An assessment of the effectiveness of design-build project delivery on the Minnesota Department of Transportation's ROC-52 project

by

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ABSTRACT

Over the past decade and a half, highway and transportation officials have begun to use a new contracting approach to deliver major projects to the public. The use of design-build delivery represents a departure from the traditional low bid system that has been used on highway projects. Design-build brings significant changes in roles, processes, and philosophies during all phases of a project. The design-build system has been recognized on numerous projects for offering certain advantages over the traditional system.

The Minnesota Department of Transportation has undertaken its first major “best value” design-build project, reconstruction of a segment of U.S. Trunk Highway 52 (the “ROC-52” project) through the city of Rochester, Minnesota. To evaluate the effectiveness of design-build utilization on this project, an interview-based case study method of research has been used. This thesis is a qualitative analysis of the ROC-52 best-value design-build project, with consideration of a set of crucial project performance characteristics. Ultimately this document will assess the effect of design-build on the success of the project, as well as provide conclusions and recommendations for future design-build endeavors.
CHAPTER 1. INTRODUCTION

The delivery of major transportation infrastructure projects is evolving. Critical expectations have been placed on transportation officials to deliver projects faster and with fewer public impacts, but still meeting budget constraints. Many states have undertaken projects with dollar amounts ranging well into the hundreds of millions, up to one billion and beyond. Transportation policy makers have been looking for new ways to deliver these major projects to the public.

The transportation industry has begun to emulate construction practices in the private sector by starting to use design-build delivery on certain projects. Design-build represents a departure from the traditional means by which transportation infrastructure is delivered. Whereas the traditional system of design-bid-build is characterized by a disconnect between the plan preparation and construction phases, design-build is a more integrated approach. In design-build, roles of the owner, designer, and contractor change.

Design-build delivery can offer certain advantages over the traditional design-bid-build system. Several key characteristics of the design-build process have been identified—projects can be completed faster, impacts to the public can be reduced, and the design-build contractor is enabled to use more innovation to save time and money.

The research effort for this report focused on a major design-build highway reconstruction project of the Minnesota Department of Transportation (Mn/DOT). The project, known as "ROC-52," is an 11-mile reconstruction of U.S. Trunk Highway 52 through the city of Rochester, Minnesota. Utilizing a case study approach, data and information have been collected regarding the effectiveness of design-build delivery on the project. Ultimately, the aim of this thesis is to identify the specific project parameters where
the use of design-build on ROC-52 contributed to the project's success, and provide recommendations for the use of design-build on future transportation projects.

**Thesis Statement**

The purpose of this thesis is to provide insight into the use of design-build project delivery on the ROC-52 project. This thesis will identify specific project parameters that were impacted by the decision to use design-build rather than the traditional system delivery system, and will methodically examine these factors. The aim will be to determine which areas have been positively impacted by design-build, as well as identify areas which could have been improved upon. Consequently, recommendations will be made that could be beneficial to Mn/DOT or other state transportation agencies (STAs) on future design-build highway projects. In addition, this document will contribute to the growing body of literature on the subject of design-build contracting on highway and transportation projects. Due to the unique nature of these projects, a common method for evaluating and recording the experiences is through a case study approach. The areas of success on ROC-52 were expected to bear some similarity to other design-build highway projects; however, there were also many outcomes from the project that make this case study a unique contribution to design-build literature.

**Background on Design-Build**

The concept of "project delivery" refers to the entire set of steps involved with both design and construction of a project, including the management activities required for these tasks. There are several different methods of project delivery which can be used on projects,
including design-build, design-bid-build, and construction manager at risk. The selection of a delivery method is dependent on many factors that involve the type of project to be constructed and the priorities of the owner.

Historically, the standard delivery method used on highway and transportation projects has been design-bid-build. The design-bid-build system is commonly referred to as either the “low bid” or “traditional” means of project delivery. As the system of roads and highways developed in the United States over the course of the 20th Century, STAs which administered the construction of these facilities adopted the design-bid-build system as the method of awarding contracts. Government agencies have been obligated to provide services at the lowest possible cost, so the design-bid-build system was utilized as the simplest way to achieve this. Design-bid-build asserts that the lowest bidder for any particular job should be granted the contract, provided they can adequately perform the work in an acceptable period of time.

While the concept of design-build project delivery is not new to the construction industry, it is relatively new to highway construction. The origins of design-build can be traced as far back as ancient Greece, where so-called “master builders” integrated the design and construction processes on major public buildings and civil projects. As early as the 1940s, the private sector used the design-build approach for construction of office buildings, industrial plants, retail centers, and a host of other projects. As of 1997, an estimated 77 percent of all private sector construction projects were built using the design-build approach (NSPE, 2003). However, the traditional design-bid-build system had been retained as the exclusive means for delivery of highway and transportation projects until the 1990s.
Design-build was not permitted in the highway industry until The Federal Highway Administration (FHWA) passed its Special Experimental Project Number 14 (known as SEP-14) in 1990. SEP-14 gave STAs the authority to pursue several new methods of innovative contracting on a provisional basis, including design-build (FHWA, 2002). Since the enactment of SEP-14, most states have begun to explore design-build delivery as an option for transportation projects. By 2005, all but 6 six states had authorized the conditional, if not universal, use of design-build (Warne, 2005).

There are several notable differences in the activities and roles of design-bid-build and design-build. First consider design-bid-build: project design in the design-bid-build method is the responsibility of the owner. For example, a department of transportation (DOT) owner using design-bid-build will either utilize its own team of in-house designers or hire a private design consultant to prepare a finished set of plans for construction. These plans are complete and suitable for any qualified contractor to build the project. The DOT would then make the plans and specifications available to contractors and solicit sealed bids for construction. The construction contract is awarded by the owner to the lowest responsive and qualified bidder.

Design-build varies from design-bid-build in how the design document is handled. At the beginning of the project, the owner defines its final product and hires a single entity—a designer-builder partnership, or design-build “team”—to complete both design and construction of the project. Design-build provides for a unique relationship between the two phases of design and construction. Unlike design-bid-build, design-build projects do not require a completed set of plans to start construction. The contractor’s designer completes plans to a minimum level so that early construction activities can start. Construction then
continues while the plans are being finished. The completed, detailed plans are handed over to the contractor in a timely manner to build the rest of the work.

The award procedure of a design-build contract is typically different from the award of a design-bid-build project as well. While traditionally delivered projects are awarded on a strictly low-bid basis, design-build project award processes typically consider other factors, such as quality and inflationary savings from faster construction, in the contractor selection process. The design-build award process encourages—if not requires—more dialogue between owner and contractor during the procurement phase, and allows the value of these other factors to be explored and quantified. The process by which these other factors are accounted for in contractor selection is referred to as “best value” design-build.

The bulk of this thesis will be the exploration how the decision to use design-build rather than design-bid-build on ROC-52 affected several key project parameters.

The ROC-52 Project

ROC-52 was the largest single highway contract in Department history when it was awarded to the design-build team of Zumbro River Constructors (ZRC) for $232 Million in 2002 (Lessons, 2003). The project’s implementation as design-build was governed by the policies established in the FHWA’s SEP-14 innovative contracting methodology. It marked the first time Mn/DOT used a “best value” approach during the procurement and construction letting processes. As a result, it was of great interest to evaluate different aspects of the project to ascertain how the use of design-build instead of traditional delivery impacted their performance.
The ROC-52 project spans a distance of approximately 11 miles through the city of Rochester in Olmsted County. At the north end, the project starts at the junction of U.S. Highway 52 and 85th Street NW. From 85th Street NW to 65th Street NW, the reconstructed section will be rural highway. The urban freeway reconstruction begins at 65th Street and carries through the city to the south end of the project, located at the junction of Highway 52 and U.S. Highway 63 (Mn/DOT, 2005).

Highway 52 is of critical importance to both the traveling public and the city’s several major industries, including the Mayo Clinic and IBM, as well as several retail centers. The Highway 52 corridor also serves as the primary connecting route between Southeastern Minnesota and the Minneapolis-St. Paul metropolitan area. These factors necessitated that minimal congestion and safe driving conditions be maintained during all phases of the ROC-52 construction.

Prior to the new construction, this segment of highway was a four-lane controlled-access freeway, consisting of two through lanes in both directions. The project will expand the highway to six lanes, with three through lanes in each direction. Included in the project scope are grading, roadway surfacing, drainage considerations and formation of detention ponds, and construction of roadway structures—bridges, noise walls and retaining walls. The improvements also include the installation of traffic signals, lighting, signing, and Intelligent Transportation System (ITS) devices. The project requires new construction, reconstruction, or modification of 12 different interchanges or overpasses along the route, as well as construction or reconstruction of 24 permanent bridges (Mn/DOT, 2003). Additional peripheral improvements encompassed by ROC-52 include modification of existing frontage
roads, creation of bicycle or pedestrian paths, and some work to a section of Trunk Highway 14 that passes under Highway 52.

**Decision to Use Design-Build on ROC-52**

Mn/DOT's decision to use design-build on ROC-52 is central to the issues addressed throughout this thesis. The aim of this study was to evaluate the use of design-build on ROC-52, so it important to understand why the project was selected for design-build. It is commonly accepted that design-build can allow a faster project schedule (discussed further in the Literature Review in the Chapter 2 of this report). Schedule was a primary consideration in the decision to use design-build on ROC-52. Exploratory planning for the project began in the late 1980s, with the Environmental Impact Statement (EIS), a key step in the planning process, being completed in 1996. At that time, Mn/DOT concluded that through their traditional project pipeline it would take more than 11 years and as many as 15 stages to complete the scope of improvements to the project corridor. This was due to the annual funding limitations for its districts (Rochester is located in Mn/DOT District 6) (Mn/DOT, 2005).

In 2000, Mn/DOT's District 6 and City of Rochester partnered to complete an Economic Impact Study for the corridor reconstruction. The study considered four different staging and timeline alternatives, along with their related impacts to retail transfer and business at the several different commercial and business centers in Rochester. The major conclusion of the study was that a five-year maximum timeline was recommended to curtail detrimental effects to local businesses and motorists (Staging, 2001).
A second major consideration in choosing design-build for the ROC-52 project was the availability of funding. District funding restrictions in Mn/DOT's program had limited the annual amount available for the project and consequently stretched its duration to 11 years, which was deemed an unacceptable alternative by the Economic Impact Study. The use of design-build allowed Mn/DOT to utilize a variety of non-traditional finance mechanisms, most notably Federal Accelerated Construction (FAC) funding.

ROC-52 was selected for the design-build process in November of 2001 as a result of the schedule and funding concerns identified by Mn/DOT. The project would be completed under a single contract, rather than being as many as 15 separate projects under the original traditional option. The reduction of construction schedule by design-build was from 11 years down to 5, which, as discussed later, was cut even more. Design-build also enabled Mn/DOT to utilize FAC money to enable funding of the project, and prevent having ROC-52 monopolize Department allocations for District 6.

**ROC-52 Letting**

Letting for ROC-52 was held on November 1, 2002. In the one-year period from project initiation to letting, Mn/DOT utilized a new procurement approach to award this best-value design-build project. They began by issuing a Request for Qualifications (RFQ) to solicit qualified teams to complete the project. Mn/DOT received and approved four Statements of Qualifications (SOQ) from proposing design-build teams, thereby establishing their “short list” of accepted proposals for the project. Mn/DOT then issued the Request for Proposals (RFP) for the project.
The best-value methodology on ROC-52 considered merits of the teams' technical proposals as well as the financial (letting date) proposals. Teams' technical proposals were reviewed by the seven-person Mn/DOT Design-Build Technical Review Committee, and each proposal was given a score on a scale of 100. Points were divided into 4 areas: project management (40), project understanding (30), schedule (25), and innovation (5). Each point earned was assigned a dollar value of $2.5 Million, for best-value scoring purposes only. The value of the technical proposals was then combined with the dollar value of the teams' bid at letting, and the resulting "low bidder" was awarded the contract. The best-value approach essentially allowed Mn/DOT to, for the first time in its history, put a dollar value on important project considerations beyond just the bid amount.

The winning design-build team for the project was Zumbro River Constructors (ZRC), LLC—a joint venture by Fluor Corporation, Ames Construction, Inc., and Edward Kraemer and Sons, Inc. ZRC had both the highest technical score and the lowest bid price for the project.
CHAPTER 2. LITERATURE REVIEW

While there have been many successful design-build projects in the United States in the past 15 years, the process is still new to the highway and transportation industry and the body of literature regarding them is still relatively small. A few sources of literature had particular relevance to design-build delivery on the ROC-52 project.

FHWA Design-Build Literature

With the enactment of SEP-14 in 1990, the FHWA enabled the use of design-build delivery on highway projects. SEP-14 allowed the provisional use of newer, innovative contracting methods which were not previously permitted on publicly-funded highway and transportation projects. Design-build was one of four methods permitted by SEP-14; the other three include lane rental, A+B contracting, and warranties. Under SEP-14, STAs were allowed to use design-build on a conditional basis with FHWA approval. Since SEP-14, all four types of innovative contracting methods have been accepted for wider use, with design-build the last of these, beginning in 2003.

In December of 2002, more than a decade after the enactment of SEP-14, the FHWA issued its “Final Rule” on Design-Build Contracting, which took effect in January of 2003. The Final Rule is a comprehensive document that essentially removed the previously conditional nature by which design-build projects were permitted, and outlined specific rules and regulations for its implementation. It affirmed that states are permitted to use design-build delivery if they choose, but that they are in no way required to use it. Final Rule was essentially an acknowledgement of the success of design-build under the SEP-14 provisions and a formality in allowing the wider use of design-build in the transportation industry.
AASHTO Design-Build Literature

The American Association of State Highway and Transportation Officials (AASHTO) has assembled some literature regarding the use of design-build delivery on highway projects. As a national organization comprised of highway and transportation officials from all 50 states, AASHTO is a leader in the development of transportation policies and standard practices.

In 2001, AASHTO issued its Primer on Contracting for the Twenty-first Century. The document summarized various new practices and contract administration techniques being used on transportation projects. The section on design-build highlights some of the potential advantages and disadvantages of design-build. Among the possible advantages mentioned: a faster project timeline can be achieved; greater flexibility is given to the contractor to use innovation in design, materials, and methods; the value of bids can be adjusted to account for timeliness, quality, and other priorities in addition to cost. The primary disadvantage of design-build discussed was the difficulty for smaller firms to compete for large projects, as design-build contracts tend to be. A key conclusion from the Primer is that influential organizations such as AASHTO have recognized the value of the design-build process.

Design-Build Research

Academic research about design-build has been conducted at some locations. Researchers at the University of Colorado and Utah State University are among the authorities on the subject of design-build project delivery in the highway and transportation industry.
University of Colorado

Keith Molenaar of the University of Colorado is a leading national researcher on design-build project delivery. As a stipulation of 1997's Transportation Equity Act for the 21st Century (TEA-21), the U.S. Department of Transportation, parent agency of the FHWA, was required to issue a set of official regulations to allow highway design-build contracting on a wider scale. Molenaar, along with two research corporations—Science Application International Corporation (SAIC) and AECOM Consult, Inc.—were contracted to complete a comprehensive study of design-build in the federal-aid highway program (Molenaar, 2005). The report was submitted to the FHWA earlier this year, and its findings are yet to be released.

Molenaar was the principal investigator on a design-build case study completed for the Washington State Department of Transportation (WSDOT). The report, issued in January of 2003, was an evaluation of several project performance characteristics of WSDOT's first design-build project, reconstruction of the SR500 Thurston Way Interchange in Vancouver, Washington. Among the performance characteristics the study considered were the project's cost, time, quality, management implications, and lessons learned. The approach to the study was to consult key project stakeholders and compare the results with design-build to the expected results if it had delivered by the traditional method.

The WSDOT case study arrived at several conclusions. In terms of cost, the project was 23% higher than anticipated under design-bid-build delivery. Molenaar's conclusion was there were too many factors different between the two delivery methods to determine exactly why the variance occurred or to necessarily attribute it to the delivery method. However, the cost growth after the award was limited to 1%, which is significantly less than
the typical design-bid-build cost growth range of 5-10%. The project was completed 16% faster with design-build than it was estimated under design-bid-build. In terms of quality, those contacted believed it to be equal to or better than expected under design-bid-build. Design-build delivery of the SR500 project required fewer personnel from the DOT perspective, but a more experienced staff would have been beneficial.

Molenaar served as a technical consultant on the Iowa State University ROC-52 case study that was the focus for this thesis. He has suggested that due to the high degree of variability and uniqueness on different design-build projects, the best way to analyze them is a performance-based case study methodology similar to the WSDOT study.

**Utah Technology Transfer Center**

Researchers at the Utah Technology Transfer (T2) Center, in conjunction with Utah State University, compiled a Design-Build Best Practices Guide that outlined some important considerations for design-build on highway projects (Bolling, 2002). The T2 guide focused primarily on selection considerations for design-build projects. Specifically, the following characteristics were recommended of highway and transportation projects being considered for design-build:

- Project has a clearly defined scope, design basis, and performance requirements
- The project is free from complicated issues such as utility conflicts, right-of-way acquisition, hazardous materials, or wetland and environmental concerns
- The project is non-controversial in nature
- The project has room for innovation in the design and construction
- The project is an emergency project or one with tight time constrains
Design-Build Journal Articles

Several academic journal articles have been published which have significance to the use of design-build on highway construction projects. Journal literature on the subject discussed a variety of areas, the most relevant of these are life cycle considerations in best-value design-build award and evaluation of owners’ quality approaches in the design-build proposal process.

Douglas D. Gransberg, associate professor of construction science at the University of Oklahoma, along with Keith Molenaar of the University of Colorado, examined life cycle cost considerations in the design-build award process. In a paper titled “Life-Cycle Cost Award Algorithms for Design/Build Highway Pavement Projects” from the December 2004 Journal of Infrastructure Systems, they study a life-cycle cost algorithm developed by the FHWA to assist with the award of best-value design-build pavement projects. Through examination of several projects, the conclusion of the paper was that the FHWA method places a strong bias on lowest cost for design and construction, and that more emphasis could be placed on life cycle concerns such as maintenance and durability. The significance to design-build as a whole is that the non-cost factors such as life cycle performance should receive greater emphasis in the proposal and selection phase of projects.

Gransberg and Molenaar also examined quality management issues in design-build. In a paper titled “Analysis of Owner’s Design and Construction Quality Management Approaches in Design/Build Projects” from the October 2004 Journal of Management in

• The project involves a significant design effort with a potential to save cost and time in the design
Engineering, the authors analyzed 78 design-build projects from 1997 to 2002 and considered the cost-schedule-quality balance that is determined by the owner for projects. The paper noted that in the design-bid-build system, quality is more of a fixed parameter of the project through the plans and specifications. Schedule is also typically a fixed aspect, leaving the cost to be the area of competition from design-bid-build projects. In design-build, however, cost and schedule are usually the fixed considerations and quality is more a competitive area in the proposal phase of a project. Six owner approaches to quality in the RFP were identified—qualifications, evaluated program, specified program, performance criteria, specification, and warranty. Design-build contractors should understand the implications and levels of specification of these approaches to be able to prepare a proposal to meet the owner’s quality expectations for a project (Gransberg, 2004).

**Tom Warne Design-Build Report**

Of particular relevance to the ROC-52 project was a report prepared by Tom Warne and Associates, LLC, consulting on behalf of the California Design Build Coalition. Warne’s study looked at 21 different design-build highway projects nationwide; ROC-52 was among these, as were several projects in states including Arizona, California, Colorado, South Carolina, and Virginia. Projects in the study ranged from $83 Million to $1.3 Billion. The report, titled *Design-Build Contracting for Highway Projects*, contains two major components: an assessment of the projects’ performance in several project parameters, and an examination of design-build practices used on the projects. Warne’s report was issued in May of 2005.
Warne's assessment of design-build performance considered each of the 21 projects in 4 key areas by which project success is measured—schedule, cost, quality and owner satisfaction. Warne contacted leaders of the 21 projects and queried them on these four project areas.

It was found that on 13 of the 21 projects studied, schedule was the primary reason behind selection of design-build as a delivery method. The effectiveness of schedule on a design-build project was evaluated two different ways—comparing the project's actual performance to its planned completion, or comparing the design-build schedule to the expected scenario using traditional design-bid-build delivery. In the first case, 76% of the projects in the study were completed ahead of the original time allotted by the owner. For the second case, interviewees were asked to estimate the time the each project would have taken if the project had been delivered by design-bid-build, and those estimates were compared to the time taken using design-build. In 100% of the projects, the design-build projects were built faster than they would have been with design-bid-build.

Warne noted that direct comparison of costs between projects of different delivery methods is difficult because of the multitude of uncertainties and variables that influence the comparisons made. The most prominent conclusion made about cost in design-build projects is that the level of price certainty is higher because cost growth is reduced. The projects in the study exhibited an aggregate cost growth rate of less than 4%, compared to the typical design-bid-build growth rate of 5-10%. The report also emphasized cost savings that come from the accelerated construction schedule in design-build. When these projects finish ahead of schedule, often in terms of months or years, savings are realized because of inflation and other factors.
Views about quality were collected from interviewees from each of the projects in the study. The report states that quality on every project was declared to be better than or equal to the quality which would have been achieved under design-bid-build delivery.

Owner representatives from the 21 design-build projects responded to a series of questions about their satisfaction with the project and whether they would have interest in doing future design-build projects. The owners were widely pleased with the design-build process, and expressed desire to use design-build delivery in the future based on their experience with the project in question.

Design-build delivery affects the roles and responsibilities of all players on a project. From an owner’s perspective, project management often involves different-from-traditional functions during the planning, RFP, and bidding phases of the project. On more than half of the projects considered, the project is managed by state DOTs with help from an outside consultant. On the contractor side, a greater level of management of day-to-day project activities is required, notably on design management and quality management.

Commonly, the decision to use design-build was driven by the need for an accelerated schedule and quicker project delivery. As stated, 13 of the 21 projects cited schedule as the primary motivation for using design-build. In some cases, the decision to use design-build is also motivated by the need to accommodate funding conditions. Some projects, including ROC-52, had limited time windows to spend available federal funding that only design-build’s accelerated nature can accommodate.

Funding for design-build comes from a range of sources, including federal and state governments, tolls, and private enterprise. Federal and state monies were the most common source of funding, as they have traditionally been for transportation projects.
Although quality was not mentioned as a primary reason why owners choose design-build, it is nonetheless an important factor in overall success of the project. The use of design-build requires contractors and owner to accept different roles than on traditional projects to reach quality objectives, particularly in the way of quality control and quality assurance. A major shift in design-build projects is that quality control (QC), the process of ensuring that craftspeople perform work in a manner that meets or exceeds expectations, is the responsibility of the contractor in 19 of the 21 projects reviewed. Quality assurance (QA), oversight and testing to make sure QC standards are met, is retained by the owners in 10 of 21 cases, with QA done by a consultant on 4 of the projects.

Warne's report bears a high level of significance to ROC-52, being one of the 21 projects reviewed. The general findings regarding design-build on all of the projects were consistent with the findings of this specific case study on ROC-52. Schedule and funding were major contributors to the decision to make ROC-52 a design-build project, as they were with other projects in the study. Warne notes that comparisons of costs of design-build vs. design-bid-build are, at best, very difficult because of numerous factors.

Overall, Warne's report seems to confirm that the motivations, processes, and results associated with the use of design-build project delivery on highway projects nationwide are consistent with the findings on ROC-52.
CHAPTER 3. RESEARCH METHOD

ISU-Mn/DOT Research Project

A team of researchers from Iowa State University was contracted by Mn/DOT in 2004 to investigate the effectiveness of alternative contracting methods on transportation projects. The aim of this research was to compare the traditional system of design-bid-build contracting to less conventional delivery systems, and provide Mn/DOT with insight and recommendations for use in transportation projects. Mn/DOT's desire for such a study occurred as completion neared on their first major best-value design-build project, ROC-52.

The research project was comprised of two principal components. The first of these was a wide-ranging investigation of several types of alternative contracting techniques presented in SEP-14, including A+B contracts, lane rental contracts, and design-build contracts. This section was intended to provide insight about success factors related to the different contracting approaches. From this, recommendations were made as to the suitability of each of these methods to different types of transportation projects.

The second part of the research effort provided the research basis for this thesis—a case study of ROC-52. The purpose of the case study was to thoroughly investigate the ROC-52 project by several different performance characteristics, evaluate the effectiveness of the delivery, and prepare a set of recommendations to improve the administration of future design-build projects in Minnesota.

Research Method

Making a comparison between two delivery methods presented a difficult challenge, since it is obviously not possible to build identical projects twice using both design-build and
design-bid-build. None of Mn/DOT's design-bid-build projects were similar enough to ROC-52 to make for a valid comparison on a project-to-project basis. Consequently, the strategy for researching the effectiveness of one method versus the other was to gather data from individuals with close knowledge of the project and the two delivery methods. Ultimately their responses would provide insight on how the use of design-build rather than design-bid-build affected the project's execution.

Keith Molenaar served as a consultant for the Mn/DOT research project. In an October 2004 meeting with Molenaar, it was determined that the best strategy for evaluating the use of design-build on ROC-52 was a case study approach similar to the one the University of Colorado research team used in their WSDOT Thurston Way Interchange case study. Data collection for the ROC-52 case study included the following steps:

- Identification of several key project performance parameters by which project success can be evaluated
- Development of a set of questions related to each of the performance parameters
- Identification of appropriate personnel to interview about the use of design-build rather than design-bid-build on ROC-52
- Collection of data from interviewees

**Project Performance Parameters**

A total of 9 project performance parameters were identified for use in the ROC-52 case study. Each parameter was determined to be an important consideration in evaluating the effectiveness of processes and the overall success of the venture, as noted in Mn/DOT's 2003 *Statewide Transportation Plan* document. For each performance category, a set of 3-5
interview questions were devised to determine how the use of design-build affected ROC-52, compared to the interviewee's expectation if traditional delivery were used. The nine specific parameters identified: administrative costs, construction costs, time, management complexity, disruptions to third parties, road user costs, quality, innovation, and funding flexibility. In addition, a brief set of general delivery and project-related questions was asked at the end of each interview.

**Administrative Costs.** The administrative costs on the project were defined as the different types of internal costs which Mn/DOT incurred in managerial, tracking, and clerical processes. Administrative costs to the project were those not directly included in design, construction, right-of-way (ROW).

**Construction Costs.** Construction costs for the project included first costs and payments to the contractor, the cost of engineering and design, and costs related to changes in scope.

**Time.** Project time referred to the overall length of time spent in planning, procurement, design, construction, and extensions.

**Management Complexity.** The concept of management complexity referred to the delivery method's effect on the relative difficulty of coordinating issues encountered over the course of the project. Management complexity could include any management-related aspect of the project—executing the procurement phase of the project, planning, establishment of scope, logistical challenges during preconstruction and construction, or unforeseen problems that arose during implementation of the project.

**Disruptions to Third Parties.** Third parties potentially affected by the project included businesses, schools, churches, residential neighborhoods, local governments, and
other establishments or destinations. The term “disruptions” encompassed any change in the normal patterns of activities at these entities necessitated by activities on the project. Affects on community events or seasonal activities were also considered.

**Road User Costs.** Road user costs referred to the costs incurred by the motoring public resulting from the project. Some examples of road user costs include accidents, driver time, and additional vehicle mileage resulting from detours. While Mn/DOT does have a method for determining road user costs, the calculation has its greatest merit after a project has been completed. This study did not attempt to quantify what the road user costs will be at project completion, but rather, it speaks to the perceptions of how they may have been different as a result of design-build delivery.

**Quality.** Quality referred to the level of workmanship and the end products’ performance versus what is expected by the owner. The quality performance parameter also included consideration of the general processes used to achieve and assure quality on the project.

**Innovation.** Innovation referred to the contractor’s use of newer or less conventional concepts, construction methods, or materials on the project. This also included their flexibility to make design changes and their ability to pursue alternative these ideas or techniques.

**Funding Flexibility.** Consideration of funding flexibility involved the project’s effect on Mn/DOT’s program, capital flows and budget sizes, staffing, and issues surrounding appropriations for special projects versus appropriations for continuing operations.
Interview Participants

Several different entities played a major role in ROC-52 project. The winning design-build team for the project was Zumbro River Constructors (ZRC), LLC—a joint venture by Fluor Corporation, Ames Construction, Inc., and Edward Kraemer and Sons, Inc. HDR Corporation served as Mn/DOT's design-build oversight consultant for the project. Kleinfelder, Inc. handled materials testing responsibilities. URS Corporation also played a significant role as ZRC’s designer for ROC-52. Key representatives from each of these organizations were interviewed, as well as several Mn/DOT project and District 6 personnel who were involved in the project.

Interviewees were chosen with input from Terry Ward (Mn/DOT) and Doug Jackson (HDR) during a December 2004 meeting with the ISU research team. Interviewees were selected based on his or her role on ROC-52, as well as their familiarity with both design-build and design-bid-build highway delivery methods. Each interviewee was believed to be able to provide insight into the delivery method’s effect on most, if not all, of the project parameters.

A total of 19 individuals participated in the ROC-52 case study interviews. A list of the participants is included in Appendix B.

Data Collection from Interviews

Interviews for the case study were conducted in a series of sessions in January and February of 2005 in Rochester, Minnesota. Each interview was scheduled to last approximately 45 minutes. The interview sessions were conducted by two members of the
ISU research team. Both interviewers recorded notes from the participants' responses, and interviews were tape-recorded for verification and accuracy assurance.

Prior to the interviews, each participant was given a list of questions to be asked in the interviews. This list of questions is contained in Appendix A.

Inclusion of the complete interview notes was decided to be impractical for this thesis. However, a table which summarizing the interviewees' responses has been included in Appendix C.
CHAPTER 4. RESULTS AND DISCUSSION

Administrative Costs

A question related to the use of design-build on publicly-funded highway projects is how the use of a different delivery method affects the costs of administration. For clarity during the interviews, administrative costs were classified as those costs incurred to the agency in beyond those directly paid for design, construction, right-of-way, and other clearly defined project expenses. Mn/DOT’s administrative costs could include any of a variety of internal managerial or clerical expenditures, right-of-way acquisition processes, design reviews, and departmental contract administration costs.

ROC-52 case study interviewees were asked to specifically identify the costs of administration on the project, to help define precisely which costs should be classified administrative costs, as well as to determine any additional administrative costs that were either less obvious or unique to this project. Several additional sources of administrative expense were suggested. Of the 19 individuals who had the opportunity to respond, at least six specifically identified HDR’s role as the project’s oversight consultant to be an additional administrative cost. Some saw HDR’s estimated $16.7 Million contract as an added cost that would not be present on traditionally-delivered Mn/DOT projects, while other stated their belief that Mn/DOT would have assumed approximately the same expense if the oversight responsibilities performed by HDR had been retained by the agency.

ROC-52 featured co-location of the design-build team and the owner—ZRC, Mn/DOT, HDR, and various consultants located their respective ROC-52 personnel in a rented office building in Rochester for the duration of the project. The cost to co-locate the collective project teams under one roof was often mentioned as an added administrative cost
unique to this project. Most of those who saw the cost of this office as an added expenditure also stated the belief that there was economic value in doing so. One reason this was seen as effective was because of the direct communication it facilitated between members of the different organizations. Co-location made it easier to track down project team members, arrange meetings, and resolve issues that arose. So although it was common to identify the cost of co-location in a separate office as an out-of-pocket administrative expense attributable to the design-build approach, it was also important to acknowledge possible savings derived from it.

Development and implementation of the Request for Proposal process for best-value design-build was cited as an added administrative cost. The project’s status as Mn/DOT’s initial best-value design-build undertaking may have caused administrative expenses to be greater on ROC-52 than they would be on future projects of the same delivery method. The cost to develop the new RFP process and contractor selection procedure tailored to the best value approach was seen as a one-time expense which, once established, would only need minor modifications the next time it is used.

Several interviewees mentioned document control as an additional or unique administrative cost to ROC-52. HDR staff was involved in the development of a database where project documents and reports were input, and the database was considered to be integral to Mn/DOT’s document control for the entire project. The cost to develop and manage a new database for this design-build project would not be incurred on traditional Mn/DOT jobs.

Overall, the responses gave no clear answer to the questions of if and how much administrative costs are different by delivery method. In general, the replies from project
personnel showed a high degree of uncertainty about how administrative costs may vary with different delivery systems.

Of the 19 individuals questioned, seven contended that administrative costs were at least somewhat higher on design-build than they would have been under traditional. The explanations for why administrative costs may have been higher were numerous. Those who perceived administrative figure to be higher cited one or more of the additional costs previously noted—the co-located office, the HDR’s oversight contract, and development and implementation of the RFP and contractor selection process. Several people also stated that administrative costs may have been higher on ROC-52 simply because of the newness of using the design-build process on Mn/DOT projects.

Another seven individuals suggested that costs were lower under design-build than they would have been otherwise. The reasons for those who believed administrative costs to be lower were less specific than those who said they were higher. The most common of these responses was that design-build’s faster project timeline and single-contract delivery streamlined the project.

Of the remaining five responses, three suggested they were the same and two had no opinion. Of the three who said they were the same, two qualified the response by noting that certain costs were higher and certain ones lower, but the resulting overall administrative cost was effectively not different.

The interview responses offered no conclusive evidence whether administrative costs were higher or lower due to delivery method, and no conclusions or generalizations could be made. Mn/DOT provided additional cost data regarding administrative costs on a traditionally-delivered project, the Wakota Bridge project in the southeastern Twin Cities.
metropolitan area. The Wakota project was thought to be a possible comparison source since the cost of the project is of similar magnitude to ROC-52. This comparison was not used, however, due to significant differences in project scope, the municipalities involved, and the presence of other complicating factors such as litigation.

Construction Costs

Construction costs encompassed the amount established in the design-builder’s original contract, which covered their share for engineering and design fees. The expense of changes to the project and cost growth over the life of the project was also a part of the construction cost. In discussing the comparative values of construction costs through different delivery methods, risk allocation also became an important consideration.

Results of discussions with ROC-52 personnel suggested uncertainty about whether using design-build may have caused construction costs to be higher or lower. 14 of the 19 interviewees commented on the construction cost criteria. Only one individual strongly believed ROC-52 construction costs were higher under design-build than they would have been otherwise, and only two strongly believed they were lower. The remaining 11 responses were qualified with uncertainty or ambiguity: 6 said they might be lower, 2 said they might be higher, 2 said they were the same, and 1 said it was unclear.

A pair of reasons—cost growth reduction and overall time savings—was mentioned by nearly all interviewees who believed construction costs to be lower on ROC-52 and on design-build projects in general. The design-build process brought a reduction of change orders, both in number and in overall dollar amount. Some cost growth typically arises on construction projects from scope changes, unforeseen environmental conditions, and other
factors. Cost growth on ROC-52 was calculated to be 2.61% at the time of the interviews. The typical Mn/DOT target for cost growth on design-bid-build projects was around 7 percent, and the average Mn/DOT cost growth on projects from the years 1998 through 2002 was approximately 9 percent. The comparison of these numbers made the ROC-52 cost growth figure appear favorable, and was probably the most convincing indicator to those who believed that the project saved over traditional means. Several who believed costs were reduced by design-build also cited inflationary savings from faster construction, although quantitative substantiation of this belief was not provided.

The most commonly mentioned reason construction costs may have been higher was the increased risk to the design-builder. Design-build contractors are subject to more economic risk, largely because they hold responsibility to reconcile design errors. An individual from the design-build team estimated that up-front construction costs on other projects may be 5 to 10 percent more on design-build. Depending on the cost reduction experienced from the decrease in change orders on the project, the final figure for construction may have been slightly higher by design-build.

The issue of risk allocation in design-build makes for a complicated comparison to the design-bid-build system. It was noted that on ROC-52, however, that at least one area of risk assignment probably helped to reduce cost growth and help lower costs from what they may have been otherwise. Upon parcel acquisition for the project, Mn/DOT was faced with numerous environmental conditions, including 79 existing buildings requiring asbestos removal and 15 more possible areas of environmental contamination. Rather than having the design-builder include absorb this risk in their bid, the RFP allowed Mn/DOT to retain the
risk and simply pay for the changes. Estimates from interviewees projected the cost savings from this decision to be as much as $3 to $4 Million.

Several interviewees discussed the processes for attaining quality on a project as one factor that drove costs higher on ROC-52. Quality control (QC) was maintained by ZRC, while the quality assurance (QA) responsibilities were retained by the owner in the form of an oversight consultant, HDR. Some mentioned the contractor having added QC staff for the project that constituted an additional overhead expense in the original bid. Others saw QC and QA as a duplication of efforts. Perceptions regarding this issue are discussed in greater detail in the Quality of Project section.

Another possible added cost for the original bid on ROC-52 was for the design-builder's handling of public relations and community outreach. ZRC handled public relations exclusively and through a single point of contact, which has not been the arrangement on traditional projects. ZRC earned a $100,000 incentive for handling public relations on the project.

The ROC-52 personnel interviewed were generally hesitant to say construction costs were clearly higher or lower; many of those interviewed, including those who believed either higher or lower, conceded there was no way to tell for sure. Opinions on how costs vary by the delivery system frequently came down to perceptions about how the systems themselves vary and how costs disparities in certain areas may be compensated for in other areas. Risk was the most often mentioned of these considerations, but there were several others.

Since risk is higher to the contractor on design-build projects, it was expected there is an adjustment in the bid compared to traditional to account for the increased exposure. A strength of the design-build method is the greater flexibility it allows allocating risk to the
party who most suited to accept it. During the planning phase of the project, the Department identified several key areas of risk and subsequently included related materials and data in the RFP. Other areas of risk including quality and schedule can be placed on the design-builder. The result is that risk is assigned so differently than in design-bid-build projects, first costs of construction and costs of changes are apt to be different. It became difficult to make reasonable comparisons regarding construction costs between the traditional and design-build methods.

**Time**

Discussion about project time effects resulting from design-build delivery was one-sided on ROC-52. Perhaps the most commonly recognized advantage of design-build, time was a performance parameter widely acknowledged as one of the primary reasons for its use on the project.

Original projections under design-bid-build had the scope of Rochester Highway 52 corridor reconstruction broken into as many as 15 separate stages spanning more than 11 years to completion. An aggressive schedule and significant reduction in time was of major importance on the project, driven by feedback received from the community and the Economic Impact Study by the City of Rochester and Mn/DOT's District 6. Once design-build materialized as the means for delivering the project, construction time was reduced down to five years—from the project letting on November 1, 2002 to the RFP required completion date of November 1, 2007. The design-builder’s schedule projected completion in Fall of 2006, a year ahead of the required timeline. Official project completion was celebrated in October of 2005, a year earlier than projected.
As expected, all participants in the ROC-52 interviews said design-build delivery reduces the time for project compared to traditional. There were several reasons, both apparent and less obvious, for why project’s duration was reduced by the use of design-build delivery.

The most commonly mentioned reason for why design-build can save time over the traditional process was the ability for design and construction to partially overlap. In design-build, this can effectively be a three-phase process: first, there is a period of design only when preliminary design considerations are addressed; second, preliminary construction activities get underway as the plans near completion; third, construction only continues to completion after the plans have been finished.

Time savings were realized from certain processes in highway construction which take a significant amount of time but which do not necessarily require a completed plan set. The time-consuming removal of existing pavement or preparation of subgrade for the new highway were two examples of tasks mentioned which did not require a completed and finalized plan set for work to begin.

Another common explanation for why design-build created time savings on ROC-52 was simply its enabling of a project of its size and scope. The process of letting the reconstruction as many separate projects rather than a single one would have been schedule prohibitive. Design-build also allowed the use of alternative funding vehicles, including Federal Accelerated Construction support, which helped to secure future federal funding in advance to help enable completion of the project in a timely manner. ROC-52 simply could not have been built in 5 years—if at all—under Mn/DOT’s traditional design-bid-build system.
Design-build also saved time on ROC-52 because it promoted pre-letting contractor involvement more than any other contracting method. Once the design-build process was initiated and Request for Qualifications (RFQ) was issued for the project, four teams submitted Statements of Qualifications (SOQ) and all were included in the Department's "short list" of teams from which proposals would be accepted. After these steps were taken, the four proposing teams became involved in the process in a way that does not occur prior to letting of traditional jobs. Teams submitted innovative technologies, termed Alternative Technical Concepts (ATCs), to the seven-member ROC-52 Technical Review Committee for evaluation, and then scored the four teams' proposals. One ATC used by ZRC on the project—mechanically stabilized earth (MSE) retaining walls—was said by personnel from both contractor and owner to have reduced the schedule by approximately one year (the ATC process is discussed in greater detail in the Innovation section later in this Chapter).

Getting potential contractors involved earlier meant that Mn/DOT had more time to evaluate and approve innovations, while the contractor could have valuable interaction about the project with the owner. Both sides had a clear idea of expectations earlier on in the process, and this favorably impacted the builders' plans, including their ability to commit equipment and resources, to use innovative technologies to save time and money, and to use sequencing and methods that allow them to build the project as efficiently as possible. This process added some time to the project planning phase, but many believed it saved a considerable amount of time over the course of the project.

Other ROC-52 individuals indicated that the nature of the plans themselves was a source of time savings. As one pointed out, design-build offered "more flexibility in the design document deliverable." The distinction between plans being "bidable" on a
traditional job versus "buildable" on design-build projects was a central point. Individuals from the contractor side of the project asserted that projects can be built to the expected level of quality and performance without the level of detail required in a traditional DOT plan set. They believed design-build plans can be completed faster and with less emphasis on details, and still produce a finished product identical to traditional in less time.

**Management Complexity**

As a performance parameter to evaluate design-build, management complexity encompassed wide array of issues. Management of any portion of the project could bring potential challenges, whether during the stages of planning, procurement, design and engineering, preconstruction or construction. Those interviewed for the ROC-52 case study included many of the managers of day-to-day activities of the project. The objective of this portion of the interviews was to be able to identify what areas of the project brought the highest levels of management complexity, and determine if ROC-52 was more or less complex from a management perspective based on the delivery method.

Of the 19 interviewees, 11 stated that management of the project was at least somewhat more complex than what would be expected of a traditional project of similar scope. The remaining individuals believed the differences in management complexity to be either ambiguous or too difficult to compare.

One of the most fundamental reasons why many believed design-build projects to present a higher level of managerial challenges was simply the newness of the system. Being Mn/DOT's first large-scale best-value design-build project meant that from the start of ROC-52, new processes were developed and used. At the start of the project, a new
approach to accepting and evaluating proposals was implemented, and included new
considerations such as short-listing teams, institution of the ATC process, and using the best-
value scoring approach to evaluating the proposals differently than traditional projects. As
the project progressed, different ways of integrating design and construction, relating to the
public, and managing quality were among notable departures from the traditional system.
The newness of each of these different methods made management responsibilities more
challenging, because, as one interviewee put it, it represented a full “culture shift.”

A point of management complexity mentioned by individuals from both the design-
build team and the owner side of the project was the role and authority of the project
managers themselves. Both sides asserted that design-build project managers must be given
the authority and trust by their respective agencies to make decisive judgments about issues
that arise. By all accounts, this seemed to have been handled well on ROC-52. Project
managers representing both sides were given the power to make decisions about project
issues without requiring escalation to greater levels of management. The belief was
expressed that the people in charge at the project level have an ideal combination of specific
project knowledge and professional experience and skill, and therefore need to be relied upon
make decisions; in design-build projects where time is such a critical factor, swift and
decisive problem resolution is essential to keeping things moving forward.

A primary reason for uncertain on whether design-build brought increased
management complexity was the difficulty of separating the complexity of the delivery
system from the complexity of the project itself. Several stated that complexity is more a
function of the specific project rather than an issue of traditional versus design-build
delivery. The project or projects that would have comprised ROC-52 under the traditional
system would have likely shared many of the same complexities—a large-scale urban reconstruction, complicated staging scenarios, difficult traffic maintenance requirements, as well as many of the same coordination issues with right-of-way, utilities, or environmental concerns. These issues were not viewed as being exclusive to design-build.

**Disruptions to Third Parties**

A project with the scope of ROC-52 could occur without affecting many parts of the community. Businesses, residential neighborhoods, schools, and churches were among the third parties whose routines were subject to disturbances from the construction. The objective of this performance area was to determine how disruptions to third parties may have differed, either greater or less, under the design-build system.

Of 17 interviewees who offered feedback regarding third party disruptions, 15 stated that disruptions during the construction were less because of design-build. The remaining two respondents were uncertain or believed disruptions to be no different than they would otherwise have been under traditional contracting practices. No interviewees believed disruptions to the community to be greater under design-build delivery.

A common reason why people believed disruptions to third parties to be less on ROC-52 was the handling of public relations (PR). An incentive-based contract provision gave PR responsibilities to ZRC, making them the exclusive point of contact for the public over the life of the project. Although a provision of this extent is not typically included in the contract, even for design-build, many of those interviewed considered the PR handling on ROC-52 to be a major success.
On traditional projects, as one interviewee explained, “The DOT or the DOT’s consultant interacts with the public as a go-between with the contractor.” Here, the design-builder maintained direct contact with the public, an arrangement believed to be advantageous for several reasons. First, the direct interaction eliminates time delay or confusion that occurs from the public-DOT-contractor communication relay. Second, having a single and exclusive PR point of contact, as ZRC did, greatly reduced any mixed messages or contradictory information that could occur if PR duties were shared. Finally, having direct contact with the public forced the design-builder to provide a different level of accountability. With no buffering organization, the design-builder had responsibility to maintain its own good reputation by being responsive to the public’s concerns. Several individuals expressed the opinion that the design-builder acted with a greater sense of urgency under this arrangement.

The use of multiple media outlets to provide comprehensive and up-to-date travel information was also considered valuable. The contractor made effective use of local television and radio outlets, a project website, and a “1-800” project phone line as well. The public was kept current on the status of the project, with particular emphasis on specific ramp closures and detour routes that affected travel.

Third party impacts were also thought to be reduced greatly by having a shorter project lifespan. The period of impact is much shorter versus what it would have been under the original design-bid-build plan. Some suggested that the public perceived impacts much more favorably on ROC-52 because their expectations for disruptions were so much worse.

During construction of the project, design-build was said to have given the contractor more flexibility to minimize disruptions by making it easier to make changes to plans and
processes. Timing and planning of construction activities, detour routes, and traffic control were just a few notable areas where changes were made to accommodate the public. Some of the following examples illustrated how this flexibility was used by the design-build team.

- ZRC made what was said to be an uncommon effort to accommodate an elementary school near the 6th Street bridge in the central region of the project. ZRC worked closely with the Rochester School District to coordinate its period of closure to minimize the effect to Folwell Elementary School. They altered their schedule to open the bridge at least 6 months ahead of the original plan; meanwhile, they erected a temporary pedestrian bridge and paid the school district for additional busing needs arising from the construction.

- On Halloween evening of 2003, parents from the neighborhoods around the 2nd Street and 6th Street raised concerns about the scheduled 8:00 PM demolition of the two bridges. The parents said that their children would be trick-or-treating after 8:00 PM in neighborhoods on the other side of Highway 52 and were counting on the bridges to get back home. The contractor responded by delaying the demolition until 10:00 PM that evening to accommodate these families. The contractor’s direct interaction and greater accountability to the public was believed to have been a significant factor in their willingness to change the schedule of a demolition event to oblige a relatively small group of residents on Halloween.

- ZRC’s construction work on a frontage road in the corridor prompted a call from a doctor employed by a Mayo Clinic hospital. The woman’s work hours at the hospital were during the night, and during the day she slept at her apartment. At one point during construction, noise from trucks and equipment prevented her from sleeping. The
contractor’s response to the complaint was decisive and generous: they changed the haul routes of the trucks and directed noise away from the doctor’s apartment complex.

Road User Costs

Road user costs (RUCs) are incurred by motorists as a result of construction projects. The determination of road user costs puts a value on driver travel time, delays, accidents, additional vehicle mileage from detour routes, and other factors. Most DOTs have their own method for estimating road user costs for projects.

The interview responses gave some qualitative impressions about the impact of design-build on road user costs. Many of the individuals interviewed did not have sufficient knowledge or felt unable to comment about road user costs. Six people believed road user costs to be reduced as a result of design-build; five said they were either the same, or that the impact on road user costs from delivery method was unclear.

The primary explanation for why road user costs may have been lower in design-build was the reduction in time to complete the project. Most interviewees believed the same types RUCs would occur for the same scope of work regardless of delivery method. Consequently, since RUCs were accumulated only while the project was in progress, intuitively they were expected to be lower for a project of shorter duration.

The reasoning was similar for the interviewees who believed RUCs would not be different regardless of delivery method. Their argument was that the same costs occur either way, regardless of duration of the project. Unfortunately, the responses to the questions of road user costs were not clear or insightful, as many felt they did not know enough to make an assertion one way or the other.
Interviewees noted that the Economic Impact Analysis from 2000 contained information about traveler and business costs on ROC-52. This consultant study looked at four different staging alternatives for the Highway 52 corridor reconstruction, before the decision to use design-build was made. The four alternatives considered in the study were 4-year, 5-year, 7-year, and 11-year scenarios (Staging, 2001). It is worth mentioning that several significant scope changes were made to the project in the time after the economic study was completed and before the procurement phase was initiated.

Traveler costs and retail transfer were the two parameters evaluated in the Economic Impact Analysis. Of the four alternatives, the lowest projected dollar amounts in both traveler and retail impacts was the 11-year alternative; however, this option was not considered because of the prohibitive timeline, project fragmentation, public dissatisfaction, and reasons previously discussed. The most costly alternative was the 7-year scenario. The second-lowest option was the 5-year plan, and this helped provided the basis for Mn/DOT targeting a five-year construction timeline.

The 4-year option was the second most costly scenario for both traveler costs and retail transfer. Although it was the shortest plan, the 4-year option was problematic for other reasons. Unlike the other options, the 4-year option would have required full closure of Highway 52 for two years. This would not have been realistic because of the lack of alternative roadway facilities to accommodate traffic demands through the city. This left the 5-year and 7-year plans as the two most plausible alternatives for the reconstruction.

For the sake of comparison regarding road user costs, consider the two most favorable staging alternatives—the 5-year and 7-year plans. The study estimated the traveler costs for the 5-year option to be approximately $80 Million; the estimated traveler costs in the 7-year
option were $150 Million (Staging, pp. 3-4). Consequently, for each year of schedule reduction, an estimated $35 Million in traveler costs was saved. Savings of this magnitude suggests that there was significant economic value for the traveling public from the reduction of schedule even between the two best options considered by the study. The actual value of this reduction in traveler costs (and retail transfer) would likely be even greater considering the actual execution of the project. With the final construction being completed in approximately three years, and with the final construction cost being more than 50% greater than considered in the 2000 study ($232 Million versus $150 million), the actual road user cost reduction to the public would have been even greater than anticipated.

Quality of Project

The quality performance parameter was a key issue on ROC-52. Quality referred to workmanship and performance of the final product and how these factors compare to the owner's expectations. Over the course of the case study interviews, quality emerged as the most contentious issue during the construction phase of the project.

A considerable amount of the discussion regarding ROC-52 centered on the processes used to achieve quality, rather than the actual quality of the final product. The issues raised about quality during the interviews were not about whether it was being sufficiently attained through design-build. Instead, the focus was on the appropriateness of the owner's approach to the processes of quality control and quality assurance.

The interviews revealed little doubt that ROC-52 has been a project of good quality. Seven interviewees said quality was better on ROC-52 than they would expect on a traditional project of the same scope. The remaining ten responses indicated that quality was
the same as what would be expected on traditional projects. No one believed quality to have been less than what traditional delivery would produce.

Several reasons were offered for why quality was superior. A number believed quality to be better on ROC-52 because the contractors have been inclined to put their best and most experienced personnel on design-build projects, often because design-build projects tend to be higher-profile, of greater dollar value, and with having higher risk. There was some sentiment that quality performance is even more crucial for a contractor to succeed in design-build delivery than in design-bid-build. Because owners of best-value design-build projects often put a greater emphasis on quality rather than exclusively the “bottom line” low bid, it is more important for design-builders to have an established track record for producing quality projects to help secure future design-build contracts.

Some said that redundancy of quality processes on ROC-52 helped to create a more quality project. The project was unlike the traditional system where processes to guarantee quality are reserved to the DOT. With the contractor handling quality control responsibilities, and HDR serving as Mn/DOT’s oversight consultant responsible for quality assurance, some personnel believed the presence of twice as many eyes helped guarantee material and process specifications were met.

Most of the interviewees believed that product quality and workmanship on the project would have been the same regardless of delivery process used. Several comments were made that product quality has more to do the capabilities and commitment of the contractor and Mn/DOT field inspectors than with contract method. On ROC-52, participants generally had praise for both the designer-builder and the Mn/DOT and HDR personnel regarding their understanding of and commitment to quality workmanship.
As mentioned, there were a number of problems related to quality processes on ROC-52. Most of these problems stemmed from confusion about decision-making authority and quality responsibilities between the design-builder and the Mn/DOT/HDR oversight team. On ROC-52, ZRC held the responsibilities for quality control (QC), while Mn/DOT via HDR handled quality assurance (QA). This was problematic, as it was a departure from the traditional arrangement where Mn/DOT would have handled QC responsibilities.

One example of where the new quality responsibilities were problematic involved soils used for subgrade fill material. The HDR oversight representative responsible for QA noted excessive clay in the soil and informed the field representative of the design-builder that the fill material was not acceptable. This QA function was appropriate. However, the QA representative then told the design-builder to halt all incoming trucks from the borrow site and stop work on that section of the roadway. This declaration extended beyond the authority of a QA oversight field representative. Remedy of the quality failure was the responsibility of the design-builder, and they hold the authority to determine the method of correction. In the case mentioned above, there were several dozen trucks in queue from the borrow site, and returning the material while stopping work until a new borrow site was located would have had serious cost and schedule implications for the design-builder. A solution to the problem was devised, but not without some difficulties in establishing authority.

In addition, several interviewees noted that the duplication of effort in quality processes led to inefficient use of project resources. Specific examples were not given, but the nature of the discussions seemed to imply that there was too much oversight in the field and too much redundancy in the system. The use of the traditionally prescriptive
specifications was inconsistent with design-build quality processes, which should focus primarily on performance outcomes.

Overall, the participants in the case study interviews believed that most of the problems associated with quality processes were a result of the newness of the design-build processes and roles, and that the situation would improve as Mn/DOT personnel became more familiar with design-build delivery. In fact, several respondents commented that the quality process issues improved substantially over the course of the ROC 52 project.

Innovation

Interviewees were unanimous in the opinion that use of design-build led to more innovation on the ROC-52 project than would have been possible under traditional delivery. In particular, the method used for submittal, review, and approval of Alternative Technical Concepts (ATCs) was particularly beneficial on the ROC 52 project. Several improvements in efficiency and reductions in cost, schedule, or third-part impacts were made possible through the introduction of ATCs by the design-builder.

The ROC-52 ATC process was seen one of the unique and advantageous aspects of the design-build process. Initially during the RFP phase, the four teams preparing ROC-52 proposals viewed Mn/DOT's specifications for the project as overly restrictive for the design-build environment. The teams, based on experience with other design-build projects highway projects, had come to expect specifications which were less prescriptive and more "performance-based." The fundamental difference between prescriptive and performance-based specifications is that the former dictates specific methods and steps, while the latter
allows flexibility and innovation in the way of materials, methods, and systems as long as required end results are met.

Mn/DOT considered the sentiments of the four proposing teams about the lack of innovation allowed under the initial RFP. Mn/DOT’s ROC-52 Project Team looked at how other DOTs had addressed this issue on design-build projects. Typically on these projects, an innovative concept would be presented by a proposing party, reviewed by the owner, and if approved, the concept would be shared with all proposing teams. Mn/DOT chose a different approach to this part of the process because they felt that sharing the approved innovative concepts between teams removed the incentive and economic advantage for each team to develop them. Instead, teams were permitted to submit new concepts to satisfy the RFP’s performance requirements, but these ATCs were kept confidential prior to letting. There were also four project areas Mn/DOT determined to have specific requirements that would not be conducive to any ATC submittals—right-of-way, ITS, pavement structure, and aesthetics. ATCs were not considered in these four areas.

The four proposing teams were allowed up to five meetings with Mn/DOT project staff to discuss ideas and obtain feedback. The teams were invited to submit innovative concepts for review, upon which Mn/DOT would decide to accept, conditionally accept, or reject the proposed ATC. Overall, 100 ATCs were received from the four teams. Of these, 9 were fully approved and 39 were conditionally approved. The topics covered in the ATC submittals were varied, but the most common were said to include roadway geometrics, walls and bridges, and maintenance of traffic.

It was stated that ZRC reduced their bid price by as much as $4 Million by being allowed to use ATCs they had proposed. The most significant ATC in terms of savings was
the use of different wall systems, particularly mechanically stabilized earth (MSE) retaining walls, which replaced the more costly and time-consuming cast-in-place cantilevered wall included in the original RFP requirements. This change alone was said by ZRC to have reduced the schedule by one year, a cost savings that is additional to $4 Million already mentioned. Other successful ATCs mentioned were the use of rock-cut material as median fill on the south end of the project, flexible traffic maintenance plans through the corridor, and an alignment shift to help facilitate construction of the interchange at US Highway 14.

The use of more performance-based specifications was believed by many to be crucial to the design-build process because it can enable innovation that can save time and money. The primary concern may be making sure that the owner's expectations are clear. As one interviewee put it, "the owner may be expecting a Mercedes-Benz, while the contractor sees a Volkswagen." The ATC process used on ROC-52 worked to minimize these types of problems by getting both sides involved in dialogue during the RFP phase, having a structured procedure for approving or conditionally approving the ATCs, and having areas of the project that were off-limits to ATCs. Still, performance-based specifications are appropriate for many situations, and all of those interviewed seemed to realize their importance to the success of projects such as this one. The ability of the contractor to use innovative concepts and have more flexibility is essential to design-build projects, and the belief seems united that the ATC process was successful on ROC-52.

**Funding Flexibility**

Funding issues and related political matters were the most difficult to gather information about on the ROC-52 project and case study. A majority of respondents stated
that they did not sufficient knowledge of the situation to comment on funding issues related to the use of design-build. However, there were 4-5 interviews with Mn/DOT administrative and District 6 personnel that gave some insight into these complex funding matters.

The recurring theme from the funding-related interviews was that using design-build required a drastic change in the approach to financing transportation infrastructure. One interviewee stated, “You can’t have innovative contracting without innovative funding; they go hand-in-hand.” The cornerstone of the innovative funding program that made ROC-52 possible was the 2003 Bond Acceleration Program that made slightly more than $400,000,000 available for construction projects in Minnesota under the Trunk Highway Bonding Authority. The $400,000,000 in debt financing allowed the state to leverage an additional $400,000,000 plus in Federal Accelerated Construction (FAC) authority to accelerate trunk highway improvements throughout the state. The net result was funding of seventeen major highway projects scheduled to be delivered more than 60 years ahead of their original schedules.

The details of transportation program financing exceeded the scope of this research effort. It was worth noting that the consequences—negative and positive—resulting from the decision to accelerate construction. The negative consequences included loss of additional FAC dollars until 2009 and the temporary reduction of Mn/DOT cash balances to historical low points. The reduction in cash balances was due to some of the peculiarities of the FAC program. The FAC program fund processing requires 30 days for reimbursable on matches, compared to seven days for conventional federal funding. At times, this delay put a strain on cash reserves for major projects.
Since many of Mn/DOT's operational issues such as design, quality control, inspections, and public relations were included in the design-builder's contract on ROC-52, capital operational budgets have needed resolution. Mn/DOT has also had to work out staffing issues created by this dilemma. The construction program in District 6 will be smaller in future years because of the need to pay for the acceleration of ROC-52, and the process of district personnel returning to operating budget lines upon the project completion is uncertain. Concern was also expressed that maintenance programs in District 6 could suffer as a result of the acceleration of ROC 52.

On the positive side, the strain on cash flows created by accelerated construction projects like ROC-52 led Mn/DOT to develop their Cash Forecasting Information Tool (CFIT), which will enable better forecasting and analysis of Departmental cash flows. Increased sophistication in fund management is one of the secondary benefits of the use of design-build for ROC-52. Other improvements have been made to accounting, procurement, program and project management systems, and project information and document controls.

Accelerating construction projects under a design-build delivery system did put a strain on Mn/DOT's cash fund balances, and contributed to some significant future challenges. However, the use of design-build allowed Mn/DOT to receive advance funding from FAC dollars to make ROC-52 a reality, while still helping to maintain a functional and sustainable District operations budget.
CHAPTER 5. CONCLUSIONS AND RECOMMENDATIONS

ROC-52 has been widely praised as a major success by project personnel, the public, and the local media. Of the performance parameters considered in this research, several—time, disruptions to third parties, road user costs, innovation—seem to have clear advantages under the design-build system. Others such as management complexity, quality, and financial flexibility, have both merits and drawbacks.

Conclusions

Administrative Costs. Delivery method’s effect on administrative costs was inconclusive. ROC-52 interviewees offered widely varying suggestions but pointed to no clear conclusion regarding administrative costs. Suggestions were made of possible differences in administrative costs between the two systems—cost of co-location, the HDR oversight contract, development of new procedures during the procurement phase. However, no clear consensus emerged from their responses. The ambiguity about administrative costs was consistent with design-build literature and with recommendations of Keith Molenaar.

Construction Costs. The effect of delivery method on total construction costs was unclear based on interview responses. It was generally believed to be very difficult to compare the two systems objectively because risk—a key, inherent economic element of the bid—is handled quite differently in design-build than in design-bid-build. The way risk is allocated on projects of different delivery methods would have made for a murky and potentially invalid comparison. Interviewees indicated that cost growth on ROC-52 was lower than rates common on traditional projects, however. The estimated ROC-52 cost
growth figure of 2.6% did bear this out. Overall, design-build appears to be competitive with design-bid-build in terms of construction costs.

**Time.** Without question, the time performance parameter was favorable under design-build. All project personnel interviewed for this study agreed that using design-build has facilitated a markedly quicker project. A considerable portion of the design and construction phases of design-build projects are able to take place simultaneously. Scope-related design changes occur less frequently and can be reconciled more dynamically, as the risk and accountability for design accuracy and schedule adherence falls squarely on the design-builder. Design-build brings contractors into the process prior to letting, allowing them to explore time-saving options for construction, as evidenced by the ATC process on ROC-52. Using design-build on ROC-52 was credited largely with having reduced the reconstruction timeline from more than a decade by traditional delivery down to approximately 3 years.

**Management Complexity.** ROC-52 interviews suggested that the design-build process has brought greater management challenges. At least some of the additional complexity must be attributed to the newness of the process, a retooled approach to procurement, greater levels of complexity and integration in scheduling design and construction, and having to change roles and responsibilities on the project. However, the management complexity of a project also has much to do with the nature of the project itself. The fact that ROC-52 and other such large and complicated projects tend to be the ones that become candidates for design-build delivery obscured some of the complexity attributed to the delivery method. Overall, ROC-52 was believed to have been somewhat more
complicated to manage, partly because it was delivered design-build, and partly because it is a large and challenging project—regardless of delivery system.

**Disruptions to Third Parties.** A 15-of-17 majority believed that disruptions to third parties were less on ROC-52 as a result of design-build; two others believed they were no different, and no one believed them to be greater. The decision to have the design-builder have complete and singular responsibility for public relations on the project was considered highly successful. It eliminated the possibility of contradictory information from multiple sources and expedited the communication process. Moreover, it held the design-builder more directly accountable to the public than having Mn/DOT relay information or concerns between the public and contractor as on traditional projects.

**Road User Costs.** Interviewees’ perceptions about the economic concept of road user costs were inconclusive. The majority of those who offered an opinion believed RUCs were reduced as a result of design-build simply because the length of the project and exposure to impacts was greatly reduced. The ROC-52 Economic Impact Analysis addressed RUCs and business impacts and suggested a 5-year maximum timeline. The report arrived prior to ROC-52’s selection for design-build and subsequent scope changes.

**Quality.** Acceptable quality was achieved on ROC-52, as all interview participants believed it was as good as or better than what would be expected under a design-bid-build scenario. However, the system of achieving quality was problematic. There were disagreements between design-builder and owner representatives about decision-making authority involving quality matters. Some also believed quality efforts were inefficient and unnecessarily redundant. Quality processes in design-build require a change of roles versus
traditional. Many felt that these difficulties improved over the life of the project as individuals were acclimated to new roles and responsibilities.

**Innovation.** Innovation was unanimously believed to have been better on ROC-52 as a result of design-build. Specifically, the Alternative Technical Concepts process fostered a productive pre-letting exchange between design-builder, which ultimately led to the use of valuable design and construction concepts which were new to Mn/DOT projects. The resulting approved ATCs allowed for the integration of several innovations that saved considerable amounts of time and money. Some felt that the process could evolve even more in the future, with a greater shift from prescriptive to performance-based specifications.

**Funding Flexibility.** Use of design-build on ROC-52 required the use of some different funding mechanisms, including debt financing and Federal Accelerated Construction dollars. Design-build delivery enabled Mn/DOT to complete the Highway 52 corridor reconstruction without jeopardizing District 6 operations budgets, but the funding arrangement has also brought some challenges. The most notable of these were reduction in future funding, strains on Departmental cash balances, and staffing complications during and after the project.

**Recommendations for Future Design-Build Projects**

Based on experiences on ROC-52, the following specific measures are recommended for future projects of similar scale utilizing design-build delivery:

- Use caution in making any cost-related comparisons between the design-build and design-bid-build delivery methods. Major differences like risk allocation make objective comparison very difficult.
• The value of faster construction should be a key factor in the selection of future projects for design-build. Design-build is especially favorable for saving time on complex corridor-type projects such as ROC-52.

• Co-location of staff offices of the design-builder and the owner is advisable. This is very valuable in creating effective communication and a team-based approach.

• Designation of public relations to a single point of contact is recommended. The design-builder’s contractual PR incentive was a successful on ROC-52.

• Increased use of performance-based specifications on design-build projects should be considered by Mn/DOT to take full advantage of the potential for innovation offered by the design-build delivery.

• On design-build projects, a distinction between “bidable” and “buildable” plans should be recognized. A plan set for a design-build highway project does not necessarily require the traditional level of comprehensiveness to be constructed.

• Project managers from Mn/DOT and from the design-builder should be trusted with decision making authority. Design-build requires decisive and timely issue resolution.

• Processes for quality control and quality assurance must be clearly understood by all parties at the onset of construction. These processes must be carried out according to the plan.

• A procedure to approve innovations, such as the ATCs, should be utilized early in the design-build process. This can allow Mn/DOT to take fuller advantage of a design-builder’s particular ideas and skills, and can have positive ramifications on cost and schedule.
APPENDIX A. INTERVIEW QUESTIONS

Administrative Costs

• What are some examples of internal (Mn/DOT) administrative costs on ROC-52?

• If ROC-52 had been administered using Mn/DOT’s traditional delivery system of design-bid-build, would Mn/DOT’s internal costs have been higher, lower, or the same? If different, specifically which types of internal costs would change?

• How did actual processes associated with these administrative costs differ on this design-build project from how they typically would be under projects of traditional delivery?

Construction Costs

• How would construction costs have been different if the project had used traditional delivery rather than design-build—higher, lower, or the same? Why?

• Are there other construction costs besides those mentioned (first costs, engineering and design, change costs)?

• If there are others, are they attributable to the type of delivery system used on this project?

Time

• Would the length of time spent in each of these project phases have been higher, lower, or the same under the traditional delivery method?

• How significant would the difference have been?

• Are there other factors that affect project time?
Management Complexity

- Was there difficulty understanding the scope or defining the project?
- If so, would this have been different under the traditional system?
- Was the project easier, more difficult, or equally as difficult to manage due to its status as design-build rather than traditional?
- Specifically, which areas of the project were more difficult to manage? (procurement processes, utility conflicts, ROW turnover, phasing, etc.)
- What were the logistical concerns with executing the project, and would they have been different under the traditional system?

Disruptions to Third Parties

- Are there other specific examples of third parties impacted by the project? What were the impacts?
- How did ROC-52's design-build delivery method affect the way disruptions to third parties were handled? Did the design-build system improve, hinder, or have no effect on how third-party impacts were managed or remedied?
- What was the disruption to residents or neighbors? Railroad crossings? Facilities or structures along the route?
- Were there environmental issues on the project? Were there any differences in the way they were dealt with stemming from the use of design-build instead of traditional?

Road User Costs

- Are there other types of road user costs which were unique to the ROC-52 Project?
Would these costs have been higher, lower, or no different under the traditional system instead of design build?

Quality of Project

• How has design-build impacted the overall quality of the project?

• Are there any specific examples of how quality was different under design-build than expected under the traditional system?

• What do you think the long-term effects will be in terms of workmanship, warranty, contractor call-backs, ongoing maintenance, and other quality-related issues?

Innovation

• How does the design-build system allow for changes to be made on the project?

• Does design-build promote or discourage contractor innovation, and to what extent?

• What were some specific examples of innovation on the project, if any?

• If applicable, in what areas is innovation made possible? Design? Methods?

Sequencing? Other areas?

Funding Flexibility

• To what degree does design-build create different options for funding flexibility?

• Are projects easier to fund than operations? (use of capital budgets versus operating appropriations for design, inspections, etc.)

• Is the impact significant or minimal?
### APPENDIX B. INTERVIEWEES FOR ROC-52 CASE STUDY

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Karl Anderson</td>
<td>Mn/DOT</td>
<td>Materials Specialist</td>
</tr>
<tr>
<td>Sim Brubaker</td>
<td>HDR</td>
<td>Field Services Manager</td>
</tr>
<tr>
<td>Jim Eshbaugh</td>
<td>URS</td>
<td>Design Manager</td>
</tr>
<tr>
<td>Craig Glazier</td>
<td>HDR</td>
<td>Segment 1 Construction Engineer</td>
</tr>
<tr>
<td>Tanya Houska</td>
<td>HDR</td>
<td>Financial Budget Manager</td>
</tr>
<tr>
<td>Trinity Houska</td>
<td>HDR</td>
<td>Field Engineer</td>
</tr>
<tr>
<td>Doug Jackson</td>
<td>HDR</td>
<td>Project Manager</td>
</tr>
<tr>
<td>Steve Kilcrease</td>
<td>ZRC (Fluor)</td>
<td>Deputy Project Manager for Administration</td>
</tr>
<tr>
<td>Herb Morgan</td>
<td>ZRC (Fluor)</td>
<td>Project Manager</td>
</tr>
<tr>
<td>Tim Odell</td>
<td>ZRC (Ames)</td>
<td>Deputy Project Manager</td>
</tr>
<tr>
<td>Barry Paye</td>
<td>Mn/DOT</td>
<td>Assistant Segment Engineer</td>
</tr>
<tr>
<td>Keith Quernemoen</td>
<td>HDR</td>
<td>Segment and Project Controls Engineer</td>
</tr>
<tr>
<td>Dave Robinson</td>
<td>Kleinfelder</td>
<td>Quality Assurance Materials Manager</td>
</tr>
<tr>
<td>Judy Schmidt</td>
<td>Mn/DOT</td>
<td>District 6 Administrative Manager</td>
</tr>
<tr>
<td>Nick Sovell</td>
<td>HDR</td>
<td>Construction Manager</td>
</tr>
<tr>
<td>Nelrae Succio</td>
<td>Mn/DOT</td>
<td>District 6 Engineer</td>
</tr>
<tr>
<td>Jim Valyntine</td>
<td>ZRC (Kraemer)</td>
<td>Structures Manager</td>
</tr>
<tr>
<td>Terry Ward</td>
<td>Mn/DOT</td>
<td>Project Manager</td>
</tr>
<tr>
<td>Tom Wiener</td>
<td>HDR</td>
<td>Project Controls Manager</td>
</tr>
</tbody>
</table>
### APPENDIX C. SUMMARY TABLE OF RESPONSES

<table>
<thead>
<tr>
<th>Performance Parameter</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Administrative Costs</strong></td>
<td>Same</td>
<td>Higher in D-B due to added staff, more reviews, etc.</td>
<td>Same or lower with D-B</td>
<td>Similar, but ultimately higher in D-B</td>
</tr>
<tr>
<td><strong>Construction Costs</strong></td>
<td>Up front costs 5-10% higher; change orders 10-15% less with design-build (D-B)</td>
<td>Lower overall in D-B; risk is higher but change orders are lower</td>
<td>Less than 5% cost overrun with D-B, better than traditional jobs</td>
<td>Less with D-B; savings from minimal change orders and low cost growth</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td>Less overall in D-B; unforeseen environmental conditions used schedule float</td>
<td>Shorter in D-B</td>
<td>Shorter in D-B; original plan was about 10 years</td>
<td>Faster and shorter in D-B; would've been several different projects in traditional</td>
</tr>
<tr>
<td><strong>Management Complexity</strong></td>
<td>Some issues are less complex in D-B, some are more complex</td>
<td>Same</td>
<td>Somewhat more complex in D-B; issues arose because process was new</td>
<td>Unclear; challenges were related to roles and newness of the system</td>
</tr>
<tr>
<td><strong>Disruptions to Third Parties</strong></td>
<td>Same, except third parties are kept more informed in D-B</td>
<td>Process is smoother in D-B</td>
<td>Disruptions are easier to handle</td>
<td>Disruptions less in D-B; public interaction was different</td>
</tr>
<tr>
<td><strong>Road User Costs</strong></td>
<td>Lower in D-B</td>
<td>Lower in D-B</td>
<td>Lower in D-B</td>
<td>Reduced by speed, schedule</td>
</tr>
<tr>
<td><strong>Quality of Project</strong></td>
<td>Quality and end result are better under D-B</td>
<td>Quality is good; disagrees with Mn/DOT belief that quality requires QC involvement</td>
<td>Definitely above average; credits contractor more than the process</td>
<td>Quality is there, but system for achieving quality didn’t function as it should</td>
</tr>
<tr>
<td><strong>Innovation</strong></td>
<td>More innovation occurs in D-B, but there could be even more</td>
<td>Unsure; feels DOT specs were too prescriptive, both sides lose potential benefit</td>
<td>Several examples of good innovation (MSE walls, GPS grading)</td>
<td>D-B allowed contractor more opportunity to be innovative</td>
</tr>
<tr>
<td><strong>Funding Flexibility</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performance Parameter</td>
<td>Interviewee No.</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Administrative Costs</td>
<td>Unsure; some added costs on this project not in traditional</td>
<td>D-B is a cost saver in large projects</td>
<td>Lower in D-B; project is accelerated and owner’s overhead is different</td>
<td></td>
</tr>
<tr>
<td>Construction Costs</td>
<td>No savings in construction costs in D-B; benefit is value of time savings</td>
<td>Lower by D-B because less mobilization costs, less change orders</td>
<td>Same or higher in D-B; hard to say if that is attributable to delivery method</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>Shorter in D-B; certain phases such as planning may take longer</td>
<td>Quite shorter in D-B</td>
<td>Time is saved in D-B</td>
<td>D-B is definitely shorter, with more contractor input before letting</td>
</tr>
<tr>
<td>Management Complexity</td>
<td>More complex in D-B</td>
<td>Much more complex in D-B</td>
<td>Unsure; some things more complex, such as verifying subcontractors’ hours</td>
<td>D-B projects are more difficult to manage because they are so schedule-driven</td>
</tr>
<tr>
<td>Disruptions to Third Parties</td>
<td>Impacts not unique to D-B, but D-B gives more flexibility to work around</td>
<td>Disruptions less in D-B because of schedule</td>
<td>Disruptions were less because certain concessions were made</td>
<td></td>
</tr>
<tr>
<td>Road User Costs</td>
<td>Same costs occur either way</td>
<td></td>
<td></td>
<td>Lower in D-B</td>
</tr>
<tr>
<td>Quality of Project</td>
<td>Issues in QC and QA were more due to Mn/DOT preferences than D-B delivery</td>
<td>Same</td>
<td></td>
<td>Quality was achieved, but not because of D-B; quality processes were less successful</td>
</tr>
<tr>
<td>Innovation</td>
<td>More innovation in D-B; easy to solve problems as they arise</td>
<td></td>
<td></td>
<td>Innovation was improved versus traditional</td>
</tr>
<tr>
<td>Funding Flexibility</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performance Parameter</td>
<td>Interviewee No.</td>
<td>9</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------</td>
<td>----------------------------------------</td>
<td>----------------------------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td><strong>Administrative Costs</strong></td>
<td></td>
<td>Less with D-B; faster and with better document control</td>
<td>More up-front costs in D-B, reduced over life of the project</td>
<td>In general, D-B costs more than D-B-B</td>
</tr>
<tr>
<td><strong>Construction Costs</strong></td>
<td></td>
<td>Higher in D-B because of newness</td>
<td>May save with D-B, but hard to compare</td>
<td></td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td></td>
<td>Shorter in D-B</td>
<td>Time saved with D-B; project is year ahead of schedule</td>
<td>Shorter in D-B due to overlap of design and construction; plans can be less comprehensive</td>
</tr>
<tr>
<td><strong>Management Complexity</strong></td>
<td></td>
<td>Unsure; depends more on project type than delivery method</td>
<td>Communication is more complex</td>
<td>D-B is much more complex, many things run concurrently</td>
</tr>
<tr>
<td><strong>Disruptions to Third Parties</strong></td>
<td></td>
<td>Community feedback more favorable for this D-B project</td>
<td>Public perception is good; disruptions are less with D-B due to schedule</td>
<td>Better with D-B; shorter duration of construction results in shorter duration of disruptions</td>
</tr>
<tr>
<td><strong>Road User Costs</strong></td>
<td></td>
<td>Same costs occur either way</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Quality of Project</strong></td>
<td></td>
<td>Quality is better on this project because of duplication of efforts</td>
<td>Same or better with D-B, due to good contractor; problems with QA and QC processes</td>
<td>D-B should not affect quality; a shady D-B-B contractor is a shady D-B contractor</td>
</tr>
<tr>
<td><strong>Innovation</strong></td>
<td></td>
<td>More innovation is possible in D-B; theme of D-B should be end product, not process control</td>
<td></td>
<td>D-B allowed more innovation in traffic maintenance, staging, economy</td>
</tr>
<tr>
<td><strong>Funding Flexibility</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
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## SUMMARY TABLE OF RESPONSES (4)

<table>
<thead>
<tr>
<th>Performance Parameter</th>
<th>Interviewee No. 13</th>
<th>Interviewee No. 14</th>
<th>Interviewee No. 15</th>
<th>Interviewee No. 16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrative Costs</td>
<td>D-B is lower</td>
<td>D-B eliminates costs of having multiple projects</td>
<td>Higher in D-B; fund increase for staffing</td>
<td>Unclear</td>
</tr>
<tr>
<td>Construction Costs</td>
<td></td>
<td>Some cost reduction in D-B from fewer changes, but hard to tell</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>D-B always quicker than traditional</td>
<td>Faster in D-B</td>
<td></td>
<td>Would have been longer by traditional</td>
</tr>
<tr>
<td>Management Complexity</td>
<td>Additional complexity with developing new D-B processes; depends on project rather than delivery</td>
<td>D-B presents challenges within DOT of balancing short-term and long-term staffing needs</td>
<td>Project itself was complex, regardless of delivery method</td>
<td></td>
</tr>
<tr>
<td>Disruptions to Third Parties</td>
<td>Disruptions were handled well on this project</td>
<td>D-B made project more reasonable to the community</td>
<td></td>
<td>Some things handled well, others were difficult</td>
</tr>
<tr>
<td>Road User Costs</td>
<td>Quality is comparable to other projects; DOT system for quality is antiquated</td>
<td>D-B will not have effect on quality; depends on contractor’s ability to produce quality</td>
<td></td>
<td>Unclear; driver stress the same</td>
</tr>
<tr>
<td>Quality of Project</td>
<td>More in D-B; HDR’s project database was useful in dispute resolution</td>
<td>D-B made funding more flexible within operations budget</td>
<td>D-B has helped flexibility, but created future funding challenges</td>
<td>Decreased district funding, problem with Mn/DOT and not with D-B</td>
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<tr>
<td>Innovation</td>
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<tr>
<td>Funding Flexibility</td>
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<tr>
<td>Performance Parameter</td>
<td>Interviewee No.</td>
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<td>17</td>
<td>18</td>
<td>19</td>
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<tr>
<td>Administrative Costs</td>
<td>Not necessarily any different</td>
<td>D-B on ROC-52 had additional costs: RFP process, oversight</td>
<td>Less in D-B because of value of time</td>
<td></td>
</tr>
<tr>
<td>Construction Costs</td>
<td>With D-B, first costs about the same, changes are less</td>
<td>Traditional is cheaper, but low cost growth makes D-B competitive</td>
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<tr>
<td>Time</td>
<td>Time is saved in D-B in many areas</td>
<td>D-B reduced time from 11 to 5 years, then down to 3 years</td>
<td>D-B is faster, allows overlap of design and construction</td>
<td></td>
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<tr>
<td>Management Complexity</td>
<td>More complex in D-B: adapting from traditional, scheduling</td>
<td>D-B challenge is to figure out roles; need effective project manager</td>
<td>Was more complex due to newness and understanding roles</td>
<td></td>
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<tr>
<td>Disruptions to Third Parties</td>
<td>Better with D-B: accommodations were made, PR was more responsive</td>
<td>Public approval is high; traffic maintenance, PR, and contractor effort</td>
<td>Contractor handled disruptions well on ROC-52</td>
<td></td>
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<tr>
<td>Road User Costs</td>
<td>Same costs either way</td>
<td>D-B helped minimize RUCs due to timeline</td>
<td>Unsure; hard to quantify</td>
<td></td>
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<tr>
<td>Quality of Project</td>
<td>Quality is being achieved, but contractor’s QC has been minimal to reduce overhead</td>
<td>Equivalent or better than on traditional; credits QA for taking this</td>
<td>Material quality is better; doesn’t attribute quality to system, QC was lacking in some areas</td>
<td></td>
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<tr>
<td>Innovation</td>
<td>Innovation sped up project and improved production</td>
<td>ATC process was successful; pressure more performance-based specs</td>
<td>D-B allowed ATCs that could not happen under traditional</td>
<td></td>
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<tr>
<td>Funding Flexibility</td>
<td>D-B enabled FAC funding</td>
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</tbody>
</table>
REFERENCES


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