Automated Overhead Catenary System Inspections
Overhead Catenary System Inspections

- Provides automated measurements of the health of the OCS
  - No need for time consuming manual measurements
  - Measurements as close as every inch along OCS (depends on run speed)

- Verify as built drawings for new construction

- Identify objects (trees, etc.) that could interfere with OCS/pantograph

- Inspect main lines, crossovers, yards/service buildings
Types of Measurements Available

- OCS wire measurements for multiple wires
  - Stagger
  - Height
  - Wire wear
- Pantograph measurements
  - Acceleration/forces
  - Current and voltage
- Clearance measurements
- Visual recordings from multiple angles
- Thermal imaging
- Vehicle state
  - Distance along line from known position (stationing/chainage)
  - Global position (latitude/longitude/altitude)
  - Vehicle speed & acceleration
- Track profile measurements
Recent Additions/Improvements

- High speed wire measurements
  - Twice the speed of previous system (~200 Hz, or every 2.5” at 30 mph)
  - Measures wire profile, not just wear surface
  - Can measure wire even when not in contact with carbon strip

- Pantograph accelerations
  - Multiple axis
  - Higher frequency
  - Doesn’t require modification of pantograph head

- Thermal imaging
- Pantograph current and voltage
Data Presentation

- All measurements synchronized and can be identified to civil stationing/chainage for rail system
- Data presented in tabular text files suitable for MS Excel or other analysis packages
- MS Excel based viewing utility available
- Synchronized images & videos to measurements
Contact Information

On the web:
http://www.autocommute.com

By e-mail:
info@autocommute.com

Or by telephone:
858-774-4553
Backup
About AutoCommute

- AutoCommute is focused on developing technologies for vehicle navigation, automated inspections, and safety.
- Many technologies were demonstrated on a fully autonomous vehicle, Flying Fox, during the 2005 DARPA Grand Challenge.
Lane Detection System

- Lane Detection System (LDS) developed for automated vehicle operation within an urban environment
- Lane Detection System determines:
  - Vehicle position relative to travel lane(s)
  - Lane curvature ahead of the vehicle
  - Cross street lane locations at intersections

Lane markings as seen from the vehicle

Output from the Lane Detection System shows lane markings for all travel lanes
Frequency of Measurements

- Most measurements are available at > ~200 Hz
- Video 30-60Hz

<table>
<thead>
<tr>
<th>Vehicle Speed</th>
<th>Measurement Spacing @ 200 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 mph</td>
<td>0.9 in</td>
</tr>
<tr>
<td>30 mph</td>
<td>2.6 in</td>
</tr>
<tr>
<td>60 mph</td>
<td>5.3 in</td>
</tr>
</tbody>
</table>
Typical Inspection Schedule

- Install of equipment on LRV typically takes 1 day
- Typically 2-3 days to inspect system depending on size of rail system, type of measurements, run speed
- Equipment is removed in 1-2 hours following completion of inspections
- Data report and reduced measurements are provided typically 2-4 weeks following completion of inspections
Typical Measurement Results

Data Path: Rs:San Diego Trolley Data 2007
Run Name: T-Blueline-SYtoO-T-Day
Segment: 25 Santa Fe Depot Station

Wire Measurements
- Height: 201.83 inch
- Stagger: 17.20 inch
- Wear Surface: 0.256 inch
- % Wire Remaining: 96.2%

Measurement Location
- Distance: 91050.00 feet
- Latitude: 32.730000
- Longitude: -117.17312
- Altitude: 65.6 feet

Update Data at This Distance
- Plot Width: 500 feet
- Check to View Images

Graphs showing height, stagger, and % wire remaining versus distance.
Previous Inspections

☐ San Diego Trolley
   ■ Mar 2007: All main lines (Bureau Veritas)
   ■ Jan 2008: All main lines (Bureau Veritas)

☐ LA Metro
   ■ Oct 2008: All LRV lines and yards (LA Metro)
   ■ Jul 2009: Gold Line extension (Balfour Beatty Rail)

☐ Calgary Transit
   ■ Dec 2011: All main lines {low speed} (ENMAX)
   ■ Dec 2012: All main lines {revenue speed} (ENMAX)
   ■ May 2014: All main lines and yards (ENMAX)

☐ Portland TriMet
   ■ Jul 2012: All main lines (TriMet)