CONSTRUCTION PROJECT
DELAY-ANALYSIS TECHNIQUES

A Thesis

by

HANOUF M. AL-HUMAIDI

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

August 2002

Major Subject: Civil Engineering

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ABSTRACT

Construction Project Delay-Analysis Techniques. (August 2002)
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The construction industry is considered one of the largest money-generating industries of the economy. Construction time is a highly critical aspect for all parties involved in a project. However, delays in construction projects seem to be inevitable. This results in conflict as every party claims that the other is responsible for the delay. Delays that can affect construction time may cause claims, some claims can reach litigation. There is a need in the construction industry to analyze delays using the most appropriate delay-analysis technique. The selection of delay-analysis method to analyze a delay is a critical factor that can dramatically affect the delay analysis results. There is a pressing need to resolve conflicts among different parties by implementing delay-analysis techniques that lead to fair analysis results depending on the amount of information that is available at the time the delay is being performed and the timing of applying the delay-analysis.

This study focuses on two aspects of delay analysis; the first aspect is to describe different delay-analysis techniques that can be applied to resolve claims among different parties involved in a dispute. The second aspect is to compare different dynamic delay-analysis methods that can be applied to resolve claims and compare the result of applying those methods. The results of this research benefit different parties among the construction industry such as the owners, designers, contractors, and lawyers.

DEDICATION

For my parents, Haya and Mohammad, whose love and support have guided me throughout and carried me at times.

For Summar and Hamad, whose unconditional love and support are never ending sources of peace and comfort.

For Noura, whose love and encouragement gave me hope from thousands of miles away.

For Hebah and Maisam, whom I hope to inspire, to pursue their ultimate happiness even when, at times, it is an up hill battle.

ACKNOWLEDGMENT

First I would like to thank my advisor, Dr. Donald A.Maxwell, for his guidance and support throughout my graduate studies at Texas A&M University. Also, I would like to thank my committee members: Dr. Stuart D. Anderson, and Dr. Kenneth C. Williamson III for their helpful comments and suggestions that enhanced this research work. Also, I would like to thank Mr. Andrew Goldsmith, who provided valuable data and great suggestions to this research. Mr. Goldsmith enhanced this research with his experience and suggestions.

TABLE OF CONTENTS

Page

Page

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

1.1 Background

The construction industry is considered one of the largest money-generating industries of the economy. Construction time is a highly critical aspect for all parties involved in a construction project. However, delays in construction projects seem to be inevitable and can arise from different causes, which can dramatically affect the project completion date. Therefore, delays can be very expensive and can result in conflicts as every party claims that the other is responsible for the delay.

Most of the time, several parties are involved in disputes. A dispute can happen between owners and contractors, between owners and designers, or between designers and contractors depending on the parties that might have been responsible for the delay that caused the dispute. Construction claims are very common in the construction industry. Furthermore, claims arising from delays sometimes reach litigation, which is expensive and time consuming for all the parties involved. "The two concepts that are used in construction claims are time and money." (Rubin 1983).

Delays that can affect construction time may cause claims, which can reach litigation, and need to be analyzed using the most appropriate delay-analysis technique and method to make sure that each party involved in the dispute is treated fairly.

This thesis follows the style and format of the *Journal of Construction Engineering and Management*, ASCE.

This research aims to identify different methods and techniques for analyzing a delay. Also, this research is intended to determine when a specific method of a delay analysis can be best used. Since most litigations reach court after the project is completed, this research will be focusing on the after-the-fact methods of delay analysis and comparing the results that these methods would provide to the analysis methods that can be implemented when the project is in the ongoing stage.

1.2 Scheduling

Antill and Woodhead (1990) define scheduling as "the determination of the timing of the operations comprising the project and their assembling to give the overall completion time." Scheduling can only take place after planning, where the process of choosing the method and the order of work is determined. The critical path method is a planning and management tool that is widely used in the construction industry. The critical path method is "the representation of project plan by a schematic diagram or network that depicts the sequence and interrelation of all the component parts of the project, and the logical analysis of this network in determining the best overall program of operation" (Antill and Woodhead, 1990).

The critical path method is a scheduling technique that can be used to evaluate a delay. At the start of each project, a planning schedule that is based upon the best estimates of activities durations and sequence is constructed. As the project is in the ongoing stage, new conditions appear, and the planning schedule can be updated to reflect the actual progress of work. During this stage, it is difficult to determine the impact a change has on the schedule. The process of updating the schedule is repeated throughout the project ongoing stage from the project start date to its completion date. When the project is completed, the final schedule update is called the as-built schedule. Other schedules such as the updated schedule, the extended schedule, the revised schedule, and the entitlement schedule might be useful in a delay-analysis process.

1.2.1 The As-Planned Project Schedule

Popescu and Charoenngam (1995) define the as-planned schedule as "the original or baseline schedule, generally developed prior or soon after project construction is begun, demonstrating the anticipated sequence, durations, and interdependencies for the activities constituting the contract work."

The as-planned schedule is the schedule that the contractor submits to the owner at the beginning of the project for the owner's approval. The as-planned schedule represents the contractor's plan and intension to pursue the work. The as-planned schedule represents the contractor's best estimate of activity time's and logic before the project start. This schedule represents the planned activities, the relationship between the planned activities, and the duration of the planned activities.

1.2.2 The As-Built Project Schedule

Popescu and Charoenngam (1995) define the as-built schedule as "an interim or final project schedule that depicts for each completed activity the actual start and completion dates, actual duration, cost, resources consumed, and actual logic relations with other activities."

The as-built project schedule can be prepared either from the schedule updates where the last schedule update represents the as-built schedule, or the as-built schedule can be prepared from the project contemporaneous documents.

1.2.3 The Updated Schedule

Arditi and Patel (1989) state "to explain the sequence of events that transform the as-planned schedule into the as-built schedule, a series of adjusted schedules are

prepared, thus explaining the major schedule variances that occurred during the course of the project."

Popescu and Charoenngam (1994) define the updated schedule as "a revised schedule reflecting project information at a given data date regarding completed activities, in-progress activities, and changes in logic, cost, and resources required and allocated at activity level."

The planned project schedule should be updated periodically. Popescu and Charoenngam state, "The updated schedule should identify the project status as behind or ahead of schedule, the problem areas impeding the project progress, activities causing delays, and in progress activities."

1.2.4 The Extended Schedule

When the as-planned schedule is updated, the new project completion date might vary from the original anticipated project completion date; this variation is a result of changes, delays, or inaccurate predictions upon which the as-planned schedule was based. The extended schedule is the projected schedule for future activities that have not yet started at the time the schedule update is performed. The extended schedule is derived from the as-planned schedule for activities that have predictions in both time and logic, as these activities are considered future activities.

1.2.5 The Revised Schedule

Popescu and Charoenngam (1994) define acceleration as "a compression of activity durations and/or logic changes modifying series work to concurrent work, such that a given quantity of work is performed in a time period shorter than the original planned performance period for that quantity of work."

As the planned project schedule is updated, delays might occur. It is a common practice to accelerate future activities to minimize the impact a delay has on the schedule. The accelerated future activities schedule is called the revised schedule.

1.2.6 The Entitlement-Schedule

The entitlement schedule is intended to show the amount of delay impact each party is entitled for by enforcing the delay that party is responsible for into the baseline schedule or removing the delay that party is responsible for from the baseline schedule depending on the implemented method of delay-analysis. The definition of the entitlement schedule is affected by the method of delay analysis. If the delay analysis is performed using the as-planned schedule updates, the entitlement schedule can be called the extended as-planned schedule, which is defined as the as-planned schedule with certain classes of delays added. In case the schedule updates are erroneous and the delay analysis is performed using contemporaneous documents such as daily logs or other contract documents, the entitlement schedule is defined as the collapsed as-built schedules, which is the as-built schedule with certain classes of delays removed and are intended to show when the project would have been completed had certain classes of delays not been encountered.

Finke (1999) states "entitlement schedules can consist of either extended as-planned schedules (i.e., the as-planned schedule with certain classes of delays added) or collapsed as-built schedules (i.e., the as-built schedule with certain classes of delays removed), and are intended to show when the project would have been completed had certain classes of delays not been encountered."

1.3 Disputes and Delays

Disputes in construction projects are usually caused by changes in the scope of work. Change is a common practice in construction projects; changes can cause variation in project time, cost or both. Antill and Woodhead (1989) define work change as "all alterations, variations, deductions, extras, or omissions of this nature, whether the work is executed by day labor or contract." In construction projects, when work changes occur, delays may also occur. Popescu and Charoenngam (1994) defines delay as "any enforced or imposed time gap between the completion of an activity and the start of its succeeding activity(s), or any enforced or imposed increase in duration of activity."

Some delays may result in late completion of the entire project, whereas other delays may not affect the project completion date depending on how critical the delay is. Riad and Arditi (1991) claim that today with tight budgets on the part of the owner, delays are becoming real cost items. As a result, delays often end up in disputes.

There are several factors that contribute to delays in a project. Analyzing the causes of delays is an essential task in resolving any conflicts or claims. Schumacher (1996) states that "Most delay claims are complicated and there is usually a dearth of relevant, useful, and contemporaneous documentation. As a result, good articles on the subject also emphasize the high cost and substantial risk associated with litigating delay claims. Most, however, do not address the more troubling aspects of lingering disputes about the responsibility for project delays."

1.4 Research Problem

One of the complicated difficulties that can occur after the project is completed and claims arise, is the resolution of conflicts among different construction parties. Resolving these conflicts involve answering the questions, "How many days of time

extension is each party liable for? What method of delay analysis is most applicable given the available information at the time the delay-analysis is performed? What is the procedure that can be followed to implement a certain method of delay-analysis once a specific method is suggested as the most applicable method for a specific case? and Does the implementation of different delay-analysis methods give the same results?

There is a need to resolve conflicts in the construction industry arising from the selection of the most applicable method of delay analysis for a specific case. Also, there is a need to document the steps that can be followed to apply a specific delay-analysis method. Additionally, there is a need to compare the results of applying different delay-analysis methods to actual project data to find out whether applying different methods of delay-analysis would lead to the same results.

1.5 Research Objectives

This research is intended to achieve three objectives. The research objectives are as follows:

1. Develop guidelines that could help the construction analysts and personnel on the selection of the most applicable method of delay analysis given the delay type, the information available when the delay-analysis is performed, and the timing at which the delay-analysis is performed.
2. Determine the applicable methods of delay-analysis that can be implemented to resolve claims among construction parties.
3. Apply recommended methods of delay-analysis to resolve claims to actual projects and compare results of each method application.

1.6 Research Plan

Four tasks compose the research plan for this thesis. The research plan tasks are:

1. Perform a literature review to identify the different methods of delay analysis and determine the factors that drive the selection of the method that can best be used.
2. Develop guidelines that determine the conditions and situations where a certain method is best used.
3. Apply the most applicable method of delay analysis to actual projects and quantify the delay. Mr. Andrew Goldsmith from Construction Management Specialties, Inc. will be providing actual projects data that can be used to perform this task. The number of projects to which the method will be applied will depend on the availability of data.
4. Analyze delays that can arise in construction claims using applicable methods of delay-analysis and compare the results of applying those methods.

2. LITERATURE REVIEW

2.1 Delay Classification

Project delays can be classified according to their origin, timing, and their compensability. Figure 1 represents delay classification.

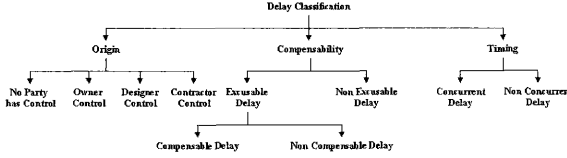

FIG. 1. Delay Classification

2.1.1Delays Classified by Their Origin

Antill and Woodhead (1989) classify delays according to their origin and the party responsible for the delay. They divide delays into the following categories:

1. Those over which no party to the contract has any control.
2. Those over which the owner has control.
3. Those over which the designer has control.
4. Those over which the contractor has control.

Figure 2 shows a classification of delays according to their origin.

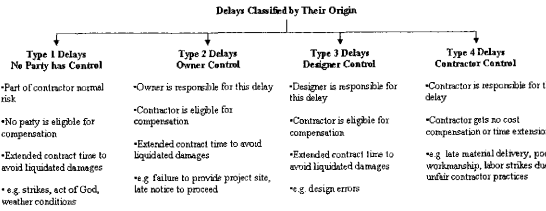

FIG. 2. Delay Classification According to Origin

Delays of Type 1 are part of the contractor's normal risk, and hence no party is eligible for compensation, but the contract time may be extended to avoid having liquidated damages imposed on the contract. Examples of this kind of delay are strikes, acts of God, and weather conditions. In delays of Type 2, the contractor should receive a fair and reasonable compensation for both time and cost since the owner is liable for the delay. Examples of Type 2 delays are delays that result from late notice to proceed and failure to provide a clear project site. In Type 3 delays, the contractor should receive a fair and reasonable compensation for both time and cost since the designer is responsible for the delay. Examples of Type 3 delays are design errors. In Type 4 delays, the contractor is responsible for the delay and is not eligible for cost compensation or time extension. Examples of Type 4 delays are those resulting from late material delivery, poor workmanship, and strikes caused by the contractor's unfair labor practices.

The complexity of analyzing a delay arises from the fact that different types of delay could take place at the same time. The progress of work on a certain activity can be impacted by a bad weather condition delay that coincides with another delay that is due to late material delivery. The two delay types impact the progress of work of the activity being analyzed and the analysis can get complicated, as the determination of the amount of delay impact each party is responsible for becomes an issue. Figure 3 shows a graphical representation of the overlapping of different types of delays classified by origin.

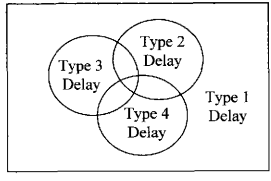

FIG 3. Different Types of Delays Based on Origin

2.1.2 Delays Classified by Their Compensability

Excusable delays are "delays that entitles the contractor to additional time for completion of the contract work, arising from causes beyond the contractor's control" (Popescu and Charoenngam, 1995). Excusable delays may be further classified as compensatory or non-compensatory delays, depending on contract terms and conditions. Excusable delays can result from various factors that can be classified as:

1. Beyond the control of any party.
2. Within owner's, architect's, or engineer's control.

The first case results in time extension to avoid any liquidated damages, whereas the latter case results in time extension and compensation to the contractor. Owners are liable to contractors for delay damages only if the delay resulted solely from compensable causes. This type of causation is sometimes referred to as "but for" causation (i.e., "but for" the compensable cause of the delay, the delay would not have occurred) (Finke, 1999).

Excusable, compensatory delays (Type 2 and Type 3 delays) entitle the contractor to reimbursement for direct and indirect costs, and to extended project time. Excusable, compensatory delays are usually due to acts or omissions of the owner or the designer. Compensatory delays are attributable to change orders. Examples of owner's excusable, compensatory delays (Type 2 delays) are late notice to proceed, failure to provide proper financing, failure to provide owner-furnished materials or components, interfering with or obstruction of work on the project, and delay in change orders approval. Examples of designer's excusable, compensatory delays (Type 3 delays) are defective plans and specifications, failure to provide drawings on schedule, delays in review or approval of shop drawings, stop-work orders, conflicts in drawings, and defective designs.

Excusable, non-compensatory delays (Type 1 delays) entitle the contractor to additional time but not additional compensation. This type of delay is not caused by any party. Examples of excusable, non-compensatory delays are acts of God, acts of a public enemy, and unusual delays in transportation, such as freight embargos, unusual weather conditions, and strikes.

Non-excusable delays (Type 4 delays) are delays that do not entitle the contractor to either time extension or cost compensation. This type of delay occurs because of the contractor's failure to meet contractual obligations. Non-excusable delays are not usually identified until disputes arise. It is difficult for the owner to identify this type of delay in the early stages of a project, because the construction schedule seldom supplies sufficient details. Examples of non-excusable delays (Type 4 delays) are slow mobilization, inadequate labor force, strikes caused by unfair labor practices, poor workmanship, late delivery of materials and components, and failure to coordinate multiple subcontractors.

Classification of delays based on their compensability is shown in Figure 4.

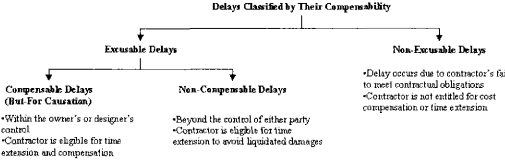

FIG. 4. Delay Classification According to Compensability

2.1.3 Delays Classified by Their Timing

A concurrent delay is defined as "the occurrence of two or more delays arising from independent causes and affecting a project during the same or overlapping time period" (Popescu, 1995). Courts examine this type of delay by determining the responsibility for concurrent delay and determining whether parties are entitled to compensation or time

extension. Rubin (1983) suggested the following guidelines for classifying these kinds of concurrent delays:

- If excusable and non-excusable delays occur concurrently, only a time extension is granted to the contractor.
- If excusable, compensable and excusable non-compensable delays occur concurrently, the contractor is entitled to time extension but not to damages.
- If two excusable compensable delays occur concurrently, the contractor is entitled to both time extension and damages.

Classification of delay based on their timing is shown in Figure 5.

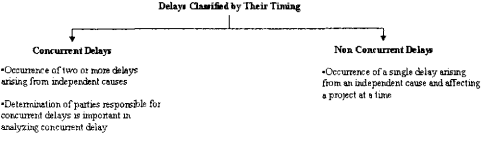

FIG. 5. Delay Classification According to Timing

2.2 Methods of Delay Analysis

In the construction industry, there are many delay-analysis methods and techniques that have been developed and implemented for analyzing delay.

The literature review shows that the same method of delay analysis can be called several names, but the same concepts apply for all those methods. In this research, the analysis-in-retrospect method is considered a generic method for the backward algorithm methods and the collapsed as-built and the but-for methods are special cases of the analysis-in-retrospect method. The following section discusses different methods of delay analysis.

2.2.1 Extended As-Planned Schedule Method or the Planned-Plus Method

This method of delay analysis is based on the as-planned schedule. The base schedule is adjusted by applying certain classes of delays and changes, such as the duration of activities or changes in relationships, to the schedule.

Figures 6 and 7 illustrate the concept of the extended as-planned method. In Figure 6, the as-planned schedule is illustrated. Here, the as-planned schedule logic is determined by two paths, the relationship between the two independent paths is a start-to-start relationship between activities J and O. The first path is determined by activities J-O, the second path is determined by activity M. The longest path in the schedule determines the critical path of the as-planned schedule, the critical path is represented by the path that consists of activities J-O. The other path, which is composed of activity M, is considered a non-critical path since activity M has an amount of float. In the extended as-planned method, certain classes of delays, depending on the kind of delay being analyzed, are inserted into the planned schedule, which produces the extended as-planned schedule (see Figure 7). X represents the delay time in activity O, and Y represents the delay time in activity M. After applying the delays to the as-planned

schedule, the path that consists of delayed activity M becomes the longest path in the schedule. Therefore, the new critical path is represented by the path that consists of delayed activity M. In the extended as-planned schedule activity M+Y become the controlling activities.

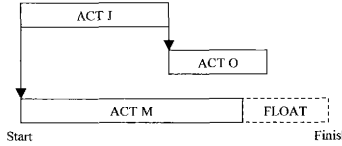

FIG. 6. As-Planned Schedule

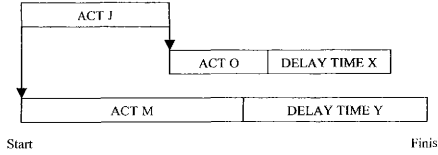

FIG. 7. Extended As-Planned Schedule

The extended as-planned method of delay analysis is applicable for projected future delays and can be used early in the project to get a feeling for the magnitude of the impact of a delay on future activities.

2.2.2 Snapshot Method and Windows Methods

The snapshot and windows methods consider the project at different time windows or segments. The snapshot and windows methods compare the planned schedule to the updated schedule over the time segment being analyzed. The main difference between the windows method and the snapshot method is that the windows method only considers the critical-path analysis of the time segment or the window analyzed.

The snapshot method compares the status of work at two points of time. The selection of the snap shot dates is critical in this analysis, because it determines the amount of affected work captured. The amount of delay is determined by comparing the as-planned schedule to the as-built schedule. Often, at the completion of delayed activity, the schedule is revised to overcome delays. The gain is called "Acceleration" (see Figure 8).

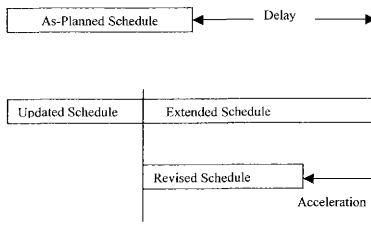

FIG. 8. Snapshot Method

The windows method is a "stop action picture of the project before and/or after experiencing a major impact to the schedule" (Leary, 1988).

In the windows method, the as-planned schedule is updated to reflect the progress of work to-date that takes place immediately before the occurrence of the delay being analyzed. The critical path can change as a result of changes and delays in activities. In the extended as-planned methods, the as-planned schedule is considered the baseline schedule in quantifying the amount of delay. This fact is considered a drawback to the extended as-planned method of delay analysis since the as-planned schedule does not reflect the work conditions right before the delay being analyzed. Since the windows and the snapshot methods could capture critical changes in the critical path and would provide a snapshot picture of the conditions of the project right before the delay takes place.

For any given time period of a project, a window schedule analysis of compensable delay will require:

1. The current schedule as of the start of the window
2. The current schedule as of the end of the window
3. An entitlement schedule showing the impact of the instant window's compensable delays on the current schedule as of the start of the window.
4. An entitlement schedule showing the impact of the instant window's non-compensable delays on the current schedule as of the start of the window (Finke. 1999).

2.2.3 Collapsed As-Built Method

In the collapsed as-built method, the as-built schedule is compared to the entitlement schedule, which is basically the as-built schedule with certain classes of delay removed. The collapsed as-built method is intended to show when the project would have been completed had certain classes of delays not been encountered. The collapsed as-built method is a backward method that starts by extracting delays starting from the last one backwards.

The classes of delays that are removed in the backward analysis are related to the delay being analyzed. In the case where the analysis is to determine the impact of excusable, non-compensable delays, delays of Type 1 are removed from the as-built schedule. If the analysis is to determine the impact of excusable compensable delays, delays of Type 2 or Type 3 are removed from the as-built schedule. If the analysis involves determining the impact of non-excusable delays, Type 4 delays are removed from the as-built schedule.

Figure 9 and Figure 10 show a graphical representation of the collapsed as-built method. In Figure 9, the as-built schedule consists of two paths. The first path is composed of delayed activity J followed by delayed activity O. Delays in activity J and O are assumed to be of the same type, that is they occur due to the responsibility of the same construction party. The second path is composed of activity M. The two independent paths are related by a start-to-start relationship. Figure 10 represents the collapsed as-built schedule. This schedule is constructed by removing delays from activity J and from activity O. The new controlling activity that determines the completion date becomes activity M. To quantify the impact the delay analyzed has on the project, the as-built schedule is compared to the collapsed as-built schedule and the difference between the completion dates of the two schedules represents the impact the delay in activity J and activity O has on the schedule.

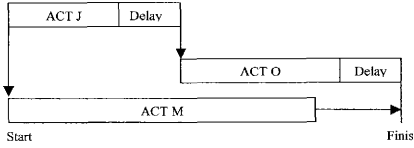

FIG. 9. As-Built Schedule

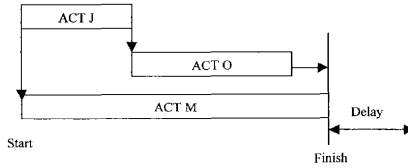

FIG. 10. Collapsed As-Built Schedule

2.2.4 But-for Method

Owners are liable to contractors for delay damages that are caused by compensable delays (Finke, 1999). This type of causation is referred to as "but for" causation, that is, "but for the compensable cause of the delay, the delay would not have occurred." In case of a concurrent delay, a contractor cannot recover delay damages since compensable and non-compensable delays are responsible for such a delay.

The but-for method is a special case of the collapsed as-built method. In the but-for method, the delay analysis is focused only on the excusable compensable delays, that are the responsibility of either the owner or the designer.

Figure 11 and Figure 12 show a graphical representation of the but-for method of delay analysis. In Figure 11, the as-built schedule consists of two paths. The first path is composed of delayed activity J followed by delayed activity O. Delays in activity J and O is compensable delays. The second path is composed of activity M. The two independent paths are related by a start-to-start relationship. Figure 12 represents the collapsed as-built schedule. This schedule is constructed by removing compensable delays from activity J and from activity O. The new controlling activity that determines the completion date becomes activity M. To quantify the impact the compensable delays have on the project, the as-built schedule is compared to the collapsed as-built schedule and the difference between the completion dates of the two schedules represents the impact compensable delays in activities J and O have on the schedule.

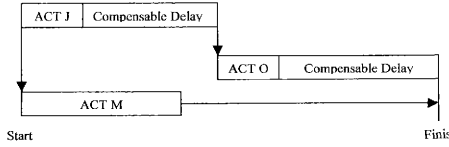

FIG. 11. As-Built Schedule

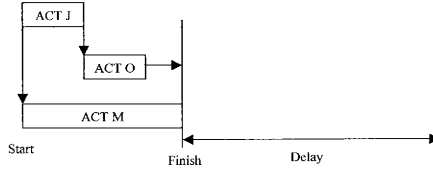

FIG. 12. Collapsed As-Built Schedule

2.2.5 Analysis–in-Retrospect Method

The analysis-in-retrospect method starts with the as-built schedule, which reflects the actual start and finish dates for the actual work carried out. The analyzed delays are identified and removed from the as-built schedule. The delay impact on the construction schedule is measured as the resulting difference between the actual activity and the adjusted activity without the delays. For a number of activities, it is the resulting difference between the actual segment or network of activities and the adjusted activities with the delays removed. The concept of applying the analysis-in-retrospect is to answer the question of "What would have happened had a certain type of delay not occurred?" The analysis-in-retrospect concept is represented graphically in Figure 13 and Figure 14. Figure 13 shows the as-built schedule, where certain classes of delay occur, and Figure 14 shows the collapsed as-built schedule with certain classes of delay removed from the as-built schedule. The two schedules are compared and the difference in time is calculated.

In the analysis-in-retrospect method the as-built schedule, that the analysis is based upon can reflect the final as-built schedule where all delays are represented in this schedule. The as-built schedule can also reflects parts of the delays depending upon the purpose of the analysis. Therefore, the analysis-in-retrospect can be considered as a generic case and the collapsed as-built and the but-for method can be considered as sub-cases of the analysis-in-retrospect method.

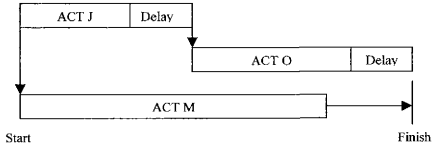

FIG. 13. As-Built Schedule

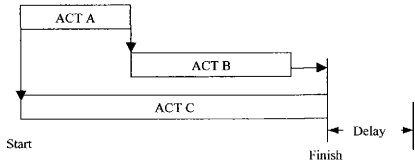

FIG. 14. Collapsed As-Built Schedule

2.2.6 Arguments Related to the Choice of Delay Analysis Method

In the construction industry, there is disagreement regarding the selection of delay-analysis technique that can be used to analyze a delay.

Popescu and Charoenngam (1994) state, "If contractors neglect to update the project schedule adequately and delay or acceleration disputes arise, the as-built schedule will be prepared from daily logs or other contract documents. The creation of an accurate as-built schedule after project completion is difficult, since sequencing or relationships of work activities may have changed from the as-planned schedule. When delay or acceleration disputes arise, the as-built and as-planned schedule will be compared to determine the causes and impacts."

Finke (1999) states "compensable delay analyses determine how much of a delay's cost are recovered by contractor. Such analyses may be postponed until the later stage of the project, because delay (i.e., extended project duration) costs typically are not incurred until after the originally specified completion date. Compensable delays can also be analyzed, and damages either liquidated or otherwise quantified, on an ongoing basis."

Cushman and Carpenter (1990) state, "A proof of the extent and liability for delay is most convincing when that proof is based on actual, contemporaneous project schedules, frequently updated at the time the delays were occurring. In the absence of such schedules, the as-built schedule for the project, supplemented by other project records, witnesses with firsthand knowledge of the delays, and an expert witness's evaluation of the as-built schedule, is often preferable to an as-planned schedule generated after-the-fact."

Trauner (1990) states, "If the analyst notes serious errors in the logic of the contractor schedule, he or she should consider not accepting the contractor's schedule as a valid tool with which to measure the delay."

"Delay analysis requires the researching and collating of all data dealing with progress and/or interruption, interferences, delays, and incidents regardless of the origin of such data, as long as it was generated by a party directly involved in the construction process" (Baram, 1994). According to Baram, there are several approaches in delay analysis and these approaches are not necessarily exclusive of one another. Approach selection depends on the information desired and the information and documentation available to apply the technique.

2.2.7 Criticisms of Different Delay-Analysis Methods

Delay-analysis methods face criticisms such as that construction projects are often completed without submission of formal planning documents such as schedules (Knoke, 1997). Lack of availability of planning documents can cause a problem in implementing delay-analysis methods that are based upon the as-planned or the updated as-planned schedule. Another criticisms is that the critical path can change as a result of changes in the process of project execution; as a result, the extended as-planned, the collapsed as-built, and the but-for methods can result in an improper analysis.

3. METHODOLOGY

The purpose of this study is to help resolve conflicts arising from the determination of the most applicable method of delay analysis to resolve claims and disputes among construction parties. To determine this method, this research starts with gathering information about the different methods of delay analysis. The main focus is analyzing delays when claims arise therefore, the next step of this research is to apply delay-analysis methods to actual project data and analyze the amount of delay that applicable method predicts. Figure 15 shows a graphical representation of the methodology of this study.

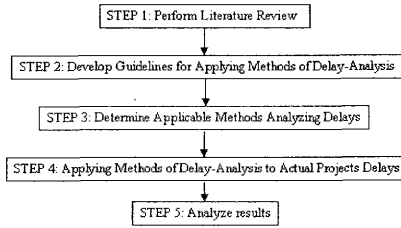

FIG. 15. Study Methodology

3.1 Perform Literature Review

The first step is to determine the different delay-analysis methods. In Chapter 2, methods of delay analysis have been identified. Furthermore, researching the topic related to the selection of the method of delay analysis that can be used for a specific case is essential for this research.

3.2 Develop Guidelines for Applying Methods of Delay Analysis

Different methods of delay analysis have been discussed in the literature review of this study. In the construction industry, there is disagreement that arises from the selection of delay-analysis technique. One of the objectives of this research is to provide guidelines for which method of delay analysis to use in a certain case. The following statements illustrate disagreements on the selection of the applicable delay-analysis technique among scheduling analysts.

Popescu and Charoenngam (1994) state, "if contractors neglect to update the project schedule adequately and delay or acceleration disputes arise, the as-built schedule will be prepared from daily logs or other contract documents. The creation of an accurate as-built schedule after project completion is difficult, since sequencing or relationships of work activities may have changed from the as-planned schedule. When delay or acceleration disputes arise, the as-built and as-planned schedule will be compared to determine the causes and impacts."

Finke (1999) states "compensable delay analyses determine how much of a delay's cost are recovered by contractor. Such analyses may be postponed until the later stage of the project, because delay (i.e., extended project duration) costs typically are not incurred until after the originally specified completion date. Compensable delays can

also be analyzed, and damages either liquidated or otherwise quantified, on an ongoing basis."

Cushman and Carpenter (1990) state "A proof of the extent and liability for delay is most convincing when that proof is based on actual, contemporaneous project schedules, frequently updated at the time the delays were occurring. In the absence of such schedules, the as-built schedule for the project, supplemented by other project records and witnesses with firsthand knowledge of the delays and an expert witness's evaluation of the as-built schedule, is often preferable to an as-planned schedule generated after-the-fact."

Trauner (1990) states, "If the analyst notes serious errors in the logic of contractor schedule, he or she should consider not accepting the contractor's schedule as a valid tool with which to measure the delay." In case of an erroneous contractor-planned schedule, the usefulness of the contractor schedule is compromised. Therefore, the analyst might work backward using the as-built schedule.

"Delay analysis requires the researching and collating of all data dealing with progress and/or interruption, interferences, delays, and incidents regardless of the origin of such data, as long as it was generated by a party directly involved in the construction process" (Baram, 1994). According to Baram, there are several approaches in delay analysis and these approaches are not necessarily exclusive of one another.

The statements above show that there is disagreement in the construction industry on the selection of the most applicable method for analyzing delays and resolving claims. One of the objectives of this research is to provide guidelines on the delay-analysis method selection process. To accomplish this objective, the second step of the research methodology is to develop guidelines on the selection of the most applicable method of delay-analysis for a certain case. A detailed discussion of the

guidelines for selecting a delay-analysis method will be presented in section 4.1.2 Guidelines for Delay-Analysis Method Selection Process.

3.3 Determine Applicable Methods for Analyzing Delays

One of the objectives of this research is to provide guidelines on the process of selecting applicable methods of delay analysis to resolve claims. After performing a thorough literature review, the two delay-analysis methods that are most useful for resolving claims and disputes that arise after the project is completed are the snapshot method and the analysis-in-retrospect method. Refer to section 4.1.2 Guidelines for Delay-Analysis Method Selection Process for further discussions related to the selection of applicable delay-analysis methods to resolving claims and disputes.

3.3.1 The Snapshot Method

The snapshot method is used to determine the impact of one or more delays on a project or segment of a project. The analysis is constructed from the as-planned schedule submitted by the contractor and approved by the owner or the owner's representative. The approved as-planned schedule represents the logic flow and durations of the activities. The contractor should have schedule updates of the planned schedule, which represent actual progress of work such as the logic flow, activities' durations, and actual dates. Schedule updates right before and right after a delay takes place are essential for applying the snapshot method of delay analysis. The updated schedule is created by integrating changes, delays, occurrences, and additions of new activities into the as-planned schedule of the project. To perform the snapshot method of delay analysis, two schedule updates are required. The first schedule update represents a snapshot picture of the project right before a delay occurs. The second schedule update represents a snapshot picture of the project after a certain delay occurs. The delays are identified by when they occurred, the activities with which they were associated, and which activities they

affected. The difference between the two schedules is the net overall delay to the project or the segment analyzed.

Net Overall Delay =Network Duration with Delay – Network Duration without Delay

3.3.1.1 Approach

Figure 16 represents a methodology for implementing the snapshot method.

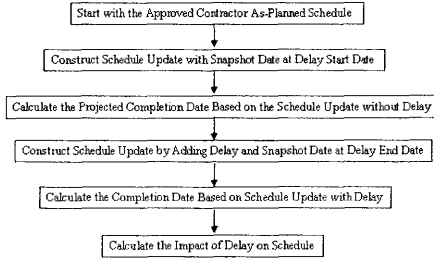

FIG. 16. Methodology for Implementing the Snapshot Method

The first step in performing the snapshot method of delay-analysis is to start with the contractor's approved, as-planned schedule as a baseline. The contractor should have performed schedule updates at intervals throughout the project that represent the actual progress of work. To analyze a delay, one needs a schedule update right before a delay

occurs and another one right after the delay occurs. In an ideal situation, where there are accurate schedule updates representing the actual progress of the work, the following steps can be used:

1. Refer to the as-planned schedule to determine the planned activities.
2. Update the schedule to show a snap shot picture of the project right before the delay took place. The schedule update represents the actual dates and sequence of activities that were performed before a delay took place. This schedule update is a dynamic schedule that could show a completion date of the project that differs from the planned project completion date. The difference could result from other delays, omissions, or accelerations of other activities.
3. Calculate the projected completion date based on the schedule update without adding the delay to the schedule.
4. Update the schedule by adding the delay being analyzed. Focus on the impact a delay has on the project, and changes in the durations or logic of other activities as a result of the delay being analyzed. Other changes in the duration or logic of activities that are not a result of the delay being analyzed are not represented in this schedule update, because the purpose of this schedule is to present a snapshot picture of the project right after the delay takes place. Therefore, this snapshot picture captures only the delay being analyzed and its impact on the schedule.
5. Calculate the projected completion date, based on the schedule update with the delay added to the schedule.
6. Calculate the impact of the delay by comparing the schedule update with the delay to the schedule without the delay. To quantify the impact of the delay, the following formula can be used:

Net Overall Delay = (Network Duration with Delay) – (Network Duration without Delay)

The previous steps represent useful snapshot method procedure that can be followed to analyze project delays. In the ideal situation, the overall project delay is calculated by adding up partial delays that are calculated by capturing snapshot pictures of the project.

3.3.2 The Analysis–in-Retrospect Method

The analysis-in-retrospect method is an after-the fact method of delay-analysis. This analysis is based on the dynamic as-built schedule that represents a record of facts. The as-built schedule consists of as-planned schedule activities, with changes, delays, occurrences, and addition of new activities. The as-built schedule is compared to the collapsed as-built schedule. The collapsed as-built schedule is basically the as-built schedule with the delay being analyzed deducted from the as-built schedule. The difference between the two schedules is the net overall delay to the project or the segment analyzed.

Net Overall Delay = (As-Built Schedule Duration) – (Collapsed As-Built Duration)

3.3.2.1 Approach

Figure 17 represents a model for implementing the analysis-in-retrospect method.

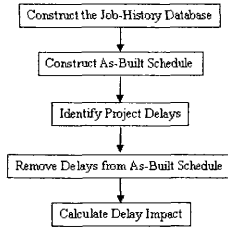

FIG. 17. Methodology for Implementing the Analysis-in-Retrospect Method

3.3.2.1.1 Construct the Job-History Database

Popescu and Charoenngam (1994) state, "If contractors neglect to update the project schedule adequately and delay or acceleration disputes arise, the as-built schedule will be prepared from daily logs or other contract documents." The collection and organization the contemporaneous data is called a job-history database. To construct the job-history database, the as-planned schedule is used to define the activities of the project. The as-planned activities are then placed into a reference list, and assigned codes. This is called an activity work code list. The following information is recorded for each entry in the work code list.

- The date.
- The work code.
- Document source.
- The number of persons working on that activity, if available.
- The number of staff-hours worked on that activity that day, if available.

- The major pieces of equipment used for that activity, if available.

After all the data has been entered into the database, it is sorted by activity work code and chronologically by date. Thus, a job-history record is created and this job-history database is used to construct the as-built schedule.

3.3.2.1.2 Construct the As-Built Schedule

The as-built schedule is constructed from contemporaneous project documents, such as correspondence, diaries, daily logs, and reports kept on each of the projects. The job-history database represents the basis for constructing the as-built schedule. The following assumptions can be followed in constructing the as-built schedule.

1. The start and finish of an activity may not necessary be the first or very last entry for that series of work codes. Start date is defined as the first day on which a significant cost expenditure in labor or equipment, or both has occurred. Finish date is similarly defined as the last day that a significant cost expenditure in labor or equipment or both has occurred.
2. Non-working days are defined as those days on which excusable non-compensable delays take place such as bad weather conditions (e.g., rain, snow, freezing weather, or high winds that impede the progress of work). Holidays are also classified as non-working days that impede the progress of work. An as-built calendar can then be created.
3. The logic of the schedule can be determined from the sequence of the activities that the contemporaneous data provide. The activities are then adjusted using negative and positive lag to reflect delays and overlaps between activities and to show each activity's actual start date in real time.

3.3.2.1.3 Identify Project Delays

The as-built schedule represents a record of facts schedule at which all project's delays are encountered. After constructing the as-built schedule, the next step is to identify delays that need to be analyzed. These delays are identified to determine the impact of each one using the analysis-in-retrospect method.

3.3.2.1.4 Remove Delays From As-Built Schedule

As a claim arises, removing the delay being analyzed from the as-built schedule and recalculating the project duration using the critical path method of scheduling can determine the impact of the delay being analyzed on the construction schedule.

3.3.2.1.5 Calculate Delay Impact

To quantify the impact of a delay on the construction schedule, two schedules are compared. The as-built schedule is compared to the collapsed as-built schedule, which is the as-built schedule without the delay being analyzed. The difference calculated from comparing the two schedules represents the impact of the delay being analyzed.

3.4 Applying After-the-Fact Methods to Actual Projects

3.4.1 Scheduling Using Primavera Project Planner

The Primavera Project Planner is a widely used scheduling tool in the construction industry. Antill and Woodhead (1990) state, "PRIMAVERA is essentially a package capable of handling large projects with many project activities and resources, and is essentially a large computer system package." Primavera Project Planner can be used to compare the forward and backward analysis methods, using the windows method and the analysis-in-retrospect method.

In this research, delays were analyzed using Primavera Project Planner. Primavera Project Planner is a package that is capable of handling large projects that consist of many activities as well as small to medium sized projects that consist of less number of activities. To analyze small to medium sized project's delays, other project management scheduling techniques that can handle the critical path method "CPM" needs for small to medium sized projects can be used to analyze delays.

3.4.2 Applying Methods of Delay-Analysis to Actual Projects Delays

There is disagreement in the construction industry on the selection of delay-analysis method to resolve conflict arising from analyzing delays. Popescu and Charoenngam (1994) state, "If contractors neglect to update the project schedule adequately and delay or acceleration disputes arise, the as-built schedule will be prepared from daily logs or other contract documents. The creation of an accurate as-built schedule after project completion is difficult, since sequencing or relationships of work activities may have changed from the as-planned schedule. When delay or acceleration disputes arise, the as-built and as-planned schedule will be compared to determine the causes and impacts." Trauner (1990) states, "If the analyst notes serious errors in the logic of the contractor schedule, he or she should consider not accepting the contractor's schedule as a valid tool with which to measure the delay." In the construction industry, some people favor use of the windows method, whereas others favor use of the analysis-in-retrospect method to analyze a delay.

The next step of this research is to analyze actual projects delays using suggested delay-analysis methods. For this purpose, Mr. Andrew Goldsmith from Construction Management Specialties, Inc. has provided data from actual construction projects. The information needed for the purpose of this study is original as-planned schedules, adjusted schedules that transform the as-planned schedule into the as-built schedule, and

the project documentation that would help in creating the Job History Database, and consequently, the as-built schedule.

For actual application of most applicable methods of delay-analysis to resolve claims arising from analyzing delays, refer to section 4.2 Application of Methods of Delay-Analysis to Actual Projects.

4. RESULTS

In general, the focus of this research is to capture delay-analysis methods and to suggest delay-analysis techniques for any given case. The first objective of this research is to provide guidelines to follow about the selection of the method of delay analysis that can be implemented for a certain case. The second objective of this research is to apply suggested delay-analysis techniques that can resolve conflict as they arise to actual projects and compare the results of applying each method.

4.1 Guidelines for Applying Delay-Analysis Techniques

4.1.1 Delay-Analysis Methods Classification

In order to suggest a specific method of delay-analysis for a certain case, different delay-analysis methods need to be further studied and classified. A new topic related to the classification of delay-analysis method is represented in this research. The suggested classifications of delay-analysis methods are according to logic, timing, or static and dynamic. Figure 18 represents delay-analysis methods classification.

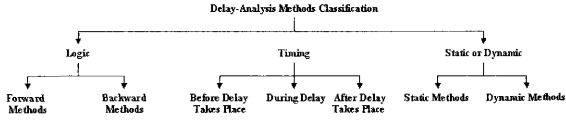

FIG. 18. Delay-Analysis Methods Classification

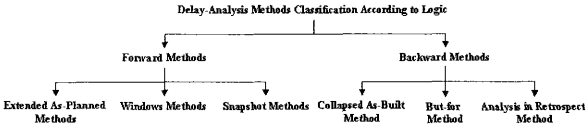

FIG. 19. Delay-Analysis Methods Classification According to Logic

Figure 19 represents classification of delay-analysis methods according to logic. In the classification of methods according to logic, the different methods of delay analysis are classified into forward methods and backward methods. This classification depends on the relevant schedule to which the analysis compares the impacted delayed schedule.

The as-planned schedule or the updated as-planned schedule represents the basis of the forward approach. In the forward method of delay analysis, the as-planned schedule or the updated as-planned schedule is compared to the entitlement schedule. In the forward analysis, the entitlement schedule is the as-planned schedule with certain classes delays added.

The classes of delays that are added in the forward analysis depend upon the delay being analyzed. In the case where the purpose of the analysis is to determine the impact of excusable non-compensable delays, delays of Type 1 are added to the as-planned or the updated as-planned schedule depending on the method of delay analysis being implemented. If the analysis is to determine the impact of excusable compensable delays, delays of Type 2 or Type 3 are added to the as-planned schedule or to the updated as-planned schedule, depending on the method of delay analysis being implemented. If the analysis involves determining the impact of non-excusable delays,

Type 4 delays are added to the as-planned schedule or the updated as-planned schedule, depending on the method of delay analysis being implemented

The as-built schedule represents a baseline for the backward analysis approach. In the backward analysis, the entitlement schedule is defined as the as-built schedule with certain classes of delays removed and is intended to show when the project would have been completed had certain classes of delays not been encountered.

The classes of delays that are removed in backward analysis depend upon the delay being analyzed. In the case where the purpose of the analysis is to determine the impact of excusable, non-compensable delays, delays of Type 1 are removed from the as-built schedule, depending on the method of delay analysis being implemented. If the analysis is to determine the impact of excusable, compensable delays, delays of Type 2 or Type 3 are removed from the as-built schedule, depending on the method of delay analysis being implemented. If the analysis involves determining the impact of non-excusable delays, Type 4 delays are removed from the as-built schedule, depending on the method of delay analysis being implemented.

The definition of the entitlement-schedule is affected by the method that is used for analyzing a delay in the forward approach; the entitlement schedule that is compared to the as-planned schedule or the updated as-planned schedule is the as-planned schedule with certain classes of delay added. In the backward approach, the entitlement schedule that is compared to the as-built schedule is the collapsed as-built schedule, that is, the as-built schedule with certain delays removed.

Methods of delay-analysis are classified according to logic to the forward methods and the backward methods. The forward methods of delay analysis are the extended as-planned schedule method, the snapshot method, and the windows method of

delay-analysis. The backward methods of delay analysis are the collapsed as-built method, the but-for method, and the analysis-in-retrospect method of delay-analysis.

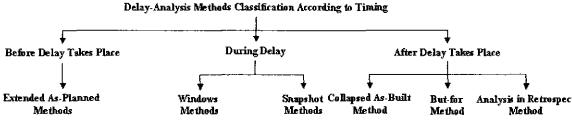

FIG. 20. Delay-Analysis Methods Classification According to Timing

The second suggested classification of delay-analysis methods is according to when the delay analysis is performed, that is, before the delay occurs, during the occurrence, and after the delay occurs. Figure 20 represents classification of delay-analysis methods according to timing. The stage at which delay analysis is performed determines the method used. Early in the project, all activities' durations and relationships are considered predictions and estimates of future work. Accordingly, one can rely upon the information in the as-planned schedule and the predictions of the analyst in terms of activities' durations, logic, and the impact that a certain delay might have on future activities. The extended as-planned method of delay analysis can be suggested as the most applicable method, if performed in the early stages of planning the project and before any actual work takes place. If a delay analysis is performed while the project is in the ongoing stage, some activities have actually started and some progress in work has been achieved. Therefore, the as-built schedule of activities that have started can be analyzed. The analyst can estimate future progress and create an acceleration schedule that would give the best estimate at the time the analysis is performed for future

progress of the work. In the case of performing the delay analysis while the project is ongoing, there is a level of certainty from past work and a level of uncertainty for future work and therefore, the windows method and the snapshot method of delay analysis can be suggested as methods of delay analysis for this case. In the case where the project is completed and all activities have been performed, there is no uncertainty and all activities are accomplished and they represent facts. The as-built schedule analysis can be performed at this stage and a backward analysis is suggested in this case, since a factual analysis is required. Consequently, the analysis-in-retrospect method can be used in this case.

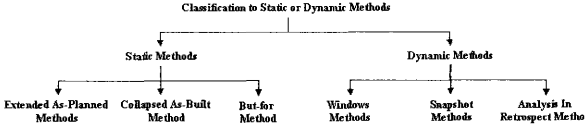

FIG. 21. Delay-Analysis Methods Classification to Static or Dynamic Methods

The last suggested classification of delay-analysis methods is the static and the dynamic methods of delay analyses. The main key to this classification is the schedule to which that the entitlement schedule is compared. Figure 21 represents delay-analysis methods classification to static or dynamic methods.

Static and dynamic delay-analysis methods represent a new classification of delay analysis methods. The suggested new definitions of static and dynamic methods are as follows:

Static methods are defined as methods that compare the entitlement schedule to a static schedule. If the available information indicates that the contractor schedule updates are accurate and can be used as a tool for the delay analysis, the static, original as-planned schedule is compared to the entitlement schedule, which is the as-planned schedule with the classes of delays added. In the case where the available information suggests that contemporaneous information provides the best source of information upon which to base the analysis, the static, as-built schedule represents the baseline schedule to which the entitlement schedule is compared.

The extended as-planned method is a static method since it is based on comparing the entitlement schedule to a static, original as-planned schedule. If the available information suggests that contemporaneous project documents can be used as a tool for the delay analysis, the static final, as-built schedule can be compared to the entitlement schedule. The entitlement schedule in this case is the as-built schedule with the classes of delays analyzed removed. The collapsed as-built method, and the but-for method are examples of static delay-analysis methods that are based upon comparing the entitlement schedule a static as-built schedule.

Dynamic methods of delay analysis are defined in this research as methods that compare dynamic schedules to quantify the impact a delay has on the schedule. If the available information indicates that the schedule updates are accurate and can be used as a tool for the delay analysis, the dynamic schedule updates right before a delay takes place can be compared to another schedule update that captures a snapshot picture of a delay right after it takes place.

If the available information suggests that contemporaneous documents such as daily logs and reports represent the best source of information that the delay analysis can be based on, in that case, the dynamic, as-built schedule is compared to the entitlement schedule, to quantify the amount of impact a delay has on the project schedule.

Dynamic methods of delay analysis that are based on the dynamic, updated schedules are the windows method of delay-analysis and the snapshot method of delay-analysis. Analysis-in-retrospect is a dynamic method of delay analysis that is based upon the dynamic, as-built schedule and compares it to the entitlement schedule.

Table 1 represents different delay-analysis methods and their related classification according to the three different classifications, according to algorithm, according to timing, and according to the static or dynamic methods. The table also provides the information required to perform each method of delay analysis.

Table 1. Delay-Analysis Methods and Different Classifications

Method Name	Algorithm	Stage Applied	Static or Dynamic Method	Required Information
Extended As-Planned Method	Forward	Early Project Stages Before Delay Occurs	Static	As-Planned Schedule Anticipated Amount of Delay
Snapshot Method	Forward	Ongoing Project Delay After-the-Fact Delay	Dynamic	Schedule Update before Delay Occurs Schedule Update after Delay Occurs
Windows Method	Forward	Ongoing Project Delay After-the-Fact Delay	Dynamic	Critical Activities Update Before Delay Occurs Critical Activities Update After Delay Occurs
Collapsed As-Built Method	Backward	After-the-Fact Delay	Static	As-Built Schedule Amount of Delay
But-for Method	Backward	After-the-fact Delay	Static	As-Built Schedule Amount of Compensable Delay
Analysis-in-Retrospect Method	Backward	After-the-Fact Delay	Dynamic	As-Built Schedule Amount of Delay

The extended as-planned method is a forward method that is based on a static as-planned schedule. The application of the extended as-planned method is a suggested in early project stages where delays are considered a projections of future events. To implement this method of delay-analysis, the original static as-planned schedule is compared to an entitlement schedule where the anticipated amount of delay is encountered.

The difference between the snapshot and the windows method is that the snapshot method compares a snapshot picture of all the scheduling activities right before the delay occurs to another snapshot picture of the scheduling activities right after the delay takes place. Whereas the windows method compares a snapshot picture of only critical activities right before the delay takes place to a snapshot picture of critical activities right after the delay occurrence. Snapshot and windows method are both forward methods since the as-planned or the updated as planned schedule is the basis for this analysis. The two methods are dynamic methods since the schedule that this analysis is based upon is a dynamic as-planned or the updated as-planned schedule. Both methods can be applied while the project is in the ongoing stage if the schedule updates represent a good indication of the progress of work on site. Also, the snapshot and the windows method can be applied in retrospect if schedule updates are accurate and they represent a valid source of information for this analysis. If the schedule updates are accurate and they represent actual progress of work on site, the finals schedule update is equivalent to the as-built schedule and therefore, the snapshot and the windows methods can be applied after the project is completed to resolve claims as they arise.

The collapsed as-built method is a backward method that is based on a static as-built schedule. To apply the collapsed as-built method, the as-built schedule is needed and therefore, the implementation of the collapsed as-built method can only be performed after the project is completed and a static as-built schedule that represent a

book of facts is constructed. The static as-built schedule is compared to an entitlement schedule that is constructed by removing analyzed delays from the as-built schedule.

The but-for method of delay analysis is similar to the collapsed as-built method as both methods follow a backward algorithm and both methods are based upon a static as-built schedule that represent a book of facts. The two methods are implemented after the project is completed. The difference between the collapsed as-built method and the but-for method is that the but-for analysis is focused only on the impact compensable delay has on the project schedule. Therefore, the entitlement schedule that is compared to the as-built schedule in the but-for method is constructed by removing compensable delays from the static as-built schedule and the delay impact is quantified by comparing the as-built schedule to the entitlement schedule.

The analysis-in-retrospect method is a generic backward method of delay analysis. Where the but-for and the collapsed as-built methods are considered special cases of the analysis-in-retrospect method. The analysis-in-retrospect is a dynamic method of delay-analysis since the entitlement schedule (the collapsed as-built schedule) is compared to a dynamic as-built schedule. This method of delay-analysis is implemented after the fact since the construction of the as-built schedule is a requirement to implement this method.

4.1.2 Guidelines for Delay-Analysis Method Selection Process

As shown in Table 1, several methods of delay-analysis are applicable to analyze delays. The next step of this research is to determine when a specific method is described as most applicable method for a certain case. There are several issues that should be considered in the selection process. These issues are:

1. The type of analyzed delay.
2. The delay-analysis source of information, and consequently the logic of the delay-analysis method.
3. Timing at which the delay analysis would take place
4. Static or dynamic method of delay analysis.

The determination of the type of the delay being analyzed is a major issue that needs consideration in the method selection process. Different delay types have been discussed in Chapter 1 of this study. Determining the party that is responsible for the analyzed delay is essential to the analysis since delays are either added to the as-planned schedule or removed from the as-built schedule depending on the logic of the selected method.

The delay-analysis source of information can be either the as-planned or the updated as-planned schedule or the as-built schedule. The source of information that the analysis is based upon can determine the method of delay analysis to be used in analyzing a delay. Popescu and Charoenngam (1994) state, "If contractors neglect to update the project schedule adequately and delay or acceleration disputes arise, the as-built schedule will be prepared from daily logs or other contract documents. The creation of an accurate as-built schedule after project completion is difficult, since sequencing or relationships of work activities may have changed from the as-planned schedule. When delay or acceleration disputes arise, the as-built and as-planned schedule will be compared to determine the causes and impacts."

The stage at which the analysis is performed can influence the selection of the delay-analysis method. Delay-analysis methods can be classified according to timing to methods that can be applied before the delay takes place, during the occurrence of a delay, and after the delay takes place. Accordingly, the timing at which the delay-analysis is performed is an issue that needs to be considered in the delay-analysis selection process.

Dynamic schedules and relatively dynamic method of delay-analysis or static schedules and ultimately static methods of delay-analysis can influence the selection of the implemented method of delay-analysis. Dynamic methods that are discussed in the guidelines are the dynamic forward windows method or the snapshot method and the dynamic backward analysis-in-retrospect method. The extended as-planned method is a static delay-analysis method that is discussed in the guidelines. The collapsed as-built and the but-for methods of delay analysis have been eliminated from the guidelines since the analysis-in-retrospect method is considered as a generic method where the collapsed as-built and the but-for methods are special cases from the analysis-in-retrospect method of delay-analysis. Figure 22 illustrates guidelines for selecting a most applicable method of delay-analysis for a given case.

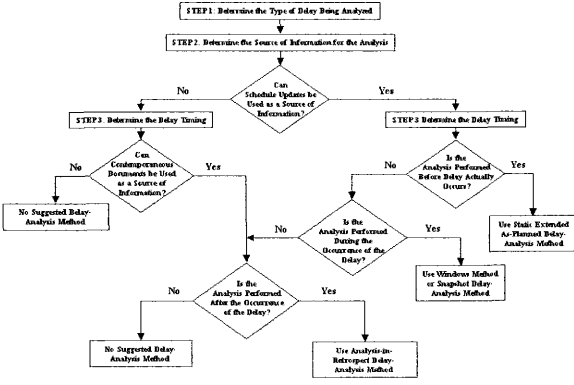

FIG. 22. Guidelines for Selecting Delay-Analysis Method

The following subsection describes the procedure that needs to be followed to select suggested most appropriate delay analysis technique for the available information at a certain time.

4.1.2.1 Step1: Determine the Type of Delay Being Analyzed

The main objective of this step is to define the Type of the delay being analyzed. This determination is reached by defining the liability of the delay being analyzed. As mentioned in the literature review of this study, delays can be classified according to their liability to four types:

- Type 1 delay, for which no party is responsible and is considered as an excusable non-compensable delay.
- Type 2 delay, which is caused by the owner and is considered an excusable and compensable delay.
- Type 3 delay, which is caused by the designer and is considered an excusable and compensable delay.
- Type 4 delay, for which the contractor is responsible and is considered a non-excusable, non-compensable delay.

4.1.2.2 Step2: Determine the Source of Information for the Delay Analysis

Once the type of delay has been defined, the next step is to determine the source of information that can be used as a basis for the analysis. The two main sources of information that the analysis can be based on are the schedule updates and contemporaneous project documents such as daily logs and daily reports.

4.1.2.3 Step3: Determine the Timing of the Delay Analysis

Once the reliable source of information is determined, the next step is to determine when the delay analysis is to be performed.

If the information is obtained from schedule updates, there are three possibilities for the timing of performing the delay analysis. The three possibilities are as follows:

1. The delay analysis is performed before the delay actually took place.
2. The delay analysis is performed while the delay actually takes place.
3. The delay analysis is performed after the delay actually takes place.

In case 1, the delay analysis took place before the delay actually occurred, and the analysis is performed to estimate the future impact of a delay on future activities. The extended as-planned method of delay analysis is the most suitable method of delay analysis since the static as-planned schedule can be compared to the entitlement schedule. The entitlement schedule in this case is the as-planned schedule to which the delay being analyzed is added.

In case 2, the delay analysis is performed while the project is in the ongoing stage and the delay is actually taking place. The windows method or the snapshot method of delay analysis can be applied in this situation. The two schedules that can be compared to each other by applying the forward dynamic windows method or the forward dynamic snapshot method of delay analysis are the updated schedule right before the delay being analyzed takes place and the updated schedule right after the delay being analyzed takes place. The two schedule updates represent snapshot pictures of the project with and without the delay being analyzed and by comparing those two schedules, the impact of the delay can be quantified.

In case 3, the delay analysis is performed after the delay takes place. In this case, the final schedule update is equivalent to the as-built schedule and the windows method or snapshot method becomes equivalent of the analysis-in-retrospect method of delay analysis in this case.

When contemporaneous project documents such as daily logs and daily reports are the source of information for the analysis the only way to perform the delay analysis is by applying it after the fact. The dynamic, backward method of delay analysis that is applicable in this case is the analysis-in-retrospect method of delay analysis.

There is no suggested method of delay-analysis, if the project data such as the as-planned schedule, the updated schedule(s), or the contemporaneous documents that can

be used to construct the as-built schedule does not represent a valid source of information. Therefore, maintaining accurate sources of information is vital to resolve conflicts and perform a fair delay-analysis.

4.2 Application of Delay-Analysis Methods to Actual Projects

An objective of this study was to determine the applicable methods of delay-analysis that can be implemented to resolve claims among construction parties and apply those delay-analysis methods to actual projects and compare results of each method.

As shown earlier in Table 1 and figure 22, the suggested methods of delay-analysis that can be applied to resolve claims are:

1. The static extended as-planned method.
2. The dynamic snapshot method as a generic method and the dynamic windows method as a sub-case of the snapshot method.
3. The analysis-in-retrospect method.

The next question that needs to be answered is applying different methods of delay-analysis would lead to the same analysis results. To answer the previous question, and fulfill one of the objectives of the study. Mr. Andrew Goldsmith from the Construction Management Specialties, INC. has provided actual data from actual projects.

To apply different methods of delay-analysis to actual projects, two major issues are considered to perform the analysis. The two issues are the available information and the timing at which the analysis is performed. The available information such as the as-planned schedule, the updated schedule, and contemporaneous documents that is used to construct the as-built schedule can impact the possibility of implementing a specific

method of delay-analysis. The timing at which the analysis is performed can impact the possibility of implementing a certain method of delay-analysis. The timing at which the analysis is performed can be early in the project before he delay takes place, in the ongoing stage while the delay is actually taking a place, or after the delay occurred.

The available information that was provided by Mr. Goldsmith was for three projects that have been completed. Therefore, the timing of performing the analysis is after the occurrence of the delay. Also, the data suggested that the contractor's schedule updates were inaccurate and they did not reflect the actual progress of work. Most updates were based on the as-planned schedule with modifications to the percentage of completed work. Therefore, relying on the as-planned schedule as a basis for performing the snapshot method of delay analysis could not be performed.

The available information suggested that the methods that can be applied to analyze delays are the snapshot method under the assumption that the as-built method without the delay represents the as-planned schedule and the analysis-in-retrospect method. The extended as-planned method of delay-analysis could not be applied to analyze delays of actual projects since the available information was for completed projects where the analysis is performed after the occurrence of the delay.

To perform the delay analysis accurately using the snapshot method of analysis, schedule updates were essential to capture snapshot pictures of the project at certain times and to represent the projected completion dates of the project at the time the snapshot picture was taken. After looking at the available data, contractor schedule updates were inaccurate and they did not match contemporaneous documents of the project. Performing the snapshot method of the delay analysis using contemporaneous documents could resolve the problem of poor schedule updates that did not provide an accurate snapshot picture of the project at a certain time. To overcome the problem that the contractor schedule updates were inaccurate and therefore, the schedule updates could not be used to perform the snapshot method. An assumption that the as-built

schedule without delays represents the baseline that is equivalent to the as-planned schedule and is used for performing the snapshot method of delay analysis was made. To perform the snapshot analysis after the project is completed, the following steps can be used:

1. Refer to the as-planned schedule to determine the planned activities.
2. Use contemporaneous daily logs and correspondence to determine any variation in the durations of, and relationship between planned activities, any additional activities that have been added to or deleted from the planned schedule.
3. Compare the contractor updates and the Job History Database and if there is any variation between the two sources, rely on the Job History Database to construct an as-built schedule that is used as a baseline for the analysis.
4. Use the Job History Database and contractor monthly updates to determine actual start and finish dates of activities that were completed and actual start dates for activities that have started and have not yet been completed.
5. Update the approved as-planned schedule using the actual dates and changes in logic or durations for activities that precede the delayed activity. The cut-off date is right before the delay being analyzed takes place. The purpose of this schedule update is to have a snapshot picture of the project right before the delay takes place.
6. Calculate the projected completion date based on the schedule update without inserting the delay.Update the approved, as-planned schedule using the actual dates and changes in logic or durations for activities starting from the project start date and inserting the delay being analyzed. The cut-off date is right after the delay being analyzed takes place.Calculate the projected completion date based on the schedule update without inserting the delay.Calculate the delay impact by comparing the schedule updates with and without the delay being analyzed. Use the following formula to quantify the delay impact.

Net Overall Delay = (Network Duration with Delay) – (Network Duration without Delay)

Three projects have been analyzed using both the forward algorithm represented by the dynamic snapshot method and the backward algorithm represented by the dynamic analysis in retrospect method and the results were compared. The selection of impacted activities by delays was based upon the fact that critical delays, that is, delays that actually impact the project completion date are correlated to critical or near critical activities. Therefore, the emphasis of the analysis was on the critical or near critical activities.

4.2.1 Public Owner Project 1

4.2.1.1 Project Overview

The first project that has been analyzed was a three-floor building. Both snapshot method and analysis-in-retrospect method of delay analysis have been applied to four critical activities and the impact of the delayed activities has been quantified.

All delays that have been analyzed in this project are delays of Type 4 or contractor's delays. Each critical delay has been applied at a time with other activities remaining as the planned duration and the impact of the delay has been quantified. Both the forward analysis and the backward analysis have been applied at a time and the results of applying each method have been compared.

4.2.1.2 Delay-Analysis Results

Four critical delays have been analyzed using both the forward and the backward dynamic methods of delay-analysis. The four critical activities are as follows:

1. Erect Structural Steel to First Floor.
2. Erect Structural Steel and Decking to Second Floor
3. Finishing the First Coat Paint of the Third Floor.
4. Painting the Final Coat and Vinyl Wall Cover of the Third Floor.

The amount of delay impact that was calculated using the snapshot method is the same as the amount of delay impact that was calculated using the analysis-in-retrospect method. The equal delay-analysis impact that has been quantified using both dynamic methods of delay-analysis suggests that the snapshot method and the analysis-in-retrospect method lead to the same scheduling results if, at the time a delay is analyzed using the snapshot method, the predictions for durations and logic of future activities is accurate and the actual progress of work would follow the same durations and logic predicted as a part of applying the snapshot method of delay analysis

The results of applying both the snapshot method and the analysis-in-retrospect method are represented in Table 2.

Table 2. Public Owner Project 1 Delay-Analysis Results

Activity ID	Activity Description	Original Duration	Early Satrt	Early Finish	Actual Start	Actual Finish	New Duration
3260	ERECT STRUCTURAL STEEL TO 1ST FLOOR	24	March 23, 1995	April 28, 1995	March 23, 1995	May 9, 1996	31
3270	ERECT STRUCTURAL STEEL & DECKING TO 2ND FLOOR	25	May 1, 1995	June 6, 1995	May 1, 1995	June 19, 1995	34
3850	FIRST FINISH COAT PAINT 3RD FLOOR	16	November 30, 1995	December 21, 1995	November 30, 1995	December 28, 1995	19
4140	FINAL COAT PAINT & VINYL WALL COVER 3RD FLOOR	28	December 29, 1995	February 6, 1996	December 29, 1995	February 8, 1996	30

Activity ID	Activity Description	Snapshot Method		Analysis-in-Retrospect Method		Amount of Delay
		Completion Date At Window Start	Completion Date At Window End	Completion Date Using As-Built Schedule	Completion Date Using Collapsed As-Built Schedule	
3260	ERECT STRUCTURAL STEEL TO 1ST FLOOR	February 21, 1996	March 1, 1996	March 1, 1996	February 21, 1996	7
3270	ERECT STRUCTURAL STEEL & DECKING TO 2ND FLOOR	February 21, 1996	March 5, 1996	March 5, 1996	February 21, 1996	9
3850	FIRST FINISH COAT PAINT 3RD FLOOR	February 21, 1996	February 26, 1996	February 26, 1996	February 21, 1996	3
4140	FINAL COAT PAINT & VINYL WALL COVER 3RD FLOOR	February 21, 1996	February 23, 1996	February 23, 1996	February 21, 1996	2

Note: Applying both the windows method and the analysis-in-retrospect method provide the same results

4.2.2 Public Owner Project 2

4.2.2.1 Project Overview

Public owner project 2 consists of a steel framed structure with concrete masonry block and brick masonry walls. The structure is a two-story building with steel columns, steel joist supporting the second floor, and steel joist supporting the roof. The structure can be further defined as a slab on grade first floor, column and steel joist supported second floor slab, steel joist supported low roof, and steel joist supported high roof.

All delays that have been analyzed in this project are near critical delays of Type 4 or contractor's delays. Each delay has been applied at a time with other activities remaining as the planned duration and the impact of the delay has been quantified. Both the forward analysis and the backward analysis have been applied at a time and the results of applying each method have been compared.

4.2.2.2 Delay-Analysis Results

Delays have been applied to four near critical activities and both the forward and the backward dynamic methods of delay-analysis have been applied to quantify the impact each delay has on the construction schedule. The four delays that have been analyzed are as follows:

1. No Work-Waiting for Steel Delivery.
2. Mobilization
3. Delays in Excavation, Filling, and Rough Grading.
4. Delays in Site Curb and Gutter.

The amount of delay impact that was calculated using the snapshot method is the same as the amount of delay impact that was calculated using the analysis-in-retrospect method. The equal delay-analysis impact that has been quantified using both dynamic methods of delay-analysis suggests that the snapshot method and the analysis-in-retrospect method lead to the same scheduling results if, at the time a delay is analyzed using the snapshot method, the predictions for durations and logic of future activities is accurate and the actual progress of work would follow the same durations and logic predicted as a part of applying the snapshot method of delay analysis.

The results of applying both the snapshot method and the analysis-in-retrospect method are represented in Table 3.

Table 3. Public Owner Project 2 Delay-Analysis Results

Activity ID	Activity Description	Original Duration	Early Satrt	Early Finish	Actual Start	Actual Finish	New Duration
1180	NO WORK - WAITING STEEL DELIVERY	0	-	-	April 6, 1995	July 24, 1995	71
10	MOBILIZATION	10	January 9, 1995	January 23, 1995	January 9, 1995	January 31, 1995	14
110	EXCAVATION, FILL, & ROUGH GRADING	94	February 15, 1995	June 28, 1995	February 15, 1995	July 10, 1995	98
160	SITE CURB & GUTTER	8	October 18, 1995	October 27, 1995	October 18, 1995	October 30, 1995	10

Activity ID	Activity Description	Snapshot Method		Analysis-in-Retrospect Method		Amount of Delay
		Completion Date At Window Start	Completion Date At Window End	Completion Date Using As-Built Schedule	Completion Date Using Collapsed As-Built Schedule	
1180	NO WORK - WAITING STEEL DELIVERY	January 22, 1996	March 22, 1996	March 22, 1996	January 22, 1996	44
10	MOBILIZATION	January 22, 1996	January 26, 1996	January 26, 1996	January 22, 1996	4
110	EXCAVATION, FILL, & ROUGH GRADING	January 22, 1996	January 26, 1996	January 26, 1996	January 22, 1996	4
160	SITE CURB & GUTTER	January 22, 1996	January 24, 1996	January 24, 1996	January 22, 1996	2

Note: Applying both the windows method and the analysis-in-retrospect method provide the same results

4.2.3 Public Owner Project 3

4.2.3.1 Project Overview

Project 3 consists of building a guard tower in the middle of a field surrounded by a newly constructed high security prison. The new situation represents a change in conditions that defer from the original contractual conditions. A major change in working conditions took place in this project, where the public sector owner decided to put the prison into full operation. The new working conditions imply constructing the guard tower in the middle of a highly secured prison. As a result of this action, the public sector owner implemented an elaborated entrance procedure for the workers to ensure safety precautions and constructed a confining temporary fence around the guard tower. As a result of the change in the working conditions, the contractor became eligible for time extension.

Delays that have been analyzed in this project are critical delays of different types. Each delay has been applied at a time with other activities remaining as the planned duration and the impact of the delay has been quantified. Both the forward analysis and the backward analysis have been applied at a time and the results of applying each method have been compared.

4.2.3.2 Delay-Analysis Results

Delays have been applied to four critical activities and both the forward and the backward dynamic methods of delay-analysis have been applied to quantify the impact each delay has on the construction schedule. The four delays that have been analyzed are as follows:

1. Tilt-Up Shop Drawings thru Approval.
2. Exterior. Determination of Walls and Floors Shop drawings
3. Delay of Foreign Steel.
4. Delay Conduit to Power Room.

The amount of delay impact that was calculated using the snapshot method was the same as the amount of delay impact that was calculated using the analysis-in-retrospect method. The equal delay-analysis impact that has been quantified using both dynamic methods of delay-analysis suggests that the snapshot method and the analysis-in-retrospect method lead to the same scheduling results if, at the time a delay is analyzed using the snapshot method, the predictions for durations and logic of future activities is accurate and the actual progress of work would follow the same durations and logic predicted as a part of applying the snapshot method of delay analysis.

The results of applying both the snapshot method and the analysis-in-retrospect method are represented in Table 4.

Table 4. Public Owner Project 3 Delay-Analysis Results

Activity ID	Activity Description	Original Duration	Early Satrt	Early Finish	Actual Start	Actual Finish	New Duration
361	Tilt-Up Shop Drawings thru Approval	12	February 19, 1997	March 10, 1997	February 19, 1997	March 31, 1997	22
821	Exterior. Det. Walls and Floors Shopdrawings	10	February 19, 1997	March 6, 1997	February 19, 1997	April 2, 1997	24
515X	Delay of Foreign Steel	0	-	-	April 22, 1997	May 9, 1997	12
1693X	Delay in Conduit to Power Room	0	-	-	March 20, 1997	March 27, 1997	6

Activity ID	Activity Description	Snapshot Method		Analysis-in-Retrospect Method		Amount of Delay
		Completion Date At Window Start	Completion Date At Window End	Completion Date Using As-Built Schedule	Completion Date Using Collpased As-Built Schedule	
361	Tilt-Up Shop Drawings thru Approval	July 9, 1997	July 16, 1997	July 16, 1997	July 9, 1997	5
821	Exterior. Det. Walls and Floors Shopdrawings	July 9, 1997	July 9, 1997	July 9, 1997	July 9, 1997	0
515X	Delay of Foreign Steel	July 9, 1997	July 25, 1997	July 25, 1997	July 9, 1997	11
1693X	Delay in Conduit to Power Room	July 9, 1997	July 9, 1997	July 9, 1997	July 9, 1997	0

Note: Applying both the windows method and the analysis-in-retrospect method provide the same results

4.2.4 Delay-Analysis Example

In public owner project 3, the foreign steel was delayed for 12 days starting from April 22nd, 1997 to May 9th, 1997. To select the most applicable method of delay-analysis, guidelines for delay-analysis selection process in section 4.1.2 were followed. The first step was to classify the delay and after going thru the daily logs and correspondence, the delay was classified as a Type 4 contractor delay. The next step was to determine the level of information that was available. After going thru the data that was provided by Mr. Goldsmith, contemporaneous documents were the most accurate source of information for the analysis. The next step was to determine the timing of performing the analysis and the analysis took place after the occurrence of the delay. The guidelines suggest that the analysis-in-retrospect method is the most applicable method of delay-analysis given the available sources of information and the timing of the analysis. The analysis was performed using the snapshot method under the assumption that the as-built schedule without delays is equivalent to the as-planned schedule. This analysis was performed to determine if the snapshot method could be implemented after-the-fact.

4.2.4.1 Application of the Snapshot Method to Delay in Foreign Steel

To perform the delay analysis accurately using the snapshot method of analysis, schedule updates are essential to capture snapshot pictures of the project at certain times and to represent the projected completion dates of the project at the time the snapshot picture was taken. After looking at the available data, contractor schedule updates were inaccurate and they did not match information provided by project's contemporaneous documents. An assumption was made to overcome the problem of lack of information to perform the snapshot method. The assumption was that the as-built schedule without delays or the collapsed as-built schedule represented a basis was equivalent to the as-

planned schedule. To perform the snapshot analysis after the project is completed, the following steps were used:

1. Contemporaneous data such as daily logs and correspondence has been used to construct the job-history database, and accordingly construct the as-built schedule. For a detailed job-history database of activity 515X delay in foreign steel refer to appendix A Job-History Database. For a detailed as-built schedule of public owner project 3 refer to Appendix B.

2. All delays in public owner project 3 have been determined and removed from the as-built schedule. The as-built schedule without the delays is assumed to represent the as-planned schedule for the forward analysis. For a detailed as-built schedule of public owner project 3 refer to Appendix B. For a detailed as-built schedule without delays that is assumed to be the as-planned schedule for the snapshot method application after-the-fact refer to Appendix C.

3. The as-planned schedule was updated by inserting actual early dates of the schedule. This schedule update represented a snapshot picture of the project right before the delay took place. The actual dates of delays in foreign steel started on April 22nd, 1997 and ended on May 9th, 1997. Therefore, the first schedule update was captured on April 21st, 1997 and all other activities that took place in the period between the start date of the project and the cut-of date of April 21st, 1997 have been updated. Rfer to Appendix D for a snapshot schedule on April 21st, 1997.

4. The projected completion date of the schedule update right before the delay took place was calculated from the updated schedule right before the delay occurred. The projected completion date based upon the snapshot picture taken on April 21st, 1997 was July 9th, 1997. Refer to Appendix D for a detailed scheduling analysis.

5. The next schedule update is intended to capture a snapshot picture of the project right after the delay in foreign steel occurred and the cut-off date of this schedule was right after the last day the delay takes place. Project schedule was updated by inserting actual dates at which the delay took place. Actual dates of delay in foreign steel of actual

start on April 21st, 1997 and actual finish on May 9th, 1997. Refer to Appendix E for a detailed scheduling analysis.The projected completion date of the schedule update right after the delay took place was calculated from the updated schedule after the delay occurred. For delay in foreign steel, the projected completion date was July 25th, 1997. Refer to Appendix E for a detailed scheduling analysis.

7. The analysis-in-retrospect method has been applied by comparing as-built schedule with the delay of foreign steel (refer to Appendix F) to the as-built schedule without the delay (refer to Appendix C).

8. The delay impact was calculated by comparing the schedule updates with and without the delay being analyzed. The difference between the two completion dates of July 9th, 1997 and July 25th, 1997 represented the delay impact on the project. The project calendar is used to determine the amount of working days the delay had on the project schedule. In foreign steel delay case, 12 days of delay in foreign steel had an impact of 11 working days on the project schedule.

4.2.4.2 Application of the Analysis-in-Retrospect Method to Delay in Foreign Steel

Popescu and Charoenngam (1994) state, "If contractors neglect to update the project schedule adequately and delay or acceleration disputes arise, the as-built schedule will be prepared from daily logs or other contract documents."

To apply the analysis-in-retrospect method to delay in foreign steel, the following steps were followed:

1. The job-history database was constructed from contemporaneous data such as-daily reports and daily logs. The activity work code list was the first step towards constructing the job-history database. The following information was recorded for each entry in the work code list.

- The date.
- The work code.
- The log notes.

After all the data has been entered into the database, it was sorted by activity work code and chronologically by date. Thus, a job-history record was created and this job-history database was used to construct the as-built schedule. For a detailed job-history database of public owner project 3 refer to Appendix A.

2. The as-built schedule was constructed from contemporaneous project documents, such as correspondence, diaries, daily logs, and reports. The job-history database represents the basis for constructing the as-built schedule. The start and finish of an activity may not necessary be the first or very last entry for that series of work codes. Start date is defined as the first day on which a significant cost expenditure in labor or equipment, or both has occurred. Finish date is similarly defined as the last day that a significant cost expenditure in labor or equipment or both has occurred. Non-working

days are defined as those days on which delays of Type 1, i.e. excusable non-compensable delays took place. Holidays are also classified as non-working days that impeded the progress of work. An as-built calendar ould then be created. The logic of the schedule could be determined from the sequence of the activities that the contemporaneous data provided. The activities were adjusted using negative and positive lag to reflect delays and overlaps between activities and to show each activity's actual start date in real time. The project completion date based upon the as-built schedule of the delayed foreign steel was projected on July 25th, 1997. For a detailed as-built schedule refer to Appendix F.

3. The next step after constructing the as-built schedule was to identify project delays that caused the disputes among the construction parties. The analysis was performed to identify the impact the delay in foreign steel had on the schedule, therefore, the actual start and finish dates of the delay in the foreign steel were identified. The delay in foreign steel started on April 22nd, 1997 and ended on May 9th, 1997.

4. Once delays were identified, the next step was to remove the delay being analyzed from the as-built schedule and recalculate the project duration using the critical path method of scheduling. The projected completion date of the collapsed as built schedule that was constructed by removing 12 days of delays of foreign steed, the projected completion date was July 9th, 1997. For a detailed scheduling analysis of this step refer to Appendix C.

5. To quantify the impact of a delay on the construction schedule, two schedules were compared, the as-built schedule (refer to Appendix F) and the collapsed as-built schedule, which is the as-built schedule without the delay being analyzed (refer to Appendix C). The difference calculated from comparing the two schedules completion dates was based upon the project calendar and it was quantified as the difference between July 9th and July 25th, which was 11 days. This difference represented the impact of the delay being analyzed.

4.2.4.3 Results of Delay in Foreign Steel

The amount of delay impact that was calculated using the snapshot method (11days) was the same as the amount of delay impact that was calculated using the analysis-in-retrospect method (11 days). The equal delay-analysis impact that has been quantified using both dynamic methods of delay-analysis suggests that the snapshot method and the analysis-in-retrospect method lead to the same scheduling results if, at the time a delay is analyzed using the snapshot method, the predictions for durations and logic of future activities is accurate and the actual progress of work would follow the same durations and logic predicted as a part of applying the snapshot method of delay analysis.

4.3 Who Owns the Float?

Fisk states, "On one hand, a contractor may create an artificial network with multiple critical paths. The intent of the contractor would be to present claims if the owner causes delay on any of the paths. On the other hand, the owner may plan the project duration and then shorten it. The owner's intent would be to obtain a bid on the shortened duration and then to hold the contractor to the time."

Fisk suggests that since the owner pays for the scheduling system, scheduling specification clauses that direct the contractor to redraw the network at any time the schedule is behind on the critical path could help in preventing the artificial networks with multiple critical paths. Fisk also suggests resources allocation to schedules with multi critical paths to prevent the problem of artificial multi critical paths networks.

Antill and Woodhead state, "theoretically the net working duration is the time taken to carry out the work with no critical delay at all. It is also clear that no contractor can expect in practice to achieve this efficiency and must allow for some lost time in the

estimate of project duration in this initial network. For this reason it must be emphasized that any float included in the initial network belongs to the contractor and may not be consumed by the owner or the engineer in ordering variations without their compensating the contractor for any critical delay that may arise in consequence."

If a delay occurs, the delayed activity will have an impact on the schedule and as a result of the delay, the contractor will reschedule activities from the date the delayed activity is completed. As a result, the project duration may or may not be maintained by rescheduling the schedule. The project cost will increase as a result of delay.

The concept that Fisk describes of redrawing the network at any time the schedule is behind could help in preventing the artificial networks in updating the construction schedule supports that contractor's schedule updates represent an actual picture of project's work progress. To analyze delays in construction projects, schedule updates represent a valuable source of information that is required to apply forward methods such as the snapshot and windows method. Additionally, the last schedule update if accurate is equivalent to the as-built schedule, which is the basis for applying backward methods of delay analysis such as the analysis-in-retrospect method.

Early in the planning stage, floats of non-critical activities are represented in the as-planned schedule to minimize the amount of risk that arises from the difference between planned and actual progress of work. When the project is in the construction stage, schedule updates represent actual progress of work with no uncertainty of completed activities, therefore, floats do not appear in as-built schedules. Different parties that work on the project need to be working as a team, accordingly, any differences between the planned and actual durations that exceed the amount of float need to be represented in contractor schedule updates and discussed as they arise. Since floats are represented in as-planned schedules to minimize the project's risk, no party

can actually own the float. Instead float is suggested to be owned by the project where any party that needs to consume part of the float as risks arise can do so.

5 CONCLUSION

5.1 Study Overview

The purpose of this study was to develop guidelines that could help resolve conflicts arising from the determination of the most applicable method of delay analysis for a specific case. Another purpose of this study was to identify applicable delay-analysis techniques that can be applied to resolve claims among different construction parties involved in a dispute. The last purpose of this study was to apply recommended methods of delay-analysis methods that can be applied to resolve claims to actual projects and compare the result of applying those methods.

To fulfill the first and second objectives of this study, research has been conducted to identify different applicable methods of delay-analysis and determine when a specific method is the "best" method for a certain case. As a result of the literature review of this study, guidelines on the selection of the most applicable method of delay analysis have been suggested (refer to Table 1 and section *4.1.2 Guidelines for Delay-Analysis Method Selection Process*). To fulfill the third objective of applying different methods that are applicable in resolving claims, actual data have been analyzed in this study to reflect the impact a delay has on a schedule (refer to section 4.2 Application of Delay-Analysis Methods to Actual Projects).

This study will help the construction industry in selecting of the most applicable method of delay analysis for a certain case. Also, this research helps answering the question of whether the windows method and the analysis-in-retrospect method of delay analysis lead to the same scheduling results.

5.2 Specific Findings

Findings were drawn from this research pertaining to the selection of delay-analysis method and the application of delay-analysis methods that can be implemented to resolve claims among different parties involved in the construction process. The study suggested findings are as follows:

1. This study suggests guidelines for selecting a delay analysis-technique that can be implemented in specific situation. A delay can be analyzed using different methods of delay analysis. In determining the most applicable method of delay analysis, the timing at which a delay analysis is performed is critical. Also, the information provided at the time of performing the delay analysis is important to determine which method of delay analysis is most applicable in a certain situation. For a detailed discussion related to this subject refer to section *4.1.2 Guidelines for Delay-Analysis Method Selection Process* and Table 1 Delay-Analysis Methods and Different Classifications on page 48.
2. In the early planning stage, the durations and logic of all activities are considered as best estimates of the scheduling analyst. To predict the future impact of a delay on the schedule, the as-planned schedule can be used. In this case, no activities have started yet, and the delay analysis would determine a best estimate of the impact of a delay on future activities. Refer to Table 1 Delay-Analysis Methods and Different Classifications and section *4.1.2 Guidelines for Delay-Analysis Method Selection Process* for further discussion related to this finding.
3. While the project is in the ongoing stage, that is where some activities have actually started and finished, or have actually started and not yet been completed, or have not yet started. In this case actual dates represent facts and future dates represent estimates that are subjective to the accuracy of the analyst predictions. To determine the impact of a delay on future activities while the project is ongoing, the snapshot method of delay analysis is suggested. Contemporaneous documents can be used to determine actual dates in schedule updates. Actual dates can provide an eligible source of

information that the scheduling analyst can base the delay analysis upon. Refer to Table 1 Delay-Analysis Methods and Different Classifications and section *4.1.2 Guidelines for Delay-Analysis Method Selection Process* for further discussion related to this finding.

4. In the case where a delay analysis is performed after the events become facts and the project is completed, there is no uncertainty level since all activity dates, durations, and logic represent facts. Contemporaneous documents can be used in this case to create the as-built schedule, which could be used in performing the after-the-fact delay analysis using the analysis-in-retrospect method of delay analysis. Refer to Table 1 Delay-Analysis Methods and Different Classifications and section *4.1.2 Guidelines for Delay-Analysis Method Selection Process* for further discussion related to this finding.

5. Steps that can be followed to apply the dynamic methods of delay analysis, i.e. the snapshot method and the analysis-in-retrospect method are documented in this research for the benefit of analysts in the construction industry. For a detailed discussion on the steps of applying the dynamic methods of delay-analysis, refer to section 3.3 Determine Applicable Methods analyzing Delays.

6. The snapshot method and the analysis-in-retrospect method lead to the same scheduling results if, at the time the delay analysis is performed using the snapshot method, the predictions for durations and logic of future activities is accurate and the actual progress of work would follow the same durations and logic predicted as a part of applying the snapshot method of delay analysis. For further information related to this finding refer to section 4.2 Application of Delay-Analysis Methods to Actual Projects

7. If the project schedule is composed of multiple chains, the total float of each chain needs to be monitored closely to prevent non-critical activities from becoming critical activities and controlling the progress of work.

8. To achieve success in a construction project, different construction parties need to work as a team. Therefore, no party should own the float; instead the float should be owned by the project. This indicates that the float is consumed by the party that needs it first as occurrences arise and force the consumption off the float. Refer to section 4.3 Who Owns the Float? for further discussions related to this finding.

5.3 Future Work

Recommendations for future research include analysis of concurrent delay using both the analysis-in-retrospect and the windows method of delay analysis and comparing the results of the two methods. Also, future research can include the application of the windows method and the analysis-in-retrospect method to actual projects delays using stochastic scheduling tools and comparing the results that different schedule-programming tools would provide.

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APPENDIX A

PUBLIC OWNER 3 JOB-HISTORY DATABASE

Table 5. Public Owner 3 Job-History Database

Item Number	Date	Work Code	Log Notes
1	2/24/1997	1810	
2	2/25/1997	1810	
3	2/25/1997	1850	
4	2/26/1997	210	
5	2/27/1997	110	
6	2/27/1997	210	
7	2/28/1997	210	
8	3/1/1997	1822	
9	3/2/1997	1822	
10	3/3/1997	1850	
11	3/3/1997	210	
12	3/4/1997	1850	
13	3/4/1997	301	Go to Transit Mix for mix design
14	3/4/1997	1860	No phone hook up in office.
15	3/5/1997	1850	
16	3/5/1997	1860	No phone hook up in office.
17	3/6/1997	1850	
18	3/6/1997	301	Pick up paper work from Transit Mix
19	3/6/1997	1860	No phone hook up in office.
20	3/7/1997	1850	
21	3/7/1997	511	Go to steel people with prints.
22	3/7/1997	1860	No phone hook up in office.
23	3/8/1997	1822	
24	3/9/1997	1822	
25	3/10/1997	1850	
26	3/10/1997	210	Lay out and shoot grade-scrape top of grass off of slab area.
27	3/10/1997	1860	No phone hook up to office.
28	3/11/1997	210	
29	3/11/1997	1860	
30	3/12/1997	1850	
31	3/12/1997	1860	Got phone hook up in office.
32	3/13/1997	1850	
33	3/13/1997	1811	Job sight is very wet & muddy.

Item Number	Date	Work Code	Log Notes
34	3/14/1997	1811	Dig ditches to drain water from slab area.
35	3/14/1997	1810	Heavy drizzle on & off.
36	3/15/1997	1822	
37	3/16/1997	1822	
38	3/17/1997	1811	Dig ditches & move dirt to drain water.
39	3/17/1997	1811	Heavy rain Saturday night. Lots of water & mood.
40	3/18/1997	1811	
41	3/18/1997	210	
42	3/18/1997	1830	Heavy rain at night. Could not get into prision. Subcontracttors had to wait 45 minutes to get into prision. Lost Time.
43	3/19/1997	330	
44	3/19/1997	230	
45	3/19/1997	1811	Heavy rain last night wet and muddy.
46	3/20/1997	280	
47	3/20/1997	220	
48	3/20/1997	1611	
49	3/21/1997	220	
50	3/21/1997	1511	
51	3/21/1997	1611	
52	3/22/1997	1822	
53	3/23/1997	1822	
54	3/24/1997	1511	
55	3/24/1997	330	
56	3/25/1997	1611	
57	3/25/1997	1511	
58	3/25/1997	330	
59	3/26/1997	330	Poured slab & finished.
60	3/27/1997	331	
61	3/28/1997	331	
62	3/29/1997	1822	
63	3/30/1997	1822	
64	3/31/1997	330	
65	3/31/1997	331	
66	3/31/1997	1830	Prison reps. Put up 6' high fence around our work area.
67	4/1/1997	1820	
68	4/2/1997	221	
69	4/3/1997	1811	They decide not to dig to wet & more rain to came lunch time.
70	4/4/1997	1810	
71	4/5/1997	1822	
72	4/6/1997	1822	

Item Number	Date	Work Code	Log Notes
73	4/7/1997	1690	
74	4/7/1997	221	
75	4/7/1997	250	
76	4/7/1997	1830	Prison would not let us in from 7:30 am to 11:30 am- all lost time.
77	4/8/1997	221	
78	4/8/1997	250	
79	4/8/1997	1690	
80	4/9/1997	1830	All Trades went to prison entry meeting 7:30 am till 1:00 p.m. 1/2 hour lunch 5 hours of no work for all.
81	4/9/1997	221	
82	4/9/1997	250	
83	4/10/1997	1690	
84	4/10/1997	221	
85	4/11/1997	1810	Electricians came in, rain to wet to work. Charles shows up to run back hoe; to wet.
86	4/12/1997	1822	
87	4/13/1997	1822	
88	4/14/1997	1690	Found 1-2" pipe from under prison. Can not find other pipe.
89	4/14/1997	1693 x	Found 1-2" pipe from under prison. Can not find other pipe.
90	4/15/1997	1693 x	Electricians can not find second pipe. Try to blow & fish tape the line. They found but does not come out in power room try again tomorrow.
91	4/16/1997	1693	Electricians can not find second pipe to power room. The one is there they can not get through to power room, waiting for man with a probe tip so they can locate where the trouble is. Electrician lost time all day looking for end of pipe.
92	4/17/1997	1693	Electricians try to fish tape in both ends of pipe with locator connected to it. Could not find middle of pipe under transformer somewhere. Electricians lost all day looking & trying to get through pipe.
93	4/18/1997	1693	Electricians still looking for pipe under prison to power room. Caddells men did all the digging. Electricians lost all day waiting to find pipe.
94	4/19/1997	1822	
95	4/20/1997	1822	
96	4/21/1997	1860	Prison had power house locked(our office) opened door at 1:30pm. And was asked to leave at 3:30pm for lock up.
97	4/21/1997	221	
98	4/21/1997	250	Started Digging for water line

Item Number	Date	Work Code	Log Notes
99	4/21/1997	1693	Crown check if Caddell found conduit (No)
100	4/21/1997	1830	Prison would not let us in gate could not find paper work on back hoe operator. Finely found 1 hr 15min lost.
101	4/22/1997	221	
102	4/22/1997	1690	Electricians find conduit (1) work on connecting to power house.
103	4/23/1997	221	
104	4/23/1997	250	
105	4/24/1997	221	
106	4/24/1997	250	
107	4/24/1997	290	
108	4/25/1997	1810	
109	4/26/1997	1822	
110	4/27/1997	1822	
111	4/28/1997	1811	To wet & muddy to move dirt.
112	4/29/1997	221	
113	4/29/1997	1690	
114	4/30/1997	290	
115	5/1/1997	1690	Electrician pull fish tape from conduit running under prison. (Prison request)
116	5/2/1997	1820	
117	5/3/1997	1822	
118	5/4/1997	1822	
119	5/5/1997	1820	
120	5/6/1997	1820	
121	5/7/1997	1820	
122	5/8/1997	1820	
123	5/9/1997	3632	truck loads of tilt up panels delivered today. Trailers parked on road till Monday unload.
124	5/10/1997	1822	
125	5/11/1997	1822	
126	5/12/1997	364	
127	5/13/1997	364	Patriot erectors stack mats - load on trailer & remove from inside of prison. Move & stack remainder of mats in prison outside of walls then load on trailer & remove.
128	5/13/1997	1870	
129	5/14/1997	1820	
130	5/15/1997	1820	
131	5/16/1997	1820	
132	5/17/1997	1822	
133	5/18/1997	1822	
134	5/19/1997	512	Lay out steel for tower top & start fabricating.

Item Number	Date	Work Code	Log Notes
135	5/20/1997	512	
136	5/21/1997	512	
137	5/21/1997	572	
138	5/22/1997	515 x	Stoped steel fabrication foreign steel
139	5/23/1997	1810	Had meeting in conference room 1:00pm
140	5/24/1997	1822	
141	5/25/1997	1822	
142	5/26/1997	515 x	
143	5/27/1997	364	Patriots men weld tilt wall panels in place.
144	5/27/1997	400	
145	5/27/1997	1830	Patriot could not get in prison yard for 2 hours gate was not working.
146	5/27/1997	1830	B&H masonry waited 21/2 hours before they could get in to drop off material.
147	5/28/1997	400	
148	5/29/1997	400	
149	5/29/1997	1830	B&H Masonry got to gate at 7:30am got into prison 11:00 am
150	5/30/1997	400	
152	5/31/1997	1822	
153	6/1/1997	1822	
154	6/2/1997	1820	Mason did not work today.
155	6/3/1997	400	
156	6/3/1997	850	Block men lay block 4' high start at 1:00pm. Set door frame in place.
157	6/3/1997	1830	35 min wait together in 1hr30min out - lock down.
158	6/4/1997	400	
159	6/4/1997	1830	1 hr wait no escorts. In 30 min out.
160	6/5/1997	400	B&H finish up block work take down scaffolding & clean up tower.
161	6/5/1997	1830	45 min in, 30 min out.
162	6/6/1997	400	B&H masonry clean up site.
163	6/6/1997	1830	40 min wait in, 20 min out.
164	6/7/1997	1822	
165	6/8/1997	1822	
166	6/9/1997	1820	
167	6/9/1997	1830	Contractor & I try to get in prison, memo sent in Thursday 6/5/ could not get in 1hr 15min wait to get in. 10 min to get out.
168	6/10/1997	1820	
169	6/10/1997	515 x	Replacement steel del. 3:00pm
170	6/11/1997	512	

Item Number	Date	Work Code	Log Notes
171	6/12/1997	512	
172	6/13/1997	512	
173	6/14/1997	1822	
174	6/15/1997	1822	
175	6/16/1997	512	
176	6/17/1997	513	Patriot set tower top & stairs in the rain.
177	6/17/1997	573	Patriot set tower top & stairs in the rain.
178	6/17/1997	1810	Lots of rain & mud.
179	6/18/1997	1811	To muddy to get around in tower area.
180	6/19/1997	513	
181	6/19/1997	573	
182	6/20/1997	340	
183	6/21/1997	1822	
184	6/22/1997	1822	
185	6/23/1997	1820	
186	6/24/1997	340	
187	6/25/1997	340	
188	6/26/1997	340	
189	6/27/1997	340	
190	6/28/1997	1822	
191	6/29/1997	1822	
192	6/30/1997	1612	
193	6/30/1997	340	
194	7/1/1997	1612	
195	7/1/1997	340	
196	7/1/1997	1830	Lost time, triangle paving 2hours lost time.H&W plumbing 11/2 hours no escorts.
197	7/2/1997	1612	
198	7/2/1997	1512	
199	7/3/1997	350	
200	7/4/1997	1820	
201	7/5/1997	1822	
202	7/6/1997	1822	
203	7/7/1997	810	Patriot Erectors lift floor hatch up to observation deck.
204	7/7/1997	350	
205	7/8/1997	1513	
206	7/8/1997	350	
207	7/8/1997	1810	
208	7/8/1997	1830	H&W lost time getting in prison 1hr in am 1-1/2 to get out dump trucks were the problem.
209	7/9/1997	1613	
210	7/9/1997	350	

Item Number	Date	Work Code	Log Notes
211	7/10/1997	1513	
212	7/10/1997	340	Pour slab
213	7/10/1997	350	Triangle pour both slabs.
214	7/11/1997	350	Triangle look at pour & make recommendations to fix.
215	7/11/1997	351	Let slab cure.
216	7/12/1997	1822	
217	7/13/1997	1822	
218	7/14/1997	350	
219	7/14/1997	351	
220	7/15/1997	520	
221	7/15/1997	1580	AC people look at framing
222	7/15/1997	260	Use fence dig holes & pour 3 poles hit concrete need to jack hammer out.
223	7/15/1997	351	
224	7/15/1997	1830	Patriot-Accurate air, wait time 11/2 hrs lock down. 1hr no scort 30 min out.
225	7/16/1997	520	
226	7/16/1997	350	Triangle pull down under side of forms.
227	7/17/1997	520	
228	7/17/1997	1580	Set AC unit on roof
229	7/17/1997	350	Triangle deck forms & work on slabs.
230	7/18/1997	350	Triangle men take down & out scaffolding from inside tower.
231	7/19/1997	1822	
232	7/20/1997	1822	
233	7/21/1997	1530	
234	7/22/1997	260	
235	7/22/1997	350	
236	7/23/1997	540	
237	7/23/1997	580	Work on ship ladder stairs.
238	7/23/1997	350	
239	7/24/1997	580	
240	7/24/1997	550	Hand rails
241	7/25/1997	1530	
242	7/25/1997	350	
243	7/25/1997	260	
244	7/26/1997	1822	
245	7/27/1997	1822	
246	7/28/1997	573	
247	7/28/1997	550	
248	7/28/1997	1530	
249	7/29/1997	550	

Item Number	Date	Work Code	Log Notes
250	7/29/1997	1530	
251	7/30/1997	550	
252	7/30/1997	1530	
253	7/30/1997	1810	Rained out p.m.
254	7/31/1997	1620	
255	7/31/1997	1530	
256	8/1/1997	1530	Plumbers went for material got here at 10:30 am.
257	8/1/1997	1830	Building locked all day tried to get building open, but could not. No phone calls to subs or supervisors. Lost time on prisons part.
258	8/2/1997	1822	
259	8/3/1997	1822	
260	8/4/1997	1530	
261	8/5/1997	1630	
262	8/5/1997	310	
263	8/5/1997	320	
264	8/6/1997	1530	
265	8/7/1997	1530	
266	8/7/1997	1620	
267	8/7/1997	1810	Rain heavy 2:00pm
268	8/8/1997	1530	
269	8/8/1997	1620	
270	8/8/1997	1810	Rain on & off all day
271	8/9/1997	1822	
272	8/10/1997	1822	
273	8/11/1997	0	
274	8/12/1997	0	
275	8/13/1997	1620	
276	8/13/1997	1530	
277	8/14/1997	1620	
278	8/15/1997	1620	Will have a meeting with Patriot to discuss corrections to steel.
279	8/18/1997	1820	
280	8/18/1997	1830	Crown Electric personnel took training course to obtain their badge.
281	8/19/1997	1620	
282	8/20/1997	1520	
283	8/21/1997	1820	Patriot (steel erectors) will come to site tomorrow to discuss scope/method of steel modifications/corrections.
284	8/22/1997	573	Corrections: Spiral stairway
285	8/22/1997	580	ship ladder
286	8/22/1997	1620	

Item Number	Date	Work Code	Log Notes
287	8/22/1997	320	
288	8/22/1997	1830	Access to complex delay: from 7:55am until 9:45am(1hr50min) Bus bringing new inmates into complex.
289	8/23/1997	1822	
290	8/24/1997	1822	
291	8/25/1997	780	Meeting with roof contractor.
292	8/26/1997	1820	
293	8/27/1997	1820	
294	8/28/1997	1650	
295	8/28/1997	1830	Permanent entrance(gate) permit denied to one electrician from Crown Electric who worked previously @ the tower.
296	8/29/1997	1650	
297	8/30/1997	1822	
298	8/31/1997	1822	
299	9/1/1997	1823	
300	9/2/1997	1650	
301	9/2/1997	1620	
302	9/2/1997	1830	Gate temp. permits were solicited for various contractors & employees on Fri. 29 Aug. 97 to allow their access on Tues. 2 Sept. 97. Permits were not available at the gate(2 Sept) and consequently the painting contractor Promark & Triangle Paving were not allowed inside the complex. These permits, as per FBOP, can be solicited sometimes. The previous working day and will be at the gate by next morning. These permits need to be exhibited in a timely manner since this situation affects our relation and credibility of our sub contractors specially at the stage where I'm pushing to mobilize and or to complete banding work.
303	9/2/1997	780	BGI(roofing contractor) called @ 3:00pm indicating that will not provide a bid for the roof, due to their present workload.Called Houston office to contact Jackson Constr. (take their bid but have not signed the contract).
304	9/3/1997	1660	
305	9/3/1997	1630	
306	9/3/1997	310	
307	9/3/1997	320	
308	9/3/1997	882	Security windows, doors(sweepers) indicated in todays telegram that delivery will be next week. Will confirm exact date.
309	9/3/1997	321	x F.B.O.P. needs to install conduit for security syst. Under entrance corner slab prior to our work in that area.(slab)

Item Number	Date	Work Code	Log Notes
310	9/3/1997	780	Roofer- called MDA home office to revive Jackson Construction who is being dormant and has not comply with my requests of accepting the roofing contract or at least to comment..., negative or whatever. Looking for a head contractor again.!! Can you suggest another?
311	9/4/1997	1660	
312	9/4/1997	770	
313	9/4/1997	310	
314	9/4/1997	320	
315	9/4/1997	321 x	PBOP to install electrical conduit for security system that are to be installed under the concrete slab.
316	9/4/1997	780	BGI mgr. Called indications that will provide a quote for roofing work early next week.
317	9/5/1997	1660	
318	9/5/1997	1690	Installing V/G electr. Conduit unit(under access slab to be}
319	9/5/1997	310	
320	9/5/1997	320	
321	9/5/1997	770	
322	9/5/1997	580	
323	9/5/1997	321 x	FBPO (not in MDA Scope) installing V/G conduit for security system(V/G access conc.. Slab to be)
324	9/6/1997	1822	
325	9/7/1997	1822	
326	9/8/1997	1620	
327	9/8/1997	850	Key drop and door assembly plate.
328	9/8/1997	770	
329	9/8/1997	321 x	Back fill over conduits under entrance & concrete slab and other work associated with the entrance slab. Backfilling was delayed for 5hrs die to ....#5 below. FBOP - Completing conduit(V/G) under access concrete slab.
330	9/8/1997	825	Today regarding ETA's- They indicated that the glass was to be delivered to their slab in Oklahoma starting next week and everything should be at this site late next week.
331	9/8/1997	1620	
332	9/8/1997	1670	
333	9/8/1997	310	
334	9/8/1997	320	
335	9/8/1997	1550	
336	9/9/1997	780	BGI- come in today with roofing contractor to inspect the site. Will provide a bid next Friday.(noon)
337	9/10/1997	1550	
338	9/10/1997	310	

Item Number	Date	Work Code	Log Notes
339	9/10/1997	320	
340	9/10/1997	930	
341	9/10/1997	1620	
342	9/10/1997	1811	Painters will not stay after quitting time toady- too muddy.. Will schedule the painting for tomorrow.
343	9/10/1997	1830	It took 2hrs for the vacuum truck to arrive @ the site to service the portable toilet. The permit(gate) for holes ..... was not at the gate. It was .....yesterday about noon time. Consequently it took about two 2hours to get in. All in all it took about 2hrs(VG) to enter the complex and arrive @ the site.
344	9/10/1997	1811	Triangle Paving will spread some rocks tomorrow about noon in the temporary facility area(inside fence) to permit and prevent similar conditions in the future.
345	9/11/1997	1620	
346	9/11/1997	1660	
347	9/11/1997	310	
348	9/11/1997	320	
349	9/11/1997	920	Wall painting (1st coat) Exterior. Done.
350	9/12/1997	1660	
351	9/12/1997	320	
352	9/12/1997	1550	
353	9/12/1997	920	Painting exterior walls (2nd coat)
354	9/12/1997	1830	Electrician (Crown Electric) arrived @ entrance yellow line @ 7:15am and Triangle Paving @ 7:35@am. Were allowed inside fence @ 8:00am to start the tool survey etc.
355	9/12/1997	1860	MDA's supt. arrived about 7:15 am Office bldg. Was locked until found someone to open it @ 8:25am.
356	9/12/1997	1870	Since office building was locked and electrician keep some of his material insider our warehouse inside the bldg. Had to arrange with Triangle Paving Supervisor to bring material to electrician @ about 9:30am or the time he was entering the complex.
357	9/12/1997	1830	MDA's super. Could not enter the complex @ about 3pm to be with the painters because there were not any escort persons available. Had to wait until partners finish their work. Thus, went home.
358	9/13/1997	1822	
359	9/14/1997	1822	
360	9/15/1997	1620	
361	9/15/1997	1550	
362	9/15/1997	1694x	
363	9/15/1997	320	

Item Number	Date	Work Code	Log Notes
364	9/15/1997	770	
365	9/15/1997	930	
366	9/15/1997	780	Roof and other work proposal provided by BGI Friday afternoon was accepted. Held planning meeting with Mr. Stuart Simpson of BGI who will start this week providing the necessary submittals. BGI indicated that there is no material problems. Work is scheduled to start on week of 22 Sept. 97 and should be completed in 21/2 - 3 weeks.
367	9/15/1997	822	Sweepers (det. Windows & doors) supt. Indicated during a telecom on last Saturday(13 Sept 97) night that he will be at the site on Monday 29 Sept 97 and all materials will be delivered that week.
368	9/15/1997	1670	Spot Lamp Delivery(Crown Electric) Originally scheduled for Oct. 17, 1997 was accelerated by having a premium to the vendors. New accelerated delivery date about 3rd Oct. 1997.
369	9/16/1997	1694 x	Crown Electric - brought in cable splicing man hole and working on splicing.
370	9/16/1997	1550 x	
371	9/16/1997	320	
372	9/16/1997	1830	Soil test (T&N Laboratory) arrived outside fence @9:05am exit complex about 10:30am about 11/2hrs from arrival. This work was completed in 15 min.
373	9/16/1997	822	Spoke to Bill Knesch(P.HIS) and was planning to ship everything by next week(w.p.22 Sept. 97)
374	9/16/1997	1695 x	Communication conduit - FBOP need to expedite roof penetrations if any.
375	9/17/1997	1694 x	
376	9/17/1997	320	Triangle Paving- Pouring entrance slab 2c.y. concrete.
377	9/18/1997	1694 x	
378	9/18/1997	340	Assisting Crown Electric and mezzanine floor & ceiling concrete repairs.
379	9/18/1997	1830	At 9:20am was allowed inside. Went to see electrician and spent about 1 minute with him. Then went to the guard tower to transmit the electricians directive. Laborers who were suppose to start fixing the concrete floor on Mezzanine were idle waiting for my instructions since did not know the time they had to assist the electrician and stated that didn't want to start the work and stop on the middle of the work and spoil the work. I got out of the complex @ 10:10am or almost 2hrs for a 10 minute or less coordination affairs.
380	9/19/1997	1694 x	Completing cable splicing work- MH concrete misc. conduit in guard tower.

Item Number	Date	Work Code	Log Notes
381	9/19/1997	1860	Could you please find out or obtain the necessary approvals for the use of 2 way radios inside the complex. Based on the verbal indication of FBOP about two wks ago that radios were allowed asked the gate guard who indicated that certain approvals are required prior to allow them inside the complex.
382	9/20/1997	1822	
383	9/21/1997	1822	
384	9/22/1997	1620	
385	9/22/1997	1694	x
386	9/22/1997	120	x Promark Painting - Came in @ 9:00 am did not enter complex(?) Apparently
387	9/22/1997	785	BGI - Roofing submittals were approved today
388	9/22/1997	1695	x FBOP evacuated a -+ 4'w 3'H 15' L trench from tower to temporary fence gate for communication/security conduits last Friday 19 Sept. 97 Pls. expedite the completion of that .... ASAP since it restricts moving of vehicles in a portion of the temporary area.
389	9/23/1997	1810	
390	9/24/1997	1620	
391	9/24/1997	825	There are indications of working long hours and possibly week ends. Need to confirm on the 29 Sept 97. Will provide the 40 hrs notice to FBOP.
392	9/25/1997	1620	
393	9/25/1997	120	x Promark Paint - came in this morning (1) man. Did not enter complex. Needed a generator.
394	9/25/1997	1695	x Pls. Expedite completion of V/G electrical by FBOP. Trench needs to be closed and compacted since is restricting movement inside. Could FBOP complete the work before Monday (29 Sept 97)
395	9/26/1997	1620	
396	9/26/1997	340	Mezz floor and core drilling (drilling for rebar installation) repairs.
397	9/27/1997	1822	
398	9/28/1997	1822	
399	9/29/1997	1620	
400	9/29/1997	1660	
401	9/29/1997	1830	General - Due to some alleged problems inside the prison complex, no one was permitted to enter until about 9:00 am. Since no one could inform us at what time we will be allowed inside, some contractors left. (Promark & H &W Plumbing)

Item Number	Date	Work Code	Log Notes
402	9/29/1997	1830	Sweeper (det. Window) employees waited from 9:45 am until after lunch to enter the complex for site inspection. Their permits had not matched the gates guard ….. Though they were solicited by MDA on 24 Sept. 97.
403	9/29/1997	1695 x	FBOP must expedite the closing of the trench for V/G conduits. Dvs up 10 days ago. Trench is restricting access to the temporary facility area.
404	9/30/1997	530	
405	9/30/1997	1620	
406	9/30/1997	822	Unloading window frames & doors. Truck scheduled @ 2:00pm arrived about #:45 p.m..
407	9/30/1997	1830	Overtime - BGI requested to work 10 hr/day and possibly this Saturday. Sweeper may also request the same. Will let me know tomorrow. Will advise FBOP who , if arrangement can be made will work those hours.
408	10/1/1997	1620	Pulling main feeder cable.
409	10/1/1997	530	
410	9/30/1997	825	Unloading glazzing
411	9/30/1997	1695 x	FBOP - Installing V/G conduit by the tower. Trench will be back filled tomorrow.
412	10/2/1997	530	
413	10/2/1997	1830	BGI - was scheduled to work until about 6:00 p.m.. To that effect they started to get ready about 5:10pm(as did yesterday) to be at the main gate & check out their tools close to the time requested for OT work (+- 6:pm) Even though there was no problem yesterday, today they were not allowed to leave the temporary facility areas.(fenced area by tower) until about ^:15pm. The escort indicated that they could not leave until all prisoners finish their dinner???? BGI left the complex about 6:40pm
414	10/2/1997	1840	Sweeper subcontractor(detnt. Window/doors) did not show up for work. Around 11:00 am got a fax from Sweeper indicating that their erection subcontractor will not return to the job(quit). Apparently their subc. Did not know their work was inside on operating complex and underestimated the scope. I suggested Sweeper to contact BGI & Patriot to do the work.
415	10/2/1997	823	
416	10/3/1997	722	Installing exterior sheathing for parapet.
417	10/3/1997	740	Placing Bilco access on roof.
418	10/3/1997	1840	Sweeper called @ 3:25pm indicating that Mr. Bryan Rochelle will be on site about noon(Monday) to plan for window frame installation expected to start the next day (Tuesday 7 Oct 97)

Item Number	Date	Work Code	Log Notes
419	10/3/1997	823	BGI will work on Saturday and Sunday.
420	10/4/1997	722	
421	10/4/1997	940	
422	10/4/1997	1830	BGI arrived @ about 7:20 am and Promark @ about 8:15am were not allowed inside until about 9:20am. Apparently there was no escort available?? Arrived at the site @ 10:00am. Thus over 2 hours lost just to get inside main gate.
423	10/5/1997	1822	
424	10/6/1997	722	
425	10/6/1997	1840	Sweeper - Supervisor arrived on site about 1:00pm. Visited the site for planning purposes.
426	10/6/1997	740	
427	10/6/1997	850	
428	10/7/1997	722	
429	10/7/1997	530	
430	10/7/1997	1840	Sweeper installation subcontractor came in about 2:30 p.m..
431	10/8/1997	722	
432	10/8/1997	530	
433	10/8/1997	1870	Brought in 2ea. Window frames will start installing them tomorrow.
434	10/8/1997	1820	Contractors were not allowed in until about 8:20am. An alarm went off inside the complex(1hour lost)
435	10/9/1997	530	
436	10/9/1997	823	Sweeper - Set in places 1st window from (tack welded) It is expected to be able to erect at least 2 ea. day.
437	10/9/1997	1810	Roofer has not mobilized as scheduled due to the rain. Rain is also expected this weekend. Thus will possibly mobilize on Monday or Tuesday next week weather permitting.
438	10/10/1997	530	
439	10/10/1997	823	Set 2 window frames. Sweeper will work this Saturday - 8hrs.
440	10/10/1997	1860	MDA's office was unlocked @ 9:00am waited outside for about 11/2 hrs.
441	10/11/1997	823	x Sweeper - no work (see item # 5 below)
442	10/11/1997	1830	No one from FBOP was at the rear gate to allow workers inside even though proper arrangements were made. Sweeper personnel arrived @ about 7:20am and left @ 8:15am. I (MDA's Super) arrived from Houston, TX. About 8:00am and left @ 8:15am
443	10/13/1997	530	

Item Number	Date	Work Code	Log Notes
444	10/13/1997	823	Sweeper - transported material inside complex.
445	10/13/1997	1810	Rain out Sweeper about 10:00 am. BGI about 2:00pm
446	10/13/1997	1860	MDA's office was locked all day. No one available to open it. (Holiday) as informed by …. Gate closed.
447	10/14/1997	530	Completed installation of ceiling metal studs. Started installation of soffit metal studs.
448	10/14/1997	723	BGI (EPDM) - Mobilized. Completed installation of Tapered insulation.
449	10/14/1997	923	
450	10/14/1997	1650	
451	10/14/1997	1860	Access door to MDA's office was locked until about 9:00 am. Waited outside since 7:30am.
452	10/14/1997	1870	Door to MDA's warehouse and toilet facilities inside the bldg. Were locked until about noon time.
453	10/15/1997	530	
454	10/15/1997	722	
455	10/15/1997	723	Installing upper layer of insulation and rubber layer.
456	10/15/1997	720	Installing upper layer of insulation and rubber layer.
457	10/15/1997	850	
458	10/15/1997	1650	
459	10/15/1997	823	
460	10/15/1997	826	
461	10/15/1997	1830	Contractors lined up and rear gate about 7:30am. Last one in line came inside the gate(1st one) @ about 8:45 to start checking tools etc…..
462	10/16/1997	530	
463	10/16/1997	722	
464	10/16/1997	720	
465	10/16/1997	750	
466	10/16/1997	823	
467	10/16/1997	1680	
468	10/16/1997	1830	Contractor were lined up at gate since 7:30am. Were not allowed thu gate until about 8:15am. Last in line(Patriot) was allowed in about 9:15am.
469	10/17/1997	710	
470	10/17/1997	750	BGI Roofing -Completing roofing details.
471	10/17/1997	823	
472	10/17/1997	1680	
473	10/17/1997	1640	
474	10/17/1997	1830	Workers allowed in @ 8:20 am - no escort was available.

Item Number	Date	Work Code	Log Notes
475	10/17/1997	1860	Brought a portable camping chemical toilet to my office due to the circumstances that in numerous occasions FBOP personnel have failed to unlock the bathroom door.
476	10/18/1997	1822	
477	10/19/1997	1822	
478	10/20/1997	710	
479	10/20/1997	1660	
480	10/20/1997	1621	
481	10/20/1997	770	
482	10/20/1997	1830	Rear gate - allowed contractors to start getting in @ 8:15am
483	10/20/1997	1860	MDA's warehouse was locked. Needed materials for painters. Called FBOP and was unlocked about 9:30am. Painters waited in my office until was opened and also waiting for an entrance permit(see below item #4)
484	10/20/1997	1860	Vacuum truck for field toilet about 8:20am. Could not get in- too many contractors waiting in line to enter plus FBOP trucks full of groceries. Would have taken at least 1 hr. to enter. Truck was here last Friday and for unknown reason was not allowed inside.
485	10/20/1997	1830	Complex entrance permits for painter Mr. Donald Bearce solicited in Oct. 7,1997 was not at the gate. Consequently painters could not enter until 9:45am+- Permit was hand carried to gate by FBOP personnel.
486	10/21/1997	1830	Roof contr. Contractor not allowed to start getting inside until about 8:30am. Apparently some new prisoners were brought in.
487	10/21/1997	1860	Warehouse was locked. No impact since have my personnel portable toilet in my office.(Since last Friday)
488	10/21/1997	1860	FBOP personnel locked my office. Was locked out until 3:05pm.
489	10/22/1997	710	
490	10/22/1997	530	
491	10/22/1997	910	
492	10/22/1997	850	
493	10/22/1997	826	
494	10/22/1997	1830	
495	10/22/1997	1670	

Item Number	Date	Work Code	Log Notes
496	10/22/1997	1830	Major delays at rear gate due to : FBOP meeting with probation employees(about 60% of all staff) resulting on shortage of escort personnel. - Malfunction of south fire exit gate. Some contractors had to use the north fire exit gate(1/4 miles further) and others had to wait (45 min) @ south gate. Until was fixed. - 3 ea. truck loads of dirt entering rear gate (takes ong time to clear them).
497	10/22/1997	1830	First contractor allowed to enter (on Tower Gate) : 8:15am last contractor allowed to enter 10:15am. -
499	10/22/1997	1830	Due to above contractors arrived at their place of work from above 10:00am to 11:15am (Promark Painting) or less then 4 hrs of work.
500	10/22/1997	1830	Overtime - Painters were willing to stay until 5:30pm. I checked with ……Lufkin who informed me that since there are 900 + inmates no one will be permitted leaving the guard tower fenced area until close to 7:00pm or dinner time(5:30 p.m. - 6:30 p.m.) earlier. Time (leaving) will be affected by the head count. Thus O.T. is becoming a difficult ……
501	10/23/1997	1810	Painter only @ about 1:00pm slight rain.
502	10/23/1997	950	Started installation of ceiling short rock.
503	10/23/1997	710	
504	10/23/1997	910	
505	10/23/1997	1680	
506	10/23/1997	1620	
507	10/23/1997	826	
508	10/24/1997	950	
509	10/24/1997	1620	
510	10/24/1997	340	Completed Mezzanine corner. Repairs.
511	10/25/1997	1822	
512	10/26/1997	1822	
513	10/27/1997	950	
514	10/27/1997	1620	
515	10/27/1997	830	Sweeper - Door installation
516	10/27/1997	1581	
517	10/27/1997	1582	A/C security bars(need to re-do)
518	10/27/1997	1583	
519	10/27/1997	1830	Entrance Delays- Due to bus(prisoners) arriving @ rear gate workers were not allowed in until. First allowed to enter rear gate : 8:30am last allowed in about 9:30am. All contractors were outside gate @ about 7:30am.
520	10/27/1997	910	Painters did not show up due to low temperatures.
521	10/28/1997	1581	

Item Number	Date	Work Code	Log Notes
522	10/28/1997	1582	
523	10/28/1997	840	Door & door locks installation.
524	10/28/1997	1680	
525	10/28/1997	1620	
526	10/28/1997	1812	Painter - Came in this morning to paint window frames. Left - too cold (47F @ 9:30 am)
527	10/28/1997	910	Painters - Came in this morning to paint window frames. Left - too cold (46 F @ 9:30am).
528	10/29/1997	950	
529	10/29/1997	1670	
530	10/29/1997	1620	
531	10/29/1997	825	Windows glazzing tape was received.
532	10/30/1997	950	
533	10/30/1997	731	
534	10/30/1997	1670	
535	10/30/1997	1550	
536	10/30/1997	826	
537	10/31/1997	731	
538	10/31/1997	1620	
539	10/31/1997	826	
540	10/31/1997	1691	
541	10/31/1997	1830	Major delays @ rear gate. As per instructions of FBOP personnel inside complex yesterday afternoon. I requested all contractors to be ready to enter by 7:30am since escorts will be tied up with contractors installing asphalt on running tracks inside. - Contractors were ready to enter and were in line by 7:20am +-. - Contractors were not allowed inside gate until 1st contractor @ about 8:30am. Last contractor about 9:00am. Reasons - Rumors of a gun in the head of inmate. Apparently were searching for it. - Bus that bring inmates arrived @ the gate (they are given 1st priority) - Contractors are arriving @ their place of work about 9:45am. Were held @ the south fire gate until FBOP completed their search inside for " illegal" materials.

Item Number	Date	Work Code	Log Notes
542	10/31/1997	1830	Lighting Contractor Mr. Vincent Guillory came about 8:00am to inspect the site (plan ahead). Due to the delays at rear gate. Left & came back @ about 10:15am. To find that the entrance permit was not at the gate(even though it was solicited yesterday \2 about 9:30am) and consequently was not allowed inside complex. I went to FBOP office trailer and the letter was hand carried to the rear gate. Contractor waited at the yellow line after letter was brought to the guard and after waiting about 10minutes (no one approached him) left @ about 11:10am. Came back about 1:pm and was able to get inside.
543	11/1/1997	1822	
544	11/2/1997	1822	
545	11/3/1997	732	
546	11/3/1997	1670	
547	11/3/1997	826	
548	11/4/1997	732	
549	11/4/1997	630	Brought inside wood cabinet & set it in observe. Floor.
550	11/4/1997	826	
551	11/4/1997	1830	Lost time @ rear gate due to bus(for inmates) arriving @ start time. 1st contractor allowed inside gate 8:00am (after bus got inside the complex. Rest of contractor were allowed inside gate @ 8:20am.
552	11/4/1997	1860	Office door was unlocked @ about 9:15am.
553	11/4/1997	1880	There is a new regulation for entrance by rear gate guard. That no person will be allowed inside of leave that complex between 10:15am thru 12:15pm.
554	11/5/1997	732	
555	11/5/1997	1670	
556	11/5/1997	1520	
557	11/5/1997	826	Completed glaze. Installation.
558	11/6/1997	1670	
559	11/6/1997	1520	
560	11/6/1997	261	
561	11/6/1997	1830	MDA's office bldg. Was locked until about 8:15am. Caused delays on Crown Electric & V.S. fence since they were in need of some information located in MDA's office.
562	11/6/1997	1830	V.S. fence had about 20 min. additional delay @ the north fire entrance, it took that long to be opened. Arrived at the construction site @ 10:15am even through they arrived at my office @ about 7:20am as agreed.

Item Number	Date	Work Code	Log Notes
563	11/7/1997	1670	
564	11/8/1997	1822	
565	11/9/1997	1822	
566	11/10/1997	1670	
567	11/10/1997	1691	
568	11/10/1997	950	
569	11/11/1997	1620	
570	11/11/1997	950	
571	11/11/1997	1820	
572	11/11/1997	1830	Lost time due to inmates fight. One inmate cut throat of another one. All contractors were ordered to leave the complex @ 9:50am and not to return. MDA's office was locked all day. Due to holiday, there was no one available to open the buildings.
573	11/12/1997	1691	
574	11/12/1997	826	
575	11/13/1997	1691	
576	11/13/1997	620	
577	11/14/1997	1620	
578	11/14/1997	1540	
579	11/14/1997	1550	
580	11/14/1997	1620	
581	11/14/1997	750	
582	11/14/1997	1860	MDA's office door was opened @ 8:30am.
583	11/14/1997	261	Fence-- can't locate contractor. Left message with answering service will try again, Monday.
584	11/15/1997	1822	
585	11/16/1997	1822	
586	11/17/1997	1621	
587	11/17/1997	1540	
588	11/17/1997	1550	
589	11/17/1997	1691	
590	11/17/1997	1830	Lost Time: Mr. N.Ech's(MDA's) entrance permit was not at the gate even though was solicited last Wednesday(19thNov) was finally hand carried by FBOP personnel.
591	11/17/1997	1880	Mr. Ech, myself could not leave the complex until about 12:30pm. Lunch period. No guard available at rear gate. A 1/2hr work lasted about 21/2hrs.
592	11/18/1997	1620	
593	11/18/1997	1540	
594	11/18/1997	1550	

Item Number	Date	Work Code	Log Notes
595	11/18/1997	826	
596	11/18/1997	1880	The new regulation (about 2wks old) that do not permit anyone entering or leaving the complex from about 10:15am until about 12:15a(?)am, and guard available @ rear gate) has and will affect the project regarding coordination and execution of work.
597	11/18/1997	1830	Today I entered the project @ about 10:00am for a 15 min coordination task with the plumbers. By 10:30am (or slightly later then 10:15am) could not get out. We did get out because of the generosity of the rear gate guard who had already locked the guard shack and had to get the key from the adjacent guard tower(with a so be & gasket) Good morale booster!!!! Plumbers were also going out with me.
598	11/19/1997	1670	
599	11/19/1997	1691	
600	11/19/1997	826	
601	11/19/1997	1830	Come in to fix punch list item. Could not bring truck inside. (too many tools in tool box) Cleaned up windows frame channels(mud, etc.) will come back on Fr. To complete repairs, etc.
602	11/19/1997	1830	MDA's office was unlocked @ about 8:15am. Had patriot personnel waiting from 7:30am, to get some material that was in my office. Took the material and left. Did not come back. I guess was not happy for having to wait until my office was unlocked by FBOP.
603	11/20/1997	1621	
604	11/20/1997	1010	Started drilling holes on netting support steel.
605	11/20/1997	1830	Patriot - arrived @ 7:30am. Could not get through until about 8:45am. No escort available. Additional lost time 1 1/4hrs.
606	11/20/1997	1830	Crown Electric - arrived @ about 8:15am (had to get some material before coming to work - roof conduits support) There was an FBOP truck ahead of him(bringing supplies) and ..... Take .... To 1hr to clear truck. Did some work by MDA's office which had to wait to be opened in order to connect external cable for power. Office was locked until 8:30am. Tried to call to get it open.
607	11/21/1997	1691	
608	11/21/1997	1020	Finish cabinet.
609	11/21/1997	1010	
610	11/21/1997	261	V.S. fence completed fence.

Item Number	Date	Work Code	Log Notes
611	11/21/1997	1830	Additional lost time: Contractors not allowed inside complex beyond guard shack until about 8:30am. No escorts available.?
612	11/22/1997	1822	
613	11/23/1997	1822	
614	11/24/1997	1621	
615	11/24/1997	826	
616	11/24/1997	940	
617	11/24/1997	1830	Crown Electric signed in at rear gate about 7:30am. Did not arrive at job site until about 8:45am or 1:45min later. Was held at cyclone fence (gate) by the south fire fate. Gate either did not work properly or there was no one available to open it.
618	11/25/1997	1621	
619	11/25/1997	1010	
620	11/25/1997	1830	Additional lost time: Crown Electric - arrived at gate about 8:15am(went to the shop to get materials before coming to job site) Could not enter (rear gate to check tools, etc.) until about 9:30am or 1 1/4hrs hours waiting, could not enter until prisoners bus left the complex.
621	11/26/1997	1621	
622	11/26/1997	1550	
623	11/26/1997	1560	
624	11/26/1997	1010	Misc. netting complete (wire support on corners)
625	11/27/1997	1823	
626	11/28/1997	940	
627	11/29/1997	1822	
628	11/30/1997	1822	
629	12/1/1997	1550	
630	12/1/1997	1621	
631	12/1/1997	1850	BGI - supt. Called to inform that they are not interested in doing the piping insulation nor the wall modifications for the toilet. Will try to get the painters to do the wall modifications and probably the insulation contractor on the FBOP project(ongoing project) will try to meet them sometime tomorrow.
632	12/2/1997	1621	
633	12/2/1997	1582	

Item Number	Date	Work Code	Log Notes
634	12/2/1997	1830	Additional lost time: Prisoners bus- HVAC contractor arrived about 7:45am. Could not enter until about 9:05am because the bus taking one prisoner from the complex. (1 hr 15min). - Rear gate guard arrived @ about 7:50am. Did not have entrance permits for contractors even though were solicited last week. Did not ……delays since contractor was held by the bus and during that time the situation was resolved.
635	12/2/1997	1830	Tried to enter complex about 2:00pm No one available. Stood on yellow line about 10 min and no one showed up.
636	12/3/1997	1550	
637	12/3/1997	1582	
638	12/3/1997	1860	MDA's office was locked yesterday about 2:50pm instead of the usual 3:30pm. Could not get in. MDA's office was unlocked @ about 8:10am(had to call to get it open)
639	12/4/1997	1621	
640	12/4/1997	1550	
641	12/4/1997	1860	Field office was unlocked at 8:45am
642	12/4/1997	1860	Turned over warehouse room to FBOP per their request placed toolbox & material in my office.
643	12/5/1997	1621	
644	12/6/1997	1822	
645	12/7/1997	1822	
646	12/8/1997	931	
647	12/9/1997	1830	Additional time lost: 1. Prisoners bus - no one could get in since bus was inside - bus left @ about 9:00am and gate was blocked by guards.
648	12/9/1997	1813	Fog.
649	12/9/1997	1860	MDA's office was not opened until about 8:50am. Had to cal FBOP to get it open. Had some primer paint inside for the painters and could not get it.
650	12/10/1997	1550	
651	12/10/1997	940	
652	12/11/1997	1550	
653	12/11/1997	1621	
654	12/11/1997	931	
655	12/12/1997	931	
656	12/13/1997	931	

Item Number	Date	Work Code	Log Notes
657	12/13/1997	1830	I.Proper arrangements were made on Friday to allow workers to paint today. Painters arrived at the gate - +8:00am. There was no one available to open gate. Painters "pressed" the button in the call box at the entrance and waited about 40 min. or until the guard showed up. All in all including guard about 1 hr. lost just to enter.
658	12/14/1997	1822	
659	12/15/1997	931	
660	12/15/1997	1621	
661	12/15/1997	1691	
662	12/15/1997	826	Started window repairs. Rollers, seal brushes, etc.
663	12/15/1997	1830	Entrance permits for Taylor Lighting even though solicited on Nov. 25, 1997 was not available at the gate. Guard made some telephone calls and finally let them in. Lost time about 1 hr. (item 1&2)
664	12/15/1997	1880	Taylor Lighting arrived at the gate about 10:20am. (comes from Katy, TX.) I had to beg the guard to let him in since no one is admitted in, nor can leave between about 10:05am and 12:15pm.
665	12/16/1997	1550	
666	12/16/1997	1621	
667	12/16/1997	1860	MDA's office bldg. Unlocked @ 8:10am. - Called to get it open @ 7:20am. Had to get some material for electrician.
668	12/17/1997	1621	
669	12/17/1997	910	
670	12/17/1997	1813	Additional lost time caused by foggy conditions. FBOP breakfast supplies truck
671	12/17/1997	1830	FBOP breakfast supplies truck
672	12/17/1997	1830	Promark Paint. Allowed in @ about 10:00am. 2hrs lost.
673	12/17/1997	1830	Crown Electric- allowed inside @ about 9:30am - 1 1/2hr. Lost.
674	12/18/1997	1621	
675	12/18/1997	910	
676	12/18/1997	1830	Promark Painting - about 1 1/2hrs lost due to alarm went off and some .....count (inmates) were held at south fire gate. Signed sub in about 8:20am and arrived @ job site at 10:15am.
677	12/19/1997	910	
678	12/20/1997	1822	
679	12/21/1997	1822	
680	12/22/1997	910	
681	12/22/1997	823	

Item Number	Date	Work Code	Log Notes
682	12/22/1997	1830	Promark - arrived @ about 8:00am. Could not get in until about 9:10am Prisoners bus @ gate - 1hr. Lost.
683	12/23/1997	910	
684	12/23/1997	1830	Promark - arrived @ 8:20am(due to rain) Not allowed inside fence until 9:20am. Stayed in guard shack area until about 10:00am. (No escorts) Total 1 3/4hrs lost.
685	12/24/1997	910	
686	12/25/1997	1823	
687	12/26/1997	1823	
688	12/27/1997	1822	
689	12/28/1997	1822	
690	12/29/1997	940	
691	12/29/1997	311	
692	12/30/1997	311	
693	12/30/1997	1696	x Poured sidewalk, started door frames grout (filling) had to stop because FBOP had not installed wiring to the door locks yet.
694	12/30/1997	940	
695	12/31/1997	940	
696	12/31/1997	0	Temporary fence - will be removed on Friday 2, Jan 1998
697	1/1/1998	1823	
698	1/2/1998	1823	
699	1/3/1998	1822	
700	1/4/1998	1822	
701	1/5/1998	940	
702	1/5/1998	1813	Lost time due to foggy conditions. Promark - Entered rear gate @ 9:45am (arrived @ 8:40am about 1hr lost)
703	1/6/1998	940	
704	1/7/1998	940	
705	1/7/1998	1550	
706	1/8/1998	1560	Remaining HVAC work i.e. heater.
707	1/8/1998	840	Door locks installation: Bilco accesses & fence gate.
708	1/8/1998	1830	Patriot- Came to install locks. Locks were inside my office. Office was locked until 8:30am (called to get it open) Had to Mr. Mollet(FBOP) in my office to review installation of locks from * 45 am till 9:15am. Patriot held at ear gate from 9:20am(after finish review in my office) until 10:00am due to FBOP grocery(/) supply truck search ahead of him. Total lost time: 1 Office locked (7:30 - 8:30 am) 2. Supply truck search: 9:20 _ 10:00am =40 min. Total say 1hr 45min.
709	1/9/1998	1550	
710	1/9/1998	840	
711	1/9/1998	270	

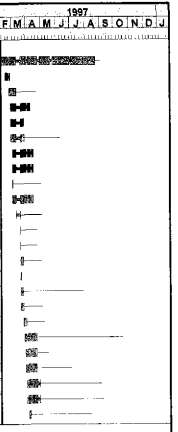
Item Number	Date	Work Code	Log Notes
712	1/9/1998	1830	Lost time: Patriot- waiting for dirt truck(loads 2 ea) to be inspected at gate - 1/2hr. - Waiting to escort with key for locks in order to adjust locks - 1hr. -
713	1/9/1998	1860	My office(MDA) was locked at about 2:00pm while I was inside the complex. Suppose to be locked at 3:30pm/ The locked time is estimated since I got out of the complex about 2:30pm and was already locked.
714	1/9/1998	1830	Triangle H&W Plumbing & Promark - 1/2hr each. (Dirt truck load inspection at rear gate) AVCO total L.T. 3/4hr.
715	1/10/1998	1822	
716	1/11/1998	1822	
717	1/12/1998	270	
718	1/12/1998	931	
719	1/12/1998	1811	Could not spread fill on temp. area around the tower- to wet.
720	1/12/1998	840	Completing lock installation
721	1/13/1998	940	Started inside door/frames painting.
722	1/13/1998	1813	Foggy conditions - Could not enter rear gate until about 9:45am.
723	1/14/1998	931	
724	1/15/1998	1621	
725	1/15/1998	940	
726	1/15/1998	1830	ACCU - air service man (start - up) not allowed inside complex since did not have an approved permit by FBOP nor MDA had solicited one, even though the information was faxed by contractor on Jan 13, 1998 but my office was already locked and consequently did not see it to expedite the permit.
727	1/16/1998	1692	
728	1/16/1998	270	
729	1/16/1998	1830	No contractor was allowed inside the complex until about 8:50am.
730	1/17/1998	1822	
731	1/18/1998	1822	
732	1/19/1998	1823	
733	1/20/1998	1692	
734	1/20/1998	1592	
735	1/20/1998	1811	Spreading fill - temp. fac. Area. Too wet to complete.
736	1/20/1998	1830	Due to foggy conditions and prisoners bus @ gate no one was allowed inside until about 9:30am.
737	1/20/1998	1830	Gate entrance permits for the HVAC man was not available @ the gate even though was solicited on 15 Jan 98.

Item Number	Date	Work Code	Log Notes
738	1/21/1998	1692	
739	1/21/1998	1860	MDA's Office: I had a meeting with one contractor in Beaumont and when I came to the jobsite about 11:00am the bldg. Door was locked.
740	1/22/1998	230	
741	1/23/1998	1820	
742	1/24/1998	1822	
743	1/25/1998	1822	
744	1/26/1998	1901	
747	10/16/1997	1110	
748	10/16/1998	1120	
749	10/16/1998	1020	
750	10/22/1997	560	
751	10/23/1997	560	

APPENDIX B

PUBLIC OWNER PROJECT 3 AS-BUILT SCHEDULE

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Actual Start	Actual Finish
001	NOTICE TO PROCEED	1	1	0	07FEB97*	07FEB97
769	Original Roofing Contractor Failed Procurement	120	120	0	10FEB97	22AUG97
110	Mobilization	7	7	0	17FEB97	27FEB97
210	Earthwork-Bldg.Fn'd.	11	11	0	26FEB97	12MAR97
361	Tilt-Up Shop, DWG. thru Approval	22	22	0	28FEB97	09APR97
511	Struct. Stl. Shop DWG thru Approval	16	16	0	28FEB97	28MAR97
571	Spiral Stair Shop-DWG	16	16	0	28FEB97	28MAR97
821	Ext. Det. W.Fr.S.DWG	24	24	0	03MAR97	15APR97
824	Ext. Det. W.Gizz.S.Drw.	24	24	0	03MAR97	15APR97
301	Concrete Material Submittal by Contractor	3	3	0	04MAR97	06MAR97
807	Det.Door Submittal by Contractor	22	22	0	05MAR97	15APR97
302	Concrete Material Submittal Approval	2	2	0	12MAR97	20MAR97
230	Trenching(Electric)	1	1	0	20MAR97	20MAR97
280	Termite Control	1	1	0	20MAR97	20MAR97
330	Building Foundation	5	5	0	20MAR97	26MAR97
220	Trenching(Pipe) for Foundation	2	2	0	20MAR97	21MAR97
1611	Elect. Foundation Rough-in	4	4	0	20MAR97	25MAR97
1511	Found. Slab Plumbing Rough-in	3	3	0	21MAR97	25MAR97
331	Foundation Slab Cure Time	5	5	0	27MAR97	02APR97
1570	HVAC Shop Drawing & Submit. Appr.	14	14	0	28MAR97	21APR97
521	Struct. Stl. Factory Fab.	15	15	0	31MAR97	23APR97
570	Spiral Stair Factory Fab.& Deliver	15	15	0	31MAR97	23APR97
221	Site Piping	15	15	0	02APR97	29APR97
240	1 1/2 FW Pipe	15	15	0	02APR97	29APR97
1690	Underground Elec. Cond 1st. Part	4	4	0	07APR97	10APR97



Start Date 07FEB97
Finish Date 22JAN98

Early Bar
Float Bar
Progress Bar
Critical Activity

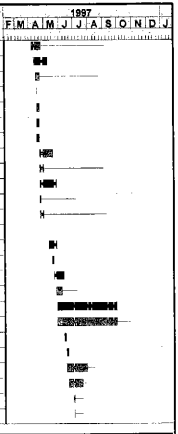
ASBT

Public Owner Project 3

As-Built Schedule

Sheet 1 of 6

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Actual Start	Actual Finish
250	4 SS Pipe	13	13	0	07APR97	24APR97
362	Tilt-Up Fabrication	18	18	0	10APR97	08MAY97
1693X	Delay-Conduit to Power Room	6	6	0	14APR97	21APR97
805	Det.Window Frame Submittal by Contractor	1	1	0	16APR97	16APR97
808	Det.Door Submittal Approval	4	4	0	16APR97	21APR97
806	Det.Window Frame Submittal Rejected by FBOP	5	5	0	17APR97	23APR97
825	Ext. Det. Window Glass Submit - Reject	5	5	0	17APR97	23APR97
809	Det.Door Fabricate & Deliver	18	18	0	22APR97	19MAY97
1696	Underground Elec. Cond 2nd Part	6	6	0	22APR97	01MAY97
816	Det.Window Frame Resubmit - AMBIGUOUS CONT.DWGS.	20	20	0	24APR97	27MAY97
572	Spiral Stair Field Fab.	1	1	0	24APR97	24APR97
290	Storm Drain Piping	3	3	0	24APR97	30APR97
363	Tilt-Up Deliver	1	1	0	09MAY97	09MAY97*
364	Tilt-Up Erection	10	10	0	12MAY97	27MAY97
512	Struct. Stl. Deliver & Start Fab.	3	3	0	19MAY97*	21MAY97
515X	Delay of Foreign Steel	12	12	0	22MAY97	10JUN97
400	Masonry-All	9	9	0	27MAY97	06JUN97
822	Ext. Det. Window Frames Fabr.& Deliver	81	81	0	28MAY97	30SEP97*
835	Ext. Det. Window Glass Fab & Deliver	81	81	0	28MAY97	30SEP97
514	Struct. Stl. Finish Fab.	4	4	0	11JUN97	16JUN97
513	Struct. Stl. Erection	2	2	0	17JUN97	19JUN97
573	Spiral Stair Erection	27	27	0	17JUN97	28JUL97
340	Mezz. Floor Slab	19	19	0	20JUN97	18JUL97
1612	Elect. Mezz. Rough-in	2	2	0	30JUN97	02JUL97
1512	Mezz. Plumbing Rough-in	1	1	0	02JUL97	02JUL97



Start Date 07FEB97
Finish Date 22JAN98

Early Bar
Float Bar
Progress Bar
Critical Activity

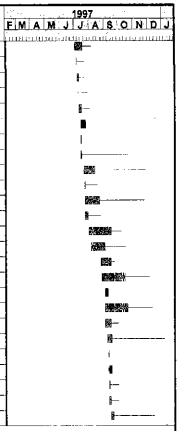
ASBT

Public Owner Project 3

As-Built Schedule

Sheet 2 of 6

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Actual Start	Actual Finish
350	Observ. Floor Slab	11	11	0	03JUL97	18JUL97
810	Steel Floor Hatch	1	1	0	07JUL97	07JUL97
1513	Observation Deck Plumbing Rough-in	3	3	0	08JUL97	10JUL97
1613	Elect. Observation Deck Rough-in	1	1	0	09JUL97	09JUL97
351	Mezz. & Observ. Floor Slab Cure Time	5	5	0	11JUL97	17JUL97
260	Security Fence Post	9	9	0	15JUL97	25JUL97
520	Steel Deck	3	3	0	15JUL97	17JUL97
1580	Air Handling U.Roof top	3	3	0	15JUL97	17JUL97
1530	Plumbing	15	15	0	21JUL97	13AUG97
540	Checkered Plate Platf.	1	1	0	23JUL97	23JUL97
580	Ship Ladder	20	20	0	23JUL97	22AUG97
550	Guard Rails	4	4	0	24JUL97	29JUL97
1614	Elect. Interior Conduit & Rough-in	29	29	0	31JUL97	15SEP97
1630	Panel Board	19	19	0	05AUG97	03SEP97
780	Roofing Contractor Procurement	14	14	0	25AUG97	15SEP97
1650	Transformer	30	30	0	28AUG97	15OCT97
321X	FBOP Com.Delay, to Entry Pad Work	4	4	0	03SEP97	08SEP97
1660	Interior Lighting	30	30	0	03SEP97	20OCT97
770	Joint Sealant	7	7	0	04SEP97	15SEP97
1550	Plumbing Fixtures	6	6	0	08SEP97	16SEP97
310	Sidewalk	2	2	0	09SEP97	11SEP97
320	Entry Pad	6	6	0	09SEP97	17SEP97
920	Paint Exterior Concrete	2	2	0	11SEP97	12SEP97
930	Paint Int Conc. & CMU	3	3	0	11SEP97	15SEP97
1694C	Contractor Delay-Cable Splice Fix	6	6	0	15SEP97	22SEP97



Start Date 07FEB97
Finish Date 22JAN98

Early Bar
Float Bar
Progress Bar
Critical Activity

ASBT

Sheet 3 of 6

Public Owner Project 3

As-Built Schedule

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Actual Start	Actual Finish
1695X	Delay-FBOP Communication Conduit Extra	10	10	0	16SEP97	30SEP97
785	Roof Material Submittals by Contractor	3	3	0	16SEP97	18SEP97
786	Roof Material Submittal Approval	2	2	0	19SEP97	22SEP97
120X	Delay, No Temp Elect. Available at Site.	3	3	0	22SEP97	25SEP97
1620	Wiring&Terminal-All	37	37	0	22SEP97	18NOV97
530	Steel Stud Framing Parapet	3	3	0	30SEP97	02OCT97
535	Steel Stud Framing Interior & Soffit	8	8	0	03OCT97	16OCT97
610	Cement Backer Units	4	4	0	03OCT97	08OCT97
740	Roof Hatch with Ladder	2	2	0	03OCT97	06OCT97
823	Ext. Det. Wind. Frame Erection	51	51	0	03OCT97	22DEC97
722	Tapered Pelite Bd.	1	1	0	14OCT97	14OCT97
850	Det.MetalDoors Frame Erection	6	6	0	15OCT97	22OCT97
720	EPDM SinglePly Membr.	2	2	0	15OCT97	16OCT97
723	Polyso.Bd.	1	1	0	15OCT97	15OCT97
826	Ext.Det.Window Glass Erection	14	14	0	15OCT97	05NOV97
750	Curbs & Pipe Seals	2	2	0	16OCT97	17OCT97
1680	Emergency Power Est.	7	7	0	16OCT97	27OCT97
1020	Gun Cabinet	1	1	0	16OCT97	16OCT97
1110	Microwave	1	1	0	16OCT97	16OCT97
1120	Refrigerator	1	1	0	16OCT97	16OCT97
710	Manuf. Stl.Walls&Soff.Panel	12	12	0	17OCT97	05NOV97
760	Roof Walkways	1	1	0	17OCT97	17OCT97
1640	Safety Switches	1	1	0	17OCT97	17OCT97
910	Paint Exterior Metals	42	42	0	22OCT97	24DEC97
560	Camera & Light Supports	2	2	0	22OCT97	24OCT97

1997
F M A M J J A S O N D J

Start Date 07FEB97
Finish Date 22JAN98

Early Bar
Float Bar
Progress Bar
Critical Activity

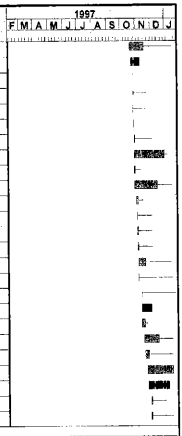
ASBT

Public Owner Project 3

As-Built Schedule

Sheet 4 of 6

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Actual Start	Actual Finish
1670	Exterior Light	19	19	0	22OCT97	19NOV97
950	Gypsum Boards	12	12	0	24OCT97	11NOV97
830	Det.Metal Doors Erection	1	1	0	27OCT97	27OCT97
1581	Ductwork	2	2	0	27OCT97	29OCT97
1583	Exhaust Fan	1	1	0	27OCT97	27OCT97
840	Det.Metal Doors Hardw.	1	1	0	29OCT97	29OCT97
724	Batt Insulation	2	2	0	29OCT97	30OCT97
1696X	Delay-FBOP Install Wiring to Door Locks&Key Info	40	40	0	30OCT97	30DEC97
731	Parapet Cap	2	2	0	30OCT97	31OCT97
1691	Lightning Protection	31	31	0	30OCT97	15DEC97
732	Sheet Metal Strap	3	3	0	03NOV97	05NOV97
630	Interior Arch. Woodwork	1	1	0	04NOV97	04NOV97
1520	Fire Protection Rough-in	2	2	0	05NOV97	06NOV97
1521	Fire Protection Finish-out	2	2	0	05NOV97	06NOV97
261	Install Security Fencing	12	12	0	06NOV97	21NOV97
827	Det. Window Glass Punch List	1	1	0	06NOV97	06NOV97
620	Const. Panels-Backer	1	1	0	13NOV97	13NOV97
1551	Plumbing Hook-up & Insulation	14	14	0	14NOV97	04DEC97
1540	Water Heater	3	3	0	14NOV97	18NOV97
1621	Elect. Finish out after Dry-in	22	22	0	17NOV97	18DEC97
1010	Netting	5	5	0	20NOV97	26NOV97
940	Paint Misc. Metals	32	32	0	24NOV97	15JAN98
1560	Unit Heater-A/C	26	26	0	26NOV97	08JAN98
1582	Sheet Metal Accs. & Louvers	2	2	0	02DEC97	03DEC97
1591	HVAC Controls	1	1	0	02DEC97	02DEC97



Start Date 07FEB97
Finish Date 22JAN98

Early Bar
Float Bar
Progress Bar
Critical Activity

ASBT

Sheet 5 of 6

Public Owner Project 3

As-Built Schedule

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Actual Start	Actual Finish
931	Paint Int. Gypsum Board	22	22	0	08DEC97	14JAN98
1552	Toilet Modification (Wall)	5	5	0	10DEC97	16DEC97
311	Sidewalk Finish Up Work	2	2	0	29DEC97	30DEC97
1553	Plumbing Drain Pan & Pipe Insulation	3	3	0	07JAN98	09JAN98
860	Complete Det. Metal Doors Hardw.& Locks	3	3	0	08JAN98	13JAN98
270	Seeding/Mulch	5	5	0	09JAN98	16JAN98
1592	Testing - Electrical	2	2	0	16JAN98	21JAN98
1592	HVAC Syst. Balance	1	1	0	21JAN98	21JAN98
1710	Final Punch List	1	1	0	21JAN98	21JAN98
1790	Substantial Completion	1	1	0	22JAN98	22JAN98

1997
F M A M J J A S O N D J

Start Date 07FEB97
Finish Date 22JAN98

Early Bar
Float Bar
Progress Bar
Critical Activity

ASBT

Sheet 6 of 6

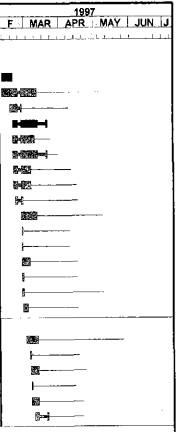
Public Owner Project 3

As-Built Schedule

APPENDIX C

PUBLIC OWNER PROJECT 3 AS-BUILT WITHOUT DELAY SCHEDULE

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Free Float	Total Float
01FEB97								
001	NOTICE TO PROCEED	1	1	0	07FEB97*	07FEB97	0	0
110	Mobilization	7	7	0	10FEB97	18FEB97	0	0
769	Original Roofing Contractor Failed Procurement	20	20	0	10FEB97	11MAR97	0	30
210	Earthwork-Bldg.Fn'd.	6	6	0	17FEB97	26FEB97	0	22
511	Struct. Stl. Shop DWG thru Approval	16	16	0	19FEB97	21MAR97	0	0
361	Tilt-Up Shop. DWG. thru Approval	12	12	0	19FEB97	10MAR97	0	5
571	Spiral Stair Shop-DWG	16	16	0	19FEB97	21MAR97	0	6
821	Ext. Det. W.Fr.S.DWG	10	10	0	19FEB97	05MAR97	0	18
824	Ext. Det. W.Glaz.S.Drw.	10	10	0	19FEB97	06MAR97	0	20
301	Concrete Material Submittal by Contractor	3	3	0	21FEB97	27FEB97	4	26
807	Det.Door Submittal by Contractor	10	10	0	26FEB97	11MAR97	0	32
230	Trenching(Electric)	1	1	0	27FEB97	27FEB97	0	22
280	Termite Control	1	1	0	27FEB97	27FEB97	0	22
330	Building Foundation	5	5	0	27FEB97	05MAR97	0	22
220	Trenching(Pipe) for Foundation	2	2	0	27FEB97	28FEB97	0	25
1611	Elect. Foundation Rough-in	2	2	0	27FEB97	28FEB97	0	40
1511	Found. Slab Plumbing Rough-in	2	2	0	28FEB97	03MAR97	0	25
01MAR97								
250	4 SS Pipe	8	8	0	03MAR97	12MAR97	6	42
302	Concrete Material Submittal Approval	2	2	0	05MAR97	06MAR97	0	22
331	Foundation Slab Cure Time	5	5	0	06MAR97	12MAR97	17	22
805	Det.Window Frame Submittal by Contractor	1	1	0	07MAR97	07MAR97	0	18
825	Ext. Det. Window Glass Submit and Appr.	4	4	0	07MAR97	12MAR97	2	20
806	Det.Window Frame Submittal Regected by FBOP	5	5	0	10MAR97	21MAR97	0	18



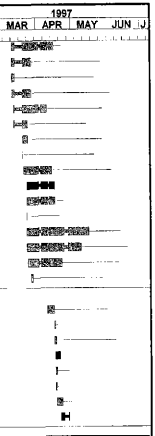
Start Date 07FEB97
Finish Date 09JUL97

Early Bar
Float Bar
Progress Bar
Critical Activity

Public Owner Project 3 Sheet 1 of 6

As-Built Schedule without Delay

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Free Float	Total Float
362	Tilt-Up Fabrication	18	18	0	11MAR97	15APR97	0	5
221	Site Piping	8	8	0	11MAR97	27MAR97	0	36
1690	Underground Elec. Cond 1st. Part	2	2	0	11MAR97	12MAR97	0	40
240	1 1/2 F/W Pipe	8	8	0	11MAR97	27MAR97	0	42
780	Roofing Contractor Procurement	14	14	0	12MAR97	09APR97	0	30
808	Det.Door Submittal Approval	4	4	0	12MAR97	24MAR97	0	32
1696	Underground Elec. Cond 2nd Part	3	3	0	20MAR97	24MAR97	27	40
1693X	Delay-Conduit to Power Room	0	0	0	20MAR97	12MAR97	0	40
1570	HVAC Shop Drawing & Submit. Appr.	14	14	0	21MAR97	14APR97	10	34
521	Struct. Stl. Factory Fab.	15	15	0	24MAR97	16APR97	0	0
570	Spiral Stair Factory Fab.& Deliver	15	15	0	24MAR97	16APR97	0	6
816	Det.Window Frame Resubmit-AMBIGUOUS	0	0	0	24MAR97	21MAR97	0	18
822	Ext. Det. Window Frames Fabr.& Deliver	35	35	0	24MAR97	18MAY97	8	18
835	Ext. Det. Window Glass Fab & Deliver	30	30	0	24MAR97	09MAY97	16	26
809	Det.Door Fabricate & Deliver	18	18	0	25MAR97	22APR97	4	32
290	Storm Drain Piping	2	2	0	27MAR97	28MAR97	23	36
01APR97								
785	Roof Material Submittals by Contractor	3	3	0	10APR97	15APR97	0	30
363	Tilt-Up Deliver	1	1	0	16APR97	16APR97	0	5
786	Roof Material Submittal Approval	2	2	0	16APR97	17APR97	20	33
512	Struct. Stl. Deliver & Start Fab.	3	3	0	17APR97	21APR97	0	0
364	Tilt-Up Erection	2	2	0	17APR97	18APR97	0	5
572	Spiral Stair Field Fab.	1	1	0	17APR97	17APR97	6	6
400	Masonry-All	3	3	0	18APR97	22APR97	5	5
514	Struct. Stl. Finish Fab.	4	4	0	22APR97	29APR97	0	0



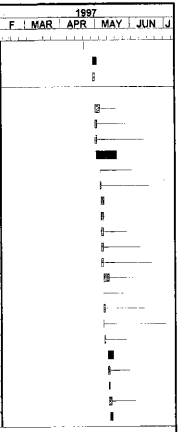
Start Date 07FEB97
Finish Date 05JUL97

Early Bar
Float Bar
Progress Bar
Critical Activity

Public Owner Project 3 Sheet 2 of 6

As-Built Schedule without Delay

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Free Float	Total Float
515X	Delay of Foreign Steel	0	0	0	22APR97	21APR97	0	0
573	Spiral Stair Erection	3	3	0	30APR97	02MAY97	0	0
513	Struct. St. Erection	1	1	0	30APR97	30APR97	0	1
01MAY97								
520	Steel Deck	3	3	0	01MAY97	05MAY97	0	18
1580	Air Handling U.Roof top	2	2	0	01MAY97	02MAY97	11	24
850	Det.MetalDoors Frame Erection	2	2	0	01MAY97	02MAY97	0	28
340	Mezz. Floor Slab	13	13	0	02MAY97	20MAY97	0	0
120X	Delay, No Temp Elect. Available at Site.	0	0	0	06MAY97	05MAY97	5	18
830	Det.Metal Doors Erection	1	1	0	06MAY97	06MAY97	0	28
1612	Elect. Mezz. Rough-in	2	2	0	07MAY97	08MAY97	1	1
1512	Mezz. Plumbing Rough-in	1	1	0	07MAY97	07MAY97	2	2
260	Security Fence Post	1	1	0	07MAY97	07MAY97	0	13
740	Roof Hatch with Ladder	1	1	0	07MAY97	07MAY97	8	21
840	Det.Metal Doors Hardw.	1	1	0	07MAY97	07MAY97	0	28
320	Entry Pad	4	4	0	08MAY97	13MAY97	0	13
321X	FBOP Com.Delay, to Entry Pad Work	0	0	0	08MAY97	07MAY97	0	13
310	Sidewalk	2	2	0	08MAY97	09MAY97	0	22
1696X	Delay-FBOP Install Wiring to Door Locks	0	0	0	08MAY97	07MAY97	18	36
540	Checkered Plate Platf.	1	1	0	09MAY97	09MAY97	0	11
350	Observ. Floor Slab	5	5	0	12MAY97	16MAY97	0	0
550	Guard Rails	2	2	0	12MAY97	13MAY97	0	11
810	Steel Floor Hatch	1	1	0	13MAY97	13MAY97	0	0
530	Steel Stud Framing Parapet	2	2	0	13MAY97	14MAY97	0	13
1513	Observation Deck Plumbing Rough-in	2	2	0	14MAY97	15MAY97	0	0



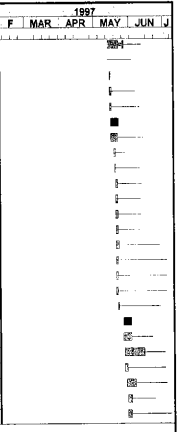
Start Date 07FEB97
Finish Date 09JUL97

Early Bar
Float Bar
Progress Bar
Critical Activity

Public Owner Project 3 Sheet 3 of 6

As-Built Schedule without Delay

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Free Float	Total Float
1614	Elect. Interior Conduit & Rough-in	8	8	0	14MAY97	27MAY97	0	11
1695X	Delay-FBOP Communication Conduit Extra	0	0	0	14MAY97	13MAY97	0	13
1613	Elect. Observation Deck Rough-in	1	1	0	15MAY97	15MAY97	0	0
610	Cement Backer Units	2	2	0	15MAY97	16MAY97	0	13
1630	Panel Board	2	2	0	15MAY97	16MAY97	0	15
351	Mezz. & Observ. Floor Slab Cure Time	5	5	0	16MAY97	22MAY97	0	0
1660	Interior Lighting	4	4	0	16MAY97	21MAY97	6	17
1650	Transformer	2	2	0	19MAY97	20MAY97	0	15
722	Tapered Pelite Bd.	1	1	0	20MAY97	20MAY97	0	13
720	EPDM SinglePly Membr.	1	1	0	21MAY97	21MAY97	0	13
723	Polyso.Bd.	1	1	0	21MAY97	21MAY97	0	13
750	Curbs & Pipe Seals	1	1	0	21MAY97	21MAY97	0	13
760	Roof Walkways	1	1	0	21MAY97	21MAY97	16	16
1680	Emergency Power Est.	2	2	0	21MAY97	22MAY97	0	23
1020	Gun Cabinet	1	1	0	21MAY97	21MAY97	27	27
1110	Microwave	1	1	0	21MAY97	21MAY97	27	27
1120	Refrigerator	1	1	0	21MAY97	21MAY97	27	27
1640	Safety Switches	1	1	0	22MAY97	22MAY97	12	23
770	Joint Sealant	5	5	0	27MAY97	02JUN97	0	0
1530	Plumbing	5	5	0	27MAY97	02JUN97	0	13
1620	Wiring&Terminal-All	13	13	0	28MAY97	13JUN97	0	11
311	Sidewalk Finish Up Work	2	2	0	28MAY97	29MAY97	0	22
1694C	Contractor Delay-Cable Splice Fix	6	6	0	29MAY97	05JUN97	7	18
580	Ship Ladder	2	2	0	30MAY97	02JUN97	0	14
270	Seeding/Mulch	2	2	0	30MAY97	02JUN97	22	22



Start Date 07FEB97
Finish Date 09JUL97

Early Bar
Float Bar
Progress Bar
Critical Activity

Public Owner Project 3 Sheet 4 of 6

As-Built Schedule without Delay

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Free Float	Total Float
01JUN97								
920	Paint Exterior Concrete	1	1	0	03JUN97	03JUN97	0	0
930	Paint Int Conc. & CMU	2	2	0	03JUN97	04JUN97	0	0
940	Paint Misc. Metals	8	8	0	03JUN97	12JUN97	14	14
823	Ext. Det. Wind. Frame Erection	5	5	0	04JUN97	10JUN97	0	10
1670	Exterior Light	9	9	0	04JUN97	16JUN97	11	11
261	Install Security Fencing	1	1	0	04JUN97	04JUN97	0	18
535	Steel Stud Framing Interior & Soffit	4	4	0	05JUN97	10JUN97	0	0
826	Ext.Det.Window Glass Erection	4	4	0	05JUN97	10JUN97	0	10
860	Complete Det. Metal Doors Hardw.& Locks	2	2	0	05JUN97	06JUN97	18	18
630	Interior Arch. Woodwork	1	1	0	09JUN97	09JUN97	2	12
1550	Plumbing Fixtures	1	1	0	09JUN97	09JUN97	13	13
710	Manuf. Stl.Walls&Soff.Panel	4	4	0	11JUN97	16JUN97	0	0
827	Det. Window Glass Punch List	1	1	0	11JUN97	11JUN97	15	15
1621	Elect. Finish out after Dry-in	4	4	0	12JUN97	17JUN97	11	11
950	Gypsum Boards	2	2	0	13JUN97	16JUN97	0	0
1581	Ductwork	1	1	0	13JUN97	13JUN97	4	5
1520	Fire Protection Rough-in	1	1	0	13JUN97	13JUN97	0	8
1521	Fire Protection Finish-out	1	1	0	13JUN97	13JUN97	8	8
910	Paint Exterior Metals	4	4	0	16JUN97	20JUN97	0	3
1583	Exhaust Fan	1	1	0	16JUN97	16JUN97	0	5
731	Parapet Cap	1	1	0	17JUN97	17JUN97	0	0
724	Batt Insulation	2	2	0	17JUN97	19JUN97	5	5
732	Sheet Metal Strap	2	2	0	19JUN97	20JUN97	0	0
560	Camera & Light Supports	1	1	0	19JUN97	19JUN97	0	2

Start Date 07FEB97
Finish Date 09JUL97

Early Bar
Float Bar
Progress Bar
Critical Activity

Public Owner Project 3 Sheet 5 of 6

As-Built Schedule without Delay

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Free Float	Total Float
620	Const. Panels-Backer	1	1	0	19JUN97	19JUN97	1	4
1551	Plumbing Hook-up & Insulation	4	4	0	20JUN97	25JUN97	0	0
1540	Water Heater	1	1	0	20JUN97	20JUN97	0	1
1560	Unit Heater-A/C	2	2	0	23JUN97	24JUN97	0	1
1691	Lightning Protection	6	6	0	24JUN97	02JUL97	2	2
1010	Netting	5	5	0	24JUN97	30JUN97	3	3
1582	Sheet Metal Accs. & Louvers	2	2	0	24JUN97	25JUN97	6	6
1591	HVAC Controls	1	1	0	24JUN97	24JUN97	7	7
931	Paint Int. Gypsum Board	3	3	0	27JUN97	02JUL97	0	0
1552	Toilet Modification (Wall)	2	2	0	30JUN97	02JUL97	0	0
01JUL97								
1553	Plumbing Drain Pan & Pipe Insulation	2	2	0	03JUL97	07JUL97	0	0
1692	Testing - Electrical	2	2	0	07JUL97	08JUL97	0	0
1592	HVAC Syst. Balance	1	1	0	08JUL97	08JUL97	0	0
1710	Final Punch List	1	1	0	08JUL97	08JUL97	0	0
1790	Substantial Completion	1	1	0	09JUL97	09JUL97	0	0

1997 F MAR APR MAY JUN J

Start Date 07FEB97
Finish Date 09JUL97

Early Bar
Float Bar
Progress Bar
Critical Activity

Public Owner Project 3 Sheet 6 of 6

As-Built Schedule without Delay

APPENDIX D

PUBLIC OWNER 3 SNAPSHOT SCHEDULE ON APRIL 21ST, 1997

Activity ID	Activity Description	Orig Dur	Rem Dur	Actual Duration	%	Early Start	Early Finish	Late Start	Late Finish	Actual Start	Actual Finish	Free Float	Total Float
01FEB97													
001	NOTICE TO PROCEED	1	0	1	100	07FEB97A	07FEB97A	07FEB97A	07FEB97A	07FEB97	07FEB97		
110	Mobilization	7	0	7	100	10FEB97A	18FEB97A	10FEB97A	18FEB97A	10FEB97	18FEB97		
769	Original Roofing Contractor Failed	20	0	20	100	10FEB97A	11MAR97A	10FEB97A	11MAR97A	10FEB97	11MAR97		
210	Earthwork-Bldg.Fn'd.	6	0	6	100	17FEB97A	26FEB97A	17FEB97A	26FEB97A	17FEB97	26FEB97		
361	Tilt-Up Shop. DWG. thru Approval	12	0	12	100	19FEB97A	10MAR97A	19FEB97A	10MAR97A	19FEB97	10MAR97		
511	Struct. Stl. Shop DWG thru Approval	16	0	16	100	19FEB97A	21MAR97A	19FEB97A	21MAR97A	19FEB97	21MAR97		
571	Spiral Stair Shop-DWG	16	0	16	100	19FEB97A	21MAR97A	19FEB97A	21MAR97A	19FEB97	21MAR97		
621	Ext. Det. W.Fr.S.DWG.	24	0	24	100	19FEB97A	02APR97A	19FEB97A	02APR97A	19FEB97	02APR97		
824	Ext. Det. W.Glzz.S.Drw.	10	0	10	100	19FEB97A	06MAR97A	19FEB97A	06MAR97A	19FEB97	06MAR97		
301	Concrete Material Submittal by Contractor	3	0	3	100	21FEB97A	27FEB97A	21FEB97A	27FEB97A	21FEB97	27FEB97		
807	Det.Door Submittal by Contractor	10	0	10	100	26FEB97A	11MAR97A	26FEB97A	11MAR97A	26FEB97	11MAR97		
220	Trenching(Pipe) for Foundation	2	0	2	100	27FEB97A	28FEB97A	27FEB97A	28FEB97A	27FEB97	28FEB97		
230	Trenching(Electric)	1	0	1	100	27FEB97A	27FEB97A	27FEB97A	27FEB97A	27FEB97	27FEB97		
280	Termite Control	1	0	1	100	27FEB97A	27FEB97A	27FEB97A	27FEB97A	27FEB97	27FEB97		
330	Building Foundation	5	0	5	100	27FEB97A	05MAR97A	27FEB97A	05MAR97A	27FEB97	05MAR97		
1611	Elect. Foundation Rough-in	2	0	2	100	27FEB97A	28FEB97A	27FEB97A	28FEB97A	27FEB97	28FEB97		
1511	Found. Slab Plumbing Rough-in	2	0	2	100	28FEB97A	03MAR97A	28FEB97A	03MAR97A	28FEB97	03MAR97		
01MAR97													
250	4 SS Pipe	8	0	8	100	03MAR97A	12MAR97A	03MAR97A	12MAR97A	03MAR97	12MAR97		
302	Concrete Material Submittal Approval	2	0	2	100	05MAR97A	06MAR97A	05MAR97A	06MAR97A	05MAR97	06MAR97		
331	Foundation Slab Cure Time	5	0	5	100	06MAR97A	12MAR97A	06MAR97A	12MAR97A	06MAR97	12MAR97		
825	Ext. Det. Window Glass Submit and Appr.	4	0	4	100	07MAR97A	12MAR97A	07MAR97A	12MAR97A	07MAR97	12MAR97		
221	Site Piping	8	0	8	100	11MAR97A	27MAR97A	11MAR97A	27MAR97A	11MAR97	27MAR97		
240	1 1/2 FW Pipe	8	0	8	100	11MAR97A	27MAR97A	11MAR97A	27MAR97A	11MAR97	27MAR97		

Start Date 07FEB97
Finish Date 09JUL97

Early Bar
Float Bar
Progress Bar
Critical Activity

B515 Public Owner Project 3 Sheet 1 of 5

Activity 515X Delay
of Foreign Steel

Snapshot Date April 21st, 1997

Activity ID	Activity Description	Orig Dur	Rem Dur	Actual Duration	%	Early Start	Early Finish	Late Start	Late Finish	Actual Start	Actual Finish	Free Float	Total Float
362	Tilt-Up Fabrication	18	0	18	100	11MAR97A	15APR97A	11MAR97A	15APR97A	11MAR97	15APR97		
1690	Underground Elec. Cond 1st. Part	2	0	2	100	11MAR97A	12MAR97A	11MAR97A	12MAR97A	11MAR97	12MAR97		
780	Roofing Contractor Procurement	14	0	14	100	12MAR97A	09APR97A	12MAR97A	09APR97A	12MAR97	09APR97		
808	Det.Door Submittal Approval	4	0	4	100	12MAR97A	24MAR97A	12MAR97A	24MAR97A	12MAR97	24MAR97		
1696	Underground Elec. Cond 2nd Part	3	0	3	100	20MAR97A	24MAR97A	20MAR97A	24MAR97A	20MAR97	24MAR97		
1570	HVAC Shop Drawing & Submit. Appr.	14	0	14	100	21MAR97A	14APR97A	21MAR97A	14APR97A	21MAR97	14APR97		
521	Struct. Stl. Factory Fab.	15	0	15	100	24MAR97A	16APR97A	24MAR97A	16APR97A	24MAR97	16APR97		
570	Spiral Stair Factory Fab.& Deliver	15	0	15	100	24MAR97A	16APR97A	24MAR97A	16APR97A	24MAR97	16APR97		
809	Det.Door Fabricate & Deliver	18	2	16	89	25MAR97A	22APR97	25MAR97A	11JUN97	25MAR97		4	32
290	Storm Drain Piping	2	0	2	100	27MAR97A	28MAR97A	27MAR97A	28MAR97A	27MAR97	28MAR97		
01APR97													
805	Det.Window Frame Submittal by	1	0	1	100	07APR97A	07APR97A	07APR97A	07APR97A	07APR97	07APR97		
806	Det.Window Frame Submittal Regected by	5	0	5	100	08APR97A	15APR97A	08APR97A	15APR97A	08APR97	15APR97		
785	Roof Material Submittals by Contractor	3	0	3	100	10APR97A	15APR97A	10APR97A	15APR97A	10APR97	15APR97		
822	Ext. Det. Window Frames Fabr.& Deliver	35	32	3	9	16APR97A	09JUN97	16APR97A	13JUN97	16APR97		0	4
835	Ext. Det. Window Glass Fab.& Deliver	30	27	3	10	16APR97A	02JUN97	16APR97A	19JUN97	16APR97		8	12
363	Tilt-Up Deliver	1	0	1	100	16APR97A	16APR97A	16APR97A	16APR97A	16APR97	16APR97		
786	Roof Material Submittal Approval	2	0	2	100	16APR97A	17APR97A	16APR97A	17APR97A	16APR97	17APR97		
816	Det.Window Frame	0	0	0	100	16APR97A	16APR97A	16APR97A	15APR97A	16APR97	15APR97		
512	Struct. Stl. Deliver & Start Fab.	3	1	2	67	17APR97A	21APR97	17APR97A	21APR97	17APR97		0	0
364	Tilt-Up Erection	2	0	2	100	17APR97A	18APR97A	17APR97A	18APR97A	17APR97	18APR97		
572	Spiral Stair Field Fab.	1	0	1	100	17APR97A	17APR97A	17APR97A	17APR97A	17APR97	17APR97		
400	Masonry-All	3	2	1	33	18APR97A	22APR97	18APR97A	01MAY97	18APR97		5	5
514	Struct. Stl. Finish Fab.	4	4	0	0	22APR97	29APR97	22APR97	29APR97			0	0
515X	Delay of Foreign Steel	0	0	0	0	22APR97	21APR97	22APR97	21APR97			0	0

Start Date 07FEB97
Finish Date 09JUL97

Early Bar
Float Bar
Progress Bar
Critical Activity

B515 Public Owner Project 3 Sheet 2 of 6

Activity 515X Delay of Foreign Steel

Snapshot Date April 21st, 1997

Activity ID	Activity Description	Orig Dur	Rem Dur	Actual Duration	%	Early Start	Early Finish	Late Start	Late Finish	Actual Start	Actual Finish	Free Float	Total Float
573	Spiral Stair Erection	3	3	0	0	30APR97	02MAY97	30APR97	02MAY97			0	0
513	Struct. Stl. Erection	1	1	0	0	30APR97	30APR97	01MAY97	01MAY97			0	1
01MAY97													
520	Steel Deck	3	3	0	0	01MAY97	05MAY97	29MAY97	02JUN97			0	18
1580	Air Handling U.Roof top	2	2	0	0	01MAY97	02MAY97	06JUN97	09JUN97			11	24
850	Det.MetalDoors Frame Erection	2	2	0	0	01MAY97	02MAY97	12JUN97	13JUN97			0	28
340	Mezz. Floor Slab	13	13	0	0	02MAY97	20MAY97	02MAY97	20MAY97			0	0
120X	Delay, No Temp Elect. Available at Site.	0	0	0	0	06MAY97	05MAY97	03JUN97	02JUN97			5	18
830	Det.Metal Doors Erection	1	1	0	0	06MAY97	06MAY97	17JUN97	17JUN97			0	28
1612	Elect. Mezz. Rough-in	2	2	0	0	07MAY97	08MAY97	08MAY97	09MAY97			1	1
1512	Mezz. Plumbing Rough-in	1	1	0	0	07MAY97	07MAY97	09MAY97	09MAY97			2	2
260	Security Fence Post	1	1	0	0	07MAY97	07MAY97	28MAY97	28MAY97			0	13
740	Roof Hatch with Ladder	1	1	0	0	07MAY97	07MAY97	09JUN97	09JUN97			8	21
840	Det.Metal Doors Hardw.	1	1	0	0	07MAY97	07MAY97	19JUN97	19JUN97			0	28
320	Entry Pad	4	4	0	0	08MAY97	13MAY97	29MAY97	03JUN97			0	13
321X	FBOP Com.Delay, to Entry Pad Work	0	0	0	0	08MAY97	07MAY97	29MAY97	28MAY97			0	13
310	Sidewalk	2	2	0	0	08MAY97	09MAY97	11JUN97	12JUN97			0	22
1696X	Delay-FBOP Install Wiring to Door Locks	0	0	0	0	08MAY97	07MAY97	03JUL97	02JUL97			18	36
540	Checkered Plate Platf.	1	1	0	0	09MAY97	09MAY97	28MAY97	28MAY97			0	11
350	Observ. Floor Slab	5	5	0	0	12MAY97	16MAY97	12MAY97	16MAY97			0	0
550	Guard Rails	2	2	0	0	12MAY97	13MAY97	29MAY97	30MAY97			0	11
810	Steel Floor Hatch	1	1	0	0	13MAY97	13MAY97	13MAY97	13MAY97			0	0
530	Steel Stud Framing Parapet	2	2	0	0	13MAY97	14MAY97	03JUN97	04JUN97			0	13
1513	Observation Deck Plumbing Rough-in	2	2	0	0	14MAY97	15MAY97	14MAY97	15MAY97			0	0
1614	Elect. Interior Conduit & Rough-in	8	8	0	0	14MAY97	27MAY97	02JUN97	11JUN97			0	11

Start Date 07FEB97
Finish Date 09JUL97

Early Bar
Float Bar
Progress Bar
Critical Activity

8515 Public Owner Project 3 Sheet 3 of 6

Activity 515X Delay
of Foreign Steel

Snapshot Date April 21st, 1997

Activity ID	Activity Description	Orig Dur	Rem Dur	Actual Duration	%	Early Start	Early Finish	Late Start	Late Finish	Actual Start	Actual Finish	Free Float	Total Float
1695X	Delay-FBOP Communication Conduit Extra	0	0	0	0	14MAY97	13MAY97	04JUN97	03JUN97			0	13
1613	Elect. Observation Deck Rough-in	1	1	0	0	15MAY97	15MAY97	15MAY97	15MAY97			0	0
610	Cement Backer Units	2	2	0	0	15MAY97	16MAY97	05JUN97	06JUN97			0	13
1630	Panel Board	2	2	0	0	15MAY97	16MAY97	09JUN97	10JUN97			0	15
351	Mezz. & Observ. Floor Slab Cure Time	5	5	0	0	16MAY97	22MAY97	16MAY97	22MAY97			0	0
1660	Interior Lighting	4	4	0	0	16MAY97	21MAY97	12JUN97	17JUN97			6	17
1650	Transformer	2	2	0	0	19MAY97	20MAY97	11JUN97	12JUN97			0	15
722	Tapered Pelite Bd.	1	1	0	0	20MAY97	20MAY97	10JUN97	10JUN97			0	13
720	EPDM SinglePly Membr.	1	1	0	0	21MAY97	21MAY97	11JUN97	11JUN97			0	13
723	Polyso.Bd.	1	1	0	0	21MAY97	21MAY97	11JUN97	11JUN97			0	13
750	Curbs & Pipe Seals	1	1	0	0	21MAY97	21MAY97	11JUN97	11JUN97			0	13
760	Roof Walkways	1	1	0	0	21MAY97	21MAY97	16JUN97	16JUN97			16	16
1680	Emergency Power Est.	2	2	0	0	21MAY97	22MAY97	26JUN97	27JUN97			0	23
1020	Gun Cabinet	1	1	0	0	21MAY97	21MAY97	03JUL97	03JUL97			27	27
1110	Microwave	1	1	0	0	21MAY97	21MAY97	03JUL97	03JUL97			27	27
1120	Refrigerator	1	1	0	0	21MAY97	21MAY97	03JUL97	03JUL97			27	27
1640	Safety Switches	1	1	0	0	22MAY97	22MAY97	27JUN97	27JUN97			12	23
770	Joint Sealant	5	5	0	0	27MAY97	02JUN97	27MAY97	02JUN97			0	0
1530	Plumbing	5	5	0	0	27MAY97	02JUN97	13JUN97	20JUN97			0	13
1620	Wiring&Terminal-All	13	13	0	0	28MAY97	13JUN97	12JUN97	02JUL97			0	11
311	Sidewalk Finish Up Work	2	2	0	0	28MAY97	29MAY97	30JUN97	02JUL97			0	22
1694C	Contractor Delay-Cable Splice Fix	6	6	0	0	29MAY97	05JUN97	25JUN97	03JUL97			7	18
580	Ship Ladder	2	2	0	0	30MAY97	02JUN97	20JUN97	23JUN97			0	14
270	Seeding/Mulch	2	2	0	0	30MAY97	02JUN97	03JUL97	07JUL97			22	22

Start Date 07FEB97
Finish Date 09JUL97

Early Bar
Float Bar
Progress Bar
Critical Activity

B515 Public Owner Project 3 Sheet 4 of 5

Activity 515X Delay
of Foreign Steel

Snapshot Date April 21st, 1997

Activity ID	Activity Description	Orig Dur	Rem Dur	Actual Duration	%	Early Start	Early Finish	Late Start	Late Finish	Actual Start	Actual Finish	Free Float	Total Float
01JUN97													
920	Paint Exterior Concrete	1	1	0	0	03JUN97	03JUN97	03JUN97	03JUN97			0	0
930	Paint int Conc. & CMU	2	2	0	0	03JUN97	04JUN97	03JUN97	04JUN97			0	0
940	Paint Misc. Metals	8	8	0	0	03JUN97	12JUN97	24JUN97	07JUL97			14	14
1670	Exterior Light	9	9	0	0	04JUN97	16JUN97	20JUN97	03JUL97			11	11
261	Install Security Fencing	1	1	0	0	04JUN97	04JUN97	02JUL97	02JUL97			0	18
535	Steel Stud Framing Interior & Soffit	4	4	0	0	05JUN97	10JUN97	05JUN97	10JUN97			0	0
860	Complete Det. Metal Doors Hardw.& Locks	2	2	0	0	05JUN97	06JUN97	03JUL97	07JUL97			18	18
630	Interior Arch. Woodwork	1	1	0	0	09JUN97	09JUN97	26JUN97	26JUN97			2	12
1550	Plumbing Fixtures	1	1	0	0	09JUN97	09JUN97	27JUN97	27JUN97			13	13
710	Manuf. Stl.Walls&Soff.Panel	4	4	0	0	11JUN97	16JUN97	11JUN97	16JUN97			0	0
823	Ext. Det. Wind. Frame Erection	5	5	0	0	12JUN97	19JUN97	19JUN97	25JUN97			0	4
1621	Elect. Finish out after Dry-in	4	4	0	0	12JUN97	17JUN97	30JUN97	07JUL97			11	11
950	Gypsum Boards	2	2	0	0	13JUN97	16JUN97	13JUN97	16JUN97			0	0
826	Ext.Det.Window Glass Erection	4	4	0	0	13JUN97	19JUN97	20JUN97	25JUN97			0	4
1581	Ductwork	1	1	0	0	13JUN97	13JUN97	23JUN97	23JUN97			4	5
1520	Fire Protection Rough-in	1	1	0	0	13JUN97	13JUN97	26JUN97	26JUN97			0	8
1521	Fire Protection Finish-out	1	1	0	0	13JUN97	13JUN97	26JUN97	26JUN97			8	8
910	Paint Exterior Metals	4	4	0	0	16JUN97	20JUN97	20JUN97	25JUN97			0	3
1583	Exhaust Fan	1	1	0	0	16JUN97	16JUN97	24JUN97	24JUN97			0	5
731	Parapet Cap	1	1	0	0	17JUN97	17JUN97	17JUN97	17JUN97			0	0
724	Batt Insulation	2	2	0	0	17JUN97	19JUN97	25JUN97	26JUN97			5	5
732	Sheet Metal Strap	2	2	0	0	19JUN97	20JUN97	19JUN97	20JUN97			0	0
560	Camera & Light Supports	1	1	0	0	19JUN97	19JUN97	23JUN97	23JUN97			0	2
620	Const. Panels-Backer	1	1	0	0	19JUN97	19JUN97	25JUN97	25JUN97			1	4

Start Date 07FEB97
Finish Date 09JUL97

Early Bar
Float Bar
Progress Bar
Critical Activity

B515

Public Owner Project 3 Sheet 5 of 6

Activity 515X Delay
of Foreign Steel

Snapshot Date April 21st, 1997

Activity ID	Activity Description	Orig Dur	Rem Dur	Actual Duration	%	Early Start	Early Finish	Late Start	Late Finish	Actual Start	Actual Finish	Free Float	Total Float
1551	Plumbing Hook-up & Insulation	4	4	0	0	20JUN97	25JUN97	20JUN97	25JUN97			0	0
1540	Water Heater	1	1	0	0	20JUN97	20JUN97	23JUN97	23JUN97			0	1
827	Det. Window Glass Punch List	1	1	0	0	20JUN97	20JUN97	07JUL97	07JUL97			9	9
1560	Unit Heater-A/C	2	2	0	0	23JUN97	24JUN97	24JUN97	25JUN97			0	1
1691	Lightning Protection	6	6	0	0	24JUN97	02JUL97	26JUN97	07JUL97			2	2
1010	Netting	5	5	0	0	24JUN97	30JUN97	27JUN97	07JUL97			3	3
1582	Sheet Metal Accs. & Louvers	2	2	0	0	24JUN97	25JUN97	03JUL97	07JUL97			6	6
1691	HVAC Controls	1	1	0	0	24JUN97	24JUN97	07JUL97	07JUL97			7	7
931	Paint Int. Gypsum Board	3	3	0	0	27JUN97	02JUL97	27JUN97	02JUL97			0	0
1552	Toilet Modification (Wall)	2	2	0	0	30JUN97	02JUL97	30JUN97	02JUL97			0	0
01JUL97													
1553	Plumbing Drain Pan & Pipe Insulation	2	2	0	0	03JUL97	07JUL97	03JUL97	07JUL97			0	0
1692	Testing - Electrical	2	2	0	0	07JUL97	08JUL97	07JUL97	08JUL97			0	0
1592	HVAC Syst. Balance	1	1	0	0	08JUL97	08JUL97	08JUL97	08JUL97			0	0
1710	Final Punch List	1	1	0	0	08JUL97	08JUL97	08JUL97	08JUL97			0	0
1790	Substantial Completion	1	1	0	0	09JUL97	09JUL97	09JUL97	09JUL97			0	0

Start Date 07FEB97
Finish Date 09JUL97

Early Bar
Float Bar
Progress Bar
Critical Activity

B515 Public Owner Project 3 Sheet 6 of 6

Activity 515X Delay
of Foreign Steel

Snapshot Date April 21st, 1997

APPENDIX E

PUBLIC OWNER 3 SNAPSHOT SCHEDULE ON MAY 10TH, 1997

Activity ID	Activity Description	Orig Dur	Rem Dur	Actual Duration	%	Early Start	Early Finish	Late Start	Late Finish	Actual Start	Actual Finish	Free Float	Total Float
01FEB97													
001	NOTICE TO PROCEED	1	0	1	100	07FEB97A	07FEB97A	07FEB97A	07FEB97A	07FEB97	07FEB97		
110	Mobilization	7	0	7	100	10FEB97A	18FEB97A	10FEB97A	18FEB97A	10FEB97	18FEB97		
769	Original Roofing Contractor Failed	20	0	20	100	10FEB97A	11MAR97A	10FEB97A	11MAR97A	10FEB97	11MAR97		
210	Earthwork-Bldg.Fn'd.	6	0	6	100	17FEB97A	26FEB97A	17FEB97A	26FEB97A	17FEB97	26FEB97		
361	Tilt-Up Shop. DWG. thru Approval	12	0	12	100	19FEB97A	10MAR97A	19FEB97A	10MAR97A	19FEB97	10MAR97		
511	Struct. Stl. Shop DWG thru Approval	16	0	16	100	19FEB97A	21MAR97A	19FEB97A	21MAR97A	19FEB97	21MAR97		
571	Spiral Stair Shop-DWG	16	0	16	100	19FEB97A	21MAR97A	19FEB97A	21MAR97A	19FEB97	21MAR97		
821	Ext. Det. W.Fr.S.DWG	10	0	10	100	19FEB97A	06MAR97A	19FEB97A	06MAR97A	19FEB97	06MAR97		
824	Ext. Det. W.Gizz.S.Drw.	10	0	10	100	19FEB97A	06MAR97A	19FEB97A	06MAR97A	19FEB97	06MAR97		
301	Concrete Material Submittal by Contractor	3	0	3	100	21FEB97A	27FEB97A	21FEB97A	27FEB97A	21FEB97	27FEB97		
807	Det.Door Submittal by Contractor	10	0	10	100	26FEB97A	11MAR97A	26FEB97A	11MAR97A	26FEB97	11MAR97		
220	Trenching(Pipe) for Foundation	2	0	2	100	27FEB97A	28FEB97A	27FEB97A	28FEB97A	27FEB97	28FEB97		
230	Trenching(Electric)	1	0	1	100	27FEB97A	27FEB97A	27FEB97A	27FEB97A	27FEB97	27FEB97		
280	Termite Control	1	0	1	100	27FEB97A	27FEB97A	27FEB97A	27FEB97A	27FEB97	27FEB97		
330	Building Foundation	5	0	5	100	27FEB97A	05MAR97A	27FEB97A	05MAR97A	27FEB97	05MAR97		
1611	Elect. Foundation Rough-in	2	0	2	100	27FEB97A	28FEB97A	27FEB97A	28FEB97A	27FEB97	28FEB97		
1511	Found. Slab Plumbing Rough-in	2	0	2	100	28FEB97A	03MAR97A	28FEB97A	03MAR97A	28FEB97	03MAR97		
01MAR97													
250	4 SS Pipe	8	0	8	100	03MAR97A	12MAR97A	03MAR97A	12MAR97A	03MAR97	12MAR97		
302	Concrete Material Submittal Approval	2	0	2	100	05MAR97A	06MAR97A	05MAR97A	06MAR97A	05MAR97	06MAR97		
331	Foundation Slab Cure Time	5	0	5	100	06MAR97A	12MAR97A	06MAR97A	12MAR97A	06MAR97	12MAR97		
805	Det.Window Frame Submittal by	1	0	1	100	07MAR97A	07MAR97A	07MAR97A	07MAR97A	07MAR97	07MAR97		
825	Ext. Det. Window Glass Submit and Appr.	4	0	4	100	07MAR97A	12MAR97A	07MAR97A	12MAR97A	07MAR97	12MAR97		
806	Det.Window Frame Submittal Regected by	5	0	5	100	10MAR97A	21MAR97A	10MAR97A	21MAR97A	10MAR97	21MAR97		

Start Date 07FEB97
Finish Date 25JUL97

Early Bar
Float Bar
Progress Bar
Critical Activity

E515 Public Owner Project 3 Sheet 1 of 6

Activity 515X Delay of Foreign Steel

Snapshot Date May 10, 1997

Activity ID	Activity Description	Orig Dur	Rem Dur	Actual Duration	%	Early Start	Early Finish	Late Start	Late Finish	Actual Start	Actual Finish	Free Float	Total Float
221	Site Piping	8	0	8	100	11MAR97A	27MAR97A	11MAR97A	27MAR97A	11MAR97	27MAR97		
240	1 1/2 FW Pipe	8	0	8	100	11MAR97A	27MAR97A	11MAR97A	27MAR97A	11MAR97	27MAR97		
362	Tilt-Up Fabrication	18	0	18	100	11MAR97A	15APR97A	11MAR97A	15APR97A	11MAR97	15APR97		
1690	Underground Elec. Cond 1st. Part	2	0	2	100	11MAR97A	12MAR97A	11MAR97A	12MAR97A	11MAR97	12MAR97		
780	Roofing Contractor Procurement	14	0	14	100	12MAR97A	09APR97A	12MAR97A	09APR97A	12MAR97	09APR97		
808	Det.Door Submittal Approval	4	0	4	100	12MAR97A	24MAR97A	12MAR97A	24MAR97A	12MAR97	24MAR97		
1696	Underground Elec. Cond 2nd Part	3	0	3	100	20MAR97A	24MAR97A	20MAR97A	24MAR97A	20MAR97	24MAR97		
1693X	Delay-Conduit to Power Room	0	0	0	100	20MAR97A	12MAR97A	20MAR97A	12MAR97A	20MAR97	12MAR97		
1570	HVAC Shop Drawing & Submit. Appr.	14	0	14	100	21MAR97A	14APR97A	21MAR97A	14APR97A	21MAR97	14APR97		
822	Ext. Det. Window Frames Fabr.& Deliver	35	5	30	86	24MAR97A	16MAY97	24MAR97A	03JUL97	24MAR97		20	30
521	Struct. Stl. Factory Fab.	15	0	15	100	24MAR97A	16APR97A	24MAR97A	16APR97A	24MAR97	16APR97		
570	Spiral Stair Factory Fab.& Deliver	15	0	15	100	24MAR97A	16APR97A	24MAR97A	16APR97A	24MAR97	16APR97		
816	Det.Window Frame	0	0	0	100	24MAR97A	21MAR97A	24MAR97A	21MAR97A	24MAR97	21MAR97		
835	Ext. Det. Window Glass Fab.& Deliver	30	0	30	100	24MAR97A	09MAY97A	24MAR97A	09MAY97A	24MAR97	09MAY97		
809	Det.Door Fabricate & Deliver	18	0	18	100	25MAR97A	22APR97A	25MAR97A	22APR97A	25MAR97	22APR97		
290	Storm Drain Piping	2	0	2	100	27MAR97A	28MAR97A	27MAR97A	28MAR97A	27MAR97	28MAR97		
01APR97													
785	Roof Material Submittals by Contractor	3	0	3	100	10APR97A	15APR97A	10APR97A	15APR97A	10APR97	15APR97		
363	Tilt-Up Deliver	1	0	1	100	16APR97A	16APR97A	16APR97A	16APR97A	16APR97	16APR97		
786	Roof Material Submittal Approval	2	0	2	100	16APR97A	17APR97A	16APR97A	17APR97A	16APR97	17APR97		
364	Tilt-Up Erection	2	0	2	100	17APR97A	18APR97A	17APR97A	18APR97A	17APR97	18APR97		
512	Struct. Stl. Deliver & Start Fab.	3	0	3	100	17APR97A	21APR97A	17APR97A	21APR97A	17APR97	21APR97		
572	Spiral Stair Field Fab.	1	0	1	100	17APR97A	17APR97A	17APR97A	17APR97A	17APR97	17APR97		
400	Masonry-All	3	0	3	100	18APR97A	22APR97A	18APR97A	22APR97A	18APR97	22APR97		
515X	Delay of Foreign Steel	0	0	12	100	22APR97A	09MAY97A	22APR97A	09MAY97A	22APR97	09MAY97		

Start Date 07FEB97
Finish Date 25JUL97

Early Bar
Float Bar
Progress Bar
Critical Activity

E515 Public Owner Project 3 Sheet 2 of 6

Activity 515X Delay of Foreign Steel

Snapshot Date May 10, 1997

Activity ID	Activity Description	Orig Dur	Rem Dur	Actual Duration	%	Early Start	Early Finish	Late Start	Late Finish	Actual Start	Actual Finish	Free Float	Total Float
01MAY97													
514	Struct. Stl. Finish Fab.	4	4	0	0	12MAY97	15MAY97	12MAY97	15MAY97			0	0
260	Security Fence Post	1	1	0	0	12MAY97	12MAY97	13JUN97	13JUN97			0	22
320	Entry Pad	4	4	0	0	13MAY97	16MAY97	16JUN97	20JUN97			0	22
321X	FBOP Com.Delay, to Entry Pad Work	0	0	0	0	13MAY97	12MAY97	16JUN97	13JUN97			0	22
310	Sidewalk	2	2	0	0	13MAY97	14MAY97	30JUN97	02JUL97			0	31
573	Spiral Stair Erection	12	12	0	0	16MAY97	04JUN97	16MAY97	04JUN97			0	0
513	Struct. Stl. Erection	1	1	0	0	16MAY97	16MAY97	19MAY97	19MAY97			0	1
520	Steel Deck	3	3	0	0	19MAY97	21MAY97	16JUN97	19JUN97			0	18
1696X	Delay-FBOP Communication Conduit Extra	0	0	0	0	19MAY97	16MAY97	23JUN97	20JUN97			4	22
1580	Air Handling U.Roof top	2	2	0	0	19MAY97	20MAY97	25JUN97	26JUN97			6	24
850	Det.MetalDoors Frame Erection	2	2	0	0	19MAY97	20MAY97	02JUL97	03JUL97			0	28
340	Mezz. Floor Slab	13	13	0	0	20MAY97	09JUN97	20MAY97	09JUN97			0	0
530	Steel Stud Framing Parapet	2	2	0	0	22MAY97	27MAY97	20JUN97	23JUN97			0	18
120X	Delay, No Temp Elect. Available at Site.	0	0	0	0	22MAY97	21MAY97	20JUN97	19JUN97			0	18
830	Det.Metal Doors Erection	1	1	0	0	22MAY97	22MAY97	08JUL97	08JUL97			0	28
1612	Elect. Mezz. Rough-in	2	2	0	0	27MAY97	28MAY97	28MAY97	29MAY97			1	1
1512	Mezz. Plumbing Rough-in	1	1	0	0	27MAY97	27MAY97	29MAY97	29MAY97			2	2
740	Roof Hatch with Ladder	1	1	0	0	27MAY97	27MAY97	26JUN97	26JUN97			3	21
840	Det.Metal Doors Hardw.	1	1	0	0	27MAY97	27MAY97	09JUL97	09JUL97			0	28
610	Cement Backer Units	2	2	0	0	28MAY97	29MAY97	24JUN97	25JUN97			0	18
1696X	Delay-FBOP Install Wiring to Door Locks	0	0	0	0	28MAY97	27MAY97	22JUL97	21JUL97			18	36
540	Checkered Plate Platf.	1	1	0	0	29MAY97	29MAY97	13JUN97	13JUN97			0	11
350	Observ. Floor Slab	5	5	0	0	30MAY97	05JUN97	30MAY97	05JUN97			0	0
550	Guard Rails	2	2	0	0	30MAY97	02JUN97	16JUN97	17JUN97			0	11

Start Date 07FEB97
Finish Date 25JUL97

Early Bar
Float Bar
Progress Bar
Critical Activity

E515 Public Owner Project 3 Sheet 3 of 6

Activity 515X Delay of Foreign Steel

Snapshot Date May 10, 1997

Activity ID	Activity Description	Orig Dur	Rem Dur	Actual Duration	%	Early Start	Early Finish	Late Start	Late Finish	Actual Start	Actual Finish	Free Float	Total Float
01JUN97													
810	Steel Floor Hatch	1	1	0	0	02JUN97	02JUN97	02JUN97	02JUN97			0	0
722	Tapered Pelite Bd.	1	1	0	0	02JUN97	02JUN97	27JUN97	27JUN97			0	18
311	Sidewalk Finish Up Work	2	2	0	0	02JUN97	03JUN97	18JUL97	21JUL97			0	31
1513	Observation Deck Plumbing Rough-in	2	2	0	0	03JUN97	04JUN97	03JUN97	04JUN97			0	0
1614	Elect. Interior Conduit & Rough-In	8	8	0	0	03JUN97	12JUN97	19JUN97	30JUN97			0	11
720	EPDM SinglePly Membr.	1	1	0	0	03JUN97	03JUN97	30JUN97	30JUN97			0	18
723	Polyso.Bd.	1	1	0	0	03JUN97	03JUN97	30JUN97	30JUN97			0	18
750	Curbs & Pipe Seals	1	1	0	0	03JUN97	03JUN97	30JUN97	30JUN97			0	18
760	Roof Walkways	1	1	0	0	03JUN97	03JUN97	07JUL97	07JUL97			21	21
1020	Gun Cabinet	1	1	0	0	03JUN97	03JUN97	22JUL97	22JUL97			32	32
1110	Microwave	1	1	0	0	03JUN97	03JUN97	22JUL97	22JUL97			32	32
1120	Refrigerator	1	1	0	0	03JUN97	03JUN97	22JUL97	22JUL97			32	32
1613	Elect. Observation Deck Rough-in	1	1	0	0	04JUN97	04JUN97	04JUN97	04JUN97			0	0
1630	Panel Board	2	2	0	0	04JUN97	05JUN97	26JUN97	27JUN97			0	15
270	Seeding/Mulch	2	2	0	0	04JUN97	05JUN97	22JUL97	23JUL97			31	31
351	Mezz. & Observ. Floor Slab Cure Time	5	5	0	0	05JUN97	11JUN97	05JUN97	11JUN97			0	0
1660	Interior Lighting	4	4	0	0	05JUN97	10JUN97	02JUL97	08JUL97			6	17
1650	Transformer	2	2	0	0	06JUN97	09JUN97	30JUN97	02JUL97			0	15
1680	Emergency Power Est.	2	2	0	0	10JUN97	11JUN97	16JUL97	17JUL97			0	23
1640	Safety Switches	1	1	0	0	11JUN97	11JUN97	17JUL97	17JUL97			12	23
770	Joint Sealant	5	5	0	0	12JUN97	19JUN97	12JUN97	19JUN97			0	0
1530	Plumbing	5	5	0	0	12JUN97	19JUN97	03JUL97	10JUL97			0	13
1620	Wiring&Terminal-All	13	13	0	0	13JUN97	03JUL97	02JUL97	21JUL97			0	11
1694C	Contractor Delay-Cable Splice Fix	6	6	0	0	16JUN97	24JUN97	15JUL97	22JUL97			7	18

Start Date 07FEB97
Finish Date 25JUL97

Early Bar
Float Bar
Progress Bar
Critical Activity

E515 Public Owner Project 3 Sheet 4 of 6

Activity 515X Delay of Foreign Steel

Snapshot Date May 10, 1997

Activity ID	Activity Description	Orig Dur	Rem Dur	Actual Duration	%	Early Start	Early Finish	Late Start	Late Finish	Actual Start	Actual Finish	Free Float	Total Float
580	Ship Ladder	2	2	0	0	17JUN97	19JUN97	10JUL97	11JUL97			0	14
920	Paint Exterior Concrete	1	1	0	0	20JUN97	20JUN97	20JUN97	20JUN97			0	0
930	Paint Int Conc. & CMU	2	2	0	0	20JUN97	23JUN97	20JUN97	23JUN97			0	0
940	Paint Misc. Metals	8	8	0	0	20JUN97	02JUL97	14JUL97	23JUL97			14	14
823	Ext. Det. Wind. Frame Erection	5	5	0	0	23JUN97	27JUN97	09JUL97	15JUL97			0	10
1670	Exterior Light	9	9	0	0	23JUN97	07JUL97	10JUL97	22JUL97			11	11
261	Install Security Fencing	1	1	0	0	23JUN97	23JUN97	21JUL97	21JUL97			0	18
535	Steel Stud Framing Interior & Soffit	4	4	0	0	24JUN97	27JUN97	24JUN97	27JUN97			0	0
826	Ext.Det.Window Glass Erection	4	4	0	0	24JUN97	27JUN97	10JUL97	15JUL97			0	10
860	Complete Det. Metal Doors Hardw.& Locks	2	2	0	0	24JUN97	25JUN97	22JUL97	23JUL97			18	18
630	Interior Arch. Woodwork	1	1	0	0	26JUN97	26JUN97	16JUL97	16JUL97			2	12
1550	Plumbing Fixtures	1	1	0	0	26JUN97	26JUN97	17JUL97	17JUL97			13	13
710	Manuf. Stl.Walls&Soff.Panel	4	4	0	0	30JUN97	07JUL97	30JUN97	07JUL97			0	0
827	Det. Window Glass Punch List	1	1	0	0	30JUN97	30JUN97	23JUL97	23JUL97			15	15
01JUL97													
1621	Elect. Finish out after Dry-in	4	4	0	0	02JUL97	08JUL97	18JUL97	23JUL97			11	11
950	Gypsum Boards	2	2	0	0	03JUL97	07JUL97	03JUL97	07JUL97			0	0
1581	Ductwork	1	1	0	0	03JUL97	03JUL97	11JUL97	11JUL97			4	5
1520	Fire Protection Rough-in	1	1	0	0	03JUL97	03JUL97	16JUL97	16JUL97			0	8
1521	Fire Protection Finish-out	1	1	0	0	03JUL97	03JUL97	16JUL97	16JUL97			8	8
910	Paint Exterior Metals	4	4	0	0	07JUL97	10JUL97	10JUL97	15JUL97			0	3
1583	Exhaust Fan	1	1	0	0	07JUL97	07JUL97	14JUL97	14JUL97			0	5
731	Parapet Cap	1	1	0	0	08JUL97	08JUL97	08JUL97	08JUL97			0	0
724	Batt Insulation	2	2	0	0	08JUL97	09JUL97	15JUL97	16JUL97			5	5
732	Sheet Metal Strap	2	2	0	0	09JUL97	10JUL97	09JUL97	10JUL97			0	0

Start Date 07FEB97
Finish Date 25JUL97

Early Bar
Float Bar
Progress Bar
Critical Activity

E515 Public Owner Project 3 Sheet 5 of 6

Activity 515X Delay of Foreign Steel

Snapshot Date May 10, 1997

Activity ID	Activity Description	Orig Dur	Rem Dur	Actual Duration	%	Early Start	Early Finish	Late Start	Late Finish	Actual Start	Actual Finish	Free Float	Total Float
560	Camera & Light Supports	1	1	0	0	09JUL97	09JUL97	11JUL97	11JUL97			0	2
620	Const. Panels-Backer	1	1	0	0	09JUL97	09JUL97	15JUL97	15JUL97			1	4
1551	Plumbing Hook-up & Insulation	4	4	0	0	10JUL97	15JUL97	10JUL97	15JUL97			0	0
1540	Water Heater	1	1	0	0	10JUL97	10JUL97	11JUL97	11JUL97			0	1
1560	Unit Heater-A/C	2	2	0	0	11JUL97	14JUL97	14JUL97	15JUL97			0	1
1691	Lightning Protection	6	6	0	0	14JUL97	21JUL97	16JUL97	23JUL97			2	2
1010	Netting	5	5	0	0	14JUL97	18JUL97	17JUL97	23JUL97			3	3
1582	Sheet Metal Accs. & Louvers	2	2	0	0	14JUL97	15JUL97	22JUL97	23JUL97			6	6
1581	HVAC Controls	1	1	0	0	14JUL97	14JUL97	23JUL97	23JUL97			7	7
931	Paint Int. Gypsum Board	3	3	0	0	17JUL97	21JUL97	17JUL97	21JUL97			0	0
1552	Toilet Modification (Wall)	2	2	0	0	18JUL97	21JUL97	18JUL97	21JUL97			0	0
1553	Plumbing Drain Pan & Pipe Insulation	2	2	0	0	22JUL97	23JUL97	22JUL97	23JUL97			0	0
1692	Testing - Electrical	2	2	0	0	23JUL97	24JUL97	23JUL97	24JUL97			0	0
1592	HVAC Syst. Balance	1	1	0	0	24JUL97	24JUL97	24JUL97	24JUL97			0	0
1710	Final Punch List	1	1	0	0	24JUL97	24JUL97	24JUL97	24JUL97			0	0
1790	Substantial Completion	1	1	0	0	25JUL97	25JUL97	25JUL97	25JUL97			0	0

Start Date 07FEB97
Finish Date 25JUL97

Early Bar
Float Bar
Progress Bar
Critical Activity

E515 Public Owner Project 3 Sheet 6 of 6

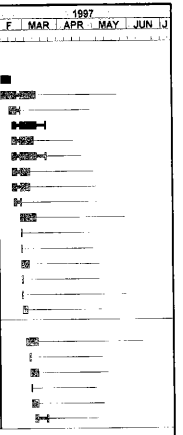
Activity 515X Delay of Foreign Steel

Snapshot Date May 10, 1997

APPENDIX F

PUBLIC OWNER 3 DELAY-ANALYSIS USING ANALYSIS-IN-RETROSPECT METHOD

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Free Float	Total Float
01FEB97								
001	NOTICE TO PROCEED	1	1	0	07FEB97*	07FEB97	0	0
110	Mobilization	7	7	0	10FEB97	18FEB97	0	0
769	Original Roofing Contractor Failed Procurement	20	20	0	10FEB97	11MAR97	0	42
210	Earthwork-Bldg.Fn'd.	6	6	0	17FEB97	26FEB97	0	34
511	Struct. Stl. Shop DWG thru Approval	16	16	0	19FEB97	21MAR97	0	0
361	Tilt-Up Shop. DWG. thru Approval	12	12	0	19FEB97	10MAR97	0	17
571	Spiral Stair Shop-DWG	16	16	0	19FEB97	21MAR97	0	18
821	Ext. Det. W.Fr.S.DWG	10	10	0	19FEB97	06MAR97	0	30
824	Ext. Det. W.Gizz.S.Drw.	10	10	0	19FEB97	06MAR97	0	32
301	Concrete Material Submittal by Contractor	3	3	0	21FEB97	27FEB97	4	38
807	Det.Door Submittal by Contractor	10	10	0	26FEB97	11MAR97	0	44
230	Trenching(Electric)	1	1	0	27FEB97	27FEB97	0	34
280	Termite Control	1	1	0	27FEB97	27FEB97	0	34
330	Building Foundation	5	5	0	27FEB97	05MAR97	0	34
220	Trenching(Pipe) for Foundation	2	2	0	27FEB97	28FEB97	0	37
1611	Elect. Foundation Rough-in	2	2	0	27FEB97	28FEB97	0	52
1511	Found. Slab Plumbing Rough-in	2	2	0	28FEB97	03MAR97	0	37
01MAR97								
250	4 SS Pipe	8	8	0	03MAR97	12MAR97	6	54
302	Concrete Material Submittal Approval	2	2	0	05MAR97	06MAR97	0	34
331	Foundation Slab Cure Time	5	5	0	06MAR97	12MAR97	17	34
805	Det.Window Frame Submittal by Contractor	1	1	0	07MAR97	07MAR97	0	30
825	Ext. Det. Window Glass Submit and Appr.	4	4	0	07MAR97	12MAR97	2	32
806	Det.Window Frame Submittal Regected by FBOP	5	5	0	10MAR97	21MAR97	0	30



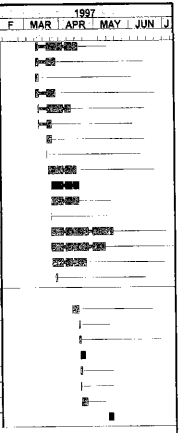
Start Date 07FEB97
Finish Date 25JUL97

Early Bar
Float Bar
Progress Bar
Critical Activity

Public Owner Project 3 Sheet 1 of 5

Activity 515X Delay of Foreign Steel
Delay Analysis Using Analysis-in-Retrospect Method

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Free Float	Total Float
362	Tilt-Up Fabrication	18	18	0	11MAR97	15APR97	0	17
221	Site Piping	8	8	0	11MAR97	27MAR97	0	48
1690	Underground Elec. Cond 1st. Part	2	2	0	11MAR97	12MAR97	0	52
240	1 1/2 FW Pipe	8	8	0	11MAR97	27MAR97	0	54
780	Roofing Contractor Procurement	14	14	0	12MAR97	09APR97	0	42
808	Det.Door Submittal Approval	4	4	0	12MAR97	24MAR97	0	44
1696	Underground Elec. Cond 2nd Part	3	3	0	20MAR97	24MAR97	27	52
1693X	Delay-Conduit to Power Room	0	0	0	20MAR97	12MAR97	0	52
1570	HVAC Shop Drawing & Submit. Appr.	14	14	0	21MAR97	14APR97	22	46
521	Struct. Stl. Factory Fab.	15	15	0	24MAR97	16APR97	0	0
570	Spiral Stair Factory Fab.& Deliver	15	15	0	24MAR97	16APR97	0	18
816	Det.Window Frame Resubmit-AMBIGUOUS	0	0	0	24MAR97	21MAR97	0	30
822	Ext. Det. Window Frames Fabr.& Deliver	35	35	0	24MAR97	16MAY97	20	30
835	Ext. Det. Window Glass Fab & Deliver	30	30	0	24MAR97	09MAY97	28	38
809	Det.Door Fabricate & Deliver	18	18	0	25MAR97	22APR97	16	44
290	Storm Drain Piping	2	2	0	27MAR97	28MAR97	23	48
01APR97								
785	Roof Material Submittals by Contractor	3	3	0	10APR97	15APR97	0	42
363	Tilt-Up Deliver	1	1	0	16APR97	16APR97	0	17
786	Roof Material Submittal Approval	2	2	0	16APR97	17APR97	27	45
512	Struct. Stl. Deliver & Start Fab.	3	3	0	17APR97	21APR97	0	0
364	Tilt-Up Erection	2	2	0	17APR97	18APR97	0	17
572	Spiral Stair Field Fab.	1	1	0	17APR97	17APR97	18	18
400	Masonry-All	3	3	0	18APR97	22APR97	17	17
514	Struct. Stl. Finish Fab.	4	4	0	12MAY97	15MAY97	0	0



Start Date 07FEB97
Finish Date 25JUL97

Early Bar
Float Bar
Progress Bar
Critical Activity

Public Owner Project 3 Sheet 2 of 6

Activity 515X Delay of Foreign Steel
Delay Analysis Using Analysis-in-Retrospect Method

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Free Float	Total Float
515X	Delay of Foreign Steel	12	12	0	22APR97	09MAY97	0	0
573	Spiral Stair Erection	3	3	0	16MAY97	20MAY97	0	0
513	Struct. Stl. Erection	1	1	0	16MAY97	16MAY97	0	1
01MAY97								
520	Steel Deck	3	3	0	19MAY97	21MAY97	0	18
1580	Air Handling U.Roof top	2	2	0	19MAY97	20MAY97	6	24
850	Det.MetalDoors Frame Erection	2	2	0	19MAY97	20MAY97	0	28
340	Mezz. Floor Slab	13	13	0	20MAY97	09JUN97	0	0
120X	Delay, No Temp Elect. Available at Site.	0	0	0	22MAY97	21MAY97	0	18
830	Det.Metal Doors Erection	1	1	0	22MAY97	22MAY97	0	28
1612	Elect. Mezz. Rough-in	2	2	0	27MAY97	28MAY97	1	1
1512	Mezz. Plumbing Rough-in	1	1	0	27MAY97	27MAY97	2	2
260	Security Fence Post	1	1	0	07MAY97	07MAY97	0	25
740	Roof Hatch with Ladder	1	1	0	27MAY97	27MAY97	3	21
840	Det.Metal Doors Hardw.	1	1	0	27MAY97	27MAY97	0	28
320	Entry Pad	4	4	0	08MAY97	13MAY97	0	25
321X	FBOP Com.Delay, to Entry Pad Work	0	0	0	08MAY97	07MAY97	0	25
310	Sidewalk	2	2	0	08MAY97	09MAY97	0	34
1696X	Delay-FBOP Install Wiring to Door Locks	0	0	0	28MAY97	27MAY97	18	36
540	Checkered Plate Platf.	1	1	0	29MAY97	29MAY97	0	11
350	Observ. Floor Slab	5	5	0	30MAY97	05JUN97	0	0
550	Guard Rails	2	2	0	30MAY97	02JUN97	0	11
810	Steel Floor Hatch	1	1	0	02JUN97	02JUN97	0	0
530	Steel Stud Framing Parapet	2	2	0	22MAY97	27MAY97	0	18
1513	Observation Deck Plumbing Rough-in	2	2	0	03JUN97	04JUN97	0	0

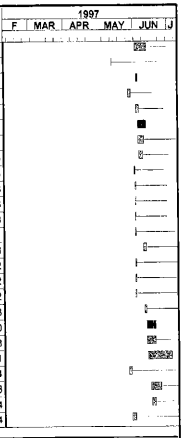
Start Date 07FEB97
Finish Date 25JUL97

Early Bar
Float Bar
Progress Bar
Critical Activity

Public Owner Project 3 Sheet 3 of 6

Activity 515X Delay of Foreign Steel
Delay Analysis Using Analysis-in-Retrospect Method

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Free Float	Total Float
1614	Elect. Interior Conduit & Rough-In	8	8	0	03JUN97	12JUN97	0	11
1695X	Delay-FBOP Communication Conduit Extra	0	0	0	14MAY97	13MAY97	7	25
1613	Elect. Observation Deck Rough-In	1	1	0	04JUN97	04JUN97	0	0
610	Cement Backer Units	2	2	0	28MAY97	29MAY97	0	18
1630	Panel Board	2	2	0	04JUN97	05JUN97	0	15
351	Mezz. & Observ. Floor Slab Cure Time	5	5	0	05JUN97	11JUN97	0	0
1660	Interior Lighting	4	4	0	05JUN97	10JUN97	6	17
1650	Transformer	2	2	0	06JUN97	09JUN97	0	15
722	Tapered Pelite Bd.	1	1	0	02JUN97	02JUN97	0	18
720	EPDM SinglePly Membr.	1	1	0	03JUN97	03JUN97	0	18
723	Polyso Bd.	1	1	0	03JUN97	03JUN97	0	18
750	Curbs & Pipe Seals	1	1	0	03JUN97	03JUN97	0	18
760	Roof Walkways	1	1	0	03JUN97	03JUN97	21	21
1680	Emergency Power Est.	2	2	0	10JUN97	11JUN97	0	23
1020	Gun Cabinet	1	1	0	03JUN97	03JUN97	32	32
1110	Microwave	1	1	0	03JUN97	03JUN97	32	32
1120	Refrigerator	1	1	0	03JUN97	03JUN97	32	32
1640	Safety Switches	1	1	0	11JUN97	11JUN97	12	23
770	Joint Sealant	5	5	0	12JUN97	19JUN97	0	0
1530	Plumbing	5	5	0	12JUN97	19JUN97	0	13
1620	Wiring&Terminal-All	13	13	0	13JUN97	03JUL97	0	11
311	Sidewalk Finish Up Work	2	2	0	28MAY97	29MAY97	0	34
1694C	Contractor Delay-Cable Splice Fix	6	6	0	16JUN97	24JUN97	7	18
580	Ship Ladder	2	2	0	17JUN97	19JUN97	0	14
270	Seeding/Mulch	2	2	0	30MAY97	02JUN97	34	34

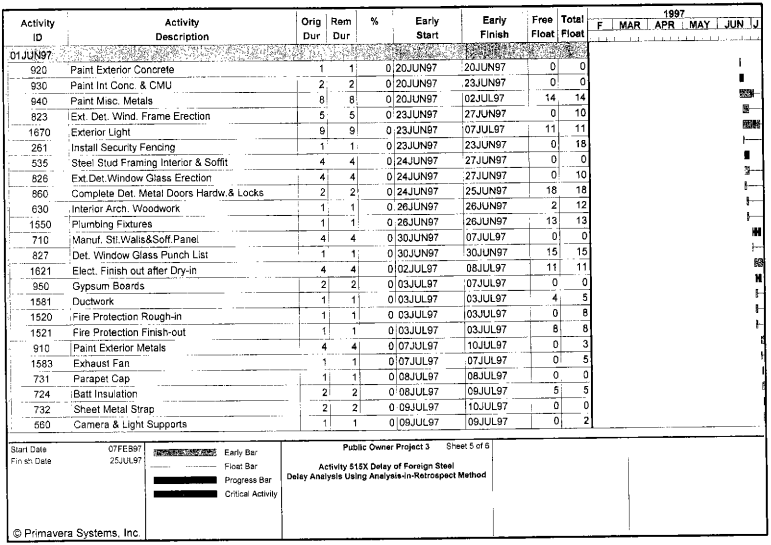


Start Date 07FEB97
Finish Date 25JUL97

Early Bar
Float Bar
Progress Bar
Critical Activity

Public Owner Project 3 Sheet 4 of 6

Activity 515X Delay of Foreign Steel
Delay Analysis Using Analysis-in-Retrospect Method



Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Free Float	Total Float
01JUN97								
920	Paint Exterior Concrete	1	1	0	20JUN97	20JUN97	0	0
930	Paint Int Conc. & CMU	2	2	0	20JUN97	23JUN97	0	0
940	Paint Misc. Metals	8	8	0	20JUN97	02JUL97	14	14
823	Ext. Det. Wind. Frame Erection	5	5	0	23JUN97	27JUN97	0	10
1670	Exterior Light	9	9	0	23JUN97	07JUL97	11	11
261	Install Security Fencing	1	1	0	23JUN97	23JUN97	0	18
535	Steel Stud Framing Interior & Soffit	4	4	0	24JUN97	27JUN97	0	0
826	Ext.Det.Window Glass Erection	4	4	0	24JUN97	27JUN97	0	10
860	Complete Det. Metal Doors Hardw.& Locks	2	2	0	24JUN97	25JUN97	18	18
630	Interior Arch. Woodwork	1	1	0	26JUN97	26JUN97	2	12
1550	Plumbing Fixtures	1	1	0	26JUN97	26JUN97	13	13
710	Manuf. Stl.Walls&Soff.Panel	4	4	0	30JUN97	07JUL97	0	0
827	Det. Window Glass Punch List	1	1	0	30JUN97	30JUN97	15	15
1621	Elect. Finish out after Dry-in	4	4	0	02JUL97	08JUL97	11	11
950	Gypsum Boards	2	2	0	03JUL97	07JUL97	0	0
1581	Ductwork	1	1	0	03JUL97	03JUL97	4	5
1520	Fire Protection Rough-in	1	1	0	03JUL97	03JUL97	0	8
1521	Fire Protection Finish-out	1	1	0	03JUL97	03JUL97	8	8
910	Paint Exterior Metals	4	4	0	07JUL97	10JUL97	0	3
1583	Exhaust Fan	1	1	0	07JUL97	07JUL97	0	5
731	Parapet Cap	1	1	0	08JUL97	08JUL97	0	0
724	Batt Insulation	2	2	0	08JUL97	09JUL97	5	5
732	Sheet Metal Strap	2	2	0	09JUL97	10JUL97	0	0
680	Camera & Light Supports	1	1	0	09JUL97	09JUL97	0	2

Start Date 07FEB97
Finish Date 25JUL97

Early Bar
Float Bar
Progress Bar
Critical Activity

Public Owner Project 3 Sheet 5 of 6

Activity 515X Delay of Foreign Steel
Delay Analysis Using Analysis-in-Retrospect Method

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Free Float	Total Float
620	Const. Panels-Backer	1	1	0	09JUL97	09JUL97	1	4
1551	Plumbing Hook-up & Insulation	4	4	0	10JUL97	15JUL97	0	0
1540	Water Heater	1	1	0	10JUL97	10JUL97	0	1
1560	Unit Heater-A/C	2	2	0	11JUL97	14JUL97	0	1
1691	Lightning Protection	6	6	0	14JUL97	21JUL97	2	2
1010	Netting	5	5	0	14JUL97	18JUL97	3	3
1582	Sheet Metal Accs. & Louvers	2	2	0	14JUL97	15JUL97	6	6
1591	HVAC Controls	1	1	0	14JUL97	14JUL97	7	7
931	Paint Int. Gypsum Board	3	3	0	17JUL97	21JUL97	0	0
1552	Toilet Modification (Wall)	2	2	0	18JUL97	21JUL97	0	0
01JUL97								
1553	Plumbing Drain Pan & Pipe Insulation	2	2	0	22JUL97	23JUL97	0	0
1692	Testing - Electrical	2	2	0	23JUL97	24JUL97	0	0
1562	HVAC Syst. Balance	1	1	0	24JUL97	24JUL97	0	0
1710	Final Punch List	1	1	0	24JUL97	24JUL97	0	0
1790	Substantial Completion	1	1	0	25JUL97	25JUL97	0	0

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Start Date 07FEB97
Finish Date 25JUL97

Early Bar
Float Bar
Progress Bar
Critical Activity

Public Owner Project 3 Sheet 6 of 6

Activity 515X Delay of Foreign Steel
Delay Analysis Using Analysis-in-Retrospect Method

VITA

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