Geodatabase design Considerations for Roads Asset Management System (RAMP)

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March 19, 2008

GIS-T 2008
Agenda

- RAMP at a Glance
- RAMP A Historical Review
- Asset Registry (GIS) Requirements
- Roads Maintenance Business Background
- RM Existing Data Structure / Architecture
- Deficiencies of the Current Architecture
- Proposed Data Model
- Future Directions
Program streams include:
- Asset Registry & Condition Assessment
- Work Management
- Cost Management
- Performance Mgt.
- Asset Management Plans
RAMP  
A Historical Review

- First Asset Registry for Streetlights in 2005.
- Implemented wireless access to GIS for Field Users via Citrix in 2007.
- Started Road Maintenance Asset Registry business requirements in 2007.
Asset Registry Requirements

• **Centralized** Asset Registry
• Capable of performing **Spatial Analysis** on each asset and between different asset types
• Being able to retrieve **Historical and Predicted** information for all the assets
• **Easy accessible** information by all the stakeholders
• Capable of working in sync with **Work Management** sub-system
• Offer **Improved Efficiency** and service level to the Citizens
Asset Registry design

To Date

- Enterprise GDB including Signals, Signs and Streetlights
- Each a “Feature Dataset” collection of related feature classes, related tables and Topological relationships
- Available in SDE layers for accessing at corporate level
- Enabled GIS data available from WM using “Editable Tables View”
A snapshot of GDB

and some Implemented GIS tools
### Hansen View of Same Asset

**Street Sign InfoViewer**

**Street Sign Asset Type**

<table>
<thead>
<tr>
<th>Sign ID</th>
<th>1109034661</th>
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<tr>
<td>Asset Description</td>
<td>SIGN LOCATION, SLS</td>
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**Location**

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<tr>
<th>ID</th>
<th>BlockType</th>
<th>BackCode</th>
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<th>Sign Text</th>
<th>Bracket</th>
<th>StatusCode</th>
<th>Condition Rating</th>
<th>PrimIndic</th>
<th>Facing Direction</th>
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<td>32015</td>
<td>SG_SPECIAL</td>
<td>SPEC1</td>
<td>SG_18-</td>
<td>0</td>
<td>0</td>
<td>North East</td>
<td></td>
<td></td>
<td></td>
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</table>

**SignBlades**

**SignLocation**
Asset Life History

- **Asset Life History**
  - **Sign ID**: 1106334561
  - **Asset Description**: SIGN LOCATION, EL3

- **Work Status**
  - **Scheduled Work Orders**: 0%
  - ** Unscheduled Work Orders**: 100%

- **Inspection Activity**
  - **Inspection Key**: No Information

- **Maintenance Schedules**
  - Asset 1106334561 has 0 Unit Maintenance Schedules

- **Inspection Schedules**
  - Asset 1106334561 has 0 Service Inspection Schedules of 0 total Inspection Schedules

- **Failures**
  - Asset 1106334561 has failed 0 times in 0 years of service with a mean time between failures of 0 days.

- **Warranties**
  - Asset 1106334561 has 0 active warranties.

- **Contacts**
  - Asset 1106334561 has 0 Contacts.

- **Associated Parts**
  - Asset 1106334561 has 0 Associated Parts.

- **Valuations**
  - Asset 1106334561 has a valuation in 0 books.
Design Work Order Plan View

WO# 181910
Signage at 22X and McKenzie Lk Bv SE
Sign Design Report

Design ID: 1014910  Prepared By: smuj

Version: USER_SHEET_MASTER  Server: idx600  Issuance: 1

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<th>SIZE</th>
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<th>TYPE</th>
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Installation:

1109329668

1109329508

1109329512

1109329516

1109329502

1109329510

1109329520

1109329533

1109329504
## Livelink with Design PDF’s

**Loaded Showing Status**

### Design Plans

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Hansen Work Order Showing Link to Design Report in Livelink

Live Link Design Plan

http://documentmanagement/lm01/livelink.exe?func=ll&objid=38833277&objAction=Download
Upload Sign Tool and Navigation Interface

Upload Sign Photo Tool
Retrieving Photo from Livelink

There are 1 photos related to location [1109045050] in Livelink. Retrieving... done!

Loading / Viewing Asset Photos

Microsoft Office Picture Manager

Type a question for help

32700123.jpg
Temporal Capabilities

- History Layer for each asset
- Stores only changed attributes in related assets
- Follows versioning schema (User vs. Manager vs. Default)
- And that is not a replacement to “as-design” / “as-built” versions
Challenges Ahead

- All previously handled assets
  - Are “point” assets
  - Have a known street address (at least most of them)
  - Have a limited spatial relationships

- And most importantly, connectivity is not a concern.

- Roads Maintenance assets
  - Are “line” assets
  - Do not have “one” street address
  - Require several relationships among themselves and with other assets

- Connectivity is a major issue
Roads Maintenance
Business Background

• Road Maintenance (RM) is responsible for managing the integrity of the City’s road and sidewalk infrastructure through processes such as snow and ice control, street cleaning and street repair. Some of the services are initiated on service request calls and some others are done on a regular basis.
Roads Maintenance
Existing Conceptual Data Structure

- Linear Assets:
  - Road Segment
    Part of a roadway between two adjacent intersections
  - Backlane
    Unpaved (normally Gravel) at the backside of properties meant to provide access to utilities
  - Pathway
    Concrete or Asphalt paved for walking/running/bike riding

- Associated Assets (called Facility):
  - Sidewalks
  - Curb and Gutter
  - Fences
  - Dividing Medians
  - Traffic Islands
  - . . .
Current Architecture

- **Streets_P**: A non-graphical Oracle schema (data inventory)
- **RSI**: A GIS Application to create and update GIS segment features
- **ROADWAY**: an SDE feature class representing linear segments
- Several service applications:
  - SNIC
  - Street Cleaning
  - Surface Overlay
  - . . .
Streets_P Database ERD
Roadway Map snapshot
Segments Identification

• Each segment is known by a 10-digit unique ID number
• ID number is composed of “Section”, “Township”, “Range” and a sequence number

Section 29 24 01 0065 Township Range Sequence
Deficiencies of the Current Architecture

- Lack of a centralized data model
- Database is loosely coupled to GIS application
- Lack of many required business rules and triggers
- Unable to share with other assets (Streetlight, Signs, Signals, …)
- Incapable to communicate with Work Management sub-system of the Asset Management
Proposed Data Model

- Roadway, Backlane and Pathway Segments (same definitions as before)
- Backlane and Pathway segments enable to refer to Roadway Segments (Foreign Key)
- Introducing Aggregated classes ("Facility", "Intersection" and "Roadway") and Inheritance Relationships
- Introducing spatial relationships
- Use of the previous developed tools (CoC_Versioning and History_Layer)
- Introducing relationship to super, general common attributes required by the Asset Management architecture
Proposed Data Model

Aggregated Features

• Roadway is an example of Aggregated Feature (created as needed and not stored physically). A Roadway is composed of one or several segments, as shown selected
Proposed Data Model

Topological Structure

• Introducing Topological Rules to prevent errors in data entry.
• Two segments are not connected unless there is a common node available.
• All segments should be cleaned and built again to be structured topologically to present the Node-Arc-Node data structure.
• A new polygon class (Intersection) to identify where two or more Roadway segments meet.
Overall RM GIS Object Model
Future Directions

- IT Test and finalizing the Object Model
- Providing relationships with other assets (Signals, Signs and Streetlight)
- Data Clean-up (summer student job)
- Data Conversion and QA/QC
- Test the model while in operation and introduce changes (if needed).
Different Asset Inter-relations

- Is at intersection of

- Located at

- Located at

- Mounted on
Questions?

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