

Relationship of Crash Statistics to Road Weather Data

Bob Koeberlein, P.E.
Mobility Services Engineer
Idaho Transportation Department



Research Team

- Dennis Jensen, Winter Maintenance Coordinator
- Miranda Forcier, Six Mile Engineering, Winter Maintenance Analyst
- Bob Koeberlein, Mobility Services Engineer

Topics

- Background
- Approach
- Results
- Conclusions

Background

- ITD has invested substantially in Road Weather Information Systems; 106 sites in current inventory, 103 with Winter Performance Reporting capability (“grip”)
- Starting in 2010 many new sites were built and most existing sites were upgraded to provide Winter Performance Reporting (WPR) data (surface grip values)

Season	New /upgraded Sites	Current Total
2010-2011	46	70
2011-2012	9	79
2012-2013	24	103

Typical RWIS Site



RWIS Site



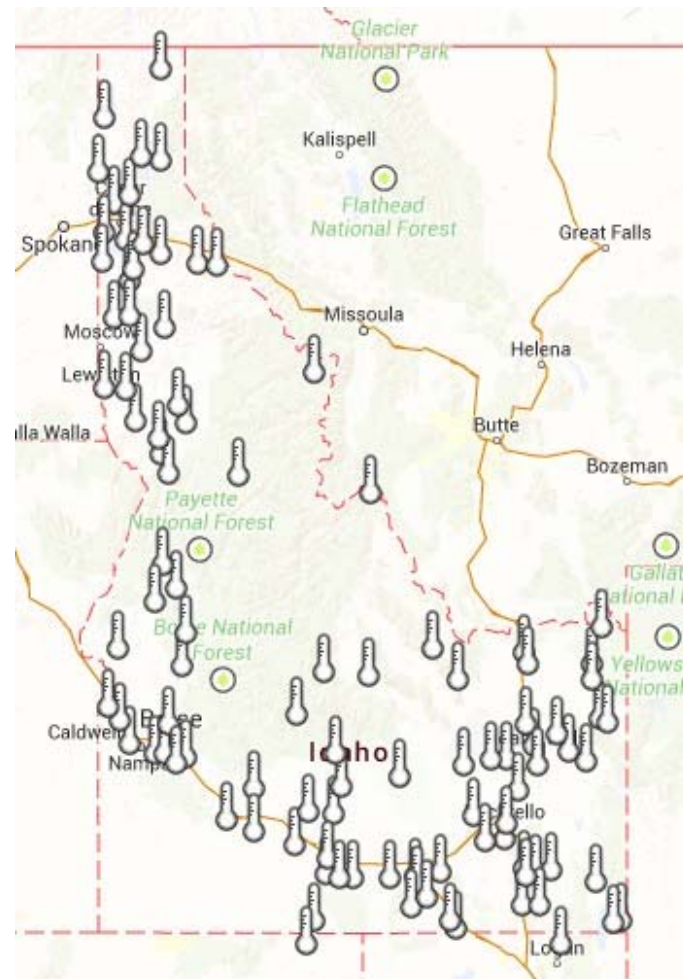
Atmospheric Sensors



RWIS Instruments



Statewide RWIS Distribution



Background (2)

- New RWIS sites average \$125,000 (design, equipment, construction)
- Annual operations costs average \$5,500 per site, including maintenance, utilities and data management
- The question to be answered is **“what is the return on investment for this expenditure in technology?”**

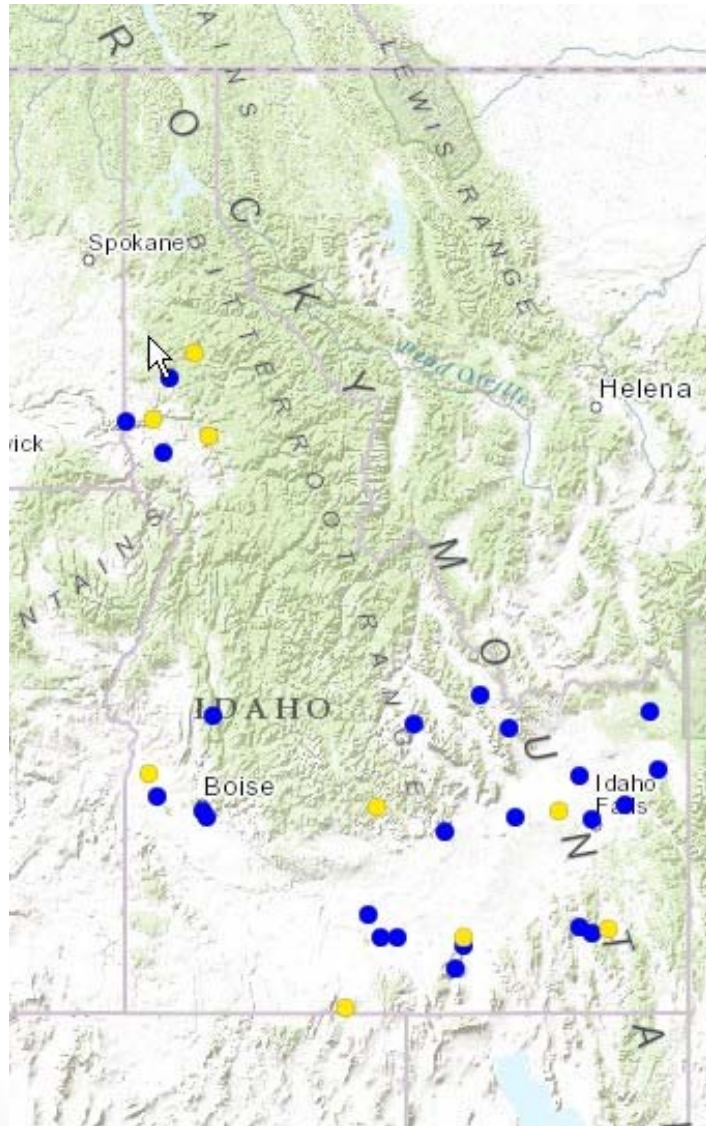
Background (3)

- The deployment of Winter Performance Measurement RWIS sites enables the following activities:
 - Better winter maintenance practices
 - Treatment timing
 - Material selection
 - Scenario review and critique
 - **Performance Measurement-Mobility Index**
 - **Winter Maintenance Cost Reduction Trend**
 - 2011-2012 \$30M
 - 2012-2013 \$25.5M
 - 2013-2014 \$21.5M
 - Higher quality road condition traveler information
 - Automated road condition reporting on 511 websites

Approach

- The benefit of the availability of Winter Performance Measurement data on winter driving safety will be evaluated by:
 - Comparing crash rates before and after data became available
 - During winter driving conditions
 - Use annual averages for multiple year data sets
 - Correlate highway segments to RWIS locations
 - Establishing metrics for crash costs and average RWIS capital and operating costs (current year dollars)
 - Average cost of a crash = \$72,700 (based on 674 crashes 2010-2013)
 - Average capital cost of RWIS = \$125,000. Assumed service life is 10 years.
 - Average annual operating cost per site = \$5,500 (operations and maintenance)

2011 & 2012 RWIS LOCATIONS



Yellow = 2011 (9)

Blue = 2012 (24)

Assumptions

- Winter storm severity is not significantly different during the 3 year study timeframe
- Traffic volumes are constant for the years in the study
- Benefits are the societal costs from reduced crashes
- Statewide average cost per crash used, averaging NHTSA values for serious injury and fatality crashes plus estimated property damage
- Grip value < 0.6 determines winter driving conditions
- Each RWIS site has associated segments of highway that it represents. There are 885 lane miles represented by the 33 RWIS sites. Winter driving condition crashes on these segments are counted in the calculations
- Data sets consist of reported crashes

Calculations

- Benefits = cumulative monetized reduction in crash incidents by site/segments (annualized)

CR (crash reduction) = crash total (before data) – crash total (after data)

Benefits = CR x average cost of crash

- Costs = annualized capital and operating costs of WPR RWIS network

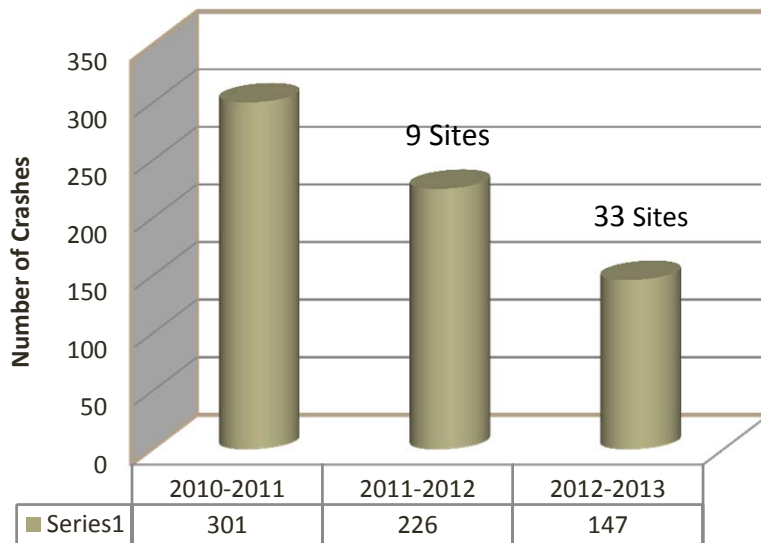
**Costs = \$capital/n + \$network operating cost/year
(n = site service life)**

Results (1)

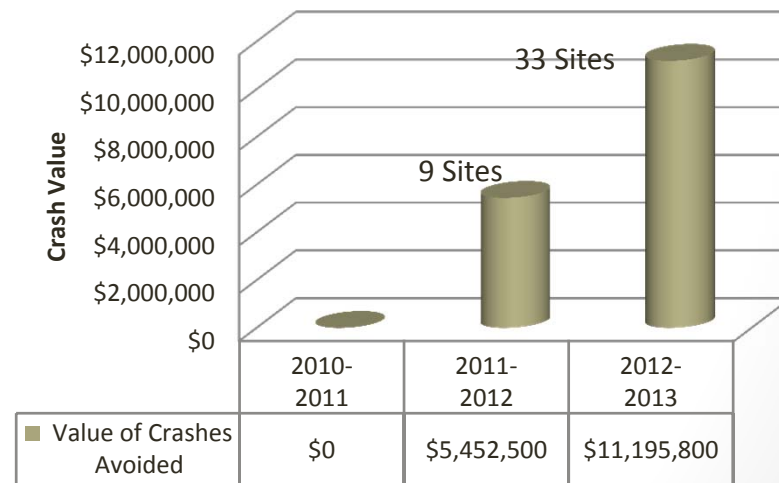
For RWIS Highway
Segments

Benefits for Crash
Reduction

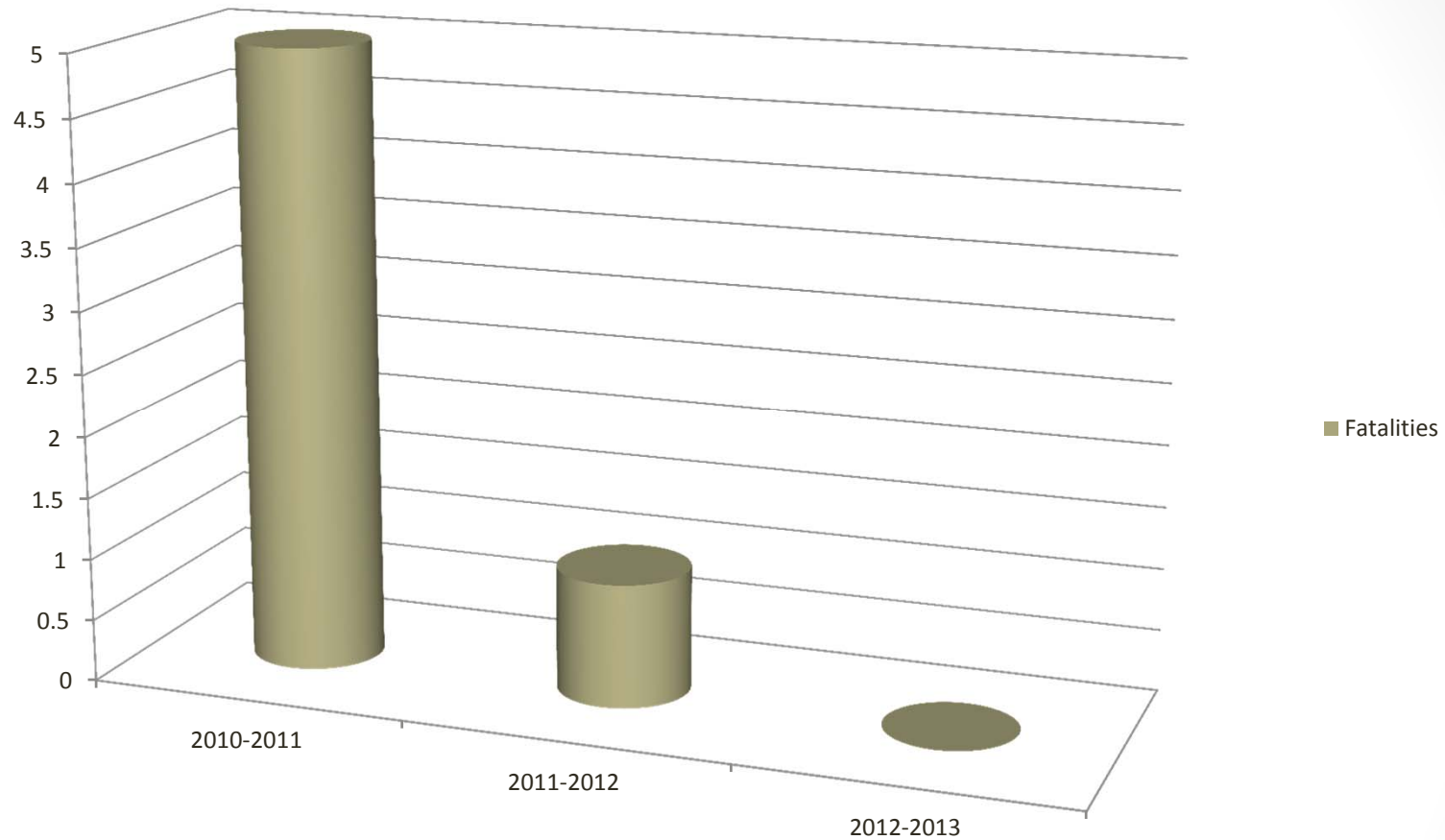
Total Crashes



Value of Crashes Avoided



Fatalities



FATALITIES HAVE DECLINED IN THE STUDY AREA

Return on Investment

Season	Annual Crashes pre data	Annual Crashes post data	Annual Net Difference	Return on Investment
2011-2012	301	226	75	33.7
2012-2013	301	147	154	18.8
Totals			229	22.0

Assuming 10 year service life of RWIS site,

2011-2012 $ROI = 75 \times 72,700 / ((125,000/10 + 5,500) \times 9) = 33.7$

2012-2013 $ROI = 154 \times 72,700 / ((125,000/10 + 5,500) \times 33) = 18.8$

Totals $ROI = 229 \times 72,700 / ((125,000/10 + 5,500) \times 42) = 22.0$

Conclusions

- For regions with winter driving conditions, strategically placed RWIS sites with pavement condition instrumentation offer attractive returns on investment when the data is integrated into a winter maintenance program and a traveler information system
- The Winter Performance Measurement program enabled by RWIS deployment meets the strategic goals of ITD
 - Safety
 - Crash reductions and fatality reductions
 - Mobility
 - Maintaining safe grip (>0.6)
 - Economic opportunity
 - Enabling commercial traffic flow

Questions or Comments?

- Bob Koeberlein, P.E.
- Idaho Transportation Department
- Mobility Services Engineer
- Robert.koeberlein@itd.idaho.gov
- 208 334 8487
- Thanks for your attention!

