



# NAC Executive Insights

## Constructability Review Before Design Commences

### Key Points

- Constructability reviews are a value-adding process.
- Constructability reviews are a multi-discipline effort.
- Benefits of constructability reviews are identified.
- Constructability goals and objectives are defined.
- In conducting constructability reviews, it is important to “build the project.”
- Solving issues at the constructability stage reduces Requests for Information (RFIs), change orders, and project delay.
- Constructability reviews drive interdisciplinary coordination, which is key to project success.
- Constructability reviews are most impactful when first conducted at project initiation.
- The process undertaken in a constructability review at project initiation is broader than at a later project stage, but it is this breadth which drives its value.
- The elements and focus of the constructability process at project initiation are detailed.

### Introduction

*Constructability* is defined as “the optimum use of construction knowledge and experience in planning, design, procurement, and field operations to achieve the overall project objectives.”<sup>1</sup>

Constructability reviews are a series of meetings, generally corresponding to and aligning with a project’s stage gate process. These reviews become increasingly detailed as the design develops and become an integral part of the overall construction planning process. Constructability reviews are a multi-discipline effort and are best begun through the development of an expanded basis of design, where addressing construction and operations and maintenance (O&M) requirements can lead to their being incorporated into the basis of design before any substantive engineering work gets underway. ([Executive Insight, Business Basis of Design](#))

Successful projects invest time and effort to build strong project foundations. These include articulation, agreement, and continuous communication of strategic business objectives (SBOs); utilization of an

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<sup>1</sup> *Constructability: A Primer*, Construction Industry Institute, 1986.

expanded basis of design that encompasses technical, construction, and O&M requirements ([Executive Insight, Business Basis of Design](#)); solid project baselines, especially the scope, recognizing its primacy among the baselines ([Know What You Are Trying to Accomplish: The Primacy of the Scope Baseline](#)); risk-based project execution ([Executive Insight, Managing Risk in Large Complex Programs](#)); and effective and comprehensive project initiation, which includes an up-front constructability review.

## Benefits of Effective Constructability Reviews

Constructability reviews are a value-adding process that lead to:

- Enhanced construction safety
- Aid in scope control (challenge)
- Shortened schedule
- Reduced costs
- Better management of risks through better planning
- Innovation in design and execution
- Enhanced quality

Constructability reviews also are a component of value creation/improvement and an element of continuous process improvement.

## Constructability Goals and Objectives

The goals and objectives we are trying to achieve with respect to constructability include:

- Ensure implementation of the construction basis of design ([Executive Insight, Business Basis of Design](#))
  - Ongoing construction input into design development process
  - Identify value-adding alternatives
- Enhance safety in design ([Executive Insight, Safety through Design](#); [Executive Insight, Safety by Design Suggestions](#))
- Enhance safety in execution (see [Safety White Papers](#))
- Minimize site footprint
  - Offsites and utilities
  - Preassembly
  - Modularization
- Minimize excavations
- Minimize work at height
- Standardization for value creation
  - Materials
  - Details of construction
  - Tools and construction technology

- Productivity improvement
  - Phasing/packageing of major elements of work
    - Sequencing of construction
  - Workface packaging/planning
  - RFI reduction
  - Construction information needs and timing
    - Granularity of detail on early design packages
  - Major equipment installation plan, sequence, and timing
  - Material management planning
    - Identification, tracking, storage and laydown requirements, and timing
  - Site logistics
- Critical equipment and skills identification and forecast needs and timing
  - Heavy lifts
  - Welders
- Minimize required interfaces with existing site operations
  - Safety considerations operating in or near existing operating units
  - Inefficiencies related to traffic or security
- Commissioning and startup planning
  - Temporary requirements and facilities
  - Sequence and accessibility
- Identify construction opportunities
  - Early works to accelerate schedule
  - Beneficial means and methods that design should accommodate
  - Tighter integration with supply chain
  - 3<sup>rd</sup> Generation modules
- Identify required tools and technologies
  - Hard to find, specialized construction equipment
  - Specialized construction equipment that creates new opportunities
  - Purpose-built tools
    - e.g., “Left Coast Lifter”
  - AI enabled safety systems
  - Robots, drones, automated warehousing

- Material tracking systems, e.g., radio frequency identification (RFID)

It is through an effective constructability process that we can achieve these goals.

As the project and team mature, project issues and opportunities will become triaged with the focus shifting to the most significant concerns and opportunities related to safety, cost, schedule, and risk. At the earliest stage, however, we must resist the temptation to dismiss too quickly the issues, concerns, and opportunities. (Resist the “We have always done it this way” syndrome.)

Solving issues at the constructability stage reduces RFIs, change orders, and project delay.

Constructability reviews also drive interdisciplinary coordination, which is key to project success. 3D model reviews represent an excellent adjunct to the traditional constructability process.

The elements of a constructability review conducted at project initiation are presented in the next section.

## **Constructability Review Process – Project Initiation**

Constructability reviews are most impactful when first conducted at project initiation. The process at this stage is broader than what we might expect to see at a later project stage, but it is this very breadth which drives its particular value. The elements and focus of the constructability process at project initiation follow.

- Establish Construction Basis of Design (CBOD) ([Executive Insight, Business Basis of Design](#))
  - This may be done before formal initiation of the project (bid stage; contract negotiation stage), but should be a key part in initiation and alignment of the engineer-procure-construct (EPC) team.
  - Optimally done as part of the broader Business Basis of Design (expanded basis of design, BOD<sup>x</sup>) process that includes O&M personnel and expertise.
  - Contribute to the scope development process ([Executive Insight, Know What You Are Trying to Accomplish: The Primacy of the Scope Baseline](#)).
  - Client involvement is essential.
  - Constructability is a key element of team alignment.
- Review discipline interfaces and construction interaction with each discipline and with the overall project team.
  - Interface issues can exist within discipline-based elements as well as at the interfaces between disciplines and facilities.
- Establish constructability program goals and objectives.
  - Safer, better, faster, cheaper
- Review overall constructability review process.

- Identify available resources.
  - Lessons learned from similar projects
  - Prior constructability reviews for similar projects/project elements
  - Discipline constructability checklists
- Outline project execution/construction philosophy.
- Review opportunity areas identified at bid stage, emphasizing those considered in bid estimate and schedule.
- Empower engineering teams to improve outputs while achieving desired outcomes.
- Create and maintain an active log of suggestions, ideas, and issues generated during the constructability review process.
  - Track, assign responsibility, and formally assign action (incorporate; reject).
  - Remember: there are no bad ideas or questions.
- Conduct discipline constructability checklist reviews.
  - Provide a starting point for review.
  - Expand with collective team knowledge.
  - Reviewed and captured as part of knowledge management and continuous process improvement processes.
- Identify major construction issues and opportunities.
- Input into plot plan and general arrangements.
  - Confirm site control points.
  - Underground plans and plant are fully considered.
  - Ensure construction logistics are incorporated.
    - Review accessibility of construction equipment and rigging.
    - Facilitate construction sequencing.
    - Address preassembly and modularization issues.
    - Incorporate field erection needs.
    - Provide for late delivery of long lead equipment.
    - Support vendor laydown requirements.
  - Ensure that operating requirements have been factored in.
    - Example: all valves on south side of plant to shield against strong arctic winds.
  - Reflect temporary facilities associated with startup and commissioning.
  - Incorporate general conditions and material management needs.
    - Offices, warehouses, commissaries and mess facilities, fuel, temporary utilities, and others
    - Site security
    - On-site transportation
- Develop and issue the construction section of the project execution plan.

- Early design requirements
- Construction related permitting requirements
- Overall construction sequence
- Construction schedule
  - Integrated with overall EPC schedule
  - Enumeration of preliminary work packages (to be refined and further decomposed at a later stage)
- Required equipment dates
- Construction risk plan (preliminary)
  - Normal risks for project type
  - Unusual risks requiring mitigation
- Input into project safety plan.
- Develop constructability plan for subsequent project phases.
- Identify constructability studies to be conducted.
- Identify modularization studies to be conducted.
- Identify specific construction means and methods to be considered in subsequent detailed construction planning.
  - Includes new and emerging tools and techniques.
- Identify material takeoff requirements and required contingency levels to guide engineering.
- Identify material tracking requirements and input into supply chain planning.
- Identify any craft labor surveys to be conducted.
- Review initial work breakdown structure (WBS) to ensure constructability and construction activities are reflected.
- Input into indirect cost estimates (general conditions cost).

## Summary

Constructability reviews are a value-adding process.

This Executive Insight focuses on the earliest of a series of constructability reviews being undertaken at the project initiation stage. In conducting constructability reviews, it is important to “build the project.” This process is most effectively begun before a myriad of drawings and specifications drive us into a problem-seeking mode, where we fail to see the “forest for the trees.”

## About the Author

Bob Prieto was elected to the National Academy of Construction in 2011. He is a senior executive who is effective in shaping and executing business strategy and a recognized leader within the infrastructure, engineering, and construction industries.

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