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Applying Asset Management Strategies to Traffic Signal and Street Lighting Systems in Portland, Oregon, USA

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Presented by

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City of Portland, Oregon

November 1, 2005

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But first introductions

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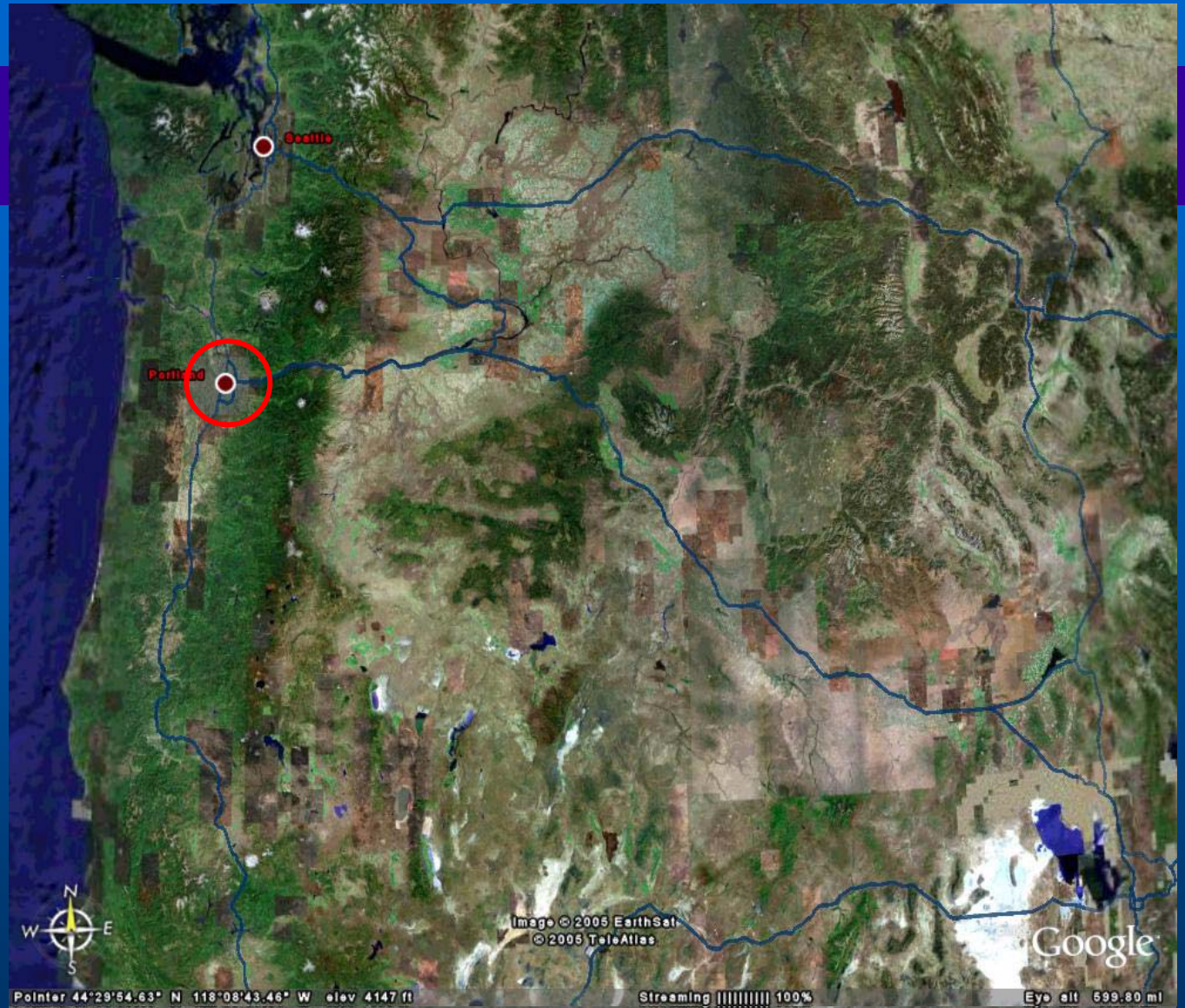
Let's start
from the
BIG picture

...

Portland,
Oregon is
here:

And KC,
MO is here:





City of Portland, Oregon

November 1, 2005

Finally in to
our base map

Population:
530,000

9.6 mi.

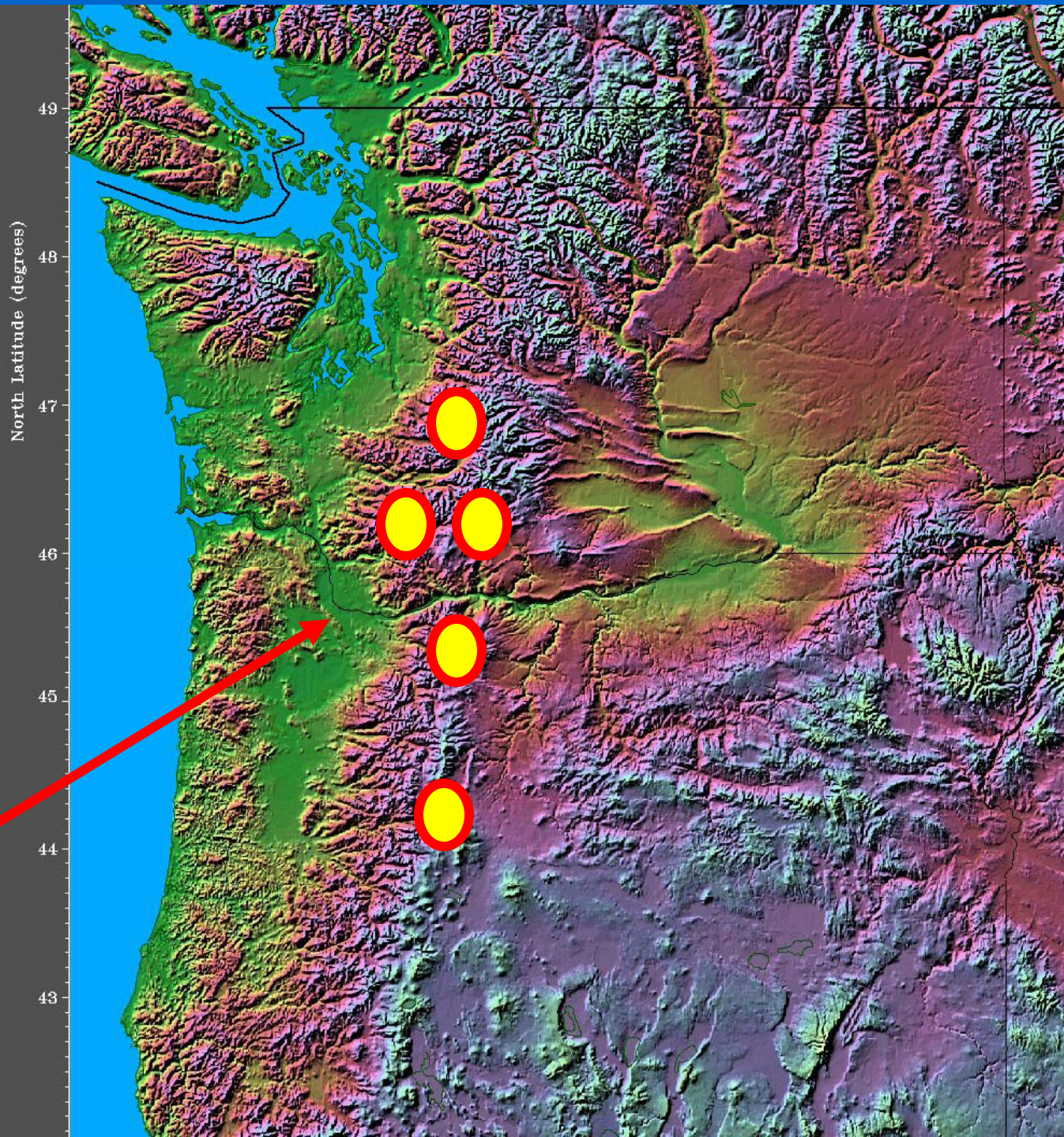
12.7
mi.

-
-
-

**We have
Volcanoes!
Two within
100K of
Portland!!**

**Portland,
Oregon**

City of P



A typical day in Portland!



City of Portland, Oregon

November 1, 2005



Assets some times manage us!

Mount St. Helens Volcano – erupted in 1980

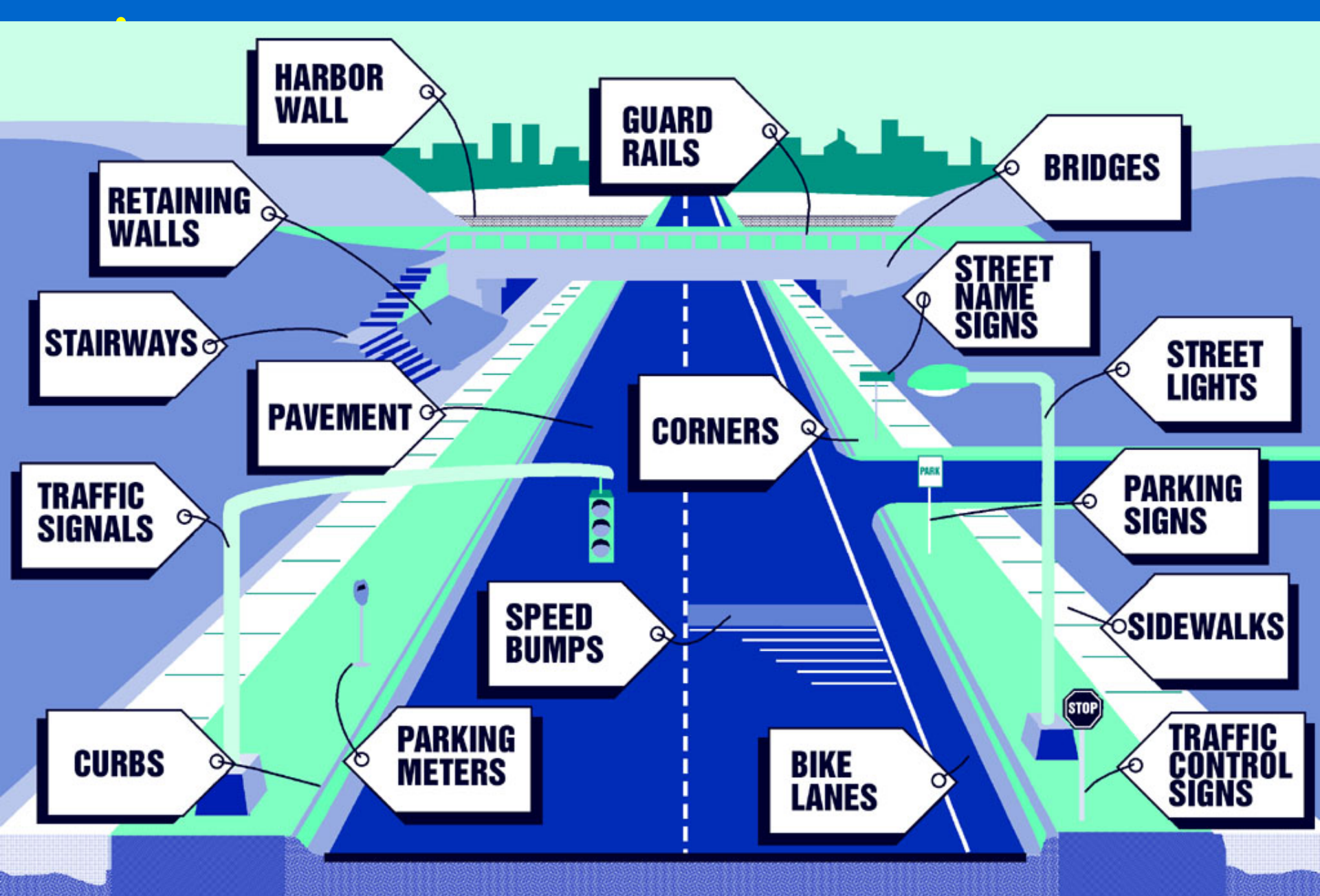


Outline for Today's Talk

- Portland's overall Asset Management (AM) program
- Signals & Street Lighting AM issues
- Portland's Signals & Street Lighting AM plans
- Revised signal reconstruction strategy
- Lessons learned – future directions

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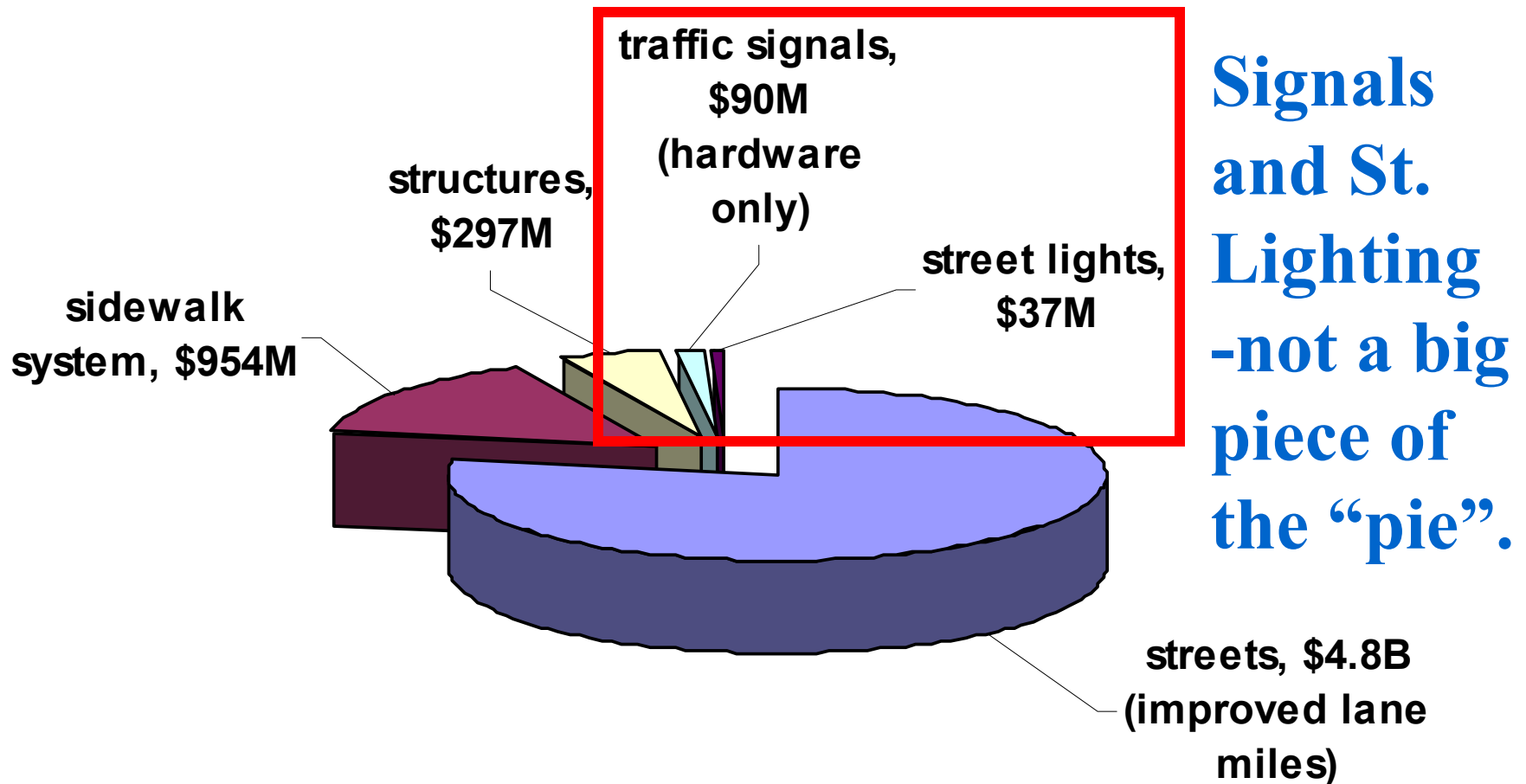
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Challenges for Transportation Asset Management in Portland

- Over 568,000 assets in 29 feature classes
- Over 233,000 operating locations
- Hierarchical and layered location structure
- Closely spaced assets
- Spatially-referenced work instructions
- Limited resources
- Many short turnaround work tasks
- Need for accurate condition and maintenance history at asset level.

Replacement Value of Transportation Assets



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Signals & St. Lighting

AM Issues

- Signals and street lights are comprised of numerous elements for each infrastructure item
- Difficult to assess condition and determine when to replace each asset since standards and specifications are continually changing.
- Technical obsolescence
 - Have you tried to buy an 8-bit microprocessor for a traffic controller recently? (Question is ... why?)

Signals and Street Lighting Elements

Signals and street lights have several common elements types:

- support structures (poles),
- electrical wires,
- underground conduits, and
- electrical service panels.

Street lights have unique elements such as:

- luminaires and photo cells

Signals and Street Lighting Elements

Signals have unique elements such as:

- traffic controllers,
- Vehicle and pedestrian indications,
- vehicle detection equipment, and
- communication networks.

Since these assets have many elements, how do we determine condition and useful life?

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Signals and Street Lighting Condition

Historically used aged based system in years:

Asset class	Good	Fair	Poor
Street lighting luminaires	0-15	16-30	>30
Traffic signal intersection hardware	0-15	16-30	>30
Traffic signal controllers	0-10	11-15	>15

Working on condition rating / life expectancy
based on field inspections.

Tracking Condition since 1986

- Used aged based system.
- Update changes in intersection age every year.
- Use spreadsheet to predict future condition based on various replacement rates.
- Provides management with long term trend information.

**Table 2. Sample Table for Tracking Aging Inventory
NUMBER OF INTERSECTIONS WITH SIGNAL HARDWARE REACHING USEFUL LIFE**

Date Remodeled	Replacement Year	Number of Intersections Reaching Useful Life		REPLACEMENT RATES														
				Reduced			Existing			Improved Level #1			Improved Level #2			Improved Level #3		
		This Year	Cumulative	Rate	Cum	Dif	Rate	Cum	Dif	Rate	Cum	Dif	Rate	Cum	Dif	Rate	Cum	Dif
prior to '80	2004	358	358	0	0	358	5	5	353	18	18	340	28	28	330	45	45	313
1980	2005	20	378	0	0	378	10	15	363	18	36	342	28	56	322	45	90	288
1981	2006	54	432	0	0	432	15	30	402	18	54	378	28	84	348	45	135	297
1982	2007	34	466	0	0	466	6	36	430	18	72	394	28	112	354	45	180	286
1983	2008	31	497	0	0	497	6	42	455	18	90	407	28	140	357	45	225	272
1984	2009	38	535	0	0	535	8	50	485	18	108	427	28	168	367	45	270	265
1985	2010	83	618	0	0	618	8	58	560	18	126	492	28	196	422	45	315	303
1986	2011	34	652	0	0	652	10	68	584	18	144	508	28	224	428	45	360	292
1987	2012	15	667	0	0	667	10	78	589	18	162	505	28	252	415	45	405	262
1988	2013	12	679	0	0	679	10	88	591	18	180	499	28	280	399	45	450	229
1989	2014	19	698	0	0	698	10	98	600	18	198	500	28	308	390	45	495	203
1990	2015	19	717	0	0	717	10	108	609	18	216	501	28	336	381	45	540	177
1991	2016	8	725	0	0	725	10	118	607	18	234	491	28	364	361	45	585	140
1992	2017	20	745	0	0	745	10	128	617	18	252	493	28	392	353	45	630	115
1993	2018	17	762	0	0	762	10	138	624	18	270	492	28	420	342	40	670	92
1994	2019	32	794	0	0	794	10	148	646	18	288	506	28	448	346	40	710	84
1995	2020	36	830	0	0	830	10	158	672	18	306	524	28	476	354	40	750	80
1996	2021	25	855	0	0	855	10	168	687	18	324	531	28	504	351	40	790	65
1997	2022	15	870	0	0	870	10	178	692	18	342	528	28	532	338	25	815	55
1998	2023	6	876	0	0	876	10	188	688	18	360	516	28	560	316	10	825	51
1999	2024	11	887	0	0	887	10	198	689	18	378	509	28	588	299	15	840	47
2000	2025	31	918	0	0	918	10	208	710	18	396	522	28	616	302	20	860	58
2001	2026	19	937	0	0	937	10	218	719	18	414	523	28	644	293	30	890	47
2002	2027	36	973	0	0	973	10	228	745	18	432	541	28	672	301	38	928	45
2003	2028	16	989	0	0	989	10	238	751	18	450	539	28	700	289	35	963	26

NOTES:

1. Assumes a 25 year life.
2. The "Dif" column shows how many intersections are beyond their rated life during that year.
3. The total number of intersections in the City is 975.

Source: Signal Inventory Database, City of Portland, Bureau of Transportation Systems Management, July 2004

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Table 3. Sample System Rating Table
SYSTEM RATING & ANNUAL COSTS FOR REPLACEMENT OF INTERSECTION SIGNAL HARDWARE

Replacement Year	REPLACEMENT RATES																			
	REDUCED					EXISTING					IMPROVED LEVEL #1					IMPROVED LEVEL #2				
	Cost		Rating			Cost		Rating			Cost		Rating			Cost		Rating		
	Annual \$	Cumulative \$	G	F	P	Annual \$	Cumulative \$	G	F	P	Annual \$	Cumulative \$	G	F	P	Annual \$	Cumulative \$	G	F	P
2004	0	0	29%	34%	38%	500,000	500,000	30%	34%	36%	1,800,000	1,800,000	31%	34%	34%	2,800,000	2,800,000	32%	34%	33%
2005	0	0	28%	34%	38%	1,040,000	1,540,000	29%	34%	37%	1,872,000	3,672,000	31%	34%	35%	2,912,000	5,712,000	33%	34%	33%
2006	0	0	27%	30%	44%	1,622,400	3,162,400	30%	30%	41%	1,946,880	5,618,880	32%	30%	38%	3,026,480	8,740,480	35%	30%	35%
2007	0	0	25%	28%	47%	674,818	3,837,318	28%	28%	43%	2,024,755	7,643,635	32%	28%	40%	3,149,618	11,890,098	36%	28%	36%
2008	0	0	23%	27%	50%	701,915	4,539,234	27%	27%	46%	2,105,745	9,749,381	32%	27%	41%	3,275,604	15,165,703	37%	27%	36%
2009	0	0	20%	26%	54%	973,322	5,512,556	25%	26%	49%	2,189,975	11,939,356	31%	26%	43%	3,406,828	18,572,331	37%	26%	37%
2010	0	0	18%	21%	62%	1,012,255	6,524,811	22%	21%	57%	2,277,574	14,216,930	29%	21%	50%	3,542,893	22,115,225	36%	21%	43%
2011	0	0	14%	21%	68%	1,315,932	7,840,743	20%	21%	59%	2,368,877	16,565,607	28%	21%	51%	3,694,609	25,799,834	36%	21%	43%
2012	0	0	12%	21%	67%	1,368,568	9,209,312	20%	21%	60%	2,463,424	19,049,032	28%	21%	51%	3,831,993	29,631,827	38%	21%	42%
2013	0	0	11%	20%	69%	1,423,312	10,632,624	20%	20%	60%	2,561,961	21,610,993	30%	20%	50%	3,985,273	33,617,100	40%	20%	40%
2014	0	0	10%	19%	71%	1,480,244	12,112,868	20%	19%	61%	2,664,440	24,275,433	30%	19%	51%	4,144,684	37,761,784	41%	19%	39%
2015	0	0	7%	20%	72%	1,539,454	13,652,322	18%	20%	62%	2,771,017	27,046,450	29%	20%	51%	4,310,471	42,072,255	41%	20%	39%
2016	0	0	5%	21%	73%	1,601,032	15,253,354	17%	21%	61%	2,881,858	29,928,308	29%	21%	50%	4,462,890	46,555,146	42%	21%	37%
2017	0	0	2%	23%	75%	1,665,074	16,918,428	15%	23%	62%	2,997,132	32,925,440	27%	23%	50%	4,662,206	51,217,351	41%	23%	36%
2018	0	0	0%	23%	77%	1,731,676	18,650,104	14%	23%	63%	3,117,018	36,042,458	27%	23%	50%	4,848,694	56,066,045	42%	23%	35%
2019	0	0	0%	20%	80%	1,800,944	20,451,048	14%	20%	65%	3,241,698	39,284,156	27%	22%	51%	5,042,642	61,108,687	42%	23%	35%
2020	0	0	0%	16%	84%	1,872,981	22,324,029	14%	16%	68%	3,371,366	42,655,522	27%	20%	53%	5,244,347	66,353,035	42%	22%	36%
2021	0	0	0%	14%	86%	1,947,900	24,271,929	14%	17%	69%	3,506,221	46,161,743	27%	19%	54%	5,454,121	71,807,156	42%	22%	35%
2022	0	0	0%	12%	88%	2,025,817	26,297,746	14%	16%	70%	3,646,470	49,808,213	27%	19%	53%	5,672,268	77,479,424	42%	23%	34%
2023	0	0	0%	11%	89%	2,108,849	28,406,595	15%	16%	70%	3,792,329	53,600,541	27%	21%	52%	5,899,178	83,378,620	42%	28%	32%
2024	0	0	0%	10%	90%	2,191,123	30,595,718	15%	15%	70%	3,944,022	57,544,563	27%	21%	61%	6,135,145	89,513,765	42%	27%	30%
2025	0	0	0%	7%	93%	2,278,768	32,874,486	15%	13%	72%	4,101,783	61,646,346	27%	20%	53%	6,380,551	95,894,315	42%	27%	31%
2026	0	0	0%	5%	95%	2,369,919	35,244,405	15%	12%	73%	4,265,854	65,912,199	27%	20%	53%	6,635,773	102,530,088	42%	28%	30%
2027	0	0	0%	2%	98%	2,464,716	37,709,121	15%	10%	75%	4,436,488	70,348,687	27%	18%	55%	6,901,204	109,431,292	42%	27%	30%
2028	0	0	0%	0%	100%	2,563,304	40,272,425	15%	8%	76%	4,613,847	74,962,635	27%	18%	54%	7,177,252	116,608,543	42%	28%	28%

At the current rate, 89% of intersections will be in poor condition in 2021. An annual expenditure of \$480,000 is spent on this service level. To replace the 358 intersections that currently exceed useful life would cost nearly \$36 million.

NOTES:

1. The cost for each intersection replacement =
2. As of 7/1/04 the overall existing rate is:
 - 28% good (0 to 15 years old)
 - 35% fair (16 to 25 years old)
 - 36% poor (greater than 25 years old)

\$100,000

Inflation factor =

4%

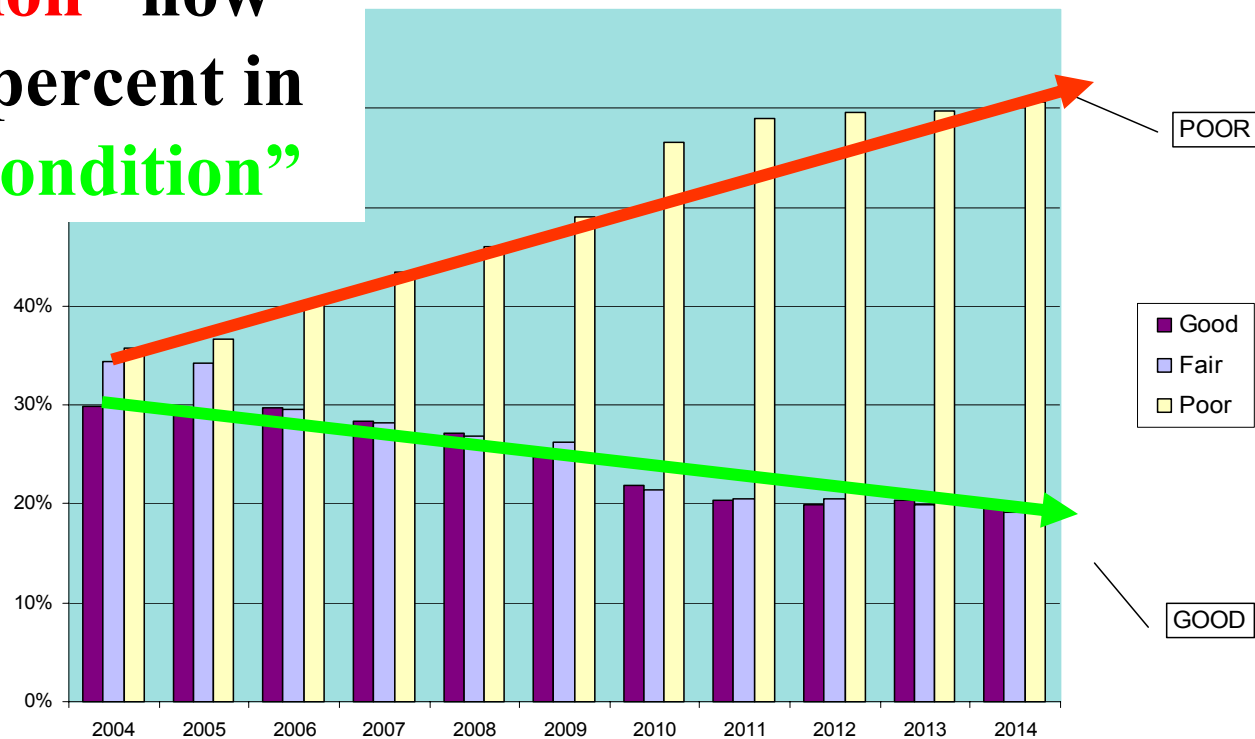
Source: Signal Inventory Database, City of Portland, Bureau of Transportation Systems Management, July 2004

Clearly shows predicted good, fair, and poor values based on various replacement rates.

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But nothing works like pictures!

Percent in “**poor**
condition” now
exceed percent in
“**good condition**”



Outline of the plans

Now developing more thorough AM plans.

- Asset Trends & Updates— Where are we?
- Standards & Current Service Level – How do we do work and what did we do?
- Update on Effectiveness/Efficiency – How are we doing?
- Update on Forecasted Conditions – Where are we headed?
- Update on Next Steps – What should we do?

Outline for Today's Talk

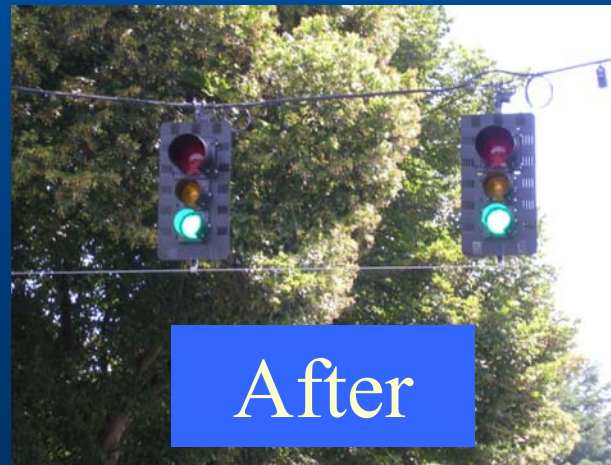
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- ➔ • **Revised signal reconstruction strategy**
- Lessons learned – future directions

Signal reconstruction

- Up to 3 years ago, did complete replacement with mast arms.
- Due to budget constraints aging infrastructure, we needed to change tactics.
- We now complete approximately four partial reconstructions for what one full replacement would have cost.

Partial signal reconstruction

- Typically we replace spans and unsound strain poles.
- Intersection ends up with new indication and cable.
- Estimated life extension of 25 years.
- New mast arm installation should last 50 years.



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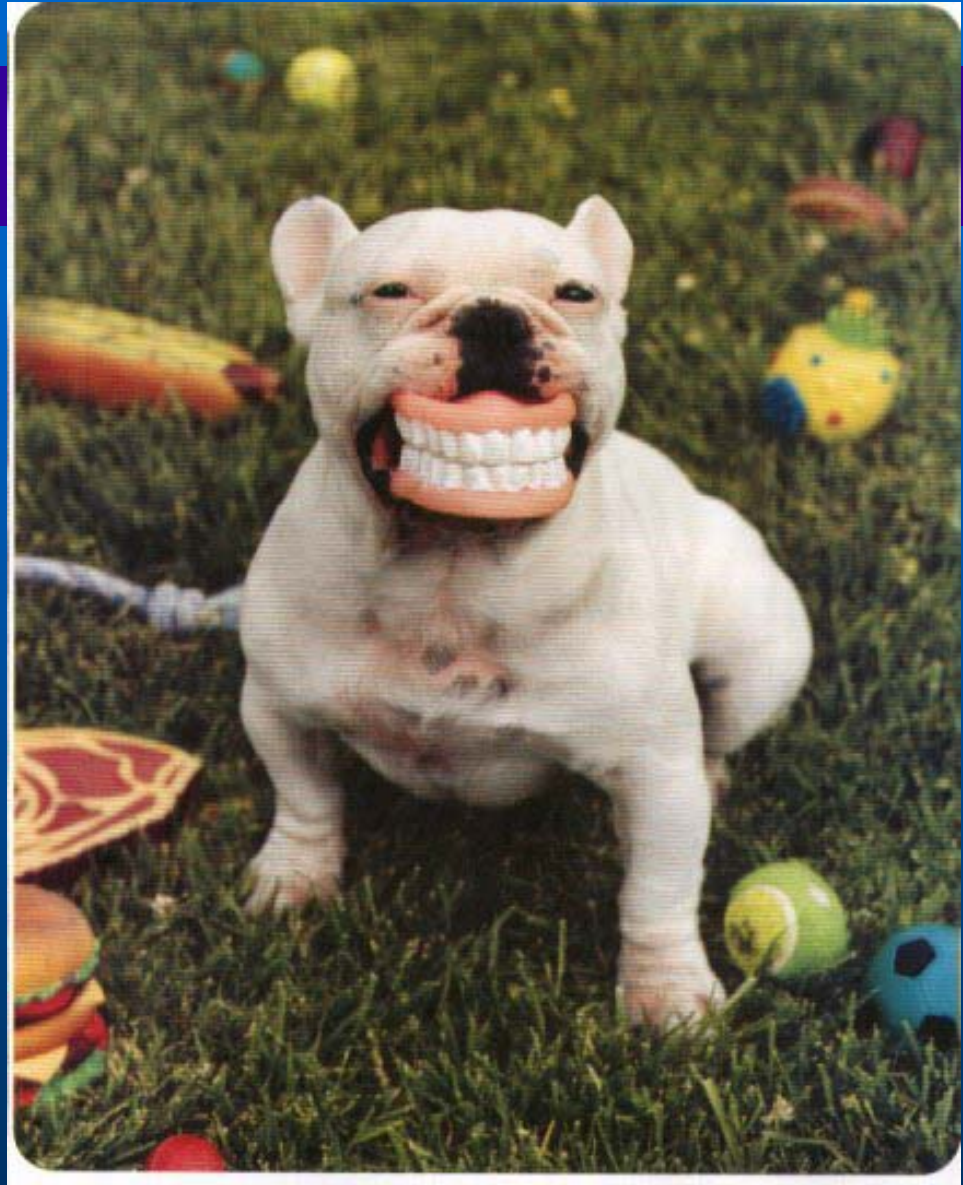
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Lessons learned

- Asset management requires an ongoing management commitment to be effective. Asset management requires time and effort to collect, analyze, and present information.
- Demonstrate a technical knowledge of the asset and an understanding of the management process in order to obtain the credibility needed to be successful in obtaining necessary resources.
- Find ways to demonstrate what happens when the assets are not replaced as needed. Take props like old, rusty signal equipment into budget discussions.
- Explain “useful life” to bureau directors and politicians, which is difficult for a complicated asset like traffic signals.

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•
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Finally, I hope
that we are all
ready to sink
our teeth into
**asset
management!**



The end.

