ODOT Design-Build Pilot Projects Evaluation

Volume II

Special Experimental Project Evaluation
For the Evans Creek - Rock Point Design-Build Pilot Project

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1.0 Introduction

The Evans Creek - Rock Point (ECRP) surface preservation project was the second of two Oregon Department of Transportation (ODOT) Design-Build (DB) pilot projects. The first was the Harrisburg Bridge project. This report provides a summary of the ECRP project, analysis of the results, and recommendations for future ODOT utilization of DB project delivery.

The ECRP project was a, surface preservation project of the northbound and southbound lanes of Pacific Highway (I-5) from Milepoint 43.1 to Milepoint 49.0 in Jackson County, Oregon. The work included Portland cement concrete (PCC) slab repairs, falling weight deflectometer void detection testing, undersealing of the existing PCC pavement, 150 mm asphalt concrete (AC) overlay, and pavement reconstruction at designated bridge ends. Work also included rumble strips, guardrail improvements, culvert structure lengthening, bridge modification, and, median barrier upgrade and installation of permanent signs and durable permanent pavement striping.

The project utilized a two-step contractor selection process. Statements of Qualifications (SOQ) were due October 15, 1998. Three submittals were received and scored. Based on SOQ, three final proposals were requested. Two were received and scored. Bid opening for the final cost proposals occurred January 11, 1999.

The contract was awarded 02/08/99. Notice to proceed was given on 2/19/99 and work began 2/25/99. After 5/15, no 24-hour lane closures were allowed. Mainline paving began 5/6/99 and was complete 7/8/99. Durable permanent striping was completed by 8/28/99. The completion of sign erections by 12/31/99 completed project work. The contract provided for monetary rewards for accelerating schedule, which the contractor earned.

ODOT authorized a budget of $9,137,015 for design, construction, and ODOT project administration costs. At completion, actual costs incurred totaled $8,650,642. The total of change orders and state force orders reached a higher than average percentage of project cost. There were no claims.

Compared to completion of the project at the original ODOT specified date of December 2000, completion by the contractor of the DB project in

December 1999 is estimated to have saved ODOT approximately $100,000 in maintenance of a badly deteriorated pavement. Delays for motorists and the associated road user costs were minimal for a project of this nature.

The project is viewed as successful, primarily because a high quality project was delivered within the established budget and one year ahead of the contractually allowable completion. This minimized ODOT maintenance expenses and minimized traffic disruptions and associated road user costs experienced by motorists. The pavement that motorists drove on in 2000 was undoubtedly safer than it would have been if the project had not been completed until December 2000.

ODOT contracted with Oregon State University (OSU) to evaluate the execution of both DB pilot projects. Both the contractor selection process and the end product delivered through the DB process were evaluated. Data were collected through interviews, questionnaire surveys, and examination of project documents and reports. Information was obtained from owner, designer, and constructor personnel involved in the development and execution of the pilot projects.

An interim report (Simas and Rogge, 1998) summarized analysis of the process used to develop ODOT DB . The remainder of this report discusses the contractor selection process and the execution of the contract. Conclusions are presented and recommendations made.

2.0 Contractor Selection Process

A two-stage procurement process was utilized. A Request for Qualifications (RFQ) was advertised in local media. The first requirement for interested contractors was a submission of a statement of qualifications (SOQ). All DB teams meeting or exceeding a specified minimum SOQ score were to be issued Request for Proposal (RFP) documents inviting them to submit proposals (ODOT, 1998).

SOQ

ODOT had retained a consultant to assist in development of processes and requirements for the contractor selection process for the DB pilot projects. The first application was in late 1998 for the Harrisburg Bridge project. The Evans Creek - Rock Point project used the same process with appropriate modifications.

ODOT issued the RFQ September 24, 1998, with a due date for SOQ's of October 15, 1998. The due date was later extended until October 28, 1998. A pre-proposal conference was scheduled for October 7, 1998. Three DB teams submitted SOQ's. All three exceeded minimum requirements and were invited to submit final proposals. Table 1 displays the evaluation criteria for the SOQ.

Table 1. SOQ evaluation.

CRITERIA	SCORE
Cover Sheet	Pass/Fail
Proposal Format and Length	Pass/Fail
Design-Build Project Team	60
Project Team work history form	Pass/Fail
Key Personnel	110
Key Personnel work history form	Pass/fail
Project description form	Pass/fail
Maximum Score	170

Final Proposals (response to RFP)

Table 2 provides a brief summary of information relating to evaluation of proposals extracted from the Request for Technical and Price Proposal. Each proposer's scores for the SOQ's and for the technical proposals were converted to a decimal by dividing each score by the maximum possible. A total technical score was determined to be (0.2 x SOQ score) + (0.8 x technical proposal score). The bid price submitted was divided by the total technical score to determine the adjusted final score (best-value score) used to determine the low bidder.

Table 2. Technical proposal evaluation.

CRITERIA	SCORE
Cover sheet	Pass/Fail
Proposal format and length	Pass/Fail
Project understanding	15
Project approach	80
Quality control program	10
Safety plan	5
Maximum Score	110

Only two of the three DB teams invited to submit final proposals actually did so. The third team did not submit a proposal because of the reasons discussed below. Table 3 compares the two final proposals submitted. The higher technical score of proposer no. 1 was not enough to offset the price advantage of proposer no. 2. Proposer no. 2 was awarded the contract.

Table 3. Final adjusted score comparison.

	Proposer No. 1	Proposer No. 2
Price proposal	$8,544,618	$7,774,000
Technical proposal score	0.8796	0.8612
Adjusted final score ("best-value" score)	$9,714,209	$9,026,939

Process Fairness and Quality

A survey of the project team included requests to compare "quality of contractor selection process" for this DB project to traditional Design-Bid-Build (DBB). Three of four contractor personnel rated DB much better, with the fourth rating it somewhat better. Two of three ODOT respondents indicated "no basis to judge," with the third responding that DB was

somewhat better. The team preferred the DB project delivery. Since the contractor selection process resulted in their selection, the contractor team would be likely to view the process favorably.

The project team was also asked to compare "level of competition" to a DBB delivery. The team's evaluation of "adequate level of competition," favored DBB. Although three of four contractor personnel considered competition equal (the fourth expressed no basis to judge), two of three ODOT personnel indicated that DBB was somewhat better and much better (the third indicated no basis to judge).

The topic of level of competition was explored further. To broaden the perspective, input was obtained from the second bidder, and from the proposer that chose not to continue after the SOQ was scored.

All three contractors involved in the selection process agreed that the selection criteria excluded contractors capable of doing the work. It was estimated that the project would have produced five bidders rather than two (three for SOQ), if it had been bid traditional DBB. The comment was made that the scoring system favored some contractors over others and could have eliminated some who were qualified under DBB criteria. Specifically, this contractor believed that the criteria regarding recent interstate freeway paving with contractor-provided quality control was unnecessarily restrictive. However, the author believes that criteria that are more stringent are justified for projects involving ODOT's early use of DB. When it appears that the number of contractors able to meet more stringent criteria is adequate to provide a competitive bidding environment, it is reasonable that ODOT would not want to take unnecessary risks while developing DB processes.

The very nature of the SOQ process is to identify characteristics of most and least successful projects, and structure the weighting system to favor the contractors most likely to deliver best value with low risk. The price competition is tempered by these weightings in an attempt to increase the likelihood that best value is obtained at a competitive price.

If there are contractors available that can provide safe, quality, and timely work, at a reasonable price with low risk of claims and litigation, the scoring system should favor their selection over contractors less proficient in any of these areas. If the deficiencies are great enough and the risk of failure

becomes high enough, the scoring system should effectively exclude high risk contractors. The challenge is identifying the factors that are predictive of project performance, and including them in selection criteria with weightings consistent with their importance.

SOQ selection criteria and weightings will always be subject to second-guessing. It is the author's opinion that ODOT was thorough in its development of SOQ processes. ODOT went the extra mile to involve stakeholders, and clearly had a goal of developing a fair effective process. ODOT attempted to develop selection criteria and scoring that reflected the most important aspects of the specific project.

For future projects, ODOT plans to continue to provide qualification criteria with enough lead time so that interested parties can assess, raise questions and issues, and if necessary, protest. ODOT intends to continue to conduct pre-bid meetings to clarify the solicitation requirements, criteria and processes.

Long-term, the transportation industry can develop SOQ criteria and weightings that are most credible if these criteria are developed from statistical analyses of an extensive database of completed projects. Projects would be given ratings from very unsuccessful to very successful. Individuals from transportation agencies and the design and construction communities would identify criteria considered to be predictive of successful and unsuccessful projects. Projects in the database would be scored on these criteria. Regression analyses of the database would determine which criteria are in fact validated, and assign weightings. Critical success factors would be identified for use in prequalification and contractor selection processes.

The assessment of balance between price proposal and technical proposal for ECRP varied greatly. The second bidder, whose technical score was best, felt that in the end, the weighting given price was overwhelming. The withdrawing proposer felt that the weighting provided technical score was significant. One reason for withdrawing after the SOQ was an appraisal that they would need to have a very significant cost advantage to overcome their SOQ technical score. These opposing views from two unsuccessful bidders may mean that a good balance was achieved. Price is likely to continue to be the most significant factor in DB contractor selection. It is ODOT's goal

to increase the weighting of non-price criteria relative to price when the opportunities for variation in technical approach increases, and vice versa.

The proposing contractors agree that the short-listed proposers should be provided a stipend for the final proposals. A number of 50% of preparation costs was suggested. This would make the decision to bid a DB project more comparable to the decision to bid a DBB project as far as cost of bid preparation is concerned. The potential bidder would still be facing higher risk with a DB proposal. Currently, agencies paying stipends for DB proposals, pay significantly less than 50% of proposal preparation costs.

By paying for a portion of the cost of final technical proposals, ODOT could treat the design concepts as nonproprietary and be perceived as entitled to incorporate valid innovations from non-selected bidders. In addition, because of statutory limitations on ODOT's liability, there may be benefits for ODOT to own the selected DB team's design.

Many in the designer and contractor communities would prefer to optimize project performance through the use of DBB with incentives and shared savings rather than use of DB. If DB is to be used, these design consultants and construction contractors want to continue to be involved in the refinement of processes and requirements to make sure that they are fair and effective.

Performance versus Prescriptive Specifications

When the decision was made to select this project for a DB pilot project, ODOT had already designed the project to about 80% of completion. This timing probably contributed to contract documents that included a mixture of performance and prescriptive specifications, and large numbers (for DB) of unit price items on the bid form. This created concern and confusion for all.

The contractor that withdrew after the SOQ cited inadequate survey information, the ambiguity of the directive to bring all guardrails up to standard, and the lack of survey data and as-built information about culvert pipes as major factors in the decision not to continue to final proposal. The carry over of SOQ technical scores to the final evaluation was also a factor in withdrawing for this potential bidder.

The mixture of performance and prescriptive criteria resulted in unusually high levels of change orders when the project was executed. Clearly improvement is needed. The selected contractor believes the improvement should be a move to a total performance specification. In his words, "ODOT should say the project starts at MP xx and ends at MP yy. The DB contractor shall improve (rebuild, rehabilitate, etc.) the section to current FHWA standards so that FHWA will participate in the funding of the project. The project shall be completed by (date) and the following restrictions apply to staging. Incentives/Disincentives are as follows: . . . . ."

The contractor that withdrew after SOQ would agree with the comment of the selected contractor if complete survey data, accurate as-built information, and amount of guardrail to be replaced is provided in the bid documents.

3.0 Project Results

Although the Oregon Department of Administrative Services (DAS) exemption request for the project projected a possible cost and time savings for the project, this specific project was chosen more for its low-risk for DB implementation than for its potential for innovation, time savings, and cost savings. It was considered to be a low-risk environment for learning about DB and developing specifications and processes, with the possibility that time and cost savings could result. The project is considered successful from a cost, schedule, quality, and safety standpoint, and ODOT and the participating designers and constructors definitely learned about DB project delivery. The project was successful.

The following sections evaluate results with respect to project delivery time, change orders and claims, total project costs, quality, user satisfaction, and innovation.

Project Time Delivery

ODOT had spent considerable design effort prior to the decision to use the project as a DB pilot project. It is therefore not possible to make a valid schedule comparison of Evans Creek - Rock Point delivered DB and DBB. However, the paving was completed two months ahead of ODOT's target, and the entire project was completed one year sooner than the contract requirement. ODOT believes that it saved approximately $100,000 in maintenance costs as a result.

The DB contract included schedule incentives that made an accelerated schedule highly desirable to both parties. The same incentives in the construction contract of a DBB delivery should have been equally motivating to the contractor, but without the DB contract, the contractor may not have been able to achieve the accelerated schedule.

To accommodate higher traffic volumes during the summer tourist season, the contract between ODOT and the DB stipulated that no 24-hour lane closures would be permitted after 5/15. This date became a critical date for completing paving in time to earn the schedule incentive payments. The DB was able to complete required work prior to 5/15 for reasons unique to DB

project delivery. The DB construction contractor had more control over the DB designer than they would have had over ODOT design because of their contractual relationship. The increased ability of the DB contractor to control design priorities and schedule may have made the difference between achieving the schedule incentives and not achieving them. In addition, the high profile of the DB pilot projects may have resulted in faster than normal response time from ODOT. This project may have received higher priority than it would have had if it had been just another DBB project.

Table 4 presents an attempt to compare the schedule for ECRP to that of three adjoining projects delivered DBB. Using the criteria of days/$million, ECRP had the best schedule performance from contract award to completion. The validity of this measurement may be questioned, but it is consistent with the belief of the project team that ECRP was delivered at an accelerated pace. How much of the performance improvement is due to the schedule incentives and how much is due to DB delivery will never be known. It might well be that the combination of the two factors was the only way to achieve the desired schedule.

Table 4. Schedule comparison with adjacent projects

Section	***Evans Creek/ Rock Point***	***N Grants Pass/ Evans Creek***	***Rock Point/ Seven Oaks***	***Seven Oaks/ Jackson St.***
Milepost	43-49	49-55	35-43	28-35
Delivery system	D/B	D/B/B	D/B/B	D/B/B
Contract number	12221	11864	11469	11383
Awarded	02/08/99	02/10/97	06/29/94	10/06/93
Notice to Proceed	02/19/99	02/18/97	06/29/94	10/20/93
Construction Started	02/25/99	03/24/97	08/12/94	01/03/94
Construction Ended	12/30/99	11/05/98	02/02/96	11/15/94
Corrected Contract amount	$7,106,069	$12,174,194	$8,034,965	$6,900,085
Award to Completion (days)	325	633	583	405
Days per $million	46	52	73	59

Change Orders and Claims

ECRP had no claims, but the total of change orders and state force orders was higher than ODOT mean values, and higher than that of three adjoining surface preservation projects delivered DBB. Table 5 documents these

comparisons with adjacent projects. ODOT normally authorizes 3.5% of original contract for "contingencies" for this type of project.

Table 5. Magnitude of changes compared with adjacent projects

Section	***Evans Creek/ Rock Point***	***N Grants Pass/ Evans Creek***	***Rock Point/ Seven Oaks***	***Seven Oaks/ Jackson St.***
Milepost	43-49	49-55	35-43	28-35
Delivery system	D/B	D/B/B	D/B/B	D/B/B
Contract number	12221	11864	11469	11383
*Total for orig. contract**	$7,324,000	13,714,355	7,984,836	6,483,181
*Totals - Corrected**	$7,106,069	$12,174,194	$8,034,965	$6,900,085
Price agreements (change orders)	$427,294	$241,649	$193,941	$217,098
Force accounts		$11,086	$144,307	$43,752
State force orders	$5,435	$8,255	$54,201	$51,900
Sum of charge orders, force accounts, and state force orders	*$432,729*	*$260,989*	*$392,449*	*$312,750*
Changes as % of original contract	*5.9%*	*1.9%*	*4.9%*	*4.8%*
Changes as % of corrected contract	6.1%	2.1%	4.9%	4.5%

*For ECRP, number is total contract amount less "professional services" pay item

Investigations of the change orders and state force orders for ECRP indicate that they result from confusion in the specifications and bid item schedule. ODOT attempted to list traditional bid items in the bid documents to alleviate risk concerns by potential bidders. Unfortunately, omissions were made, and paid for as extra work. In retrospect, ODOT might have done better by providing good survey and as-built data, not listing work items and quantities required, and requiring a lump sum price for all work required in the project.

This was a learning experience for ODOT. The change order and state force order work had to be done, regardless of project delivery format. Because the pricing was done piecemeal and in a noncompetitive negotiation, ODOT likely paid a higher price for the work represented by these change orders and state force orders than they would have if included in the base bid. A detailed analysis of the change orders associated with this project is available (Gobble, 2001).

Total Project Costs

Appendix A is the exemption evaluation report required by Oregon's Department of Administrative Services (DAS). It includes cost analyses that

compare the actual delivered DB project costs to costs estimated with DBB delivery using several different sources of information and assumptions. Table 6 summarizes these cost comparisons.

Table 6. Actual total project costs delivered DB compared to estimates of project delivered DBB.

			DB Savings	
Actual Cost with DB Delivery Compared With:	**Base**	**Comparable DB Actual**	**($)**	**(%)**
DB budget	$9,137,015	$8,650,642	$486,000	5%
Agency DBB Estimate	$9,021,281	$8,650,642	$371,000	4%
Probable Agency DBB Actual	$8,951,992	$8,650,642	$301,000	3%
DBB Estimate with traditional 0.95 factor	$8,342,398	$8,328,346	$14,000	0.1%
DBB estimate with 0.85 factor from contemporary bids	$7,568,632	$8,328,346	($760,000)	(10%)
DBB estimate based on adjoining projects	$7,773,545	$8,328,346	($555,000)	(7%)

Note: The difference between "Comparable DB Actual" costs for the first three comparisons (rows) and the last three comparisons is the amount paid for asphalt quality and schedule incentives.

Depending upon the analysis chosen, DB delivery may have saved ODOT 4%, or ODOT may have paid a 10% premium. The author believes that the comparison that shows a 3% savings resulting from DB project delivery is the most valid comparison. Because ODOT had already completed about 80% of the design before the decision to use the project as a DB pilot project was made, opportunities for savings from engineering efficiencies were minimal for this project.

Quality

The project was completed to a high quality standard. The consensus of the ODOT/design-build team is that no quality difference can be attributed to DB delivery of the project.

User Satisfaction

The accelerated completion of the project, particularly the paving work, clearly resulted in reduced inconvenience and reduced costs to road users. As discussed above in the "Project Delivery Time" section, the relative contributions of contract schedule incentives and DB project delivery can not be determined. The favorable outcome may not have been possible without DB delivery.

Innovation

The selection of this surface preservation project for DB delivery did not provide fertile ground for innovation. The largest single cost item was the AC overlays. The mix design and thickness were specified by ODOT. Opportunities for innovation were reduced primarily to traffic staging plans. The contractor did innovate by using, with ODOT approval, a new barrier design that resulted in elimination of one of three stage lane changes.

Coordination of Disciplines and Trades

ODOT hypothesized that DB would provide advantages in coordination of design disciplines and trades. No one interviewed or surveyed could cite evidence supporting this hypothesis. No one associated with ECRP considered this to be a notable advantage for this project.

Performance vs Prescriptive Specifications

A request for "top issues" from the project team in the survey described below in section 4.0 indicated that confusion about project specifications, roles, and responsibilities was the greatest concern. In addition to the concerns previously described in the section on contractor selection process, and in the discussion of change orders, the following issues were noted:

- With respect to drainage on the structures, it was not clear what was required by the specifications and what was required by the project needs.
- The contract was set up with some design by ODOT and some by the DB contractor. This resulted in questions about responsibility on the overall project and about overlapping issues.
- It was not clear how much construction could take place with what degree of design and what degree of ODOT approval.

4.0 Subjective Evaluations by Project Team

All of the participants in ECRP had extensive previous experience with ODOT's traditional DBB process. It was important to capture their perceptions of the results obtained through the use of DB project delivery, and contrast them with DBB delivery. The evaluation discussed in this section was accomplished with a survey of key personnel involved in the project.

The survey questionnaires, which were distributed as the projects were concluded, had two distinct parts. The first part asked respondents to compare, based on their project appraisal and previous experiences, the use of DB against DBB on twelve pre-established parameters (see Figure 1).

Project evaluation parameters

1. Construction cost
2. Total project cost
3. Construction schedule
4. Total project schedule
5. Quality
6. Safety
7. Innovation
8. ODOT / Contractor teamwork
9. Inconvenience to the public
10. Quality of contractor selection process
11. Effect on level of non-contract costs
12. Adequate level of competition

Figure 1 – Project evaluation parameters

After the forms were returned, each response was scored as shown in Table 7. The lower the score, the higher the perception of the respondent that the DB approach was better suited for that parameter. Conversely, higher scores indicated that the DBB approach was preferred, and would consequently produce better results.

Table 7. Project evaluation responses scoring

Response	Design-build much better	Design-build somewhat better	No significant difference	Design-bid-build somewhat better	Design-bid-build much better	No basis to judge
Rank	1	2	3	4	5	Not ranked

The second part of the questionnaire allowed respondents to describe any relevant issues faced during the project's execution. For each issue, the respondent indicated if it was unique to design-build, briefly described how it was resolved, and indicated whether the design-build approach facilitated or complicated its resolution. A questionnaire sample is presented in Appendix B.

The number of responses to the questionnaires is indicated in Table 8. It is important to note that due to the relatively small size of the projects, the number of responses obtained, though small, is representative of the total number of key personnel involved in each project.

Table 8. Evaluation Questionnaire Respondents

	ODOT personnel	Design-builder Personnel
Number of responses	3	4

Figure 2 displays the performance ratings from the survey for ECRP. Please note that low numbers indicate a preference for DB (1.0 = lowest possible score) and high numbers indicate a preference for DBB (5.0 = highest possible score). A value of 3.0 indicates a neutral response ("no significant difference"). Parameters are listed from lowest (most favorable to DB project delivery) combined score to highest (most favorable to DBB project delivery) combined score. Complete survey results are presented in Appendix C.

In general, contractor responses result in lower ratings than ODOT results. This means that contractor personnel showed a greater preference for DB. All contractor averages are at or below 3.0, indicating an average preference for DB in all cases. The four parameters judged to be most favorable for DB are "quality of contractor selection process," "construction schedule," "ODOT/contractor teamwork," and "inconvenience to public." The only parameter favoring DBB is "adequate level of competition." In addition, ODOT personnel indicated a preference for DBB with respect to "effect on level of non-contract costs," "construction cost," and "total project cost."

The results displayed in Figure 2 show perceptions of individuals intensely involved in the project. Where objective measurements exist, such as for

construction cost and total project cost, the objective measurements are considered more relevant.

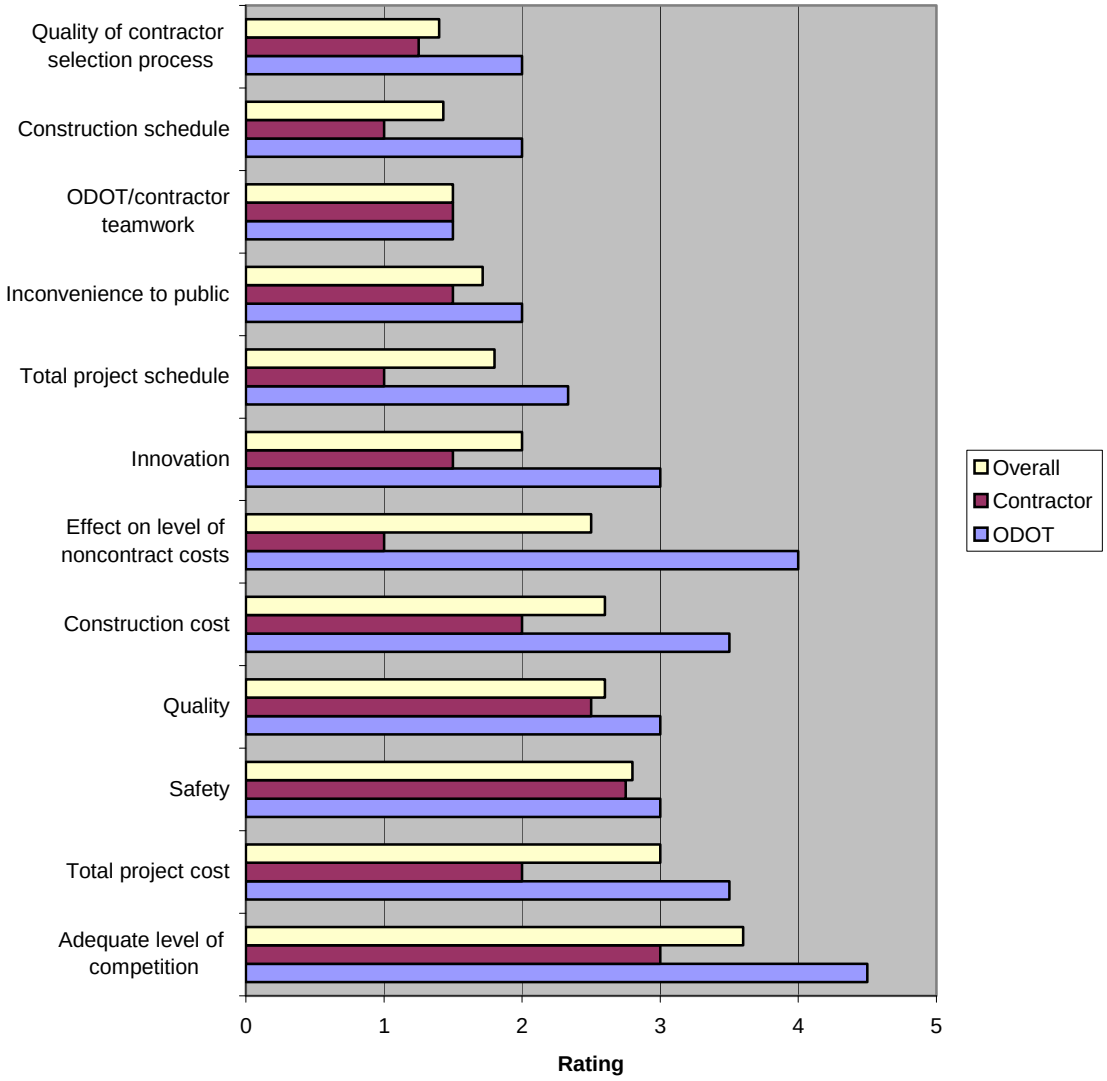

Figure 2. Subjective evaluation of ECRP project performance

5.0 Conclusions

Analysis of the information contained in this report and the Appendix leads to the following conclusions:

1. The project accomplished its primary objective -- testing and refining newly developed ODOT processes for DB project delivery in a low risk environment.
2. The project was completed 5.3% under ODOT target cost.
3. Cost comparisons with DBB project delivery show wide variation depending on assumptions made. DB delivery may have saved ODOT 4%, or ODOT may have paid a premium of as much as 10%. The author believes that a savings of approximately $300,000 or 3% resulted from DB delivery. In addition, road user cost savings and reduced maintenance costs resulted from the accelerated schedule.
4. ODOT has estimated savings of maintenance expenditures of $100,000 due to the rapid completion of paving. Earlier construction means that the new surface will wear out one year sooner, requiring maintenance one year sooner. But because of the time value of money, the cost of earlier maintenance at the end of the new pavement's life does not significantly reduce the present value of savings.
5. The project was delivered at an accelerated pace due to a combination of contractual schedule incentives and DB delivery. The incentives provided the motivation and DB delivery helped provide the means.
6. Quality was comparable to DBB project delivery.
7. Early completion and reduced lane closures after the May 15 start of the heavy summer travel season provided safer driving conditions, increased user satisfaction, and reduced road user costs.
8. The number of bidders was less than would have been expected DBB. Repeated procurements with only two responsive bidders would not be acceptable.
9. Due to the nature of the surface preservation project, innovations were minimal. A new barrier design was used that eliminated one of three stage lane changes.
10. When bidding DB projects, it is important for ODOT to further let go of the details and rely on effective performance specifications. Listing of large numbers of pay items with quantities in the bid form is not a good idea. If multiple pay items are considered for use, there must be a compelling reason to use them.

11. The mix of performance and prescriptive specifications created confusion for bidders, probably reduced competition, and resulted in unusually high costs of change orders.
12. For effective DB project delivery, ODOT must clearly affix responsibility for meeting project objectives to the DB team, provide requested support, and otherwise stay out of their way as much as possible.

6.0 Recommendations

The following recommendations for ODOT DB projects are made:

1. Consider DB project delivery for projects that have high potential for innovation or alternates, that allow ODOT comfort with performance specification and minimal oversight, or where design resource limitations prevent timely delivery DBB.
2. When DB delivery is used, pay stipends to short-listed DB teams to partially offset higher bid preparation costs, thus encouraging competition. Consider ODOT ownership of all designs submitted.
3. Avoid bid forms with large numbers of pay items and quantities specified. Specify required outcomes. Avoid prescriptive specifications wherever possible.
4. To use DB effectively, ODOT personnel must not become involved at the level of detail to which they are accustomed for DBB project delivery. Training of selected ODOT personnel in effective administration of DB projects is desirable.
5. The transportation industry should perform a study to determine critical success factors for use in future contractor selection processes not based exclusively on price, both DB and DBB. The study should include statistical analyses of an extensive database of past projects, relating potential selection criteria to project success.

7.0 References

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Appendix A

Evaluation -- Evans Creek - Rock Point Surface Project, Oregon Department of Administrative Services Exemption 345, As Required by ORS 279.103

Evaluation -- Evans Creek - Rock Point Surface Project
Oregon Department of Administrative Services Exemption 345
As required by ORS 279.103

The Oregon Department of Transportation's (ODOT) Evans Creek - Rock Point Surface Project received an order from the Department of Administrative Services allowing an exemption from competitive bidding to allow the use of Design-Build (DB) project delivery. This project became one of two DB pilot projects used by ODOT to refine newly developed processes for DB contracts.

ORS 279.103 requires an evaluation of the public improvement upon its completion. The evaluation must include the following:

1. The actual project cost as compared with original project estimates.
2. The amount of any guaranteed maximum price.
3. The number of project change orders issued by the public agency.
4. A narrative description of successes and failures during the design, engineering, and construction of the project.
5. An objective assessment of the use of the alternative contracting process as compared to the findings required by ORS 279.015.

In addition, ORS 279.015 requires that projects may not be exempted unless "it is unlikely that such exemption will encourage favoritism in the awarding of public contracts or substantially diminish competition for public contracts; and the awarding of public contracts . . . will result in substantial cost savings to the public contracting agency." Compliance with these criteria is also evaluated in this report.

The evaluation of project performance with respect to all of these criteria follows a brief summary of project highlights.

Project Overview

The Evans Creek - Rock Point Surface Project was being developed for conventional Design-Bid-Build (DBB) project delivery. Design was about 80% complete when it was chosen as a DB pilot project. It was selected because it offered some potential for innovation or alternative staging approaches, while minimizing the risk associated with delivery of a project by a method with which most ODOT and industry personnel had little or no experience. To encourage early completion, the contract contained provisions for incentive payments, as well as disincentive payments if schedule was not met.

Three design-build teams submitted Statements of Qualifications (SOQ's). One team dropped out after SOQ evaluation. Two final proposals were submitted. The DB team selected had a price proposal of $7,774,000 and a technical score of 0.8612. The other bidder submitted a price proposal of $8,544,618 and received a technical score of 0.8796. The contract was awarded 02/08/99. Notice to proceed was given on 2/19/99 and work

began 2/25/99. After 5/15, no 24-hour lane closures were allowed. Mainline paving began 5/6/99 and was complete 7/8/99. Traffic was restored 8/26/99, over two months ahead of the ODOT target of 10/31/99, and the project completed one year early. Budget targets for total project costs (including design and ODOT project administration) were also achieved. (See Table 1.)

Table 1. Evans Creek - Rock Point Surface Preservation Project summary.

	Target	Actual
Budget	$9,137,015	$8,650,646
Paving work completion	10/31/99	8/26/99
Project completion	12/31/00	12/31/99

Actual Project Cost Compared with Original Project Estimates

Estimating is not an exact science, particularly when preparing estimates for comparison of the same project with different methods of project delivery. Consequently, several estimating approaches are presented.

First, a comparison is made between how estimated costs would have been estimated for Design-Bid-Build (DBB) delivery, how they probably would have occurred DBB, and how they resulted for the actual DB delivery. The design-build contract includes not only the traditional construction contract, but also engineering design costs that ODOT did not have to spend. ODOT's normal project authorization also adds any expected bonuses or incentives, 3.5% of contract amount for contingencies, and an allowance for "Engineering" costs, which are really costs incurred by ODOT in project administration. Table 2 below makes this comparison.

Table 2. Comparison of probable DBB estimate, DBB actual, and actual DB.

DBB Estimate		DBB Estimated Actual Cost		DB Actual Costs
Design costs -- complete engineering design	$601,000		$601,000	(ODOT) $99,048 (DB) $450,000
Construction contract	$7,476,000		$7,476,000	$7,106,069
Incentives; bonuses	$292,000	Incentives -- early completion	$0	$223,800
		Incentives and bonuses - other	$98,496	$98,496
		Contract Change Order 14 (CCO14) - early substantial completion bonus adjustment.	$0	$17,700
Contingencies (3.5%)	$261,660	CCO1 -- Add concrete barrier	$48,983	$48,983

		CCO2 - No cost	$0	$0
		CCO3 - No cost	$0	$0
		CCO4 - Add traffic control at dig-outs	$10,168	$10,168
		CCO5 - No cost	$0	$0
		CCO6 - Add variable message board	$27,996	$27,996
		CCO7 - Increase guard rail - MP 43 and MP 44	$23,220	$23,220
		CCO8 - Flatten slope station 8+100 - 9+200	$10,124	$10,124
		CCO9 - Temporary portable message signs	$15,877	$15,877
		CCO10 - Reopen deck drains		$19,721
		CCO11 - Guardrail, etc. 3+180 - 10+400	$126,673	$126,673
		CCO12 - Aggregate shoulders; guardrail paving	$106,192	$106,192
		CCO13 - Convert non-standard shoulder slopes to 6 to 1	$11,663	$11,663
		CCO14 (see above)		
		CCO15 - Added design time		$8,988
		State force order (SFO)1 -- haul fill material to right shoulder	$4,979	$4,979
		SFO2- Paint striping		$456
		SFO3- Not Used		
		SFO4- Flexible delineators		
Engineering (5.23%)	$390,621		$390,621	$240,500
Total project costs	$9,021,281		$8,951,992	$8,650,642
		Reduced maintenance from year early completion	$0	($100,000)
Total project and ODOT maintenance costs	$9,021,281		$8,951,992	$8,550,642

Notes:

Project cost information from ODOT project management, "Progress Estimate and Cost Report, 11/02/2000"
DB Design Costs include ODOT PE costs and portion of DB contract designated as "Professional Services"
DB Construction Contract = Total contract amount less "Professional Services."
Reduced maintenance cost value provided by ODOT project management.

Estimated actual cost values show change order work at the same cost as for DB. Although this work had to be done, it is likely that the cost would have been less because much of the cost should have been included in a competitive bid. The work fell through the cracks created by partial listing of pay items and quantities. Variations in completeness of specifications contributed to this problem.

CONCLUSION: Cost to ODOT delivered DB was about $301,000 (3%) less than the estimate of actual cost if the project had been delivered DBB. Combined project cost and ODOT maintenance cost delivered DB was about $401,000 less than estimated for project delivered DBB.

The next cost comparisons presented follow the methodology prescribed in the findings required by ORS 279.015 for this project. This methodology prescribed use of factors based on historical relationship of engineers' estimates to contract price (0.95) and of final cost to initial contract price (1.025). Subsequent investigation shows that the 1.025 factor came from the Florida DOT. A more appropriate number for ODOT is 1.035. Also, a separate calculation is to be performed where the first factor is computed from other ODOT projects bid at the same time.

The Evans Creek - Rock Point project was bid between ODOT bid openings on 12/10/98 and 1/28/99. For the 16 projects for which bids were received at these openings, the average ratio of bid to engineers' estimate is 0.87. For the five paving jobs included in this group, the ratio is 0.85. The analysis presented is based on the ratio for paving jobs. Table 3 compares both factor analyses with the actual costs experienced with DB delivery. It may be seen that the choice of factor makes a big difference.

Table 3. Comparison of factored engineers' estimate for DBB with actual DB costs.

	Factor = 0.95	Factor = 0.85	Actual DB Costs
Engineers' estimate of the construction contract as design-bid-build (DBB)	$7,476,000	$7,476,000	
Multiply by factor =	$7,102,200	$6,354,600	$7,106,069*
Add 3.5% for change orders, etc. =	$ 248,577	$ 222,411	$432,729
Subtotal	$7,350,777	$6,577.011	$7,538,798
Add for engineering (ODOT project admin. costs)	$ 390,621	$ 390,621	$240,500
Estimated project costs as	$7,741,398	$6,967,632	$7,779,298

DBB			
Estimated design costs	$ 601,000	$ 601,000	(DB) $450,000* (ODOT PE) $99,048
Estimated total project costs at completion - DBB	$8,342,398	$7,568,632	
Actual project costs at completion-DB			$8,328,346

*Corrected DB contract split into $450,000 design and $7106,069 construction.

CONCLUSION USING 0.95 FACTOR: Project delivered DB cost ODOT $14,000 (0.1%) less than estimated as DBB.

CONCLUSION USING 0.85 FACTOR: Project delivered DB cost $760,000 (10%) more than estimated as DBB.

Finally, yet another analysis is performed. Within the past eight years, three adjoining surface preservation projects on I-5 have been delivered DBB. These were the North Grants Pass - Evans Creek, Rock Point - Seven Oaks, and Seven Oaks - Jackson St. projects. Table 4 shows average factors from the three adjoining projects. These ratios were applied to ODOT's estimate of the cost to deliver Evans Creek - Rock Point as a DBB project. The total cost was compared to actual costs with DB delivery. Table 5 shows this comparison.

Table 4. Average ratios from adjoining I-5 DBB projects

Original Contract
---------- = 0.935
Construction Estimate

Corrected Contract
---------- = 0.986
Original Contract

Change Orders + Force Accounts + State Force Orders
---------- = 0.039
Original Contract

Preliminary Engineering (PE)
----------= 0.03
Construction Estimate

Engineering $
---------- = 0.055
Original Contract Amount

Table 5. Comparison of actual DB costs to Evans Creek - Rock Point estimated as DBB project applying average ratios from adjoining projects.

	Estimate from adjoining project average factors		Actual DB Costs
ODOT construction estimate DBB	$7476,000		
Original contract ($7,476,000*0.935)	$6,990,060	DB contract less $450,000 professional services pay item	$7,324,000
Corrected contract ($6,990,060*0.986)	$6,892,199	Corrected DB contract less $450,000 professional services	$7,106,069
Change orders, force accounts, etc. ($6,990,060*0.039)	$272,612		$432,729
Preliminary Engineering (PE) ($7,472,000*0.03)	$224,280	ODOT PE DB professional services	$99,048 $450,000
ODOT Engineering ($6,990,060*0.055)	$384,453		$240,500
TOTAL	$7,773,545		$8,328,346
Added cost for DB			$554,801
Percent increase for DB			7.1%

CONCLUSION COMPARING TO ADJOINING DBB PROJECTS: Project delivered DB cost ODOT $555,000 (7%) more than estimated as DBB.

Results from the four cost comparisons presented vary widely. The analyses indicate that the DB project could have saved ODOT 4%, or that ODOT may have paid a premium of as much as 10%. The author believes that the analysis summarized in Table 2, showing savings of 3%, is the most appropriate cost analysis.

The Amount of Any Guaranteed Maximum Price -- Not Applicable

The Number of Project Change Orders Issued

Fifteen change orders (three were no-cost), totaling $427,294, and 3 force account orders, totaling $5,435 were issued. The change orders and state force orders together represent $432,729 or 5.9% of construction portion of original contract amount ($7,724,750 less $450,000 professional services).

Investigations of the change orders and state force orders indicate that they result from confusion in the bid documents surrounding the scope of work. ODOT attempted to list traditional bid items in the bid documents to alleviate risk concerns by potential bidders. Unfortunately, omissions were made, and paid for as extra work. In retrospect, ODOT should have not listed work items and quantities required but rather required a lump sum price for all work required in the project, and provided complete survey and as-built information. Although this was a learning experience for ODOT, the change order and state force order work had to be done. Because the pricing was done piecemeal and in a noncompetitive negotiation, ODOT likely paid a higher price for the work represented by the change orders than they would have if included in the base bid.

Successes and Failures During the Design, Engineering, and Construction of the Project

The project restored traffic over two months ahead of the ODOT target and completed essentially one year ahead of schedule. Road user inconvenience and associated road user costs were therefore minimized. An additional year of maintenance expenditures, valued at approximately $100,000 was avoided.

Because the contract provided financial incentives for early completion, it is difficult to separate the influence of the schedule incentives and the DB form of project delivery for this project. It is likely that the schedule incentives were the prime driver for the accelerated schedule. The DB project delivery may have allowed the design-build team to set priorities to allow a very aggressive schedule that quite possibly would not have been attainable with DBB delivery.

ODOT personnel and the members of the DB team worked together very well to assure the success of the project. Whether this was a result of DB project delivery is impossible to tell. This effective teamwork was an important factor in project success.

Objective Assessment Compared to Findings Required by ORS 279.015

Each of the eight findings from the exemption order are first stated, then followed by an evaluation at the conclusion of the project.

Finding 1. <u>Operational, Budget and Financial Data</u> - The only significant added effort due to pursuing the Evans Creek-Rock Point Surface Preservation Project as a Design/Build project has already been expended in research, methodology development, and coordination with interested and affected parties in a general study of Design/Build

acquisition. In the future, as our Design/Build methodology is refined and appropriately applied, we anticipate realizing consistently significant cost and schedule benefits.

> EVALUATION: Expectations for future significant cost and schedule benefits remain.

Finding 2. Public Benefits - The anticipated benefit of reduced performance schedule, and associated reduction in public inconvenience, has been estimated to save the driving public delays by reducing the lane closure period. In addition, a significant cost savings to the public agency, ODOT, of $85-100,000 is estimated.

> EVALUATION: Road users experienced fewer delays and reduced road user costs because the combination of schedule incentives and DB delivery of this project resulted in early completion. As demonstrated in previous sections of this report, it is not clear that ODOT saved agency costs on this project. The combination of limited opportunities for innovation in a resurfacing project, and the confusion around scope resulting in fifteen change orders (three were no cost) did not allow ODOT to realize the full advantage of DB. However, the cost analysis that the author believes is most appropriate indicates that ODOT did save about $300,000 (3%) in project costs, and an additional $100,000 in maintenance costs because the project was completed one year earlier than anticipated.

Finding 3. Value Engineering - Innovation is expected under Design/Build contracting which should result in Value Engineering and the closure reduction and cost savings mentioned . . . Since a good deal of the project design and planning will be accomplished during the proposal phase, ODOT can expect to realize benefits in the initial contract price.

> EVALUATION: Value Engineering was not a significant factor for this project.

Finding 4. Specialized Expertise Required - No specialized expertise is required beyond that needed by performing this project in the traditional 2 contract phases, except for the procurement expertise concerning Design/Build contracting that is being acquired, in large measure, through this pilot program and the engineering and project management of an integrated Design/Build project, which will become necessary to realize the full potential of Design/Build.

> EVALUATION: Statement is still valid.

Finding 5. Public Safety - We are confident that this procurement approach being pursued for this project will introduce no new safety concerns, and by minimizing lane closure time, resultant traffic disruption impacts to the public should be minimal, and our Design-Build approach may improve safety.

EVALUATION: The effect on public safety of the changes facilitated by DB delivery was positive. Traffic back-ups and associated safety concerns were reduced.

Finding 6. Market Conditions - Indications through our Stakeholder contacts and meetings are that both the Construction and Design Engineering communities are becoming familiar with and accepting of, and even supportive of, ODOT's Design/Build pilot program.

EVALUATION: Statement is still valid.

Finding 7. Technical Complexity - The Evans Creek-Rock Point Surface Preservation Project was selected as a Design/Build pilot project, in part because it is not technically complex, while still offering areas where some technical innovation may be applied.

EVALUATION: Technical innovation was minimal, although a new barrier design was implemented that allowed elimination of one of three stage lane changes.

Finding 8. Funding Sources - The project is being funded by State of Oregon "Advance Construct" funding, holding open the possibility of subsequent Federal reimbursement, pending approval of ODOT's Special Experimental Project (SEP-14) approval which we expect to receive in mid-April, 1998.

EVALUATION: SEP-14 approval was received for this project.

Competition

Three DB teams submitted SOQ's for this project, but only two teams submitted technical and price proposals. Consistent submission of bids by only two bidders over an extended period of time would not provide acceptable competition.

The DB teams submitting bids had to take on additional risks in bidding a job that they perceived as experimental with ODOT. They were willing to take the risk because they saw promise in DB project delivery and wanted to gain a competitive advantage if future DB work developed. The risk would be reflected in their bid prices. If ODOT ever reaches a position where a steady stream of projects are procured DB, the number of DB teams comfortable with DB project delivery will grow, competition should be adequate, and risk premiums will decrease.

Cost to ODOT

The project was completed within the authorized budget. Cost savings may or may not have occurred, depending on the cost analysis chosen. The author believes that the cost

analysis showing 3% savings in project costs is the most valid analysis. It is estimated that the early completion save ODOT about $100,000 in maintenance costs. Road users realized cost savings. The lessons learned on this and the other pilot project should allow ODOT to effectively deliver future DB projects with greater potential for financial gains.

Conclusions

Analysis of the preceding information leads to the following conclusions:

1. The project accomplished its primary objective -- testing and refining newly developed ODOT processes for DB in a low-risk environment.
2. Exact true cost impact relative to DBB cannot be determined with accuracy. Various cost analyses presented indicate a range from 4% cost savings to a possible premium of 10% for DB delivery. The author's favored analysis indicates 3% savings. The project was completed 5.3% under ODOT target cost.
3. When bidding DB projects, it is important for ODOT to let go of the details and rely on effective performance specifications. Listing of large numbers of pay items in the bid form with quantities is to be avoided or minimized.
4. For effective DB project delivery, ODOT must clearly affix responsibility for meeting project objectives to the DB team.

Appendix B

ODOT Design-Build Pilot Project Evaluation Questionnaire

ODOT
DESIGN-BUILD PILOT PROJECT EVALUATION QUESTIONNAIRE
OCTOBER 1999

Name _____

Phone _____ E-mail _____

ODOT is required by law to perform an evaluation of the design-build pilot projects. This questionnaire is part of that evaluation process. Please help make this a thorough and comprehensive evaluation. Thank you. Please return completed document to:

Dr. David F. Rogge
Department of Civil Engineering
Oregon State University
Corvallis, OR 97331

EVANS CREEK RESULTS:

PART I. For the Evans Creek project, please try to envision the project as a traditional design-bid-build project and compare the result for the criterion presented in each row with the outcome of the design-build project. Indicate your appraisal of the outcome by placing an X in the appropriate column for the criterion of each row.

DB = design-build
DBB = design, bid, build

	No Basis To Judge	DB Much Better	DB Somewhat Better	No difference	DBB Somewhat Better	DBB Much Better
Construction cost						
Total project cost						
Construction schedule						
Total project schedule						
Quality						
Safety						
Innovation						
ODOT/contractor teamwork						
Inconvenience to public						

Comments (Please use additional sheets of paper if required):

* * * * *

PART II. In the blocks provided below, list up to four of what you consider to be the top "issues" faced by the Evans Creek project. (If you have more issues, please supply the information on additional sheets of paper.) For each issue, please indicate in the space provided . . .

- whether the issue was unique to design-build, or resulted from technical/site conditions of the project,
- the resolution of the issue, and
- was resolution of the issue complicated or facilitated by the fact that the project was executed design-build.

ISSUE # 1 -- Evans Creek

ISSUE DESCRIPTION:
Was this issue unique to design-build? [ ] Yes. [ ] No.
RESOLUTION OF ISSUE:
Please check the response that best describes your opinion regarding the resolution of the issue. [ ] The design-build process very much facilitated the resolution of the issue. [ ] The design-build process somewhat facilitated the resolution of the issue. [ ] The design-build process had little or no effect on resolution of the issue. [ ] The design-build process somewhat complicated the resolution of the issue. [ ] The design-build process very much complicated the resolution of the issue..

ISSUE # 2 -- Evans Creek

ISSUE DESCRIPTION:
Was this issue unique to design-build? [ ] Yes. [ ] No.
RESOLUTION OF ISSUE:
Please check the response that best describes your opinion regarding the resolution of the issue. [ ] The design-build process very much facilitated the resolution of the issue. [ ] The design-build process somewhat facilitated the resolution of the issue. [ ] The design-build process had little or no effect on resolution of the issue. [ ] The design-build process somewhat complicated the resolution of the issue. [ ] The design-build process very much complicated the resolution of the issue.

Appendix C

Survey Results

Appendix C:
Evans Creek - Rock Point Project – Survey results

ODOT DESIGN-BUILD PILOT PROJECT EVALUATION QUESTIONNAIRE

EVANS CREEK PROJECT

	No Basis to Judge	DB Much Better	DB Somewhat Better	No Significant Difference	DBB Somewhat Better	DBB Much Better
	NoBase	DB++	DB	Equal	DBB	DBB++
Points	0	1	2	3	4	5

Answered by:	ODOT	ODOT	ODOT	DB	DB	DB	DB
Construction Cost	NoBase	DBB	Equal	DB	DB	DB	NoBase
Total Project Cost	NoBase	DBB	Equal	NoBase	DB	NoBase	NoBase
Construction Schedule	DB	Equal	DB++	DB++	DB++	DB++	DB++
Total Project Schedule	DB	DBB	DB++	NoBase	DB++	NoBase	DB++
Quality	NoBase	Equal	NoBase	Equal	DB	DB	Equal
Safety	NoBase	Equal	NoBase	Equal	DB	Equal	Equal
Innovation	Equal	Equal	NoBase	DB++	DB++	DB	DB
ODOT/contractor teamwork	NoBase	DB	DB++	DB++	DB	DB++	DB
Inconvenience to public	DB	Equal	DB++	DB	DB++	DB++	DB
Quality of contractor selection process	NoBase	NoBase	DB	DB++	DB	DB++	DB++
Effect on level of non contract costs	NoBase	DBB	NoBase	NoBase	DB++	NoBase	NoBase
Adequate level of competition	NoBase	DBB++	DBB	Equal	Equal	Equal	NoBase

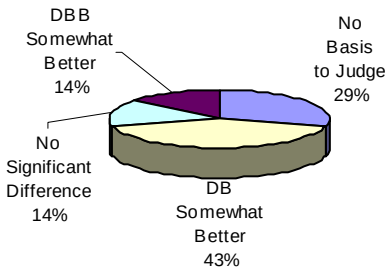
Total number of questionnaires: 7

Questionnaires distribution:
ODOT: 3
Design-builder: 4

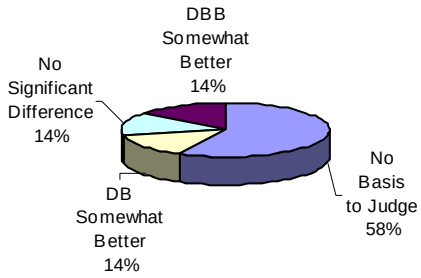
Evans Creek Rock Point surface preservation project

Questionnaire summary – ODOT and Contractor responses combined

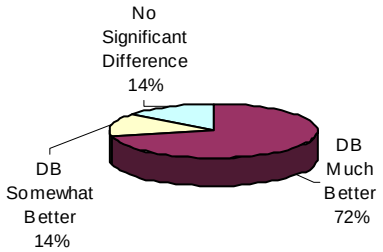
Construction Cost



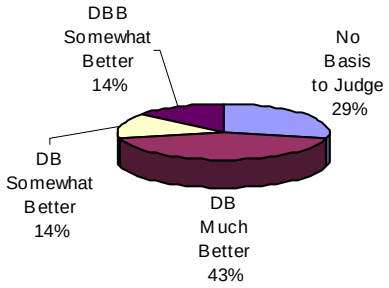
Total Project Cost



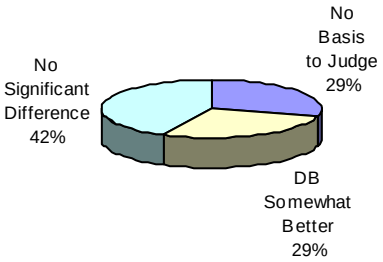
Construction Schedule



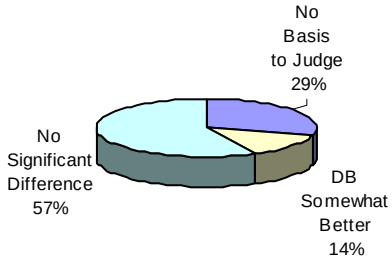
Total Project Schedule



Quality



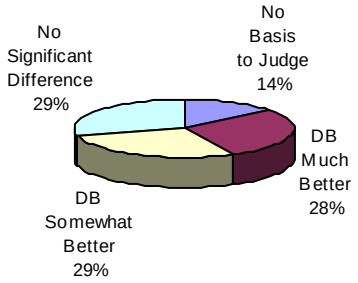
Safety



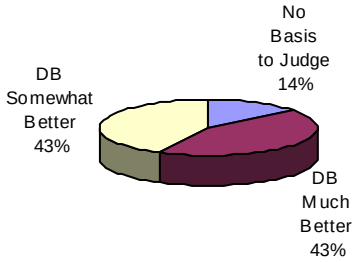
Evans Creek Rock Point surface preservation project

Questionnaire summary – ODOT and Contractor responses combined

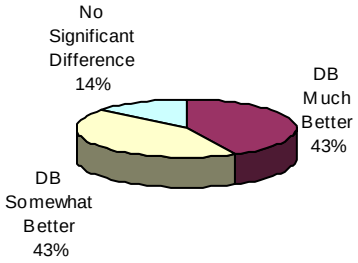
Innovation



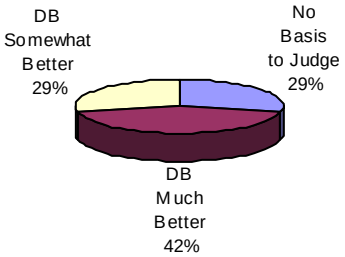
ODOT/contractor teamwork



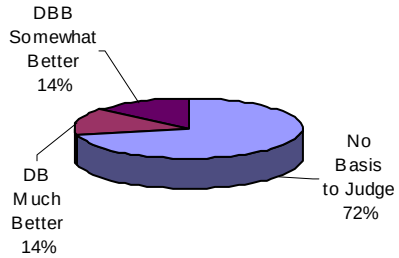
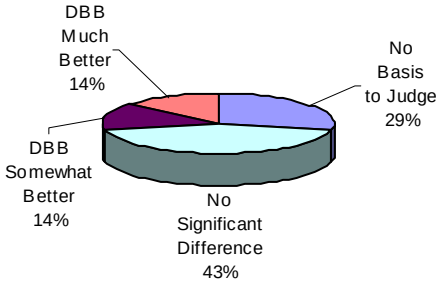
Inconvenience to public



Quality of contractor selection process



Effect on level of non contract costs



Adequate level of competition