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16. Abstract

The primary objective of this research study was to develop a rational procedure for the Texas Department of Transportation to determine the time required to complete a construction contract for different types of highway construction projects. The final product of this research project is the TxDOT Contract Time Determination System (CTDS). The system was developed to complement the existing TxDOT Pre-Construction Management System which categorizes all projects into fourteen different classes. The CTDS is a conceptual estimating system for predicting contract time for highway construction projects and is not to be used for the detailed planning of actual construction activities for a project. It is a bar chart scheduling system based on standard work items for each project class with the flexibility to add other work items as desired. It includes both a manual method and a computerized method. The CTDS user supplies actual work quantities for a project and by applying standard production rates, or preferred rates of the user, a contract duration is established. The computer version of the system was based on existing software already used for the TxDOT Pre-Construction Management System, and must be used with Lotus 123 (Version 2.0), Flash-Up Version (3.05), and SuperProject (Version 2.0). The system can be used for the majority of TxDOT projects; however, for very large or complex projects, it will be necessary to develop the estimated project duration using a detailed planning approach.

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CONSTRUCTION CONTRACT TIME DETERMINATION

by

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Research Report 1262-1F
Research Study Number 2-6-91/2-1262
PROCEDURES AND DATA FOR DETERMINING PROJECT COMPLETION TIMES

Sponsored by

Texas Department of Transportation

in cooperation with

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METRIC (SI*) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	2.54	centimeters	cm
ft	feet	0.3048	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	6.452	centimeters squared	cm^2
ft^2	square feet	0.0929	meters squared	m^2
yd^2	square yards	0.836	meters squared	m^2
mi^2	square miles	2.59	kilometers squared	km^2
ac	acres	0.395	hectares	ha
		MASS (weight)		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams	Mg
		VOLUME		
fl oz	fluid ounces	29.57	millimeters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.0328	meters cubed	m^3
yd^3	cubic yards	0.765	meters cubed	m^3

Note: Volumes greater than 1000 L shall be shown in m^3.

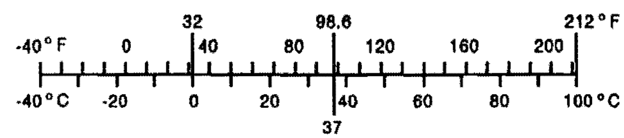
Symbol	When You Know	Multiply By	To Find	Symbol
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
yd	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	millimeters squared	0.0016	square inches	in^2
m^2	meters squared	10.764	square feet	ft^2
yd^2	kilometers squared	0.39	square miles	mi^2
ha	hectares (10,000 m^2)	2.53	acres	ac
		MASS (weight)		
g	grams	0.0353	ounces	oz
kg	kilograms	2.205	pounds	lb
Mg	megagrams (1000 kg)	1.103	short tons	T
		VOLUME		
mL	millimeters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	meters cubed	35.315	cubic feet	ft^3
m^3	meters cubed	1.308	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

These factors conform to the requirement of FHWA Order 5190.1A

*SI is the symbol for the International System of Measurements



ABSTRACT

The primary objective of this research study was to develop a rational procedure for the Texas Department of Transportation to determine the time required to complete a construction contract for different types of highway construction projects. The final product of this research project is the TxDOT Contract Time Determination System (CTDS). The system was developed to complement the existing TxDOT Pre-Construction Management System that categorizes all projects into fourteen different classes. The CTDS is a conceptual estimating system for predicting contract time for highway construction projects and is not to be used for the detailed planning of actual construction activities for a project. It is a bar chart scheduling system based on standard work items for each project class with the flexibility to add other work items as desired. It includes both a manual method and a computerized method. The CTDS user supplies actual work quantities for a project and by applying standard production rates, or preferred rates of the user, a contract duration is established. The computer version of the system was based on existing software already used for the Pre-Construction Management System, including Lotus 123, Flash-Up, and SuperProject. The system can be used for the majority of TxDOT projects; however, for very large or complex projects, it will be necessary to develop the estimated project duration using a detailed planning approach, most likely a bar chart or Critical Path schedule, for the special work items involved. **IT IS IMPORTANT TO NOTE THAT CTDS MUST BE USED WITH LOTUS 123 (VERSION 2.0), FLASH-UP (VERSION 3.05) AND SUPERPROJECT (VERSION 2.0) TO OPERATE.**

PREFACE

The authors are indebted to Dr. Khali Persad of the Texas Department of Transportation for his assistance throughout this project as the technical coordinator for TxDOT. They are especially indebted to Bob Richardson and Ray Meier from the Bryan district for their many hours of guidance and consultation during the development of the basic approach to the contract time determination system. The authors are also indebted to the following persons who served on a special liaison committee to assist with the project: Don Clark and Martin Rodin (Amarillo); Terry Jackson (Austin); Ed Vernon (Brownwood); Kim Carroll (Dallas); Walter Torres (Houston); Russel Neil (Odessa), Bill Geiger (San Antonio); Jerry Blackburn (Tyler); and Don Sims (Waco). They also would like to thank the numerous individuals in the 35 State DOT's and in FHWA that provided information for use in the project.

IMPLEMENTATION STATEMENT

The Contract Time Determination System (CTDS) developed in this research has been designed for easy implementation into TxDOT operations. Implementation of the manual method developed for contract time estimation has already begun. The necessary computer equipment and computer software needed to implement the computer method for CTDS already exist in most division and district offices. This will include an IBM microcomputer or compatible (at least a 386 machine is strongly recommended), plus the Lotus 123 (Version 2.0), Flash-Up (Version 3.05), and SuperProject (Version 2.0) computer software packages. Training sessions for initial instruction in the use of CTDS is proposed for key division and district personnel responsible for construction contract time determination.

DISCLAIMER

This study was conducted in cooperation with the Texas Department of Transportation and the U.S. Department of Transportation, Federal Highway Administration. The contents of this report reflect the views of the authors and do not necessarily represent the official views or policies of the FHWA or TxDOT. This report does not constitute a standard, a specification, or a regulation, and is not intended for construction, bidding or permit purposes. The person responsible for this project is Donn E. Hancher, P.E. (#67125 Texas).

SUMMARY

The primary objective of this research study was to develop a rational procedure for the Texas Department of Transportation to determine the time required to complete a construction contract for different types of highway construction projects. The procedure to be developed was to be flexible to accommodate the wide range of projects and conditions undertaken by TxDOT throughout the State, plus was to be easy to modify and update in the future. It was to be based on production rates and work quantities that are common to the projects undertaken by the Department. Finally, the procedure should be logical, easy to use and defensible in contract disputes and litigation proceedings.

Literature reviews and contacts with other DOTs revealed that there are several scheduling techniques used by transportation agencies to determine how much contract time to allow for construction projects. Most of the scheduling, especially for setting contract duration, is based on simple prediction techniques or bar charts based on standard production rates. Whatever methods are used, the empirical judgement of experienced DOT personnel still plays a major role in contract time setting.

The final product of this research project is the TxDOT Contract Time Determination System (CTDS). The system was developed to complement the existing TxDOT Pre-Construction Management System which categorizes all projects into fourteen different classes. The CTDS is a conceptual estimating system for predicting contract time for highway construction projects and is not to be used for the detailed planning of actual construction activities for a project. It is a bar chart scheduling system based on standard work items for each project class, with the flexibility to add other work items as desired. It includes both a manual method and a computerized method.

The CTDS user supplies actual work quantities for a project, and by applying standard production rates, or preferred rates, a contract duration is established. The system has been designed to allow the districts to use production rates specific to their operations due to the wide variation in production situations in Texas. The computer version of the system was based on existing software already used for the Pre-Construction Management System, including Lotus 123 (Version 2.0), Flash-Up (Version 3.05) and SuperProject (Version 2.0). **These versions of the software must be used to effectively run CTDS.**

Production data for highway construction was requested from all state DOTs, from all TxDOT Districts, and from highway contractors for developing the base production rates for the major work items used in the final prediction system. The research effort also involved updating the project time estimating system developed by TTI researchers in 1987. The major benefit of the completed research is that the Construction Contract Time Determination System developed will provide TxDOT with a rational procedure for estimating its contract completion times. The system developed will serve as a basis for the collection and analysis of production rates of past projects, which can be used to update existing production data. Recommendations were given for implementing CTDS into TxDOT operations.

TABLE OF CONTENTS

CHAPTER PAGE

TABLE OF CONTENTS (con't.)

CHAPTER PAGE

TABLE OF CONTENTS (con't.)

CHAPTER 1 - INTRODUCTION

1.1 - STUDY BACKGROUND

A major requirement of the bidding procedure for public highway construction contracts is the setting of the contract completion time for a project. This can be done either by setting an actual completion date for the project or by setting a working time allowance for the project. The work time allowance can be defined either in terms of calendar days or actual workdays. Although some projects have a set date for completion, most highway projects are bid with a workday allowance, with a wide variation in practices used by transportation agencies to estimate this completion time requirement. Until recently, most states used a system heavily dependent on the experience of their senior engineering staff to set the work time allowance. Except for very large or complicated projects where Critical Path scheduling was used, this practice has also been followed by most districts of the Texas Department of Transportation (TxDOT).

Contract completion times were not a major problem for TxDOT for many years, with most of the times set being quite reasonable for contractors. However, in recent years there has been a marked increase in litigation by contractors who have been cited for liquidated damages due to project delays. As a matter of fact there are now many consulting firms who specialize in assisting contractors prepare "as built" CPM schedules; these firms claim that delays were actually caused by TxDOT. Although the districts have been using graphs, tables, rules of thumb, etc. to estimate project completion times, such methods have not stood up to the cases presented by the contractors. The result has been a considerable loss of money because of such litigation.

In the fall of 1991 the Federal Highway Administration issued a requirement that all state departments of transportation must have a formal method for establishing contract durations for federally-funded highway projects. TxDOT was able to report that it had already initiated a research study with the Texas Transportation Institute to develop such a system, and that it had implemented a manual method for contract time determination as an interim part of the study.

The goal of this research was to develop a rational procedure using quantities of major work items, production rates, and related factors for different types of construction projects in Texas. This goal was accomplished through developing a computerized method for estimating project completion time and through developing production rates based on Texas data supplemented with data on rates from other states. This report describes the method in detail, demonstrates how to use the program with a detailed example project, and discusses procedures for updating the system.

1.2 - CURRENT PRACTICES IN DOT'S

There are several scheduling techniques used by transportation agencies to determine how much contract time to allow for construction projects. These range in complexity from simple predictions of senior engineers based on past experience with similar projects, to bar charts, to Critical Path networks, to linear scheduling models. Although the CPM and linear scheduling models have been available for many years, prior research on the scheduling of transportation projects has revealed little use of these methods. Most of the scheduling, especially for setting contract duration, is based on simple prediction techniques or bar charts based on standard production rates. (Arditi, 1986; Herbsman, 1987; Rowings and Hancher, 1981)

The construction engineers of the departments of transportation of all 50 states and the District of Columbia were surveyed as part of this research. They were all sent a letter requesting information on the system(s) that their agencies used to establish contract time durations and any production rate data that they use. Responses were received from 38 separate agencies, plus several were contacted by telephone for additional information. Of the 38 responses many different practices were outlined, some in very clear detail with many production rates for standard work items, and several not so clear. The data shown in Table 1 represents the breakdown of the prevalent methods used by the 38 respondents to establish the contract duration for highway construction projects. As can be seen, 58 percent use bar charts, 18 percent use senior personnel judgement, 13 percent use historical data in tables or curves, and 11 percent use CPM.

TABLE 1 **Methods Used by DOTs to Establish Contract Time Duration for Highway Construction Projects**

METHOD	NUMBER USING	PERCENTAGE
Bar Chart (no prod rates)	3	8%
Bar Chart (production rates)	19	50%
Critical Path Methods	4	11%
Tables or Curves (time vs cost or quantities for project types)	5	13%
Judgement of Senior Personnel	7	18%
Total =	38	100%

A similar survey of transportation agencies was conducted recently by Dr. James E. Rowings, Department of Civil and Construction Engineering, Iowa State University, in a research study for the Iowa DOT. He received responses from 36 DOTs and shared the following results about the scheduling practices of various agencies. Fourty-four percent determine the project duration based on personal experience and judgement, depending on project type, size, and complexity, 30 percent use standard production rates, and 22 percent use past projects and historical records. Only 4 percent use CPM to establish contract durations. Fifty-three percent indicated that they did not utilize computers for scheduling; of those who do, 56 percent use microcomputers. Primavera and Supertrack were the software used by most. (Rowings, 1992)

Although the two surveys do not match up directly on questions, it is obvious that judgement and bar charts are much more used techniques than CPM network methods, except for complex projects. Since the setting of contract time is really a conceptual scheduling problem and not a detailed construction scheduling issue, it is not surprising that more use the bar chart technique. It is much easier for most persons to use bar charts than CPM for highway

1.3 - EXISTING SCHEDULING SOFTWARE

There are many software packages available for construction project scheduling with a wide range of applications and cost. Probably the most popular system used is Primavera, which is a sophisticated system with many special applications and a price ranging from $3,000 to $5,000 depending on the features wanted. There are also several software in the $500 price range available which will do both bar charts, CPM networks and some project management functions. Microsoft Project is a popular system in this category and is now available with Windows. Rowings found that several DOTs were using Supertrack. TxDOT is currently using Super Project Expert as the scheduling software for its Pre-Construction Management System. A new version of Super Project Expert was issued during the study and is now called SuperProject. This new software and Microsoft Project were the two systems studied for this project because of their bar charting capabilities and for their price and user friendliness.

1.4 - TxDOT CONTRACT TIME DETERMINATION SYSTEM (CTDS)

The final product of this research project is the TxDOT Contract Time Determination System (CTDS). The system was developed to complement the existing TxDOT Pre-Construction Management System. The CTDS is a conceptual estimating system for predicting contract time for highway construction projects and is not to be used for the detailed planning of actual construction activities for a project. It is a bar chart scheduling system based on standard work items for each project class with the flexibility to add other work items as desired. It includes both a manual method and a computerized method.

The CTDS user supplies actual work quantities for a project and by applying standard production rates, or preferred rates, a contract duration is established. The system has been designed to allow the districts to use production rates specific to their operations due to the wide variation in production situations in Texas. The computer version of the system was based on existing software already used for the Pre-Construction Management System, including Lotus 123, Flash-Up, and SuperProject. The remainder of this report will detail the system developed.

CHAPTER 2 - CONTRACT TIME DETERMINATION SYSTEM FOR TxDOT

2.1 - SELECTION OF BASIC SYSTEM

There are several methods available for estimating the allowable contract time to set for a highway construction project. Practices used in different departments of transportation were discussed in Section 1.2 of this report. They range in complexity from estimates based on the intuition and judgment of experienced personnel, to time-cost curves, to bar charts to detailed CPM schedules for complex projects.

An important fact to remember when developing a system for determining a feasible contract time for highway projects is that it is a conceptual scheduling system, not a detailed construction scheduling system. The purpose is not to develop a schedule for the contractor to follow to build the job, which is the responsibility of the contractor. A construction schedule includes many activities and is highly dependent on the methods and resources used by the person building the job. The DOT is trying to establish a reasonable period of time to allow for the contract, which is controlled by fewer more critical activities. It also takes a great deal of time to develop a detailed construction schedule, much more than is usually available for most contract document preparation periods. Occasionally, very detailed schedules are developed for large and complex projects, but these are certainly atypical of most projects.

The system developed was based on the project classification system used for TxDOT's design project management system. There are fourteen (14) different classes of projects identified for the system:

The Fourteen Categories of TxDOT Highway Projects

1.	SC	Seal Coat
2.	OV	Overlay
3.	RER	Rehabilitate Existing Road
4.	CNF	Convert Non-Freeway to Freeway
5.	WF	Widen Freeway
6.	WNF	Widen Non-Freeway
7.	NLF	New Location Freeway
8.	NNF	New Location Non-Freeway
9.	INC	Interchange
10.	BWR	Bridge Widening/Rehab
11.	BR	Bridge Replacement
12.	UPG	Upgrade Freeway to Standards
13.	UGN	Upgrade Non-Freeway to Standards
14.	MSC	Miscellaneous Construction

Since the last category is not for a specific type of project, only the first thirteen classes were used for the TxDOT Contract Time Determination System (CTDS).

Another major decision was the selection of the basic scheduling system to use for CTDS. Many state DOTs currently use bar charts for their systems, as do several of the TxDOT District Offices. Although many states use the Critical Path Method for complex projects, few use it for routine projects due to the extra work involved to prepare a schedule. Since most highway projects are linear in nature, with some overlap between the finish of the preceding activity and the start of a following activity, some are proposing Linear Scheduling Methods. However, it was decided that CPM and LSM are better for detailed scheduling and too cumbersome for conceptual scheduling.

It was decided to base CTDS on a bar chart approach. Standard work items with established relationships were determined for each of the thirteen categories. This decision was made because of the wide familiarity of bar charts plus the ease in training persons to develop them. A computerized system was developed to encourage usage, but a manual system was also developed.

2.2 - MAJOR WORK ITEMS AND RELATIONSHIPS

Major work items and their relationships to each other were developed for each of the thirteen categories of highway projects. Early attempts to determine those activities which controlled the major flow of work on a project became bogged down in minutia. It was necessary to back up and remember that the system was to be a conceptual one and not a detailed one. To assist in identifying these major work items and relationships, the assistance of personnel from the Bryan District Office who set contract times was solicited. Bob Richardson and Ray Meier readily volunteered and were invaluable in setting up the system. Input was also sought from other areas of the State by setting up a liaison committee for the study from nine other districts (see the Preface), plus Khali Persad from D8.

The Major Work Items and Relationships selected for the standard project categories are listed in Appendix A of the report. Note that some work items may not be included in a specific project, if so then their duration would be set as 0 (zero) for that project. Also note the percentages listed in the right hand column. This signifies the percentage of the preceding activity that is completed before the following activity is started. For example note that for an OVERLAY project, Work Item 2, Detour, is preceded by Work Item 1, Initial Traffic Control, by 100% which means that the Initial Traffic Control is completely finished before starting the Detour activity. The percentage is referred to as the "lag" in standard CPM terminology and a 100% lag would result in a Finish to Start relationship.

2.3 - SELECTION OF SYSTEM SOFTWARE

The decision to set up CTDS so it could be facilitated on a computer system necessitated the selection of standard software packages to be used. A search was made for a software package that had good bar chart capabilities and also could revert to a CPM schedule from the bar chart once developed. Microsoft Project was originally selected for its excellent bar charting capabilities, but was later rejected since it requires the Windows software for optimal use. This would result in too much computer storage required. Therefore, SuperProject, which also had a very good bar chart system, was selected. It is already used in the TxDOT Pre-Construction Management System and is owned by most of the district offices.

SuperProject does have one weakness that was discovered late in the study. It does not allow multiple relationships between activities, a very unexpected weakness since this is standard in most CPM programs, but is not felt to be a serious problem for CTDS since it is a conceptual system. This weakness will not impact the schedule as long as care is taken to insure that no following activity is shown to finish before its predecessor. This can be avoided by making sure that the percentage value (lag) on the relationship is high enough (100% assures no problem) to prevent this occurrence. The developers of SuperProject are aware of this minor problem and hopefully will update the program to alleviate it in the future.

Lotus 123 was used as the data base/spreadsheet software system for CTDS to handle the storage and manipulation of productivity data for the standard work items and standard project schedules. This was done because of the widespread use of Lotus 123 in engineering practice and since most TxDOT Districts already have it in their offices. CTDS also uses the software package Flash-Up to allow Lotus 123 and SuperProject to communicate. It was chosen because it is inexpensive and also is used in the existing design project management system. It is important to note that CTDS must be used with Version 2.0 of Lotus 1-2-3, Version 3.05 of

Flash-up, and Version 2.0 of SuperProject. (No version of Flash-up is currently available that is compatible with later versions of Lotus 1-2-3.)

2.4 - ESTIMATING DURATIONS OF LARGE AND COMPLEX PROJECTS

The procedure presented in this report can be used to estimate contract time for large, complex projects. However, for large and complex projects it may be desirable to develop a detailed CPM schedule, perhaps using outside consultants, but standard schedules may be hard to establish due to the uniqueness of each project. This approach requires an in-depth analysis of the work to be performed, special constraints on the work, traffic handling and detour plans, weather impacts, and resource constraints. Detailed development of a schedule using a bar chart with interrelationships noted would also be possible. Many suitable and inexpensive computer software packages for CPM analyses are available and many are now used by different District offices of TxDOT for detailed, complex projects.

Again, it must be remembered that the purpose is to determine a reasonable contract time for a project. The contractor should develop the detailed construction schedule for the project based on milestones, schedule constraints, work restrictions and completion dates defined in the contract specifications by TxDOT.

CHAPTER 3 - PRODUCTION RATE DATA FOR CTDS

3.1 - DATA FROM OTHER STATE DOT'S

Production rate data for highway construction projects was requested from all 50 state DOTs as part of the research effort. As was discussed in Section 1.2 of this report 38 responses were received back with information about their system for establishing contract time for projects. Of those responses only 24 supplied production rate data that was used in their system. The data received from several was quite minimal with several states simply sending a copy of the FHWA Technical Advisory of October 11, 1991 which outlined the need for a formal procedure for contract time determination and gave several example production rates. At least 12 of the respondents had very detailed production data; example data from Idaho and Michigan are included in Appendix B-1. Instructions on how the data is used to develop a contract time allowance were not clear, as expected, since experience on the part of the planner is needed to set a basic schedule for a project and select the appropriate production rates to estimate the time requirements for key activities.

Several interesting items on productivity were received from a few states. Some have developed production curves for major work items similar to those shown in Appendix B-2 for Maryland and Alaska. New Mexico has an interesting system to predict contract time based on the estimated project cost with adjustments for project characteristics and cost indices. Although it is uncertain how effective the system is, it is easy to apply. The New Mexico system is shown in Appendix B-3. New Jersey has an interesting system for predicting the time required for bridge projects as shown in Appendix B-4. The FHWA memorandum also gave some data on bridge rates per span. The problem with such systems is that they can be used only for standard types of bridges and conditions, and the user must know the bases for the data to avoid errors. A more detailed bridge time prediction system was used for CTDS, and it is believed to be more accurate for most Texas applications.

A major issue with any production data is the basis for the data. Do the production rates include only the time to do the specific work item or is the time to do related activities also included? For instance consider the placing of concrete in bridge decks; does the rate given include only the time to actually place and finish the concrete or does it also include time for forming, placing steel and proper curing? Dramatically different time estimates can be predicted from such rates and it is essential that the user know the basis of the rates used. This is especially critical for a conceptual system such as CTDS where the activities are broad in definition and include all the work efforts associated with a major element of the highway or bridge project being scheduled.

3.2 - DATA FROM TxDOT DISTRICTS

Production rate data was also solicited from all TxDOT Districts for developing base production rates for the major work items used in CTDS. A comprehensive list of the work items included on all thirteen project categories was put on a single form and is included in Appendix C as Attachment #1. Daily production rates in the units shown were requested for these items with estimates asked for low, average and high rates typical for TxDOT projects. For those work items at the bottom of Attachment #1 which are lump sum time estimates, the respondents were asked to give a low, average and high estimate of the workdays typically required to do these activities. In all 43 persons responded to the survey but not all questions were answered, with most of the items only having 35 or less responses. The averages for each of the production estimates are shown in Table 3.1.

Production rates for construction are highly variable with almost an infinite array of possible values for every work item considered. Depending on many variables such as location, weather, labor conditions, site conditions, traffic, and state of the economy, production rates can not be standardized easily. Data need to be collected and stratified for all important variables to be meaningful, especially for detailed scheduling of construction. Such an effort was beyond the scope of this project; however, the initial data collected will serve as the base for CTDS and continued data collection may now be encouraged since there is an obvious beneficial application of the data.

One method to determine feasible production rates for projects is to adjust the standard production rates by correction factors which indicate the change in production rate for different job conditions. This would entail the identification of all factors impacting a work item's production and quantifying this impact for different conditions or values of the factors. For a detailed construction scheduling system this detailed level would be required and would take considerable data collection to develop. However, for the conceptual CTDS such an effort was not considered feasible. Therefore, five common factors that impact most construction projects were selected and TxDOT personnel surveyed were also asked to indicate which factors impacted individual work items on Attachment #1. In summary of all responses almost every factor was indicated for each work item.

The correction factors selected for CTDS were Location, Traffic Conditions, Complexity, Soil Conditions and Quantity of Work. Attachment #2 in Appendix C was included in the survey with persons requested to estimate the impact of each factor on project production for different levels of the correction factors. Base conditions for the correction factors were set as "rural" location, "light" traffic, "low" complexity, "good" soil conditions, and "large" quantities of work. The average values of the 43 responses received from TxDOT personnel for each of the factors is shown in Table 3.2. Although all of the correction factors are less than 1.0, several respondents set values greater than 1.0 for some of the factors. This is quite possible and should be specific for the conditions of the project of concern in the appropriate TxDOT District.

More discussion of the application of the job correction factors for the TxDOT Contract Time Determination System is presented in Section 3.6 of this report.

TABLE 3.1 TxDOT Personnel Responses

DAILY PRODUCTION RATES FOR STANDARD WORK ITEMS

		DAILY PRODUCTION RATE		
MAJOR WORK ITEMS	UNIT	LOW	AVERAGE	HIGH
ROW Preparations				
- Clear and grub	Sta.	8.6	19.1	29.8
- Remove old pavement	S.Y.	871	1,638	3,045
- Remove old curb & gutter	L.F.	602	1,435	2,111
- Remove old sidewalks	S.Y.	313	615	1,395
- Remove old drainage/utility str.	L.F.	174	391	712
Earth excavation	C.Y.	1,527	3,841	8,117
Rock excavation	C.Y.	536	1,411	3,032
Embankment	C.Y.	1,380	3,569	7,296
Bridge Structure(s)				
- Cofferdams	S.Y.	115	219	379
- Footings & Piers	C.Y.	18.3	41.2	73.5
- Caps & Bents	C.Y.	14.6	27.7	50.0
- Beams	C.Y.	21.9	42.3	69
- Slabs	S.Y.	229	548	1,122
- Railings	L.F.	145	418	715
Drainage Structures/Storm Sewers				
- Pipe	L.F.	118	281	554
- Box culverts	C.Y.	17.4	40.3	92.9
- Inlets & manholes	Each	1.16	2.62	4.92
Retaining walls	S.F.	177	382	709
Base Preparations				
- Lime stabilization	S.Y.	1,795	4,104	6,734
- Flexible base material	S.Y.	1,870	4,820	8,108
- Cement treated base material	S.Y.	2,161	4,396	8,113

TABLE 3.1 TxDOT Personnel Responses
(cont.) DAILY PRODUCTION RATES FOR STANDARD WORK ITEMS

		DAILY PRODUCTION RATE		
MAJOR WORK ITEMS	UNIT	LOW	AVERAGE	HIGH
New curb and gutter	L.F.	374	820	1,810
Asphalt pavement repair	S.Y.	141	352	574
Concrete pavement repair	S.Y.	93	209	307
Hot mix asphalt base	Ton	872	1,751	3,178
Hot mix asphalt surface	Ton	797	1,642	3,040
Asphalt surface treatment	S.Y.	23,646	51,510	82,964
Concrete paving	S.Y.	1,832	5,020	8,801
Permanent concrete traffic barriers	L.F.	575	1,493	2,568
Permanent Signing and Traffic Signals				
- Small signs	Each	9.1	19.3	33.0
- Overhead signs	Each	0.92	1.88	3.17
- Major traffic signals	Each	0.19	0.36	0.76
Permanent pavement markings	L.F.	21,967	41,369	67,177
Seeding and landscape	S.Y.	2,572	5,293	8,238
Final clean-up	Sta.	13.6	27.4	51.3

		DURATION IN WORKDAYS		
MAJOR WORK ITEMS	UNIT	LOW	AVERAGE	HIGH
Initial traffic control	L.Sum	1.1	2.2	4.5
Detour	L.Sum	3.7	7.4	13.5
Major structure demolition	L.Sum	6.7	12.3	22.6
Remove old structures (small)	L.Sum	1.4	3.0	5.8
Bridge demolition	L.Sum	5.5	12.2	23.3
Erect temporary bridges	L.Sum	11.7	17.8	29.8
Remove temporary bridges	L.Sum	3.5	6.4	10.9

TABLE 3.2 TxDOT Personnel Evaluation of Adjustment Factors

FACTORS	ADJUSTMENTS FOR NOTED CONDITIONS		
LOCATION:	**rural** = 1.00	**small city** = 0.87	**big city** = 0.68
TRAFFIC CONDITIONS	**light** = 1.00	**moderate** = 0.86	**high** = 0.61
COMPLEXITY:	**low** = 1.00	**medium** = 0.86	**high** = 0.62
SOIL CONDITIONS:	**good** = 1.00	**fair** = 0.85	**poor** = 0.62
QUANTITY OF WORK:	**large** = 1.00	**medium** = 0.90	**small** = 0.74

3.3 - DATA FROM TEXAS HIGHWAY CONSTRUCTORS

The same survey forms on work item production rates and correction factors, plus a complete listing of the standard project categories, the major work items for each category and their relationships, were sent to 50 of the largest contractors doing business with the Texas Department of Transportation requesting their input. Shortly after sending out the requests to the contractors, a letter was received from the President of the Highway, Heavy, Utilities & Industrial Branch of AGC of Texas noting that several of their members had received our request for information. The letter stated that AGC felt it was more productive to meet with a subcommittee of their group to discuss this issue than to fill out questionnaires. Several attempts were made to set up meetings with this group but all attempts were unsuccessful. One survey response was a complete one from an out-of-state contractor who does work in Texas, the second response was partially completed by a non-AGC contractor, while the third response was from another out-of-state contractor who did not complete the survey. Therefore, almost no input was received from contractors, although the rates used in the system were in reasonable agreement with those proposed by the one contractor who did complete the entire survey.

3.4 - DESCRIPTION OF WORK INCLUDED IN MAJOR WORK ITEMS

All of the work items used in CTDS to identify major segments of the work on various projects include all of the preparation, installation and final adjustment operations that pertain to the work item. These are referred to as "major work items" for the system and do not include all work items for a project, but only those believed to control the typical project schedule. A brief description of each work item and its unit of measure is given below.

3.4.1 - MAJOR WORK ITEMS EXPRESSED IN TERMS OF A UNIT

ROW Preparations:

Clear and grub (Acres): The removal of top soil, small trees, minor physical objects and other vegetation from the construction site using mechanical equipment.

Remove old pavement (S.Y.): The identification, breakout and removal of old pavement from the construction site using mechanical equipment.

Remove old curb & gutter (L.F.): The breakout and removal of old curb and gutter from the construction site using mechanical equipment.

Remove old sidewalks (S.Y.): The breakout and removal of old sidewalks from the construction site using mechanical equipment.

Remove old drainage/utility str. (L.F.): The breakout and removal of old drainage and utility systems from the construction site using mechanical equipment.

Earth excavation (C.Y.): The removal and transporting of in situ soils on the construction site using mechanical equipment.

Rock excavation (C.Y.): The removal and transporting of in situ rock deposits on the construction site using mechanical equipment.

Embankment (C.Y.): The placing and compaction of soil on the construction site using mechanical equipment.

Drainage Structures/Storm Sewers:

Pipe (L.F.): The excavation, installation and backfilling of drainage or sewer pipe systems on the construction site using manufactured pipe.

Box culverts (C.Y.): The excavation, installation and backfilling of cast in place concrete box culverts on the construction site. If using precast units, then the units should be changed to L.F. and appropriate production rates substituted.

Inlets & manholes (Each): The installation of premanufactured inlets and manholes for drainage or sewer systems on the construction site.

Bridge Structures: (NOTE: The production rates on several items appear low since they must include time for the total scope of activities necessary to complete an item.)

Cofferdams (S.Y.): The installation, dewatering and minor excavation associated with building a cofferdam system for a bridge construction site.

Piling (L.F.): The installation of piling for bridge foundations.

Footings (C.Y.): The layout, forming, reinforcing, placing, curing and removing forms for reinforced concrete bridge footings.

Columns, Caps & Bents (C.Y.): The layout, forming, reinforcing, placing, curing and removing forms for reinforced concrete bridge columns, caps and bents.

Wingwalls (S.F.): The layout, forming, reinforcing, placing, curing and removing forms for reinforced concrete wingwalls for bridges.

Beams (erection only) (L.F.): Erection of premanufactured bridge beams by crane.

Bridge deck (total depth) (C.Y.): The layout, forming, reinforcing, placing, curing and removing forms for reinforced concrete bridge decks. The production rates have been set to include time for all components of the deck, including precast plank under slab, thus the full depth of the deck is used to calculate quantity.

Bridge curbs/walks (L.F.): The layout, forming, reinforcing, placing, curing and removing forms for reinforced concrete bridge curbs and walkways.

Bridge handrails (L.F.): The layout, forming, reinforcing, placing, curing and removing forms for cast in place reinforced concrete bridge handrails.

Retaining walls (S.F.): The layout, excavation, forming, reinforcing, placing, curing and removing forms for cast in place reinforced concrete retaining walls.

Base Preparations:

Lime stabilization (S.Y.): The placement, mixing and compaction operations involved in the lime stabilization of highway subgrade soils.

Flexible base material (S.Y.): The placement and compaction of flexible base material.

Cement treated base material (S.Y.): The placement, mixing and compaction of cement treated base materials.

New curb and gutter (L.F.): The layout and construction of new roadway curb and gutter using automated equipment.

Asphalt pavement repair (S.Y.): The removal and replacement of sections of unsatisfactory or failed asphalt concrete pavement.

Concrete pavement repair (S.Y.): The removal and replacement of sections of unsatisfactory or failed portland cement concrete pavement.

Milling/planing (S.Y.): The removal of the surface level of existing pavements using automated milling or planing equipment.

Hot mix asphalt base (Ton): The laydown and compaction of hot mix asphalt concrete base course material.

Hot mix asphalt surface (Ton): The laydown and compaction of hot mix asphalt concrete surface course material.

Asphalt surface treatment (1 course) (S.Y.): The application of liquid asphalt to an existing roadway followed by the spreading and rolling of fine aggregate materials to form an improved roadway surface, often referred to as a Chip and Seal operation.

Concrete paving (rebar + curing) (S.Y.): The layout, reinforcing, placing, curing and jointing of portland cement concrete pavement.

Precast traffic barriers (L.F.): The layout and installation of precast concrete traffic barriers. If barriers are to be cast in place, then the units should be changed to C.Y. and the production rates adjusted accordingly.

Permanent Signing and Traffic Signals:
Small signs (Each): The installation of small highway information and warning signs mounted on metal posts driven into soil along a highway.

Overhead signs (Each): The installation of large highway information and directional signs mounted on metal frames over a highway. It is assumed that the footings and poles that support the frames are already in place.

Major traffic signals (Each): The installation of automated traffic signals and their support systems at highway intersections. It is assumed that the footings for the supports are already in place.

Pavement markings (L.F.): The application of thermoplastic pavement marking materials to a highway pavement. If the markings are made using paint or reflectors, then the production rates need to be adjusted accordingly.

Seeding and landscape (S.Y.): The seeding of grasses, planting of small plants, and the application of protective materials along a highway using high production techniques.

Final clean-up (Sta.): The removal of debris, dirt and other construction materials from a highway pavement and adjacent right of way at the end of a construction project.

3.4.2 - MAJOR WORK ITEMS ESTIMATED AS A LUMP SUM UNIT (WORKDAYS)

Initial traffic control (WKDAYS): The establishment of the initial traffic control system components (barricades, flashers, signs, flagpersons, etc.) necessary on a new project prior to the start up of construction operations.

Detour (WKDAYS): The establishment of the initial traffic detour system components (concrete traffic barriers, temporary pavement run-arounds or crossovers, etc.) necessary on a new project prior to the start up of construction operations.

Major structure demolition (WKDAYS): The demolition and removal of the materials for large structures (multi-story buildings, retaining walls, towers, underground tanks, etc.) from the right of way of new construction projects.

Remove old structures (small) (WKDAYS): The demolition and removal of the materials for small structures (single-story wood buildings, storage sheds, fences, road signs, etc.) from the right of way of new construction projects.

Bridge demolition (WKDAYS): The demolition and removal of all materials for an existing bridge structure and related appurtenances (approaches, gates, signals, etc.).

Erect temporary bridge (WKDAYS): The layout and construction of a temporary bridge structure and related appurtenances for a highway construction project.

Remove temporary bridges (WKDAYS): The demolition and removal of all materials for a temporary bridge structure and related appurtenances for a highway construction project.

3.5 - SELECTED PRODUCTION RATES FOR MAJOR WORK ITEMS

The Contract Time Determination System was developed so that Districts could substitute their own data for standard production rates or select project specific rates. This flexibility also applies to the job correction factors that may or may not be used to adjust standard production rates for specific project conditions. CTDS was set up with default values for the production rates for each major work item that existed on any of the thirteen project standard schedules, plus two sensitivity factors were selected for each work item to be used if the job correction option was desired by the user. The system can be modified by the user to utilize other desired production rates or correction factor values.

Three daily production rates were established for each major work item, a low, average and high value. These values were developed from the data supplied by other state departments of transportation and from the data obtained in the study surveys. These daily production rates are listed in Table 3.3. From the data in Table 3.3 a single base production rate was established as the default value in CTDS for the production rate of each work item. These Daily Production Base Rates plus the Sensitivity Factors for each work item are shown in Table 3.4. Obviously, the lump sum work items at the bottom of the table have Base Durations in Workdays instead of production rates.

TABLE 3.3 Daily Production Rates for Standard Work Items (includes "total workdays" to complete each item)

MAJOR WORK ITEMS	UNIT	DAILY PRODUCTION RATE LOW	AVERAGE	HIGH
ROW Preparations				
- Clear and grub	Acres	1.0	3.0	6.0
- Remove old pavement	S.Y.	1,000	2,000	3,000
- Remove old curb & gutter	L.F.	600	1,200	2,000
- Remove old sidewalks	S.Y.	350	700	1,100
- Remove old drainage/utility str.	L.F.	100	300	500
Earth excavation	C.Y.	1,200	3,400	7,000
Rock excavation	C.Y.	500	1,100	1,500
Embankment	C.Y.	1,200	3,500	7,000
Drainage Structures/Storm Sewers				
- Pipe	L.F.	100	200	300
- Box culverts	C.Y.	10	15	25
- Inlets & manholes	Each	1	2	3
Bridge Structure				
- Cofferdams	S.Y.	100	200	300
- Piling	L.F.	200	300	400
- Footings	C.Y.	10	15	20
- Columns, Caps & Bents	C.Y.	4	7	10
- Wingwalls	S.F.	100	150	200
- Beams (erection only)	L.F.	150	200	250
- Bridge deck (total depth)	C.Y.	6	10	14
- Bridge curbs/walks	L.F.	50	80	120
- Bridge handrails	L.F.	150	200	300
Retaining walls	S.F.	100	150	200
Base Preparations				
- Lime stabilization	S.Y.	2,000	4,000	6,000
- Flexible base material	S.Y.	1,500	3,000	4,500
- Cement treated base material	S.Y.	1,500	3,000	4,500

TABLE 3.3 (cont.) Daily Production Rates for Standard Work Items

MAJOR WORK ITEMS	UNIT	DAILY PRODUCTION RATE LOW	AVERAGE	HIGH
New curb and gutter	L.F.	300	500	1,000
Asphalt pavement repair	S.Y.	100	200	300
Concrete pavement repair	S.Y.	50	100	200
Milling/planing	S.Y.	5,000	10,000	14,000
Hot mix asphalt base	Ton	500	1,200	2,000
Hot mix asphalt surface	Ton	500	1,200	2,000
Asphalt surface treatment (1 course)	S.Y.	30,000	50,000	70,000
Concrete paving (rebar + curing)	S.Y.	1,000	3,000	5,000
Precast traffic barriers	L.F.	500	1,000	1,500
Permanent Signing and Traffic Signals				
- Small signs	Each	10	20	30
- Overhead signs	Each	1.0	1.5	3.0
- Major traffic signals	Each	0.2	0.3	0.7
Pavement markings	L.F.	5,000	10,000	20,000
Seeding and landscape	S.Y.	2,000	4,000	7,000
Final clean-up	Sta.	10	30	50

MAJOR WORK ITEMS	UNIT	DURATION IN WORKDAYS LOW	AVERAGE	HIGH
Initial traffic control	L.Sum	1	2	4
Detour	L.Sum	3	6	12
Major structure demolition	L.Sum	5	10	20
Remove old structures (small)	L.Sum	1	3	5
Bridge demolition	L.Sum	5	15	30
Erect temporary bridge	L.Sum	10	15	25
Remove temporary bridges	L.Sum	5	10	15

TABLE 3.4 CTDS Base Production Rates and Sensitivity Factors (includes "total workdays" to complete each item)

MAJOR WORK ITEMS	UNIT	DAILY PRODUCTION BASE RATE	SENSITIVITY FACTORS
ROW Preparations			
- Clear and grub	Acres	4.0	l t c **S** **Q**
- Remove old pavement	S.Y.	2,200	**L** t c s q
- Remove old curb & gutter	L.F.	1,200	**L** t c s q
- Remove old sidewalks	S.Y.	700	**L** t c s q
- Remove old drainage/utility str.	L.F.	350	**L** t c **S** q
Earth excavation	C.Y.	4,200	l t c **S** **Q**
Rock excavation	C.Y.	1,200	l t c **S** **Q**
Embankment	C.Y.	4,200	l t c **S** **Q**
Drainage Structures/Storm Sewers			
- Pipe	L.F.	225	**L** t c **S** q
- Box culverts	C.Y.	16	l t c **S** q
- Inlets & manholes	Each	2	**L** t c **S** q
Bridge Structure			
- Cofferdams	S.Y.	225	l t **C** **S** q
- Piling	L.F.	325	l t c **S** q
- Footings	C.Y.	16	l t c **S** q
- Columns, Caps & Bents	C.Y.	8	l t **C** s **Q**
- Wingwalls	S.F.	160	l t c **S** q
- Beams (erection only)	L.F.	200	**L** t c s q
- Deck slab (plus curing)	C.Y.	12	l t **C** s **Q**
- Bridge curbs/walks	L.F.	90	l t c s **Q**
- Bridge handrails	L.F.	225	l t c s **Q**
Retaining walls	S.F.	160	l t c **S** q
Base Preparations			
- Lime stabilization	S.Y.	4,500	l t c **S** **Q**
- Flexible base material	S.Y.	3,400	**L** t c s **Q**
- Cement treated base material	S.Y.	3,400	l t c **S** **Q**

TABLE 3.4 (cont.) CTDS Base Production Rates and Sensitivity Factors (includes "total workdays" to complete each item)

MAJOR WORK ITEMS	UNIT	DAILY PRODUCTION BASE RATE	SENSITIVITY FACTORS
New curb and gutter	L.F.	700	L t c s Q
Asphalt pavement repair	S.Y.	225	l T C s q
Concrete pavement repair	S.Y.	125	l T C s q
Milling/planing	S.Y.	11,000	l T c s Q
Hot mix asphalt base	Ton	1,400	L t c s Q
Hot mix asphalt surface	Ton	1,400	l T c s Q
Asphalt surface treatment (1 course)	S.Y.	56,000	l T c s Q
Concrete paving (rebar + curing)	S.Y.	3,400	L t c s Q
Precast traffic barriers	L.F.	1,200	l t c s Q
Permanent Signing and Traffic Signals			
- Small signs	Each	20	L t c s q
- Overhead signs	Each	1.5	L t c s q
- Major traffic signals	Each	0.4	L T c s q
Pavement markings	L.F.	12,000	l t c s Q
Seeding and landscape	S.Y.	5,000	l t c s Q
Final clean-up	Sta.	35	l t c s Q

MAJOR WORK ITEMS	UNIT	BASE DURATION IN WORKDAYS	SENSITIVITY FACTORS
Initial traffic control	L.Sum	2	L T c s q
Detour	L.Sum	6	L T c s q
Major structure demolition	L.Sum	10	L t c s q
Remove old structures (small)	L.Sum	3	L t c s q
Bridge demolition	L.Sum	15	L t c s q
Erect temporary bridge	L.Sum	15	L t c s q
Remove temporary bridges	L.Sum	10	L t c s q

3.6 - PRODUCTION RATE ADJUSTMENT FACTORS

Listed below are five factors that were selected as the most common impactors of the production rates of major work items on TxDOT highway projects. Each factor was classified into three conditions of project characteristics which were used to set adjustments to production rates accordingly. For each factor, the first condition note below (e.g. **rural** for Location, **light** for Traffic conditions, **low** for Project Complexity, **good** for Soil Conditions and **large** for Quantity of Work) was also the basis used to set the daily production rates for the standard work items used in the contract time determination system.

The estimation of the impact of the different conditions used will vary significantly for different persons depending on their own situation and experience. There are many factors which could be used; however, the five selected for this system were believed to be sufficient. Except for Complexity, most of the conditions listed are common descriptors. Complexity refers to the technical difficulty of the project requirements and unusual site conditions which may reduce productivity, e.g. utilities, existing structures, work space, access to existing businesses, railroads. The values shown below in Table 3.5 were determined as a composite of all the values submitted by several TxDOT employees and others; persons using the system should use their own values if they disagree with the default values given.

It is known that most of these factors are correlated and not truly independent, thus when using the values to adjust production rates, **it is highly recommended that only 2 Sensitivity Factors maximum be selected for each work item.** If the user disagrees with the factors used for the Basic Production Rates and Sensitivity Factors used for default values in the system, then they should use their own. The use of the adjustment factors will be illustrated with the following example. Embankment work has a base production rate of 4200 cyds per day and the sensitivity factors for Embankment are Soils and Quantity. If the project conditions are fair soil (0.85) and medium quantity (0.88), then the adjusted production rate would be:

"Embankment Daily Production" = 4200 x 0.85 x 0.88 = 3142 cyds

TABLE 3.5 Default Values for CTDS Job Correction Factors

FACTORS	ADJUSTMENTS FOR NOTED CONDITIONS		
LOCATION:	**rural** = 1.00	**small city** = 0.85	**big city** = 0.75
TRAFFIC CONDITIONS	**light** = 1.00	**moderate** = 0.88	**high** = 0.70
COMPLEXITY:	**low** = 1.00	**medium** = 0.85	**high** = 0.70
SOIL CONDITIONS:	**good** = 1.00	**fair** = 0.85	**poor** = 0.65
QUANTITY OF WORK:	**large** = 1.00	**medium** = 0.88	**small** = 0.75

CHAPTER 4 - MANUAL METHOD FOR CONTRACT TIME DETERMINATION

4.1 - BASIC CONCEPTUAL SCHEDULING PROCEDURE

Chapter 2 of this report outlined the basic elements of the Contract Time Determination System (CTDS) that was developed in this research. The standard set of schedules and the major work items for each of the thirteen classes of TxDOT highway projects was presented along with the relationships between the major work items. Chapter 3 outlined the productivity data developed for each of the major work items used in CTDS. The purpose of this chapter is to outline how to prepare a contract time estimate using a manual procedure; Chapter 5 will outline how to do this using the computer system developed for CTDS. For smaller and simple projects it may be desirable to use the manual procedure, although all contract times can be estimated manually if so desired.

The activities used for each of the thirteen TxDOT project categories are the major ones believed to control the project schedule and are by no means an inclusive list of all the work activities for the project. Time estimates for projects which do not fit the standard classifications will have to be developed specifically for the project. Even for the standard projects, modifications will often be needed for project requirements different from the standard assumptions.

The TxDOT conceptual scheduling procedure (CTDS) being developed is described below as a procedure, or series of basic steps, to follow. The output is to be used by the scheduler, along with their judgment, to set an allowable contract time for a project. An allowance for set-up and clean-up activities has been included for each standard schedule; however, it may often be desirable to add more workdays to the estimated contract duration to allow for contingencies such as bad weather, complexities or other problems that may be anticipated for a specific project. The procedure outlined is the same for either a manual or computer system determination of contract time, except for Steps 5 and 6.

Step 1: Collect Necessary Project Data

The first step is to examine any available information about the specific project such as design drawings, specifications, quantity take-offs, construction site conditions, etc. This step is very important for the scheduler to obtain exact values of quantities of work to be performed and details of any special conditions that might affect the overall project duration.

Step 2: Determine Standard Classification Category of Project

The next step is to determine which of the existing thirteen categories of TxDOT highway projects the specific project falls into; a listing is shown below. If the project fits into Category 1 thru 13, then the scheduler can use the standard schedule for the category as a basis for project. The 14th category, Miscellaneous Construction, is used to classify projects that do not to fit one of the standard classifications. Projects such as these will require special handling to determine the set of work activities to use for estimating the project schedule.

The Fourteen Categories of TxDOT Highway Projects

1. SC Seal Coat
2. OV Overlay
3. RER Rehabilitate Existing Road
4. CNF Convert Non-Freeway to Freeway
5. WF Widen Freeway
6. WNF Widen Non-Freeway
7. NLF New Location Freeway
8. NNF New Location Non-Freeway
9. INC Interchange
10. BWR Bridge Widening/Rehab
11. BR Bridge Replacement
12. UPG Upgrade Freeway to Standards
13. UGN Upgrade Non-Freeway to Standards
14. MSC Miscellaneous Construction

Step 3: Review/Select Activities for Schedule

Once the project type has been identified, it is recommended all of the pre-established activities for that project type be checked to determine if there are any that are not to be performed for that particular project. Such activities will be neglected (assigned a duration of zero) during the procedure. Also, any special activities that are required for the project should be added to the list, with the appropriate sequencing relationships and overlap information. If the project requires phasing, then activities should be identified for each phase of the project and the phases linked sequentially as to be built in the field.

Step 4: Identify Production Rates for Listed Activities

The next step is to check the standard production rates for activities (Chapter 3) to be included in the conceptual schedule. If the scheduler is not satisfied with some of the standard production rates suggested for the particular case, preferred rates should be used. Also, the scheduler should examine the effect of the factors proposed by the system (such as location, complexity, and soil conditions) on these production rates and make any necessary adjustments. If special activities are added to the project schedule, then the scheduler will have to determine the appropriate production rate to use for the activity.

Step 5: Develop Project Schedule (Manual or Computer Method)

The scheduler is now ready to develop the conceptual schedule for the project and can decide to use either the manual method proposed or the computerized system developed. Details of the manual method of scheduling are described later in this chapter, while guidelines for the computer system are presented in Chapter 5. It is believed that the computer system will provide a more convenient method to follow for most projects.

Having obtained an estimate for the total project duration, the scheduler should check the number of working days to see if the total appears reasonable. Depending on the project conditions and constraints, it might be feasible to add more time to allow for contingencies or even to reduce the number of working days allowed, if appropriate. As long as the contract time determined appears to be reasonable, then the time should be used. If the time period appears short, this situation should be checked now before going out for bids. If the time must be shorter due to special project constraints, then the durations must be emphasized in the bid documents so that the bidders can plan accordingly. DO NOT STATE THAT THE TIME IS UNREASONABLE, JUST EMPHASIZE WHAT IT IS!!

Once the final schedule has been determined, an appropriate bar chart or CPM diagram should be produced for the project files and for the use of the project management team. Contractors should be required to submit their own detailed construction schedules for the project and should not use the conceptual schedule since it is only used to set a feasible contract time.

Step 6: Conversion to Calendar Date (Optional)

There may be times when a project milestone date or completion date is desired in addition to the workday schedule. This can be easily accomplished if the project start time is known, the normal work week used, and appropriate holidays are known. If the computer system is being used, this information is already part of the computer output information. If the manual method is used, this information can be readily obtained from calendar information with holidays, weekends and other non-work periods crossed off.

4.2 - Step 5: PROCEDURES FOR MANUAL SCHEDULE CALCULATIONS

The manual process for developing a conceptual schedule for TxDOT highway construction projects differs primarily in Step 5. Although in Step 6 the calendar dates must be calculated by hand, this is straightforward as was just discussed. To implement the manual process, one would first carry out the first four steps as outlined in Section 4.1:

Step 1: Collect Necessary Project Data
Step 2: Determine standard classification category of project
Step 3: Review/Select Activities for Schedule
Step 4: Identify Production Rates for Listed Activities

The manual method for Step 5 will now be outlined utilizing the special worksheet developed as depicted in Figure 4.1 and by referring to the example Overlay Project depicted in Figure 4.2.

Each line on the worksheet is for one work item, or activity, for the project being scheduled. All durations are expressed in terms of workdays. The objective of the process is to determine a Start Time (ST) and Finish Time (FT) for each work item on the worksheet. Start times refer to the morning of that particular workday whereas finish times stand for the evening of the workday. For instance, the third activity of the example project (see Figure 4.2), Remove Old Pavement, has a start time of 5 and a finish time of 14. This means that it starts on the morning of the 5th workday and finishes by the evening of the 14th. The following steps are to be followed to develop a conceptual schedule for a project.

STEP 5a: Calculate Durations of Work Items

The duration of each work item (activity) should be calculated in workdays by either using the lump sum duration identified on the standard schedule, or by dividing the estimated quantity of work by the standard daily production rate used for the activity. **All fractional durations should normally be rounded up to the nearest whole day for use on the schedule**. Again, it should be noted that it will be necessary to convert calendar day information to workdays for the project schedule. For instance, if the utility work is to take two weeks, then this would be represented by 10 workdays for the project schedule, assuming 5 workdays per week.

Refer to the calculations shown in Figure 4.2.

STEP 5b: Calculate Start and Finish Times for Work Items

It is now time to calculate the start and finish times for each of the work items on the project. Unlike Critical Path schedules where the start and finish times are expressed in CPM days, this conceptual method uses workdays. Since this basically is a bar chart system, another difference from CPM is that there is only a single start time (Early Start Time) and a single finish time (Early Finish Time) for each work item. They will simply be referred to as the Start

Time (ST) and the Finish Time (FT).

All work item times are referenced to the morning of the workday; this is fine for start times, but means that all finish times should be converted back to the evening before to avoid confusion. Therefore, the following rules are used to calculate work item times for this conceptual scheduling system:

1. Start Time for First Work Item :

   ST = 1 = Morning of Workday #1

2. Start Time, Work Items with No Overlapping Predecessor :

   ST = [(Largest FT of All Work Items Preceding Them) + 1]

3. Start Time, Work Items with Overlapping Predecessor :

In addition to checking the FT of regular preceding work items, a possible value for the ST is the ST of the preceding work item plus Lag Time when overlapping occurs. The Lag Time is the percentage of completion required multiplied by the duration of the preceding work item, rounded up to whole days.

Predecessor Duration x % Complete = Lag Time

ST = ST of Predecessor + Lag Time

(Use as ST if larger than alternative from Step 2)

4. Finish Time for All Work Items :

   FT (Any Work Item) = [ST + Duration - 1]

NOTE: DO NOT CALCULATE THE START TIME OR FINISH TIME FOR WORK ITEMS WITH A DURATION OF 0 (ZERO) WORKDAYS.

For example, if any activity has two activities which precede it, one with a Finish Time of 25 days and the other of 30 days, then the Start Time for the activity would be [30 + 1 = 31], e.g., Workday 31. If the activity had a 5 day duration, then its Finish Time would be [31 + 5 - 1 = 35], e.g., the evening of Workday 35.

Be sure to watch out for overlapping activities, e.g., those activities which start before their predecessors are completely done, as noted by the percentage shown beside the predecessor's Activity Number; this and other calculations will be illustrated for an example project in Section 4.3.

Having obtained an estimate for the total project duration, the scheduler should check the number of working days to see if the total appears reasonable. Depending on the project conditions and constraints, it might be feasible to add more time to allow for contingencies or even to reduce the number of working days allowed, if appropriate. Finally, a bar chart should be prepared for the project using the start and finish times for the work items on the worksheet. It may be necessary to make adjustments for contingency times or for time reductions for other project constraints.

Step 6: Conversion to Calendar Date (Optional)

There may be times when a project milestone date or completion date is desired in addition to the workday schedule. This can be easily accomplished if the project start time is known, the normal work week used, and appropriate holidays are known. For the manual method, this information can be readily obtained from calendar information with holidays, weekends and other non-work periods crossed off.

4.3 - EXAMPLE CALCULATIONS FOR AN OVERLAY PROJECT

The worksheet shown in Figure 4.2 is for an example overlay project which was developed to illustrate how to perform the time calculations for estimating a project completion time.

As a rule, the first work item always starts on the first project workday, e.g. in this project, the Start Time of Set Up Traffic Control is 1 (one). In calculating the finish times, one should take the start time of an activity, add its duration to it, and subtract 1. For Set Up Traffic Control, this equals 1 + 1 - 1, e.g. a FT = 1, which is the evening of the first workday.

To calculate the ST of an activity other than the first one, one should follow the directions outlined in Step 5b in Section 4.2. For example, Work Item 3, Remove Old Pavement, succeeds both Work Items 1 and 2, having FT's of 1 and 4, respectfully. Since it follows both after 100% completion of their work, e.g. these are Finish to Start relationships and no Lag is involved. Therefore, its ST is the larger of (1 + 1 = 2) or (4 + 1 = 5); thus the ST for Work Item 3 is set at 5.

Work Item 3 has an estimated duration of 10 workdays; thus, its Finish Time is calculated as follows: FT = (ST + Duration -1), which equals (5 + 10 - 1 = 14). In other words, to complete this work item, they need to work on the 5th thru the 14th workdays, which is 10 full workdays.

If there is overlapping of work items, then it is not a F-S relationship and a work item may start before its predecessor is completely done (e.g. 100% completed). This is a Start to Start relationship which is usually accompanied by a Lag Time, e.g. the start of the following activity "lags" behind the start of the predecessor activity by a specified number of workdays. The Lag Time is usually expressed as a percentage of the predecessor's duration and is calculated as shown in the Step 5b instructions.

In the example project, Work Item 6, Hot-Mix Asphalt Base, follows both Work Items 3 and 4 upon 80% of their completions. Both work items start on the fifth workday, having durations of 10 and 5 days, respectfully. The Lag Time for Work Item 3 would equal (10 days x 0.80 = 8 days). This is the work time to be completed on Work Item 3 before starting Work Item 6. Considering Work Item 3 as a predecessor, the possible ST of Work Item 6 is (5 + 8 = 13).

Going through the same calculations for the other predecessor, Work Item 4, the possible ST for Work Item 6 is (5 + 4 = 9). Since the largest ST calculated from all of the preceding activities controls, the ST of Work Item 6 is determined to be 13. Similar STs and FTs for the other work items are listed in Figure 4.2.

As a final remark, it is usually not recommended to calculate the Start Time or Finish Time of a work item that has a duration of 0 (zero) days; e.g. in this case, Work Item 5, Concrete Paving. In such a case, the zero activity should not be shown as a predecessor of any other activity for the project, even though it is shown on the CTDS standard schedules. These schedules must include all possible major activities for a project and it is necessary for the user to eliminate those not needed for a specific project. For the standard Overlay Project, both Work Items 5 and 6 are shown to precede Work Item 7, Permanent Paving Markings. However, for the example project, only Work Item 6 is listed as a predecessor.

The start and finish times for all of the work items on the example overlay project were calculated using the rules given in Step 5b of Section 4.2. The total duration of the project is equal to the FT of the last work item on the project, Final Clean-Up, and equals 33 workdays for the example project. At this point the planner may want to adjust this number upwards to allow for any contingencies which may arise due to the complexity of the project, or adjust it downwards to satisfy known project constraints such as political pressures or other demands. The project completion date can also be determined as outlined in Step 6 in Section 4.2.

An optional final step in the process is to draw a bar chart representing the estimated time schedule of the project. Again, it must not be construed as a construction schedule since only major activities controlling the project time are shown and not the many other non-controlling activities. The bar chart for the example overlay project is also shown in Figure 4.2.

Figure 4.1 THE TEXAS TRANSPORTATION INSTITUTE OF THE TEXAS A&M UNIVERSITY SYSTEM

CONCEPTUAL CONSTRUCTION SCHEDULE WORKSHEET

Project: Date:

ID No	Work Item	Quantity & Unit	Daily Production Rate	Duration (days)	Preceding Activities & Relationships (% complete of pred)	Start Time	Finish Time	Workdays

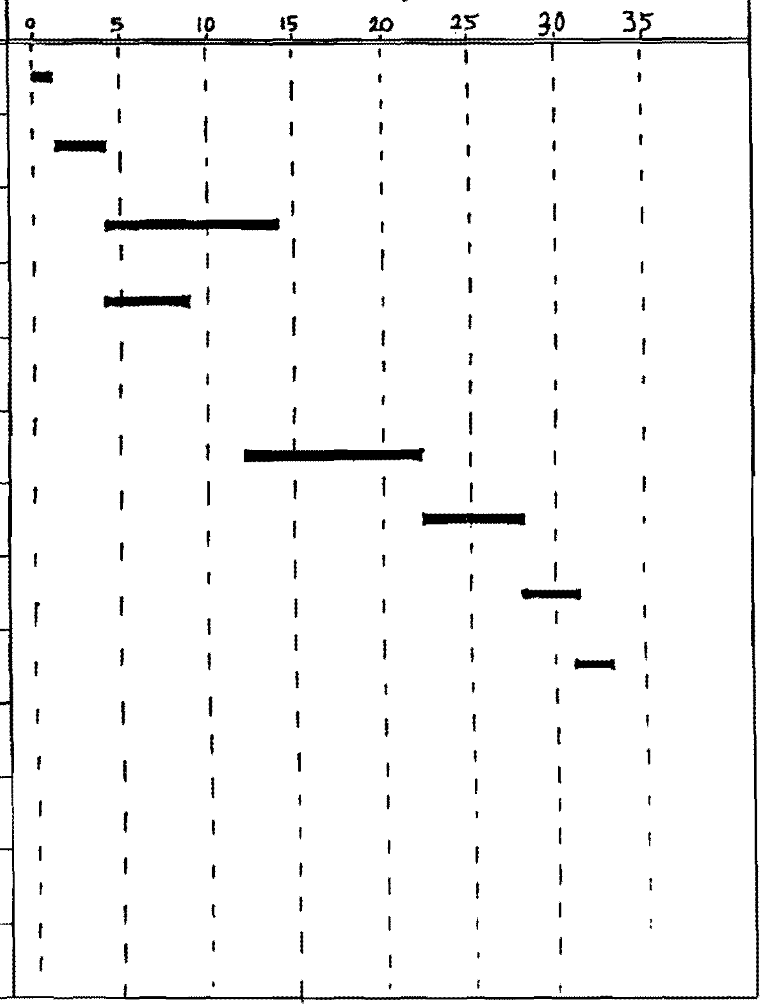
Figure 4.2 THE TEXAS TRANSPORTATION INSTITUTE OF THE TEXAS A&M UNIVERSITY SYSTEM
CONCEPTUAL CONSTRUCTION SCHEDULE WORKSHEET

Project: EXAMPLE OVERLAY PROJECT

Date: 02. 13. 92

ID No	Work Item	Quantity & Unit	Daily Production Rate	Duration (days)	Preceding Activities & Relationships (% complete of pred)	Start Time	Finish Time
1	SET UP TRAFFIC CONTROL	L.S.		1	-	1	1
2	DETOUR	L.S.		3	1, 100%	2	4
3	REMOVE OLD PAVEMENT	6700 SY	700 SY	10	1, 100%; 2, 100%	5	14
4	PAVEMENT REPAIR	500 SY	100 SY	5	1, 100%; 2, 100%	5	9
5	CONCRETE PAVING	-		-			
6	HOT-MIX ASPHALT BASE	5000 t	500 t	10	3, 80%; 4, 80%	13	22
7	HOT-MIX ASPHALT SURFACE	4000 t	700 t	6	6, 100%	23	28
8	PERMANENT PAVEMENT MARKINGS	22,000 LF	9000 LF	3	7, 100 %	29	31
9	FINAL CLEAN-UP	L.S.		2	8, 100 %	32	33

Workdays



CHAPTER 5 - COMPUTER METHOD FOR CONTRACT TIME DETERMINATION

5.1 - SYSTEM ENVIRONMENT REQUIREMENTS

1. IBM microcomputers and compatibles. (at least a 386 is highly recommended)
2. Minimum 640 K random access memory (RAM). No software should be running other than DOS in order to maximize available memory.
3. 3 1/2" or double-sided 5 1/4" floppy disk drive.
4. Hard disk, at least 6 Mb of which should be reserved for this computerized system. Actual capacity may vary depending on other applications and their software requirements.
5. PC or MS DOS, version 2.1 or higher.
6. 80 column or greater, and 32 row or greater screen display; color monitor strongly recommended.
7. Math co-processor.

5.2 - SYSTEM SOFTWARE REQUIREMENTS

1. **Flash-Up; version 3.05**. Its functions in this system are as follows:
   a. To integrate Lotus 123 and SuperProject, which are the other two software packages used in this system.
   b. To allow transfer of information between these two software.
   c. To give instructions to the user about how to use the system.
   d. To ask for input when necessary.
   e. To provide user-friendliness.

2. **Lotus 123; version 2.0**. Its functions are:
   a. To keep the standard information on project types, their activities, and the relationships between them.
2 b. To act as a database on daily production rates.

c. To make modifications on production rates and durations based on project characteristics.

d. To calculate individual activity durations given the work quantities.

e. To provide the flexibility of being updated.

3. **SuperProject; version 2.0.** In this system, its functions are:

a. To come up with an estimate of the total project duration by using the information provided from Lotus 123.

b. To produce a preliminary project schedule.

c. To determine project finish date given the project start date.

d. To allow utilization of standard calendar set to reflect average number of working days in each month of the year for each different district or location.

e. To produce graphical aid such as bar charts for better tracking of project information.

5.3 - INSTALLATION OF SOFTWARE

Installation of the software required by this system may vary a lot depending on which particular versions are being installed. The DOS command *COPY* is used to install SuperProject 2.0 B files on the hard disk whereas SuperProject 2.0 D comes with its own installation procedure. Therefore to install the software required by this system, it is best to follow the installation instructions that come with the software. However, for this system to work, it is absolutely required that the software should be installed in the following directories:

Flash-Up:	**C:\FLASH**
Lotus 123:	**C:\123**
SuperProject:	**C:\SPJ2**

5.4 - INITIAL SET-UP OF SUPERPROJECT

After installing SuperProject into the directory *C:\SPJ2*, you must modify the initial set-up of the program according to the requirements of the system by following the steps below:

1. To go into this directory, type **CD SPJ2** and press ***Enter***.
2. To run the software, type **SPJ** and press ***Enter Enter***.
3. To be able to make use of some of the advanced capabilities of the software, at the initial screen, press / **P***references* **E***xpert Modes* **A***dvanced Planning*.
4. To set the software to do the calculating and updating automatically in case of changes:
    a. Press / **P***references* **C***alculation Option*.
    b. On the popped-up dialogue box, mark the box next to *Auto Calculation* by moving the cursor on it using the arrow keys and pressing ***Spacebar***.
    In case you have a mouse, clicking the left button of the mouse on the box next to this option will do the same thing. The result should have the following appearance:

    Auto Calculation **X**

    No other changes are necessary in this window. Press ***Enter*** to confirm this change.
5. To eliminate the unnecessary display of hours in a day:
    a. Press / **P***references* **D***ate & International Formats*.
    b. On the dialogue box, following the same procedure described above, choose *None* for *Time Format*.
    c. Press ***Enter*** to confirm this change.
6. To customize the *Export/Import* feature of the program:
    a. At the initial screen, press / **F***ile* **E***xport/Import*.
    b. In the *Export/Import* window which appears after the step stated above, mark the circle or box right next to the option to be chosen at each section. Use the arrow

keys to move the cursor around, and then press ***Spacebar*** to choose when the cursor is on a desired selection. If you have a mouse, just click its left button on the desired selection. Upon completion of all the customizations, this screen should have the entries shown below for each section:

Function:	*Import*
Data:	*Task*
Data Format:	*WK1*
Column Titles:	**X**
Filename:	**C:\SPJ2\PROJ-1.WK1** (optional filename)

c. To customize the column layout, press **F6** to activate the related option. This is to eliminate the columns that have redundant information for the purpose of this system. When the table with the names of all the fields appears (each column contains a field), press ***Spacebar*** or - (hyphen) next to the names of such unwanted columns. For this system, only five fields (columns) are necessary, and are to be kept in the following order from left to right:

Field Name	Column	Sort
Task Name:	**1**	-
Task I.D.:	**2**	-
Estimated Duration:	**3**	-
Estimated Duration Type:	**4**	-
Work Breakdown Code:	**5**	-
others...	-	-

d. To save the changes, press **F3** to activate *Save* option for this layout.

e. Edit the dialogue box so that it will have the information given on the following page:

Preference File Name: C:\SPJ2\SYSPREF.SPJ (should remain as it appears)

Layout Name: **TxDOT SCHED** (it is absolutely essential that you use this name)

Layout Description: **Export/Import Layout for TxDOT Scheduling System** (optional description)

f. Press ***Enter*** to save the changes.

g. If the program asks *Create New Preference File C:\SPJ2\SYSPREF.SPJ ?*, type **Y** for Yes.

h. When back in the *Export/Import* screen, press **Esc** to return to the initial screen of the program.

7. Following the steps above, the column layout of the *Export/Import* feature has been customized. Now, the column layout of the default initial screen of the program should be customized. This is a similar procedure to exclude the unnecessary fields that appear with the initial screen. To do this:

a. Press / **L***ayout* **C***olumn Layout* to activate this feature.

b. In the popped-up table, under *Column*, right next to the name of each field to be included, type in the number to determine its order from left to right. For the fields that are to be excluded, press ***Spacebar*** or **-** so that a hyphen will appear. No modifications are necessary for the *Sort* column. The fields to be included and their order of appearance are mentioned below. This table should have the final form shown below after your modifications:

Field Name	Column	Sort
Task Name	**1**	-
Gannt Display	**2**	-
Scheduled Duration	**3**	-
Task I.D.	**4**	-
Scheduled Start	**5**	-
Scheduled Finish	**6**	-
others...	-	-

c. Press ***Enter*** to confirm the changes.

d. As the final modification on *Layout*, press / Layout Outline Layout.

e. Under *View Options*, move the cursor to *Headings/Tasks* by using the arrow keys and press ***Spacebar*** to choose, or if you have a mouse, just click its left button once on this option to choose it as shown below:

View Options: X *Headings/Tasks*

For the other options, the default selections are to be used.

f. Press ***Enter*** to confirm the entries.

g. To save all these changes under *Layout* press / Layout Save and type:

Preference File Name: C:\SPJ2\REPORTS.SPJ (should remain as it appears)
Layout Name: **BASIC OUTLINE** (optional name)
Layout Description: **Bar Chart w/ Task Name, Sch Dur., ID, Sch Start & Finish** (optional description)

h. Press ***Enter*** to save the above information to a new layout.

8. Now, you need to save all these customizations on initial set-up as the default. Before doing this, however, you should also set the position of the cursor so that whenever the system is run, it will be located in the desired position in SuperProject. More specificly, the cursor should rest on the top line of the *Schd Dur* column to the right of the project name without the Gannt chart (bar chart) being displayed. The reason for setting the cursor to be on the scheduled duration of the project is that after running the system and obtaining a schedule for a project each time, the scheduled project duration would be the first thing the user would notice. To do this:

a. Press the left arrow key enough times to bring the cursor on the top line of the *Heading/Task* column with the time scale of the Gannt chart and the *Schd Dur* column being displayed.

b. Hit the right arrow key three times and then the left arrow key once. This way, you should get the cursor on the top line of the *Schd Dur* column as required.

On the left of this column should be the *Heading/Task* column, and on the right of it should be the *Task I.D.*, *Scheduled Start*, and *Scheduled Finish* columns, respectively.

c. Having set the cursor, press / **P***references* **S***ave Preferences*. Edit the popped-up dialogue box so that it will have the information shown below:
Preference File Name: C:\SPJ2\SYSPREF.SPJ (should remain as it appears)
Preference Description: **Initial Settings for TxDOT Scheduling System** (optional description)

d. Press *Enter* to save.

e. When the program asks *C:\SPJ2\SYSPREF.SPJ exists, overwrite ?* type **Y** for Yes.

5.5 - OTHER DIRECTORIES AND FILES

You will be given a diskette containing some other files developed for this computerized procedure. You should copy them to the appropriate directories as mentioned below:

1. a. Make a sub-directory called PRJWRKST in directory C:\SPJ2. At *C:\SPJ2>* type **MD PRJWRKST** and *Enter*.
   b. Make a sub-directory called PROJECTS in directory C:\SPJ2. At *C:\SPJ2>* type **MD PROJECTS** and *Enter*.
   c. Make a sub-directory called CURR1 in directory C:\SPJ2. At *C:\SPJ2>* type **MD CURR1** and *Enter*.
   d. Make a sub-directory called CURR2 in directory C:\SPJ2. At *C:\SPJ2>* type **MD CURR2** and *Enter*.
2. Put the diskette that you will be provided with to the appropriate drive. Type **A:** and *Enter*. (or **B:** *Enter*, depending on the type of diskette and disk drive you have)
   a. Type **COPY *.WK1 C:\SPJ2\PRJWRKST** and *Enter*.
   b. Type **COPY *.XQT C:\SPJ2** and *Enter*.
   c. Type **COPY *.HOL C:\SPJ2** and *Enter*.
   d. Type **COPY SCHEDULE.WIN C:\FLASH** and *Enter*.
   e. Type **COPY REVISION.WIN C:\FLASH** and *Enter*.

After modifying the initial settings and copying all the necessary files to the appropriate directories, the computerized method, sometimes simply referred to as the system or CTDS, is ready to be utilized. The rest of this chapter serves as a software manual for CTDS; it includes detailed instructions and explanations as well as illustrated examples.

5.6 - LOADING FLASH-UP AND CALLING THE LIBRARY FILE

For a typical daily application of the scheduling system, the first thing to do would be to load Flash-Up following the steps mentioned below:

1. Go to the root directory:

   C: ***Enter.***

2. Go to the directory in which Flash-Up is stored:

   CD C:\FLASH ***Enter.***

3. Load the program:

   FLASHUP ***Enter.***

ATTENTION: By default, Flash-up has mouse support, and so does SuperProject. For the purpose of this application, however, it is more suitable to disable Flash-Up's mouse support since it will interfere with SuperProject's mouse support causing uncontrolled movements of the cursor when SuperProject is loaded. There are two ways of disabling its mouse support. One would be to type:

FLASHUP /MOUSE=NO ***Enter***

when loading the program. The second way is to do it through Flash-Up's menu after it is loaded. To activate its menu, press the ***Alt*** key and the ***Home*** key included in the Numeric keypad (the one that also has the number "7" on it) at the same time. When the menu appears, move the cursor to *Flash-Up Options*. Then bring it down to *Mouse Support* next to which it says *Enabled* by default. Press ***Enter*** and for a very short amount of time, a box will appear saying *Flash-Up Mouse Control Is Now Disabled.*

Then in Flash-Up, the library which keeps the macros for the scheduling system should be loaded. To do this:

1. Activate the menu bar of Flash-Up:

   Press ***Alt-Home***. (Again, make sure you use the ***Home*** key in the Numeric keypad that shares the same key with the number "7")

2. Using the arrow keys, move the cursor to *Load & Save* and choose *Load Library from disk.*

3. Load the library file. At the prompt type:

   C:\FLASH\SCHEDULE.WIN and press ***Enter.***

   This can also be done by pressing the down arrow key at the prompt and choosing *SCHEDULE* among the list of library files that pops up. Do this by moving the cursor onto this name and pressing ***Enter.***

5.7 - RUNNING THE SYSTEM

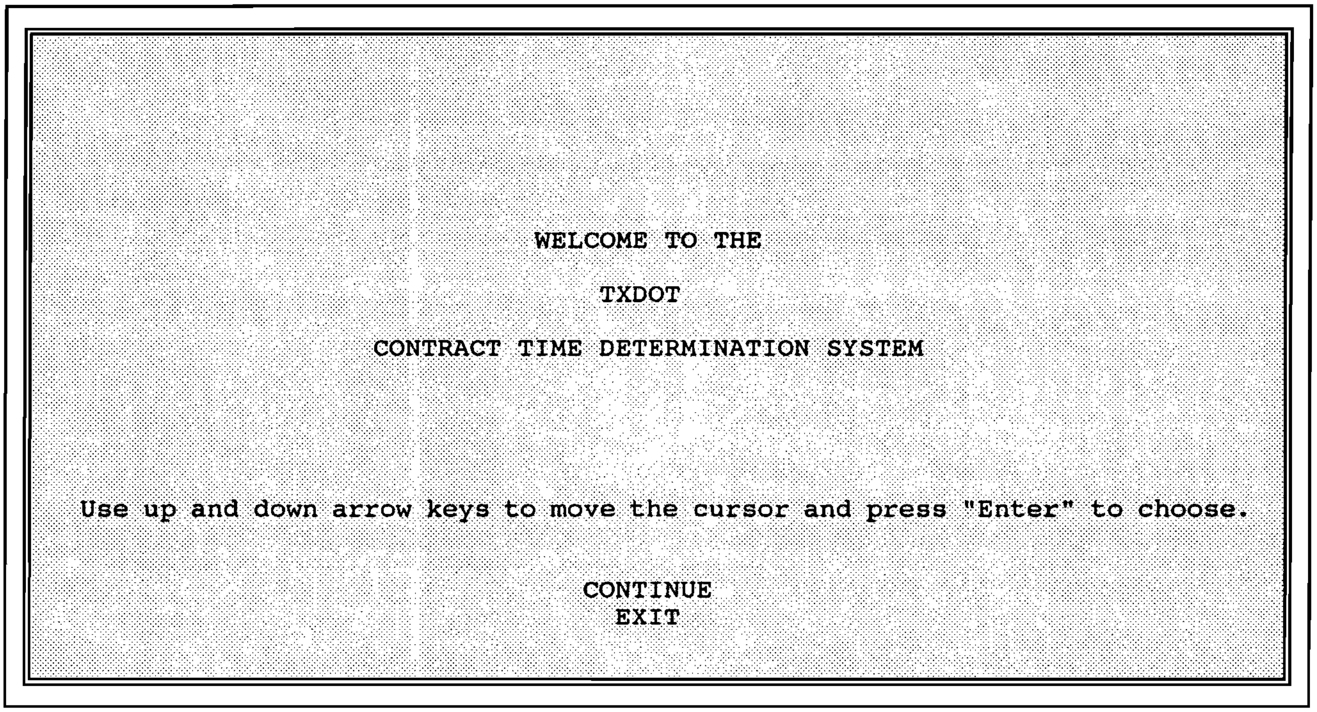
Now, everything is ready to start running the system. In this section, a totally fictitious project is used to better explain how the procedure works. Illustrations are provided within text to reflect what the user would actually see on the screen. The text is covered in a format consisting of two elements: Action and Explanations. Action describes what the user should actually do to get the system to run the procedure step by step. Explanations give the user information about the reasons behind a certain action or instruction as well as describing the fictitious project itself. Also, headers are included at the top of each different section of the procedure to enable the user to find what he/she is looking for in this manual.

The scheduling system has primarily two parts: 1. Scheduling of new projects, and 2. Editing existing project files. First, we will concentrate mainly on scheduling new projects.

5.7.1 - SCHEDULING NEW PROJECTS: EXAMPLE PROJECT APPLICATION

5.7.1.1 - Starting the Procedure for Scheduling New Projects

Action: Press ***Alt-T*** to start the Contract Time Determination System.



Explanations: The initial screen of the system comes up. At the bottom of the screen, a menu consisting of two choices, *CONTINUE* and *EXIT* is seen. The cursor, which is a horizontal bar, can move between these two choices. You will often encounter such menus throughout the procedure. Sometimes instructions will be provided on the same screen as the menu is on to guide the user. To choose an option, move the cursor onto the menu line by using the arrow keys and press ***Enter***. You may choose *EXIT* to terminate the procedure and exit to DOS at anytime.

Action: Choose *CONTINUE* to proceed.

This system is a guide to prepare conceptual construction schedules for TXDOT projects in order to estimate project durations.

It makes use of pre-established standard types of projects and major activities (work items) specific to each project type that are believed to control the project schedule. It also utilizes a database on production rates of major work items.

CONTINUE
EXIT

Action: Choose *CONTINUE* to proceed.

It is required that the user provide the system with the exact quantities of work items to be performed in appropriate units.

All the work items in a certain project type, their sequential relationships with each other, and production rates are subject to the user's approval or adjustment.

CONTINUE
EXIT

Action: Choose *CONTINUE* to proceed.

5.7.1.2 - Choosing the Project Type

```
Please make your choice from the four options listed below:

   Option A.   RESURFACING PROJECTS
                 1. Seal Coat  (SC)
                 2. Overlay  (OV)

   Option B.   PROJECTS WITH BRIDGE STRUCTURES
                 3. Rehabilitate Existing Road  (RER)
                 4. Convert Non-Freeway to Freeway  (CNF)
                 5. Widen Freeway  (WF)
                 6. Widen Non-Freeway  (WNF)
                 7. New Location Freeway  (NLF)
                 8. New Location Non-Freeway  (NNF)
                 9. Interchange  (INC)
                 10. Bridge Widening/Rehabilitation  (BWR)
                 11. Bridge Replacement/New Bridge  (BR)
                 12. Upgrade Freeway to Standards  (UPG)
                 13. Upgrade Non-Freeway to Standards  (UGN)

   Option C.   PROJECTS WITHOUT BRIDGE STRUCTURES (project types 3-13)

   Option D.   BRIDGE STRUCTURES ONLY
```

Explanations: The above screen has the four options used by this system to categorize TxDOT projects. Part of the effort in this study was spent on determination of the typical work items which were believed to control the work for each of the fourteen standard project types used by TxDOT (actually thirteen, since the fourteenth one, Miscellaneous Construction has no typical work items). Findings were such that the work items used in the first two project types, Seal Coat and Overlay, were mainly the same. Also, the work items determined for the other project types were again mainly the same, differing only a few work items from one project type to another. Therefore, for practical purposes and to reduce the memory space required by the system, four categories were used instead of thirteen.

The first option seen on this screen represents the first category of projects. It is called *Option A. RESURFACING PROJECTS* and combines Seal Coat and Overlay.

The second option, *Option B. PROJECTS WITH BRIDGE STRUCTURES*, combines all the other project types under one name, with each project including one bridge in it. These project types, as can be seen on the screen above, are Rehabilitate Existing Road, Convert Non-Freeway to Freeway, Widen Freeway, Widen Non-Freeway, New Location Freeway, New Location Non-Freeway, Interchange, Bridge Widening/Rehabilitation, Bridge Replacement/New

Bridge, Upgrade Freeway to Standards, and Upgrade Non-Freeway to Standards.

The third option, *Option C. PROJECTS WITHOUT BRIDGE STRUCTURES*, refers to exactly the same project types mentioned in the second option but is to be used only if no bridge structures exist in the project to be worked on.

The fourth option, *Option D. BRIDGE STRUCTURES ONLY*, contains nothing but work items related to a bridge. This option was included considering a one-phase project or a certain phase of a project that might have more than one bridge in it. In that case, at first, the user would choose the second option, *Option B. PROJECTS WITH BRIDGE STRUCTURES* for that phase, and follow the routine procedure to get a schedule. After that, the user would continue with the procedure to include another bridge to that particular phase. Details on how to do this will be covered with the example project held in this chapter.

Let us assume that the example we are going to use is a Convert Non-Freeway to Freeway type of a project. Let us also assume that because of traffic requirements, it has to be handled in two phases the first of which contains no bridge structures, whereas two bridges exist in the second phase. Therefore, starting from the first phase:

Action: Bring the cursor over *Option C. PROJECTS WITHOUT BRIDGE STRUCTURES* and press ***Enter*** to select.

Explanations: Of the thirteen standard project types used by TxDOT, Convert Non-Freeway to Freeway is fourth one, and it is included in both the second and third options shown on the screen. Since the first phase of our example, Convert Non-Freeway to Freeway project, does not include a bridge, the third option, *Option C. PROJECTS WITHOUT BRIDGE STRUCTURES* is the appropriate choice.

5.7.1.3 - Checking and Modifying Relationships

```
     Now, you will be able to check the pre-established relationships
between these work items and make any necessary changes.
     In this table, each row stands for a relationship defined between
two activities.  For each row, the first activity is the predecessor,
the second one is the successor.
     The numbers in the last column stand for the required percent com-
pletion of the predecessor for the successor to start.  The number "100"
represents a "Finish-to-Start" relationship in which the predecessor
should be 100% completed before the successor can start.  The number "0"
represents a "Start-to-Start" relationship in which the successor can
start at the same time as the predecessor.  Any number in between will
be used to determine the lag time between the start of the two activities
with the lag calculated as that percentage times the duration of the pre-
decessor.

                      PLEASE PRESS  "ENTER"  TO PROCEED
```

Explanations: After choosing the appropriate category for the project at hand, the above screen appears which gives information about the upcoming table on relationships. At this stage of the procedure, the user has a chance to check the pre-established relationships which determine the sequence of the typical work items or activities included in that category. Each relationship or dependency link is defined between a pair of activities. This information is stored in the system in a tabular format described as follows: Each row of this table represents a relationship defined between two activities. The first activity in each row is the predecessor, and the second one is the successor. The third cell in each row contains a number between 0 and 100 which represents the required percent completion of the predecessor for the successor to start. For example, if that number is 100, it means the relationship stated is a Finish-to-Start type. That is, the predecessor should be finished 100% before the successor can start. If the number is 0, it means the dependency link is a Start-to-Start type of a relationship in which the successor can start at the same time as the predecessor. Any number between 0 and 100 is used to determine the lag time between the start of the two activities with the lag calculated as that percentage times the duration of the predecessor. For example, assume Activity B succeeds Activity A by 50%. If Activity A has a duration of 12 days, that means the lag time between the start of the two activities is 6 days (12 days x 50%). In other words, Activity B can start after 6 days of work is done on Activity A.

Action: Press *Enter* to continue.

```
      Y              Z                         AA                  AB        AC
75                                                            % complete of
76          PREDECESSOR NAME         SUCCESSOR NAME          predecessor
77          Initial Traf. Control    Detour                       100
78          Detour                   Major struc. demoli'n        100
79          Detour                   Clear & Grub                 100
80          Detour                   Rmv. old strc.(small)        100
81          Detour                   Rmv. old pavement            100
82          Detour                   Rmv old curb & gutter        100
83          Detour                   Rmv. old sidewalks           100
84          Detour                   Rmv old drai/util str        100

     On the spreadsheet, move the cursor by using the up or down arrow
keys.  To make any necessary changes on percentages, move the cursor to
the cell you want to change, type the correct entry, and then move the
cursor to another cell.
      DO NOT HIT  "Enter"  if you still have more changes to make.
      When you are completely finished, press  "Enter".

               PLEASE PRESS  "ENTER"  TO START EDITING
```

Explanations: The information on relationships is kept in a Lotus 123 file reserved for the project category you have chosen. As you can notice from the illustration above by the spreadsheet frame with the row numbers on the left and the column letters at the top, you are in Lotus 123 at this stage of the procedure. The system has already opened that file and taken you to the particular block containing the information on relationships. At the bottom of the screen, a window appears giving instructions on how to make changes on percentages in case you would like to input your own entries. Basically, for making entries on the spreadsheet, the common spreadsheet principle applies. That is, to type an entry in a cell and move the cursor away from that cell. This way, the entry that has just been typed would be accepted by the spreadsheet. Typing the entry and pressing *Enter* would also work; however, in this system pressing *Enter* means that the user has completed editing. Therefore, it is recommended that the user should NOT press *Enter* until ALL the changes he or she would like to make are finished. This is also stated on the window that appears at the bottom of the screen at this point. If, however, the user presses *Enter* by mistake without completing all the changes to be done, a menu appears with one of the choices offering to return to editing again.

Action: Press ***Enter*** to start editing.

	Y	Z	AA	AB	AC
75				% complete of	
76		PREDECESSOR NAME	SUCCESSOR NAME	predecessor	
77		Initial Traf. Control	Detour	100	
78		Detour	Major struc. demoli'n	100	
79		Detour	Clear & Grub	100	
80		Detour	Rmv. old strc.(small)	100	
81		Detour	Rmv. old pavement	100	
82		Detour	Rmv old curb & gutter	100	
83		Detour	Rmv. old sidewalks	100	
84		Detour	Rmv old drai/util str	100	
85		Major struc. demoli'n	Earth Excavation	25	
86		Major struc. demoli'n	Rock Excavation	25	
87		Major struc. demoli'n	Embankment	25	
88		Clear & Grub	Earth Excavation	25	
89		Clear & Grub	Rock Excavation	25	
90		Clear & Grub	Embankment	25	
91		Rmv. old strc.(small)	Earth Excavation	25	
92		Rmv. old strc.(small)	Rock Excavation	25	
93		Rmv. old strc.(small)	Embankment	25	
94		Rmv. old pavement	Earth Excavation	25	

Explanations: At this point, you have direct access to this table of the spreadsheet where the information on relationships between the work items is kept. You will find the cursor at the very top of the column that contains the percentages. Moving the cursor up and down, you can check the whole list, and modify any of the percentages by following the editing process described in the previous explanations section.

For the example project, assume the scheduler thinks Excavation/Embankment activities should not start before all of Major Structure Demolition and Remove Old Structures (small) is completed. This would be shown by having 100 in the *% complete of predecessor* column of the rows that contain dependency link information between the activities mentioned. Also, other Right-of-Way Preparations items, Clear and Grub, Remove Old Pavement, Remove Old Curb and Gutter, Remove Old Sidewalks, and Remove Old Drainage and Utility Structures should be completed at least half way through before Excavation/Embankment items can start. The way to tell this to the system would be to have 50 in the *% complete of predecessor* column of the rows that contain relationship information between the activities mentioned.

Action: Move the cursor down to the row which has *Major struc. demoli'n* as the predecessor and *Earth Excavation* as the successor. Change the percentage from 25 to 100. Then, move the cursor down by one, and do the other changes by following the editing process until all the modifications are done according to the scenario covered in the example project. Here is all the necessary changes in terms of new percentages shown in bold figures that you need to input to the system:

PREDECESSOR	*SUCCESSOR*	%
:	:	:
Major struc. demoli'n	*Earth Excavation*	**100**
Major struc. demoli'n	*Rock Excavation*	**100**
Major struc. demoli'n	*Embankment*	**100**
Clear & Grub	*Earth Excavation*	**50**
Clear & Grub	*Rock Excavation*	**50**
Clear & Grub	*Embankment*	**50**
Remove old strc.(small)	*Earth Excavation*	**100**
Remove old strc.(small)	*Rock Excavation*	**100**
Remove old strc.(small)	*Embankment*	**100**
Rmv. old pavement	*Earth Excavation*	**50**
Rmv. old pavement	*Rock Excavation*	**50**
Rmv. old pavement	*Embankment*	**50**
Rmv old curb & gutter	*Earth Excavation*	**50**
Rmv old curb & gutter	*Rock Excavation*	**50**
Rmv old curb & gutter	*Embankment*	**50**
Rmv. old sidewalks	*Earth Excavation*	**50**
Rmv. old sidewalks	*Rock Excavation*	**50**
Rmv. old sidewalks	*Embankment*	**50**
Rmv old drai/util str	*Earth Excavation*	**50**
Rmv old drai/util str	*Rock Excavation*	**50**
Rmv old drai/util str	*Embankment*	**50**
:	:	:

When you have typed in all the modifications as shown in bold numbers above, hit ***Enter*** to proceed.

MORE EDITING RELATIONSHIPS

CONTINUE TO THE NEXT STEP OF THE PROCEDURE

TERMINATE PROCEDURE & EXIT TO DOS

83	Detour	Rmv. old sidewalks	100
84	Detour	Rmv old drai/util str	100
85	Major struc. demoli'n	Earth Excavation	100
86	Major struc. demoli'n	Rock Excavation	100
87	Major struc. demoli'n	Embankment	100
88	Clear & Grub	Earth Excavation	50
89	Clear & Grub	Rock Excavation	50
90	Clear & Grub	Embankment	50
91	Rmv. old strc.(small)	Earth Excavation	100
92	Rmv. old strc.(small)	Rock Excavation	100
93	Rmv. old strc.(small)	Embankment	100
94	Rmv. old pavement	Earth Excavation	50

Explanations: A menu appears on top of the table you have just worked on. The first option, *MORE EDITING RELATIONSHIPS* will take you back to editing. Choosing this option will take you back to the window that gives instructions about how to edit, and then to the top of the *% complete of predecessor* column for you to check the list of relationships and make more changes. You may wish to choose this option in case you accidentally hit ***Enter*** before making all the changes you needed, or if you think you have just made a wrong input, etc.

The third option, *TERMINATE PROCEDURE & EXIT TO DOS* is included if the user decides not to continue with the procedure. Choosing this option will close Lotus 123, and take you to DOS prompt. If you need to run the scheduling procedure once again, pressing ***Alt-T*** at the DOS prompt will start it right from the beginning.

Finally, the second option, *CONTINUE TO THE NEXT STEP OF THE PROCEDURE*, will let the user proceed with the computerized method, which is the right option to choose in order to follow this example project.

Action: Move the cursor over to *CONTINUE TO THE NEXT STEP OF THE PROCEDURE*, and press ***Enter***.

5.7.1.4 - Factors Influencing Production Rates

Please select information about certain project characteristics in terms of factors that influence production rates. For each factor, please choose the condition from the menu that best suits your project.

LOCATION

rural

small city

big city

ignore the effect on production rates

Explanations: At this stage you encounter the factors that influence production rates and durations of lump-sum work items. These factors are Location, Traffic, Complexity of Project, Soil Conditions and Quantities of Work Items. Each factor has three conditions used to categorize project characteristics. It is believed that production rates vary according to these conditions. The system uses a base production rate for each activity (or a base duration if the activity is a lump-sum one). The base production rate is established on a set of conditions including one of the three conditions of each factor. The system was built to have the following conditions constitute the basis for base production rates: rural for Location, light for Traffic, low for Complexity, good for Soil Conditions, and large for Quantity. If these conditions are chosen for a project, the system will automatically take the base production rates (or durations for lump-sum items) kept in its database and propose that the scheduler shall use those. If a different combination of conditions are chosen, the proposed value will be adjusted accordingly to reflect the variations in production rates. This process is done by multipliers assigned to each condition of the five factors. For each factor, the base condition has a multiplier of 1.00, and the multipliers of the other two conditions are set in ratio to that. For a more detailed discussion of this subject, please refer back to Chapter 3, Section 6.

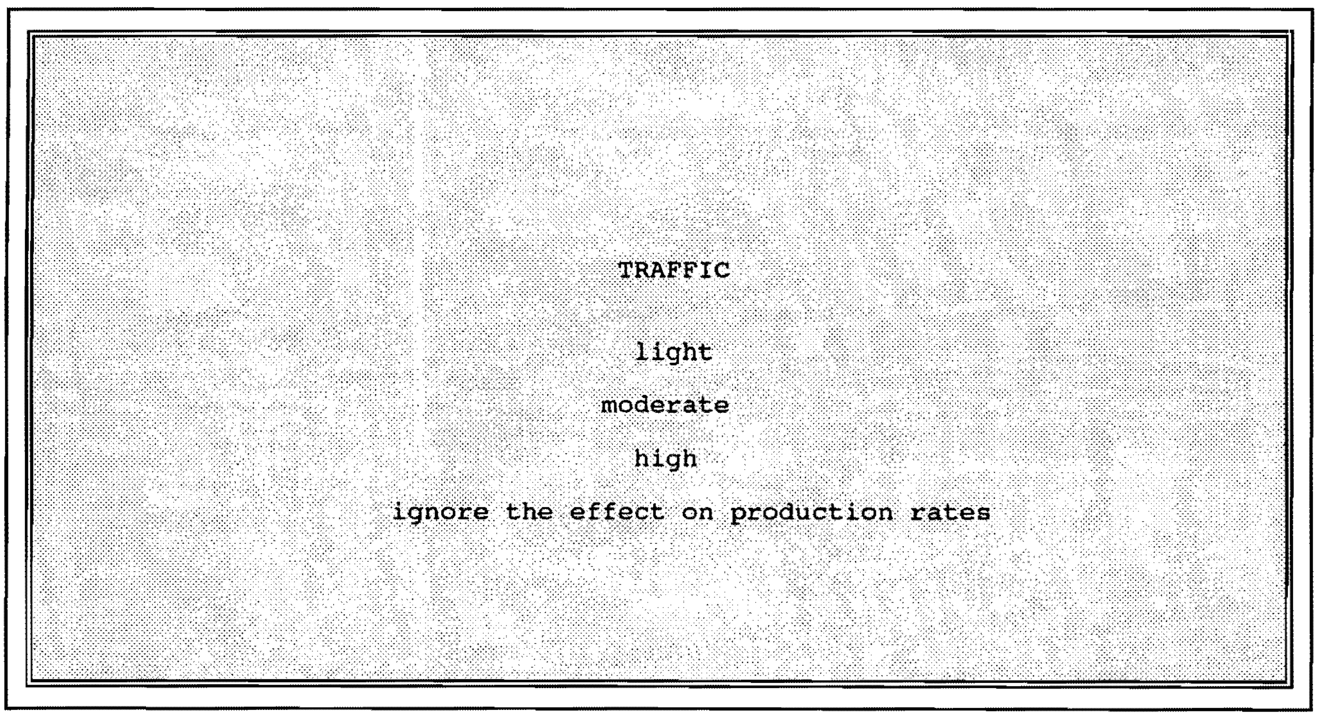
At this point of the computerized method, for each of the five factors, the user selects a condition that best suits the characteristics of the project at hand. Accordingly, the system will adjust base production rates, and propose them to the user.

On the other hand, the user may also choose to ignore the impact of these factors on production rates. Then again, base production rates will be proposed to the user since there will be no necessary adjustments. In effect, this would be equal to choosing the base condition for each factor.

It may be worthwhile to state here that base production rates are set on those conditions that favor higher production rates. Therefore, normally they would be considerably higher than average production rates as the user will be able to compare during the procedure.

For the example project, assume the following conditions apply: rural for Location, light for Traffic, medium for Complexity, good for Soil Conditions, and medium for Quantity.

Action: Choose *rural* and press ***Enter***.



Action: Choose *light* and press ***Enter***.

```
COMPLEXITY

low

medium

high

ignore the effect on production rates
```

Action: Choose *medium* and press ***Enter***.

```
SOIL CONDITIONS

good

fair

poor

ignore the effect on production rates
```

Action: Choose *good* and press ***Enter***.

```
                    QUANTITY

                     large

                     medium

                     small

      ignore the effect on production rates
```

Action: Choose *medium* and press *Enter*.

5.7.1.5 - Low, Average, High and Proposed Production Rates: Checking and Editing

```
             T              U         V         W         X         Y
1   Project Type:
2   PROJECT WITH NO BRIDGE         D A I L Y   P R O D U C T I O N   R A T E
3   TASK NAME              UNITS          LOW   AVERAGE     HIGH  PROPOSED

   In the upcoming table you will see four production rates listed next
to each activity's name.  For each activity, the first three values stand
for a typical low, average, and high rate, respectfully.  The fourth one is
the rate proposed by the system based on the choices you have made on the
factors that affect the production rates.  For lump-sum items, the same si-
tuation applies in terms of working days instead of production rates.
   If you would like to use a rate or a duration other than what the system
proposes, simply make the change by moving the cursor to the cell which has
the value to be changed, type in the new value, and then move the cursor to
another cell.  AVOID HITTING "Enter" until all your changes are done.

              PLEASE PRESS  "ENTER"  TO SEE THE TABLE
```

Explanations: As stated on the popped-up window, there are four production rates given next to each activity's name. The first three are, respectively, typical low, average, and high values for the production rate of an activity. These values are established from past projects, and kept in the system as a database on production rates. The fourth one is what the system proposes to the user in the scheduling process. This proposed rate might be equal to the base rate if: 1. The base condition is chosen for all the factors; or 2. The user decides to ignore the effect of the factors on production rates. Otherwise, the proposed rate will be adjusted based on the conditions that best reflect the project characteristics. In this table, the user has an opportunity to compare the proposed rate by the system with the low, average, and high rates presented. This is important since the user might wish to know where a certain value proposed by the system stands within the range established from past projects. It provides assistance to the user in utilizing his or her judgement in determining the final rate to be used.

Action: Press *Enter* to see the table on production rates.

	T	U	V	W	X	Y
1	Project Type:					
2	PROJECT WITH NO BRIDGE		D A I L Y	P R O D U	C T I O N	R A T E
3	TASK NAME	UNITS	LOW	AVERAGE	HIGH	PROPOSED
4	ROW Preparations					
5	Clear & Grub	Acres	1	3	6	3.52
6	Rmv. old pavement	S.Y.	1000	2000	3000	2200
7	Rmv old curb & gutter	L.F.	600	1200	2000	1200
8	Rmv. old sidewalks	S.Y.	350	700	1100	700
9	Rmv old drai/util str	L.F.	100	300	500	350
10	Excavation/Embankment					
11	Earth Excavation	C.Y.	1200	3400	7000	3696
12	Rock Excavation	C.Y.	500	1100	1500	1056
13	Embankment	C.Y.	1200	3500	7000	3696
14	Drainage str/Storm sw					
15	Pipe	L.F.	100	200	300	225
16	Box Culverts	C.Y.	10	15	25	16
17	Inlets & Manholes	Each	1	2	3	2
18	Retaining Walls	S.F.	100	150	200	160
19	Base Preparations					
20	Lime Stabilization	S.Y.	2000	4000	6000	3960

Explanations: Once the cursor is in the table that contains production rates, you can move it up and down the list to check the values presented. In case you wish to make changes on any of the proposed production rates and/or durations for lump-sum items, first move the cursor onto a cell that you would like to edit. Then type in the new value, and move the cursor to the next cell that you need to change without hitting ***Enter***. Hitting ***Enter*** would mean your editing process is completed. However, if you accidentally hit ***Enter*** without completing all your changes, a menu will appear with one of the choices offering to go back to editing process.

For demonstration purposes, assume the user does the following changes on proposed production rates and/or durations of lump-sum items for the example project. These changes may be based on his/her personal experience, some requirements specific to this project, etc.

Action: Change the proposed rate of the work items below:

Clear & Grub	from	*3.52*	to	**4**
Earth Excavation	from	*3696*	to	**4500**
Embankment	from	*3696*	to	**5000**
Lime Stabilization	from	*3960*	to	**4250**
Flexible Base Mater'l	from	*2992*	to	**3250**
Hot-mix Asphalt Base	from	*1232*	to	**1750**
Precast Traf. Bar'ers	from	*1056*	to	**1250**

Change the proposed duration of the work items below:

Detour	from	*6*	to	**15**
Major struc. demoli'n	from	*10*	to	**20**
Rmv. old strc. (small)	from	*3*	to	**10**

Press ***Enter*** when you make all of the changes above.

	T	U	V	W	X	Y
1	Project Type:					
2	PROJECT WITH NO BRIDGE		D A I L Y P R O D U C T I O N R A T E			
3	TASK NAME	UNITS	LOW	AVERAGE	HIGH	PROPOSED
4	ROW Prep					
5	Clear &					4
6	Rmv. ol					2200
7	Rmv old	MORE EDITING RATES & DURATIONS				1200
8	Rmv. ol					700
9	Rmv old	CONTINUE TO THE NEXT STEP OF THE PROCEDURE				350
10	Excavati					
11	Earth E	TERMINATE PROCEDURE & EXIT TO DOS				4500
12	Rock Ex					1056
13	Embankm					5000
14	Drainage					
15	Pipe	L.F.	100	200	300	225
16	Box Culverts	C.Y.	10	15	25	16
17	Inlets & Manholes	Each	1	2	3	2
18	Retaining Walls	S.F.	100	150	200	160
19	Base Preparations					
20	Lime Stabilization	S.Y.	2000	4000	6000	4250

Explanations: A menu appears on the table you have just made your changes on. The first option of the menu, *MORE EDITING RATES AND DURATIONS*, takes you back to the table for more editing. Selection of this option will pop up the window that gives instructions about how to edit, and then will take you to the table itself. You may wish to choose this option in case you accidentally hit ***Enter*** before making all the changes you needed, or if you think you have just made a wrong input, etc.

The third option, *TERMINATE PROCEDURE & EXIT TO DOS*, will quit the procedure, and let you exit from Lotus 123 to DOS prompt. You may choose this if you decide not to continue with the procedure; **however, please keep in mind that you will lose all your work.**

Finally, the second option, *CONTINUE TO THE NEXT STEP OF THE PROCEDURE*, will let the user proceed with the computerized method.

Action: Move the cursor over to *CONTINUE TO THE NEXT STEP OF THE PROCEDURE*, and press ***Enter***.

5.7.1.6 Entering Quantities

```
    L              M                 N       O         P         Q
79     Project Type:
80     PROJECT WITH NO BRIDGE
81   # TASK NAME                UNITS   QUANTITY   PROD RATE   DURATION
82   1 Initial Traf. Control    L.Sum                                2

   At this step, you will be asked for exact quantities for each work item
listed.  Enter "0" (zero) for those that do not exist in your project.
   Notice that the production rates and durations of lump-sum items you
see in this table come from the last column of the previous table. They are
either the values proposed by the system or those that you chose to substi-
tute.  After you enter quantities for all the work items, you will be able
to edit values in this table if necessary, e.g. make corrections, change
production rates, etc.
   The cursor will lead you to the necessary cells for your input.  On each
cell, type in the quantity and hit "Enter" to proceed to the next work item.

              PLEASE PRESS  "ENTER"  TO START INPUT QUANTITIES
```

Explanations: Now it is time to enter estimated quantities for the tasks included in this project type. For each task, the quantity you input will be divided by the production rate to calculate the duration.

In the upcoming table, the system will ask you to enter a quantity for each task listed. Right next to each task name, you will see the unit used to measure volume of work for that task; it is important that you input your quantities according to the units specified. To the right of the column in which you will enter your inputs, is the *Production Rate* column. Notice the rates presented in this column come from the *Proposed Rate* column of the previous table in which the user earlier checked the rates proposed by the system by comparing them to low, average, and high values, and changed some based on his/her own judgement. Therefore, the rates you will see in the upcoming table are either the ones proposed by the system which were approved by the user or those that the user substituted instead. This also applies for the durations of the lump-sum items. For instance, previously in this example the duration of *Detour* was changed from 6 to 15 days, and the production rate of *Earth Excavation* was changed from 3570 to 4500 C.Y./day. You will notice that these new figures are taken into account whereas those that were not modified are still considered valid by the system.

ATTENTION: Entering quantities is the only exception for which you MUST HIT ***Enter*** after you type in an input on the spreadsheet. The cursor will lead you to the cells in which you are expected to enter a quantity. It will not move to the next task in the list unless you enter a logical input for the quantity of that task. By a logical input, it is meant that the entry should be a pure number to express a quantity of work in reality; alphanumeric characters, letters, negative numbers are NOT accepted. Also, using commas or periods to separate thousands are NOT allowed; for several-digit figures, simply type the numbers. If the figure is a decimal, use a period to separate the integers from decimals. Here are some examples of invalid forms of entries: 1,000,000 ; 3.250.500 ; 12,5 .

The correct forms for these entries would be: 1000000 ; 3250500 ; 12.5. Also, for those tasks that do not exist in your particular project, you MUST ENTER **0** (zero) for quantity. Simply pressing ***Enter*** to pass to the next item or trying to use the arrow keys to move the cursor will not work; you must enter **0** for the quantity of a task to tell the system it is not present in the project at hand. Such tasks will appear to have a duration of 0 in the upcoming table.

If you make an entry that is acceptable by the system and yet incorrect as far as the quantity is concerned, such as omitting a zero in a several-digit figure or typing a wrong digit by hitting a wrong number key, etc., it is not possible to go back to that task and correct the mistake immediately. In such a case, the cursor would move down to the next task and ask for its quantity, and would continue to do so until all the tasks are covered. You would then get a chance to correct your mistake by choosing the related editing option from the menu that would appear on the screen.

Action: Press ***Enter*** to go in the table for input on quantities.

Please Enter Quantity in Appropriate Units:

	L	M	N	O	P	Q
79		Project Type:				
80		PROJECT WITH NO BRIDGE				
81	#	TASK NAME	UNITS	QUANTITY	PROD RATE	DURATION
82	1	Initial Traf. Control	L.Sum			2
83	2	Detour	L.Sum			15
84	3	ROW Preparations				
85	4	Major struc. demoli'n	L.Sum			20
86	5	Clear & Grub	Acres	ENTER #	4	Duration Req'd
87	6	Rmv. old strc.(small)	L.Sum			10
88	7	Rmv. old pavement	S.Y.	ENTER #	2200	Duration Req'd
89	8	Rmv old curb & gutter	L.F.	ENTER #	1200	Duration Req'd
90	9	Rmv. old sidewalks	S.Y.	ENTER #	700	Duration Req'd
91	10	Rmv old drai/util str	L.F.	ENTER #	350	Duration Req'd
92	11	Excavation/Embankment				
93	12	Earth Excavation	C.Y.	ENTER #	4500	Duration Req'd
94	13	Rock Excavation	C.Y.	ENTER #	1056	Duration Req'd
95	14	Embankment	C.Y.	ENTER #	5000	Duration Req'd
96	15	Drainage str/Storm sw				
97	16	Pipe	L.F.	ENTER #	225	Duration Req'd
98	17	Box Culverts	C.Y.	ENTER #	16	Duration Req'd
99	18	Inlets & Manholes	Each	ENTER #	2	Duration Req'd
100	19	Retaining Walls	S.F.	ENTER #	160	Duration Req'd
101	20	Base Preparations				
102	21	Lime Stabilization	S.Y.	ENTER #	4250	Duration Req'd
103	22	Flexible Base Mater'l	S.Y.	ENTER #	3250	Duration Req'd
104	23	Cement Treated Base M	S.Y.	ENTER #	2992	Duration Req'd
105	24	New Curb & Gutter	L.F.	ENTER #	616	Duration Req'd
106	25	Asph. Pavement Repair	S.Y.	ENTER #	191.25	Duration Req'd
107	26	Conc. Pavement Repair	S.Y.	ENTER #	106.25	Duration Req'd
108	27	Milling/Planing	S.Y.	ENTER #	9680	Duration Req'd
109	28	One-course Surf. Trmt	S.Y.	ENTER #	49280	Duration Req'd
110	29	Hot-mix Asphalt Base	Ton	ENTER #	1750	Duration Req'd
111	30	Hot-mix Asphalt Surf.	Ton	ENTER #	1232	Duration Req'd
112	31	Concrete Paving	S.Y.	ENTER #	2992	Duration Req'd
113	32	Precast Traf. Bar'ers	L.F.	ENTER #	1250	Duration Req'd
114	33	Signing/Traf. Signals				
115	34	Small signs	Each	ENTER #	20	Duration Req'd
114	33	Signing/Traf. Signals				
115	34	Small signs	Each	ENTER #	20	Duration Req'd
116	35	Overhead signs	Each	ENTER #	1.5	Duration Req'd
117	36	Major traffic signals	Each	ENTER #	0.4	Duration Req'd
118	37	Seeding & Landscaping	S.Y.	ENTER #	4400	Duration Req'd
119	38	Pavement Markings	L.F.	ENTER #	10560	Duration Req'd
120	39	Final Clean-up	Sta.	ENTER #	30.8	Duration Req'd
121						
122						
123						

Explanations: The above figure is kept long enough to show the whole of the table on the spreadsheet before any input is given. The cursor is under the *QUANTITY* column and at the first task that requires a quantity input from the user where it says *ENTER #*. In the same row containing that task, it says *Duration Req'd* under the *DURATION* column. The prompt at the top of the screen indicates that the user should enter a quantity for that task. As the user types in a number for quantity and hits ***Enter***, the system takes that value and divides it by the production rate shown right next to it, and calculates the duration for that task always rounding up to the nearest integer to express duration in terms of working days. This process will continue until the user enters a quantity for all the tasks that require an input from the user.

Since we are currently working only on the first phase of the example project, it is required to enter assumed quantities for work to be performed only in this phase. On the next page is that table again with all the activities and assumed quantities you need to input for this example project. Please remember once again that this project is totally fictitious and given as just an example to illustrate how the computerized method works.

Action: For each task in the table, please type in its assumed quantity shown in bold digits on the following page and press ***Enter*** to go down to the next one until you finish the whole list of tasks.

	L	M	N	O	P	Q
79		Project Type:				
80		PROJECT WITH NO BRIDGE				
81	#	TASK NAME	UNITS	QUANTITY	PROD RATE	DURATION
82	1	Initial Traf. Control	L.Sum			2
83	2	Detour	L.Sum			15
84	3	ROW Preparations				
85	4	Major struc. demoli'n	L.Sum			20
86	5	Clear & Grub	Acres	14.6	4	4
87	6	Rmv. old strc.(small)	L.Sum			10
88	7	Rmv. old pavement	S.Y.	35200	2200	16
89	8	Rmv old curb & gutter	L.F.	10560	1200	9
90	9	Rmv. old sidewalks	S.Y.	1760	700	3
91	10	Rmv old drai/util str	L.F.	3120	350	9
92	11	Excavation/Embankment				
93	12	Earth Excavation	C.Y.	100000	4500	23
94	13	Rock Excavation	C.Y.	0	1056	0
95	14	Embankment	C.Y.	60000	5000	12
96	15	Drainage str/Storm sw				
97	16	Pipe	L.F.	4000	225	18
98	17	Box Culverts	C.Y.	200	16	13
99	18	Inlets & Manholes	Each	21	2	11
100	19	Retaining Walls	S.F.	0	160	0
101	20	Base Preparations				
102	21	Lime Stabilization	S.Y.	55000	4250	13
103	22	Flexible Base Mater'l	S.Y.	50000	3250	16
104	23	Cement Treated Base M	S.Y.	0	2992	0
105	24	New Curb & Gutter	L.F.	11500	616	19
106	25	Asph. Pavement Repair	S.Y.	0	191.25	0
107	26	Conc. Pavement Repair	S.Y.	0	106.25	0
108	27	Milling/Planing	S.Y.	0	9680	0
109	28	One-course Surf. Trmt	S.Y.	0	49280	0
110	29	Hot-mix Asphalt Base	Ton	65000	1750	38
111	30	Hot-mix Asphalt Surf.	Ton	19000	1232	16
112	31	Concrete Paving	S.Y.	0	2992	0
113	32	Precast Traf. Bar'ers	L.F.	22000	1250	18
114	33	Signing/Traf. Signals				
115	34	Small signs	Each	115	20	6
116	35	Overhead signs	Each	4	1.5	3
117	36	Major traffic signals	Each	1	0.4	3
118	37	Seeding & Landscaping	S.Y.	75000	4400	18
119	38	Pavement Markings	L.F.	43000	10560	5
120	39	Final Clean-up	Sta.	55	30.8	2
121						
122						
123						

<u>Explanations:</u> Above you see the whole of the table after all the assumed quantities are input and durations are calculated by the system. As you input quantity for the last task in the list and hit ***Enter***, a new menu appears.

5.7.1.7 Editing Quantities, Production Rates and Durations

```
Press Alt-C to make Changes  Press Alt-P to Proceed  Press Alt-Q to Quit
EDIT
     L             M              N       O          P         Q
70
71
72      Please Press "Alt-C" to Make CHANGES
73
74      Please Press "Alt-P" to PROCEED
75
76      Please Press "Alt-Q" to QUIT and Go to DOS
77
78
     L             M              N       O          P         Q
79      Project Type:
80      PROJECT WITH NO BRIDGE
81     # TASK NAME              UNITS   QUANTITY   PROD RATE   DURATION
82     1 Initial Traf. Control  L.Sum                                2
83     2 Detour                 L.Sum                               15
84     3 ROW Preparations
85     4  Major struc. demoli'n L.Sum                               20
86     5  Clear & Grub          Acres       14.6           4         4
87     6  Rmv. old strc.(small) L.Sum                               10
88     7  Rmv. old pavement     S.Y.       35200        2200        16
```

Explanations: This menu consists of three options. The first one, pressing ***Alt-C***, will take you back to the table, and let you make changes on quantities, production rates, and durations. The second option, pressing ***Alt-P*** will carry on the procedure to the next step. How these two options work is explained and demonstrated in the content of this text. The last option, pressing ***Alt-Q***, will stop the procedure, exit Lotus 123 without saving, and take you to DOS prompt. If this option is chosen, a window will appear on the screen warning that you will lose all your work if you decide to quit at this point, and offering an alternative option of going back to the menu shown above. After reconsidering what to do, the user might want to go back to this menu or exit the computerized system.

ATTENTION: The way to choose an option from this menu is different than the other menus used throughout this procedure. As opposed to moving the cursor onto the desired option in a menu and pressing ***Enter*** to choose it, you need to do the key strokes attached to each option of this menu. These key strokes consist of pressing the ***Alt*** key with a letter key as stated for each option at the same time.

It is recommended that the user first chooses ***Alt-C*** in order to go through the list of activities, their quantities, production rates, and durations calculated by the system to check if all the project information is proper to get an initial schedule. Especially after entering quantities, durations of some activities may come out to be much more or unnecessarily less than what can be allowed. Therefore, the user might want to do some final adjustments in figures before obtaining a project schedule. For instance, for a certain activity, once the quantity is entered correctly, the user might want to change the production rate up or down to be able to see immediately how it affects the duration. Only then the user might wish to decide on what exact production rate should be used. Also, it might be useful to compare durations of activities in relation with durations of other activities and make adjustments accordingly perhaps even putting the priority of production rates behind.

Let us try to illustrate why and how changes can be done in this table with a few examples. Imagine a scenario in which the user thinks:

1. The duration for *Initial Traf. Control* may exceed 2 days. It is safer to assign 3 days to it.

2. Building a *Detour* will probably be finished in at most 12 days instead of 15.

3. It is possible to get a higher production rate than 616 L.F./day for *New Curb & Gutter*, perhaps as much as 800 L.F./day.

4. A duration of 38 days for *Hot-mix Asphalt Base* is too much. What if the production rate can be increased from 1750 to 2000 Tons/day?

5. It is not comforting to think that *Hot-mix Asphalt Surface* will take only 16 days to finish. It might take longer than that. How about decreasing its production rate from 1232 to 900 Tons/day?

6. For *Precast Traf. Bar'ers*, the production rate can be maintained to go up from 1250 to 1500 L.F./day.

7. *Overhead Signs* will probably go at a slower rate than 1.5 Each/day; 0.75 Each/day should be used instead of that.

8. 3 days for *Major Traffic Signals* may be a little optimistic. Lowering down its production rate from 0.4 to 0.25 Each/day might allow some extra time to finish it.

9. It should be possible to get a much higher rate than 4400 S.Y./day for *Seeding & Landscaping*, perhaps as much as 8000 S.Y./day.

10. *Final Clean-up* for this phase may take longer than 2 days. Its production rate should

be decreased from 30.8 to 20 Sta./day in order to add some extra time to this task.

ATTENTION: It is recommended to modify durations directly for only lump-sum tasks. For those items for which a production rate is specified, it is NOT recommended to change the duration directly. Rather, the user should play up and down with the rate specified (meaning increasing/decreasing it) until he/she gets the duration desired. The reason for this is that the system is designed to calculate durations by using production rates, NOT vice versa. If a duration is directly edited, the matching production rate will not be mathematically adjusted to represent the situation.

Action: Press *Alt-C* to start the editing process.

	L	M	N	O	P	Q
79		Project Type:				
80		PROJECT WITH NO BRIDGE				
81	#	TASK NAME	UNITS	QUANTITY	PROD RATE	DURATION
82	1	Initial Traf. Control	L.Sum			2
83	2	Detour	L.Sum			15
84	3	ROW Preparations				
85	4	Major struc. demoli'n	L.Sum			20
86	5	Clear & Grub	Acres	14.6	4	4
87	6	Rmv. old strc.(small)	L.Sum			10

You can edit quantities, production rates and durations of lump-sum work items in this table. Use the arrow keys to move the cursor to the cell you want to change, type in the correct entry and move the cursor to another cell.
AVOID HITTING "Enter" until you are completely done.
When finished editing, press "Enter" to proceed.

PLEASE PRESS "ENTER" TO START EDITING

Action: Press *Enter* to start editing the table. Do the 10 changes required by this scenario without hitting *Enter* after each time you edit a value; rather, move the cursor to the next cell you wish to change. (same editing principle applies as described earlier). Press *Enter* only after you finish all of your editing. The whole of this table is illustrated once again on the following page with the changes shown in bold figures.

	L	M	N	O	P	Q
79		Project Type:				
80		PROJECT WITH NO BRIDGE				
81	#	TASK NAME	UNITS	QUANTITY	PROD RATE	DURATION
82	1	Initial Traf. Control	L.Sum			3
83	2	Detour	L.Sum			12
84	3	ROW Preparations				
85	4	Major struc. demoli'n	L.Sum			20
86	5	Clear & Grub	Acres	14.6	4	4
87	6	Rmv. old strc.(small)	L.Sum			10
88	7	Rmv. old pavement	S.Y.	35200	2200	16
89	8	Rmv old curb & gutter	L.F.	10560	1200	9
90	9	Rmv. old sidewalks	S.Y.	1760	700	3
91	10	Rmv old drai/util str	L.F.	3120	350	9
92	11	Excavation/Embankment				
93	12	Earth Excavation	C.Y.	100000	4500	23
94	13	Rock Excavation	C.Y.	0	1056	0
95	14	Embankment	C.Y.	60000	5000	12
96	15	Drainage str/Storm sw				
97	16	Pipe	L.F.	4000	225	18
98	17	Box Culverts	C.Y.	200	16	13
99	18	Inlets & Manholes	Each	21	2	11
100	19	Retaining Walls	S.F.	0	160	0
101	20	Base Preparations				
102	21	Lime Stabilization	S.Y.	55000	4250	13
103	22	Flexible Base Mater'l	S.Y.	50000	3250	16
104	23	Cement Treated Base M	S.Y.	0	2992	0
105	24	New Curb & Gutter	L.F.	11500	800	15
106	25	Asph. Pavement Repair	S.Y.	0	191.25	0
107	26	Conc. Pavement Repair	S.Y.	0	106.25	0
108	27	Milling/Planing	S.Y.	0	9680	0
109	28	One-course Surf. Trmt	S.Y.	0	49280	0
110	29	Hot-mix Asphalt Base	Ton	65000	2000	33
111	30	Hot-mix Asphalt Surf.	Ton	19000	900	22
112	31	Concrete Paving	S.Y.	0	2992	0
113	32	Precast Traf. Bar'ers	L.F.	22000	1500	15
114	33	Signing/Traf. Signals				
115	34	Small signs	Each	115	20	6
116	35	Overhead signs	Each	4	0.75	6
117	36	Major traffic signals	Each	1	0.25	4
118	37	Seeding & Landscaping	S.Y.	75000	8000	10
119	38	Pavement Markings	L.F.	43000	10560	5
120	39	Final Clean-up	Sta.	55	20	3
121						
122						
123						

Explanations: Hitting ***Enter*** after all the changes are input in the table takes you back to the previous menu.

```
Press Alt-C to make Changes  Press Alt-P to Proceed  Press Alt-Q to Quit
EDIT
     L             M               N       O          P         Q
70
71
72      Please Press "Alt-C" to Make CHANGES
73
74      Please Press "Alt-P" to PROCEED
75
76      Please Press "Alt-Q" to QUIT and Go to DOS
77
78
     L             M               N       O          P         Q
79      Project Type:
80      PROJECT WITH NO BRIDGE
81    # TASK NAME               UNITS   QUANTITY   PROD RATE   DURATION
82    1 Initial Traf. Control   L.Sum                                3
83    2 Detour                  L.Sum                               12
84    3 ROW Preparations
85    4  Major struc. demoli'n  L.Sum                               20
86    5  Clear & Grub           Acres       14.6           4         4
87    6  Rmv. old strc.(small)  L.Sum                               10
88    7  Rmv. old pavement      S.Y.       35200        2200        16
```

Explanations: Assuming the user is pleased with the current state of quantities, production rates and durations, he/she wants to get a schedule for this project now.

Action: Press ***Alt-P*** to proceed to the next step of the computerized system.

5.7.1.8 Saving the Spreadsheet File

```
Enter save file name: C:\SPJ2\CURR1\

        To obtain a project schedule from SuperProject, it is required that
you first save this information on the spreadsheet file that you have been
working on.  You are allowed to use up to 8 (eight) characters to name this
file.

      To save this file, please type a filename of up to 8 characters
at the prompt on top of the screen which is:

             Enter save file name: C:\SPJ2\CURR1\ . . . . . . . .

      Press  "Enter"  twice when done.

95    14  Embankment              C.Y.        60000        5000        12
96    15 Drainage str/Storm sw
97    16  Pipe                    L.F.         4000         225        18
98    17  Box Culverts            C.Y.          200          16        13
```

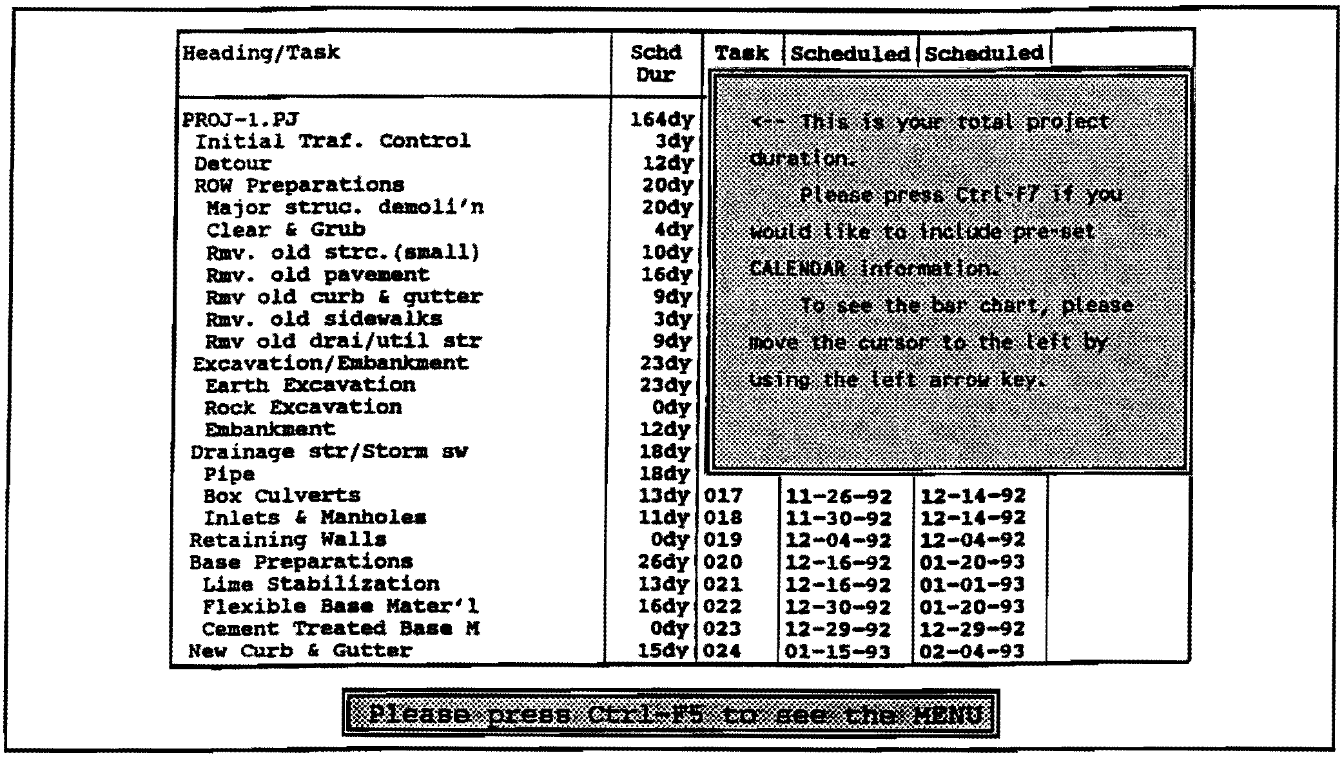
Explanations: Now, you need to save all this information you have given to the system about your project. Remember so far you have only accessed Lotus 123, and have done all your work on a spreadsheet file. To be able to obtain a project schedule and a bar chart from SuperProject, you need to save this spreadsheet file you have been working on. Therefore, as stated in the window that has appeared on the screen, a filename of up to 8 characters should be entered the system. It is essential that this file is saved in the directory specified on the screen; therefore, all you need to do is type a filename. Please do not try to save it in another directory or on diskette at this time; you should be able to do this through DOS commands later on if you wish to.

Action: As a suggestion, use **CNF-PH1** as your filename. Type this, press ***Enter*** twice, and then WAIT without pressing any key for a few seconds until new instructions come up.

5.7.1.9 In SuperProject

Explanations: As you type the filename and press ***Enter*** twice, the system will save your file, and automatically start the process of information transfer from this Lotus 123 file to SuperProject. You will see windows popping up and disappearing one after another. Please do not interfere with the system by pressing keys on the keyboard or clicking the mouse. Simply wait for a few seconds until new instructions come up on the screen.

When this process is over, you will realize that you are no longer in Lotus 123 but in SuperProject. Below is an illustration of what you will see on the screen at this point.



The cursor is on the top number in the *Schd Dur* column which stands for scheduled duration. This number coincides with the header reserved for the project name. Therefore, as also stated with an arrow on the window that has appeared on the screen, this number, which came out to be 164 days, is the total project duration of the first phase of this example project. Below that are the individual activity durations which were checked by the user during earlier stages of the procedure.

On the same window, the key stroke that would let the user make use of any calendar information pre-set in the system is mentioned. Discussion of this subject, however, would be more appropriate after both of the phases of this example project are reviewed.

It is also mentioned on the same window that to see the bar chart produced by the system, the cursor should be moved to the left of where it is at this point.

5.7.1.10 Viewing the Bar Chart (Gannt Chart)

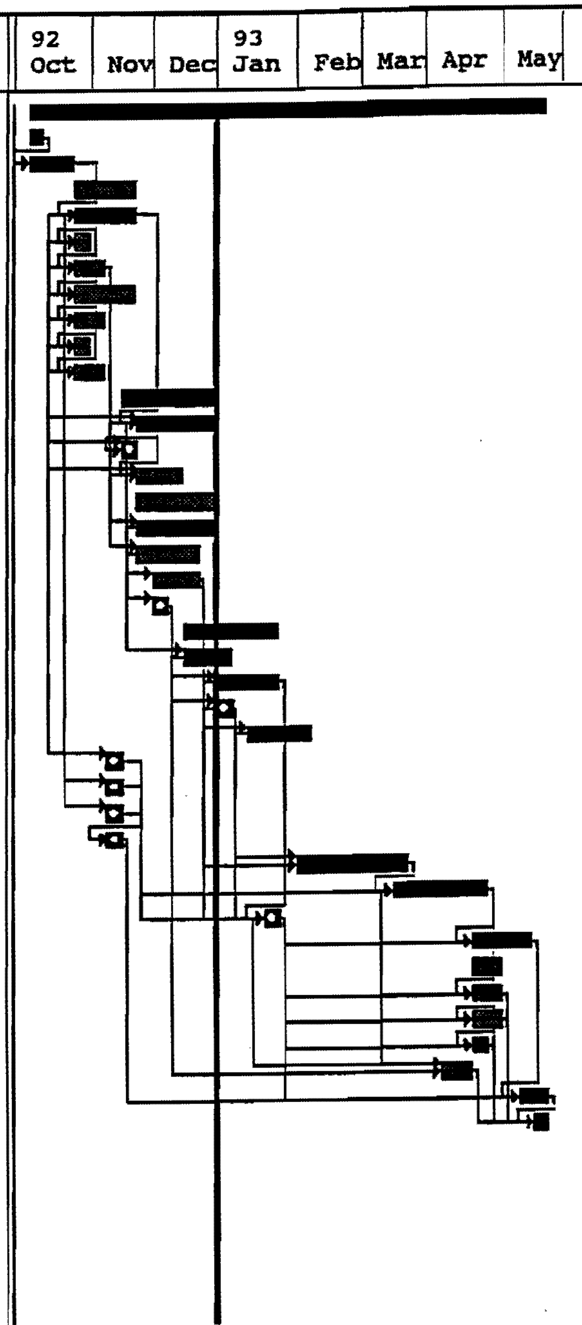
Action: Using the left arrow key, move the cursor to the left of the screen.

Explanations: You should be able to see the bar chart, also referred to as Gannt chart next to activity names at this time. As you can notice, the length of the bars are in proportion to the durations of the activities they represent since the bar chart is drawn on a time scale shown at the top. Those activities that do not exist in this example project have been input a quantity of zero earlier in the procedure. In SuperProject, you will notice that their names have also been carried among the others, and they each appear to have a duration of zero in *Schd Dur* column. On the bar chart, they are represented by a figure that is actually used to represent milestones in schedule by SuperProject. It might be worthwhile here to mention this to the reader to avoid confusion. As far as the total project duration is concerned, these tasks have no direct effect since they each have practically no duration. However, it is essential to keep them in the schedule because they, together with the other tasks, constitute the sequencing of the work. This sequencing of work may be observed on the bar chart itself by the arrows drawn from one task to another if a relationship has been defined between them.

Once you are in SuperProject, and the bar chart is being displayed on the screen, you can adjust its size if you wish to. You can reduce the size by pressing ***Ctrl-R***. This way, you will get a smaller time scale and shorter bars. This feature is especially useful if you wish to see all of the time span of the project in one screen lengthwise; you can do so by pressing ***Ctrl-R*** enough times. On the other hand, to enlarge the size, you can press ***Ctrl-E***. This feature might be useful to get a larger, more accurate bar chart in which it is easier to see the details. Both of these commands are characteristics of SuperProject.

Action: Press ***Ctrl-R*** several times to reduce the bar chart so that it will cover the whole length of the project as seen on the following page.

Heading/Task 7 Days Per Column	Schd Dur
CNF-PH1.PJ	164dy
Initial Traf. Control	3dy
Detour	12dy
ROW Preparations	20dy
Major struc. demoli'n	20dy
Clear & Grub	4dy
Rmv. old strc.(small)	10dy
Rmv. old pavement	16dy
Rmv old curb & gutter	9dy
Rmv. old sidewalks	3dy
Rmv old drai/util str	9dy
Excavation/Embankment	23dy
Earth Excavation	23dy
Rock Excavation	0dy
Embankment	12dy
Drainage str/Storm sw	18dy
Pipe	18dy
Box Culverts	13dy
Inlets & Manholes	11dy
Retaining Walls	0dy
Base Preparations	26dy
Lime Stabilization	13dy
Flexible Base Mater'l	16dy
Cement Treated Base M	0dy
New Curb & Gutter	15dy
Asph. Pavement Repair	0dy
Conc. Pavement Repair	0dy
Milling/Planing	0dy
One-course Surf. Trmt	0dy
Hot-mix Asphalt Base	33dy
Hot-mix Asphalt Surf.	22dy
Concrete Paving	0dy
Precast Traf. Bar'ers	15dy
Signing/Traf. Signals	6dy
Small signs	6dy
Overhead signs	6dy
Major traffic signals	4dy
Seeding & Landscaping	10dy
Pavement Markings	5dy
Final Clean-up	3dy

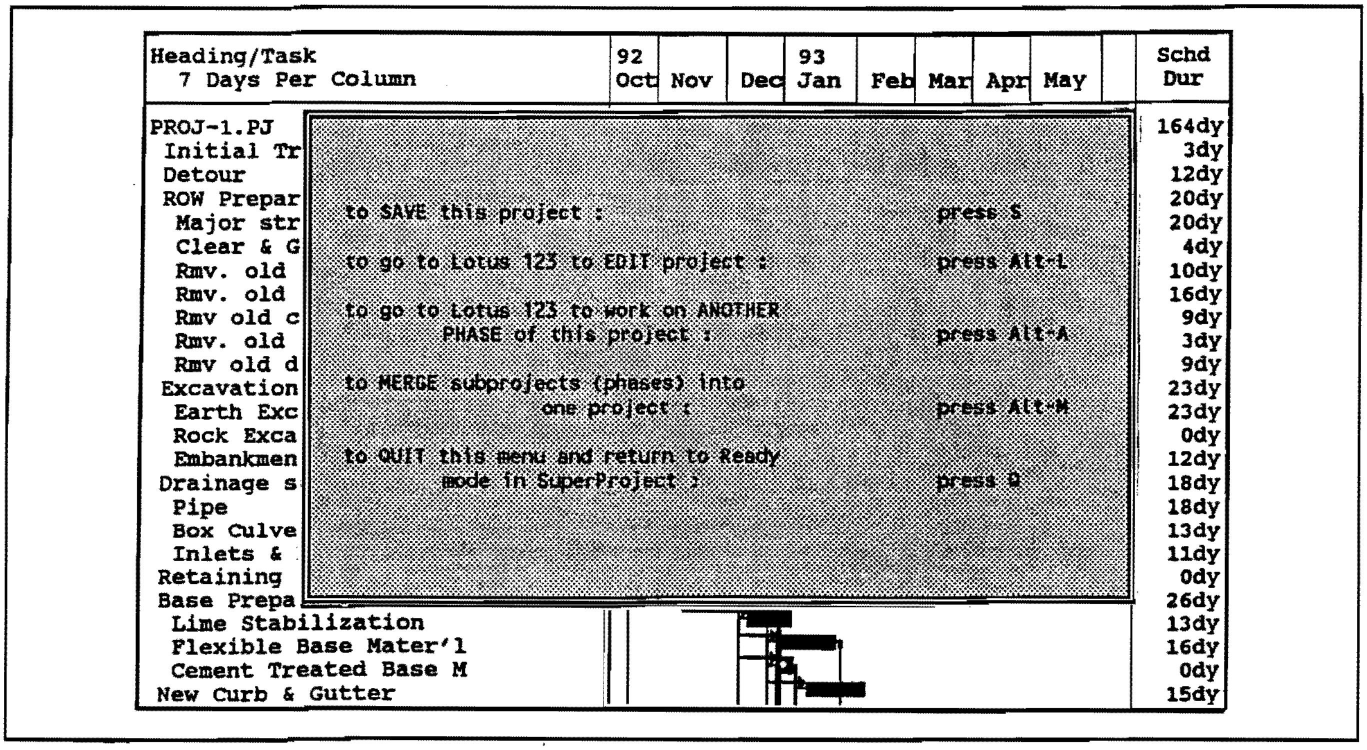


Unassigned
Critical
Interrupted
Milestone
Noncritical

5.7.1.11 CTDS Menu in SuperProject

Explanations: A menu has been built in SuperProject particularly for this computerized method. You can activate this menu at the Ready mode of SuperProject by pressing *Ctrl-F5*, that is the Control key and the F5 function key at the same time. It is useful to keep this in mind to be able to call this menu when needed, because the options included in this menu make some tedious manual work automatic and thus easier for the user. Sometimes, a note at the bottom of the screen will remind you how to call this menu; however, this reminder will not be available on the screen at all times, so you should keep this command in mind.

Action: Press *Ctrl-F5* to activate this menu in SuperProject.



Explanations: As seen in the illustration above, this menu has five options. The first option is used for saving the current project file in SuperProject. It is activated simply by pressing the *S* key on the keyboard. Then a window pops up telling the user to type a filename of up to 8 characters and press ***Enter***. This will save the file in the directory *C:SPJ2*, which is the directory that SuperProject is loaded in.

ATTENTION: Each full application of the computerized system produces two files: The spreadsheet file which the user has accessed to earlier, and the SuperProject file which gets the information it requires from that spreadsheet file. Remember that the spreadsheet file is given a name and saved by the user at an earlier point during the procedure. Since each application generates a pair of files, it is recommended for practical purposes that the SuperProject file is given the same name as the spreadsheet file has been.

The second option will let you edit the project information you have input in Lotus 123 if you are not pleased with its outcome after seeing the schedule in SuperProject. Pressing ***Alt-L*** activates this option. Without saving the current schedule file, you will be taken to Lotus 123 again, and asked to identify the file of that project in which you would like to do your editing. After choosing the correct file from a list of other project files that were produced from earlier applications of the computerized method, you will get a chance to edit relationship percentages, quantities, production rates, and durations. Then you can obtain another schedule for the changes you have made.

The third option is to be chosen for multi-phase projects in which you would like to continue applying the procedure to the next phase after getting a schedule for the phase you have just worked on. This selection can be activated by pressing ***Alt-A***. As a precautionary process, in case you forget to save the current file, you will be asked to save it before continuing to the next phase. The saving process is similar to choosing the save option of this menu. If you already have, just press ***Enter*** when the prompt asks you to type a filename. Then you will be taken to the window in which you can select the project category, and go through the whole procedure once again for the next phase.

The fourth option is for merging separate phases into one whole multi-phase project. For a multi-phase project, after the user has worked separately on each phase, he/she can choose this option and assemble those phases to constitute the whole project. When ***Alt-M*** is pressed to activate this option, the current project shown on the screen is discarded. The system then asks the user to choose the project file to be used as the first phase of the whole project. When this file is specified, a window pops up asking if the user wants to add another phase to this project. This cycle goes on for every phase until there are no more phases to be added. A detailed coverage of how this option works will be held later while merging the two phases of the example project at hand.

The last option is for quitting this menu to go to the Ready mode in SuperProject. Notice that when this menu is on the screen, no other command other than the ones that activate the options in this menu works. Therefore, if you need to do something other than what this menu offers, for example using one of SuperProject's features through its own pull-down menu like exiting SuperProject manually, you need to quit this menu and get into the Ready mode of SuperProject. Pressing the *Q* key would let you do that.

For demonstration purposes, the third option should be chosen to continue with the second phase of the example project.

5.7.1.12 Second Phase of the Example Project

Action: Press *Alt-A* to work on the second phase of this project.

When the window pops up to ask you to type a name of up to 8 characters to save this SuperProject file, type in the same filename used for saving the spreadsheet file earlier which is **CNF-PH1** and press *Enter*. Then WAIT for a few seconds without pressing a key until the menu containing the project category options appear.

```
Please make your choice from the four options listed below:

   Option A.   RESURFACING PROJECTS
                 1. Seal Coat  (SC)
                 2. Overlay  (OV)

   Option B.   PROJECTS WITH BRIDGE STRUCTURES
                 3. Rehabilitate Existing Road  (RER)
                 4. Convert Non-Freeway to Freeway  (CNF)
                 5. Widen Freeway  (WF)
                 6. Widen Non-Freeway  (WNF)
                 7. New Location Freeway  (NLF)
                 8. New Location Non-Freeway  (NNF)
                 9. Interchange  (INC)
                 10. Bridge Widening/Rehabilitation  (BWR)
                 11. Bridge Replacement/New Bridge  (BR)
                 12. Upgrade Freeway to Standards  (UPG)
                 13. Upgrade Non-Freeway to Standards  (UGN)

   Option C.   PROJECTS WITHOUT BRIDGE STRUCTURES (project types 3-13)

   Option D.   BRIDGE STRUCTURES ONLY
```

Explanations: As you know the first phase of the example two-phase Convert Non-Freeway to Freeway project which we have just covered did not have a bridge in it. As mentioned earlier, let us assume the second phase has two bridges, just for demonstration purposes. In general, the way to handle a single phase with more than one bridge structure in it would be to choose *PROJECTS WITH BRIDGE STRUCTURES* at first. This option, however, contains only one bridge structures by default for the project types listed below its name. After running the procedure for this phase as if it had only one bridge in it, the next step would be to add the second bridge by choosing the fourth option, *BRIDGE STRUCTURES ONLY* from this same menu, and insert it to that phase. Let us illustrate this process by following the example project at hand.

Action: Bring the cursor over *Option B. PROJECTS WITH BRIDGE STRUCTURES*, and press ***Enter*** to select.

```
    Now, you will be able to check the pre-established relationships
between these work items and make any necessary changes.
    In this table, each row stands for a relationship defined between
two activities.  For each row, the first activity is the predecessor,
the second one is the successor.
    The numbers in the last column stand for the required percent com-
pletion of the predecessor for the successor to start.  The number "100"
represents a "Finish-to-Start" relationship in which the predecessor
should be 100% completed before the successor can start.  The number "0"
represents a "Start-to-Start" relationship in which the successor can
start at the same time as the predecessor.  Any number in between will
be used to determine the lag time between the start of the two activities
with the lag calculated as that percentage times the duration of the pre-
decessor.

                    PLEASE PRESS  "ENTER"  TO PROCEED
```

Action: Press ***Enter*** to continue.

	Y	Z	AA	AB	AC
75				% complete of	
76		PREDECESSOR NAME	SUCCESSOR NAME	predecessor	
77		Initial Traf. Control	Detour	100	
78		Detour	Major struc. demoli'n	100	
79		Detour	Clear & Grub	100	
80		Detour	Rmv. old strc.(small)	100	
81		Detour	Rmv. old pavement	100	
82		Detour	Rmv old curb & gutter	100	
83		Detour	Rmv. old sidewalks	100	
84		Detour	Rmv old drai/util str	100	

On the spreadsheet, move the cursor by using the up or down arrow keys. To make any necessary changes on percentages, move the cursor to the cell you want to change, type the correct entry, and then move the cursor to another cell.

DO NOT HIT "Enter" if you still have more changes to make.

When you are completely finished, press "Enter".

PLEASE PRESS "ENTER" TO START EDITING

Action: Please press ***Enter*** to start editing.

	Y	Z	AA	AB	AC
75				% complete of	
76		PREDECESSOR NAME	SUCCESSOR NAME	predecessor	
77		Initial Traf. Control	Detour	100	
78		Detour	Major struc. demoli'n	100	
79		Detour	Clear & Grub	100	
80		Detour	Rmv. old strc.(small)	100	
81		Detour	Rmv. old pavement	100	
82		Detour	Rmv old curb & gutter	100	
83		Detour	Rmv. old sidewalks	100	
84		Detour	Rmv old drai/util str	100	
85		Major struc. demoli'n	Earth Excavation	25	
86		Major struc. demoli'n	Rock Excavation	25	
87		Major struc. demoli'n	Embankment	25	
88		Clear & Grub	Earth Excavation	25	
89		Clear & Grub	Rock Excavation	25	
90		Clear & Grub	Embankment	25	
91		Rmv. old strc.(small)	Earth Excavation	25	
92		Rmv. old strc.(small)	Rock Excavation	25	
93		Rmv. old strc.(small)	Embankment	25	
94		Rmv. old pavement	Earth Excavation	25	

Explanations: For simplicity, assume the user does not wish to modify any relationship percentages. In such a case, pressing ***Enter*** would take you out of the Edit Mode, and let you continue with the procedure. Editing relationship percentages was described in detail when covering the first phase of this example project. In case of any doubt on this subject, you might want to refer to section 5.6.1.3.

Action: Press ***Enter*** to proceed without making any changes.

```
                MORE EDITING RELATIONSHIPS

          CONTINUE TO THE NEXT STEP OF THE PROCEDURE

            TERMINATE PROCEDURE & EXIT TO DOS

83          Detour                   Rmv. old sidewalks        100
84          Detour                   Rmv old drai/util str     100
85          Major struc. demoli'n    Earth Excavation          100
86          Major struc. demoli'n    Rock Excavation           100
87          Major struc. demoli'n    Embankment                100
88          Clear & Grub             Earth Excavation           25
89          Clear & Grub             Rock Excavation            25
90          Clear & Grub             Embankment                 25
91          Rmv. old strc.(small)    Earth Excavation           25
92          Rmv. old strc.(small)    Rock Excavation            25
93          Rmv. old strc.(small)    Embankment                 25
94          Rmv. old pavement        Earth Excavation           25
```

Action: Move the cursor over to *CONTINUE TO THE NEXT STEP OF THE PROCEDURE*, and press ***Enter***.

When the screens for the factors influencing the production rates appear one after another, do the following selections:

For *LOCATION*, choose *rural* and press ***Enter***.

For *TRAFFIC*, choose *light* and press ***Enter***.

For *COMPLEXITY*, choose *medium* and press ***Enter***.

For *SOIL CONDITIONS*, choose *fair* and press ***Enter***.

For *QUANTITY*, choose *medium* and press ***Enter***.

	T	U	V	W	X	Y
1	Project Type:					
2	PROJECT WITH NO BRIDGE		D A I L Y	P R O D U	C T I O N	R A T E
3	TASK NAME	UNITS	LOW	AVERAGE	HIGH	PROPOSED

In the upcoming table you will see four production rates listed next to each activity's name. For each activity, the first three values stand for a typical low, average, and high rate, respectfully. The fourth one is the rate proposed by the system based on the choices you have made on the factors that affect the production rates. For lump-sum items, the same situation applies in terms of working days instead of production rates.

If you would like to use a rate or a duration other than what the system proposes, simply make the change by moving the cursor to the cell which has the value to be changed, type in the new value, and then move the cursor to another cell. AVOID HITTING "Enter" until all your changes are done.

PLEASE PRESS "ENTER" TO SEE THE TABLE

Action: Press ***Enter*** to see the table on production rates.

	T	U	V	W	X	Y
1	Project Type:					
2	PROJECT WITH BRIDGE		D A I L Y	P R O D U	C T I O N	R A T E
3	TASK NAME	UNITS	LOW	AVERAGE	HIGH	PROPOSED
4	ROW Preparations					
5	Clear & Grub	Acres	1	3	6	2.992
6	Rmv. old pavement	S.Y.	1000	2000	3000	2200
7	Rmv old curb & gutter	L.F.	600	1200	2000	1200
8	Rmv. old sidewalks	S.Y.	350	700	1100	700
9	Rmv old drai/util str	L.F.	100	300	500	297.5
10	Excavation/Embankment					
11	Earth Excavation	C.Y.	1200	3400	7000	3141.6
12	Rock Excavation	C.Y.	500	1100	1500	897.6
13	Embankment	C.Y.	1200	3500	7000	3141.6
14	Drainage str/Storm sw					
15	Pipe	L.F.	100	200	300	191.25
16	Box Culverts	C.Y.	10	15	25	13.6
17	Inlets & Manholes	Each	1	2	3	1.7
18	Bridge Structures					
19	Cofferdams	S.Y.	100	200	300	162.5625
20	Piling	L.F.	200	300	400	276.25

Explanations: Again for simplicity, assume the user does not wish to change any of the proposed rates. Checking and editing rates with comparison to low, average and high values was covered in detail for the first phase of this example project. You might want to refer to section 5.6.1.5 in case of any help on this subject. Notice, however, that most of the proposed rates are different than the ones proposed for the first phase. The reason for this is that a different combination of conditions for factors affecting production rates were chosen to represent project characteristics for this second phase. Reviewing this outcome might be useful in comprehending how those five factors affect production rates the way they are set in the system.

<u>Action:</u> Press *Enter* to proceed without making any changes.

```
                T              U         V         W         X         Y
1   Project Type:
2   PROJECT WITH NO BRIDGE          D A I L Y   P R O D U C T I O N   R A T E
3   TASK NAME               UNITS       LOW    AVERAGE      HIGH   PROPOSED
4   ROW Prep
5    Clear &                                                          2.992
6    Rmv. ol                                                           2200
7    Rmv old          MORE EDITING RATES & DURATIONS                   1200
8    Rmv. ol                                                            700
9    Rmv old     CONTINUE TO THE NEXT STEP OF THE PROCEDURE           297.5
10  Excavati
11   Earth E          TERMINATE PROCEDURE & EXIT TO DOS               141.6
12   Rock Ex                                                          897.6
13   Embankm                                                          141.6
14  Drainage
15   Pipe                   L.F.        100       200       300      191.25
16   Box Culverts           C.Y.         10        15        25        13.6
17   Inlets & Manholes      Each          1         2         3         1.7
18  Bridge Structures
19   Cofferdams             S.Y.        100       200       300   162.5625
20   Piling                 L.F.        200       300       400     276.25
```

<u>Action:</u> Move the cursor over to *CONTINUE TO THE NEXT STEP OF THE PROCEDURE*, and press *Enter*.

When the new window with instructions on how to enter quantities pops up, press *Enter* to go in the table to input quantities. Once in the table, type in the quantity shown in bold digits and press *Enter* for each activity on the list as shown on the following page.

	L	M	N	O	P	Q
79		Project Type:				
80		PROJECT WITH BRIDGE				
81	#	TASK NAME	UNITS	QUANTITY	PROD RATE	DURATION
82	1	Initial Traf. Control	L.Sum			2
83	2	Detour	L.Sum			6
84	3	ROW Preparations				
85	4	Major struc. demoli'n	L.Sum			10
86	5	Clear & Grub	Acres	18	2.992	7
87	6	Rmv. old strc.(small)	L.Sum			3
88	7	Rmv. old pavement	S.Y.	32000	2200	15
89	8	Rmv old curb & gutter	L.F.	4600	1200	4
90	9	Rmv. old sidewalks	S.Y.	0	700	0
91	10	Rmv old drai/util str	L.F.	1900	297.5	7
92	11	Excavation/Embankment				
93	12	Earth Excavation	C.Y.	88000	3141.6	29
94	13	Rock Excavation	C.Y.	12000	897.6	14
95	14	Embankment	C.Y.	79000	3141.6	26
96	15	Drainage str/Storm sw				
97	16	Pipe	L.F.	3500	191.25	19
98	17	Box Culverts	C.Y.	220	13.6	17
99	18	Inlets & Manholes	Each	14	1.7	9
100	19	Bridge Structures				
101	20	Erect Temp. Bridge	L.Sum			15
102	21	Bridge Demolition	L.Sum			15
103	22	Cofferdams	S.Y.	0	162.5625	0
104	23	Piling	L.F.	1700	276.25	7
105	24	Footings	C.Y.	180	13.6	14
106	25	Columns, Caps & Bents	C.Y.	90	5.984	16
107	26	Wingwalls	S.F.	700	136	6
108	27	Beams (erection only)	L.F.	1000	200	5
109	28	Bridge Deck	C.Y.	250	8.976	28
110	29	Bridge Curbs/Walks	L.F.	400	79.2	6
111	30	Bridge Handrails	L.F.	400	198	3
112	31	Remove Temp. Bridge	L.Sum			10
113	32	Retaining Walls	S.F.	1760	136	13
114	33	Base Preparations				
115	34	Lime Stabilization	S.Y.	64000	3366	20
116	35	Flexible Base Mater'l	S.Y.	66000	2992	23
117	36	Cement Treated Base M	S.Y.	0	2543.2	0
118	37	New Curb & Gutter	L.F.	13200	616	22
119	38	Ashp. Pavement Repair	S.Y.	0	191.25	0
120	39	Conc. Pavement Repair	S.Y.	0	106.25	0
121	40	Milling/Planing	S.Y.	0	9680	0
122	41	One-course Surf. Trmt	S.Y.	0	49280	0
123	42	Hot-mix Asphalt Base	Ton	47000	1232	39
124	43	Hot-mix Asphalt Surf.	Ton	25000	1232	21
125	44	Concrete Paving	S.Y.	0	2992	0
126	45	Precast Traf. Bar'ers	L.F.	21000	1056	20
127	46	Signing/Traf. Signals				
128	47	Small signs	Each	150	20	8
129	48	Overhead signs	Each	6	1.5	4
130	49	Major traffic signals	Each	3	0.4	8
131	50	Seeding & Landscaping	S.Y.	67500	4400	16
132	51	Pavement Markings	L.F.	80000	10560	8
133	52	Final Clean-up	Sta.	110	30.8	4
134						
135						
136						

Explanations: As you type in the quantity for the last item on the list and press ***Enter***, the menu below appears. Assume the durations of some of the lump-sum items are required to be modified as follows:

Initial Traf. Control	from	*2*	to	**4**	days
Detour	from	*6*	to	**10**	days
Major struc. demoli'n	from	*10*	to	**0**	days
Rmv. old strc.(small)	from	*3*	to	**0**	days.

```
Press Alt-C to make Changes  Press Alt-P to Proceed  Press Alt-Q to Quit
EDIT
     L              M                N       O          P          Q
70
71
72      Please Press "Alt-C" to Make CHANGES
73
74      Please Press "Alt-P" to PROCEED
75
76      Please Press "Alt-Q" to QUIT and Go to DOS
77
78
     L              M                N       O          P          Q
79      Project Type:
80      PROJECT WITH BRIDGE
81     # TASK NAME                UNITS   QUANTITY   PROD RATE   DURATION
82     1 Initial Traf. Control    L.Sum                               2
83     2 Detour                   L.Sum                               6
84     3 ROW Preparations
85     4  Major struc. demoli'n   L.Sum                              10
86     5  Clear & Grub            Acres         18      2.992         7
87     6  Rmv. old strc.(small)   L.Sum                               3
88     7  Rmv. old pavement       S.Y.       32000       2200        15
```

Action: Press ***Alt-C*** to start making the four changes shown in bold digits on the following page. Make the changes without hitting ***Enter*** after each time you edit a value; rather, move the cursor to the next cell to be changed. Press ***Enter*** only after you finish all of your editing.

	L	M	N	O	P	Q
79		Project Type:				
80		PROJECT WITH BRIDGE				
81	#	TASK NAME	UNITS	QUANTITY	PROD RATE	DURATION
82	1	Initial Traf. Control	L.Sum			4
83	2	Detour	L.Sum			10
84	3	ROW Preparations				
85	4	Major struc. demoli'n	L.Sum			0
86	5	Clear & Grub	Acres	18	2.992	7
87	6	Rmv. old strc.(small)	L.Sum			0
88	7	Rmv. old pavement	S.Y.	32000	2200	15
89	8	Rmv old curb & gutter	L.F.	4600	1200	4
90	9	Rmv. old sidewalks	S.Y.	0	700	0
91	10	Rmv old drai/util str	L.F.	1900	297.5	7
92	11	Excavation/Embankment				
93	12	Earth Excavation	C.Y.	88000	3141.6	29
94	13	Rock Excavation	C.Y.	12000	897.6	14
95	14	Embankment	C.Y.	79000	3141.6	26
96	15	Drainage str/Storm sw				
97	16	Pipe	L.F.	3500	191.25	19
98	17	Box Culverts	C.Y.	220	13.6	17
99	18	Inlets & Manholes	Each	14	1.7	9
100	19	Bridge Structures				
101	20	Erect Temp. Bridge	L.Sum			15
102	21	Bridge Demolition	L.Sum			15
103	22	Cofferdams	S.Y.	0	162.5625	0
104	23	Piling	L.F.	1700	276.25	7
105	24	Footings	C.Y.	180	13.6	14
106	25	Columns, Caps & Bents	C.Y.	90	5.984	16
107	26	Wingwalls	S.F.	700	136	6
108	27	Beams (erection only)	L.F.	1000	200	5
109	28	Bridge Deck	C.Y.	250	8.976	28
110	29	Bridge Curbs/Walks	L.F.	400	79.2	6
111	30	Bridge Handrails	L.F.	400	198	3
112	31	Remove Temp. Bridge	L.Sum			10
113	32	Retaining Walls	S.F.	1760	136	13
114	33	Base Preparations				
115	34	Lime Stabilization	S.Y.	64000	3366	20
116	35	Flexible Base Mater'l	S.Y.	66000	2992	23
117	36	Cement Treated Base M	S.Y.	0	2543.2	0
118	37	New Curb & Gutter	L.F.	13200	616	22
119	38	Ashp. Pavement Repair	S.Y.	0	191.25	0
120	39	Conc. Pavement Repair	S.Y.	0	106.25	0
121	40	Milling/Planing	S.Y.	0	9680	0
122	41	One-course Surf. Trmt	S.Y.	0	49280	0
123	42	Hot-mix Asphalt Base	Ton	47000	1232	39
124	43	Hot-mix Asphalt Surf.	Ton	25000	1232	21
125	44	Concrete Paving	S.Y.	0	2992	0
126	45	Precast Traf. Bar'ers	L.F.	21000	1056	20
127	46	Signing/Traf. Signals				
128	47	Small signs	Each	150	20	8
129	48	Overhead signs	Each	6	1.5	4
130	49	Major traffic signals	Each	3	0.4	8
131	50	Seeding & Landscaping	S.Y.	67500	4400	16
132	51	Pavement Markings	L.F.	80000	10560	8
133	52	Final Clean-up	Sta.	110	30.8	4
134						
135						
136						

Explanations: This table containing quantities, production rates and durations for the second phase should have the final form shown on the previous page before you save all this information to get a schedule. As you make your last change and press ***Enter*** to confirm your changes, the previous menu appears once again.

Action: Now being ready to go to SuperProject, press ***Alt-P*** to proceed to the next step of CTDS.

When the window instructing the user on how to save this information on the spreadsheet appears, use **CNF-PH2** as the filename for this second phase. Type this name and press ***Enter*** twice, and then WAIT without pressing any key for a few seconds until new instructions come up.

Once you are in SuperProject, move the cursor to the left to see the bar chart for this second phase, which, so far, includes one bridge structures. Press ***Ctrl-R*** to reduce the size of the bar chart if needed (or ***Ctrl-E*** to enlarge size). This bar chart is presented on the following two pages.

BASIC OUTLINE

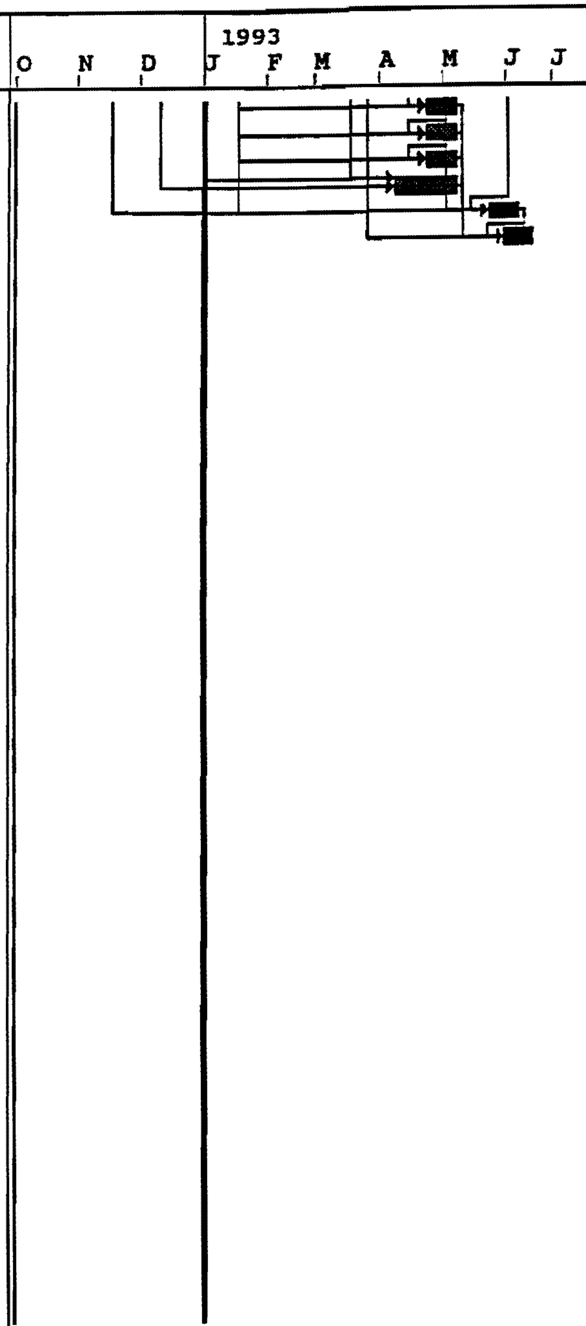
Project: CNF-PH2.PJ

Heading/Task 8 Days Per Column	Schd Dur
CNF-PH2.PJ	178dy
Initial Traf. Control	4dy
Detour	10dy
ROW Preparations	15dy
Major struc. demoli'n	0dy
Clear & Grub	7dy
Rmv. old strc.(small)	0dy
Rmv. old pavement	15dy
Rmv old curb & gutter	4dy
Rmv. old sidewalks	0dy
Rmv old drai/util str	7dy
Excavation/Embankment	29dy
Earth Excavation	29dy
Rock Excavation	14dy
Embankment	26dy
Drainage str/Storm sw	19dy
Pipe	19dy
Box Culverts	17dy
Inlets & Manholes	9dy
Bridge Structures	115dy
Erect Temp. Bridge	15dy
Bridge Demolition	15dy
Cofferdams	0dy
Piling	7dy
Footings	14dy
Columns, Caps & Bents	16dy
Wingwalls	6dy
Beams (erection only)	5dy
Bridge Deck	28dy
Bridge Curbs/Walks	6dy
Bridge Handrails	3dy
Remove Temp. Bridge	10dy
Retaining Walls	13dy
Base Preparations	38dy
Lime Stabilization	20dy
Flexible Base Mater'l	23dy
Cement Treated Base M	0dy
New Curb & Gutter	22dy
Ashp. Pavement Repair	0dy
Conc. Pavement Repair	0dy
Milling/Planing	0dy
One-course Surf. Trmt	0dy
Hot-mix Asphalt Base	39dy
Hot-mix Asphalt Surf.	21dy
Concrete Paving	0dy
Precast Traf. Bar'ers	20dy
Signing/Traf. Signals	8dy

Unassigned　Critical　Interrupted　Milestone　Noncritical

BASIC OUTLINE

Heading/Task 8 Days Per Column	Schd Dur
Small signs	8dy
Overhead signs	4dy
Major traffic signals	8dy
Seeding & Landscaping	16dy
Pavement Markings	8dy
Final Clean-up	4dy



Unassigned
Critical
Interrupted
Milestone
Noncritical

5.7.1.13 Second Bridge Structures in the Same Phase

Action: Press *Ctrl-F5* to activate the menu built in SuperProject specially for CTDS.

Explanations: At this point, the schedule obtained for the second phase should be saved to be used for the schedule of the whole project. Also remember that the second phase has not totally been completed yet; the second bridge structures are required to be included in this phase. Therefore, the user should choose the option *go to Lotus 123 to work on ANOTHER PHASE of this project* and give input to the system about this second bridge. Choosing this option would automatically ask the user to name the current file for saving before closing SuperProject.

Action: Press *Alt-A* to start working on the second bridge structure to be included in the second phase of the example Convert Non-Freeway to Freeway project.

When the small window pops up to ask you to type a filename for saving this SuperProject file, type in the same filename used for saving the spreadsheet file you worked on for the second phase, which is **CNF-PH2** and press *Enter*. (As mentioned earlier, it is recommended that the same filename is used for both the Lotus 123 and SuperProject files produced by CTDS for each phase of a project application.) Then WAIT for a few seconds without pressing a key until the menu containing the project category options appear.

```
Please make your choice from the four options listed below:

   Option A.  RESURFACING PROJECTS
                1. Seal Coat  (SC)
                2. Overlay  (OV)

   Option B.  PROJECTS WITH BRIDGE STRUCTURES
                3. Rehabilitate Existing Road  (RER)
                4. Convert Non-Freeway to Freeway  (CNF)
                5. Widen Freeway  (WF)
                6. Widen Non-Freeway  (WNF)
                7. New Location Freeway  (NLF)
                8. New Location Non-Freeway  (NNF)
                9. Interchange  (INC)
                10. Bridge Widening/Rehabilitation  (BWR)
                11. Bridge Replacement/New Bridge  (BR)
                12. Upgrade Freeway to Standards  (UPG)
                13. Upgrade Non-Freeway to Standards  (UGN)

   Option C.  PROJECTS WITHOUT BRIDGE STRUCTURES (project types 3-13)

   Option D.  BRIDGE STRUCTURES ONLY
```

Action: Bring the cursor over *Option D. BRIDGE STRUCTURES ONLY* and press ***Enter*** to select.

As you have done for the second phase earlier, skip checking and modifying relationship percentages for simplicity; following the instructions on screen would help you to do so.

When the factors affecting production rates come up in the procedure, select the same conditions you have for the second phase, that is:

For *LOCATION*, choose *rural* and press ***Enter***.

For *TRAFFIC*, choose *light* and press ***Enter***.

For *COMPLEXITY*, choose *medium* and press ***Enter***.

For *SOIL CONDITIONS*, choose *fair* and press ***Enter***.

For *QUANTITY*, choose *medium* and press ***Enter***.

When the table containing the low, average, high and proposed production rates and durations comes up, again for simplicity of this example, skip to the next step of the procedure by following the instructions on screen.

As you reach the point where you need to enter quantities for the items listed under bridge structures, type in the input shown in bold digits below.

	L	M	N	O	P	Q
79		Project Type:				
80		BRIDGE STRUCTURES				
81	#	TASK NAME	UNITS	QUANTITY	PROD RATE	DURATION
82	1	Bridge Structures				
83	2	Erect Temp. Bridge	L.Sum			15
84	3	Bridge Demolition	L.Sum			15
85	4	Cofferdams	S.Y.	**0**	162.5625	0
86	5	Piling	L.F.	**2000**	276.25	8
87	6	Footings	C.Y.	**200**	13.6	15
88	7	Columns, Caps & Bents	C.Y.	**100**	5.984	17
89	8	Wingwalls	S.F.	**1000**	136	8
90	9	Beams (erection only)	L.F.	**1100**	200	6
91	10	Bridge Deck	C.Y.	**260**	8.976	29
92	11	Bridge Curbs/Walks	L.F.	**400**	79.2	6
93	12	Bridge Handrails	L.F.	**400**	198	3
94	13	Remove Temp. Bridge	L.Sum			10
95						
96						
97						
98						

Action: When the menu appears as you have input quantity for the last item on the list and hit ***Enter***, press ***Alt-C*** to make changes on the durations of the lump-sum items, assuming there is no old or temporary bridge work. Edit without pressing ***Enter*** after each change; press ***Enter*** only after all your changes are completed. The changes you should make are displayed in bold digits in the table below which is shown in its final form.

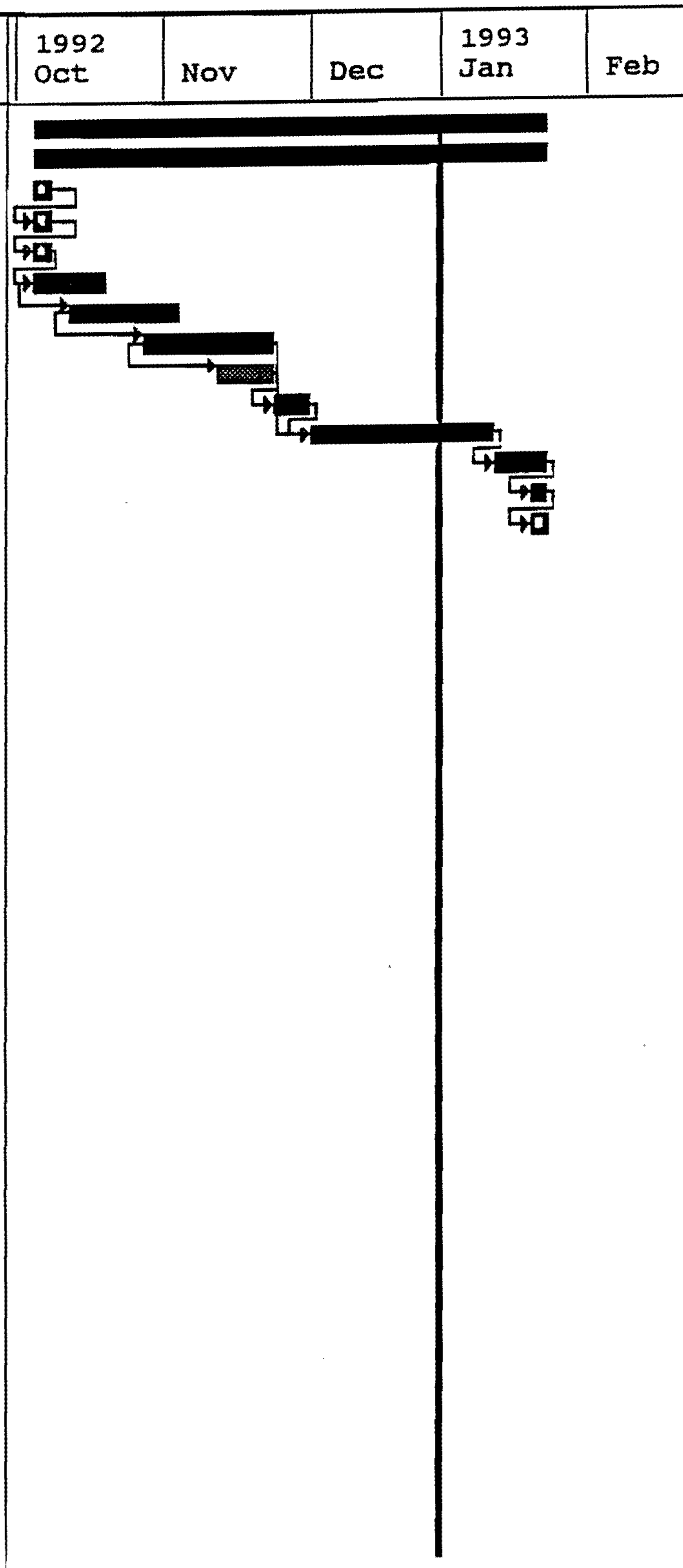
	L	M	N	O	P	Q
79		Project Type:				
80		BRIDGE STRUCTURES				
81	#	TASK NAME	UNITS	QUANTITY	PROD RATE	DURATION
82	1	Bridge Structures				
83	2	Erect Temp. Bridge	L.Sum			**0**
84	3	Bridge Demolition	L.Sum			**0**
85	4	Cofferdams	S.Y.	0	162.5625	0
86	5	Piling	L.F.	2000	276.25	8
87	6	Footings	C.Y.	200	13.6	15
88	7	Columns, Caps & Bents	C.Y.	100	5.984	17
89	8	Wingwalls	S.F.	1000	136	8
90	9	Beams (erection only)	L.F.	1100	200	6
91	10	Bridge Deck	C.Y.	260	8.976	29
92	11	Bridge Curbs/Walks	L.F.	400	79.2	6
93	12	Bridge Handrails	L.F.	400	198	3
94	13	Remove Temp. Bridge	L.Sum			**0**
95						
96						
97						
98						

Action: When the same menu appears once again as you have made all your changes and hit ***Enter***, press ***Alt-P*** to proceed to the next step in the procedure.

When the window instructing the user on how to save this information on the spreadsheet appears, use **CNF-BR** as the filename for this bridge structures work which is to be included in the second phase of the example project. Type this name and press ***Enter*** twice, and then WAIT without pressing any key for a few seconds until new instructions come up in SuperProject.

Once in SuperProject, move the cursor to see the bar chart. Press ***Ctrl-R*** to reduce the size of the bar chart if needed (or ***Ctrl-E*** to enlarge size). This bar chart is displayed on the following page.

Heading/Task 4 Days Per Column	Schd Dur
CNF-BR.PJ	79dy
Bridge Structures	79dy
Erect Temp. Bridge	0dy
Bridge Demolition	0dy
Cofferdams	0dy
Piling	8dy
Footings	15dy
Columns, Caps & Bents	17dy
Wingwalls	8dy
Beams (erection only)	6dy
Bridge Deck	29dy
Bridge Curbs/Walks	6dy
Bridge Handrails	3dy
Remove Temp. Bridge	0dy



Unassigned
Critical
Interrupted
Milestone
Noncritical

5.7.1.14 Merging Separate Phases into One Project / Linking Activities

Action: Press *Ctrl-F5* to activate the menu built in SuperProject specially for CTDS.

Explanations: Having obtained separate schedules for the first and second phases of the example project as well as the second bridge structure to be included in the second phase, the objective now is to combine them into one single project and obtain a schedule and a bar chart for all. Before that, however, the current schedule on screen, which belongs to that second bridge structure, should be saved and put in the memory of the system. Therefore, to save this portion of the project information, the first option of this menu should be chosen. As you remember, during the previous applications of CTDS on the first and second phase of the example project at hand, this saving process was automatically included by default for precautionary purposes as a part of the third option of this menu which is *go to Lotus 123 to work on ANOTHER PHASE of this project*. However, it is recommended first to save a schedule by selecting the save option of this menu in SuperProject, unless the schedule is otherwise undesired.

Action: Press *S* to save the current schedule on the second bridge structures. When asked for a name, type **CNF-BR** and press *Enter* to confirm.

Explanations: Now you may begin the process of merging the three schedules produced in this example into one. For this particular case, there are actually two ways of doing it. One would be to combine the bridge structures portion with the second phase and obtain the second phase in its finished form, and then to merge that with the first phase to get the whole project schedule. The second way would be to combine the first and the second phases together, and then add the bridge structures to that. Both ways are good as far as obtaining the whole project schedule is concerned. The second way is a little shorter to apply; however, if the user needs to obtain a separate schedule for the second phase in its finished form, he/she should choose the first way. Here, the second way is selected for review. Nevertheless, by following this, the reader should be able to figure out how to apply the first way too, since the procedures are actually very similar.

Action: Press *Alt-M* to start the merging process and WAIT until new instructions appear.

Explanations: New instructions will come up in a window at the bottom of the screen, and a list of SuperProject files will appear at the top. The three files you have named and saved for this example application will be among those projects listed on the top portion of the screen. At this point, you need to select the file that will constitute the first phase of this example project, which is **CNF-PH1**.

Action: By using the up and down arrow keys, move the cursor onto **CNF-PH1.PJ** and press ***Enter*** to select.

When asked if you want to add another phase to this project, press **Y** for yes in order to include the second phase.

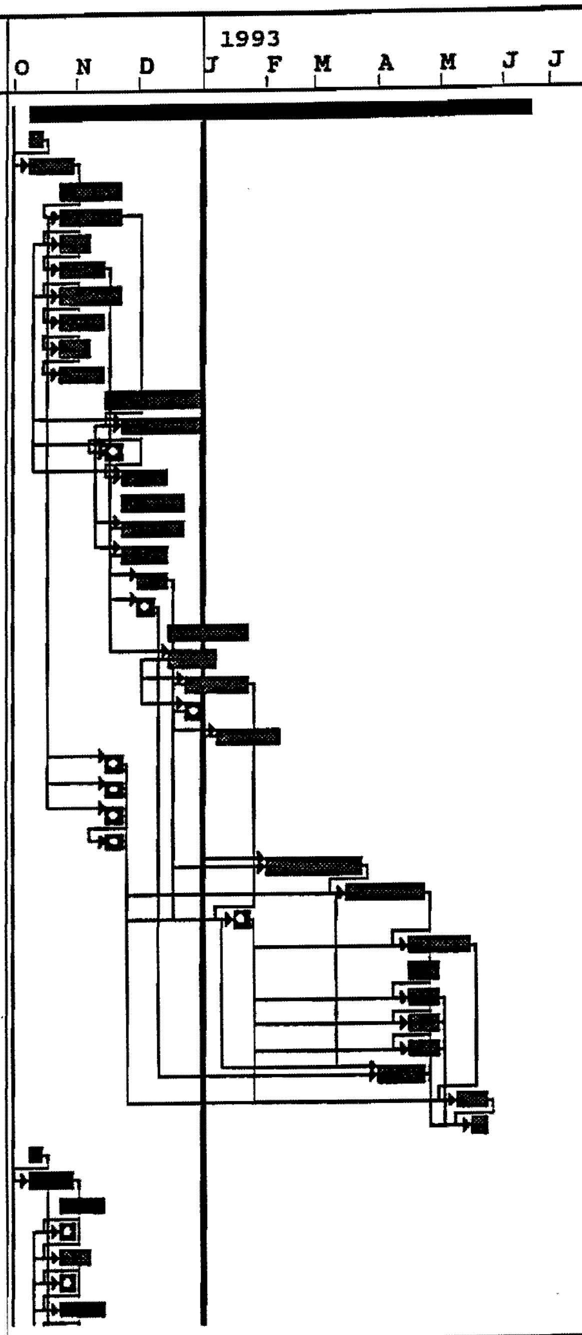
When the list of projects and the instructions window appear again, move the cursor over to **CNF-PH2.PJ** and press ***Enter*** to select.

At the "yes or no" window, press **Y** again to add the bridge structures.

When the list of projects and the instructions window appear again, move the cursor over to **CNF-BR.PJ** and press ***Enter*** to select.

At the "yes or no" window, this time press **N** since there are no other phases to be added.

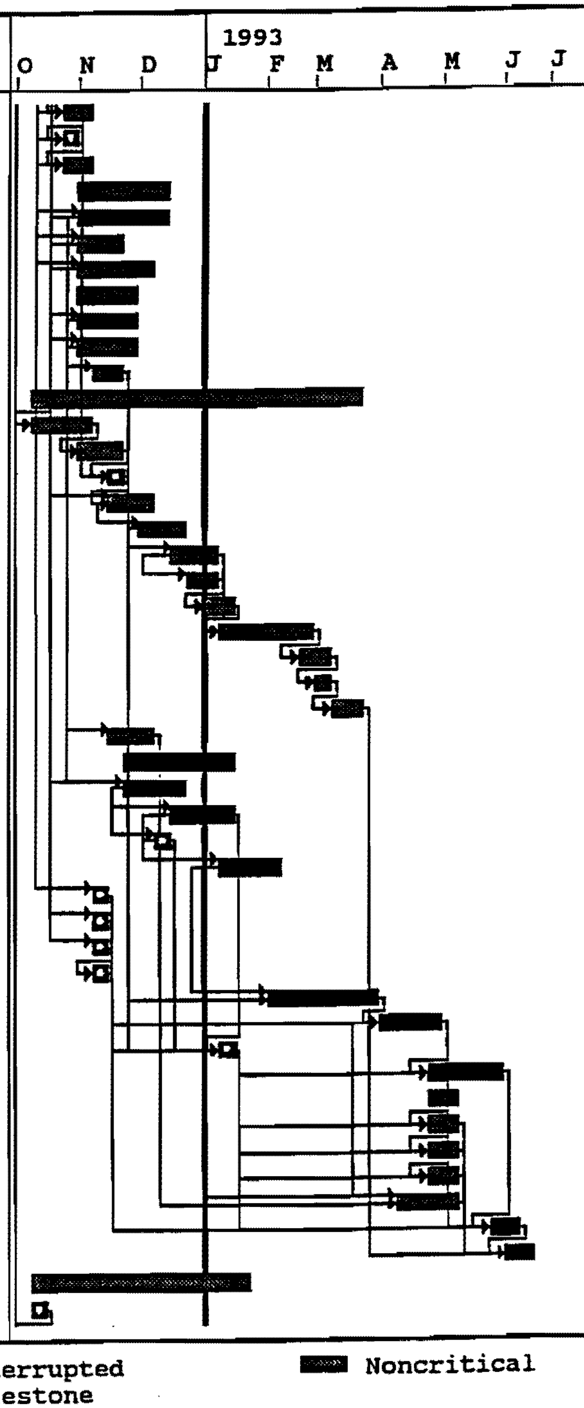
Explanations: After the applications above, you should get the three separate schedules displayed on the same bar chart. As can be seen on the following pages, they would show as if they start at the same time, and proceed concurrently. Therefore, the next step would be to do the sequencing of these phases, and tie them together to constitute the whole project frame.



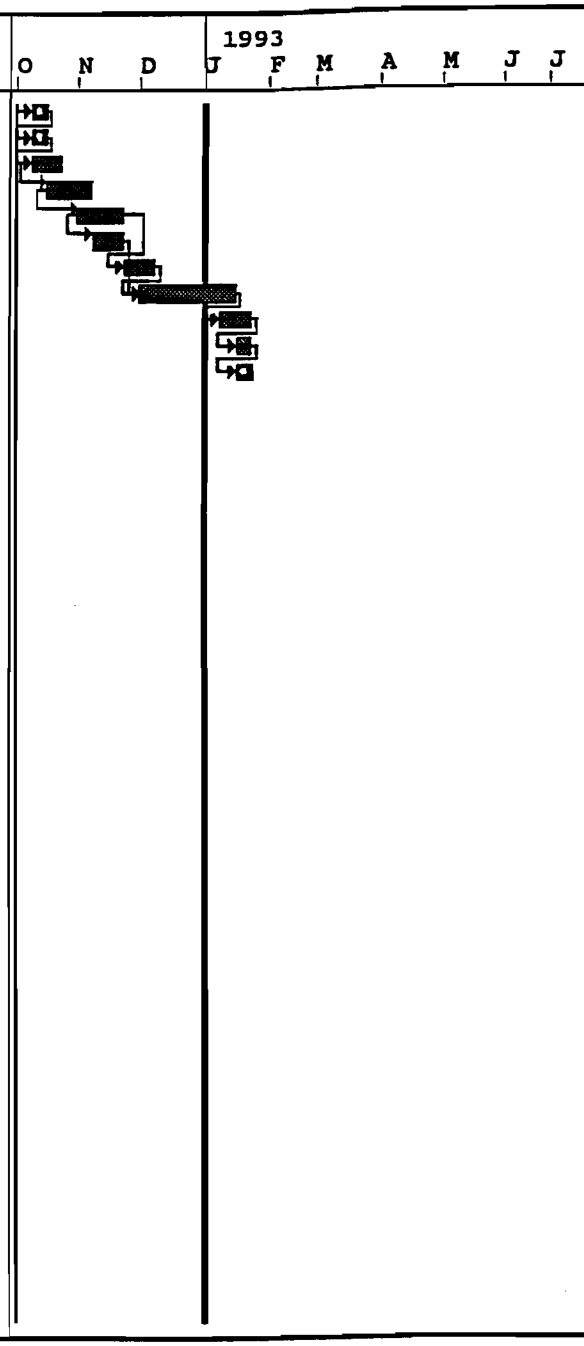
Heading/Task (8 Days Per Column)	Schd Dur
PROJ-1.PJ	178dy
Initial Traf. Control	3dy
Detour	12dy
ROW Preparations	20dy
Major struc. demoli'n	20dy
Clear & Grub	4dy
Rmv. old strc.(small)	10dy
Rmv. old pavement	16dy
Rmv old curb & gutter	9dy
Rmv. old sidewalks	3dy
Rmv old drai/util str	9dy
Excavation/Embankment	23dy
Earth Excavation	23dy
Rock Excavation	0dy
Embankment	12dy
Drainage str/Storm sw	18dy
Pipe	18dy
Box Culverts	13dy
Inlets & Manholes	11dy
Retaining Walls	0dy
Base Preparations	26dy
Lime Stabilization	13dy
Flexible Base Mater'l	16dy
Cement Treated Base M	0dy
New Curb & Gutter	15dy
Asph. Pavement Repair	0dy
Conc. Pavement Repair	0dy
Milling/Planing	0dy
One-course Surf. Trmt	0dy
Hot-mix Asphalt Base	33dy
Hot-mix Asphalt Surf.	22dy
Concrete Paving	0dy
Precast Traf. Bar'ers	15dy
Signing/Traf. Signals	6dy
Small signs	6dy
Overhead signs	6dy
Major traffic signals	4dy
Seeding & Landscaping	10dy
Pavement Markings	5dy
Final Clean-up	3dy
Initial Traf. Control	4dy
Detour	10dy
ROW Preparations	15dy
Major struc. demoli'n	0dy
Clear & Grub	7dy
Rmv. old strc.(small)	0dy
Rmv. old pavement	15dy

Unassigned — Critical — Interrupted — Milestone — Noncritical

Heading/Task 8 Days Per Column	Schd Dur
Rmv old curb & gutter	4dy
Rmv. old sidewalks	0dy
Rmv old drai/util str	7dy
Excavation/Embankment	29dy
Earth Excavation	29dy
Rock Excavation	14dy
Embankment	26dy
Drainage str/Storm sw	19dy
Pipe	19dy
Box Culverts	17dy
Inlets & Manholes	9dy
Bridge Structures	115dy
Erect Temp. Bridge	15dy
Bridge Demolition	15dy
Cofferdams	0dy
Piling	7dy
Footings	14dy
Columns, Caps & Bents	16dy
Wingwalls	6dy
Beams (erection only)	5dy
Bridge Deck	28dy
Bridge Curbs/Walks	6dy
Bridge Handrails	3dy
Remove Temp. Bridge	10dy
Retaining Walls	13dy
Base Preparations	38dy
Lime Stabilization	20dy
Flexible Base Mater'l	23dy
Cement Treated Base M	0dy
New Curb & Gutter	22dy
Ashp. Pavement Repair	0dy
Conc. Pavement Repair	0dy
Milling/Planing	0dy
One-course Surf. Trmt	0dy
Hot-mix Asphalt Base	39dy
Hot-mix Asphalt Surf.	21dy
Concrete Paving	0dy
Precast Traf. Bar'ers	20dy
Signing/Traf. Signals	8dy
Small signs	8dy
Overhead signs	4dy
Major traffic signals	8dy
Seeding & Landscaping	16dy
Pavement Markings	8dy
Final Clean-up	4dy
Bridge Structures	79dy
Erect Temp. Bridge	0dy



Heading/Task 8 Days Per Column	Schd Dur
Bridge Demolition	0dy
Cofferdams	0dy
Piling	8dy
Footings	15dy
Columns, Caps & Bents	17dy
Wingwalls	8dy
Beams (erection only)	6dy
Bridge Deck	29dy
Bridge Curbs/Walks	6dy
Bridge Handrails	3dy
Remove Temp. Bridge	0dy



Unassigned
Critical
Interrupted
Milestone
Noncritical

Explanations: Assume the sequencing should be done in the following way: The last task of the first phase, *Final Clean-up*, should be followed by the first task of the second phase, *Initial Traf. Control*. Also, the second bridge structures should begin right after the first one is completed in the second phase. Finally, the last task of the second phase, *Final Clean-up* should also follow the last task of this second bridge structures, *Remove Temp. Bridge*.

The function key ***F4*** is the default hot key in SuperProject that would activate the linking process. Following a certain format required by SuperProject, you can link tasks to other tasks. This format is as follows:

LINK from: Pred. ID   Pred. Name   *To:* Succ. ID   Succ. Name   *Type:* __ *Lag:* __

As the above format is activated on the bottom of the screen by pressing ***F4***, a second cursor appears down on the first displayed setting which is the predecessor ID. This bottom cursor moves only in between the settings shown above that are used in the linking process. To move it to the right, you would press the ***Tab*** key. Pressing ***Shift-Tab*** would move it to the left. To indicate which task the predecessor is, you need to move the upper cursor over to the task that you want to do the linking from by using the up and down keys, and press the ***Tab*** key to skip to the successor setting. You would do the same procedure to indicate the succeeding task. The next setting is reserved to indicate the type of dependency or relationship that exists between the two activities. To represent a Finish-to-Start type of a relationship, **FS** should be used. Also, a Start-to-Start type of a relationship would be represented by **SS**, and although less commonly used, a Finish-to-Finish type of a relationship would be represented by **FF**. Finally, the last setting on the very left is to indicate the lag time if any in terms of working days.

Action: Using the left arrow key, move the cursor to the very left column of the screen layout in which the task names are listed; this way it will be easier to operate the instructions.

Press the function key ***F4***. When the linking format appears at the bottom of the screen, move the upper cursor onto the last task of the first phase, *Final Clean-up*. When the upper cursor is on this task, down in the linking format, the name and also the ID number of this task which is *039* should appear right next to *LINK from :*. Press ***Tab*** to move the lower cursor to the right of where it says *To:*. Then using the up and down keys, move the upper cursor onto the first task of the second phase which is *Initial Traf. Control* with the ID number of *040*. By default, it should say *FS* for *Type*, and *0 dy* for *Lag*. If not, type in these entries to indicate a Finish-to-Start type of a relationship with a lag of 0 days between the mentioned tasks. Press ***Enter*** to confirm this linking information. After doing so, you should be able to see that the second phase is now tied to the end of the first phase on the bar chart.

5.7.1.15 Inclusion of Separate Bridge Structures into Main Project

Action: Using the up and down keys, move the cursor onto the header *Bridge Structures* (ID number = *092*, duration = *79 days*) which now should appear to be separate than the first and the second phases. When the cursor is resting on this header, press ***Shift*** and the ***Up*** arrow key together to move this set of tasks up among the list of other activities. Move this whole set of second bridge structures up until they are placed right below the first set of bridge structures. Then press ***F4*** to activate the linking process. Following the same procedure on linking tasks, link the last task in the first bridge structures, *Remove Temp.Bridge* (ID number = *070*), to the first task in the second set, *Erect Temp. Bridge* (ID number = *093*) with a Finish-to-Start type of a relationship with no lag time. Finally, link the last task in the second set, *Remove Temp.Bridge* (ID number = *104*), to the last task of the second phase which is also the last task of the whole project, *Final Clean-up* (with ID number = *091*), again having **FS** for *Type* and **0 dy** for *Lag*.

Explanations: Now every portion of the project has been linked to each other, the schedule and the bar chart shown represent the whole of the project. Coinciding with the project header, you can see under the *Schd Dur* column that the total project duration came out to be 366 days. On the following 3 pages you can review the bar chart produced by the system for this example project.

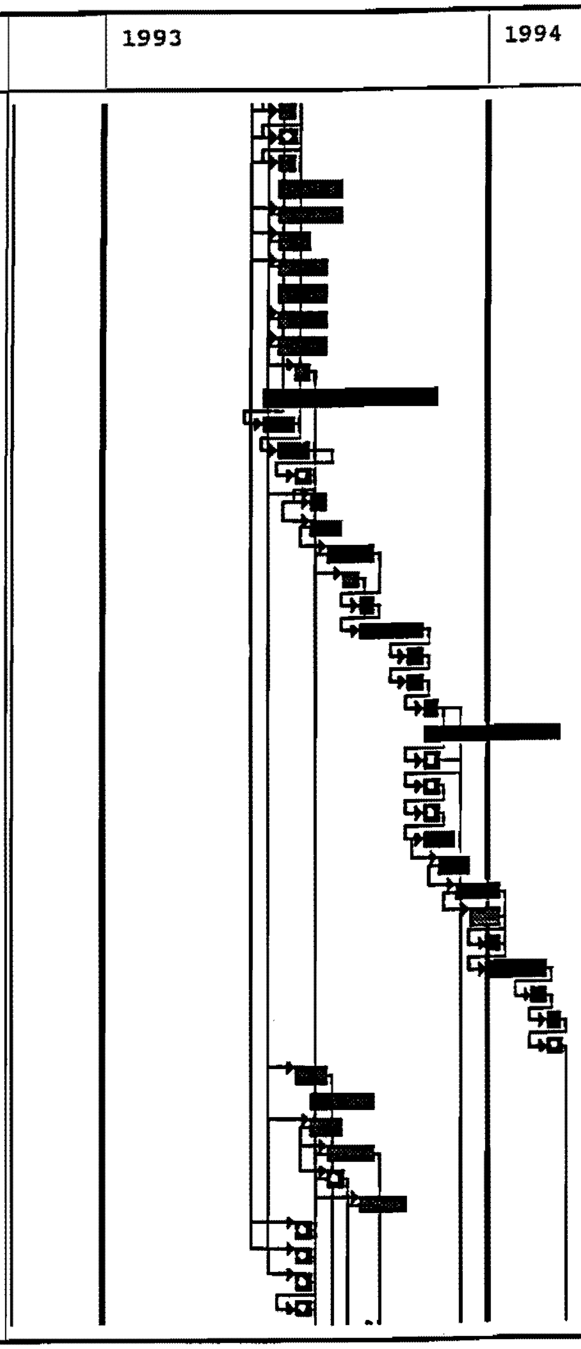
BASIC OUTLINE

Project: PROJ-1.PJ

Heading/Task (15 Days Per Column)	Schd Dur
PROJ-1.PJ	366dy
Initial Traf. Control	3dy
Detour	12dy
ROW Preparations	20dy
Major struc. demoli'n	20dy
Clear & Grub	4dy
Rmv. old strc.(small)	10dy
Rmv. old pavement	16dy
Rmv old curb & gutter	9dy
Rmv. old sidewalks	3dy
Rmv old drai/util str	9dy
Excavation/Embankment	23dy
Earth Excavation	23dy
Rock Excavation	0dy
Embankment	12dy
Drainage str/Storm sw	18dy
Pipe	18dy
Box Culverts	13dy
Inlets & Manholes	11dy
Retaining Walls	0dy
Base Preparations	26dy
Lime Stabilization	13dy
Flexible Base Mater'l	16dy
Cement Treated Base M	0dy
New Curb & Gutter	15dy
Asph. Pavement Repair	0dy
Conc. Pavement Repair	0dy
Milling/Planing	0dy
One-course Surf. Trmt	0dy
Hot-mix Asphalt Base	33dy
Hot-mix Asphalt Surf.	22dy
Concrete Paving	0dy
Precast Traf. Bar'ers	15dy
Signing/Traf. Signals	6dy
Small signs	6dy
Overhead signs	6dy
Major traffic signals	4dy
Seeding & Landscaping	10dy
Pavement Markings	5dy
Final Clean-up	3dy
Initial Traf. Control	4dy
Detour	10dy
ROW Preparations	15dy
Major struc. demoli'n	0dy
Clear & Grub	7dy
Rmv. old strc.(small)	0dy
Rmv. old pavement	15dy

Unassigned — Critical — Interrupted — Milestone — Noncritical

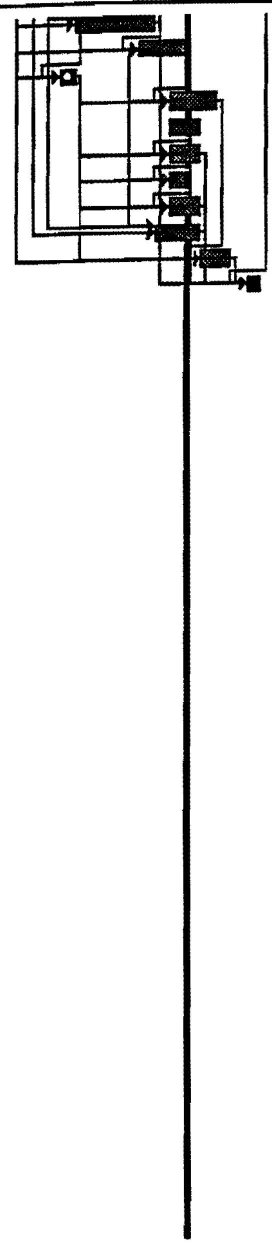
Heading/Task 15 Days Per Column	Schd Dur
Rmv old curb & gutter	4dy
Rmv. old sidewalks	0dy
Rmv old drai/util str	7dy
Excavation/Embankment	29dy
Earth Excavation	29dy
Rock Excavation	14dy
Embankment	26dy
Drainage str/Storm sw	19dy
Pipe	19dy
Box Culverts	17dy
Inlets & Manholes	9dy
Bridge Structures	115dy
Erect Temp. Bridge	15dy
Bridge Demolition	15dy
Cofferdams	0dy
Piling	7dy
Footings	14dy
Columns, Caps & Bents	16dy
Wingwalls	6dy
Beams (erection only)	5dy
Bridge Deck	28dy
Bridge Curbs/Walks	6dy
Bridge Handrails	3dy
Remove Temp. Bridge	10dy
Bridge Structures	79dy
Erect Temp. Bridge	0dy
Bridge Demolition	0dy
Cofferdams	0dy
Piling	8dy
Footings	15dy
Columns, Caps & Bents	17dy
Wingwalls	8dy
Beams (erection only)	6dy
Bridge Deck	29dy
Bridge Curbs/Walks	6dy
Bridge Handrails	3dy
Remove Temp. Bridge	0dy
Retaining Walls	13dy
Base Preparations	38dy
Lime Stabilization	20dy
Flexible Base Mater'l	23dy
Cement Treated Base M	0dy
New Curb & Gutter	22dy
Ashp. Pavement Repair	0dy
Conc. Pavement Repair	0dy
Milling/Planing	0dy
One-course Surf. Trmt	0dy



Unassigned
Critical
Interrupted
Milestone
Noncritical

BASIC OUTLINE

Heading/Task 15 Days Per Column	1993 / 1994	Schd Dur
Hot-mix Asphalt Base		39dy
Hot-mix Asphalt Surf.		21dy
Concrete Paving		0dy
Precast Traf. Bar'ers		20dy
Signing/Traf. Signals		8dy
Small signs		8dy
Overhead signs		4dy
Major traffic signals		8dy
Seeding & Landscaping		16dy
Pavement Markings		8dy
Final Clean-up		4dy



Unassigned
Critical
Interrupted
Milestone
Noncritical

5.7.1.16 Adding and Linking Extra Activities

Explanations: In case the user wants to add any extra activities that are not included in the typical work items listed for that project type, the appropriate time to do it is after obtaining a schedule in SuperProject. For a multiphase project, whether it is better to do it separately for each single phase that requires additional items to be included, or to do it after combining all the phases together depends merely on the project itself or the user's preference. For demonstration purposes, assume a rip-rap work of 10 days needs to be added to the second phase with the following dependencies: Rip-rap should start after all of the embankment work, and 50% of the wingwalls work of the second bridge structures is completed. The seeding and landscaping task should be its successor with a Finish-to-Start relationship.

Action: Move the cursor over onto *Remove Temp. Bridge* (ID number = *104*) which is the last task of the second bridge structures. To create a new task right below it on the list, press ***F3*** which is the key assigned by default for this purpose in SuperProject. The software will automatically create a new task below *Remove Temp. Bridge* with the initial name of *Task-105*. While the cursor is still on this name, type **Rip-rap** to name the task properly and press ***Enter*** to confirm. This task would now show like it is the last task in *Bridge Structures* after *Remove Temp. Bridge*. To get this activity out of the header *Bridge Structures* and have it as a separate activity of its own above *Retaining Walls* on the list, press the ***Shift*** key and the ***Left*** arrow key at the same time.

Explanations: Although this new task follows *Wingwalls* in sequence of work, and therefore could be put right below that on the list, it is better to have it right after the last task in *Bridge Structures*, and then specify that it is not included in this group of tasks. This way, it would not show as one of the tasks under the header *Bridge Structures*, and its duration would have no effect on the duration of this header. When it is first created, it would show like it is the last task included in *Bridge Structures* because its position in the list falls under this header. Pressing the ***Shift*** key together with the ***Left*** arrow key would promote its position to one upper level in the Work Breakdown Structure, and it will become an independent individual activity. The way to distinguish this is that it would not be indented like the other activities under this header when it is a separate activity of its own.

Action: Once the new task has been created and named, move the cursor over to the *Schd Dur* column, and type **10** for the duration of this task and press ***Enter***. (Notice that for this new task, a duration of 5 days was assigned at first which is the default value used by SuperProject.)

Once a duration is entered for the task, press ***F4*** to do its linking. (Each time you press ***Enter*** in SuperProject, the cursor skips one column to the right. Therefore, after naming the new task and specifying its duration, you might first want to bring the cursor back to the *Heading/Task* column on the left to provide easiness in trailing task names while doing the linking process.) When the linking format appears at the bottom of the screen, move the upper cursor up to have *Embankment* (ID number = *053*) come after *LINK from:*. Press ***Tab*** to confirm that this is the predecessor you want to have, and skip to specify the successor. When the bottom cursor is on the right of *To:*, move the upper cursor down onto *Rip-rap* (ID number = *105*). When this name shows as the successor in the linking format at the bottom of the screen, input *FS* for *Type*, and *0 dy* for *Lag*, press ***Enter*** to confirm.

Press ***F4*** again to start linking it to *Wingwalls* (ID number = *099*) as well. Apply the same procedure to specify that *Wingwalls* is the predecessor, and *Rip-rap* is the successor. To show that *Rip-rap* starts after 50% completion of *Wingwalls*, input **SS** for *Type* indicating that it is a Start-to-Start relationship, and input **4 dy** for *Lag* which is 50% of the duration of *Wingwalls*.

> **ATTENTION:** SuperProject does not accept percentages in determining lag times between the start of two activities. In a manual linking process, the user should calculate lag time by multiplying the duration of the predecessor with the specified percent completion of the predecessor. This must be done for the successor to start, and should be input to the system in terms of days.

Once *Rip-rap* is linked to its predecessors as described, press ***F4*** again to link its end to *Seeding & Landscaping* (ID number = *089*). Following the same process, define a relationship in which this time *Rip-rap* is the predecessor, and *Seeding & Landscaping* is the successor, with *Type* being **FS**, and *Lag* being **0 dy**.

Explanations: After the process of adding and linking this extra activity is finished, it may be worthwhile to see the effect on the total schedule. If you check the total project duration shown as the first thing under *Schd Dur* column, you will realize that it has not changed. The reason for this is that *Rip-rap*, which is the work item that has just been added, does not appear to be on the Critical Path. Just for experimental purposes, you might want to try to change the duration of *Rip-rap* from 10 to 40 days. In that case, observe how the project duration goes up from 366 to 374 days, and how the Critical Path changes as you can tell by the color of the bars in the bar chart (red bars are for critical activities, and blue bars are for non-critical ones).

5.7.1.17 Entering Scheduled Start Date

Explanations: Whenever CTDS is applied to obtain an estimate of project duration and a schedule, it takes the date at the time of the application as the start date of the project. This is a characteristic of SuperProject. If the user is interested in knowing an estimated finish date of the project aside from an estimate of project duration, he/she might do so by using SuperProject's features. The software would calculate the scheduled finish date if provided with a scheduled start date. It would also calculate the scheduled finish date of each task in the project based on its early finish date.

> **ATTENTION:** The scheduled start date to be input into the software should be later than the date at the time of the application. This would mean that the project being scheduled is actually a future project. If the user enters a scheduled start date earlier than the current date, the software would warn the user about this, and ask if he/she wants that to be taken as the actual start date of the project. If the answer is yes, the schedule would be revised to show the progress of a currently undergoing project. Concepts like percent completion of tasks to date would come into issue. Discussion of such issues is beyond the scope of this study; however, SuperProject does have the capability of enabling the user to monitor project progress. Further information on this can be obtained from the documentation that comes with SuperProject.

For demonstration, let us use January 11, 1993 as the scheduled start of the example project. Please notice that this date was a future date at the time this report was written. If this date appears to be a past date for the reader, he/she is welcome to use any future date as his/her scheduled start date.

Action: Move the cursor over onto the first date under the *Scheduled Start* column so that it corresponds to the project name. Type **01-11-93** to specify that the project shall start on January 11, 1993, and press ***Enter***. Observe that the scheduled finish date of the total project is immediately calculated to be *06-06-94*.

5.7.1.18 Inclusion of Pre-set Calendar Information

Explanations: SuperProject uses 5 days a week standard working time. Saturdays and Sundays are considered as holidays. Unless otherwise specified by the user, these values are taken as default. However, a CTDS user might want to use a different calendar information that is set previously to reflect the average number of working days per each month in his/her district. Utilization of such a calendar would not necessarily change the number of working days obtained to estimate the project duration; nevertheless, it would make a difference in scheduled finish dates of activities, and consequently the total project itself.

To illustrate this process, an example calendar has been created to have the following average number of working days for each month of the year.

Name of Month	Average number of working days
January	10
February	12
March	14
April	17
May	20
June	20
July	20
August	19
September	18
October	18
November	15
December	12

How to create one's own calendar information is discussed in a further section. At this step, inclusion of a pre-set calendar with the above information is reviewed for the example project at hand.

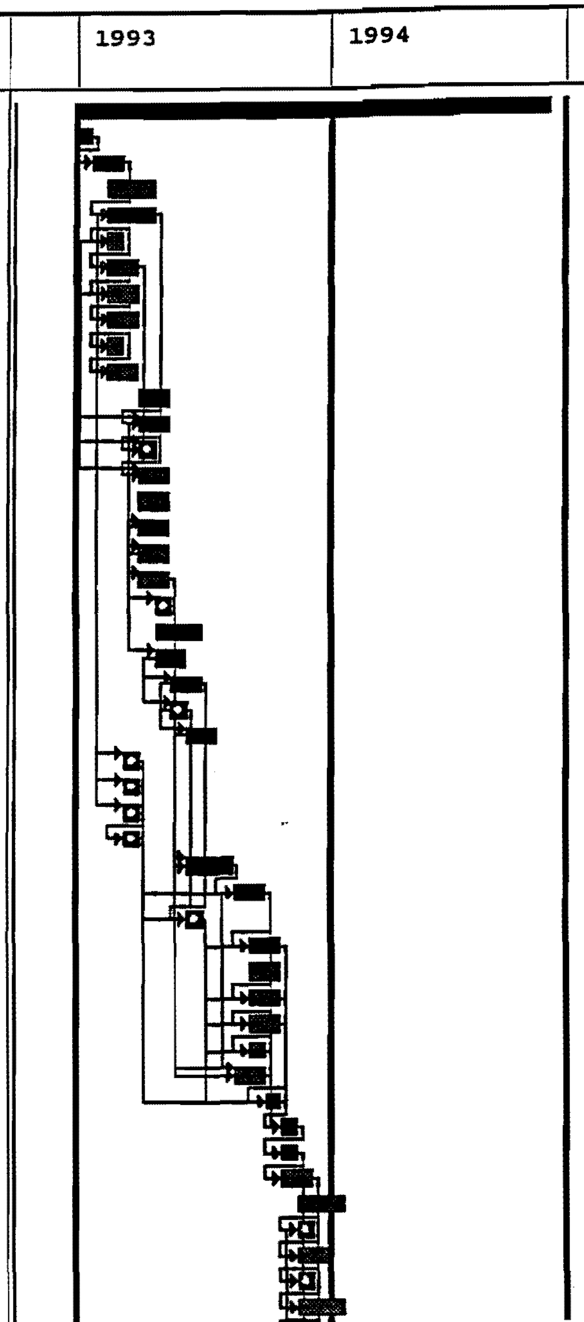
As stated in one of the windows as SuperProject comes into scene with each application of the system, pressing ***Ctrl-F7*** would activate the feature designed specially for CTDS which would enable you to include such calendar information in your project. As ***Ctrl-F7*** is pressed, a window pops up instructing the user how to choose the desired pre-set calendar among the others in the list. Basically, you need to bring the cursor over onto the one you wish to use for your project and press ***Enter*** to choose.

Action: Press ***Ctrl-F7*** to activate the feature for inclusion of pre-set calendar. When the list appears along with the instructions window, choose *CALTxDOT.HOL* by pressing ***Enter*** after having moved the cursor on it. Observe how the scheduled finish date of the project changes from *06-06-94* to *11-09-94*.

Explanations: This change in the scheduled finish date of the project is due to the reduction in the number of working days per month, as specified in the selected calendar file set to reflect the monthly averages for this fictitious location. In setting this calendar, certain number of days were assigned as holidays for each month so that what is left would be equal to the average number of working days in that month determined for that location. Please keep in mind that this new scheduled finish date is only an estimate, and only to be used to give the user a rough idea about the completion date of the project. It is not a definite date since it makes a difference which days were chosen to be as holidays in each month in the standard calendar. As mentioned before, setting such a standard calendar is discussed in a further section.

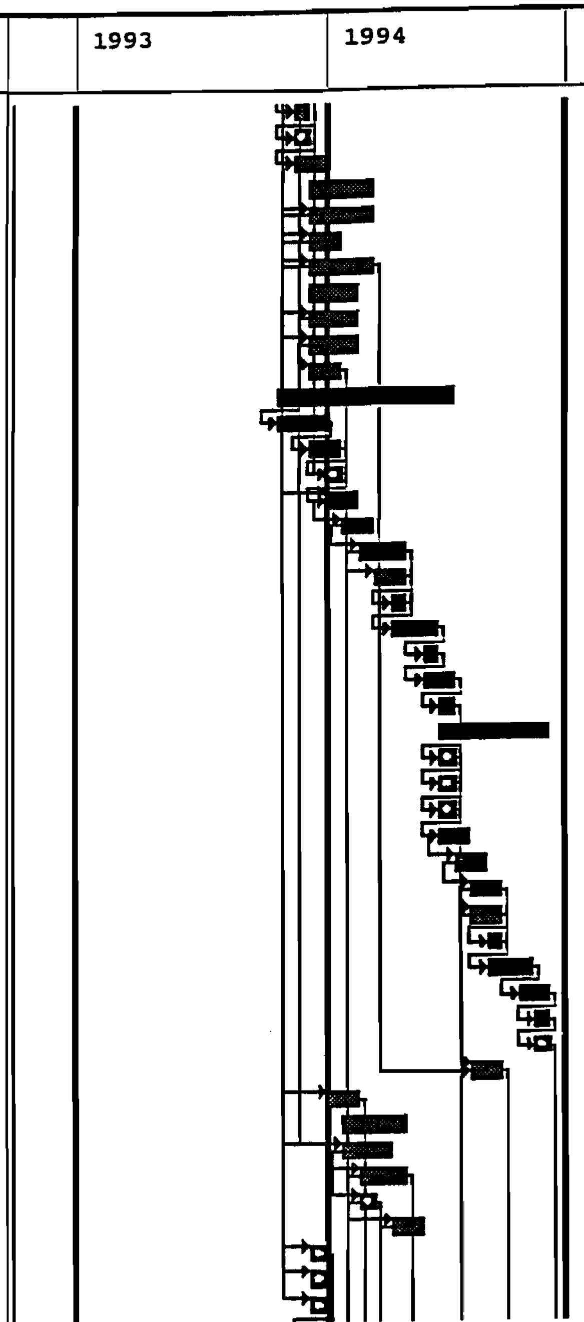
On the following 6 pages, you may find the bar chart obtained from the example project in its final form, as well as the scheduled start and finish times of the tasks and the whole project itself.

Heading/Task 23 Days Per Column	Schd Dur
CNF-ALL.PJ	366dy
Initial Traf. Control	3dy
Detour	12dy
ROW Preparations	20dy
Major struc. demoli'n	20dy
Clear & Grub	4dy
Rmv. old strc.(small)	10dy
Rmv. old pavement	16dy
Rmv old curb & gutter	9dy
Rmv. old sidewalks	3dy
Rmv old drai/util str	9dy
Excavation/Embankment	23dy
Earth Excavation	23dy
Rock Excavation	0dy
Embankment	12dy
Drainage str/Storm sw	18dy
Pipe	18dy
Box Culverts	13dy
Inlets & Manholes	11dy
Retaining Walls	0dy
Base Preparations	26dy
Lime Stabilization	13dy
Flexible Base Mater'l	16dy
Cement Treated Base M	0dy
New Curb & Gutter	15dy
Asph. Pavement Repair	0dy
Conc. Pavement Repair	0dy
Milling/Planing	0dy
One-course Surf. Trmt	0dy
Hot-mix Asphalt Base	33dy
Hot-mix Asphalt Surf.	22dy
Concrete Paving	0dy
Precast Traf. Bar'ers	15dy
Signing/Traf. Signals	6dy
Small signs	6dy
Overhead signs	6dy
Major traffic signals	4dy
Seeding & Landscaping	10dy
Pavement Markings	5dy
Final Clean-up	3dy
Initial Traf. Control	4dy
Detour	10dy
ROW Preparations	15dy
Major struc. demoli'n	0dy
Clear & Grub	7dy
Rmv. old strc.(small)	0dy
Rmv. old pavement	15dy



Unassigned
Critical
Interrupted
Milestone
Noncritical

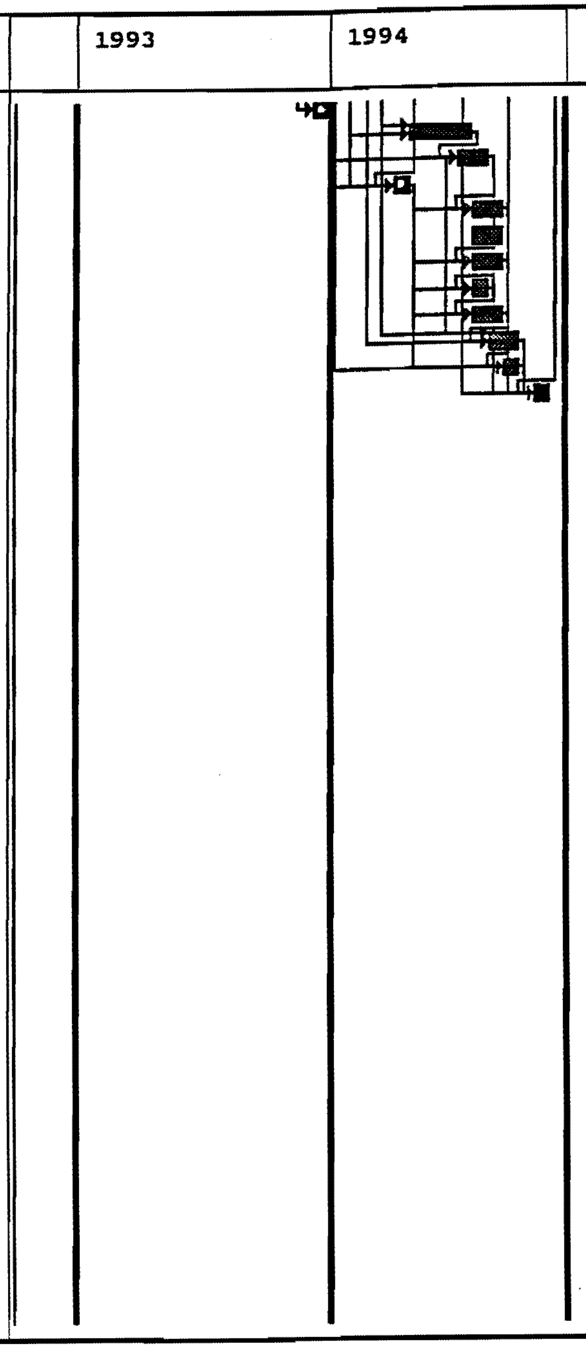
Heading/Task 23 Days Per Column	Schd Dur
Rmv old curb & gutter	4dy
Rmv. old sidewalks	0dy
Rmv old drai/util str	7dy
Excavation/Embankment	29dy
Earth Excavation	29dy
Rock Excavation	14dy
Embankment	26dy
Drainage str/Storm sw	19dy
Pipe	19dy
Box Culverts	17dy
Inlets & Manholes	9dy
Bridge Structures	115dy
Erect Temp. Bridge	15dy
Bridge Demolition	15dy
Cofferdams	0dy
Piling	7dy
Footings	14dy
Columns, Caps & Bents	16dy
Wingwalls	6dy
Beams (erection only)	5dy
Bridge Deck	28dy
Bridge Curbs/Walks	6dy
Bridge Handrails	3dy
Remove Temp. Bridge	10dy
Bridge Structures	79dy
Erect Temp. Bridge	0dy
Bridge Demolition	0dy
Cofferdams	0dy
Piling	8dy
Footings	15dy
Columns, Caps & Bents	17dy
Wingwalls	8dy
Beams (erection only)	6dy
Bridge Deck	29dy
Bridge Curbs/Walks	6dy
Bridge Handrails	3dy
Remove Temp. Bridge	0dy
Rip-rap	10dy
Retaining Walls	13dy
Base Preparations	38dy
Lime Stabilization	20dy
Flexible Base Mater'l	23dy
Cement Treated Base M	0dy
New Curb & Gutter	22dy
Ashp. Pavement Repair	0dy
Conc. Pavement Repair	0dy
Milling/Planing	0dy



Unassigned
Critical
Interrupted
Milestone
Noncritical

BASIC OUTLINE

Heading/Task 23 Days Per Column	Schd Dur
One-course Surf. Trmt	0dy
Hot-mix Asphalt Base	39dy
Hot-mix Asphalt Surf.	21dy
Concrete Paving	0dy
Precast Traf. Bar'ers	20dy
Signing/Traf. Signals	8dy
Small signs	8dy
Overhead signs	4dy
Major traffic signals	8dy
Seeding & Landscaping	16dy
Pavement Markings	8dy
Final Clean-up	4dy



Unassigned
Critical
Interrupted
Milestone
Noncritical

BASIC OUTLINE

Heading/Task	Task ID	Scheduled Start	Scheduled Finish	
CNF-ALL.PJ	P6	01-11-93>	11-09-94	
Initial Traf. Control	001	01-11-93	01-18-93	
Detour	002	01-19-93	02-16-93	
ROW Preparations	003	02-17-93	04-05-93	
Major struc. demoli'n	004	02-17-93	04-05-93	
Clear & Grub	005	02-17-93	02-24-93	
Rmv. old strc.(small)	006	02-17-93	03-10-93	
Rmv. old pavement	007	02-17-93	03-24-93	
Rmv old curb & gutter	008	02-17-93	03-09-93	
Rmv. old sidewalks	009	02-17-93	02-23-93	
Rmv old drai/util str	010	02-17-93	03-09-93	
Excavation/Embankment	011	04-05-93	05-12-93	
Earth Excavation	012	04-06-93	05-12-93	
Rock Excavation	013	04-05-93	04-05-93	
Embankment	014	04-06-93	04-26-93	
Drainage str/Storm sw	015	04-12-93	05-10-93	
Pipe	016	04-12-93	05-10-93	
Box Culverts	017	04-12-93	05-03-93	
Inlets & Manholes	018	04-14-93	05-03-93	
Retaining Walls	019	04-21-93	04-21-93	
Base Preparations	020	05-05-93	06-11-93	
Lime Stabilization	021	05-05-93	05-21-93	
Flexible Base Mater'l	022	05-19-93	06-11-93	
Cement Treated Base M	023	05-18-93	05-18-93	
New Curb & Gutter	024	06-08-93	06-29-93	
Asph. Pavement Repair	025	03-23-93	03-23-93	
Conc. Pavement Repair	026	03-23-93	03-23-93	
Milling/Planing	027	03-23-93	03-23-93	
One-course Surf. Trmt	028	03-23-93	03-23-93	
Hot-mix Asphalt Base	029	06-25-93	08-12-93	
Hot-mix Asphalt Surf.	030	08-16-93	09-21-93	
Concrete Paving	031	06-11-93	06-11-93	
Precast Traf. Bar'ers	032	09-22-93	10-13-93	
Signing/Traf. Signals	033	09-22-93	09-30-93	
Small signs	034	09-22-93	09-30-93	
Overhead signs	035	09-22-93	09-30-93	
Major traffic signals	036	09-22-93	09-28-93	
Seeding & Landscaping	037	09-02-93	09-20-93	
Pavement Markings	038	10-14-93	10-21-93	
Final Clean-up	039	10-25-93	10-27-93	
Initial Traf. Control	040	10-28-93	11-03-93	
Detour	041	11-04-93	11-24-93	
ROW Preparations	042	11-24-93	01-03-94	
Major struc. demoli'n	043	11-24-93	11-24-93	
Clear & Grub	044	11-29-93	12-13-93	
Rmv. old strc.(small)	045	11-24-93	11-24-93	
Rmv. old pavement	046	11-29-93	01-03-94	

Heading/Task	Task ID	Scheduled Start	Scheduled Finish	
Rmv old curb & gutter	047	11-29-93	12-06-93	
Rmv. old sidewalks	048	11-24-93	11-24-93	
Rmv old drai/util str	049	11-29-93	12-13-93	
Excavation/Embankment	050	12-07-93	02-21-94	
Earth Excavation	051	12-07-93	02-21-94	
Rock Excavation	052	12-07-93	01-10-94	
Embankment	053	12-07-93	02-14-94	
Drainage str/Storm sw	054	12-14-93	02-02-94	
Pipe	055	12-14-93	02-02-94	
Box Culverts	056	12-14-93	01-25-94	
Inlets & Manholes	057	12-20-93	01-10-94	
Bridge Structures	058	11-04-93	06-28-94	
Erect Temp. Bridge	059	11-04-93	12-07-93	
Bridge Demolition	060	12-08-93	01-17-94	
Cofferdams	061	01-17-94	01-17-94	
Piling	062	01-18-94	02-07-94	
Footings	063	02-07-94	03-08-94	
Columns, Caps & Bents	064	03-02-94	04-05-94	
Wingwalls	065	03-22-94	04-01-94	
Beams (erection only)	066	04-06-94	04-13-94	
Bridge Deck	067	04-14-94	05-30-94	
Bridge Curbs/Walks	068	05-31-94	06-07-94	
Bridge Handrails	069	06-08-94	06-13-94	
Remove Temp. Bridge	070	06-14-94	06-28-94	
Bridge Structures	092	06-28-94	11-02-94	
Erect Temp. Bridge	093	06-28-94	06-28-94	
Bridge Demolition	094	06-28-94	06-28-94	
Cofferdams	095	06-28-94	06-28-94	
Piling	096	06-29-94	07-11-94	
Footings	097	07-08-94	07-28-94	
Columns, Caps & Bents	098	07-26-94	08-22-94	
Wingwalls	099	08-09-94	08-22-94	
Beams (erection only)	100	08-23-94	08-31-94	
Bridge Deck	101	09-01-94	10-18-94	
Bridge Curbs/Walks	102	10-19-94	10-27-94	
Bridge Handrails	103	10-31-94	11-02-94	
Remove Temp. Bridge	104	11-02-94	11-02-94	
Rip-rap	105	08-16-94	08-31-94	
Retaining Walls	071	01-05-94	02-09-94	
Base Preparations	072	01-24-94	04-18-94	
Lime Stabilization	073	01-24-94	03-14-94	
Flexible Base Mater'l	074	03-02-94	04-18-94	
Cement Treated Base M	075	03-01-94	03-01-94	
New Curb & Gutter	076	04-11-94	05-16-94	
Ashp. Pavement Repair	077	12-22-93	12-22-93	
Conc. Pavement Repair	078	12-22-93	12-22-93	
Milling/Planing	079	12-22-93	12-22-93	

Heading/Task	Task ID	Scheduled Start	Scheduled Finish	
One-course Surf. Trmt	080	12-22-93	12-22-93	
Hot-mix Asphalt Base	081	05-09-94	07-07-94	
Hot-mix Asphalt Surf.	082	07-08-94	08-08-94	
Concrete Paving	083	04-18-94	04-18-94	
Precast Traf. Bar'ers	084	08-09-94	09-08-94	
Signing/Traf. Signals	085	08-09-94	08-22-94	
Small signs	086	08-09-94	08-22-94	
Overhead signs	087	08-09-94	08-15-94	
Major traffic signals	088	08-09-94	08-22-94	
Seeding & Landscaping	089	09-01-94	09-27-94	
Pavement Markings	090	09-12-94	09-22-94	
Final Clean-up	091	11-03-94	11-09-94	

5.7.1.19 Saving the Whole Project in its Final Form

Action: To save the project in its final form, press ***Ctrl-F5*** to activate the menu built specially for CTDS. When that comes into scene, press ***S*** to save. When asked for a project name, type a name of your preference of up to 8 characters and press ***Enter*** to confirm. (**CNF-ALL** is a suggested name, and is used here to indicate that this version contains all the phases, and is finished to its final form.)

5.7.2 - EDITING EXISTING PROJECTS

An Edit Feature is built in CTDS to allow the user to change project information on relationship percentages, quantities, production rates and durations of lump-sum items in a project on which the procedure has already been applied. This feature is designed to give the user a freedom of modifying a project file in Lotus 123 without having to start from the very beginning. Especially after obtaining a schedule in SuperProject, if the outcome is not as desired, the user may use this to change some of the information he/she has previously input the system. Consequently, this feature becomes a useful tool in applying what-if analysis on projects by changing some of the parameters to see the effect not only on individual activity durations which you can immediately observe on the spreadsheet, but also on the total project duration as obtained in SuperProject. It can be used in crashing projects in order to meet certain deadlines or in giving some extra time to allow for contingencies.

This feature can be activated in two ways: From a DOS prompt, or from the CTDS menu specially built in SuperProject.

5.7.2.1 - Using the Edit Feature from a DOS Prompt

Explanations: To demonstrate how to use the Edit Feature from a DOS prompt, an example is covered in which the procedure is applied on the file that contains information on the second bridge structures. Please keep in mind that to activate the Edit Feature this way, you have to be at a DOS prompt.

Action: At a DOS prompt, press ***Alt-Y*** to start the Edit Feature.

```
                WELCOME TO THE EDIT FEATURE

                          OF THE

            CONTRACT TIME DETERMINATION SYSTEM


       This feature can be used in revising values on
       quantities, production rates, durations and
       relationships between work items in case any
       changes are necessary on projects that have
       already been worked on.  It may also be used as
       a useful tool to do what-if analysis on projects.


            PLEASE PRESS  "ENTER"  TO PROCEED
```

Action: At the initial screen shown above, press ***Enter*** to proceed.

```
A1:                                                              FILES
Name of file to retrieve: C:\SPJ2\PROJECTS\*.wk?

ABC.WK1      CNF-PH1.WK1   CNF-PH2.WK1   CNF-BR.WK1    D-059.WK1
FM-HO.WK1    FNZ27-2.WK1   HONDO.WK1     HONDO2.WK1    HONDOBR.WK1
RER-1.WK1    RER-2.WK1     RER-3.WK1     WIDEN.WK1     WNF.WK1
ZZ-TOP.WK1

              From the list of projects
            above, choose the one that you
              would like to work on again.

          Then press "Enter" twice to proceed.
```

Explanations: A list of all the Lotus 123 files created in earlier applications of CTDS will appear as well as a window giving instructions. Each file contains information on either a single-phase project or a phase of a multi-phase project. As stated in this window, at this point you are supposed to choose the project file you wish to do your editing on.

Action: Move the cursor over *CNF-BR.WK1* which is the file that contains information on that second bridge structures. Then press ***Enter*** twice to choose and proceed.

Please make your choice from the menu below:

EDIT RELATIONSHIPS

EDIT QUANTITIES/PRODUCTION RATES/DURATIONS

GO TO SUPERPROJECT FOR OBTAINING A SCHEDULE

EXIT TO DOS

Explanations: The menu window of the Edit Feature appears. As can be seen, it has four options in it. The first option, *EDIT RELATIONSHIPS*, takes the user to the table in which percentages of the relationships between the activities are stored. The user can check the whole list, and make any necessary modifications.

The second option, *EDIT QUANTITIES/PRODUCTION RATES/DURATIONS*, takes the user to the table in which quantities for work items were input previously. In this table, the user has the opportunity to re-enter any of the quantities if changes are needed. Also, any of the production rates and/or durations of the lump-sum items, whether proposed by the system, or modified by the scheduler in the previous application, or a combination of both, can be edited in this table once again.

The third option, *GO TO SUPERPROJECT FOR OBTAINING A SCHEDULE*, activates the saving process for this new file that contains the editing the user has just done, and opens SuperProject to produce a schedule and a bar chart reflecting the changes.

Finally, the fourth option, *EXIT TO DOS*, quits the Edit Feature and returns to DOS prompt. It does not save the previous editing done if any. Therefore, if changes are to be saved at all, the third option in this menu should be chosen.

For demonstration purposes, an imaginary scenario is applied that requires selection of both the first and the second options in this menu for editing the project file on the second bridge structures. The details of this scenario are as follows:

1. For some reason, none of the tasks should overlap; they all should begin after their predecessors are 100% completed.

2. A design change requires 3000 L.F. of *Piling* instead of 2000 L.F.

3. The quantity of *Beams (erection only)* was input wrong the first time. It is supposed to be 1500 L.F., not 1100 L.F.

4. The production rate on *Beams (erection only)* should be lowered down to 150 L.F./day from 200 L.F./day.

Action: Along with the information above, move the cursor onto the first option which is *EDIT RELATIONSHIPS* and press ***Enter*** to choose.

```
      Y            Z                      AA                   AB      AC
75                                                             % complete of
76          PREDECESSOR NAME        SUCCESSOR NAME             predecessor
77          Erect Temp. Bridge      Bridge Demolition              100
78          Bridge Demolition       Cofferdams                     100
79          Cofferdams              Piling                         100
80          Piling                  Footings                        75
81          Footings                Columns, Caps & Bents           75
82          Columns, Caps & Bents   Wingwalls                       50
83          Columns, Caps & Bents   Beams (erection only)          100
84          Wingwalls               Bridge Deck                    100

        On the spreadsheet, move the cursor by using the up or down arrow
   keys.  To make any necessary changes on percentages, move the cursor to
   the cell you want to change, type the correct entry, and then move the
   cursor to another cell.
         DO NOT HIT  "Enter"  if you still have more changes to make.
         When you are completely finished, press  "Enter".

                    PLEASE PRESS  "ENTER"  TO START EDITING
```

Action: Press ***Enter*** to start editing. Once you get the cursor in the table, do your editing without pressing ***Enter*** each time you make a change; rather, move the cursor away to another cell. Make the changes shown in bold digits on the following page.

	Y	Z	AA	AB	AC
75				% complete of	
76		PREDECESSOR NAME	SUCCESSOR NAME	predecessor	
77		Erect Temp. Bridge	Bridge Demolition	100	
78		Bridge Demolition	Cofferdams	100	
79		Cofferdams	Piling	100	
80		Piling	Footings	100	
81		Footings	Columns, Caps & Bents	100	
82		Columns, Caps & Bents	Wingwalls	100	
83		Columns, Caps & Bents	Beams (erection only)	100	
84		Wingwalls	Bridge Deck	100	
85		Beams (erection only)	Bridge Deck	100	
86		Bridge Deck	Bridge Curbs/Walks	100	
87		Bridge Curbs/Walks	Bridge Handrails	100	
88		Bridge Handrails	Remove Temp. Bridge	100	
89					
90					
91					
92					
93					
94					

Action: Press ***Enter*** when all the editing is done.

MORE EDITING

GO BACK TO THE MAIN MENU

	Y			AB	AC
75				% complete of	
76		PREDECESS		predecessor	
77		Erect Tem		100	
78		Bridge Demolition	Cofferdams	100	
79		Cofferdams	Piling	100	
80		Piling	Footings	100	
81		Footings	Columns, Caps & Bents	100	
82		Columns, Caps & Bents	Wingwalls	100	
83		Columns, Caps & Bents	Beams (erection only)	100	
84		Wingwalls	Bridge Deck	100	
85		Beams (erection only)	Bridge Deck	100	
86		Bridge Deck	Bridge Curbs/Walks	100	
87		Bridge Curbs/Walks	Bridge Handrails	100	
88		Bridge Handrails	Remove Temp. Bridge	100	
89					
90					
91					
92					
93					
94					

Action: Choose *GO BACK TO THE MAIN MENU* and press ***Enter***.

Please make your choice from the menu below:

EDIT RELATIONSHIPS

EDIT QUANTITIES/PRODUCTION RATES/DURATIONS

GO TO SUPERPROJECT FOR OBTAINING A SCHEDULE

EXIT TO DOS

Explanations: Now the relationships have been edited to satisfy the requirements of this scenario, it is time to do the rest of the editing on quantities, production rates and durations.

Action: From the menu, choose *EDIT QUANTITIES/PRODUCTION RATES/DURATIONS* and press *Enter*.

	L	M	N	O	P	Q
79		Project Type:				
80		BRIDGE STRUCTURES				
81	#	TASK NAME	UNITS	QUANTITY	PROD RATE	DURATION
82	1	Bridge Structures				
83	2	Erect Temp. Bridge	L.Sum			0
84	3	Bridge Demolition	L.Sum			0
85	4	Cofferdams	S.Y.	0	162.5625	0
86	5	Piling	L.F.	2000	276.25	8
87	6	Footings	C.Y.	200	13.6	15

You can edit quantities, production rates and durations of lump-sum work items in this table. Use the arrow keys to move the cursor to the cell you want to change, type in the correct entry and move the cursor to another cell.
AVOID HITTING "Enter" until you are completely done.
When finished, press "Enter" to proceed.

PLEASE PRESS "ENTER" TO START EDITING

Action: Press *Enter* to start editing. Once you get the cursor in the table, do your editing without pressing *Enter* each time you make a change; rather, move the cursor away to another cell. Make the changes shown in bold digits below.

	L	M	N	O	P	Q
79		Project Type:				
80		BRIDGE STRUCTURES				
81	#	TASK NAME	UNITS	QUANTITY	PROD RATE	DURATION
82	1	Bridge Structures				
83	2	Erect Temp. Bridge	L.Sum			0
84	3	Bridge Demolition	L.Sum			0
85	4	Cofferdams	S.Y.	0	162.5625	0
86	5	Piling	L.F.	**3000**	276.25	11
87	6	Footings	C.Y.	200	13.6	15
88	7	Columns, Caps & Bents	C.Y.	100	5.984	17
89	8	Wingwalls	S.F.	1000	136	8
90	9	Beams (erection only)	L.F.	**1500**	**150**	10
91	10	Bridge Deck	C.Y.	260	8.976	29
92	11	Bridge Curbs/Walks	L.F.	400	79.2	6
93	12	Bridge Handrails	L.F.	400	198	3
94	13	Remove Temp. Bridge	L.Sum			0
95						
96						
97						
98						

Action: Press *Enter* when all the editing is done.

MORE EDITING

GO BACK TO THE MAIN MENU

	L	M				Q
79		Project Type:				
80		BRIDGE STRUCTU				
81	#	TASK NAME			RATE	DURATION
82	1	Bridge Structures				
83	2	Erect Temp. Bridge	L.Sum			0
84	3	Bridge Demolition	L.Sum			0
85	4	Cofferdams	S.Y.	0	162.5625	0
86	5	Piling	L.F.	3000	276.25	11
87	6	Footings	C.Y.	200	13.6	15
88	7	Columns, Caps & Bents	C.Y.	100	5.984	17
89	8	Wingwalls	S.F.	1000	136	8
90	9	Beams (erection only)	L.F.	1500	150	10
91	10	Bridge Deck	C.Y.	260	8.976	29
92	11	Bridge Curbs/Walks	L.F.	400	79.2	6
93	12	Bridge Handrails	L.F.	400	198	3
94	13	Remove Temp. Bridge	L.Sum			0
95						
96						
97						
98						

Action: Choose *GO BACK TO THE MAIN MENU* and press ***Enter.***

```
Please make your choice from the menu below:

EDIT RELATIONSHIPS
EDIT QUANTITIES/PRODUCTION RATES/DURATIONS
GO TO SUPERPROJECT FOR OBTAINING A SCHEDULE
EXIT TO DOS
```

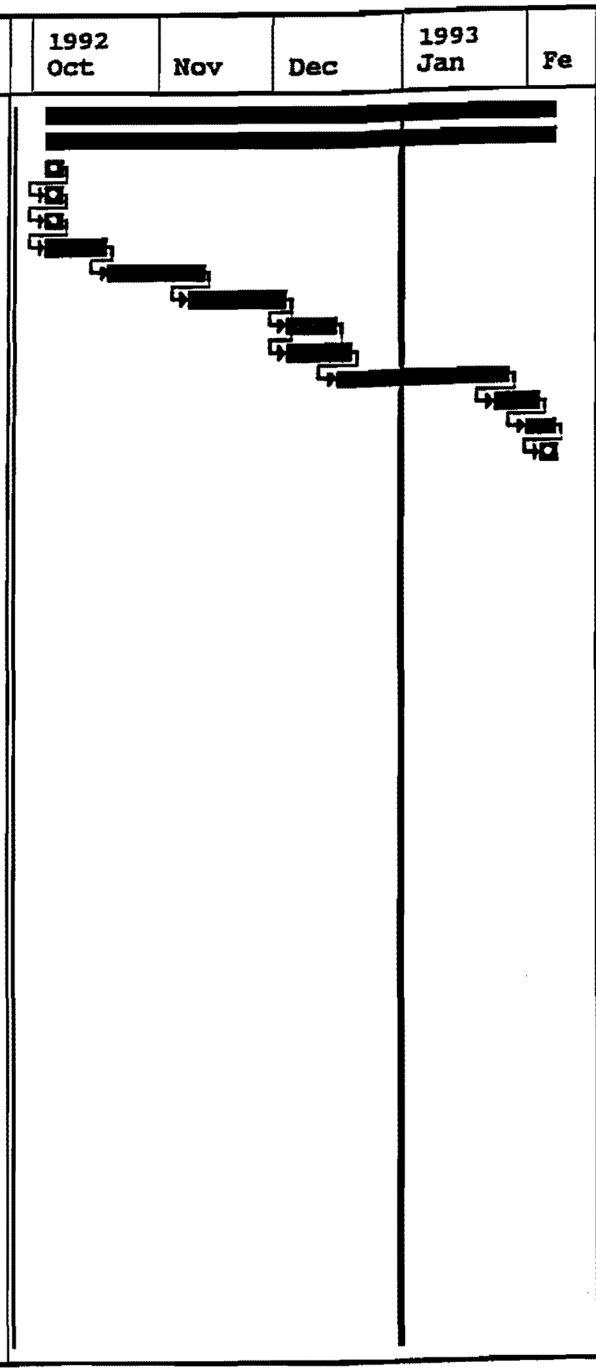
Explanations: At this point, all the editing is completed to meet the requirements of the scenario at hand. Now it is time to save the changes, open SuperProject and obtain a schedule and a bar chart for this new file. Therefore, choose the third option, *GO TO SUPERPROJECT FOR OBTAINING A SCHEDULE*, should be chosen to continue with the procedure. The rest of the procedure is identical to scheduling of new projects, so it is unnecessary to review that once again here. However, it would be worthwhile to point out that after editing, the duration of this second bridge structure has increased to 91 days from 79 days. For your reference, on the following page, there is a copy of the bar chart produced by the system for this application.

This second bridge structure in its revised form can be substituted (instead of the old one) in the total project if desired. This process requires merging the second bridge structure with the other two phases just like it was done the first time. Sections 5.7.1.14 and 5.7.1.15 cover this process in detail.

BASIC OUTLINE

Project: CNF-BR-2.PJ

Heading/Task 4 Days Per Column	Schd Dur
CNF-BR-2.PJ	91dy
Bridge Structures	91dy
Erect Temp. Bridge	0dy
Bridge Demolition	0dy
Cofferdams	0dy
Piling	11dy
Footings	15dy
Columns, Caps & Bents	17dy
Wingwalls	8dy
Beams (erection only)	10dy
Bridge Deck	29dy
Bridge Curbs/Walks	6dy
Bridge Handrails	3dy
Remove Temp. Bridge	0dy



Unassigned
Critical
Interrupted
Milestone
Noncritical

5.7.2.2 - Using the Edit Feature from the CTDS Menu in SuperProject

```
to SAVE this project :                          press S

to go to Lotus 123 to EDIT project :            press Alt-L

to go to Lotus 123 to work on ANOTHER
    PHASE of this project :                     press Alt-A

to MERGE subprojects (phases) into
        one project :                           press Alt-M

to QUIT this menu and return to Ready
    mode in SuperProject :                      press Q
```

Explanations: When the menu built specially for CTDS in SuperProject appears on screen after the user presses *Ctrl-F5* to call it, the Edit Feature can be activated from this menu. This is particularly useful for the user when he/she does not like the schedule produced in SuperProject after an application of CTDS. This option gives the user a chance to call right back the spreadsheet file containing information on that current project, and make some editing to get a new schedule in SuperProject again.

While the CTDS Menu in SuperProject is on screen, pressing *Alt-L* would activate this feature. The option listed in the menu for this is *go to Lotus 123 to EDIT project*, which is the second option. It closes SuperProject without saving the current schedule file, based on the fact that some editing needs to be done before obtaining a schedule in its final form. Then it opens Lotus 123, and displays the list of all the project files produced from earlier applications of CTDS. The user is required to choose the file that he/she wants to edit in order to get a new schedule in SuperProject. Aside from the very first command to activate it, using the Edit Feature from the menu built in SuperProject specially for CTDS is identical to using it from a DOS prompt.

5.8 - QUITTING THE SYSTEM

When the user is of no longer in need of using CTDS, he/she can quit the system. This is a manual process consisting of mainly two steps: Closing SuperProject and closing Flash-Up.

5.8.1 - CLOSING SUPERPROJECT

To close SuperProject, the user must be in the Ready Mode of SuperProject which allows him/her to use the pop-up menu options of the software. The closing process can be done manually using the quit option in this pop-up menu. Please notice that this menu is different from the menu built specifically for CTDS applications; this is the menu bar displayed at the top of the screen, and is a characteristic of the software itself used for all other operations as well. If however, you are in the other menu, that is the special CTDS menu with five options in it, first you should press **Q** to quit that menu and get into the Ready Mode in SuperProject. Once you are in the Ready Mode, you can press **/ File Quit** and then when the program asks *Are you sure you want to quit?* press **Y** for yes. After this action, you should be at the DOS prompt *C:>SPJ2>*.

5.8.2 - CLOSING FLASH-UP

To close Flash-Up, follow the steps mentioned below:

1. Activate the menu bar of Flash-Up.
   Press ***Alt-Home***. (Again, make sure you use the ***Home*** key in Numeric keypad that shares the same key with the number "7")
2. Using the arrow keys, move the cursor to *Flash-Up Commands* and choose *Uninstall Flash-Up*.
3. When the program asks *Uninstall Flash-Up?*, type **Y** for yes. (You might also encounter a message saying *You Have Not Saved the Library in Memory. Continue Anyway?*. If so, again type **Y** for yes.) For a second, you will see a note saying *Flash-Up Is Now Uninstalled*, and will be at the last DOS prompt you were in, that is *C:>FLASH*, if you have not changed it for some reason.

CHAPTER 6 - SUMMARY AND RECOMMENDATIONS

6.1 - SUMMARY

The primary objective of this research study was to develop a rational procedure for the Texas Department of Transportation to determine the time required to complete a construction contract for different types of highway construction projects. The procedure to be developed was to be flexible to accommodate the wide range of projects and conditions undertaken by TxDOT throughout the State, plus it was to be easy to modify and update in the future. It was to be based on production rates and work quantities that are common to the projects undertaken by the Department. Finally, the procedure was to be logical, easy to use and defensible in contract disputes and litigation proceedings.

Literature reviews and contacts with other DOTs revealed that there are several scheduling techniques used by transportation agencies to determine the contract time to allow for construction projects. Due to the 1991 Federal Highway Administration requirement that all state departments of transportation must have a formal method for establishing contract durations for federally-funded highway projects, much activity is underway. The techniques used range in complexity from simple predictions of senior engineers based on past experience with similar projects, to bar charts, to Critical Path networks, to linear scheduling models. Although the CPM and linear scheduling models have been available for many years, there is little use of these methods. Most of the scheduling, especially for setting contract duration, is based on simple prediction techniques or bar charts based on standard production rates. Whatever methods are used, the empirical judgement of experienced DOT personnel still play a major role in setting contract time.

An important fact to remember when developing a system for determining a feasible contract time for highway projects is that it is a conceptual scheduling system, not a detailed construction scheduling system. The purpose is not to develop a schedule for the contractor to follow to build the job, which is the responsibility of the contractor. A construction schedule includes many activities and is highly dependent on the methods and resources used by the person building the job. The DOT is trying to establish a reasonable period of time to allow for the contract, which is controlled by fewer more critical activities. It also takes a great deal of time to develop a detailed construction schedule, much more than is usually available for most contract document preparation periods. Occasionally, very detailed schedules are developed for large and complex projects, but these are certainly atypical of most projects.

Production data for highway construction was requested from all state DOTs; 24 supplied data, but only 12 had very detailed production data. Instructions on how the data is used to develop a contract time estimate were often not clear. Some of the data received was quite interesting with a variety of methods used to express production rates. The major problem with any production data is the basis used to express the data. It appeared that most of the data was for actual construction time for a specific item and did not include time for related activities such as forming and curing. The data received was very useful.

Production data was also solicited from all TxDOT Districts for developing base production rates for the major work items used in the final prediction system. Over 35 useful responses were obtained and used. Similar production data were also requested from 50 major contractors doing work for TxDOT, but only 1 full and one partial response were received.

Production rates for construction are highly variable, with almost an infinite array of possible values for every work item considered. Depending on many variables such as location, weather, labor conditions, site conditions, traffic, and state of the economy, production rates can not be standardized easily. Data need to be collected and stratified for all important variables to be meaningful, especially for detailed scheduling of construction. Such an effort was beyond the scope of this project; however, the initial data collected from all sources contacted was used to develop a base for the time estimation system developed. Continued data collection may now be encouraged since there is an obvious beneficial application of the data.

The final product of this research project is the TxDOT Contract Time Determination System (CTDS). The system was developed to complement the existing TxDOT Pre-Construction Management System which categorizes all projects into 14 different classes. The CTDS is a conceptual estimating system for predicting contract time for highway construction projects and is not to be used for the detailed planning of actual construction activities for a project. It is a bar chart scheduling system based on standard work items for each project class, with the flexibility to add other work items as desired. It includes both a manual method and a computerized method.

The CTDS user supplies actual work quantities for a project and by applying standard production rates, or preferred rates, a contract duration is established. The system has been designed to allow the districts to use production rates specific to their operations due to the wide variation in production situations in Texas. The computer version of the system was based on existing software already used for the Pre-Construction Management System, including Lotus 123, Flash-Up, and SuperProject.

The major benefit of the completed research is that the Construction Contract Time Determination System developed will provide TxDOT with a rational procedure for estimating its contract completion times. The system developed will serve as a basis for the collection and analysis of production rates of past projects, which can be used to update existing production data. Since the procedure will be based on work quantities, it will not be subject to variations (related to changes in unit costs) that are encountered in approaches that are based on the dollar value of projects. It will lead to improved and more dependable time estimates as well as better documentation. This should lead to less litigation and/or collection of additional liquidated damages when there are project time overruns. CTDS can also be used by the Design Division for checking district estimates.

6.2 - RECOMMENDATIONS FOR IMPLEMENTING AND UPDATING CTDS

a) TxDOT should organize and conduct training sessions for selected division and district employees on the use of the Contract Time Determination System (CTDS). Personnel from TTI could assist with the development of the training sessions. The basic goal of the sessions should be to train participants on how to use the CTDS manual and computer methods for contract time estimation, with special emphasis on the steps for revising the computer system to adjust for local district needs and conditions.

b) District offices should acquire the necessary computer equipment and software to operate CTDS and train additional personnel as needed to use CTDS. Most districts already have the equipment and software needed; however, they will need to assign a person to take the lead on implementing CTDS for their operations.

c) District offices should form a study team to review the standard work items and relationships, the proposed production rates for these standard work items, and the optional job condition factors to see how they relate to the work environment of the district. Several projects, past and current, should be used to test the feasibility of CTDS for direct application. Modifications should then be made to CTDS to make it compatible to the district.

d) District offices should set up a mechanism to collect and synthesize production data from district construction projects to update or develop new production rates and/or job condition factors for CTDS. Care must be taken to collect the data so that it relates to the work items in CTDS, i.e., conceptual work items covering all of the operations related to a major element of a project, such as preparation, installation, adjustments, and clean up. Other prediction tools will most likely be developed as part of this data collection and analysis process.

e) District offices determine how the contract time estimates for large or complex projects will be handled in the district. Such projects can not be standardized such as those in

CTDS and must be handled by in-house personnel with construction planning and scheduling expertise or by consultants. Decision criteria should be established to guide the efforts in this process. Additional training for in-house personnel and the acquisition of additional computer software may be needed.

REFERENCES

Alabay, R. T., "Conceptual Highway Construction Scheduling System," Master of Engineering Report, Civil Engineering Department, Texas A&M University, Dec. 1991.

Arditi, D., "Line of Balance Scheduling in Pavement Construction," Journal of Construction Engineering, Vol. 112, No. 3, September 1986.

Hancher, D., "A Conceptual Scheduling System for Construction Projects," Special Report for the Indianapolis Department of Transportation, 1987.

Herbsman, Z., "Evaluation of Scheduling Techniques for Highway Construction Projects," Transportation Research Record 1126, Transportation Research Board, Washington, D.C., 1987.

McFarland, F., et al., "Project Completion Times and Evaluation of Bidding Strategies with Bonuses and Liquidated Damages," Research Report 412-1F, Texas Transportation Institute, Texas A&M University, May 1987.

Persad, K., O'Connor, J., and Hugo, F., "Pre-Construction Management System: Procedures Manual," Research Report 922-1F, Center for Transportation Research, University of Texas at Austin, February 1990.

Prendergast, J., "A Survey of Project Scheduling Tools," Engineering Management Journal, Vol. 3, No. 2, June 1991.

Rowings, J., and Hancher, D., "Setting Highway Construction Contract Duration," Journal of Construction Division, ASCE, Vol. 107, No. CO2, pg. 169-179, June 1981.

APPENDIX A - Listing of Major Work Items and Relationships by Project Type

1. SEAL COAT

MAJOR WORK ITEMS	PRECEDING ACTIVITIES & RELATIONSHIP (% complete of predecessor)
1. Initial traffic control	-
2. Detour	1, 100%
3. Pavement repair	
A. Asphalt	2, 100%
B. Concrete	2, 100%
4. One-course surface treatment	3, 100%
5. Permanent pavement markings	4, 100%
6. Final clean up	5, 100%

2. OVERLAY

MAJOR WORK ITEMS	PRECEDING ACTIVITIES & RELATIONSHIP (% complete of predecessor)
1. Initial traffic control	-
2. Detour	1, 100%
3. Milling/planing	2, 100%
4. Pavement repair	
A. Asphalt	2, 100%
B. Concrete	2, 100%
5. Concrete paving	3, 75% ; 4B, 75%
6. Hot mix asphalt surface	3, 75% ; 4A, 75%
7. Permanent pavement markings	5, 100% ; 6, 100%
8. Final clean up	7, 100%

3. REHABILITATE EXISTING ROAD

MAJOR WORK ITEMS	PRECEDING ACTIVITIES & RELATIONSHIP (% complete of predecessor)
1. Initial traffic control	-
2. Detour	1, 100%
3. ROW Preparations	2, 100%
A. Clear and grub	
B. Remove old structures (small)	
C. Remove old pavement	
D. Remove old curb & gutter	
E. Remove old sidewalks	
F. Remove old drainage/utility structur	
4. Excavation/embankment	
A. Earth excavation	3, 25%
B. Rock excavation	3, 25%
C. Embankment	3, 25%
5. Drainage structures/storm sewers	
A. Pipe	4A, 10% ; 4B, 10%
B. Box culverts	4A, 10% ; 4B, 10%
C. Inlets & Manholes	5A, 10%
6. Base preparations	
A. Lime stabilization	4A, 50% ; 4C, 50% ; 5A, 75% ; 5B, 75%
B. Flexible base material	6A, 75%
C. Cement treated base material	6A, 75%
7. New curb and gutter	6B, 75% ; 6C, 75%
8. Pavement repair	
A. Asphalt	3, 75%
B. Concrete	3, 75%
9. Milling/planing	3, 75%
10. Hot mix asphalt base	5C, 100% ; 7, 75%
11. Concrete paving	5C, 100% ; 6B, 100% ; 6C, 100% ; 9, 100%
12. One-course surface treatment	8A, 100%
13. Hot mix asphalt surface	8A, 100% ; 8B, 100% ; 9, 100% ; 10, 100%
14. Permanent pavement markings	11, 100% ; 12, 100% ; 13, 100%
15. Final clean up	14, 100%

4. CONVERT NON-FREEWAY TO FREEWAY

MAJOR WORK ITEMS	PRECEDING ACTIVITIES & RELATIONSHIP (% complete of predecessor)
1. Initial traffic control	-
2. Detour	1, 100%
3. ROW Preparations	2, 100%
A. Major structure demolition	
B. Clear and grub	
C. Remove old structures (small)	
D. Remove old pavement	
E. Remove old curb & gutter	
F. Remove old sidewalks	
G. Remove old drainage/utility structures	
4. Excavation/embankment	
A. Earth excavation	3, 25%
B. Rock excavation	3, 25%
C. Embankment	3, 25%
5. Drainage structures/storm sewers	
A. Pipe	4A, 10% ; 4B, 10%
B. Box culverts	4A, 10% ; 4B, 10%
C. Inlets & Manholes	5A, 10%
6. Bridge structures	
A. Erect temporary bridge	1, 100%
B. Bridge demolition	6A, 100%
C. Cofferdams	2, 100% ; 6B, 100%
D. Piling	4A, 10% ; 4B, 10% ; 6C, 100%
E. Footings	6D, 75%
F. Columns, Caps & Bents	6E, 75%
G. Wingwalls	6F, 50%
H. Beams (erection only)	6F, 100%
I. Bridge deck (total depth)	6G, 100% ; 6H, 100%
J. Bridge curbs/walks	6I, 100%
K. Bridge handrails	6J, 100%
L. Remove temporary bridge	6K, 100%
7. Retaining walls	4A, 40% ; 4C, 40%
8. Base preparations	
A. Lime stabilization	4A, 50% ; 4C, 50% ; 5A, 75% ; 5B, 75%
B. Flexible base material	8A, 75%
C. Cement treated base material	8A, 75%
9. New curb & gutter	8B, 75% ; 8C, 75%
10. Pavement repair	
A. Asphalt	3, 75%
B. Concrete	3, 75%
11. Milling/planing	3, 75%
12. One-course surface treatment	10A, 100%
13. Hot mix asphalt base	5C, 100% ; 9, 75%
14. Concrete paving	5C, 100% ; 8B, 100% ; 8C, 100% ; 11, 100%
15. Hot mix asphalt surface	10A, 100% ; 10B, 100% ; 11, 100% ; 13, 100%
16. Precast traffic barriers	14, 100% ; 15, 100%
17. Permanent signing and traffic signals	
A. Small signs	14, 100% ; 15, 100%
B. Overhead signs	14, 100% ; 15, 100%
C. Major traffic signals	14, 100% ; 15, 100%
18. Seeding and landscape	7, 100% ; 14, 50% ; 15, 50%
19. Pavement markings	12, 100% ; 14, 100% ; 15, 100%
20. Final clean up	6L, 100% ; 17, 100% ; 18, 100% ; 19, 100%

5. WIDEN FREEWAY

MAJOR WORK ITEMS	PRECEDING ACTIVITIES & RELATIONSHIP (% complete of predecessor)
1. Initial traffic control	-
2. Detour	1, 100%
3. ROW Preparations	2, 100%
A. Major structure demolition	
B. Clear and grub	
C. Remove old structures (small)	
D. Remove old pavement	
E. Remove old curb & gutter	
F. Remove old sidewalks	
G. Remove old drainage/utility structures	
4. Excavation/embankment	
A. Earth excavation	3, 25%
B. Rock excavation	3, 25%
C. Embankment	3, 25%
5. Drainage structures/storm sewers	
A. Pipe	4A, 10% ; 4B, 10%
B. Box culverts	4A, 10% ; 4B, 10%
C. Inlets & Manholes	5A, 10%
6. Bridge structures	
A. Erect temporary bridge	1, 100%
B. Bridge demolition	6A, 100%
C. Cofferdams	2, 100% ; 6B, 100%
D. Piling	4A, 10% ; 4B, 10% ; 6C, 100%
E. Footings	6D, 75%
F. Columns, Caps & Bents	6E, 75%
G. Wingwalls	6F, 50%
H. Beams (erection only)	6F, 100%
I. Bridge deck (total depth)	6G, 100% ; 6H, 100%
J. Bridge curbs/walks	6I, 100%
K. Bridge handrails	6J, 100%
L. Remove temporary bridge	6K, 100%
7. Retaining walls	4A, 40% ; 4C, 40%
8. Base preparations	
A. Lime stabilization	4, 50% ; 5A, 75% ; 5B, 75%
B. Flexible base material	8A, 75%
C. Cement treated base material	8A, 75%
9. New curb & gutter	8B, 75% ; 8C, 75%
10. Hot mix asphalt base	5C, 100% ; 9, 75%
11. Concrete paving	5C, 100% ; 8B, 100% ; 8C, 100%
12. Hot mix asphalt surface	10, 100%
13. Precast traffic barriers	11, 100% ; 12, 100%
14. Permanent signing and traffic signals	
A. Small signs	11, 100% ; 12, 100%
B. Overhead signs	11, 100% ; 12, 100%
C. Major traffic signals	11, 100% ; 12, 100%
15. Seeding and landscape	7, 100% ; 11, 50% ; 12, 50%
16. Pavement markings	11, 100% ; 12, 100% ; 13, 100%
17. Final clean up	6L, 100% ; 14, 100% ; 15, 100% ; 16, 100%

6. WIDEN NON-FREEWAY

MAJOR WORK ITEMS	PRECEDING ACTIVITIES & RELATIONSHIP (% complete of predecessor)
1. Initial traffic control	-
2. Detour	1, 100%
3. ROW Preparations	2, 100%
A. Major structure demolition	
B. Clear and grub	
C. Remove old structures (small)	
D. Remove old pavement	
E. Remove old curb & gutter	
F. Remove old sidewalks	
G. Remove old drainage/utility structures	
4. Excavation/embankment	
A. Earth excavation	3, 25%
B. Rock excavation	3, 25%
C. Embankment	3, 25%
5. Drainage structures/storm sewers	
A. Pipe	4A, 10% ; 4B, 10%
B. Box culverts	4A, 10% ; 4B, 10%
C. Inlets & Manholes	5A, 10%
6. Bridge structures	
A. Erect temporary bridge	1, 100%
B. Bridge demolition	6A, 100%
C. Cofferdams	2, 100% ; 6B, 100%
D. Piling	4A, 10% ; 4B, 10% ; 6C, 100%
E. Footings	6D, 75%
F. Columns, Caps & Bents	6E, 75%
G. Wingwalls	6F, 50%
H. Beams (erection only)	6F, 100%
I. Bridge deck (total depth)	6G, 100% ; 6H, 100%
J. Bridge curbs/walks	6I, 100%
K. Bridge handrails	6J, 100%
L. Remove temporary bridge	6K, 100%
7. Retaining walls	4A, 40% ; 4C, 40%
8. Base preparations	
A. Lime stabilization	4, 50% ; 5A, 75% ; 5B, 75%
B. Flexible base material	8A, 75%
C. Cement treated base material	8A, 75%
9. New curb & gutter	8B, 75% ; 8C, 75%
10. Hot mix asphalt base	5C, 100% ; 9, 75%
11. Concrete paving	5C, 100% ; 8B, 100% ; 8C, 100%
12. Hot mix asphalt surface	10, 100%
13. Permanent signing and traffic signals	
A. Small signs	10, 100% ; 11, 100%
B. Overhead signs	10, 100% ; 11, 100%
C. Major traffic signals	10, 100% ; 11, 100%
14. Seeding and landscape	7, 100% ; 11, 50% ; 12, 50%
15. Pavement markings	11, 100% ; 12, 100%
16. Final clean up	6L, 100% ; 13, 100% ; 14, 100% ; 15, 100%

7. NEW LOCATION FREEWAY

MAJOR WORK ITEMS	PRECEDING ACTIVITIES & RELATIONSHIP (% complete of predecessor)
1. Initial traffic control	-
2. Detour	1, 100%
3. ROW Preparations	2, 100%
A. Major structure demolition	
B. Clear and grub	
C. Remove old structures (small)	
D. Remove old pavement	
E. Remove old curb & gutter	
F. Remove old sidewalks	
G. Remove old drainage/utility structures	
4. Excavation/embankment	
A. Earth excavation	3, 25%
B. Rock excavation	3, 25%
C. Embankment	3, 25%
5. Drainage structures/storm sewers	
A. Pipe	4A, 10% ; 4B, 10%
B. Box culverts	4A, 10% ; 4B, 10%
C. Inlets & Manholes	5A, 10%
6. Bridge structures	
A. Erect temporary bridge	1, 100%
B. Bridge demolition	6A, 100%
C. Cofferdams	2, 100% ; 6B, 100%
D. Piling	4A, 10% ; 4B, 10% ; 6C, 100%
E. Footings	6D, 75%
F. Columns, Caps & Bents	6E, 75%
G. Wingwalls	6F, 50%
H. Beams (erection only)	6F, 100%
I. Bridge deck (total depth)	6G, 100% ; 6H, 100%
J. Bridge curbs/walks	6I, 100%
K. Bridge handrails	6J, 100%
L. Remove temporary bridge	6K, 100%
7. Retaining walls	4A, 40% ; 4C, 40%
8. Base preparations	
A. Lime stabilization	4, 50% ; 5A, 75% ; 5B, 75%
B. Flexible base material	8A, 75%
C. Cement treated base material	8A, 75%
9. New curb & gutter	8B, 75% ; 8C, 75%
10. Hot mix asphalt base	5C, 100% ; 9, 75%
11. Concrete paving	5C, 100% ; 8B, 100% ; 8C, 100%
12. Hot mix asphalt surface	10, 100%
13. Precast traffic barriers	11, 100% ; 12, 100%
14. Permanent signing and traffic signals	
A. Small signs	11, 100% ; 12, 100%
B. Overhead signs	11, 100% ; 12, 100%
C. Major traffic signals	11, 100% ; 12, 100%
15. Seeding and landscape	7, 100% ; 11, 50% ; 12, 50%
16. Pavement markings	11, 100% ; 12, 100% ; 13, 100%
17. Final clean up	6L, 100% ; 14, 100% ; 15, 100% ; 16, 100%

8. NEW LOCATION NON-FREEWAY

MAJOR WORK ITEMS	PRECEDING ACTIVITIES & RELATIONSHIP (% complete of predecessor)
1. Initial traffic control	-
2. Detour	1, 100%
3. ROW Preparations	2, 100%
A. Major structure demolition	
B. Clear and grub	
C. Remove old structures (small)	
D. Remove old pavement	
E. Remove old curb & gutter	
F. Remove old sidewalks	
G. Remove old drainage/utility structures	
4. Excavation/embankment	
A. Earth excavation	3, 25%
B. Rock excavation	3, 25%
C. Embankment	3, 25%
5. Drainage structures/storm sewers	
A. Pipe	4A, 10% ; 4B, 10%
B. Box culverts	4A, 10% ; 4B, 10%
C. Inlets & Manholes	5A, 10%
6. Bridge structures	
A. Erect temporary bridge	1, 100%
B. Bridge demolition	6A, 100%
C. Cofferdams	2, 100% ; 6B, 100%
D. Piling	4A, 10% ; 4B, 10% ; 6C, 100%
E. Footings	6D, 75%
F. Columns, Caps & Bents	6E, 75%
G. Wingwalls	6F, 50%
H. Beams (erection only)	6F, 100%
I. Bridge deck (total depth)	6G, 100% ; 6H, 100%
J. Bridge curbs/walks	6I, 100%
K. Bridge handrails	6J, 100%
L. Remove temporary bridge	6K, 100%
7. Retaining walls	4A, 40% ; 4C, 40%
8. Base preparations	
A. Lime stabilization	4, 50% ; 5A, 75% ; 5B, 75%
B. Flexible base material	8A, 75%
C. Cement treated base material	8A, 75%
9. New curb & gutter	8B, 75% ; 8C, 75%
10. Hot mix asphalt base	5C, 100% ; 9, 75%
11. Concrete paving	5C, 100% ; 8B, 100% ; 8C, 100%
12. Hot mix asphalt surface	10, 100%
13. Permanent signing and traffic signals	
A. Small signs	11, 100% ; 12, 100%
B. Overhead signs	11, 100% ; 12, 100%
C. Major traffic signals	11, 100% ; 12, 100%
14. Seeding and landscape	7, 100% ; 11, 50% ; 12, 50%
15. Pavement markings	11, 100% ; 12, 100%
16. Final clean up	6L, 100% ; 13, 100% ; 14, 100% ; 15, 100%

9. INTERCHANGE

MAJOR WORK ITEMS	PRECEDING ACTIVITIES & RELATIONSHIP (% complete of predecessor)
1. Initial traffic control	-
2. Detour	1, 100%
3. ROW Preparations	2, 100%
A. Major structure demolition	
B. Clear and grub	
C. Remove old structures (small)	
D. Remove old pavement	
E. Remove old curb & gutter	
F. Remove old sidewalks	
G. Remove old drainage/utility structures	
4. Excavation/embankment	
A. Earth excavation	3, 25%
B. Rock excavation	3, 25%
C. Embankment	3, 25%
5. Drainage structures/storm sewers	
A. Pipe	4A, 10% ; 4B, 10%
B. Box culverts	4A, 10% ; 4B, 10%
C. Inlets & Manholes	5A, 10%
6. Bridge structures	
A. Erect temporary bridge	1, 100%
B. Bridge demolition	6A, 100%
C. Cofferdams	2, 100% ; 6B, 100%
D. Piling	4A, 10% ; 4B, 10% ; 6C, 100%
E. Footings	6D, 75%
F. Columns, Caps & Bents	6E, 75%
G. Wingwalls	6F, 50%
H. Beams (erection only)	6F, 100%
I. Bridge deck (total depth)	6G, 100% ; 6H, 100%
J. Bridge curbs/walks	6I, 100%
K. Bridge handrails	6J, 100%
L. Remove temporary bridge	6K, 100%
7. Retaining walls	4A, 40% ; 4C, 40%
8. Base preparations	
A. Lime stabilization	4, 50% ; 5A, 75% ; 5B, 75%
B. Flexible base material	8A, 75%
C. Cement treated base material	8A, 75%
9. New curb & gutter	8B, 75% ; 8C, 75%
10. Hot mix asphalt base	5C, 100% ; 9, 75%
11. Concrete paving	5C, 100% ; 8B, 100% ; 8C, 100%
12. Hot mix asphalt surface	10, 100%
13. Permanent signing and traffic signals	
A. Small signs	10, 100% ; 11, 100%
B. Overhead signs	10, 100% ; 11, 100%
C. Major traffic signals	10, 100% ; 11, 100%
14. Seeding and landscape	7, 100% ; 11, 50% ; 12, 50%
15. Pavement markings	11, 100% ; 12, 100%
16. Final clean up	6L, 100% ; 13, 100% ; 14, 100% ; 15, 100%

10. BRIDGE WIDENING/REHABILITATION

MAJOR WORK ITEMS	PRECEDING ACTIVITIES & RELATIONSHIP (% complete of predecessor)
1. Initial traffic control	-
2. Detour	1, 100%
3. ROW Preparations	2, 100%
A. Major structure demolition	
B. Clear and grub	
C. Remove old structures (small)	
D. Remove old pavement	
E. Remove old curb & gutter	
F. Remove old sidewalks	
G. Remove old drainage/utility structure	
4. Excavation/embankment	
A. Earth excavation	3, 25%
B. Rock excavation	3, 25%
C. Embankment	3, 25%
5. Bridge structures	
A. Erect temporary bridge	1, 100%
B. Bridge demolition	5A, 100%
C. Cofferdams	2, 100% ; 5B, 100%
D. Piling	4A, 10% ; 4B, 10% ; 5C, 100%
E. Footings	5D, 75%
F. Columns, Caps & Bents	5E, 75%
G. Wingwalls	5F, 50%
H. Beams (erection only)	5F, 100%
I. Bridge deck (total depth)	5G, 100% ; 5H, 100%
J. Bridge curbs/walks	5I, 100%
K. Bridge handrails	5J, 100%
L. Remove temporary bridge	5K, 100%
6. Retaining walls	4A, 40% ; 4C, 40%
7. Base preparations	
A. Lime stabilization	4, 100%
B. Flexible base material	7A, 100%
C. Cement treated base material	7A, 100%
8. New curb & gutter	7B, 100% ; 7C, 100%
9. Hot mix asphalt base	8, 75%
10. Concrete paving	7B, 100% ; 7C, 100%
11. Hot mix asphalt surface	9, 100%
12. Precast traffic barriers	10, 100% ; 11, 100%
13. Permanent signing and traffic signals	
A. Small signs	10, 100% ; 11, 100%
B. Overhead signs	10, 100% ; 11, 100%
C. Major traffic signals	10, 100% ; 11, 100%
14. Seeding and landscape	6, 100% ; 10, 50% ; 11, 50%
15. Pavement markings	10, 100% ; 11, 100% ; 12, 100%
16. Final clean up	5L, 100% ; 13, 100% ; 14, 100% ; 15, 100%

11. BRIDGE REPLACEMENT / NEW BRIDGE

MAJOR WORK ITEMS	PRECEDING ACTIVITIES & RELATIONSHIP (% complete of predecessor)
1. Initial traffic control	-
2. Detour	1, 100%
3. ROW Preparations	2, 100%
A. Major structure demolition	
B. Clear and grub	
C. Remove old structures (small)	
D. Remove old pavement	
E. Remove old curb & gutter	
F. Remove old sidewalks	
G. Remove old drainage/utility structures	
4. Excavation/embankment	
A. Earth excavation	3, 25%
B. Rock excavation	3, 25%
C. Embankment	3, 25%
5. Drainage structures/storm sewers	
A. Pipe	4A, 10% ; 4B, 10%
B. Box culverts	4A, 10% ; 4B, 10%
C. Inlets & Manholes	5A, 10%
6. Bridge structures	
A. Erect temporary bridge	1, 100%
B. Bridge demolition	6A, 100%
C. Cofferdams	2, 100% ; 6B, 100%
D. Piling	4A, 10% ; 4B, 10% ; 6C, 100%
E. Footings	6D, 75%
F. Columns, Caps & Bents	6E, 75%
G. Wingwalls	6F, 50%
H. Beams (erection only)	6F, 100%
I. Bridge deck (total depth)	6G, 100% ; 6H, 100%
J. Bridge curbs/walks	6I, 100%
K. Bridge handrails	6J, 100%
L. Remove temporary bridge	6K, 100%
7. Retaining walls	4A, 40% ; 4C, 40%
8. Base preparations	
A. Lime stabilization	4, 50% ; 5A, 75% ; 5B, 75%
B. Flexible base material	8A, 75%
C. Cement treated base material	8A, 75%
9. New curb & gutter	8B, 75% ; 8C, 75%
10. Hot mix asphalt base	5C, 100% ; 9, 75%
11. Concrete paving	5C, 100% ; 8B, 100% ; 8C, 100%
12. Hot mix asphalt surface	10, 100%
13. Precast traffic barriers	11, 100% ; 12, 100%
14. Permanent signing and traffic signals	
A. Small signs	11, 100% ; 12, 100%
B. Overhead signs	11, 100% ; 12, 100%
C. Major traffic signals	11, 100% ; 12, 100%
15. Seeding and landscape	7, 100% ; 11, 50% ; 12, 50%
16. Pavement markings	11, 100% ; 12, 100% ; 13, 100%
17. Final clean up	6L, 100% ; 14, 100% ; 15, 100% ; 16, 100%

12. UPGRADE FREEWAY TO STANDARDS

MAJOR WORK ITEMS	PRECEDING ACTIVITIES & RELATIONSHIP (% complete of predecessor)
1. Initial traffic control	-
2. Detour	1, 100%
3. ROW Preparations	2, 100%
A. Major structure demolition	
B. Clear and grub	
C. Remove old structures (small)	
D. Remove old pavement	
E. Remove old curb & gutter	
F. Remove old sidewalks	
G. Remove old drainage/utility structures	
4. Excavation/embankment	
A. Earth excavation	3, 25%
B. Rock excavation	3, 25%
C. Embankment	3, 25%
5. Drainage structures/storm sewers	
A. Pipe	4A, 10% ; 4B, 10%
B. Box culverts	4A, 10% ; 4B, 10%
C. Inlets & Manholes	5A, 10%
6. Bridge structures	
A. Erect temporary bridge	1, 100%
B. Bridge demolition	6A, 100%
C. Cofferdams	2, 100% ; 6B, 100%
D. Piling	4A, 10% ; 4B, 10% ; 6C, 100%
E. Footings	6D, 75%
F. Columns, Caps & Bents	6E, 75%
G. Wingwalls	6F, 50%
H. Beams (erection only)	6F, 100%
I. Bridge deck (total depth)	6G, 100% ; 6H, 100%
J. Bridge curbs/walks	6I, 100%
K. Bridge handrails	6J, 100%
L. Remove temporary bridge	6K, 100%
7. Retaining walls	4A, 40% ; 4C, 40%
8. Base preparations	
A. Lime stabilization	4, 50% ; 5A, 75% ; 5B, 75%
B. Flexible base material	8A, 75%
C. Cement treated base material	8A, 75%
9. New curb & gutter	8B, 75% ; 8C, 75%
10. Hot mix asphalt base	5C, 100% ; 9, 75%
11. Concrete paving	5C, 100% ; 8B, 100% ; 8C, 100%
12. Hot mix asphalt surface	10, 100%
13. Precast traffic barriers	11, 100% ; 12, 100%
14. Permanent signing and traffic signals	
A. Small signs	11, 100% ; 12, 100%
B. Overhead signs	11, 100% ; 12, 100%
C. Major traffic signals	11, 100% ; 12, 100%
15. Seeding and landscape	7, 100% ; 11, 50% ; 12, 50%
16. Pavement markings	11, 100% ; 12, 100% ; 13, 100%
17. Final clean up	6L, 100% ; 14, 100% ; 15, 100% ; 16, 100%

13. UPGRADE NON-FREEWAY TO STANDARDS

MAJOR WORK ITEMS	PRECEDING ACTIVITIES & RELATIONSHIP (% complete of predecessor)
1. Initial traffic control	-
2. Detour	1, 100%
3. ROW Preparations	2, 100%
A. Major structure demolition	
B. Clear and grub	
C. Remove old structures (small)	
D. Remove old pavement	
E. Remove old curb & gutter	
F. Remove old sidewalks	
G. Remove old drainage/utility structures	
4. Excavation/embankment	
A. Earth excavation	3, 25%
B. Rock excavation	3, 25%
C. Embankment	3, 25%
5. Drainage structures/storm sewers	
A. Pipe	4A, 10% ; 4B, 10%
B. Box culverts	4A, 10% ; 4B, 10%
C. Inlets & Manholes	5A, 10%
6. Bridge structures	
A. Erect temporary bridge	1, 100%
B. Bridge demolition	6A, 100%
C. Cofferdams	2, 100% ; 6B, 100%
D. Piling	4A, 10% ; 4B, 10% ; 6C, 100%
E. Footings	6D, 75%
F. Columns, Caps & Bents	6E, 75%
G. Wingwalls	6F, 50%
H. Beams (erection only)	6F, 100%
I. Bridge deck (total depth)	6G, 100% ; 6H, 100%
J. Bridge curbs/walks	6I, 100%
K. Bridge handrails	6J, 100%
L. Remove temporary bridge	6K, 100%
7. Retaining walls	4A, 40% ; 4C, 40%
8. Base preparations	
A. Lime stabilization	4, 50% ; 5A, 75% ; 5B, 75%
B. Flexible base material	8A, 75%
C. Cement treated base material	8A, 75%
9. New curb & gutter	8B, 75% ; 8C, 75%
10. Hot mix asphalt base	5C, 100% ; 9, 75%
11. Concrete paving	5C, 100% ; 8B, 100% ; 8C, 100%
12. Hot mix asphalt surface	10, 100%
13. Permanent signing and traffic signals	
A. Small signs	10, 100% ; 11, 100%
B. Overhead signs	10, 100% ; 11, 100%
C. Major traffic signals	10, 100% ; 11, 100%
14. Seeding and landscape	7, 100% ; 11, 50% ; 12, 50%
15. Pavement markings	11, 100% ; 12, 100%
16. Final clean up	6L, 100% ; 13, 100% ; 14, 100% ; 15, 100%

APPENDIX B - 1.1 - Example Production Rate Data from Idaho

AVERAGE PRODUCTIVITY RATES

FEBRUARY 1992

Work Activity		Type	Productivity Rate
MOBILIZATION		Small (Sealcoat or small project)	2 days minimum
		Medium (less than $2 million)	5 days
		Large (greater than $2 million)	8 days
EARTHWORK	Excavation	Small , (shoulder work)	1500 C.Y./Day
		Medium (reconstruction)	4000 C.Y./Day
		Large (scraper work)	6000 C.Y./Day
	Borrow	Truck	5000 C.Y./Day
		Scraper	8000 C.Y./Day
	Rock	Blasting	2000 C.Y./Day
AGGREGATE	- PRODUCTION		
	Base		2400 Tons/Day
	Plantmix		2000 Tons/Day
	Cover Coat		800 Tons/Day
AGGREGATE	- PLACEMENT		
	Base		2000 Tons/Day
	Plantmix	Leveling Course	2000 Tons/Day
		Base Course	2400 Tons/Day
		Wearing Course	2000 Tons/Day
	Cover Coat		8 lane miles/day
CONCRETE PAVING	Placement	Standard Width	10,000 S.Y./Day
		Non- Standard Width	2,000 S.Y./Day
	Repair	Grinding	3,500 S.Y./Day
		Joint Sealing	10,000 L.F./Day
MISCELLANEOUS	Curb & Gutter		2,000 L.F./Day
	Sidewalk		2,500 L.F./Day
	Fencing	Woven Wire/Barbwire	4,000 L.F./Day
		Chain Link	2,000 L.F./Day
	Guardrail	Precast concrete	1,200 L.F./Day
		Cast in Place	1,500 L.F./Day
		Steel	750 L.F./Day
	Pipe Culvert	24" or less	300 L.F./Day
		30" or more	150 L.F./Day

AVERAGE PRODUCTIVITY RATES

FEBRUARY 1992

Work Activity		Type	Productivity Rate
BRIDGE	- SUBSTRUCTURE General	Structure Excavation	1 day/footing
		Compacting Backfill	1 day/footing
		Drive Piles	300 LF/day
		Construct Cofferdams	25 ft/day *(measured along perimeter of cofferdam)*
		Place Seal Concrete	1 day/footing
		Cure Seal Concrete	5 days/footing
		Dewater Cofferdam	1 day/footing
		Shoring	320 S.F./day
	Footings	Form Footings	150 S.F./day
		Place Footing Reinforcement	2500 #/day
		Place Footing Concrete	400 C.Y./day ≤ 1 footing/day
		Cure Footing Concrete	3 days
		Strip Footing Forms	1 day/footing
	Columns	Form Columns	300 S.F./day
		Place Column Reinforcement	5000 #/day
		Place Column Concrete	32 ft/day/column
		Cure Column Concrete	3 days
		Strip Column Forms	2 columns/day
	Piers	Form Pier	600 S.F./day
		Place Pier Reinforcement	3000 #/day
		Place Pier Concrete	400 C.Y./day
		Cure Pier Concrete	3 days
		Strip Pier Forms	1 day/pier
	Abutments	Form Abutment	175 S.F./day
		Place Abutment Reinforcement	2500 #/day
		Place Abutment Concrete	400 C.Y./day
		Cure Abutment Concrete	3 days
		Strip Abutment Forms	2 day/abutment
	Wing Walls	Form Wing Wall	250 S.F./day
		Place Wing Wall Reinforcement	2500 #/day
		Place Wing Wall Concrete	400 C.Y./day
		Cure Wing Wall Concrete	3 day
		Strip Wing Wall Forms	1 day/wing wall
	Bent Caps	Form Bent Cap Wall	250 S.F./day
		Place Bent Cap Reinforcement	5000 #/day
		Place Bent Cap Concrete	400 C.Y./day
		Cure Bent Cap Concrete	7 day
		Strip Bent Cap Forms	1 day/cap

AVERAGE PRODUCTIVITY RATES

FEBRUARY 1992

Work Activity		Type	Productivity Rate
BRIDGE -	SUPERSTRUCTURE Prestress Girders	Shop Drawing	15 days
		Form Diaphragms	320 S.F./day
		Place Diaphragm Reinforcement	2500 #/day
		Place Diaphragm Concrete	200 C.Y./day
		Fabrication[1]	200 L.F./day
		Erection	4 girders/day
	Steel Girders	Shop Drawings	21 days
		Fabrication	10 tons/day
		Erection	4 pieces/day
	Cast-In Place Post-Tension:	Falsework Shop Drawings	15 days
		Falsework Erection	10 days/span
		Place Reinforcement	3500 #/day
		Place Bottom Slab Concrete	400 C.Y./day
		Form Webs	1300 S.F./day
		Place Web Concrete	400 C.Y./day
		Form Deck Slab	1300 S.F./day
		Place Deck Slab Concrete	400 C.Y./day
		Deck Cure	14 days
		Post-Tensioning Shop Drawings	15 days
		Post-Tensioning	6 tendons/day
		Grouting	6 tendons/day
		Remove Falsework	3 days/span
	Decks:	Deck Forms	1300 S.F./day
		Place Deck Reinforcement	10000 #/day
		Place Deck Concrete[2]	400 C.Y./day
		Cure Deck Concrete	7 days
		Strip Deck Forms	3 days/span
	General:	Concrete Parapet	80 L.F./day
		Scarifying Bridge Decks	1400 S.Y./day
		Place Concrete Deck Overlay	75 C.Y./day
		Cure Concrete Deck Overlay	4 days
		Install Metal Railing	200 L.F./day

[1]The time for fabrication should only be used for small projects when erection of girders is expected within 45 days from the beginning of the project.

[2]The amount of concrete in a deck pour is usually governed by the deck placing sequence shown on the plans.

APPENDIX B - 1.2 - Example Production Rate Data from Michigan

CRITICAL PATH

CONSTRUCTION TIME ESTIMATES

I.	Drainage			
	A.	Cross Culverts (Generally Included in G & DS)		
		1.	Rural Highways	120 lft/Day
		2.	Expressways	150 lft/Day
		3.	Large Headwalls	5 Days/Unit
		4.	Slab or Box Culverts	5 Days/Pour
		5.	Plowed in Edge Drain (Production Type Project)	150 Stas/Day
		6.	Open-Graded Underdrain (Production Type Project)	40 Stas/Day
	B.	Sewers		
		1.	0'-14' (Up to 60")	120 Lft/Day
		2.	0'-14' (Over 60")	80 Lft/Day
		3.	14'-Over(Up to 60")	80 Lft/Day
		4.	14'-Over (Over 60")	60 Lft/Day
		5.	Jacked-in-Place	40 Lft/Day
			Inc. Excavation Pit & Set-up	Min.5 Days
		6.	Tunnels	
			a. Hand Mining	24 Lft/Day
			b. Machine Mining	60 Lft/Day
			Inc.Excavation Pit and Set-up	Min.5 Days
	C.	Manholes		3 Units/Day
	D.	Catch Basin		4 Units/Day

II.	Utilities		
	A.	Water Main (To 16")	300 Lft/Day
		Flushing, Testing & Chlorination	4 Days
	B.	Water Main (20" to 42")	80 Lft/Day
		Flushing, Testing & Chlorination	5 Days
	C.	Order and Deliver 24" HP Water Main	50 Days @ 5 Day Week
	D.	Gas Lines	300 Lft/Day

			Det.Exp.	Rural
III.	Earthwork and Grading			
	A.	Embankment CIP	2,000	7,000 Cyds/Day
	B.	Excavation and/or Embankment (Freeway)	2,000	12,000 Cyds/Day
	C.	Excavation and/or Embankment (Reconstruction)	1,000	5,000 Cyds/Day
	D.	Embankment (Lightweight Fill)	400	800 Cyds/Day
	E.	Muck (Excavated Waste & Backfill)		2,000 Cyds/Day
	F.	Excavation (Widening)		20 Stas/Day
	G.	Grading (G & DS)		25 Stas/Day
	H.	Subbase and Sel Sub (24' or Less)		20 Stas/Day
	I.	Subbase and Sel Sub (More than 24')		15 Stas/Day
	J.	Subgrade Undercut and Backfill		2,000 Cyds/Day
	K.	Subbase and Open-Graded Drainage Course		15 Stas/Day

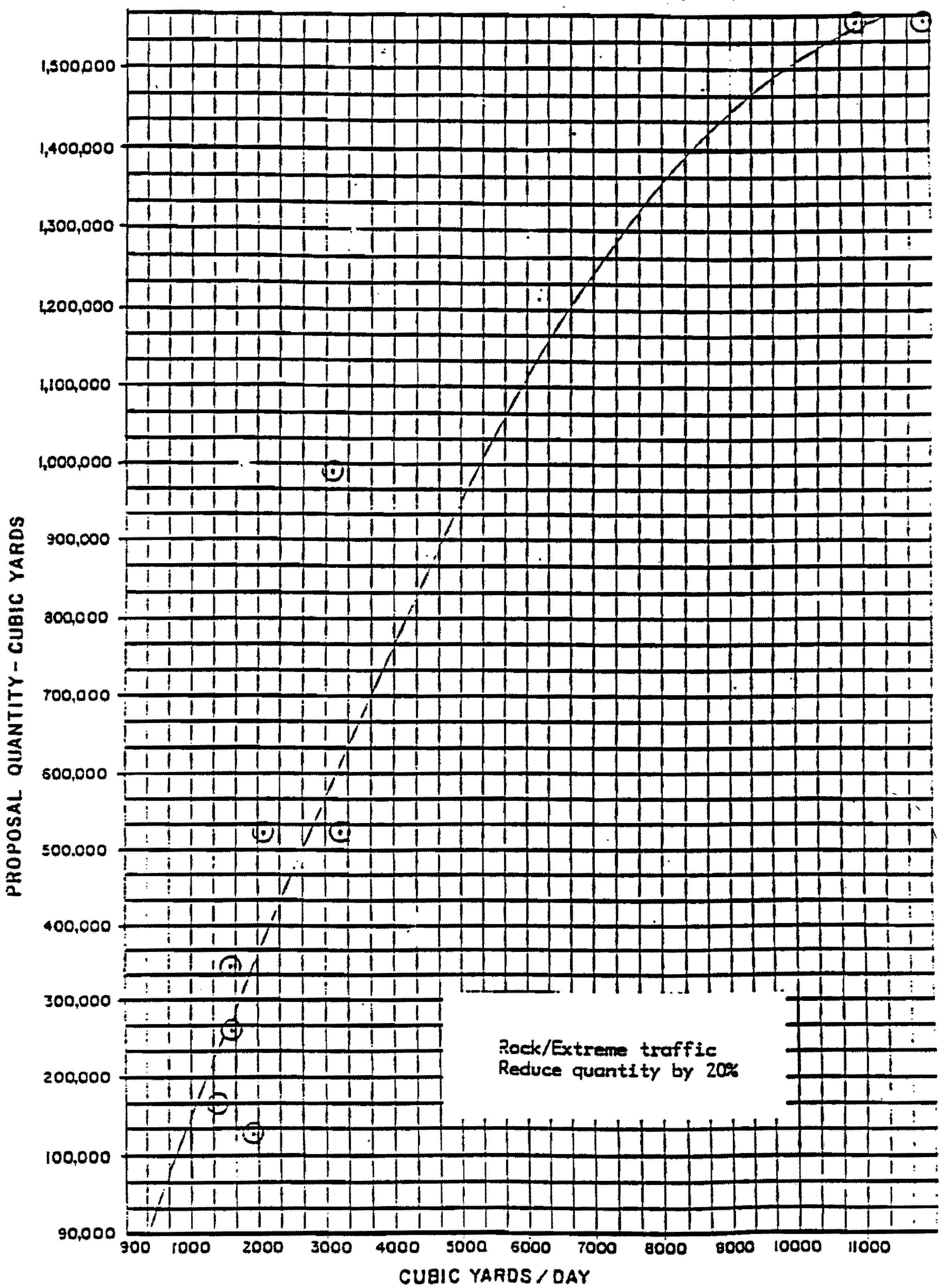
IV.	Surfacing Items	
A.	24' Concrete Pavement (Including Forming and Curing)	15 Stas/Day* Minimum 7 Days
B.	24' Bituminous Pavement(Per Course)	40 Stas/Day
C.	16' Concrete Pavement(Ramps) (Including Forming and Curing)	10 Stas/Day* Minimum 7 Days
D.	Curb (One Side)	2,500 Lft/Day*
E.	Concrete Shoulder (Median) 15 Sta./Day or	1,500 Syds/Day
F.	Bituminous Shoulders (One Side Per Course)	25 Stas/Day
G.	Sidewalk	2,000 Sft/Day
H.	Sidewalk (Patching)	700 Sft/Day
V.	Structures	
A.	Sheeting (Shallow)	100 Lft/Day
B.	General Excavating at Bridge Site	1,000 Cyds/Day
C.	Excavating for Footings	1 Day/Unit
D.	Piles (40')	15 Piles/Day
E.	Substructure	5 Days/Unit
F.	Order and Deliver Beams	
	1. Plate Girders	(100-120 Days @ 5 Day Week)
	2. Rolled Beams	(90-120 Days @ 5 Day Week)
	3. Concrete Beams	(50 Days @ 5 Day Week)
G.	Erection of Structural Steel	3 Days/Span
H.	Bridge Decks	
	1. Form and Place Reinforcement (For 200' Structure)	15 Days
	2. Pour Deck Slab (1 1/5 Days per Pour)	2 Days/Span
	3. Cure	(14 Days @ 5 Day Week)
I.	Two Course Bridge Decks	
	1. Add 9 Days for Second Course Latex	
	2. Add 12 Days for Second Course Low Slump	
J.	Sidewalks and Railings	
	1. Sidewalks and Parapets	5 Days/Span
	2. Slip Formed Barriers	2 Days/Span
K.	Clean-up	10 Days
VI.	Retaining Walls	1 Panel/Day Minimum 10 Days
VII.	Railroad Structures	
A.	Grade Temporary Runaround	1,000 Cyds/Day
B.	Ballast, Ties, and Track	150 Lft/Day
C.	Place Deck Plates	5 Days/Span
D.	Waterproof, Shotcrete, and Mastic	5 Days/Span

* ADD FIVE DAYS CURE TIME (MINIMUM 7 DAYS) 5 DAYS @ 5 DAY WEEK

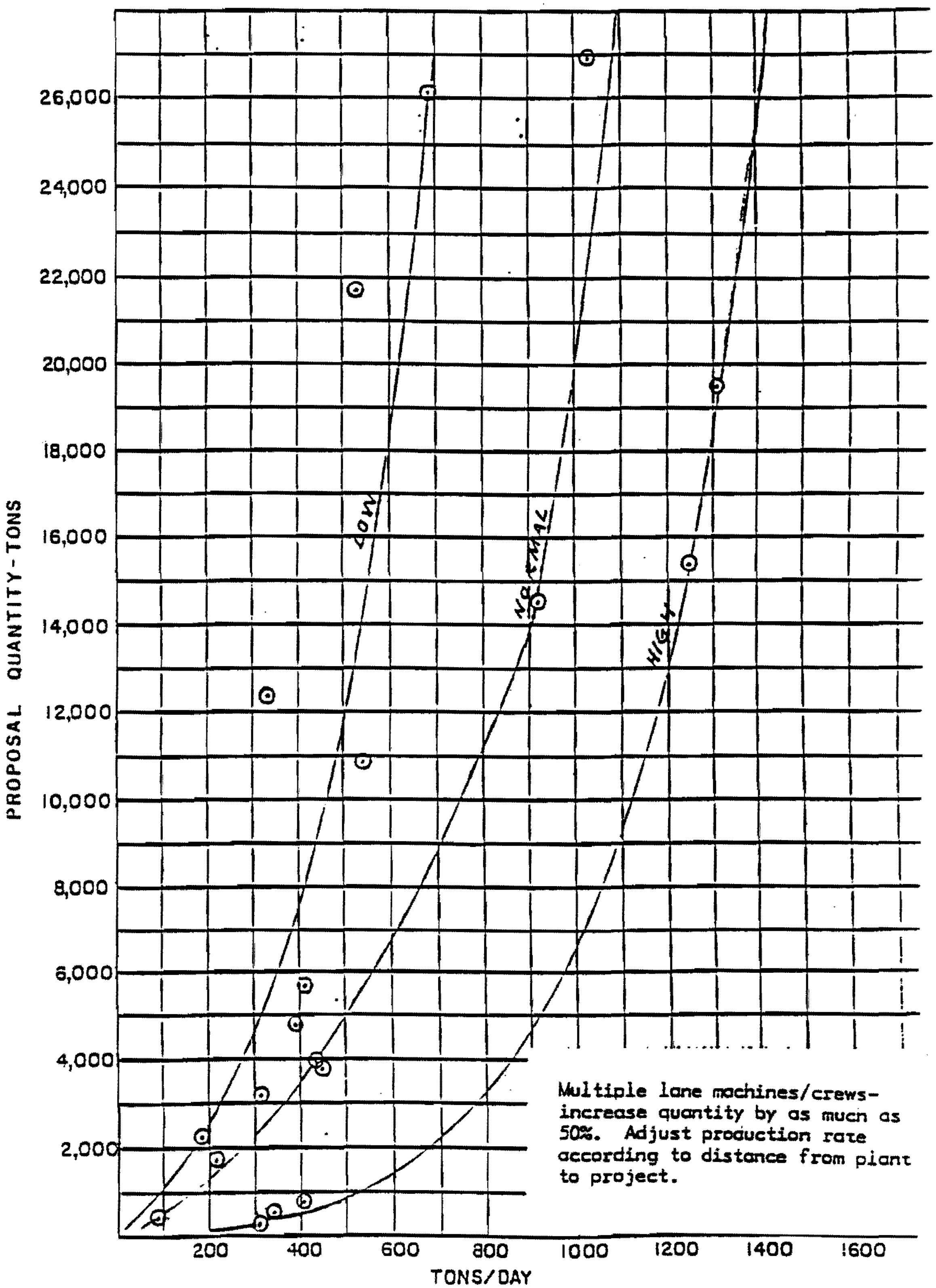
VIII.	Temporary Railroad Structure	
	A. Order and Deliver Steel	55 Days @ 5 Day Week
	B. Erect Steel	1 Day/Span
	C. Ties and Track	3 Day/Span
IX.	Pumphouse	
	A. Structure	10 Days/Lft
	B. Order and Deliver Mechanical and Electrical Equipment	90 Days
	C. Install Mechanical and Electrical Equipment	30 Days
X.	Miscellaneous	
	A. Removing Old Pavement	200 Lft/Day
	B. Removing Old Pavement for Recycling (24')	1500 Lft/Day
	C. Crushing Old Concrete for 6A or OGDC	1500 Tons/Day
	D. Removing Trees (Urban)	15 Each/Day
	E. Removing Trees (Rural)	30 Each/Day
	F. Clearing	2 Acres/Day
	G. Sodding	2500 Syds/Day
	H. Seeding	10 Acres/Day
	I. Guard Rail	750 Lft/Day
	J. Fencing Woven Wire	1200 Lft/Day
	K. Fencing, Chain Link	500 Lft/Day
	L. Clean-up ✓	20 Stas/Day
	M. Concrete Median Barrier	1000 Lft/Day*
	N. Reroute Traffic (Add 4 Days if 1st Item)	1 Day/Move
	O. Concrete Glare Screen	1500 Lft/Day
	P. Light Foundations	6 Each/Day
	Q. Remove Railing and Replace with Barrier (1 or 2 Decks at a Time)	4 Days/Side
	* Add 5 Days Cure Time (Minimum 7 Days)	5 Days @ 5 Day Week

APPENDIX B - 2.1 - Example Production Curves from Maryland

CLASS I EXCAVATION (90,000 to 1,000,000+ cu.yds.)



PAVING-BITUMINOUS CONCRETE SURFACE

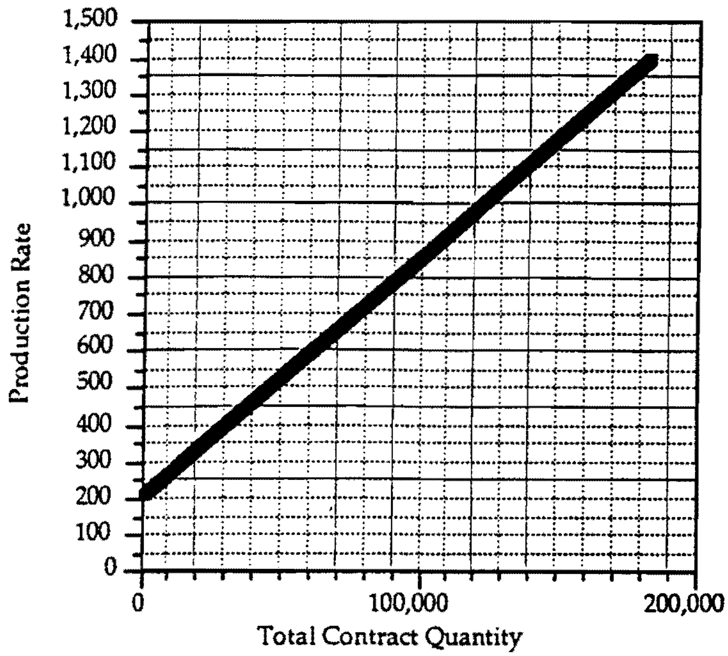


APPENDIX B - 2.2 - Example Production Curves from Alaska

DRAFT

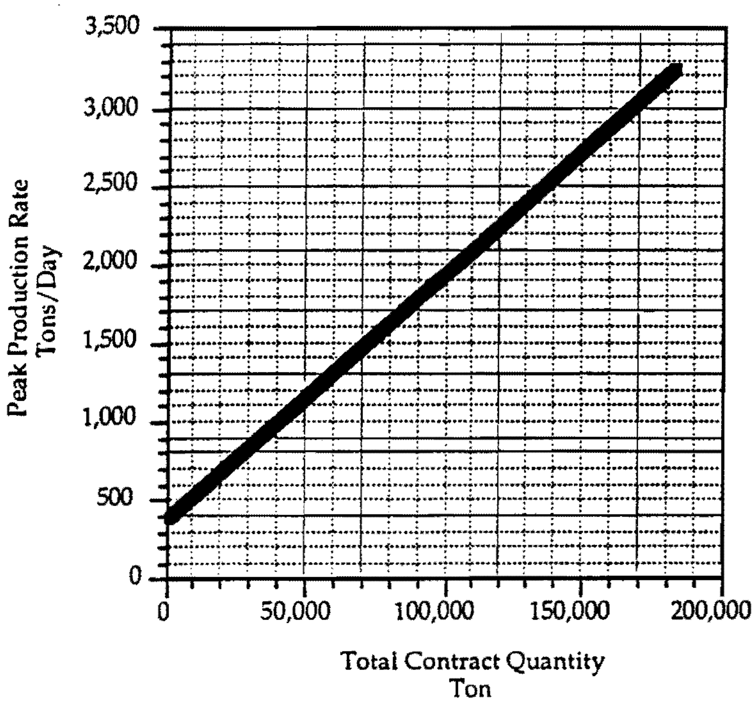
ASPHALT CONCRETE

MEAN PRODUCTION



Working Days = Q / (0.0065Q + 212)

PEAK PRODUCTION



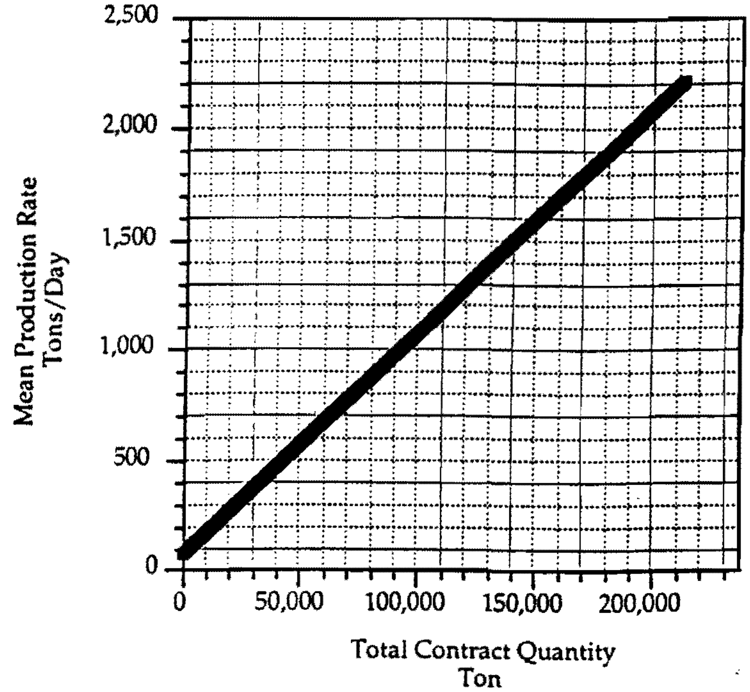
Working Days = Q / (0.0157Q + 389)

Figure 4-80(12)

DRAFT

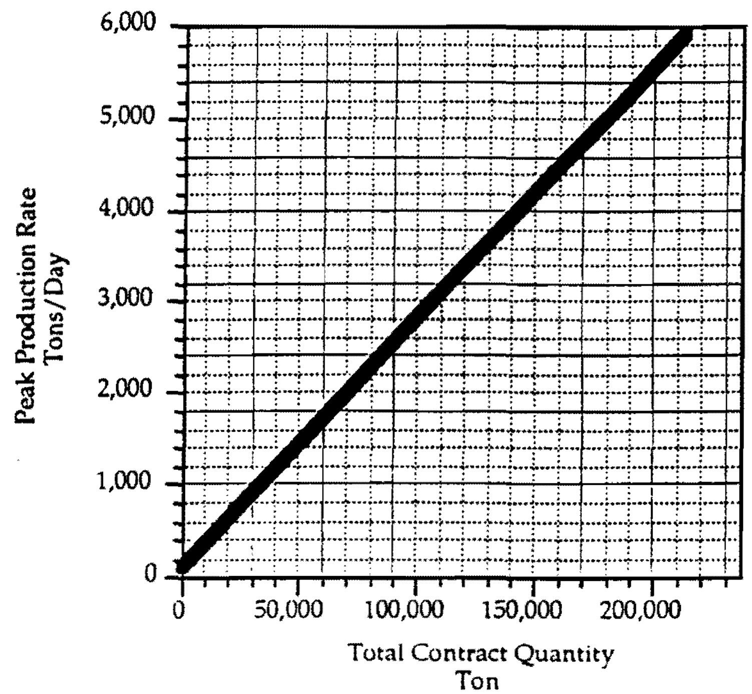
CRUSHED AGGREGATE BASE COURSE

MEAN PRODUCTION



Working Days = Q / (0.0099Q + 88)

PEAK PRODUCTION



Working Days = Q / (0.0270Q + 153)

Figure 4-80(9)

REMOVAL OF PAVEMENT

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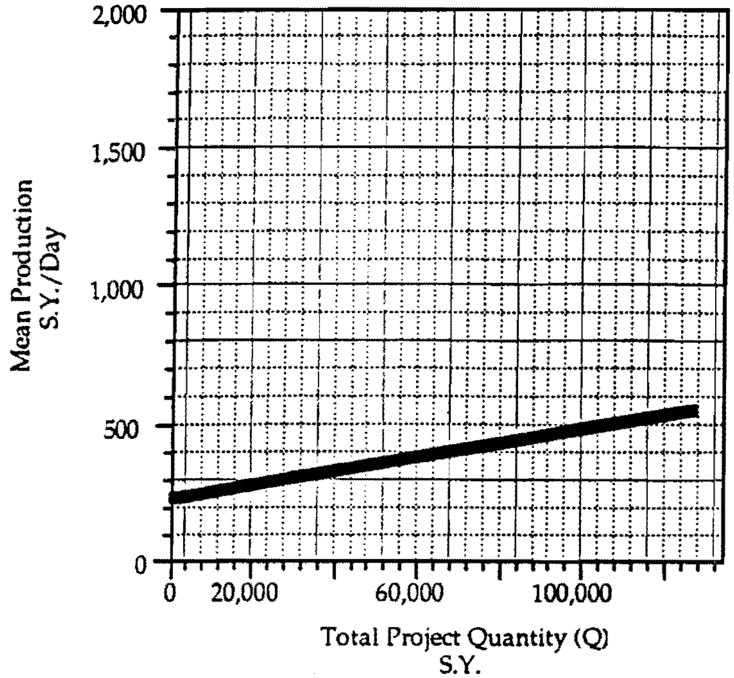
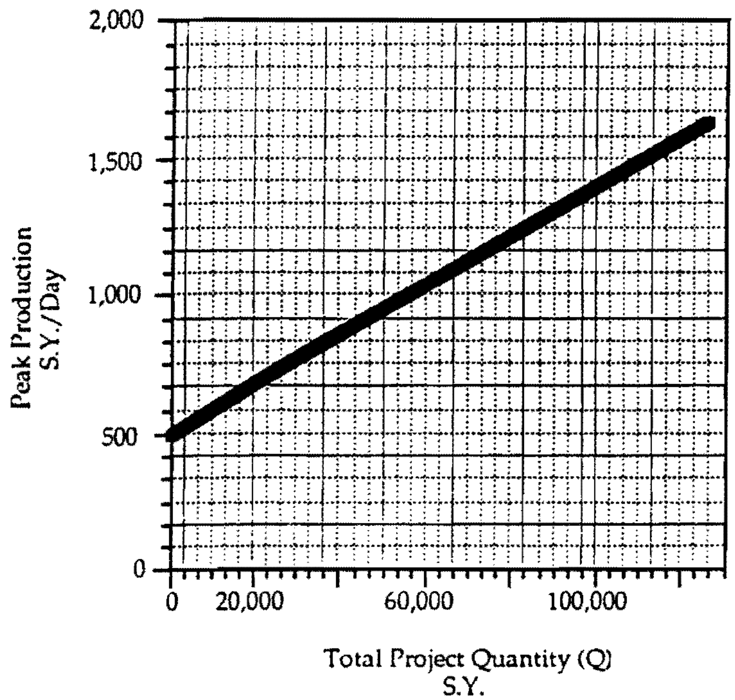
MEAN PRODUCTION



Working Days = Q / (0.0027Q + 230)

PEAK PRODUCTION



Working Days = Q / (0.009Q + 500)

Figure 4-80(4)

APPENDIX B - 3 - New Mexico Contract Workdays Prediction Worksheets

CONTRACT WORKDAYS

New Mexico State Highway And Transportation Department - Highway Design Section

PROJECT No. ______________________________ ESTIMATED COST ______________________________

ADJUSTED ESTIMATE = ESTIMATED COST * 100 / (CURRENT YEAR) = ______________________________

(See Table 1 For Construction Cost Indices)

BASE WORKING DAYS (From Table 2) = ______________________________

FACTOR	RANGE		SELECTED VALUE (One Per Factor)
CONTRACT TYPE	New Construction Reconstruction Overlay & Widening Overlay Safety	1.00 0.90 0.80 0.70 0.60	
NUMBER OF MAJOR STRUCTURES	0 1-2 3-5 >5	0.90 0.95 1.00 1.10	
TRAFFIC HANDLING	Minor Moderate Major	0.90 1.00 1.10	
LOCATION	Rural Urban	0.90 1.10	
TERRAIN	Flat Rolling Mountainous	0.95 1.00 1.15	
SPECIAL CONSIDERATIONS	Simple Items Unusual Items	0.90 1.10	
		FACTOR TOTAL	

NUMBER OF WORKING DAYS = BASE WORKING DAYS * [(1 + FACTOR TOTAL) - (NUMBER OF FACTORS SELECTED)]

= ______________ * [(1+ ______________) - (______________________)]

NUMBER OF WORKING DAYS = ______________________________

CHECKED W/ USE ______________________________

TABLE 1 - CONSTRUCTION COST INDICES Base Year (1977) - 100.00 Current Year (1991) - 175.19

TABLE 2 - CONTRACT WORKDAY TABLE

CONSTRUCTION COSTS	BASE WORKING DAYS	CONSTRUCTION COSTS	BASE WORKING DAYS
Less Than 100,000	100	1,000,000	250
100,000	100	2,000,000	300
250,000	125	3,000,000	350
500,000	150	5,000,000	400
750,000	200	7,000,000	450

NEW MEXICO CONSTRUCTION COST INDEX - PRICE TRENDS
1977 = 100

			SURFACING					STRUCTURES							
	UNCLASSIFIED EXCAVATION		PLANT MIXED BITUMINOUS		PORTLAND CEMENT CONC. PAVEMENT			STRUCTURAL CONC. CLASS-A		REINFORCING BARS		STRUCTURAL STEEL			
YEAR	BID PRICE	INDEX	BID PRICE	INDEX	BID PRICE	INDEX	SURF. INDEX	BID PRICE	INDEX	BID PRICE	INDEX	BID PRICE	INDEX	STRUCT. INDEX	COMPO -SITE INDEX
1984															
1ST. 1/2	2.315	150.78	16.585	216.58	31.100	163.11	214.87	333.259	196.81	0.426	142.12	1.918	293.75	195.46	199.22
ANNUAL	2.267	147.64	16.113	210.40	31.100	163.11	209.59	275.449	162.67	0.433	144.32	1.056	161.74	156.28	186.83
1985															
ANNUAL	2.341	152.41	17.307	226.00	34.000	178.32	224.99	328.959	194.27	0.528	175.94	0.832	127.42	162.14	203.13
1986															
1ST. 1/2	2.916	189.82	16.095	210.17	33.472	175.55	208.94	341.209	201.51	0.494	164.52	2.640	404.30	200.28	203.72
ANNUAL	2.624	170.85	16.239	212.06	32.115	168.44	210.58	323.623	191.12	0.470	156.50	0.771	118.05	159.39	190.76
1987															
1ST. 1/2	2.047	133.29	14.195	187.57	30.857	161.84	187.01	290.797	171.73	0.488	162.68	1.458	223.23	173.68	168.37
2ND. 1/2	2.428	158.09	14.275	188.62	26.830	140.72	185.39	335.633	198.21	0.547	178.24	1.684	257.95	198.01	180.16
ANNUAL	2.218	144.41	14.237	188.12	27.607	144.79	186.24	316.397	186.85	0.517	172.61	1.581	242.11	187.73	174.50
1988															
1ST. 1/2	2.294	149.32	13.123	173.40	29.749	156.02	172.96	248.847	146.96	0.495	164.86	0.867	132.79	142.62	165.12
2ND. 1/2	2.040	132.81	16.557	218.77	33.750	177.01	216.46	298.017	176.00	0.549	182.97	1.978	302.98	183.70	179.86
ANNUAL	2.097	136.52	14.635	193.38	34.366	180.24	192.99	280.399	165.59	0.524	174.82	0.947	145.00	161.22	173.27
1989															
1ST. 1/2	2.686	174.86	14.529	191.97	39.600	207.69	192.10	243.217	143.63	0.465	155.11	1.138	174.32	153.01	179.52
2ND. 1/2	2.312	150.53	15.259	201.62	37.125	194.71	201.54	269.862	159.37	0.572	190.61	1.077	165.00	167.89	180.50
ANNUAL	2.509	163.35	14.810	195.70	39.600	207.69	195.75	250.865	148.15	0.501	167.01	1.102	168.76	158.92	179.88
1990															
1ST. 1/2	1.981	128.96	12.751	168.49	27.060	141.92	168.25	298.833	176.48	0.508	169.47	1.946	298.07	197.04	160.04
2ND. 1/2	2.223	144.71	12.515	165.36	23.538	123.45	163.21	291.557	172.18	0.551	183.62	2.421	370.70	185.69	159.33
ANNUAL	2.156	140.37	12.615	166.70	23.538	123.45	165.39	292.851	172.95	0.544	181.31	2.206	337.85	187.91	159.61
1991															
1ST. 1/2	2.424	157.83	13.795	182.28	51.902	272.21	184.28	291.473	172.13	0.527	175.51	1.126	172.50	173.15	175.19

Starting with 1987, prices for Portland Cement Concrete Surfacing reflect adjustments to Standard 9 inch thickness in N. M.. Prices shown for previous years are for various thickness. Prices do not include costs for reinforcing steel and joints.

Prepared by Preliminary Design Bureau/Project Development/Internal Section - Estimating Unit

APPENDIX B - 4 - New Jersey Production Rates for Bridges

CONTRACTOR'S PRODUCTION RATES FOR BRIDGES

ITEM	TYPE 1 CONSTRUCTION	TYPE 2 RECONSTRUCTION	TYPE 3 SUPERSTRUCTURE	TYPE 4 DECK	TYPE 5 OVERLAY
SIZE OF BRIDGE					
ONE SPAN (1)					
2 LANES	80	100	40	30	20
4 LANES	90	110	50	40	25
6 LANES	100	120	60	50	30
TWO SPANS (2)					
2 LANES	100	120	50	40	25
4 LANES	110	130	60	50	30
6 LANES	120	140	70	60	35
FOR EACH ADDITIONAL SPAN, ANY NUMBER OF LANES	10/SPAN	5/SPAN	5/SPAN	5/SPAN	5/SPAN
COFFERDAMS	20	20	N/A	N/A	N/A
PILES	10	10	N/A	N/A	N/A
RETAINING WALLS (3,5) (CAST-IN-PLACE)	20/100 FT.	20/100 FT.	N/A	N/A	N/A
BOX CULVERTS (CAST-IN-PLACE)	10/30 FT.	10/30 FT.	N/A	N/A	N/A
BOX CULVERTS (4) (PRECAST)	5/35 FT.	5/35 FT.	N/A	N/A	N/A

Notes: Production Rates are per working day unless otherwise indicated.
For two bridges add 50%, for each additional bridge add 25%.
For Stage Construction, consider each stage to be a separate bridge.
For bridges over water or railroads add 30 days, except for Type 5 for which no adjustment is necessary.

(1) Allow 2 months (steal beams) and 3 months (concrete beams) for shop drawing approval, fabrication and delivery.
(2) Allow 3 months (steal beams) and 4 months (concrete beams) for shop drawing approval, fabrication and delivery.
(3) Add 5 days per 100 ft. if temporary sheeting is required.
(4) Includes excavation and placing, allow 3-4 months for shop drawing approval, fabrication and delivery.
(5) Use for Reinforced Earth, Double Wall and Anchored Walls.

TYPE 1 = New construction on new alignment.
TYPE 2 = Remove existing bridge and construct new bridge at same location.
TYPE 3 = Replace deck and beams including minor substructure repair.
TYPE 4 = Replace deck.
TYPE 5 = Deck patching and LMC overlay (subtract 10 days if overlay is bituminous concrete).

APPENDIX C - Survey Forms on Major Work Item Production Rates and Job Correction Factors for Production Rates

ATTACHMENT #1 - MAJOR WORK ITEMS PRODUCTION RATES / SENSITIVITY FACTORS

MAJOR WORK ITEM	UNIT	DAILY PRODUCTION RATE			SENSITIVITY FACTORS
		LOW	AVERAGE	HIGH	
ROW Preparations					
- Clear and grub	Sta.				L T C S Q
- Remove old pavement	S.Y.				L T C S Q
- Remove old curb & gutter	L.F.				L T C S Q
- Remove old sidewalks	S.Y.				L T C S Q
- Remove old drainage/utility str.	L.F.				L T C S Q
Earth excavation	C.Y.				L T C S Q
Rock excavation	C.Y.				L T C S Q
Embankment	C.Y.				L T C S Q
Bridge structure(s)					
- Cofferdams	S.Y.				L T C S Q
- Footings & Piers	C.Y.				L T C S Q
- Caps & Bents	C.Y.				L T C S Q
- Beams	C.Y.				L T C S Q
- Slabs	S.Y.				L T C S Q
- Railings	L.F.				L T C S Q
Drainage structures/storm sewers					
- Pipe	L.F.				L T C S Q
- Box culverts	C.Y.				L T C S Q
- Inlets & manholes	Each				L T C S Q
Retaining walls	S.F.				L T C S Q
Subgrade preparations					
- Lime stabilization	S.Y.				L T C S Q
- Flexible base material	S.Y.				L T C S Q
- Cement treated base material	S.Y.				L T C S Q
New curb and gutter	L.F.				L T C S Q
Asphalt pavement repair	S.Y.				L T C S Q
Concrete pavement repair	S.Y.				L T C S Q
Hot mix asphalt base	Ton				L T C S Q
Hot mix asphalt surface	Ton				L T C S Q
Asphalt surface treatment	S.Y.				L T C S Q
Concrete paving	S.Y.				L T C S Q
Permanent concrete traffic barriers	L.F.				L T C S Q
Permanent signing and traffic signals					
- Small signs	Each				L T C S Q
- Overhead signs	Each				L T C S Q
- Major traffic signals	Each				L T C S Q
Permanent pavement markings	L.F.				L T C S Q
Seeding and landscape	S.Y.				L T C S Q
Final clean-up	Sta.				L T C S Q

NOTE: Please estimate duration in workdays required for the following lump-sum items :

MAJOR WORK ITEM	UNIT	DURATION IN WORKDAYS			SENSITIVITY FACTORS
		LOW	AVERAGE	HIGH	
Set up Traffic control (initial set-up only)	L.Sum				L T C S Q
Detour	L.Sum				L T C S Q
Major structure demolition	L.Sum				L T C S Q
Remove old structures (small)	L.Sum				L T C S Q
Bridge demolition	L.Sum				L T C S Q
Erect temporary bridge(s)	L.Sum				L T C S Q
Remove temporary bridges(s)	L.Sum				L T C S Q

L = Location T = Traffic conditions C = Complexity S = Soil conditions Q = Quantity of work

Attachment # 2
Job Correction Factors Form

Listed below are five factors that may impact the production rates of major work items on highway projects. Each factor is divided into three conditions which help determine the project characteristics and adjust the production rates accordingly. For each factor, the first condition is also the basis for the rates requested in Attachment #1, Major Work Items Production Rates/Sensitivity Factors. That is, rural for Location, light for Traffic conditions, low for Project Complexity, good for Soil Conditions and large for Quantity of Work.

The estimation of the impact of the different conditions listed below will vary for different persons. Except for Complexity, we feel that most of the conditions listed are self explanatory. By Complexity, we are referring to the technical difficulty of the project requirements and existing site conditions which may reduce productivity, i.e. utilities, existing structures, work space, access to existing businesses, railroads, etc.

Please indicate in the blank spaces below your estimate of the change in basic construction production rate due to the condition noted for each of the five factors. In doing so, please consider each factor independently and ignore the effect of the others. For instance, considering only the Location Factor, if the production rate in small cities is only 85% of that in rural areas, put 0.85 right next to small city. If the production rate in big cities is only 60% of that in rural areas, put 0.60 next to big city. Correction factors can also be greater than 1.00 if appropriate; for instance, if you feel that the production rate in small cities is 110% of that in rural areas, then put 1.10 next to small city, etc. Please fill out the whole table following the same principle for each of the factors.

Factors		Conditions	
LOCATION:	**rural** = 1.00	small city = ___	big city = ___
TRAFFIC CONDITIONS	**light** = 1.00	moderate = ___	high = ___
COMPLEXITY:	**low** = 1.00	medium = ___	high = ___
SOIL CONDITIONS:	**good** = 1.00	fair = ___	poor = ___
QUANTITY OF WORK:	**large** = 1.00	medium = ___	small = ___

Please note once again that the first condition given for each factor (shown in bold letters) is taken as the basis for the rates requested in Attachment #1. In estimating the multipliers for each factor, these should again be taken as the base condition (i.e. the multiplier = 1.00).

APPENDIX D - Setting Your Own Calendar

APPENDIX D - Setting Your Own Calendar

By default, SuperProject uses a five-days-a-week standard working time. Saturdays and Sundays are considered as holidays. However, there is a feature in SuperProject that allows the scheduler to use a different calendar established previously to contain information on working time other than the default values. Section 5.7.1.18 of this report 110 covers the inclusion of such a calendar to the project schedule obtained by running CTDS. This section will illustrate how to create a calendar of your own. For convenience, setting the calendar used in section 5.7.1.18 is described as an example.

Let us start by reminding that this calendar was set to display the average number of working days in each month of the year for a fictitious location. It was set to reflect the following information:

Name of Month	Average number of working days
January	10
February	12
March	14
April	17
May	20
June	20
July	20
August	19
September	18
October	18
November	15
December	12

In setting this calendar, certain number of days should be assigned as holidays for each month so that what is left would be equal to the average number of working days determined for that month. There is really no particular way of choosing which days should be taken as holidays in order to do that. It may be advantageous, however, to distribute holidays more or less equally within a given month; e.g. instead of marking one whole week off mark one day off as holiday from each week within that month. Also, for practical purposes, only the years 1993 and 1994 were modified to contain the information shown above. On the following page are the steps to follow in setting the calendar used for the example project:

1. At the Ready mode of SuperProject, press / *View Calendars*.
2. Since only the years 1993 and 1994 are to be modified for this example, bring the cursor down to the beginning of 1993 and start marking off some of the days as holidays going down the calendar. For a day that you want to select as holiday, move the cursor over on it and press the function key ***F3*** to create a holiday. Go through the whole calendar for 1993 and 1994 until you mark off exactly the same days as shown on the following 7 pages so that they would appear to be holidays. It is important that you modify exactly the same days as holidays only for demonstration purposes; in general, you are free to choose any day as holiday. After this process has been completed, you should get the remaining number of days in each month to be equal to the average number of working days determined in that same month for the years 1993 and 1994.
3. After these revisions, to save this new calendar information, press / *Edit Save as Default*.
4. On the window that has just appeared, at the prompt *Holiday File Name:*, type **C:\SPJ2\CALTXDOT.HOL** and press *Enter*. (This is the file name for the calendar information used for the case study.)
5. To return to the screen with the bar chart, press / *View Task Outline*.

Now that the new calendar is ready to be utilized, pressing ***Ctrl-F7*** activates the special feature built for CTDS for inclusion of this to a project. Please refer back to section 5.7.1.15 for more details on how to include a new calendar information to a project schedule.

Project Calendar

1992	Sun 0.0	Mon 8.0	Tue 8.0	Wed 8.0	Thu 8.0	Fri 8.0	Sat 0.0
Nov	15 WKND	16	17	18	19	20	21 WKND
Nov	22 WKND	23	24	25	26	27	28 WKND
Nov Dec	29 WKND	30	01	02	03	04	05 WKND
Dec	06 WKND	07	08	09	10	11	12 WKND
Dec	13 WKND	14	15	16	17	18	19 WKND
Dec	20 WKND	21	22	23	24	25	26 WKND
Dec Jan	27 WKND	28	29	30	31	01 Holiday	02 WKND
Jan	03 WKND	04	05	06	07 Holiday	08 Holiday	09 WKND
Jan	10 WKND	11	12	13 Holiday	14 Holiday	15 Holiday	16 WKND
Jan	17 WKND	18	19	20	21 Holiday	22 Holiday	23 WKND
Jan	24 WKND	25	26	27 Holiday	28 Holiday	29 Holiday	30 WKND
Jan Feb	31 WKND	01	02	03	04 Holiday	05 Holiday	06 WKND
Feb	07 WKND	08	09	10	11 Holiday	12 Holiday	13 WKND
Feb	14 WKND	15	16	17	18 Holiday	19 Holiday	20 WKND
Feb	21 WKND	22	23	24	25 Holiday	26 Holiday	27 WKND
Feb Mar	28 WKND	01	02	03	04 Holiday	05 Holiday	06 WKND

Project Calendar

1993	Sun 0.0	Mon 8.0	Tue 8.0	Wed 8.0	Thu 8.0	Fri 8.0	Sat 0.0
Mar	07 WKND	08	09	10	11 Holiday	12 Holiday	13 WKND
Mar	14 WKND	15	16	17	18 Holiday	19 Holiday	20 WKND
Mar	21 WKND	22	23	24	25 Holiday	26 Holiday	27 WKND
Mar Apr	28 WKND	29	30	31 Holiday	01	02 Holiday	03 WKND
Apr	04 WKND	05	06	07	08	09 Holiday	10 WKND
Apr	11 WKND	12	13	14	15	16 Holiday	17 WKND
Apr	18 WKND	19	20	21	22	23 Holiday	24 WKND
Apr May	25 WKND	26	27	28	29	30 Holiday	01 WKND
May	02 WKND	03	04	05	06	07	08 WKND
May	09 WKND	10	11	12	13	14	15 WKND
May	16 WKND	17	18	19	20	21	22 WKND
May	23 WKND	24	25	26	27	28	29 WKND
May Jun	30 WKND	31 Holiday	01	02	03	04 Holiday	05 WKND
Jun	06 WKND	07	08	09	10	11	12 WKND
Jun	13 WKND	14	15	16	17	18 Holiday	19 WKND
Jun	20 WKND	21	22	23	24	25	26 WKND

Project Calendar

1993	Sun 0.0	Mon 8.0	Tue 8.0	Wed 8.0	Thu 8.0	Fri 8.0	Sat 0.0
Jun Jul	27 WKND	28	29	30	01 Holiday	02 Holiday	03 WKND
Jul	04 WKND	05	06	07	08	09	10 WKND
Jul	11 WKND	12	13	14	15	16	17 WKND
Jul	18 WKND	19	20	21	22	23	24 WKND
Jul	25 WKND	26	27	28	29	30	31 WKND
Aug	01 WKND	02	03	04	05	06	07 WKND
Aug	08 WKND	09	10	11	12	13 Holiday	14 WKND
Aug	15 WKND	16	17	18	19	20 Holiday	21 WKND
Aug	22 WKND	23	24	25	26	27 Holiday	28 WKND
Aug Sep	29 WKND	30	31	01	02	03 Holiday	04 WKND
Sep	05 WKND	06	07	08	09	10 Holiday	11 WKND
Sep	12 WKND	13	14	15	16	17 Holiday	18 WKND
Sep	19 WKND	20	21	22	23	24 Holiday	25 WKND
Sep Oct	26 WKND	27	28	29	30	01	02 WKND
Oct	03 WKND	04	05	06	07	08	09 WKND
Oct	10 WKND	11	12	13	14	15 Holiday	16 WKND

Project Calendar

1993	Sun 0.0	Mon 8.0	Tue 8.0	Wed 8.0	Thu 8.0	Fri 8.0	Sat 0.0
Oct	17 WKND	18	19	20	21	22 Holiday	23 WKND
Oct	24 WKND	25	26	27	28	29 Holiday	30 WKND
Oct Nov	31 WKND	01	02	03	04	05 Holiday	06 WKND
Nov	07 WKND	08	09	10	11 Holiday	12 Holiday	13 WKND
Nov	14 WKND	15	16	17	18 Holiday	19 Holiday	20 WKND
Nov	21 WKND	22	23	24	25 Holiday	26 Holiday	27 WKND
Nov Dec	28 WKND	29	30	01	02 Holiday	03 Holiday	04 WKND
Dec	05 WKND	06	07	08	09 Holiday	10 Holiday	11 WKND
Dec	12 WKND	13	14	15	16 Holiday	17 Holiday	18 WKND
Dec	19 WKND	20	21	22	23 Holiday	24 Holiday	25 WKND
Dec Jan	26 WKND	27	28	29 Holiday	30 Holiday	31 Holiday	01 WKND
Jan	02 WKND	03	04	05	06 Holiday	07 Holiday	08 WKND
Jan	09 WKND	10	11	12 Holiday	13 Holiday	14 Holiday	15 WKND
Jan	16 WKND	17	18	19	20 Holiday	21 Holiday	22 WKND
Jan	23 WKND	24	25	26 Holiday	27 Holiday	28 Holiday	29 WKND
Jan Feb	30 WKND	31 Holiday	01	02	03 Holiday	04 Holiday	05 WKND

Project Calendar

1994	Sun 0.0	Mon 8.0	Tue 8.0	Wed 8.0	Thu 8.0	Fri 8.0	Sat 0.0
Feb	06 WKND	07	08	09	10 Holiday	11 Holiday	12 WKND
Feb	13 WKND	14	15	16	17 Holiday	18 Holiday	19 WKND
Feb	20 WKND	21	22	23	24 Holiday	25 Holiday	26 WKND
Feb Mar	27 WKND	28	01	02	03 Holiday	04 Holiday	05 WKND
Mar	06 WKND	07	08	09	10 Holiday	11 Holiday	12 WKND
Mar	13 WKND	14	15	16	17 Holiday	18 Holiday	19 WKND
Mar	20 WKND	21	22	23	24 Holiday	25 Holiday	26 WKND
Mar Apr	27 WKND	28	29	30	31 Holiday	01	02 WKND
Apr	03 WKND	04	05	06	07	08 Holiday	09 WKND
Apr	10 WKND	11	12	13	14	15 Holiday	16 WKND
Apr	17 WKND	18	19	20	21	22 Holiday	23 WKND
Apr	24 WKND	25	26	27	28	29 Holiday	30 WKND
May	01 WKND	02	03	04	05	06	07 WKND
May	08 WKND	09	10	11	12	13 Holiday	14 WKND
May	15 WKND	16	17	18	19	20	21 WKND
May	22 WKND	23	24	25	26	27 Holiday	28 WKND

Project Calendar

1994	Sun 0.0	Mon 8.0	Tue 8.0	Wed 8.0	Thu 8.0	Fri 8.0	Sat 0.0
May Jun	29 WKND	30	31	01	02	03	04 WKND
Jun	05 WKND	06	07	08	09	10 Holiday	11 WKND
Jun	12 WKND	13	14	15	16	17	18 WKND
Jun	19 WKND	20	21	22	23	24 Holiday	25 WKND
Jun Jul	26 WKND	27	28	29	30	01	02 WKND
Jul	03 WKND	04 Holiday	05	06	07	08	09 WKND
Jul	10 WKND	11	12	13	14	15	16 WKND
Jul	17 WKND	18	19	20	21	22	23 WKND
Jul	24 WKND	25	26	27	28	29	30 WKND
Jul Aug	31 WKND	01	02	03	04	05 Holiday	06 WKND
Aug	07 WKND	08	09	10	11	12 Holiday	13 WKND
Aug	14 WKND	15	16	17	18	19 Holiday	20 WKND
Aug	21 WKND	22	23	24	25	26 Holiday	27 WKND
Aug Sep	28 WKND	29	30	31	01	02	03 WKND
Sep	04 WKND	05	06	07	08	09 Holiday	10 WKND
Sep	11 WKND	12	13	14	15	16 Holiday	17 WKND

Project Calendar

1994	Sun 0.0	Mon 8.0	Tue 8.0	Wed 8.0	Thu 8.0	Fri 8.0	Sat 0.0
Sep	18 WKND	19	20	21	22	23 Holiday	24 WKND
Sep Oct	25 WKND	26	27	28	29	30 Holiday	01 WKND
Oct	02 WKND	03	04	05	06	07	08 WKND
Oct	09 WKND	10	11	12	13	14 Holiday	15 WKND
Oct	16 WKND	17	18	19	20	21 Holiday	22 WKND
Oct	23 WKND	24	25	26	27	28 Holiday	29 WKND
Oct Nov	30 WKND	31	01	02	03	04 Holiday	05 WKND
Nov	06 WKND	07	08	09	10 Holiday	11 Holiday	12 WKND
Nov	13 WKND	14	15	16	17 Holiday	18 Holiday	19 WKND
Nov	20 WKND	21	22	23	24 Holiday	25 Holiday	26 WKND
Nov Dec	27 WKND	28	29	30	01 Holiday	02 Holiday	03 WKND
Dec	04 WKND	05	06	07	08 Holiday	09 Holiday	10 WKND
Dec	11 WKND	12	13	14	15 Holiday	16 Holiday	17 WKND
Dec	18 WKND	19	20	21	22 Holiday	23 Holiday	24 WKND
Dec	25 WKND	26	27	28	29 Holiday	30 Holiday	31 WKND
Jan	01 WKND	02	03	04	05	06	07 WKND

APPENDIX E - Procedure for Updating CTDS: The Revision Feature

APPENDIX E - Procedure for Updating CTDS: The Revision Feature

A Revision Feature has been built to modify or update the information used in CTDS. This feature can be utilized in making modifications on the four template spreadsheet files each containing standard information about one of the four categories used to classify projects: Resurfacing Projects, Projects With Bridge Structures, Projects Without Bridge Sturctures, and Bridge Structures Only. The Revision Feature can be utilized to revise or update several types of standard information, perhaps the most important of which are the daily production rates. Other elements include durations of lump-sum work items, factors influencing production rates and/or durations, multipliers assigned to each condition of these factors, percentages used to determine the relationship between two work items, and units of measure for work items.

Modifications made by utilizing the Revision Feature change the essential template files permanently once saved to come in effect. Therefore, not only is it strongly recommended to consider the changes very carefully before actually making them but also to keep at least two copies of the original files, one on the hard disk of your computer, and one on diskette.

This appendix contains all the screens built for the Revision Feature for your reference. You will find that the process of revising or updating CTDS is quite self-explanatory with the instructions provided on these screens once you run the Revision Feature. Therefore, no example is covered to illustrate how to use this feature, and also to avoid unnecessary changes resulting from going through an example application.

The Revision Feature is stored in a different Flash-Up library than the one that contains the Scheduling and Editing Features. Therefore, this library should be loaded as the first step after opening Flash-Up. (Please refer to section 5.6 in case of any doubt on how to load Flash-Up.) To load this library:

1. Activate the menu bar of Flash-Up:

   Press ***Alt-Home***. (The ***Home*** key in the Numeric Keypad that shares the same button with the number "7".)

2. Using the arrow keys, move the cursor to *Load & Save* and choose *Load Library from disk.*

3. Load the library file. At the prompt type:

   C:\FLASH\REVISION.WIN and press *Enter.*

This can also be done by pressing the down arrow key at the prompt and choosing *REVISION* among the list of library files that pops up by moving the cursor onto this name and pressing ***Enter***.

After the Flash-Up library has been loaded, the Revision Feature is ready to run. To start running the system, press ***Alt-R***. On the following pages, the screens you will encounter during an application are displayed in order of appearance after each selection from the main menu.

After pressing ***Alt-R*** to start the Revision Feature:

```
                    WELCOME

         TO THE REVISION FEATURE OF THE

       CONTRACT TIME DETERMINATION SYSTEM


     This feature can be used to revise the
     values stored for the basic components
     (production rates, units, multipliers,
     relationships, etc.) of the CTDS in the
     standard project files.


      PLEASE PRESS  "ENTER" TO CONTINUE
```

After pressing *Enter* to continue:

```
Please make your choice from the four options listed below:

   Option A.  RESURFACING PROJECTS
                1. Seal Coat  (SC)
                2. Overlay  (OV)

   Option B.  PROJECTS WITH BRIDGE STRUCTURES
                3. Rehabilitate Existing Road  (RER)
                4. Convert Non-Freeway to Freeway  (CNF)
                5. Widen Freeway  (WF)
                6. Widen Non-Freeway  (WNF)
                7. New Location Freeway  (NLF)
                8. New Location Non-Freeway  (NNF)
                9. Interchange  (INC)
                10. Bridge Widening/Rehabilitation  (BWR)
                11. Bridge Replacement/New Bridge  (BR)
                12. Upgrade Freeway to Standards  (UPG)
                13. Upgrade Non-Freeway to Standards  (UGN)

   Option C.  PROJECTS WITHOUT BRIDGE STRUCTURES (project types 3-13)

   Option D.  BRIDGE STRUCTURES ONLY
```

After choosing the project type that needs to be revised:

```
REVISION OPTIONS

1. REVISE BASE PRODUCTION RATES & DURATIONS

2. REVISE LOW, AVERAGE, & HIGH PRODUCTION RATES & DURATIONS

3. REVISE FACTORS INFLUENCING PRODUCTION RATES & DURATIONS

4. REVISE MULTIPLIERS OF INFLUENCING FACTORS

5. REVISE RELATIONSHIP PERCENTAGES

6. REVISE UNITS OF WORK ITEMS


   SAVE ALL REVISIONS

   EXIT TO DOS
```

After choosing *1. REVISE BASE PRODUCTION RATES AND DURATIONS:*

```
        You have chosen to revise the base production rates and base dura-
tions used in the selected project type.

        Base production rates and base durations (for lump-sum work items
only) are what the system takes into account in proposing values to the
user during the conceptual scheduling process.

        For each of the five factors (Location, Traffic, Complexity, Soil
Conditions, and Quantity) that have an impact on production rates and
durations, one condition is taken as the basis on which these values are
based.  If all the base conditions are chosen for a project (or if the
effect of those five factors are ignored), values proposed by the system
will be equal to these base production rates and durations since the base
conditions all have a multiplier of 1.00.  If not, base production rates
and durations will be adjusted by the multipliers of the selected conditions
in determining the proposed values.

                    PLEASE PRESS  "ENTER"  TO PROCEED
```

After choosing *2. REVISE LOW, AVERAGE, & HIGH PRODUCTION RATES & DURATIONS*

```
     You have chosen to revise the low, average and high production rates
(or durations for lump-sum work items) given for the activities used in the
selected project type.

     For each work item listed in the project type you have selected, a low,
average, and high value is shown to reflect a typical range of the daily
production rates of that item.  For lump-sum items, these values represent
durations in terms of working days.

     During a regular scheduling procedure of this system, you will be
given an opportunity to compare all the rates or durations proposed by the
system with these low, average, and high values.  This is provided to help
the user know where a certain value proposed by the system stands within
the range given for that work item.

                    PLEASE PRESS  "ENTER"  TO PROCEED
```

After choosing *3. REVISE FACTORS INFLUENCING PRODUCTION RATES & DURATIONS*

```
      You have chosen to revise the information on the factors that
influence production rates or durations of lump-sum work items.
      Five factors are believed to do so.  These are: Location, Traffic,
Complexity of the Project, Soil Conditions, and Quantities of Work Items.
Each factor has three different conditions set to reflect project
characteristics.
      Every work item might be affected differently by these factors.
In other words, a different combination of one or more of these factors
affect the production rate of each work item.
      Information on which of these five factors influence the production
rate or duration of each particular work item is stored in the system.
The proposed rates or durations of lump-sum items are adjusted according
to this information once the user enters input on project conditions
related to these factors.

                  PLEASE PRESS  "ENTER"  TO PROCEED
```

After pressing *Enter* to proceed:

```
       A certain format is followed to keep the information on which of
the five factors have an effect on a particular activity.
       On the spreadsheet, to the right of the column that contains
activity names, five more columns are seen.  Each column stands for a
factor.  The numbers "1" and "0" are used to represent if a certain factor
influences a certain activity.  Next to an activity's name, if the number
"1" is used in the column of one of the factors, it means that factor has
an effect on the production rate of that activity.  In case it is a "0",
it means that factor does NOT influence the activity being mentioned.
For example:
               LOCATION  TRAFFIC  COMPLEXITY  SOIL COND.  QUANTITY
Activity A        1         0          0          0           1

means Activity A's production rate is influenced by the factors "Location"
and "Quantity" only, since only those two have a value of "1" indicated.
(i.e.  1 = yes, 0 = no)

               PROCEED WITH INSTRUCTIONS ON HOW TO REVISE

                        GO BACK TO THE MAIN MENU
```

After choosing *4. REVISE MULTIPLIERS OF INFLUENCING FACTORS*:

```
        You have chosen to revise the multipliers assigned to each of the
three conditions of the factors influencing production rates and durations.
        All of the factors (Location, Traffic, Complexity of Project,
Soil Conditions, and Quantities of Work Items) have three conditions
which are used to categorize project characteristics.  Each condition has
a multiplier value assigned to it which is used by the system to adjust the
base production rates in furnishing the proposed rates and durations.
        For each factor, one of the three conditions is to be taken as the
base, and its multiplier should be set to 1.00.  The multipliers of the
other two conditions should be set in ratio with the change in the product-
ion rate going from the base condition to the other two conditions.
        For example, the three conditions used for the factor "Location" are
"rural", "small city", and "big city".  If rural is taken as the base con-
dition and it is believed that production rates decrease about 15% for pro-
jects in small cities, and 25% for those in big cities, the multipliers
should be set as below:
                           rural          small city          big city
             LOCATION      1.00              0.85                0.75
so that the base production rates of those activities which are affected by
the Location factor would be adjusted in relation to these multipliers.

                      PLEASE PRESS  "ENTER"  TO PROCEED
```

After choosing *5. REVISE RELATIONSHIP PERCENTAGES*:

```
         You have chosen to revise the relationships established between
the work items in the selected project type.  These relationships are used
to determine the sequencing of the work items in a project.

         The way this information is kept in the system is that in the re-
lated table, each row represents a relationship defined between two acti-
vities.  For each row, the first activity is the predecessor, the second
one is the successor.

         The numbers in the last column represent the required percent
completion of the predecessor for the successor to start.  The number "100"
stands for a "Finish-to-Start" relationship in which the predecessor should
be 100% completed before the successor can start.  The number "0" stands for
a "Start-to-Start" relationship in which the successor can start at the same
time as the predecessor.  Any number in between will be used to determine
the lag time between the start of the two activities with the lag calculated
as that percentage times the duration of the predecessor.

                      PLEASE PRESS  "ENTER"  TO PROCEED
```

After choosing *6. REVISE UNITS OF WORK ITEMS*:

```
          You have chosen to revise the units used for the work items listed
in the selected project type.

          This option lets you change the units assigned to the activities
of this project type in case some different units are more suitable for
your application.

          REMINDER:  If the unit of an activity is changed, normally it
would be necessary to adjust the figures given for the daily production
rates of that activity (low, average, high, and base values) in terms
of the new unit of measure.

                      PLEASE PRESS  "ENTER"  TO PROCEED
```