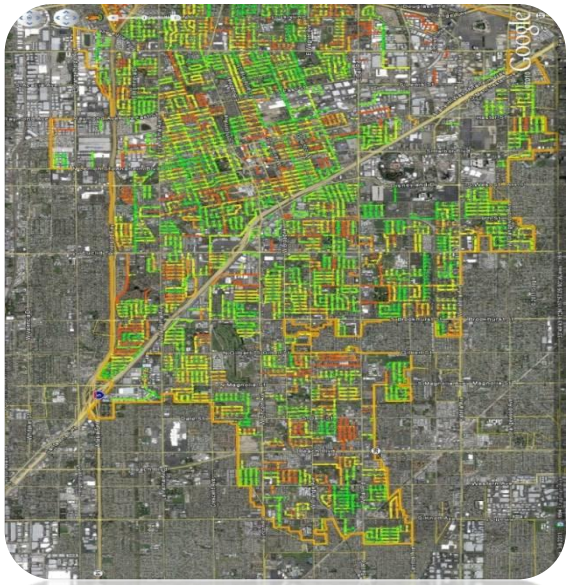
Colorado Asphalt Pavement Association

PAVEMENT MANAGEMENT IMPLEMENTATIONS

ONE SIZE DOESN'T FIT ALL



IMS Infrastructure Management Services

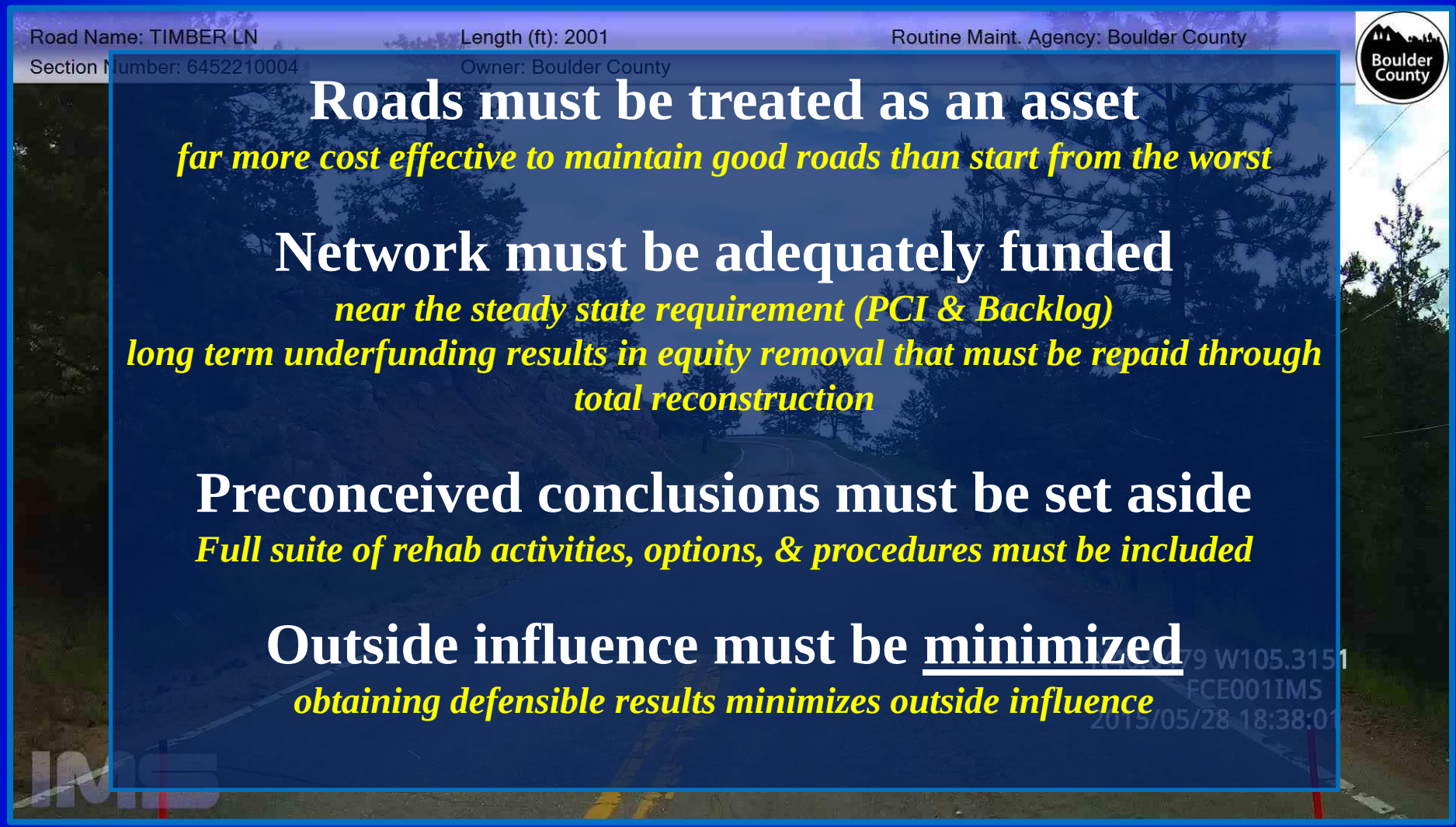
Consultants | Engineers

Pavement management is the process of evaluating, prioritizing and monitoring pavements in an effort to provide maximum benefits from available funds.

In reality, it is the process of picking winners and losers in a defensible manner.

Zac Thomason, M.B.A.
National Client Services Manager

Success Starts Right Here…



Roads must be treated as an asset

far more cost effective to maintain good roads than start from the worst

Network must be adequately funded

near the steady state requirement (PCI & Backlog)

long term underfunding results in equity removal that must be repaid through total reconstruction

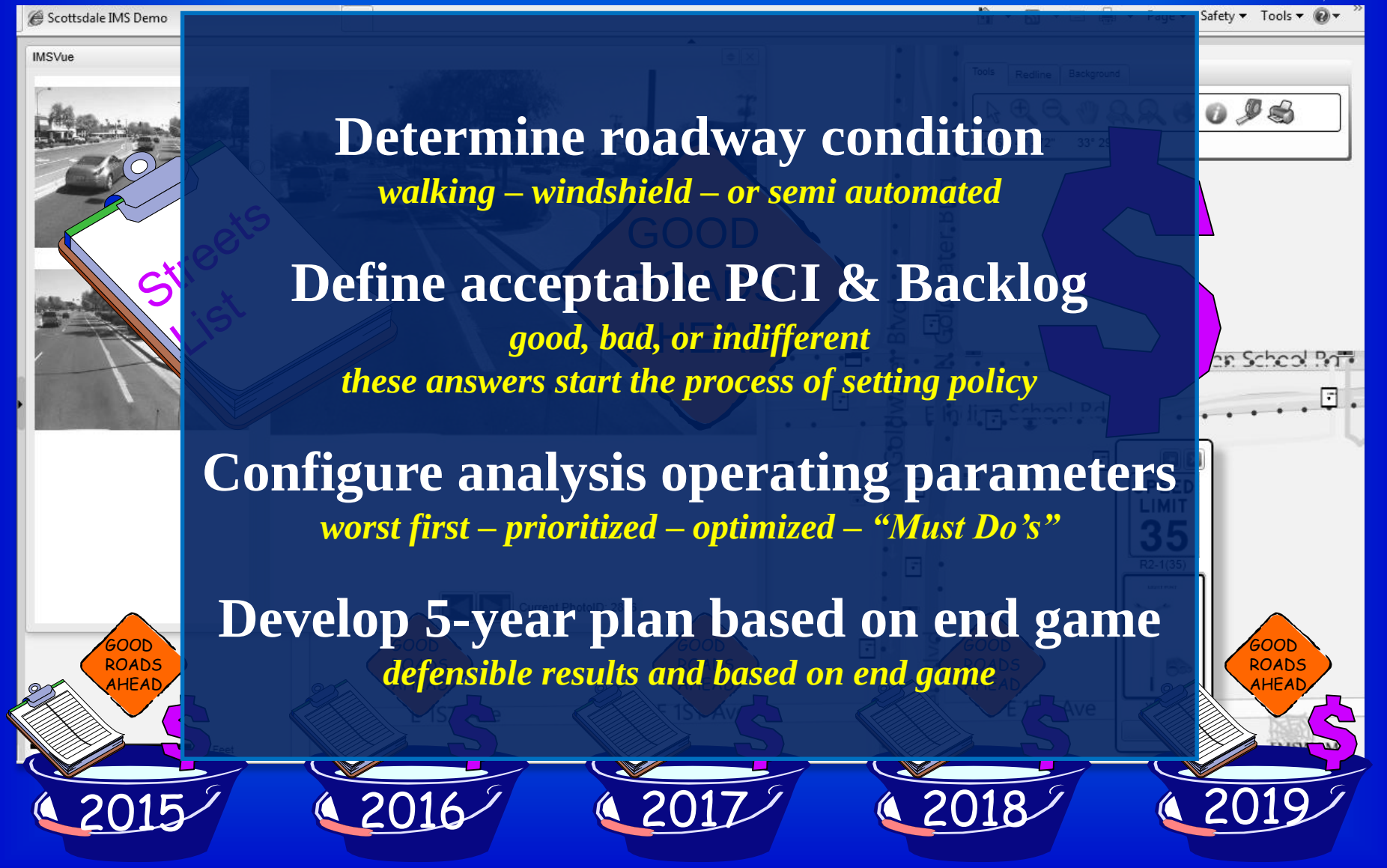
Preconceived conclusions must be set aside

Full suite of rehab activities, options, & procedures must be included

Outside influence must be <u>minimized</u>

obtaining defensible results minimizes outside influence

Determine Your End Game



Determine roadway condition

walking – windshield – or semi automated

Define acceptable PCI & Backlog

good, bad, or indifferent

these answers start the process of setting policy

Configure analysis operating parameters

worst first – prioritized – optimized – "Must Do's"

Develop 5-year plan based on end game

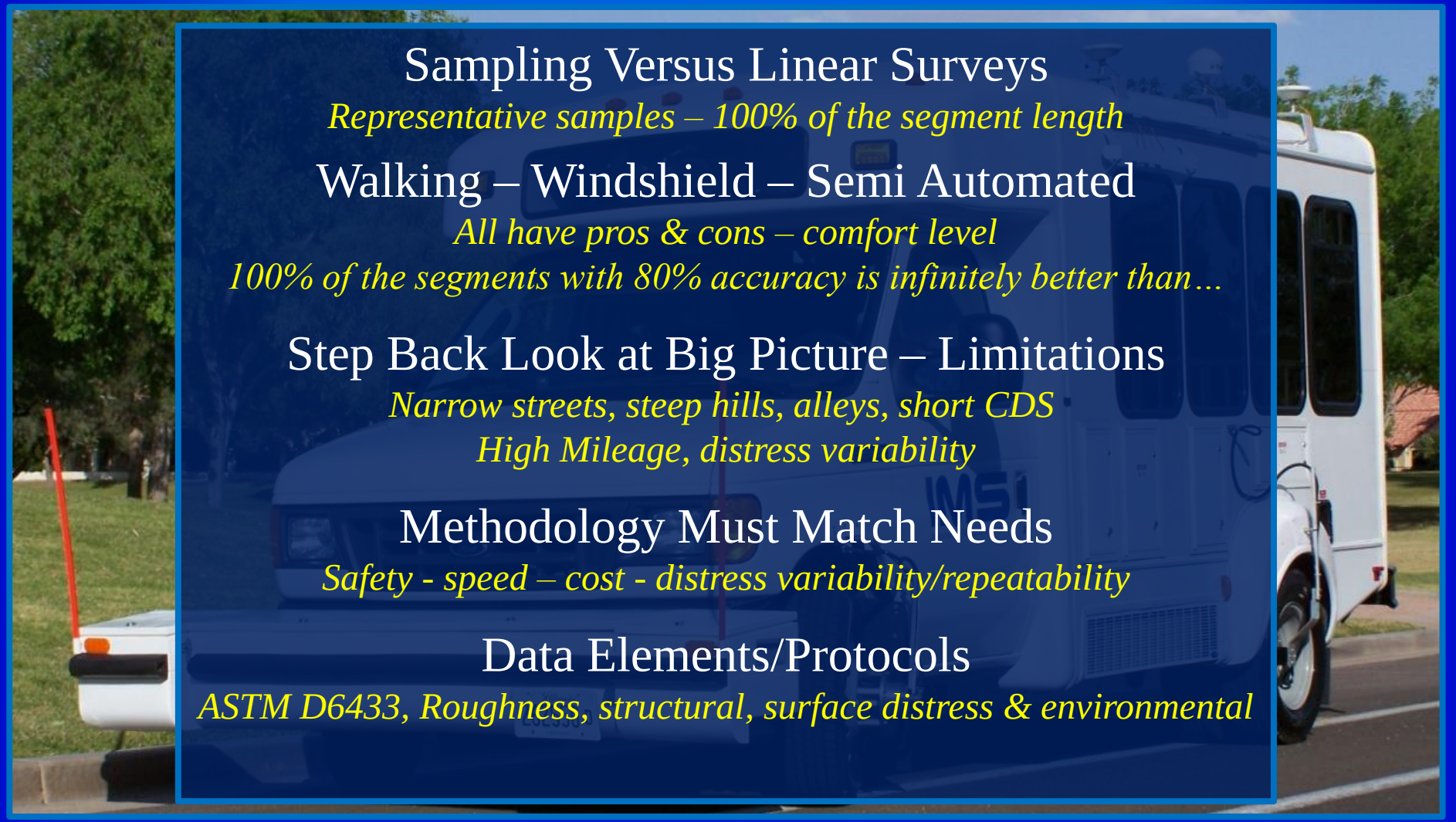
defensible results and based on end game

Basic End Game Checks…

Asphalt Deficiency	Total Cost ($)	% of Total	PART	MnART	MCOL	MnCOL	LOC	Life Cycle (years)	Life Cycle Cost ($)
Reconstruction (Base)	1,622,700	2.7	0	131,200	0	74,000	1,417,500	50	32,000
Reconstruction (Surface)	18,054,800	30.4	0	521,100	540,800	3,555,400	13,437,500	35	516,000
Thick Olay (> 2.0 - 3.0)	21,094,600	35.5	439,300	2,425,800	16,800	4,194,500	14,018,200	25	844,000
Mod Overlay (2.0 - 3.0)	13,457,500	22.7	115,300	2,007,000	406,000	2,334,000	8,595,200	20	673,000
Thin Overlay (1.5 - 2.0)	4,702,900	7.9	0	467,200	0	814,900	3,420,800	20	235,000
Surface Treatment	251,100	0.4	0	9,300	0	59,600	182,200	10	25,000
Slurry Seal	196,900	0.3	0	3,200	0	87,600	106,100	5	39,000
Routine Maintenance	5,400	0.0	0	0	0	2,200	3,200	2	3,000
Total Asphalt Network:	**59,385,900**	**100**	**554,600**	**5,564,800**	**963,600**	**11,122,200**	**41,180,700**		**2,367,000**

Concrete Deficiency	Total Cost ($)	% of Total	PART	MnART	MCOL	MnCOL	LOC	Life Cycle (years)	Life Cycle Cost ($)
PCC Reconstruction	0	0.0	0	0	0	0	0	75	0
PCC Partial Recon	0	0.0	0	0	0	0	0	50	0
Extensive Pnl Rplcmnt	0	0.0	0	0	0	0	0	25	0
Moderate Pnl Rplcmnt	31,200	22.7	0	0	0	0	31,200	20	2,000
Slight Pnl Rplcmnt	35,400	25.8	0	0	9,000	0	26,400	20	2,000
Localized Rehab	13,400	9.8	0	0	0	0	13,400	10	1,000
Joint Rehab	22,900	16.7	0	0	7,200	8,000	7,700	5	5,000
Routine Maintenance	34,500	25.1	0	0	0	5,100	29,400	2	17,000
Total Concrete Network:	**137,400**	**100**	**0**	**0**	**16,200**	**13,100**	**108,100**		**27,000**
Total Network :	**59,523,300**		**554,600**	**5,564,800**	**979,800**	**11,135,300**	**41,288,800**		**2,394,000**

Types of Pavement Condition Surveys



Sampling Versus Linear Surveys

Representative samples – 100% of the segment length

Walking – Windshield – Semi Automated

All have pros & cons – comfort level

100% of the segments with 80% accuracy is infinitely better than…

Step Back Look at Big Picture – Limitations

Narrow streets, steep hills, alleys, short CDS

High Mileage, distress variability

Methodology Must Match Needs

Safety - speed – cost - distress variability/repeatability

Data Elements/Protocols

ASTM D6433, Roughness, structural, surface distress & environmental

Subgrade Strength Data

Presence of Load Associated Distresses

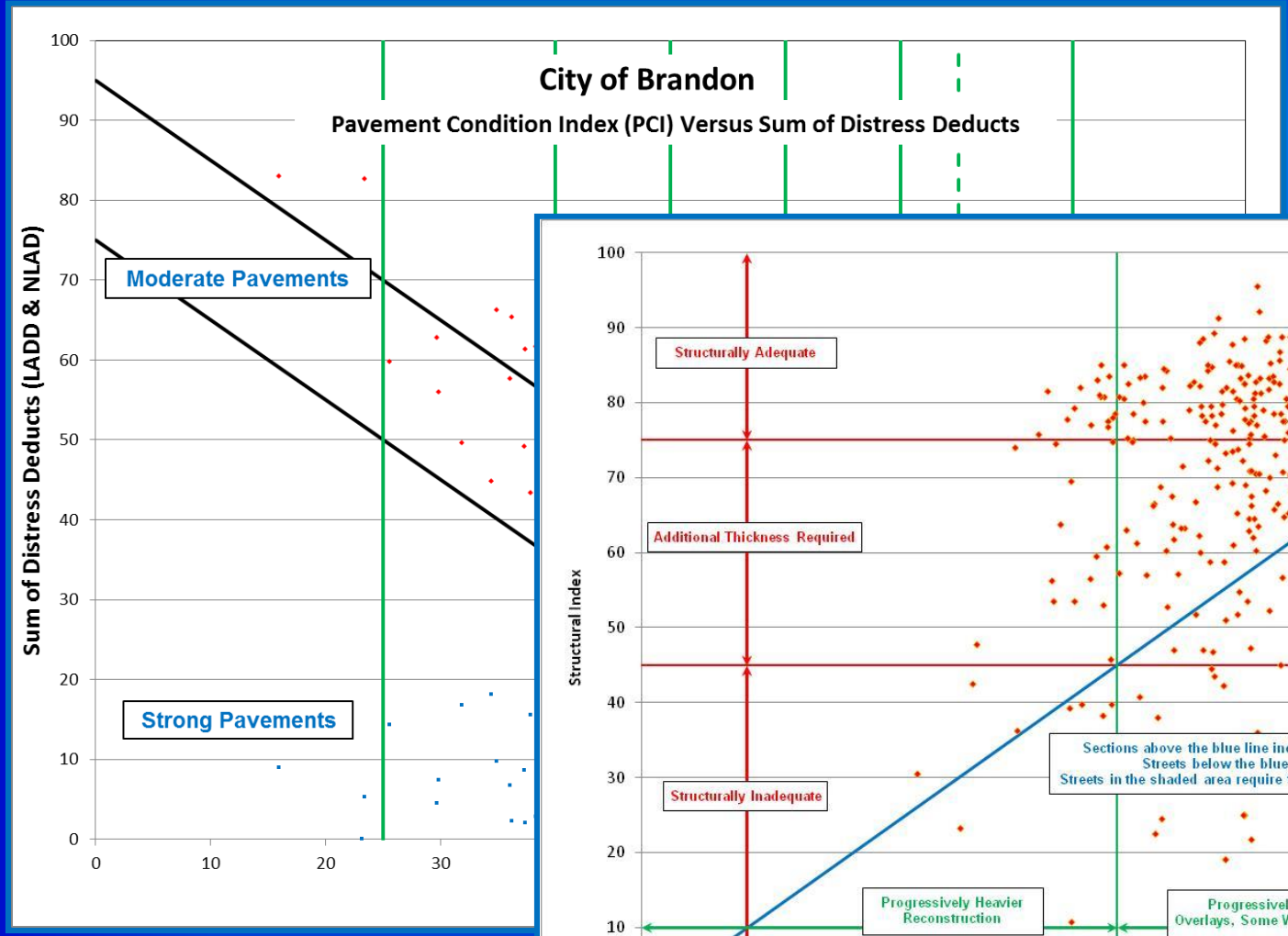
Utilize Available Core Data

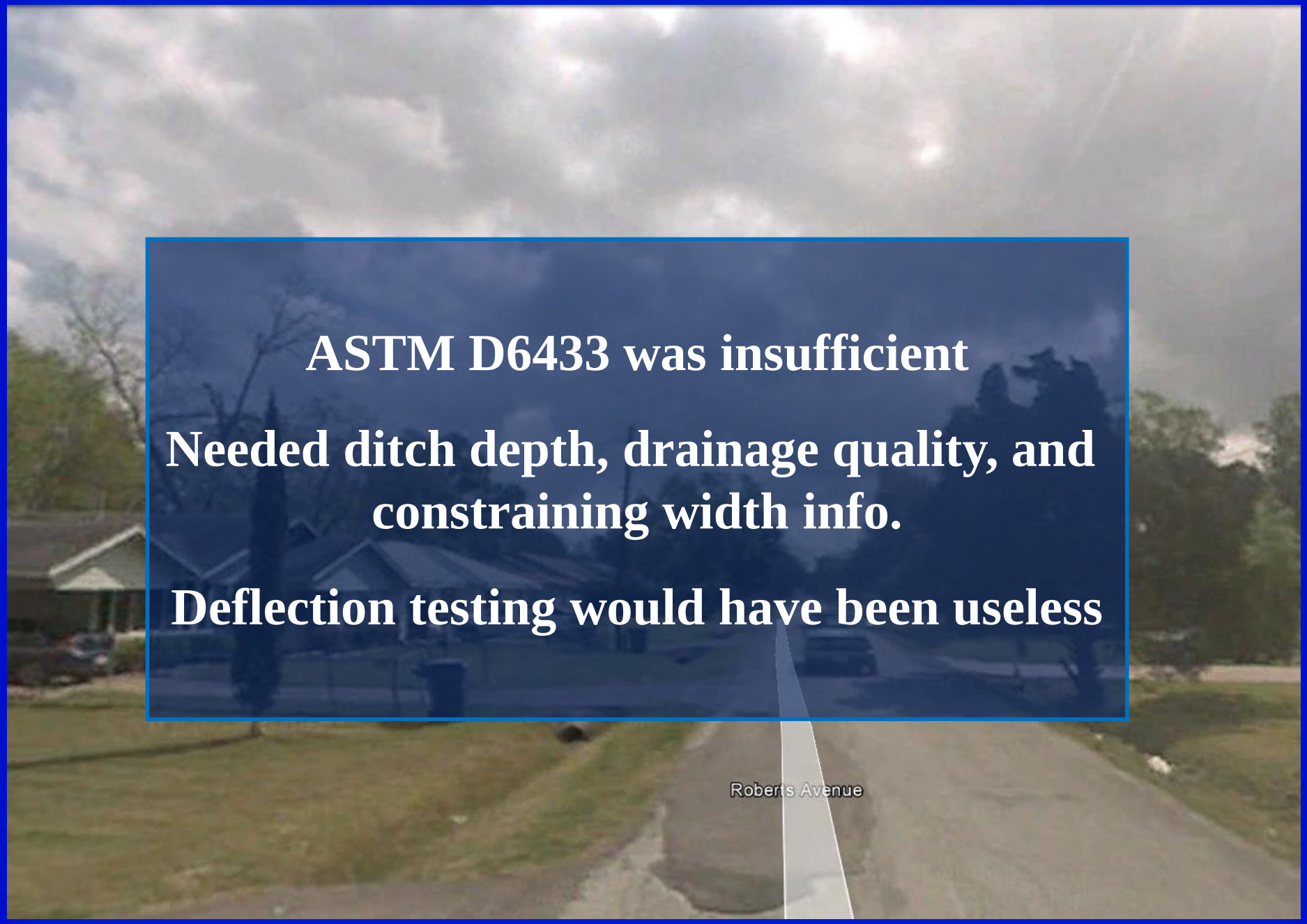
Must be available on all roads

Perform Structural Testing Using a Dynaflect or FWD

300 – 500 foot intervals

Subgrade Strength Options…





ASTM D6433 was insufficient

Needed ditch depth, drainage quality, and constraining width info.

Deflection testing would have been useless

How Often Should We Update….

Funding Agency

Surface Distress Only
1 to 3 years

Surface Distress and Roughness
2 to 4 years

Surface Distress, Roughness and Deflection
3 to 5 years

Critical to update pavement management system between cycle with completed projects

Segmentation Is Critical

Homogenous Segmentation

Block-to-block, intersection, mile post, landmark

Software specific, adopt agency standard referencing rules

Develop Logical Projects (supersegments)

Supersegments are segments aggregated to form projects – must be homogeneous as it blends the data

Rehab is based on supersegment and can be street or neighborhood based

Rules of Thumb:

- ✓ *Any single project < 25% of total budget, upset limit*
- ✓ *Upset length = 1 miles +/- ½ mile*
- ✓ *Do not cross arterials/collectors*

Components Of A PCI Score…

40

Suggested PCI Components (Summary Indexes: SDI, RI, SI)

ASTM D6433 for Surface Distress Index (ASTM/MicroPAVER PCI)

Not all distresses carry equal weighting

Q corrected for overlapping/multiple distresses

Not user friendly, convert individual distresses to a 0 – 10 index, 9-10 minimal distresses <5 extensive distresses present

SDI > 90 is a like new pavement while <50 requires extensive rehab – possibly base stabilization

International Roughness Index (IRI) for Roughness Index

Open ended scale measuring bumps/mile (mm/m or in/mile), 1mm very smooth road 8mm very poor road

Falling Weight Deflectometer analysis for Structural Index

DeflCON – ability of pavement to withstand design loading (60%) – traffic

DynaCON – layers analysis to identify structural adequacy (40%) – deflection bowl

SI > 75 is structurally adequate; 45 – 75 needs pavement structure, < 45 needs base rehab & structure

No deflection data? Ample core data or sum of load associated distresses

Suggested PCI Algorithm

ASTM D6433 PCI = SDI only (no roughness or structural input)

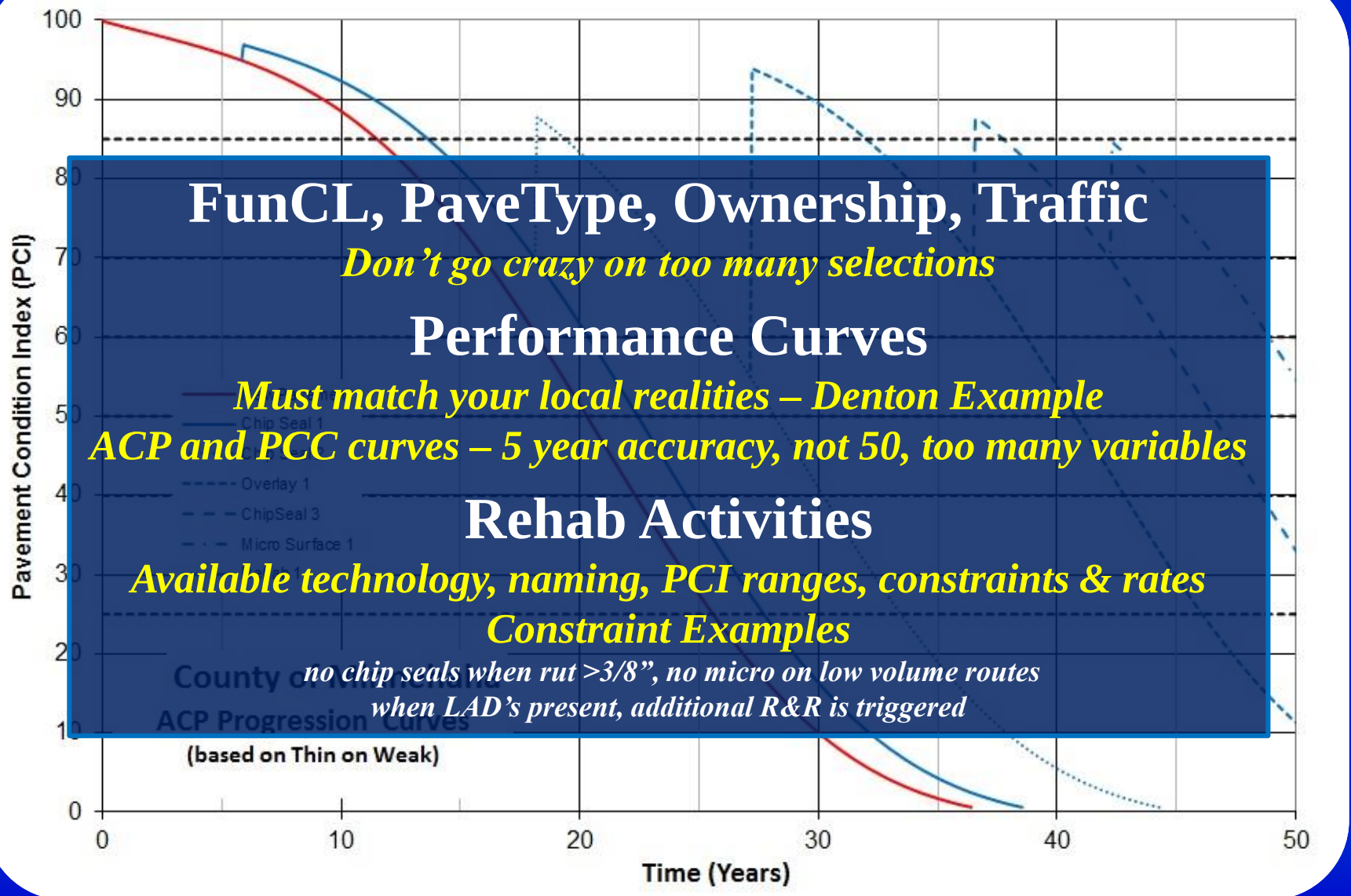
PCI = 67% SDI + 33% RI

PCI = 50% SDI + 25% RI + 25% SI

Define condition description and use them in place of PCI, numbers fixation

Pavement Condition Using Descriptive Terms

Analysis Configuration Options



FunCL, PaveType, Ownership, Traffic

Don't go crazy on too many selections

Performance Curves

Must match your local realities – Denton Example

ACP and PCC curves – 5 year accuracy, not 50, too many variables

Rehab Activities

Available technology, naming, PCI ranges, constraints & rates

Constraint Examples

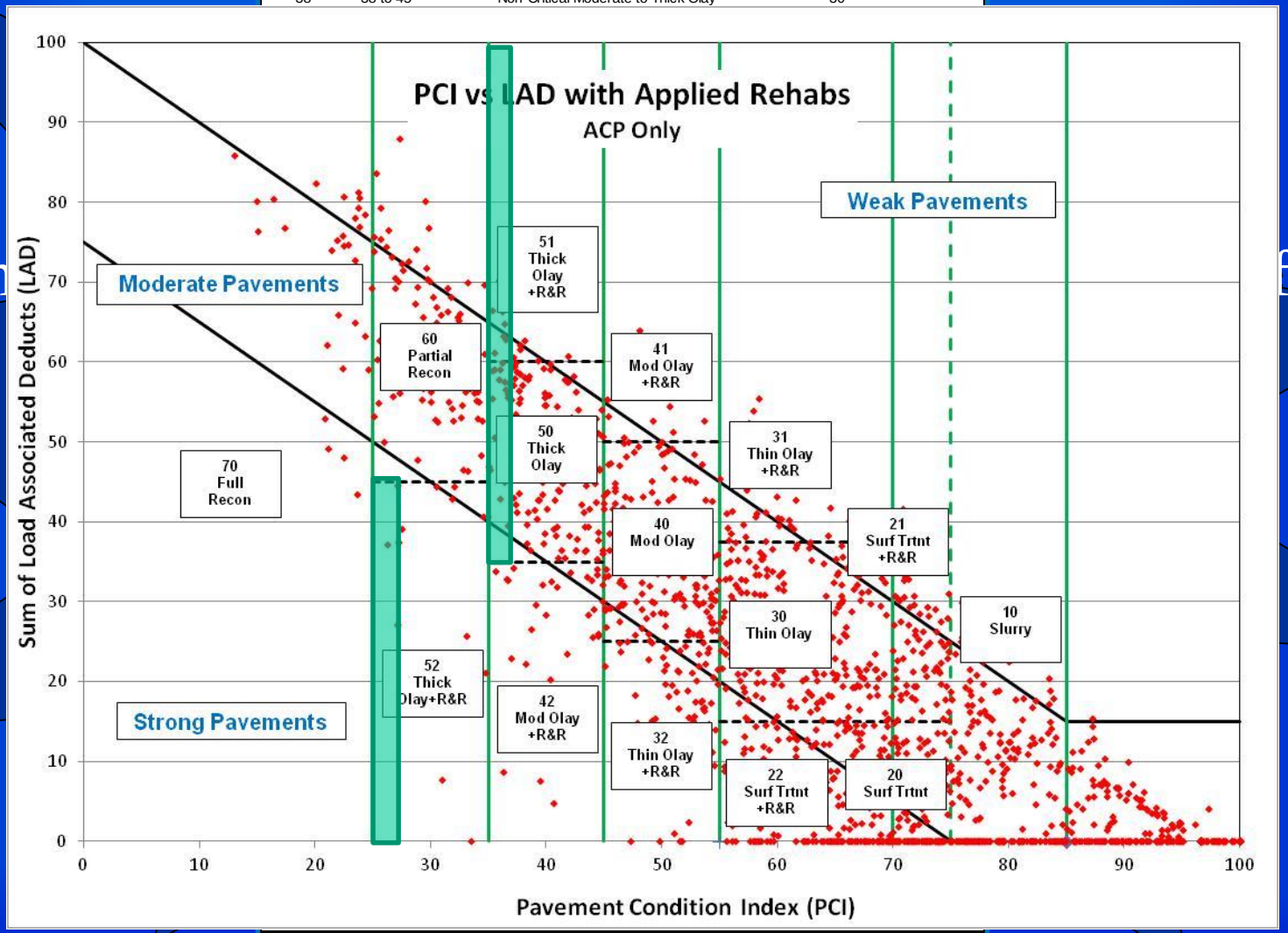
no chip seals when rut >3/8", no micro on low volume routes

when LAD's present, additional R&R is triggered

Operating P

Optim fitt

Need Year		Prioritizes Candidates in Their Need Year Based on Cost of Deferral		
OCI B/P	Range	Action	NPR Factor	Weighting
0	0 to 10	Critical Recon	70	40
10	10 to 20	Non-Critical Recon	5	
20	20 to 25	Critical Thick Olay or Partial Recon	100	
25	25 to 35	Non-Critical Thick Olay or Partial Recon	35	
35	35 to 38	Critical Moderate to Thick Olay	95	
38	38 to 45	Non-Critical Moderate to Thick Olay	30	



OCI	Introduces Worst First Element	= 100-OCI	10

Analysis Techniques…

Start Outside the System

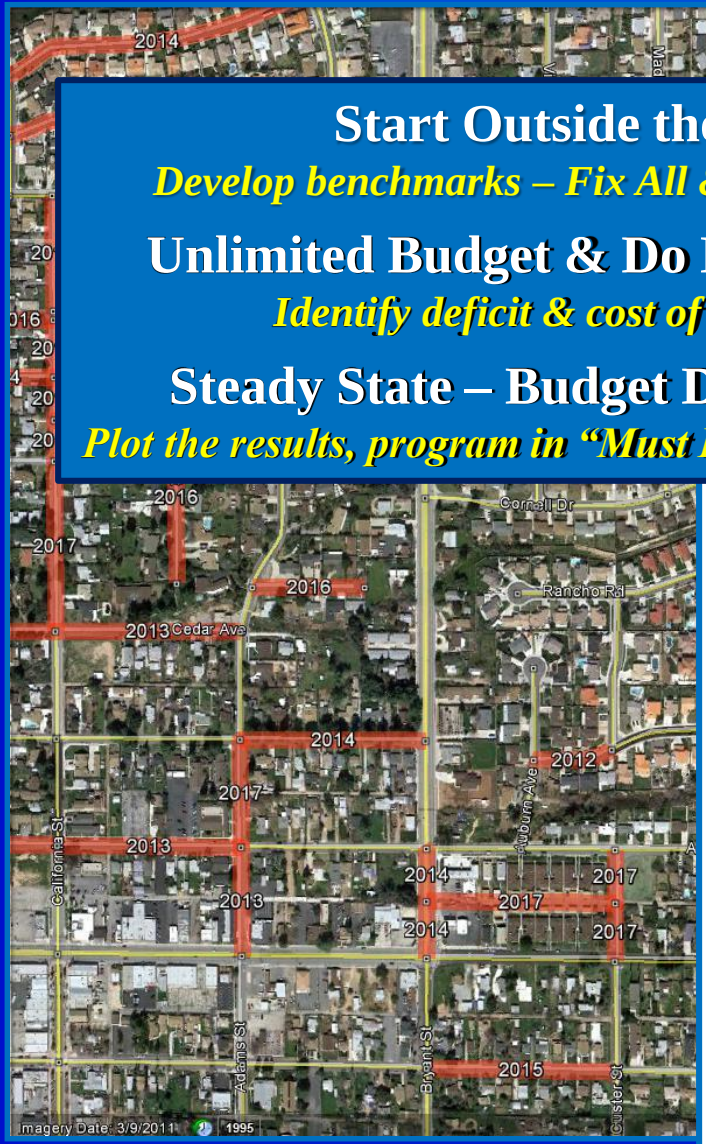
Develop benchmarks – Fix All & Life Cycle Analysis

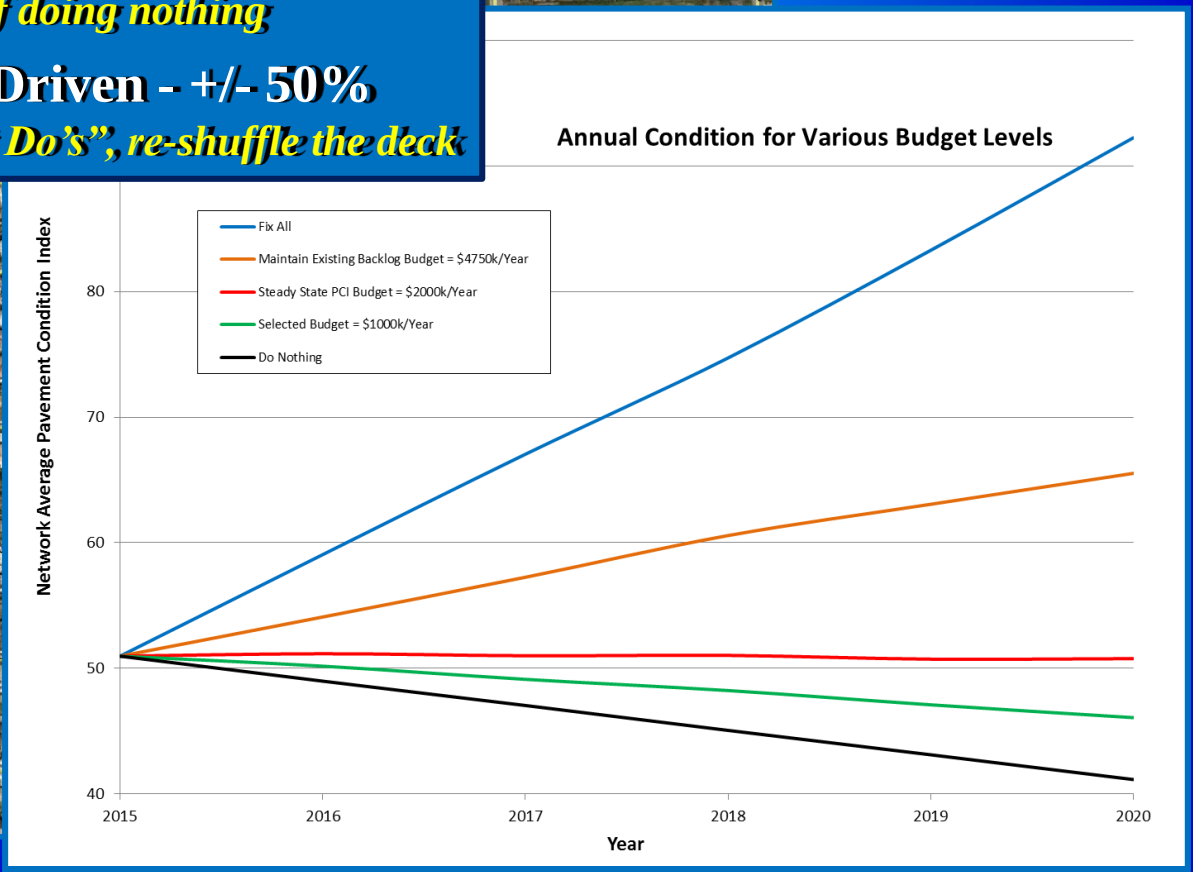
Unlimited Budget & Do Nothing Analysis

Identify deficit & cost of doing nothing

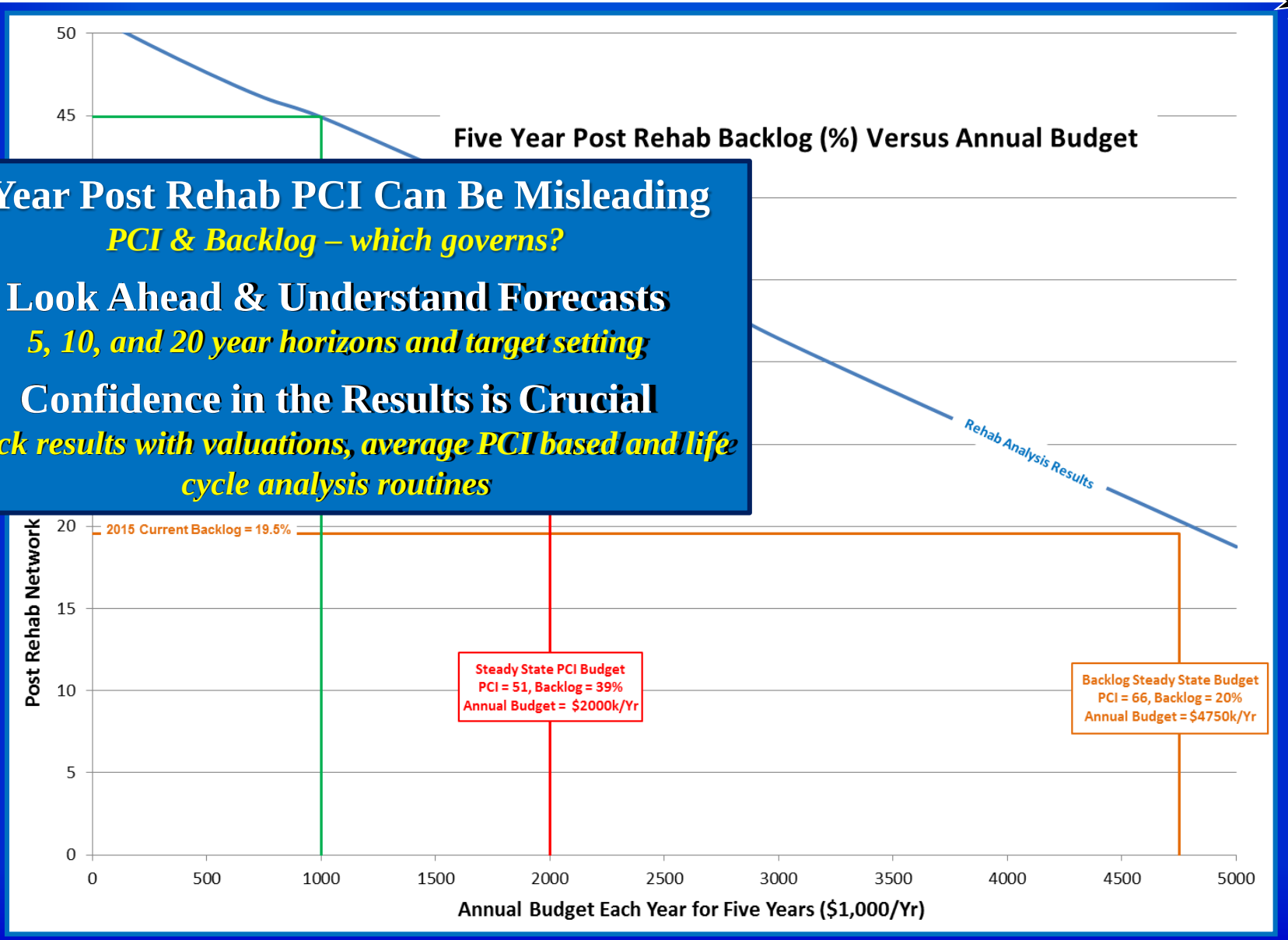
Steady State – Budget Driven - +/- 50%

Plot the results, program in "Must Do's", re-shuffle the deck





What About Backlog?



5-Year Post Rehab PCI Can Be Misleading

PCI & Backlog – which governs?

Look Ahead & Understand Forecasts

5, 10, and 20 year horizons and target setting

Confidence in the Results is Crucial

Check results with valuations, average PCI based and life cycle analysis routines

What If Your Underfunded?

City of Sandy Springs

Equity Removal Summary

Strategies For Being Underfunded

There are none, you can only minimize the net loss

Two Almost Workable Strategies

Maintain the best and let the rest slide

Apply substandard rehabs with hopes of recovering later – in reality this never works

Long term underfunding of rehabilitation and maintenance is the direct equivalent of removing equity from an asset – eventually it must be repaid through total reconstruction.

Cost Per Point

Equity Removal Based On F

For PCI Controlled Agencies

				nual	$4.00M Annual	Steady State
Annual Budget ($k/Year):	0	1,000	2,000	3,100	4,000	4,250
Starting PCI	71	71	71	71	71	71
Ending PCI	71	71	71	71	71	71
Backlog	0	0	0	0	0	0
Ending Backlog	0	0	0	0	0	0
5 Year Budget Expenditure ($):	0	5,000,000	10,000,000	15,500,000	20,000,000	21,250,000
Total 5 Year Cost ($):	31,141,000	29,600,000	26,848,000	24,346,000	22,028,000	21,250,000
Cost Over Steady State Budget ($):	9,891,000	8,350,000	5,598,000	3,096,000	778,000	0
Additional Annual Cost Over Steady State ($/year):	**1,978,200**	**1,670,000**	**1,119,600**	**619,200**	**155,600**	**0**

Defensible Results…Why This And Not That?

What About ADA Compliance…

Ignoring A

Evolving

Legal a

Commercial

Don't Believe Results are 100% Correct

Follow up network level testing with project level testing

Network level testing develops budgets and project level completes the design

Do not assume a 2" overlay selected by the system means a 2" overlay

Perform deflection testing, pull cores, and design an appropriate overlay

Types of PM Software Available

Deciding Which Is Right For You?

Buying software in the first place

about 1/3 of the implementations sit on the shelf, accessed a few times a year and folks forget how to operate the system (be honest with yourself)

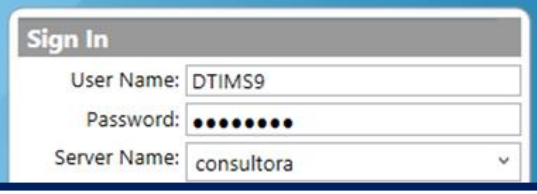
Buying too little software

GIS Integration, rigid segmentation, black box (one size fits all approach), no assets, no optimization, no scalability, no enhancements (IRI, deflection, customization), doesn't integrate with existing agency functions

Buying too much software

empty box, open configuration, unlimited prioritization, operating parameters are customizable, high technical competency

Software Example



City of Brandon

Inventory and Condition Summary | **Pavement Condition Summary** | **Projects Summary**

Today: 10/8/2015

PCI: 76 | Current Network PCI: 74

5 Year Rehab Plan Summary

Annual Budget: 350,000

Analysis Start Date: 7/1/2014

Program Year	Calendar Year	Block Count	Annual Expenditure	Miles	PCI	B/L
0	2014	497	6,177,300	47.3	74	3.7%
1	2015	17	349,700	2.0	74	
2	2016	15	349,600	1.3	74	
3	2017	18	349,900	1.7	73	
4	2018	32	349,300	2.9	73	
5	2019	13	349,900	1.3	73	5.4%
Final:		95	1,748,400	9.3	73	5.4%

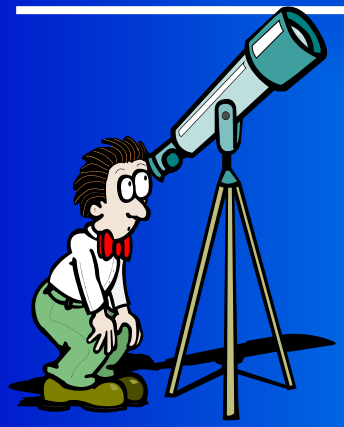
GSID	Street Number	Block Number	On Street	From Street	To Street	Surface Distress Index (SDI)	Roughness Index (RI)	Pavement Condition Index (PCI)	PCI Override	PCI Override Date	Current PCI	Project ID	Project Description	Project Block Count	Project Length (ft)	Project Area (Yd2)	Project Current PCI	Project Strength	Project FunCL	Project Pavetype	Need Year	Selected Rehab Year	Segment Rehab Results	Rehab Activity Code	Rehab Activity	Unit Rate ($/yd2)	Segment Cost ($)	5 Year Post Rehab PCI
9746	1000	10	1ST AVE	CEDAR ST	DOGWOOD ST	64	36	55			52	1000	1000 - 1ST AVE	4	1,906	7,079	46	Moderate	Local	ACP	3	3	Selected Year 3	50	Thick Overlay (> 2.0 - 3.0)	13.50	19,500	94
9701	1000	20	1ST AVE	DOGWOOD ST	ELM ST	63	33	53			50	1000	1000 - 1ST AVE	4	1,906	7,079	46	Moderate	Local	ACP	3	3	Selected Year 3	50	Thick Overlay (> 2.0 - 3.0)	13.50	21,600	94
9735	1000	30	1ST AVE	ELM ST	FIR ST	65	39	56			53	1000	1000 - 1ST AVE	4	1,906	7,079	46	Moderate	Local	ACP	3	3	Selected Year 3	50	Thick Overlay (> 2.0 - 3.0)	13.50	18,800	94
9728	1000	40	1ST AVE	FIR ST	HOLLY BLVD	43	29	39			36	1000	1000 - 1ST AVE	4	1,906	7,079	46	Moderate	Local	ACP	3	3	Selected Year 3	50	Thick Overlay (> 2.0 - 3.0)	13.50	35,700	94
10833	1010	10	1ST AVE	WILLOW ST	HEMLOCK BLVD	90	70	83			81	1010	1010 - 1ST AVE	1	926	3,188	81	Moderate	Local	ACP	1	0	Fall Through Year 1					72
10795	1020	10	2ND AVE	ASPEN BLVD	LARK ST	70	50	63			61	1020	1020 - 2ND AVE	7	1,547	5,415	54	Strong	Local	ACP	2	0	Fall Through Year 2					50
9702	1020	20	2ND AVE	LARK ST	BEECHNUT ST	68	42	59			56	1020	1020 - 2ND AVE	7	1,547	5,415	54	Strong	Local	ACP	2	0	Fall Through Year 2					46
9790	1020	30	2ND AVE	BEECHNUT ST	BEECHNUT ST	67	42	59			56	1020	1020 - 2ND AVE	7	1,547	5,415	54	Strong	Local	ACP	2	0	Fall Through Year 2					46
9742	1020	40	2ND AVE	BEECHNUT ST	CEDAR ST	62	35	53			50	1020	1020 - 2ND AVE	7	1,547	5,415	54	Strong	Local	ACP	2	0	Fall Through Year 2					40
9791	1020	50	2ND AVE	CEDAR ST	DOGWOOD ST	65	38	56			54	1020	1020 - 2ND AVE	7	1,547	5,415	54	Strong	Local	ACP	2	0	Fall Through Year 2					43
9772	1020	60	2ND AVE	DOGWOOD ST	ELM ST	54	31	46			44	1020	1020 - 2ND AVE	7	1,547	5,415	54	Strong	Local	ACP	2	0	Fall Through Year 2					34
9737	1020	70	2ND AVE	ELM ST	ELM ST	69	45	61			59	1020	1020 - 2ND AVE	7	1,547	5,415	54	Strong	Local	ACP	2	0	Fall Through Year 2					48
10722	1030	10	3RD AVE	ASPEN BLVD	LARK ST	90	70	83			81	1030	1030 - 3RD AVE	1	231	822	81	Moderate	Local	ACP	1	0	Fall Through Year 1					72
9723	1030	20	3RD AVE	LARK ST	BEECHNUT ST	65	38	56			53	1040	1040 - 3RD AVE	3	1,116	4,057	51	Strong	Local	ACP	1	0	Fall Through Year 1					43
9775	1030	30	3RD AVE	BEECHNUT ST	BEECHNUT ST	82	63	76			73	1040	1040 - 3RD AVE	3	1,116	4,057	51	Strong	Local	ACP	1	0	Fall Through Year 1					63
9795	1030	40	3RD AVE	BEECHNUT ST	ELM ST	58	36	51			48	1040	1040 - 3RD AVE	3	1,116	4,057	51	Strong	Local	ACP	1	0	Fall Through Year 1					38
12349	1040	10	4TH AVE	ASPEN BLVD	BEECHNUT ST	70	47	63			60	1050	1050 - 4TH AVE	5	2,658	9,735	50	Strong	Local	ACP	5	0	Fall Through Year 5					49
9738	1040	20	4TH AVE	BEECHNUT ST	CEDAR ST	55	30	47			44	1050	1050 - 4TH AVE	5	2,658	9,735	50	Strong	Local	ACP	5	0	Fall Through Year 5					34
9763	1040	30	4TH AVE	CEDAR ST	ELM ST	49	37	45			42	1050	1050 - 4TH AVE	5	2,658	9,735	50	Strong	Local	ACP	5	0	Fall Through Year 5					32
9782	1040	40	4TH AVE	ELM ST	FIR ST	41	31	38			35	1050	1050 - 4TH AVE	5	2,658	9,735	50	Strong	Local	ACP	5	0	Fall Through Year 5					26
9800	1040	50	4TH AVE	FIR ST	HOLLY BLVD	68	43	60			57	1050	1050 - 4TH AVE	5	2,658	9,735	50	Strong	Local	ACP	5	0	Fall Through Year 5					47
10734	1050	10	5TH AVE	6TH AVE	ASPEN BLVD	97	89	94			93	1060	1060 - 5TH AVE	1	977	3,366	93	Moderate	Local	ACP	5+	0	Not Selected					87
10721	1050	20	5TH AVE	ASPEN BLVD	LARK ST	77	57	70			68	1070	1070 - 5TH AVE	5	2,658	9,386	57	Strong	Local	ACP	3	0	Fall Through Year 3					58
9765	1050	30	5TH AVE	LARK ST	CEDAR ST	62	41	55			52	1070	1070 - 5TH AVE	5	2,658	9,386	57	Strong	Local	ACP	3	0	Fall Through Year 3					42
9724	1050	40	5TH AVE	CEDAR ST	ELM ST	56	33	48			45	1070	1070 - 5TH AVE	5	2,658	9,386	57	Strong	Local	ACP	3	0	Fall Through Year 3					35
9788	1050	50	5TH AVE	ELM ST	FIR ST	67	42	59			56	1070	1070 - 5TH AVE	5	2,658	9,386	57	Strong	Local	ACP	3	0	Fall Through Year 3					46
9761	1050	60	5TH AVE	FIR ST	HOLLY BLVD	73	52	66			64	1070	1070 - 5TH AVE	5	2,658	9,386	57	Strong	Local	ACP	3	0	Fall Through Year 3					53
10783	1060	10	6TH AVE	5TH AVE	7TH AVE	88	71	82			80	1080	1080 - 6TH AVE	2	1,198	4,196	80	Moderate	Local	ACP	5+	0	Not Selected					70
10761	1060	20	6TH AVE	7TH AVE	ASPEN BLVD	87	72	82			80	1080	1080 - 6TH AVE	2	1,198	4,196	80	Moderate	Local	ACP	5+	0	Not Selected					70
10780	1060	30	6TH AVE	ASPEN BLVD	LARK ST	66	40	58			55	1090	1090 - 6TH AVE	4	2,656	9,377	55	Strong	Local	ACP	2	0	Fall Through Year 2					44
9796	1060	40	6TH AVE	LARK ST	CEDAR ST	63	34	54			51	1090	1090 - 6TH AVE	4	2,656	9,377	55	Strong	Local	ACP	2	0	Fall Through Year 2					41
9784	1060	50	6TH AVE	CEDAR ST	FIR ST	66	39	57			54	1090	1090 - 6TH AVE	4	2,656	9,377	55	Strong	Local	ACP	2	0	Fall Through Year 2					44
9752	1060	60	6TH AVE	FIR ST	HOLLY BLVD	68	44	60			57	1090	1090 - 6TH AVE	4	2,656	9,377	55	Strong	Local	ACP	2	0	Fall Through Year 2					47
10798	1070	10	7TH AVE	6TH AVE	ASPEN BLVD	90	78	86			84	1100	1100 - 7TH AVE	1	768	2,730	84	Moderate	Local	ACP	1	0	Fall Through Year 1					75

Bonding….

DON'T !

You cannot bond your way out of an ongoing obligation
Think of streets as a utility, not a general fund expense
Bonding doesn't make financial **CENTS!**

One Minute Close...



Its Only Pavement Management

horse shoes and hand grenades

don’t sweat the small stuff

Start From a Good Foundation

GIS, understanding, training

1Agecny, 1 Network, 1 Funding Source

Avoid managing pavements by districts

Questions ?