Fourth International Conference on Construction in the 21st Century (CITC-IV)
"Accelerating Innovation in Engineering, Management and Technology"
July 11-13, 2007, Gold Coast, Australia

Potential Project Benefits From Improved Project Review Decisions

Ming Xu
(PhD student, Department of Civil & Environmental Engineering, the University of Melbourne, Melbourne, Victoria, Australia)

Collette Burke
(Lecture, Department of Civil & Environmental Engineering, the University of Melbourne, Melbourne, Victoria, Australia)

Colin Duffield
(A/Prof., Department of Civil & Environmental Engineering, the University of Melbourne, Melbourne, Victoria, Australia)

Abstract
Construction projects are high risk and frequently highly complex. Decisions made during the delivery of such projects are pivotal to the success or otherwise of the project. Project review is a powerful managerial technique to assist in the achievement of positive project outcomes. It does this through constant revision of critical decisions to control the performance of projects. This paper reports the findings of a study into the rationale for project reviews. The significance of early decisions to minimise risk is discussed and the strengths and weaknesses of existing processes, such as Gateway, are identified. A project review method is proposed to bridge gaps in the current project review processes. This process offers potential benefits to construction projects, to overcome current hurdles.

Keywords
Decisions, Risk, Project Reviews, Gateway, Project Delivery

1. Introduction

Delivery of construction projects is well recognised as a complex process (Fewings 2005; Gould and Joyce 2000; Kerzner 2006). Numerous decisions are required to determine project performance when facing risks and uncertainties (White *et al*. 1999), which are divided into four aspects with sixty seven factors according to Chua and Kog *et al* (1999).Critical decisions made by Senior Project Managers tend to dictate the success, or otherwise, of a project. Therefore quality decisions are important to the overall success of projects.

Successful decision making tends to take an integrated point of view (Fewings 2005; Lewis 1998) and benefits from a holistic project management approach (Burke 2004; Xu *et al*. 2006). The most effective time to make critical decisions is at the earliest stage in a project, and to do so with the highest level of authority and thus maximise potential project benefits.

Among all the possible management techniques, Thamhain (1999) states that project review methods are more valuable in supporting decisions than single-criterion management methods, such as PERT/CPM

(schedule management) and Earned Value Management (cost management). Thamhain (1999) even noted that project review methods had a total popularity of ninety three percent, which demonstrates that project review is well recognised and widely adopted. Anecdotal evidences also confirm the potential benefits from such integrated project management approach. Integrated with the concept of Stage-Gate Review (Thamhain 1999), a new project review technique named Gateway Review™ has been developed by the Office of Governance Commerce (OGC) in the UK and adopted by Department of Treasury and Finance (DTF), Victoria, Australia. This technique proposes a managerial approach to help promote the quality of critical decisions in medium to high risk projects at early stages. Anecdotal information suggests the Gateway Review™ process is adding considerable value.

The new generation of the project review technique brings potential benefits to project outcomes by providing support and confidence to senior managers at critical decision points. This paper discusses the interrelationships between project benefits, project review techniques and critical decisions. In particular it considers the following aspects:

(1) Rationales of project review and Gateway Review Process;
(2) Contributions of Gateway Review™ to early critical construction decisions;
(3) Potential requirements on Gateway Review™; and
(4) Development of a new technical approach to be integrated with the existing managerial approach to improve the accuracy of review Gateway Review™.

2. Project Review Techniques and Construction Decisions

Project review has different definitions according to corresponding applications. A basic understanding is reappraisal or re-evaluation on project performance (Thomsett 2002), from this point of view, some common grounds can be found between project review and project audit (Cleland and Ireland 2000). A traditional project review generally focuses on certain criteria and is triggered by predefined thresholds, e.g. deviation in preliminary project objective-time, cost, and quality may lead to a project review on the effectiveness of the project's execution (Cleland and Ireland 2000). Expectation on the benefits of project review is the continuous improvement in project performance. This improvement is conducted by employing the project review outcomes into decision making. Hence, project review reports the project deviation from initial plan. The outcomes of review assist decision makers identify the deficiency so as to improve the project performance by correcting relevant decisions and corresponding activities.

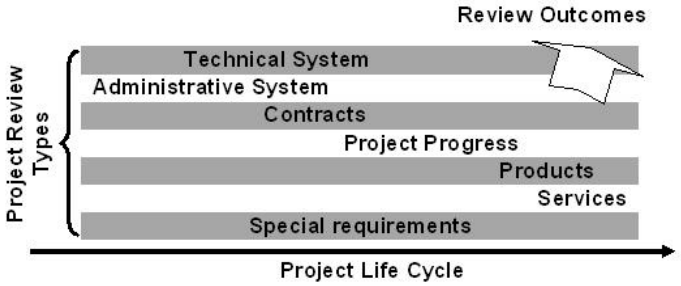

Figure 1: Traditional Project Review Process

Traditional project reviews are carried out after the completion of stages or project to audit project performance, with the purpose of capturing lessons learnt to assist in the improvement of performance for future projects, refer Figure 1.This figure demonstrates some possible situations to carry out different types of project review. Each review may be initiated from different level of management hierarchies and at different times. Due to limitations on separate reviews, various outcomes are not able to be integrated to support a timely decision from higher level management within the current project. The traditional

project review always performs as post-decision review. The characteristics of traditional project review s are static, discontinuous, predefined criterion-focused, and generally applicable to repeated projects.

Construction industry, projects are generally high risk, expensive and unique; these features determine the non-repeatability of projects with high cost, high complexity and interactivity among different criteria. Therefore, an accurate holistic understanding with specified considerations tailored for different projects is essential for senior managers to make appropriate decisions. Obviously traditional project reviews do not assist the current project and thus a more accurate and dynamic approach is required. Some improved review techniques, that incorporate auditing of project performance, have been developed and adopted within different companies, this paper focuses on publicly techniques.

A new project review technique named Gateway Review™ was developed by the Office of Governance Commerce (OGC) in the UK and is popularising throughout Australia. Gateway Review™ is a review of an acquisition programme or procurement project carried out at a key decision points by a team of experienced people, independent of the project team. Different from generic project review, Gateway Review™ emphasis is on early reviews in supporting critical decision, to maximise value added. As the scope shown in Figure 2, the earlier the decision is made and the higher the level of management involved in the decision, the more potential benefits will be gained to project.

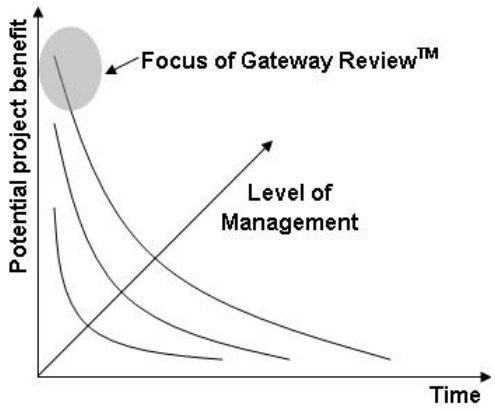

Figure 2: Project Focus of Gateway Review™

On comparing Gateway Review™ technique with traditional project review technique, there are some distinct advantages within Gateway Review™ technique. The first one is systematic review of the whole project to improve the consistency of project understanding and continuity of evidences in making decisions. This feature overcomes the possible conflicts among different review outcomes and increases the efficiency of review by bonding it with critical decisions. Secondly, the early application of review outcomes into project execution maximises the potential value of Gateway technique. Thirdly, this kind of review is only available to the senior decision maker on critical decisions. The Gateway technique will be analysed along with some of its features within the following sections.

3. Analysis of Gateway Review Process

The whole Gateway Review Process includes five Gates (OGC) or six stages (DTF), and both of them are similar processes. Figure 3 shows the flow chart of this process as Victorian government adopts, while Figure 4 explains the procedure to carry out a typical review.

After passing each 'Gate', an external review is conducted by an independent group of experts to provide decision makers with decision evidences for the next stage. This confidence is delivered as a confidential report to senior managers only and is employed as an internal tool. This process takes advantages of external experiences to keep the project on a stable, sustainable and beneficial track.

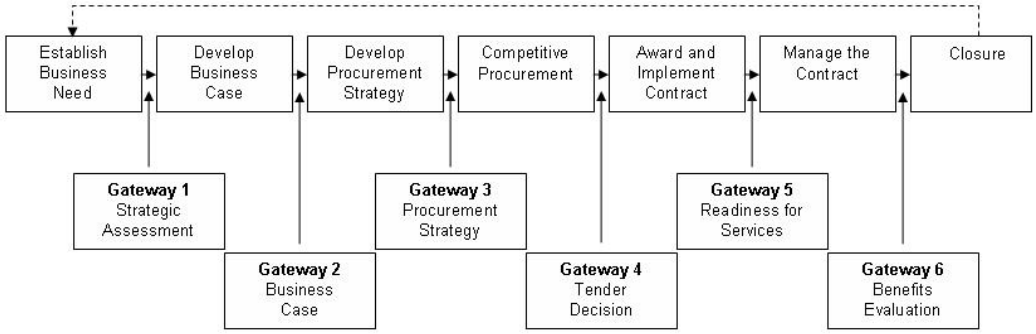

Figure 3 Gateway Review Process
Source: Based on Department of Treasury and Finance, Victoria, Australia

A typical procedure of Gateway Review™ is detailed in Figure 4. When a project is judged to be suitable for this review, a discussion is then made among Gateway Unit (GU) and decision makers (equals to Senior Responsible Owner (SRO)) to decide the review process. After selection of the Gateway Review Team (GRT) and provision of relevant documents, a planning day is held functioning as a meeting between Review Team and project teams, to extend the understanding of project. The review starts once all the required information is provided to the Review Team, and then a confidential report will be provided only to decision maker after the two to five days review period.

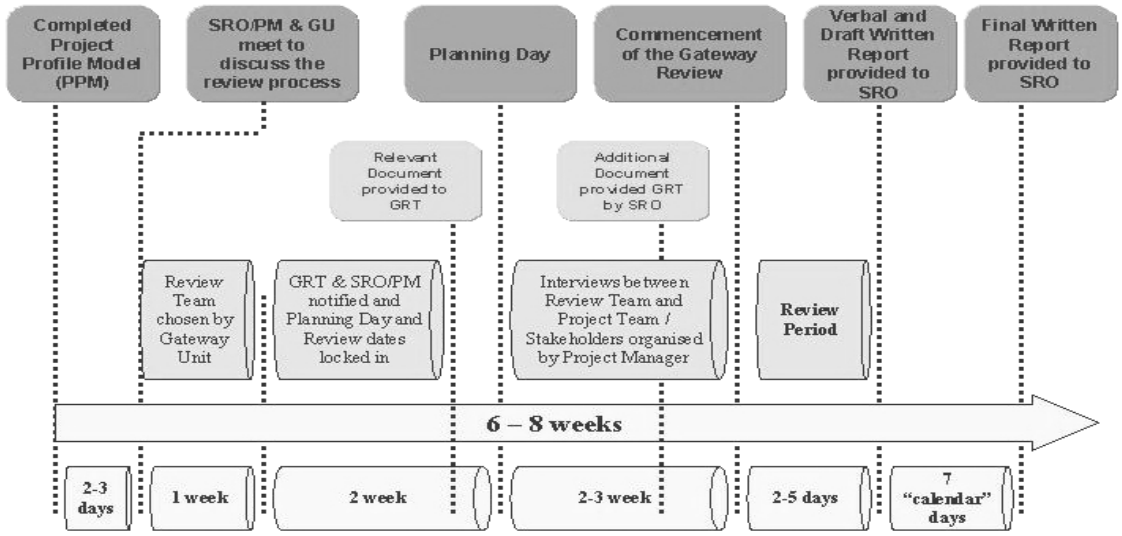

Figure 4 Procedure of carrying out a Gateway Review™

The Gateway Review Process (GRP) provides a managerial opportunity to senior managers to decide the readiness of the project. Due to different emphases and special focuses within each "Gate", the purposes of the reviews change from one "Gate" to another. A detailed introduction to the whole Gateway Review Process is listed in Table 1, which summarises all the purposes from the process.

The bold cell represents mutual purposes required from different Gates, while NIL means 'no contents in this cell'.

Table 1: Detailed Purposes of Gateway Review Process

Purposes of Gateway Review Process							
Gateway Review 1 *Strategic Assessment*	Policy & organisational context	Business case: scope & stakeholder	**NIL**	Review of current phase	Management of intended outcomes	**Risk Mangement**	**Readiness for next phase**
Gateway Review 2 *Business Case*	**NIL**	**Business case & stakeholders**	Wider context	**NIL**	**NIL**		
Gateway Review 3 *Procurement Strategy*			Procurement approach	**Review of current phase**			
Gateway Review 4 *Tender Decision*			Assessment of the proposed solution				
Gateway Review 5 *Readiness for Service*			**NIL**				
Gateway Review 6 *Benefits Evaluation*		Business case & benefits management		Review of operating phase	Plans for ongoing improvements in value for	Plans for ongoing improvements in performance	Readiness for the future

Gate 1 focuses on the feasibility and robustness of business needs and strategy, the context of broad project environment, such as financial provision, potential contributions and the ability to handle risks, is well researched at this stage. Assurance to decision makers about the extent to which the project can fulfil business needs is the focus of Gate 2, and business case is still the focal point within this review. Gate 3 and Gate 4 review the project procurement and tender decisions separately, after the viability of project being tested to invite proposals from market, the decisions on tender will be confirmed to award the contracts. Then the period up to commissioning will be covered by Gate 5 to review the project performance and its readiness in fulfilling business needs and ability to suit potential changes. Finally, Gate 6 will be carried out to ensure the proposed benefits are delivered.

In Table 1, it is obvious that "Business case and stakeholders", "Review of current phase", "Risk management" and "Readiness for next phase" are the most frequently included purposes. These recurrent review purposes give decision makers a constant understanding on the project profile, status, variances and their reasons. Based on the framework set up by the proposed purposes and questions specified, a continuously improved decision refining process is formed with external supports from expertises.

Another characteristic of the Gateway Review Process is that the external review focuses on the validity of decision improvement rather then performance of any single criterion. In a review, any element impacting decisions will be taken into consideration. For example, risk management is a mutually included aspect within Gate 1 to 5, however risk is not the only factor observed by the review team, and the ultimate review report will balance the effect of risk factors in the entire decision evidence, instead of a number calculated from merely likelihoods and consequences. Therefore, from this perspective, Gateway Review^{TM} generates holistic decision evidences to senior managers.

Visualising the contributions of Gateway Review Process, a modified model is detailed in Figure 5. The differences can be identified by comparing Figure 1 with Figure 5. A holistic project performance criterion is adopted in Gateway Review Process through decision improvement, instead of discrete focuses in generic project reviews. Also a bidirectional mode in Gateway technique allows the early decision improvement, which provides the chance for decision makers to maximise the benefits from

critical decisions along the project life cycle. Gate 6 also provides an opportunity to assess special lessons and their benefits. Any change in a similar decision environment can be broken down and reacted to in a timely manner prior to the decision points in Gateway Review Process, so that benefits are gained by adjusting critical decisions corresponding to the dynamic decision situation. Comparing with internal review, the external and composite review conducted by Gateway broadens the understanding of senior managers on the projects, which utilises resources outside the project, including historical information and experiences to improve project outcomes. Besides that, independent review and confidential review outcomes ensures critical decisions to be made with few "interruptions".

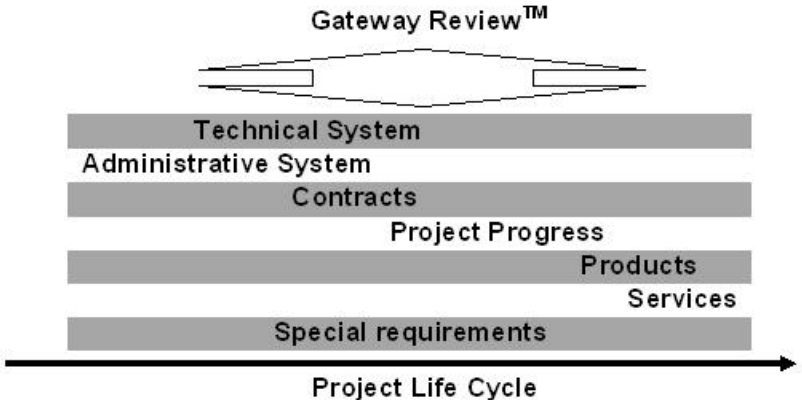

Figure 5: Contributions of Gateway Review Process

Besides the advantages discussed above, further careful consideration needs to be made when Gateway Review is applied. The importance of quantification of decision evidences is well recognised (Haimes 2004; Pratt *et al*. 1995). To take advantages of Gateway Review Process, a quantitative method is then expected to accompany the review to deliver an "accurate" decision. Suggestions from project reviews are always human-dependent (Russell 1992), not quantitatively expressed. Although several models have been developed to deliver the quantitative assessment (Hastak and Shaked 2000; Nasir *et al*. 2003; Shi 1999), Gateway Review Process requires an approach to quantify the review outcomes and measure the value for money from the improved decisions in precise means. This approach should be a combination of the ability to fit the characteristics of Gateway Review Process and specialisation for the particular considerations of each Gate.

Early implementation and refinement of correct Gateway Review recommendations provides the greatest project benefit. Similarly, dynamic monitoring and refinement of such recommendations in a real-time basis would further enhance project benefits.

The advantages of information visualisation to construction projects are discussed sufficiently by Korde *et al*. (2005), and visualisation of abstract descriptions provides extra convenience in communications. Once the project is observed as a whole, visualisation of suggestions from different Gates will bring confidences to decision makers in accepting review outcomes with interactions included. Therefore the ability of senior managers in making decisions in complicated decision situation will be enhanced.

All the considerations mentioned above can gain potential benefits to the application of Gateway Review Process. And all of them would be independent to the review process and be realised by one approach.

4. Proposed Project Review Approach

After previous analysis on Gateway Review Process and discussion on potential improvements to maximise its ability in decision supporting, a proposed model is created with an external functional approach integrated. This model is explained in Figure 6.

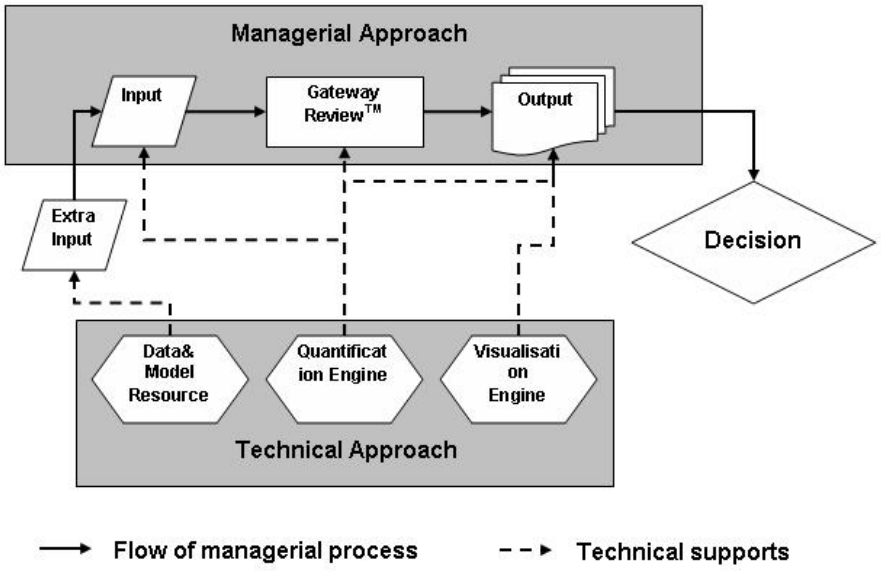

Figure 6: Proposed Model in Gateway Review Process

The proposed model includes two approaches to generate decision evidences for decision makers. A managerial approach is delivered by Gateway Review™, while the other section with the predefined functions is realised by a technical approach. In this model, along with the existing inputs from meetings, interviews and provision of documents by the project team, another input is considered. This input is the dynamic reflection of project situation as an objective data set from other projects as well as interactions caused by multi-Gates. These interactions include both impacts from previous review outcomes and the possible influences to the potential reviews. All this information is monitored and quantified by the technical approach. After the review period, Gateway suggestions will be provided to senior managers and alternative visualised suggestions will be generated at the same time. This extra output helps decision makers to understand the significance of the suggestions to the project. This model analysis is conducted prior to the commencement of subsequent stage.

This model is a unified approach through all the Gateways. To match the variant focus from different Gates, the technical approach in quantifying inputs and visualising the outputs should also be tailored to satisfy the corresponding purposes of the review. One method to achieve this objective is to use the mechanism in Decision Support System (Marakas 1999; Mora *et al*. 2003; Sauter 1997). The implementation of this technical approach can function as a decision quantification method both before and after the critical decision points to maximise the benefits from decisions and calculate what the total benefits are.

To develop this technical approach, three aspects require potential efforts. Extra inputs rely on the decision model establishment and data tailored for specific project considerations. The quantification engine calls for analysis for appropriate risk assessment techniques to identify suitable approach for a given decision inputs. The visualisation engine discusses an efficient means to communicate the review outcomes with decision makers. The most important component of the technical approach is to computerise all the above functions to create a friendly interface to the users.

5. Conclusions

In the construction project management field, holistic management is increasingly being realised as a necessity to the success of projects. Project review technique is a representative of holistic management. It provides not only the ability to correct the deficiency of performance but also the flexibility in deciding the priority of project interests within the changing project environment.

Gateway Review technique is a new generation of project review integrating another critical factor of decision making into consideration. Decisions especially from senior managers are vital to the project performance. In Gateway Review Process, systematic provision of decision evidences in the form of suggestions is made directly to decision makers and emphases on the benefit of early decision improvement ensures Gateway as a managerial approach to achieve the rational decisions.

To improve the rationality of decisions from senior decision makers to maximise benefits gained from early decisions, a technical approach is required to be integrated into Gateway Review Process. It should resolve the deficiency of current Gateway Review technique in quantifying value for money from the reviews and decision evidences to improve the decisions. Besides the benefits from early decisions, constantly revising the critical decisions is also beneficial by controlling the project performance. A corresponding function within the technical approach to improve decisions will be the monitoring of dynamic changes and inter-impacts from other Gateway Reviews from the same project. From this study, the combination of the managerial and technical approaches is the proposed solution to maximise potential project benefits through improved project review decisions.

However, this model only introduces the theoretical possibility of the solution, the managerial approach of this solution has been well certified from various project from both OGC and DTF. To develop the technical approach with proposed functions, it will require great endeavours in detailed model development, verification by real projects and integration with existing Gateway Review Process.

6. References

Burke, C. S. (2004). "Risk Management Over The Life Cycle of Construction Projects," PhD, RMIT, Melbourne.

Chua, D. K. H., Kog, Y. C., and Loh, P. K. (1999). "Critical Success Factors for Different Project Objectives." *Journal of Construction Engineering and Management*, 125(3), pp. 142-150.

Cleland, D. I., and Ireland, L. R. (2000). *Project manager's portable handbook*, McGraw Hill, New York.

Fewings, P. (2005). *Construction project management : an integrated approach*, Taylor & Francis, London ; New York.

Gould, F. E., and Joyce, N. (2000). *Construction project management*, Prentice Hall, Upper Saddle River, N.J.

Haimes, Y. Y. (2004). *Risk modeling, assessment, and management*, Wiley, New York.

Hastak, M., and Shaked, A. (2000). "ICRAM-1: Model for International Construction Risk Assessment." *Journal of Management in Engineering*, 16(1), pp. 59-69.

Kerzner, H. (2006). *Project management : a systems approach to planning, scheduling, and controlling*, J. Wiley, Hoboken, N.J.

Korde, T., Wang, Y., and Russell, A. "Visualization of Construction Data." *Canadian Society of Civil Engineers*, Toronto, Canada.

Lewis, J. P. (1998). *Mastering project management : applying advanced concepts of systems thinking, control and evaluation, resource allocation*, McGraw-Hill, New York.

Marakas, G. M. (1999). *Decision support systems in the twenty-first century*, Prentice Hall, Upper Saddle River, N.J.

Mora, M., Forgionne, G. A., and Gupta, J. N. D. (2003). *Decision making support systems : achievements, trends, and challenges for the new decade*, Idea Group Pub., Hershey, PA.
Nasir, D., McCabe, B., and Hartono, L. (2003). "Evaluating Risk in Construction--Schedule Model (ERIC--S): Construction Schedule Risk Model." *Journal of Construction Engineering and Management*, 129(5), pp. 518-527.
Pratt, J. W., Raiffa, H., and Schlaifer, R. (1995). *Introduction to statistical decision theory*, MIT Press, Cambridge, Mass.
Russell, J. S. (1992). "Decision models for analysis and evaluation of construction contractors." *Construction Management and Economics*, 10(3), pp. 185-202.
Sauter, V. L. (1997). *Decision support systems : an applied managerial approach*, John Wiley, New York.
Shi, J. J. (1999). "Activity-Based Construction (ABC) Modeling and Simulation Method." *Journal of Construction Engineering and Management*, 125(5), pp. 354-360.
Thamhain, H. J. "Emerging project management techniques: a managerial assessment." *Management of Engineering and Technology, 1999. Technology and Innovation Management. PICMET '99. Portland International Conference on*, pp. 363-368.
Thomsett, M. C. (2002). *The little black book of project management*, Amacom, New York.
White, S., Dorchak, S., Keane, J., Pallack, W., Owens, J., Rozenblit, J., Davis, J., and Sztipanovits, J. "Situation assessment and decision making integrated into the process centered environment." *Engineering of Computer-Based Systems, 1999. Proceedings. ECBS '99. IEEE Conference and Workshop on*, pp. 129-135.
Xu, M., Duffield; C., and Burke, C. "Stepping past the gap bewteen risk analysis software." *Australasian Universities Building Educators Association (AUBEA) Conference*, Sydney, 55.