

# Virtual Design and Construction Requirements

## *Design-Build Delivery Method*

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## 1.0 PURPOSE

This Virtual Design and Construction (VDC) requirements document introduces the information, management and technical requirements to support the implementation of Building Information Modeling (BIM) and Computer Aided Design and Drafting (CADD) for The Port Authority of New York & New Jersey ("Authority"). The Authority's requirements apply to the full life cycle of a project from conceptual design through construction, close out and operation. This document should be read in conjunction with the following:

**Table 1.1-A Associated Materials**

Document	Type	Owner
BIM Standard	Standard	The Port Authority of NY & NJ
CAD Standard	Standard	The Port Authority of NY & NJ
Document and Information Management Standard	Standard	The Port Authority of NY & NJ
BIM Guidelines	Guidelines	The Port Authority of NY & NJ
Information Delivery Plan	Specification	The Port Authority of NY & NJ
BIM Execution Plan Template	Template	The Port Authority of NY & NJ
BIM and CAD Support Files	Templates	The Port Authority of NY & NJ
<b>BIM</b> Progress Report Templates	Template	The Port Authority of NY & NJ
Data Quality Control Plan	Standard	The Port Authority of NY & NJ
Geographic Information System (GIS) Standard	Standard	The Port Authority of NY & NJ
Protected Information Practices and Procedure Manual	Standard	The Port Authority of NY & NJ

## 1.1 INSTRUCTIONS

All sections shall be reviewed by **BIM** users. Additionally, there are sections in this document which **CAD** users should be familiar with. **CAD** users are specifically directed to the following sections:

Number	Content
2.0	<a href="#">Objectives</a>
3.2	<a href="#">Construction Sheet Set Document information and Models</a>
3.3	<a href="#">Deliverables</a>
4.0	<a href="#">Information Management</a>
5.1	<a href="#">Software</a>
5.5	<a href="#">Quality Control and Coordination</a>

**Note that associated materials and content in this VDC Requirements are in grey and are under development.**

## **1.2 BIM EXECUTION PLAN**

At the start of every project (stage I), a **BIM** Execution Plan (BEP) must be submitted within 14 days of project initiation.

Upon contract award (stage III) the Contractor/Consultant shall submit a revised BEP within 14 days of contract award. Once approved by the Authority, within 30 days after submission, the BEP shall become the resource for requirements, methodologies and workflows for a specific project.

The BEP is considered a “living” document, in the sense that it will be updated throughout the project’s duration. Situations that may trigger a revision on the BEP by the Contractor/Consultant include, but are not limited to:

- Changes in key personnel
- Changes in processes
- Changes in requirements
- Changes in schedule
- If required by the Authority.

Refer to **Appendix E and F** of the BIM Standards to access the BEP Templates used during Design and Construction.

**Note:** In the event existing BIM models or CAD files are provided, the use of these files should be for reference only and shall not relieve the Contractor of their sole responsibility for verifying accuracy of conditions indicated within these files.

## 2.0 OBJECTIVES

This section applies to **BIM** and **CAD** users.

The Authority's strategic objectives, relative to these requirements, are to:

1. Achieve interoperability between project teams to facilitate information exchanges, enhance communication and enable collaboration between functions.
2. Deploy the use of VDC to support the following:
  - a. 3D and Advanced Visualization - Design development, review and coordination.
  - b. 4D - Scheduling, field coordination and logistics management.
  - c. 5D - Quantity take off and estimating.
  - d. 6D - Resilience and Sustainability
  - e. 7D - Facility management and enterprise asset management (EAM).
3. Ensuring that all content, CAD and BIM, is detailed appropriately, meeting the standards of the Authority and is fit for purpose. For the avoidance of doubt all models shall be in compliance with the Authority's BIM standard and/or CAD standard.

VDC is underpinned by robust data governance and all BIM data shall be assured prior to use and analysis. This is covered in more detail in the Data Quality Control Plan but aims to ensure the following is achieved:

<b>Quantum</b>	Increase the quantity of structured, machine readable, data to at least 80 percent.
<b>Timeliness</b>	Ensure that BIM data is shared monthly on design-build projects.
<b>Quality</b>	Deploy performance measures with a compliance target of 80 percent.

## 2.1 PERFORMANCE MEASURES

Per the Data Quality Control Plan the following Key Performance Indicators (KPIs) will be reported according to the project schedule and in line with compliance requirements:

- Availability and timeliness of data produced in accordance with submittal requirements.
- Completeness and accuracy of data provided at project milestones/stages including project close out.
- Number of issues, i.e. non-conformance of data, identified as a ratio of number of issues assigned to appropriate Contractor/Consultant.
- Compliance against Authority functional and technical requirements.

### 3.0 INFORMATION REQUIREMENTS

This section applies to **BIM** and **CAD** users. Users should be aware that the Information Delivery Plan is under development. In the interim period please refer to the information requirements in the **BIM** and **CAD** standards.

#### 3.1 INFORMATION DELIVERY PLAN

The Information Delivery Plan (IDP) schedules the required information deliverables across the Authority's plan of work including:

- List of information models to be created to fulfill the scope of work.
- Information exchange schedule.
- Model development specification specifying the Level of Detail (LOD) and Level of Information (LOI) for each deliverable in accordance with the prescribed definitions and classifications contained therein.
- The intended role or appointed Contractor/Consultant for the information deliverable.
- Nomenclature requirements defining naming requirements for documents and objects.
- Taxonomy and classification requirements.

##### 3.1.1 INFORMATION EXCHANGE SCHEDULE

All information deliverables shall be exchanged as work in progress monthly, as a minimum. BIM and CAD related deliverables are confirmed in the IDP.

##### 3.1.2 LEVEL OF DEFINITION

The Authority adopts the LOD definitions as stated in the BIM Forum's most current LOD specification<sup>1</sup>. LOD requirements per element are defined in the IDP.

##### 3.1.3 NOMENCLATURE

Contractor/Consultants shall conform to the nomenclature and filenaming requirements.

##### 3.1.4 CLASSIFICATION

Each element shall be classified in accordance with the Authority's asset hierarchy, defined by the Enterprise Asset Management Office (EAMO). This applies to both spaces and physical assets. In addition, each element shall be classified in accordance with Unifomat 2010.

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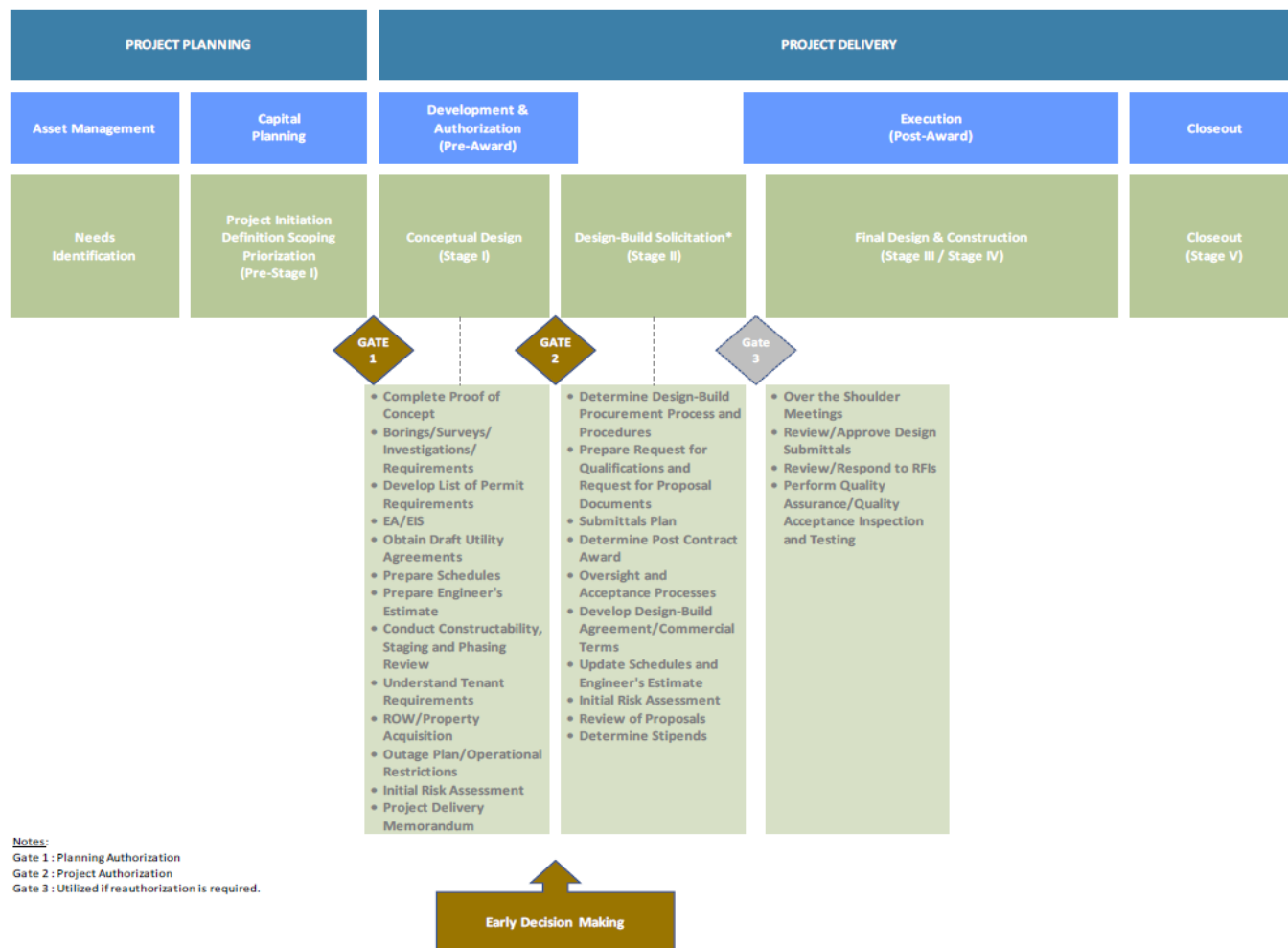
<sup>1</sup> <https://bimforum.org/loa/>

### 3.2 CONSTRUCTION SHEET SET DOCUMENT INFORMATION AND MODELS

Refer to BIM standard and CAD standard.

### 3.3 DELIVERABLES

Information shall be exchanged in accordance with the design-build stage gates.



In general, the Contractor shall assume all responsibility for delivery at the commencement of stage III (final design). The following deliverables are required:

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Stage	Responsibility	First Submittal	Recurring Submittal	Deliverable
I	EAD	Project initiation	Monthly	<b>BIM</b> Execution Plan
II	EAD	Project initiation	-	Site Model
II	EAD	Stage II	Monthly	Preliminary Design Model
III	Contractor	Within 14 days	Monthly	Updated <b>BIM</b> Execution Plan
III	Contractor	Within 60 days	-	Site Model with added Context
III	Contractor	Within 60 days	Monthly	Design Model
III	Contractor	Within 60 days	Monthly	4D model
IV	Contractor	Stage IV	Monthly	Construction model
IV	Contractor	Per construction schedule	Monthly	As-constructed model and point cloud survey data.
IV	Contractor	Per construction schedule	-	As-constructed data

Refer to [Appendix A](#) for detailed descriptions of deliverables.



## 4.0 INFORMATION MANAGEMENT

This section applies to **BIM** and **CAD** users.

### 4.1 STANDARDS AND GUIDELINES

The core related standards and guidelines are listed in **Table 4.1-A**.

**Table 4.1-A Standards and Guidelines**

Name	Type	Purpose
BIM Standard	Standard	Details the technical requirements to support projects produce, collect, and analyze BIM data that is consistent, relevant and high quality.
CAD Standard	Standard	Establishes requirements and procedures for the preparation and milestone submissions of CAD based drawings throughout the project life cycle.
BIM Guidelines	Guideline	Provides guidance on achieving the BIM standards.
Protected Information Practices and Procedure Manual	Standard	Provides policy and procedures to safeguard and secure the Authority's data.
BIMForum LOD	Standard	Enables practitioners to specify and articulate the content and reliability of BIMs at various stages of a project lifecycle.
Uniformat 2010	Standard	Classifies information into elements to arrange project descriptions, cost information, BIM elements and other associated documentation.

### 4.2 ROLES AND RESPONSIBILITIES

The following VDC related roles shall be taken on directly by the Authority:

- VDC Engineer / Manager

Roles performed by the Contractor/Consultant must be described fully within the BIM Execution Plan (BEP). These roles may include:

- BIM Coordinator
- BIM Manager(s)

The Contractor/Consultant shall confirm the parties and named persons who will be responsible for the project, describing what activities will be performed and what authorities will be held. Candidates shall have the requisite experience for the size and scale of the project and shall seek clarification from the Authority prior to nomination. Table 4.2-A outlines typical activities and the stakeholder involved:

Table 4.2-A RACI Matrix

Activity	PANYNJ VDC Support Group	PANYNJ EAD	Contractor / Consultant
Initiating and implementing the information requirements.	R	C	I
Development and implementation of Authority standards	R	R	I
Ensure all sub-contracted organizations (design or construct) meet the requirements and are procured correctly.	A	A	R
Managing data exchange and data exchange procedures	R	C	I
Implementation of the BIM protocols and procedures	C	I	R
Enable integration and coordination of data	I	I	R
Develop and manage the BIM Execution Plan	C	C	R
Create a site set-up model with coordinated, measurements and bearings to be used disseminated to all design team members.	R	A	I
Create content in line with Authority requirements and standards	I	C	R
Configure information for CAD and or BIM submittals	C	C	R
Support the project team through the digital delivery process	A	A	R
Chairing look ahead meetings	I	A	R
Ensure compliance with the BIM Execution Plan.	A	I	R
Development of 'rule sets' for use in accordance with the Quality Control Plan.	R	C	I
Manage the data assurance process in line with the Quality Control Plan, producing outputs and reports for project and program consumption.	C	R	C/I
Make use of shared data in accordance with the project requirements and objectives	C	R	R
Report on findings from quality assurance process	I	R	R
Migrate data to program and business-as-usual systems in accordance with the agreed migration procedures.	R	A	C

- R – Responsible; A – Accountable; C – Contributor; I – Informed

### 4.3 MEETINGS

**Table 4.3-A** defines the meetings that shall take place on a regular cycle.

Meeting Name	Occurrence	Objective(s)
Kick Off	Once at project initiation, once at contract award.	Stakeholder introduction. Confirm requirements and expectations.
Progress Review	Monthly	Review progress. Discuss outstanding issues.
Submission Review	Stage gates	Discuss submission results / compliance.

### 4.4 DOCUMENT MANAGEMENT

Refer to Document and Information Management Standard.

#### 4.4.1 FOLDER STRUCTURE

Contractor/Consultants shall adhere to the folder structure requirement. Go to:

- Section 1.6.1 of the CAD Standard
- Section 1.13 of the BIM Standard

#### 4.4.2 STANDARD NAMING CONVENTION

All electronic project information should be named following the Authority's standard naming conventions. To find the standard naming convention go to:

- Section 1.6.5 of the CAD Standard
- Section 13 of the BIM Standard

#### 4.4.3 ELECTRONIC SUBMITTALS

All project-related files must be submitted on Live Link or the nominated Project Management Information System (PMIS) e.g. eBuilder. All files must be submitted and labeled with the following information:

- Consultant's name, Contract Number and Project Identification Number (PID)
- Contact name, E-mail Address and phone number of consulting project manager
- Discipline-Facility (e.g. Civil-JFK)
- Submittal Date and Percent Completed
- Data Format (e.g. Revit Version .dwg)
- File Name(s) on CD

- Company Name and Address
- Project Name
- Percent Completed

## 4.5 DELIVERY

From stage III the requirements shall be managed in 4 weekly sprints to coincide with the project's governance procedures and in accordance with Figure 4.5-1.



Figure 4.5-1 Overall Sprint Cycle

### 4.5.1 WEEK ONE

During week one the project team shall meet with a meeting agenda to discuss the following items:

- Actions and minutes from previous meeting
- Issues arising from previous sprint
- Overview of progress
- Areas of concern
- Areas of best practice to be shared
- Commitments for upcoming sprint

### 4.5.2 WEEK ONE / TWO

At the beginning of or during week two all data sources shall be exchanged via the agreed Project Management Information System (PMIS) as work in progress. Note that at key milestones during a project all information sources shall be exchanged as formal submittals via PMIS.

Refer to Document and Information Management Standard.

#### **4.5.3 WEEK TWO & THREE**

During week two and three data shall be assured in accordance with the program data governance strategy. For the avoidance of doubt, it is expected that all Contractor/Consultants assure their deliverables to maintain an appropriate and acceptable level of quality by deploying three lines of defense in which this strategy deploys the first line:

- Data is assured by the author of the data to ensure compliance with agreed standards.
- Data is assured by the lead Contractor/Consultant; detailed non-compliance issues identified and reported.
- Data is assured by the program controls team; analysis is undertaken on the data to report on progress and performance.

#### **4.6 INFORMATION SECURITY**

Refer to the Protected Information Practices and Procedure Manual.

## 5.0 TECHNICAL REQUIREMENTS

This section applies to **BIM** and **CAD** users.

### 5.1 SOFTWARE

The Authority has adopted the following relevant software applications:

**Table 5.1-A Software Applications**

	PANYNJ Use
Data Authoring *Specialist tools to be used where appropriate	
Autodesk Revit	Y
Autodesk Civil 3D	Y
Autodesk AutoCAD	Y
Autodesk Architecture	Y
Autodesk MEP	Y
Autodesk MAP 3D	Y
Data Capture	
<i>To be confirmed</i>	
Data Exchange	
eBuilder *project specific	Y
LiveLink	Y
Data Assurance	
<i>To be confirmed</i>	
Data Analysis	
Autodesk Navisworks Manage	Y
Primavera P6	Y
Data Visualization	
Microsoft Power BI	Y
Asset Information Management	
IBM Maximo	Y

### 5.2 DATA SEGREGATION AND PERFORMANCE

The following IT system restrictions and requirements need to be considered when developing the BIM Execution Plan (BEP):

- Model size: No physical size restriction but practically 500MB max, to be reviewed monthly.
- Security issues: In accordance with Authority security requirements.

The BEP shall confirm adoption of system performance requirements.

### 5.3 TEMPLATES

The following templates shall be used by the Contractor/Consultant:

**Table 5.3-A Templates**

Name	Type	Purpose
Shared Parameters	Template	Ensure consistent data entry
Autodesk Revit Templates	Template	Ensure consistent content creation
BIM Execution Plan Template	Template	Ensure an agreed, executable plan.

### 5.4 COORDINATES AND GEOGRAPHIC INFORMATION SYSTEM

For all Authority projects the default horizontal coordinate systems are:

- State Plane NAD83 New York East and Long Island Foot systems
- The default vertical system is the State Plane NAVD 88 system.

The project coordinate system will be established in the BIM Site Model file provided by the Authority.

Refer to Geographic Information System (GIS) standard.

### 5.5 QUALITY CONTROL AND COORDINATION

The Project Team is to use automated conflict checking software and as outlined in the BEP. The clash detection report should show any outstanding coordination issues between the Project Team members.

The Contractor/Consultant is to use Navisworks Manage software for clash detection reporting. These reports shall include the following information at a minimum:

- Description of Clash detection Report
- Date of Clash detection Report Run
- List of all Clash detections detected, their status, and their proposed solution.

The clash detection must be clear on the models before each coordination. The Authority shall conduct BIM and CAD compliance reviews as described in the relevant standard. Results will be provided to the Contractor noting that the compliance of the data will support the project acceptance procedures.

Refer to **BIM** Standard section 7.5 and section 8.4.2 and **CAD** Standard section 1.11.

**APPENDIX A: GLOSSARY OF DELIVERABLES**

Deliverable	Description
<b>Site Model</b>	Digital 3D representation of the Work containing information regarding Construction activities other than the finished and final work (e.g. Fencing, Traffic Control where applicable, excavation works, Job trailer location, crane positions, etc.). Definitions and requirements are separated for practical and applicability purposes, but this model may or may not be integrated with the Construction Model.
<b>Design Model</b>	Digital 3D representation of the design at preliminary and final design stage containing information to a level of development as defined in the Information Delivery Plan's model development specification. The Consultant shall ensure that the final Design Intent Model is used to produce the Detailed Contract Drawings. The Design Intent Model shall be passed to the Contractor at the start of Stage III to support the Contractor's 4D Model and developed into the As-Constructed Model.
<b>Construction Model</b>	3D Elements. Within 60 calendar days after the initial <b>BIM</b> meeting, the Contractor/Consultant shall prepare a Construction Model developed from and based on the Contract Drawings and submit it to the Engineer for review. Model shall be the primary reference for production and coordination of Shop Drawings submitted by the Contractor/Consultant).
<b>4D Model</b>	Not later than the date established at the initial <b>BIM</b> meeting (which shall be not later than 90 calendar days after the initial <b>BIM</b> meeting), the Contractor/Consultant shall prepare and submit a 4D Model and 5D Model to the Engineer for review. If an approved Baseline Schedule is not available at the time of submission, the Contractor/Consultant shall provide a 4D and 5D Model representing schedule and cost based on the draft schedule.
<b>As-Constructed Model &amp; Point Cloud Data</b>	Prior to issuance of the Certificate of Final Completion, the Contractor/Consultant shall submit for review and approval, all as-constructed model and ancillary data in accordance with the agreed project submittal schedule.
<b>As-Constructed Data</b>	Prior to issuance of the Certificate of Final Completion, the Contractor/Consultant shall submit for review and approval, all as-constructed data in accordance with the agreed project submittal schedule.