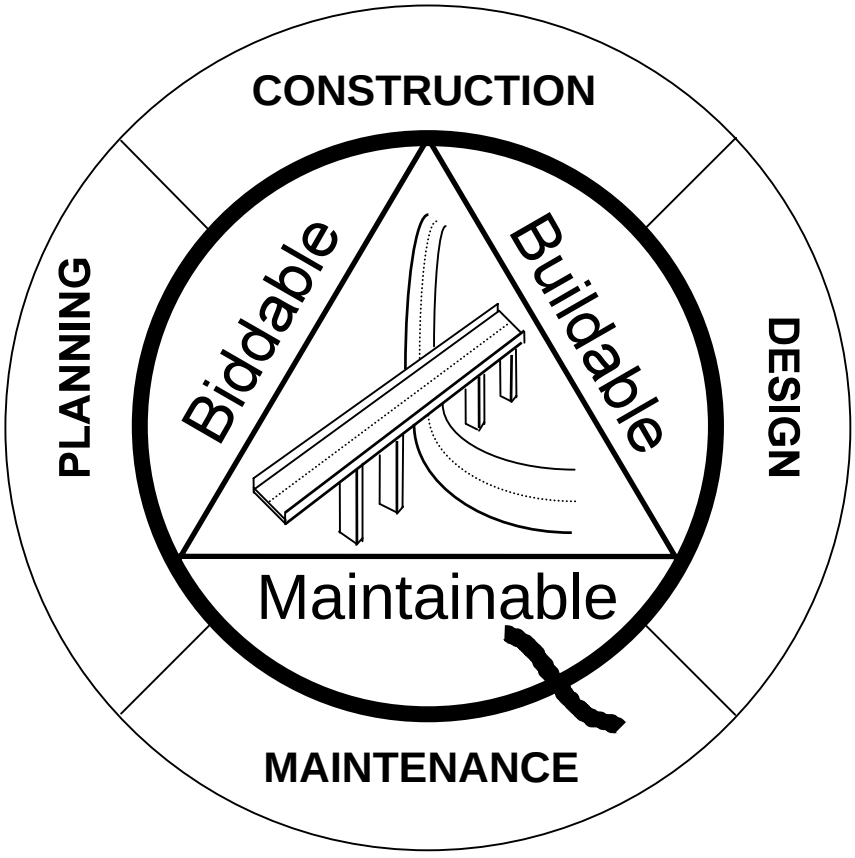
Washington State Department of Transportation

A MANUAL OF INSTRUCTION

FOR THE

IMPLEMENTATION OF THE CONSTRUCTABILITY REVIEW PROCESS



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EXECUTIVE SUMMARY

This document provides guidelines for the implementation of the Washington State Department of Transportation (WSDOT) Constructability Review Process (CRP) into the Department's overall Project Development Process. These guidelines were created to outline the Constructability Review Process, and to describe and facilitate its integration and coordination with the various elements of the Project Development Process. The Constructability Review Process (CRP) was developed through research conducted by the Department of Civil Engineering at the University of Washington in coordination with WSDOT staff and management.

The Constructability Review Process is designed to help improve the level of constructability of a project. The most important benefits expected from the CRP are the achievement of an efficient project development process and the realization of a cost-effective project that is biddable, buildable, and maintainable. To achieve these goals, the CRP is composed of a number of constructability reviews performed at various stages during the course of the Project Development Process. The first review occurs during project planning when the draft Project Definition Report (PDR) is complete. Subsequent reviews occur at the 0 percent, 30 percent, 60 percent and final stages of PS&E development. While the entire CRP includes a four-step review process, all four reviews only apply to major or very complex projects. For smaller or less complex projects, a modified CRP review sequence is required which utilizes fewer reviews.

Each review is directed at addressing constructability issues pertinent to a particular stage in the Project Development Process. The reviews are performed by a review team comprised of the disciplines and functions involved in planning, designing, constructing, and maintaining the project. The Constructability Review Process is initiated and managed by the project engineer in charge of designing the project. However, the review process should emphasize construction and maintenance knowledge during the reviews. This knowledge can then be used to aid in guiding the design of the project. The reviews should also reflect back on previous decisions and establish whether the project is still on track.

Each constructability review involves the formation of a review team, completion of two checklists, interoffice coordination, and completion of a review meeting. Since the reviews emphasize construction and maintenance knowledge, it is imperative that Construction and Maintenance Managers and key staff participates in the reviews. The first checklist, completed by the project engineer, is used for assistance in scheduling and conducting the review. The second checklist focuses on the constructability aspects of projects. Each scheduled review has a unique constructability checklist that incorporates a level of detail suitable for that particular stage of design and plans preparation. The checklists, which are designed to carry over from one stage of design and plans preparation to the next, are hierarchical in nature and add elements and details in successive stages. The difference between each checklist is the information and documentation required at each review stage, and the percentage of contingencies that accounts for the unpredictable or unknown.

Follow-up and reporting efforts begin with recording the decisions made and actions taken during each review. The record should document issues that were not resolved, who was assigned the responsibility of resolving the issue and when the resolution will occur. This allows for the tracking and monitoring of schedules, progress, and documents produced between reviews. In addition, the follow up and reporting allows the checklists to be updated, and enables the design office to evaluate what worked and what did not work during the reviews.

Assuming that some items or issues might remain unresolved at the conclusion of a review meeting, an appeal describing them would be prepared by the team leader and submitted to the Region Arbitration Committee for a decision. The Appeals Report should describe the issue, impacts to the project (scope, scheduling, cost), and why an impasse has been reached. The report is then used by the Region Arbitration Committee to resolve the issue. Issues that are Statewide in nature or that cannot be resolved at the Regional level should be forwarded to Olympia for final resolution.

The CRP process also requires that records be kept of lessons learned during all project phases. The record of lessons learned should be stored in an electronic database that is updated regularly, as the project develops. In addition to being used to guide other projects in the future, a database of lessons learned could serve as an expert system to help train new staff.

A critical element of the CRP is monitoring for success. This will entail the establishment of benchmarks and performance goals. These measures of effectiveness need to be monitored to determine whether the plan quality improvement targets are being met.

Benchmarking is a measure of effectiveness in determining whether established quality improvement targets are being met. WSDOT should consider both external and internal benchmarking. In order to choose the type of benchmarking to perform, WSDOT needs to select a benchmarking team. This team should be from six to eight members in size and cross functional in nature. The members should include internal customers, suppliers to the process, senior staff that will benefit from the improvements the most, and employees that will have to make the changes. Other benchmarking team members could include Olympia Service Center (OSC) representation and Associated General Contractor (AGC) participation.

In order to determine whether the CRP is successful, target goals must be established. The goals are an essential feature to assure that successful CRP performance is achieved. The following benchmarks and performance goals are proposed “Critical Success Factors” for the CRP.

A. Contract Addenda:

Establish June 1999 as a target for reducing the number of project addenda statewide to zero. An exception procedure and prior approval requirement would be in place for “acceptable” addenda after June 1999.

B. Contract Change Orders (CCO’s):

1. By June 1999, reduce the sum of all CCO cost increases to less than 5% over the original contract bid amount for all projects.
2. By June 1999, reduce the total number of CCO's processed annually statewide to 50% of the total number processed in 1995.
3. By June 1999, reduce the annual statewide cost of Construction and Project Development staff resources spent processing CCO's to less than 5% of the total staff resources allocated to Construction field staff.

C. Advertisement Dates:
   Eliminate advertisement date slides due to constructability issues.
D. Project Scope:
   Maintain the original scope of the project, during the life of the project.
E. Project Schedule:
   Ensure that the project schedule is tracked and milestone dates are met.
F. Project Budget:
   Keep the final construction cost within the initial project estimate.

Once the benchmarks and performance goals have been established, they will need to be monitored for success. Monitoring for success could take on many forms. The recommended monitoring strategy includes:

1. Electronic tracking of CCO's and addenda
2. Tracking advertisement dates for slides due to constructability issues
3. Tracking progress against benchmarks
4. Establish a priority system, by project type, that identifies the level of importance of the Ad date. In some cases maintaining the advertisement date and putting out addenda or revising by CCO may be preferred. In other cases, sliding the advertisement date may be preferable to generating addenda or CCO's. However, these cases should not be related to constructability issues.
5. Adequately identifying the project scope at project inception and continually monitoring to ensure that the scope does not change during the project life.
6. Monitoring the schedule and budget and tracking actual dates and expenditures against planned dates and budgets.

Monitoring for success will require that a means of achieving the goals is put in place. Achieving the goals necessitates setting an official start date, intermediate milestone dates, and a final goal attainment date.

INTRODUCTION

This document provides guidelines for the implementation of the Washington State Department of Transportation (WSDOT) Constructability Review Process (CRP). The important principle associated with these guidelines is that the CRP is not a stand-alone procedure but an integral element within the WSDOT statewide Project Development Process. These guidelines were created to outline the Constructability Review Process, and to describe and facilitate its integration and coordination with all of the various elements included in the Project Development Process.

The Constructability Review Process (CRP) was developed through research conducted by the Department of Civil Engineering at the University of Washington in coordination with WSDOT staff and management personnel. The initial research effort, Phase I, focused on reviewing existing WSDOT procedures and past projects to identify critical issues of concern regarding the planning and development of construction projects. A model process was developed to address constructability issues on projects. The results of Phase I are outlined in a report titled "A Framework for the Constructability Review of Transportation Projects" (McManus et al. 1996).

The second research effort, Phase II, focused on testing the model process on various WSDOT projects, evaluating the project level criteria, and determining CRP performance goals, benchmarks, and a monitoring process. This implementation guide, along with a CRP Training Guide, has been developed as part of the second phase of the research effort.

1.1 Motivation for Implementing the CRP

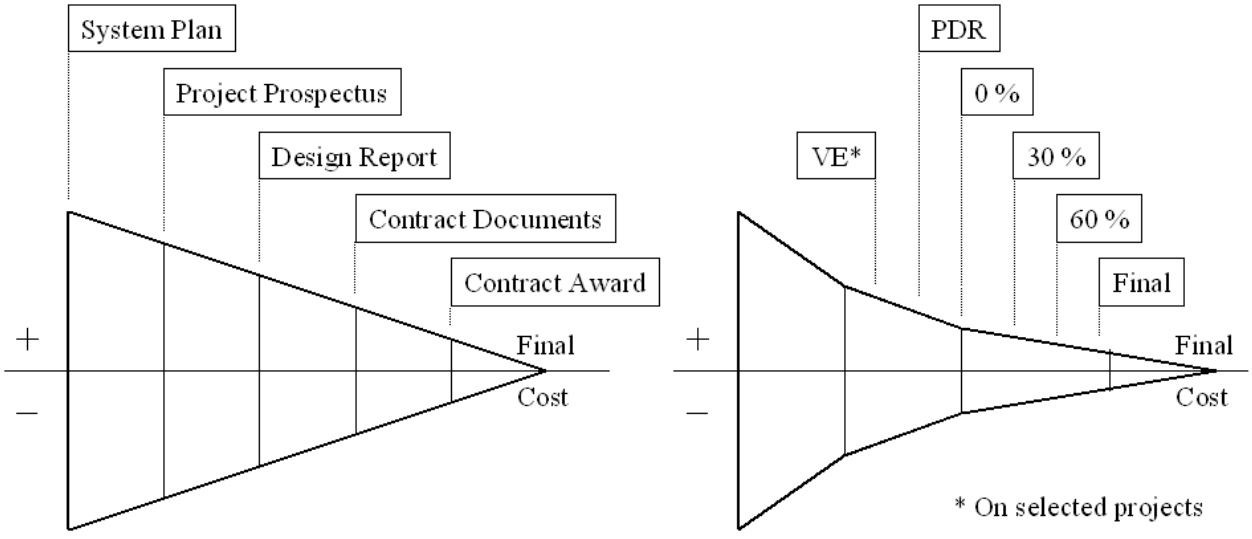
WSDOT and most other transportation agencies in the U.S. are continually facing increasing technical complexities, increasing regulatory restrictions, and tremendous internal and external pressures to deliver quality products on time, within budget, and with unchanged scopes. These pressures tend to create a schedule-driven environment during project development, especially during the Plans, Specifications, and Estimate (PS&E) development phase, which leads to errors, omissions, and constructability problems. The Department has become increasingly concerned about the constructability and quality of design plans for its major roadway construction projects. Furthermore, WSDOT, like many public agencies, periodically has large turnovers of experienced staff that leads to a depletion of valuable construction knowledge. Each of these issues results in or exacerbates problems related to constructability.

Constructability and quality of design plans have been identified as significant national issues in need of being addressed and improved upon. The construction industry, as a whole, has expressed concern about the increasing number of projects proposed for construction that appear to be marginally biddable. Several construction industry publications have reported increases in the number of contract change orders, contracts being settled through litigation, and construction contracts that exceed the original bid (ASCE 1991). While there is much speculation about the root causes of constructability problems and the diminishing quality of design plans, it has been

shown that constructability reviews applied throughout the project development process have provided cost and time savings (Construction Industry Institute 1991). Constructability improvements have been identified as an integral step in achieving quality projects.

For WSDOT, the aforementioned pressures and associated problems have resulted in an increasing number of addenda, contract change orders (CCOs), and final contract costs on projects in the past few years. Most of the circumstances leading to the addenda and CCOs involve errors in the design documents that were not corrected prior to contract advertisement and award. It appears that errors not corrected prior to advertisement are directly attributed to the schedule-driven environment. The primary motivation of implementing the CRP is to meet WSDOT's goal of delivering high quality projects while maintaining project scope, schedule, and budget. Attaining these goals will result in a reduction of the number of project addenda, CCOs, and final contract cost. The attainment of these goals can be reached by emphasizing on construction and maintenance knowledge during the review process.

Reduction of final contract costs is facilitated by an early determination of the actual cost of construction. Variability in the cost of construction is reduced as the design progresses and more detailed project information becomes available or is developed. Under WSDOT's old Project Development Process, Figure 1a shows how the variability of construction costs changed from planning through construction. WSDOT's goal is to move toward the process shown in Figure 1b. The new Project Development Process involves performing more engineering effort earlier in the project timeline. By performing some engineering during the planning stages, more information will be available earlier, thus reducing the variability in the process. The CRP, which involves performing constructability reviews during both the planning and design stages, provides one means of developing project information earlier in the project timeline.



a) Old Project Development Process b) New Project Development Process

Figure 1: Variability of Construction Costs

The optimal level of engineering and design effort is based on a tradeoff between competing cost factors. Errors in the contract documents incur costs directly in dollars and indirectly in construction delays and construction administration. Other issues, such as loss of political and customer credibility with the Transportation Commission and the State Legislature, also arise. On the other hand, early detection and correction of errors add cost for additional time spent to conduct in-depth reviews and eliminate errors. Figure 2 shows the correlation between effort expended to minimize design errors and the cost associated with the errors. This figure indicates that high construction costs result when design errors are neglected. The cost of construction related to design errors tend to be greater than costs of additional design effort to minimize errors. It is unrealistic to expect a contract to proceed with no errors or changes at all. However, the minimum cost cannot be achieved without minimizing errors and omissions.

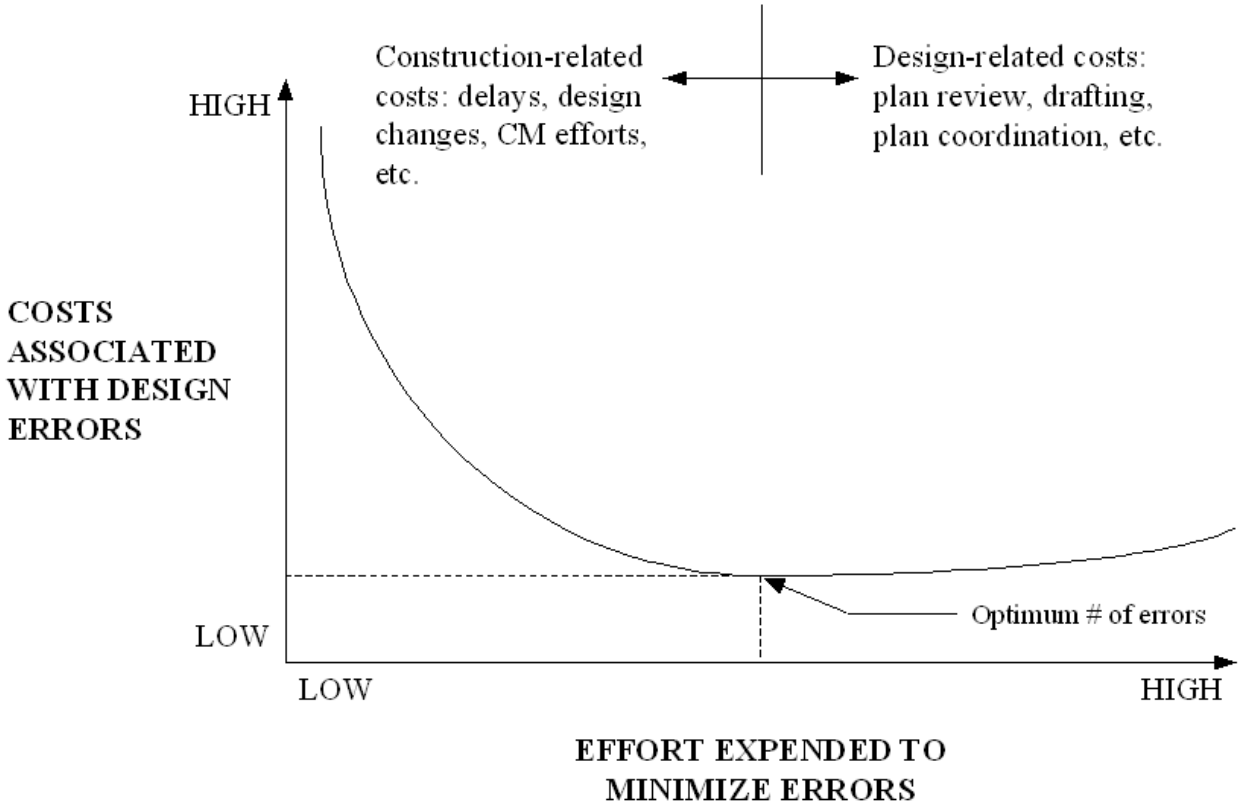


Figure 2: Relationship Between Cost and Number of Errors

The Intermodal Surface Transportation Act (ISTEA) of 1991 outlined the need for the transportation industry to look for continuous improvements, especially in the quality of transportation products and services. Constructability improvements have been identified as an integral step in achieving this quality. As a result, quality improvement programs, of which constructability and existing project development process problems are key focal points, have been started by the American Association of State Highway and Transportation Officials (AASHTO), the Federal Highway Administration (FHWA), and many states.

1.2 Constructability Defined

The Constructability Review Process is a systematic process that provides a framework for improving the constructability of transportation construction projects. The definition of constructability adopted for this process is as follows:

> Constructability is the property of a project where construction and maintenance knowledge is applied during the design process, and where errors and omissions in the contract plans and special provisions have been minimized to enable the contractor to construct a high quality project that is biddable, buildable, and maintainable.

An evaluation of the level of constructability of a project is performed through constructability reviews. Constructability reviews are defined as follows:

> A constructability review is a systematic process to ensure that the project possesses the foregoing attributes of constructability. The process starts at the inception of the project and continues throughout its duration. Various constructability reviews are incorporated into the planning and development stages of a project. The combination of the various reviews comprises the Constructability Review Process.

The definition of constructability embodies the primary goals for the success of a project

Constructability can be divided into Programmatic Constructability and Technical Constructability. Both are equally important, but each assumes different weights at different times during the development of a project.

> Programmatic Constructability dominates the early phases of project development. It focuses on whether the project scope will solve the problem identified by the Department, whether the project meets the definition of constructability, and, if it is programmable for construction within the desired time frame of need.
>
> Technical Constructability addresses the technical details of the project. It concerns the engineering aspects of the final design and the possible means, methods, techniques, sequences, and procedures by which the project can be built.

Both Programmatic and Technical Constructability address the project's adherence to WSDOT's current design, construction, and maintenance standards and practices.

Maintenance preserves the investment, the quality, and the operational integrity of the facility for as long as practical and cost effective. Features designed or constructed as part of the facility should consider, address, or enhance maintenance through the operational life of the facility. Maintainability is considered an integral, life cycle aspect of a quality project. The

following definition encompasses the maintainability goals in the Constructability Review Process.

> Maintainability is the ease of maintenance, workability, and accessibility, and the minimizing of operational conflicts and exposure of maintenance staff and equipment to moving traffic or other hazardous conditions. Maintainability is a property of each constructed project, and is as important as biddability and buildability.

1.3 Relationship of the CRP to the Project Development Process

WSDOT's Project Development Process (PDP) is a comprehensive set of procedures involving project management, planning, and design. These procedures incorporate and integrate all elements of the WSDOT's planning, design, and contract development for transportation projects. The Constructability Review Process (CRP) is but one element that has been integrated into the Project Development Process.

The PDP incorporates two main phases as illustrated in Figure 3. The first phase encompasses the initial planning and engineering efforts for the project. Three stages of effort occur within the first phase. The first stage is planning, followed by the preliminary engineering stage, and finally the final environmental studies stage.

The second phase of the PDP is the development of the plans, specifications, and estimate (PS&E). The PS&E phase utilizes the information developed in the initial phase and concludes with a complete set of project documents ready for advertisement. The second phase also incorporates three stages of effort. The three stages are: geometric development, general plan development, and contract plan development. Within the geometric development stage, the project's primary geometric features are developed. Following this stage, the general plan development stage involves advancement of the project's critical design features and major enhancement of the project documents. The final stage, contract plan development, encompasses the development of specific project details and final completion of the plans.

The CRP is incorporated throughout the PDP by performing various constructability reviews. Each review should incorporate construction and maintenance knowledge in the review, which can then be used to guide the design of the project. Figure 3 illustrates the points in project development when the constructability reviews occur. The actual number of reviews will depend on the size, complexity, and phasing of the project through the complete Project Development Process. In addition, each review should reflect back on previous decisions and determine whether the project is still on track.

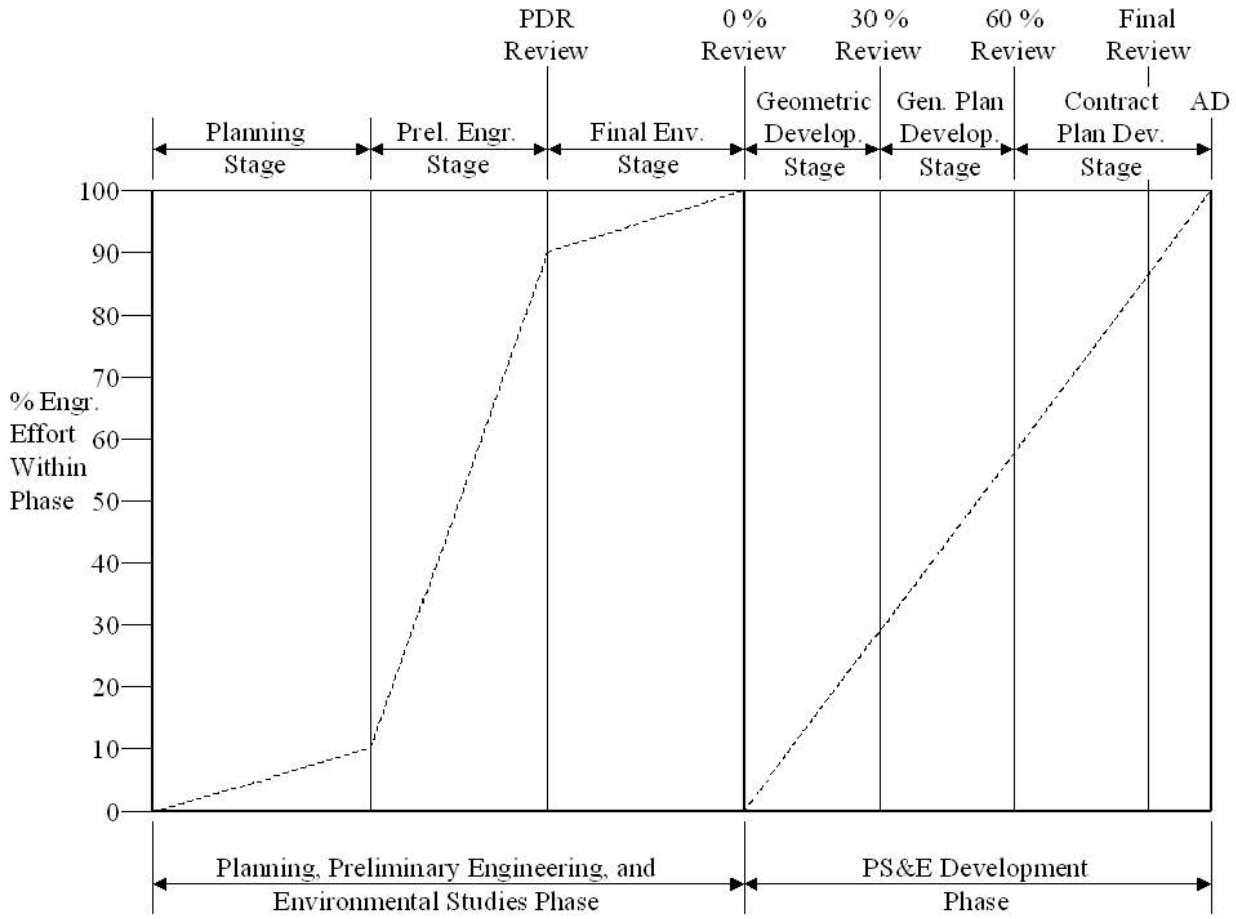


Figure 3: WSDOT Project Development Process

The initial CRP review occurs at the completion of the draft Project Definition Report (PDR). This review should be done in coordination with the project Value Engineering (VE) study, provided that a VE study is planned for the project. Coordination of an initial constructability review with the VE study initiates a partnering between several project functions at an early stage and assists in developing a team approach for the life of the project. The purpose of reviewing the project before submission of the PDR is to investigate the major alternative solutions for the project early in the process before the concepts are locked in and change becomes disruptive and expensive. The project cost estimate should be reassessed and adjusted as needed, at this time. Long-term savings to the project as a whole are to be expected by applying these procedures early.

The initial constructability review is followed by additional reviews during the PS&E development phase. A 0 percent review occurs at the onset of the PS&E phase of project development and signals the start of the geometric plans development. Once the geometric plans are completed, a 30 percent review is held. A 60 percent review is performed following the completion of the general plans. Lastly, a final review of the contract plans is conducted which coincides with approximately the 90% level of project completion. The purpose of the final

review is to review the final set of contract plans prior to advertising for contractor bids. The final review should not be considered an opportunity to complete the project design work.

1.4 Expected Benefits from the CRP

As pointed out earlier, there has been an increase in the number of contract change orders (CCOs) leading to an increase in the final contract costs on WSDOT projects during the past few years. A large proportion of the CCOs appear to involve plan errors that were not corrected prior to contract award. Minimizing errors, omissions, and other constructability issues during the pre-construction phase of project development should reduce the amount of increase in the final cost of construction in comparison to the original contract bid amount. There should also be an appreciable reduction of WSDOT construction work force working full time processing change orders, thereby reducing the final costs of construction engineering.

Significant improvements should be realized from the implementation of the CRP. Implementation of a structured review process that is initiated at the beginning of a project and that provides on-going monitoring of constructability issues should lead to better quality design plans and specifications. This in turn leads to fewer scheduling delays, fewer cost overruns, a better ability to avoid costly conflicts and contract claims, and assurance of a higher quality final product.

2

OVERVIEW OF THE CRP

The Constructability Review Process is designed to help improve the level of constructability of a project. The most important benefits expected from the CRP are the achievement of an efficient project development process and the realization of a cost-effective project that is biddable, buildable, and maintainable. To achieve these goals, the CRP is composed of a number of constructability reviews performed at various stages during the course of the project development process.

Each review consists of the formation of a review team, completion of relevant checklists, interoffice coordination, and participation in a review meeting. The review team should emphasize construction and maintenance knowledge that can be used to guide the design of the project.

The first review occurs during project planning after the draft Project Definition Report (PDR) is complete. Subsequent reviews occur at the 0 percent, 30 percent, 60 percent and final stages of PS&E development. Each review is directed at addressing constructability issues pertinent to a particular stage in the Project Development Process. The reviews are performed by a review team comprised of the disciplines and functions involved in planning, designing, constructing, and maintaining the project.

2.1 General Description of the CRP Process

The Constructability Review Process is initiated and managed by the project engineer in charge of designing the project. The project engineer establishes the actual review points in the project development phase, and the dates when and locations where the reviews will occur. If the project is being designed by a consultant, the project engineer would coordinate the reviews with the consultant. Construction and Maintenance Management and staff are recognized as being key to the success of the CRP process. Thus, their involvement is necessary to the review process.

The CRP involves the completion of constructability checklists prior to each review meeting. These checklists are completed by each discipline involved in the project. Specific project information and documentation is also required for each review. The project engineer ensures that all documentation related to the project that might be needed for reference during the meeting is available.

Prior to each review meeting, the project engineer develops an approximate meeting agenda. Each segment of the meeting is timed so that the meeting can be accomplished in one day. All major disciplines and functions involved in the project are scheduled for the entire day. Other disciplines or functions needed to address specific issues are scheduled in the meeting at the appropriate times. If some of the work has been done under contract by consultants, representatives of those firms are made available at the meeting.

During the CRP review meeting, the project engineer conducts the meeting in accordance with the agenda, allowing adequate time for questions, explanations, and discussions regarding any pertinent items or issues that could impact schedules, costs, scope, biddability, buildability, and maintainability. Interactions should be primarily inter- rather that intra-disciplinary to make the best use of time. It is assumed that issues within a discipline would have been largely resolved before the meeting, so that the time could be used to explore problems that would only become visible when different disciplines discuss the design. The review meeting participants should reflect back on previous decisions and determine whether the project is still on track regarding scope, schedule, and cost. It is critical that the meeting be controlled for timing, completeness, and resolution of any issue raised or problem identified. It is important to periodically remind all attendees that the goal is to complete the meeting in one day. At the conclusion of the meeting an approximate date for the next review is discussed and, if possible, agreed upon by the review team.

Each review meeting is recorded to provide a complete and accurate record of the meeting. All decisions, agreements, directions, and scheduling are documented. It is beneficial to write every issue and corresponding action on a display board so that decisions are unambiguous. Individuals should be made clearly responsible for each required action and for addressing any unresolved issues. A brief report is developed by a designated person outlining the results of the meeting and documenting the directions discussed and agreed to for the next phase of project development. A copy of the report is circulated to all meeting participants for their records and a copy is retained in the design files. If any unresolved issues remain at the conclusion of the meeting and an impasse occurs, an Appeal and Resolution process is followed (See Chapter 9).

The review meeting is an appropriate forum to discuss unique technical and programmatic solutions or engineered approaches to designing a project element. From this forum and ensuing discussions and analysis, new and creative ideas may surface that improve upon biddability, buildability, and/or maintainability. These ideas should also be recorded for exchange in possible design newsletters.

A WSDOT regional staff member at the Project Development Management level is permanently assigned as responsible for the CRP issues. This individual assures that the CRP reviews are conducted, that the CRP checklists are kept applicable, up-to-date, and complete, and that recommendations are implemented. Any positive or negative feedback from the CRP reviews is forwarded to this person so that monitoring and future improvements to the process can be made. A designated CRP manager is assigned as the statewide monitor, coordinator, and focal point for process updating and improvements. The CRP manager is also responsible for expediting any appeals or issue resolutions elevated beyond the regional level.

2.2 Selecting the CRP Review Sequence

2.2.1 CRP Review Level

While constructability reviews are effective over a broad range of project types and provide the benefit of allowing multiple functions to view the overall project as it develops, the effort and cost of conducting reviews and documenting their results are significant. Therefore, the decision regarding the number of reviews is a trade-off between the expected benefits and the expected cost of these reviews. As a result, selecting the number of reviews for a project should be keyed to the type, size, and complexity of the project, and the timeline of the program. Table 1 provides direction on the appropriate number and type of reviews for particular projects. While the entire CRP includes a four-step review process, all four reviews only apply to major or very complex projects. For smaller or less complex projects, a modified CRP review sequence is applied in which fewer reviews are conducted and/or a PDR review is not necessary.

Table 1. CRP Review Level by Project Type

CRP LEVEL	TYPE OF PROJECT
LEVEL 1 PDR, 30%, 60%, and Final reviews	• Major roadway / facility improvements • Major, complex interchanges • Major structures with complex or very high cost features • Major preservation projects that include widening, replacement of existing structures / drainage features, etc.
LEVEL 2 PDR, 30%, and Final reviews	• All other roadway / facility improvements • Major, less complex, structures and interchanges • Preservation projects that involve widening, structure rehabilitation, new R/W, or safety improvements, including roadside features
LEVEL 3 PDR and Final reviews	• All other projects

While the number of reviews may, at first glance appear to be excessive, the number of Level 1 and Level 2 projects make up approximately half of the total number of projects. The other 50 percent of the projects are Level 3 projects, which consist of only two reviews. A graphical representation of the project dollars versus percent of projects at each level is shown in Figure 4.

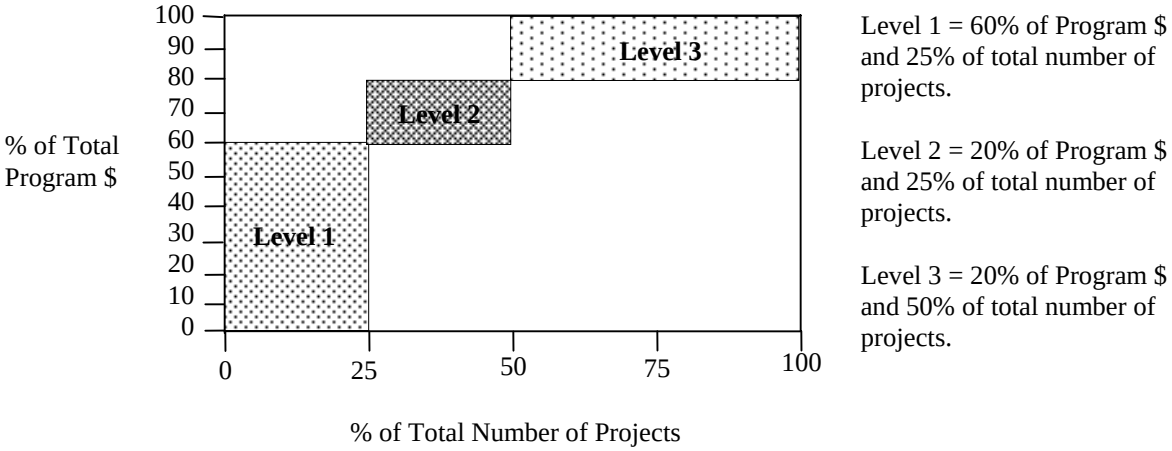


Figure 4: CRP Level by Program $ vs. Percent of Projects

In addition, the duration of Level 1 projects is substantially greater than Level 2 and Level 3 project durations, as shown in Table 2. Approximate project durations for each project level type provides a time period relationship over which the reviews would be scheduled. Due to the complexity, environmental impacts, and associated high costs, Level 1 projects may require 6 to 10 years for the planning and design phases. For a Level 1 project, the CRP involves four constructability reviews over this time frame. Three of the reviews occur during the design stage, which spans a period of two to four years. Considering the goals, objectives, and expected benefits, four CRP reviews, spread over a 6 to 10 year process is reasonable. The number of CRP reviews recommended for Levels 2 and 3 is also reasonable considering their respective duration and complexities involved.

Table 2. Estimated Project Durations

CRP LEVEL	PRE-DESIGN DURATION	DESIGN DURATION	TOTAL DURATION
1	3.5 - 6 years	2.5 - 4 years	6 - 10 years
2	0.5 - 1.0 years	1.5 - 2.0 years	2 - 3 years
3	0 - 0.5 years	0.5 - 1.0 years	0.5 - 1.5 years

2.2.2 Multiple-Programmed Projects

When projects involve multiple programs, the reviews should reflect each particular portion of the project. The meeting agendas should be structured to reflect the different programs and, if necessary, the multiple programs should be a topic of discussion. Topics of discussion should center on impacts on scope, schedule and cost to each program. These impacts should be included in the pertinent review meeting record. Increased scope, cost, and negative impacts to the schedule should be reported to Program Management in a timely manner. Depending on the complexity of the project, the project engineer should consider various ways

of scheduling and planning for the constructability reviews. The following provide two possible ways of performing reviews on multiple-programmed projects.

1. Treat each program portion independently and perform separate reviews for each portion.
2. Perform reviews that combine each program portion as one project. The program portion having the greater or more stringent constructability review level, as defined in Chapter 2.2.1, should dictate the number of reviews.

2.2.3 Modifying the CRP Review Sequence

Occasion may arise that a fifth constructability review should be considered. This case will occur when a PDR review has been held on a Level 1 project, but at the onset of PS&E, the project is reassigned to a new design office. In this case, adding a 0 percent review would be a good strategy to assure that the team and the project scope, schedule, budget, and technical plan for the project are clearly defined as the PS&E phase begins. A 0 percent review may also be necessary on small projects that do not involve any significant technical issues, or on projects in transition, where a PDR review was not performed. The criteria for determining the number of reviews appropriate for modified project reviews is shown in Table 3.

Table 3. CRP Modified Review Level by Project Type

CRP LEVEL	TYPE OF PROJECT
LEVEL 1M PDR, 0%, 30%, 60%, and Final reviews	• Level 1 projects re-assigned to a new design office at the start of PS&E • Level 1 projects that have been shelved for an extended period of time between preliminary engineering and the start of PS&E
LEVEL 1M 0%, 30%, 60%, and Final reviews	• Level 1 projects that are in transition between the old Project Development Process and the new Project Development Process where a PDR review was not performed
LEVEL 2M 0%, 30%, and Final reviews	• Level 2 projects that are in transition between the old Project Development Process and the new Project Development Process where a PDR review was not performed
LEVEL 3M 0% and Final reviews	• Level 3 projects in transition between the old Project Development Process and the new Project Development Process where a PDR review was not performed • Small Level 3 projects with minimal technical issues that do not warrant a PDR review

A 0 percent review is appropriate whenever there is a delay, especially more than nine months, between establishing the scope, schedule, and budget at the programming stage and the start of the PS&E phase.

2.3 Constructability Reviews

2.3.1 General Description of the Reviews

Performing constructability reviews at various key points during project development is extremely beneficial to the outcome of the project. Constructability reviews provide the teamwork forum necessary when multiple disciplines, functions, and special expertise are involved. Therefore, participation must include the Design project engineer, Construction project engineer, Maintenance and key support staff. Construction inspection and maintenance staffs are recognized as having special constructability knowledge. Constructability reviews have been found effective on all types of projects, but are very important and effective on large and complex projects. Reviews are also critical when complex structures are being designed, when traffic control is a major construction item, when complex or difficult drainage features may be encountered, and with any required design elements that are new or seldom used and/or where constructability problems arise and can be best resolved in a team environment.. The most significant decision at the project level is determining the number and type(s) of reviews to schedule for each project.

The CRP typically includes a maximum of four reviews on a project. The first review is performed at the completion of the draft Project Definition Report (PDR). Successive reviews are conducted at the 30 percent, 60 percent, and Final points in the PS&E completion, as illustrated in Figure 5. The purpose of these reviews is to raise issues, resolve problems, recommend modifications, suggest any actions required, and provide direction and guidance for the next stages of design. The primary objective of the reviews is to ensure that design concepts and considerations are complete to that stage and that further design can proceed with development toward PS&E completion.

While the entire CRP includes a four-step review process, as discussed earlier, all four reviews only apply to major or very complex projects. For smaller or less complex projects, a modified CRP review sequence is required which utilizes fewer reviews. For example, a 0 percent review may be required on certain projects, in lieu of the PDR Review. The criteria for determining the number of reviews appropriate for a particular type, size, and complexity of project are provided in Chapter 2.2.

Each decision developed during the reviews should be endorsed by the review team before going any further with the PS&E development. Agreements should be reached and firm commitment to schedules and actions should be given. Any modified design directions or guidance should be provided that is needed to complete the next phase of the project development process. The issues raised at one constructability review are expected to have been resolved before the next review is held. If not, a mutual decision should be made by the involved project and functional management on expediting resolution of any outstanding problems impacting PS&E progress and re-scheduling the constructability review if necessary. Each review should reflect back on previous decisions and verify whether the project is still on track regarding scope, schedule, and cost.

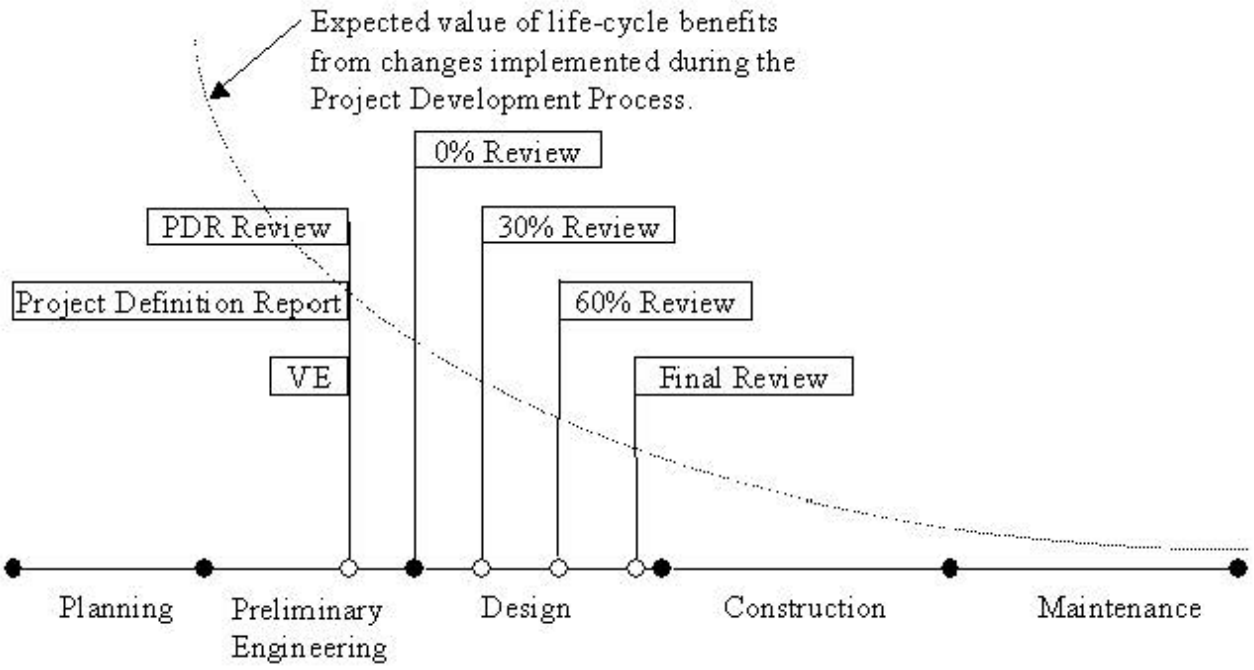


Figure 5: Timeline of the Project Development Process

2.3.2 PDR Constructability Review

The Project Definition Report (PDR) constructability review is primarily a programmatic review. A review at this stage ensures that the engineering study has been adequate, including the Value Engineering analysis if planned for the project, and that the information generated by the study for the PDR is adequate to determine the scope and sufficient to schedule and program the project. The project cost estimate should be reassessed and updated at this stage, if necessary. An objective of this review is to ensure a viable and constructable project meets the detail needed for the State Multi-year Program and that the programmed project fulfills and meets the transportation need and can be programmed.

2.3.3 Relationship of the PDR Review to Value Engineering

The purpose of Value Engineering (VE) studies is to ensure that the most cost-effective methods are used to reach the project goals. VE is defined as the "systematic application of recognized techniques by multi-disciplinary teams to identify the function of a product or service, to establish a worth for the function, to generate alternatives through the use of creative thinking, and to provide the needed function at the lowest overall life-cycle cost. The VE team also evaluates the alternatives and makes recommendations to the design office." (WSDOT 1988) As a result, VE can be a very effective tool to use during the alternative analysis phase of the scoping stage of project development. The benefit of having VE information at this stage of Project Development is that the information can have a strong impact on the PDR CRP review.

Value Engineering is a valuable tool that, unfortunately, has seldom been implemented at the most effective time. The beneficial effects of systematically reviewing alternatives are greatest near the start of a project and diminish with time thereafter, as shown in Figure 6. To provide the most effective results within the Project Development Process, the VE study is performed at the draft stage of the PDR Report. The purpose of having such a study at this point is to investigate the major alternative solutions for the project early in the process, prior to design and before the concepts are locked in and change becomes disruptive and expensive.

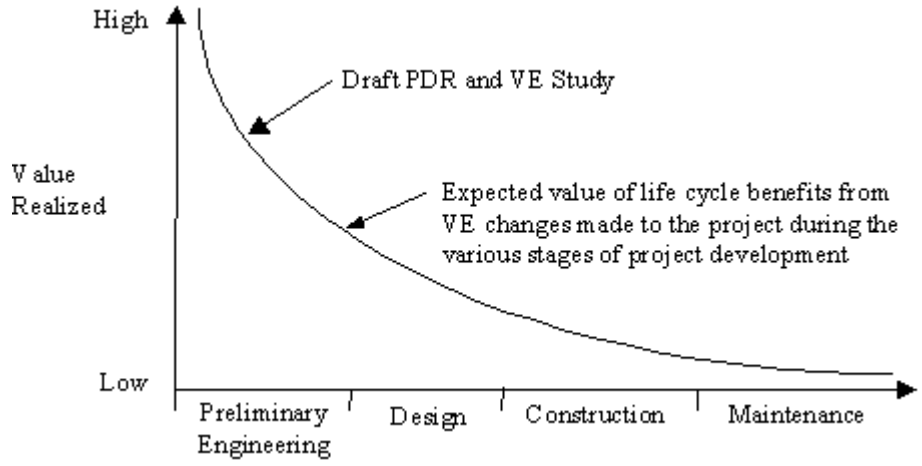


Figure 6: Expected Value from Early VE Study

Value Engineering done at this stage should be used as the tool to analyze all proposed alternatives and to evaluate the environmental draft. The objective of the VE study is to determine the "favored alternatives" to recommend in the final PDR and use in completing the environmental-public input phase and for the programming and scheduling plan. The VE study represents an additional opportunity for partnering and customer involvement. VE applied after this point should only be used to analyze, evaluate and determine the best project or project alternatives to consider for design. In addition, VE training for all participants is highly recommended.

VE studies done later during the PS&E phase should only be considered to analyze and evaluate specific design features (i.e., very complex or high cost structures, interchanges, intersections, materials, etc.) where those functions may be performed by a lesser complex or costly solution.

2.3.4 0 Percent Constructability Review

The Zero (0) percent constructability review is focused on the constructability of non-typical projects. Non-typical projects include small projects which do not include any significant technical issues, “transitional” projects which are currently in the planning stage beyond completion of the Project Definition Report, and projects that are transferred between design offices following preliminary design but before PS&E development. In essence, this

review is performed in lieu of the PDR review, and is performed at the beginning of development of the PS&E.

2.3.5 30 Percent Constructability Review

The 30 percent constructability review is mainly focused on a constructability assessment following development of the project's primary geometric features. Geometric details are checked, and directions or guidelines given to various disciplines, such as Right of Way, Structures, Traffic, and Hydraulics, to facilitate the performance of engineering studies and provide the required design details for the PS&E.

2.3.6 60 Percent Constructability Review

The 60 percent constructability review is set at a critical stage of design and PS&E development. The focus of this review is on several design features and details, and should address all items that are or will be critical to the completion of the project. Reviews should be made and discussions held on such items as the bridge general plans, costs, and structural requirements including any special foundation considerations or materials involved, traffic requirements for the project including the initial plan for handling traffic during construction, and hydraulics requirements along with any special drainage structures and designs that may be involved. This review is also crucial in assuring that the design team and all accompanying functions have the necessary guidance and direction to proceed into the final detailed design stage, and that any major changes, revisions, or other special considerations have been identified and assignment for resolution has been made and scheduled.

2.3.7 Final Constructability Review

The Final constructability review focuses on the contract plans and special provisions as the project design phase is being completed and made ready to advertise for construction. The final review of the contract plans occurs at the 90 percent level of project completion. The purpose of the final review is to serve as a final check of the contract plan documents prior to going to advertisement and is not meant to serve as a last opportunity to complete the project designs. At this stage, it is anticipated and assumed that all major decisions have been met, and that the proposed PS&E for the project fulfills that of the programmed item in the Department's Multi-year Program. Only minor details, omissions, or design problems not previously addressed should materialize or be identified at this review stage. If successful, no other check would be needed after this review. If there are no other changes or revisions to be made, the final plans, specifications, and estimate are ready for transmittal to Olympia Service Center for completion of contract plans and documents, and advertising of the project for construction.

2.4 Constructability Review Checklists

A consistent system of checklists is useful for minimizing the number of errors, inconsistencies, and omissions on construction projects. Checklists can never take the place of experience or good engineering, but are a valuable means of minimizing oversights and errors, particularly for less experienced staff, and help avoid the problems associated with last-minute fixes.

Each constructability review involves the completion of two checklists. The first checklist, completed by the project engineer, is used for assistance in scheduling and conducting the review and the review meeting. This checklist addresses all planning items such as the date and location of the meeting and the meeting agenda. It outlines the specific disciplines to be in attendance for the meeting, and the project documents required for the review. Lastly, this checklist addresses issues on conducting the review, follow-up, and reporting.

The second checklist focuses on the constructability aspects of projects. Each scheduled review has a unique constructability checklist that incorporates a level of detail suitable for that particular stage of design and plans preparation. The checklists, which are designed to carry over from one stage of design and plans preparation to the next, are hierarchical in nature and add elements and details in successive stages. The difference between each checklist is the information and documentation required at each review stage, and the percentage of contingencies that accounts for the unpredictable or unknown.

Each constructability checklist is sub-divided into sections according to various Departmental disciplines. The checklist items within each section directly apply to the portion of the design controlled or affected by the particular discipline.

Prior to each review meeting, the related constructability checklist is reviewed and completed by each discipline. In order to maximize the effectiveness and efficiency of the review meeting, it is imperative that each discipline has completed its portion of the checklist before the review meeting. All items found to need further discussion should be brought up during the review meeting.

2.5 Follow-Up and Reporting

Follow-up and reporting efforts begin with recording the decisions made and actions taken during each review. A review report is created which is an accurate record of the review and includes the topics of discussion and resolution of issues. In addition, the record should document issues that were not resolved, who was assigned the responsibility of resolving the issue, and when the resolution will occur. This allows for the tracking and monitoring of schedules, progress, and documents produced between reviews. In addition, the follow up and reporting allows the checklists to be updated, and enables the design office to evaluate what worked and what did not work for the review.

Following completion, constructability review meeting reports should be forwarded to the WSDOT regional staff member in charge of overseeing the constructability review process, with copies circulated to the CRP team members. The regional staff member should review the report for content and discuss items of concern with the design office in charge of the project. Resolutions that are deemed unacceptable to the staff member should be returned to the design office for reassessment. The design office is then responsible for reopening the issue and seeking a new resolution with the appropriate functions.

3

CONDUCTING THE CRP REVIEW

3.1 Organizing the Review Team

The task of organizing the review team can be just as critical as conducting the constructability reviews. This effort is a major internal partnering opportunity and is a crucial step towards attaining the CRP objectives.

Two features related to the review team are essential for successful implementation of the CRP: multi-disciplinary participation and an early start. Multi-disciplinary teamwork is needed from the beginning to the end of the project development process. Gathering all disciplines involved in a project provides the benefit of being able to immediately resolve all issues that may arise plus the long-term advantage of building a team comprised of many talents. "Team building" is a concept upon which successful constructability is dependent.

> "Very few constructability concepts are single discipline activities. The team environment is essential to ensure that each concept is reviewed for inter-discipline impact before being endorsed for implementation. Constructability is a project team process and that is where the greatest gains are made." (Houston Business Roundtable 1995)

The creation of a multi-disciplinary team allows each discipline (or function) to be more knowledgeable about the other disciplines' involvement, provides for cross-training of the Department's staff, and facilitates formal communication needed throughout the process.

While team building benefits many aspects of the project, success through team building may require recognizing, addressing, and overcoming barriers. Crucial to the success of the team is the breaking of business, cultural, traditional, and internal functional barriers. Breaking barriers can be done in various ways.

> "Barriers can be broken by educating team members on the Constructability Process and by Team Building. This will substantially improve communication and reduce adversarial relationships. Making teams, not individuals, the focus for improved performance enhances the ability of the team to execute projects efficiently. Barriers are reduced significantly if players with several competencies are encouraged as team members rather than specialists." (Houston Business Roundtable 1995)

The constructability review team should be made up of a mix of reviewers and managers most familiar with the project, along with others who can provide objectivity and independent thought. All team members should have the authority to make on-site decisions regarding issues that may arise during the review meeting. In addition, the team members must be able to

contribute to the decision making/information gathering process. Thus, the meeting attendees must come to the meeting prepared and willing to participate. Each team member should be able to commit, if necessary, a full day for performing each review meeting. The review team must include Construction managers and inspection staff, as well as Maintenance and Maintenance personnel.

In order to maximize the efficiency of assembling the group, multiple projects might be reviewed on the same day. The designated project engineer designing the project is considered the team leader and is responsible for coordinating the schedule and location for the review meeting with all of the team members. The goal for the multi-disciplinary team is to ensure that the issues which arise in the reviews are discussed and resolved during the course of the review meeting. Emphasis should be placed on the knowledge of the Construction and Maintenance personnel attending the meeting. Any knowledge gained should be used as an aid in guiding the design of the project.

The review team membership will depend on the type, size, and complexity of the project. For projects that are large in size and contain numerous, complex issues of design and construction, team membership should include most, if not all, of the Departmental project development disciplines. On the other hand, a selected number of disciplines might only be appropriate for smaller, less complex projects. The review team should include, at the minimum, personnel from the following disciplines: Design, Construction, Maintenance, Environmental, Traffic, Right of Way, and Bridge/Structures (whenever bridges or structures are included in the project). Personnel from the following disciplines should be included as needed depending on the type, size, and complexity of the project: Geotechnical, Hydraulics, Permits, and any other discipline or function pertinent to providing a complete review of issues that need to be addressed to develop the PS&E. If a consultant is designing a portion of the project they should also be included as a team member.

In order to achieve a high level of constructability on a project, consistent teamwork is especially needed between the Construction and Design disciplines, and the Bridge/Structures and Roadway Design disciplines. Exceptional coordination and communication of these disciplines greatly adds to the success of a project. The Environmental discipline is often another critical team member needed at the early stages of a project. Experience has shown that major late design changes can often be required as a result of environmental procedures, issues, and permits that were not brought forth and considered early enough. Early involvement and input from Maintenance personnel is also very important. Maintenance involvement from the start of the project can ensure greater maintainability, a key objective of constructability. Involvement of Right of Way personnel in many instances can help the Design discipline recognize opportunities and options for avoiding costly access, easement, and existing or future real estate issues. Depending upon the project, complexity, etc., many different disciplines, both internal and external, could make significant input into the constructability success of the project.

Review team member attendance at the review meetings may vary with each successive review. Attendance by specific members at a particular meeting will depend on the nature of the issues to be discussed at that meeting. All members who represent disciplines affected by any

issues discussed should be in attendance. Lists of the disciplines expected to be involved in each review are provided in later chapters of this guide.

Successful implementation of the CRP is also dependent on an early start by the review team. The need for an early start is demonstrated by the fact that opportunities to influence costs diminish throughout the duration of the project, as illustrated in Figure 7. It has been determined that the most cost effective constructability successes are realized when constructability evaluations are initiated in the project scoping phase and conducted at key points throughout the development of the project prior to construction (Construction Industry Institute 1986).

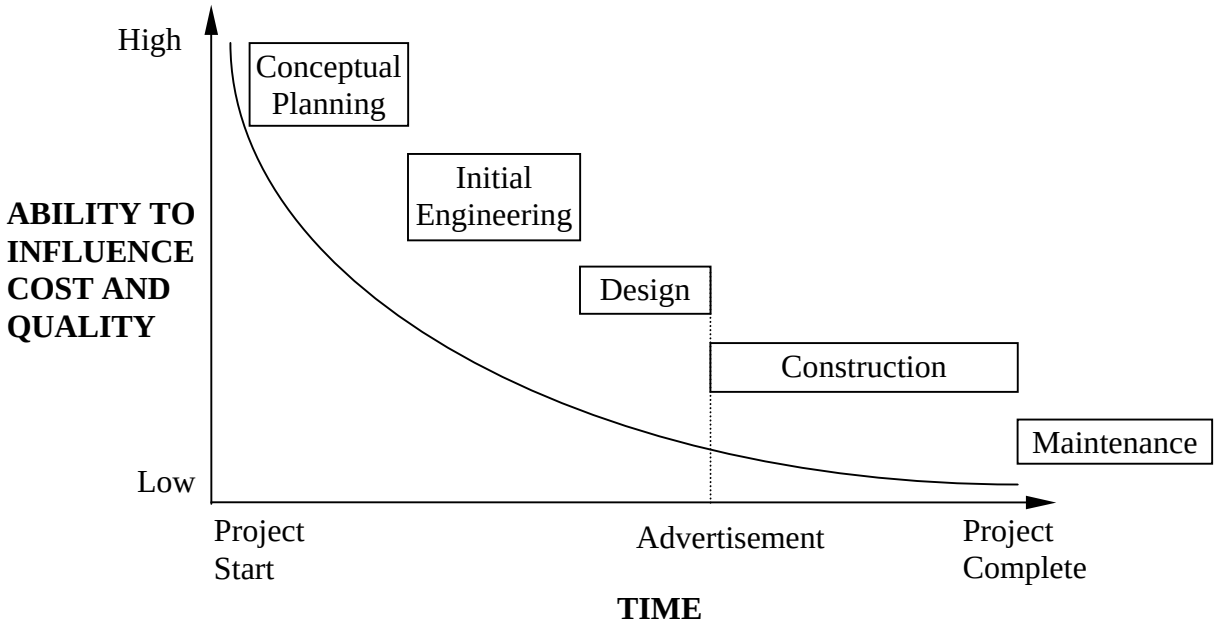


Figure 7: Ability to Influence Project Costs and Quality Over the Life of the Project

3.2 Project Documentation

Project documentation is an integral part of the project development process and oftentimes serves as important reference for the CRP Team. Documents necessary for the majority of projects should include; planning documents (20 year plans, comprehensive plans, corridor studies, etc.), disciplinary reports, project plans and specifications, project meeting minutes. The purpose of these documents is to provide a basis for which to communicate the design intent, and to record decisions made during each phase of development. The documents are the basis for addressing constructability issues at each stage. The project engineer's office is responsible for retaining and developing a current set of project documents.

Prior to developing the Project Definition Report (PDR) and later documents, the project must be "scoped." The project scoping phase identifies the major items of work, the available funding sources, and the project constraints. The scoping process also identifies the timeline for

design and construction of the project. The documents required to initiate the scoping process include early planning documents such as the Twenty Year Plan, local comprehensive plans, previous project contract plans, current Right of Way plans, County assessor maps, abutting property title reports, existing utility plans. These early planning documents will be used to generate the engineering studies needed for the PDR and later project development. Early engineering studies include:

- Early Value Engineering study, when needed
- PDR, including an estimate of cost, major items of work, documentation of the concepts used, and any issues regarding potential complexities or major engineering complications, exceptions, or deviations proposed.
- Preliminary draft environmental information/studies
- Preliminary bridge/structures, geotechnical, and hydraulic studies

The Value Engineering (VE) study is performed immediately prior to completion of the final PDR. This enables the study team to investigate major alternatives before the concepts are locked in. The recommendations and findings of the VE study should be recorded and submitted, through appropriate channels, to the project engineer for action.

The Project Definition Report is completed during the planning stage of development. The purpose of the report is to determine the project scope, budget, and time frame for project development and construction. The PDR verifies that a programmed project is biddable, buildable, and initial considerations of maintainability are explored.

Constructability review reports are prepared after each review. The reports should be brief summaries of each constructability review. These reports, developed by the project engineer, outline the review meeting minutes and results and identify directions discussed and agreed to for the next phase of project development. Copies of the reports should be circulated to the CRP team members for their files. In addition, a copy should be placed in the design files for future reference.

Documentation is also developed to reflect issues resolved through the appeals resolution process. An Appeals Resolution Report is developed to address unresolved issues remaining at the end of a review. The report should discuss the issue and how it relates to the project, i.e. is the issue on the critical path of the project, does the issue increase the project cost, does the issue impact the project scope, etc. In addition, the report should address why an impasse has been reached. The report is submitted through supervisory channels for immediate action and resolution within the appropriate region, and the Olympia Service Center when needed.

Maintaining records of lessons learned avoids implementing new decisions that are inconsistent with the reasoning on which previous decisions were based, provides a history of the project, and serves as a guide on future projects. Lessons learned should be recorded, and shared with support groups, during all phases of project development and construction. Ideally, the record of lessons learned is electronically stored for ease of access to all disciplines within the Department. Project documentation includes a record of lessons learned during the project development stages and construction stage.

3.3 Preparing for CRP Review Meetings

3.3.1 Objective of the Review Meeting

Meetings are only necessary and effective when there is a verifiable need. To that end, the constructability review meetings should only be held when the appropriate documentation is complete and the team members are available to meet. In order to be effective, it is crucial that all attendees understand the purpose and objective of the meeting and be willing to participate. The objective of the CRP reviews is to verify that a project is biddable, buildable, and maintainable. The objective of each review is related to the level of development of the project. The main objective of the Zero (0) percent constructability review is to assess the constructability of non-typical type projects. It is envisioned that the 0 percent review would be used in the following circumstances:

1. On small projects that do not include significant technical issues and the Project Engineer has not participated in the scoping efforts. The 0 percent constructability review would be held in lieu of the Project Definition Review (PDR) on these types of projects.

2. On "transitional" projects which are currently in the planning stage beyond completion of a Project Definition Report when the Constructability Review Process is initially implemented.

3. On projects that are shelved for an extended period or are transferred between design offices following scoping completion but before PS&E development has begun.

The main objective of the 30 percent constructability review is to assess the constructability of the project following the development of the project's primary geometric features. For many projects, the 60 percent constructability review will occur at the most critical stage of design and PS&E development. The objective of the 60 percent review is to focus on specific design features and details in addition to addressing all items that are or will be critical to the completion of a constructible and maintainable project. The main objective of the Final constructability review is to review the contract plans and special provisions as the project design stage is being completed and the project is being made ready to advertise for construction.

3.3.2 Organizing the Meeting

Procedures for organizing the constructability review meetings should include:

1. Establish the actual point in the project development phase at which the appropriate constructability review meeting will be held.

2. Set a date and location for the meeting that is mutually convenient to all parties. The master schedule of reviews should be checked to verify that there are no scheduling conflicts with other project CRP reviews. The date should be selected far enough in advance that attendees can perform independent

project site visits prior to the meeting and schedule their time accordingly on the day of the review meeting.

3. Develop an agenda for each segment of the meeting. Include in the agenda the major functions involved in the project. Also allocate time for each item of discussion. Time should also be allocated to reflect back on previous decisions and to determine whether the project is on track regarding scope, schedule, and cost.

4. Accumulate, organize, and make available to each review participants, all pertinent documentation related to the project that might be needed for reference during completion of the constructability checklist and the review meeting. This information should be made available far enough in advance that the attendees can review the documents in preparation for the meeting.

5. Ensure that all disciplines scheduled to be involved in the meeting have reviewed the applicable documents and plans, field reviewed the project site, reviewed the proposed agenda, and completed the applicable checklist before the scheduled meeting date.

Each meeting should be conducted in accordance with the agenda, and the meeting minutes recorded. A photo log, through the use of still photographs and/or videotape, of the project site should be available at the meeting for use in specific points of discussion. The meeting record should indicate all decisions and agreements, along with all directions and scheduling impacts identified during the meeting. At the conclusion of the meeting, an approximate date for the next constructability review meeting should be discussed and agreed upon by the review team.

3.3.3 Creating a Meeting Agenda

Meetings are generally most effective when an agenda has been prepared and sent to the invited participants prior to the meeting. The agenda should have specific items of discussion and time allocations. The project engineer should allow a reasonable amount of time for discussion and any problem solving that may be necessary. In addition, the agenda should be arranged in such a manner that the most serious items of discussion do not use up the meeting time or the meeting time runs out before the serious issues are thoroughly discussed.

The project engineer of design is responsible for creating and circulating a meeting agenda in a timely manner prior to the review meeting. In addition, the appropriate CRP checklist and review documents should be provided with the agenda, to the relevant functions to allow sufficient time to prepare for the meeting. The project engineer is also responsible for managing the meeting, including: ensuring the meeting starts and ends on time, strictly adhering to the agenda, and monitoring the time allocated for items of discussion. Frequent references to the agenda, during the meeting, should aid in keeping the meeting on track.

The agenda must be timed in order to complete the meeting in one day. The agenda should include specific items of concern to the design office, and allotted time for discussion and

resolution of issues. In addition, time should be used to reflect back on previous decisions and determine whether the project is on track with respect to scope, schedule, and cost. The agenda should also incorporate items of concern identified by the appropriate checklist. A title, meeting date, starting and ending times, and location should also be shown on the agenda. These items give the attendees a sense of purpose and the ability to plan other activities on the meeting date. Two sample agenda are provided on the following pages.

SAMPLE AGENDA 1

SR 525, SR 99 Interchange
October 30, 1996
NW Region Boardroom

AGENDA ITEM	SPEAKER	TIME FRAME
I Introduction	Gary Kirk	9:00-9:15
II Traffic		9:15-10:15
A. Design office specific items of concern	Kirk Wilcox	
B. Traffic office specific issues of concern	Mike Forbis	
III Environmental		10:15-11:15
A. Design office specific items of concern	Kirk Wilcox	
B. Env. office specific issues of concern	Dan Hagglund	
IV Hydraulics/Utilities		11:15-12:15
A. Design office specific items of concern	Kirk Wilcox	
B. Hydraulic/Utilities specific issues of concern	Erik Hansen/Dick Anderson	
LUNCH		12:15-1:00
V Structures/Geotechnical		1:00-2:00
A. Design office specific items of concern	Kirk Wilcox	
B. Structures/Geo. specific issues of concern	Karl Kirker/Tony Allen	
VI Right-of-Way		2:00-3:00
A. Design office specific items of concern	Kirk Wilcox	
B. Right-of-Way specific issues of concern	Paul Tollefson	
VII Construction/Maintenance		3:00-4:00
A. Design office specific items of concern	Kirk Wilcox	
B. Const./Main. specific issues of concern	Al Dyer/Ralph Knutson	
VIII Recap of issues	Kirk Wilcox	4:00-4:30
A. Issue		
B. Responsible Parties for Resolution		
C. Deadline dates for resolution		

SAMPLE AGENDA 2

SR 525, SR 99 Interchange
October 30, 1996
NW Region Boardroom

ITEM	SPEAKER	TIME
1. Meeting Overview	Gary Kirk	9:00-9:15
2. Roadway Sections	Kirk Wilcox	9:15-9:30
3. Geometrics	Kirk Wilcox	9:30-9:45
4. Earthwork, Geotechnical/Soils Report, Foundation Survey	Wilcox/F. Miller	9:45-10:15
5. Retaining Walls/Noise Walls	T. Nau/Teitsel	10:15-11:45
LUNCH		11:45-12:30
6. Shoring	Wilcox	12:30-12:45
7. Drainage	Wilcox/Hansen	12:45-1:15
8. Bridges	Wilcox/Zhang	1:15-1:45
9. Utilities Involvement	Wilcox/Anderson	1:45-2:00
10. Agreements	Wilcox/TransAid	2:00-2:15
11. Coordination with Other Agencies	Wilcox/TransAid	2:15-2:30
12. Construction Schedule/Sequence	Wilcox/Steinert	2:30-2:45
13. Stage Construction Plans	Steinert	2:45-3:00
14. Special Traffic Control Plans Project	Wilcox/Steinert	3:00-3:15
15. Environmental	Wilcox/Hagglund	3:15-3:45
16. Erosion Control/Storm Water Site Plans	Wilcox/Hansen	3:45-4:00
17. Maintenance Issues	Wilcox/Knutson	4:00-4:15
18. Right of Way	Wilcox/Wilson	4:15-4:30
19. Real Estate Services	Wilcox/Tollefson	4:30-4:45
20. Signing	Wilcox/Balboa	4:45-5:00
Recap of Issues and assigning responsible parties:	Wilcox	5:00-5:30

ADDITIONAL INFORMATION
Observers: Jim McManus, John Gambatese (UW Constructability Team)
Resource persons:

DESIGN ISSUES		**Time:** 1:00
Discussion: Noise Wall		
Considerations: Interchange has been redesigned and the noise wall appears either unnecessary or incorrectly located.		
Conclusions: The walls will be reassessed for need and correct placement		
Action Items:	**Responsible Person:**	**Deadline:**
Provide I/C information to Air and Noise section	Tim Nau	11/7/96
Reevaluate the noise model for need and location	Sam Teitsel	12/30/96

DESIGN ISSUES		**Time:** 3:00
Discussion: Access to noise walls and detention ponds appear inadequate		
Considerations: The noise wall need to be placed at the R/W line or additional room provided		
Detention ponds need to be modified to include access roads		
Conclusions: Design office to add access road around detention ponds		
Access behind the noise wall will be addressed with the redesigns of the noise walls		
Action Items:	**Responsible Person:**	**Deadline:**
Add access to ponds and walls	Kirk Wilcox	12/30/96

DESIGN ISSUES		**Time:** 3:30
Discussion: Night work and weekend work may be precluded in this area due to residential zoning, concern with staging of construction activities due to heavy traffic volumes during the day and the Mukilteo Speedway nearby.		
Considerations: The local agencies may have weekend and night restrictions on construction activities due to noise. Holiday weekends may also be restricted due to tourist traffic.		
Conclusions: The Design Office will need to discuss with TransAid and the local agencies to address noise during construction activities and relevant weekend and night restrictions.		
Action Items:	**Responsible Person:**	**Deadline:**
determine local noise & holiday restrictions	Kirk Wilcox	12/30/96

The following pages contain blank agenda forms. These forms can be copied and used for constructability reviews.

AGENDA

PROJECT: _____
PROJECT NO.: _____ **DATE:** _____
MEETING LOCATION: _____

AGENDA ITEM	SPEAKER	TIME FRAME

I Introduction

II Traffic
- A. Design office specific items of concern
- B. Traffic office specific issues of concern

III Environmental
- A. Design office specific items of concern
- B. Env. office specific issues of concern

IV Hydraulics/Utilities
- A. Design office specific items of concern
- B. Hydraulic/Utilities specific issue of concern

V Structures/Geotechnical
- A. Design office specific items of concern
- B. Structures/Geo. specific issues of concern

VI Right-of-Way
- A. Design office specific items of concern
- B. Right-of-Way specific issues of concern

VII Traffic Control
- A. Design office specific items of concern
- B. Traffic control specific issues of concern

VIII Construction/Maintenance
- A. Design office specific items of concern
- B. Const./Main. specific issues of concern

IX Recap of issues
- A. Issues
- B. Responsible Parties for Resolution
- C. Deadline dates for resolution

Agenda

PROJECT: _____

PROJECT NO.: _____ **DATE:** _____

MEETING LOCATION: _____

ITEM	SPEAKER	TIME
1. Meeting Overview		
2. Roadway Sections		
3. Geometrics		
4. Earthwork, Geotechnical/Soils Report, Foundation Survey		
5. Retaining Walls/Noise Walls		
6. Shoring		
LUNCH		
7. Drainage		
8. Bridges		
9. Utilities Involvement		
10. Agreements		
11. Coordination with Other Agencies		
12. Construction Schedule/Sequence		
13. Stage Construction Plans		
14. Special Traffic Control Plans unique to the Project		
15. Environmental		
16. Erosion Control/Storm Water Site Plans		
17. Maintenance Issues		
18. Right of Way		
19. Real Estate Services		
20. Signing		
Recap of issues & assigning responsible parties		

ADDITIONAL INFORMATION
Observers:
Resource persons:

DESIGN ISSUE RESOLUTION ASSIGNMENTS

PROJECT: _____

PROJECT NO.: _____ **DATE:** _____

MEETING LOCATION: _____

DESIGN ISSUES		**Time:**
Discussion:		
Considerations:		
Conclusions:		
Action Items:	**Responsible Person:**	**Deadline:**

DESIGN ISSUES		**Time:**
Discussion:		
Considerations:		
Conclusions:		
Action Items:	**Responsible Person:**	**Deadline:**

DESIGN ISSUES		**Time:**
Discussion:		
Considerations:		
Conclusions:		
Action Items:	**Responsible Person:**	**Deadline:**

4

PROJECT DEFINITION REPORT (PDR) CONSTRUCTABILITY REVIEW DESCRIPTION AND PROCEDURES

4.1 Review Objective

For all projects, the Project Definition Report (PDR) constructability review is primarily a programmatic review. The objective of this review is to ensure that the engineering study has been adequate and that information generated and available in the PDR is adequate and sufficient to schedule, program, and develop the project.

4.2 PDR Review Team

The PDR constructability review is to be performed by a review team composed of those designers, reviewers, and managers most familiar with the project. Each team member should be able and authorized to make immediate recommendations and decisions regarding items addressed, questioned, or directed during the review. The project engineer responsible for designing the project will be the team leader and is responsible for coordinating the schedule and location for the review meeting with the other team members. The team should include representatives from the following departments as applicable to the specific project:

- Project Development
- Program Management
- Planning
- Design
- Construction Management and Staff
- Maintenance Management and Staff
- Environmental
- Traffic Design
- Traffic Operations
- Bridge /Structures
- Right of Way
- Utilities
- Plans Review
- Federal and State regulatory agencies, county and city agencies (if appropriate for pre-environmental study and/or agency or public input)
- Local citizen groups (if appropriate for pre-environmental study and/or agency or public input)
- any other function pertinent to the review of issues that need to be addressed to schedule, program, and develop the project.

4.3 PDR Review Documentation

In order to conduct the PDR constructability review, the following project documentation is required:

- Early Value Engineering study (when designated)
- Planning document (i.e., 20-year plan)
- Draft PDR with estimate of costs, items used, documentation of the concept used, and any issues regarding potential complexities or major engineering complications, exceptions, or waivers proposed.
- Preliminary draft environmental information
- Mapping used in scoping study
- Preliminary bridge/structures, geotechnical, and hydraulic studies
- List of deviations from the standard specifications
- PDR and other studies or information available for adjacent projects

4.4 PDR Constructability Checklists

The following checklist is used for the PDR constructability review. The relevant portions of this checklist are submitted to the appropriate CRP team members by the project engineer in charge of design prior to the review meeting. The project engineer is responsible for providing enough time for the CRP team members to complete their portions of the checklist and review the pertinent documents before arriving at the meeting.

Each CRP team member should assess their portion of the checklist for relevance to the project, actions that are required to complete each item, and whether that item will negatively impact the project scope, schedule, or cost. The review team member is responsible for independently reviewing the project site prior to the meeting, bringing the completed checklist to the review meeting, and discussing the pertinent items of concern.

PDR CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____PREPARER:_____DATE_____

- **REVIEW OF ENGINEERING STUDIES**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
1. VE Studies/Alternatives:				
VE studies completed				
Alternatives identified				
Review of feasibility of combining projects				
2. Favored Proposal:				
Deviations from the planning study or concept				
cost estimate reassessed for budget constraints				
Ad Date reassessed due to constructability issues				
3. Environmental Study:				
Permit requirements				
special mitigations				
list of environ. Resources				
Potential impacts				
type of environmental study determined				
Environmental study completed				
Hydraulic study identified				
4. Hazardous Materials:				
Hazardous sites identified				
site assessment completed				
5. Traffic Control Plan				
traffic impacts identified and combining with other projects explored				
Staging issues considered				

PDR CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____PREPARER:_____DATE_____

- **REVIEW OF ENGINEERING STUDIES (cont.)**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
6. Structures:				
preliminary study including alternatives and cost				
environmental considerations impacting structures				
permits				
traffic				
7.Geotechnical Investigation:				
Critical issues				
slides				
erosion				
poor foundation, etc.				
8. Landscaping:				
landscaping requirements				
irrigation/water conservation				
9. Right of Way:				
adequate mapping/plats				
Improvements				
property ownership				
assessors parcel numbers				
size of each parcel				
proposed right of way lines				
Access control				
easements (permanent and temporary)				
significant property ingress modifications				
utilities				
Railroad facilities				
10. Design Standards:				
Lane width				
Design speed				
Cross slope				
grade				
Superelevation				

PDR CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____PREPARER:_____DATE_____

- **REVIEW OF ENGINEERING STUDIES (cont.)**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
10. Design Standards (cont.):				
stopping sight distance				
horizontal/vertical alignment				
horizontal/vertical clearance				
bridge structural capacity				
11. Design Standards Exceptions:				
description of the project				
Project cost				
description of existing highway				
proposed nonstandard items				
added cost to make standard				
traffic and safety data				
incremental and other alternatives to the proposed nonstandard design				
plan drawings, cross-sections, details, photos, etc. To show the problem and justify the nonstandard features				

- **SPECIAL CONSTRUCTION AND/OR MAINTENANCE ISSUES**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost

- **CONTINGENCIES**

Identified Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
25%				

PDR CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____PREPARER:_____DATE_____

- **REVIEW OF ALTERNATIVES, COST ESTIMATES, AND SCHEDULES**

Item	Quantity	Unit	Unit Cost	Total Cost
1. Roadway Items:				
1.1 – Earthwork				
stabilization treatment				
roadway excavation				
imported borrow				
clearing and grubbing				
develop water supply				
special foundation treatment (roadway)				
1.2 - Structural section				
PCC pavement				
asphalt concrete				
lean concrete				
cement-treated base				
aggregate base				
aggregate subbase				
permeable material blanket and edge drains				
contractor/state supplied aggregates; sources				
1.3 - Roadway drainage				
large drainage facility				
storm drains				
pumping plants				
Retention/detention ponds				
1.4 - Specialty items				
retaining walls				
sound walls				
equipment/animal passes				
relocate private irrigation facilities				
landscaping				

PDR CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____PREPARER:_____DATE_____

- **REVIEW OF ALTERNATIVES, COST ESTIMATES, AND SCHEDULES (cont.)**

Item	Quantity	Unit	Unit Cost	Total Cost
1.4 - Specialty items (cont.)				
irrigation				
erosion control				
slope protection				
barriers and guardrails				
hazardous waste work				
Environmental mitigation				
1.5 - Traffic items				
Traffic signals and lighting				
permanent signing				
traffic control systems				
Traffic management plan				
minor item				
2. Structure Items:				
Structure 1:				
superstructure				
substructure				
Structure 2:				
superstructure				
substructure				
Structure 3:				
superstructure				
substructure				
Structure 4:				
superstructure				
substructure				
3. Right of Way:				
acquisition, including excess lands and damages to remainders				
utility relocation				
clearance / demolition				
Relocation Assistance Program				
title and escrow fees				
Construction contract work				
4. Other:				
roadway mobilization				
roadway additions				
5. Engineering, right of way staffing cost:				

4.5 Conducting the PDR Review

The PDR constructability review should follow the structured format described below. The review is to be planned, organized, and conducted by the project engineer in charge of designing the project. A checklist for planning, scheduling, and conducting the review is provided at the end of this section.

Procedures for conducting the PDR constructability review:

1. Establish the actual point in the project development phase at which the Project Definition Report will be completed. This point should follow completion of all of the documentation required for the review listed in Section 4.3.

2. Set a date for the review meeting. Check the master schedule of reviews to verify that another review meeting has not been planned on the date chosen. If the project is being designed by a consultant coordinate the meeting date with the consultant.

3. Select a location for the review meeting that is convenient for all expected representatives. If the project is being designed by a consultant coordinate the meeting location with the consultant.

4. Develop an agenda for each segment of the review meeting (segments may be numbered items in the checklist or categories of proposed work and/or functions involved). The agenda should include all pertinent issues to be discussed and design features and details to be reviewed. The agenda should be timed to allow for completing the meeting in one day.

5. Determine and schedule in the agenda the major disciplines involved in the project that are being requested to be present during the entire review meeting. Schedule other minor disciplines involved in the project to be present as needed to cover the agenda items. Construction and Maintenance should be represented at all review meetings. The Bridge/Structures representative should be viewed as a very important member of the Review Team, and should be included in any discussion where structures are or may be involved. Schedule outside consultants involved in the project to be present during the meeting as needed.

6. Accumulate and organize, or make available to each review team member, all pertinent documentation related to the project that might be needed for reference during the review meeting.

7. Send out the plans, checklist, documents, and agenda, a minimum of two weeks in advance of the review meeting. Ensure that all disciplines scheduled to be involved in the review have reviewed the applicable

documents and plans, independently field reviewed the project site, reviewed the proposed agenda, and completed the applicable PDR review checklists before the scheduled meeting date.

8. Conducting the PDR review meeting:

   a.) Record the meeting either by a designated note keeper or by video or tape recorder. At a minimum, all decisions and agreements, along with all directions and scheduling, should be documented. It might be beneficial if all issues and corresponding actions were written on a display board so that decisions were unambiguous. Individuals should be made clearly responsible for addressing any unresolved issues. Establish a date to receive revised, missing, or corrected data, plans, and documents. Discuss and resolve maintaining the project schedule.

   b.) Conduct the review in accordance with the agenda, allowing adequate time for questions, explanations, and discussions regarding any pertinent item or issue that could impact schedules, costs, scope of work, biddability, buildability, and maintainability. Include time to reflect back on previous decisions and determine whether the project is on track with respect to scope, schedule, and cost. It is critical that the meeting be controlled for timing, completeness, and resolution of any issue raised or problem identified. It is important to periodically remind all attendees that the goal is to complete the meeting in one day.

   c.) At the conclusion of the meeting, an approximate date for the 30 percent constructability review should be discussed and agreed upon by the review team.

9. Develop, or designate an individual present at the review meeting to develop, a brief report outlining the review results and documenting the directions discussed and agreed to for the phase of the project design development.

10. If any unresolved issues remained at the conclusion of the review meeting, and an impasse occurred, implement the Appeal and Resolution process.

11. Provide a summary of the review to the WSDOT regional staff member at the Project Development Management level who is in charge of overseeing constructability reviews. The summary should include any issues related to the constructability review process, including positive and negative feedback from the review participants, which would allow for periodic monitoring of the review process so that future improvements

can be made. Copies of the report should be circulated to the CRP team members and one copy placed in the design files.

The following checklist is used by the project engineer for scheduling and planning the PDR constructability review. This checklist is used to determine the date that the review will be held, the location of the review meeting, and establishing the meeting agenda. In addition, this checklist is used by the project engineer to assign action items to appropriate design team members, what needs to be accomplished, when the item must be completed by, and, if relevant, where the work is to be performed.

PDR CONSTRUCTABILITY REVIEW MEETING PLANNING CHECKLIST

PROJECT:_____
PROJECT #_____PREPARER:_____DATE_____

- **PDR REVIEW PLANNING ITEMS**

Item	Action/who, what, when, where
Date when PDR will be completed:	
Scheduled date for review meeting:	
Location for review meeting:	
Review meeting agenda developed	
PDR checklists/meeting agenda/project documentation sent to each function/discipline	

- **PDR REVIEW TEAM**

Function	Representative	Involved	Not Involved	Date Contacted
Management				
Planning				
Design				
Construction				
Maintenance				
Environmental				
Envir. Agencies				
Traffic Design				
Traffic Operations				
Bridge/Structures				
Geotechnical				
Hydraulics				
Right of Way				
Utilities				
Plans Review				
Citizens Group				
Other				

PDR CONSTRUCTABILITY REVIEW MEETING
PLANNING CHECKLIST

PROJECT:_____
PROJECT #_____PREPARER:_____DATE_____

- **DOCUMENTATION REQUIRED FOR PDR REVIEW**

Document	Action/who, what, when, where
Early Value Engineering study	
Planning document (i.e., 20-year plan)	
Draft PDR	
costs	
items used	
concepts	
Issues regarding potential complexities	
Issues re: major engineering complications	
Preliminary draft Environmental information	
Mapping used in scoping study	
Preliminary Bridge/Structures study	
Maintenance issues or concerns pertaining to project area, location, proposal, etc.	
Preliminary Geotechnical study	
Preliminary Hydraulic study	
List of deviations from the standard specifications	
PDR and other studies or information available for adjacent projects	
Alternatives recommended to meet the approved schedule, scope of work, and budget	
Other	

- **CONDUCTING THE PDR REVIEW**

Item	Action/who, what, when, where
Process developed for recording the meeting	
All agenda items reviewed	
Date for 30 percent review established	
Report of review results developed	
Appeals and Resolution process implemented for all unresolved items on which an impasse occurred	
Summary report given to WSDOT Project Development Management	

PDR CONSTRUCTABILITY REVIEW MEETING
PLANNING CHECKLIST

PROJECT:_____
PROJECT #_____PREPARER:_____DATE_____

- **REVIEW NOTES:**

5

0 PERCENT CONSTRUCTABILITY REVIEW DESCRIPTION AND PROCEDURES

5.1 Review Objective

This review is considered, in effect, a substitute for the review normally conducted at the Project Definition Report stage. The main objective of the Zero (0) percent constructability review is to assess the constructability of:

1. Small projects which do not include any significant technical issues and the project engineer does not participate in the scoping efforts. The 0 percent constructability review would be held in lieu of the Project Definition Report (PDR) review on these types of projects.

2. "Transitional" projects that are currently in the planning stage beyond completion of the Project Definition Report when the Constructability Review Process is initially implemented.

3. Projects that are transferred between design offices following preliminary design but before PS&E development.

In this review, geometric details are determined, and guidelines and directions are given to Structures, Traffic, Hydraulics, Right of Way, Geotechnical, and any other functions involved in the project so that these functions can perform the required studies and provide the preliminary design details for the PS&E. Important input that can be critical for project design is received by the constructability team from Maintenance, Construction, Planning, Environmental, and any other functions knowledgeable about special conditions or features that should be considered during design.

5.2 0 Percent Review Team

The 0 percent constructability review is to be performed by a review team composed of those designers, reviewers, and managers most familiar with the project. Each team member should be able and authorized to make or obtain immediate recommendations and decisions regarding items addressed, questioned, or directed during the review. The project engineer in charge of designing the project will be the team leader and is responsible for coordinating the schedule and location for the review meeting with the other team members. The team should include representatives from the following departments as applicable to the specific project:

- Project Development

- Program Management
- Planning
- Design
- Construction Management and staff
- Maintenance Management and staff
- Environmental
- Environmental Agencies
- Traffic Design
- Traffic Operations
- Bridge/Structures
- Geotechnical
- Hydraulics/Drainage
- Right of Way
- Utilities
- Plans Review
- any other function pertinent to the review of outstanding issues or concerns that need to be addressed to complete the PS&E

5.3 0 Percent Review Documentation

In order to conduct the 0 percent constructability review, the following project documentation is required.

- Value Engineering study for the project, if required.
- Design level mapping
- Federal and State project approval
- Preliminary Geotechnical/Soils report (desirable)
- Preliminary Bridge report/plans (schematic, including planning level scheduling and cost estimate information) (desirable)
- Planning level Traffic design and traffic control plan recommendations on major projects (desirable)
- Planning level Hydraulics report and preliminary drainage plan including water management requirements (desirable, if available)
- Environmental summary
- Start of R/W appraisal and acquisition
- Preliminary horizontal and vertical alignments, and geometric layout including intersections and interchanges
- Preliminary earthwork and grading plan
- Description of any identified permits
- List of any design modifications and/or deviations
- List of any alternatives recommended that would be required to meet the approved schedule, scope, and budget for the project

5.4 0 Percent Constructability Checklists

The following checklist is used for the 0 Percent constructability review. The relevant portions of this checklist are submitted to the appropriate CRP team members by the project engineer of design prior to the review meeting. The project engineer is responsible for providing enough time for the team members to complete their portions of the checklist and review the pertinent documents before arriving at the meeting.

Each CRP team member should assess their portion of the checklist for relevance to the project, actions that are required to complete each item, and whether that item will negatively impact the project scope, schedule, or cost. The review team member is responsible for independently field reviewing the project site, bringing the completed checklist to the review meeting, and discussing the pertinent items of concern.

0 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____ REVIEWER:_____DATE_____

- **PUBLIC INVOLVEMENT**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Community Meeting scheduled				
Public Involvement Newsletter/flyers				

- **PERMITS**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Utilities agreements				
Detour/Haul Agreements				
Participatory Agreements				
Environmental permits:				
U.S. Corps of Engineers (section 10 and section 404)				
Hydraulic Project Approval (WS Dept. of Fish and Wildlife)				
U.S. Coast Guard				
U.S. Forest Service				
Federal Aviation Administration				
Wash. State Dept. of Natural Resources				
Wash. State Dept. of Ecology				
sensitive area ordinance/public agency utility exemption (SAO/PAUE)				
grading/clearing				
noise variance				
temporary erosion and sedimentation control plan				
temporary water quality modification				
national pollution discharge elimination system permit application (NPDES)				
storm water site plan				
Other Agreements				

0 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **GEOTECHNICAL / EARTHWORK**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Structure excavation				
Fill				
Stockpiling / storage / dumpsites				
Materials usage / salvage				
Stabilization				
Site conditions (topography, profiles, etc.)				
Boring / drilling				
Soil compaction				
Clearing / grubbing / roadside cleanup				
Removal of structures and obstructions				
Earthwork haul				
Slope treatment				
Subgrade preparation				
Watering				
Ditch and channel excavation				
Trimming and cleanup				

0 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____ REVIEWER:_____DATE_____

- **ROADWAY SURFACE**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Pavement (cement concrete, asphalt concrete, bitumen)				
Base and subbase				
Sidewalk				
Curb				
Shoulders / shoulder repair				
Sawcutting				
Slopes				
Lanes (narrow lane widths must match roadway sections)				
Stationing (road, paving, striping, etc.)				
Pavement method				

0 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **RIGHT OF WAY / ACCESS CONTROL**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Existing/proposed right of way limits				
Appraisal				
Transaction				
Acquisition				
Condemnation				
Relocation				
Cattle passes				
Pit, stockpile, and waste sites (haul road, detour routes)				
Utility				
Railroad				
International boundaries				
Easement/construction permits				
Programming for funds				
Access control				
Access report/access hearing plans				
Monuments (alignment, property corner)				
Fencing				
At the Project Definition stage:				
right of way estimate				
purchase cost				
relocation assistance benefits payments				
other land management staff expenses (acquisition services, relocation services, interim property management services)				

0 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **DRAINAGE**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Water quality				
Surface drainage				
Groundwater problems				
Structures drainage:				
retaining walls				
bridges				
Roadway drainage:				
dewatering systems				
irrigation systems				
sewers				
detention ponds				
retention ponds				
temporary sediment ponds				
jacked pipes				
culverts				
crossdrain				
underdrain				
downdrain				
storm drain system / storm sewer pipes				
special drainage structures (energy dissipaters, filters, flow restrictors, etc.)				
ditches				
catch basins				
junction boxes				
manholes				
water lines (removal)				
shafts				
swales				

0 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **UTILITIES**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Electricity / power lines / power poles				
Wire conduits				
Power sources location				
Gas				
Cable				
Telephone				
Sewer lines				
Utility conflicts				

0 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **ENVIRONMENTAL MITIGATION**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Planting / wetland planting and re-vegetation				
Seeding / fertilization				
Trees / shrubs removal				
Sandbag diversion dams				
Hazardous waste cleanup				
Pollution control				
Groundwater contamination				
Dust control				

0 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **LANDSCAPING**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Irrigation system				
Planting (seeding, fertilizing)				
Plant establishment period				
Fencing				

0 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **TRAFFIC**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Traffic Control/Staging:				
number of closed lanes				
night operations				
influence on surrounding streets				
construction traffic control				
detour roads				
sequential arrows				
closure (days and hours)				
labor (number of hours)				
Design:				
delineation (pavement markings, guideposts, barrier delineation, raised pavement markers, impact attenuator markings)				
intersections				
interchanges				
auxiliary lanes				
signalization				
signage				
detection systems				
safety items (crash cushions)				
barriers, guardrails				
work zones				
illumination and lighting				
ramp meters				
transitions				
climbing lanes (for slow vehicles)				
special shoulder designs				
bicycle paths				
HOV lanes				

0 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **STRUCTURES**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Site data report				
Timber structures				
Bridges:				
concrete mix / steel				
bearings				
girder				
foundation				
expansion joints				
piles / columns				
reinforcement				
bridge railing				
Walls/retaining walls:				
material (concrete mix)				
live poles between wall layers				
foundation				
panels				
reinforcement				
panels/stem panels				
Appurtenant structures:				
pedestrian				
animal (habitat for fish, animal passage, etc.)				
Tunnel:				
mud slab/waterproofing				
roof slab				
Pavement method				
Painting				
Waterproofing				
Cribbing				

0 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **CONSTRUCTION**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Access roads				
Construction signs				
Temporary signals / striping / illumination / impact attenuators				
Site preparation				
Construction space				
Field office building location				
Equipment / material				
Construction schedule / sequence				
Survey control staking and monuments				
Construction equipment:				
cranes, derricks				
trucks				
graders				
bulldozers				
excavators				

0 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **MAINTENANCE**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Roadside cleanup				
Drainage cleanup				
Fire protection systems				
Noise Wall Accessibility				
Drainage accessibility:				
to detention/retention ponds				
to downdrains/underdrains				
special drainage features/structures				
Slope accessibility:				
top of cut / toe of fill				
Environmental/maintenance special permit				

- **CONTINGENCIES**

Identified Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
25 percent				

5.5 Conducting the 0 Percent Review

The 0 percent constructability review should follow the structured format described below. The review is to be planned, organized, and conducted by the project engineer in charge of designing the project. A checklist for planning, scheduling, and conducting the review is provided at the end of this section.

Procedures for conducting the 0 percent constructability review:

1. Establish the actual point in the project development phase at which onset of the PS&E will begin. This point should include as much preliminary engineering and documentation as possible, as listed in Section 5.3.

2. Set a date for the review. Check the master schedule of reviews to verify that another review meeting is not planned on the date chosen. If a consultant is designing the project coordinate the review meeting date with the consultant.

3. Select a location for the review meeting that is convenient for all invited representatives. If a consultant is designing the project coordinate the review meeting location with the consultant.

4. Develop an agenda for each segment of the review meeting (segments may be a numbered item in the checklist or categories of proposed work and/or functions involved). The agenda should include all pertinent issues to be discussed and design features and details to be reviewed. The agenda should be timed to allow for completing the review meeting in one day.

5. Determine and schedule in the agenda the major disciplines involved in the project that are being requested to be present during the entire review meeting. Schedule other minor disciplines involved in the project to be present as needed to cover the agenda items. Construction and Maintenance should be represented at all review meetings. The Bridge representative should be viewed as a very important member of the review team, and should be included in any discussion where structures are or may be involved. Schedule consultants involved in the project to be present during the meeting as needed.

6. Accumulate and organize, or make available to each review team member, all pertinent documentation related to the project that might be needed for reference during the review meeting.

7. Send out the plans, checklist, documents, and meeting agenda, a minimum of two weeks in advance of the review meeting. Ensure that all disciplines scheduled to be involved in the review have reviewed the applicable

documents and plans, independently field reviewed the project site, reviewed the proposed agenda, and completed the applicable 0 percent review checklists before the scheduled review meeting date. Send site data and site map to Bridge/Structures.

8. Conducting the 0 percent review meeting:

   a.) Record the meeting either by a designated note keeper or by video or tape recorder. At a minimum, all decisions and agreements, along with all directions and scheduling, should be documented. It might be beneficial if all issues and corresponding actions were written on a display board so that decisions were unambiguous. Individuals should be made clearly responsible for addressing any unresolved issues. Establish a date to receive revised, missing, or corrected data, plans, and documents. Discuss and resolve maintaining the project schedule.

   b.) Conduct the review meeting in accordance with the agenda, allowing adequate time for questions, explanations, and discussions regarding any pertinent item or issue that could impact schedules, costs, scope of work, biddability, buildability, and maintainability. Include time to reflect back on previous decisions and determine whether the project is still on track with respect to scope, schedule, and cost. It is critical that the meeting be controlled for timing, completeness, and resolution of any issue raised or problem identified. It is important to periodically remind all attendees that the goal is to complete the meeting in one day.

   c.) At the conclusion of the meeting, an approximate date for the 30 percent constructability review should be discussed and agreed upon by the review team.

9. Develop, or designate an individual present at the review meeting to develop, a brief report outlining the review results and documenting the directions discussed and agreed to for the phase of the project design development.

10. If any unresolved issues remained at the conclusion of the review meeting, and an impasse occurred, implement the Appeal and Resolution process.

11. Provide a summary of the review to the WSDOT regional staff member at the Project Development Management level who is in charge of overseeing constructability reviews. The summary should include any issues related to the constructability review process, including positive and negative feedback from the review participants, that would allow for periodic monitoring of the review process so that future improvements can

be made. Copies of the report should be circulated to the CRP team members and a copy placed in the project design files.

The following checklist is used by the project engineer for scheduling and planning the 0 Percent constructability review. This checklist is used to determine the date that the review will be held, the location of the review meeting, and establishing the meeting agenda. In addition, this checklist is used by the project engineer to assign action items to appropriate design team members, what needs to be accomplished, when the item must be completed by, and, if relevant, where the work is to be performed.

0 PERCENT CONSTRUCTABILITY REVIEW MEETING PLANNING CHECKLIST

PROJECT:_____
PROJECT #_____PREPARER:_____DATE_____

- **0 PERCENT REVIEW PLANNING ITEMS**

Item	Action/who, what, when, where
0 percent date established in PS&E development	
Scheduled date for review meeting:	
Location for review meeting:	
Review meeting agenda developed	
0 percent checklists/meeting agenda/ Project Documentation sent to each function/discipline	

- **0 PERCENT REVIEW TEAM**

Function	Representative	Involved	Not Involved	Date Contacted
Management				
Planning				
Design				
Construction				
Maintenance				
Environmental				
Envir. Agencies				
Traffic Design				
Traffic Operations				
Bridge				
Geotechnical				
Hydraulics				
Right of Way				
Utilities				
Plans Review				
Other				

0 PERCENT CONSTRUCTABILITY REVIEW MEETING PLANNING CHECKLIST

- **DOCUMENTATION FOR 0 PERCENT REVIEW**

Document	Action/who, what, when, where
*Value Engineering study	
Project Prospectus	
Design level mapping	
Federal project approval	
State project approval	
*Preliminary Geotechnical/Soils report	
*Preliminary Bridge report/plans (schematic)	
*Planning level recommendations of Traffic design	
*Preliminary Hydraulics report	
Environmental summary	
*Start of R/W appraisal and acquisition, for core R/W needs	
Preliminary Horizontal and vertical alignments	
Planning level Geometric layout	
Intersections	
Interchanges	
Preliminary earthwork and grading plan	
Description of any identified permits needed	
Design modifications and/or deviations from preceding reviews	
Alternatives recommended to meet the approved schedule, scope of work, and budget	
Other	

*desirable

0 PERCENT CONSTRUCTABILITY REVIEW MEETING PLANNING CHECKLIST

- **CONDUCTING THE 0 PERCENT REVIEW**

Item	Action/who, what, when, where
Process developed for recording the meeting	
All agenda items reviewed	
Date for 30 percent, 60 percent, or Final review established	
Report of review results developed	
Appeals and Resolution process implemented for all unresolved items on which an impasse occurred	
Summary report given to WSDOT Project Development Management	

- **REVIEW NOTES:**

6

30 PERCENT CONSTRUCTABILITY REVIEW DESCRIPTION AND PROCEDURES

6.1 Review Objective

The main objective of the 30 percent constructability review is to assess the constructability of the project following the development of the project's primary geometric features. It is anticipated that this is the 30 percent point in the development of the PS&E. In this review, geometric details are checked, and guidelines and directions are given to Structures, Traffic, Hydraulics, Right of Way, Geotechnical, and any other functions involved in the project so that these functions can perform the required studies and provide the final design details for the PS&E.

6.2 30 Percent Review Team

The 30 percent PS&E constructability review is to be performed by a review team composed of those designers, reviewers, and managers most familiar with the project. It is desirable to include those who have been involved in the Project Definition Report review, or 0 percent review, if applicable, on the specific project. Each team member should be able and authorized to make or obtain immediate recommendations and decisions regarding items addressed, questioned, or directed during the review. The project engineer in charge of designing the project will be the team leader and is responsible for coordinating the schedule and location for the review meeting with the other team members. The team should include representatives from the following departments as applicable to the specific project.

- Project Development
- Program Management
- Design
- Construction Management and staff
- Maintenance Management and staff
- Environmental
- Environmental Agencies
- Traffic Design
- Traffic Operations
- Bridge/Structures
- Geotechnical
- Hydraulics/Drainage
- Right of Way
- Utilities
- Plans Review
- any other function pertinent to the review of outstanding issues or concerns that need to be addressed to complete the PS&E

6.3 30 Percent Review Documentation

In order to conduct the 30 percent constructability review, the following project documentation is required.

- Planning Documents
- Project Definition Report (PDR)
- Value Engineering study for any complex items (i.e., Structures or Hydraulics)
- Design level mapping
- Approved environmental document
- Federal and State project approval
- Approved Channelization Plans and conceptual traffic control plans
- Completed Hydraulics Report, preliminary PS&E drainage plans and stormwater site plans
- Completed Soils Report
- Bridge Site Data to Bridge/Structures
- Bridge preliminary plans (schematic, including scheduling and cost estimate information) complete
- Approved R/W Red Line Plans and initiation of R/W appraisals
- Firm line and grade, and geometric layout including intersections and interchanges
- Preliminary earthwork and grading plan
- Preliminary Utility Plans developed
- Description of all environmental and local agency permits needed
- List of any design deviations and/or variations resulting from the Project Definition Report constructability review
- List of any alternatives recommended that would be required to meet the approved schedule, scope, and budget for the project

6.4 30 Percent Constructability Checklists

The following checklist is used for the 30 Percent constructability review. The relevant portions of this checklist are submitted to the appropriate CRP team members by the project engineer of design prior to the review meeting. The project engineer is responsible for providing enough time for the team members to complete their portions of the checklist and review the pertinent documents before arriving at the meeting.

Each CRP team member should assess their portion of the checklist for relevance to the project, actions that are required to complete each item, and whether that item will negatively impact the project scope, schedule, or cost. The review team member is responsible for independently field reviewing the project site, bringing the completed checklist to the review meeting, and discussing the pertinent items of concern.

30 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____ REVIEWER:_____DATE_____

- **PUBLIC INVOLVEMENT**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Community Meeting scheduled				
Public Involvement Newsletter/flyers				

- **PERMITS**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Utilities agreements				
Detour/Haul Agreements				
Participatory Agreements				
Environmental permits:				
U.S. Corps of Engineers (section 10 and section 404)				
Hydraulic Project Approval (WS Dept. of Fish and Wildlife)				
U.S. Coast Guard				
U.S. Forest Service				
Federal Aviation Administration				
Wash. State Dept. of Natural Resources				
Wash. State Dept. of Ecology				
sensitive area ordinance/public agency utility exemption (SAO/PAUE)				
Grading/clearing				
Noise variance				
temporary erosion and sedimentation control plan				
temporary water quality modification				
national pollution discharge elimination system permit application (NPDES)				
storm water site plan				
Other Agreements				

30 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **GEOTECHNICAL / EARTHWORK**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Structure excavation				
Fill				
Stockpiling / storage / dumpsites				
Materials usage / salvage				
Stabilization				
Site conditions (topography, profiles, etc.)				
Boring / drilling				
Soil compaction				
Clearing / grubbing / roadside cleanup				
Removal of structures and obstructions				
Earthwork haul				
Slope treatment				
Subgrade preparation				
Watering				
Ditch and channel excavation				
Trimming and cleanup				

30 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____ REVIEWER:_____DATE_____

- **ROADWAY SURFACE**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Pavement (cement concrete, asphalt concrete, bitumen)				
Base and subbase				
Sidewalk				
Curb				
Shoulders / shoulder repair				
Sawcutting				
Slopes				
Lanes (narrow lane widths must match roadway sections)				
Stationing (road, paving, striping, etc.)				
Pavement method				

30 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **RIGHT OF WAY / ACCESS CONTROL**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Existing/proposed right of way limits				
Appraisal				
Transaction				
Acquisition				
Condemnation				
Relocation				
Cattle passes				
Pit, stockpile, and waste sites (haul road, detour routes)				
Utility				
Railroad				
International boundaries				
Easement/construction permits				
Programming for funds				
Access control				
Access report/access hearing plans				
Monuments (alignment, property corner)				
Fencing				
At the Project Definition stage:				
right of way estimate				
purchase cost				
relocation assistance benefits payments				
other land management staff expenses (acquisition services, relocation services, interim property management services)				

30 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **DRAINAGE**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Water quality				
Surface drainage				
Groundwater problems				
Structures drainage:				
retaining walls				
bridges				
Roadway drainage:				
Dewatering systems				
Irrigation systems				
sewers				
detention ponds				
retention ponds				
Temporary sediment ponds				
jacked pipes				
culverts				
crossdrain				
underdrain				
downdrain				
storm drain system / storm sewer pipes				
special drainage structures (energy dissipaters, filters, flow restrictors, etc.)				
ditches				
catch basins				
junction boxes				
manholes				
Water lines (removal)				
shafts				
swales				

30 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **UTILITIES**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Electricity / power lines / power poles				
Wire conduits				
Power sources location				
Gas				
Cable				
Telephone				
Sewer lines				
Utility conflicts				

30 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **ENVIRONMENTAL MITIGATION**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Planting / wetland planting and re-vegetation				
Seeding / fertilization				
Trees / shrubs removal				
Sandbag diversion dams				
Hazardous waste cleanup				
Pollution control				
Groundwater contamination				
Dust control				

30 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **LANDSCAPING**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Irrigation system				
Planting (seeding, fertilizing)				
Plant establishment period				
Fencing				

30 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **TRAFFIC**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Traffic Control/Staging:				
Number of closed lanes				
night operations				
influence on surrounding streets				
Construction traffic control				
detour roads				
Sequential arrows				
closure (days and hours)				
labor (number of hours)				
Design:				
delineation (pavement markings, guideposts, barrier delineation, raised pavement markers, impact attenuator markings)				
intersections				
interchanges				
auxiliary lanes				
signalization				
signage				
Detection systems				
safety items (crash cushions)				
Barriers, guardrails				
work zones				
Illumination and lighting				
ramp meters				
transitions				
Climbing lanes (for slow vehicles)				
special shoulder designs				
bicycle paths				
HOV lanes				

30 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **STRUCTURES**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Site data report				
Timber structures				
Bridges:				
Concrete mix / steel				
bearings				
girder				
foundation				
expansion joints				
piles / columns				
reinforcement				
bridge railing				
Walls/retaining walls:				
Material (concrete mix)				
live poles between wall layers				
foundation				
panels				
reinforcement				
Panels/stem panels				
Appurtenant structures:				
pedestrian				
animal (habitat for fish, animal passage, etc.)				
Tunnel:				
mud slab/waterproofing				
roof slab				
Pavement method				
Painting				
Waterproofing				
Cribbing				

30 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **CONSTRUCTION**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Access roads				
Construction signs				
Temporary signals / striping / illumination / impact attenuators				
Site preparation				
Construction space				
Field office building location				
Equipment / material				
Construction schedule / sequence				
Survey control staking and monuments				
Construction equipment:				
cranes, derricks				
Trucks				
Graders				
Bulldozers				
Excavators				

30 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **MAINTENANCE**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Roadside cleanup				
Drainage cleanup				
Fire protection systems				
Noise Wall Accessibility				
Drainage accessibility:				
to detention/retention ponds				
to downdrains/underdrains				
special drainage features/structures				
Slope accessibility:				
top of cut / toe of fill				
Environmental/maintenance special permit				

- **CONTINGENCIES**

Identified Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
15 percent				

6.5 Conducting the 30 Percent Review

The 30 percent constructability review should follow the structured format described below. The review is to be planned, organized, and conducted by the project engineer in charge of designing the project. A checklist for planning, scheduling, and conducting the review meeting is provided at the end of this section.

Procedures for conducting the 30 percent constructability review:

1. Establish the actual point in the project development phase at which approximately 30 percent of the PS&E will be completed. This point should follow completion of all of the documentation required for the review listed in Section 6.3.

2. Set a date for the review meeting. Check the master schedule of reviews to verify that another review meeting is not planned on the date chosen. If the project is being designed by a consultant coordinate the meeting date with the consultant.

3. Select a location for the review meeting that is convenient for all invited representatives. If a consultant is designing the project coordinate the review meeting location with the consultant.

4. Develop an agenda for each segment of the review meeting (segments may be a numbered item in the checklist or categories of proposed work and/or functions involved). The agenda should include all pertinent issues to be discussed and design features and details to be reviewed. The agenda should be timed to allow for completing the meeting in one day.

5. Determine and schedule in the agenda the major disciplines involved in the project that are being requested to be present during the entire review meeting. Schedule other minor disciplines involved in the project to be present as needed to cover the agenda items. Construction and Maintenance should be represented at all review meetings. The Bridge representative should be viewed as a very important member of the review team, and should be included in any discussion where structures are or may be involved. Schedule consultants involved in the project to be present during the meeting as needed.

6. Accumulate and organize, or make available to each review team member, all pertinent documentation related to the project that might be needed for reference during the review.

7. Send out the plans, checklist, documents, and meeting agenda a minimum of two weeks in advance of the review meeting. Ensure that all disciplines scheduled to be involved in the review have reviewed the applicable

documents and plans, independently field reviewed the project site, reviewed the proposed agenda, and completed the applicable 30 percent review checklists before the scheduled review meeting date. Send site data and site map to Bridge/Structures.

8. Conducting the 30 percent review meeting:

   a.) Record the meeting either by a designated note keeper or by video or tape recorder. At a minimum, all decisions and agreements, along with all directions and scheduling, should be documented. It might be beneficial if all issues and corresponding actions were written on a display board so that decisions were unambiguous. Individuals should be made clearly responsible for addressing any unresolved issues. Establish a date to receive revised, missing, or corrected data, plans, and documents. Discuss and resolve maintaining the project schedule.

   b.) Conduct the review meeting in accordance with the agenda, allowing adequate time for questions, explanations, and discussions regarding any pertinent item or issue that could impact schedules, costs, scope of work, biddability, buildability, and maintainability. Include time to reflect back on previous decisions and determine whether the project is on track with respect to scope, schedule, and cost. It is critical that the meeting be controlled for timing, completeness, and resolution of any issue raised or problem identified. It is important to periodically remind all attendees that the goal is to complete the review meeting in one day.

   c.) At the conclusion of the meeting, an approximate date for the 60 percent constructability review should be discussed and agreed upon by the review team.

9. Develop, or designate an individual present at the meeting to develop, a brief report outlining the review results and documenting the directions discussed and agreed to for the phase of the project design development.

10. If any unresolved issues remained at the conclusion of the meeting, and an impasse occurred, implement the Appeal and Resolution process.

11. Provide a summary of the review to the WSDOT regional staff member at the Project Development Management level who is in charge of overseeing constructability reviews. The summary should include any issues related to the constructability review process, including positive and negative feedback from the review participants, which would allow for periodic monitoring of the review process so that future improvements

can be made. Copies of the report should be circulated to the CRP team members and a copy placed in the project design files.

The following checklist is used by the project engineer for scheduling and planning the 30 Percent constructability review meeting. This checklist is used to determine the date that the review meeting will be held, the location of the review meeting, and establishing the meeting agenda. In addition, this checklist is used by the project engineer to assign action items to appropriate design team members, what needs to be accomplished, when the item must be completed by, and, if relevant, where the work is to be performed.

30 PERCENT CONSTRUCTABILITY REVIEW MEETING

PLANNING CHECKLIST

PROJECT:_____
PROJECT #_____PREPARER:_____DATE_____

- **30 PERCENT REVIEW PLANNING ITEMS**

Item	Action/who, what, when, where
30 percent point in project PS&E development	
Scheduled date for review meeting:	
Location for review meeting:	
Review meeting agenda developed	
30 percent checklists/meeting agenda Project Documentation sent to each function/discipline	

- **30 PERCENT REVIEW TEAM**

Function	Representative	Involved	Not Involved	Date Contacted
Management				
Planning				
Design				
Construction				
Maintenance				
Environmental				
Envir. Agencies				
Traffic Design				
Traffic Operations				
Bridge				
Geotechnical				
Hydraulics				
Right of Way				
Utilities				
Plans Review				
Other				

30 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PLANNING CHECKLIST

- **DOCUMENTATION FOR THE 30 PERCENT REVIEW**

Document	Action/who, what, when, where
Planning Documents	
Project Definition Report (PDR)	
Value Engineering study, if needed	
Design level mapping	
Approved environmental document	
Federal project approval	
State project approval	
Channelization Plans & conceptual Traffic Control	
Completed Soils report	
Completed Hydraulics Report	
Bridge Site Data to OSC	
Bridge Prelim. Plans complete	
Preliminary Utility Plans	
R/W Red Line Plans	
Initiate R/W appraisals	
Line and grade	
Geometric layout	
Intersections	
Interchanges	
Preliminary earthwork and grading plan	
Description of env./local agency permits needed	
Design modifications/deviations from:	
PDR and/or 0% reviews	
Alternatives recommended to meet the approved schedule, scope of work, and budget	
Other	

- **CONDUCTING THE 30 PERCENT REVIEW**

Item	Action/who, what, when, where
Process developed for recording the meeting	
All agenda items reviewed	
Date for 60% review established	
Report of review results developed	
Appeals and Resolution process implemented for all unresolved items on which an impasse occurred	
Summary report given to WSDOT Project Development Management	

30 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PLANNING CHECKLIST

- **REVIEW NOTES**

7

60 PERCENT CONSTRUCTABILITY REVIEW DESCRIPTION AND PROCEDURES

7.1 Review Objective

For many projects, the 60 percent constructability review will be at the most critical stage of design and PS&E development. The objective of this review is to focus on specific design features and details in addition to addressing all items that are or will be critical to the completion of a constructible and maintainable project. The review is to include an evaluation and discussion of such items as the bridge layout plans, traffic requirements, hydraulic requirements, special drainage structures, and any other special design features included in the project. Specifically, bridge plans are to be reviewed with respect to costs and structural requirements including any special foundation considerations or materials involved. This review must also address and assure that the design team, including all involved functions, has the necessary guidance and direction to proceed into the final detailed design stage. Any major changes, revisions, or other special considerations must be identified and assignment for resolution be made and scheduled.

7.2 60 Percent Review Team

The 60 percent constructability review is to be performed by a review team composed of those designers, reviewers, and managers most familiar with the project. It is desirable to include those who have been involved in prior reviews on the specific project. Each team member should be able and authorized to make immediate recommendations and decisions regarding items addressed, questioned, or directed during the review. The project engineer in charge of designing the project will be the team leader and is responsible for coordinating the schedule and location for the review meeting with the other team members. The team should include representatives from the following departments as applicable to the specific project:

- Project Development
- Program Management
- Design
- Construction Management and staff
- Maintenance Management and staff
- Environmental
- Traffic
- Bridge/Structures
- Geotechnical
- Hydraulics/Drainage
- Permits
- Right of Way
- Utilities
- any other function pertinent to the review of outstanding issues or concerns that need to be addressed to complete the PS&E

7.3 60 Percent Review Documentation

In order to conduct the 60 percent constructability review, the following project documentation is required:

- Completed Value Engineering study
- Completed Geotechnical/Soils report
- Bridge Layout Plans with schedules, costs, concepts, and preliminary quantities for all structures
- Completed draft of the Traffic control plan
- Completed Hydraulics report including drainage layout and preliminary quantities
- Environmental re-evaluation
- Approved R/W plan with any recommended mitigation and design/construction commitments
- Firm line and grade, and geometric layout including intersections and interchanges
- Completed earthwork and grading plan
- List of completed permit requirements and/or recommendations of commitments to meet permit requirements and related schedules
- Commitments provided by the permitting agencies
- List of any design deviations and/or variations resulting from the 30 percent and Project Definition Report constructability reviews
- List of any alternatives recommended that would be required to meet the approved schedule, scope, and budget for the project

7.4 60 Percent Constructability Checklists

The following checklist is used for the 60 Percent constructability review. The relevant portions of this checklist are submitted to the appropriate CRP team members by the project engineer of design prior to the review meeting. The project engineer is responsible for providing enough time for the team members to complete their portions of the checklist and review the pertinent documents before arriving at the meeting.

Each CRP team member should assess their portion of the checklist for relevance to the project, actions that are required to complete each item, and whether that item will negatively impact the project scope, schedule, or cost. The review team member is responsible for independently field reviewing the project site, bringing the completed checklist to the review meeting, and discussing the pertinent items of concern.

60 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____ REVIEWER:_____DATE_____

- **PUBLIC INVOLVEMENT**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Community Meeting scheduled				
Public Involvement Newsletter/flyers				

- **PERMITS**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Utilities agreements				
Detour/Haul Agreements				
Participatory Agreements				
Environmental permits:				
U.S. Corps of Engineers (section 10 and section 404)				
Hydraulic Project Approval (WS Dept. of Fish and Wildlife)				
U.S. Coast Guard				
U.S. Forest Service				
Federal Aviation Administration				
Wash. State Dept. of Natural Resources				
Wash. State Dept. of Ecology				
sensitive area ordinance/public agency utility exemption (SAO/PAUE)				
grading/clearing				
noise variance				
temporary erosion and sedimentation control plan				
temporary water quality modification				
national pollution discharge elimination system permit application (NPDES)				
storm water site plan				
Other Agreements				

60 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **GEOTECHNICAL / EARTHWORK**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Structure excavation				
Fill				
Stockpiling / storage / dumpsites				
Materials usage / salvage				
Stabilization				
Site conditions (topography, profiles, etc.)				
Boring / drilling				
Soil compaction				
Clearing / grubbing / roadside cleanup				
Removal of structures and obstructions				
Earthwork haul				
Slope treatment				
Subgrade preparation				
Watering				
Ditch and channel excavation				
Trimming and cleanup				

60 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____ REVIEWER:_____DATE_____

- **ROADWAY SURFACE**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Pavement (cement concrete, asphalt concrete, bitumen)				
Base and subbase				
Sidewalk				
Curb				
Shoulders / shoulder repair				
Sawcutting				
Slopes				
Lanes (narrow lane widths must match roadway sections)				
Stationing (road, paving, striping, etc.)				
Pavement method				

60 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **RIGHT OF WAY / ACCESS CONTROL**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Existing/proposed right of way limits				
Appraisal				
Transaction				
Acquisition				
Condemnation				
Relocation				
Cattle passes				
Pit, stockpile, and waste sites (haul road, detour routes)				
Utility				
Railroad				
International boundaries				
Easement/construction permits				
Programming for funds				
Access control				
Access report/access hearing plans				
Monuments (alignment, property corner)				
Fencing				
At the Project Definition stage:				
right of way estimate				
purchase cost				
relocation assistance benefits payments				
other land management staff expenses (acquisition services, relocation services, interim property management services)				

60 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **DRAINAGE**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Water quality				
Surface drainage				
Groundwater problems				
Structures drainage:				
retaining walls				
bridges				
Roadway drainage:				
dewatering systems				
irrigation systems				
sewers				
detention ponds				
retention ponds				
temporary sediment ponds				
jacked pipes				
culverts				
crossdrain				
underdrain				
downdrain				
storm drain system / storm sewer pipes				
special drainage structures (energy dissipaters, filters, flow restrictors, etc.)				
ditches				
catch basins				
junction boxes				
manholes				
water lines (removal)				
shafts				
swales				

60 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **UTILITIES**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Electricity / power lines / power poles				
Wire conduits				
Power sources location				
Gas				
Cable				
Telephone				
Sewer lines				
Utility conflicts				

60 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **ENVIRONMENTAL MITIGATION**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Planting / wetland planting and re-vegetation				
Seeding / fertilization				
Trees / shrubs removal				
Sandbag diversion dams				
Hazardous waste cleanup				
Pollution control				
Groundwater contamination				
Dust control				

60 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **LANDSCAPING**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Irrigation system				
Planting (seeding, fertilizing)				
Plant establishment period				
Fencing				

60 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT _____REVIEWER:_____DATE_____

- **TRAFFIC**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Traffic Control/Staging:				
Number of closed lanes				
Night operations				
influence on surrounding streets				
Construction traffic control				
detour roads				
Sequential arrows				
closure (days and hours)				
labor (number of hours)				
Design:				
Delineation (pavement markings, guideposts, barrier delineation, raised pavement markers, impact attenuator markings)				
intersections				
interchanges				
auxiliary lanes				
signalization				
signage				
Detection systems				
safety items (crash cushions)				
Barriers, guardrails				
work zones				
Illumination and lighting				
ramp meters				
transitions				
Climbing lanes (for slow vehicles)				
special shoulder designs				
bicycle paths				
HOV lanes				

60 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **STRUCTURES**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Site data report				
Timber structures				
Bridges:				
concrete mix / steel				
bearings				
girder				
foundation				
expansion joints				
piles / columns				
reinforcement				
bridge railing				
Walls/retaining walls:				
material (concrete mix)				
live poles between wall layers				
foundation				
panels				
reinforcement				
panels/stem panels				
Appurtenant structures:				
pedestrian				
animal (habitat for fish, animal passage, etc.)				
Tunnel:				
mud slab/waterproofing				
roof slab				
Pavement method				
Painting				
Waterproofing				
Cribbing				

60 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **CONSTRUCTION**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Access roads				
Construction signs				
Temporary signals / striping / illumination / impact attenuators				
Site preparation				
Construction space				
Field office building location				
Equipment / material				
Construction schedule / sequence				
Survey control staking and monuments				
Construction equipment:				
cranes, derricks				
trucks				
graders				
bulldozers				
excavators				

60 PERCENT CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **MAINTENANCE**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Roadside cleanup				
Drainage cleanup				
Fire protection systems				
Noise Wall Accessibility				
Drainage accessibility:				
to detention/retention ponds				
to downdrains/underdrains				
special drainage features/structures				
Slope accessibility:				
top of cut / toe of fill				
Environmental/maintenance special permit				

- **CONTINGENCIES**

Identified Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
10 percent				

7.5 Conducting the 60 Percent Review

The 60 percent constructability review should follow the structured format described below. The review is to be planned, organized, and conducted by the project engineer in charge of designing the project. A checklist for planning, scheduling, and conducting the review is provided at the end of this section.

Procedures for conducting the 60 percent constructability review:

1. Establish the actual point in the project development phase at which approximately 60 percent of the design will be completed. This point should follow completion of all of the documentation required for the review listed in Section 7.3.

2. Set a date for the review meeting. Check the master schedule of reviews to verify that another review meeting is not planned on the date chosen. If the project is being designed by a consultant coordinate the meeting date with the consultant.

3. Select a location for the review meeting that is convenient for all expected representatives. If the project is being designed by a consultant coordinate the meeting location with the consultant.

4. Develop an agenda for each segment of the review meeting (segments may be a numbered checklist item or categories of proposed work and/or functions involved). The agenda should include all pertinent issues to be discussed and design features and details to be reviewed. The agenda should be timed to allow for completing the meeting in one day.

5. Determine and schedule in the agenda the major disciplines involved in the project that are being requested to be present during the entire review meeting. Schedule other minor disciplines involved in the project to be present as needed to cover the agenda items. Construction and Maintenance should be represented at all reviews. The Bridge representative should be viewed as a very important member of the Review Team, and should be included in any discussion where structures are or may be involved. Schedule outside consultants involved in the project to be present during the meeting as needed.

6. Accumulate and organize, or make available to each review team member, all pertinent documentation related to the project that might be needed for reference during the review meeting.

7. Send out the plans, checklist, documents, and meeting agenda, a minimum of two weeks in advance of the review meeting. Ensure that all disciplines scheduled to be involved in the review have reviewed the applicable

documents and plans, independently field reviewed the project site, reviewed the proposed agenda, and completed the applicable 60 percent review checklists before the scheduled meeting date.

8. Conducting the 60 percent review meeting:

   a.) Record the meeting either by a designated note keeper or by video or tape recorder. At a minimum, all decisions and agreements, along with all directions and scheduling, should be documented. It might be beneficial if all issues and corresponding actions were written on a display board so that decisions were unambiguous. Individuals should be made clearly responsible for addressing any unresolved issues. Establish a date to receive revised, missing, or corrected data, plans, and documents. Discuss and resolve maintaining the project schedule.

   b.) Conduct the review meeting in accordance with the agenda, allowing adequate time for questions, explanations, and discussions regarding any pertinent item or issue that could impact schedules, costs, scope of work, biddability, buildability, and maintainability. Include time to reflect back on previous decisions and determine whether the project is on track with respect to scope, schedule, and cost. It is critical that the meeting be controlled for timing, completeness, and resolution of any issue raised or problem identified. It is important to periodically remind all attendees that the goal is to complete the meeting in one day.

   c.) At the conclusion of the meeting, an approximate date for the Final constructability review should be discussed and agreed upon by the review team.

9. Develop, or designate an individual present at the meeting to develop, a brief report outlining the review results and documenting the directions discussed and agreed to for the phase of the project design development.

10. If any unresolved issues remained at the conclusion of the review meeting, and an impasse occurred, implement the Appeal and Resolution process.

11. Provide a summary of the review to the WSDOT regional staff member at the Project Development Management level who is in charge of overseeing constructability reviews. The summary should include any issues related to the constructability review process, including positive and negative feedback from the review participants, that would allow for periodic monitoring of the review process so that future improvements can be made. Copies of the report should be circulated to the CRP team members and a copy placed in the project design files.

The following checklist is used by the project engineer for scheduling and planning the 60 Percent constructability review. This checklist is used to determine the date that the review will be held, the location of the review meeting, and establishing the meeting agenda. In addition, this checklist is used by the project engineer to assign action items to appropriate design team members, what needs to be accomplished, when the item must be completed by, and, if relevant, where the work is to be performed.

60 PERCENT CONSTRUCTABILITY REVIEW MEETING PLANNING CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **60 PERCENT REVIEW PLANNING ITEMS**

Item	Action/who, what, when, where
60 Percent point in project PS&E development	
Scheduled date for review meeting:	
Location for review meeting:	
Review meeting agenda developed	
60 Percent checklists/meeting agenda sent to each function/discipline	

- **60 PERCENT REVIEW TEAM**

Function	Representative	Involved	Not Involved	Date Contacted
Management				
Design				
Construction				
Maintenance				
Environmental				
Traffic Design				
Traffic Operations				
Bridge				
Geotechnical				
Hydraulics				
Plans Review				
Right of Way				
Utilities				
Other				

60 PERCENT CONSTRUCTABILITY REVIEW MEETING PLANNING CHECKLIST

- **DOCUMENTATION REQUIRED FOR 60 PERCENT REVIEW**

Document	Action/who, what, when, where
Value Engineering study	
Geotechnical/Soils report	
Bridge Layout Plans	
Schedule	
Costs	
preliminary quantities	
Draft Traffic control/staging/detour plan	
Construction Hours of Operation determined	
Approved Hydraulics Report	
PS&E level drainage plans/profiles	
preliminary quantities estimated	
Environmental re-evaluation	
Status report of R/W acquisitions	
Finalized roadway sections and profiles	
Geometric layout	
Intersections	
Interchanges	
Earthwork and grading plan	
Permit requirements and/or commitments to meet permit requirements and related schedules	
Commitments provided by permitting agencies	
Design modifications and/or variations from preceding reviews:	
Project Definition Report review	
0% and 30% review	
Alternatives recommended to meet the approved schedule, scope of work, and budget	

- **CONDUCTING THE 60 PERCENT REVIEW**

Item	Action/who, what, when, where
Process developed for recording the meeting	
All agenda items reviewed	
Date for the Final review established	
Report of review results developed	
Appeals and Resolution process implemented for all unresolved items on which an impasse occurred	
Summary report given to WSDOT Project Development Management	

60 PERCENT CONSTRUCTABILITY REVIEW MEETING PLANNING CHECKLIST

- **REVIEW NOTES:**

8

FINAL CONSTRUCTABILITY REVIEW DESCRIPTION AND PROCEDURES

8.1 Review Objective

The main objective of the Final constructability review is to review the contract plans and special provisions as the project design stage is being completed and the project is being made ready to advertise for construction. The Final review of the contract plans should coincide with approximately the 90% completion point in the PS&E stage. The purpose of the Final review is to review the contract documents prior to going to advertisement and should not be used as an opportunity to complete the final project designs. It is anticipated and assumed that all major decisions have been met and that the proposed PS&E for the project has been completed and meets the respective programmed item in the Department's Multi-year Program. Only minor details, omissions, or design problems not previously addressed should materialize or be identified at this review. If the review is successful, no further check should be needed after this review. If there are no other changes or revisions to be made, the final plans, specifications, and estimate should be sent to Olympia for completion of contract plans and documents, and advertising of the project for construction.

8.2 Final Review Team

The Final constructability review is to be performed by a review team composed of those designers, reviewers, and managers most familiar with the project. It is desirable to include those who have been involved in prior reviews on the specific project. Each team member should be able and authorized to make immediate recommendations and decisions regarding items addressed, questioned, or directed during the review. The project engineer for the project will be the team leader and is responsible for coordinating the schedule and location for the review meeting with the other team members. The team should include representatives from the following departments as applicable to the specific project:

- Project Development
- Program Management
- TransAid
- Design
- Construction Management and staff
- Maintenance Management and staff
- Environmental
- Traffic Design
- Traffic Operations
- Bridge/Structures
- Geotechnical
- Hydraulics/Drainage
- Utilities

- Right of Way
- Plans Review
- any other function pertinent to the review of outstanding issues or concerns that need to be addressed to complete the PS&E

8.3 Final Review Documentation

In order to conduct the Final constructability review, the following project documentation is required:

- Completed Traffic plans
- Completed Bridge plans
- Completion of plans, specifications, and estimate
- Permit conditions received: Environmental, Construction, Local Agencies
- Right of Way certification date established
- List of any design modifications and/or variations resulting from the 60 percent, 30 percent, and Project Definition Report constructability reviews
- List of any alternatives recommended that would be required to meet the approved schedule, scope, and budget for the project

8.4 Final Constructability Checklists

The following checklist is used for the Final constructability review. The relevant portions of this checklist are submitted to the appropriate CRP team member by the project engineer of design prior to the review meeting. The project engineer is responsible for providing enough time for the team members to complete their portions of the checklist and review the pertinent documents before arriving at the meeting.

Each CRP team member should assess their portion of the checklist for relevance to the project, actions that are required to complete each item, and whether that item will negatively impact the project scope, schedule, or cost. The review team member is responsible for, independently field reviewing the project site, bringing the completed checklist to the review meeting and discussing the pertinent items of concern.

FINAL CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____ REVIEWER:_____DATE_____

- **PUBLIC INVOLVEMENT**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Community Meeting scheduled				
Public Involvement Newsletter/flyers				

- **PERMITS**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Utilities agreements				
Detour/Haul Agreements				
Participatory Agreements				
Environmental permits:				
U.S. Corps of Engineers (section 10 and section 404)				
Hydraulic Project Approval (WS Dept. of Fish and Wildlife)				
U.S. Coast Guard				
U.S. Forest Service				
Federal Aviation Administration				
Wash. State Dept. of Natural Resources				
Wash. State Dept. of Ecology				
sensitive area ordinance/public agency utility exemption (SAO/PAUE)				
grading/clearing				
noise variance				
temporary erosion and sedimentation control plan				
temporary water quality modification				
national pollution discharge elimination system permit application (NPDES)				
storm water site plan				
Other Agreements				

FINAL CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **GEOTECHNICAL / EARTHWORK**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Structure excavation				
Fill				
Stockpiling / storage / dumpsites				
Materials usage / salvage				
Stabilization				
Site conditions (topography, profiles, etc.)				
Boring / drilling				
Soil compaction				
Clearing / grubbing / roadside cleanup				
Removal of structures and obstructions				
Earthwork haul				
Slope treatment				
Subgrade preparation				
Watering				
Ditch and channel excavation				
Trimming and cleanup				

FINAL CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____ REVIEWER:_____DATE_____

- **ROADWAY SURFACE**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Pavement (cement concrete, asphalt concrete, bitumen)				
Base and subbase				
Sidewalk				
Curb				
Shoulders / shoulder repair				
Sawcutting				
Slopes				
Lanes (narrow lane widths must match roadway sections)				
Stationing (road, paving, striping, etc.)				
Pavement method				

FINAL CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **RIGHT OF WAY / ACCESS CONTROL**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Existing/proposed right of way limits				
Appraisal				
Transaction				
Acquisition				
Condemnation				
Relocation				
Cattle passes				
Pit, stockpile, and waste sites (haul road, detour routes)				
Utility				
Railroad				
International boundaries				
Easement/construction permits				
Programming for funds				
Access control				
Access report/access hearing plans				
Monuments (alignment, property corner)				
Fencing				
At the Project Definition stage:				
right of way estimate				
purchase cost				
relocation assistance benefits payments				
other land management staff expenses (acquisition services, relocation services, interim property management services)				

FINAL CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **DRAINAGE**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Water quality				
Surface drainage				
Groundwater problems				
Structures drainage:				
retaining walls				
bridges				
Roadway drainage:				
dewatering systems				
irrigation systems				
sewers				
detention ponds				
retention ponds				
temporary sediment ponds				
jacked pipes				
culverts				
crossdrain				
underdrain				
downdrain				
Storm drain system / storm sewer pipes				
special drainage structures (energy dissipaters, filters, flow restrictors, etc.)				
ditches				
catch basins				
junction boxes				
manholes				
water lines (removal)				
shafts				
swales				

FINAL CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **UTILITIES**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Electricity / power lines / power poles				
Wire conduits				
Power sources location				
Gas				
Cable				
Telephone				
Sewer lines				
Utility conflicts				

FINAL CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **ENVIRONMENTAL MITIGATION**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Planting / wetland planting and re-vegetation				
Seeding / fertilization				
Trees / shrubs removal				
Sandbag diversion dams				
Hazardous waste cleanup				
Pollution control				
Groundwater contamination				
Dust control				

FINAL CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **LANDSCAPING**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Irrigation system				
Planting (seeding, fertilizing)				
Plant establishment period				
Fencing				

FINAL CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **TRAFFIC**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Traffic Control/Staging:				
number of closed lanes				
night operations				
Influence on surrounding streets				
construction traffic control				
detour roads				
sequential arrows				
closure (days and hours)				
labor (number of hours)				
Design:				
Delineation (pavement markings, guideposts, barrier delineation, raised pavement markers, impact attenuator markings)				
intersections				
interchanges				
auxiliary lanes				
signalization				
signage				
detection systems				
safety items (crash cushions)				
barriers, guardrails				
work zones				
illumination and lighting				
ramp meters				
transitions				
climbing lanes (for slow vehicles)				
special shoulder designs				
bicycle paths				
HOV lanes				

FINAL CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **STRUCTURES**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Site data report				
Timber structures				
Bridges:				
concrete mix / steel				
bearings				
girder				
foundation				
expansion joints				
piles / columns				
reinforcement				
bridge railing				
Walls/retaining walls:				
material (concrete mix)				
live poles between wall layers				
foundation				
panels				
reinforcement				
panels/stem panels				
Appurtenant structures:				
pedestrian				
animal (habitat for fish, animal passage, etc.)				
Tunnel:				
mud slab/waterproofing				
roof slab				
Pavement method				
Painting				
Waterproofing				
Cribbing				

FINAL CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____REVIEWER:_____DATE_____

- **CONTRACT/BID DOCUMENTS**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
consistency between/within documents				
consistency of presentation				
Organization of plans				
Completed Special Provisions				

- **CONSTRUCTION**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Access roads				
Construction signs				
Temporary signals / striping / illumination / impact attenuators				
Site preparation				
Construction space				
Field office building location				
Equipment / material				
Construction schedule / sequence				
Survey control staking and monuments				
Construction equipment:				
cranes, derricks				
trucks				
graders				
bulldozers				
excavators				

FINAL CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT#_____REVIEWER:_____DATE_____

- **MAINTENANCE**

Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
Roadside cleanup				
Drainage cleanup				
Fire protection systems				
Noise Wall Accessibility				
Drainage accessibility:				
to detention/retention ponds				
to downdrains/underdrains				
special drainage features/structures				
Slope accessibility:				
top of cut / toe of fill				
Environmental/maintenance special permit				

- **CONTINGENCIES**

Identified Item	Action/who, what, when, where	Impacts		
		Scope	Sched	Cost
5 percent				

FINAL CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT #_____ REVIEWER:_____DATE_____

Item No.	Item	Check (Y/N)	Action
1	PLANS		
1.1	*Completeness*		
1.1.1	All originals provided with the PS&E submittal		
1.1.2	All original plan sheets signed		
1.1.3	Required information complete:		
a	Typical layouts		
b	typical sections		
c	profiles, grade lines, superelevations		
d	contour grades, topo, original ground elevations		
e	summary of quantities, stationing		
f	Construction details		
g	Construction area signing		
h	drainage profiles		
i	Earthwork		
j	Structural details		
k	Quantity and unit designations		
l	utilities		
m	Illumination		
n	traffic signal systems		
o	final pay designations		
p	other		
1.2	*Accuracy and clarity*		
1.2.1	Clarity of plans in general (readable)		
1.2.2	Limits of work		
1.2.3	Details		
1.2.4	Terminology, abbreviations, symbols (legends on drawings)		
1.2.5	Summary of quantities (exactitude and appropriateness)		
1.2.6	Cross references		
1.2.7	Final pay designations		
1.2.8	Other		

FINAL CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT#_____REVIEWER:_____DATE_____

Item No.	Item	Check (Y/N)	Action
1	PLANS (cont.)		
1.3	*Conformance to policy*		
1.3.1	Drafting and plans manual followed		
1.3.2	High and low risk policy		
1.3.3	Use standard plans		
1.3.4	Final pay items		
1.3.5	Traffic control		
1.3.6	Trade names		
1.3.7	Required local agency plans		
1.3.8	Other		

Item No.	Item	Check (Y/N)	Action
2	SPECIFICATIONS		
2.1	*Completeness*		
2.1.1	All items of work covered		
2.1.2	Order of work		
2.1.3	Method of payment included for each item of work		
2.1.4	Obstructions included		
2.1.5	Cooperation included		
2.1.6	Railroad requirements included		
2.1.7	Special conditions covered		
2.1.8	State furnished materials complete		
2.1.9	Method of measurements explained		
2.1.10	All documents provide (soils, borings report)		
2.1.11	Other		
2.2	*Accuracy and clarity*		
2.2.1	Accepted terms and abbreviations well used or correct		
2.2.2	Conflicting or ambiguous requirements solved		
2.2.3	Structures requirements properly integrated		
2.2.4	Materials needed known (concrete)		
2.2.5	Stationing correct		
2.2.6	Order of work		
2.2.7	Other		

FINAL CONSTRUCTABILITY REVIEW CHECKLIST

PROJECT:_____
PROJECT#_____REVIEWER:_____DATE_____

Item No.	Item	Check (Y/N)	Action
2	SPECIFICATIONS (cont.)		
2.3	*Conformance to policy*		
2.3.1	Specific Special Provisions edited correctly		
2.3.2	Standard specifications reworded or repeated		
2.3.3	Specific Special Provisions instructions followed		
2.3.4	Standard format and style used		
2.3.5	Required local agencies specs included (fills in, permits)		
2.3.6	Standard pay clauses used		
2.3.7	Special construction procedures		
2.3.8	Other		
2.4	*Specific Special Provisions*		
2.4.1	Material		
2.4.2	Combining structures		
2.4.3	Order of work		
2.4.4	Maintenance of traffic		
2.4.5	Traffic control		
2.4.6	Pavement (PCC, AC)		
2.4.7	Existing highway facility		

Item No.	Item	Check (Y/N)	Action
3	ESTIMATES		
3.1	*Completeness*		
3.1.1	All pay items of work covered		
3.1.2	Specialty items included		
3.1.3	Supplemental work complete		
3.1.4	State furnished materials and expenses complete		
3.1.5	Structures items included		
3.2	*Accuracy and clarity*		
3.2.1	Correct item code numbers and descriptions		
3.2.2	Use of standard units of measure		
3.2.3	One-time items (specialty items) in correct order		
3.2.4	Correct quantities		
3.2.5	Reasonable prices		
3.3	*Conformance to policy*		
3.3.1	Rounding of quantities correct		
3.3.2	Decimal quantities correct		
3.3.3	Other		

8.5 Conducting the Final Review

The Final constructability review should follow the structured format described below. The review is to be planned, organized, and conducted by the project engineer in charge of designing the project. A checklist for planning, scheduling, and conducting the review is provided at the end of this section.

Procedures for conducting the Final constructability review:

1. Establish the actual point in the project development phase at which approximately 90 percent of the PS&E will be completed. This point should follow completion of all of the documentation required for the review listed in Section 8.3.

2. Set a date for the review meeting. Check the master schedule of reviews to verify that another review meeting is not planned on the date chosen. If the project is being designed by a consultant coordinate the meeting date with the consultant.

3. Select a location for the review meeting that is convenient for all expected representatives. If the project is being designed by a consultant coordinate the meeting location with the consultant.

4. Develop an agenda for each segment of the review meeting (segments may be a numbered item in the checklist or categories of proposed work and/or functions involved). The agenda should include all pertinent issues to be discussed and design features and details to be reviewed. The agenda should be timed to allow for completing the meeting in one day.

5. Determine and schedule in the agenda the major disciplines involved in the project that are being requested to be present during the entire review meeting. Schedule other minor disciplines involved in the project to be present as needed to cover the agenda items. Construction and Maintenance should be represented at all reviews. The Bridge representative should be viewed as a very important member of the review team, and should be included in any discussion where structures are or may be involved. Schedule outside consultants involved in the project to be present during the meeting as needed.

6. Accumulate and organize, or make available to each review team member, all pertinent documentation related to the project that might be needed for reference during the review meeting.

7. Send out the plans, checklist, documents, and agenda, a minimum of two weeks in advance of the review meeting. Ensure that all disciplines scheduled to be involved in the review have reviewed the applicable

documents and plans, independently field reviewed the project site, reviewed the proposed meeting agenda, and completed the applicable Final review checklists before the scheduled review date.

8. Conducting the Final review meeting:

   a.) Record the meeting either by a designated note keeper or by video or tape recorder. At a minimum, all decisions and agreements, along with all directions and scheduling, should be documented. It might be beneficial if all issues and corresponding actions were written on a display board so that decisions were unambiguous. Individuals should be made clearly responsible for addressing any unresolved issues. Establish a date to receive revised, missing, or corrected data, plans, and documents. Discuss and resolve maintaining the project schedule.

   b.) Conduct the review meeting in accordance with the agenda, allowing adequate time for questions, explanations, and discussions regarding any pertinent item or issue that could impact schedules, costs, scope of work, biddability, buildability, and maintainability. Include time to reflect back on previous decisions and determine whether the project is on track with respect to scope, schedule, and cost. It is critical that the meeting be controlled for timing, completeness, and resolution of any issue raised or problem identified. It is important to periodically remind all attendees that the goal is to complete the meeting in one day.

9. Develop, or designate an individual present at the review meeting to develop, a brief report outlining the review results and documenting the directions discussed and agreed to for the phase of the project design development.

10. If any unresolved issues remained at the conclusion of the review meeting, and an impasse occurred, implement the Appeal and Resolution process.

11. Provide a summary of the review to the WSDOT regional staff member at the Project Development Management level who is in charge of overseeing constructability reviews. The summary should include any issues related to the constructability review process, including positive and negative feedback from the review participants, which would allow for periodic monitoring of the review process so that future improvements can be made. Copies of the report should be circulated to the CRP team members and a copy placed in the project design files.

The following checklist is used by the project engineer for scheduling and planning the Final constructability review. This checklist is used to determine the date that the review will be

held, the location of the review meeting, and establishing the meeting agenda. In addition, this checklist is used by the project engineer to assign action items to appropriate design team members, what needs to be accomplished, when the item must be completed by, and, if relevant, where the work is to be performed.

FINAL CONSTRUCTABILITY REVIEW MEETING
PLANNING CHECKLIST

PROJECT:_____
PROJECT#_____REVIEWER:_____DATE_____

- **FINAL REVIEW PLANNING ITEMS**

Item	Action/who, what, when, where
Final point in project PS&E development	
Scheduled date for review meeting:	
Location for review meeting:	
Review meeting agenda developed	
Final checklists/meeting agenda/ Project Documentation sent to each function/discipline	

- **FINAL REVIEW TEAM**

Function	Representative	Involved	Not Involved	Date Contacted
Management				
TransAid				
Design				
Construction				
Maintenance				
Environmental				
Traffic Design				
Traffic Operations				
Bridge				
Geotechnical				
Hydraulics				
Plans Review				
Right of Way				
Utilities				
Other				

FINAL CONSTRUCTABILITY REVIEW MEETING
PLANNING CHECKLIST

PROJECT:_____
PROJECT#_____REVIEWER:_____DATE_____

- **DOCUMENTATION REQUIRED FOR FINAL REVIEW**

Document	Action/who, what, when, where
Completed Traffic plans	
Utility relocations complete	
Completed Bridge plans	
Completed plans, specifications, and estimates	
Environmental Permits received	
Local Agency agreements received	
Right of Way certification date	
Design modifications and/or variations from preceding reviews:	
PDR review and/or 0% review	
30% review	
60% review	
Alternatives recommended to meet the approved schedule, scope of work, and budget	
Other	

- **CONDUCTING THE FINAL REVIEW**

Item	Action/who, what, when, where
Process developed for recording the meeting	
All agenda items reviewed	
Report of review results developed	
Appeals and Resolution process implemented for all unresolved items on which an impasse occurred	
Summary report given to WSDOT Project Development Management	

FINAL CONSTRUCTABILITY REVIEW MEETING PLANNING CHECKLIST

PROJECT:_____
PROJECT#_____REVIEWER:_____DATE_____

- **REVIEW NOTES:**

9

APPEALS RESOLUTION PROCESS

9.1 Purpose of the Resolution Process

The purpose of the resolution process is to elevate unresolved CRP review issues to an appropriate level for final settlement. The resolution process is primarily needed to expedite the resolution of the outstanding issue and keep the project on track. In addition, the resolution process is needed to apprise the Management team of conflicting issues that are potentially relevant on a statewide basis.

9.2 Description of the Appeals Resolution Process

Assuming that some items or issues might remain unresolved at the conclusion of a review meeting, an appeal describing them would be prepared by the team leader and submitted to the Region Arbitration Committee for a decision. The Region Arbitration Committee is comprised of the Assistant Administrators for Project Development, Construction, Traffic, Maintenance, and, if a bridge issue is involved, an appropriate level of Bridge Management.

The Appeals Report should describe the issue, impacts to the project (scope, scheduling, cost), and why an impasse has been reached. The report is then used by the Region Arbitration Committee to resolve the issue. Issues that are Statewide in nature or that cannot be resolved at the Regional level should be forwarded to Olympia for final resolution. The transmittal letter to Olympia should include any recommendations or concerns identified by the Region Arbitration Committee. If resolution still could not be attained, the issue should be submitted to the State Design Engineer, who would promptly process the resolution.

10

CHECKLIST REVIEW AND UPDATING

10.1 Checklist Review

Each constructability review involves the completion of two checklists. The first checklist, prepared by the project engineer, is used to plan and schedule the review meeting. The second checklist focuses on constructability issues related to the project. The constructability checklist is circulated to all pertinent functions prior to the review. Personnel completing the checklist in preparation for the review should document their findings regarding the relevance and appropriateness of the checklist items. A discussion regarding the applicability of the constructability checklist should occur during the review meeting. The discussion should include positive and negative feedback and allow for future improvements to be made to the process. The comments received during the meeting should be included in the constructability review meeting report.

10.2 Checklist Updating

The constructability review meeting report should be forwarded to the WSDOT regional staff member in charge of overseeing the constructability review. The person receiving the report should compile the positive and negative feedback regarding the checklists. Appropriate comments should be forwarded to the State Design Office in Olympia. The State Design Office is responsible for determining which revisions are applicable, on a statewide basis, and update the Design Manual accordingly. The State Design Engineer should also determine the frequency with which the checklists are updated.

11

RECORDING LESSONS LEARNED

11.1 Purpose of Recording Lessons Learned

The CRP process requires that records be kept of lessons learned during all project phases. The primary purpose of recording lessons learned is to avoid implementing new decisions that are inconsistent with the reasoning on which previous decisions were based. Records of lessons learned will provide two benefits:

1. They will form a history of the project, so that any member of the design/construction team can access the rationale underlying an earlier step in the design.

2. The lessons learned can be used to guide future projects.

In addition, there needs to be a correlation between lessons learned during the design process and the contract change order findings. This correlation is necessary in order to establish whether the change order was a constructability issue resulting from design error. These types of change orders can then be targeted for corrective action in the design process.

Finally, the record of lessons learned will provide for continuous plan quality improvements once the CRP process is established. Continuous plan quality improvements must be an ongoing process and continue after the original CRP target goals are met.

11.2 Format of Recording Lessons Learned

The record of lessons learned should be stored in an electronic database that is updated regularly, as the project develops. In addition to being used to guide other projects in the future, a database of lessons learned could serve as an expert system to help train new staff. The usefulness of the system would depend greatly on its accessibility. Having the lessons shared on the network would allow users from various disciplines to refer to them at any time.

The database should be indexed by function, location, level of detail, or other elements. In addition, the lessons learned should be keyed to the stage of project development that the learning process occurred.

Paper storage is not recommended for recording lessons learned. The CRP study effort has shown that updating the file is seldom performed in a timely manner. In addition, access to the information is not easy and seldom arrives at the engineer's desk at the appropriate time.

11.3 Lessons Learned Documents

The lessons learned documents should provide a historic record of the project and serve as a tool to avoid similar problems on future projects. Also, the database could help participants identify which functions are having problems so that actions could be taken to improve their status. Information concerning design, permit regulations, right-of-way, environmental, construction and other experiences should form the "historic" database of lessons learned. The database should include text, plans, maps, and any other relevant documentation.

The record of lessons learned should include the stage of development where the lesson occurred, what triggered the learning process, and what project changes were implemented due to that learning process. These lessons should be cross referenced to pertinent constructability review reports, appeals and resolutions reports, contract change orders, or other project documents.

Lastly, the final constructability review should be used as an opportunity for reviewing and completing the lessons learned during the design process. A post-construction evaluation should be performed to provide similar opportunities for wrapping up lessons learned during construction.

12

MONITORING CRP RESULTS

A critical element of the CRP is monitoring for success. This will entail the establishment of benchmarks and performance goals. These measures of effectiveness need to be monitored to determine whether the plan quality improvement targets are being met. Monitoring should also serve to inform the management team when goals are reached and new goals are needed. As quality improvements are made, new targets should be developed, new benchmarks considered, and a continuous quality improvement (CQI) process should be implemented. Some of the fundamental purposes of benchmarking and goal setting are as follows.

1. Goal setting and performance monitoring is necessary to the success of Continuous Quality Improvement (CQI)
   a. Meet the needs of the customer (Construction Offices, Maintenance & Contractors)
   b. Method of measurement is needed to determine whether plan quality is met
   c. Method of measuring the CRP process
2. Uniform expectations are needed in order to have a shared vision
3. To continually enhance WSDOT Plan Quality

12.1 CRP Benchmarks

Benchmarking is a measure of effectiveness and expected performance. The purpose of benchmarking is to find the "reasonably high expectation levels" and strive to surpass those attributes. WSDOT should consider both external and internal benchmarking. External benchmarking can be done by identifying the best private sector corporations that develop civil engineering style plans and then working towards those quality plans. Internal benchmarking can be done by identifying the best organizational division, without regard to function, and then working towards those attributes.

In order to choose the type of benchmarking to perform, WSDOT needs to select a benchmarking team. This team should be from six to eight members in size and cross functional in nature. The members should include; internal customers, suppliers to the process, senior staff that will benefit from the improvements the most, and employees that will have to make the changes. Other benchmarking team members could include Olympia Service Center personnel and Associated General Contractor's agents.

The purpose of the team is to determine who to benchmark against and how to benchmark for constructability issues. This type of information can be determined by performing customer surveys. In addition to employees, the customer surveys could include contractors involved in bidding and constructing of WSDOT contract plans.

12.2 Performance Goals

In order to determine whether the CRP constructability review process is successful, target goals must be established. The goals are an essential feature to assure that successful CRP performance is achieved. The benchmarks and performance goals should be used as a management monitoring and measurement program for the CRP. The benchmarks and performance goals must be consistent with management practices for the Project Development and Construction programs.

The following benchmarks and performance goals are proposed "Critical Success Factors" for the CRP.

A. Contract Addenda:
   Establish June 1999 as a target for reducing the number of project addenda statewide to zero. An exception procedure and prior approval requirement would be in place for "acceptable" addenda after June 1999.
B. Contract Change Orders (CCO's):
   1. By June 1999, reduce the sum of all CCO cost increases to less than 5% over the original contract bid amount for all projects.
   2. By June 1999, reduce the total number of CCO's processed annually statewide to 50% of the total number processed in 1995.
   3. By June 1999, reduce the annual statewide cost of Construction and Project Development staff resources spent processing CCO's to less than 5% of the total staff resources allocated to Construction field staff.
C. Advertisement Dates:
   Eliminate advertisement date slides due to constructability issues.
D. Project Scope:
   Maintain the original scope of the project, during the life of the project.
E. Project Schedule:
   Ensure that the project schedule is tracked and milestone dates are met.
F. Project Budget:
   Keep the final construction cost within the initial project estimate.

12.3 Monitoring CRP for Effectiveness

Once the benchmarks and performance goals have been established, they will need to be monitored for success. Monitoring for success will require that a means of achieving the goals is put in place. Achieving the goals necessitates setting an official start date, intermediate milestone dates, and a final goal attainment date.

Meeting the performance goals and monitoring for success will require employee development in an official training program. While a recommended training plan is better defined under a separate document (WSDOT Constructability Review Training Plan), some of the key training elements include instructing pertinent personnel on performing effective meeting and constructability reviews.

Monitoring for success could take on many forms. The recommended monitoring strategy includes:

1. Electronic tracking of CCO's and addenda
2. Tracking advertisement dates for slides due to constructability issues
3. Tracking progress against benchmarks
4. Establish a priority system, by project type, that identifies the level of importance of the advertisement date. In some cases maintaining the advertisement date and putting out addenda or revising by CCO may be preferred. In other cases, sliding the advertisement date may be preferable to generating addenda or CCO's. However, these cases should not be related to constructability issues.
5. Adequately identifying the project scope at project inception and continually monitoring to ensure that the scope does not change during the project life.
6. Monitoring the schedule and budget and tracking actual dates and expenditures against planned dates and budgets.

Monitoring for success will require that a means of achieving the goals is put in place. Achieving the goals necessitates setting an official start date, intermediate milestone dates, and a final goal attainment date.

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