

Implementation of a GPS-Based Software Tool to Conduct Road Inventory and Safety Audits

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Outline

- Problem Description
- Tool Development Process & Description
- Example Application
- Data Analysis Options
- Conclusions



Road Asset Management and Safety Audits

- Highway systems
 - Consist of a variety of physical elements and facilities
 - Comprehensive and integrated management efforts
 - Investment, maintenance, and rehabilitation decisions

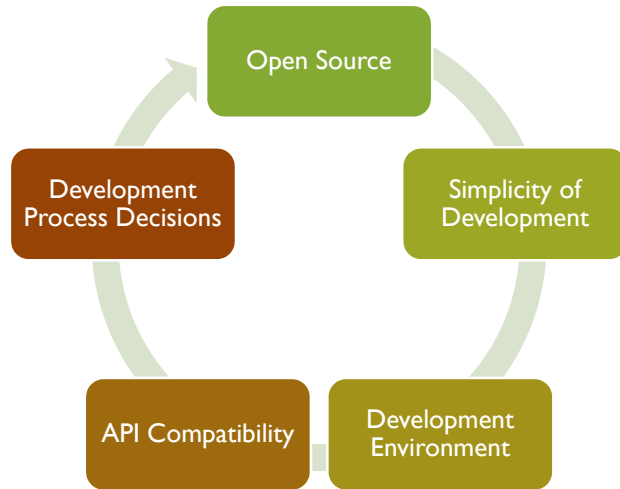


Problem Description

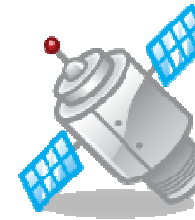
- Survey Process
- Accuracy of Methods
- Data Storage
 - Hard to integrate with existing systems
- Available Solutions
 - Proprietary products
- Cost
 - Not accessible for small agencies



Road Condition and Survey Analysis Development Process

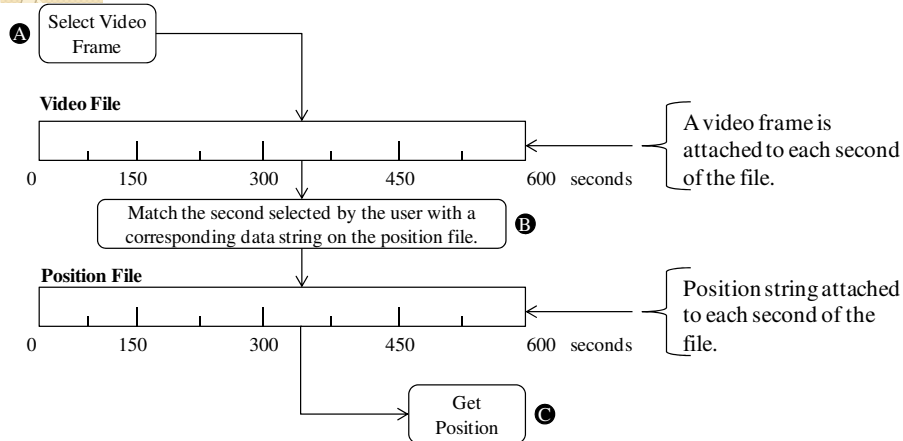


Video and GPS Integration

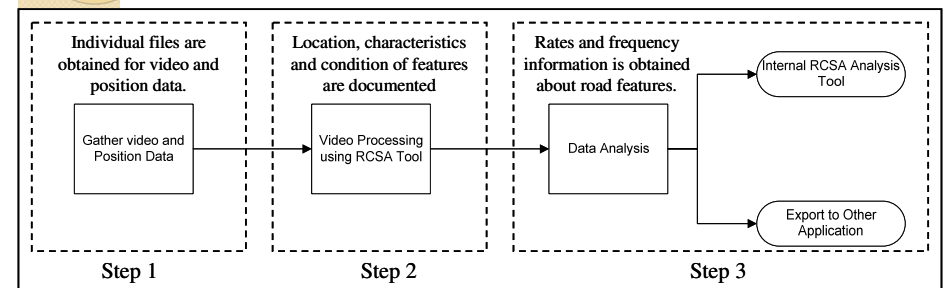


- Record alignment video.
- Collect GPS position data along the alignment.
- Do both things simultaneously.
- Data reduction is done later.

Video and GPS Integration



RCSA Video Survey Procedure



RCSA Tool Screenshot



Implementation Options

- Macroscopic Level
 - Video recorded while driving along alignment.
- Microscopic Level
 - Clipboard substituted by video camera and handheld GPS device



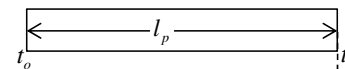
Accuracy Considerations

- GPS Precision
- Video Speed
- Driving Speed
- User Errors
- Intended Use

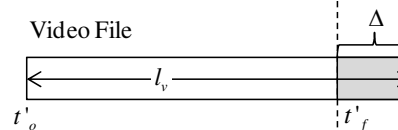


Accuracy Considerations

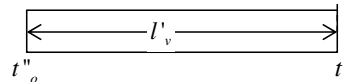
Position File



Video File



Scaled Video File



Equations for Scaling the Video

$$l_p = t_f - t_o \quad (1)$$

$$l_v = t'_f - t'_o \quad (2)$$

$$\Delta = |l_v - l_p| \quad (3)$$

$$S = \frac{\Delta}{l_p} \quad (4)$$

$$t''_f = \frac{t'_f}{S} \quad (5)$$

$$l'_v = t''_f - t''_o \quad (6)$$

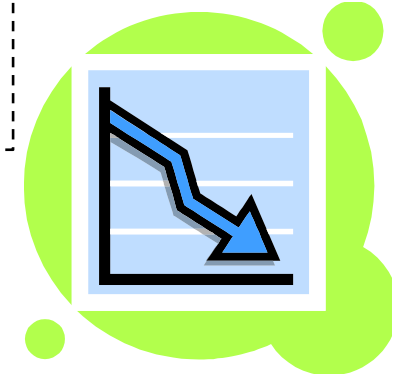
Cost Considerations

- Equipment Acquisition
- Vehicle Operation
- Data Reduction
- Management
- Training

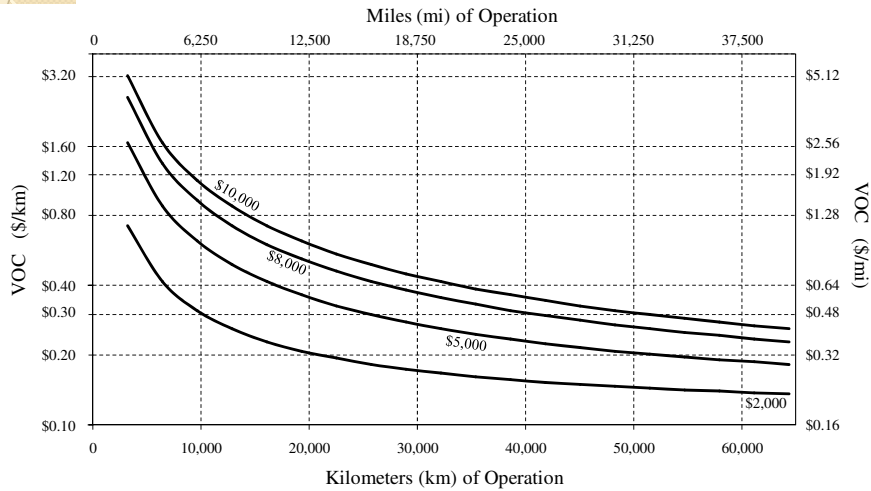


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Cost Considerations

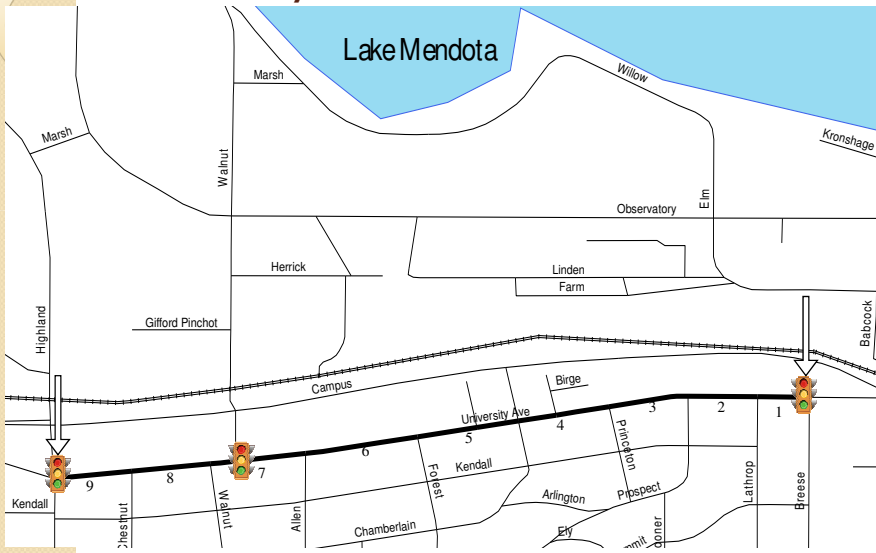


Data Analysis Options

- Data is exported using a CSV format
- Compatible with GIS systems
- Compatible with spreadsheet software



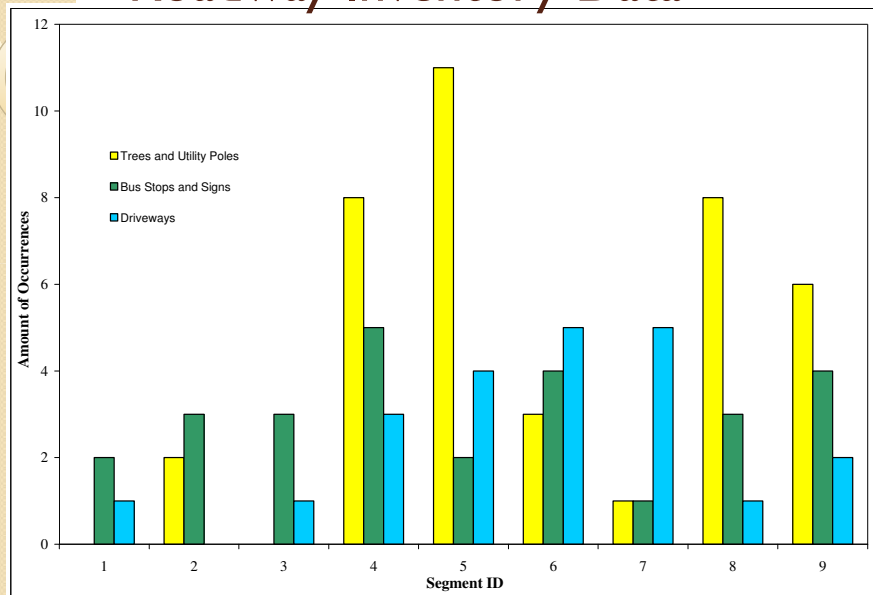
Example Application University Ave., Madison, WI



Roadway Element per Segment Report

Roadside Feature	University Avenue Segment ID								
	1	2	3	4	5	6	7	8	9
Right Side									
1. Trees	0	0	0	7	11	3	0	8	6
2. Utility Poles	0	2	0	1	0	0	1	0	0
3. Bus Stops	0	0	1	1	0	2	0	1	0
4. Signs	2	3	2	4	2	2	1	2	4
5. Driveway Entrances	1	0	1	3	4	5	5	1	2
Left Side	1	2	3	4	5	6	7	8	9
1. Trees	5	0	7	8	8	7	5	8	4
2. Utility Poles	3	4	3	5	5	5	5	5	4
3. Bus Stops	0	0	1	0	1	2	0	1	1
4. Signs	2	2	2	2	2	3	2	2	1
5. Driveway Entrances	0	0	1	4	4	3	3	1	3

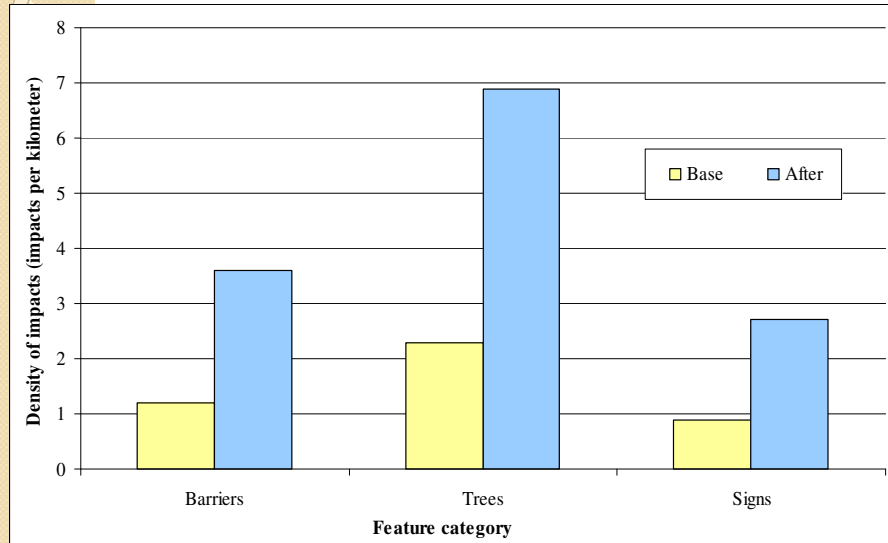
Roadway Inventory Data



Safety Evaluation Over Time

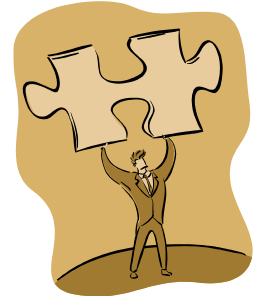
- Generate time-dependent roadside feature conditions.
- Perform evaluation of inventory deterioration over time.
- Merge accident data and inventory data to generate crash prediction models.

Safety Analysis Comparison of Historical Data



Conclusions

- Integration of GPS and video on a open-source software
- Macroscopic-level analysis of roadway elements for road condition, road inventory, safety reviews applications
- Alternative to paper- based methodology
- Provides relatively accurate position
- Cost-feasible for small agencies



Thanks for your attention

