# Update on GIS & PMS (PMS to AMS)

Presented by

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# Outline

- Trend on Location-based Pavement Management System (PMS)
- Asset Management System (AMS) Data Inventory Needs and Challenges
- Automatic Asset Data Collection Using Location-based Sensor Technology (NCHRP IDEA Project)
- Demo

# Trend on Location-based PMS

- GIS for PMS on supporting
  - **In-depth data integration** on the future data and **historical** data (e.g. 1963 pavement design).
  - **Visualization** and future performance **forecasting/modeling/simulation** (e.g. Where, when, and what to perform preservation).
  - **Project and network-level** pavement management **decisions integration**.
  - Network-wide project-level **pavement performance study** to fine-tune **forecasting** model.
  - From PMS to **Asset Management System (AMS)**.

# AMS Data Inventory Needs & Challenges

- AMS Data Inventory **Needs**
  - Where are they located?
  - When are they built?
  - What are they (e.g. speed limit, etc)?
  - What are their conditions?
- AMS Data Inventory **Challenges**
  - Very labor-intensive.
  - time consuming (i.e.Year).
  - Not getting up-to-date roadway data.
  - Very costly (million of dollars).

# Automatic Asset Data Collection using Location-based Sensor Technology for (NCHRP IDEA Project, January, 2006 – July, 2007)

- Save time (i.e. month).
- Save cost (reduce at least 50%).
- Quickly get up-to-date roadway data that can be used for emergency response/recovery.

# Pavement Geometry/Sign Inventory and Mapping

**Digital Image Capturing**

**Visual Inspection (*automatic recognition*)**

**Quality Control**

**GIS Linkage presentation, mapping and Analysis**

**Reports**

**Storage**

# Automatic AMS Data Inventory

- Automatically recognize sign, pavement geometry (number of lanes, travel lane, shoulder width, edge to edge pavement width), pavement marking, guardrail, passing/no passing lanes, etc.
- Automatically compute their location (lat, lon; milepost).
- Data are automatically stored into a database.
- Reporting on asset inventory can be done.
- The data can be presented with a GIS format compatible with the agencies' GIS system or other location-based system such as Google Earth.

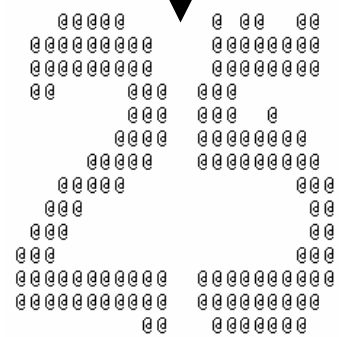
# Location-based Spatial Sensor Technology

- Innovative computer vision/image pattern recognition algorithms.
- Camera geometrical optics.
- Global Position System (GPS).
- Geographic Information System (GIS).

# Automatic Sign Inventory


Image containing speed limit


Processed binary image after color segmentation



Final speed limit extraction

# Automatic Sign Location Calculation

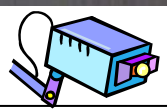



Image taken here

**GPS Location:**

**LAT: 36.149039055**

**LON: -86.863680089**

**Sign Location Calculated:**

**LAT: 36.149049212**

**LON: -86.863794344**

# Automatic Sign Recognition


Image Processing


Character Recognitions

**Result - Speed Limit : 15 MPH**

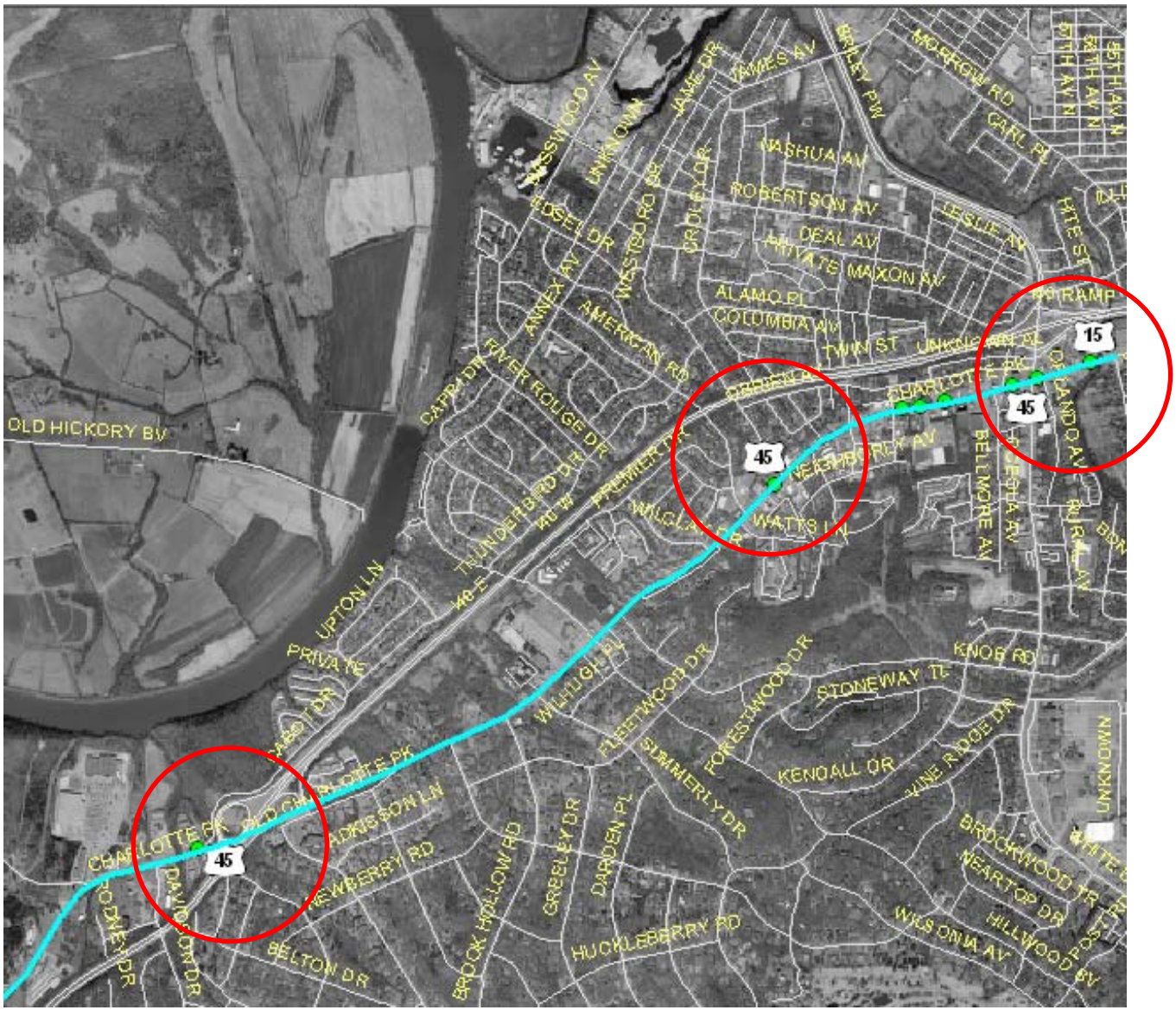
# Automatic Database Recording and Data Management


Processed Results

| MP | Image | SignType | Legend | x1 | y1 | x2 | y2 | confidence | gpsx |
|---|---|---|---|---|---|---|---|---|---|
| 130 | 2F000130.JPG | speedlimit | 45 | 1051 | 88 | 1116 | 123 | 100 | -86.858961029 |
| 184 | 2F000184.JPG | speedlimit | 15 | 1073 | 236 | 1130 | 279 | 100 | -86.862467148 |
| 204 | 2F000204.JPG | speedlimit | 15 | 1054 | 145 | 1102 | 182 | 100 | -86.863794344 |
| 214 | 2F000214.JPG | speedlimit | 45 | 941 | 210 | 980 | 233 | 100 | -86.864654566 |
| 332 | 2F000332.JPG | speedlimit | 45 | 1122 | 193 | 1169 | 218 | 100 | -86.871287980 |
| 766 | 2F000766.JPG | speedlimit | 45 | 1207 | 253 | 1260 | 284 | 100 | -86.901091216 |

# GIS Format Data and Presentation

**Signs**



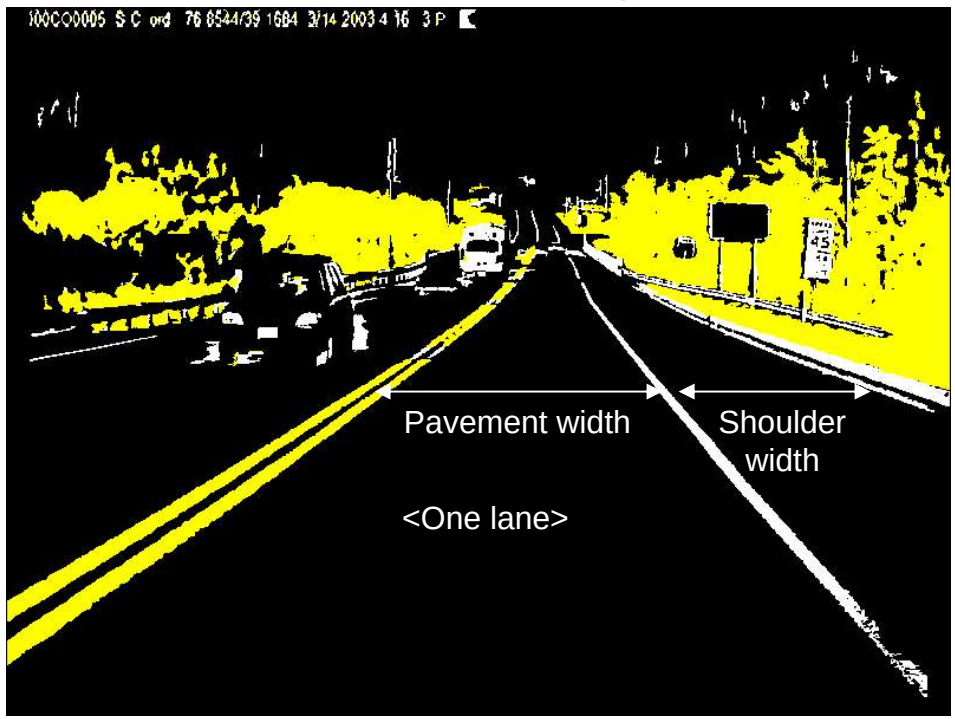
# Automatic Pavement Geometry Inventory

- Extract travel lane width
- Extract shoulder pavement widths
- Extract edge to edge pavement width

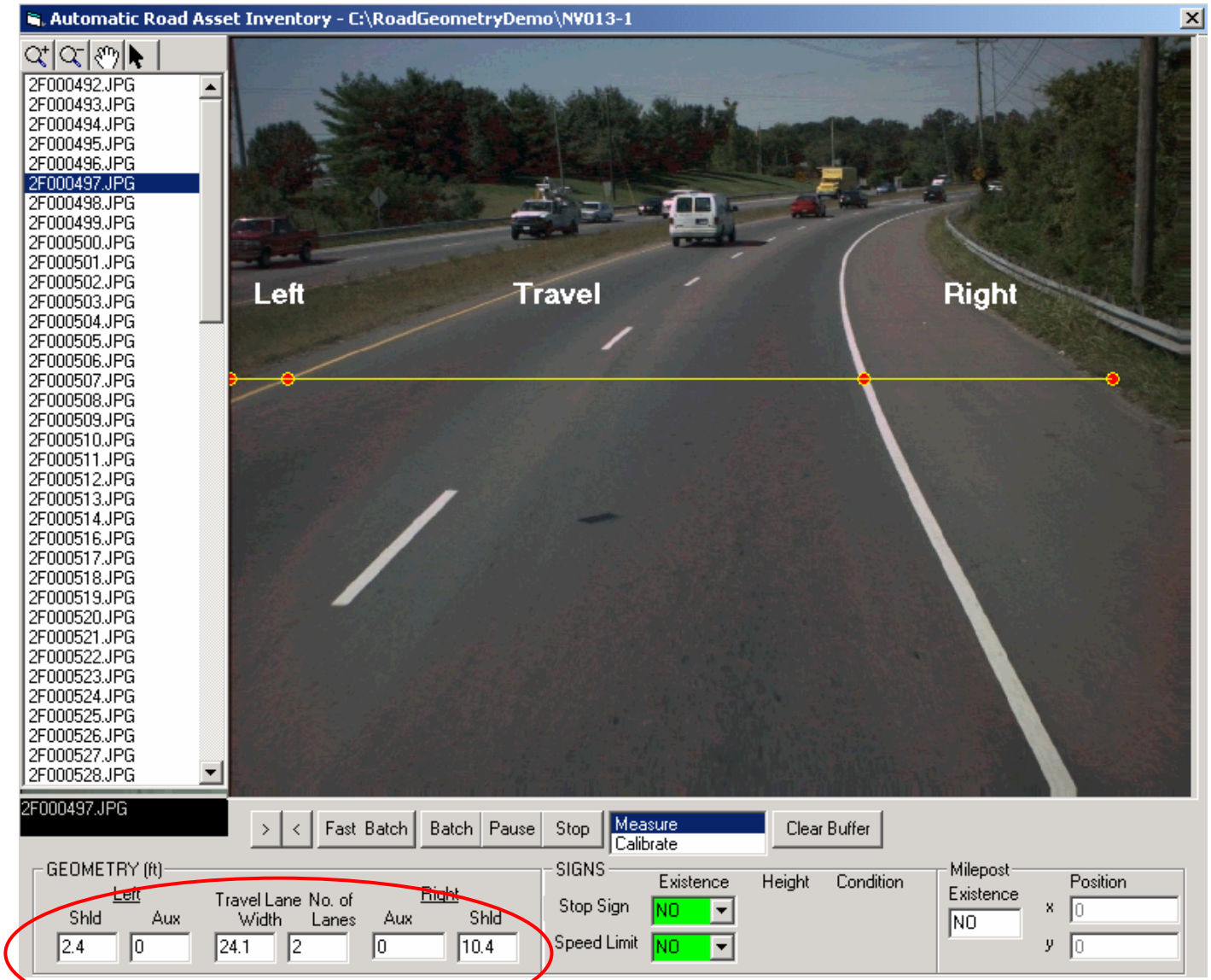
# Extract # of lanes, pavement width, and shoulder width

Videolog image

Processed image



# Pavement Geometry Extraction - Old Hickory BV (Cont.)



# Utilization of Technology

- In network-level, to perform.
  - QA/QC.
  - Support focused asset data collection.
- In project-level, to streamline the data collection and to focus the visual inspection.

# NCHRP IDEA Project

- Different lighting conditions (dim, strong lighting).
- Different sign conditions.
  - Type of signs (red stop sign, speed limit, yellow warning)
  - Different sizes and fonts.
- Different roadway conditions.
  - Contrast of pavement marking.
  - Contrast between pavement and non-pavement boundary (I.e. grass)
- Type of roadway.
  - Interstate/ non-interstate; rural/urban roadways.
- Integrate the extracted data into state agencies' database.

# Q/A?

# Contact Info

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