An Introduction to Digital As-Builts and Strategies for Implementation

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INTRODUCTION

Digital as-builts can serve many purposes; two of which are highlighted here. First, digital as-builts can make the construction close-out process more efficient. Second, digital as-builts can improve how the as-built information reaches the individuals responsible for operating, maintaining, and managing assets. Digital as-builts are the next logical step for many agencies seeking to adapt project delivery processes for the digital age. This fact sheet will clarify what a digital as-built is and identify approaches that an agency may consider to implement digital as-builts.
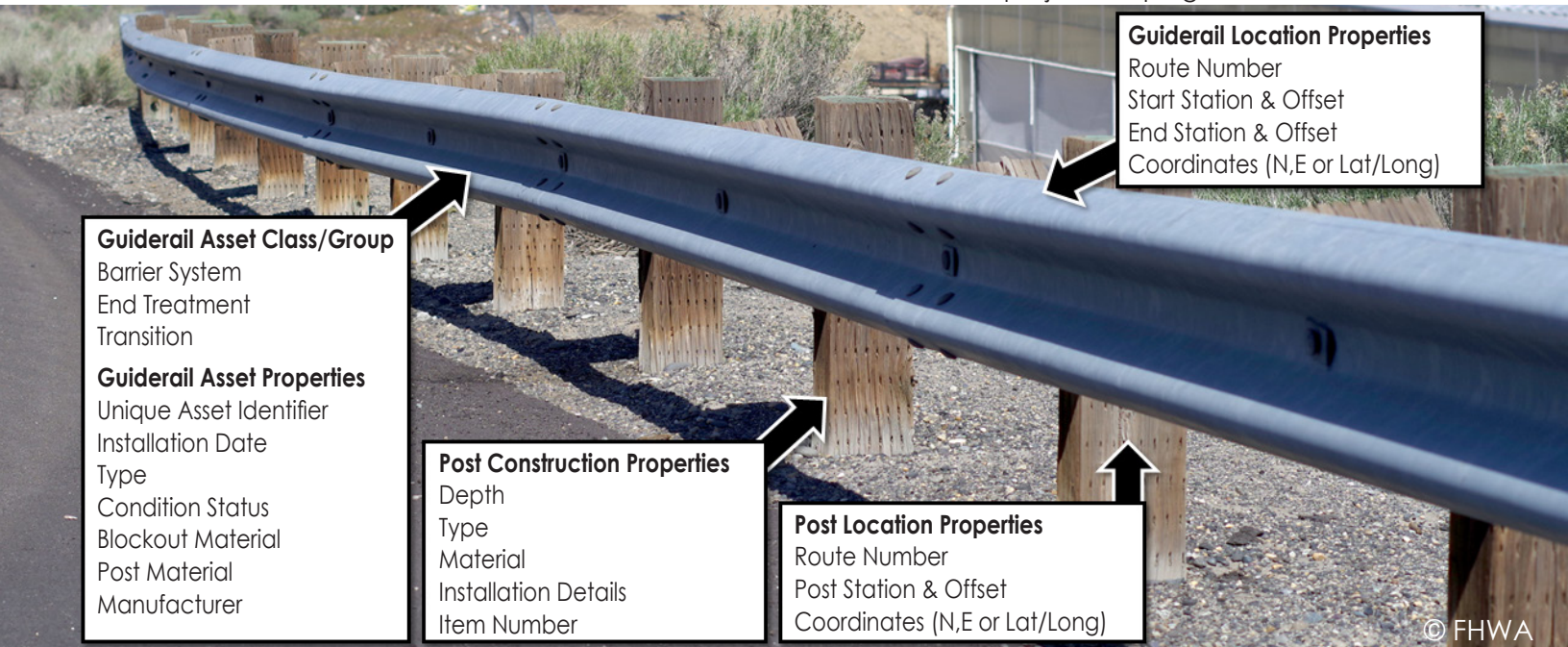
PURPOSE OF DIGITAL AS-BUILTS

Many agencies have replaced paper plans and other construction documents with electronically signed Portable Document Format (PDF) documents. Storing and managing these documents electronically has made the close-out process more efficient. Nevertheless, old practices for marking up as-built information on paper remain. It is difficult to compile paper as-built records when construction is complete.

Missing, incomplete, inaccurate, and disorganized project documentation (including as-built plans) delays the project close-out process. Resolving the issues with capturing, storing, and delivering organized as-built information is a primary use for digital as-builts during construction. Subsequently, there is an opportunity to improve how as-built records are delivered to the individuals who need to use them during close-out and post-construction.

Agencies use a variety of tools and methods to store and access the asset information needed to operate, maintain, and manage the various assets that make up the transportation system. These include geographic information systems (GIS), databases, field notes, inspection records and spreadsheets. The image below shows types of as-built guiderail and post information.

It is easier to distribute digital as-built records to the many individuals who need to receive them. Furthermore, it is easier to extract and incorporate digital information into an agency's various asset records where they will support business uses, like maintenance or project scoping.

Guiderail Location Properties
Route Number
Start Station & Offset
End Station & Offset
Coordinates (N,E or Lat/Long)

Guiderail Asset Class/Group
Barrier System
End Treatment
Transition

Guiderail Asset Properties
Unique Asset Identifier
Installation Date
Type
Condition Status
Blockout Material
Post Material
Manufacturer

Post Construction Properties
Depth
Type
Material
Installation Details
Item Number

Post Location Properties
Route Number
Post Station & Offset
Coordinates (N,E or Lat/Long)

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Digital as-builts can capture asset information like the indicated properties for guidrail and guiderail posts.

WHAT IS A DIGITAL AS-BUILT?

Agencies are approaching digital as-builts in a variety of ways to meet agency-wide, business needs to manage the constructed assets. The format and content of a digital as-built may vary for different agencies and even for different asset classes. A digital as-built is a digital record of the constructed condition in a format that is:

- **Electronic.** Information can be stored on a network, uploaded to a file sharing site, or emailed,
- **Searchable.** Information can be located within the file using query or search features,
- **Extractable.** Information can be extracted by an export or import feature, and
- **Durable.** Information will be accessible over the life of the asset.

TACTICAL IMPLEMENTATION SOLUTIONS

Tactical solutions can be implemented quickly at a small scale, such as on a pilot project. Such solutions can solve a narrowly defined need or test a concept for wider, more strategic implementation.

- **Vector PDF mark-ups.** PDF files conform to an international standard, ISO 32000-1:2008, ensuring that the information will be accessible over the asset lifecycle. PDF plan sets use vector text and graphics, raster graphics, or a combination of both. Vector format is extractable with text and geometry as created, whereas raster format is simply an image.
- **Field survey points.** There are standard conventions for capturing, encoding, and storing field survey information digitally. Survey points can document individual instances, linear features, and area boundaries in a searchable, extractable format.
- **GIS datasets.** As-built information that will be federated with an existing GIS-based asset inventory can be collected directly into a compatible file format. GIS data is searchable and extractable and is stored in a durable database format.
- **3D models.** 3D model-based information is electronic, searchable, and extractable only when accessed with compatible proprietary software. AASHTO has resolved to adopt Industry Foundation Class (IFC), an international open data standard, ISO 16739. IFC-formatted 3D models will be a durable format that will be available for use in all software products that have implemented Version 4.3 of the IFC standard.

AS-BUILTS WITH DIGITAL TWINS

There are potential efficiencies and cost savings if all business units have access to a single source of current, relevant, reliable information about the assets they touch. A digital twin is a digital representation of an asset that is geospatially located within the system and connected to relevant inventory, condition, and performance information. Digital twins would provide a "one-stop-shop" for users to locate the history, status, and performance information for each asset. The graphic below illustrates the Utah DOT vision for using digital twins throughout the asset lifecycle.
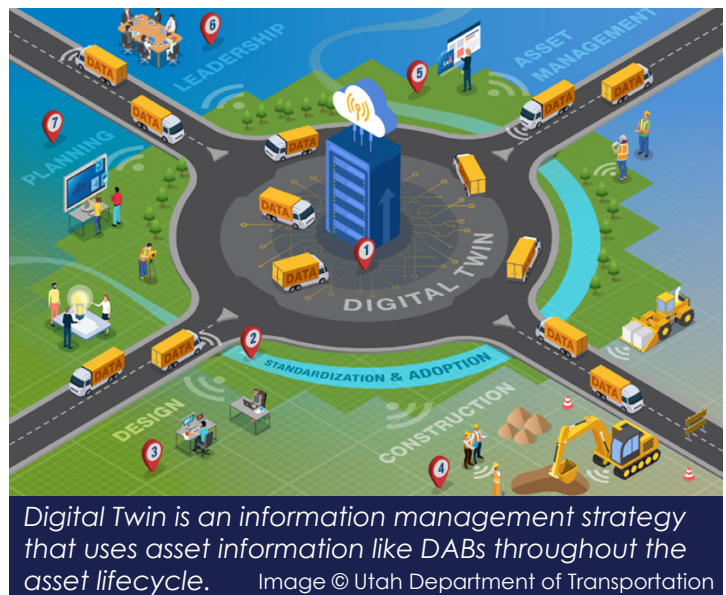
Digital twins connect the business systems that store asset information and use processes and tools to capture and store complete asset histories. Digital as-builts are a way to capture an essential chapter of the asset histories. The as-designed information could be stored in the digital twin to be verified or updated during construction to reflect the as-built conditions. In this way, digital twins could increase the efficiency both of capturing as-built records and creating and maintaining current asset information for priority assets.

RESOURCES

FHWA Digital As-Builts Page
Minnesota DOT Digital As-Built Deliverables
Utah DOT Digital Twin Strategic Plan

Digital Twin is an information management strategy that uses asset information like DABs throughout the asset lifecycle. Image © Utah Department of Transportation