

INCENTIVE/DISINCENTIVE PROJECT SUCCESS FACTORS DURING MACARTHUR MAZE I-580 BRIDGE SPAN REPLACEMENT

Jae-Ho Pyeon¹ and Marc Zomoradi²

¹ Assistant Professor, Civil and Env. Engineering, San Jose State University, California, USA

² Graduate Student, Civil and Env. Engineering, San Jose State University, California, USA

Correspond to jae.pyeon@sjsu.edu

ABSTRACT: Incentive/Disincentive (I/D) contracting experiences in many states have been evaluated in terms of time and cost performance and substantial project time savings were found in many project cases. However, there is little understanding on individual project success factors for I/D projects during construction. This paper explores the significance of I/D clause in the success of the MacArthur Maze reconstruction project and summarizes a list of group causes that explains and elaborates on the detailed factors. The methods used for carrying out this study started with a search of online media and news reports and contract documents were also obtained from Caltrans. After review of the preliminary information, Interviews were performed with the Caltrans Resident Engineer and the contractor's project manager who were in charge of the MacArthur Maze reconstruction. In conclusion, the evaluation of their responses hinted at six significant cause groups responsible for the project's success. These groups can be listed as: 1) Motivation, 2) Policy, 3) Teamwork, 4) Communication, 5) Expectation, and 6) Resource Management.

Keywords: Incentive/Disincentive; Alternative Contracting; Project Factor; Highway Reconstruction

1. INTRODUCTION

Incentive/Disincentive (I/D) contracting is designed to encourage the contractor to complete the construction project as early as possible by proposing an incentive for early completion and charging a disincentive for delay [1]. State Transportation Agencies have widely used I/D contracting as one of their management tools to achieve early project completion. I/D contracting experiences in many states have been evaluated in terms of time and cost performance and substantial project time savings were found in many project cases [2-5]. However, there is little understanding on individual project success factors for I/D projects during construction. The onset goal of the research was to explore the significance of I/D clause in the success of the MacArthur Maze project. The objectives are:

- To unearth the contributing factors for the success of the project
- To investigate the significance of those factors
- To develop a summary list of group causes that explains and elaborates on the detailed factors.

2. MACARTHUR MAZE RECONSTRUCTION

On April 29, 2007, a full gasoline tanker truck lost control on the Interstate 880 connector (MacArthur Maze) in Northern California, crashed, and exploded into an inferno. The extensive heat generated from the fire melted and collapsed a portion of the Interstate 580 connector

ramp crossing above the accident site [6]. To alleviate the anticipated gridlock on the following day (Monday) Caltrans announced that all modes of public transportation would be free. The California Department of Transportation immediately began an emergency project plan to mitigate the expected massive traffic delays on this vitally busy section (the collapsed ramp traffic alone was 80,000 cars per day) of the San Francisco Bay Area road. The repair and rebuild of the damaged I-580 off-ramp immediately began after Caltrans accepted a bid for \$867,075 from a contractor, C.C. Myers (CCM), Inc. The Caltrans' engineer estimate for its replacement was \$5.2 million [7].

The bid package for this project included an incentive bonus clause of \$200,000 per day for every day the work was completed ahead of the contract deadline. Equally, any delays beyond the phase one contract deadline, was subject to \$200,000 per day penalty. This was a huge disincentive for the contractor. A cap of \$5 million was the maximum amount that a contractor could collect as bonus. The first phase of the contract called for a work schedule of 50 days (Caltrans, 2007). Finishing 32 days earlier than the contract deadline, C.C. Myers, Inc. collected the maximum \$5 million bonus as well as the contract amount (ENR, 2007).

3. METHODOLOGY

The methods used for carrying out this study started with a search of online media and news reports to obtain

the necessary backdrop information about the reconstruction project and its outcome. Contract documents were also obtained from Caltrans. After review of the preliminary information, a meeting with the Caltrans Resident Engineer (RE), in charge of the MacArthur Maze reconstruction, was scheduled. A similar interview with the contractor's project manager (PM) was performed. These interviews provided additional details and existing dynamics that prevailed in working with the contractor.

4. SUMMARY OF INTERVIEWS

The personal interviews with Caltrans and the contractor's representatives yielded the interaction data. It revealed the inner working relations between Caltrans and the contractor, such as the means and intervals of communications, inspections, cooperation, and resource managements.

4.1 Caltrans Perspective

An interview was conducted to collect data from Caltrans perspective with a review of all events, from the news of the accident to completion of the reconstruction. It pointed out that Caltrans approached this project with a sense of urgency and flexibility. From the beginning, the focus was on a fast process to clear the site, design the collapsed section, select a qualified contractor, and implement the project in the most efficient manner.

The insertion of I/D provision in the contract, intended to insure the contractor's best effort in project delivery time. Furthermore, the assignment of additional Caltrans staff to the project and their extended hours were part of the strategy to expedite the reconstruction plan. According to Caltrans' RE, there was a concerted effort by designers to complete the job urgently and make necessary modifications that accelerated the process. For example, the original steel bent cap design was replaced with reinforced concrete to eliminate the wait time for steel fabrication.

In addition, they used daily meetings with the contractor as well as an open channel of communication to respond to constructors inquires. This meant prompt review of submittals and inspections. It was estimated that Caltrans' additional time spent on the project from engineers, staff, and even deputy director, swelled to 300 to 400 percent of a similar non-urgent project. To accelerate the project and respond to the concern of the affected areas such as the City of Oakland, where the detour for the collapsed section was directed, Caltrans provided assistance and assurance of future goodwill. Finally, it was the declaration of "emergency" that afforded the "environmental waiver" that could be a potential delay factor.

4.2 Contractor's Perspective

The contractor's reconstruction PM interview revealed the speed that the contractor acted to pull a team of estimators, schedulers, superintendents, project manager together to provide a bid within two days from notice. This was just the beginning of a series of actions that led

to the accelerated completion of the project. After the award of the contract, the contractor focused on two controlling items: 1) Thirty days estimate for completion and 2) Subcontractors' commitment (ConFab - Bent caps fabricator and Stinger Welding - Girders fabricator).

It is noteworthy that CCM had this project on their radar since the accident date. They had successfully arranged the control of needed steel for the project by offering a bonus to their subcontractor, Stinger Welding. The bonus offer brought the commitment of the subcontractor for the hard to find steel in a short time, even prior to the grant of the contract by Caltrans. This enabled CCM to complete the project ahead of schedule.

5. DISCUSSION

As the research on the project progressed, it became evident that I/D alone could not be the sole or the single main factor behind the success of this project. In fact, individual interviews with the Caltrans Project RE, and the contractor's reconstruction PM, pointed at other contributing factors as well. The evaluation of their responses hinted at six significant cause groups responsible for the project's success. These groups can be listed as: 1) Motivation, 2) Policy, 3) Teamwork, 4) Communication, 5) Expectation, and 6) Resource Management

5.1 Motivation

The contractor was motivated by the I/D amount of \$200,000/day to expedite the project completion ahead of a 50-day deadline in phase 1. Likewise, there was a disincentive of \$200,000/day when project completion dragged beyond the same deadline. This fueled the contractor's desire to plan expedited arrival of all materials.

Similarly, Caltrans was highly motivated by the public relations and high expectation of many elected officials who had visible involvement in this project, to find a quick response to this unexpected accident. The appearances by the governor, senators, congress members, mayors, DOT secretary, and other officials in reconstruction events or media talks, left little guesswork as to how eager and concerned they were for a speedy and well done job. This was a great opportunity for most of them to capitalize on the follow-up publicity and credit.

5.2 Policy

The general policy for a non-emergency project is a thorough and meticulous environmental investigation prior to construction approval. The announcement of an "emergency" by the Governor allows Caltrans to issue an environmental waiver. In this instance, the California Governor, Arnold Schwarzenegger, issued an emergency proclamation. It effectively resulted in exemption from California Environmental Quality Act, and restoration process began, immediately. Caltrans also investigated the site, where the tanker truck exploded and burned. The unburned portion of the spilled gasoline contaminated the soil. An accelerated sampling and investigation by an environmental firm was conducted, and a total of 1700

cubic yards of contaminated soil was excavated and hauled-off to a class 1 landfill. The removal of the contaminated soil and the environmental waiver issued by Caltrans paved the way for the satisfaction of the project's environmental requirements in a swift manner. This allowed the reconstruction of the collapsed off-ramp to resume within days and not years.

5.3 Teamwork

The mutual interest of the contractors and the project owner (Caltrans) required coordination and protocols to facilitate the implementation of the project. In short, it required teamwork. The contractors worked very amicably with each other as well as Caltrans. Each contractor or subcontractor performed his/her duties in a timely manner, maintained the accessibility of the work environment, and moved as the next one mobilized.

Caltrans coordinated the sequence of main events and the flow of work by using collective internal cooperation from design group in Caltrans office to external group of field contractors. Teamwork was adopted as the norm in planning, communication, and implementation. The direct line of contact between contractor's project manager and Caltrans' resident engineer set the stage for all daily meetings and coordination with inspectors.

The presence of inspectors on short notice for inspection boosted the team spirit. To assist and expedite a subcontractor's fabrication work, Stinger Welding, Caltrans dispatched engineers and inspectors to his shop in Arizona. Yet, in another case, Caltrans and the contractor agreed to start work without the benefit of approved detailed drawings. The work progressed while the drawings were reviewed and approved. This was a risky decision, but the pay off was about five days acceleration in completion date.

5.4 Communication

Although teamwork was very high on the priority list, clear channels for contact and speed in communication were crucial in the achievement of the minimum length of time for the project. There were daily meetings between Caltrans and CCM representatives. The contacts were via e-mails, telephone calls, and submittals. Time was of an essence, the project success hinged on prompt responses. The fact that work was scheduled around the clock necessitated atypical hours of communications. According to the CCM project manager, Caltrans representatives availed themselves even in late hours to respond to inquiries by the contractor. This action expedited the approval of the submittals and reduced the wait time for response. It helped the project planners to move ahead with full speed and no delays.

5.5 Expectation

The sensitive location of this project was due to the importance of the hub that connected some of the widely used roads in the Bay Area. A sizeable number of 160,000 cars on a daily basis used the affected two connectors, I-880, and I-580 prior to damage. Within a week, Caltrans repaired I-880 off-ramp portion and returned the road to operation. However, the collapsed

overpass connector, I-580, that was previously carrying nearly 80,000 vehicles daily remained closed. The off-ramp served high value economic centers of the Bay Area by connecting San Francisco to Oakland. Moreover, the required detour as the result of off-ramp closure imposed considerable burden on commuters. The Caltrans road users cost estimate for this closure was four to six million dollars daily. Consequently, the affected public had very high expectations from all officials involved, for a rapid reconstruction of the destroyed section. The media's focus on the project and special traffic reports and comments were an indication of high public interest.

5.6 Resource Management

Finally, it is the people who make things happen. Both the contractor and Caltrans used all their resources, particularly their people to the utmost of their abilities to conclude this episode. The contractor C.C. Myers, Inc. in order to fulfill its tight schedule established two 12-hour shifts extended work hours. To provide more incentive for high productivity during the long shifts and reduction of stress on employees, CCM initiated a free food program. Additionally, CCM offered hotel accommodations near the site for those employees who lived farther away from the project site, to curtail and remove their commute time and stress.

Caltrans assigned several additional field individuals to this project to speed up the progress oversight. Moreover, those individuals spent more time on the project, due to its emergency status, than if it was a non-emergency project. According to Caltrans' project resident engineer, the extended work hours by them amounted to as high as 300 to 400 percent of typical hours.

5. CONCLUSIONS

A project such as the MacArthur Maze collapse and reconstruction is not a common occurrence. Accidents of this magnitude at a crucial location such as the Maze are even scarcer. A well-organized time sensitive project design and implementation was vital to minimize the public inconvenience and cost. Public cost of four to six million dollars on a daily basis justified the \$200,000 incentive/disincentive clause in the contract. The project contractors and Caltrans noticed the gravity of the situation and positively responded. The response was multifaceted. Caltrans quickly moved to clear the site, removed the environmentally impacted soil, and waived any further environmental requirements that could have caused massive delays.

After collection and analysis of data, it was clear that I/D factor cannot be the sole reason for the success of this project. In turn, several factors emerged as the driving forces behind its outcome. In conclusion, the evaluation of interview responses revealed six significant cause groups responsible for the project's success. These groups can be listed as: 1) Motivation, 2) Policy, 3) Teamwork, 4) Communication, 5) Expectation, and 6) Resource Management.

6. RESEARCH LIMITATIONS AND FUTURE STUDIES

Engineering News Record, 258 (20), pp. p11-11. May 30, 2007.

The authors made an effort to collect and analyze as much detailed information as possible for this project to insure the utmost accuracy of the findings and conclusions. The personal interviews with the Caltrans engineer and the CCM project manager provided very useful information. However, more research efforts should be made to come to a statistically significant conclusion by performing more interviews and/or surveys for the key individuals who were intimately involved with the project. In addition, when access and data from other similar projects are feasible, an inclusive study of more I/D projects may promote a universal list for project success factors.

ACKNOWLEDGMENTS

The authors would like to express their gratitude to the California Department of Transportation and C.C. Myers for providing valuable inputs. The authors would also like to thank the Mineta Transportation Institute for the financial support that made this research possible.

REFERENCES

- [1] Federal Highway Administration (FHWA). (1989). *Incentive/Disincentive for Early Contract Completion*. FHWA Technical Advisory T5080.10, Federal Highway Administration, Washington, D.C.
- [2] Ellis, R. and Pyeon, J. *A Study of Simulation-Based Contract Incentives and Disincentives Usage*. Construction Research Congress: Broadening Perspectives, American Society of Civil Engineers, San Diego, CA, April 5 – 7, 2005.
- [3] Herbsman, Z. J. *A + B Bidding Method – Hidden Success Story for Highway Construction*. Journal of Construction Engineering and Management, vol. 121(4), 1995, 430-437.
- [4] American Association of State Highway and Transportation Officials (AASHTO). (2006). *Primer on Contracting for the Twenty-first Century*. Report, Contract Administration Section of the AASHTO Subcommittee on Construction, Fifth Edition, Washington, D.C.
- [5] PinnacleOne. (2004) *Summary Level Study of A+B Bidding*. Final Report, California Department of Transportation, Sacramento, CA.
- [6] Caltrans. (2007). *Unprecedented Teamwork Repairs Collapsed Freeway in Record Time*. Caltrans District 4, California Department of Transportation, Oakland, California.
- [7] Carlsen, R. (2007). *Contractor Bids Low on Maze Fix*. Engineering News Record (ENR), 258 (18), pp. p21-21.
- [8] Caltrans. (2007). *Notice to Contractors and Special Provisions for Construction on State Highway in Oakland 580/880*. California Department of Transportation, Sacramento, California.
- [9] Nolan, M. and Carlsen, R. (2007). *Early Opening Earns Highway Contractor \$5-Million Bonus*.