RALPH J. STEPHENSON, P.E.
CONSULTING ENGINEER

June 20, 1978

Subject: Consultation with Tuttle White Constructors staff re project planning, monitoring and control systems (PPMCS)

Dates of meetings: Monday, Tuesday, Wednesday, June 5, 6, 7, 1978

Mr. Koon and I met on Monday, June 5, 1978 to continue discussions regarding evaluating and critiquing the planning and scheduling process being used and to be used at Tuttle White Constructors, Inc. The information below is given as a brief review of each point covered in our agenda material. The discussion items are arranged at random and numbered for ease of reference.

From this material Mr. Koon will continue to prepare and implement procedures and methods which can be incorporated into the planning and scheduling work of Tuttle White Constructors, Inc.

On Monday after setting a random agenda we began our detailed discussions by reviewing a procedural document Mr. Koon had prepared entitled Steps in Scheduling by CPM for TWC (I dated this June 5, 1978). The observations below are identified by the paragraph headings used by Mr. Koon. In some cases I suggest the heading be changed and this is discussed as a part of each point.

1. Successful low bidder or job confirmed

It is assumed that the planning and scheduling process begins only after TWC has obtained a job by being the low bidder or by negotiating and having it confirmed. In general, this is a good starting point but frequently network techniques have value before this point. For instance, it is becoming quite common to prepare summary diagrams during the bidding or negotiation period. There is a planning expense incurred, of course, but the effort helps clarify how a job can best be acquired by isolating and identifying problems and opportunities before negotiations actually are completed.

It has been my experience in recent years that selective prebid summary diagramming is extremely valuable and quite often can be a major deciding factor in awarding a project. In addition, good planning has useful sales value, particularly in private work where through negotiation a job may be obtained even though the quoted price is not the lowest. Here the network model can tilt the scale in favor of the firm who prepares a workable plan of action.

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Another value of early networks is that in the event of claims or claim prone situations on acquired jobs, the early network conclusively shows intent. This is a critical part of proving damages when changes to sequence or changes to the processing of a project become necessary through the actions of others. At this time deviations from the procedure originally intended can be the basis of proving either in arbitration or in litigation what impact was felt.

My summary comment on this paragraph is that there should be no locking into place by policy of when a network study should be prepared. Each project and each network should stand on its own set of conditions.

2. Study plans

This is a critical part of the entire planning and scheduling process and should be required of the project manager, the superintendent and of course, the job planner and scheduler. Planning a project with network systems usually requires selective inspection of the contract documents, particularly when time is limited. I find a quick run through of each sheet in the entire working drawing set is helpful to get an overview. During this inspection unusual building configurations should be identified, non-standard notes studied and key sheets noted such as finish schedules, reflected ceiling plans, building sections, unique framing situations and locations of underground plumbing. Potential interferences should be noted in above ceiling work between sheet metal, sprinkler piping, plumbing and light fixtures.

Phasing of field work where major succeeding operations can proceed profitably based upon previous work is usually formulated in part during the study period. An hour or so spent identifying important milestones when making a summary review of the plans and details can often repay many times over the time spent in early study.

Once an initial inspection of all of the drawings has been completed, it is wise to then look at the structural system, the exterior wall details, the finish schedules, the architectural floor plans and drawings of above ceiling piping, fire protection and sheet metal ductwork. Also, underground plumbing usually has a sizable impact upon how the slab on grade work is to proceed in the building and should be given careful consideration, particularly when working in areas where weather conditions can cause delays to slab on grade construction.

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The initial review is one that should be done individually by each person participating but it also is suggested at the first diagramming session to make a quick tour of the working drawings with everybody present to identify key sheets and key points. It sometimes is helpful to note the numbers of key sheets such as finish schedules, structural plans or other such frequently referred to documents so time can be saved in locating information as diagramming proceeds.

During the initial review it is often wise for the planner and scheduler to prepare a random laundry list of each item to be done as he goes through the initial study. This laundry list can be expanded when the job is reviewed with the superintendent and project manager. I find a scope of work checklist is very helpful in giving an easily referenced format to record the random laundry list items.

A copy of the scope of work checklist that I use is attached (see attachment A).

3. Logistics meeting

It was the intent of Mr. Koon in preparing this section of his memo to describe an additional discussion period to go over the actual logistics of the job and the major plan of attack. I recommend, however, that the period of time from the start of a diagramming session to the point where you are preparing network plans be kept just as short as possible. Usually I try to start diagramming a job within the first one or two hours after beginning detailed discussions with those concerned. This would correspond to the second thumb-through of the drawings mentioned in 2 above.

By starting quickly on the planning process once the laundry list is partially or totally prepared, the project is kept fresh and interesting to the people. Whenever a job is hashed over many times orally before beginning diagramming, it tends to become stale and those participating tend to lose interest. Since generally there are several people involved in diagramming sessions, it is mandatory that the planner and scheduler maintain a high level of enthusiasm and interest among all concerned if he is to obtain the best of their thinking. It should be constantly kept in mind that there are collective activities (where many are needed) in planning a job as well as individual activities (where one makes the decisions). Those activities that are collective in nature should be organized carefully, an agenda

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prepared, preferably written, and as a general rule, time limits should be placed on the planning conference. I have found that if I feel the meeting should be a four hour session and we wish to complete diagramming on through erection of the structural frame that it maintains better meeting morale to convey this in a pre-meeting agenda. Frequently it will be found that the enthusiasm will run high and that diagramming can continue past the time limits set. This is a bonus and an excellent situation.

During the meeting when discussions of logistics occur, it is very important to identify the project organization, the decision-makers, the administrative processes for issuing the network and acceptable procedures for monitoring. The discussion should be somewhat uninhibited and if conclusions can be reached, they should be put directly on the network model rough sheets. Later, if appropriate, they can be reduced to memo form if so desired.

It is psychologically wise to always allow a fair amount of latitude to change decisions made in these early sessions. At some point naturally the decisions have to be firmed but allowing prerogatives and mind changes in early sessions will usually stimulate more discussion and will allow a better examination of alternates uninhibited by the threat of prematurely firming up a decision. The objective is to keep the early thinking as loose and as creative as possible so as to combine ideas (synergize), rather than to harden them into a final position prematurely.

The early network meetings should be structured loosely so as to encourage bringing forth ideas, both good and bad. Then after the ideas have been looked at, the judgmental process can be applied which allows you to make final or relatively final decisions.

Being prematurely judgmental will severely inhibit good planning.

4. Rough draft of logic

I suggest this rough drafting of the logic be combined with the logistics session and the latter phase of studying the plans. Mr. Koon stressed the need to have field personnel to give the work credence - I thoroughly agree without qualification. The

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logic plan is one that must spring from those people who are going to manage the work. Without their participation, the plan is merely an imposition which may or may not correspond to the way they actually intend to proceed. Thus, a network model prepared without adequate field involvement oftentimes works only when there is an accidental correlation between the planner's thoughts and the field manager's thoughts.

It is wise during this phase of the work to establish all important intermediate milestones such as the close-in point, the provision of temporary power, when heat or other environmental control is necessary and of course, when specific occupancy points are to be made.

The rough, random laundry list should be used as a comprehensive checklist to insure that all tasks are incorporated into the sequence prepared during the rough draft period. Questioning during this period is very important and use should be made of the direct, the overhead, the delay and reverse questioning techniques. The direct question is asked specifically of a person; the overhead question is asked of the group in general; the relay question is one asked from the man asked to some other individual, with the reverse question being a similar question being asked of the questioner by the one being questioned.

Effective use of questioning techniques is critical in identifying planning needs. Adequate time should be given for responses to questions so that people are not leveraged into positions with which they do not agree.

Care should be taken during the diagramming process not to dwell on minor points too long. Maintaining a proper priority balance of attention to the various elements of the planning will insure that the diagram is completed without boring or unduly wearing out your diagramming welcome with those involved in the meeting. This is particularly true when there are outsiders at the meeting who do not participate in every phase of the work.

During the rough draft period, it is oftentimes wise to have subcontractor managers involved. I personally prefer to work with the project management staff of the subcontractor, allowing him to obtain the necessary input from his field personnel. The only reason for this is to keep down the people involved in the diagramming sessions. In a general contract arrangement,

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usually the first 2 to 4 hours of diagramming are best done with the general contractor staff only. Subcontractors should join the meeting at a later point where their information becomes of importance. If a subcontractor desires to be present at the meetings, it is generally to be encouraged, rather than discouraged. Good subcontractor performance is generally obtained by involving them in the early planning process. Decisions as to which major subcontractor should be invited to the planning session should be a function of the planner and the general contractor project manager.

At the rough draft session there should be a clear understanding about approvals of the logic plan. If key people are present during the diagramming process, it is assumed that they approve the network or else they make comments and request revisions as the planning proceeds. Thus, at the end of any rough diagramming session, there should be assumed approval of the logic unless qualified. I generally find that it is of help to put in heavy black lettering on the early logic plans preliminary - for study. This gives the official option of network plan review to those participating.

It is important also to assign an issue number to these early networks, to number the sheets and above all, to date them. In addition, all abbreviations should be lettered on the sheet, responsibility codes should be clearly identified and general amplifying notes provided where needed. It is normally desirable in these early meetings to identify those attending. I usually try to do it by listing them on the network drawing itself. However, quite frequently, it is helpful to prepare a short memo once the meeting is completed, summarizing who attended, the actions taken and making provision for future approval sessions or diagramming meetings. This followup is useful to both in-house staff and external participants on the job.

During early diagramming sessions I usually try to make a preliminary assignment of durations. This allows a quick pass-through computation of early starts and early finishes to give an idea of the time scale involved. It is valuable even though the durations are to be revised later along with the logic in subsequent meetings to have an initial assignment to provide a scale of time needs to everyone concerned. If the

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preliminary critical paths of network calculations show an excessively short or excessively long period of time, it indicates a restudy of the logic and durations is necessary. Calculating the network manually establishes the immediate needs more clearly in the minds of those who are to run the job.

It is wise to assign durations only after a major phase point has been reached in the logic. For instance, it is frequently helpful to diagram foundation work and erection of the structural frame and then to assign durations and calculate early starts and early finishes. This gives a good look at when exterior skin work can be expected to start. Sometimes the work is carried on through to close-in in the logic before durations are assigned and then, of course, it is possible to identify when interior rough and finish work can begin. Durations should not be assigned as the logic is prepared.

It is important to allow those participating in the meeting the prerogative of reviewing their work and suggesting revisions or changes prior to putting the diagram into final form. The good diagrammer also sets deadlines on when such comments are to be given. Thus, when the rough draft of the logic is completed, it will contain all the data needed inciuding durations and calculations to make a thorough evaluation of the simulation intended by that model.

5. Redraft network - (logic plan)

Final drafting of the network can often be dovetailed with preparation of the rough diagrams particularly where there is a need to issue the network quickly. By the time final drafting is in work, the rough logic and durations should be totally approved by all parties. The final draft copy should then not be significantly different in content from the rough logic plan.

I recommend highly that the rough plan contain all of the key elements, issue number, dates, abbreviations, responsibility codes, general notes, title block, job number, job identification and node numbers that are to appear in the final draft.

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The reason for this is that the rough issue is an extremely important base document and if properly done, can serve as the interim planning tool while the final draft is being prepared. Many times I will have my computer input prepared from the rough diagram and then checked against the final drafted network. This is a good cross check procedure and insures the rough plan has been properly converted to a final drafted copy.

An integral part of each final drafted network should be the task key identifying the various elements of the arrow and the data that are used. In addition, where color coding is used, the colors should be identified on the final drafted model.

6. Review logic plan

By now the reviews necessary should have been made of the rough draft logic with durations assigned and calculations manually done. Therefore, there should be no need to again review the final draft copy prior to its issue.

7. Add durations

Normally durations have been added during the rough logic period and should not be necessary to redo except whenever minor corrections have been suggested subsequent to the final review of the rough logic plans.

Mr. Koon noted that if money is to be added to the network, a listing of activities should be made now and the dollar amounts assigned. This is a convenient point to make the final assignment although during the review and approval of the rough logic plan there is no reason why costs cannot be assigned directly on the tasks at that time. If cost data is to be kept confidential, insertion of costs should be on a sepia of the rough logic. Distribution of this document can then be controlled.

8. Number nodes

Node numbering is usually best done at the close of a rough logic plan preparation period. This allows a complete tying in of the network. It also permits early preparation of partial computer input if desired.

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9. Make final tie-ins

Major final tie-ins should have already been prepared in the rough logic preparation. I recommend these major tie-ins be done very early so they are not forgotten or overlooked as the network is processed.

Generally major tie-ins deal with policy matters and thus, it is best to accomplish them while the full project team is working on the logic.

10. Manual forward pass

Making manual computations, particularly of early starts and early finishes is invaluable in getting a hands-on feeling for the job and in giving an immediate usable, rough logic document. It should be done when major phases of the work have been planned and durations assigned.

It is also helpful to make a backward pass identifying the critical path through the network. This can easily be done once early starts and early finishes are computed.

11. Final review and revisions

This is best done to the preliminary rough logic plan with durations assigned and calculations made.

* * * * * *

From the above discussion it can be seen that preparing a good network model consists of the several steps:

1. Determine when the diagram is to be prepared.

2. Study the plans and specifications carefully.

3. Prepare the rough preliminary network model including the logic, geographic codes, responsibility codes, durations and early and late start and finish manual computations in working days. If possible, nodes should be numbered on the rough diagram.

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4. Review and approve the network by those affected.

5. Final draft the network.

6. Prepare computer runs.

Note: Items 4, 5 and 6 are sometimes done concurrently with completion of step 3.

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12. Computerized networks

The input can be prepared by relatively untrained personnel. However, I recommend that checking the computer run against the network model be a responsibility of the planner. In my work I make use of three checks - these begin once the first computer run is prepared. This basic computer run is a node sequence containing all tasks and all dummies.

Checks are made as follows:

a. The computer run is compared to the rough or finished network for a correspondence of the node numbers, the task responsibility codes and the task durations. Generally descriptions and geographic codes are not checked in detail at this time. Dangling or free end task errors are corrected as identified by the computer run. Loops must be located although I suggest looping be minimized by careful attention to the node numbering and logic preparation.

b. Revisions are made as required by the initial check described in 'a'. This then should provide a close-to-correct set of computer calculations on early and late starts and finishes.

The next check consists of spot dating tasks in the logic model and comparing these to the early start dates contained in the node sequence computer run. By making such progressive spot dating checks through the network, errors and their locations can be determined quickly by a bracketing process. I reviewed this in detail with Mr. Koon and showed him the technique.

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b. (continued)

It should be kept in mind that this check is only for early starts and early finishes. Late starts and late finishes are automatically set either by the natural logic or by the imposition of end time restraints (ETR's).

c. Once a final computer run has been made, I recommend the graphic network model be dated. The process for doing this usually encompasses obtaining a reverse sepia of the final drafted networks and manually printing the early and late starts and finishes at each node on this network. Thus, the actual logic plan displays all key data contained in the computer run.

Frequently it is found that field managers and others prefer to use the dated model rather than the computer run. Others, of course, prefer the computer printout. Full options should be given to all those who participate to use whatever translations and documentation best fit their purposes.

The third check occurs as the network is being dated since discrepancies sometimes are found that were not seen earlier in the checks described in 'a' and 'b'.

Check 'a' can be made by the person preparing the input with some guidance by the planner. Check 'b' can be made by the planner or by someone who is reasonably familiar with network systems. Check 'c' is usually made by the person drafting the network in final form as he or she dates it. By following the checking procedures, it has been my experience, mistakes will be minimized although not necessarily eliminated. It is important to minimize errors so as to maintain a high level of credibility of the network with all those who must use it.

13. <u>Distribute network and printout</u>

Proper distribution of network models is important since those who need them and use them should have full access while those who are only marginally concerned may not wish to have copies of all translations.

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It is always good to provide a network to anyone with whom there may be a liability involvement. On most projects the general contractor should distribute the network to his project staff and if purchasing is involved, to them. Copies should also be sent to major subcontractors who occasionally may request additional copies to send to their major suppliers and contractors.

The architect/engineer should normally receive a copy and of course, the client should have a copy. I suggest that supplying the architect/engineer and the client with copies be done automatically. Generally if the network is well conceived and straightforwardly prepared, it is wiser to broaden rather than restrict distribution. Each project is unique in its characteristics and should be handled on its own merits.

Where computer runs are coded so responsibility codes are identified, it is possible to make selective runs wherein each trade or each contractor is given a printout with his trade alone on it. This is good general practice but if there is the possibility of claims or a liability disagreement, it generally is better to give subcontractors full data runs. Selective runs are often taken out of context and misunderstood, particularly in relation to unidentified restrains applied to the selective tasks and the restraints that these tasks, in turn, apply to others of other trades.

14. Conduct job monitor

Monitoring is probably one of the most critical elements of the entire network control system. A full book could undoubtedly be written on the monitoring process and Mr. Koon has touched on some of the more critical elements in his brief paragraph on the subject. A few additional points to amplify his statements:

a. Monitoring should be on a regular basis which may vary throughout the job life.

b. In my opinion the original logic is best not altered, nor should durations be changed as a routine monitoring practice. I have found it best to maintain an original standard of performance and attempt to bring the project back into line with that standard of performance when minor deviations occur.

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b. (continued)

If it is decided that the logic plan or durations are no longer valid, the network should then be updated. However, this should be done only when there is little, if any, possibility of recapturing the original logic sequencing or duration targets.

c. Formal monitoring should basically be done by other than field personnel, hopefully by those who can take a purely objective and skilled view of the monitoring process and be constructive and knowledgeable in helping solve problems and analyze deviations.

Every monitoring should be recorded by a monitoring report, the format of which I discussed in detail with Mr. Koon. The monitoring report should be a document that discusses all situations that might require later reference in problem job resolution. It should be remembered in legal situations these often become extremely important.

d. The program to be used for processing networks in-house by Tuttle White provides a vehicle by which monitoring can be done either on site or remotely. The computerized project status report technique is an excellent method of monitoring and has been used successfully by me for several years. It compares present project status against the constant standard of performance and thus, gives a method by which trending on the job can quickly be analyzed.

I shall discuss the use of these reports in more depth with Mr. Koon as the Tuttle White program is brought on line.

15. Update network when necessary

Mr. Koon's analysis of this process is good and requires very little additional commentary. The major philosophy behind updating is that the point where the job no longer can be brought into line with the projected plan is the time when an updating should be done. At any other time efforts should be made to realign the actual progress of the project with the original plan of action.

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16. Historic record

Mr. Koon's brief description of this is complete and I feel he has the matter in proper perspective. Valuable data can be obtained from the network for use in future planning processes and the network model should be made a part of the permanent job file.

* * * * * *

Mr. Koon had several questions concerning the use of the computer in processing network diagrams. These are addressed below in a continuation of the numbering system used for the major points above.

17. How can we cut down on the quantity of printout material from the computer without losing effectiveness?

There are five basic printouts - the node sequence, early start, late start, late finish and total float. Each has a place in using the network system. The only printout in which the dummies appear is the node sequence which is also the master sequence.

In my processing of networks I transcribe the calendar dates directly on the network model from the node sequence. Therefore, it is not actually necessary to issue a node sequence for job use.

In the early start/late start/late finish and total float sequences dummy restraints are eliminated since they are of no interest in terms of specific data. Therefore, bulk is cut down considerably in these runs.

Relative to the value of the runs, the early start sequence is normally used most by field personnel as a checklist. Also, it is valuable in that it sets the early dates and prevents thinking patterns from becoming too lazy relative to getting the work done. I suggest it remain a standard part of the printout. The late start sequence is a very valuable monitoring run and I strongly suggest that it also be made a standard part of the total run.

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Information contained in the late finish sequence can be abstracted with some small difficulty from the late start sequence. However, it is an extremely valuable document in that a direct comparison of late finishes can be made to pick up tasks that have started but have not completed within the given monitoring period. It is a sequence that could be eliminated but generally is valuable, particularly to the direct field manager.

The total float sequence, I find, is very seldom used in the field and is primarily given to those who are interested in knowing what a critical path is and how to identify it.

From the above brief analysis, it then appears that the node sequence, total float sequence and perhaps the late finish sequence could be eliminated from the standard issues. This, coupled with elimination of dummies, would reduce the bulk of paper work considerably.

If a project status report system is used, the automatic comparison of tasks with their late start/late finish (or early start/early finish, if desired) is done by computer and therefore, the manual comparison may not be necessary. However, there is still a hands-on feeling that is best to maintain with networks that can only be achieved by having the actual printouts in hand and being used.

An integral part of being able to use the printouts, as noted above, is to have the early starts/early finishes, late starts/late finishes put directly in calendar dates on the network model. I do this on most of my projects presently and find it is a great help in insuring higher utilization of the network system. I showed this technique to Mr. Koon during our session.

18. Can the computer cut off sorts at an earlier date than project completion?

The intent here is to provide to the user of the network a sort not for the full project life. I have never had occasion to do this in my own work and therefore, cannot speak from any experience. However, I have found that almost invariably when considering a network model analysis, it has been best to have the full network in hand. It would not seem that cutting off the run at a selected point saves much trade off bulk on a normal diagram.

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Generally I recommend the full printout always be issued, particularly early start/late start and late finish runs. Of course, for the node sequence and the total float sequence the full run must be issued since these are not time listed.

19. How is the network planning data best provided to the various parties using the model?

This is a complex question and gets into the area of translations. Translations are conversion of basic network information (early and late starts and finishes, float times, costs, durations, codes, etc.) into a form best used by each party.

The general approach I have used in my work is to give all concerned the base document package. This consists of the dated network model and the five standard arrays in the computer printout generally bound in a letter size folder. From there it is normally the user's responsibility to make whatever translation of the data he may wish.

Translations can include bar charts, slant charts, purchasing schedules, tickler files and any of several others that depend only upon the ingenuity of the user for application. Occasionally a party to the project will require a selective run showing his trade or duty or responsibility only. I recommend this be done if it is requested by the user. Again, it is best to provide more data than needed and let it be weeded down, rather than provide inadequate data and have to build up to it.

Each case is individual and I suggest conferring with the user if there is a feeling he is receiving redundant data. To summarize, I recommend that all users receive a full set of runs but that selective runs be provided upon request. Thus, the user has the option of discarding the full set and using the selective set if he wishes.

20. What sorting capabilities does the new program give?

It provides all the conventional sorts - node sequence/early start/late start/late finish and total float. In addition, selective runs can be made by responsibility code or area. Additional sorting by various identification codes should be available as needed.

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21. How do we best train and educate?

Mr. Koon and I discussed the potential need for additional in-house training and education which may result from the new program being used. I recommend we evaluate this very carefully since many methods of training and education can be used. Internal coaching on actual projects is one good technique. Formal class sessions are another. And there are several variations that should be studied before embarking upon such a training program.

I shall review this matter in detail with Mr. Koon and whomever else he wishes to have involved. Out of these discussions we will prepare a training outline to assist Tuttle White in bringing their entire staff up to a desirable level of performance in network planning.

22. Summary diagramming

There are three basic levels of networks, the first of which is the summary diagram; second, the working diagram and third, detailed sub-networks of a special nature. The first of these - the summary diagram - is usually prepared early in the project life. It attempts by broad groupings to display the interrelationship between all elements of the project. As a general rule, the summary diagram can be prepared rapidly and oftentimes is used as a preproposal plan of work. Although the concept is relatively straightforward and application is simple, actual preparation can get quite complex. I have discussed the summary diagramming technique with Mr. Koon, and I recommend we continue our discussions at our future sessions.

23. Front end work

Identification of non-field construction activities sometimes called front end work, or detailing, approval and delivery work (D series) is proving to be a very critical and influential part of every construction project being launched today. The reasons are many but essentially they all deal with the increasing numbers of people, agencies and organizations involved in the monitoring, regulatory and implementation processes. Identification of front end work, particularly submittals, reviews and approvals, fabrication and delivery, is the responsibility of the project planner and scheduler, along with the project team.

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I have recently tended toward keeping all front end work on separate sheets with unique sheet numbers (usually prefixed with an F or D). I recommend Tuttle White engage in an ongoing evaluation of their front end work and as new jobs are brought on line that a standard checklist of front end elements be prepared.

I reviewed the nature of front end or D series work with Mr. Koon and gave him the data needed to look into this material in further detail.

24. New computer program material

We briefly discussed the capabilities of the new program now being rewritten for Tuttle White's computer equipment. I talked to Mr. Richardson who had provided the material to Tuttle White and he said that contained in the program are the regular critical path calculations, the data for converting to a bar schedule from the basic network - this is, I believe, in both early and late starts and finishes - and the full project status reporting system.

This latter program is very good and when used properly can be a powerful tool to effective monitoring and control.

25. Networks as a sales tool

Network modeling is being used with increasing frequency as a sales tool. The prebid or pre-negotiation network model often will highlight the abilities and talents of a firm in a way that cannot be demonstrated by any other technique.

The summary network modeling form is especially useful since it can be prepared rapidly and usually gives enough data to show interrelationships between major sectors of the project. In addition, where complex move-ins and move-outs are required such as in institutional remodeling or in other large facilities where progressive shifts in space are to be made, the sales diagramming process can help point out to the client the needs for expert attention such as can be provided by companies like Tuttle White.

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26. Maintaining original network identity

Mr. Koon mentioned that oftentimes when a network is updated that the relation between the updated network and the old network becomes obscure and sometimes disappears. The linkage between networks can be maintained by keeping the original standard of performance as a measuring tool until it can no longer be used as a standard of performance.

At that point it is updated and a new standard of performance issued with a new issue number. Thus, both the original and the updated networks are related in that they are used in the same manner to measure job status.

There is no need in this case to maintain any specific correlation between the two except knowing that the later issue supersedes the earlier.

27. The afternoon of June 5, 1978 Mr. Brian Cline, Mr. Chris Blazik, Mr. Koon and I discussed the network planning computer output form. We reviewed each heading and established preliminary recommendations for space assignment. Referring to the present Tuttle White printout headings, a brief discussion of our meeting is given below for each of the headings.

a. Bid item

This column will be retitled and used for miscellaneous codes. The name is to be selected by Mr. Cline, Mr. Blazik and Mr. Koon - 4 spaces allocated.

b. i node - 4 spaces allocated

c. j node - 4 spaces allocated

d. Estimated duration - 3 spaces allocated

e. R/A duration - after considerable discussion it was recommended this column be deleted since it apparently sees little present use.

f. Total dollar value - 5 spaces allocated

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g. Percent complete - 2 spaces allocated. It was decided here that the two spaces could accommodate all percentages complete if 100% was designated by a unique alpha pair.

h. Value to date - 5 spaces allocated

i. Description - 30 spaces allocated. There is additional capacity in the printout form, however, it was decided not to use the full line space capacity since it takes up disk storage space that can be better used for other functions. It was pointed out by Mr. Cline that the description can go to two lines if necessary.

j. Responsibility codes - 3 spaces allocated

k. Plug or actual start - 7 spaces allocated. It was decided that all dates would be given with alpha numeric, same as presently printed. This would include two spaces for the day, three spaces for the abbreviation of the month and two spaces for the year.

l. Plug/actual finish - 7 spaces allocated

m. Early start/late start/early finish/late finish - 7 spaces allocated for each. The printout is to use alpha numeric.

n. Total slack - it was suggested this heading be revised to total float, 4 spaces allocated.

The present system prints out a negative float if the project is behind and the current dates are inserted. This feature should be kept in the program but I recommended to Mr. Koon that we adopt a project status report system that measures against the standard current issue and states the number of days lag over that issue in a separate brief report. This has the

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advantage of maintaining the integrity of the standard of performance. Updating then is only done at infrequent intervals when the original logic plan no longer can be used. Use of this approach also reduces the amount of runs necessary because the monthly run is merely a listing of tasks that are to be accomplished during the succeeding designated period and identifies those tasks that are lagging. Varied arrays are not necessary.

o. Free slack - it is recommended this column be deleted.

Mr. Cline and Mr. Blazik are going to proceed based on the above to draw up a format for review and approval or comment by Mr. Koon and his management. It is very important that before the full program be written and tested that everyone is in agreement that it is the proper form and the proper sequence. This review and approval are critical and should be done by all responsible members of the Tuttle White organization involved in the planning, control and monitoring process.

28. Considerable time was spent with various members of the staff discussing the concept of monitoring projects. Monitoring is a rather complex procedure and it was discussed briefly back a bit in reviewing Mr. Koon's memo.

Essentially in the project process, it is desirable to combine the functions of excellent planning, simple but complete documentation and translation of the plan into usable language, all of which allows intelligent and positive evaluation of work progress against the desired model, giving an excellent management and control system over project activities and resulting in a profitable project, satisfactorily done so it is a credit to Tuttle White.

In working to a system of this type, we are faced with approaching a third point, namely, monitoring and evaluation by some technique that will insure full utilization of the good plan and the good translation. By translation it should be understood this could be computer printouts, bar charts, slant charts, purchasing schedules, item processing schedules, narrative schedules, cost histograms, manpower histograms, cumulative use curves, lines of balance and other such devices. These are all useful in interpreting the basic non-scaler quantified network.

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The monitoring process makes use of the documents described above, usually those preferred by the individual or group responsible for monitoring. Monitoring strives to be objective and take into account that the project team has to be an advocate of their project while still recognising that deviations from an accepted and approved plan of performance (commonly called problems) are inevitable in almost any construction program.

The purpose of monitoring is to regularly evaluate the job so as to insure that potential problem areas are identified and corrected by good management before they become catastrophies.

Also, it is for the purpose of identifying potential legal problem areas and hopefully to avert them but if this is not possible, to fully identify and report them so loss situations do not occur by claim or other method of settlement.

Monitoring consists of a black and white analysis of the mathematics of the model saying this task is so and so many days behind late starts or late finishes or it lags early starts/early finishes by such and such an amount. The monitoring process then moves from pure black and white data into grey questioning areas such as - is the task a part of a desired logic sequence or a necessary logic sequence? As such, is it actually behind or is it merely causing a temporary dislocation that already has been taken care of by bypassing the logic? Is it a heavy impact upon the completion dates or the major milestones of the project? Is it something that has to require immediate management attention? If it does require attention, what courses of action are available? (Here, for instance, it may be desirable to generate a decision tree to indicate various alternatives .)

The monitoring process should result in a monitoring report which contains a statement of the raw data and an interpretation of the raw data. I went over suggested monitoring report formats in some detail with Mr. Koon and he has available to him examples of what constitutes a typical monitoring situation.

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Monitoring should be both qualitative and quantitative, with the qualitative process using the quantitative data to obtain a true picture of the job. Generally it has been my experience that the project team, both field and office, will cooperate fully in a competently run monitoring situation. Naturally there is a desire to make the project appear to be in good shape even though there may be some deviation from the model or standard of performance. The good professional, competent monitor must take into account the needs, desires and abilities of those who are managing the project in making his evaluation.

I suggest that the monitoring process evolve out of Tuttle White's new project planning monitoring and control system. I am presently working to that end in the training and education being done with Mr. Koon. It would be wise to review the training and coaching content occasionally with top management to insure we are moving in the right direction.

I recommend that regular monitoring of the projects be instituted by encouraging job visits on a regular basis to make the comparisons needed. We went through some typical monitoring frequencies and Mr. Koon has a copy of our discussion notes. We also went through the procedures for preparing to monitor and the method by which the actual inspection process can best proceed.

It must be continually kept in mind that the objective of the monitoring is to improve project performance where needed. We will continue discussions of monitoring processes in our subsequent meetings.

29. To prepare for our next conference, I suggested to Mr. Koon that he establish in conjunction with the Tuttle White staff an agenda for the working sessions. This will permit him to plan his agenda items effectively and help the work move more smoothly.

It would be wise to cover the summary diagramming technique at least in part at our next session since it has proven to be a very good method of early diagramming complex projects to establish overall patterns. Also, I would like to discuss front end work in more depth since it is here that many claim prone situations begin.

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I want to thank the Tuttle White staff, and particularly Mr. Koon, for their courtesy on my recent visit and am looking forward to the next trip to Altamonte Springs. I shall be in touch with Mr. Sutton shortly regarding this trip. It probably will be scheduled for sometime in mid or late July 1978.

Ralph J. Stephenson, P.E.

RJS
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To: Mr. Curtis Koon

cc: Mr. Tommy L. Sutton
Chief Estimator

RALPH J. STEPHENSON, P.E.
CONSULTING ENGINEER

SCOPE OF WORK CHECKLIST ITEMS

1. Conditions existing as of the defined start of project work.
(Permits, contracts, easements, obstructions, pre-ordered materials, agreements, etc.)

2. Front end work
(Work involving permits, contract documents, procurement, detailing, fabrication, deliveries, approvals and other non-construction project items)

3. Off-site work
(Work outside the project property line that has a direct influence and is of importance to achieving project goals)

4. Site work
(Work outside the building line and within the property line or contract limits)

5. Substructure
(Footings, foundation walls, piling, caissons and all related work which transmits loads to the sub-soil)

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6. Superstructure
(All structural items which directly or indirectly transmit building loads back to the substructure)

7. Exterior skin
(All work to close the building to weather)

8. Interior rough work
(Interior work which can be totally or partially exposed to weather)

9. Interior finish work
(Interior work which must be partially or totally protected from weather)

10. Systems work
(Work which collectively makes up a total operating unit and can be identified as a separate work project from other project elements)