CTA's Asset Management Initiatives

CTA TAM Update

and

Linear Asset Management Implementation

Chicago Transit Authority (CTA)

July 2016

Overview

- **CTA – Facts at a Glance**
- **CTA Asset Management - Where Are We Now**
  - TAM History
  - Recent Accomplishments
  - Linking Data with AM
- **Linear Asset Implementation**
  - Project Structure
  - System Structure
  - Track/Mobile Implementation
  - Structure
  - Signal
- **Lessons Learned**
- **Final Thoughts**

CTA - FACTS AT A GLANCE

The CTA operates the nation's second largest public transportation system. On an average weekday, 1.6 million rides are taken on CTA. The CTA is a regional transit system that serves 35 suburbs, in addition to the City of Chicago, and provides 83 percent of the public transit trips in the six-county Chicago metropolitan area.

- **CTA has 1,888 buses that operate 130 routes utilizing 10,813 bus stops, and 1,301 route miles.**
- **On the rapid transit system, CTA's 1,492 rail cars operate eight routes, 145 rail stations, and 224.1 miles of track (elevated, at grade and subway).**
- **Other CTA Facilities:**
  - Seven (7) Bus Garages
  - Twelve (12) Rail Maintenance Facilities
  - One (1) Heavy Maintenance Shop
  - Sixty Nine (64) Substations
  - Three (3) Misc. Facilities
- **2016 Operating Budget – 1.475 Billion**
- **2016 Capital Budget – 638 Million**

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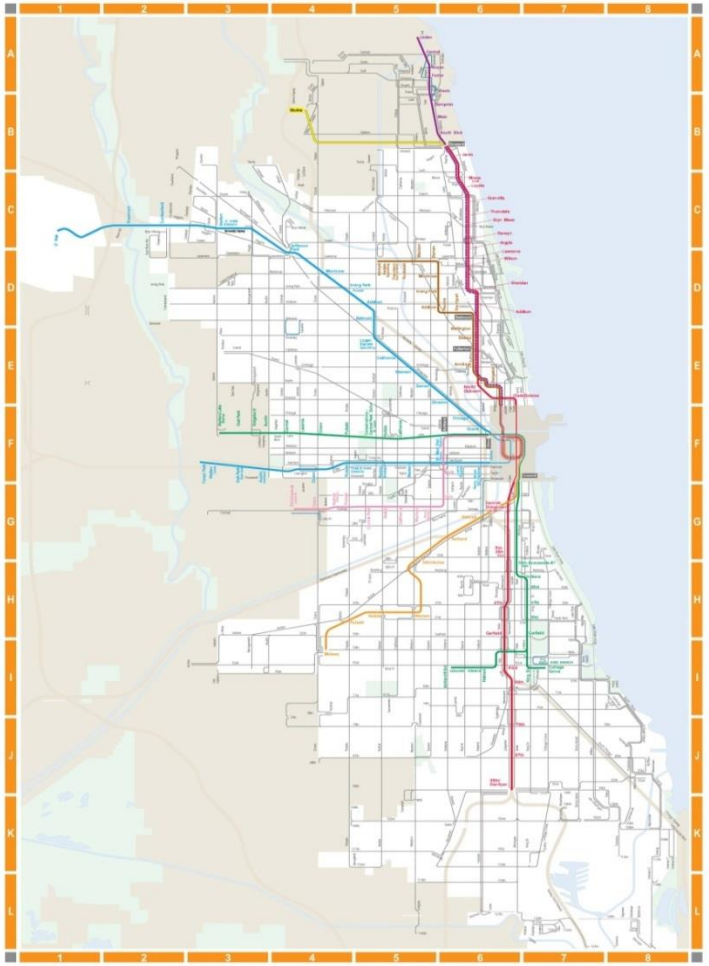


CTA - MOVIES AT A GLANCE

- **The Sting (1973)**
- **The Blues Brothers (1980)**
- **Risky Business (1983)**
- **Running Scared (1986)**
- **Planes, Trains and Automobiles (1987)**
  "Those aren't Pillows!"
- **While You Were Sleeping (1995)**
- **Batman Begins (2012)**

CTA – Transit Legacy System

- **Aging Assets**
- **Legacy/Antiquated Data Systems**

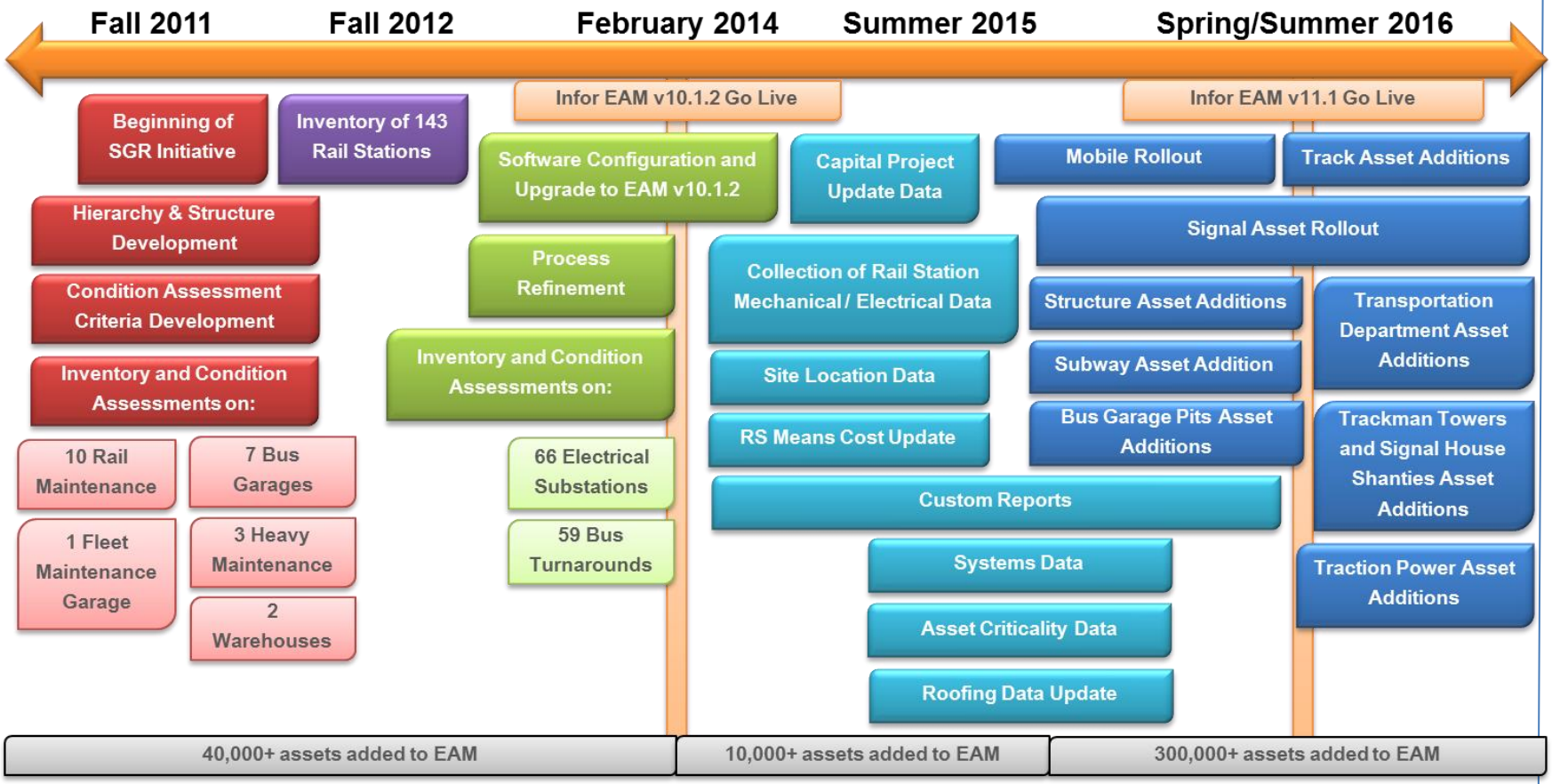
Asset Age + Asset Complexity = High EAM Implementation Complexity

"***Complexity of change:*** *Change complexity refers to how complicated executing change within the organisation is. Organisations with many or all of the high-complexity characteristics face many challenges during an EAM implementation. Therefore, the ability to design a pragmatic EAM implementation with a systematic, believable roadmap for change is essential (and especially so where confidence is low due to failed initiatives in the past*)"…….. ***Implementing Enterprise Asset Management*** FOR DUMmIES

History of TAM at CTA

- 1992 - Asset inventory and engineering condition assessment
- 2007 – Vehicle maintenance management system implemented
- 2008 - Facilities management system upgraded
- **2010** - CTA receives grant for EAM development through the US Dept. of Transportation State of Good Repair Initiative (SGR) 2010
- 2010 - Regional capital asset inventory
- 2011 - Regional capital decision tool
- **2012** - CTA receives additional grant award for continued EAM development
- 2014 – CTA upgrades the Facilities software system from a work order management tool to an Enterprise Asset Management System.
- 2015 – CTA implements structure linear asset management in the EAM system
- **2016 – CTA's EAM Software 'Roadmap' is developed**
- **2016 – Track assets and associated functionality to be implemented Summer 2016**
- **2016 – AMP Consultant chosen. Work to begin Summer 2016**

TAM Timeline



Linking Data with AM Practices – Recent Accomplishments

- **CTA Specific Cost Markups**
  - Base RSMeans cost values are marked up to include an area cost factor, escalation to current year, and subcontractor/GC-related costs.
  - Intended for rough order magnitude planning purposes only. Actual construction and project costs will vary significantly.

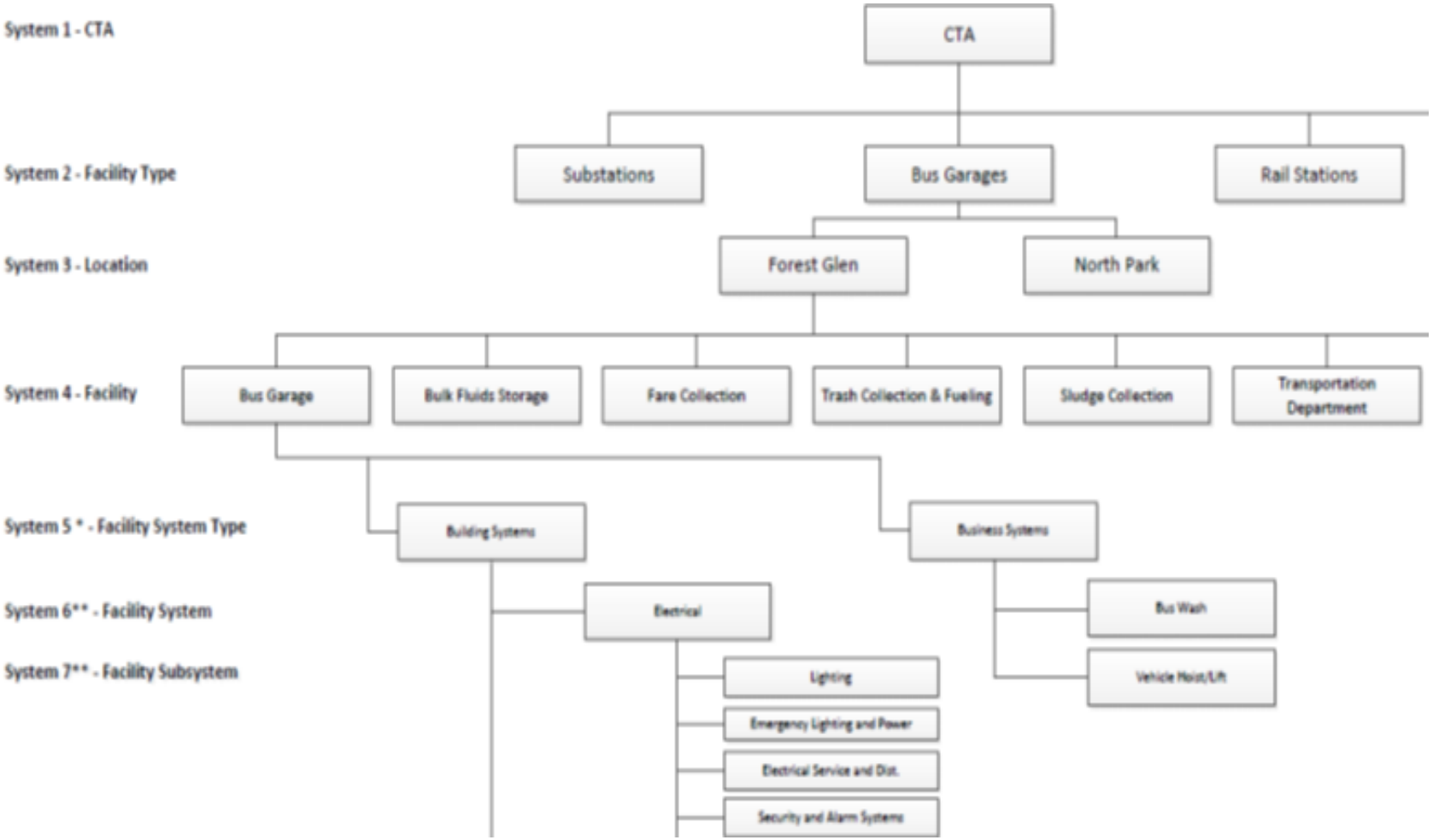
- **Capital Project Asset Update**
  - Contractual language added to include requirements for asset data from project planning through construction.
  - Intent is to place responsibility on the design and construction contractors to provide data that optimizes this lifecycle stage to better manage total asset lifecycle cost, risk and performance.

- **Asset Criticality (In combination with condition and replacement cost)**
  - Maintenance can use asset criticality in combination with condition rating for prioritizing work and resource allocation
  - Data analysis for capital project identification and prioritization.

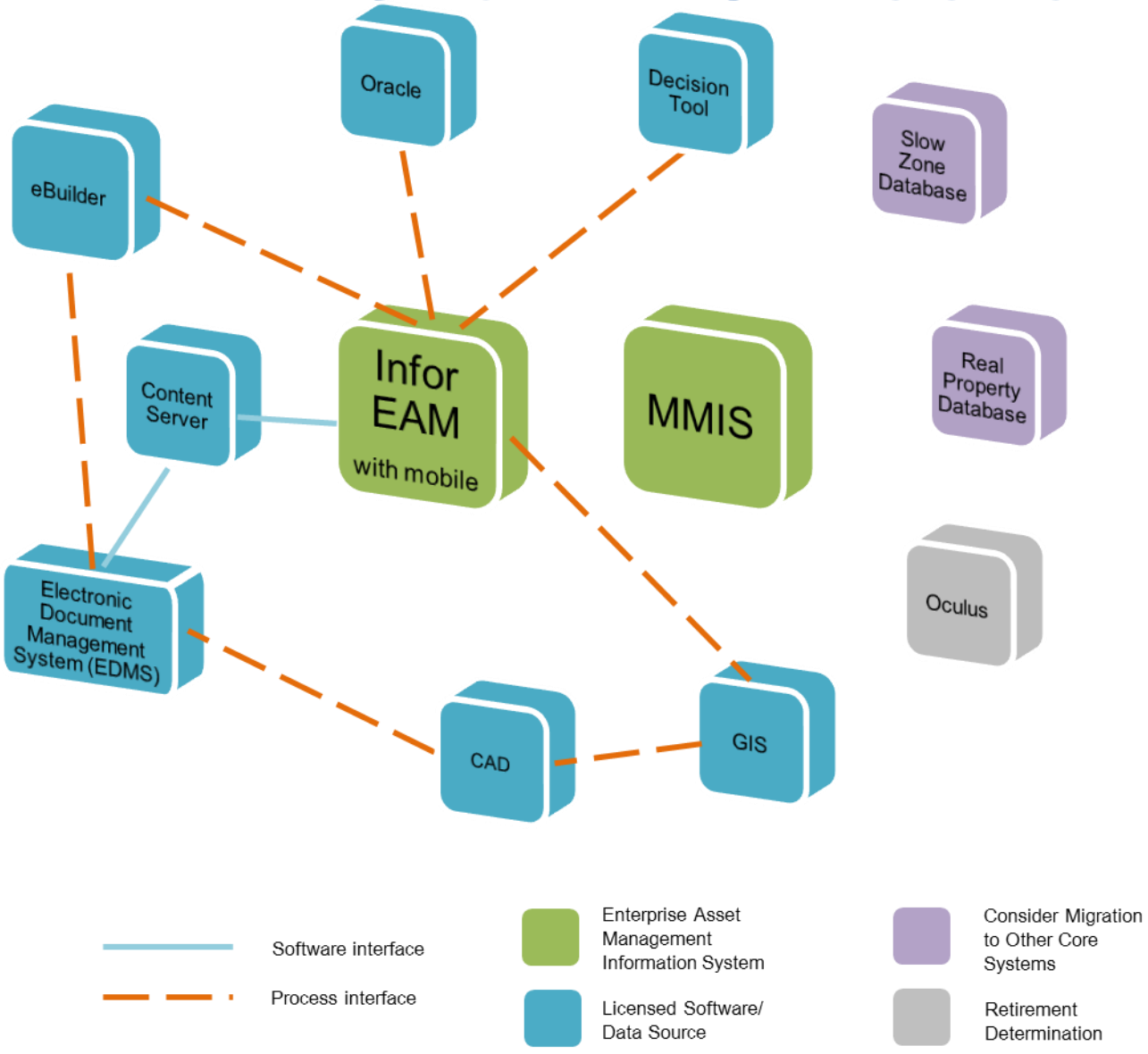
Linking Data with AM Practices – Recent Accomplishments

System level data collection and reporting

Applying data attributes/rolling-ups at location, and facility type/systems provides for more effective data analysis and reporting.

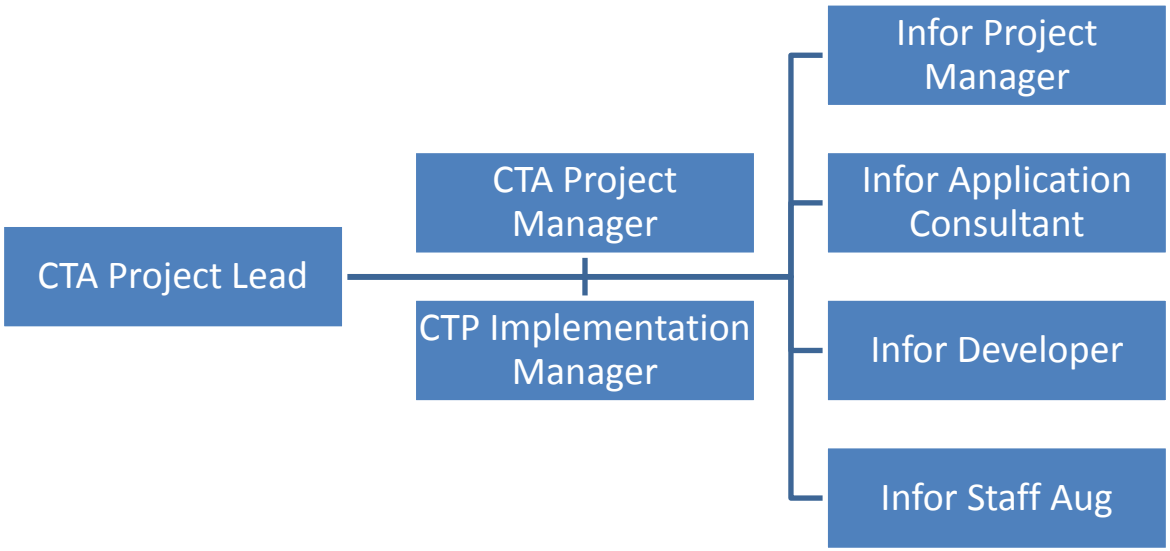


Software System Structure



Track/Structure/Signal Project Management Structure

- **CTA Project Lead -** Strategic Oversight
- **CTA/CTP Managers -** Ensure business requirements are achieved



CTA Linear Assets – Track/Structure/Signal

Power & Way Department Mission

"Efficiently maintain a safe and reliable rail infrastructure, while minimizing disruptions to rail service and the impact to its customers."

The CTA rail system consists of approximately 242 miles of revenue, siding and yard track. The system is powered by 239 miles of traction power contact rail, or "3rd Rail," that is fed through a network of cables and 64 substations. Over 40% of the CTA's Rail System operates on elevated structure. The balance of the system is at grade or in subways.

- **Track Overview**
  - 224 Track Miles
  - Elevated/At Grade/Subway
  - Track Markers every 100 feet
  - Inspection and Maintenance business processes
  - Mobile Technology

- **Structure Overview**
  - Structure supporting Track – Bents Only
  - Over 7k bents as 'Positions." Assets total over 112k
  - Two (2) year inspection cycle
  - Mobile not included as part of Phase I

- **Signal Overview**
  - Includes Signals, Switches, Track Circuits, Relays, Crossing Gates, Junction Boxes and Relay Houses.
  - Implementation on hold until Track Go-Live

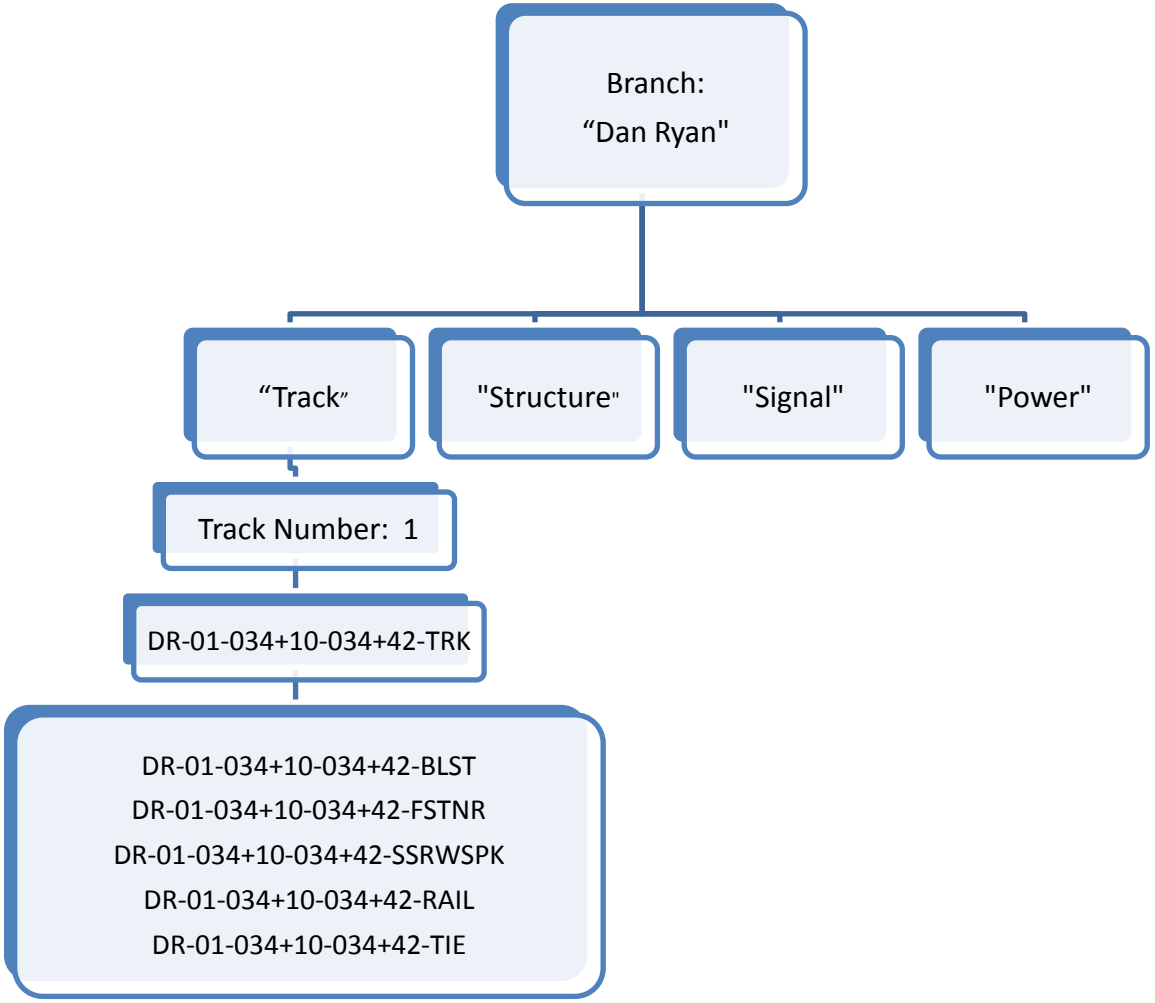
Track Asset Management Implementation with Mobile

- **Background**
  - Antiquated software legacy system
  - No conversion; defects to be entered beginning day one of go-live inspection schedule
- **Foundation for linear asset location reference**
  - Track Marker used as location reference across all assets on a linear plane
- **Phase I Implementation**
  - Asset hierarchy build out
  - Mobile functionality for inspection and maintenance
  - PM scheduling with labor tracking
- **Future Phases**
  - Infor GIS and Linear Referencing modules
  - Slow Zone Mapping
  - Geometry car for standard gauge track data
  - Electronic Charts

Track Asset Setup

- **Track markers are used to define approximate 100 foot segments of track to form Positions.**
- **These segments correspond to the physical track markers located in the field.**
- **Each track Position contains approximately 10 Assets, which can be looked at as discrete elements. Each Asset has a discrete list of associated problem codes. The assets that are inspected for typical rail segment inspections include, but are not limited to:**
  - Ballast
  - Fastener
  - Grade Crossing
  - Guard Rail
  - Insulated Joint
  - Joint
  - Rail
  - Spike/Screw spike
  - Tie
  - Turnout/Switch

Track Data Structure



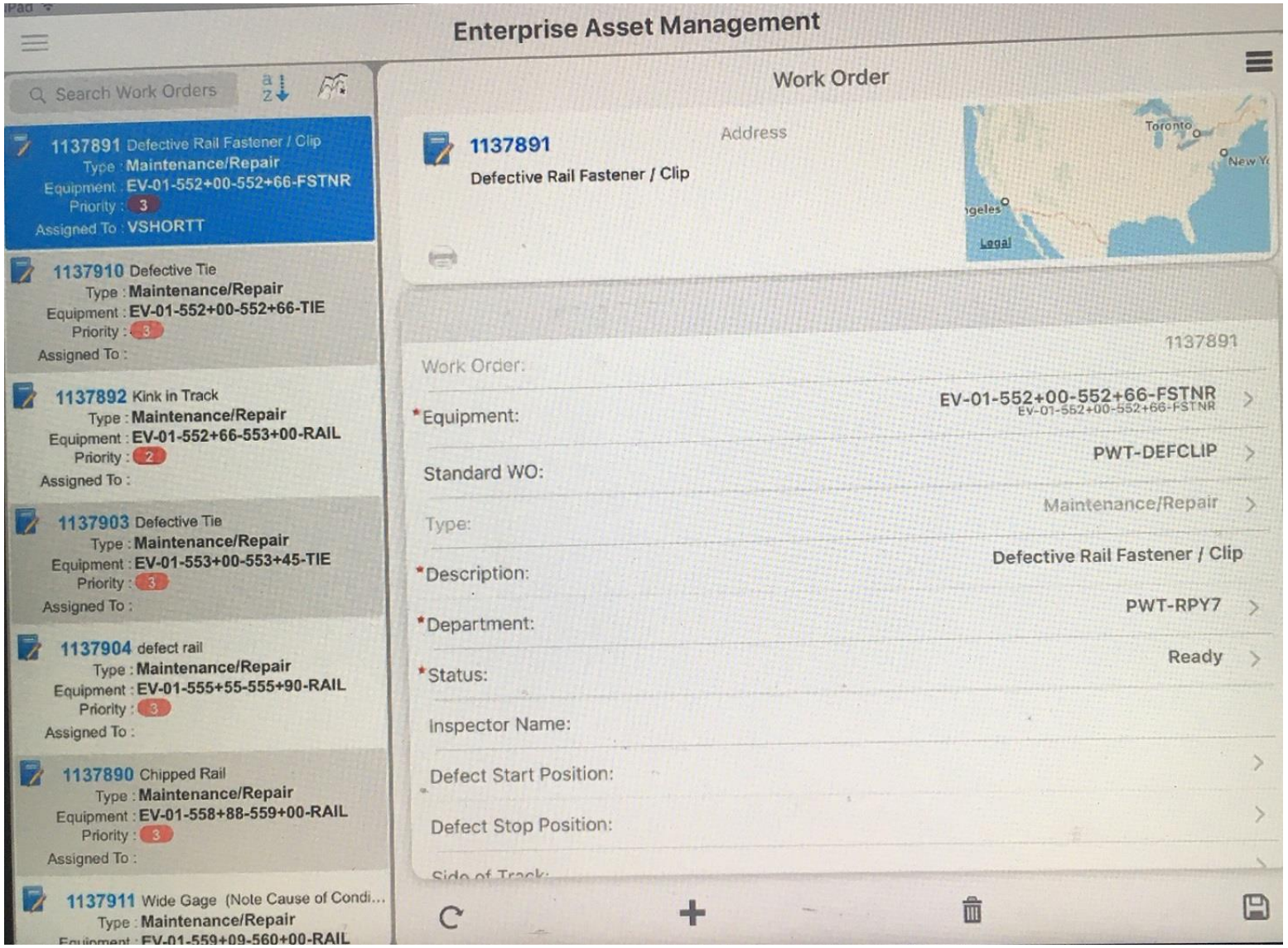
Track Asset Attribute Example

Track Segment Name	Segment Attribute	Example
Position	Branch	EV
EV-01-551+00-551+88-TRK	Track #	01
	Start Track Marker	551
	Start Footage	0
	End Track Marker	551
	End Footage	88
	Geometry	Spiral
	Elevation	Elevated
Element (Asset)	Branch	EV
EV-01-551+00-551+88-BLST	Track #	01
	Design Life	35
	Installation Year	2016
	Remaining Life	35
	Age	0
	Ballast Type	Granite
	Unit Replacement Cost	$0.00
	Condition Rating (1-5)	5
	Condition Rating Source	West Shops
	ConditionRatingDate	12/21/2015
	Service Line Color	Purple

Track Inspection

- **CTA's 224 miles of revenue track is rolled up into approximately 25 geographical territories (e.g. Territories EL1, EL2, RPY1)**
- **Track inspections originate from three physical locations with track lines segmented as follows:**
  - Green/Loop/Orange/Brown – 406k feet
  - Red/Purple/Yellow – 406k feet
  - Blue/Pink – 370k feet
- **There is one (1) Track Roadmaster and approximately eight (8) Track Inspectors at each of the three locations. Revenue track is inspected twice every seven consecutive days by teams of two (2) Inspectors.**
- **Prior to sending the Inspectors out in the field, the Roadmaster will assign a mobile tablet to each pair of Inspectors**
- **The mobile device will display the PM walk for the day and all open defect work orders (see next slide)**
- **The Inspectors will need the ability to:**
  - Sort work orders by track marker
  - Select a track element when a new defect has been identified for a corrective action and quickly create a work order for the element within the defined segment
- **The goal is to develop a defined track territory that, when walked at a reasonable pace, allows inspectors to produce a detailed inspection report within the allowable timeframe.**
- **Inspectors will conduct their walk in a disconnected mode.**
- **Mobile devices will be ruggedized and glare resistant.**

Track Inspection



TRACK MAINTENANCE

- **Track Maintenance originates from three physical locations separate from Inspection.**
- **There are two (2) Track Maintenance Roadmasters and approximately fifteen (15) Trackmen at each of the three locations.**
- **The Roadmaster III is responsible for daily lineups and supervises all aspects of Trackmen's daily operations. On a daily basis the Roadmaster III will query Infor EAM to review, prioritize and schedule defect work orders for repair.**
- **The Roadmaster II will receive his/her daily assignments from the Roadmaster III. The Roadmaster II will then give each crew a mobile tablet listing their assigned work orders.**
- **After repairs have been completed, the Trackmen will book labor and return tablets to their designated location.**
- **The Roadmaster II will review work and close defect work orders within EAM.**

Track Asset Implementation - Lessons Learned

- **A scalable asset hierarchy foundation that meets both operations/maintenance and capital planning needs is not easy, but very necessary.**
- **Develop a Track Requirements document to delineate all necessary configurations and processes throughout the project lifecycle.**
- **Demonstrate Proof of Concepts for major functionality is crucial for ensuring functionality can be performed as well as identifying next steps and build-out level of effort.**
- **Involve key end users early and often.**
- **Selection of mobile devices and associated functionality must support safe and efficient operations.**
  - Decision to operate in disconnected mode
  - Ruggedized, glare-resistant tablets
  - Longer battery life
  - Sort by equipment for work orders

STRUCTURE

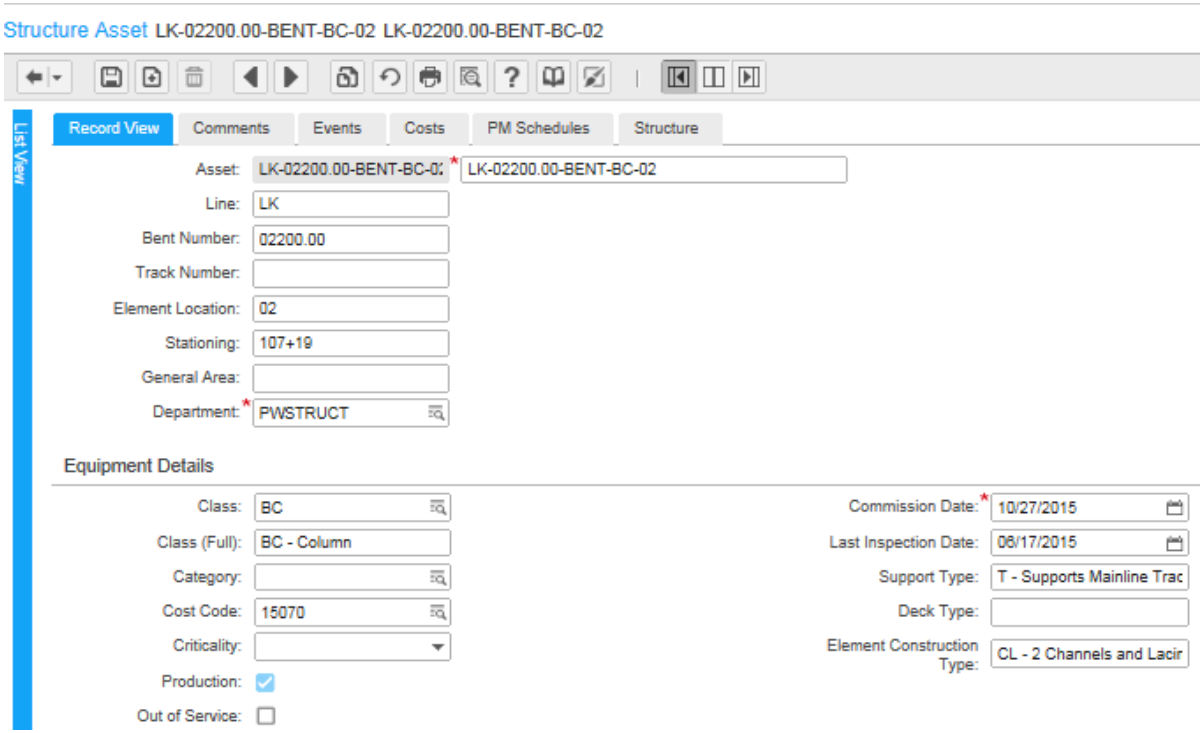
Over 40% of CTA's Rail System operates on elevated structure. The balance of the system is at grade or in subways. There are approximately 52.3 miles of structure, which is equivalent to 104.6 track miles of elevated single span structure to maintain, as well as 115 bridges and viaducts over streets, highways and waterways along with 64 elevated stations.

- **Legacy data system on last leg**
- **Over 7k bents, 112k assets, and converted work orders**
- **Two (2) year inspection cycle**
- **Mobile not part of Phase I**

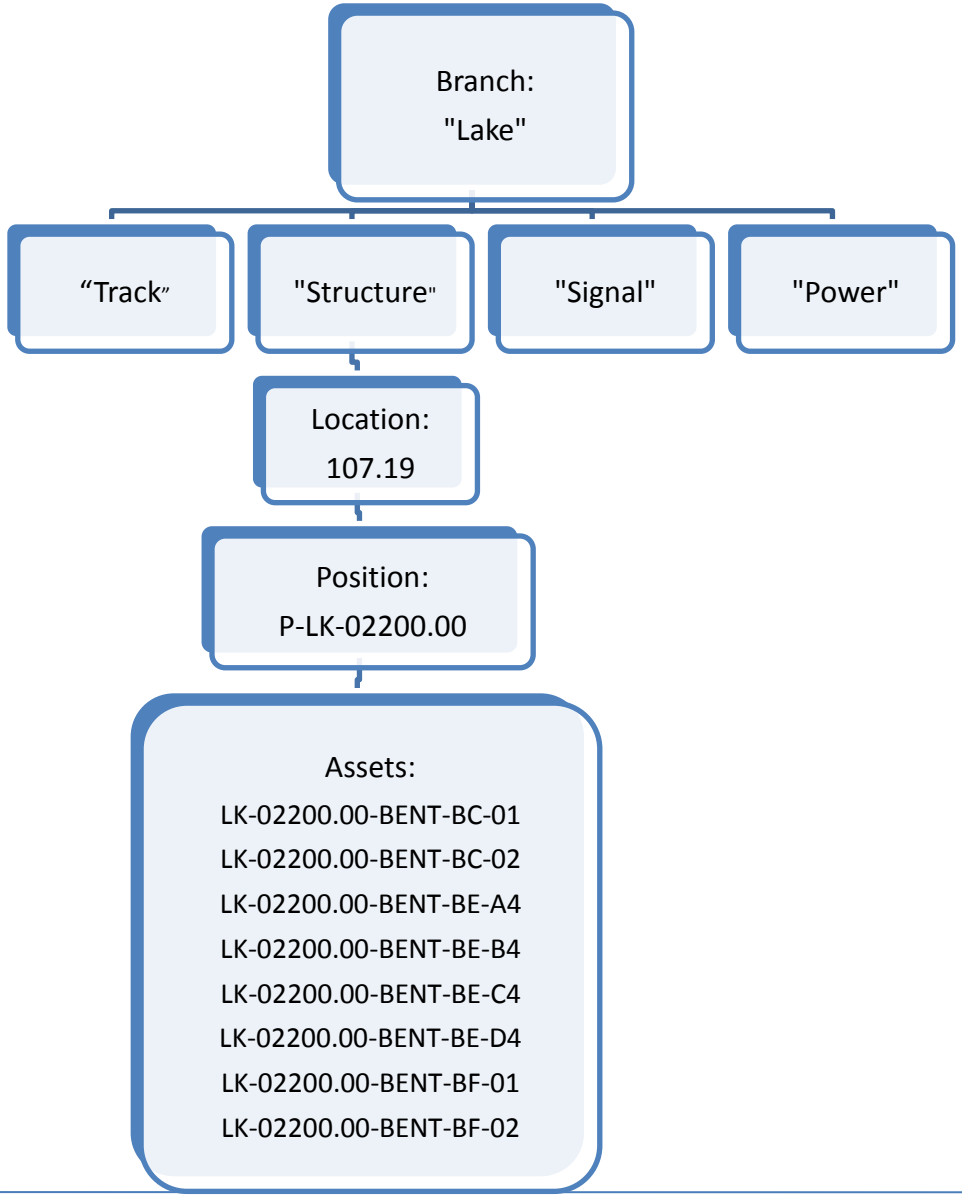
Structure Hierarchy Setup and Data Attributes

- **Position = Bent (P-LK-02200.00)**
- **Asset = Element (LK-02200.00-BENT-BC-01)**
- **Assets under P-LK-02200.00:**
- LK-02200.00-BENT-BC-01
- LK-02200.00-BENT-BC-02
- LK-02200.00-BENT-BE-A4
- LK-02200.00-BENT-BE-B4
- LK-02200.00-BENT-BE-C4
- LK-02200.00-BENT-BE-D4
- LK-02200.00-BENT-BF-01
- LK-02200.00-BENT-BF-02

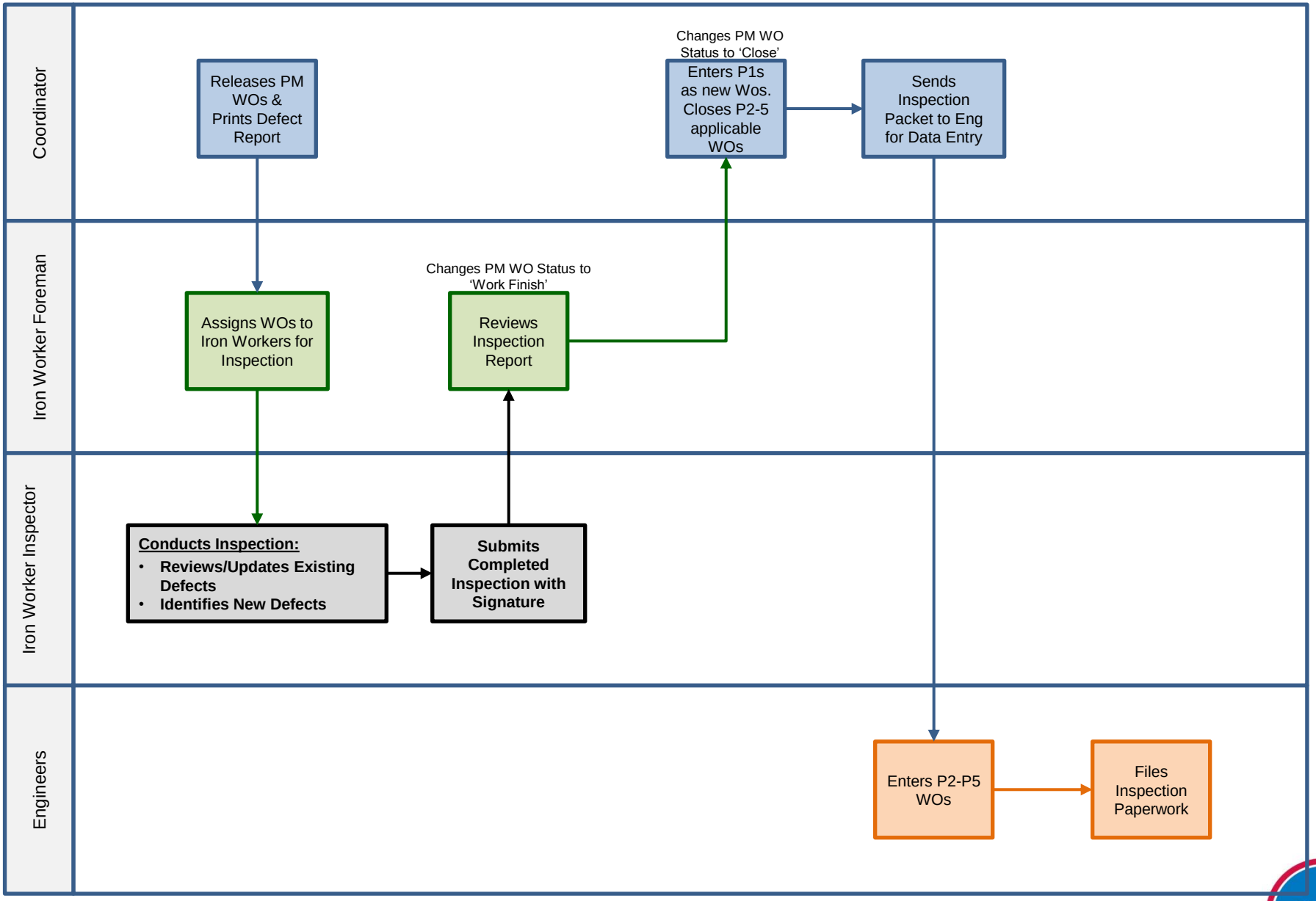
- **Each Asset will have the following attributes:**
  - **EAM Class "BC – Column"**
  - **Asset Location (Stationing)**
  - **Element Location Code**
  - **Element Construction Type i.e. "CO – Concrete"**
  - **Support i.e. "P - Supports Platform"**
  - **Deck Type i.e. "OD - Open Deck, Ties on Stringer"**
  - **Last Inspection Date**



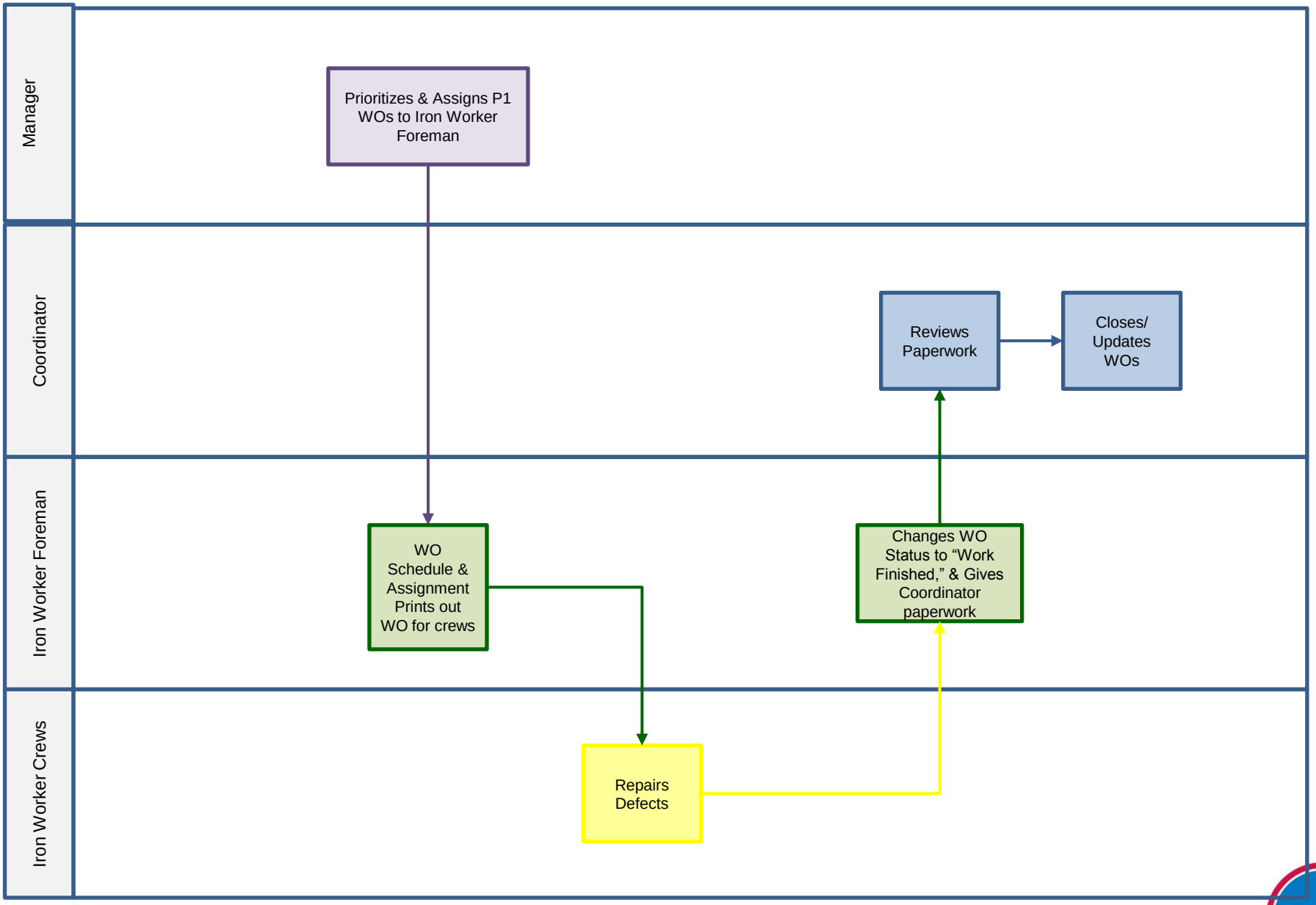
Bent Data Structure



EAM Bent Inspection Process– 2-Year Cycle



EAM Bent Maintenance Repairs



Structure Implementation – Lessons Learned

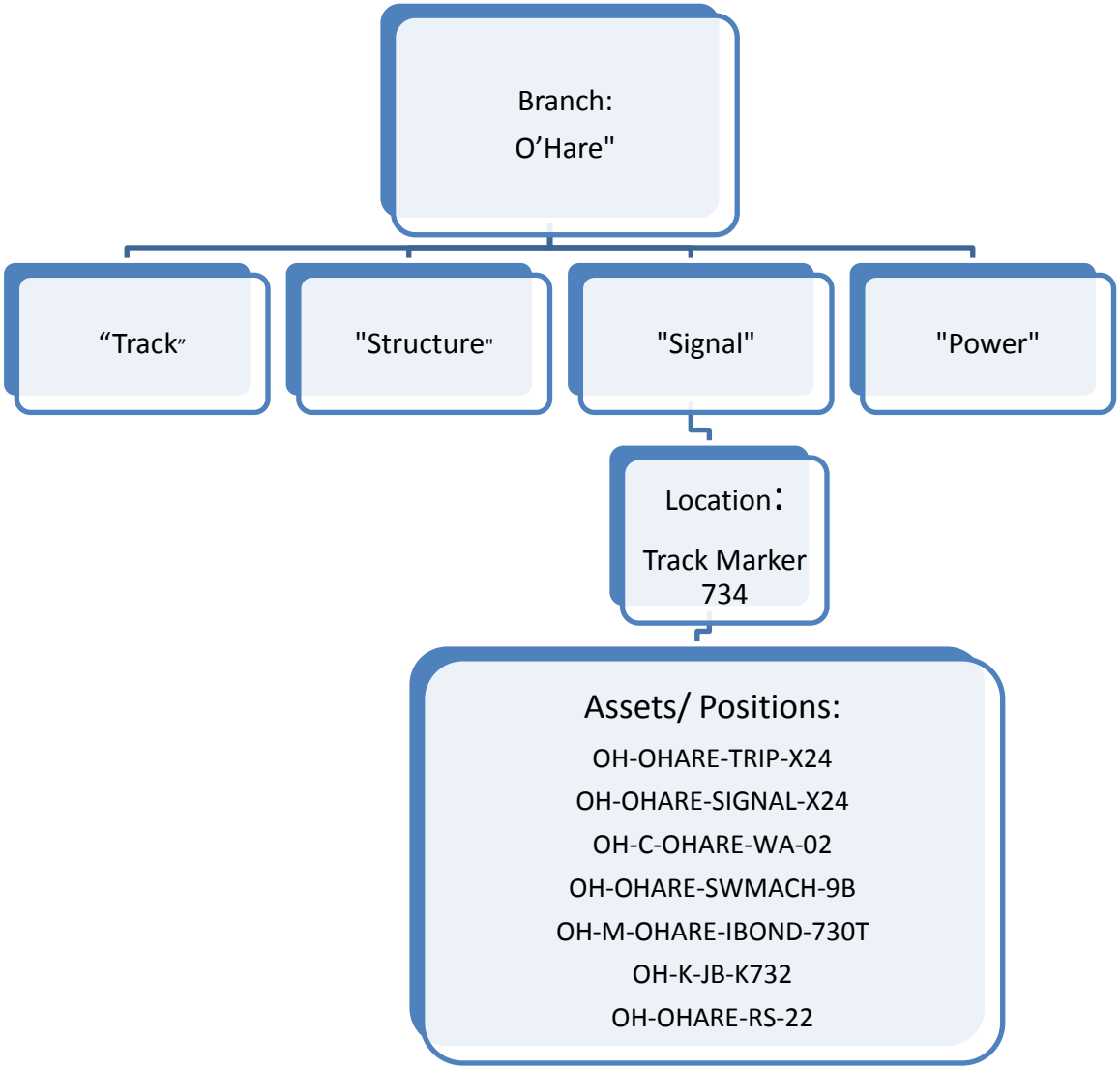
- A pilot conversion, requirements document with POC would have been the preferable approach, however an unstable legacy system necessitated a 'Big Bang' adoption.
- Review and adjustment of legacy data took considerable amount of time.
- A script was created by the vendor to upload the large volume of legacy work orders into EAM.
- Engagement of key stakeholders across departments in early stages is essential.
- Initial work flows documented business practices centered around a legacy system which relied heavily on manual processes. Must get out of mode of manual collection of data, and shift towards real-time data collection using mobile technology.

SIGNAL

The CTA Signal System is designed to permit the safe operation of trains over the 224 track miles at speeds up to 70 mph with intervals between trains as close as 90 seconds. The combination of safety and speed is necessary to provide rapid transit service to the system's 160 million annual riders.

Inspects and maintains 813 signals, 1,064 rail track switches, 1,835 track circuits and 24,000 vital signal relays.

SIGNAL


Branch:
O'Hare"
"Track"
"Structure"
"Signal"
"Power"
Location:
Track Marker
734
Assets/ Positions:
OH-OHARE-TRIP-X24
OH-OHARE-SIGNAL-X24
OH-C-OHARE-WA-02
OH-OHARE-SWMACH-9B
OH-M-OHARE-IBOND-730T
OH-K-JB-K732
OH-OHARE-RS-22

Signal Summary

- **No Central Repository of Asset Data**
- **Project to resume upon Track Go-Live**
- **All Positions have been Identified**
- **Challenges**
  - Having the right people at the right time to make the right decisions
  - Buy in at all levels
  - Asset definition and setup across territories
  - Resource constraints for collecting data
  - Connectivity at relay houses
  - Phased approach
- **Use Lessons Learned from Track and Structure:**
  - Requirements Document
  - Proof of Concept

Lessons Learned - Summary

- **System Setup**
  - Build a hierarchy of assets is critical to achieve the ultimate goal in asset tracking and reporting.
  - Configure your system to support both Operations/Maintenance and Capital Planning.

- **Software Selection, Implementation and Use**
  - Place substantial selection criteria on a vendor's ability to present and demonstrate software functionality.
  - Continued focus to use the system for asset management and not only as a work order tool.

- **Project Implementation**
  - A recognized entity for asset management is needed for effective implementation and ongoing process management.
  - To implement a best practice approach, create a detailed requirements document reviewed and approved by all project members.
  - Critical to tie business practices to technology to support data management
  - Demonstrating Proof of Concepts for major functionality is crucial for ensuring the functionality can be performed as well identifying next steps and build-out level of effort.

Final Thoughts

- AM processes currently in place will be utilized for the linear asset rollout providing for multiple levels of operations and capital planning analysis.
- Challenges of making the tool an "AM system" and not just "WO system" include data rolling up to right levels, including all attributes, as well as having a process for updating those attributes (condition, etc.).
- It takes a lot of extra work to implement a system with detailed asset information, with appropriate asset hierarchy rollup, that can link different areas of the organization and serve multiple purposes.
- But the ultimate utility is greater for the agency than a high level listing of assets with no drill-down capability. And while this level of detail is not necessarily the one to share at the federal or regional level, we recognize the value of putting in the extra work to get to this level of detail and cross-department coordination in the implementation.

CTA TAM Update and Linear Asset Implementation

Thank You!

CTA Contact Information
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