Analysis and Evaluation of a Plan Quality Evaluation Form

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The results of an investigation to analyze and evaluate a plan quality evaluation form that was developed by the Wisconsin Department of Transportation (WisDOT) are presented. Forty projects were selected by WisDOT to be used in testing the effectiveness of the evaluation form. Second, a questionnaire survey of the state departments of transportation (DOTs) in all 50 states, the District of Columbia, and Puerto Rico was conducted. The survey provided information about procedures used in other states to evaluate the quality of highway plans. A large number of state DOTs have procedures for evaluating the quality of project plans and specifications. Third, interviews were conducted with the prime contractors and designers of the 40 projects that were selected for the test of the form. The results obtained from the prime contractor interviews were similar to the comments received from the test of the evaluation form. Finally, alternatives to accomplish plan quality evaluation were developed and analyzed for possible effectiveness. The alternatives that were developed were to (*a*) do nothing, (*b*) use narrative project critiques, or (*c*) use an evaluation form. The researchers recommended that WisDOT develop a new evaluation form based on the forms used by other state DOTs. This form could be used in a postconstruction meeting between representatives of the designer, prime contractor, FHWA, and WisDOT, if found necessary. The researchers further recommended that an evaluation not be performed for every project and presented guidelines that can be used to determine the selection of a project for evaluation.

In the past, nearly all highway designs were performed in-house by state designers. In recent years, many state departments of transportation (DOTs) have lost qualified engineers to retirement. Many of these state DOTs have not been able to replace these engineers because of budgetary cuts and a lack of available civil engineering graduates entering the highway construction field. As a result, there is a lack of adequate resources at the state level. In addition, there has been a movement in recent years to privatize many of the services previously or currently performed by government agencies. For these reasons, there has been an increased use of design engineer consultants in the preparation of highway designs.

Many design engineer consultants are inexperienced in the preparation of highway project plans and specifications. These consultants, however, are gaining experience in the area by obtaining and completing design contracts with state DOTs. It is believed that the trend of hiring design engineer consultants to perform necessary functions for state DOTs will continue.

Poor-quality plans and specifications can affect contractor efficiency, increase the likelihood of contractor failure, and increase the amount of resources required of the constructor, designer, and owner in preparing change orders, negotiations, mediation, and litigation. Research has found that the probability of contractor failure is higher on projects that have a large number of design errors and omissions (*1*). Hence, high-quality design documents facilitate efficient construction through reduced costs, fewer changes, reduced number of disputes, better schedule performance, and higher quality in the final constructed facility. Consequently, a method to measure the quality of plans produced by both state design engineers and design engineer consultants needs to be developed.

The approach and results of a 10-month research investigation conducted for the Wisconsin Department of Transportation (WisDOT) are described (*2*). The purpose of the investigation was to analyze and evaluate a plan quality evaluation form that was previously developed by WisDOT. Alternatives for accomplishing plan quality evaluation are also presented along with the final recommendation that was made to WisDOT.

RESEARCH APPROACH

The objectives of this research investigation were (*a*) the identification of the individual entities associated with the highway design and construction processes; (*b*) the development of suggested modifications to the existing evaluation form, (*c*) the development of alternatives to the evaluation form, and (*d*) recommendation of a future course of action regarding constructibility analysis and review for WisDOT.

The scope of the investigation was limited to the analysis and evaluation of a WisDOT-developed evaluation form. Selected prime contractors and design engineer consultants involved in grading, asphaltic cement concrete (AC) paving, portland cement concrete (PC) paving, and bridge projects were contacted. In addition, design engineers within the WisDOT districts were contacted. As part of the investigation, a questionnaire survey of the state DOTs in all 50 states, the District of Columbia, and Puerto Rico was conducted.

WisDOT-Developed Evaluation Form

Personnel in WisDOT Central Office recognized the importance of quality design documents in the success of a project and developed a postconstruction plan quality evaluation form during fall 1990. The form was sent to the prime contractors of 40 selected projects. The form asked the prime contractor to evaluate five specific areas of the project's plans. The form contained a description of the basis that was to be used during

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the evaluation of the contract provisions and construction plan. The form asked for a numerical rating of each of the specific areas. The possible numerical ratings were whole numbers between 0 and 10. A 0 rating indicated that the area was totally inadequate and unacceptable. A rating of 10 indicated perfection. A rating of 5 (acceptable) was defined as plans and specifications that substantially met the stated basis for evaluation. The numerical ratings would then be averaged for a composite rating for the project. Space was provided for written comments about each of the specific areas. A copy of the developed plan quality evaluation form can be found in Russell and Severson (*2*).

Projects Selected for Evaluation

The previously described evaluation form was sent to the prime contractors of 40 selected projects. The 40 selected projects included 10 grading, 10 AC paving, 10 PC paving, and 10 bridge projects. Table 1 indicates that the minimum, average, and maximum contract amounts for the 40 projects were $119,000, $2,244,667, and $11,256,000, respectively. The 40 selected projects included 26 prime contractor organizations and 21 design organizations. Of the 21 design organizations, 8 were WisDOT districts, 1 was a city designer, and 12 were design engineer consultants. A total of 18 design engineer consultant–prepared designs and 22 state-prepared designs were selected for evaluation.

Results from Evaluation Forms

Of the 40 evaluation forms sent out, 28, or approximately 70 percent, were returned. The group of returned forms represented 20 different prime contractor organizations. The largest number of responses came from the grading (8) and bridge (8) prime contractors. The fewest responses came from the PC paving prime contractors (5). Seven responses were received from the AC paving prime contractors. The group of returned forms represented 16 state-prepared projects and 12 design engineer consultant–prepared projects.

Table 2 indicates that the average overall project rating by project type varied from 4.1 to 5.6. The average overall rating for all projects was 4.9. This average rating indicates that the project plans and specifications were prepared to an acceptable standard. Table 2 also indicates that state-prepared projects received higher average ratings than design engineer consultant–prepared projects for every project type except PC paving projects. There are two possible reasons why the state-prepared projects received higher ratings: (*a*) because of the state's experience in preparing highway projects, the state-prepared projects are of an overall higher quality than design engineer consultant–prepared projects; and (*b*) the prime contractors completing the evaluation forms gave higher ratings to the state-prepared projects because of a fear that a low rating would adversely affect the relationship between the prime contractor and WisDOT.

TABLE 1 Contract Amount and Type of Projects Selected for Evaluation

Project Type	Sizes of Projects Selected for Evaluation		
	Minimum	Average	Maximum
Grading	$982,000	$2,975,900	$5,887,000
A.C. Paving	$593,000	$1,757,100	$2,443,000
P.C. Paving	$563,000	$3,277,200	$11,256,000
Bridge	$119,000	$799,200	$2,050,000
Overall Sample	$119,000	$2,244,667	$11,256,000

Written Comments from Evaluation Forms

The written comments from the evaluation forms covered the following six general areas: right-of-way difficulties, utility location difficulties, sequencing difficulties, inadequate field and soils investigations, equipment capabilities and limitations not considered, and constructibility difficulties.

Questionnaire Survey of State DOTs

A questionnaire survey was developed and sent to the DOTs in all 50 states, the District of Columbia, and Puerto Rico. Responses were received from 39 states and the District of Columbia. This is a response rate of approximately 77 percent. The objectives of the questionnaire survey were to (*a*) determine the amount of design work prepared by outside design consultants in other states, (*b*) identify previously established procedures for evaluating contract specifications and con-

TABLE 2 Summary of Ratings from Evaluation Forms by Project Type

	Project Type				Average Ratings
	Grading	A.C. Paving	P.C. Paving	Bridge	
State Prepared Designs					
Minimum Rating	4.0	4.0	4.0	5.0	4.3
Average Rating	4.8	5.8	4.7	5.0	5.1
Maximum Rating	5.0	8.0	5.0	5.0	5.8
Consultant Prepared Designs					
Minimum Rating	2.0	4.0	5.0	4.0	3.8
Average Rating	3.5	4.0	5.5	4.6	4.4
Maximum Rating	5.0	4.0	6.0	5.0	5.0
Overall Ratings					
Minimum Rating	2.0	4.0	4.0	4.0	3.5
Average Rating	4.1	5.6	5.0	4.8	4.9
Maximum Rating	5.0	8.0	6.0	5.0	6.0

struction plans, and (*c*) obtain the results of any previous investigations regarding the evaluation of the quality of contract specifications and construction plans. The questions in the survey were used to compare methods of evaluating contract specifications and construction plan quality used by different states. Questions were asked to determine who is involved in the evaluation, what types of projects are evaluated, what specific areas are evaluated, and what criteria are used to evaluate these areas.

The questionnaire first asked the states what percentage of projects designed in their state were designed by design engineer consultants. The responses varied from 0 percent (North Dakota) to 85 percent (New Jersey). The average percentage of designs performed by design engineer consultants was 26 percent.

The questionnaire next asked whether the states had procedures for evaluating construction project contract specifications. Sixty percent (22/37) of the respondents to this question had procedures for evaluating construction contract specifications. The questionnaire also asked whether they had procedures for evaluating the quality of construction plans. Seventy-four percent (29/39) of the respondents to this question did have procedures for evaluating the quality of construction plans. Clearly, a large number of state DOTs are evaluating the quality of project plans and specifications.

The states were then asked who was involved with the evaluation of construction plans. Table 3 indicates that approximately 90 percent of all states responding to this question solicit comments from state personnel involved in the project. Twenty-one percent of the states answering this question formally solicit comments from the prime contractor. Several other states indicated that even though they do not formally solicit comments from the prime contractor, they do informally solicit their comments.

The states were next asked whether evaluations were performed for every completed project. Seventy-one percent (20/28) indicated that they perform evaluations for every completed project. The balance of the sample, 29 percent (8/29), are states that do not evaluate every project. These states were then asked what percentage of completed projects are evaluated. As Table 4 indicates the percentage of completed projects evaluated varied from 7 (Maryland and Oklahoma) to 50 (Virginia). The average percentage of projects evaluated, where the state did not evaluate every project, was approximately 20 percent of completed projects.

States that did not evaluate every project were also asked what types of projects are evaluated. Thirty-eight percent (3/8) of the respondents to this question evaluate a sample of projects of every type and size. Twenty-five percent (2/8) of the respondents to this question evaluate only projects designed by design engineer consultants.

The states were next asked what specific areas of the construction plans were evaluated. Table 5 shows that nearly 90 percent of the states responding evaluate the sheets showing the estimate of quantities and the sheets showing the plan, profile, and cross-section details. The specific areas least evaluated are the standard and supplemental specifications, special provisions, and addenda. Even though these areas were the least evaluated, nearly 80 percent of the states responding evaluate them.

The states were finally asked what criteria are used to evaluate the specific areas. Table 6 shows that 93 percent of the states responding use sound engineering thought, judgment, and practice as one of the criteria. The next criteria used are whether the plan was clear, easy to understand, and bid and whether the plan contained information that was correct, complete, and adequate for the purpose. The criterion used least often was whether the design incorporated innovative and original ideas.

TABLE 3 Participants Involved in Project Evaluations

Participant	Number of Responses (N=29)	Percent
State Personnel	26	89.7
Design Engineer Consultant	8	27.6
Prime Contractor	6	20.7
Subcontractor	3	10.3

TABLE 4 Percentage of Completed Projects Sampled

State	Percent
Virginia	50
North Carolina	25
Hawaii	20
Arkansas	15
Nevada	10
Maryland	7
Oklahoma	7
Illinois	Random

TABLE 5 Specific Areas Evaluated

Specific Area Evaluated	Number of Responses (N=28)	Percent
Estimate of quantities sheets, miscellaneous estimate sheets, and computer earthwork sheets.	25	89.3
Plan and profile sheets, structure detail sheets, and cross section sheets.	25	89.3
Title sheet, typical sections, general notes, index of drawings, miscellaneous detail sheets, alignment diagrams, and standard detail sheets.	24	85.7
Traffic control plan, erosion control plan, and other special plans.	24	85.7
Standard specifications, supplemental specifications, special provisions, and addenda.	22	78.6

TABLE 6 Criteria Used as Basis for Evaluation

Criteria Used as Basis for Evaluation	Number of Responses (N=28)	Percent
Design demonstrated sound engineering thought/judgment/practices.	26	92.9
Plan was clear, easy to understand, and to bid.	25	89.3
Information was correct, complete, and adequate for the purpose.	25	89.3
Sequencing and staging of activities were included.	23	82.1
Soils investigation recommendations were included.	22	78.6
Utility and railroad needs and conflicts were included.	22	78.6
Outside influences and sources of conflict were considered.	20	71.4
Design was cost effective.	20	71.4
Plan was well-organized, well-formatted, and professionally drafted.	20	71.4
Plan was clean, uncluttered, and free of unneeded detail.	18	64.3
Capabilities of construction personnel and equipment were considered.	15	53.6
Design incorporated innovative and original ideas.	10	35.7

Prime Contractor Organization Interviews

The prime contractors that were selected to be interviewed were those who constructed the 40 projects that were selected by WisDOT for evaluation. In most cases, it was possible to meet with the person who completed the plan quality evaluation form that was sent to the prime contractor. As stated earlier, the 40 selected projects were constructed by 26 different prime contractor organizations. Of this group, 20 prime contractors were able to be contacted for interviews. The other six were not interviewed after numerous attempts to contact them failed. Fifteen of the interviews were conducted in person, and the remaining five were conducted by telephone.

During the interviews, the prime contractor representatives were asked a set of approximately seven questions. These questions had three objectives: to identify the types of difficulties the prime contractor has encountered in past project designs, to identify how the prime contractor would like to communicate feedback to the project designer, and to identify how often this information should be communicated.

From the interviews conducted, several areas where prime contractors have had difficulties with project designs were identified. Five of these areas were consideration of equipment capabilities and limitations, lack of adequate field and soils investigation, inaccurate quantity estimates, utility coordination difficulties, and soil quantities for staged projects not listed by stages.

The prime contractors were also asked how feedback about a project should be communicated to the project designer. Half (10) of the prime contractors were supportive of an in-person meeting near the completion of the project. The meeting could include representatives of the designer, prime contractor, subcontractors, FHWA, and WisDOT. These prime contractors believed that in-person meetings would be more effective in communicating their difficulties with the project design than written comments.

Four prime contractors were not supportive of in-person meetings because they believed that the meetings would require too much time and would be difficult to schedule. Another reason of nonsupport was a fear that the meeting would turn into an argument rather than a constructive meeting for the exchange of ideas and comments.

Six prime contractors were supportive of an evaluation form similar to that already developed. Those prime contractors favoring an evaluation form believed that the form could be successful if results from the form were incorporated into future projects. One representative of a prime contractor organization stated that he would support an evaluation form if the amount of time required to evaluate the project equaled the amount of time spent by WisDOT evaluating the prime contractors. Three of the prime contractors not supportive of an evaluation form were not supportive because the form would add to the paperwork that they currently have to complete for WisDOT projects.

Several other suggestions of how to communicate feedback to designers were received: have the designer present at or involved in the final inspection of the project, have the contractor communicate project feedback to the project engineer who would in turn communicate the information to the designer, and maintain and possibly expand the current annual designer-contractor meetings held through the Wisconsin Road Builders Association to include a discussion of difficulties encountered by contractors on specific project details.

The prime contractors were finally asked how often they would like to provide feedback to the project designer. Half (10) of the prime contractors stated that they would like to provide feedback for every project. If providing feedback for every project were not possible, several suggestions were offered: randomly sample all project types and sizes; evaluate only projects where major difficulties were encountered; have the prime contractor choose the project to comment about; base the selection of projects on type, size, and complexity; and select projects with unique or unusual conditions.

Designer Organization Interview

The designers selected to be interviewed were those who designed the 40 projects selected by WisDOT for evaluation. Many times it was not possible to meet with the actual designer of the project because multiple individuals were involved in the design. However, meetings were scheduled with representatives of the design organizations that were familiar with the projects and served as managers or supervisors of highway design. As stated earlier, the 40 selected projects were de-

signed by 13 design engineer consultants and 8 WisDOT design sections. Seventeen of these design organizations were contacted for interviews (11 design engineer consultants and 6 state design sections). One additional WisDOT design section not included in the projects selected was also contacted. Eleven of the interviews were conducted in person, and the remaining seven interviews were conducted by telephone.

During the interviews, the representatives of the design organization were asked a set of approximately five questions. The questions were meant to determine whether feedback about projects from contractors would be helpful to designers, what type of information from contractors would be helpful, in what form the information would be most helpful, and how often this information should be communicated to the designers.

From the interviews conducted, it was determined that constructive feedback about completed projects from highway construction contractors would be helpful. The designers were next asked what types of information from contractors would be helpful. Examples of the types of information that designers were interested in receiving from contractors included equipment capabilities and limitations, accuracy of estimate of quantities, adequacy of traffic control plans, adequacy of soils investigation, cost-effectiveness of the design, completeness of plans, clearness of plans, and ease of understanding of plans.

The designers were next asked in what form the information from contractors would be most helpful. Several ways of communicating feedback were suggested. One suggestion involved having the prime contractor use an unmarked set of plans during construction. When difficulties were encountered during construction, the contractor could mark the difficulties on the set of plans. After construction, a follow-up meeting between the prime contractor, designer, FHWA, and WisDOT representatives to discuss the difficulties encountered could be scheduled. Related to this was a suggestion to have the prime contractor submit written comments and, if necessary, conduct a follow-up meeting between representatives of the prime contractor, designer, FHWA, and WisDOT.

Other suggestions were related to conducting meetings either during the project at a major milestone or at completion of the project. The meetings could be between the representatives of the prime contractor, designer, FHWA, and WisDOT. The remaining suggestions included having the designer visit the project during the construction or having the designer involved with the final inspection of the project.

The designers were next asked how often they would like to receive feedback information from the contractors. Most designers responded that they would like to have feedback from every project. Since this may not be possible, the designers were also asked how projects should be selected for evaluation. The following criteria were suggested: random sampling of all project types and sizes, major projects only, only projects that encountered major difficulties, projects that were unique or had unusual conditions, projects that had difficulties that might be of interest to designers, and projects selected by the project engineer.

The designers were finally asked for general comments regarding feedback from highway contractors. Nearly all of the designers stated that specific written comments, both positive and negative, from the contractors would be more helpful than a numerical rating number that indicated the quality of the plans. Most designers also stated that a meeting between the designer, prime contractor, FHWA, and WisDOT representatives could also be helpful in communicating difficulties encountered during a project. With regard to the meetings, some of the design engineer consultants were concerned that their firms would not be compensated for the time required for a representative of their firm to attend these meetings. Thus, a method to compensate the design engineer consultants for their time would have to be developed. Other designers commented on the existing plan quality evaluation form, stating that if a rating number continued to be used, the range of possible ratings should be narrower and more meaning should be attached to the individual rating numbers. Other designers suggested that the Wisconsin Road Builders Asssociation be further used to help enhance communication between prime contractors and designers.

During the interviews with the representatives from the WisDOT design sections, several methods and forms for project evaluation were identified. Most districts have the state project engineer complete an evaluation form at the end of the project. Other districts had the state project engineer write a narrative project critique at the completion of a project. The narrative described the difficulties encountered with the plans and areas of the plan that worked well in the field. These project critiques are circulated through the district's in-house design and construction staffs as well as any consultants involved.

ALTERNATIVES TO ACCOMPLISH PLAN QUALITY EVALUATION

From the results of this investigation, three possible alternatives to accomplish plan quality evaluation were identified: do nothing, narrative project critique, and evaluation form. Within the evaluation form alternative, four options are available for the development of such a form: use the existing WisDOT plan quality evaluation form, modify the existing WisDOT plan quality evaluation form, adopt a form developed by another state DOT, and modify a form developed by another state DOT to meet the specific needs of WisDOT.

To analyze the possible effectiveness of each alternative, it was necessary to develop a framework to be used. To be effective, each alternative should answer five questions. As Table 7 indicates, the five questions are what, why, who, when, and how. Specific answers to these questions with the exception of "when" and "how" are also presented in Table 7. To answer the "what" and "why" questions, each alternative should evaluate plan quality because plan quality can affect the performance achieved on a project. To answer the "who" question, each alternative should involve a representative from at least one of the following project participants: prime contractor, designer, FHWA, and WisDOT.

The question of when the evaluation should be performed has two parts: (*a*) the selection of the project to be evaluated and (*b*) once selected, the timing of the evaluation during the construction of the project. Several options are available to determine when a project should be selected for evaluation: evaluate every completed project, evaluate a fixed percentage of each type of project completed, evaluate only design en-

TABLE 7 Implementation Considerations Related to Alternatives

Question	Response
What?	Evaluate plan quality.
Why?	Plan quality impacts cost, schedule, quality, and safety achieved on project.
Who?	Participants involved in the project (i.e., prime contractor, designer, FHWA, and WisDOT).
When?	Selection of project and timing of evaluation during construction of project.
How?	Means by which WisDOT performs plan quality evaluation.

gineer consultant–prepared projects, evaluate projects that encountered difficulties, and evaluate projects with unique or unusual characteristics or conditions.

The second part of the "when" question is that once a project is selected for evaluation, when during the construction of the project should the evaluation take place. Several options are available: evaluation at 33 percent, 66 percent, and completion of the project; evaluation at 50 percent and completion of the project; and evaluation at completion of project only.

The following sections describe "how" each plan quality evaluation may be performed.

Do Nothing Alternative

This is the least effective method to accomplish plan quality evaluation. This alternative fails to answer any of the five questions that were presented as part of the framework to analyze the alternatives. As a result, the do nothing alternative is not a feasible alternative to accomplish plan quality evaluation and is discarded as a practical alternative.

Narrative Project Critique

This alternative consists of having the state project engineer write a narrative project critique at the completion of the selected project. The critique should include a description of items that caused difficulties during construction as well as descriptions of items that worked well during construction. An advantage of this alternative is that it could provide design engineers with specific comments from the perspective of the state project engineer on difficulties encountered rather than generalities. This alternative would be an efficient means of evaluating a project when no significant difficulties were encountered.

A disadvantage of this alternative is that comments from the prime contractor may not be directly incorporated into the project critique. Another disadvantage is that the critique could become lengthy and, as a result, may not be read by designers. Also, this format is open ended and ill structured. Hence, there is not a standard format to present the comments. This would complicate the compilation and analysis of the data. Another disadvantage is that the meaningfulness of the results could be suspect because of the variability between individuals writing the critique. A final disadvantage is that this alternative does not provide a relative assessment of design engineer consultant performance.

Evaluation Form Alternative

This alternative consists of using a form to guide the evaluation of plan quality. The form could be filled out directly by the prime contractor or the state project engineer. It could also be used as a guide for discussion between the designer, prime contractor, FHWA, and WisDOT representatives at an end-of-project meeting. An advantage of using a form for evaluation is that it could allow for direct comments from the prime contractor. Also, if used at an end-of-project meeting as a guide for discussion, communication between the designer, prime contractor, FHWA, and WisDOT representatives could perhaps be enhanced. A disadvantage of using a form for evaluation is that the prime contractor may not fill out the form. Another disadvantage is that an end-of-project meeting between the designer, prime contractor, FHWA, and WisDOT representatives may be difficult to coordinate and schedule. Also, the prime contractor and designer representatives may not be willing to spend the time to attend such a meeting.

As mentioned previously, the following four options are available for the development of a plan quality evaluation form:

1. Use existing plan quality evaluation form. This option would require the least effort on the part of WisDOT. However, on the basis of the test conducted using the existing evaluation form, the meaningfulness and usefulness of the results obtained are suspect.
2. Modify existing plan quality evaluation form. This option consists of several possible modifcations that could be made to the existing evaluation form: (*a*) shorten the range of possible rating numbers and explicitly define the meaning of each number; (*b*) convert the form from a combination of rating numbers and written comments to one of written comments only; (*c*) reformat the form to one with specific questions to meet the needs of WisDOT; (*d*) reformat the form into a checklist where different areas to be evaluated are listed with the possible responses; and (*e*) integrate modifications (*b*),

(*c*), and (*d*) into a form with a checklist for easily answered questions, specific short answer questions to meet the needs of WisDOT, and a section for written comments. Each of these modifications would make the form easier to use and would help ensure that the information obtained from the form would be meaningful and useful to the designer of the selected project and future projects.

3. Adopt a form developed by another state DOT. From the questionnaire survey of the state DOTs, several copies of forms used by other states were obtained. The formats of these forms ranged from specific questions about the project to checklists of easily answered questions.

4. Modify a form developed by another state DOT. The form could be modified to incorporate positive attributes of several different forms used by other state DOTs and further modified to meet the specific needs of WisDOT.

RECOMMENDATIONS

On the basis of the research and findings described in this paper, the researchers recommended the development of a new form based on the forms from other state DOTs. This will enable WisDOT to take advantage of the positive attributes of each form. Figure 1 shows a sample form that was developed for consideration by WisDOT. This form was reviewed by WisDOT staff and modified to better meet the needs of WisDOT. The form is currently being implemented by WisDOT.

This form consists of three parts. The first part consists of a checklist that rates items of the plan that appears to be straightforward. The possible responses to the items would be either qualitative in nature (e.g., excellent, good, fair, or poor) or simply yes or no. The number of possible qualitative

PART I -- Checklist

Were the plans complete?
_____ Very complete _____ Generally complete _____ Several omissions _____ Many omissions

Could you easily stake the project from the plans?
_____ No problems _____ Few problems _____Some problems _____ Serious problems

Were the quantities correct?
_____ Correct _____ Some errors _____ Several errors _____ Large errors

Was the drafting of – _____ Excellent _____ Good _____ Fair or _____ Poor quality?

Was the plan accuracy – _____ Excellent _____ Good _____ Fair or _____ Poor?

Did the plans contain – _____ Few _____ Several _____ Many or _____ Serious errors?

Were the plans – _____ Very easy _____ Easy _____ Difficult _____ Very difficult to read?

If the Designer or Consultant was called on to make changes, was the response –
_____ Effective _____ Slow _____ Poor or _____ Ineffective?

Would you rate this Designer or Consultant's plans –
_____ Better _____ About the same or _____ Inferior to other Consultant designed plans?

Would you rate this Designer or Consultant's plans –
_____ Better _____ About the same or _____ Inferior to other Department of Transportation designed plans?

If the Designer or Consultant produced similar plans, would you recommend that the Designer or Consultant be –
_____ Used again _____ Given work ahead of other consultants
_____ Never given more work or _____ Given a penalty?

FIGURE 1 Sample evaluation form for consideration. (***continued on next page***)

PART II -- Short Answer Questions

Roadway

Were the quantity summaries correct? State any major departure from plans quantity and reason for same.

Were there any problems in location in the field? If so, state problems.

Was right of way detailed properly?

State any other facts that may have presented problems relative to plans.

Were incidental items (i.e., embankment curbs, down drains, catch basins, etc.) properly located?

Earthwork

Was soil profile reasonably accurate as to type of material encountered?

Structures

Were dimensions, details, and elevations accurate?

Were any Change Orders required? Explain the purpose and the need.

In your opinion, what could have been done to improve the structure plans?

Traffic and Signing

Were the traffic and signing plans complete and accurate?

Was the detour striping plan clear and accurate?

Were there any problems associated with the temporary concrete barriers?

Were there any problems encountered with installing delineators? Were the delineator quantities reasonably correct?

Special Provisions: Bidding Schedule

Although the special provisions supersede the plans, were there any apparent contradictions between them?

Were there any items normally specifically paid for but left out of the bidding schedule?

Were there any ambiguities within the special provisions?

What might have been done to improve the special provision?

Were any change orders necessary that resulted from errors, omissions, or ambiguities in the plans, special provisions, and bidding schedule? Explain briefly.

PART III -- Additional Comments

This section is for written comments related to difficulties encountered that require further elaboration.

FIGURE 1 (*continued*)

responses should be few in number. By having fewer choices for responses, more meaning will be attached to each of the possible responses. There should also be a section in the first part where comments regarding adverse conditions related to the items in the checklist could be recorded. This section of the form could easily be filled out and should not require much time of the evaluator. Second, by scanning the responses, a designer could get a general impression of the quality of the plans without reading several pages of text.

The second section of the form consists of several short-answer questions. The questions posed in this section should address areas where WisDOT has perceived the most difficulties or provide designers with beneficial information that could be used when preparing designs for future projects. The

questions should be posed in such a way that the evaluator is encouraged to write more than short and simple responses.

The third section would allow additional comments regarding the project to be noted. This section would be of benefit to the evaluator because it would allow for further descriptions of specific difficulties that were encountered and suggestions for improvement. This section would also be of benefit to designers because the specific comments and suggestions could help the designer in the preparation of future designs.

The selection of projects for evaluation should be based on the professional judgment of the WisDOT project engineer and construction area supervisor. Criteria that could be used to select projects are whether there were many questions regarding the intent of the design during bidding and construction, whether there were a large number of change orders due to design errors and omissions, or whether the project contained any unique or unusual conditions or characteristics. The researchers did not recommend the evaluation of every project, nor did they recommend evaluating a fixed percentage of projects. The reasoning is that there is no reasonable justification for consuming the scarce time resources of the prime contractor, designer, FHWA, and WisDOT representatives when the quality of the plans was fine and no significant difficulties were encountered. As a result, this scheme of implementation will evaluate project quality by exception. Not selecting a project for evaluation implies that the plan quality was fine and no significant difficulties were encountered. Success of this implementation scheme depends on the appropriate use of judgment by the project engineer and construction area supervisor.

The use of the evaluation form at the project level should involve the prime contractor, designer, FHWA, and WisDOT representatives. The researchers recommended that if a project is selected for evaluation, a postconstruction meeting between the prime contractor, designer, FHWA, and WisDOT representatives be conducted, if necessary. The evaluation form could be used as a guide for discussion during the meeting.

Following the evaluation of a project, the comments and suggestions received should be passed to the district construction supervisor, who would in turn submit the evaluations for that district to a designated person within WisDOT Central Office. The results from the meetings and evaluation forms should be compiled jointly by the Central Office Design and Construction sections into a report. A possible outline for this report could be (*a*) Introduction, (*b*) Summary of Difficulties Encountered, (*c*) Suggestions for Improvement, and (*d*) Conclusions. The report could then be disseminated to state designers as well as design engineer consultants. It could also be used as part of an expanded designer-contractor annual meeting held by the Wisconsin Road Builders Association. The meeting would communicate the difficulties encountered in project designs and the suggestions for improvement.

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