

Project Risk Reduction

Using Project Management Modeling Tools to Quantify, Analyze and Reduce Exposure to Risk

Some project histories are very complex and traditional schedule and damage analysis methods are not able to quantify the impacts of events that have occurred over the life of the project. In these situations MDC has relied upon more sophisticated mathematical and system based models to attribute impacts to particular events. The usual methods of determining and reducing risk on construction projects include schedule forecast, cost forecasts and change review analysis performed by the project team. However, sometimes these techniques do not allow for an overview that properly adds the effects of many individual events. On these occasions the project team needs more powerful and sophisticated tools that can include multiple project factors including resource availability, site conditions, environmental factors and productivity levels for both planned and actual conditions on the project to date, all factors that cannot be completely comprehended by the project manager without the aid of analysis.

MDC Systems has successfully used a computerized modeling tool called Project Management Modeling System (PMMS) to analyze and quantify impacts involving a large Middle East refinery renovation and expansion project. PMMS was developed in the late 1980's in conjunction with MIT in Boston to model large complex, multi-phase design and construction programs and forecast the effects of changes and impacts to the work.

PMMS can quantify the indirectly affected components of a project that were influenced by a specific known change to a project. One example of this is a late design change where the owner is willing to pay for the direct change only. PMMS allows you to examine and quantify the indirect effects caused by out-of-sequence work, lack of available drawings, and lack of available manpower. The program requires the user develop a computer model using various inputs from the project plan and as-built data. Once a computerized model is developed, the known change orders are systematically added back into the model. After the project data is loaded and the model is calibrated, the model then determines the allocated impact of the events on the cost and schedule of the project. Calibration consists of adjusting the preset average model values for various conditions of a construction project. Some of these included craft availability, worker moral, skill level of the workers, and quality of drawings. The model is especially good at quantifying each "ripple effect" of simultaneous events and changes. Some of these included:

- Effect of numerous change orders
- Effect of craft availability
- Effect of overtime on craft efficiency
- Effect of craft overcrowding
- Effect of out of sequence work
- Effect of worker moral

- Effect of late engineering
- Effect of late drawings and deliveries
- Effect of site conditions

To develop this model, various skills and training are required. First, the user should have a general knowledge of construction and project management skills. Also, the user has to be trained by a certified PMMS trainer that has taught the user how to input the project specific data into the model. In addition to project input, the user must be trained on how to “fine tune” or calibrate the model by adjusting these parameters.

The model is able to determine the “System Effect” of individual events while traditional analysis can usually validate the direct cost of each change order, but not the cumulative cost and schedule impacts of all the events and changes over the life of the project. Most project teams know that the above listed effect has occurred, but are not able to separately quantify these effects. PMMS quantified these “ripple effects” and allowed MDC to validate the results of traditional schedule and cost analysis for this project. Using the model in “real time” as the work proceeds gives the Project Management Team another tool for Project Risk Reduction.