



NAC Executive Insights

Digital Passports for Modular Construction

Key Points

- **The Digital Passport Is the Operational Golden Thread** - It becomes the single, auditable documented record that carries identity, fabrication, QC, logistics, installation, and commissioning evidence across the entire module's lifecycle—eliminating ambiguity and strengthening governance.
- **Passports Transform Gate Control and Quality Assurance** - They replace subjective signoffs with objective, evidence-based release criteria at fabrication, shipment, delivery, installation, and commissioning, dramatically reducing rework and disputes.
- **Evidence-First, Machine-Readable Design Enables Automation and Integration** - Structured data fields, URN/UUID identifiers (Uniform Resource Name/Universally Unique Identifier), and Application Programming Interfaces (API) ready formats allow ERP (Enterprise Resource Planning), SPC (Statistical Process Control), calibration, and sensor systems to autopopulate the passport, reducing human friction and increasing accuracy.
- **A Clear, Comprehensive Field Set Defines What “Good” Looks Like** - Identity, design revision, QC/SPC, Nonconformances (NCs,) shipment logs, commissioning tests, AIM (Asset Information Model) links, sustainability data, warranty, and change logs create a more complete digital asset record—not just a document.
- **Digital Passports Strengthen Compliance and Sustainability** – EPDs¹(Environmental Product Declaration), LCA (Life Cycle Assessment) links, hazardous substance data, certificates, and take-back terms support regulatory compliance, carbon reporting, and circularity requirements.
- **The Passport Becomes a Strategic Advantage** - When implemented well, digital passports reduce defects, accelerate acceptance, strengthen warranty protection, and enable scalable modular delivery—turning data discipline into competitive leverage.

Introduction

A digital passport is a portable, machine-readable record that travels with a prefabricated module or component throughout its lifecycle. It captures identity, provenance, design and fabrication data, quality evidence, transport logs, commissioning results, warranty and maintenance information, and the audit trail of changes. The passport is the operational embodiment of the golden thread for a module. It links

¹ EPD stands for Environmental Product Declaration. It's a standardized document that provides transparent, verified data about the environmental impact of a product throughout its lifecycle—covering aspects like raw material sourcing, energy use, emissions, water consumption, and end-of-life disposal. In modular construction, EPDs are often linked to materials and components (e.g., insulation, framing, finishes) and may be embedded in the module's digital passport to support sustainability tracking and compliance with green building standards like LEED or BREEAM.

evidence across the Common Data Environment (CDE), the Asset Information Model (AIM), and downstream facilities management systems.

Core Purposes

The core purposes of a digital passport include:

- **Traceability:** show who did what, when, and with what evidence.
- **Gate control:** provide objective release criteria for fabrication, shipment, installation, and commissioning.
- **Quality assurance:** store QC records, SPC summaries, and Non-Conformance (NC) closure evidence.
- **Handover:** deliver AIM-ready as-built data, spare parts, and maintenance instructions.
- **Compliance & sustainability:** record certificates, Environmental Product Declarations (EPDs), hazardous substance data, and take-back terms.

Key principles for passport design include:

- Unique identifier: every passport must have a persistent, globally unique ID.
- Evidence-first: every claim in the passport must link to verifiable evidence (photo, test report, sensor log).
- Machine readable: use structured data fields and standard identifiers to enable API exchange with CDE/BIM/AIM.
- Versioned audit trail: every update is recorded with author, timestamp, and reason (change log).
- Access control: role-based permissions for read/write and legal/contractual visibility.
- Minimal human friction: prefill from fabrication systems and enable mobile capture at delivery/installation.

Minimum recommended passport fields are shown in the following table.

Recommended Digital Passport Fields			
Field	Description	Type / Format	Required
passportId	Persistent unique passport identifier; Uniform Resource Name/ Universally Unique Identifier (URN/UUID)	string	Yes
moduleId	Project module reference (project code + module number)	string	Yes

Recommended Digital Passport Fields			
Field	Description	Type / Format	Required
moduleType	Module family/type (e.g., bathroom pod)	string	Yes
projectId	Parent project identifier	string	Yes
manufacturer	Legal entity manufacturing the module	object (name; contact; supplierId)	Yes
serialNumber / batch	Manufacturer serial or batch number	string	Yes
productionDate	Date of fabrication completion	ISO 8601 date	Yes
lot / batchNumber	Batch for materials or components	string	No
designRevision	Design revision or drawing reference	string	Yes
Level of Development (LOD) / shopDrawingRef	Link to shop drawing or model (CDE URL)	URL	Yes
externalDimensions	L×W×H and weight	object (mm; kg)	Yes
liftingPoints	Lifting plan reference and coordinates	URL / structured list	Yes
maxTransportDims	Transport envelope constraints	object	Yes
materialSummary	Key materials and major components	list (materialid; qty)	Yes
EPD / LCA	Environmental Product Declaration or LCA link	URL / doc ref	Recommended
hazardousSubstances	SDS links and flags for regulated substances	list / URL	Conditional

Recommended Digital Passport Fields			
Field	Description	Type / Format	Required
certificates	CE ² , ISO, fire rating, test reports	list of docs (type; ref; date)	Conditional
fabricationRecords	Fabrication step logs, operator IDs	list (step; operator; timestamp; evidence)	Yes
jigCalibrationRefs	Calibration certificates for jigs used	list of doc refs	Conditional
qcChecks	QC checklist results and pass/fail	list (checkId; result; evidenceLink)	Yes
spcSummary	SPC metrics for critical dimensions (mean, sigma, control status)	object	Conditional
nonconformances	NC records linked to this module	list (ncId; severity; status; evidence)	Conditional
changeLog	Versioned change entries (author; date; reason)	list	Yes
shipmentRecords	Transport events, carrier, sensor logs (shock/tilt), timestamps	list (event; carrier; sensorLink)	Yes for shipped modules
deliveryAcceptance	Delivery acceptance checklist and signature	object (inspector; date; evidence)	Yes

² CE stands for Conformité Européenne, which is French for “European Conformity.” A CE mark is a certification label required for many products sold within the European Economic Area (EEA). It indicates that the product meets EU standards for: Health and safety; Environmental protection; Performance requirements; and Regulatory compliance. In modular and off-site manufacturing, CE marking may apply to: Electrical components; Mechanical systems; Fire rated assemblies; Structural elements; Lifts, HVAC units, and prefabricated MEP equipment. When a component carries a CE mark, it means the manufacturer has verified—through testing, documentation, and quality systems—that the product complies with all relevant EU directives.

Recommended Digital Passport Fields			
Field	Description	Type / Format	Required
installationRecords	On-site installation steps, tolerances measured	list (step; measurement; evidence)	Conditional
commissioningTests	Commissioning scripts, results, tester IDs	list (testId; result; evidence)	Yes, for commissioned systems
aimLink	Link to AIM entry or as-built model	URL	Yes, at handover
sparePartsList	Recommended spares and part numbers	list (partId; qty)	Recommended
warranty	Warranty start date, duration, terms, contact	object	Yes
maintenanceSchedule	Recommended maintenance tasks and intervals	list	Recommended
takeBackTerms	Reuse / take-back instructions and credits	object / doc ref	Conditional
apiMetadata	Schema version, last updated, source System	object	Yes
accessControl	Permissions and visibility rules	object	Yes
legalClauses	Contractual notes (ownership, tooling co-funding)	doc refs	Conditional
attachments	Photos, test reports, sensor raw logs, certificates	list of file refs	As required
digitalSignatures	Signatures for release, delivery, commissioning	list (role; signatureRef; date)	Yes, at gates

Suggested data types and evidence mapping

- **Document links:** store as CDE (Common Data Environment) URLs or object storage references with checksum.
- **Photos & sensor logs:** timestamped and geotagged where possible; attach raw files and derived summary.

- **Measurements:** store numeric values with units and measurement method (laser, tape, jig).
- **Signatures:** cryptographic or system-logged approvals; include role and contact.

Implementation notes and best practices

- **Schema governance:** publish a canonical passport schema and version it; map fields to CDE object types and AIM attributes.
- **Mandatory gates:** require passport completeness and digital signature for fabrication release, shipment, delivery acceptance, and commissioning gates.
- **Automation:** integrate fabrication ERP, jig calibration systems, SPC tools, and sensor platforms to auto-populate passport fields and reduce manual entry.
- **Data retention & privacy:** define retention periods and redact personal data where required by law.
- **Interoperability:** adopt standard identifiers (UUIDs, URIs) and align with Digital Product Passport / DPP concepts where relevant.
- **User experience:** provide mobile capture forms for delivery and installation teams; minimize required fields for rapid capture and enforce evidence attachment for critical fields.

Conclusion

A well-designed digital passport transforms a module from a physical object into a traceable, auditable digital asset. Start with a compact, mandatory core (identity, fabrication records, QC, shipment, delivery acceptance, commissioning, AIM link, change log) and expand to include sustainability, warranty, and maintenance data as program maturity grows. Ensure the passport is machine-readable, evidence-first, and tightly integrated with your CDE and operational gates so it becomes the single source of truth across fabrication, logistics, installation, and handover.

Glossary	
Term	Definition
AIM	Asset Information Model; as-built dataset and documentation handed to facilities management for operations and maintenance.
CDE	Common Data Environment; centralized repository for models, documents, passports, evidence, and audit trails used across project teams.
Digital badges	Verifiable digital credentials awarded for completed training modules or competencies, stored in the LMS/CDE and linked to worker records.
Golden thread	Immutable, auditable chain of evidence linking design, fabrication, inspection, transport, commissioning, and handover records.
KPI	Key Performance Indicator; quantifiable metric used to evaluate success against operational targets (e.g., first-pass yield).
LMS	Learning Management System; platform that delivers, tracks, and records training courses, assessments, certifications, and learning progress.
LMS/CDE	Integrated view where LMS certification records and assessment evidence are linked to the CDE module passport and QC data for traceability.
Module passport	Portable digital record that travels with each module containing fabrication data, QC evidence, test results, transport logs, commissioning status, and change history.
NC	Nonconformance; logged defect or deviation from specification that requires corrective action, verification evidence, and closure.
OJT	On-the-Job Training; hands-on training delivered at the workplace where trainees learn tasks under supervision while performing real work.
Playbook	Operational manual that codifies standards, templates, gates, roles, training curricula, and procedures for modular delivery and governance.
RAMS	Risk Assessment Method Statement; documented hazards, controls, and safe methods for a task, station, transport leg, or installation activity.
RCA	Root Cause Analysis; structured process to identify underlying causes of failures or NCs and define corrective and preventive actions.
SPC	Statistical Process Control; method using control charts and sampling to monitor and control production quality and detect process drift.
VR/AR	Virtual Reality / Augmented Reality; immersive and overlay technologies used for simulation, training, assembly sequencing, and remote guidance.

For Further Reading – Other Executive Insights

- Craft Training for Modular Construction
- Golden Thread
- Modular Construction Contract Consideration
- Spare Parts in Modular Construction
- Modular Construction Transportation Risk
- Economic & Schedule Trade-Offs in Modular vs. Stick-Built Execution
- Modularization vs. Stick-Built Readiness Strategy

About the Author

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