MASSPORT VIRTUAL DESIGN AND CONSTRUCTION ROADMAP

MASSPORT LEAN VALUES

CAPITAL PROGRAMS VISION

Transform our industry through innovation, create value for our clients, and deliver "best-in-class" infrastructure projects for our customers.

CAPITAL PROGRAMS MISSION

Excel in delivering projects that enhance our customers' experience by programming, designing, and building safe, efficient, and sustainable infrastructure. We commit to this by being inclusive, leveraging technology, and finding opportunities to continue. improve our project management and delivery

MISSION and VISION

VDC VISION

Maximize Lean, BIM, and related technologies to deliver value and reduce waste when executing world-class project delivery.

VDC MISSION

Create integrated teams that maximize technology, lean thinking, and principles to achieve the highest level of project execution for Massport.

BUSINESS DRIVERS

DIGITAL TRANSFORMATION GOALS

MODEL-FIRST PROJECT DELIVERY	OPTIMIZE TECHNOLOGY & DATA	ADOPT LEAN CULTURE	MAXIMIZE ASSET VALUE	DIGITAL TWIN AI TRANSFORMATION
Utilize the capabilities and increase the model value across MPA operations	Optimize technologies, standardize data, and innovate technology use	Be a continuously learning organization using Lean as a system & tools	Incorporate project & MICA data for planning & asset value management	MPA will use Digital Twin strategies to increase project and operational value
OUTCOMES				
• Improve BIM quality during project delivery and increase post-project use • Standardize models and integrate them for Virtual Campus development • Integrate models, data, and AI capabilities for Digital Twins	• Increase data value and usefulness through standardization requirements • Integrate data and life-cycle workflows for project and asset management • Innovate technology use and integrate AI capabilities	• Normalize Lean workflows and seek continuous improvement to raise project efficiency and reduce waste • Become a Lean learning and mentoring organization, improving project and organizational management	• Utilize project and MICA data for better asset management • Increase life-cycle planning to protect asset value • Implement predictive maintenance management	• Digital Twin technology increases operational understanding of asset value • Visualize & integrate complex data supporting capital program decisions • AI provides increased data management and access

Virtual Design and Construction Framework

PEOPLE LEAN

- Develop LEAN Culture of Excellence, Team Respect,
- Collaboration for Efficient Project Delivery
- Last Planner System Series of Promises
- Continuous Learning and Improvement
- LEAN Management for High-Performing Teams

PROCESS VDC

- Reliable, Repeatable, Predictable Processes to Create Value and Achieve Project Success.
- Support Model-first Design & Construction.
- Support Data-Driven Decisions

TECHNOLOGY DATA

- Maximize Value of Data
- Integrate CAD, BIM, GIS, AMS
- Standardize Information and Common Data Environment
- Simulate Operation Reality and Use AI to Optimize Planning, Production, and Asset Lifecycle

MODEL-FIRST DESIGN & CONSTRUCTION

PROJECT START

- VDC Guide
- BIM Standard
- BIM Execution Plan
- LEAN Deployment Plan
- Massport Resources
- Big Room
- BIM Set-Up on CDE
- Kickoff with Stakeholders Milestone Planning
- Common Data Environment (CDE)

PROJECT SUCCESS PLAN → CONDITIONS of SATISFACTION + BIMxP + LEAN DEPLOYMENT PLAN + LPS®

CONTRACTING: IN-HOUSE | DESIGN BID BUILD | CM@RISK | DESIGN BUILD

- MAINTAINS → CONDITIONS of SATISFACTION & PROGRAM REQUIREMENTS
- CREATES → BIG ROOM LPS® WORKPLAN UNIFIED VDC STRATEGY
- IDENTIFIES → ASSETS RELATED TECHNOLOGIES DATA REQUIREMENTS
- UNIFIES → HIGH PERFORMING TEAMS COLLABORATION
- FOCUS ON → MODEL-FIRST BIM EXECUTION VDC PROJECT DELIVERY
- BALANCES → COSTS, SCHEDULE, QUALITY PERFORMANCE

CAPITAL IMPROVEMENTS Important Documents

INSTITUTIONALIZE A LEAN CULTURE

HOW WE WORK TOGETHER AND HOW WE PLAN OUR WORK

Master Schedule Alignment → Phase Pull Planning → Make Ready Work Planning → Constraints WPP Updates → Weekly Work Planning → PPC Variances

LAST PLANNER® SYSTEM

5 Connected Conversations

LEAN TOOLS

- Last Planner System®
- Daily Check-Ins
- LEAN Dashboard
- Visual Management
- Choosing by Advantage
- Target Value Delivery
- Big Room
- A-3 Process
- Plus/Delta
- Retrospective

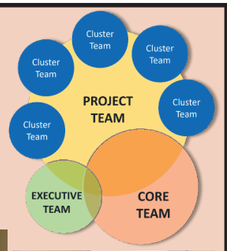
Teams unify to create a VDC LEAN culture for Model-First project delivery. VDC maximizes the collaboration capability of LEAN management tools

OPTIMIZE DATA & TECHNOLOGY

HIGH-PERFORMING TEAM

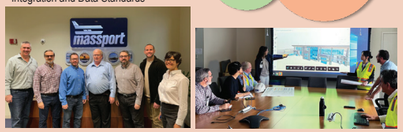
- Cluster teams w/ DTIG Support
- Executive team
- Core team

Teams use LEAN Management to become a high-performing team that achieves the Conditions of Satisfaction.



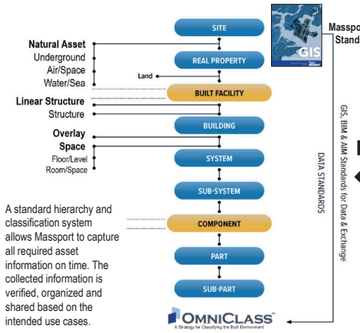
Digital Technology Integration Group

The Digital Technologies Integration Group (DTIG) Manages Technology Integration and Data Standards



CAPITAL PROGRAMS

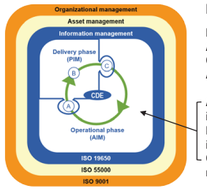
KNOW WHAT WE OWN, WHAT IT IS, and WHERE IT SITS



A standard hierarchy and classification system allows Massport to capture all required asset information on time. The collected information is verified, organized and shared based on the intended use cases.

COMMON INFORMATION REQUIREMENTS AND EXCHANGE

ISO 19650 provides a framework that delivers the right information at the right time to the right actors. It is critical to have strong knowledge of asset management operations and that this information flows into the Organization Information Requirements (OIR) and Asset Information Requirements (AIR), which in turn inform the Project Information Requirements (PIR) and Exchange Information Requirements (EIR).

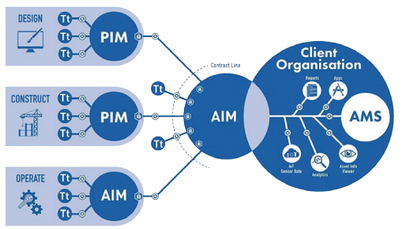


ISO INFORMATION MODELS

PIM – Project Information Model
AIM – Asset Information Model
CDE – Common Data Environment
AMS – Asset Management System

A - Start of delivery – transfer relevant information from AIM to PIM
B – Progress of the design intent model into the virtual construction model
C – End of delivery phase – transfer of relevant information from PIM to AIM

ENTERPRISE COMMON DATA ENVIRONMENT



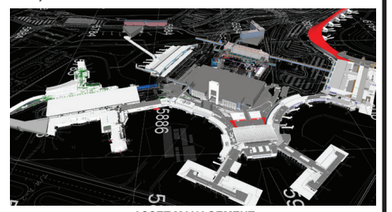
A Common Data Environment (CDE) is defined as the agreed source of information for any given project or asset for collecting, managing, and disseminating data and information through a managed process. It provides a *"single source of truth"* for the project and ensures that all parties work from the same information and use the same processes.

ASSET MANAGEMENT

VIRTUAL CAMPUS

The vision of a Virtual Campus at Massport is to create an integrated and comprehensive enterprise platform that provides users with valuable information about the organization's infrastructure portfolio. By leveraging mature BIM, CDE, GIS and other cutting-edge tools, Massport aims to achieve a holistic understanding of its buildings, projects, systems, and infrastructure assets, thereby maximizing value for stakeholders.

A Virtual Campus combines asset, systems, and geospatial information, and a well-defined ontology to digitally represent and manage an entire facility and infrastructure, enhancing collaboration, decision-making, and efficiency throughout its life cycle.



ASSET MANAGEMENT

Massport asset database documents the condition, useful life, and capital needs for project prioritization, maintenance, decommission, and replacement. Massport is committed to visual access to all data about an asset. Massport Virtual Campus will be an aggregation tool for all asset data, allowing users to understand the asset's performance, use, needs, and ongoing maintenance or projects.

MICA ASSET ASSESSMENT

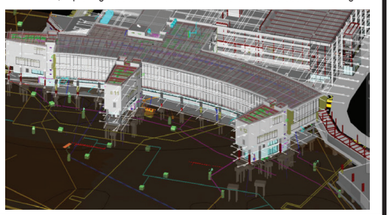
Massport Integrated Condition Assessment Database

- Condition assessment
- (Process, Info, & Tech)
- Asset Register
- Capital Needs
- Informs CIP

DIGITAL TWIN, AI/ML, and IoT CAPABILITIES

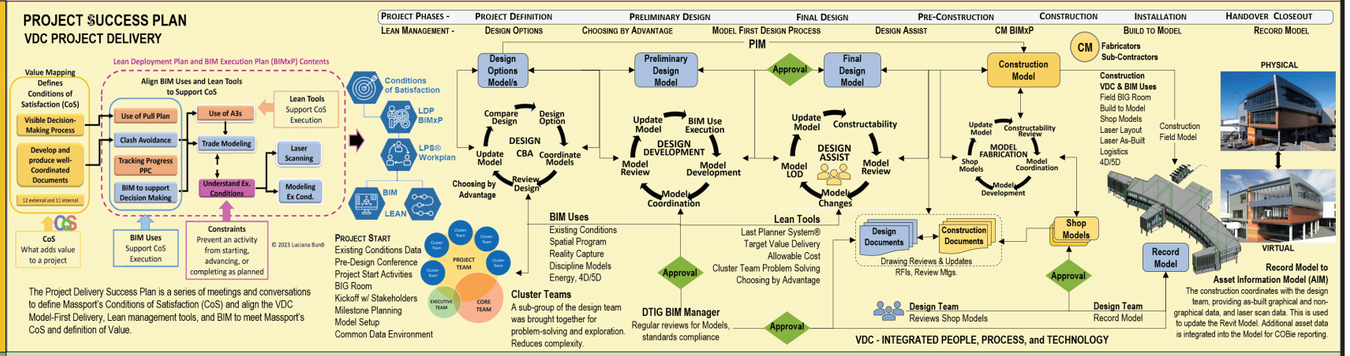
Digital Twins (DT) are "living" versions of BIM project models that use multiple data streams to provide a real-time virtual representation of a physical asset. Using integrated sensor data, DTs mirror their physical counterparts' performance, providing users with valuable insights into how assets function and may perform in the future.

DTs help plan future projects and change through simulations, combining complex data to predictably understand asset use before a physical asset, behavior, or situation exists. Artificial Intelligence (AI) and Machine Learning (ML) facilitates automating simulations to test the conditions and behaviors and understand potential outcomes. Using Internet of Things (IOT), DTs will provide real-time analysis and visualization, improving situational awareness and more informed decision-making.



PROJECT $UCCESS PLAN

VDC PROJECT DELIVERY



The Project Delivery Success Plan is a series of meetings and conversations to define Massport's Conditions of Satisfaction (CoS) and align the VDC Model-First Delivery, Lean management tools, and BIM to meet Massport's CoS and definition of Value.

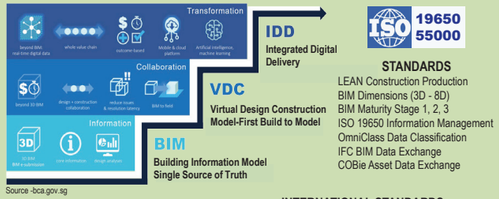
VDC PROJECT TECHNOLOGIES

Build to and with the model
Use technology to capture, process, and visualize data

PROJECT METRICS

- Planning, performance, and reporting tools
- Automated workflows and data exchange
- Technology-enhanced collaboration

STANDARDS and PRACTICES



Source -bca.gov.sg

ISO 19650 - International BIM Management Standard. Provides the process and management standards for BIM Use.
ISO 55000 - Series provides a framework for optimizing asset value throughout its life cycle, from acquisition to disposal, ensuring effective asset management.

STANDARDS

LEAN Construction Production
BIM Dimensions (3D - 8D)
BIM Maturity Stage 1, 2, 3
ISO 19650 Information Management
OmniClass Data Classification
IFC BIM Data Exchange
COBie Asset Data Exchange

INTERNATIONAL STANDARDS

Massport has adopted national and international standards that support a better industry. These Standards allow Massport to use the recognized best practices defined by the industry, with readily available education for consultants and reduced overhead for Massport. As these standards are updated, the DTIG will review and adopt those supporting Massport's goals.

VDC Timeline

Integrated and Inter-dependent Milestones for VDC Success

2024	2025	2026	2027	2028	2029	2030
VDC Processes	Launch VDC/BIM Stage 2	Pilot Project VDC/BIM Stage 2	Launch BIM/VDC BIM Stage 2		Achieve BIM/VDC Stage 2 Maturity	Achieve BIM/VDC Stage 3 Maturity
People, Standards	Issue VDC Roadmap; Issue VDC Guide & BIM Standard	CAD, GIS, Scan Standards; Issue Asset Information Request 1.0	Update Project Delivery Guide; Issue Enterprise Integration Strategy	Issue Asset Management Roadmap; Issue Asset Information Requests	Issue Asset Information Model; Update Project Model Asset Requirements	Pilot EAMS Facility Complete; Issue Asset Information Request 1.0
BIM Implementation	BIM Standards Pilot	Scan2BIM Group 1 Bldgs.	Scan2BIM Group 2 Bldgs.	BIM EAMS GIS Integration	BIM EAMS GIS Integration; Logan Campus Model	Pilot EAMS Facility Complete; Digital Twin Test Deployed; Virtual Campus 2.0 Operational; Logan Campus EAMS Complete
Technology Implementation	Project CDE 1.0	Project CDE Implementation; Project CDE 1.0; Project CDE Workflows	Integration Strategy Complete; Project CDE 2.0 Operational	Enterprise CDE Integration; Project CDE 3.0 Launch	Project CDE 3.0 Workflows	Integrated CDE 3.0 Automation; Integrated CDE 3.0 Operational

BIM STAGE 1 – CAD/BIM Integration

Discipline Modeling **File–based BIM**
BIM Uses

Use of 3D modeling with integrated CAD for documentation. File-based model sharing

BIM STAGE 2 – BIM Collaboration

Model-first process **Minimal File–based BIM**
Common Data Environment **n BIM Dimensions 4D,5D**

A model-first production process using a shared digital representation of the built asset. Use of a Common Data Environment, BIM Uses, and Data Standards.

BIM STAGE 3 – Enterprise Integration

Models Integrated in Enterprise CDE **Secure Custom User Access**
Standardized Workflows **Real-time data development**

Real-time integration and access to data model information in an enterprise CDE. Digital Twins and use of artificial intelligence (AI) for decision-making. Interoperable model and data standards.