

Estimating
the Schedule

Scheduling
the Estimate

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An estimator in today's environment has many requirements to fulfill in order to prepare and submit a complete and accurate estimate in a timely way. This article deals with a subject which is often not considered a requirement for a complete estimate, that is producing a schedule during estimate preparation. It also addresses a subject which is becoming more and more critical to effective estimating, scheduling time for the estimator to adequately prepare the estimate.

ESTIMATING THE SCHEDULE

Why estimate the schedule at all? In competitively bid projects, it is usually given in the bidding documents as a contractual requirement, and in negotiated projects, it is usually set by the owner before the estimator comes on the scene. At first glance, it seems an added burden to the already over-burdened estimator.

There are a number of reasons why the estimator should take on this burden, however. The first is that the schedule has an impact on general conditions -- whether the contract schedule is too long or too short. If it is too long, a bid advantage may be realized by determining a realistic schedule and pricing it. If it is too short, the general conditions must be adjusted to reflect the probable increase in staff, facilities, etc., which will be required to build an accelerated schedule. In this latter case, if the estimate does not reflect these added costs, they go straight to the bottom line, as a loss.

The real versus contract schedule may also impact how the estimate deals with liquidated damages or bonus clauses. If the contract schedule is too short and liquidated damages are likely, the estimator may want to add the liquidated damages expected into the estimate. This assumes, of course, that the amount of money added for potential liquidated damages is less than the added costs incurred in meeting a shortened schedule. On the other hand, if the contractor believes a schedule shorter than that mandated by the contract is achievable and there are provisions for paying a bonus for early completion, the contractor may decide to deduct all or part of the anticipated bonus to better its competitive position. Both of the actions, adding to the estimate for liquidated damages, or reducing the bid for anticipated bonus collections, carry risks, but the author can testify to their occurring, more often than might be imagined.

The estimate schedule may also prove important for the purpose of demonstrating the contractor's intent in building the project when issues of change orders arise. Change orders all too often have a detrimental effect on general conditions, one that is difficult to demonstrate and more difficult to collect for. Change order provisions in typical contracts allow a set percentage to be added to the cost of change orders to cover overhead and fee, and that amount is quite often insufficient to cover the added costs generated by the change. Where the estimated schedule can be produced (assuming estimated general conditions follow the estimated schedule) and the change order can be shown to lengthen the schedule, the likelihood of collecting extended general conditions is increased. As an aside, it is a matter of well-tested construction contract law that a contractor, in the absence of very strong contractual provisions to the contrary, can bid any schedule it wishes, and as long as it can demonstrate that its schedule is a reasonable one, can be

entitled to recover damages from a party to the contract which causes the contractor's bid schedule to be exceeded. As in all matters of law, the principle is messier in real life than in theory, but it is there.

Another reason for producing an estimate schedule is its marketing value. In a competitively bid project, subcontractors often rely on the general contractor to tell them when it anticipates their work will be done, and the more reasoned the general contractor's response, the more likely it will be favored with a better bid. Not having produced a schedule creates the appearance of not understanding the job as well as could be expected and so erodes the confidence of subcontractors and suppliers. In a negotiated project, the contractor's own schedule, carefully thought out, may assist in its being awarded the project. It may also demonstrate how the owner's schedule is unrealistic, or perhaps how the owner's schedule is difficult but achievable, and how the contractor intends to achieve it. This latter purpose of the estimate schedule as a marketing tool can, in fact, become very elaborate, dealing with duration, manpower requirements, equipment considerations, etc. The writer has participated in presentation of a proposal which included such a schedule. In this instance, the owner's schedule was so necessary and so aggressive that our proposal identified manpower requirements by craft, demonstrated that the requirements could not be met by the local building community, and propounded strategies for solving this manpower shortage, including setting up craft training programs on the jobsite.

A final reason to provide a estimated schedule is to assist in determining what personnel are available for the project at the time they are anticipated to be needed. In this day of maximizing resources, most construction companies are spending more time looking at the deployment of its personnel. This is sometimes displayed, during pre-bid or pre-proposal strategy sessions, by a personnel schedule, showing what personnel are or will be available at what times. This schedule quite often includes all supervisory personnel, down to craft foremen. Such considerations enable the manager of the company to bid a project confident in the personnel available, or, conversely, to bid knowing that personnel are not available, which is oftentimes equally important.

ESTIMATING THE SCHEDULE

The estimate schedule should be prepared in such a way as to be as accurate as possible, but without devoting too much time to its preparation. The format of the schedule produced is important for these reasons and because it is also a tool for communication, both within and without the company. As such, the format most often used is the basic bar chart format. When properly prepared, the bar chart is accurate, not overly complex and time consuming to prepare, and an excellent communication tool.

The schedule is often prepared by the "seat of the pants" method, which at its best, is an excellent tool. In it, the estimator uses his judgment and experience, or that of the company's operations personnel, or both, to break the schedule down into logical activities with rational duration. The schedule prepared in this way should show the probable sequence of activities, and their overlap in starting, if any.

Another way to determine activity duration is by the productivity method. Here, the productivity of a given crew for an activity is either known from past experience or taken directly from the estimated prices for the activity at hand. For example, the contractor may not have estimated electrical work in detail. However, the approximate value of the work may be approximated with reasonable assurance. If the estimator knows what percentage of the total electrical work anticipated will likely be labor, and the wage rate for the electrician, the number of crew days or weeks, based upon a certain size crew, may be easily determined. Assume the electrical work to be worth approximately \$500,000. This assumption is based not only upon the estimator's past experience with similar buildings, but also on conversations with electrical subs who are preparing bids for this project. We can determine that the portion of this value attributable to labor to be 33%, or \$165,000. If we know that an electrician's average burdened wage rate is \$20.00, the job will contain 8250 man-hours (or 1031 man-days) of electrical work. If we assume a crew of a certain size, say 10, we can determine that it will take 103 work days to do the electrical work. A similar analysis may be made for other portions of the work which the estimator has not estimated in detail.

For items the estimator has surveyed, duration may be determined more directly. If the estimating system does not accumulate man-hours by division of work, they can be determined by dividing total labor for, say, formwork, by an average crew wage rate to determine man-hours and thereby man-days.

See figure 1.

**ESTIMATE MANPOWER REVIEW
BAR CHART SCHEDULE**

ESTIMATE MANPOWER SCHEDULE ACTIVITY	MANPOWER BREAKDOWN				DURATION		
	TOTAL CONTRACT DOLLARS	% BURDENED LABOR	BURDENED LABOR DOLLARS	BURDENED WAGE + FRINGES	MAN DAYS	WORK MO	NO OF MEN
Site Clearing	3,030	47.4%	1,436				
Site Grading	12,120	50.0%	6,060				
Excavation & Backfill	28,386		22,879				
Soil Treatment	1,463	60.0%	878				
Site Drainage	18,180	40.0%	7,272				
Site Utilities	9,600	40.0%	3,840				
Asphalt Paving	59,063		30,098				
Curb & Gutters	31,999		14,839				
Walks	36,981		20,101				
Misc. Site Improvements	3,408		800				
Concrete Finishes	13,839		12,407				
Formwork	43,305		33,162				
Wire Mesh	8,871		5,309				
Rebar	5,980		2,018				
Concrete	38,512		5,021				
Precast Concrete	188,847		21,976				
Masonry	299,546		183,543				
Structural Steel	36,398		2,392				
Metal Joists	123,078		7,586				
Metal Deck	44,013		10,042				
Miscellaneous Metals	31,155		9,876				
Rough Carpentry	1,882		1,048				
Finish Carpentry	4,074		1,256				
Waterproofing & Dampproofing	7,269		3,567				
Insulation	7,522	50.0%	3,761				
Preformed Roofing & Siding	103,089	52.0%	53,606				
Roofing, Sheetmetal, & Acc.	29,785	55.5%	16,531				
Caulking & Sealants	10,100	60.0%	6,060				
Metal Doors & Frames	13,276		2,649				
Wood & Plastic Doors	15,251		1,895				
Metal Windows	23,755	20.0%	4,751				
Hardware	16,006	20.0%	3,201				
Entrances & Storefronts	8,484	25.0%	2,121				
Glazed Curtainwall	114,930	15.0%	17,240				
Drywall	46,638		32,109				
Ceramic Tile	26,943	38.0%	10,238				
Acoustical Treatment	50,984	18.0%	9,177				
Resilient Flooring	14,499	30.0%	4,350				
Carpet	41,834	16.0%	6,713				
Painting	35,598		8,809				
Specialties	28,282	30.0%	8,485				
Equipment	51,544	10.0%	5,154				
Multiple Seating	31,563	10.0%	3,156				
Elevators	40,400	37.0%	14,948				
Plumbing	59,336	40.0%	23,734				
Fire Protection	13,578	40.0%	5,431				
HVAC	477,644	40.0%	191,058				
Electrical	438,219	33.3%	145,927				

Fig. 1

Here we have created a spreadsheet in which we have listed the activities we want to include in our bar chart schedule. We have input values for those items, some of which come directly from work we have surveyed and priced in detail, some from past experience, some from input from subs. We may also do a quick estimate of items we have not surveyed in detail but feel comfortable in using unit prices from our experience, for example, roofing. This particular example is from an estimate for a small project in Arkansas which the writer performed.

After determining a value for the various schedule items we either enter a percentage of those items which we feel is burdened labor or the actual burdened labor from our detail estimate. In the case of the percentage items, the value used may be determined from past experience, from conversations with subs, or from some recognized estimating information source, such as those published by R.S. Means, Means Building Construction Cost Data. The percentages used in the example are derived from Means for purposes of this illustration. They must be carefully chosen.

The next step is to determine the burdened wage rate we will use in the wage rate column, to enter the rate and have the spreadsheet calculate the man-days in that activity. Then we assign crew sizes to each activity and determine the number or work (crew) days per activity. This is shown in our example in figure 2.

ESTIMATE MANPOWER SCHEDULE	MANPOWER BREAKDOWN					DURATION	
	TOTAL CONTRACT DOLLARS	% BURDENED LABOR	BURDENED LABOR DOLLARS	BURDENED WAGE + FRINGES	MAN DAYS	NO OF MEN	WORK DAYS
Site Clearing	3,030	47.4%	1,436	17.55	10	2	5
Site Grading	12,120	50.0%	6,060	17.55	43	4	10
Excavation & Backfill	28,386		22,879	17.55	163	8	20
Soil Treatment	1,463	60.0%	878	15.60	7	1	5
Site Drainage	18,180	40.0%	7,272	17.55	52	3	20
Site Utilities	9,600	40.0%	3,840	17.55	27	1	20
Asphalt Paving	59,063		30,098	17.55	214	14	15
Curb & Gutters	31,999		14,839	17.30	107	7	15
Walks	36,981		20,101	17.30	145	10	15
Misc. Site Improvements	3,408		800	17.30	6	1	5
Concrete Finishes	13,839		12,407	19.50	80	5	15
Formwork	43,305		33,162	17.55	236	12	20
Wire Mesh	8,871		5,309	20.80	32	2	20
Rebar	5,980		2,018	20.80	12	1	10
Concrete	38,512		5,021	15.60	40	4	10
Precast Concrete	188,847		21,976	20.15	136	7	20
Masonry	299,546		183,543	18.85	1,217	30	40
Structural Steel	36,398		2,392	20.80	14	5	3
Metal Joists	123,078		7,586	20.80	46	5	10
Metal Deck	44,013		10,042	20.80	60	6	10
Miscellaneous Metals	31,155		9,876	20.80	59	3	20
Rough Carpentry	1,882		1,048	17.55	7	1	5
Finish Carpentry	4,074		1,256	17.55	9	1	10
Waterproofing & Damproofing	7,269		3,567	15.60	29	3	10
Insulation	7,522	50.0%	3,761	15.60	30	2	15
Preformed Roofing & Siding	103,089	52.0%	53,606	20.80	322	16	20
Roofing, Sheetmetal, & Acc.	29,785	55.5%	16,531	19.50	106	11	10
Caulking & Sealants	10,100	60.0%	6,060	15.60	49	5	10
Metal Doors & Frames	13,276		2,649	17.55	19	1	20
Wood & Plastic Doors	15,251		1,895	17.55	13	1	20
Metal Windows	23,755	20.0%	4,751	20.80	29	3	10
Hardware	16,006	20.0%	3,201	17.55	23	1	20
Entrances & Storefronts	8,484	25.0%	2,121	20.80	13	3	5
Glazed Curtainwall	114,930	15.0%	17,240	20.80	104	7	15
Drywall	46,638		32,109	17.55	229	11	20
Ceramic Tile	26,943	38.0%	10,238	19.50	66	7	10
Acoustical Treatment	50,984	18.0%	9,177	19.50	59	4	15
Resilient Flooring	14,499	30.0%	4,350	19.50	28	2	15
Carpet	41,834	16.0%	6,713	19.50	43	4	10
Painting	35,598		8,809	19.50	56	4	15
Specialties	28,282	30.0%	8,485	17.55	60	3	20
Equipment	51,544	10.0%	5,154	17.55	37	4	10
Multiple Seating	31,563	10.0%	3,156	17.55	22	2	10
Elevators	40,400	37.0%	14,948	23.40	80	3	30
Plumbing	59,336	40.0%	23,734	23.40	127	3	45
Fire Protection	13,578	40.0%	5,431	23.40	29	2	15
HVAC	477,644	40.0%	191,058	23.40	1,021	13	80
Electrical	438,219	33.3%	145,927	26.00	702	9	80
Punchlist							

Fig. 2

With the duration, creating the schedule is a matter of drawing the duration in the time frame we assign in the schedule. We do this by building the project in our mind. What happens first? Site clearing. The bar for site clearing will begin the schedule. Notice that our duration are in work days, that is, the number of days it will take the crew of the size we assigned to the work activity to complete the activity. Our schedule will usually be shown in months, so that the bars for duration will take up a fractional portion of the month. See figure 3.

ESTIMATE MANPOWER REVIEW BAR CHART SCHEDULE																			
ESTIMATE MANPOWER SCHEDULE		MANPOWER BREAKDOWN				DURATION		MONTHS											
ACTIVITY	TOTAL CONTRACT DOLLARS	% BURDENED LABOR	BURDENED LABOR DOLLARS	BURDENED WAGE + FRINGES	MAN DAYS	NO OF WORK MEN	DAYS	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB
Site Clearing	3,030	47.4%	1,436	17.55	10	2	5	■											
Site Grading	12,120	50.0%	6,060	17.55	43	4	10	■											
Excavation & Backfill	28,386		22,879	17.55	163	8	20	■	■										
Soil Treatment	1,463	60.0%	878	15.60	7	1	5		■										
Site Drainage	18,180	40.0%	7,272	17.55	52	3	20		■	■									
Site Utilities	9,600	40.0%	3,840	17.55	27	1	20		■	■									
Asphalt Paving	59,063		30,098	17.55	214	14	15												
Curb & Gutters	31,999		14,839	17.30	107	7	15												
Walks	36,981		20,101	17.30	145	10	15												
Misc. Site Improvements	3,408		800	17.30	6	1	5												
Concrete Finishes	13,839		12,407	19.50	80	5	15		■			■							
Formwork	43,305		33,162	17.55	236	12	20		■	■									
Wire Mesh	8,871		5,309	20.80	32	2	20					■							
Rebar	5,980		2,018	20.80	12	1	10			■									
Concrete	38,512		5,021	15.60	40	4	10					■							
Precast Concrete	188,847		21,976	20.15	136	7	20						■	■					
Masonry	299,546		183,543	18.85	1,217	30	40						■	■	■				
Structural Steel	36,398		2,392	20.80	14	5	3												
Metal Joists	123,078		7,586	20.80	46	5	10												
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Rough Carpentry	1,882		1,048	17.55	7	1	5												
Finish Carpentry	4,074		1,256	17.55	9	1	10												
Waterproofing & Damproofing	7,269		3,567	15.60	29	3	10			■									
Insulation	7,522	50.0%	3,761	15.60	30	2	15												
Performed Roofing & Siding	103,089	52.0%	53,606	20.80	322	16	20												
Roofing, Sheetmetal, & Acc.	29,785	55.5%	16,531	19.50	106	11	10												
Caulking & Sealants	10,100	60.0%	6,060	15.60	49	5	10												
Metal Doors & Frames	13,276		2,649	17.55	19	1	20												
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Metal Windows	23,755	20.0%	4,751	20.80	29	3	10												
Hardware	16,006	20.0%	3,201	17.55	23	1	20												
Entrances & Storefronts	8,484	25.0%	2,121	20.80	13	3	5												
Glazed Curtainwall	114,930	15.0%	17,240	20.80	104	7	15												
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Carpet	41,834	16.0%	6,713	19.50	43	4	10												
Painting	35,598		8,809	19.50	56	4	15												
Specialties	28,282	30.0%	8,485	17.55	60	3	20												
Equipment	51,544	10.0%	5,154	17.55	37	4	10												
Multiple Seating	31,563	10.0%	3,156	17.55	22	2	10												
Elevators	40,400	37.0%	14,948	23.40	80	3	30			■									
Plumbing	59,336	40.0%	23,734	23.40	127	3	45			■									
Fire Protection	13,578	40.0%	5,431	23.40	29	2	15			■									
HVAC	477,644	40.0%	191,058	23.40	1,021	13	80												
Electrical	438,219	33.3%	145,927	26.00	702	9	80			■									
Punchlist																			

Fig. 3

We have plotted all the activities in the time frame we believe they will occur in the same fashion as we did site clearing and we have our schedule. The spreadsheet has been reduced to fit on this page, but in practice we will print it on a larger scale.

The template has been modified in figure 4 to be used in another way for another purpose.

ESTIMATE MANPOWER REVIEW BAR CHART SCHEDULE																					
ESTIMATE MANPOWER SCHEDULE		MANPOWER BREAKDOWN				DURATION		MONTHS													
ACTIVITY	TOTAL CONTRACT DOLLARS	% BURDENED LABOR	BURDENED LABOR DOLLARS	BURDENED WAGE + FRINGES	MAN DAYS	WORK DAYS	NO OF MEN	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB		
	Site Clearing	3,030	47.4%	1,436	17.55	10	5	2	2												
Site Grading	12,120	50.0%	6,060	17.55	43	10	4	4													
Excavation & Backfill	28,386		22,879	17.55	163	20	8	4													
Soil Treatment	1,463	60.0%	878	15.60	7	5	1	8	8												
Site Drainage	18,180	40.0%	7,272	17.55	52	20	3		3	3											
Site Utilities	9,600	40.0%	3,840	17.55	27	20	1		1	1											
Asphalt Paving	59,063		30,098	17.55	214	15	14													14	
Curb & Gutters	31,999		14,839	17.30	107	15	7													7	
Walks	36,981		20,101	17.30	145	15	10													10	
Misc. Site Improvements	3,408		800	17.30	6	5	1													1	
Concrete Finishes	13,839		12,407	19.50	80	15	5		5		5	5									
Formwork	43,305		33,162	17.55	236	20	12	12													
Wire Mesh	8,871		5,309	20.80	32	20	2				2										
Rebar	5,980		2,018	20.80	12	10	1		1												
Concrete	38,512		5,021	15.60	40	10	4		4		4	4									
Precast Concrete	188,847		21,976	20.15	136	20	7							7	7						
Masonry	299,546		183,543	18.85	1,217	40	30					30	30	30							
Structural Steel	36,398		2,392	20.80	14	3	5			5											
Metal Joists	123,078		7,586	20.80	46	10	5			5											
Metal Deck	44,013		10,042	20.80	60	10	6				6										
Miscellaneous Metals	31,155		9,876	20.80	59	20	3						3	3							
Rough Carpentry	1,882		1,048	17.55	7	5	1									1					
Finish Carpentry	4,074		1,256	17.55	9	10	1													1	
Waterproofing & Damproofing	7,269		3,567	15.60	29	10	3		3												
Insulation	7,522	50.0%	3,761	15.60	30	15	2									2	2				
Preformed Roofing & Siding	103,089	52.0%	53,606	20.80	322	20	16							16							
Roofing, Sheetmetal, & Acc.	29,785	55.5%	16,531	19.50	106	10	11								11	11					
Caulking & Sealants	10,100	60.0%	6,060	15.60	49	10	5													5	
Metal Doors & Frames	13,276		2,649	17.55	19	20	1						1								
Wood & Plastic Doors	15,251		1,895	17.55	13	20	1									1					
Metal Windows	23,755	20.0%	4,751	20.80	29	10	3							3							
Hardware	16,006	20.0%	3,201	17.55	23	20	1									1	1				
Entrances & Storefronts	8,484	25.0%	2,121	20.80	13	5	3									3					
Glazed Curtain wall	114,930	15.0%	17,240	20.80	104	15	7									7					
Dry wall	46,638		32,109	17.55	229	20	11									11	11				
Ceramic Tile	26,943	38.0%	10,238	19.50	66	10	7										7	7			
Acoustical Treatment	50,984	18.0%	9,177	19.50	59	15	4										4	4			
Resilient Flooring	14,499	30.0%	4,350	19.50	28	15	2										2	2			
Carpet	41,834	16.0%	6,713	19.50	43	10	4													4	
Painting	35,598		8,809	19.50	56	15	4										4	4			
Specialties	28,282	30.0%	8,485	17.55	60	20	3													3	
Equipment	51,544	10.0%	5,154	17.55	37	10	4													4	
Multiple Seating	31,563	10.0%	3,156	17.55	22	10	2													2	
Elevators	40,400	37.0%	14,948	23.40	80	30	3			3				3	3	3	3				
Plumbing	59,336	40.0%	23,734	23.40	127	45	3		3		3									3	
Fire Protection	13,578	40.0%	5,431	23.40	29	15	2		2		2									2	
HVAC	477,644	40.0%	191,058	23.40	1,021	80	13							13	13	13	13	13			
Electrical	438,219	33.3%	145,927	26.00	702	80	9							9	9	9	9	9			
Punchlist																					
Total Men/month								30	37	25	17	44	41	95	79	96	52	27			

Fig. 4

Here the columns for number of men and work days has been reversed. Given the number of man-days in an activity and the number of workdays allotted for accomplishing the activity, the necessary crew size to accomplish the activity will be determined. Putting the number on the schedule in the same location as the bar in figure 4 and totaling the monthly columns will result in the number of men required on the job each month. For example, the crew size for site drainage is determined to be three and the duration of twenty work days overlaps April and May. So we place a 3 in the April column and 3 in the May column for site drainage. This is just another way of saying that the site drainage crew of 3 will be present on the job in April and again in May. We do this for all our

activities, let the spreadsheet total the months, and have thereby created a manpower loading chart.

Some very interesting data is revealed by this chart, which may help us determine whether our schedule is rational. Traditional construction manpower charts take the form of a bell curve, with less manpower at the beginning and end of the project and a peak somewhere in the middle. The example schedule above certainly does not fit the profile. We now have to ask ourselves why not. Do the crew sizes need to be adjusted? Are the duration too short? Are the activities sequenced properly?

These are not idle questions. If we cannot do the project in the eleven months we show, the general conditions we calculate as a result of this schedule will be in error. Without going through the exercise in figure 5, we may have been content with the schedule shown in figure 4, and have regretted it later.

The spreadsheet in figure 4 can be used during the preparation of the actual schedule for the project to highlight the same type of potential problems with manpower. Most scheduling programs will do the same task, of course.

Once the schedule has been produced and is satisfactory, it becomes a valuable communication tool for use with subs, owners, and others. If the crew size is correct, the duration follow. It may help if a sub sees the schedule and agrees with the duration, so that the age-old question to a sub, "Can you meet our schedule?" becomes more concrete.

As an aside, a general contractor will often want to tie a sub to a schedule in the sub's contract. While this is undoubtedly a proper thing to do, assuming the sub knows what the schedule is. Such a contractual requirement is a two-edged sword, however. The general may have leverage on the sub to meet its duration, if the overall project schedule is achieved, but the sub may have leverage if the overall schedule is not achieved, and that is only fair.

One final comment about the schedule. If a project has a number of the same repetitive activities, such as several floors which are the same or similar, it may be beneficial to create a short interval production schedule for one cycle of these activities, and having determined the duration for this cycle, place the entire cycle as one activity on the overall schedule. The cycles can then be overlapped in the bar chart. An alternate way would be to overlap the cycles in the SIPS, and use the total cycle for the activity on the bar chart. An oversimplified definition of a short interval production schedule is that it is a more detailed version of an activity which is usually to be repeated several times. A SIPS activity duration is usually much less than a normal schedule duration, sometimes measured in hours, or even minutes. But using an activity duration measured in the most suitable units will prove helpful in developing a good estimate schedule.

THE ESTIMATE SCHEDULE AND SUBCONTRACTORS

The discussion above deals primarily with the development of an estimate schedule by general contractors. An estimate schedule is of value for subcontractors as well. Subcontractors will want to be as aware as possible of a project's tentative schedule so as to be able to fit their part of the project into their own business plan.

Perhaps the easiest, and most often used, method for determining what the schedule is likely to be is to ask the general contractor(s). As alluded to above, asking the general contractor for schedule information is valuable not only to aid in planning the sub's work and thereby its bid strategy, but also to help the sub gather some additional information about the general contractor's knowledge of the job, and its intentions toward the job. For example, the sub talks to 6 general contractors about the job. Five of them have developed schedules which are relatively consistent, while the sixth is saying the job can be finished in 4 months less than the others. Is this valuable information for the sub to have?

It is, and for many reasons. The general contractor may be quoting numbers without analyzing the schedule. If the project will actually take the time being propounded by the other GCs, a subcontractor might find itself in an uncomfortable position if the sixth contractor gets the job, then runs out of general conditions money four months from completion. On the other hand, the sixth general contractor may have analyzed the job so thoroughly that it has come up with a better mousetrap, so to speak, and the sub would be well advised to find out what the mousetrap is. It may be that working under the sixth general's schedule the sub will make more profit, and the sub may thereby want to give the sixth general a lower bid than it gives to the others. At the very least, the sub must satisfy itself as to the rationale of the sixth general, and its bid may well be different to that general.

Suppose the sub asks the general for its schedule and is told that the general does not have one. Is this valuable information? Again, it is. The sub must then determine why. It may just not yet be prepared, or the general may not think it important, or there may be other reasons. But asking the question will enable the sub to probe sufficiently to make a more informed decision as to how to bid that general.

Suppose the general has developed a schedule and tells the sub what duration it sees for the sub's work and the sub feels that the time allotted is only half the time the sub thinks will be needed. Is this valuable to know? In such a case, will the sub need to adjust its bid to the general to include extra supervision and other costs of acceleration? Maybe and maybe not. But without asking, the sub is effectively robbing itself of the opportunity to adjust its bid.

It follows from the foregoing that it behooves a subcontractor to develop a schedule for its own work as a part of its bid preparation. Coupled with information the sub garners from the generals as to where its work fits into the overall schedule, this will help the sub manage its own resources, both personnel and material. A subcontractor's competitive attitude toward a job is usually directly influenced by the people it will have available to

the job, much in the same way as the general. The schedule the sub creates may not have as many activities, but the process of creating it remains much the same.

At some point the general will probably ask for sub input into the schedule, and the sub's own schedule may serve to blunt the impact of an unrealistic general's schedule. The sub's schedule for actual construction is likely to have activities, e.g., procurement of the sub's submittals and materials, that are not included in the general's schedule but are nonetheless important for the sub to effectively manage its work.

As mentioned with regard to the general's schedule, the sub's own schedule may have an impact when change orders are negotiated. It also may be an aid in the sub's overall manpower management, allowing the sub to schedule its crews more efficiently. Managing its crews as efficiently as possible is the key to maximum profitability when the sub is busy, and may be a key to survival when it is not. Another benefit to the sub's operation is to aid in determining the sub's site overhead. Many subcontractors do not calculate field overhead, they use a percentage rate. Doing a schedule and calculating the field overhead may produce some surprises.

One final benefit to a subcontractor producing a schedule for its work and correlating a specific job to its overall operation is perhaps the most subtle and the most important, on occasion. Suppose the subcontractor finds out that it will have a substantial conflict in providing its crews, due to its other work, when the general's schedule calls for them. By bringing this potential conflict to the general's attention, the sub and general may be able to change the general schedule to accommodate the conflict. This is much, much, preferable to waiting until the general schedule has progressed to the point of no return for the sub, and the sub having to scramble to find enough bodies to man the job. It is a truism, but a valuable one, changes made on paper early are less expensive than those made late with craftsmen.

SCHEDULING THE ESTIMATE

A common and legitimate complaint of construction estimators is that they do not have adequate time to adequately and accurately put estimates together. In many cases, especially for subcontractors, estimators wear more than one hat; estimating is only part of their responsibility. In the case of the estimator who works full time in estimating, the number of items which must be accomplished to successfully prepare an estimate is becoming somewhat mind-numbing. And there is the seemingly constant pressure to bid more projects in the same amount of time, and to do so to the same level of competence, thereby compounding the problem.

A observation with which there is unanimous agreement is that no one in the industry can work only 40 hours/week and do the job correctly. So when we discuss estimating we are not discussing whether there will be overtime, only how much. It is probably not possible to eliminate the overtime, but we may be both able to reduce it and to increase its productivity.

The first step in so doing may be to objectively determine how long it takes to produce an estimate of acceptable quality. This is analogous to field cost accounting, where the goal is establish historical records of cost to use as a guide in pricing future work. The industry is becoming ever more diligent in this regard, but only a small segment of it has paid attention to the cost of estimating on a unit basis. Many construction firms are unsure of how to attempt to find out.

How can it be done? In the field we decide what is produced, how we want to measure it, and structure our accounting systems in such a way as to generate the information as an everyday part of our day. The same must be done for estimating. What is the output of an estimator? Estimates. How are they quantified? The common denominator is probably dollars. The question may then become what is the cost for our firm to produce one dollars worth of estimate, or one thousand, or one million, or whatever. The cost/dollar may be significant to the company in budgeting, bonuses, and other benefits, and is a legitimate candidate for review for those reasons alone. For purposes of scheduling, however, what we really want to know is how much time does it take to prepare an estimate, and by extension, how much will it take to prepare the estimate on the job at hand?

Assume for the moment that our estimators keep records of their time spent on estimates. The most basic record is the number of man-hours spent working on a particular estimate, although the records could be broken into as much detail as desired. A company might have an estimating code of accounts and have its estimator charge their time to the various aspects of the process, for example, quantity survey, pricing, soliciting sub and vendor quotes, bidding, etc. For the sake of our discussion, we will confine ourselves to total man-hours/estimate. After a time, we will have a list of estimates and the number of man-hours required for the preparation of each. We will, upon reviewing the list, no doubt have formed an opinion as to which were done better than others, so we may want to divide the list into those done best, those done adequately, and those done inadequately. Incidentally, it is instructive to list the reasons for this latter group, case by case, to help in coming to understand what we must change to perform better.

By dividing the dollar amounts of the estimates by the man-hours expended upon them, we develop a set of statistics. Averaging the jobs, we will have an average dollars/man-hour for each of the categories we define, as well as a dollar/man-hour figure for each job, and an overall dollar/man-hour for the year to date or the period to date.

Accumulating this information for a period of time will enable us to come to some understanding of our productivity as estimators. When the productivity is low for a period, we will be able to investigate why this might be so, and to make some changes in our system or personnel so that it does not reoccur. Conversely, when the productivity is very high, we may surmise that our estimators are not doing as thorough a job as needed, and again we can investigate why.

These statistics help us control the output of our department, but they are equally as effective in helping us prepare the estimate at hand. If we can predict the value of the

work we are looking at, we can easily determined how long it will take us to put together the estimate. Suppose our stats tell us that it requires us 10 man-hours to prepare \$100,000 worth of bids, and this job is a million dollar job. It will take us 50 hours to prepare the estimate. Do we have the time? Who will work on it? When is the estimate due? If it is due in three weeks, our decision about how it must be done is different, in all likelihood, than if it is due in three days. Do we have adequate staff, or must we supplement our staff? Do we have time to do an adequate but not superior job, and is that OK? Is the job so important that we must work twice as much overtime to get it done, and what will be the risks of the extra overtime in terms of mistakes caused by fatigue, employee burnout, etc.

If adequate time is available, the efficiency of estimate preparation can be enhanced by developing a complete checklist of items which must be done in estimate preparation. This helps to insure that all the necessary steps are taken without the estimator being required to keep all the steps in mind. For the peace of mind of the estimator's superior, a periodic review of progress in completing the estimate is helpful, both for the superior and the estimator. A final review of the estimate by all management is also helpful, both to "see with another set of eyes" and to insure that all the team is in accordance with bid strategy.

It is also helpful if the estimator has the requisite tools at hand to aid in efficient estimate production. These may vary from company to company, but they may include a computerized estimating system both to aid in quantity survey and pricing, and to minimize errors in pricing extensions and addition. Some estimating systems have the checklists for various construction activities built into them, and are thereby more useful. They may include pricing data banks, digitizers for more rapid quantity survey, automated bid solicitation systems, etc. There is a cost associated with all these tools, of course. But the analysis of the decision to purchase them should be based not only on the time they will save the estimator, but also on their impact upon the quality of the estimate produced.

In addition to the foregoing, the estimator must objectively determine ways in which he or she can become more productive. Some possible ones are discussed in the article "Time Management for Estimators" also available on our website.. Some of them bear repeating here.

1. Isolate yourself from outside interference during your most productive estimating time of the day. Estimators will recognize times of day when they are more productive than others, so cut yourself off from the outside world, except for legitimate emergencies, during those times. This is especially true of isolation from the telephone. Have your secretary or receptionist take messages for you to return later. You will find that not only will your estimating time be more productive, so will your phone time.

2. With regard to the phone, keep a log of the calls you make for a week -- the subject and time of each. You will undoubtedly find that with proper care you can reduce your phone time substantially while remaining as effective. Remember, every

extra minute you spend on the phone is probably an extra minute you add to your overtime.

3. Have the appropriate space in which to work, which is to say, enough space, quiet space.
4. Look for ways to improve that are specific to your job. Remember, the time you can save will benefit you directly.
5. Develop a set of standard documents you use in your preparation, for example, quotation letters, and modify them for each project. Use forms on your computer, like the spreadsheets above, and only modify them as needed.
6. Finally, and most difficult, learn to say no. Some bids are better left alone, given the particular set of circumstances you face at the time. An inadequately prepared estimate, mistakes due to rushing too much, fatigue, etc., can be a financial disaster.