



# **CONTRACT TIME DETERMINATION**

**MISSOURI DEPARTMENT  
OF  
TRANSPORTATION**

**March 15, 2004**

## DEFINITIONS

**Calendar Day:** Any day shown on the calendar beginning and ending at midnight.

**Working Day:** A calendar day during which major construction operations could proceed for 6 hours or more. The following days are not counted as working days: Saturday, Sundays, holidays, and the period from December 15 to March 15, both dates inclusive.

**Controlling Item(s):** Contract work item(s) that (a) is large enough in volume, (b) requires a lengthy period for completion, or (c) is on the critical path of a precedence diagram.

**Completion Date:** The contractor must have all (essential) work completed by a specific date without regard for working days.

**Production Rate:** The amount constructed over a specified time period.

## CONTRACT TIME DETERMINATION

The validity of the contract time included in contracts is extremely critical. Contracts that specify too few working days or a short time period may:

- Encourage higher bids
- Eliminate some qualified contractors
- Increase number of time overruns and contractor claims
- Increase bond costs for contractors
- Encourage good management and thus high production
- Lower administration and engineering costs

Contracts that specify an excessive number of working days or a long time period may:

- Encourage lower bid prices
- Permit both high and low production contractors to bid on project
- Allow contractors to stop all work on projects for extended periods.
- Encourage contractors to bid more work than they can handle in a timely manner
- Subject the public to added inconvenience by forcing travel on a roadway where safety is less than desirable.
- Reduce the bonding capacity of contractors
- Discourage innovative management and/or construction techniques
- Increase administration and engineering costs

Several different procedures can be used to estimate the number of working days or calendar days needed to complete construction projects. Some of these techniques are simple and depend on individual judgment. Others are more complicated, drawing heavily on past data accumulated by the department and possibly using a computer program to develop time schedules. Each of these procedures, however, depends on first developing a progress schedule.

## **DISTRICT ROLE**

District Design personnel should develop the progress schedule. This should be developed late in the design phase of the project. Preferably after the quantities have been completely tabulated. District Construction personnel should review this schedule prior to submitting it to GHQ with final plan submittal. A suggested time for review would be during the final field check for the project when both functional units can discuss the length of contract time.

### **A. Developing A Progress Schedule**

The progress schedule shows the items of work and the durations associated with the chosen production rates. The time to complete each controlling item of work included in the progress schedule is computed based on the production rates applicable to that project. Items should be arranged by chronological sequence of construction operations. Minor items that may be performed concurrently with controlling items or that can be completed in a comparatively short length of time need not be analyzed.

In determining a progress schedule it should be remembered that the start and ending dates for each controlling item need to be based on the earliest date on which work on that time will begin and how long it will take to complete. The earliest start date for each activity will be determined by the completion of the activities which precede it, allowing for the fact that some activities can begin before the preceding activity is entirely completed.

Along with the time established for all controlling items, additional time should be allowed in the contract for initial mobilization and final cleanup. It should be remembered there are seasonal limitations for some construction activities and consideration should be made in the progress schedule (i.e. asphalt paving). Care should be exercised at this stage to coordinate controlling items with the average working days per month (see Exhibit A).

#### **1. Adapting Production Rates To a Particular Project**

Before time durations for individual work items can be computed, certain project specific information should be determined and some management decisions made. A determination should be made relative to the urgency of the completion of the proposed project. The traffic volumes affected as well as the effect of detours should be analyzed. The size and location of the project should be reviewed as well as the effects of staging, working double shifts, and the feasibility of night work as well as restrictions on closing lanes and other restrictions set out in the traffic control plan.

Also, the availability of material for controlling items of work should be investigated. For example, it might be appropriate to consider the need for multiple crews on a specific item to expedite the completion when there are exceptionally large quantities or when there is a large impact on traffic.

In April 1993, December 1997 and August 2000, a survey of the production rates in all ten districts and the AGC was made, and the results tabulated (see Exhibit B).

The low production rates category would include those projects which may include some of the following characteristics:

- heavy traffic
- urban area
- tight working conditions
- complex staging
- mostly hand work or "piece-work"
- not readily available material
- reconstruction
- difficult earthwork (poor soil type; steep grading; truck haul)
- non-standard construction (variable pavement widths, etc.)

The average production rates category would include those projects which may include some of the following characteristics:

- light traffic
- rural area
- simple staging
- mostly machine work (i.e. slip-form paving)
- readily available material
- new construction or relocation
- easy earthwork (good soil type; scraper haul)
- standard construction (uniform pavement widths, etc.)

The high production rates or "accelerated" category would include critical types of projects where an efficient contractor is working more than 8 hours per day, more than 5 days per week, and possibly with additional workers.

The production rates used should be based on the desired level of resource commitment (labor, equipment, etc.) deemed practical given the physical limitations of the project.

## **2. Other Factors Which Influence Contract Time**

In addition to production rates, the following items should be considered when determining contract time:

- (a) Effects of maintenance of traffic requirements on scheduling and the sequence of operations.

- (b) Curing time and waiting periods between successive paving courses or between concrete placement operations, as well as specified embankment settlement periods.
- (c) Seasonal limitations for certain items which affect the number of days the contractor will be able to work as well as production rates.
- (d) Conflicting operations of adjacent projects, both public and private.
- (e) Review time for falsework plans, shop drawings, post-tensioning plans, mix designs, etc.
- (f) Time for fabrication of structural steel, signal mast arms, and other specialty items.
- (g) Coordination with utilities.
- (h) Time to obtain permits.
- (i) The effect of permit conditions and/or restrictions.
- (j) Restrictions for nighttime and weekend operations.
- (k) Time of the year of the letting as well as duration of the project.
- (l) Location.
- (m) Delivery of materials
- (n) Coordination with major community events and holidays.
- (o) Commitments which have been made.
- (p) Other pertinent items.

**B. Procedures For Setting Contract Time**

Once the progress schedule is developed, then a decision must be made on which procedure to use for setting the contract time. The working-day and calendar-day methods have an advantage over the completion-date method in that the contractor is not liable for circumstances beyond his control; however, each day that is charged must be carefully documented. In setting contract time it is recommended that a completion date be applied only when project completion is critical or when a large volume of traffic is affected.

Management should be involved in identifying the projects that must be completed at the earliest practical date. Procedures which would accelerate project completion, such as a "Liquidated Damages Specified," "Liquidated Savings" or "Acceleration of Work" clause, should be considered when construction will affect traffic substantially or when project completion is crucial. It should be remembered that while high traffic volumes can greatly delay a contractor's work, if a contractor were to initiate double shifts to complete a project by an unreasonable date, greater exposure to hazards and traffic disruptions might result than would occur with the expeditious continuation of work with moderate use of overtime.

### **1. Working Days Based on Quantity and Production Rates**

Working days which are developed from production rates for work items are usually based on experience and past data from completed projects. The controlling items are used as the primary basis for specifying contract time.

Large, complicated projects requiring extensive coordination of materials, equipment, personnel, and administrative support can best be handled by means of work-flow techniques such as CPM (Critical Path Method).

### **2. Completion Date Based on Construction Season Limits**

Time limits are set at the end of the construction season for certain surfacing and paving projects. This method is satisfactory when:

- (a) the projects are awarded early in the season
- (b) a sufficient time is available to finish the project before the completion date
- (c) a large number of projects is not awarded to a single contractor
- (d) materials are readily available
- (e) the contractor is held responsible for the expense of maintaining the project over the winter or paying liquidated damages

**Example:** Leveling course jobs, let in the spring, are assigned a completion date of October 1, which is the last day asphalt may be placed by specification.

### **3. Completion Date Based on Stage Construction**

Some projects or portions of projects must be completed by a specific date to allow access by subsequent contractors to adjoining projects. Delays in completion of the project can result in considerable claims for delay costs by the subsequent contractor. Therefore a specific completion date associated with a sufficiently high rate for

liquidated damages is advisable. A realistic completion date must be assigned or the final costs will outweigh the desired benefits.

#### **4. Calendar Days Set by Contractor**

Contractors enter a bid and Calendar Days. For specific phases or final completion of project, the product of the number of calendar days and the road user cost is then added to the amount bid for work items and the total is used to determine the low bidder. This procedure is known as an Acceleration of Work Clause or "A plus B" bidding. It should be used sparingly, generally when phases or final completion is one season or less and only when the desired project completion is critical.

### **GENERAL HEADQUARTERS ROLE**

One objective in the determination of a time period is to encourage a reasonable number of contractors to bid on the project. This allows for competitive bidding and results in lower bid prices. Knowledge of the capabilities and work loads of the contractors that normally bid each type of work is required.

GHQ will review the district's working day study so that these factors are considered, as well as to insure that production rates and other considerations are applied uniformly throughout the state. GHQ will also review the district's progress schedule for coordination with the progress schedule supplied by Bridge, or for any projects which are let in combination. GHQ may adjust the working day counts as necessary for the reasons previously stated after consultation with the project manager.

### **CONCLUSIONS AND RECOMMENDATIONS**

In setting contract time limits, a decision must be made on whether to have the construction project completed by a specific date at any cost, or to have the project completed in a reasonable period of time at a reasonable cost. Once specified, contract time becomes a contractual condition, and as such, affects both the bidding and the administration of the project.

An essential element of MoDOT's procedure should be the monitoring of existing projects to determine if the contract times being specified are appropriate. As a part of this process, updates and changes should be made as determined to be necessary. In addition, good communication between Design, Construction and Bridge is essential in preparing realistic working day counts.

When establishing a new time-estimation procedure or modifying the existing procedure, the performance of the existing procedure should be carefully monitored both for projects with major time overruns and for projects completed much earlier than the contract date. It is also important to identify projects that were completed on time, even though work was not continuous. Special attention should be given to identifying items of work that must be completed in specific sequence. Although the experience of other organizations can be useful in

establishing contract time estimating procedures, MoDOT should use its own data and historical files to develop new methods or to check the validity of existing procedures.



<b>Missouri North and Central (D1, D2, D3, D5)</b>						
<b>MONTH</b>	<b>CLASS A EXC.</b>	<b>CLASS C EXC.</b>	<b>BRIDGE SUBS.</b>	<b>BRIDGE SUPERS.</b>	<b>CONC. PAVING</b>	<b>ASPH. PAVING</b>
JANUARY	0	2	0	0	0	0
FEBRUARY	0	2	0	0	0	0
MARCH	3	5	7	5	0	0
APRIL	11	13	11	12	7	6
MAY	14	14	15	15	13	13
JUNE	15	16	16	16	17	18
JULY	18	18	17	17	18	19
AUGUST	18	18	18	18	18	19
SEPTEMBER	16	16	15	15	16	15
OCTOBER	12	13	13	13	14	4
NOVEMBER	9	10	10	10	4	0
DECEMBER	3	5	5	0	0	0
<b>TOTAL</b>	<b>119</b>	<b>132</b>	<b>127</b>	<b>121</b>	<b>107</b>	<b>94</b>
<b>Missouri Urban (D4 and D6)</b>						
JANUARY	0	8	0	0	0	0
FEBRUARY	0	9	0	0	0	0
MARCH	6	10	9	9	0	0
APRIL	11	13	14	14	11	7
MAY	14	15	15	16	15	14
JUNE	16	16	17	17	17	15
JULY	16	17	18	17	17	17
AUGUST	18	18	18	18	18	18
SEPTEMBER	17	17	16	16	16	17
OCTOBER	14	15	15	14	15	10
NOVEMBER	9	11	12	9	8	3
DECEMBER	5	8	7	0	0	0
<b>TOTAL</b>	<b>126</b>	<b>157</b>	<b>141</b>	<b>130</b>	<b>117</b>	<b>101</b>
<b>Missouri South (D7, D8, D9, D10)</b>						
JANUARY	0	6	0	0	0	0
FEBRUARY	0	6	0	0	0	0
MARCH	5	8	8	6	0	0
APRIL	10	12	13	13	10	8
MAY	13	14	13	14	14	14
JUNE	16	16	16	16	16	17
JULY	17	18	17	17	18	18
AUGUST	19	19	19	19	18	18
SEPTEMBER	16	17	16	16	16	16
OCTOBER	15	15	15	15	15	8
NOVEMBER	8	9	10	11	7	0
DECEMBER	3	5	5	0	0	0
<b>TOTAL</b>	<b>122</b>	<b>145</b>	<b>132</b>	<b>127</b>	<b>114</b>	<b>99</b>

**Exhibit A**