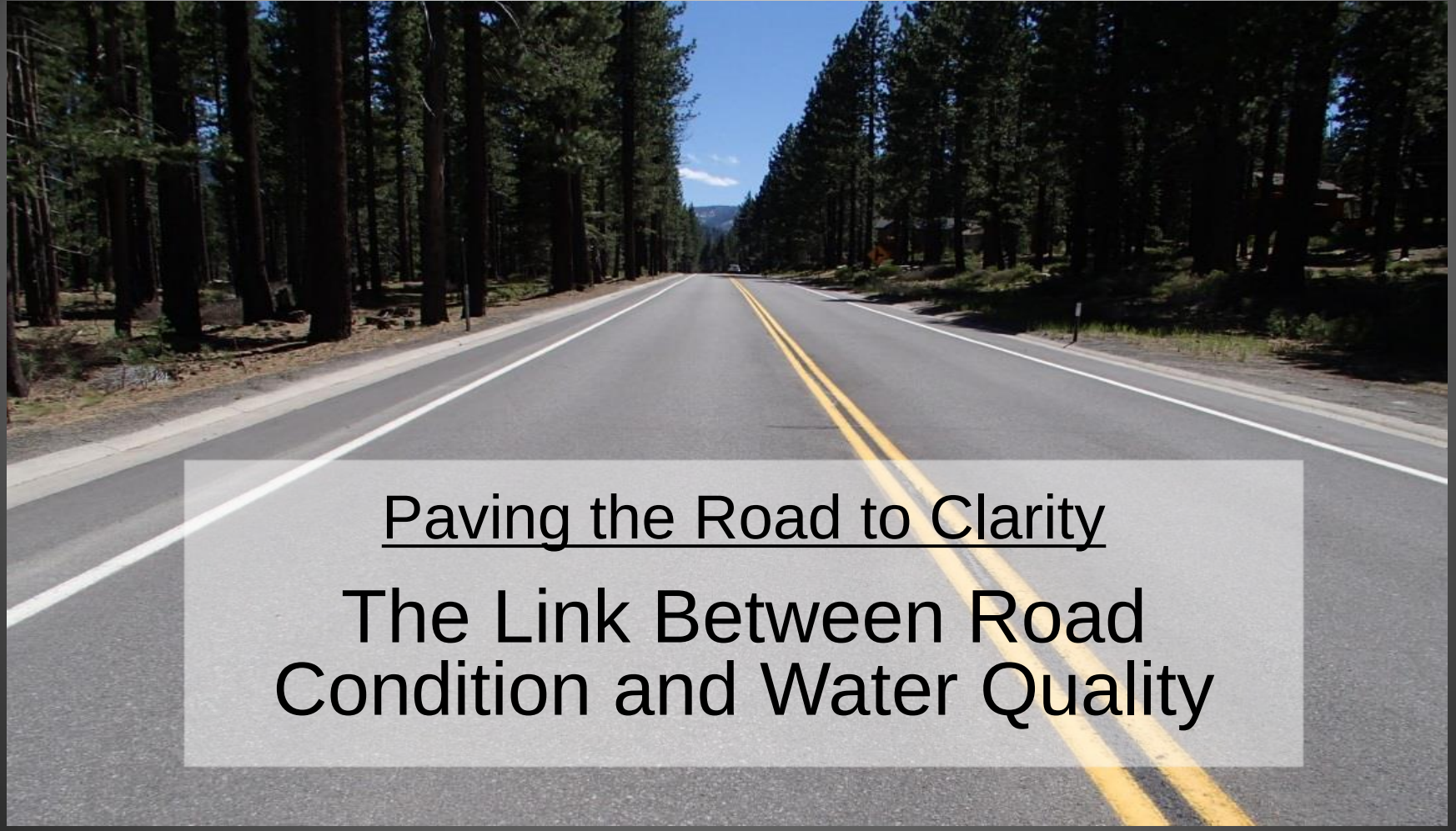

Paving the Road to Clarity

The Link Between Road Condition and Water Quality

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Paving the Road to Clarity

Water Quality Drivers in the Tahoe Basin

- Phase I Municipal Permit
- Total Maximum Daily Load (TMDL)
  - 21% Fine Sediment Particle (FSP) reduction
  - Multi-faceted load reduction approach
- This presentation will outline perhaps a new innovation in our Program

Paving the Road to Clarity

Lake Tahoe TMDL

Problem

- Lake Tahoe lost about one third of its clarity between 1968 and 2000

Goal

- Restore lake clarity to 1968 levels – about 100 feet

Primary Objective

- Reduce FSP by 65% over the several decades – Primary driver for clarity loss

Paving the Road to Clarity

Sources of FSP in Stormwater

- Erosion
- Atmospheric deposition
- Traction abrasives (road sand)
- Vehicle wear (tires, brakes, exhaust etc.)
- **The road surface itself**

Paving the Road to Clarity

Pavement Degradation

Sand Trucks

Loaders

Tire Chains

Road Abrasives

Traffic Volume

Freeze/Thaw

Tire Chains

Rotary Blowers

Paving the Road to Clarity

Maintaining pavement is a BMP

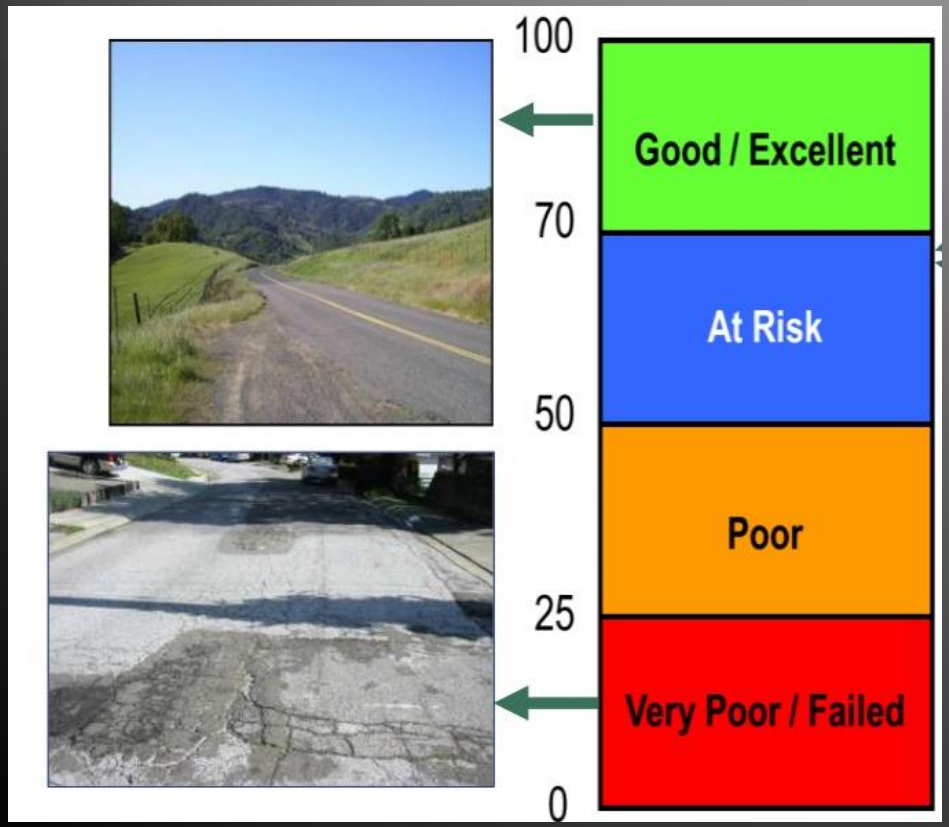
Paving the Road to Clarity

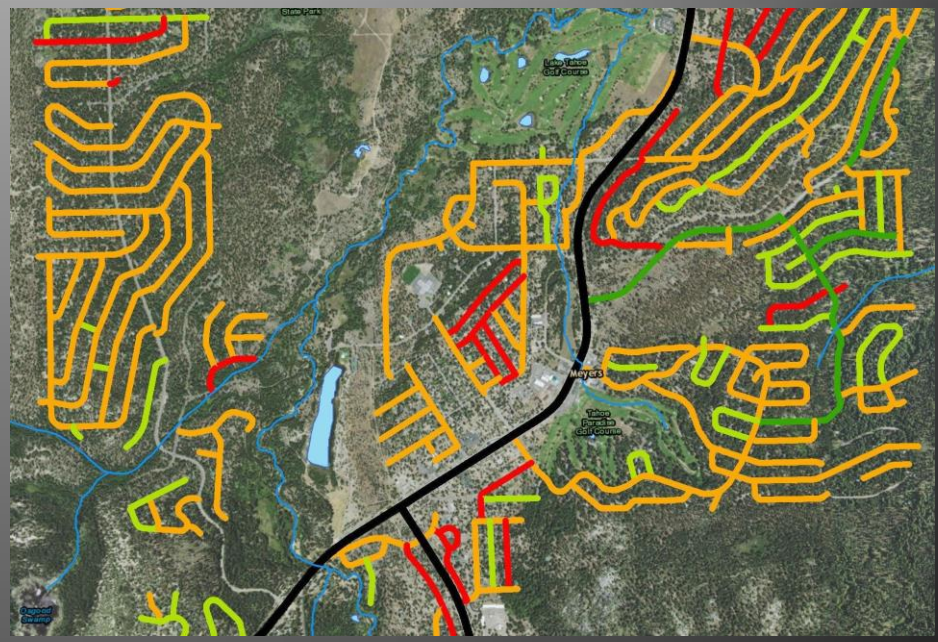
Well maintained pavement

- Looks nicer
- Safer
- Better for vehicles
- Better water quality
- Easier to sweep
- Resists damage

Paving the Road to Clarity

Pavement Condition Index (PCI)





Paving the Road to Clarity

Paving the Road to Clarity

PCI = 37

Paving the Road to Clarity

Paving the Road to Clarity

PCI = 71

Paving the Road to Clarity

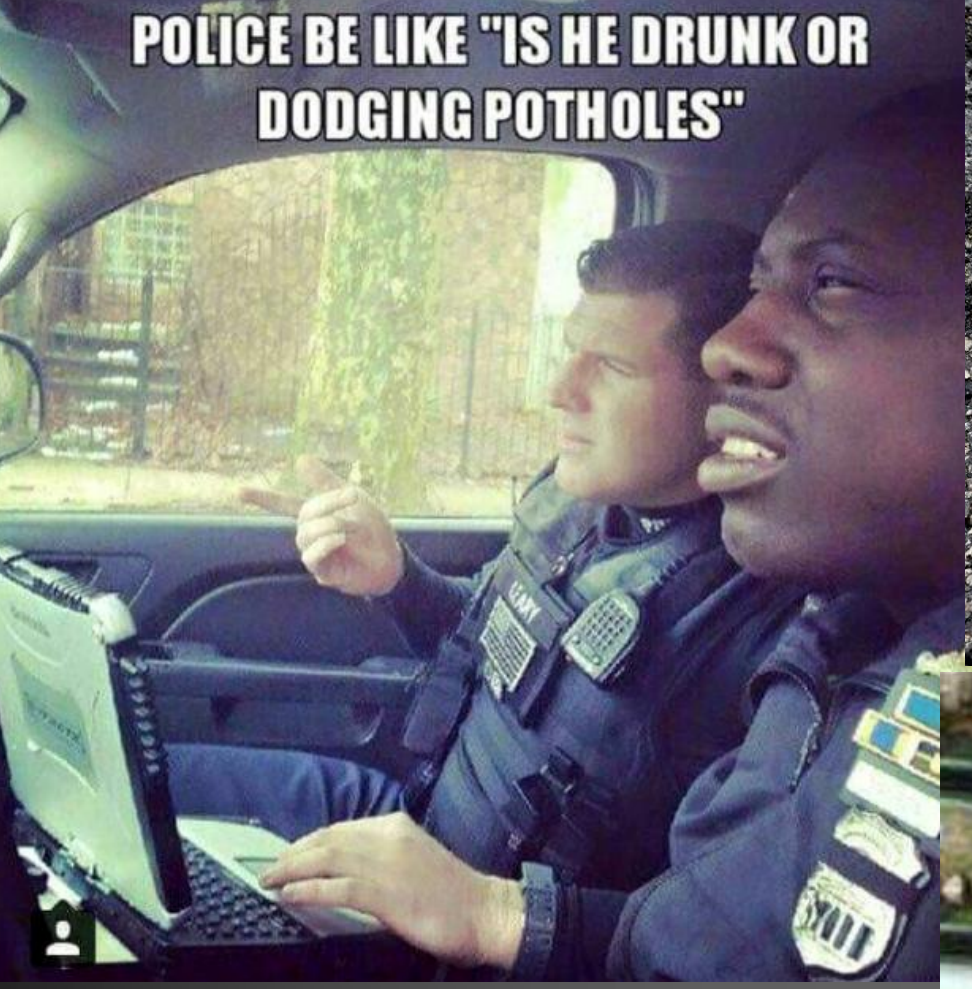
Paving the Road to Clarity

Conflicting interests… But are they?

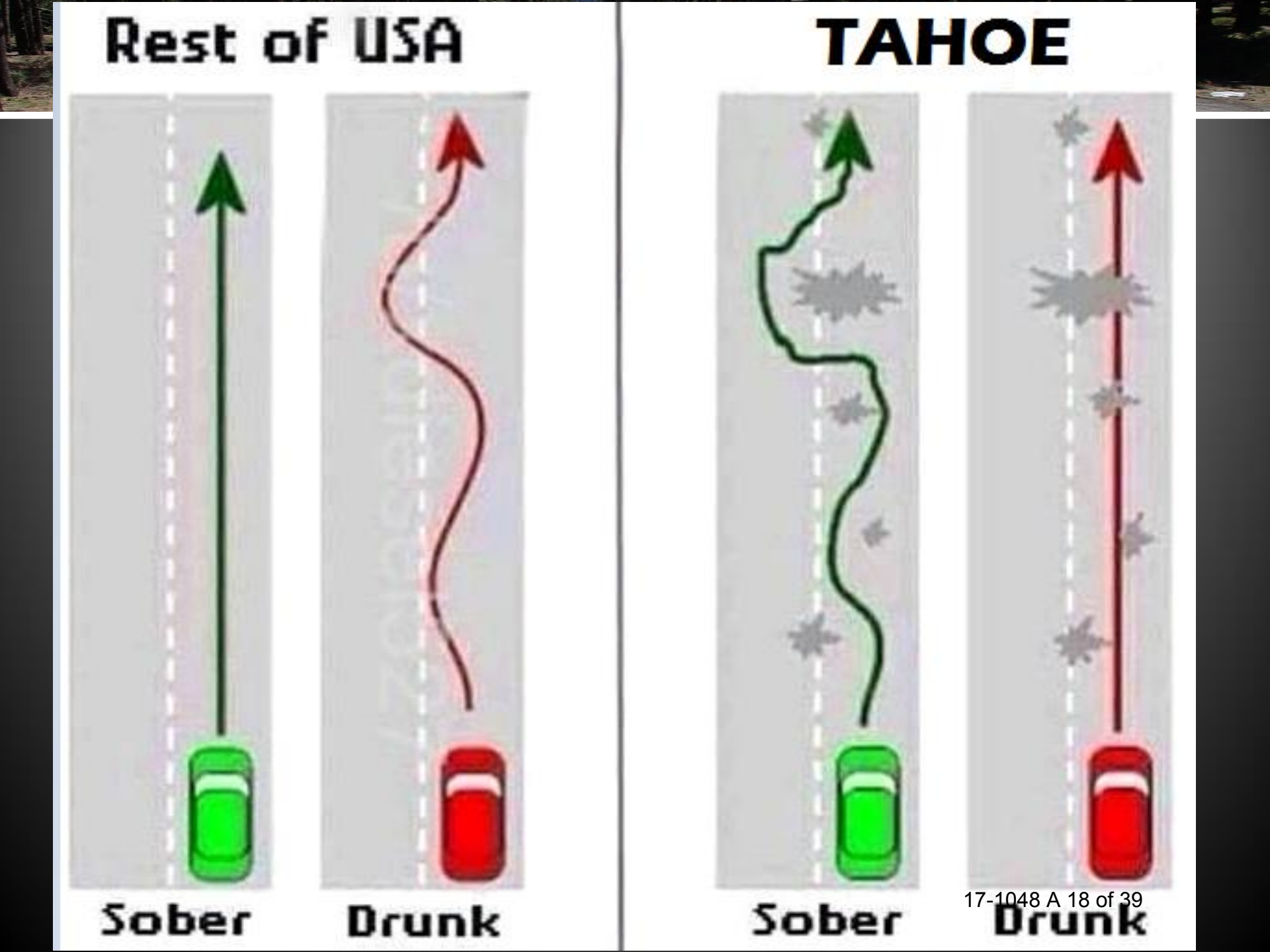
KEEP TAHOE BLUE®

League to Save Lake Tahoe


1800 YEAR OLD ROMAN ROAD
STILL IN BETTER SHAPE THAN
50


POLICE BE LIKE "IS HE DRUNK OR
DODGING POTHOLES"


THIS WILL BE THE THIRD TIME
WE'VE FILLED THIS POTHOLE
AND WE HAVE BECOME
EXCEEDINGLY EFFICIENT AT IT


Rest of USA
TAHOE
Sober
Drunk
Sober
Drunk

Does Pavement Wear Contribute to Total Suspended Solids (TSS) and FSP in Stormwater Runoff?


17-1048 A 20 of 39

Paving the Road to Clarity


STOP
GMC


ROAD
CLOSED


WHEN FLASHING
ROAD INFO
AM 1610

Paving the Road to Clarity

Sources of fine sediment particles (< 20 µm) in roadway runoff in the Lake Tahoe Basin

Prepared for:

Pacific Southwest Research Station

United States Department of Agriculture Forest Service

Prepared by:

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South Lake Tahoe, California
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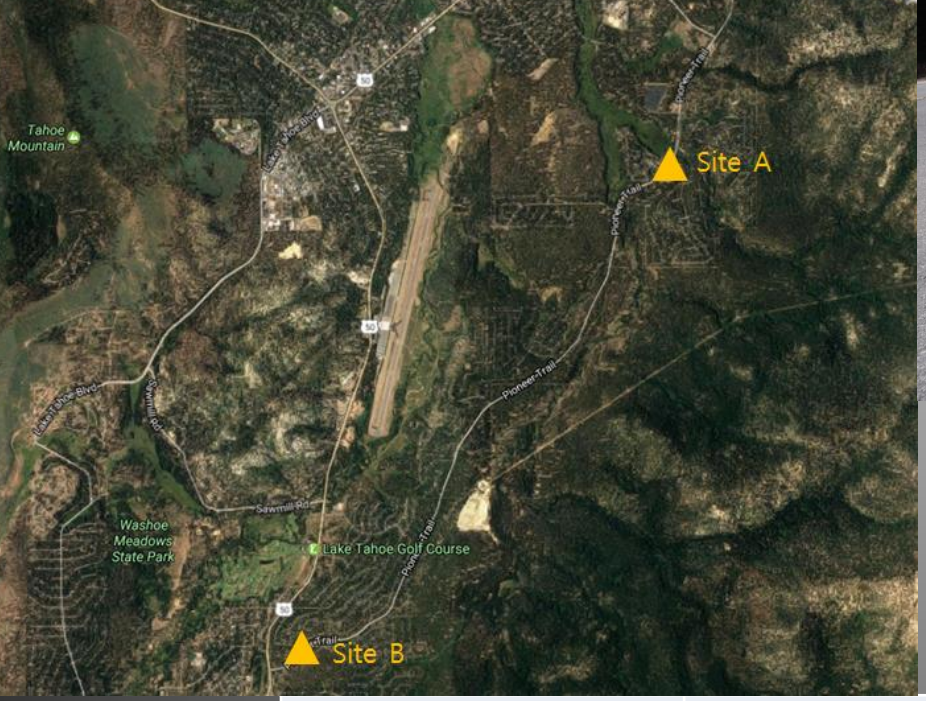
January, 2017



Two Sites
10 Storm Events

	3/19/2013			3/29/2013			4/15/2013	
	1	2	3	1	2	3	1	2
Roadside Soil	34.1%	37.0%	33.0%	45.0%	36.0%	41.0%	40.0%	39.0%
Aggregate	30.0%	29.0%	27.1%	21.0%	28.0%	24.0%	16.3%	21.0%
Binder	8.4%	6.7%	6.2%	8.3%	8.2%	6.2%	1.6%	7.4%
Washoe Sand	20.0%	21.0%	23.0%	18.0%	21.0%	21.0%	21.0%	18.0%
Vegetation Debris	4.0%	3.0%	6.0%	4.0%	3.0%	4.0%	3.5%	10.0%
Atmospheric Deposition	2.0%	1.0%	1.0%	1.0%	1.0%	1.0%	4.0%	1.0%
Tire	1.0%	1.0%	2.6%	1.6%	2.5%	2.6%	3.4%	3.0%
Motor Oil	0.5%	0.3%	0.1%	0.1%	0.3%	0.1%	0.6%	0.5%
Brake Drum and Pad	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Lead Balance Weight	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Paving the Road to Clarity

Breakdown of Pollution Sources

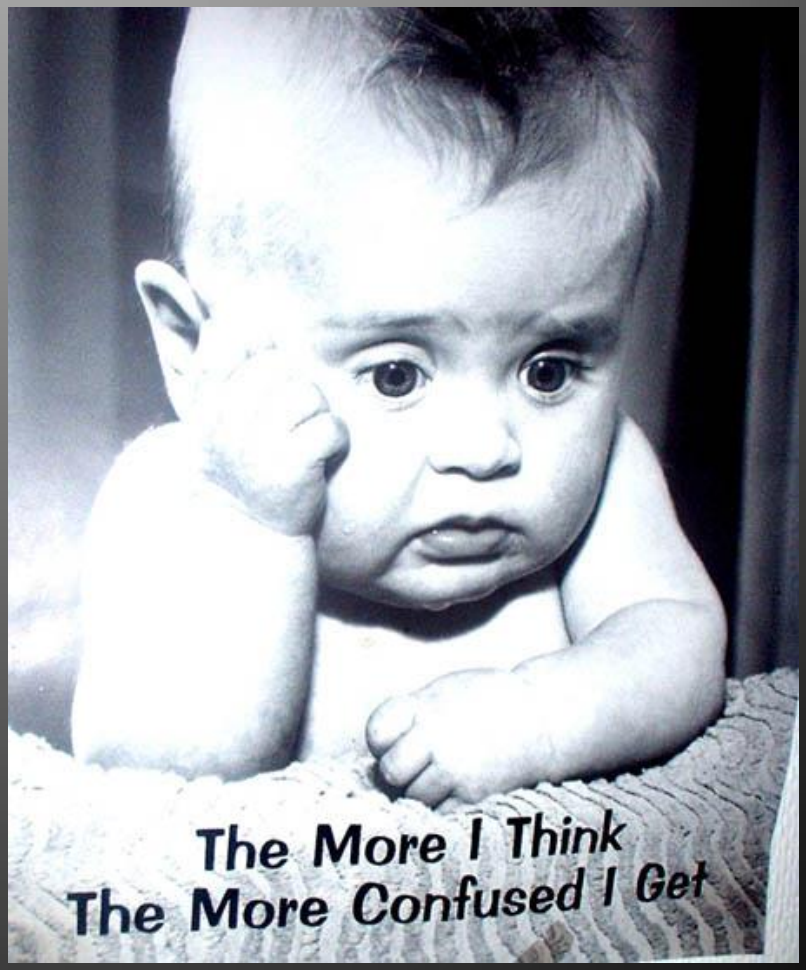
Roadside Soil – 43% (20-70%)

Asphalt Pavement – 31% (18-53%)

Abrasive Sand – 16 % (7-23%)

*This study was completed during a period of low winter moisture but the results still show that asphalt surfaces are a dominant source.

So What Does This All Mean?



Paving the Road to Clarity

- Lake Tahoe Clarity is directly related to road condition
- Road pollution is a major part of our Water Quality Program
- Plows operate to support the touring public during winter
  - Plows destroy roads
- Smooth roads are easier to plow and sweep and contribute less pollution to the lake
- Quality roads provide a pleasurable driving experience and cause less damage to vehicles

Solution: Healthy Roads = Healthy Lake

Quality roads = Quality Driving experience = Quality Lake

Pave the Road to Clarity!

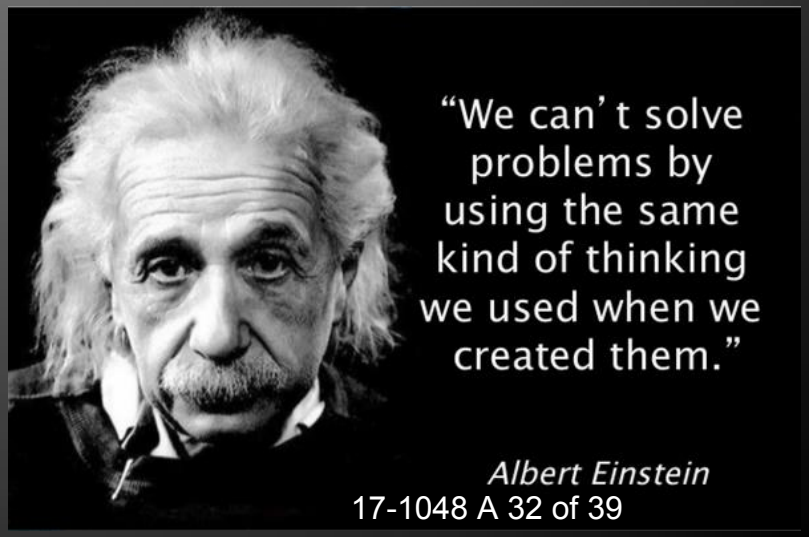
Paving the Road to Clarity

- How do we generate money for Roads?
  - Tax / Vehicle Fee / Access Fee / Toll Road
  - Fast Track?

Paving the Road to Clarity

Ways to Prevent Road Damage During Winter Operations

- Anti-ice / De-ice
  - Brine / Beet Juice
- Run on Snow Pack in low traffic areas
- Remove chains after storm events
- Using Polyurethane Cutting Edges
- Use good road sand abrasives and apply responsibly



Communication and Collaboration

Paving the Road to Clarity

Brine / Beet Juice

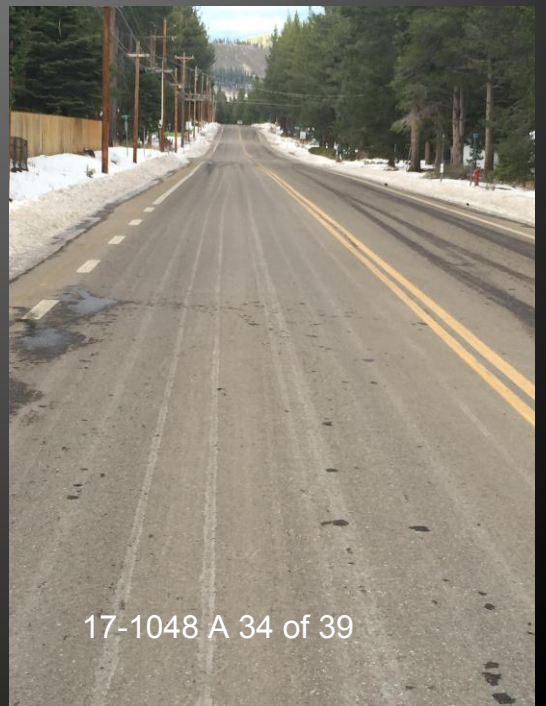
Brine (County has reduced Salt usage by 86% by switching to brine)

15 Farenheit

Beet Juice – Ice Bite

-15 Farenheit

Dry Application	
lb/mi	500
total miles	66
NaCl (lb)	32,850
NaCl (ton)	16.4
Brine Application	
lb/mi	68
total miles	66
NaCl (lb)	4,486
NaCl (ton)	2.2
Reduction in NaCl usage	86%



Traction Sand

Material Distribution based on 1000 ton of aggregate used as winter abrasive	<16 micron load (lbs)
Volcanic Cinders	32,436
Washoe Sand (DG)	2,008
% Reduction	94%
Total Load Reduction	30,428
Credits	152

UCDAVIS
TAHOE ENVIRONMENTAL RESEARCH CENTER

TAHOE: STATE OF THE LAKE REPORT 2017

CLARITY

Winter Secchi depth

Yearly since 1968

Annual winter (December-March) Secchi depth measurements from 1968 to the present indicate that winter clarity at Lake Tahoe is showing definite improvement. In 2016, winter clarity increased by 11.7 feet. The winter average of 83.3 feet (25.4 m) was still well above the worst winter average, 65.6 feet (20.0 m), seen in 1997. Winter precipitation (which was close to the long-term average) had little effect on clarity, due to stormwater control and watershed restoration projects.

Road Sweeping

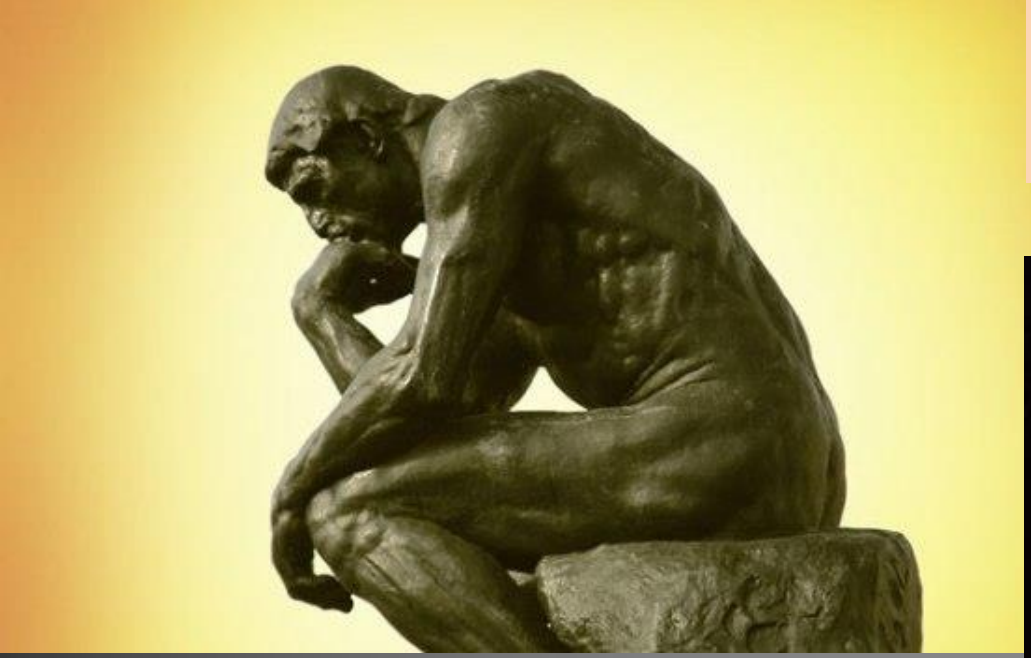
- Street sweeping is a source control BMP and provides lots of LCCP credits.
- Most Tahoe roads are difficult to sweep due to excessive wear (spalling, cracking etc.) and other issues (crowning, overlays, recessed curb lines etc.).
- Improving PCI will improve sweeper effectiveness resulting in large sediment load reductions.

Paving the Road to Clarity

Next Steps

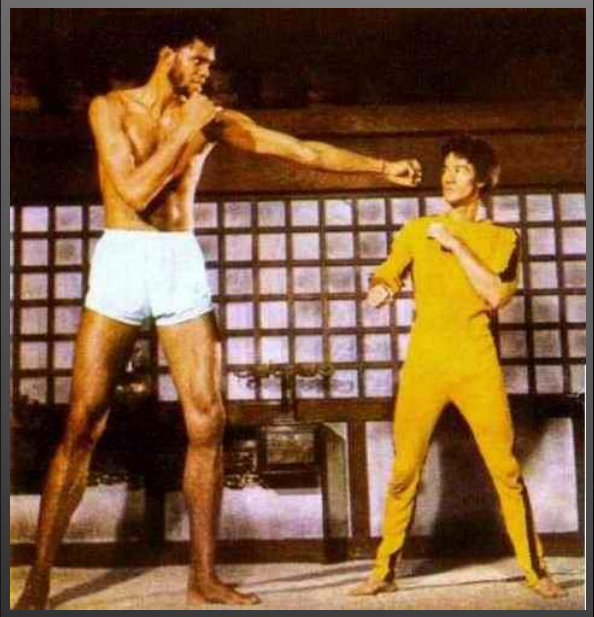
- Further investigate relationship between PCI and runoff concentrations
  - Grants
- Understand correlation between PCI and particle loading
- Look at pavement material type (asphalt vs concrete) and engineering mix design (aggregate size, binders etc.)
- Determine benefit-cost analysis of load reduction efforts
  - Pavement Management System
- Have PCI incorporated into Resource Plans - viewed as a multiple benefit for the environment. Grant Funding!!

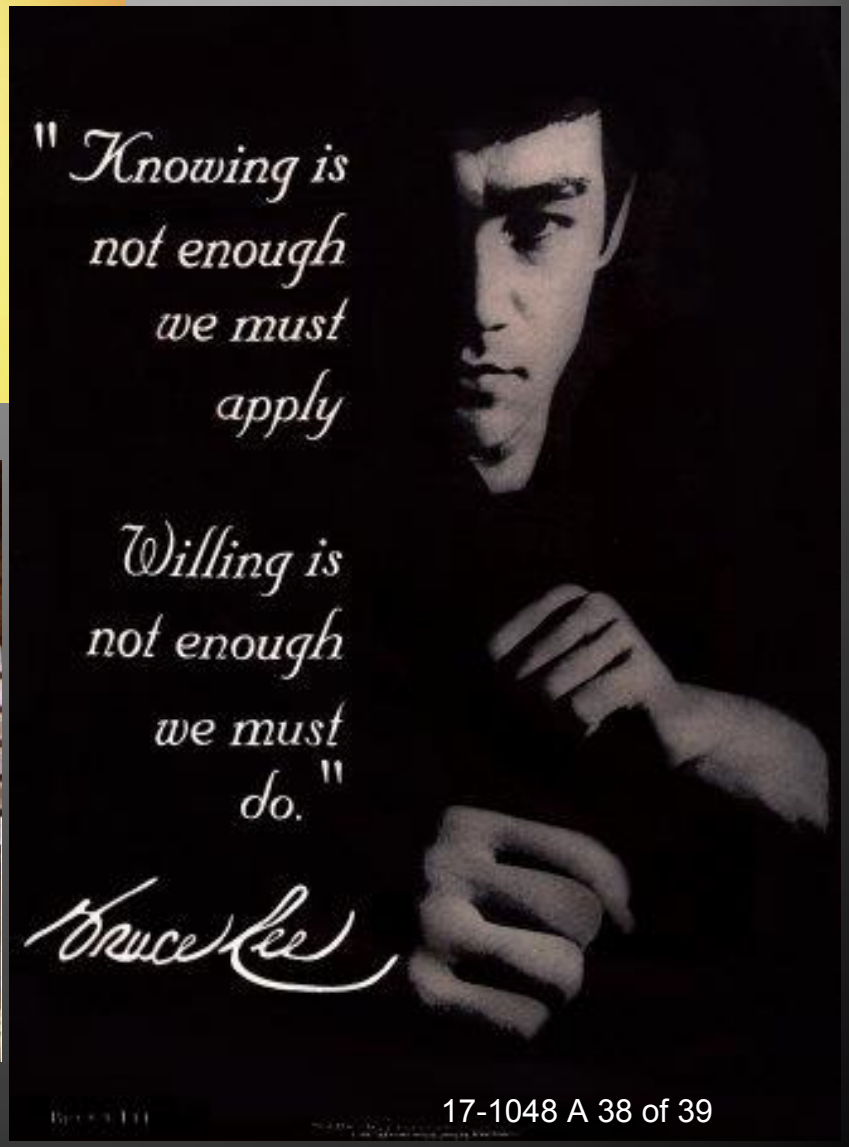
Be Like Bruce



"A goal is not always meant to be reached, it often serves simply as something to aim at."

~ Bruce Lee






QUESTIONS?