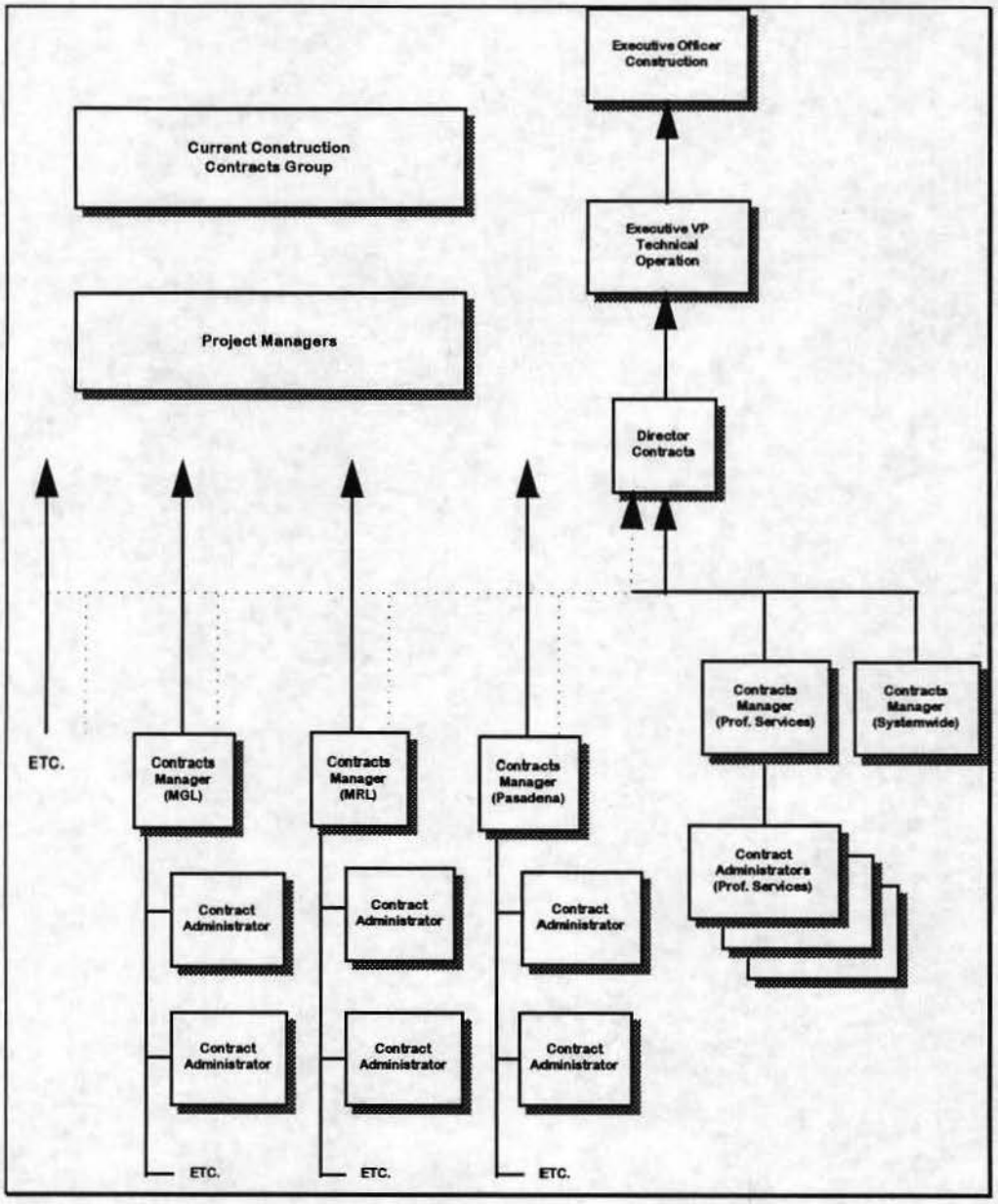

Executive Officer Construction
Current Construction Contracts Group
Executive VP Technical Operation
Project Managers
Director Contracts
ETC.
Contracts Manager (MGL)
Contracts Manager (MRL)
Contracts Manager (Pasadena)
Contracts Manager (Prof. Services)
Contracts Manager (Systemwide)
Contract Administrator
Contract Administrator
Contract Administrator
Contract Administrator
Contract Administrator
Contract Administrator
Contract Administrators (Prof. Services)
ETC.
ETC.
ETC.

Exhibit 1

1.2 *MTA Responsibilities*

The Award Process for construction and systems contracts - which are generally sealed bids (lowest responsible, responsive bidder gets the award), is slightly different than professional service contracts - which are generally competitive proposals (most qualified firm is awarded the contract subject to successful price negotiations with the MTA).

- Overall responsibility for procurement management for construction unit contracts in the pre-award phase lies with the MTA's Director of Construction Contracts.
- Responsibility for ensuring technical compliance with the contract's specification lies with the MTA Construction Unit and its consultants, including the CM.
- Contractual administration aspects of the contracts are the responsibility of MTA Construction Unit's Contracts Group.
- Contract DBE/MBE/WBE issues are the responsibility of the Contract Compliance group located in the Administration Unit.

2.0 Issues of the Function

1. What organizational structure should be implemented at the MTA to perform the Contract Award process?
2. Are changes to the levels of "approval authority" within the MTA and the Board recommended?
3. What procedures should the MTA perform as it relates to the Contract Award process?
4. What level of performance has the MTA demonstrated regarding contract awards?
5. What recommendations are proposed to enhance the contract award process?

3.0 Findings Regarding the Function

3.1 The following summarizes the major Contract Award duties being performed by the CM organization:

1. Perform all purchasing and subcontracting necessary to support all CM activities, including service subcontracts and construction subcontracts of less then $50,000

2. Provide pre-construction services, for construction contracts still under design and to be awarded, including:

   a. Provide the MTA and the designers with construction advice from the planning phase through final-bid document preparation (constructability reviews, cost reviews, risk sharing analysis)
   b. Review the Request for Bid (RFB) documentation including the contract, general conditions, DBE/MBE/WBE potential, and technical specifications
   c. Perform reviews of the construction contract documents to evaluate work task coverage and consistency of work scope and tasks
   d. Participate in pre-bid and pre-construction meetings and site visits
   e. Provide assistance with the evaluation of bidders, as requested.

3.2 The following summarizes the major Contract Award duties being performed by the MTA organization:

1. Overall responsibility for the Contract Award process
2. Prepare the Request for Bid (RFB) - Construction and System Contracts and the Request for Proposal (RFP) - professional service provider contracts, utilizing in-house and consultant expertise
3. Advertise the RFB/RFP and coordinate/execute the pre-bidders conference
4. Evaluate bids submitted utilizing the MTA's pre-determined bid evaluation parameters and calling upon other consultant expertise, as needed, to evaluate the quality/responsiveness of the bidders
5. Utilize the contracts compliance group located in the Administration Unit to assess the DBE/MBE/WBE qualifications of bidders
6. Execute/coordinate the process of oral presentations (when necessary) to facilitate determining the recommended bidder
7. Obtain a "Best and Final Offer" (BAFO) from all short-listed bidders (when required), and evaluate the BAFO prior to recommending a successful bidder (when required)
8. Perform a Pre-Award survey, if necessary, prior to finalizing a recommendation, utilizing consultant expertise when necessary
9. Prepare Award Recommendation and submit to Board for approval

4.0 Findings and Implications Regarding the Process

4.1 Award Process Performance

Historically, the Contract Award Process has performed well utilizing the MTA Construction unit's Contracts department. Based on our interviews and reviews of data, the Contract Award process has withstood the scrutiny of the Board and the dispute/appeal process on a consistent basis. Their recommendations for Professional Service firms and construction and systems contractors appear to have been determined based on sound procedures being followed by the Contract Administrators (CA), their supervisors, and the evaluation teams established. We are currently aware of a confidential report issued by the MTA Inspector General that identified a number of concerns regarding the recent contract award process for the CM contract on MRL-Segment 3. The final determination of the Inspector General and the Board's decisions regarding the award of the CM contract are very relevant issues to the evaluation of the Contract department's recent performance, and should be considered in conjunction with this report. Regardless of the outcome of this incident, it is critical that this function remain within the Construction Division for reasons identified throughout this Chapter.

4.2 Award Disputes

Eighty to Ninety percent of the unsuccessful bidders generally challenge the contract award recommendation. There have been at least 86 disputes during the last four years. This situation has been aggravated by the MTA Board's willingness to become involved in the award protest process. The general theme of the challenges is based on DBE/MBE/WBE certification and "good faith efforts" determinations. The contract compliance group in the Administration Unit of the MTA performs these determinations based on the minority goal parameters established by the Construction Unit and the Board. When the challenges are received, the Contracts group follows established challenge procedures. The large majority of award recommendations (over 95%) remain consistent once the dispute process is resolved. Those that are overturned are usually due to the contractor or consultant not meeting the DBE/MBE/WBE goals or the "good faith efforts" requirements. Of the 86 disputes reviewed, only two protests were upheld. There were 12 contracts re-bid based on miscellaneous issues identified during the protest.

4.3 *Award Variances*

The ranges between high and low bidders has been relatively narrow and the winning bid amount has been within a very reasonable range, often below, the engineer's estimate for the anticipated contract being awarded. This is a strong indicator that the RFP/RFIQ documentation and the contract award activities are operating effectively. Exhibit 2 shows a listing of the recent MRL Segment 2 contracts and a comparison of the contract Award Value to the Engineer's Estimate of anticipated contract award value.

In (000's) Contract	Engineer's Estimate	Award Value	Award Variance	Award Variance % (FAV)/UNF
B201	$50,640	$44,577	($6,063)	(12%)
B211	45,613	38,487	(7,126)	(16%)
B215	23,961	26,178	2,217	9%
B221	80,010	79,813	(197)	(0%)
B231	51,637	53,645	2,008	4%
B241	47,950	40,958	(6,992)	(15%)
B251	141,606	129,656	(11,950)	(8%)
B252	59,864	50,880	(8,984)	(15%)
B261	47,819	44,967	(2,852)	(6%)
B271	45,680	38,948	(6,732)	(15%)
B281	56,469	49,287	(7,182)	(13%)
Stations and Tunnels	$ 651,249	$597,396	($53,853)	(8%)
B610	16,034	16,690	656	4%
B611	3,243	2,719	(524)	(16%)
B612	5,097	3,995	(1,102)	(22%)
B614	2,549	2,647	98	4%
B616	1,365	760	(605)	(44%)
B620	24,678	18,031	(6,647)	(27%)
B641	6,462	10,230	3,768	58%
B643	902	780	(122)	(14%)
B644	2,373	3,261	888	37%
B645	6,764	2,567	(4,197)	(62%)
B646	3,286	2,546	(740)	(23%)
B710	19,943	14,443	(5,500)	(28%)
B740	9,325	10,526	1,201	13%
B745	4,056	1,808	(2,248)	(55%)
Systems	106,077	91,003	(15,074)	(14%)
Total	$757,326	$688,399	($68,927)	(9%)

Exhibit 2

The range of award variances is larger for systems contracts due to the "technological requirements" that are subjected to more interpretation than the "bricks and mortar" requirements of stations and tunnels. The system contracts are also smaller in size, so variances can show larger percentage swings with small dollar award variances.

4.4 *Process Timing*

The award process, while working well with its current compliment of Contract Administrators, is a long, drawn out, time consuming process. The process is controlled within the Construction unit by matrixing the Contracts group into the Construction unit utilizing trained construction Contract Administrators. The Contracts group (within the Construction unit) reports directly to the Executive VP of Technical Operations. This solid line reporting is a benefit to keeping the award process controlled and on schedule. However, because of the award process requirements (effort, volume, process), the resources within Construction's Contracts group are currently insufficient to perform all their required tasks. The contract awards process is managed and performed, but the follow on work (after award) of contract administration suffers. **The procedures associated with the Contract Administration function is the subject of Chapter VI within Volume B.**

5.0 Findings and Implications Regarding Award Delegation

The current delegation of construction contract award approvals is as follows:

Approving Party	Approving Level
Construction EO	Up to $25,000
MTA CEO	Up to $100,000
MTA Board	Above $100,000

The last two years have been an active time for awarding construction related contracts for Metro Transit projects. The following table (Exhibit 3) reports the awards stratified by dollar amounts:

Contract Award Analysis 1993-94

Range	Number of Awards	Percentage of Total Awards	Award Value	Percent of Award Value	Approval Level
< $100,000.	2	4.0%	$ 164,478	0.0%	CEO
$100,001-$500,000	5	10.0%	1,036,717	0.1%	MTA Board
$500,001-$1,000,000	4	8.0%	3,216,344	0.4%	MTA Board
$1,000,001- $5,000,000	16	32.0%	43,831,218	4.8%	MTA Board
> $5,000,000	23	46.0%	865,419,864	94.7%	MTA Board
Total	50	100.0%	$ 913,668,621	100.0%	

Exhibit 3

Exhibit 3 reflects the awarding of 50 construction and system contracts for the Rail Program during the last 2 years and the dollar volume of over $900 million. Of this total, the Board was required to approve over 99% of the total award dollars. Prior to the Board review, the Construction Committee has to review and recommend the award.

Arthur Andersen was asked to recommend an appropriate level of contract award delegation to the construction committee. To assess the propriety of any delegation it was necessary to (1) determine the future level of contract awards and (2) compare the MTA process to other rail transit properties. Exhibit 3 reflects the future anticipated transit awards currently programmed in the MTA which will continue to be significant. The vast majority of the contracts are programmed to be awarded during the next five years.

Anticipated Future Contract Award Analysis - Stratified by Award Size
As of March 1995

Range	Number of Awards	Percentage of Total Awards	Anticipated Award Value	Percent of Total Award Value	Recommended Approval Levels
< $100,000	12	10.5%	$ 637,000	0.0%	CEO
$100,001-$500,000	13	11.4%	3,024,500	0.2%	Construction Committee
$500,001-$1,000,000	11	9.6%	8,555,400	0.6%	MTA Board
$ 1,000,001- $5,000,000	39	34.2%	95,725,300	6.8%	MTA Board
> $5,000,000	39	34.2%	1,292,690,700	92.3%	MTA Board
Total	114	100.0%	$ 1,400,632,900	100.0%	

Source: Per MTA system output report "Projected Award Value Cost Level Breakdown" of project lines (R05, R23, R81, R82, R83, R84) for all future years.

Exhibit 4

Our review of other transit properties reflected that their Boards were generally awarding contracts above the $200,000 to $250,000 range. The other transit properties did not have experienced, developed committees like the MTA. Generally the other transit properties were not utilizing committees to facilitate their award process. However, we are aware of one transit property considering delegating their award authority to their Senior Construction staff.

6.0 Findings and Implications Regarding Award Processing

The current contract award timeframe continues to be an extended process due to the intense interest in all awards by the public, the bidders and the Board. The Contracts Group prepares the Board recommendation documents and prepares for the Board meeting. They spend a significant amount of time preparing to respond to the Board, as a result of the anticipated in-depth involvement of the Board in the process of awarding contracts and challenging contract awards. The process takes a significant amount of time from the CAs, the PMs and the technical staff. This prevents them from administering their assigned contracts, because the Contract Administrators are trying to anticipate all questions that potentially would arise from the Board during their contract award presentation preparation. Award process delays and contract procurement interruptions can cause potentially significant adverse cost

elements to the MTA. Potential results of delaying the contract award process are: (1) the contract schedule could fall behind the critical path, (2) resulting contractor delay claims could arise, or (3) claims for additional costs resulting from coordination efforts between other contractors could result.

7.0 Recommendations for this Function

7.1 MTA/CM Structure:

We recommend that the MTA not assume any additional tasks from the CM related to the Contract Award function. The Contract Award function and its associated separation of assignments and duties between the MTA and the CM is a preferred structure. The MTA should continue to perform the Contract Award function in its current fashion, coordinating and utilizing the consultant's technical expertise, as necessary, throughout the award process. By retaining the current structure we believe that the MTA retains maximum control over the Contract Award function at the most cost effective level. This structure provides the MTA with the following benefits:

1. Flexibility: technical expertise can be brought in when necessary at an agreed-upon contractual rate
2. Timeliness: technical expertise is immediately available from the resources within the CM and the EMC.
3. Cost Efficiency: the MTA does not need to employ all disciplines of construction and engineering technical skills in-house to be able to address those issues that arise during the entire Contract Award process, because the resources are available through the CM and the EMC.

The current process of the MTA performing and controlling the contract award function should remain consistent. The pre-award activities utilizing the CM to perform constructability reviews, evaluate contractor bids, etc. is still appropriate for future transit projects.

7.2 MTA Organization/Reporting

The organizational structure of the Contracts group in the Construction unit should retain its direct line reporting to the Project Managers and the Executive Officer of Construction. There should also be dotted line reporting to the Administration unit for policy issues and coordination with the Contract Compliance personnel. The current structure of the Construction Contracts group having

direct line reporting to the Executive Officer of Construction for day-to-day oversight and direction was previously reflected in Exhibit 1.

Our recommendation is to modify the current structure by formally recognizing the dotted line reporting from the Director of Contracts to the Director of Procurement in the Administration unit. We also recommend solid line reporting for all the construction unit's contracts group staff to the Director of Contracts and dotted line reporting to the PMs. Due to the internal discussions at the MTA regarding transferring the Construction Contracts group's direct reporting relationship from the Executive Officer of Construction to the new position of Director of Procurement in the Administration unit, we wanted to express our recommendation for an internal MTA organizational structure related to the Construction Contracts group. We do not agree with having the Contracts group currently in the Construction unit report directly to the Administration unit. The direct reporting of the CA's to the Director of Contracts will facilitate his control over the contract award process and the contract administration process. This will still provide the PMs with the ability to direct the CA's assigned to their projects, without unduly influencing their overall activities. Our recommended structure is reflected in Exhibit 5.

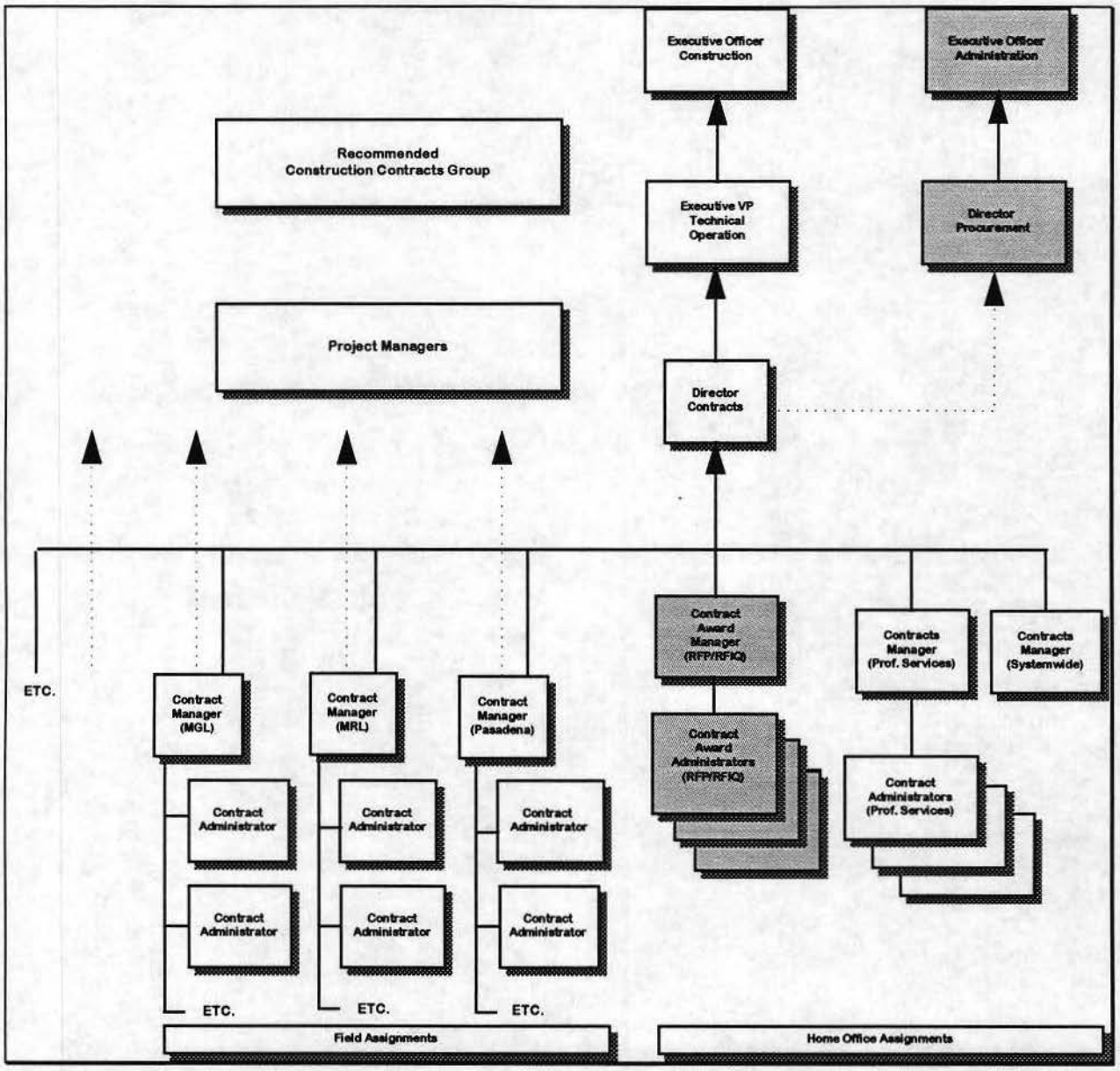


Exhibit 5

This reporting/organization structure provides the following benefits:

1. The Construction Contracts unit has a unique set of skills that are essential to serve the needs of the Construction unit. The Contracts group should therefore remain in the Construction Division.
2. The work performed by the Construction Contracts unit is very schedule sensitive. If the contract award and approval process is not able to maintain a rigid schedule and meet all programmed deadlines, significant costs to the Construction project can result. This "cost risk" factor makes it

imperative that the individuals responsible for the project/program's budget have an ability to control the technical resources necessary. This ability is available through the dotted line reporting between the PMs and the CAs, but it would not be possible if contacts were centralized in the Administration Division.

3. The requirements of the Construction unit related to the contract awards process requires "on-site" rapid response with direct and frequent communication. In our experience, to achieve that level of availability and control over a resource, it requires a shared mindset of common objectives and critical success points that is only developed through being physically co-located and supervised by the same program unit (in this case - Construction)
4. The dotted line relationship that will exist between Construction's Contracts group and the Administration's Procurement group should be sufficient to provide consistency of policy and quality across the MTA. MTA's Procurement group in the Administration unit can be very effective in setting policy and enforcing procurement guidelines through its dotted line relationship, especially if periodic compliance audits are performed.

If the MTA should choose to centralize the construction, systems and professional services contract procurement, they run the risk of impacting a well run function. The need to maintain the contract award function within the construction unit is predicated on the function's use of technical skills, its needed coordination among the parties (engineering, construction, project control) and the need to react quickly to changing demands. We believe that centralizing this function would increase the risk of potentially impacting the quality, timing and costs of the MTA's construction programs.

7.3 Delegation to Construction Committee

Based on the anticipated contract awards during the next 5 years, we recommend that the following approval levels be established:

Approving Party	Approving Level
Executive Officer of Construction	Up to $25,000
MTA CEO	Up to $100,000
MTA Construction Committee	Up to $500,000
MTA Board	Above $500,000

To expedite the Contract Award process we recommend that the approval levels for Contract Awards be modified such that the Construction Committee of the Board has the authorization to issue contracts with award levels up to $500,000. Approval of Contract Awards in excess of $500,000, which are projected to constitute approximately 99% of the Contract Awards in dollars, but only 78% of the physical volume, would remain the sole responsibility of the MTA Board. This recommendation will reduce the physical volume of contract awards approved by the Board by approximately 20%, while not reducing their control or involvement in the dollar value volume. **See previous Exhibit 4 for Anticipated Future Contract Award Statistics and Recommended Approval levels.**

To ensure that all Board members are informed of the specific contracts being awarded, the Construction Committee will formally notify the Board of their award actions after Committee approval. The benefits to the Board are three-fold: (1) the Board still retains control over the vast majority of award dollars with reduced efforts, (2) the Board obtains additional time that will be available to focus on the "big picture" addressing the Rail Transit Program's Vision and Policy for the future and (3) The Board will continue to develop and demonstrate an increasing environment of trust and confidence in their Construction Committee and Construction Staff and (4) the Board will still be cognizant of all contract awards through the status report provided by the Construction Committee.

CHAPTER VI
Volume B

CONTRACT ADMINISTRATION

1.0 Nature of the Function

The major categories of duties within the Contract Administration function include:

- Contract Compliance and Administration - the monitoring and oversight activities performed by the CM and the MTA Contract Administrators to assess the contractors performance and how it agrees with or disagrees with the contract terms and conditions. Also, the monitoring of the consultant's performance and evaluation of how it relates to terms and conditions of their contract.
- Billing and Payment Applications (Invoice Processing) - preparing, reviewing, approving and paying the Billings submitted by contractors and consultants [see Chapter VII, Volume B]
- Change Order and Claims - the oversight and monitoring activities performed by the MTA Contract Administrators over the CM's performance of the activities associated with the initiation, and approval of contractor changes. Also, the processing of consultant changes (initiation, negotiation, approval by the MTA Contract Administrators. [see Chapter IX, Volume B]

The current process of Contract Administration is designed to achieve the MTA's objectives of obtaining the product or service from the "contractor" in accordance with the contractual specifications, in a fashion that ensures compliance with MTA policies, local, state and federal requirements and adheres to contractual limitations of cost and schedule.

Currently, the responsibility for the Contract Administration function is assigned to the CM for construction and systems contracts, while the responsibility resides with the MTA for professional service providers (consultants). The primary duties are performed by the CM staff located at the RE's field office for construction and systems contracts. Based on the contracts size, complexity and activity the Contract Administration may be performed by a specially assigned CM contract administrator or by the CM's general field office staff including the RE, the Office Engineer and the PCE. Contract Administrators within the MTA perform the Contract Administration function for all Professional Service Provider (consultants) contracts and oversees the CM's performance of Contract Administration for the construction and systems contracts.

2.0 Issues of the Function

1. What current involvement should the CM have in the Contract Administration process?
2. What organizational structure should be implemented at the MTA to perform the Contract Administration process?
3. What role should the MTA and more specifically the Contracts Group execute as it relates to Construction & System Contracts and Professional Service Provider (Consultant) Contracts?
4. What procedures should the MTA perform as it relates to the Contract Administration process?
5. What Contract Administration process improvements would enhance the MTA's execution of their oversight role and provide them with a sufficient level of cost and schedule control?

3.0 Findings, Implications and Recommendations Regarding the Performance of the Contract Administration Function

3.1 For construction and Systems Contracts

The following summarizes the major Contract Administration duties being performed by the CM organization:

Provide a support staff to the field operations (the RE office) with an expertise in Contract Administration to manage the construction and systems contracts being performed on the project. The support staff duties would include the following tasks:

1. Review and process submittals from the contractor, to the EMC and back to the contractor
2. Monitor contracts for environmental compliance
3. Coordinate the Request for Information (RFI) process and respond to contractor inquiries regarding contract interpretation
4. Maintain contractor deficiency lists and coordinate the enforcement of corrective actions
5. Cooperate with the MTA's contract compliance staff regarding DBE requirements
6. Support the MTA in enforcing contract warranty provisions
7. Verify contractors have obtained all required permits, licenses, certificates, bonds and insurance
8. Verify that contractors maintain as-built drawings in accordance with the contract requirements

9. Assist the RE with the preparation of reports, including the Cost and Construction Contract Status Report, the Project Manager's Status Report (PMSR), the FTA Quarterly Supplemental Report and monthly reports on CM Expenditures and Services
10. Assist the RE with the RE's required procedures supporting Contract Close-out, Beneficial Occupancy, Substantial Completion and Final Acceptance activities
11. Perform document control procedures including providing a document control system to index, file, track and retrieve all contract and project documents including contractors' submittals prepared and distributed in accordance with each parties contractual requirements.
12. Assist the RE with the procedures associated with the change orders and claims function, including merit and cost determinations and negotiations.

The following summarizes the major Contract Administration duties being performed by the MTA Construction unit's Contracts group:

1. Oversight/Monitoring of contracts, excluding the technical and minority compliance issues
2. Monitor contractor performance including administering the incentive fee process which evaluates contractors' management plans, costs, schedules and procedures
3. Monitor the CM's Contract Administration functions regarding their reporting on contractor compliance within the contractual terms of the contract between the MTA and the contractor (e.g. contractor compliance with federal requirements, compliance with environmental requirements, etc.)
4. Monitor the CM's Contract Administration functions, regarding contract interpretation for contractors and coordination of the Request for Information (RFI) process
5. Ensure contractor compliance with DBE requirements, utilizing the assistance of the CM and the contract compliance group in the Administration unit, as necessary
6. Enforce the warranty provisions of all contracts, utilizing the assistance of the CM as necessary
7. Monitor and assure procedures are followed regarding the RE's post-construction phase activities related to warranties, contract documentation, certificates of acceptance, claims and lien releases and other contract close-out activities
8. Monitor the actions of the RE office related to change orders and claims.

3.2 *For Professional Service Provider (Consultant) Contracts*

The following summarizes the major Contract Administration duties being performed by the CM organization:

1. Administer the contract between the CM and the MTA, the coordination of insurance requests, compilation of records and the administration of the CM's subcontracts

The following summarizes the major Contract Administration duties being performed by the MTA organization:

1. For professional service provider contracts (e.g. CM, EMC, PMOC) the Contracts Administrators performs all the Contract Administration duties to manage the contract including:

    a. Coordinate the activities performed with the professional service provider's contract administrator to monitor whether the performance is in compliance with the terms of the contract
    b. Facilitate the responses to requests for contract term clarification
    c. Coordinate the payment application process including the actual approval of the payment
    d. Administer the performance-based-fee evaluation process
    e. Coordinate the evaluation process regarding contract changes and answering questions regarding the scope of the contracts, assist in the review and approval of CCRs
    f. Coordinate the contract amendment process

3.3 *Recommendations*

We recommend that the MTA not assume any additional tasks from the CM related to the Contract Administration process. The current structure of assignments for Contract Administration between the MTA and the CM is a preferred structure. For Construction and Systems contracts, the CM should continue to be the primary performer of Contract Administration duties while the MTA would monitor the performance and the output of the CM's Contract Administration personnel. The MTA should continue to be the primary performer of Contract Administration duties for professional service provider contracts.

This structure provides the MTA with the following benefits:

1. Control: this structure provides a desired level of control over the process and a system of checks and balances
2. Control Over Staffing: this structure provides an ability to mandate that qualified personnel be provided by the CM for the execution of this function
3. Reduced Staffing Constraints: this structure has less staff limitations within the MTA as construction/system contract volume grows, and
4. Technical Ability: this structure allows the MTA access to the "Best and the Brightest" talent available

The primary function of the MTA should be to oversee the contract administration functions for construction and system contractors. The CM should perform the Contract Administration function as it relates to construction and system contracts. With the CM performing the Contract Administration functions over construction/system contractors and the MTA performing an adequate oversight function (providing assurance), regarding the performance of the CM, the risks associated with cost increases and schedule delays would be reduced.

4.0 Findings, Recommendations and Implications Regarding the Procedural Direction for Contract Administrators

The current procedural descriptions for the Contract Administrators does not provide adequate instructions and guidance to the Contract Administrators regarding their day-to-day activities. The parameters of their performance, the directives as to priorities and the means to reconcile conflicting directives are not generally known by the CAs. Currently, the CAs appear to be addressing the issues as they arise or as they become a top priority in their determination. Currently, there is only one overriding priority - to get the contracts awarded on time - the rest of the contract administration duties take a lower priority. This is in part a consequence of the inadequate personnel resources in the Contract Administration area.

Without clearly defined written and monitored procedures and priorities governing the actions of the MTA CA's, their execution of the oversight function is subject to improper and limited performance.

Without proper execution of the oversight function, the MTA increases its potential for risks that could result in increased costs, schedule impacts or quality issues.

We recommend that specific procedural directives be prepared for the CAs that establish the performance directives and parameters that the CAs should follow to perform their function. These parameters must indicate priorities and conflict resolution methods to address the anticipated conflicts or inconsistencies that may evolve regarding their functional duties. These manuals should be prepared after the reorganization of the Contracts group is implemented. The reorganization recommendations follow later in this write up. To establish the specific performance parameters of the contract administrators it will be necessary to write procedures that direct the contract administrators as to what their duties are to be and the anticipated level of involvement they will have in each of the major processes of general contracts administration and document control, billing, change orders and claims and project reporting. In addition, Contract Administrators handling professional service providers will have a specific set of written procedures that they must follow as it relates to performing contract administration functions on the entire contract. These procedural manuals can be created from current MTA contract administration manuals and the contract administration procedures within the CM organizations.

5.0 Findings, Implications and Recommendations Regarding the Consultant Incentive Fee Administration

Many of the Professional Service Providers (PSP) have "Incentive Fee" clauses within their contracts. These clauses provide for additional moneys to be paid to the PSP above their contractual hourly fee rates. This incentive fee is based on a "Report Card" scoring system that takes their final grade and converts it to a percentage to be multiplied by the base of approved work earned during the period under evaluation. Each incentive fee contract term is slightly different, but the most common is an incentive fee that can range between 0% and 13%. The PSP is allowed to directly bill the incentive fee at 5% each month. When the evaluation process is completed, the actual incentive fee due is compared to the 5% billed previously, and an additional payment is made to reconcile the incentive fee net difference.

5.1 The evaluation process is performed either every three months or every four months depending on the contract terms. The evaluators are MTA staff who have worked with the PSP during the previous period in selected evaluation areas. The scores from the evaluators are consolidated

by the CA and then the CA administers the remaining steps of the incentive fee process. The incentive fee process has evolved over time, as the MTA has attempted to improve the process.

5.2 Based on our review of the results from the incentive fee process, we have noted some concerns:

1. The process utilizes a number of graders from the MTA (approximately 10). These individuals all have exposure to the PSP, but generally in different areas or functions. When their scores are combined to determine the fee earned, the end results have been very consistent. One CM has received the same nine percent incentive fee for 7 of the last 9 evaluation periods and ten percent for the other 2 periods. Another CM has received ten percent on 5 of the 7 periods analyzed The EMC has received between seven and nine percent on each of its last 6 evaluations. These evaluations cover the last two years for the Metro Transit program The report card scores seem to evolve into an average score in the B range, reflecting a limited or non-existent level of "continuous improvement." During this time frame there have been many events that we would anticipate to have an impact on the incentive fee earned by the MTA's PSPs. There were schedule deterioration's, reductions in safety performance, cost escalation's, failure to perform quality audits, etc. However, the scores as described above do not appear to reflect those events and the consultants related performance consequences.
2. The process is currently at least 6 months behind schedule. The last evaluation for the PSPs analyzed were dated June 1994 and August 1994. The incentive fee process is established to "incentivize" the PSP to perform better during the current period than they did the previous period. Without processing the report cards in a timely fashion (within 45 days of the period end date), the training and communication benefits are diminished. Currently, the delay can be attributed to the limited personnel resources in the Contract Administration area and the time consuming process of performing the incentive fee evaluations. If the PSP has not performed well during a period, they do not have the incentive to finalize the report card process timely. They have an incentive to delay the evaluation until the situation improves. Therefore, the MTA must establish the timeline and administer the process in accordance with that timeline. This is a responsibility of the CA.
3. The report cards include many rating scores based on the categories listed within the report card, but very few written comments. It is a much more valuable evaluation if the reviewers would include narrative comments that describe the positive and negative performance features of the PSP, concerns of the evaluator about the PSP or problems of the PSP impacting the

evaluator. This information is much more valuable when it is accompanied by specific examples.

5.3 Based on our review of the results from the incentive fee process, we also have noted some positive attributes:

1. The current process includes a requirement for the PSP to prepare a self-evaluation prior to the MTA discussing the incentive fee earned for the period by the PSP. This requirement has specific benefits to the process. It facilitates a reconciliation between the MTA and the PSP regarding their performance. It allows the PSP an opportunity to voice its concerns about its performance and explain why certain actions happened or were necessary and it forces the PSP to look at their performance on a regular basis so that they too are looking for ways to continuously improve their performance to the MTA.
2. The incentive fee is paid to the PSP firm that has contracted with the MTA, but it is earned by the PSP's employees. When the employees do a very good or excellent job, the incentive fee should reflect this performance and vice versa. Some PSPs have made arrangements to share the incentive fee with their employees, rather than having the firm retain the fee. This sharing of incentive fee has had a positive effect on the PSP employees. The employees have been "incentivized" to perform better, and as reflected in the level of incentive fee earned, it appears to have worked for the PSP firms who have instituted the sharing concept.

5.4 **We recommend the following requirements should be implemented into all incentive fee arrangements, if possible:**

1. The Contract Administrator for the PSP contract must be held responsible for administering the Incentive Fee process and meeting all time requirements
2. Mandate that the PSP prepare a self review report card within 30 days of the period end date, including written comments, or be subjected to a penalty for the period
3. Mandate that the MTA select an evaluation team that is large enough to cover all services provided by the PSP
4. The MTA evaluators must only report on those area that they have been involved with during the period
5. The MTA evaluators must provide written comments justifying their scores - for all scores, not just the outliners. These comments should identify the strengths of the performance

during the past rating period, the weaknesses identified during the past rating period and the procedures to be improved upon during the next rating period

6. Specific performance criteria for each category being evaluated need to be defined (e.g. a B in Report preparation means the CM did "this" accurately and did "that" on time each time, etc.) to obtain consistency of scoring between reviewers, because different reviewers have different perceptions of what type of performance should earn a B rating so inconsistencies could arise
7. The incentive fee process must be made more uniform across PSPs. Currently, each PSP has a different structure and requirements within their incentive fee evaluations and terms.
8. Mediocre performance should be reflected when it is present with a corresponding reduction in the incentive fee for the period under evaluation. Correspondingly, when the performance is outstanding, the incentive fee should reflect that performance
9. The MTA evaluators must complete their report cards within 40 days of the period end (this should be a staff performance measure)
10. The CA will compute the scores and the incentive fee within the next 5 days (this should be a staff performance measure)
11. The MTA PM will meet with the PSP representative by the 45th day after the period ends

5.5 Beneficial elements of the incentive fee program that should be implemented into all future incentive fee contracts include the following:

1. Evaluations done every four months (mandatory and on schedule)
2. The range of incentive fee that can be earned should be set between 0% and 13%, rather than utilizing a range that does not start at zero (e.g. 4-11%) as it is in some PSP's incentive fee structure.
3. The incentive fee earned is shared with the PSP employees working during the evaluation period (if contractually possible)

6.0 Findings, Implications and Recommendations Regarding the Organization of the Function

6.1 Organization and Workload

The current Construction Contracts group consists of:

- Director of Contracts
- Contracts Managers for the construction/system contracts of each Metro Transit Line (MGL, MRL, etc.)
- Contracts Mangers for Professional Services contracts and Systemwide contracts
- Contract Administrators for both construction/system contracts and professional service provider contracts.

The construction/system contracts Contract Managers and their Contract Administrators report directly through to the Project Mangers (solid line) and indirectly to the Director of Contracts within the Construction unit (dotted line). The Professional Service Provider Contract Administrators and the Systemwide Contract Administrators report directly to the Director of Contracts in the Construction unit (solid line). This structure is reflected in Exhibit 1.

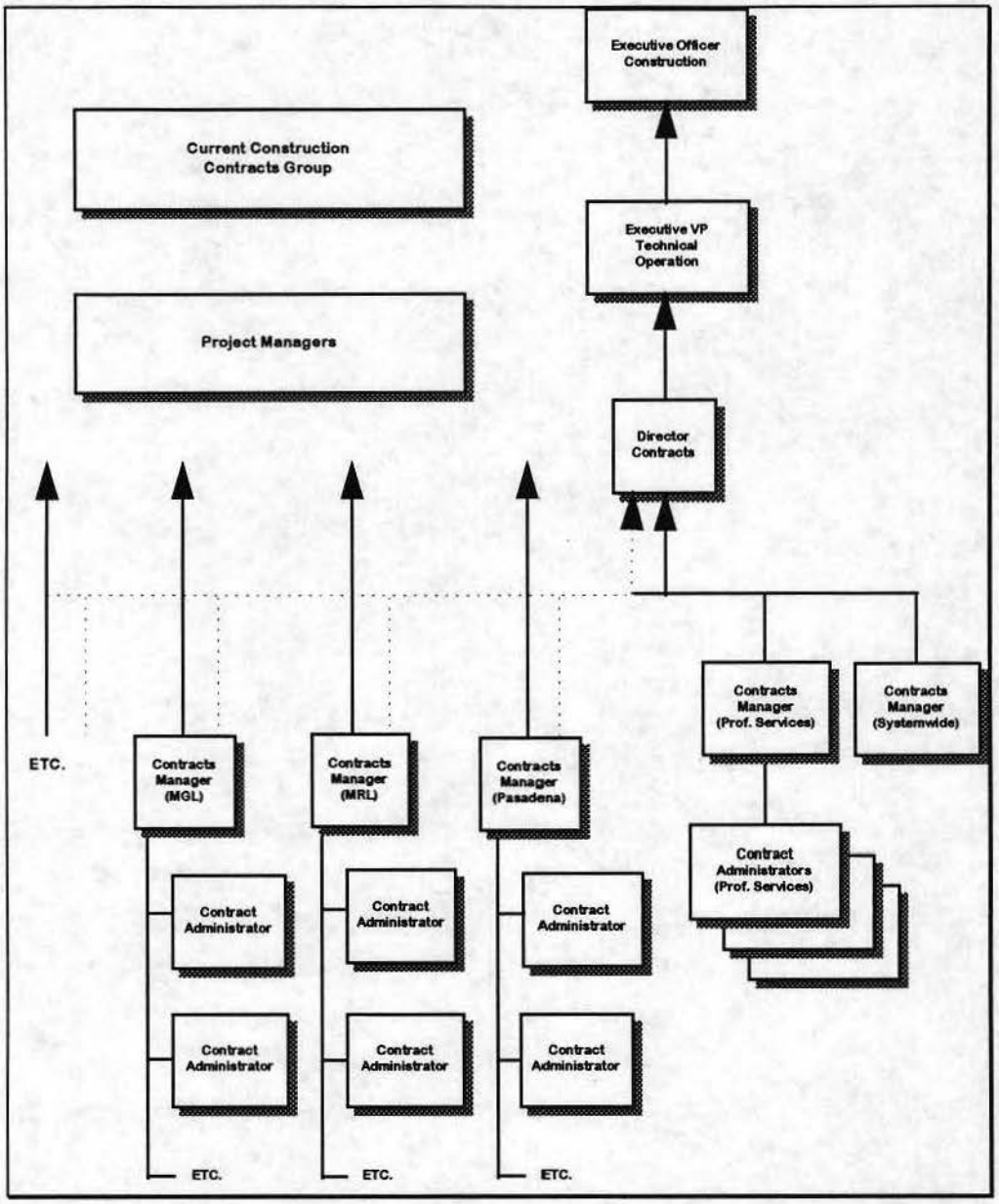


Exhibit 1

There are currently 6 Contract Administrators handling 35 construction/systems contracts for the MRL - Segment 2. These individuals are also responsible for assisting in the administration of the contract award process (RFP/RFIQ). Because of the significant workload of contracts on each administrator (average number of contracts =6) there are Administrators overseeing well over $100 million of contracts and one individual who is overseeing contracts valued at over $200 million. These administration duties are in addition to the contract award duties which all administrators share.

There are also six Professional Service Provider (PSP) Contract Administrators handling the Metro Transit program. These individuals are administering 161 contracts currently in addition to contract award duties. The range of contract assignments is from 6 to 87 contracts per person. The value of these contracts are so large that two Administrators are monitoring and administering over $200 million worth of contracts. The PSP Contract Administrators handle all contract administration activity - they do not oversee the function, they perform the function.

6.2 *Performance Activities*

Based on our interviews and review of data, the Contract Administration procedures are being performed at a limited level. The Contract Award Process (RFB/RFP Process) consumes the majority of the Contract Administrator's (CA) available time. The CA's priority is definitely the RFB/RFP process. If an RFB/RFP is due to be produced so a contract can be awarded, that RFB/RFP will take priority over all other CA tasks. The RFB/RFP process has the highest priority status because of the critical interrelationship between contract award, Notice to Proceed (NTP) and the Project's schedule to meet ROD. If the contract award process is interrupted or delayed there could be serious schedule and financial implications to the Program. As a result, contract administration suffers.

Contract Administrators within the MTA are currently not becoming involved in processes critical to Contract Administration early enough. Their involvement in the change process is generally at the end of the negotiation phase, their involvement in the billing process is generally after the billing has been approved by the CM's upper management and their involvement in the reporting function is limited to final review of the produced documents from the CM. The reason for this limited involvement is due primarily to resource shortages within the Construction unit's Contracts group.

Because of the limitations with the availability of Contract Administrators, the MTA is currently not performing an adequate job of the oversight function as it relates to:

- Contract Compliance and Administration
- Billings and Payment Applications [see Chapter VII, Volume B]
- Change Orders and Claims [see Chapter IX, Volume B]

This section will discuss the Contract Administration function in detail while lightly discussing the other two functions. The Billings and Payment Applications and Change Orders and Claims functions are the subjects of other Chapters in Volume B, as noted above.

The Construction CAs do not involve themselves in the day-to-day activities of the Resident Engineer Field Offices. The CAs mainly operate out of the MTA home office. It is very difficult, if not impossible to perform an adequate job of the oversight function when you are not actively involved with the individuals performing the function. The REs and their support staff at the field office are performing the contract administration function. The RE office is:

- Interpreting the contract
- Acting on their interpretations and financially committing the MTA to additional obligations when they are executing the change order process for a contractor's change
- Preparing the payment application with the contractor
- Preparing the estimate to complete analyses for the cost reports
- Verifying contractor compliance with DBE/MBE/WBE requirements and
- numerous other contract administration tasks detailed in the RE procedures manual

As a result of the limited Contract Administration oversight, the performance of contract administration is almost solely being handled by the CM. This puts the MTA at risk. The desired function of the MTA and its staff, as it relates to contract administration, is for the MTA to operate an effective oversight function. The MTA should be monitoring the contract administration services which are being provided by the CM so that the potential for risk (cost and/or schedule) is minimized. This oversight is performed by the CA being involved with the RE office to monitor and discuss the RE's findings and interpretations of contract issues.

The construction/system contract CA's should have the duty to oversee the contract administration performance of the CM. However, the number of Contract Administrators within the MTA is insufficient to execute a quality oversight role of the CM as they administer the construction/systems contracts. Therefore, the MTA has placed itself in an environment of increased risks and reduced control, because they have removed themselves from the oversight function as it relates to the contract administration functions for all construction/systems contracts As a result of this insufficient oversight performance, the MTA is subject to increased risks which could, and most likely have, resulted in increased project costs and impacts on schedule or quality.

The following structural enhancements are necessary:

- The MTA should perform a more significant oversight role for construction and system contractors, with the CM performing the Contract Administration process
- The MTA should perform Contract Administration procedures over professional service providers' contracts more diligently

6.3 Staffing Levels within the Construction unit's Contracts group

A. **The MTA should increase the number of contract administrators to properly perform an oversight function of the CM/RE as they perform the Contract administration function on construction/systems contracts.** The MTA should be staffed with an additional number of Contract Administrators and Contract Managers for each line of the Metro Transit project. Structural modifications are pictured in Exhibit 2 below. The new structure requires the following items:

1. Some Contract Administrators will be strictly assigned to handling the RFP process
2. Some administrators will be strictly assigned to handle field assignments of Contract Administration oversight
3. There must be a sufficient number of CAs to monitor the day-to-day actions of the RE. The number would be contingent on the construction and systems contracts volume (field assignments)
4. There must be a sufficient number of PSP CAs to adequately administer and control the PSP contracts

By assessing the skills of the CAs, it will be possible to identify certain CAs whose skill strength is in the RFB/RFP process, while others will be stronger in the field office (RE) Contract Administration process (e.g. change orders, billings). The CA assignments should be based on the CAs strength. All CAs that handle PSPs will be based in the home office and will handle a PSP contract from the RFP through to contract close-out (cradle to grave).

We do not know exactly how many new individuals this will require, the exact number will increase or decrease as contract volume and RFP activity evolves. We do estimate that the number of individuals

necessary for administering the Construction unit's contracts could increase by 5 to 8 staff members. In our opinion, to adequately perform the PSP Contract Administration function (minimize cost and schedule risks), so that costs and schedule risks are minimized for the Professional Service Provider contracts, will require at least two CAs assigned to the EMC contract, one assigned to the P-D contract, and one CA assigned to the MRL - Segment 3 CM and the PMO contract combined. These assignment changes would force additional hiring from outside the MTA or transferring some Contract Administrators from the Administration group. However, the value of the additional controls over the contracts and their changes should offset the cost of the additional staff.

B. **We recommend a revised and expanded Construction unit's Contracts group - also discussed in the Contract Award function write up**. The recommended organization structure is represented in Exhibit 2 below.

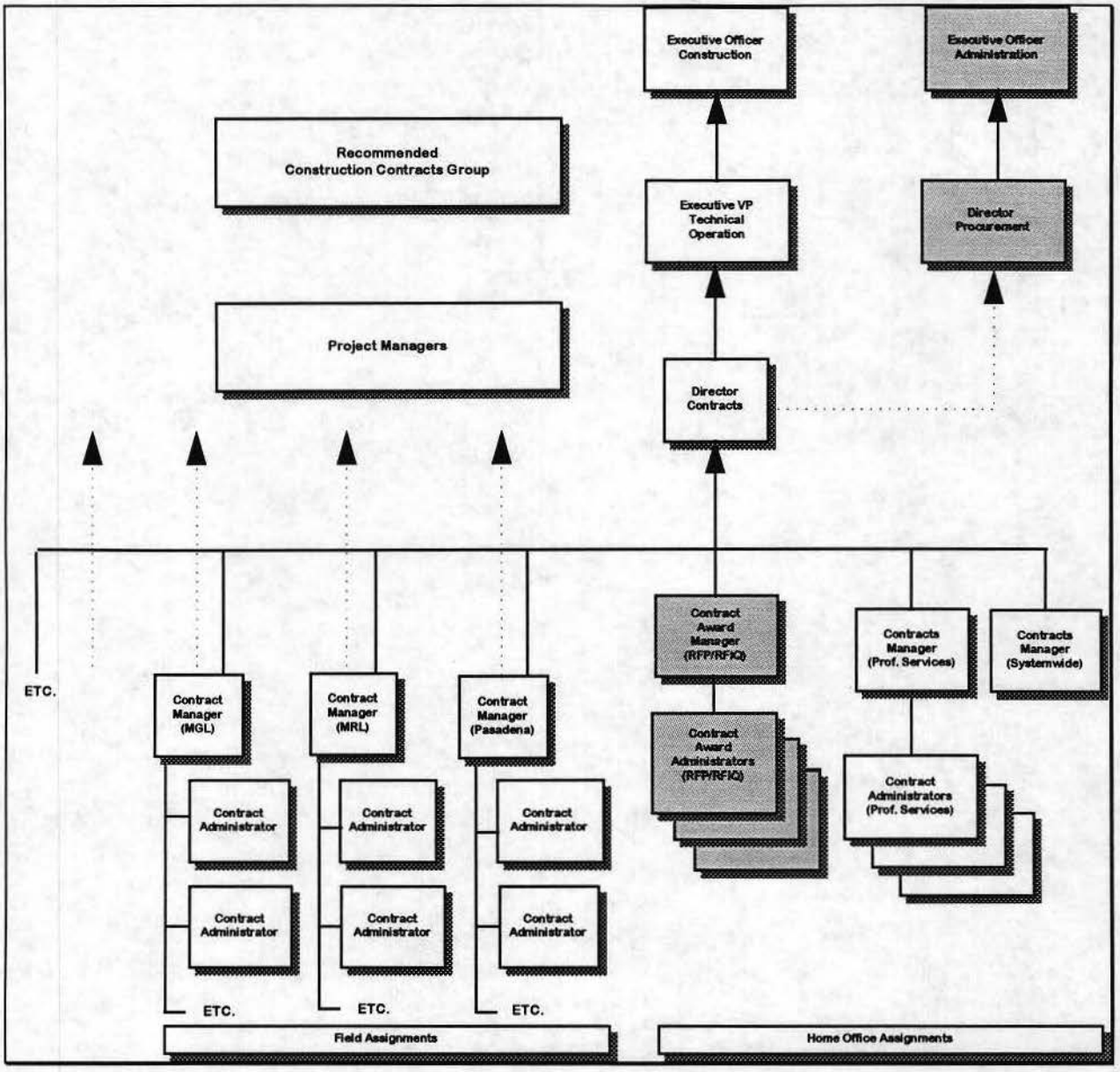


Exhibit 2

C. The organizational structure of the Contracts group in the Construction unit should revise its direct line reporting to the Project Managers. The CAs should have dotted line reporting to the PMs and solid line reporting to the Director of Contracts. The Director of Contracts would have solid line reporting to the Executive Officer of Construction. There should also be dotted line reporting from the Director of Contracts to the Administration unit for policy issues and coordination with the Contract Compliance personnel.

This reporting/organization structure provides the following benefits:

1. The Construction Contracts unit has a unique set of skills that are essential to serve the needs of the Construction unit.
2. The work performed by the Construction Contracts unit is very schedule sensitive. If the contract award and approval process is not able to maintain a rigid schedule and meet all programmed deadlines, significant costs to the Construction project can result. This "cost risk" factor makes it imperative that the individuals responsible for the project/program's budget have access to the technical resources necessary (e.g. CAs).
3. The requirements of the Construction unit related to the contract awards process requires "on-site" rapid response with direct and frequent communication. In our experience, to achieve that level of availability and control over a resource, it requires a shared mindset of common objectives and critical success points that is only developed through being physically co-located and supervised by the same program unit (in this case - Construction)
4. The dotted line relationship that will exist between Construction's Contracts group and the Administration's Procurement group should be sufficient to provide consistency of policy and quality across the MTA. MTA's Procurement group in the Administration unit can be very effective in setting policy and enforcing procurement guidelines through its dotted line relationship, especially is periodic compliance audits are performed.

By having additional resources at the Contract Administrator level it will allow the CA's to be involved in processes that they have previously been unable to devote sufficient attention. These include the billing process, the claims and change order process, and the project cost reporting process. Currently these processes are handled by the CM. The MTA contract administrators are not involved at a detailed level. The CA's are only involved at the end of the process for signatory approval and minor verification.

The new performance levels of the field CAs will allow them to actively monitor the contract related activities being performed by the RE office by being on-site with the PCEs and Office Engineers of the CM/RE. They will observe and analyze change orders, pay applications, general contract administration duties and the calculations and report issues of the Project/Management reporting activities of the CM on a scope basis. The CAs will not be directing or instructing the REs, the REs have the responsibility to perform contract administration, but the CAs will be involved to contribute

thoughts and ideas and to generally oversee the performance of the RE office as it relates to contract administration activities. The benefits of this involvement is a set of owner's eyes and ears within the production center of what the MTA is buying. The CAs will be able to discuss critical concerns regarding contracts with the RE and then elevate any issues needing attention to the appropriate individuals within the MTA.

This approach will ensure MTA involvement in the production process at an early stage to reduce some of the inherent risks of the processes. For example, the CA will be an observer in the negotiation between the RE/PCE and the contractor on selected significant payment applications. When issues come to light that need reconciliation between the contractor and the CM, the CA will be able to invoke involvement of the MTA. When the RE/Estimators/PCEs are involved in the process of costing change notices or negotiating selected change orders with the contractor, the CA will a part of this process. The CA may deem it appropriate to bring key issues to the attention of the appropriate party within the MTA (i.e. the construction manager assigned to that particular contract) or maybe even ask the MTA Estimating department to prepare their own Fair Cost Estimate of the change. CA involvement in the discussions between the RE/PCE and the CM's Program Cost Control home office staff regarding the monthly reports being prepared by the CM (e.g. Project Cost Report, Executive Report on Rail Program Status or the Project Manager's Status Report), will bring the key discussion issues to the attention of the MTA prior to the final issuance of the reports. This involvement will enhance the timeliness of the communication between the CM, the contractors and the MTA, while also enhancing MTA's oversight function to provide them more control over the events of their Transit Rail Program.

6.4 Overall Issue

In discussions with contract administrators, they believe if the barriers were removed and they had adequate time to provide the oversight roles of Contract Administration functions, they would be able to provide a return to the MTA in reduced costs, improved schedule or higher quality construction that would more than pay for the increased costs of the additional contract administrators. The current situation indicates that the CM has too much flexibility as it related to expanding the scope of contracts (change orders) due to the limited involvement of the MTA at the early phase of billings, changes, claims and reporting. The CA's involvement throughout these processes will provide key reporting on a very timely basis to the correct levels of the MTA.

Due to the internal discussions at the MTA regarding transferring the Construction Contracts group's direct reporting relationship from the Executive Officer of Construction to the new position of Director of Procurement in the Administration unit, we wanted to express our opinions regarding those discussions. We do not agree with having the Contracts group currently in the Construction unit report directly to the Administration unit. Our recommendation is to modify the current structure to add only dotted line reporting to the Director of Procurement in the Administration unit.

The potential of centralizing the contract procurement process within the MTA organization could seriously impact a successful segment of the MTA. If the MTA should so chose to centralize the construction, systems and professional services contract procurement, they run the risk of impacting a well run function. The need to maintain the contract award function within the construction unit is predicated on the function's use of technical skills, its needed coordination among the parties (engineering, construction, project control) and the need to react quickly to changing demands. We believe that centralizing this function would potentially impact the quality, timing and costs of the MTA's construction programs.

CHAPTER VII
Volume B

BILLINGS AND PAYMENT APPLICATIONS

1.0 Nature of the Function

The Billing and Payment Application function (also called Invoice Processing) is a process of determining the magnitude of progress performed by contractors or professional service providers (consultants), quantifying the value of this progress based on the terms of their contract and processing the payment to the contractor or consultants.

The MTA's objectives for the Billings/Payment Application function are to pay the contracted amount to the contractors/consultants in a timely fashion and control the process so that the MTA receives their contracted service/product on time, at the contracted level of quality, at a cost-effective price and in compliance with MTA policies, local, state and federal requirements.

The major risk for an owner/Authority related to payment applications is a contractor billing for services not yet performed or for product not yet delivered or installed based on contract terms. Under these circumstances, the owner has (1) negatively and unnecessarily impacted its cashflow (2) placed itself at risk if that contractor were to cease performing on the contract (3) placed itself at risk if the contractor were to suffer financial distress and file for bankruptcy or liquidation and (4) failed to administer its financial responsibilities in a fiduciary manner.

The payment application is the billing documentation submitted by the contractor or consultant each month requesting payment for services or products provided. Because of the fixed price component of the construction and system contracts, determining the amount of monthly progress the contractor has produced and therefore what amount of the fixed contract amount the contractor is entitled to receive is a primary responsibility and concern each month for the CM and the MTA. The consultants payment applications are based on hours of input related to specifically designed work tasks and their contractual hourly rates. The subjective areas relate to propriety of hours spent for the produced output, the interpretation of the scope of the work tasks and assessing the contractors requests for additional cost reimbursement for hours expended in excess of the budgeted hour limits for specific work tasks.

2.0 Issues of the Function

- What organizational structure changes within the CM and/or MTA are necessary to achieve the appropriate level of oversight by the MTA regarding this process?
- What organizational structure is necessary within the CM for MRL Segment 3 to perform the payment application procedures to minimize cost and schedule risks?
- What involvement should the MTA and CM have as it relates to the billing/payment application process?
- What enhancements to the process could be implemented to increase the control over the process by the CM and/or the MTA?

3.0 Procedural Findings Regarding the Function

Construction and System Contracts

The overall responsibility to perform the tasks associated with the Billing and Payment Application process for construction and system contracts resides with the CM. The MTA is responsible for the oversight of the CM as they perform the tasks associated with this process. The responsibility for accuracy and propriety rests with the CM. The Billing/Payment Application process, including the majority of the assurance procedures, are currently being performed by the CM. The MTA is only performing a minimal oversight role regarding this function.

3.1 The following summarizes the major duties being performed by the CM organization:

1. Provide staff capable of addressing and performing the Billing/Payment process
2. Review and certify monthly invoices submitted by the contractors, verify accuracy and compliance with all applicable terms and conditions of the construction and systems contracts, and to recommend payment by the MTA
3. Monitor stop notice actions, lien releases and waivers, inform the MTA of such actions, and recommend any adjustments to the progress/retention payments
4. Identify and document all required back charges

5. Determine when enforcement activities (e.g. assessing liquidating damages, initiating withholding on progress payments, initiating contract termination for default) should be initiated on construction contracts and make recommendations for such actions to the MTA.
6. Perform contract close-out procedures related to final payment processing, release of retention recommendations and settlement of outstanding liens
7. Provide cost engineers to analyze and process monthly payment information in a timely fashion, to maintain the computerized payment system and to forecast cost at completion

3.2 The following summarizes the major duties being performed by the MTA organization:

1. Oversee the duties being performed by the CM and the deliverable being created as they execute their Billing/Payment Application responsibilities
2. Evaluate the recommendations of the CM regarding enforcement activities necessary and release of retention and final payments, and then execute the required actions if the recommendations are accepted by the MTA management and MTA construction PM/CM
3. Process the actual payments to the contractors based on the invoices reviewed and certified by the CM

3.3 The following process (Exhibit 1) diagram summarizes the function's activities performed by each participant:

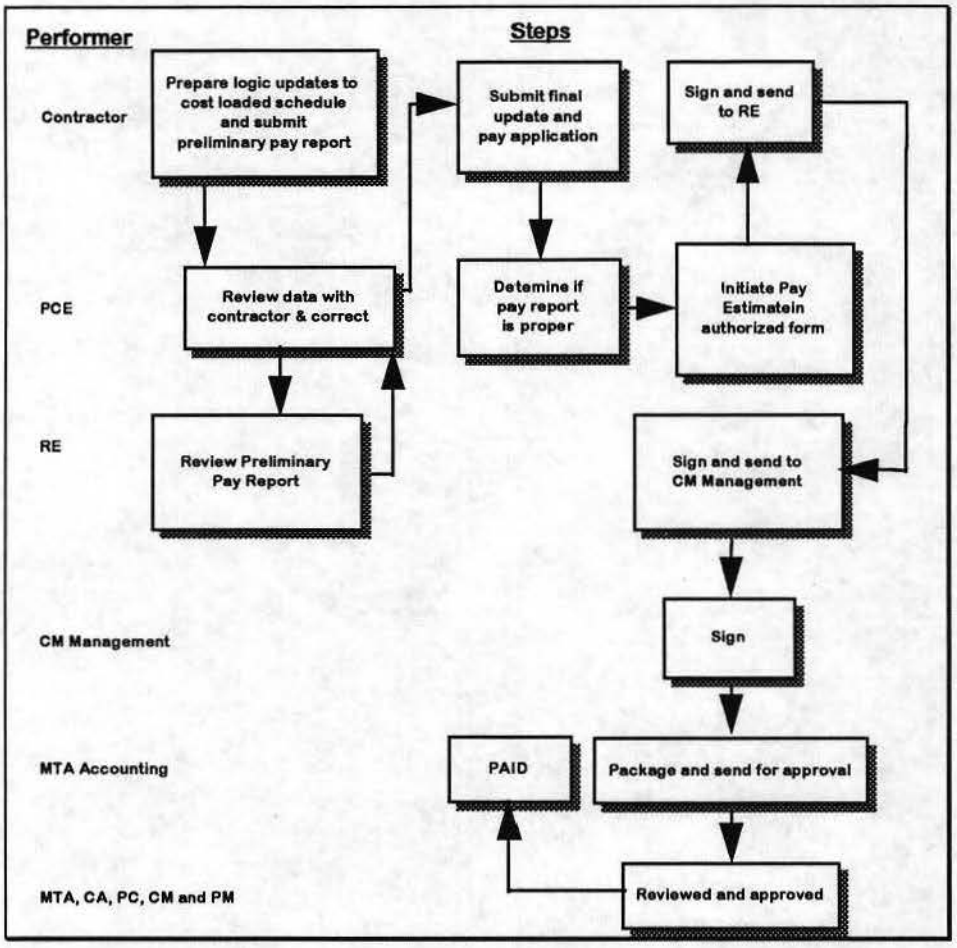


Exhibit 1

4.0 General Findings and Implications

4.1 PCE Performance

The Payment Application is initially processed within the CM (after the initial draft comes from the contractor) from inception to final packaging without adequate involvement of a representative from the MTA. The payment application is then circulated through the MTA only after it has been formally packaged and approved by the CM. There is a risk inherent in having the entire process administered by the CM with no required involvement by the MTA, because inadequate assurance/oversight

procedures performed by the MTA could give rise to contractor payments in excess of actual performance.

The payment is based on (1) the fixed contract value established for a specific scope of work, (2) the production to date and (3) the production during the period. The payment level would only be accurate if the records regarding production maintained by the CM were accurate and in agreement with the contractor's records. The PCEs are the primary CM consultant responsible for processing the payment application. The PCE is the CM consultant who should know the level of work the contractor has accomplished during the month. If the PCE is tracking performance during the month, the RE will be in a stronger position when it is time to review, negotiate, and adjust the monthly progress and payment application.

As described in the Contract Administration and Resident Engineer sections of our report, the PCEs at the CM level do not have (1) adequate time to perform the detailed activities related to tracking progress during the billing period, (2) sufficient technical abilities as they relate to cost control and (3) an adequate level of resources available to call upon for guidance. As a result, the potential exists for the contractor to be paid for services not yet provided if they claim progress that in reality has not taken place and the PCE is unable to identify the situation.

It is difficult to determine if the above situation is taking place, unless a progress interruption event occurs such as a bankruptcy or a contractor default. Throughout our inquiries and studies we have not found any specific examples where a contractor was significantly prepaid. However, this does not mean it is not happening because often prepayments during the life of a contract can go unnoticed even by internal audit when they are performing their close-out audit. Because the symptoms are hard to detect, it is important that the process to prepare the pay applications is very sound and have the appropriate "checks and balances" and controls.

4.2 MTA Involvement

The involvement of the MTA representatives (CA, PC, CM, PM) is occurring too late in the process to provide the necessary oversight essential to minimize cost as it relates to the progress payments to the contractor. There is a risk for payments to be submitted by the contractors in excess of the contractor's progress because of the lack of MTA involvement. The authorizations that come from the MTA tend to be more perfunctory than actual affirmation of approval. The MTA CA's admit they have inadequate

time to review the payment application packages in detail, and as a result they are relying on other individuals within the MTA to do the detail review. However, the other individuals being relied upon within the MTA are also extremely busy and generally would not have ample time to verify the details of the payment application and typically be at a level within the organization where they would not be familiar with the details of the process.

The contract between the MTA and the CM addresses this risk by assigning responsibility to the CM as it relates to payment amounts. It is this requirement, that provides the MTA with an alternative if a negative situation were to arise. However, it is preferable to implement a procedure that adequately controls the process and avoids utilizing that alternative.

As the Project Control Department is utilizing a cost loaded schedule, it is imperative that those people acting as PCE's have the talent and technical skills in both scheduling (critical path methodology) and cost control estimating/reporting. Currently, the CM's PCE individuals are strong schedulers but generally they only have fair cost control knowledge and experience. The PCE's background is generally in engineering/scheduling rather than cost issues/accounting. This information was provided through interviews and survey results. The additional duties of cost control and project reporting are generally new areas for them. They are in need of additional training in these areas. This issue, coupled with the limited review by the MTA, subjects the program to increased risk.

The invoices that are processed by accounting and paid by treasury are often extremely significant payments. There are strict prompt payment requirements that the MTA must adhere to when paying a contractor. As a result, the construction invoices need to receive timely processing and attentive service from accounting and treasury. It would facilitate the control of this process if an individual within these areas could be assigned the responsibility to monitor the flow of invoices, and when bottlenecks occur redirect some resources to address the issue.

5.0 Recommendations for this Function

5.1 The current structure of assignments for the Billing/Payment Application process between the MTA and the CM is an acceptable structure and in accord with their overall philosophy of Oversight vs. Perform. Therefore, we recommend the MTA not assume this function from the CM. The MTA should continue to require the CM to verify and certify the billings/payment applications for construction and system contracts, while the MTA performs the oversight role.

This structure provides the MTA with the following benefits:

1. Reduced risks: the structure of having the CM verify progress and the MTA overseeing the process reduces the risk of pre-paying for services or products (a system of dual "checks and balances")
2. Consistency & Efficiency: by having the billing prepared and verified by the same individuals who monitor and check contractor progress, consistency and efficiencies are created

5.2 **To sufficiently perform its oversight role, it is essential that the MTA (1) execute their oversight role earlier in the functional processes - they cannot wait until a report is issued to review the performance of their CM and (2) incorporate more assurance type activities into the functions performed by the CM and (3) employ the "best and the brightest" skilled individuals within their own ranks and within their consultant ranks.** The following items discuss recommendations for the MTA to enhance their oversight role and to also enhance the payment application/billing function.

5.3 **The CM must employ qualified technical Schedule and Cost Control individuals who will monitor the progress of their contractors' on a more timely basis (daily or weekly based on the type of contract).** If the PCE maintained a progress log on the contractor's activities, the process of reviewing and negotiating the contractor's pay request would be more accurate and expeditious, because they would have preformulated their opinion on progress for the month. We are aware of some PCEs who are currently utilizing this type of log with positive results.

5.4 **The MTA Contract Administrators assigned to a specific contract should be involved in the payment application process monthly negotiations between the PCE, the office engineer and the contractor.** The CA could perform the oversight role for this function by being a part of the negotiations between CM and Contractor regarding quantities and progress resolution for the monthly pay request. The risk of surprises and/or potential over payments will be significantly reduced with the MTA's CA procedures redefined (as recommended in the Contract Administration section) so that the majority of their time is spent in the field working with and overseeing the PCEs on billings, changes, claims, contract administration and reporting.

5.5 **The Contract Administrators within the MTA should be assigned accountability (through performance measures) for the payment applications they authorize.** This requirement would only be after the CA became involved in actually providing oversight during the preparation of the payment applications. Currently, the authorization signatures appear to be more superficial than based on the signer's confidence that the document being signed has been personally checked for accuracy. Currently, there is a tendency for the signer to place too much reliance on other individuals within the MTA or the CM to review or prepare this document and other related documents accurately and/or to verify its propriety. This situation is perpetuated due to the staff resource limitations.

5.6 **The section on Contract Administration identifies the need and discusses the recommendations regarding adding additional Contract Administrators.** The additional CAs recommended to be employed with their new scope of work and procedures will provide the necessary skilled personnel, with the correct focus on the oversight function, for the MTA as it relates to the billing/payment application process.

5.7 **We recommended that a specific individual from the internal audit department of the MTA be assigned the responsibility to audit billing and payment applications being submitted on a random basis.** This individual would spend his or her time auditing the payment applications and verifying that adequate payment application support exists for payment. The focus would be on the adequacy and propriety of the support documentation used as justification for the payment. This would include the daily records recording the progress during the billing period, records for cost reimbursable items, change order payment support including overhead documentation and assessing the issue of prepayment. The benefits achieved would include: (1) an enhanced oversight role for the MTA providing them with more control, (2) notification to the contractors that accuracy of the payment applications is a key objective of the MTA and it is being monitored.

The benefits of incorporating a higher quality assurance function within the billing/payment application process will benefit the Agency in a number of ways. (1) The contractors will know that their payment applications are subject to audit on a random basis and therefore they will be less inclined to prebill or erroneously bill for progress and (2) the CM will be aware that their performance functions (as they relate to billings) are being adequately overseen by an employee of the MTA, therefore giving them the

additional incentive for accurate and timely performance. The Agency receives both objective and subjective benefits from these additional procedures.

6.0 Procedural Findings Regarding the Function

Professional Service Contracts (Consultants)

The CM and EMC's only involvement in consultant payment applications is preparing their own monthly invoice for payment based on the terms of their contract. The MTA is responsible for performing the duties associated with reviewing and authorizing consultant invoices for payment.

The following summarizes the major duties being performed by the MTA organization:

1. Review, certify and authorize for payment the monthly invoices submitted from Professional Service Providers including performance-based fee payments
2. Administer the performance based fee evaluation process (incentive fees) and process the payments for this fee.
3. Perform internal audits of overhead rates utilized by Professional Service Providers (cost reimbursable contracts) in their invoices/payment applications

7.0 General Findings and Implications Regarding the Function

The professional service providers (Consultant) payment applications consist of reimbursements for time and materials that the consultant is providing to the MTA. The consultant contracts are comprised of specific work packages which have budgeted dollar values and scope outlines describing what service and deliverables are to be provided with that work package. As the consultant progresses through the performance of a particular work package, the consultant will bill the hours and expenses incurred in providing that service. The contract administrators review those monthly invoices for reasonableness and provide their level of approval. The level of approval that the contract administrator applies consists of a recommendation that the invoice is accurate and a valid and to be paid by accounting. The contract administrators determine their recommendation based on their knowledge of the scope of the work task and the reasonableness of the fee being billed. The contract

administrators are not involved in determining the efficiency of the consultant. The efficiency of the consultant is monitored by either the engineering group within the MTA (for the EMC) or the construction group within the MTA assigned to a specific project (for the CMs).

The ability to accurately quantify the value of the service being provided by a consultant is a difficult process. There was a study done by Fluor Daniel in June 1993 regarding the EMC and its submission of invoices and the MTA's review of those invoices for approval before payment. Fluor Daniel concluded that, "The MTA's (RCC) practice regarding the review, processing and auditing of EMC charges met the intent of established MTA (RCC) policies and procedures. Additionally, based on the sample invoices that were reviewed, it appears that the EMC submits a sufficient level of detail to support cost charges to the various projects". Fluor Daniel did not recommend any substantial deviation from the MTA's (RCC) current practices. Based on our review, the level of scrutiny provided by the MTA as it relates to consultant invoices, is consistent between the EMC and the construction management firms. In general, we are in agreement with the opinion of Fluor Daniel, with certain additional recommendations.

The MTA controls consultant charges via (a) initial establishment of a project budget, (b) having accounting personnel check the mathematical accuracy of the invoices prior to processing the invoice for payment, (c) having internal audit perform post payment or post contract audits which review the wage rates utilized in the invoice, the adequacy and accuracy of the support documentation provided to justify the level of hours charged to a particular work package and the overhead rates utilized within the invoice.

These procedures are standard control procedures for consultant pay application verifications. The level of control achieved through post invoice preparation review procedures however, is not a sufficient control mechanism. By the time the internal audit department can review most materials, the invoice has been paid by the MTA.

8.0 Recommendations for this Function

8.1 We recommend that the contract administrator take a more active role in reviewing the payment applications. Many of these recommendations as they relate to the performance by the contract administrator are included in our contract administration write-up.

8.2 **We recommend that internal audit continue to monitor the payment applications on a sample basis during the life of the contract and ultimately at contract close out.** There should be specific audit procedures developed to assess if any prepayment situations or cost risks are present within the in-process contracts, or if any prepayments or cost risks existed during the life of the closed out contracts.

8.3 **We recommend that the assigned MTA Engineering and Construction staff continue to monitor the hours being requested for reimbursement during each monthly pay application.** Please see the Engineering and Project Controls - Cost write-ups for additional recommendations that would have by-product benefits to the consultant pay application process.

8.4 **We recommend the MTA require all consultants to prepare detail billings of their time, identifying hours worked and tasks accomplished.** Because of the subjective nature of a consultant's service, detailed billings describing the tasks being performed by individual consultants are a valuable control mechanism. We are aware that the MTA has currently instituted a procedure for the EMC to submit detailed billings describing the work the consultants are performing. We commend the MTA for instituting this requirement and we recommend they continue to require detail billings from the EMC. In addition, we would recommend that they institute a policy to obtain detailed billings from their other consultants in those areas where the work package details are not of such a specific nature that control of the hours can be assured. By instituting this requirement for detailed billing, a message is sent to the consultant that their performance is being monitored from not only a technical basis but also from an efficiency basis. A change in the mind set of both the consultant and the MTA regarding controlling costs will be a positive benefit to the MTA transit program.

8.5 **We recommend that as contracts with consultants are initiated, a procedure should be instituted whereby the budgets for particular work packages are increased in detail and scrutinized prior to approval and acceptance. Through this scrutiny, better estimates regarding the level of effort needed to perform a particular work package should be documented and agreed to by both the MTA and the consultant.** A great deal of subjectability exists through the consultant contracts and ultimately is reflected in the consultant's payment application because initial budgets are established at a more global basis rather than at a specific task-driven detail basis. Therefore, when payment applications are submitted, if the MTA

utilizes the recommended detailed budgets, a clean reconciliation process will be possible comparing the hours billed and the products produced to the anticipated level of effort to produce that product (detailed budget). Through this process, disputes regarding cost recovery of fees incurred in excess of the work package budget will be better understood, documented and justified. In addition, this procedure institutes an additional control procedure regarding the cost issues of consultants. By instituting this control procedure there exists the potential of limiting the cost growth of a consultant contract through accurate, timely and continuous monitoring.

Please see the Contract Administration, Engineering and Project Control - Cost chapters for additional recommendations that would have by-product benefits to the consultant pay application process.

CHAPTER VIII
Volume B

RESIDENT ENGINEER

1.0 Nature of the Function

The Resident Engineer function is the primary function of the Construction Management Consultant (CM). The Resident Engineer (RE), as delegated by the CM, is the authorized representative of the MTA charged with the professional administration of the construction and systems contracts. The RE is the focal point for on-site construction management activities, and he is the primary point of contact with the contractors during construction. The REs report to a CM Area Manager responsible for multiple construction and systems contracts. Other personnel who perform specific RE duties and report directly or indirectly to the RE include:

- Office Engineers
- Quality Inspectors
- Geotechnicians
- Document Controllers
- Administrative Support
- Project Control Engineers (Cost and Schedule) [PCE]
- Contract Administrators
- Estimators

Currently, the overall responsibility to perform the tasks associated with the Resident Engineer function resides with the CM. However, many of the tasks of a specific Resident Engineer are monitoring and controlling related. REs review the contractor's progress, provide guidance and problem solving ideas to the contractors and the MTA and monitor compliance with contract terms. The staff that assists the RE are the "performers" of the tasks within the Resident Engineering function. The MTA is responsible for the oversight of the CM's activities as they perform the tasks associated with this function.

2.0 Issues of the Function

The current process of Resident Engineer is designed to achieve the MTA's objectives that:

1. Projects are accomplished through quality construction and with sound safety practices
2. Projects are completed on schedule and within budget

3. All charges, progress payments, changes and claims are well documented, negotiated and processed in a timely and cost-effective manner
4. Field quality control surveillances and inspections are accomplished and issues are resolved in a timely, cost effective manner
5. The interrelated CM services and activities are monitored and coordinated so that the construction and systems contracts are not impacted (e.g., Environmental, Permitting, Geotechnical, Third-party interactions and Surveying).

The RE is the focal point of the CM, therefore the RE function needs to be the subject of a system of checks and balances from the CM's home office to protect the interests of the MTA. *What are those checks and balances that are currently in place, or recommended to be put in place, to minimize the project's risks and balance the issues of cost, schedule, quality and safety?*

The MTA must also perform oversight activities of the RE office to assure themselves that they are obtaining the correct products and services at a fair and equitable price for the citizens of LA County. *What oversight activities/procedures are being performed by the MTA, or should be performed by the MTA, to execute their oversight role?*

3.0 Findings Regarding the Function

3.1 Organization and Division of Duties

The following summarizes the major Resident Engineer duties being performed by the CM organization:

1. Provide qualified professionals who can perform the RE function, including office engineering, cost engineering, scheduling, estimating, change analysis, construction contract administration, third party coordination, environmental, safety and quality control
2. Coordinate all construction activities, monitor contractor progress against the accepted schedule, recommend construction techniques to expedite the project and work with the contractors to mitigate schedule impacts
3. Make recommendations for construction improvement to the MTA and contractors including quality enhancements, safety enhancements, construction techniques, and "off hour" construction recommendations

4. Enforce contractor compliance with all terms of the contract including construction impact mitigation requirements
5. Contract Administration function: **this function is the subject of Chapter VI, Volume B**
6. Billing and Payment Application function: **this function is the subject of Chapter VII, Volume B**
7. Change Order and Claim function: **this function is the subject of Chapter IX, Volume B**
8. Manage, review, inspect, monitor, verify and document quality and safety issues: **see separate Chapters XIII and XIV in Volume B**
9. Coordinate (1) utility work, (2) the movement of MTA supplied equipment and materials, (3) with the MTA public affairs department to respond to community concerns and recommend mitigation actions, (4) survey work and (5) third parties to the project
10. Assist the MTA's Environmental Services department in regulatory compliance and permitting
11. Coordinate the review of submittals with the EMC and the MTA as required, track the acceptance process of submittals (time related) and maintain the document control over the submittals through the MTA's submittal tracking system
12. Ensure operational and start-up tests are satisfactorily completed
13. Provide training for operations personnel

The following summarizes the major Resident Engineer related duties being performed by the MTA organization:

1. Set policy, provide funds, enter into contracts with the contractors and provide the formal contact with third parties, the public and high-level agencies
2. Oversee the RE's activities, and discuss and resolve construction and systems issues as they arise utilizing resources from the CM and from the MTA
3. Monitor the construction and systems contracts' activities through interaction with the Area Managers, the REs and their staff, provide direction as determined appropriate, and authorize those related events that require authorization after review
4. Review contract modifications including schedule changes, change orders and claims, discuss the issues with the RE, request alternative solutions from the RE and ultimately approve all required contract changes to the level of each entity's authority
5. Review and approve payment applications from the contractors and the CM

An RE is the on-site individual who has day to day responsibilities for CM services. The RE directs, supervises and monitors the other CM personnel that are on site. The RE supervises, monitors and

coordinates with the contractors. The REs report to specific Area Managers (AMs) that have an overall responsibility to coordinate and control a group of contracts in the assigned area and to address those issues and risks that impact more than one specific contract. The REs and the Area Managers are experienced professionals in construction with a specific skill set related to rail construction. The REs and AMs average between 17 and 20 years of construction experience and approximately 8 years of specific Rail Construction experience. These experience levels are consistent with the REs counterparts in the MTA and the EMC

The RE office is coordinated and supported by the home/area office of the CM firm and its upper management. The RE office is subjected to a system of checks and balances from the home/area office and the MTA organization as discussed below:

3.2 *Cost*

The REs only have change authorization to $25,000. Any change above $25,000 but below $50,000 must be approved by the CM's upper management. Changes above $50,000 must be approved by the MTA Staff and/or its Board.

The process of cost determination for changes and claims (Preparation of a Fair Cost Estimate) is primarily performed by the CM's home office through their Estimators. This separation of duties allows the RE and a home office Estimator to both look at the change parameters utilizing their own set of skills and resources. Due to the volume of changes and claims to this program, there has been a concern on the part of the REs about adequate access to Estimators. The quality of the Estimators is rated as very good within the CM and the MTA, but there is a limited level of this resource available to address the volume of critical changes.

The work of the PCEs has been generally focused on historical cost reporting for the project rather than forecasting or "forward - looking" analysis of the cost situation. There was a recent move by the CM to combine the skills of schedule analysis and cost reporting within an individual PCE at each RE field office. This process saved the MTA consultant fees, but it has diminished the overall skill set of the RE office. The PCEs that remain generally have strong schedule skills but are generally not as skilled in the area of cost analysis and exception reporting. Based on the PCEs responses to our survey, they are currently responsible for many critical activities within the RE office (e.g., they are concerned about

their workload, because some beneficial management data analysis cannot be performed due to time pressures). They commented that:

1. 30 - 50% of their time can be spent related to schedule issues
2. Pay application (Invoice Processing) was their prime activity and it had to be performed on specific days of the month (10% of their time).
3. Were required to assist the RE with changes and claims (10% of their time).
4. They prepared reports, attended meetings, surveyed the field activities and performed forecasting analysis. Those items encompassed the remaining 30 - 50%.

The time requirements of the PCEs has a direct impact on their ability to perform "forward-looking" cost and schedule analysis (forecasting). As a result of their time pressures, they generally are limited in their ability to assist the RE with this type of analysis. The more global schedule analysis and "forward-looking" activities are to be performed by the head Schedule Managers from the CM's home office.

The monthly calculation of the Estimate to Complete (ETC) and the anticipated cost at completion is prepared by a group of CM professionals including the RE (field), the PCE (field) and the Project Controls department (home office) including the Lead Cost Manager (home office). After this group determines the ETC and the anticipated cost at completion, the upper management of the CM must review and approve the calculations. The reports are then sent to the MTA's Lead Cost Manager and the MTA PM for review and approval. This combination of resources coming together to prepare the cost estimates provides a level of control within the CM organization through the inherent checks and balances of the process.

3.3 Schedule

The overall schedule analysis of the RE office has been generally viewed as positive. The PCEs are responsible for the preparation of the project schedule information and maintenance of the CPM programs. Again, the PCE's performance has been generally very strong as it relates to historical reporting and basic file maintenance of the schedule programs and data (as detailed above). They have generally not been as proactive in analytical review ("what if analysis") of schedule mitigation issues as the MTA would expect. Generally, the PCEs do not consistently determine on a "forward-looking" basis what activity reorganization could be performed to enhance the projects schedule without direction from the MTA's Program Controls Group. It is important that the PCE's don't focus on

analysis and projections to the detriment of the program up keep, but when the situation demands analysis, the PCE should act without the need for MTA direction.

Schedule control resides with the MTA's Senior Schedule Engineer. This individual is provided the overall program CPM data for analysis and review. In addition, he is provided with a schedule report addressing the elements of the specific projects. This single individual handling the oversight of the scheduling work being performed by the CM as it relates to major projects such as MRL - Segment 2 provides the MTA with a single focus oversight with control feature.

3.4 Quality

The area of Quality Control and Quality Assurance is the subject of chapter XIV, Volume B. The checks and balances for quality related to the RE function are addressed in that write-up.

3.5 Safety

The area of safety is the subject of chapter XIII, Volume B. The checks and balances for safety related to the RE function are addressed in that write ups.

3.6 General

The performance of the RE's has been observed to be good. However, they have consistently receive a B rating from the MTA through their incentive fee report cards. This indicates a lack of "Continuous Improvement " within this function for the CM organization as a whole. The MTA employees working with the REs report that they are providing an appropriate, cost effective service to the MTA. However, there are some concerns in the day to day operations of the RE office. Those concerns include (1) the RE offices' need for Estimators to perform timely FCEs generally are not being met due to a resource limitation within the CM organization. For example, certain projects such as B251 Vermont/Hollywood Tunnel could employ an Estimator on a full time basis to facilitate the timely resolution on CNs and claims, but instead the B251 RE has to request the services of the Estimators through the CM's Home Office like all other RE offices.

Recently the MTA Construction Division employees assigned to MRL Segment 2 have been combined with the MRL Segment 3 construction employees. Through this combination, the Segment 3 employees

have been given the authority and the lead positions for the combined MRL. This combination has created confusion among the MTA employees and their consultants as it relates to reporting, communication and action plan determination. Working relationships that had been developed based on performance styles, project detail knowledge and patterns of communication and reporting have all been impacted due to the combination of MTA Construction staff.

The REs responded in their survey and in interviews that they spend a significant amount of their time responding to requests for information from the MTA staff and meeting with interested parties addressing the most recent performance of the project (20%-25%). The program has been subjected to such a high level of visibility within the public's eye and the media that the MTA staff feels compelled to be intimately informed of the recent day to day activities of the projects. This involvement requires the REs and AMs to be very responsive to the informational requests of the MTA staff. Because of the involvement with the MTA staff, the REs are not as active with the contractors and promoting progress on the projects. This situation is exacerbated by the combination of Segment 2 and 3 MTA leadership mentioned above because now MRL Segment 3 staff and Segment 2 staff are both contacting the REs.

The CM contracts have an incentive fee clause which allows the MTA to produce a report card or evaluation of the CM. This evaluation is converted into an incentive fee grade and then into a performance based payment to the CM (X% of a calculated base). Within the MRL Segment 2 CM's contract and report card format there are numerous categories for grading associated with the RE function. As the CM's performance has evolved from 1992 to 1994, their fee earned percentage has remained surprisingly constant. The last four evaluations (September 1993 - June 1994) available for the CM reflect that the RE's performance has begun to slip in a number of areas, but their overall score and fee remains the same. These areas also are those items subject to a number of our recommendations reflected throughout our report. During the last four evaluation periods, the CM has lost approximately one-half of a grade (B to B-) on the following RE duties:

- Reports
- Claims mitigation
- Contract compliance
- Schedule
- As-Built Drawings

Written evaluations tended to reflect the problem encountered during the evaluation period for the entire project (i.e. as the project's schedule began to slip, the RE's evaluation scores for schedule also

slipped and as the level of claim activity increased, the RE's evaluation scores for claims mitigation declined.)

4.0 Implications of Our Findings

4.1 Cost:

Cost information is analyzed and prepared primarily within the ranks of the CM (RE, AM, PCE, PC Managers) and then provided to the MTA, and as a result, the MTA is not an active participant in the discussions regarding cost issues, including anticipated estimates to complete and changes and claims potential costs. This lack of detailed involvement has the impact of increasing the volume of data requests from the MTA staff. Since the MTA staff are not involved in the detail discussions of future anticipated cost issues they are required to contact the RE for the backup information and discussion details of contract cost changes. These conversations may or may not bring all issues to light for the MTA staff and the Board on a timely basis. As a result, there is a valid concern that important project information is not being shared with the owner on a free and open basis. The detrimental cost issues that are a "potential" are not always brought to the attention of MTA staff on a timely basis and very often are not quantified into the Management reports when they are first known or suspected. Generally, a great deal of analysis, discussion and refinement to the details take place within the CM before the MTA is adequately notified of the full situation in writing.

Because of the limitation on the availability of the Estimators within the CM organization, the RE is responsible for preparing some of the Fair Cost Estimates. When the estimate is prepared by the individual who has detailed daily perspective on the activities that led to the change (RE), the potential exists that the RE's FCE will be different than an FCE prepared by a specialized Estimator who was focusing on the change facts and was not intimately involved with the contractor's daily activities. Because of the increase in volume of change order and claim activity, there is insufficient Estimator capacity available on a timely basis to the REs. This lack of availability impacts the RE and ultimately the MTA in a number of ways. First, changes may not be reconciled in a timely fashion necessary to maintain schedule and minimize cost. Second, potential impacts of the change or claim may not be adequately controlled (cost and schedule impacts), because the RE may not have the specific technical ability of the Estimator (mechanical, structural, electrical, etc.) to facilitate the costing of a particular change or claim.

4.2 *Schedule*

The issue of meeting the Revenue Operations Date (ROD) is at the forefront of the minds of the CM/RE, MTA Staff and the Board. Once a commitment for delivering a product on a scheduled date has been established, it is correct to do whatever possible to meet that commitment as long as (1) the commitment is appropriate and possible and (2) the elements of cost, quality and safety are addressed when setting the commitment and when subsequently evaluating the continued propriety of that schedule commitment. The process of continually evaluating schedule decisions by factoring into the decision making process the associated impacts on cost, quality and safety is essential. To have a mindset that is too focused on schedule can increase the program's risk level. A project may be completed on time, but it could have cost significantly more than budgeted, might not be of the correct quality and/or the construction process could have put individuals in unsafe situations because schedule was the driving decision factor.

Schedule analysis that attempts to improve the schedule through work - around situations is always required of the CM/Contractors, but it is not being performed sufficiently by the CM. The MTA has to request and direct the CM individuals (REs/PCEs) to perform the "what if analysis", rather than simply being provided with the information. The "value added service" of the CM (i.e. creating schedule options for the MTA to consider) is not always being provided for two primary reasons (1) the PCEs of the RE office do not have ample time to do the "forward- looking" analysis because of their heavy work load of payment application processing, cost reporting and schedule program updates and (2) the PCEs, even though more skilled in schedule issues than in cost reporting and projecting issues, are generally focused on historical reporting and file maintenance to the detriment of analytical "forward - looking" analysis.

4.3 *General*

The quality of the RE is one of the key factors in ultimately obtaining a high quality project. The MTA has the ability to remove any consultant that it does not deem to be performing up the MTA contractual requirements. The current composite of REs is rated highly by the MTA and our review has also indicated that they are doing a good job. There is a recommendation on the part of the CM to assign and include the REs as soon as possible into a project. Having an RE assigned to a particular project early in the planning phases would provide additional benefits to the MTA as that RE would

understand the fundamental parameters of the contract and the basic scope of the project. If REs are assigned late in the process, they are not able to build a strong foundation from which to control the contractor's activities and the project's progress.

The same control benefit exists from requiring the REs to close-out a project prior to departing for a second (new) project. When REs delegate the close-out procedures to others there are intimate details which are lost, and as a result, there exists an increased risk of changes arising or being approved for amounts in excess of fair and equitable levels. When an RE is only dealing with contract close-out on a part time basis there also is a significant increase in the cost risk, because the time span of contact close-out increases significantly. Memories have a tendency to fail, details lose some of their clarity, and the documentation may not adequately describe the details of a change or the accuracy of the costs associated with that change.

The timeline of a project can often be summarized graphically to show the change activity. In a theoretical project, the change activity is high in the beginning of a project as design issues are addressed and the "bugs" are worked out, followed by a steady period of production and then culminating in change and claim activity during the punch list and close out period. This pattern is reflected in Exhibit 1 below.

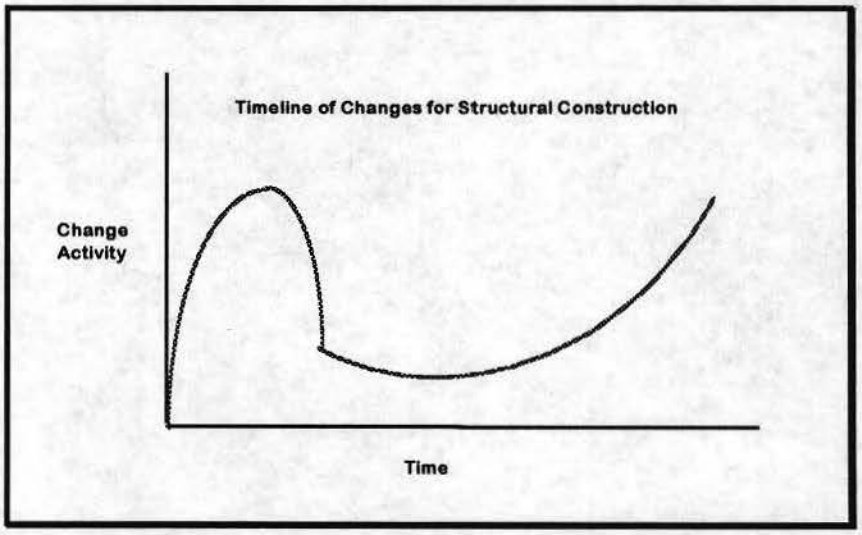


Exhibit 1

Therefore, having the REs assigned at the earliest point in design possible and retaining them through prompt close-out maximizes the ability to reduce the cost and schedule risks of a project.

REs are subjected to multiple MTA personnel requesting data or information and potentially directing the RE to perform conflicting services. With multiple MTA persons also providing information that the RE may rely upon in making a decision, there is an increased risk of confusion and misdirected actions from the MTA. Because of the combination of Segment 2 and Segment 3 of MRL there are multiple leaders and sub-leaders for particular projects and areas. The former leaders are still interested in the project and therefore are communicating with the REs, and at times providing information to the REs, which they are utilizing in their decision making process. In addition, the new MTA leaders of these projects are also communicating with the REs and providing guidance and information that is being utilized in their decision making process. These two levels of involvement and information appear to be absorbing an inordinate amount of the RE's time and increasing the potential for inconsistent direction coming from the MTA. The REs are also initiating some of these communications. In the absence of clear lines of communication a "spider web" of communication will exist which can impact clear direction, create inefficiency and compromise actions. See **Exhibit 2** for an example of the web of communication that exists on MRL.

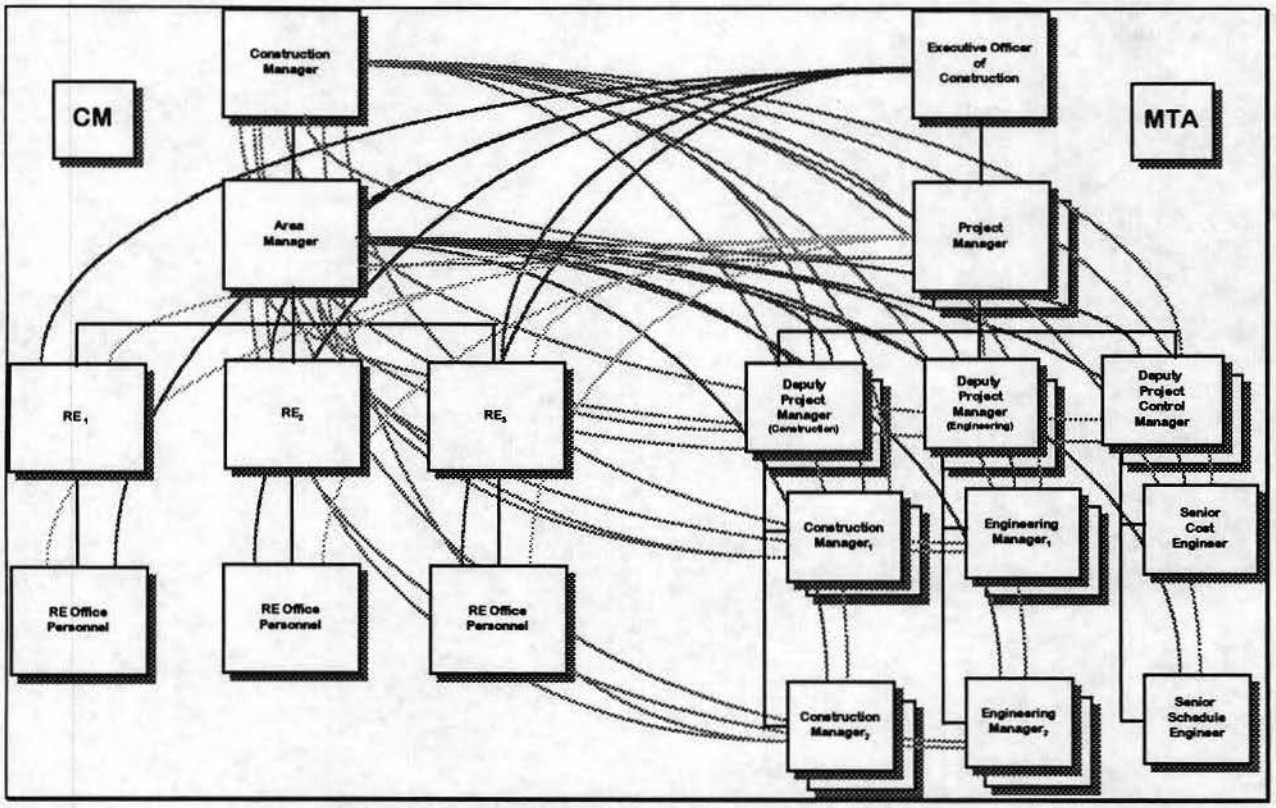


Exhibit 2

5.0 Recommendations for this Function

5.1 Organization and Division of Duties:

A team of CM professionals, lead by the RE, perform the production related CM duties. The MTA oversees the RE activities through their Project and Construction Managers. The job of the MTA is to ensure the Resident Engineering function is being adequately performed and to assist in the resolution of issues and conflicts as they arise. Therefore, a system of checks and balances over the RE function is essential for the MTA to be able to execute its oversight function of the REs. The system of checks and balances also assists the RE by setting a framework for their performance. The following are specific recommendations for enhancing the RE function:

We recommend that the MTA not assume any additional tasks from the CM related to the Resident Engineering function but rather adjust certain elements of each key function of the construction process as discussed throughout Volume B. The MTA has to be capable of performing the oversight function on the CM as a whole. The current structure of assignments for Resident Engineering between the MTA and the CM is a preferred structure to facilitate the MTA's oversight role. This current MTA/CM structure provides the MTA with the following benefits:

1. Owner Control: this structure leaves the control in the hands of the MTA and the duties to perform within the CM
2. Staffing Flexibility: as project volume increases and decreases, the CM can adjust its personnel compliment to provide the MTA with cost-effective service that is not restricted by delays in obtaining or removing personnel
3. Managerial Leverage: the MTA construction department can oversee/control the functions of the CM/RE at a cost effective level - they have an enhanced span of control (approximately 1 MTA to 5 CM)
4. Specialization Availability: by utilizing a large organization for CM/RE services, the MTA obtains the benefit of timely availability to specialized professionals and technicians for problem solving, without the required long-term commitments or limitations in obtaining the necessary professionals and technicians
5. Avoidance of the Risks Associated with Change: because of the intricate inter-relationships between the individual RE, his site staff and the area/home office personnel, the process of bringing the RE function in-house to the MTA would generally require bringing in all associated functions and

personnel (e.g. change order and claims, billing/payment applications, program control - cost, schedule, report, etc.). This change would be a difficult process for the MTA due to the magnitude of the change, the economics of the conversion and the associated ties to all projects within the MTA rail program.

5.2 Cost:

Retain the current levels of change authorization for the RE and the CM. The current delegation is $0 to $25,000 for the RE, and between $25,000 and $50,000 for the CM. These levels are consistent with other transit properties. We recommend that this remain the same. These are the high volume, low dollar changes that need to be controlled and approved by those individuals handling the day-to-day production activities of the contractor, which is the RE and the CM organization.

The CM Area Office needs increased estimating resources. The technical level of the Estimators is not in question, but rather the magnitude of the resource. To process changes on a timely basis, Fair Cost Estimates must be prepared. Due to the level of changes and claims in existence on the MTA's transit program, there is an essential need for adequate estimating capabilities. This may require obtaining additional Estimators within the CM organization and potentially assigning specific Estimators to some of the key contracts such as B251 (Vermont/Hollywood Tunnel). The benefits of this recommendation will be more timely processing of changes and resulting in a better ability to control cost. There is a full discussion on enhancements to the change order process in the change order and claim chapter [Volume B, Chapter IX].

The CM needs to have an increased resource of PCEs skilled in cost as well as schedule for "forward-looking" analysis. It is important from an information processing and management reporting perspective to maintain a high level of quality within the RE office. An area of particular importance is the PCE position. The concept of combining cost and schedule talents within a single individual is an appropriate change, however, the level of expertise in the cost/financial area must be sufficient for the RE office to perform its cost control role. Currently cost is an area where the PCEs need additional training and knowledge to help facilitate their cost control role. In addition, the PCEs need to be more "forward-looking" in their analysis of cost and schedule. The PCE's performance should be evaluated on their ability to address issues in a timely fashion without significant direction from the MTA's Program Control staff. Only by looking ahead in the project activities can one attempt to mitigate the risk of cost and schedule impact that are going to arise. Changes to the direction of a contract later in its

life are generally not as beneficial as changes early in a contract's life in controlling cost and schedule risks. Therefore, the potential for changes in the future needs to be addressed early so that any mitigation activities can be enacted. It is the responsibility of the REs office to have a mindset of anticipating changes and contract impacts, and the PCE is a key player.

The MTA needs to be more involved in the day to day on-site activities of the RE office. The MTA is responsible for performing an oversight role of the RE function. To execute this oversight role they need to be involved in the process earlier than they currently are. Generally speaking, the RE acts on matters during the day or during the week then a report is prepared by the CM which is submitted to the MTA for review and approval. The same type of process exists for the majority of change orders. The MTA is involved and notified about the change when they are asked to authorize the change. The autonomy in the RE office needs to be tempered by the desired level of oversight by the MTA while still working within the parameters of the CM contract. Because of recent events and the current focus of interested parties on this project, it is recommended that the MTA take a more active oversight role as it relates to the RE offices on certain contracts. **See the other functional recommendations in Volume B related to the MTA performing a more active oversight role to obtain all performance related recommendations.**

5.3 *Schedule*

We recommend that the MTA take a more balanced look at "schedule" as they continue to make decisions regarding schedule, cost, quality and safety. It is imperative that the MTA temper their schedule desires by addressing the cost impacts of those desires prior to making a decision. The potential exists for numerous decisions to be made that select cost, quality or safety over the primary desired issue of schedule. For example, it may be beneficial to delay starting a contract rather than expedite a contract award based on plans and specifications that have not been adequately verified for accuracy, propriety and completeness. The delay in time would be evaluated against the anticipated extra cost that may arise as a result in future changes and claims and future delays that may be necessary. The MTA has historically made some decisions based on cost as the prime decider, to the detriment of schedule, but that type of decision-making is limited.

5.4 *General*

The REs should be identified and assigned to a project as soon as possible and required to close-out a contract before moving to a new project. The earlier they are assigned, the more foundational work they can perform to facilitate controlling the project when construction begins. The RE should also be responsible for completely closing out a project, rather than moving on to the next project and either letting another RE close out their project or attempting to close out the project as they primarily work on another new project. The close-out process could be substantially shortened if change orders and claims are handled more expeditiously when they occur during the project rather than at the end. REs should be assigned at least by the 85 % design stage, if not earlier. There are practical constraints to mandating an RE to perform complete close-out due to the cost factor of having an RE assigned to a task that may not require full utilization of his time. The MTA and the CM need to balance the elements associated with this recommendation and the practical constraints.

It is imperative that the MTA address the performance weaknesses identified through the report card process more directly with their CM. The RE office as stated previously has had grade reductions in five general areas under the RE office including Reports, Claims mitigation, Contract compliance, Schedule and As-built drawings. A specific performance parameter should be established in these five areas between the MTA and the CM to facilitate direct improvement in these areas. Many of the previous recommendations within this section and the recommendations within the other sections in this Chapter provide the guidance to the MTA as to what may facilitate improving the CM performance in these five areas. Overall, the performance has been rated as good in most areas. Our recommendations provide an opportunity for the MTA to improve the overall performance of the CM so that the MTA obtains a better product and the CM obtains an incentive fee that corresponds with their actual performance.

The MTA needs to prepare and assign specific and direct lines of communication and supervision within its own organization, and how they interface with their direct counterparts within the CM organization. As the summer of 1995 arrives and the Green Line completes construction, the MTA will consist of MRL Segment 2, Segment 3, East-Side and the functional potential for the Mid-Cities Lines. We recommend that these four segments remain separate within the MTA organizational charts. Each Line Segment should have a Project Manager, because it currently appears the four segments will potentially each have a separate CM organization and this separation within the MTA will facilitate communication and control. We recommend that the MTA leadership within the Construction Division

be separated between MRL Line Segments. For certain positions, the same individual may perform the same functions as it relates to different MRL Line Segments. What is important, is that no two individuals be assigned one functional position within the Construction Division and that clear delineations of reporting between functional positions exist. Once the MTA establishes their reporting structure, direct counterparts should be identified within the CM organizations so that communication between the two entities would flow cleanly and directly across the organizations. See **Exhibit 3** for an example of an Organizational Lines of Communication Diagram.

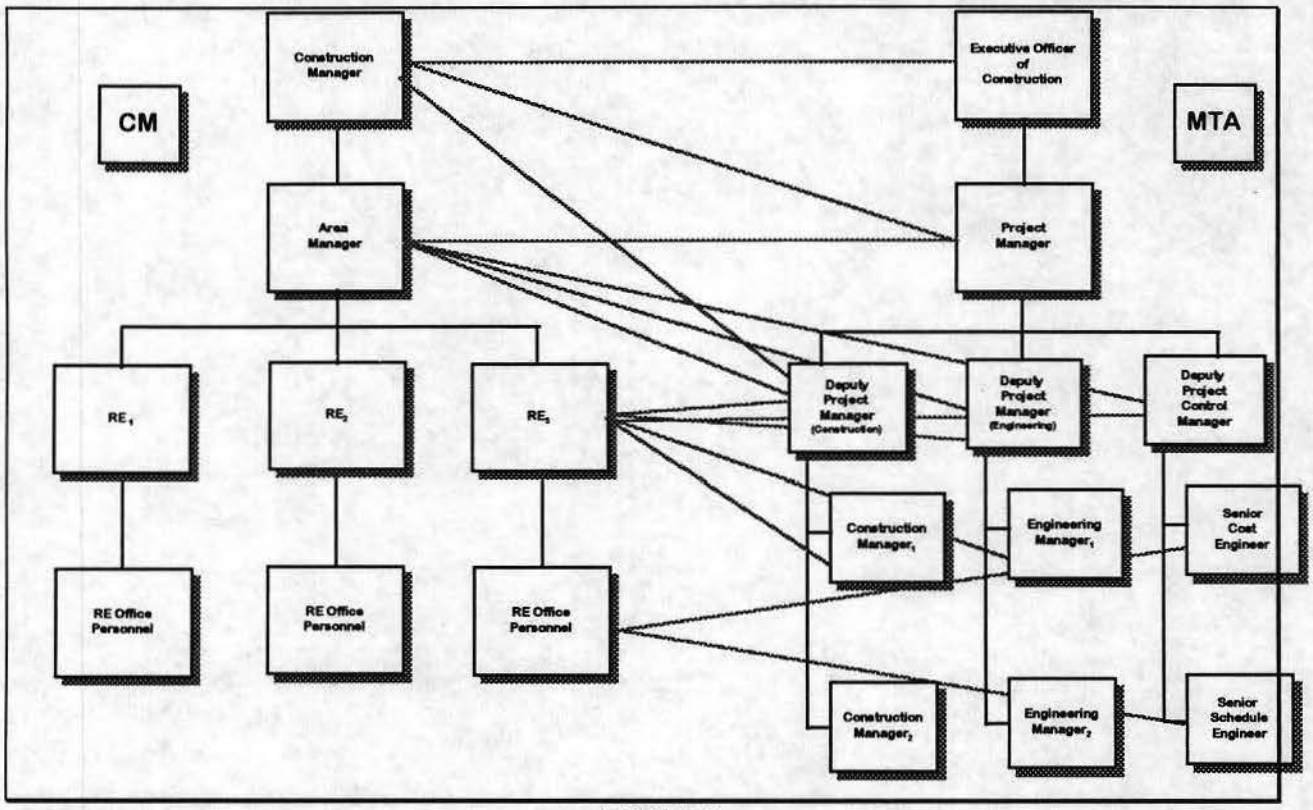


Exhibit 3

The benefit of clear lines of communication will be a reduction in contradictory direction from the MTA to the CM and a reduction in valuable CM time used to address numerous redundant or conflicting requests from the MTA. These specific lines up and down the MTA organization as well as across to the CM organization should be documented and made available so that those individuals interested in obtaining additional information can contact the appropriate communicator.

The RE function is a key position in the CM process. It will be necessary to review the other sections of Volume B to identify all recommendations that may impact the RE function.

CHAPTER IX
Volume B

CHANGE ORDERS AND CLAIMS

1.0 Nature of the Function

The Change Orders and Claims function is a process of one or more parties determining that a change in the anticipated scope of work has resulted or will result which will require a modification to the contract's cost and/or schedule terms. The process to resolve the magnitude of these cost/schedule changes requires the MTA, the CM, the EMC and the specific contractor to all provide technical information and to enter into fair and equitable negotiations. This information is then utilized to resolve the cost/schedule issues among the parties, and based on this resolution, the contract(s) are adjusted.

Changes are a major element in the successful management of a construction project. All parties involved must be keenly aware of the change process and its ramifications and dedicate the necessary resources to properly manage changes in a timely and cost effective manner. The MTA staff must be properly trained and alert for changes and be dedicated to the pursuit of resolving them as quickly and as cost effectively as possible. The failure to have an attitude focused on resolving and controlling changes can lead to significant cost and schedule problems and disputes. This failure can impact the parties involved in the program and the quality of the rail transit project being delivered to Los Angeles County. By properly managing the change order process, risks related to cost, schedule and quality can be controlled within a well established budget of cost and time. Mis-administration of the change process can and will result in unnecessary additional cost, impacts to the quality of the program and potential delays to the ultimate operation of the rail transit lines.

The MTA's objectives for the Change Orders and Claims function are to approve only those changes and claims that have been determined to have merit, at a cost-effective but equitable level, after they have been evaluated for program and project impacts. The Change Orders and Claims process should be administered in accordance with MTA's policies and procedures and in compliance with local, state and federal requirements.

Change Orders result from a modification to a contractual relationship. Some of the prime elements of a satisfactory contractual relationship, and therefore the required abilities of the contracting parties are:

- Competence
- Managerial Ability
- Technical Knowledge
- Satisfactory Performance
- Discretion
- Timely compliance
- Financial Responsibility

It is the purpose of each party to a contract to perform their role within the contract. Good management will arrange that these performances be integrated to produce the final desired results. One truism in regards to contracts and relationships is that difficulties can and will arise. More often than not, these difficulties or contractual disputes are attributable to a failure on the part of one party to adhere to their performance of the primary elements of the contract or the perception that one party failed to adhere to the contract. Since all potential events that can evolve during the course of contract execution cannot be foreseen or pre-planned, no universal formula can be instituted to guarantee that contract disruptions and changes will not transpire. The best method possible to deal with the potential of contract changes is to be aware of their potential and minimize the impacts of the change.

2.0 Issues of the Function

The claims and change order process is one of the most critical processes within a construction project. The element of change is an issue that is prevalent within all construction projects, but the successful projects are those that can control or reduce the risks and impacts associated with cost, schedule, quality and safety issues. The number of parties and individuals associated with the claims and change order process is significant. The process involves contractors and subcontractors, Resident Engineers, Estimators, Program Control Engineers and Managers, Legal Counsel, Contract Administrators, CM Area Managers and Management, MTA Program Control, MTA Construction Managers, MTA Project Managers and the MTA Construction Committee and Board.

The change order and claims process impacts many variables (cost, schedule, quality, safety, cash flow, scope) that must be analyzed and utilized to evaluate the necessary trade-offs inherent in the change process to maximize the benefits to the program. Therefore, we needed to address the following global question:

What recommendations are necessary to strengthen the change order and claims process to ensure that the best interests of the MTA are secured, the benefits of the process are maximized and the detriments of the process are minimized?

2.1 Specific Issues to be Addressed Include:

Global

1. What organizational structure should be put in place (CM, MTA) to allow the MTA a sufficient level of oversight?

Construction and System Changes

2. What recommendations for the process should be implemented to enhance the timing of change order processing without detracting from the other objectives of cost and schedule control?
3. What recommendations for the process are necessary to minimize the cost and schedule impacts to the individual contracts and the overall program?
4. What recommendations for the process are necessary to enhance the quality of the costing and negotiation procedures and end results?
5. What level of delegation of authority to approve changes should be passed from the MTA Board to the MTA Construction Committee?

Consultant Changes

6. What recommendations for the consultant change process should be implemented to enhance the consultant change request processing without detracting from the other objectives of cost and schedule control?

2.2 TABLE OF CONTENTS

3.0 Organizational Responsibilities

For construction and systems contracts the overall responsibility to perform the tasks associated with the Change Orders and Claims process resides with the CM. The MTA is responsible for the oversight of the CM as they perform the tasks associated with this process. The responsibility for accuracy, propriety, cost and schedule control and documentation rest primarily with the CM.

- The CM is responsible for daily administration of the change control process including the preparation and processing of all change documents for field originated changes. The CM is responsible for evaluation and analysis of all proposed changes. The CM is responsible for responding to all requests for information (RFI) for changes involving construction issues. The key individual within the CM regarding the change order process is the Resident Engineer (RE).

- The RE is the sole point of formal communication between the CM, the contractor and the MTA. The RE is the responsible party for all key processing steps within the claims and change order process. The RE is responsible for determining whether a "negotiation team" is necessary to negotiate the CN with the contractor and ultimately obtain resolution or whether the RE alone will negotiate the change. As the change negotiation activities take place it is the responsibility of the Resident Engineer to utilize those technical professionals necessary from either within the CM organization or from the EMC organization to facilitate a timely and cost-effective resolution. Overall, the RE is to communicate with the contractor, determine if merit exists for the CN and resolve the pricing of the CN/CO with the contractor for the lowest amount possible without impacting quality, safety or schedule.

- The CM's Project Control Engineer (PCE) is to be involved in the Change Order and Claim process through the preparation of a Time Impact Analysis (TIA) (the schedule impacts related to the potential change) and also address the cost impacts associated with the potential change or claim in conjunction with the RE and the CM's Estimators.

- The CM's Estimating personnel prepare a Fair Cost Estimate (if the change is anticipated to be in excess of $25,000), to facilitate resolution of the change. The FCE is used in the negotiation phase of the change process as the owner's estimate of the cost of the change.

- The MTA Contracts group is responsible for ensuring that all contract changes are processed in accordance with contract requirements, are contractually valid and if they require Board approval they are presented to the Board for their review.

- The Configuration Management department is responsible for maintaining the MTA designed changed control system (CCS) which is the vehicle for capturing all claims and change order information.

- The MTA's Engineering group is responsible for evaluating all changes requiring CCB approval, including all design changes.

- The MTA Project Manager is responsible for overall budget and schedule control of the project and he is involved in the approval process of all changes in excess of $50,000.

- The MTA Construction Manager and Project Manager reviews and evaluates all changes requiring Board approval.

- The MTA Cost/Schedule Program Control department is responsible for evaluating all changes requiring CCB approval.

- The MTA Internal Audit department reviews contractor proposals for all changes over $100,000. This was revised from $200,000 approximately three months ago based upon a recommendation from the Inspector General's office. Generally, the internal auditors will review the proposal and ensure that wage rates are in accordance with prevailing labor standards or contractual provisions, review equipment reimbursement rates and contrast them to contractor industry rates (generally included in the original contract), ensure that materials are reasonably priced based on prior experience, prevailing rates, etc. Additionally, internal audit will determine whether material mark-ups (if any) are in accordance with contractual provisions and that overhead is calculated at the contractual rate and adequately supported. The cost proposal will be checked for mathematical accuracy. The internal auditors will work with RE's, CM's and Estimators as needed. Internal audit does not evaluate the number of hours or amount (volume) of materials included in the cost proposal as these determinations are of a technical nature. Those determinations are left to the CM's Estimator or RE or the MTA PM. Internal audit issues a report to the contract administration department which is primarily used for negotiating purposes. If the change is anticipated to be in excess of $100,000, and

if internal audit does not have ample time to perform their audit, the change process will not be delayed because the internal audit department will perform a post-authorized audit.

- The MTA Legal Counsel is required to review all changes anticipated to exceed $50,000. Legal Counsel contrasts the merit of the change to the scope of the contractor's written contract and amendments.

- The Change Control Board (CCB) evaluates contract changes requiring MTA level approval (greater than $50,000). The CCB is comprised of the PM and the MTA functional managers within the respective project, the CM the EMC and other technical support personnel within these organizations.

- The contractors are responsible for compliance with all contract requirements related to claims and changes to their contract.

4.0 Process Overviews and Flowcharts

4.1 Construction and Systems Contracts - Change Control Process Overview

Step 1. Prepare/Submit RFI/C: A project participant prepares a Request for Information(RFI) or Request for Change(RFC) and Submits it to the Resident Engineer (RE). The EMC or MTA can also issue Design Change Notices (DCN) which identify a change to the designs that could impact multiple contracts due to the uniformity within stations.

Step 2. Log Issue for Evaluation: The RE logs the information in the Change Control System(CCS). The CCS will generate the appropriate documents for review and comment.

Step 3. Review/Response: The RE will review the RFI/C to determine if a Change Notice (CN) is required. If the RFI/C pertains to a design issue, a design engineer from the EMC will provide guidance to the RE. The RE will then provide the requester with a response indicating whether a CN is required. A negative response can be challenged by filing a claim (See Summary of Claims Process section).

Step 4. Change Notice: If the RE determines a CN is required, a CN package is prepared and submitted for approval. Approval of the CN is granted by the either the RE, the Construction Manager(CM), the Project Manager(PM)/Change Control Board (CCB) or the MTA Board of Directors depending upon cost and schedule criteria.

A Change Technical Evaluation (CTE) is performed for all contracts requiring the approval of the PM or MTA Board. For such changes, the RE prepares a change evaluation form which is distributed to the CM staff, the MTA project team and the EMC for review and comment. These responses are summarized and presented to the CCB. Additionally, all CNs in excess of $50,000 must be reviewed by MTA legal counsel.

Step 5. Approval of Change Notice: Once approved, the RE will issue the Change Notice. The EMC will prepare any necessary drawing/document revisions. A decision not to approve issuance of the change order may be challenged by filing a claim.

Step 6. Work Authorization Change Notice: In instances when it is critical that work begin as soon as possible, or if the paper work associated with a change is deemed more costly than the change itself, a Work Authorization Change Notice (WACN) is issued by the CM/RE or the PM. WACNs are also issued when no forward cost estimate is available. The WACN may be issued on a time and material, field order or "to be negotiated" basis. Those issued on a "to be negotiated basis" follow steps 7 and 8 below. For all others, the work is performed, time and material records submitted and negotiations over final price are conducted and agreement reached. All WACN are reported to the MTA Board via standard monthly reports. Only WACNs with "not to exceed values" greater than $200,000 require Board approval.

Step 7. Time and Cost Impact : Upon approval of the CN, the contractor will prepare a cost/schedule proposal, the CM's PCE a Time Impact Analysis and the CM's estimator a Fair Cost Estimate (prepared by the RE if < $25,000). If the contractor's proposal exceeds $100,000, MTA Internal Audit will issue a report on the proposal to be reviewed by the RE and the MTA negotiating team.

Step 8. Negotiations: The RE will form a negotiation team to develop a negotiating strategy based on the Time Impact Analysis and the Fair Cost Estimate. The negotiation position must be

recorded on the Record of Negotiation generated by the CCS and signed by the RE. A Detailed Record of Negotiations will be prepared and included in the Change Documentation (Optional for Changes under $25,000). Minutes will be kept of all negotiating meetings. Upon completion of negotiations, a Summary of Negotiations is prepared and signed by the RE and contractor.

Step 9. Change Order (CO) Processing: A change order is then prepared by the RE for contractor and MTA approval. Once approved by the proper level of authority, an executed Change Order is issued by the RE.

4.2 A summary of the tasks associated with each of the major categories included in the claims and change order process for construction and systems contract change orders is as follows:

1. Change Initiation
   - a) Submit RFI/C (Contractor)
   - b) Evaluate RFI/C (CM or EMC)
   - c) Responded to RFI/C (CM or EMC)

2. Change Notice Processing
   - a) Change Notice (CN) Preparation by CM
   - b) Change Technical Evaluation (CTE) by CM, EMC and MTA (CCB)
   - c) Change Notice Approval by CM and MTA, if necessary
   - d) Change Notice Issuance by CM
   - e) Change Notice Acknowledgment by Contractor

3. Negotiations
   - a) Contractor's Cost and Schedule Proposal
   - b) CM's Cost and Schedule Analysis (Fair Cost Estimate)
   - c) Conduct Negotiations (CM and Contractor)
   - d) Time and Material Cost Verification by CM and Contractor (for WACN)
   - e) Prepare Negotiation Records by CM

4. Change Order Processing
   a) Change Order Preparation by CM
   b) Change Order File Preparation by CM

5. Change Order Issuance for Acceptance by Contractor by CM
   a) Change Order Execution
   b) Change Order Final Issuance by CM

6. Cost Posting and File Close Out
   a) Cost Posting by CM
   b) CM Change File Quality Audit and Transfer to MTA Contracts by CM
   c) Cost Recovery and Other follow-up by MTA and CM
   d) Funding Eligibility Review by MTA

7. Change Status Reporting by CM

8. Lesson Learned Review by CM

4.3 The following summarizes the Change Order process for construction and systems contract changes:

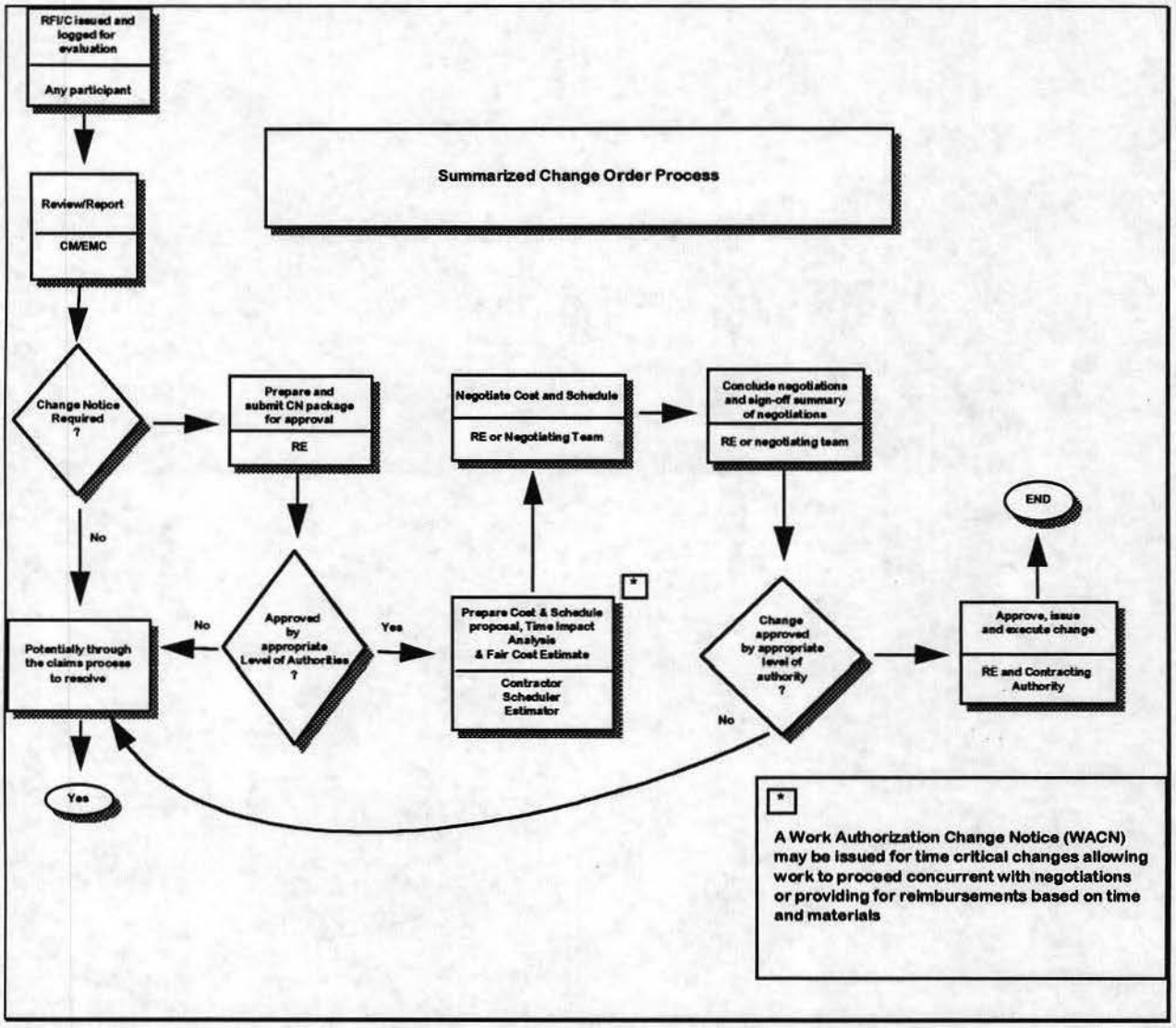


Exhibit 1

4.4 Construction and System Contracts - Summary of the Claims Process

If a request has been denied, and the contractor believes the request has merit, the contractor is allowed to file a claim for damages or delays. The claim must be supported by adequate documentation. No claims may be made after payment is made to the contractor for the work. Following is a summary of the claims process.

Submission of NOI and RE review: The contractor files a Notice of Intent to Claim (NOI). The RE reviews the contractor's NOI for merit. If it is determined that the NOI has merit, the request is processed as a normal Change Notice (CN). If the request is denied, and the contractor disagrees with the RE's determination, the matter is brought before the Disputes Review Board (DRB).

DRB Review: The DRB reviews the request and issues a finding granting or denying the contractor's request. If the DRB's decision is not accepted, the contractor must file a Notice of Intent to Sue. If the claim is greater than $375,000, the lawsuit will proceed in a normal fashion. Claims less than $375,000 are governed by Public Utilities Code Section 20104 requiring non-binding mediation. If no resolution results, the matter is submitted to "non-binding judicial arbitration" conducted through the Superior Court. Either party may appeal the judicial arbitrator's decision to the Superior Court and initiate "regular court" proceedings. However, should the appealing party fail to obtain a more favorable decision, that party will pay attorneys' fees and other costs of the opposing party.

4.5 The following summarizes the Claim process for all Contracts:

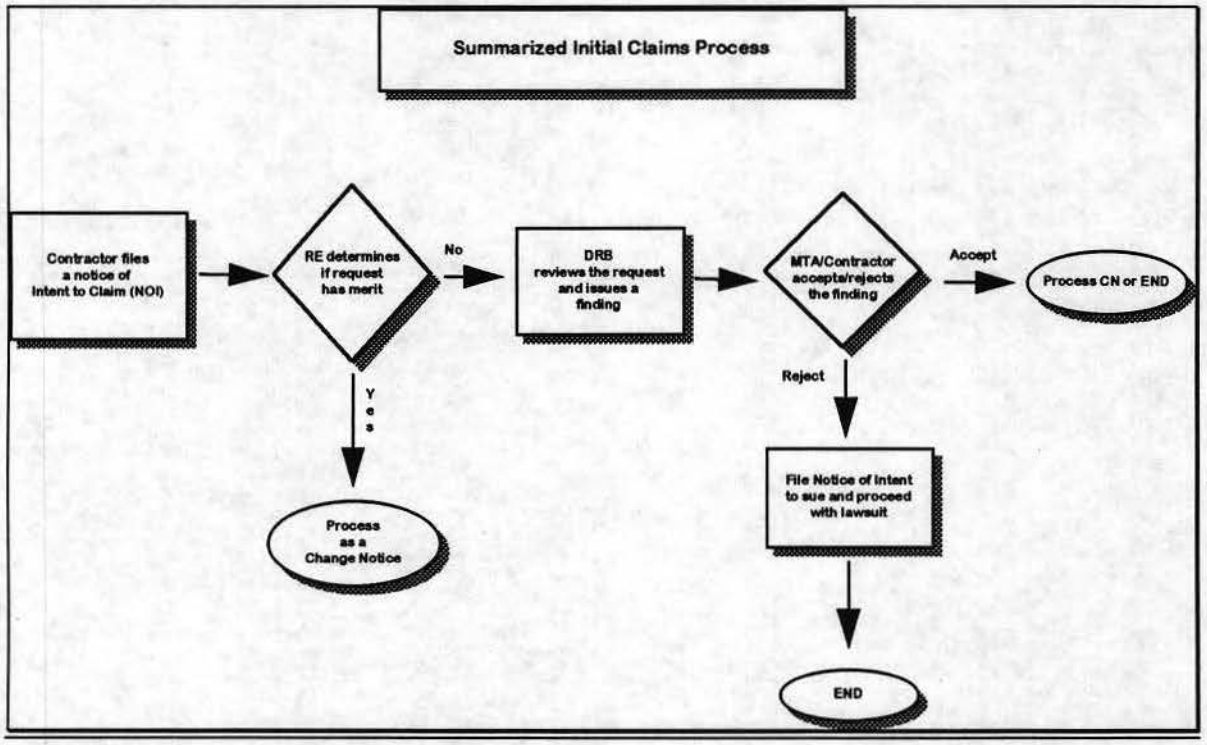


Exhibit 2

4.6 Professional Service Provider Contracts - Change Control Process Overview [Consultant Change Request (CCR) Process Overview]

Step 1. Determine Need For CCR: A project participant determines the need for a CCR. The request is prepared and presented to the Project Manager(PM).

Step 2. Preparation and Authorization of Advance Work Authorization (AWA) : The consultant or MTA staff member then prepares an AWA describing the work (scope, time frame and preliminary rough cost estimate, etc.). If the PM approves the AWA, all pertinent information is logged into the Change Control System (CCS), a job number is assigned and work may then proceed concurrent with the steps below on a "Not-to-Exceed" basis. The Board and the Construction Committee are provided an Advance Information Report as notice of the AWA. A formal CCR package must be presented within ten days of the PM's approval of the AWA.

Step 3. Preparation of CCR/CTE Forms: A project participant then prepares the CCR and Finding of Fact Forms for review by the MTA's project team. MTA Project Team prepares a CCR evaluation form - Change Technical Evaluation(CTE). The PM approves all CCR's under $200,000 while CCR's over $200,000 are approved by the MTA Board. Once the CCR is approved, the consultant is directed to prepare a contract change proposal.

Step 4. Negotiations: A negotiating team is established to review the MTA's responses to the CTEs and evaluate ROM hours, the consultants cost proposal, etc. A negotiating strategy responding to the consultant's proposal is formulated and negotiations are scheduled.

Step 5. Contract Amendment: Upon completion of negotiations, a Summary of Negotiations is prepared and signed, MTA Contracts department will prepare all necessary contract amendments for MTA Board approval. The Contracts department often "batches" (combines) CCRs for submission to the Board. However, as changes are determined and their magnitude identified, they are reported to the Construction committee and the Board through a periodic "Change Look - Ahead" report, if they are anticipated to exceed $200,000. Once approved, the changes are incorporated into the contract and the work is completed.

4.7 The following summarizes the Change Order process for professional service contract changes (Consultant Change Request Process):

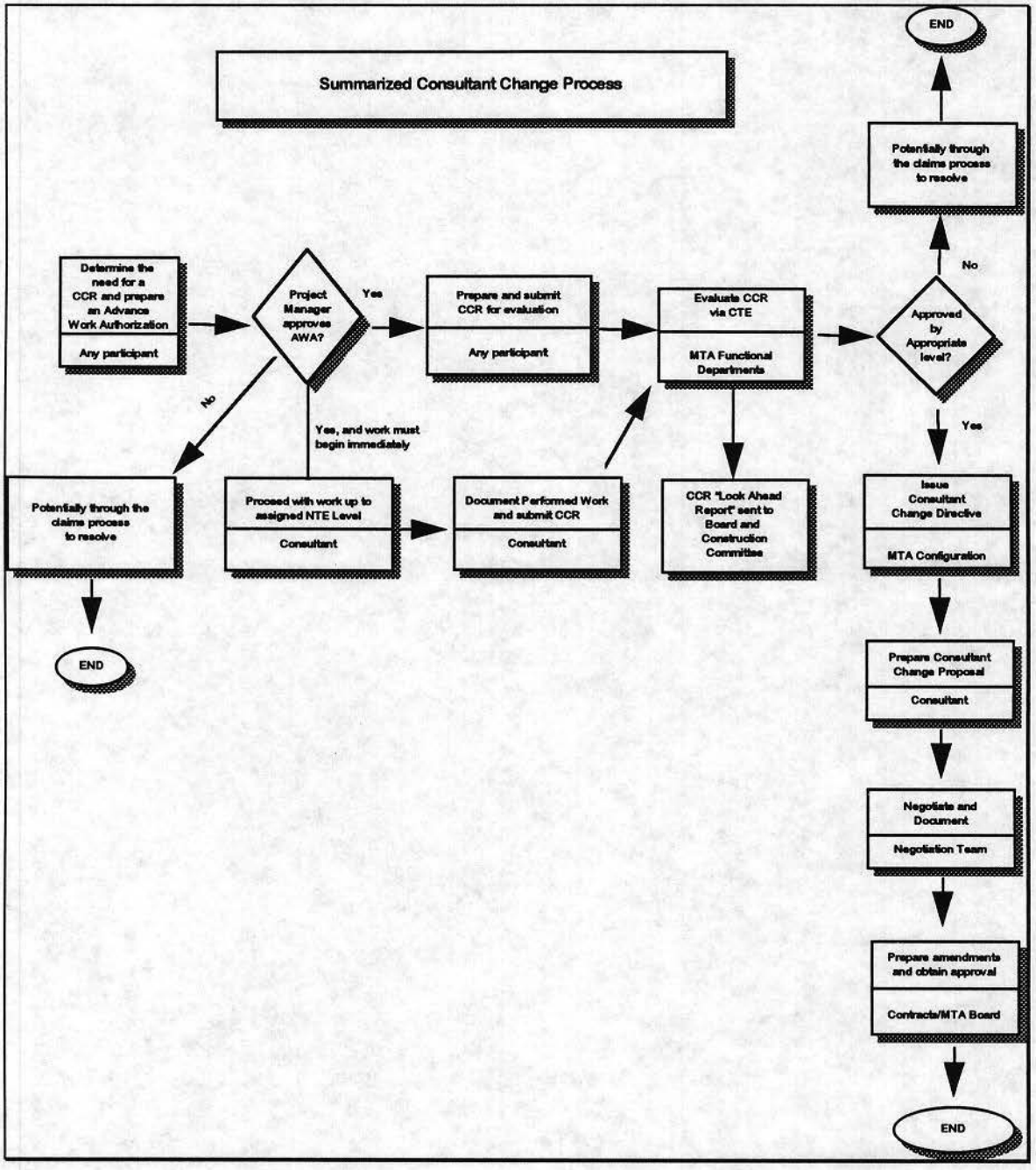


Exhibit 3

4.8 Change Order and Consultant Change Request Approval Levels

The current levels of approval necessary to authorize a change order are as follows:

Contract Change	Resident Engineer	Construction Manager	MTA Project Manager	MTA Board
Cost Change	Up to $25,000	Up to $50,000	Up to $200,000	Over $200,000
Schedule Impact	No Authority	No Authority	Contract Schedule only	All Changes Affecting ROD
Design Impact	Contract Baseline Only	Contract Baseline Only	Project Baseline Only	All Changes Affecting ROD
Cumulative Cost	Up to AFE Limit Only	Up to AFE Limit Only	Up to AFE Limit Only	All Increases to the AFE Limit
Contract Scope	In General Scope of Contract	In General Scope of Contract	In General Scope of Contract	Out of Scope

Any schedule impacts must be approved by the MTA PM and, if the schedule issue will impact ROD, it also needs Committee and Board approval. Any change, no matter the magnitude, that when approved would establish a contract's cumulative cost to exceed the approved AFE, must be approved by the Board. All Changes that are to be pre-approved by the MTA Board must also be preapproved by the Construction Committee of the MTA. Their recommendations are necessary for Board approval, but the Construction Committee does not maintain any specific authorization for approving changes.

The approval levels for Consultant Change Requests are with the PM for changes below $200,00 and with the Board for changes above $200,000.

5.0 Findings and Implications Regarding the Function's Organizational Structure and Performance

5.1 The following summarizes the major Change Control duties being performed by the CM organization

1. Provide support staff to the field operations (the RE office), with an expertise in the Change Order and Claim process, to manage the construction and system contract changes in the field
2. Provide support to the MTA's administration and management of the change process and utilize the MTA's Change Control System (CCS)

3. Prepare monthly status reports for the MTA which reflect the anticipated results/impacts of all actual and potential Change Orders and Claims and a status of all changes in process
4. Analyze contractor requests for claims for extra payments, initiate approval actions for valid claims, and develop basis for rejection of claims/payments
5. Process Change Notices (CNs) and assist in the identification of a funding source for each CN
6. Process valid contract Change Orders (CO) and extensions of time including assisting in preparation of Board agenda items, when applicable. Identify funding sources for each CO
7. Implement claims mitigation and resolution actions
8. Provide technical analysis and review of all requested changes submitted by the contractor
9. Review each completed CO documentation package to ensure that it complies with local, state and federal requirements
10. Notify the MTA of any actual or potential changes and evaluate the potential impacts of the change to the project and the program (cost, schedule, contract)
11. Review and evaluate Requests for Change, negotiate the change (through resolution) subject to the CM's delegated authority, prepare CO documentation (including Fair Cost Estimate and Schedule Analysis) and submit to MTA for approval, as necessary
12. Evaluate value engineering change proposals
13. Provide similar technical analysis and recommendation services, as described above, for claims
14. Provide support to the MTA for all Dispute Resolution activities including the Change Control Board and the Dispute Review Board

5.2 ***The following summarizes the major duties being performed by the MTA organization***

1. Contracts department reviews all large (greater than $50,000) changes to ensure they are processed in accordance with contract requirements and are contractually valid
2. Configuration Management maintains the automated Change Control System (CCS) and ensures that change control practices are implemented and operating on all projects
3. Engineering evaluates all large changes and all design changes and provides direction to the EMC regarding design change follow-up
4. The project Construction Manager is responsible for evaluating all large changes and ensuring compliance with change control procedures
5. Program Control is responsible for evaluating all large changes and ensuring all cost and schedule changes are reflected in project reporting documents

6. The Project Manager is responsible for control of contract changes and chairs the Change Control Board (CCB) which evaluates large changes and recommends their disposition
7. Legal and internal audit are required to review the large changes for merit and cost calculation propriety, respectively.

5.3 *The following summarizes our organizational performance observations*

Based on our interviews with project related personnel and the review of documented information it is evident that the CM is performing the activities involved with the change order and claims process. The MTA has been attempting to execute the oversight function regarding the change order and claims process. However, the CM has a significant level of control over the end results achieved regarding changes and claims. The MTA needs to understand that their current mode of performance places reliance on the CM to perform the change order and claims process effectively and efficiently, while they attempt to monitor and control (oversee) the process through the MTA PM and the approval levels established for changes.

During the construction phase, the occurrence of change can generally not be minimized because most change minimization needs to have occurred during the design process. During construction the parties are simply attempting to minimize the risks associated with the cost and schedule impact of those changes that are inherent in the project based on the design of the program and the plans and specifications that were prepared during the bid process. However, the quality of your field RE and his field supervision can impact the change volume as much, or more, than poor design issues.

In resolving changes, it is often beneficial to view the problem and the cost of the change from the other parties perspective. For example, the MTA needs to realize that the contractor entered into a negotiation to establish an original bid price based on a set scope of work. If the plans and specifications are inadequate to address the true nature of the project, then it is correct to assume that changes will be necessary. There will be a cost to those changes. If the plans and specifications had been accurate when the original bid was prepared by the contractor, their original bid based on the revised plans and specifications would not have been the same. The second original bid would have been higher reflecting the cost of the work included in the change. The contractor is simply attempting to recover these costs which were not bid, due to the difference between the plans and specifications originally issued and those that are currently required, now that the deficiency has been identified.

Generally allowing the contractor to perform the work prior to negotiating the cost of the work does not benefit the owner. In essence, the contractor will have accurate cost records for what the change cost and it will not be willing to negotiate a price that does not compensate him for all the recorded costs. If the RE believes that the cost incurred by the contractor are excessive, the CM organization will not be willing to reimburse the contractor for the cost incurred and a long protracted dispute resolution process may result. Dispute resolution proceedings are generally not advantageous for either party. The DRB is a viable option, but the results are subject to interpretation because the DRB's opinions may not be grounded in the most recent legal facts or the parties will potentially be dissatisfied with the resolution. Generally the results from mediations or arbitrations are a compromise between the parties and therefore neither party is completely satisfied with the results. The cost of taking an issue to arbitration, mediation or litigation is a cost that would not necessarily be incurred if the change could have been resolved during the change negotiation process.

The owner must consider the ultimate cost of agreeing to a change during the change negotiation process and the precedent that it may set for future similar changes for this contractor and other contractors performing on the rail transit program. In addition, the MTA must assess the ultimate benefits achieved by not negotiating a change early in the process and contrast them with the cost that will be incurred if a change request is taken through the DRB, mediation, arbitration and litigation process.

The necessary control element for the claims and change order process is the establishment of a quality oversight function to be performed by the MTA. Currently, the MTA is not able to execute a well controlled oversight role through the change process. The personnel assigned, do not have the ability to administer this role due to time constraints and procedural limitations. A complete oversight function would involve the contract administrators, the construction manager, the project manager, the cost and schedule program control staff, the estimators and engineers and the Board. Each MTA team member should have specific roles to perform during the execution of the change process. Since the change process touches all segments and functions of a project - each MTA function should have some active day-to-day oversight duties with the change process.

For the MTA to be adequately operating in an oversight role which reduces the risks of the project, they must be involved early on in the process so that issues that come to light can be dealt with as early in the change process as possible. The CM will generally not bring damaging issues to light until they are sure that the issue can not be resolved any other way than a claim or change. To glean the information out of

the process at the early stages, so that it may be dealt with and discussed by MTA management and the Board of the MTA, it is essential that the MTA staff become involved in the evaluation and information gathering process.

6.0 Change Order Process - Timing and Approval

The ability to process changes in a timely fashion is a critical success factor for the change order and claims process. However, the supporting records to quantify the cost of the contract change can be quite vast. The contractor should be allowed a reasonable time to accumulate these records and quantify their estimate of the cost of the change. The CM will also be performing their quantification which will entail a similar time period based on the complexity of the change. It is important to expedite the quantification and negotiation process of a change due to the ramification and impacts time has upon quantification, negotiation and ultimate resolution of the change. Time is of the essence because the nature of the construction business is time sensitive. As time evolves, memories fade, facts are misconstrued and records no longer support the ultimate reality that existed immediately following the contract change. As an overall constraint, as the processing time increases it usually is to the benefit of the contractor. Therefore, timely preparation by both the contractor and the CM as it relates to change quantification and negotiation are of the utmost importance.

6.1 *Who is responsible for Change Order Processing?*

Exhibit 4 reflects the Timeline of a Change and the responsibility assignments currently present to control the creation, preparation and approval of changes. As shown, the CM/RE has the performance responsibility. The RE performs the process, and as a result, controls the process from inception until it is ready for approval by the MTA.

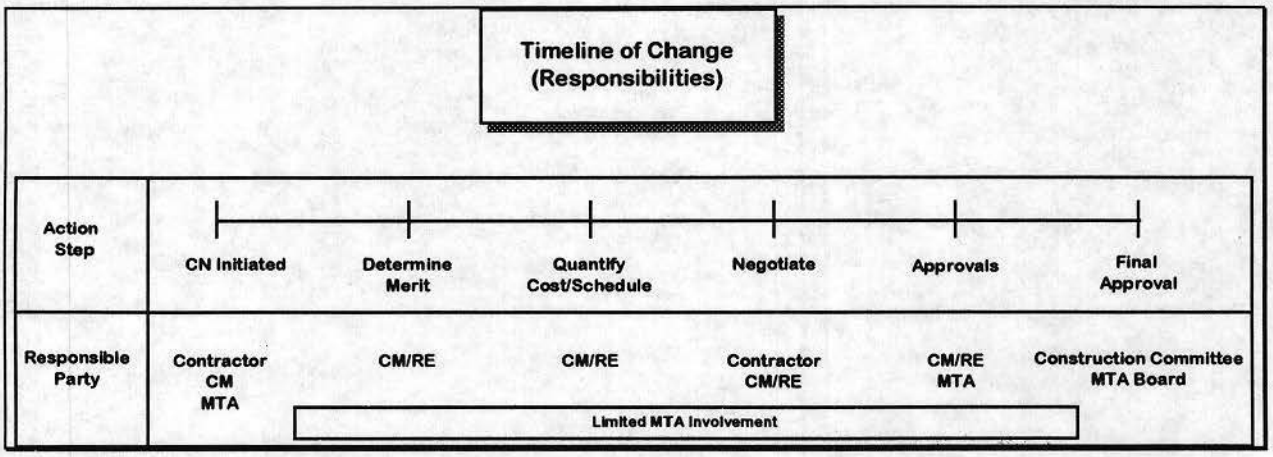


Exhibit 4

The first critical element in the change order processing timeline is the initial determination of merit. In other words, is there truly a change to the contractual relationship between the owner and the contractor? This determination is currently being performed by the CM through the RE office. The CM's determination is often being made independent of the owner. Without the owner being involved with the change process and the determination of merit, it is difficult, if not impossible, for the MTA to truly execute its oversight role.

Throughout this change order and claims process up to the approval phase, there tends to be little involvement by the employees of the MTA. The day-to-day involvement with the change order and claims process to facilitate the MTA's oversight role is not sufficiently present. The performance is being handled and controlled primarily by the CM. The MTA has not been performing a sufficient oversight role to ensure that the MTA is paying the appropriate amount for changes to the contractor's base contract. In essence, the MTA has been performing an administrative function as it relates to changes and claims rather than an assurance/oversight function. They have been receiving the change order and claim information from the CM as the CM completes its' review and negotiations. At this

stage, oversight activities are implemented through the use of the Change Technical Evaluations (CTE) and the Change Control Board (CCB) reviews. The MTA does not play an active day to day role monitoring the decisions of the CM regarding changes - especially those within the authorization level of the CM ($50,000).

With the Resident Engineer coordinating the change order process and the negotiations (provided they are within the authorization levels of the CM), the entire process can be completed within the CM ranks. For changes not exceeding $25,000, the RE can handle and authorize these changes individually. For changes up to $50,000, the involvement of CM management is required, but the authorization level still resides within the CM. For changes that exceed $50,000 but do not exceed $200,000 the MTA Project Manager has the authorization to approve these changes, but the RE is primarily performing and controlling the change resolution process. For changes in excess of $200,000, changes that modify the critical path schedule or changes that will put the contract in excess of the AFE level, it is necessary for the Construction Committee to recommend these changes for approval and for the Board to approve these changes.

As a result of the limited involvement of the MTA staff in the day to day processing of changes, it is necessary to evaluate the performance of the CM as it relates to timely processing of changes, their ability to control the creation of changes and their capacity to control the cost and schedule impacts of necessary/valid changes.

The volume of Change Notices (both in-process and executed) has continued to rise during the life of MRL - Segment 2 as the volume of active contracts has increased. The MTA's Project Reporting has consistently provided an aging report of these open CNs. The aging as of December 1994 is reflected in **Exhibit 5** and identifies that there are a significant number of in-process changes to the construction and system contracts and that more than 50% of these CNs have been in existence for more than 90 days.

MTA- MRL-2
Active Change Notice Aging - December 1994

Time	0-30 days	30-60 days	61-90 days	Over 90 days	Total Active
Volume	161	48	57	286	552
Percent	29%	9%	10%	52%	100%

Exhibit 5

An overall objective of the CM and the MTA is to limit the number of changes to the contract because changes are a significant risk to providing a cost effective transit system. It should be the objective of the MTA to limit changes, but if a change arises it should generally be resolved within 90 days. The process of reconciling changes once merit exists and a CN is issued is a process of pricing and negotiating, and therefore sometimes a timetable can not be mandated.

The CN process requires the contractor to submit a cost and schedule proposal for the change prior to negotiations taking place between the CM/RE and the contractor. The CM/RE also needs to prepare their estimate of the anticipated cost and schedule impacts of the change (Fair Cost Estimate). For the majority of the changes, this process should be completed in approximately 90 days, but for some of the more complex changes, this may not be feasible. Therefore, it is important to prioritize the changes based on a "Need Date". The Need Date will be determined by the CM/RE based on (1) when the contractor's work needs to be performed to maintain the contract's schedule and (2) for items over $200,000 when the change needs to be taken to the Board for approval.

The MTA tracks change activity by (1) which organization should be currently processing the change or preparing a deliverable for negotiation and (2) what is the "Need Date" of each change. This tracking of need dates facilitates addressing the high priority changes. **Exhibits 6 and 7** reflects the March 1995 statistics of open changes, who is currently responsible for those changes and which contracts carry the bulk of the open changes:

Which entity is responsible for open changes as of March 1995?

MTA: MRL - Segment 2 March 1995 Action Summary	Systems	Facilities	Totals	Percent
RE Action	29	234	263	34%
Contractor	41	289	330	43%
EMC	4	7	11	1%
Other (MTA, AM, CM)	24	145	169	22%
Totals	98	675	773	100%

Exhibit 6

Which contracts have the most open changes and which entity is responsible for action?

MTA: MRL - Segment 2
March 1995
Action Summary Extracts (Top 7 Contracts)

Contract	RE Action	Contractor	EMC	Other	Total
B231	64	72	0	52	188
B251	37	51	0	15	103
B221	45	31	0	23	99
B215	18	19	0	21	58
B261	10	29	0	1	40
B241	5	21	0	8	34
B252	3	13	4	7	27
Totals	182	236	4	127	549

Exhibit 7

Based on recent reviews of Change Action Summaries, the Contractor owes (responsible for action) the Contractor Cost proposals for about 40% of the open changes. The CM/RE is also responsible for processing about 40% of the open changes. The remaining 20% are in the hands of the MTA. There are currently seven specific contracts containing the majority of the open changes - these are listed above.

On the surface, simply having open changes may not be a risk for the MTA. The factor that needs to be assessed is "the time critical nature of the specific change and its relationship to the critical path of the program". **Exhibit 8** reflects the Priority Needs Status of unissued change orders and the aging of their "Need Date" as of March 1995.

Unissued Change Orders- Priority Need Status
March 1995

Summary (8/93- 3/95)

	Approximate # High	Low	Average
Unissued	375	75	225
Past Need Date	75	25	50

Current Priority Need Status Aging

Aging	Past Need Date	0-30 TND	31-60 TND	61-90 TND	> 90 TND	No Date Assigned	Total
Volume	48	83	15	6	13	57	222
Percent	21.60%	37.40%	6.70%	2.70%	5.90%	25.70%	100.00%

Items of Note:

Contract	No Need Date Assigned
B231	37
B610	5
B221	3
B620	3
B251	2

Contract	Unissued Changes Past the Need Date
B221	9
B241	9
B610	5
B231	4
B631	4
B215	2
B644	2
B761	2

Exhibit 8

For all but one contract, the CM is doing a good job identifying the need dates of changes and processing the changes in a timely fashion. There are a few contracts that are carrying unissued changes past their priority need date and one contract that is currently not assigning need dates to unissued changes. The practice of identifying need dates and prioritizing change processing activities for those nearing the need date is a correct and necessary process to assist in cost and schedule control.

It is imperative that the CM and the MTA Construction Division develop an attitude to "keep pushing" the change quantification and negotiation process at all times. Timely negotiation and change resolution will ultimately provide benefit to the MTA in the area of cost control and schedule impact mitigation.

Generally the argument put forth by the contractor explaining that they cannot perform an adequate cost estimate of the change until they perform the work is an inconsistent argument. The contractor's strength resides in their ability to estimate an entire project based on the details strictly encompassed within the plans and specifications of the bid documents. When the change is being estimated the

contractor has had the opportunity to have worked on the site, he knows the productivity of his work force and he has a familiarity with the details surrounding the contract change requirement. Therefore, generally the contractor should be able to estimate the cost of performing a change prior to actually executing that performance. It is important for the MTA and the CM to force the issue with the contractor to provide its cost estimate before the work necessitated finds itself on the critical path.

All parties to the project must be alert to the occurrence of changes. They must be prepared to resolve them as soon as possible. The longer a change remain unresolved, the greater the chance that they will not be amicably resolved.

6.2 *Does the MTA have any tools available to expedite the change order process?*

The MTA is fortunate because it has developed a high quality, very technically complete change process tool. The change control system (CCS) developed by the MTA is an outstanding tool for administering and documenting the change process. The CCS is a tool. The CCS does not determine merit for the RE, it does not quantify the change and it certainly does not negotiate with the contractor for a timely resolution of the change. However, it provides the framework which expedites the process for the RE to the benefit of the MTA. Having tools is an essential element for quality performance regarding change resolution. Tools however need to be utilized accurately and effectively.

The change control system is preprogrammed to identify those persons responsible for signing the change order as either (a) recommending the change for approval or (b) approving the change. Currently there can be as many as 8-10 signatures required for a change order approval. Each signature is authorizing the change in one form or another. Therefore, each participant must take ownership of the responsibility associated with signing the change order. This requires the MTA staff to take an ownership role in the change order and authorization process. A sign that the MTA staff has lost the "ownership mentality" regarding changes is that there are concerns being voiced by project participants that change orders and other change process documents are not being reviewed in a timely manner.

There are significant delays in finalizing change orders and obtaining all signatures of recommendation for approval and/or final approval. The CCS system should institute a due date for each signature that establishes parameters to expedite the changes through the signature and review process. No change orders should sit dormant in a project participant's IN basket.

The current time frame to move a change from the end of negotiations to Board approval has been estimated at between 4 and 12 weeks. This time frame delay is significantly greater than the process should require. The lack of timely review and approval by each of the MTA staff members required to sign a change order does contribute to this delay. It is imperative that each project participant realize the importance of his or her signature and the importance of processing the change in the most expeditious means possible.

Often times the change requires approval prior to performance by the contractor, and for the large changes requiring Board approval, timing the change to meet the Board's agenda, is a process requiring significant levels of coordination. The single Board meeting each month and the lead time necessary to put a change order on the Board's agenda contributes to the processing delays, and therefore also to the use of WACNs.

As projects near full utilization of the contingency, it may be necessary to arrange for additional budgeted funds to finance a change. This change to the contract's contingency (budget/AFE) can only be approved by the Board and as a result these changes need to be expedited through the entire process to arrive on the Board's agenda at the appropriate time. Therefore, as the MTA nears contract completion on some of the station contracts, Board approvals will be needed more often. As the Board's approval is needed more often, the coordination of events leading up to Board approval takes on a greater significance. The MTA and the consultants must expedite the change process, while still maintaining an eye toward fair and equitable pricing of changes and thorough arms-length negotiations.

6.3 Review of Change Order Process - Timing and Approval Issues

We have observed through the review of numerous change order documentation files, and review of other consultant's reports, that the level of documentation being prepared by the CMs is not as complete as is necessary. Two primary areas where documentation generally is insufficient are the areas of (1) justification for the determination that merit exists regarding the change and (2) the documentation regarding the process of negotiation that took place between the RE and the contractor to reconcile the change's cost and schedule impacts.

As has been evidenced by the Inspector General's report and other Construction Management Consultant's reports, the potential exists for disputes regarding the validity and accuracy of a change, when one tries to assess the propriety of a change strictly from the documentation that exists. After a

change has been identified, quantified, negotiated, processed and the work performed by the contractor, it is difficult to reconstruct the events of that change process strictly through documentation. This is especially compounded when the documentation regarding merit determination, cost determination and final settlement negotiations does not completely describe the steps and the processes that existed to determine the final change amount. Because of this, it is essential for the documentation practices of the CM and the MTA Construction Division to be enhanced.

Based on our review of the change order documentation, we noted that there are specific requirements regarding the Change Technical Evaluations. The change control system automatically prepares a routing slip and forms for specific individuals to review material changes and comment on the CTE form. The clause on the CTE forms stating "Non-response will be considered as concurrence with the change" is an improper clause to have within the CTE documentation. This clause allows non-action to be interpreted as agreeing with a change, and thereby taking the next step in the process of committing the MTA's funds. We recommend that it be mandatory for each individual receiving a CTE packet to respond regarding that change.

An overall observation regarding the MTA's Construction Division is that due to numerous issues and events that have transpired over the last two to three years, an attitude has developed among the staff members reflecting a reluctance to make decisions and take responsibility for those decisions. There is an overriding attitude of "hands-off" of the program activities and the decision -making process. There is an excessive level of delegation to the consultants, fostered by the "Partnering-Concept" and the punishments inflicted on staff for errors by the MTA Board and Top Management. The punishment philosophy of the Board and the CEO has created a very negative environment for a construction operation that requires a healthy attitude about "Risk Taking".

The policy of participation and cooperation between contractual parties has its positive attributes, but it cannot be an attitude of total delegation. It is important for the MTA as they execute their oversight role to monitor the actions on a day-to-day basis with an attitude of healthy skepticism regarding the performance of their CM, their EMC and their contractors. With this monitoring comes the attitude to probe and verify that the service being provided is beneficial to the MTA. With an attitude evolving of healthy skepticism the MTA Construction Division will be exercising its fiduciary duty to provide the highest quality transit program to the citizens of Los Angeles County. As the Construction Division's staff develops this attitude of healthy skepticism, they will be more active in the change process and that action will involve them in the decision making process. As they become involved in that process they

will generate and attitude that will benefit the MTA in controlling costs and minimizing schedule impacts from contract changes. By posing questions and testing the validity of a merit award or a contract change cost negotiation determination, the MTA will see enhanced rewards regarding cost expanding for contract changes and reduced schedule impacts as a result of contract changes.

Based on review of change order documentation there is the appearance of an inordinate amount of Work Authorization Change Notices (WACN) during the change process. These WACNs are issued at Not To Exceed (NTE) amounts within the authorization level of the MTA project manager ($200,000). Having the ability to issue a WACN to expedite the performance of work when necessary is an essential characteristic of a well run organization. The use of a WACN should only be when time is of the essence regarding the performance of the activities. In all other change situations, the formal, normal process should be followed. When a change is negotiated and quantified prior to the performance of the work, the MTA obtains a benefit in regards to cost control and schedule impacts. When the contractor is allowed to perform the work and then prepare a cost estimate, the negotiation advantage has passed to the contractor. The contractor may or may not be controlling the cost of the WACN execution, as it would be if a fixed price had been established for the change prior to the beginning of the contractor's performance.

7.0 Change Order Process - Cost and Schedule Control

The process of controlling costs and schedules can better be defined as "attempting to minimize the risks associated with cost and schedule", because <u>total control</u> is generally not a cost - effective, viable alternative. Construction contracts and cost and schedule decisions are often based on trade-offs and negotiations. There will be multiple alternative solutions for any given situation e.g. we could expand a station to have marble flooring, but the cost would force us into adjusting the station seating to be plastic, is this a trade-off we are interested in? If we shift the ROD date for a project, the contractor will not need to accelerate his forces and we could avoid an acceleration claim. The intent of a successful owner organization is to minimize the cost and schedule risks by performing an oversight function of the CM, to obtain a level of confidence that the CM is acting in the best interests of the owner. The CM should be assessing and utilizing all cost and schedule control tools and techniques available while providing that service. **See the sections on Project Control-Cost and Construction Estimating for additional discussions of CM tools and techniques to assist with costs and schedule control.**

Exhibit 9 is a representation of the Control Continuum that relates to the change process. It is important to identify the MTA's needs of the change order and claims process. Through the change process, the MTA should be looking to assure themselves that the following elements exist within the process:

1. Legally valid merit determinations
2. Fair and equitable costing
3. Accurate schedule determinations
4. Arms length negotiations
5. Full disclosure of the change process and the end final results
6. Open communication between the MTA and the CM
7. Timely processing of changes to maintain project schedule
8. Timely processing of changes to maximize cash flow through the MTA
9. Consistency in the change order process from day one of a contract until final day of contract close-out

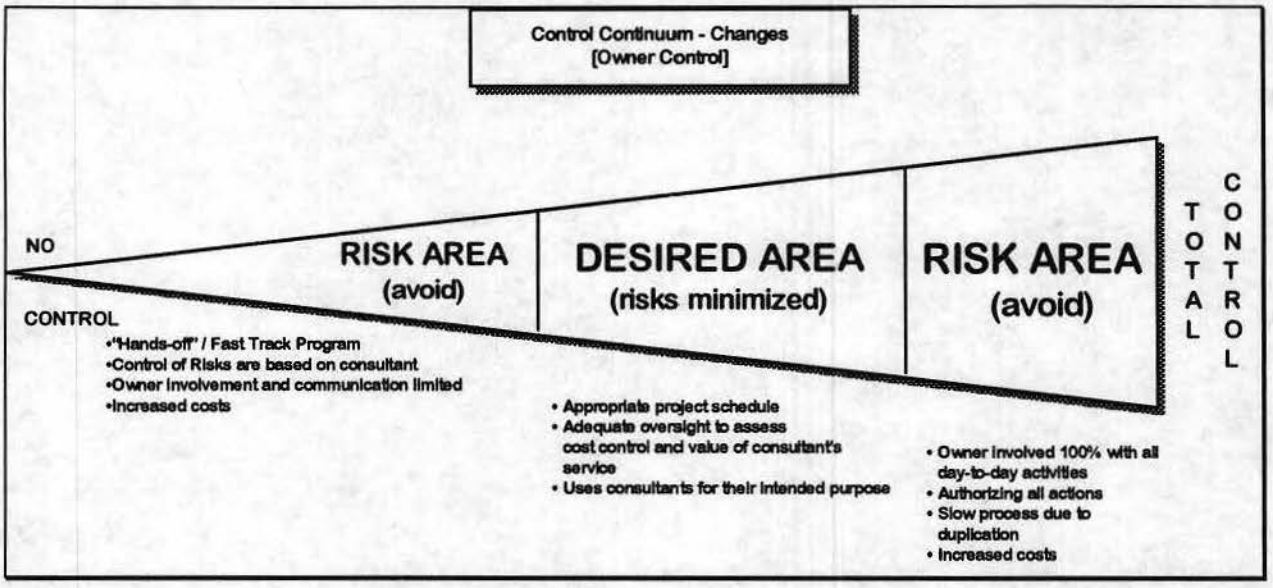


Exhibit 9

The MTA is attempting to locate their change order and claims processing function at the appropriate location on the Control Continuum. Their objective is to execute an oversight function that will adequately control the risks of the performance of their consultants, contractors and subcontractors. It is important that the MTA not perform at the lower range of the continuum (no control) because the

project cost, schedule, quality and safety issues are purely subjected to the quality performance of the other parties. It is also important for the MTA not to place themselves at the upper extremity of the control continuum (total control). At this position on the continuum, the MTA constricts the performance of its consultants and through this constriction ultimately increases costs, delays schedule and subjects itself to significantly increased liability due to their active involvement.

The position the MTA should occupy on the control continuum is near the center where there is both trust and skepticism placed on the consultants hired. The MTA goes through extensive contract award procedures to identify the best qualified consultant for their program. Once this consultant is engaged it is important that the MTA work with that consultant in a positive frame of mind. That positive frame of mind also includes a healthy dose of skepticism. The MTA should be monitoring on a scope/selected basis those material or "mission-critical" actions of their consultants.

The processes or functions that the consultants perform should be structured with a system of "checks and balances" to facilitate the MTA's oversight role. In addition, the MTA should execute post process assurance (audit) procedures. These assurance procedures would allow the MTA to assess the performance of their consultants, and based on that performance they could modify the function requirements as necessary to enhance the overall program performance.

7.1 Change Order Statistics and Observations

The MTA has experienced a significant amount of contract changes during the life of the Metro Rail Program. Many of the contracts have incurred costs in excess of their original budget/AFE. This indicates that changes are exceeding 10% on average. This is true on a number of MRL contracts. As the MRL - Segment 2 program moves to 50% complete many of the tunnel and station contracts are forecast to exceed their AFE. The Metro Rail Program has experienced the following levels of changes for construction and system contracts since inception:

MTA- Total Program
Change Notice Basis Analysis
Executed Changes from Inception to February 15, 1995

Change Type	Number	Dollar Value	Average Dollar Value Per Change	Percent of Dollar Volume
Work Scope	2,512	$75,796,741	$30,174	28%
Design Changes	2,608	59,227,905	22,710	22%
Management Issues	61	43,636,144	715,347	16%
Schedule Changes	279	40,164,802	143,960	15%
Differing Conditions	892	28,580,870	32,041	11%
Contract Options	28	14,375,511	513,411	5%
Outside Agency Requests	170	5,027,151	29,571	2%
Other	105	1,932,564	18,405	1%
Terms and Conditions	292	1,897,099	6,497	1%
	6,947	$270,638,787	$38,958	100%

Exhibit 10

7.2 *Change Order Volume and Resolution Statistics*

Exhibit 10 identifies the type of changes that have plagued the MTA since inception, sorted by dollar volume. The top two change types have amounted to 50% of the total changes. These two (Work Scope and Design Changes) are changes indicative of a program that is evolving. The work scope is additional work that often comes from re-performing work or performing new work based on a change of direction or desires. The design change costs are another indicator of a program that has a history of evolving or meandering in different directions. High quality, well controlled change programs are able to limit these "preference" or "insufficient planning" driven changes. The third largest type of change is "Management Issues". There have been only 61 of these changes, but they have averaged over $700,000 per change. These top three areas indicate a program that is unsure of where it is heading, and until the Mission and Vision are clear, changes will most likely continue at excessive rates.

This necessary perspective the entire MTA organization should develop regarding its consultants will need to be developed over time. As the parties gain confidence in each other's high quality performance, trust will develop and the "necessary oversight" function will begin to operate correctly, then less obtrusively. This description of the MTA perspective above also identifies and illustrates the

fundamental reliance that exists on the part of the MTA regarding the performance of the CM/RE as it relates to the change orders and claims process.

MTA Red Line Segment 2
Change Analysis: ROM vs. Contractor's Request vs. Actual Cost for Large Contracts
As of 2/7/95
Note: Executed Changes Only. Excludes T&M Changes and Changes still in the Negotiation Stage

Contract	Award Value	ROM	CM/ Owner's Estimate	Contractor's Request	Actual Cost	Actual/ROM	Actual/ CM Estimate	Actual/Contractor's Request
B201	44,577,273	4,222,951	3,499,746	5,412,104	3,925,903	93%	112%	73%
B211	38,487,177	1,465,985	1,574,321	2,452,556	1,807,103	123%	115%	74%
B215	26,177,700	58,900	74,526	48,649	65,082	110%	87%	134%
B221	79,812,793	2,590,089	3,181,439	5,438,814	3,826,632	148%	120%	70%
B231	53,645,201	1,325,027	1,783,221	3,335,459	1,894,184	143%	106%	57%
B251	129,655,578	519,521	(238,351)	520,051	23,548	5%	-10%	5%
B261	44,966,998	0	0	(50,330)	(50,330)			100%
B271	38,948,000	(110,520)	(110,520)	(110,520)	(110,520)	100%	100%	100%
B281	49,287,000	10,000	6,831	9,584	6,704	67%	98%	70%
B610	16,689,652	17,000	29,036	17,545	17,057	100%	59%	97%
B620	18,031,265	(67,229)	(28,717)	79,104	(11,808)	18%	41%	-15%
B630	6,157,150	25,000	0	24,974	22,487	90%		90%
B710	14,442,962	195,000	207,433	244,282	207,433	106%	100%	85%
B740	10,526,268	183,300	378,484	297,472	274,874	150%	73%	92%
B761	3,226,672	10,000	35,323	65,593	48,500	485%	137%	74%
Total	$574,631,689	$10,445,024	$10,392,772	$17,785,337	$11,946,849	114%	115%	67%

Exhibit 11

Exhibit 11 demonstrates the EMC and the CM have quantified changes similarly in total. For the above analysis both the EMC and the CM priced changes 13% below the final settled change order amount. There are specific contracts and changes where the EMC and the CM did not agree (i.e. B221 or B231), but overall their amounts average out to be similar. The contractor's total request was 24% above the final settled change order amount. These three indicators identify that the CM and the EMC may at times differ as to the cost of a change, but overall they are closely approximating each other's estimates. The contractors are, as expected, estimating the value of changes in excess of both the EMC and the CM. Through the negotiation and settlement phase of the change orders processed and reflected in Exhibit 11, the CM (and the MTA) are reducing the contractor's cost estimate by 49% of the award value, while the CM/EMC are only increasing their estimate by 13% of the final change value during the negotiation phase.

7.3 Management Reporting:

Governing all of this control continuum selection and monitoring for oversight, is a requirement for adequate Management Reporting to facilitate the Board and Top Management with their oversight role. This Management Reporting informs the Board and the MTA's Executive Management regarding the performance of their Agency staff, their consultants and their contractors. From this reporting, the Board and Executive Management can address the global issues for the program and assure themselves that the participants performance is capable of meeting their global program objectives.

The major element of Management Reporting related to the Change Order and Claims function is the determination of each contract's contingency amount. High quality exception Management Reporting will monitor contracts based on their progress and their utilization of contract contingency compared to the plan. Currently, the MTA establishes a 10% contingency on all contracts. This 10% is calculated as an addition to the award value to arrive at the AFE. As a rule of thumb, 10% is not an unreasonable figure. However, there is a natural tendency for the contractor and the RE to take ownership of the contingency and not be concerned with cost control until the total contract value begins to approximate the award value plus the contingency. To more accurately determine the appropriate contract contingency, it is essential to prepare a Risk Assessment analysis of each contract.

7.4 Risk Assessment:

Certain types of construction activities carry with them certain levels of risk. The contract's contingency should be established to fund that level of risk. Risks results into issues, which evolve into changes, and changes result in additional contract costs. Certain actions have related risks based on time and also risks with a range of values, that may result if the risk issue arises. For example, a tunnel contractor may experience a soil-based differing site condition and a resulting change order at any point during the tunneling process, while a station contractor should only experience a soil-based differing site condition during excavation and sub-surface construction.

The contract contingency level should be based on specific historical results regarding change types (DSC, Design change, etc.), industry experience and statistics and an assessment of the specific issues anticipated to be encountered within a contract. Each of these risk items should be assigned a probability of occurrence and an estimate or range of estimates of cost. An anticipated timeline of occurrence should also be determined for each of these risk factors.

The probability factors multiplied by the anticipated cost of the risk factor can be calculated to identify an estimate of the necessary contingency for specific, identified risk factors. Specific techniques exist to facilitate the modeling of probability and cost estimates, including Regression Analysis and the Monte Carlo Technique. In addition to each contract contingency there would be a general "Owners Contingency" available to compensate for those unpredictable changes or those global changes that impact all contracts (i.e. earthquake, legislation, owner desired betterments, community improvements, etc.).

If a risk factor event does not occur during the anticipated time frame for its occurrence, the associated contingency for that risk factor should be removed from the contract's contingency and placed back into the overall owner's contingency. In this fashion, there are parameters set around the project's budget that limit the contingency dollars available for the contractor or the CM to erroneously consider "their own to issue at their discretion".

The following two exhibits (12 and 13) reflect the realized Risk Factor Result differences experienced by the MTA. These Risk Factor Results are reflected in the volume and type of changes present on the MTA projects. The Exhibits contrast changes between types of contracts (Tunnel, Station, Systems, Other) [12] and between different Rail Line Structures (MRL Segment 2 vs. MGL) [13]. The historical change activity is stratified by Change Type to reflect the type of risk incurred by the MTA as well as the monetary impact of risk experienced.

Analysis of Resolved Contract Changes by Contract Type
Resolved Changes Since Inception Through Mid-March 1995
MRL - Segment 2
Construction/Procurement Contracts Only

Contract Type	Line/Tunnel Contracts			Station Contracts			System Contracts		
Change Type	Number of Changes	Dollar Value of Changes	Percentage of Change Cost	Number of Changes	Dollar Value of Changes	Percentage of Change Cost	Number of Changes	Dollar Value of Changes	Percentage of Change Cost
Work Scope	83	$ 2,016,677	10%	62	$ 646,876	8%	11	$ 360,223	28% (*)
Schedule Changes	8	2,838,355	15% (*)	20	784,988	10%	9	(13,575)	(1%)
Differing Conditions	77	4,554,839	24% (*)	52	1,254,054	15% (*)	6	18,157	1%
Terms and Conditions	13	0	0%	33	(983)	(0%)	26	25,000	2%
Design Changes	181	9,252,208	48% (*)	188	4,304,654	53% (*)	30	873,146	69% (*)
Management Issues	0	0	0%	4	200,223	2%	0	0	0%
Outside Agency Requests	36	371,921	2%	31	846,268	10%	0	0	0%
Contract Options	4	270,000	1%	4	125,915	2%	0	0	0%
Other	2	(87,324)	(0%)	3	960	0%	4	4,000	0%
Totals	404	$ 19,216,676	100%	397	$ 8,162,955	100%	86	$ 1,266,951	100%
Cost Growth to Date			7.6%			2.4%			1.1%

* change types that exceed 10% of change totals

Exhibit 12

Analysis of Resolved Contract Changes by Contract Type
Resolved Changes Since Inception Through Mid-March 1995
MRL - Segment 2
Construction/Procurement Contracts Only
(Continued)

Contract Type	Other Contracts				Totals			
Change Type	Number of Changes	Dollar Value of Changes	Percentage of Change Cost		Number of Changes	Dollar Value of Changes	Percentage of Change Cost	
Work Scope	10	$ 50,664	65%	(*)	166	$ 3,074,440	11%	(*)
Schedule Changes	0	0	0%		37	3,609,768	13%	(*)
Differing Conditions	2	9,350	12%	(*)	137	5,836,400	20%	(*)
Terms and Conditions	0	0	0%		72	24,017	0%	
Design Changes	3	18,331	23%	(*)	402	14,448,339	50%	(*)
Management Issues	0	0	0%		4	200,223	1%	
Outside Agency Requests	0	0	0%		67	1,218,189	4%	
Contract Options	0	0	0%		8	395,915	1%	
Other	0	0	0%		9	-82,364	0%	
Totals	15	$ 78,345	100%		902	$ 28,724,927	100%	
Cost Growth to Date			0.1%				3.8%	

* change types that exceed 10% of change total

Exhibit 12 (continued)

The above analysis indicates that there are change order differences between contract types. The Tunnel contracts are inherently more risky than a systems or station contract, and therefore, this contract type may need a larger contingency. The Systems contracts or other small contracts may not need a 10% contingency based on their historical results. The available budgeted funds from one contract could be assigned to another more risky contract. The appropriate assigning of contingency facilitates control over the change process. When a contingency is excessive, the pressure to negotiate changes down is reduced, compared to a contract where there is little contingency.

MRL Segment 2- Executed Changes as of 12/16/94
(Statistics as Reported:)

Change Type	Number	Percentage of Total Volume	Change Cost (000's)	Percentage of Total Cost
Work Scope	121	16%	$2,555	12.3%
Schedule Changes	29	4%	728	3.5%
Differing Conditions	124	16%	5,553	26.7%
Terms and Conditions	64	8%	24	0.1%
Design Changes	343	45%	9,984	48.0%
Management Issues	3	0%	180	0.9%
Outside Agency Requests	59	8%	1,458	7.0%
Contract Options	8	1%	396	1.9%
Other	6	1%	(83)	(0.4%)
Totals	757	100%	$20,795	100.0%

Green Line- Executed Changes as of 1/04/95
(Statistics as Reported:)

Change Type	Number	Percentage of Total Volume	Change Cost (000's)	Percentage of Total Cost	Red vs. Green Line Variance
Work Scope	165	17.5%	($187)	(0.5%)	12.8%
Schedule Changes	75	8.0%	10,648	28.8%	(25.3%)
Differing Conditions	186	19.8%	7,099	19.2%	7.5%
Terms and Conditions	82	8.7%	1,273	3.4%	(3.3%)
Design Changes	319	33.9%	6,617	17.9%	30.1%
Management Issues	15	1.6%	575	1.6%	(0.7%)
Outside Agency Requests	52	5.5%	2,710	7.3%	(0.3%)
Contract Options	10	1.1%	6,939	18.8%	(16.9%)
Other	37	3.9%	1,314	3.6%	(4.0%)
	941	100.0%	$36,988	100.0%	

Exhibit 13

The type of construction influences the type of changes that one may anticipate on a project as evidenced in Exhibit 13. The risk assessment studies to be performed in setting the appropriate contract contingency would consider the types of changes present in past projects (as shown above) and the types of changes anticipated based on the plans and specifications and the "Lessons Learned" since the past project was performed.

8.0 Change Approval Delegation

Arthur Andersen was asked to recommend an appropriate delegation level to the construction committee for approval of Change Orders and Consultant Change Requests. To assess the propriety of any delegation it was necessary to (1) determine the historical level of change order and consultant change request activity, (2) compare the MTA process to other rail transit properties and (3) assess the "Best practices" of other construction "Mega Projects".

To assess the delegation of any change approval authority it is necessary to assess the historical volume of Construction and Systems contracts and Consultant Change Requests.

The volume of changes approved on the MTA Rail Transit program from 1987 to 1994, stratified by level are reflected in Exhibit 4. This table indicates the significant volume of changes that take place at amounts currently controlled by the CM, and the significant dollar values that are controlled by the MTA Board.

Construction and Systems Contract Changes - All Projects
1987-1994

Range	Volume	Percentage of Total Volume	Change Value ($ in Millions)	Percent of Change Value
< $100,000	6,221	93.5%	$64	24.8%
$100,000-200,000	255	3.8%	30	11.6%
Sub-totals	**6,476**	**97.3%**	**$94**	**36.4%**
$200,000-500,000	84	1.3%	22	8.5%
$500,000- 1,000,000	40	0.6%	20	7.8%
$1,000,000-2,000,000	35	0.5%	24	9.3%
$2,000,000-3,000,000	12	0.2%	24	9.3%
$3,000,000-$4,000,000	1	0.0%	3	1.2%
$4,000,000-$5,000,000	6	0.1%	26	10.1%
> $5,000,000	3	0.0%	45	17.4%
Sub-totals	**181**	**2.7%**	**$164**	**63.6%**
Total	**6,657**	**100.0%**	**$258**	**100.0%**

Exhibit 14

This Exhibit indicates the volume of changes that are entirely handled by the RE (CM) and the PM (MTA) [97%] and the magnitude of dollars handled by the MTA Board [63%].

Exhibit 14 reflects the change levels during the last eight years for construction and system contracts. Exhibit 15 reflects the amount of construction and system contracts changes and their stratified levels during the life of the MRL - Segment 2 project.

Change Notice Breakdown
Redline Segment 2
Executed Changes from inception to 3/2/95
MTA: All Projects

Range		Number of CNs	%	Dollar Volume	%	Averages CN Size	Recommended Authorization
< $100,000	(1)	812	92%	$8,102,399	28%	$ 9,978	RE/ CM/ MTA Staff
$100,-$200,000		51	6%	$6,357,898	22%	124,665	Construction Committee
$200,-$500,000		12	1%	$2,927,920	10%	243,993	
> $500,000		12	1%	$11,120,066	39%	926,672	MTA Board
Totals		887	100%	$28,508,283	100%	$ 32,140	

Note 1> Changes greater than $50,000 comprise approximately $6 million (21%) of the change volume

Exhibit 15

The Consultant Change Request process has the same upper delegation limits for approving changes. The MTA Board must approve all CCRs above $200,000 after the Construction Committee recommends the change for approval. The changes under $200,000 are approved by the MTA PMs. Exhibit 16 reflects Consultant Change Request activity for the last four years, stratified by change request size.

Professional Service Contract Changes
1991-1994 MTA All Projects

Range	Volume	Percentage of Total Volume	Change Value ($ in millions)	Percent of Change Value
$0 to $200,000	464	85%	$25	29%
$200,000 to $500,000	45	8%	13	15%
$500,000 to $1 Million	21	4%	16	19%
Above $1 Million	16	3%	31	36%
Total	**546**	**100.0%**	**85**	**100%**

Exhibit 16

Our review of other transit properties reflected that their approval levels were varied. Overall, the other properties were more conservative with their delegation levels for their Agency Staff, than the MTA. The data available did not reflect if they were utilizing committees to facilitate their change order approval process.

The current change order processing timeframe continues to be an extended process due to the intense interest in all change orders by the public, the contractors and the Board. The Construction Division not only prepares the Board recommendation documents and prepares for the Board meeting, but they also spend a significant amount of time preparing to respond to the Board. As a result of the in-depth involvement of the Board members in the process of approving changes, the Board's time available to address MTA policy and its global mission is diminished.

The logistics of bringing a change to the Board for approval can be a difficult feat. The change order generally has to be approved by the CM and the MTA PM 4 to 12 weeks before the change approval is actually needed from the Board. It can take 1 to 3 months to move the change through the Committee and the Board, because of their single meeting time during the month and their requirements to place an item on the agenda. Change Order process delays and contract interruptions have potentially significant adverse cost elements to the MTA associated with them. Potential results of delaying the change order process are that (1) the contract schedule could fall behind the critical path, (2) resulting

contractor delay claims could arise or (3) claims for additional costs resulting from coordination efforts between other contractors could result.

9.0 Recommendations for the Change Orders and Claims Function

9.1 Organizational Structure:

Our recommendation is to retain the current structure of assignments for the Change Order and Claim function between the MTA and the CM. Therefore, we recommend that the MTA not assume any additional tasks from the CM related to the Change Order and Claim function. The MTA should continue to require the CM to perform their activities related to claims and changes, while the MTA acts in a very involved oversight (assurance) posture.

This structure provides the MTA with the following benefits:

1. Control and Flexibility Over Staffing: An ability to mandate qualified personnel be provided and available for this function so that qualified technical assessments of change propriety and change cost can be achieved, and as Change Order and Claim volume increases, the CM can staff up more quickly than compared to the MTA
2. Flexibility and Timeliness: Technical changes can be evaluated in a timely and cost effective manner by the CM through their use of experienced professionals
3. System of Checks and Balances: A flexible and desired level of oversight control regarding the process that could be increased or decreased as MTA management desired through assignment of technical evaluators or additional qualified staff from the MTA or the CM

We recommend that the MTA become more intimately involved with the change process. To accomplish this goal it will be necessary for them to be selectively involved with the day-to-day determinations and quantification's being made by the CM. To accomplish this goal there is a need for MTA staffing within the RE office. ***This staffing is discussed in the Contract Administration section of our report.***

We recommend that through our discussion of the contract administration function that additional contract administrators be employed by the MTA and staffed in the field offices of the major, active

contracts. These individuals would be involved in the oversight of the RE activities related to the major changes. They would observe and contribute to the activities of merit determination, cost quantification and change negotiation. The contract administrators would be utilizing their skills related to understanding the scope and details of the contract written between the contractor and the owner. They would assist the RE in the determination of merit. They would be able to involve MTA legal in the review of the merit determination of certain contracts that went beyond their technical ability. The contract administrators would also be able to draw upon the increased MTA estimating department to facilitate an independent determination of cost and schedule impacts of selected material changes. The determination of cost is not a skill/technical ability that the contract administrators possess, but they could escalate challenging cost issues to the qualified cost individual within the MTA on an as needed basis. In addition, during the negotiation phase of material selected changes they could participate as an observer and as a contributor to the extent their skills facilitated timely negotiation of the change.

The CM/RE performs the determination regarding merit for a change, the quantification of the cost of the change, the impact on schedule of the change, the negotiation process regarding the change and the ultimate resolution and notification of the change to the MTA and the Board.

The MTA contract administrator will observe and facilitate the process where possible based on their selection of particular changes to observe. The CA's will:

- Look at the issue of merit
- Involve legal for those particular instances where merit is an issue
- Involve MTA estimating when cost is an issue of change
- Review the sufficiency of the documentation regarding the change

The project manager will be involved with approving merit, cost and schedule of a change. The construction committee will test the validity of the CM or PM recommendation regarding the change. In addition, the committee will look to the grander vision of the program and identify the interrelationships between this change and other changes currently in existence or envisioned to take place on the program overall.

The Board will be involved in final approval of the changes after they have adequately tested the validity of the recommendations from the CM, PM and construction committee. As their confidence grows based on desired correct performance from all parties within the Metro Transit program, they

will move from strictly an approval of changes to providing global vision for the program. Through this vision process they will relate particular changes to the overall program and the impact that the change and interrelated changes will have on the public.

We recommend that the contract administrators monitor the change potential situation on a regular basis in conjunction with resources drawn from internal audit, the estimating department of the MTA and the utilization of the CM and PM personnel within the MTA. When the determination is made that the documentation does not accurately reflect the observations of the contract administrator for those changes that they are monitoring and observing, they will be able to involve the appropriate level of the MTA staff to address the issue. By utilizing timely review and selected day-to-day interaction between the MTA and the CM, the MTA's oversight role will have a higher success rate of actual execution. In addition, adequate documentation describing the full process regarding the change will reduce the likelihood that subsequent reviews of the change documentation will result in confusion and differences of opinion regarding the issues of merit, cost determination and the adequacy of the negotiation techniques of the CM.

This new structure identifying the MTA oversight involvement in the change process is diagrammed in **Exhibit 17**

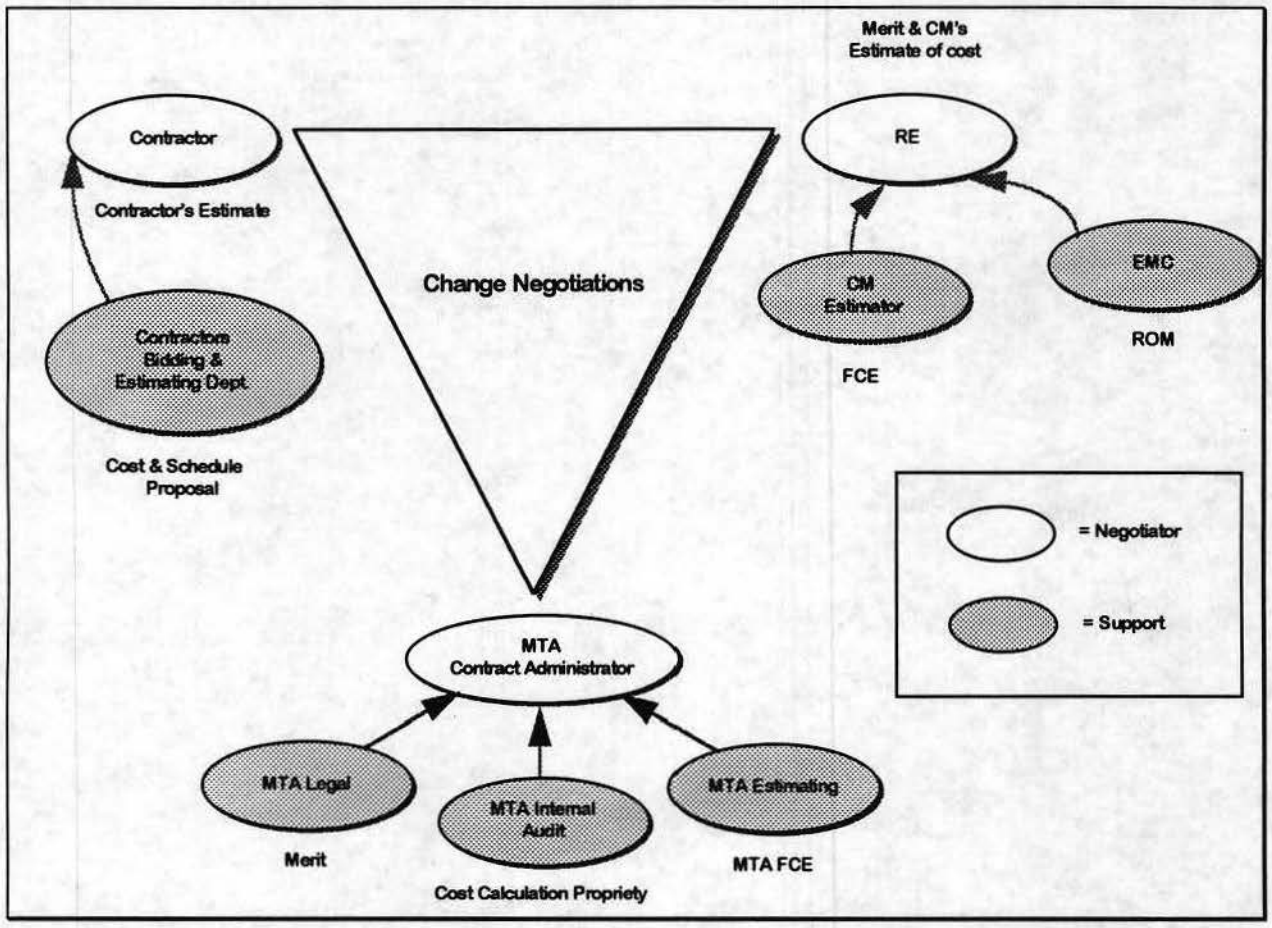


Exhibit 17

The MTA's emphasis on reviewing and approving changes should be increased in the following areas:

1. MTA legal counsel should provide merit guidance while internal audit assures the MTA change cost estimates are calculated based on contractual rates for direct and indirect costs.
2. The MTA project manager or deputy project manager are the individuals who can assess the realistic nature regarding the quantity of work being claimed within the cost proposal.
3. The MTA estimating department can issue their opinion regarding the cost based on the description of the changed work, but the Project Manger, Deputy Project Manager and the Construction Manager for the MTA should be the individuals who have been involved with monitoring the performance of the contractor and can comment on the validity of the request for additional

compensation, for system contract changes, the EMC is in a position to comment on the requested additional compensation.

4. The MTA should execute post process assurance (audit) procedures. These assurance procedures would allow the MTA to assess the performance of their consultants, and based on that performance they could modify the function requirements as necessary to enhance the overall program performance.

9.2 *Timing and Approval of Change Order Processing:*

As the change order process moves forward (from change identification through cost negotiations) the MTA must assume more responsibility to review and evaluate changes, prior to providing their approvals. The Change Order and Claim process for construction and systems contracts is a function that is primarily performed by the CM. However, the CM still has the responsibility to perform the tasks within the Change Order and Claim function, which includes evaluating and negotiating the cost of the change or claim. It is important for the MTA as they execute their oversight role, to monitor the actions on a day-to-day basis with an attitude of healthy skepticism regarding the performance of their EMC, CMs and their contractors. However, to perform this adequate oversight it will require additional construction staff. The cost associated with the new staff should be recovered from the benefits of "enhanced oversight". With this monitoring comes the attitude to probe and verify that the service being provided is beneficial to the MTA. With an attitude evolving of healthy skepticism the MTA Construction Division will be exercising its fiduciary duty to provide the highest quality transit program possible.

We recommend that it be mandatory for each individual receiving a CTE packet to respond regarding a change under review by the CCB. The respond date will be electronically printed on the CTE forms when created by the CCS and the Contract Administrator assigned to the contract will be responsible for enforcement and logistics.

We recommend that the contract administrators monitor the sufficiency of the change documentation on a regular basis in conjunction with resources drawn from internal audit, the estimating department of the MTA and the MTA Construction staff. It is essential for the documentation practices of the CM and the MTA Construction Division to be enhanced. With the contract administrators more involved with the change negotiation and documentation phase of the function, if the documentation does not accurately reflect the observations of the contract administrator they are

monitoring and observing, they will be able to involve the appropriate level of the MTA staff to address the issue.

Each participant in the approval process of changes must take ownership of the responsibility associated with recommending and approving the change orders. The MTA staff must take an ownership role in the change order and authorization process by reviewing and processing the change in a timely fashion so that schedule is not impacted by inaction, while still maintaining an eye toward fair and equitable pricing of changes and thorough arms-length negotiations.

9.3 Cost and Schedule Control within the Change Order Process:

We recommend the Change Control Board meet between two and four times per month based on the volume of the changes. We understand the CCB currently meets two times per month and that urgent changes can be discussed at the Consultant CCB meetings. However, as the volume of changes being cleared increases due to our other recommendations, we believe it would be beneficial for the CCB to be meeting more frequently. Currently there is an extensive volume of changes and timing is of a critical issue. During the last two years, construction and system contracts on MRL-Segment 2 have generated approximately 320 changes per year. This volume is in excess of previous years volume and the dollar value is slightly lower than the historical MRL-Segment 2 average. Based on the cash flow projections for MRL, we anticipate the volume of changes to at least remain in the 300 per year average. Therefore, increasing the frequency of the CCB meetings will enhance the processing of these changes. The critical timing issue is to get the change on the agenda for Board approval at the appropriate time so that schedule is not impacted.

We recommend that the Construction Committee meet at least two times per month to facilitate the movement of changes through the change process in preparation for the required Board approval. Because of the additional meeting of the Construction Committee, changes that need further refinement prior to Board discussion will have approximately two weeks to be processed before they need to be placed on the agenda. This will facilitate a higher first time resolution of changes that pass to the Board, because of the pre-screening that the construction committee will require. The potential of a significant change not being approved at the appropriate time by the Board can significantly impact a program's schedule.

We recommend the MTA Staff must identify alternatives for the Board related to the changes that are being taken to the Board for approval. When the staff offer the Board the option of approving the change or suffer the potential consequences of a lawsuit, there generally is no option. The Board has its hands tied because of the limited options. The staff needs to identify cost mitigating changes that could be enacted to offset the cost of those changes that are essential. This may entail performing cost benefit analysis that identify scope reduction possibilities that do not severely impact the project, but can assist in the funding of the required change. When changes arrive on the Board agenda at the last minute, the options available to the Board regarding approval or not approving a change are limited. The MTA staff should strive to provide as many viable alternatives as possible to the MTA Board, which includes processing changes on a timely basis so that schedule impacts do not mandate change approval prior to resolution of all change issues raised by the Board.

9.4 Change Order Approval Level Delegation:

Delegation to Construction Committee:

It is very evident that simply changing delegation will not enhance the contract award and change process by itself. There needs to be a cultural shift within the actions and perceptions of the MTA Board. They have to establish trust of their committees and their staff. The staff and the committees need to take ownership for their actions so that they realize that when they approve an item they are to stand behind that approval. Without this cultural shift and development of trust, the desired benefits from delegating contract awards and change orders to the Construction Committee will not be achieved.

To enhance and expedite the change order process we recommend that the approval levels for change orders (construction, systems, consultants) be modified such that the Construction Committee of the Board has the authorization to approve changes up to $500,000. Change Orders in excess of $500,000, which have generally consisted of 40 to 50 percent of the dollar value of the changes, but only 1 to 2 percent of the physical volume, would remain the responsibility of the MTA Board.

We recommend that the Construction Committee formally notify the Board of their actions related to change approval. This will ensure that all Board members are informed of the specific contracts change orders and their program-wide ramifications. The benefits to the Board are three-fold: (1) the Board still retains control over the vast majority of award dollars with reduced efforts, (2) the Board obtains additional time that will be available to address the Rail Transit Program's Vision and Policy for the

future and (3) the Board will continue to develop and demonstrate an environment of increasing trust and confidence in their Construction Committee and Construction Staff.

We recommend that the delegation levels within the RE offices and the CM remain the same. The current delegation of $0 to $25,000 with the RE, and $25,001 to $50,000 with the CM are appropriate delegation levels that are not materially different from the other Transit properties. The changes between $1 and $50,000 are the high volume, low dollar changes that need to be controlled and approved by those individuals handling the day-to-day production activities of the contractor, which is the RE and the CM organization.

We recommend that the top MTA staff level be reduced to $100,000 for construction, systems and consultants. Currently the MTA staff is delegated the authority from $50,000 to $200,000. There appears to be a number of situations where changes are established at a NTE (not to exceed) level of $200,000. One reason for this level of approval for NTE changes is that $200,000 is the upper level of the MTA staff authorization. This type of action has the appearance of limited control by the MTA Staff and therefore needs to be reduced. By issuing NTE changes, the MTA is subjecting itself to post-action negotiations or full time and material payments for changes. In addition, the upper level of $100,000 is also consistent with the contract award level. A change order is identical to a contract award in that its additional dollars being established for a contractor or consultant to earn and therefore there should be consistent treatment.

The current delegation for $200,000 and above is a two step final approval process. First, to the Construction Committee for their recommendation and then to the full Board for their approval and authorization. We recommend that the change order delegation be for $100,000 to $500,000 with the Construction Committee and notification to the Board only. The change orders in excess of $500,000 would be approved by the Board after the Construction Committee provides their recommendation.

The majority of the dollars remain with the Board and large changes are controlled by the Board. However, by separating a segment of the change order process and the associated volume (approximately 20 to 30 percent of the volume) the Board will have more critical time available so they may deal with policy and vision issues. The Construction Committee is already trained in the process of change order approval, so there would not be a need for detailed, time-consuming training for the Committee.

These recommendation levels are somewhat different than some of the other transit properties. However, what is evident is that the MTA Board is significantly different than the majority of the other Transit Boards visited. The MTA Board is more involved in the day to day activities which absorb significant amounts of their valuable time. By delegating some change order approvals to the Construction Committee, the Board will have additional time to devote to mission-critical areas, and more importantly, they will begin to develop a level of trust and an ability to actually delegate responsibility first to the Construction Committee and eventually to the MTA Construction Division.

10.0 Findings, Implications and Recommendations Specific to Consultant Changes

The primary concern regarding consultant changes relates to valuing the service being provided by the consultant. When a CCR arises the MTA is the party that needs to perform the procedures regarding the change process. The project manager/deputy project manager must assess the consultant change request cost proposal documentation. The PM/DPM is assessing the technical requirements related to quantity of hours to be provided to execute the change. The MTA contract administrator will be involved to assess the merit of the CCR. Where necessary, the MTA CA may involve the MTA's legal counsel. To facilitate the determination of the accurate CCR cost, internal audit will be required to review the direct and indirect rates being utilized in the change for propriety to the contract. This process is depicted in Exhibit 18.

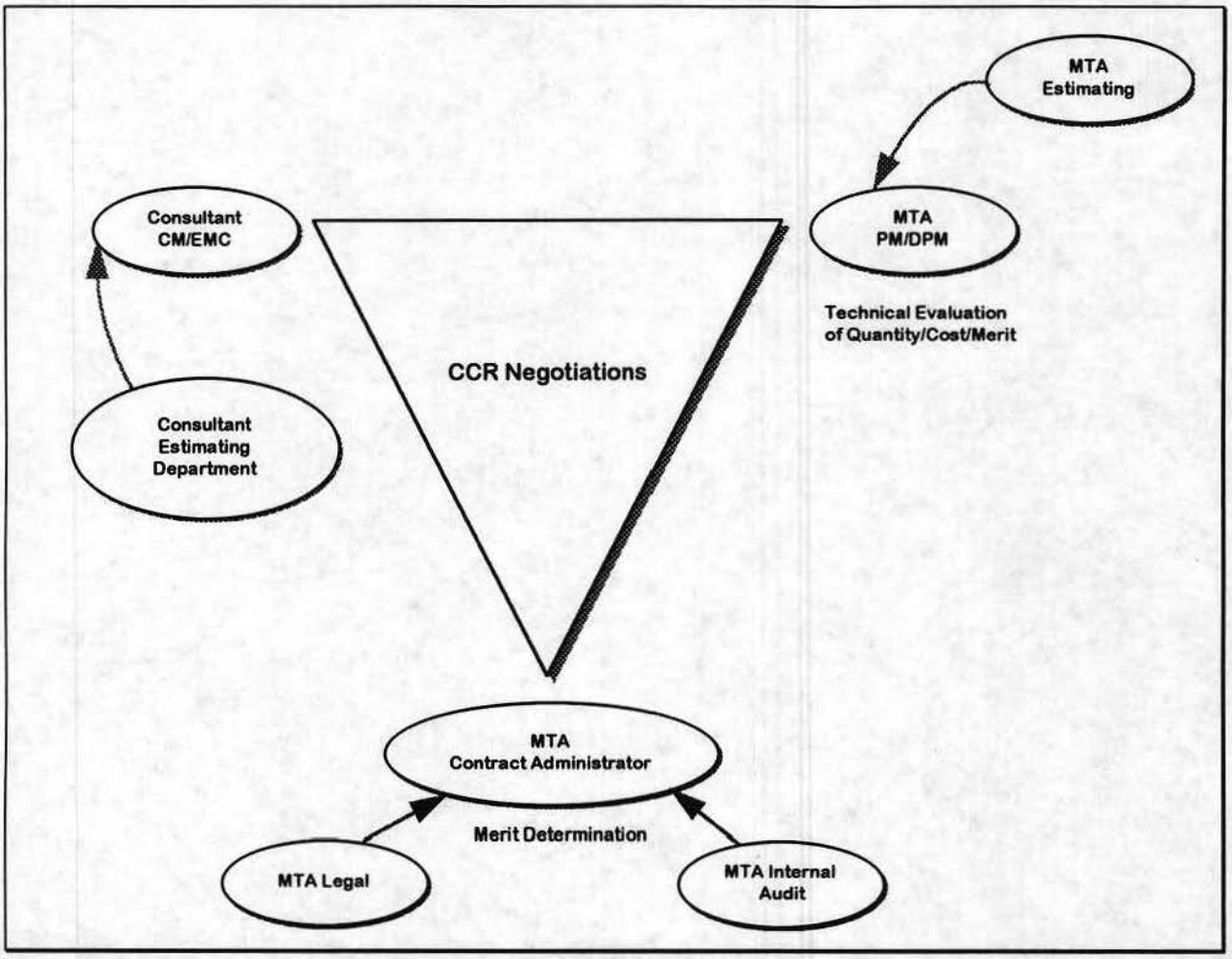


Exhibit 18

To facilitate and potentially reduce the changes and their associated costs for consultants on upcoming projects, we recommend that the MTA consider the use of fixed fee bids from the section designers handling the 30%-100% design services. There exists a lengthy track record regarding the base cost bid for these services and the level of cost associated with subsequent changes prior to final delivery of the product. By attempting to fixed fee bid a small sample of these projects, the MTA can contrast the past results with the future results to identify whether a cost savings arises from the fixed fee bidding process. **We do not recommend that fixed fee bidding be applied to the 0-30% design work currently being performed by the EMC due to its conceptual nature and its potential for revisions.**

There is a current backlog of CCRs awaiting processing. The statistics for the processing of CCRs is similar to the CN process. The reports identifying the aging of the CCRs, the dollar values for the pending CCRs and the "Ball-in-Court" status report (addressing who is responsible for processing the next phase of the CCR) are also produced. The following Exhibit 19 addresses the current aging statistics and pending values for December 1994's CCRs:

MTA- MRL-2
Aging of Consultant Change Requests
Unresolved Consultant Changes December 1994

Aging	0-30 days	30-60 days	61-90 days	over 90 days	Total Active
Volume	15	4	7	57	83
Percent	18%	5%	8%	69%	100%

The volume of active CCRs has increased 14% over the volume active in October. The over 90 day category increased 5%age points from October.

Consultant Change Request Values (000s)

	Pending	Approved	Resolved	Total
Amount	$9,087	$5,626	$28,166	$42,879
Percent of Total Value	21%	13%	66%	100%
Volume of CCRs	49	34	204	287

Both the pending and the approved CCRs are still active and awaiting final resolution.

Exhibit 19

Consultant Change Requests
MRL- Segment 2
Ball in Court/Responsibility Summary
As of February 23, 1995

Entity Responsible	Number of CCR's	Current Forecast	Number of CCR's Where Next Action Due Date has Passed
CM	11	$1,725,213	1
MTA for CM/PD	10	$2,665,059	0
LKG	1	$3,200	0
MTA for LKG	1	$0	0
EMC	31	$4,390,301	16
MTA for EMC	30	$5,205,427	24
MTA for OKA	6	$797,078	1
Totals	90	$14,786,278	42
Totals for MTA	47	$8,667,564	25

Exhibit 20

The data in Exhibit 19 shows that the process of resolving CCRs does not proceed any more expeditiously than the CN process. More than 60% of the CCRs are over 90 days old. The Ball in Court report [Exhibit 20] identifies the MTA as the largest bottle-neck [47 of 90 CCRs are currently their responsibility]. There is a significant issue with the EMC's contract, because there are currently 40 of 61 CCRs past their Need Date. **This is indicative of the Contract Administration issues that affect the MTA and are discussed in the Contract Administration chapter of Volume B.**

To assess the cost propriety of the CCR and to expedite the processing of the CCRs , the MTA estimating department should construct a cost and pricing data base based on the history of CCRs that have been approved during the life of the MTA program. By creating this database they will be able to facilitate the evaluation of CCR costs and provide insight to the PM/DPM as he negotiates the CCR with the consultant.

CHAPTER X
Volume B

PROJECT CONTROL - SCHEDULE

1.0 Nature of the Function

The current function of Project Control - Schedule (scheduling) during the project construction phase is to ensure that the "project schedule", with all its component contract schedules, is properly managed and controlled to critical milestone dates established by the MTA Board. The overall responsibility to perform the tasks associated with Project Control - Schedule performance activities resides with the CM. The MTA is responsible for the oversight of the CM as they perform the tasks.

During construction, the contractor submits a monthly schedule update to the CM identifying physical progress made. A CM Project Control Engineer (PCE) assigned to the contract verifies the contractor's progress by walking the site, having discussions with the Contractor and Resident Engineer, reviewing Inspector Daily Logs and attending field meetings. The PCE compares actual progress with plan to perform variance and trend analyses and offers commentary on the contract's schedule status. This commentary may include recommendations on schedule delay mitigation.

The CM Project office consolidates the individual construction and procurement contract schedules, along with EMC and other updates into a project master schedule. Schedule status is communicated to the MTA primarily through the Monthly Project Schedule Report, the Schedule section of the Project Manager's Status Report, the monthly CM sponsored cost and scheduling meeting and a monthly stand-up meeting of the Resident Engineer and MTA project management. In addition, MTA staff may view current schedule information on-line through the MTA's computer system.

Initially, custodial responsibility for maintaining the project schedule rests with the EMC. Once construction activities dominate, the MTA transfers custody of the project schedule to the CM, therefore, scheduling responsibility for individual contracts shifts from the EMC to the CM after contract award. During the construction phase, the overall responsibility to perform the tasks associated with the Project Control - Schedule process resides with the CM. The MTA is responsible for oversight of the CM as they perform the tasks associated with this process.

2.0 Issues of the Function

The schedule preparation, maintenance and monitoring is a primary component of the Project Control area. Schedule carries with it a very high level of emphasis, because contracts are measured based on schedule completion, total cost and the quality of the facility produced. Within the MTA, schedule is treated as the primary constraint and factor for decision making. The cost, quality and safety issues are generally treated as secondary constraints in the decision making process. For the Project Control - Schedule function there are some global issues to address. These issues are:

1. What organizational structure should be implemented within the MTA and between their CMs to adequately provide the Project Control - Schedule function?
2. What procedures should the MTA perform as it relates to the Project Control - Schedule function?
3. What level of performance has the MTA demonstrated regarding this function?
4. What recommendations are proposed to enhance the Project Control - Schedule function?

3.0 Findings Regarding the Function

3.1 Resulting Duties of the CM

The following summarizes the major duties being performed by the CM organization, in sequential order, as it relates to the Project Control - Schedule function:

1. Prepare a Schedule Basis and Assumptions outline that details the scope, quantities, production rates and all other influencing factors and assumptions built into the project schedule
2. Review scope, progress, changes, milestones, and work arounds for the project schedule. The project schedule includes all construction contracts, systems contracts, professional services contracts, as well as the EMC design schedule
3. Review the Contractor's detailed construction schedule for reasonableness and compliance. Update the current summary level network showing the critical path of the scheduled construction contract activities along with the appropriate detail cost and manpower information
4. Perform a regular analysis of the contractor's schedule performance, identify potential problems and recommend actions for improving schedule status. Assist Resident Engineers in the development of an accelerated work schedule and a contractor's work around schedule

5. Identify project schedule critical path and changes along with suitable revisions to the Basis and Assumptions outline. Obtain MTA approval for schedule changes prior to incorporating them into the project schedule database
6. Utilize the Primavera Project Planner system to summarize the project schedule database into three levels of maintenance and presentation: Level 0 (Executive), Level 1 (Management) and Level 2 (Control) schedules
7. Update the MTA's Cost Management System (CMS) with the latest schedule information. The CMS system uses a cost-loaded schedule to determine the contractor's progress payments
8. Provide schedule impact analysis for proposed changes and Board requests

3.2 *Resulting Duties of the MTA*

The following summarizes the major duties being performed by the MTA organization, in priority order, as it relates to the Project Control - Schedule function:

1. Provide MTA policy directives determining the nature of schedule information to be collected, the frequency of collection, the methodology for primary analysis and overall reporting requirements. Ensure that schedule reporting is consistent in content and form with schedule information being compiled for other projects within the Metro Rail program
2. Review the schedule changes submitted by the CM and recommend them for approval before incorporation into the Master Project Schedule
3. Intercede and provide direction on the interpretation of schedule input for instances where two or more participant organizations, such as the CM and EMC differ in their assessment
4. Combine Project Control - Schedule information provided by the CM with schedule updates from other projects under separate cover for the MTA Board and other entities
5. Evaluate the CM's ability to provide timely schedule information, sound analysis, and perform effective Project Control - Schedule procedures
6. Direct and monitor special studies and analyses

4.0 Organizational Restructuring

Project Control - Schedule is a function that is currently performed by the CM. The CM is responsible for receiving the contractor's schedule status and updating the computerized scheduling system. In accordance with the MTA's requirements for schedule status reporting, the CM is responsible for performing the analyses required to identify potential schedule slippage beyond critical milestones. By supporting the Resident Engineer with mitigation recommendations, the CM Project Control - Schedule function is responsible for alternative solutions to facilitate schedule enhancements.

Currently the MTA oversees the function by first receiving and reviewing Project Control - Schedule products from the CM, and then by approving all changes to the program schedule. Project Control - Schedule policies and procedures, including the manner with which schedule data is maintained and how Project Control - Schedule analyses are to be performed, are defined by the MTA.

5.0 Recommendations for Organizational Changes to Project Control - Schedule

5.1 We recommend that the MTA not assume all Project Control - Schedule tasks from the CM. The MTA should continue in its oversight role subject to the recommended changes included in section 5.2 and in the Cost Control chapter. There is a full discussion with associated recommendations regarding restructuring the Project Controls functions of the MTA, EMC and the CMs in the Project Control - Cost section of our report (Chapter XI, Volume B). This restructuring would remove the Project Control - Schedule function from each of the entities and centralize the function under the direction of the MTA. Each entity would potentially be providing some resources for the Project Control - Schedule function to the MTA, but the function would not be solely performed by the CM.

5.2 We recommend that the MTA develop a Project Controls team comprised of a selected group of individuals from the MTA, the CM firms, the EMC or other consultants. This Project Control team would also provide the Project Control - Schedule function. We propose a organization structure with the Project Control Team reporting to a Project Control Manager, a Senior Cost Manager and a Senior Schedule Manager mandated to be MTA employees.

5.3 **The MTA must also amend the CMs and EMC scope of services to eliminate the requirement for a full Project Control - Schedule capability.** The CMs and the EMC will be required to provide quality candidates to fill available Project positions when requested by the Project Controls Committee which is discussed in the Project Controls - Cost chapter.

With these recommendations, we believe the MTA will obtain the following benefits:

1. Qualified Personnel: An ability to mandate qualified personnel are provided and available for this function
2. Staffing Flexibility: Less MTA staff limitations as project control function demands increase, particularly during peak construction, compared to if the MTA were to take this function totally in-house
3. Improved Cost Control Oversight: MTA Senior Cost and Schedule Managers will assume a more active role in directing specific schedule programming and analytical analysis to facilitate mitigating schedule issues and ensuring that Project Control - Schedule methodologies are uniformly applied
4. Better Project Control Quality: Selecting the best available project control candidates from an inter-company pool or external hires will facilitate the MTA's ability to obtain the best skills for the required positions
5. Lower Costs: Eliminating redundancies in project control management will save the MTA in consulting fees and Agency expenses
6. Enhanced Communications: By establishing an integrated multi-organizational, project focused team, potential organizational barriers to communication will be removed. More timely and candid Project Control - Schedule information will likely result.