CITY OF TUCSON, ARIZONA
DEPARTMENT OF TRANSPORTATION

ENGINEERING DIVISION
ACTIVE PRACTICES GUIDELINES

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APPROVED BY: [signature] DATE: 2/1/95
City Engineer

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SUBJECT: CALCULATION OF CONTRACT TIME

A. PURPOSE

To standardize the calculation of contract time and to fulfill the Federal requirements for written procedures.

B. POLICY

The Engineering Division has adopted the enclosed ADOT Procedures Manual to develop contract time for all projects. The Engineering Division is committed to accomplishing all construction projects in the most timely and efficient manner that will promote customer satisfaction. A bar chart will be generated for each project the Division will bid. This bar chart will be developed between the 60% and 95% design stage and will accompany the review submittal to the other offices or agencies for input as required. In order to proceed to ADOT for a final review on Federal-aid projects, each project will have an accompanying bar chart detailing the various durations of significant items of work including any phasing that may be involved.

C. BACKGROUND

It is believed that inappropriately long or short contract time allotments contribute to delays and cost overruns. There has been a need for some time for a uniform method of determining contract duration that could be universally applied and understood by designers, consultants, and field personnel.

D. IMPLEMENTATION

The preparation of the bar chart will have set parameters and will be used by all personnel affected including the designer (in-house or consultant) and field personnel. If all personnel involved use the same parameters, then unique project circumstances can be immediately identified.

ADOT Contracts and Specifications Services are responsible for producing and maintaining the ADOT Procedures Manual. The manual is intended to be flexible to accommodate unique situations.

The success of contract time development hinges on the accuracy of production rates and a thorough understanding of the job parameters and limitations. Each project must be evaluated for projected productivity. This will be based on historical files and communication with field personnel as to actual work that can be accomplished.

Controlling items of work must be identified and projected productivity must be calculated. A method of constructing the project must be developed using a proposed phasing sequencing plan.

Each project must be evaluated for factors that affect the timing of the project such as the seasonal variations of use and weather conditions, coordination with other work and other considerations. Contract time calculations should reflect only the amount of time necessary to accomplish the work.

When the contract time is on a calendar day basis, it shall consist of the number of working days figured in accordance with ADOT procedure, inclusive of Saturdays, Sundays, and State recognized holidays.

PROCEDURES MANUAL FOR

CALCULATING

CONTRACT TIME SCHEDULES

Contracts and Specifications Services

March, 1992

VDB:71T3

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PROCEDURES MANUAL
CONTRACT TIME

INTRODUCTION

Contract time is normally figured in terms of working days as defined in Subsection 101.68 of the Standard Specifications. This allows the contractor some measure of relief if events occur which are beyond his control, such as rain days, that impact the completion of the contract. The contract time clock is simply suspended for the duration of the event. Once the problem is resolved, contract time resumes.

There are situations where, because of political considerations, coordination with other contracts or weather limitations, a certain number of calendar days or a specific completion date are established. The contractor is informed prior to bidding on the contract that he has time restrictions and will need to bid the work accordingly. In this case, it is necessary to "back" into the schedule knowing the completion date and anticipated start date and to determine the accomplishment of the work within the given time frame, or if it is even possible to do so. More often than not these kind of situations are accompanied by incentive/disincentive provisions making it "worth" the contractor's effort to get the job done on time or earlier.

In order to standardize the calculation of contract time for all ADOT projects the Department has established the use of a bar chart.

This manual reviews the aspects of a project that need to be considered when calculating contract time. The manual is not intended to dictate the calculations, but it is intended to guide the process. The manual further discusses considerations to be evaluated. Occasionally a "rule of thumb" will be included.

Each user will modify the process for their own use, however, the basic format provided herein should be followed in every case. This manual is written from an in-house perspective. Consultants that have a company procedure will continue to follow their company policy. Any suggestions for improvements to this manual or updated information from the consultant or construction community will be appreciated.

QUANTITY TAKE-OFF

In-house project plans come from Highway Plans Control Desk with a quantity estimate at each phase of design. Project plans come from the design consultant in a similar manner except that the quantity estimate will probably be in the form of the bidding schedule. This estimate is dynamic during design, and is subject to considerable change.

The designer has calculated and a team member has checked the quantities on the design. When the estimate is received, a random check of the quantities needs to be performed. "Big ticket" items such as earthwork, asphaltic concrete pavement, structural concrete, etc. that have a major bearing on the cost of a project need to be reviewed carefully. Other items, such as temporary concrete barrier, which are subject to considerable fluctuation from planned quantities need to be verified.

Check the quantity summary sheets in the plans. A simple math check and location check against what is shown on the plans may be adequate. Check that no "incidentals" are missing, ie. BCT's on guard rail, end sections on culverts, etc.

Review the Bidding Schedule and do an item check off --- be sure that all bid items are covered in the bidding schedule and that all items have the proper bid item number. Check to make sure that the method of measurement in the quantity calculation is the same unit of measure as shown on the bidding schedule. Finally, read the bidding schedule and the plans to review if the type of work has all of the normal items included. It is useful to have another member of your team do this if they have the time.

CONTROLLING WORK ACTIVITY

For the purpose of estimating the contract time, controlling work activities are those activities that control the work sequence and scheduling of the job. Many of these activities include work referred to as controlling items in the Standard Specifications and defined as: "A controlling item is a work activity in which any delay in its completion will result in a delay in the completion of the contract." Controlling work activities are used here to include work activities that require a lengthy amount of time to complete. For instance, it is necessary to consider the time required for the review of shop drawings, the time necessary for delivery of special items and the time necessary to receive approvals for tested items.

A controlling work activity can be only one item of work such as Roadway Excavation or it could be a composite of several items such as a traffic signal installation, which includes foundations, poles, mast arms, conduit, controllers, signal faces, etc.

The first work activities to plan for are those that include the controlling items. These activities may include earthwork, structures, paving, etc.

Controlling items of work and controlling work activities change throughout the project. At the beginning, roadway excavation may be the controlling work activity but once it is complete, it no longer has control. A structure is often a controlling work activity.

Other non-controlling items of work can be done at almost any time during the course of the project or may be done simultaneously. These items are of such magnitude that they do not normally alter the course of construction.

PRODUCTION RATES

A listing of average production rates is attached for use. This list is compiled from information provided by ADOT District offices, consultants, in-house sources and manufacturers' manuals. This list will eventually be available on a database that will be updated monthly and based on the reports that each construction office forwards to Field Reports for their monthly estimate. Until the database is available and a large volume of data can be accessed in order to obtain reasonable averages, the production rates listed require considerable discretion in their employment.

Once average production rates are established, consider productivity as site specific for each project. Productivity varies with both the total quantities involved and the geography of the job site. District personnel (both construction and maintenance) are good sources of information for expected conditions affecting specific projects. District personnel may be able to supply the typical production rates for adjacent or similar projects already completed.

Equipment

Determine the type of equipment that will probably be used. In order to do this the size and complexity of the project needs to be considered. These are the factors that govern which contractors will be bidding and which types of equipment will probably be used. Most projects use typical equipment that every contractor has readily available, but on occasion there are special requirements. If special equipment or attachments are going to be needed, they will affect the productivity.

Topography

Consider the topography and location of the jobsite. Long, flat, rural jobs are quite easy to access and construct. Urban jobs must be done in restricted areas with restricted access often under heavy traffic conditions.

Lag Time

What are the lag times associated with the various items of work? There are lag times of a few days to several weeks for the approvals of mix designs and chemicals used. Anticipate lag times of one or two months for final approvals on shop drawings and sometimes several months delay for fabrication of these items.

Pits can take several months if they are new and untested. All submittals must be in proper form and approved prior to use. Once a pit is approved, the delays associated with producing, stockpiling and testing enough material to start production may be anticipated. The total job quantity does not have to be manufactured prior to starting a given phase of work, but there needs to be enough stockpiled to accommodate several days or a week of production.

A structure can also take months to complete. Fabrication off-site may take many months to acquire all the necessary certifications and approvals and shipment to the jobsite. A cast-in-place concrete structure has long forming and curing times. There is often a lag between the concrete placement and the time that the forms may be stripped off and a new phase of forming may start. There is also a lag between the time that the forms are stripped and the backfilling or even traffic use can begin. There is also a lot of time during structure construction that there is no visible activity at the structure. During this time work needs to be scheduled that can be accomplished elsewhere on the jobsite.

These items of work must be scheduled to accommodate the associated lag time. On most projects, other items of work can be scheduled and the lag time is not as critical. However, if there is no other work, the lag time must be scheduled.

CONSTRUCTION PHASING

The phasing on the job is as critical as the controlling items of work. The phasing anticipated by the designer is shown in the project plans. It is necessary to evaluate it's feasibility, constructability and if it is likely that the contractor will follow this phasing or propose his own.

If the phasing involves transfer of traffic from one portion of the roadway to another, be aware that the first phase must be essentially complete and clean before the transfer can be made. The transfer itself must also be scheduled.

If the traffic dictates the construction phasing, or the hours available for work are predetermined, then the productivity must match the time available.

Productivity should also be based on the time frame that the District is willing to make available for the construction. If a job must be accomplished prior to a certain date or event, there may be a need to estimate longer work hours and weekend work for the project. (Additional costs generated under these circumstances must also be evaluated in the estimated costs).

Canal dry-ups are a unique feature to consider in construction phasing in some parts of the State. There are a series of irrigation canals that are dry for maintenance at least once per year; many projects have work involving these canals and the work must be scheduled to coincide with a dry-up period.

DEVELOPMENT OF THE BAR CHART

The following are the anticipated steps to compiling the bar chart. (Please refer to the attached worksheet example). The pertinent information in the heading needs to be filled in for each project.

Skip to the Item Analysis. In this section, fill in the major items of work, the estimated quantity and the estimated productivity. For each item of work, the quantity divided by the productivity will provide the number of working days needed to accomplish the work activity.

The bar chart can then be filled in using the anticipated productivity and the known delays and lag times. The bar chart schedules orderly start-finish dates as determined by the projected phasing and productivity. Overlapping schedules reflect that one phase may start before a previous phase is complete. In some instances certain activities may start/stop several times throughout the duration of the project. The bar chart reflects actual expectations of jobsite activity.

All jobs need time to mobilize. This can be as little as one hour to several weeks depending on location, complexity, and sources for materials.

Earthwork is usually the first item of business for a project. Once mobilization is complete, or far enough along, this activity can start. Most of the scheduled time is a reflection of the anticipated productivity. During this phase the contractor starts his submittals on materials, mix designs, shop drawings and ordering material. The contractor starts manufacturing any aggregate materials from approved pits.

Manufacturing of aggregate materials can be a very time consuming part of the contract. The following issues need to be kept in mind when calculating productivity:

1. Where is the material source? How far is it to the job site? The materials memo gives the estimated haul distance.

2. Talk to District. If the listed materials source is not mandatory, is there a closer source that is both available and acceptable? Would an existing commercial source be more cost effective?

3. Is the pit new or previously established? If the contractor selects a new site, it must be evaluated for environmental, archeological, and wetlands impacts. Each of the evaluations and the associated mitigation measures can be very lengthy processes.

4. Is the haul road also a public road? This would probably limit the size and weight of haul vehicles to legal loads.

The specifications require minimum amounts of material to be stockpiled and approved prior to the start of a related phase of the work.

In some instances the availability of water and the need to develop a water source are time consumers before other aspects of the work can be accomplished.

If there are major structures, structural excavation may also start during the earthwork phase. Small structures and culvert placement will normally proceed during the latter stages of subgrade construction. (Occasionally, a contractor will elect to install storm culverts prior to the subgrade construction.)

If there is curb and gutter it is normally constructed on top of the subgrade prior to the base and surface courses.

Normally the aggregate subbase course, if any, will follow the earthwork. This work can start while the earthwork is still ongoing, or if the job is small, this may not start until the earthwork is complete.

Aggregate base courses are also placed following construction of the subgrade or subbase courses and culvert installations. The aggregate base is followed by the surface courses. These are normally straightforward production calculations. (The productivity includes both the placement and the finishing of the various courses). When calculating the start-finish be aware of projected productivity. It is important to protect the earthwork just complete, but it is not economical to mobilize the base course and then shut down because it is overtaking the earthwork. This is also true of the surfacing courses following the base course.

Surface courses are similar to the base courses in that production generally dictates the work. Surface courses normally require a large mobilization of equipment and crew. It is not economical to shut down a surfacing operation once it has started. Therefore, the surfacing will not usually start until it can continue uninterrupted.

Structures often dictate a separate item analysis. A concrete box culvert can normally be absorbed in the flow of other construction. However, many concrete box culverts and the curing time involved will affect the scheduling of other items of work.

If a bridge is to be constructed, it is necessary to do an item analysis for it separate from the balance of the job. Then the production for the bridge and the production for the balance of the work on the project can be combined. It is not uncommon for a major bridge structure to control the entire contract time.

Depending on the traffic control included in the job, this phase will usually be simultaneous to other phases. Conduit locations can be established once curbs are located, etc. Loops are installed during the surface course and normally will not affect time very much.

Roadside improvements can usually be included in the phasing of other work unless landscaping is a significant portion of the work. Landscaping normally takes place after the earthwork is complete. Some landscaping can even be done under traffic. This will rarely affect the schedule.

Normally, incidental items such as R/W markers, delineators, etc. do not have much impact on the schedule. If there is a large quantity of a particular item that cannot be done during other phases, it needs to be scheduled. Striping and marking are exceptions, these must be done after the surfacing and must be scheduled.

The final phase of every construction project is the clean up and transfer of traffic back to its normal flow pattern.

ADJUSTMENTS TO THE CHART

The bar chart for the contract time is an estimate for the purpose of protecting the owner's interest in a project. It is not advisable to cut the contract time too short or make it too long. Both of these conditions lead to inefficient construction management at an unnecessary cost to the owner.

There are factors beyond the production calculations that may dictate adjustments to the schedule for contract time.

Seasonal variations often dictate when certain phases of work can be accomplished. Seal coats on a new surface and landscaping at higher elevations are good examples of the seasonal dictates. The contract award time needs to be coordinated to allow for the completion of the seal coat prior to the change of season. If this is not possible, the contract will go into a new year and another construction season. Many times this is not feasible or acceptable. The contract may need to be adjusted to include overtime and extra work days with a shortened schedule to avoid winter shutdowns. (Contract time is not charged for winter shutdowns or weather days. There is, however, additional mobilization and additional cost involved due to a winter shutdown).

Many times a contract is tied into a major event and the contract schedule needs to be altered to allow for completion to coincide with the event. Tourism is a "major event" affecting working conditions at several locations throughout the state. The east Valley and the area around Yuma have large winter visitor populations. This directly impacts the contractor's productivity and the quality of tourism. The contract award needs to be adjusted so the project is completed prior to the season. If this is not possible the schedule may need to be adjusted.

After the contract time has been reviewed, there may need to be some additional considerations given for the difficulty of the work or the location. If it is a very complex project, there are many factors that can delay a contract schedule. Unusual fabrications for structures or one of a kind design will result in slower production rates. An unusually remote location with difficult delivery access will decrease productivity. The remote location will also require long travel times that eat up time that can be spent on the job. Labor costs are much higher in these remote locations where there are no reasonable lodging facilities for employees, subsistence pay impacts labor rates.

Regardless of the adjustments to the contract time, it is necessary to be aware of any inefficiencies in the project that will result in more cost to the Department. Prior to making a change in the contract time the additional costs need to be evaluated to determine if there is any benefit to the Department.

CONTRACT FOR COMPLETION

PROJECT: _____ TYPE OF WORK: _____ BY: _____ ____/____/____

LETTING DATE: _____ PROBABLE START DATE: ____/____/____ CK: _____ ____/____/____

DATE										
Working Days	0	10	20	30	40	50	60	70	80	90	100

ITEM ANALYSIS

Item	Contract Quantity	Unit	Amount Per Working Day	Working Days

TRACS NO.
PROJECT NO.
HIGHWAY
LOCATION

Month	Days Month	Days Total	Saturday	Sunday	Holiday	Possible Working Days	Probable Work Days Month	Probable Work Days Total	SUB TOTAL

REMARKS

Total Work Days _____

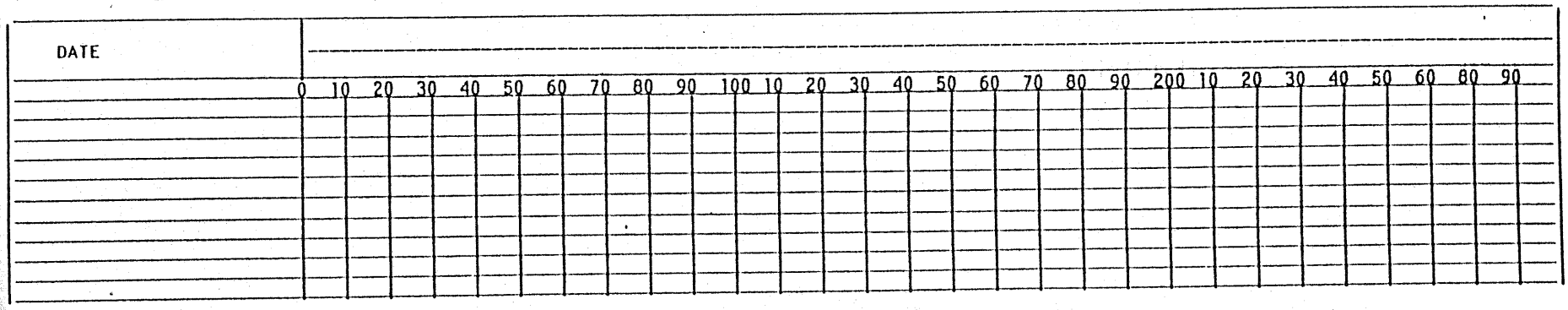
End Date ____/____/____

 AA0/33/1

CONTRACT TIME FOR COMPLETION

PROJECT: _____ TYPE OF WORK: _____ BY: _____ ____/____/____

LETTING DATE: _____ PROBABLE START DATE: ____/____/____ CK: _____ ____/____/____



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TRACS NO.
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LOCATION

Month	Days		Saturday	Sunday	Holiday	Possible Working Days	Probable Work Days	
	Month	Total					Month	Total

REMARKS

Total Work Days _____

End Date ____/____/____

PRODUCTIVITY RATES

The following is a guideline of productivity rates collected over a period of about five years. There are a variety of sources and a variety of rates. Many times there will be more than one rate for the same item number and there are many item numbers with no rates listed. This is only intended to organize the rates into categories and not into item numbers. When using these rates be aware of the project conditions, possible equipment and other factors affecting the actual productivity.

The column "Productivity" is normally listed as units/shift. For these productivity rates a shift can be considered as 8 or 10 hours, there may be more than one shift per day. Sometimes the productivity is better described using units not normally encountered and the figures will have to be massaged to fit the actual project. Where applicable (R) is rural, (I) is interstate, and (U) is urban.

ITEM NO.	DESCRIPTION	UNIT	PRODUCTIVITY
2010001	CLEARING & GRUBBING	MI	1(R)
2020001	REMOVAL STR. & OBSTRUCTIONS	MI	.1(U) - .5(R)
2020017	REMOVE AC	SY	1,000 - 2,000
2020021	REMOVE C&G	LF	800
2020024	REMOVE S/W & D/W	SY	500 - 1,000
2020024	REMOVE SIDEWALK	SF	1,500
2020029	REMOVE PAVEMENT	SY	1,000
2020030	MILLING	SY	1,000 - 5,000
2020401	REMOVE AND RESET METAL HANDRAIL	LF	50
2030201	MATERIAL PITS	CY	1,000(U) 10 - 12,000(R)
2030300	GRADING (INC. EXC. & BORROW)	CY	500 - 10,000
2030300	EARTH	CY	FIG 8-5
	SPECIAL	CY	500
2030300	NATURAL GROUND	MI	.5(U) - 1(R)
2030300	SUBGRADE	CY	500(U) 1,625(R) 6,500(I)
2030305	ROCK	CY	100
2030401	DRAINAGE	CY	
	FABRICATION & FURNISHING STRUCTURAL STEEL (AVG. 3-SPAN STRUCTURE		
	W-F BEAM	C. DAY	150
	WELDED PLATE GIRDER	C. DAY	180
2030401	TRENCH AND BACKFILL	LF	450
2030451	CHANNEL EXCAVATION	CY	650
2030451	CHANNEL	CY	75
2030501	EXCAVATION (STRUCTURAL)	CY	150
2030505	TRENCH EXCAVATION (52" DEEP)	LF	200

2030901	(SCRAPER)		6,000 - 10,000
	(TRUCK)		4,000 - 6,000
	(RECONSTRUCTION, REDUCE TO)		2,000
	(BLASTING, HIGH PRODUCTION)		2,000
2030901	BORROW EXCAVATION	CY	FIG 8-5
2030901	BORROW	CY	FIG 8-5
2030903	EMBANKMENT	CY	2,200
2031010	SHOULDER COMPACTION	MI	1 - 2
2031011	SHOULDERING	LF/HR	880
2050001	GRADE ROADWAY FOR PAVEMENT	SY	4,000
2050001	GRADING ROADWAY FOR PAVEMENT	SY	3,000
2080008	REMOVE CONCRETE	CY	20
3020001	TREATED SUBGRADE	SY	4,000(U) 9 -10,000(R)
3030022	ABC	CY	500 - 2,000
	(RURAL, NO DIFFICULTY) 3,000		
3030022	AGGREGATE BASE COURSE	TON	800
3030022	AB	TON	635(U) 1,900(R) 3,000(I)
3030121	GRANULAR BACKFILL	TON	800
3040001	CTB	TON	850(U) 1,900(R) 2,200(I)
3050001	LCB	SY	4,000(U) 26,4000(I)
4010010	PCCP	SY	1,000 - 5,000
	(CONCRETE REPAIR - MEASURE IN SF OR LF)		
		SF	400 - 500
		LF	150 - 2,000
	PROFILING	SY	2,000
4010012	MAINLINE PAVEMENT (3,000 CY)	SY	5,000(U) 7,000(R) 9,000(I)
4010012	RAMP AND TAPER	SY	5,000
4010016	CONCRETE PAVEMENT	SY	FIG. 8-5
4010040	CONTINUOUSLY REINFORCED CONCRETE PAVEMENT	SY	FIG 8-5
4020046	GRINDING	SY	5,000
	JOINT REPAIR	LF	1,000
4040101	FLUSH & PRIME COATS	SY	16,000(U) 110,000(R)
4040151	HEATER SCARIFY (REJUVENATE)	SY	15 - 20,000
4040160	SEAL COAT	SY	16,000(U) 40,000(R) 100,000(I)
4040162	COVER MATERIAL	TON	800
4070001	ACFC	TON	250
4070001	ACFC (INC. TACK)	TON	500(U) 1,000(R)
4080001	HOT RECYCLE (INC. TACK)	TON	400(U) 1,500(R) 3,000(I)
4080001	COLD RECYCLE	SY	3,900(U) 8,000(R)

4160001	AC-PAVEMENT (USUALLY CLOSE TO 2,000)	TON	400 - 2,000
4160003	AC WIDENING	TON	300 - 1,500
4160008	AC (INC. TACK)	TON	1 - 1,500(U) 2 - 2,500(R) 3,500(I)
5010001	CULVERTS (STORM DRAIN TRUNK UP TO 500 LF)	LF	100 - 300
5010002	PIPE CULVERTS	LF	200
5012524	STORM SEWER, LESS THAN 24"		LF 300
5012530	STORM SEWER, 30" AND GREATER	LF	150
5012548	STORM SEWERS	LF	200
5012924	PIPES 6" - 36"	LF	50
5012948	PIPES 42" AND ABOVE	LF	30
5020120	STRUCTURAL PLATE	LF	10 - 15
5030001	CATCH BASIN	EA	5
5030236	CATCH BASINS	EA	1
5030500	JUNCTION BOX	EA	1/WK
5050001	INLETS/MANHOLES	EA	5
5050021	MANHOLES	EA	3
5050089	MANHOLES, STANDPIPES	EA	3 DAYS
5050096	ELECTRIC MANHOLE	EA	4
	CONCRETE HANDRAIL	CY	1
5050201	ADJ. M/H FRAMES	EA	5
5060190	WELLS	EA	100 DAYS
6010001	CONCRETE (STRUCTURAL)	CY	8
6010002	BOX CULVERT (CONCRETE)	CY	10 - 20
6010002	STRUCTURAL CONCRETE	CY	25 - 75
6010003	CONCRETE, SUBSTRUCTURE	CY	8
6010005	CONCRETE, SUPERSTRUCTURE	CY	12
6012028	PRESTRESS CONCRETE BEAMS	LF	3 WEEKS FOR APPROVAL OF SHOP PLANS, THEN 3 BEAM @ 50'/DAY PLUS 3 DAYS FOR CURING
6016087	CONCRETE HEADWALLS	CY	4
6016087	HEADWALLS	EA	1
6030001	PILING	LF	140
	CAISSONS	EA	2
6030101	STEEL PILES	LF	350
6040001	STRUCTURAL STEEL	LB	25,000
6041101	POST TENSIONING	DAY	11
6050002	STR. STEEL (SUBSTRUCTURE)	LB	2,500
6050002	STR. STEEL (SUPERSTRUCTURE)	LB	5,000
6050002	STRUCTURAL STEEL	LF?	160
	BOX CULVERT STEEL	LB	WITH CONCRETE
6080010			
6110201	METAL HANDRAIL	LF	80
7010010	TEMPORARY CONCRETE BARRIER	LF	1,200
7040001	PAVEMENT MARKING	LF	10,000
7040003	THERMOPLASTIC PVMT. MRKG.	LF	15,000
7050026	THERMOPLASTIC PVMT. SYMBOL	SF	45
7310010	TRAFFIC SIGNAL POSTS	EA	4

7320010	LAYING SIGNAL CONDUIT	LF	375
7330031	LIGHT STANDARDS, TRAFFIC SIGNALS, BUFFALO BOXES, ETC.	EA	2
7330031	TRAFFIC SIGNALS (INSTALLATION)	EA	15 DAY/INTERSEC
7330031	TRAFFIC SIGNAL SYSTEM	EA	21 DAYS (MORE COMPLEX = 40)
7330620	RELOCATE TRAFFIC SIGNAL POSTS	EA	4
7350010	SIGNS & LOOP DETECTORS	EA	2
7360104	LIGHTING	EA	3 DAYS
8040001	TOP SOIL	CY	350
8050000	PLANTS		EA 25
8050003	SEEDING	AC	3
8050003	SEEDING	AC	10
8050003	SEEDING & MULCHING	AC	5
8060001	TREES (INTERMEDIATE)	EA	25 - 50
8061002	EVERGREEN TREES	EA	20 - 25
	EXCAVATION		
8061020	SHADE TREES	EA	15 - 20
8061067	SEEDLING TREES	EA	2,000 (HAND)
8061067			10,000 (MACHINE)
8061296	SHRUBS	EA	250 - 350
8080644	WATER VALVE, RESET MANHOLE	EA	7
	LANDSCAPE IRRIGATION & SMALL		
8080655	RELOCATE (MOVE) FIRE HYDRANTS,		
8080664	PUMP HOUSE	EA	5 MONTHS
9020001	FENCE (CHAIN LINK)	LF	1200
9020029	FENCING - CHAIN LINK	LF	2,000
9030005	WOVEN WIRE FABRIC	LF	2,000
9030005	FENCING - WOVEN WIRE	LF	4,000
9030008	FENCE	LF	200
9030011	FENCE (WIRE)	LF	1,500 - 3,000
9050001	GUARD RAIL	LF	400
9050001	GUARD RAIL (STEEL PLATE BEAM)	LF	250
9050001	GUARDRAIL	LF	400
9050006	GUARD RAIL	LF	275
9060021	CATTLEGUARDS	EA	1/WK
9080084	C&G	LF	300
9080100	C&G	LF	300 - 2,000
9080131	VALLEY GUTTER	LF	100
9080140	CONC. GUTTER	LF	500
9080201	CONCRETE SIDEWALK	SF	1,000
9080201	S/W, D/W, SLOPE PAVING,		
9080201	SIDEWALK	SF	2,500
9080303	CONCRETE D/W	SY	300 - 2,000
9080303	CONCRETE DRIVEWAY	SY	100
9090001	MOBILIZATION		USUALLY 5 DAYS
9100008	BARRIER WALLS	LF	300 - 1,000
9100008	CAST IN PLACE BARRIER	LF	1,500
9100201	CONCRETE MEDIAN BARRIER	LF	300
9110001	RIGHT-OF-WAY MARKERS	EA	30
9110001	R/W & SURVEY MARKERS	EA	20
9130001	RIPRAP	CY	100
9130001	BANK PROTECTION (RIPRAP)	CY	75

9140006	REST AREA STRUCTURE	EA	10 DAYS
9140118	RETAINING WALLS	LF	300
9140131	NOISE WALL	SF	1,000
9141473	UTILITIES	LF	500
9170037	INLETS	EA	5
9170071	SPILLWAYS, CURB, C&G,		
9170151	ENERGY DISSAPATORS	EA	1/WK
9200001	PAVED DITCH	LF	300
9201001	LINED CHANNEL	SY	500
9999903	CONCRETE BOX CULVERTS	CY	100(U) 250(R) 300(I)

BRIDGE STRUCTURES

NEW CONSTRUCTION

SUBSTRUCTURE EXCAVATION	EA	1.5
PILE DRIVING	LF	600
FOOTINGS	LF	600
(PILES AND FOOTINGS COULD BE 2 DAYS/STRUCTURE)		
COLUMNS, CAPS, ABUTMENTS		4 DAY/STRUCT
BEAM ERECTION		1 DAY/SPAN
SUPERSTRUCTURE		9 DAYS/SPAN
FINISHING, PAINTING, ETC.		3 DAYS/SPAN

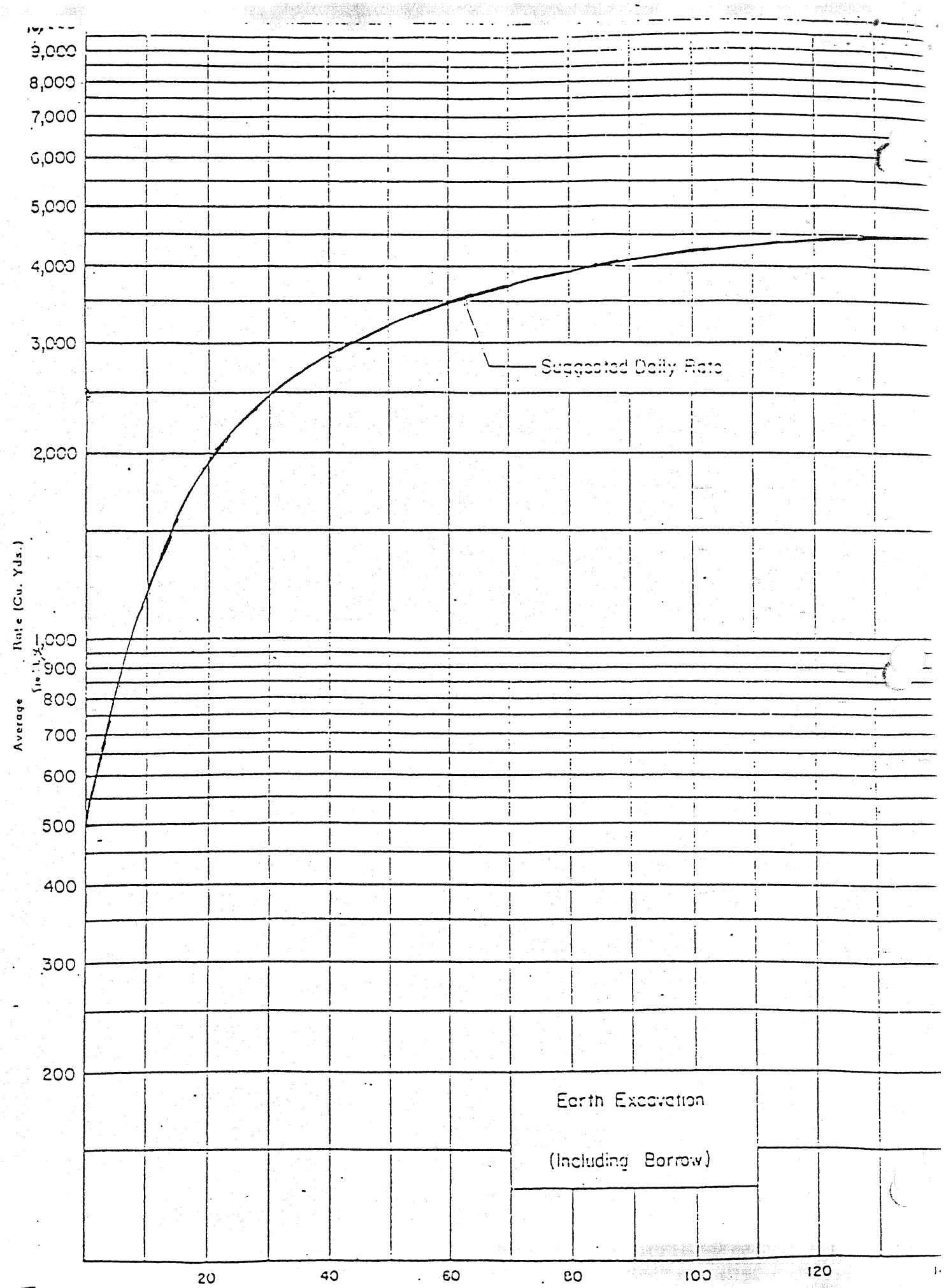
OR

2 SPANS	DAY	40 - 50
3 SPANS	DAY	60 - 70
4 SPANS	DAY	70 - 90

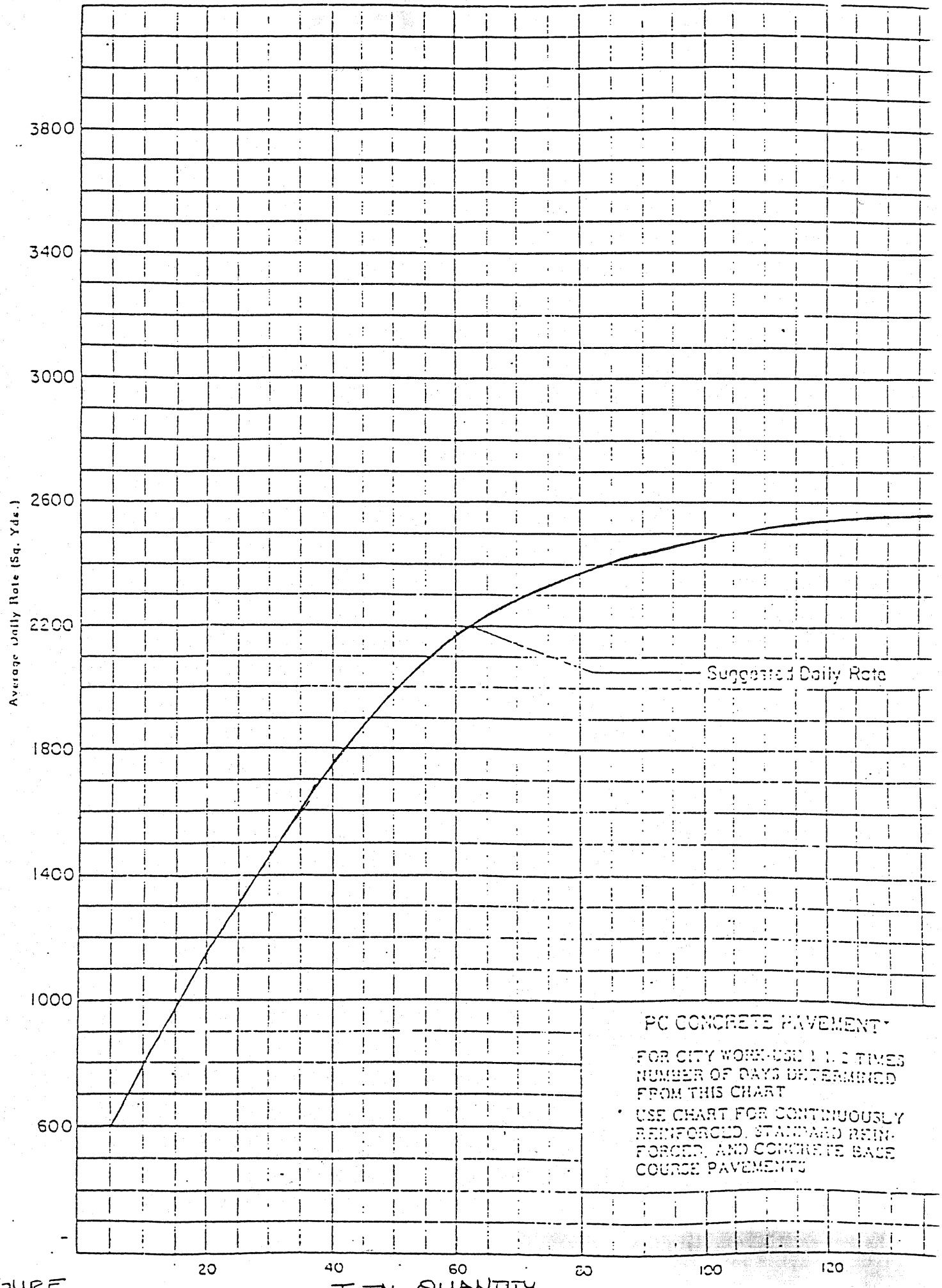
BRIDGE RECONSTRUCTION

MILL DECK (1/4")	SF	8,000
EXPANSION JOINT REPLACEMENT	LF	5 - 10
RAILING RECONSTRUCTION	LF	30
REMOVE BRIDGE DECK	SF	2,000
REPLACE OR WIDEN BRIDGE DECK	SF	200

SOURCES: (BRW, DONOHUE, DISTRICT, C&S ~~SELF~~, TEXTBOOK and MANUFACTURER'S MANUALS)


9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
900
800
700
600
500
400
300
200
Average Rate (Cu. Yds.)
Suggested Daily Rate
Earth Excavation
(Including Borrow)
20
40
60
80
100
120
THOUSANDS OF CU YD / MILE

FIGURE


3800
3400
3000
2600
2200
1800
1400
1000
600
-
Average Daily Rate (Sq. Yds.)
Suggested Daily Rate
20
40
60
80
100
120
TOTAL QUANTITY
PC CONCRETE PAVEMENT*
FOR CITY WORK-USE 1 1/2 TIMES NUMBER OF DAYS DETERMINED FROM THIS CHART
* USE CHART FOR CONTINUOUSLY REINFORCED, STANDARD REINFORCED, AND CONCRETE BASE COURSE PAVEMENTS

FIGURE