

## DB Section 155 - Design Management and Design Quality Management

### DB155.01 General and Design-Builder Responsibilities –

**(a) General** - Per **DB General Provisions**, Section 154, Design-Builder shall develop and implement a Quality Program for all phases of the Work. Design-Builder, through its Quality Plan, shall be responsible to assure the quality of Work, both design and construction, complies with the requirements and standards set forth in the Contract, including the workmanship and products of Subcontractors, fabricators, suppliers, and vendors both on-site and off-site. Agency reserves the right to conduct verification oversight Inspections, audits, sampling and testing, and Independent Assurance.

**(b) Design-Builder Responsibilities** - It shall be Design-Builder's sole responsibility to provide Plans, Working Plans, and **Design-Builder Specifications** of such a nature to deliver the finished construction Work in accordance with all Contract requirements. Neither Agency's Review and Comment pertaining to design documents nor its Acceptance of Definitive Design or Readiness-for-Construction Plans and Specifications shall relieve Design-Builder of that responsibility.

Design-Builder shall not begin construction Work until the Readiness-for-Construction Plans and Specifications and Working Plans covering such Work have been Accepted by Agency. Such Plans and Specifications and Working Plans shall not thereafter be amended or altered without the prior approval of Design-Builder's Designer, completion of the necessary Design Review processes set out herein, and Acceptance by Agency.

Design-Builder shall perform each of the following:

- Manage the design and design quality of the Work
- Coordinate with and obtain necessary approvals from Authorities regarding temporary road diversions and detours, shutdowns, temporary traffic diversions, Utility relocations, temporary sidewalk closures, pedestrian detours and all other matters for which authorization may be required
- Ensure that the Designer and Design Manager complete the necessary reviews, evaluations and design checks in accordance with the procedures set out herein, and provide the appropriate documentation and certifications
- Ensure that the Design Quality Manager certifies that quality procedures have been followed in accordance with all Contract requirements

The procedures for the checking of design of permanent components of the Project also apply to design of major temporary components and construction sequences of the Work that affect the permanent components.

References in this Section 155 to performance of Contract obligations by the "Designer," "Design Manager," "Responsible Engineer," "Design Quality Manager," or other designee of Design-Builder shall mean performance by Design-Builder by and through the specified designee.

## **DB155.02 Design-Builder's Design Organization and Functions**

**(a) Location of Design-Builder's Design and Design Quality Personnel** - Design-Builder shall require the Designer to have or establish an office in the Project vicinity and maintain adequate staffing throughout the term of the Contract to enable Design-Builder to meet Baseline Progress Schedule performance deadlines. The Design Manager shall remain in the Project vicinity as necessary to manage the Design Services and thereafter as necessary to manage design support during construction, design changes, and completion of As-Constructed Plans. Each Responsible Engineer shall be in the Project vicinity as necessary to coordinate the Work on the assigned Design Unit and to attend all Design Reviews of the assigned Design Unit. Other design personnel listed in the Design-Build Agreement shall remain in the Project vicinity for the duration of the design of the Project.

The Design Quality Manager shall remain in the Project vicinity throughout the design process, and shall be present as necessary thereafter to manage design quality related to design support during construction, design changes, and completion of As-Constructed Plans.

**(b) Responsible Engineer** - The Designer shall designate and assign a Responsible Engineer for each Design Unit. Each Responsible Engineer shall sign and stamp design reports, Plans, Working Plans, and **Design-Builder Specifications** for the assigned Design Unit.

**(c) Designer** - Design-Builder shall appoint a suitably qualified and experienced Designer to undertake the design of the permanent components and the major temporary components of the Project. The Designer shall determine and certify completeness of design.

**(1) Completeness of Design** - Each of the following must be evaluated by the Designer as a part of his/her certification of completeness of design:

- Effects of all loading requirements
- Dimensions of all elements
- Structural redundancies, where they exist
- Subsoil interaction to support the loads from above
- Effects of seismicity
- Effects of fatigue
- Durability and maintainability requirements
- Details of required Quality Management procedures, monitoring, and controls
- Effects of hydrology, design flows, and scour depths
- All such other analysis as may be necessary

**(d) Design Manager** - Design-Builder shall designate a Design Manager to manage all Work performed by the Designer.

**(1) Design Manager Responsibilities** - The Design Manager shall be responsible for the supervision and quality of all design Work and design processes, including but not limited to each of the following:

- Accuracy
- Adequacy
- Conformance to professional standards of practice
- Compliance with all Legal Requirements and contractually-mandated Standards and other Contract requirements
- Cost effectiveness
- Quality
- Fitness for purpose and function as specified or implied in the Contract

**(2) Scope of Review** - The Design Manager shall, at a minimum, review each of the following:

- Design reports
- Analytical approach
- Drawing details for conformity with all Contract requirements
- **Design-Builder Specifications** for conformity with all Contract requirements
- Contract Baseline Concepts, Definitive Design, Readiness-for-Construction Plans, and Working Plans for conformity with all Contract requirements
- Major temporary components' effect on permanent components
- Field-proposed design changes
- Design approvals for Materials, Equipment, and procedures
- As-Constructed Plans for conformity with Readiness-for-Construction Plans and Specifications and Working Plans

**(e) Design Quality Manager** - Design-Builder shall assign a Design Quality Manager, who shall report to the Project Quality Manager. The Design Quality Manager shall be responsible for independently reviewing Design Documents received from the Design Manager prior to requesting Acceptance from Agency. The Design Quality Manager shall evaluate design development processes and procedures and Design Documents in accordance with the Quality Plan, and shall certify to Design-Builder and to Agency that the design complies with all Contract requirements. The Design Quality Manager shall modify the Quality Plan as necessary to assure that the plan is effective.

**(1) Scope of Design Quality Management Review** - The Design Quality Manager shall have independent quality review and internal Design-Builder acceptance responsibilities for each of the following:

- Design of permanent and major temporary components
- Changes in design of permanent components
- Definitive Design
- Interim Design Documents
- Readiness-for-Construction Plans and Specifications
- Working Plans

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- As-Constructed Plans and Specifications
- Design reports and calculations

The Design Quality Manager shall also:

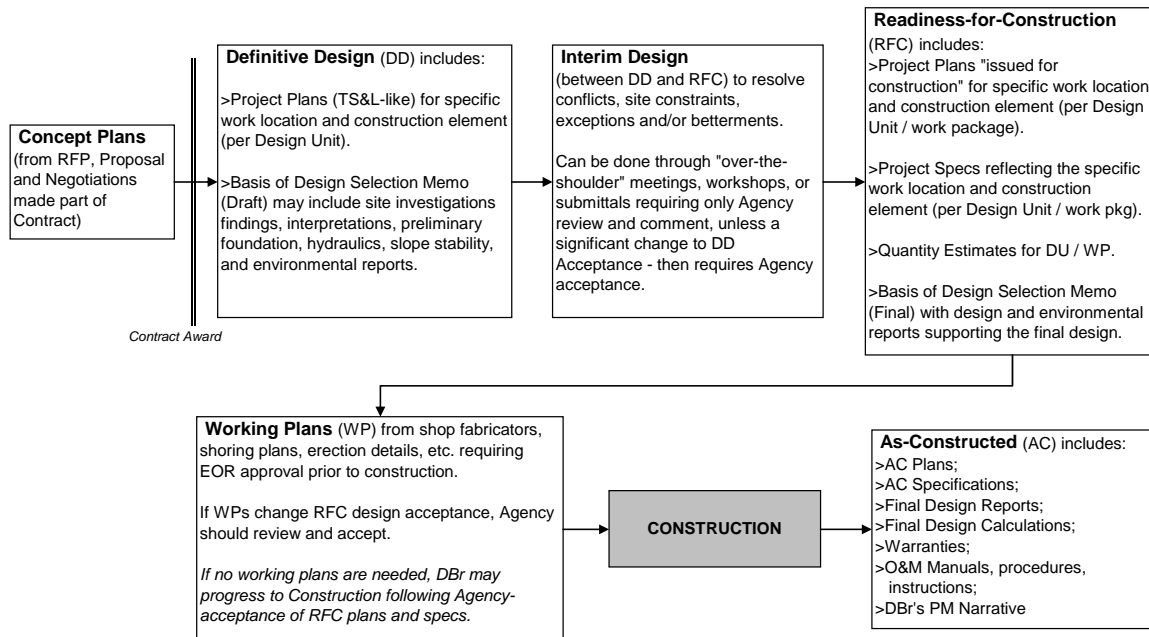
- Identify and report non-conformity/non-compliance
- Track, monitor, and report on status of outstanding design-related non-conformance reports
- Supply monthly Design Quality Management status reports
- Assure presence of and review quality of specified certificates (permanent components and major temporary components)

**(2) Design Quality Manager Certification of Readiness-for-Construction Plans and Specifications** - The Design Quality Manager shall receive from the Design Manager, independently review, and when acceptable, issue a written certification to Agency that each of the following conditions have been met before Readiness-for-Construction Plans and Specifications and Working Plans are released for construction or any construction Work represented therein is commenced:

- Design checks have been completed
- The design conforms to all Legal Requirements and other Contract requirements
- Any Design Exceptions have been approved in writing by Agency
- Design Quality Management procedures have been complied with in accordance with all Contract requirements and the Quality Plan
- All outstanding issues and comments from the Design Review have been resolved

**DB155.03 Design Development Process** – Prior to the commencement of design, Design-Builder shall schedule a design mobilization meeting with Agency PM to finalize the Design Unit breakdown, content, and submittal schedule in support of the Baseline Progress Schedule. The design development process will move from Notice to Proceed to Construction as depicted in Figure 1 below:

**Figure 1**  
**Design Development Process**



**DB155.04 Design Review Plan** - As part of the Quality Plan, Design-Builder shall prepare and submit to Agency PM a written Design Review Plan within 30 Calendar Days of NTP, and prior to the design mobilization meeting, for Review and Comment. The Design Review Plan shall include both the quality responsibilities of the Design Manager and the independent responsibilities of the Design Quality Manager. The Design Review Plan shall describe the level of design completion that the Designer shall accomplish for each of the planned stages of design development, and shall include a description and/or checklist for each Design Unit, clearly identifying the design package that will be reviewed. Statements of percent complete shall not be acceptable. Refer to **DB General Provisions**, Section 141, for delineation by design discipline of the Work Products to be submitted with each design development Milestone (Definitive Design, Readiness-for-Construction, and As-Constructed) for Agency review and Acceptance.

**DB155.05 Stages of Design Development** - Design-Builder shall make a single comprehensive design check and Design Review for each Design Unit at the following five (5) stages of design development:

- Definitive Design
- Interim designs
- Readiness-for-Construction Plans, Specifications, and quantity estimates
- Working Plans
- As-Constructed Plans

The general purpose of each stage of design development and Design Review is to:

- Verify that the design complies with all Contract requirements

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- Allow components of Design Units for which the component Readiness-for-Construction Plans and Specifications have been Accepted to be constructed prior to completion of the complete set of Readiness-for-Construction Plans and Specifications for the entire Design Unit
- In the case of reviews of Working Plans, enable construction to continue

**DB155.06 Design Units** - Design-Builder shall package all Contract Baseline Concepts, Definitive Design, Plans and **Design-Builder Specifications** for the Work into separate Design Units. Design Units shall not exceed individual Work Locations. Within 30 Calendar Days of NTP, and prior to the design mobilization meeting, Design-Builder shall provide to Agency PM a written report identifying each Design Unit and including each of the following:

- Design Unit description, including scope of design Work within each Design Unit, including limits and interface points
- Planned Design Unit review schedule, including specific information to be reviewed and percent complete represented by each review
- Responsible Engineer
- Locations where design Work will be performed

Design-Builder shall submit any proposed revisions in writing to Agency PM concurrent with the Monthly Progress Report.

**DB155.07 Design Exceptions** - All Design Exceptions (as defined in the ODOT *Highway Design Manual*) from specified Standards must be submitted not later than the Definitive Design Review to Agency PM for review and authorization by Agency and FHWA. All requests for Design Exceptions must be submitted with a justification report detailing justifications for retaining a non-standard or substandard feature, or for providing an improvement that does not bring the feature up to Standards. Design Exceptions must be authorized in writing before the relevant Readiness-for-Construction Plans and Specifications for the affected Design Units may be released for construction.

**DB155.08 Revisions to Design** - If the design is amended subsequent to the Definitive Design Review, Design-Builder shall re-check and re-certify the design as an additional Definitive Design Review. Changes to Plans initiated by Design-Builder and already checked by the Designer and certified by the Design Quality Manager shall be subjected to the Design Review process as an entirely new design. Design-Builder shall not be entitled to any increase in Contract Amount or additional Contract Time for the re-check and re-certification except when the amended design results from a Change Order initiated by Agency for reasons other than design non-compliance.

All design changes requiring alteration of Readiness-for-Construction Plans and Specifications subsequent to their release for construction shall undergo all review procedures required in Design-Builder's Quality Plan and herein for original Design Documents, including re-check and re-certification.

**DB155.09 Design Mobilization Meeting** - Within 45 Calendar Days of NTP, Design-Builder shall arrange a design mobilization meeting to familiarize the Designer's personnel and Agency review personnel (and Stakeholders, if invited by Agency) with the Contract Baseline Concepts, issues, status, and review procedures. The agenda shall include

developing agreements regarding time to be allowed for Design Reviews Agency and Design-Builder shall jointly develop the agenda of the meeting and determine how it will be organized (i.e., by Design Unit and engineering discipline). The purpose of the meeting is to make the subsequent Design Reviews more effective and efficient for both Parties.

All agreements, schedules, and understandings reached during the design mobilization meeting shall be documented in writing and signed off on by Design-Builder's Project Manager and Agency PM.

#### **DB155.10 Schedule for Design Checks and Design Reviews**

**(a) Schedule** - Design-Builder shall include the Design Review schedule for all Design Units (including their components and elements) in the Baseline Progress Schedule, which shall be reviewed monthly until the design Work is complete. The Design Review schedule shall indicate all independent Design Reviews required to be performed by the Design Quality Manager prior to Design Reviews with Agency.

**(b) Design Review Notices** - Design-Builder shall give written notice of scheduled Design Reviews to Agency PM at least one (1) week prior to any Design Review, and shall not schedule more than two (2) concurrent Design Reviews.

#### **DB155.11 Design Reviews**

**(a) Meeting Location and Participants** - Design Reviews shall be conducted by the Design Manager. Design Review meetings shall be held in the offices of the Designer or Design-Builder in the Project vicinity. The Design Quality Manager, the Responsible Engineer, and any specialists having significant input into the design or review shall be present. Design-Builder shall notify and invite Agency to participate in all Design Reviews conducted by the Design Manager. Agency may also invite Stakeholders to attend.

**(b) Documentation to be Provided** - Design-Builder shall make available to participants all Design Documents (e.g., drawings, copies of calculations, reports and other information) pertinent to the Design Review, including all prior comments and actions resulting therefrom, as set out herein.

**(c) Design-Builder Action Required** - Design-Builder shall address and attempt to resolve Agency's comments in consultation with Agency. Stakeholder comments, if any, will be forwarded to Design-Builder by Agency and addressed by Design-Builder. Design-Builder shall resolve all comments to Agency's satisfaction and correct all non-conformances and resubmit the document to Agency PM in accordance with the comment resolution procedures stipulated herein.

**(d) Time and Cost Impacts Borne by Design-Builder** - Design-Builder's time and cost impacts of revisions arising from Agency's participation in Design Reviews and Review and Comment, or required due to Design-Builder's non-compliance with Contract requirements, shall be borne by Design-Builder.

**(e) Design-Builder Continuing Responsibility** - Agency's participation in Design Reviews shall not relieve Design-Builder of its responsibility for the satisfactory completion of the Work in accordance with all Contract requirements.

**(f) Stages of Design Review** – Design Reviews shall be conducted for the following:

**(1) Definitive Design Review** - The Definitive Design Review shall be the first Design Review requiring participation of Agency, and is intended to verify that the Contract Baseline Concepts proposed by Design-Builder meet all Contract requirements. The Design Quality Manager shall verify prior to the Definitive Design Review that:

- All Contract requirements applicable to the proposed Contract Baseline Concepts, including all applicable Standards and Legal Requirements, have been identified, and the proposed Contract Baseline Concepts are in compliance
- The Contract Baseline Concepts are substantiated and justified by adequate site investigation and analysis
- Right of Way requirements have been identified
- The proposed Contract Baseline Concepts are constructible
- Required Materials and Equipment are available
- The Contract Baseline Concepts meet all quality requirements, and all required design quality procedures have been followed

**(2) Interim Design Review** - Design development occurring after Definitive Design Acceptance and prior to Readiness-for-Construction submittal may call for Interim Designs to remedy conflicts, account for exceptions, and incorporate betterments. Design-Builder shall notify Agency if Interim Design Reviews are necessary for particular Design Units, and shall schedule the necessary Design Reviews following independent review by the Design Quality Manager, which may be presented at a design workshop or meeting with Agency.

Design-Builder shall also use Interim Design Reviews to verify that the concepts and parameters established and represented by Definitive Design are being followed, and that all Contract requirements continue to be met. Design-Builder shall specifically highlight, check, and bring to the attention of Agency any information differing from or supplemental to that presented at the Definitive Design Review. Significant changes to the Definitive Design will require a re-submittal and Agency review and Acceptance prior to the submittal of the Readiness-for-Construction Plans and Specifications.

**(3) Readiness-for-Construction Design Review** - Design-Builder shall use the Readiness-for-Construction Design Review to verify that the concepts and parameters established and represented by Definitive Design are being followed and that all Contract requirements continue to be met. Design-Builder shall specifically highlight, check, and bring to the attention of Agency any information differing from or supplemental to that presented at the Definitive Design Review. Prior to scheduling the Readiness-for-Construction Design Review with Agency, the Design Quality Manager's independent review shall have been completed.

**(4) Design-Builder Specifications** - Design-Builder shall be responsible for demonstrating that any proposed Specifications meet or exceed the minimum Contract requirements, as determined by Agency in its sole discretion, and are suitable and appropriate to control the Work. Agency will determine, in its sole discretion, if **Design-**

**Builder Specifications** meet all Contract requirements and are otherwise suitable and appropriate.

**(5) Working Plans Design Review** - It shall be solely Design-Builder's responsibility to provide Working Plans of such a nature as to develop a finished Project in accordance with the Readiness-for-Construction Plans and Specifications, and all Contract requirements. Design-Builder shall verify pertinent dimensions in the field prior to conducting a Working Plans Design Review. Design-Builder shall invite Agency to participate in a Review and Comment of Working Plans. Agency may invite Stakeholders to attend reviews of Working Plans. Design-Builder shall check, review, and certify Working Plans as specified herein, prior to their being issued for or used in construction. This includes Designer, Design Manager, and Design Quality Manager reviews, approvals, and certifications. Subsequent modifications must be processed through Design-Builder's design review and approval/certification process and Agency Review and Comment prior to being utilized.

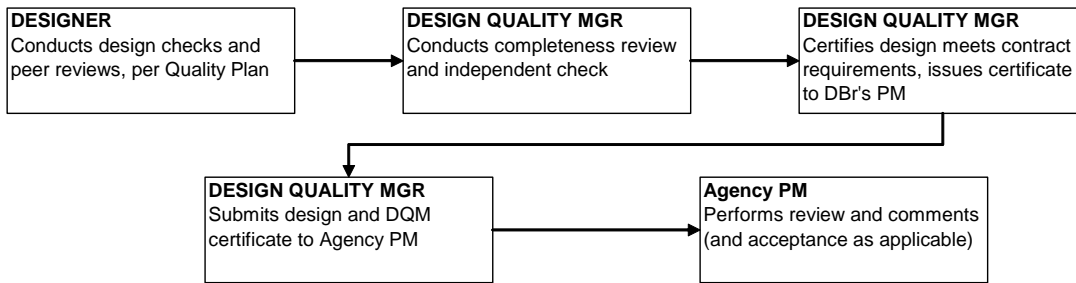
**(6) Design Review of Major Temporary Components** - The Design Manager shall conduct a Design Review of Design Documents for major temporary components that represent complex Structures, or that potentially can affect the safety, quality, and durability of the permanent Project components. The review shall include the effect of the major temporary components as designed on the permanent Project components.

**(7) Additional Design Reviews** - Agency PM (with Stakeholder involvement, if invited by Agency) may require such additional "over-the shoulder" reviews as Agency considers necessary to monitor continued and uniform consistency in the quality and effective incorporation into Design Documents of design revisions. Design-Builder may also conduct additional reviews it deems necessary to facilitate release of Readiness-for-Construction Plans and Specifications.

**(8) As-Constructed Design Review** - Design-Builder shall submit the As-Constructed Plans and **Design-Builder Specifications** for each Design Unit to Agency for review and Acceptance within 30 Calendar Days of completion of the construction Work. As-Constructed Plans and **Design-Builder Specifications** shall thoroughly describe and identify every aspect of the Project as constructed. Design-Builder shall make all corrections noted in Agency comments, if any, resulting from Agency's review, and shall resubmit the corrected version to Agency PM for review and Acceptance.

**(g) Design Review Process Flow Chart** - In its Quality Plan, Design-Builder shall expand upon the sequences shown in Figure 2 for Design Reviews to fully describe its internal design review processes, and the interface between both Design-Builder's design and design quality organizations and Design-Builder's design quality organization and Agency during the development of Design Documents.

**Figure 2  
Design Review Flow Chart**



**DB155.12 Design Documentation**

**(a) Progress Tracking** - Design-BUILDER shall include engineering and design progress and changes in its Baseline Progress Schedule (including Work on any design change) in the Monthly Progress Report. Design-BUILDER's progress tracking for design shall reflect the Design Units proposed and a mutually agreed-upon percent complete for Milestones achieved.

**(b) Design Quality Records** - Design-BUILDER shall maintain an auditable record of all Quality Plan procedures. An independent auditor must be able to determine by reviewing the documentation if all procedures included in the Quality Plan and required herein have been followed. Design-BUILDER shall submit all monitoring reports and records of checks and reviews within seven (7) Calendar Days of the completion of the applicable review.

**(1)** The Design Manager shall be responsible for preparing and maintaining the following design quality records.

- a. Monitoring reports of all design issues and review comments resulting from the scheduled and additional checks and reviews, including "over-the-shoulder" reviews, and final resolution of those issues and comments.
- b. A log of design Non-Conformance Reports and/or notices indicating date issued, reasons, status or resolution, and date of resolution.
- c. Daily records of design activities, using forms acceptable to Agency.

**(2)** The Design Quality Manager shall be responsible for preparing and maintaining the following design quality records:

- a. Monthly Report to Agency PM by the third Business Day of the following reporting month that includes each of the following:
  - 1. Summary of Design Reviews conducted;
  - 2. Nonconforming Work and current status and disposition (based on design non-conformance log); and

3. Submissions from Design-Builder and status.

b. Final Design Report - Upon completion of the Readiness-for-Construction Plans and Specifications for each Design Unit, including all its components and elements, the Design Quality Manager shall notify Design-Builder, with a copy to Agency PM, of any outstanding monitoring report issues or unresolved review comments or non-conformances.

**DB155.13 Comment and Non-Conformance Resolution** - All Design Reviews shall include a comment and non-conformance report resolution process, whereby unresolved comments and instances of non-conformance are discussed and a written action plan and schedule for resolution is developed. The Design Manager will lead the process.

**(a) Comments** - Agency and Stakeholder comments from Design Reviews will be transmitted to Design-Builder. Design-Builder shall record its proposed disposition and response to each comment and meet with Agency to resolve outstanding comments and dispositions. Design-Builder shall document final disposition and resolution of all Agency and Stakeholder comments.

**(b) Non-Conformances** - If a Design Review reveals non-conformance with Contract requirements, Agency will prepare a Design Non-Conformance Report and submit it to Design-Builder for action. Design-Builder shall make all required corrections and return to Agency PM documentation of the corrective action taken.

**DB155.14 Design Review Submittals** - Design-Builder shall deliver with the written notice of scheduled Design Review a copy of the Design Documents to be reviewed. Design-Builder shall also make available in its Designer's office sufficient copies to accommodate all participants in the Design Review. Design-Builder may combine submittals for multiple Design Units upon Agency's written authorization.

**(a) Definitive Design** - For Definitive Design, Design-Builder shall submit two (2) hard copies and one (1) electronic copy of the Definitive Design and the draft Basis of Design Memorandum (BDM). Definitive Design submittals shall consist of preliminary plans sufficient to depict the design concepts and the spatial setting (including site-specific characteristics) for major Design Unit components. The draft Basis of Design Memorandum (BDM) shall identify and describe the design alternatives considered, as well as Materials, means and methods evaluated and selected for the Definitive Design. The BDM may include preliminary reports on additional site investigations, a foundation report, hydraulic report, slope stability report, environmental findings, etc., applicable to the Design Unit and in support of the design decisions made.

**(b) Interim Design** - For Interim Design Reviews, Design-Builder shall submit two (2) hard copies and one (1) electronic copy of the Interim Plans.

**(c) Working Plans** - Working Plans shall contain necessary fabrication details, shop drawings, erection diagrams and shoring plans associated with the particular stage of construction and Design Unit.

**(d) Readiness-for-Construction** - For Readiness-for-Construction Design Reviews, Design-Builder shall submit two (2) hard copies and one (1) electronic copy of the

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Readiness-for-Construction Plans and Specifications, a copy of the quantity estimates, the final Basis of Design Memorandum, and any other supporting data required by Agency for the Design Unit or portion of the Work covered by the Readiness-for-Construction Plans and Specifications. The final Basis of Design Memorandum shall include foundation reports, hydraulics reports, slope stability reports, and all other technical reports and memoranda prepared in support of the Readiness-for-Construction Plans and Specifications.

**(e) As-Constructed Plans and Design-Builder Specifications** - As-Constructed Plans and **Design-Builder Specifications** are submitted, in native file format complying with CADD standards, following construction completion, and shall incorporate any changes to the Readiness-for-Construction Plans and Specifications. This submittal shall also include all final design reports, design calculations, Operation & Maintenance manuals, special instructions, and Design-Builder's PM Narrative.

**(1) PM Narrative** - The PM Narrative shall consist, at a minimum, of the following:

- General discussion of Project progress
- Highlight of problems and solutions that were implemented
- Discussion of design issues, solutions, and suggested improvements for future projects
- Discussion of each of the significant Change Orders issued for the Project
- Discussion of new or innovative methods employed and the results achieved, whether or not successful
- Discussion of potential for improvement in future designs, quality management processes and projects
- Discussion of the results of the post-Project joint review/debrief
- Feedback regarding an Agency project, or aspect of a project, that worked well

**(2) Construction Manual** - Refer to Agency's Construction Manual, Section 37, page 37-3 and -4 for additional instructions.

### **DB155.15 Design-Builder's Design and Design Quality Checks and Certifications**

**(a) Design Checks** - Design-Builder shall require its Designer to check all Design Documents (Working Plans, Plans, **Design-Builder Specifications**, calculations, memoranda, and reports) as they are produced, to confirm compliance with all Contract requirements. The Design Manager shall conduct such independent reviews and evaluations as may be necessary to enable him/her to certify that the Design Documents have been checked per Contract requirements and Design-Builder's Quality Plan.

**(b) Independent Design Checks** - Design-Builder's Design Review shall include independent design checks on specific project components as identified in **DB Special Provisions**, SP155.15. Design-Builder shall carry out independent design checks of Plans and **Design-Builder Specifications** for permanent components and major temporary components, and for effects of temporary components on the permanent components. Such checks shall be performed by senior engineers employed or retained by Design-Builder who are not involved in the production of the design documents being reviewed,

and who have qualifications and experience equal to or greater than the Responsible Engineer for the design or the Design Unit being checked.

Independent design checks shall comprise design assessment and analytical checks, as specified herein.

**(1) Design Assessment** - Design assessment constitutes a review of the Design Document for general compliance with all Contract requirements, taking into consideration the proposed method of construction, and shall cover each of the following areas:

- Loads
- Legal Requirements and Standards
- Methods of analysis
- Computer software and its validation
- Interface requirements
- Maintenance requirements
- Materials and Material properties
- Durability requirements
- Fatigue performance
- Hydrology
- Design flows

**(2) Analytical Check** - Independent design checks shall include an independent analytical check using independently-derived calculations (without reference to Designer's calculations) to evaluate the structural adequacy and integrity of critical structural members as designed. This shall include, but is not limited to the following:

- The structural geometry and modeling
- Material properties
- Member properties
- Loading intensities
- Structural boundary conditions

**(c) Design Quality Manager Certifications** - The Design Quality Manager shall conduct all necessary reviews to enable him/her to issue written certification in accordance with the requirements specified herein.

**DB155.16 Conditions to be Met Prior to Commencement of Construction** - Construction on any Design Unit or portion thereof may begin at any time after Agency's Acceptance of the Quality Plan or those portions of the Plan covering the Work to be performed, and after the applicable Readiness-for-Construction Design Review has been completed and Agency has issued its Acceptance. Design-Builder shall not commence construction of any permanent components or major temporary components until the applicable design checks, Design Reviews, and Design Manager and Design Quality Manager's certifications have been completed, design-related Non-Conformance Reports have been addressed and resolved to the satisfaction of Agency, Agency comments have

been resolved, and Agency's Acceptance has been delivered to Design-Builder. All the following must also have occurred.

**(a)** The Readiness-for-Construction Plans and Specifications have been signed and stamped by the Responsible Engineer. For those drawings and documents other Design Documents included in the submittal that are prepared by a manufacturer or supplier or other persons not under his/her direct supervision, the Responsible Engineer shall affix a stamp that indicates the design shown on the sheet or document conforms to the overall design and all Contract requirements.

**(b)** The Design Manager has completed his/her checks and reviews in accordance with the requirements stated herein, and has issued a written certification that each of the following conditions have been met:

**(1)** The design has undergone constructability review and is constructible as represented in the Readiness-for-Construction Plans and Specifications;

**(2)** Working Plans and Readiness-for-Construction Plans and Specifications for the portion of the Project to be constructed are complete and checked in accordance with this Subsection;

**(3)** The design and drawings for the Traffic Control Plan and temporary erosion control and environmental measures applicable to the Work have been properly completed; and

**(4)** Adequate stakes, lines, and/or monuments necessary to control the Work have been established on the Project Site.

**(c)** The Design Quality Manager has conducted his/her independent design quality review and has issued a written certification that each of the following conditions have been met:

**(1)** Design checks have been completed;

**(2)** The design conforms to all Legal Requirements and other requirements;

**(3)** Any Design Exceptions have been approved in writing by Agency;

**(4)** Design quality activities are following Design-Builder's Quality Plan; and

**(5)** All outstanding issues and comments from the Design Review have been resolved.

**(d)** Agency has provided Review and Comment regarding the Readiness-for-Construction Plans and Specifications and applicable Traffic Control Plan, temporary erosion control measures, and environmental requirements.

**(e)** All Design Non-Conformance Reports issued by the Design Quality Manager or Agency have been addressed and resolved by Design-Builder to the satisfaction of Agency.

**DB155.17 Design Support During Construction** - The Designer and Design Quality Manager shall verify during construction that the site conditions are accounted for in, and the construction Work performed is consistent with, the relevant Working Plans and Readiness-for-Construction Plans and Specifications. The Designer shall prepare any necessary adjustments in such Plans, Working Plans, and Specifications, and Design-Builder shall conduct the appropriate checks, certifications, and reviews in accordance with the requirements stated herein pertaining to design changes. Design-Builder shall also be responsible for obtaining any permits or authorizations, if any, that may be required as a result of the changes.

**DB155.18 Quantity Estimates** - To facilitate progress measurement, determine sampling and testing requirements, and to provide quantities for determining the price adjustment calculations described in **DB General Provisions**, Subsections 195.10 and 195.11, as well as the Pavement Materials and smoothness price adjustments, Design-Builder shall develop and maintain quantity estimates and actuals for the Work. The quantity estimates shall be in units that facilitate sampling and testing, i.e. the units shall be consistent with the units used to determine frequency of sampling and testing. For example, if "X" numbers of compaction tests are specified to be taken for every "Y" cubic yards of embankment, the quantity estimate would need to be in cubic yards of embankment. Construction progress shall be measured as defined in Design-Builder's Quality Plan and be able to facilitate the Project Quality Manager's certification that percent complete claimed on the Pay Request is reflected in the Quantity Tracking System (QTS). The QTS shall be developed and maintained by Design-Builder and made available for Agency review upon request.

**DB155.19 Survey Standards** - Survey standards shall reflect those established in Agency's *Highway Design Manual (HDM)*.

**DB155.20 Specifications** - Design-Builder shall assemble the **Readiness-for-Construction Specifications** from among the existing **Agency-Supplied Specifications**. In the event available **Agency-Supplied Specifications** do not cover or adequately address an aspect of the design, Design-Builder shall submit all additional necessary Specifications to Agency with the Readiness-for-Construction Plans prior to the applicable Design Review for Agency Review and Comment, in accordance with the Design Review process set out herein.

**DB155.21 CADD Standards** - CADD formatting for Design Documents, including Definitive Design, Readiness-for-Construction Plans, and As-Constructed Plans, shall conform to Agency's *Contract Plans Development Guide*.

