Don’t Throw Paving Dollars Out with the Trash

2023 CEAC Spring Conference
March 9, 2023

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Speakers:

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Lisa Petersen, City of Pacifica
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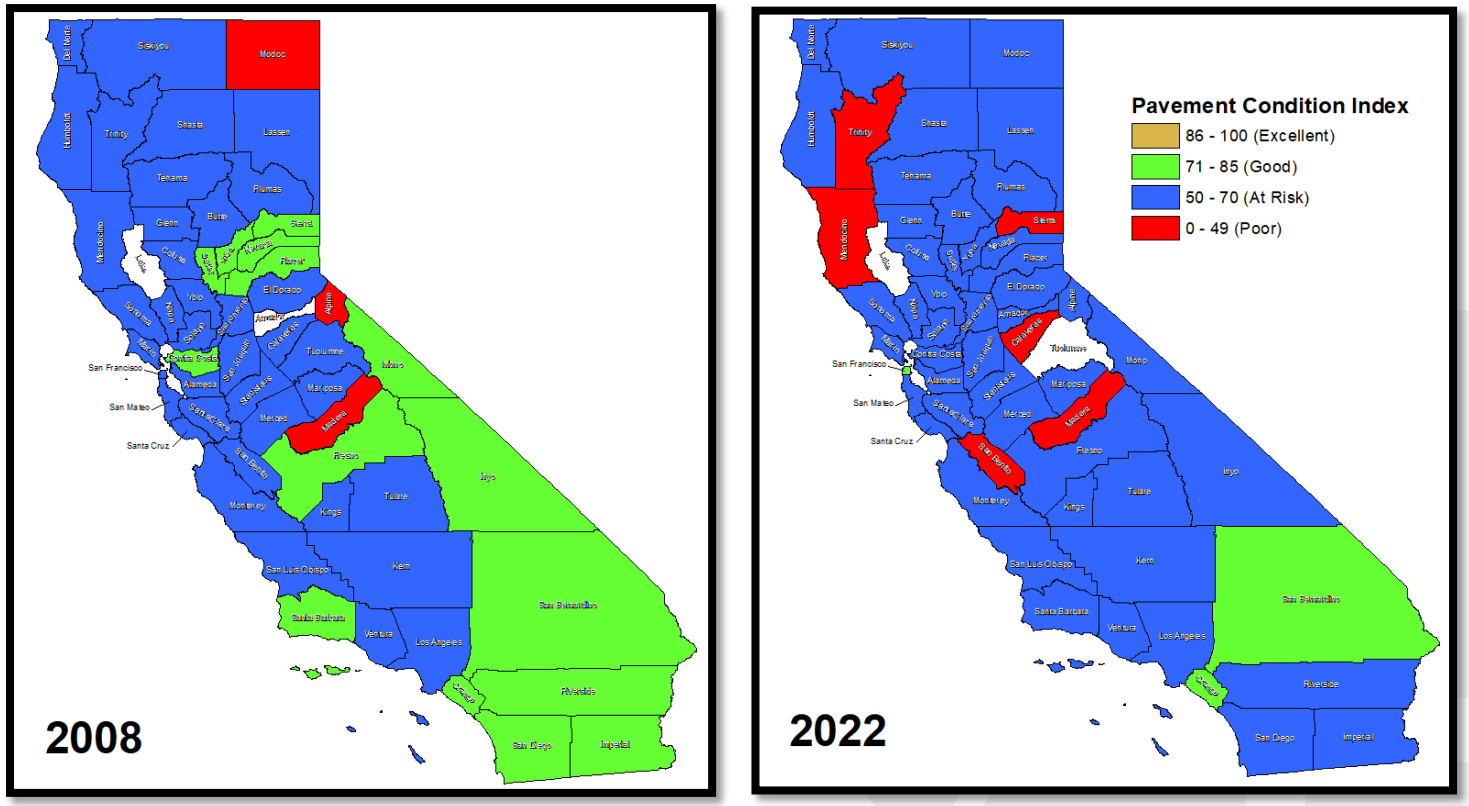
INTRODUCTION

- Many local agencies throughout the country are seeing discouraging declines in the network pavement condition.

- Influencing Factors
  - Increased construction costs
  - Projects delayed to COVID
  - Insufficient funding



EXAMPLE: CALIFORNIA

FUNDING SOURCES

Federal

- Regional Surface Transportation Program (RSTP)
- Community Development Block Grant (CDBG)
- Surface Transportation Program (STP)
- Bipartisan Infrastructure Investment and Jobs Act (IIJA)

State

- Gas Tax
- Transportation Development Act (TDA)
- State Transportation Improvement Program (STIP)
- Vehicle Registration Fees
- CalRecycle
- Traffic Congestion Relief Fund

Local

- General Fund
- Local Transportation Fund
- Parcel Tax
- Sales Tax/Local Measure
- Impact Fees
  - Development
  - Waste Vehicle
  - Utility Cut

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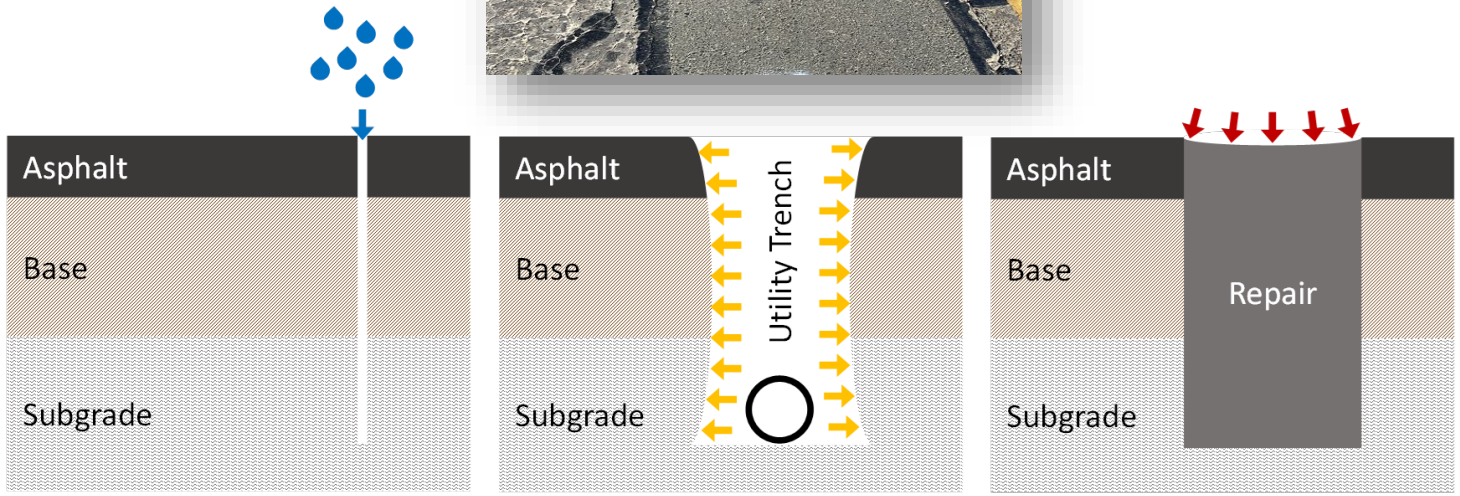
IMPACT FEES TO COMPENSATE FOR PAVEMENT DAMAGE

Pavement Damage = Higher Maintenance Cost

Utility Cuts

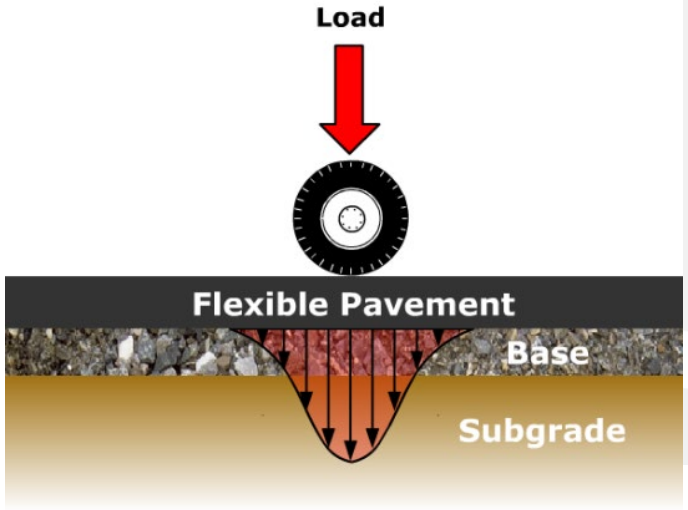


1. Increased Water Access to Pavement Structure

2. Reduced Lateral Support

3. Increased Surface Roughness

Heavy/ Waste Vehicles



HOW TO DEVELOP IMPACT FEES

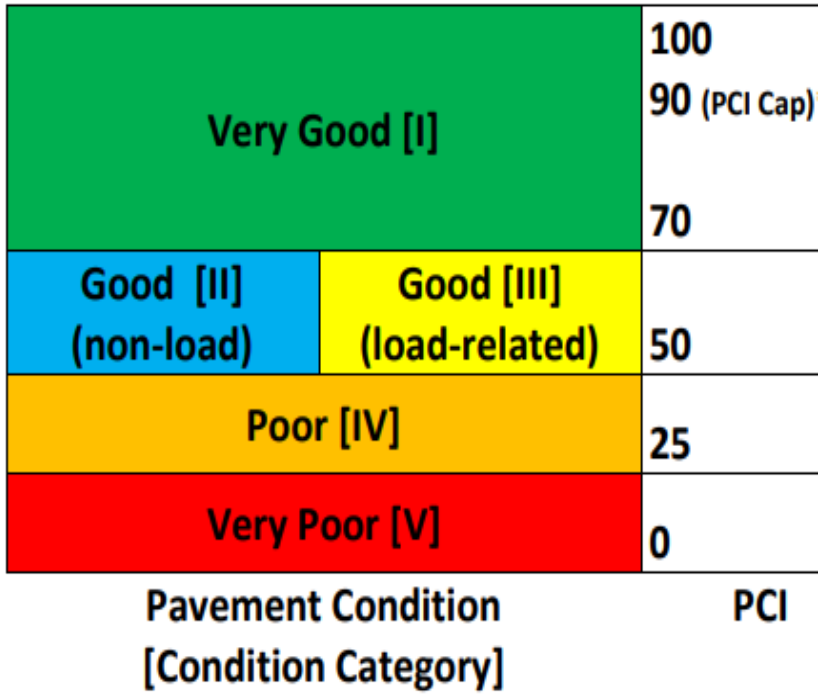
- Agency specific study needs to be conducted

- Fee development depends on

  - Network Size
  - Existing Pavement Condition
  - Subsoil Properties
  - Pavement Layer Thicknesses
  - Available Funding Level
  - Vehicle Frequencies/Routes (Vehicle Impact Fee)
  - Utility Cut Restoration Practice (Utility Cut Fee)

CASE STUDY: BACKGROUND AND OVERVIEW

- City responsible for 90 centerline miles streets
- Oct. 12, 2020 Council Mtg. - 5-year street maintenance program and study to identify pavement impact fees approved
- Metropolitan Transportation Commission (MTC) consultant report- Pacifica streets in poor condition and dropping



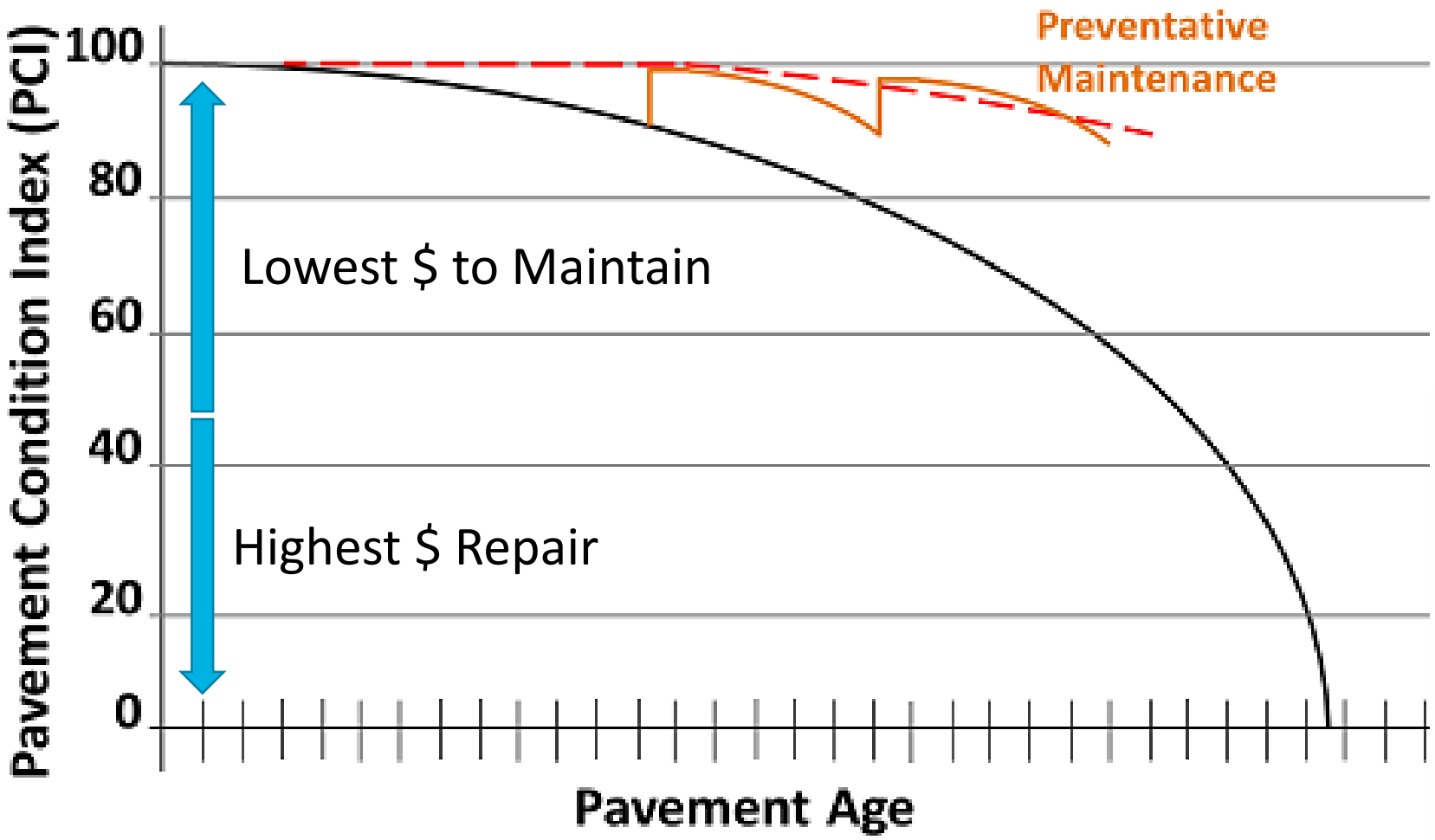
Pacifica 2022

Pavement Condition Index (PCI) – 40

CASE STUDY: BACKGROUND AND OVERVIEW

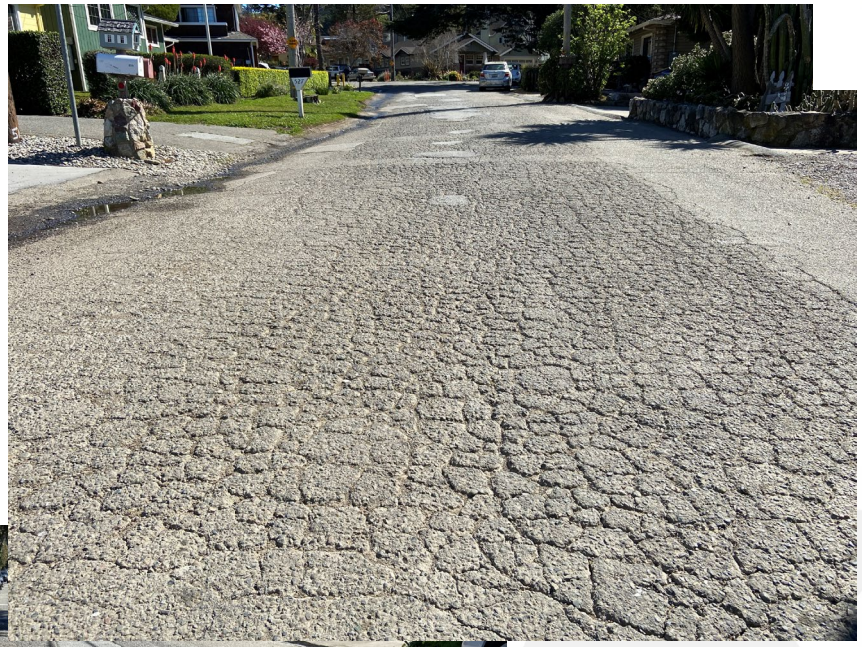
- Recent MTC Bay Area pavement report showed Pacifica with lowest PCI of all 101 Bay Area cities (nine counties)
- Current City Yearly Pavement Funding Level:
  - State Senate Bill 1 and County Measure W = ~$1,040,000
  - City rollover Measure A = $350,000 (will end in FY24/25)
- To stop PCI decline:
  - City must identify new additional funding of $900,000 by Fy22/23
  - This need will increase to $1,250,000 by FY24/25
- To increase PCI, money beyond this is required

CASE STUDY: HOW PAVEMENTS DETERIORATE



← **Pacifica**

CASE STUDY: PACIFICA STREET CONDITIONS



City of Pacifica- Impact Study

VEHICLE IMPACT FEE STUDY: QUESTIONS

- Waste-vehicle repetitions on local roads and streets have increased
- Constructions have increased due to land development

- Question 1: What impact do waste and heavy construction vehicles have on pavement life?

- Question 2: What is the corresponding financial impact?

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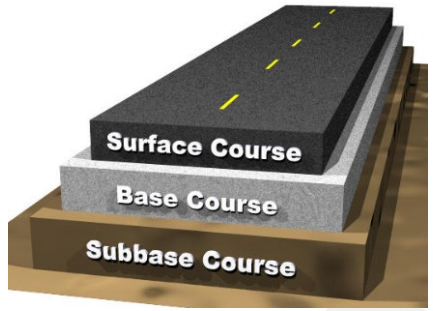
VEHICLE IMPACT FEE STUDY: INFORMATION NEEDED

- Waste vehicle traffic information
  - Frequency/ type of vehicle

- Pavement structural information
  - Layer thicknesses by functional class



- PMS data for existing condition
  - Pavement condition index by functional class
  - Percent network in each condition category

Condition Category	PCI Range
Excellent	85-100
Very Good/Good	70-84
Fair	50-69
Poor	25-49
Failed	0-24

- Annual budget or budget to meet PCI goal

VEHICLE IMPACT FEE STUDY: PROCESS

- Calculate waste vehicle traffic demand and pavement capacity in ESALs

(Equivalent Single Axle Load)

- Perform budget analysis using PMS software over an analysis period (i.e, 10 years or 15 years)
- Obtain condition category breakdown for each year
- Calculate impact in each condition category for each year

$$Impact = \frac{Traffic\ Demand}{Structural\ Capacity}$$

- Calculate equivalent cost /year = Impact * Annual Budget (or Budget goal)

WASTE VEHICLE IMPACT CASE STUDY: TRAFFIC DEMAND

Vehicle Type	Vehicles per Week	
	Residentials	Arterials/Collectors
Garbage	1	40
Green Waste	1	30
Recycling	1	40
Bulky Waste	0.25	2.5
Total	**3.25**	**112.5**

Equivalent Single Axle Load (ESAL)
Residential Demand ≈ 300 ESALs/Yr
Art & Col Demand ≈ 11,000 ESALs/Yr

WASTE VEHICLE IMPACT CASE STUDY : PAVEMENT STRUCTURAL CAPACITY

- Pavement Structure
  - Res: TI of 5 → 7,161 ESALs
  - Art/Col: TI of 7 → 121,021 ESALs

- Pavement Current Condition

Condition Category	% of Network in Condition Category	
	Residential	Arterial/Collector
Excellent	1.4%	14.5%
Good	9.1%	11.4%
Fair	13.7%	22.6%
Poor	28.7%	27.8%
Failed	47.1%	23.7%
Total	100.0%	100.0%

Calculation of Remaining ESALs based on pavement deterioration curve

New Pavement Capacity

ESALs Remaining Based on Condition	
Res	Art/Col
7,161	121,021
6,950	116,847
5,054	83,462
2,948	45,904
842	12,519
0	0

WASTE VEHICLE IMPACT CASE STUDY : FINANCIAL IMPACT

- Residential Goal: Improve PCI to 60
- Arterial and Collector Goal: Improve PCI to 70

Total Budget = $120.7 M

Avg Budget = $8.05M/yr

Avg Budget for Residential~ $5M/yr

WASTE VEHICLE IMPACT CASE STUDY : EXAMPLE ANALYSIS

Example: Residential for Year 5

Condition Category	ESALs Remaining Based on Condition	Year 5 Residential Condition	Year 5 Remaining ESALS
Excellent	6,950	X 31%	= 2,148
Good	5,054	12%	628
Fair	2,948	2%	50
Poor	842	3%	29
Failed	0	52%	0

Weighted Average= 2,855

These steps of analysis were conducted for each year

Average Pavement Life Reduced per year over 15 years:

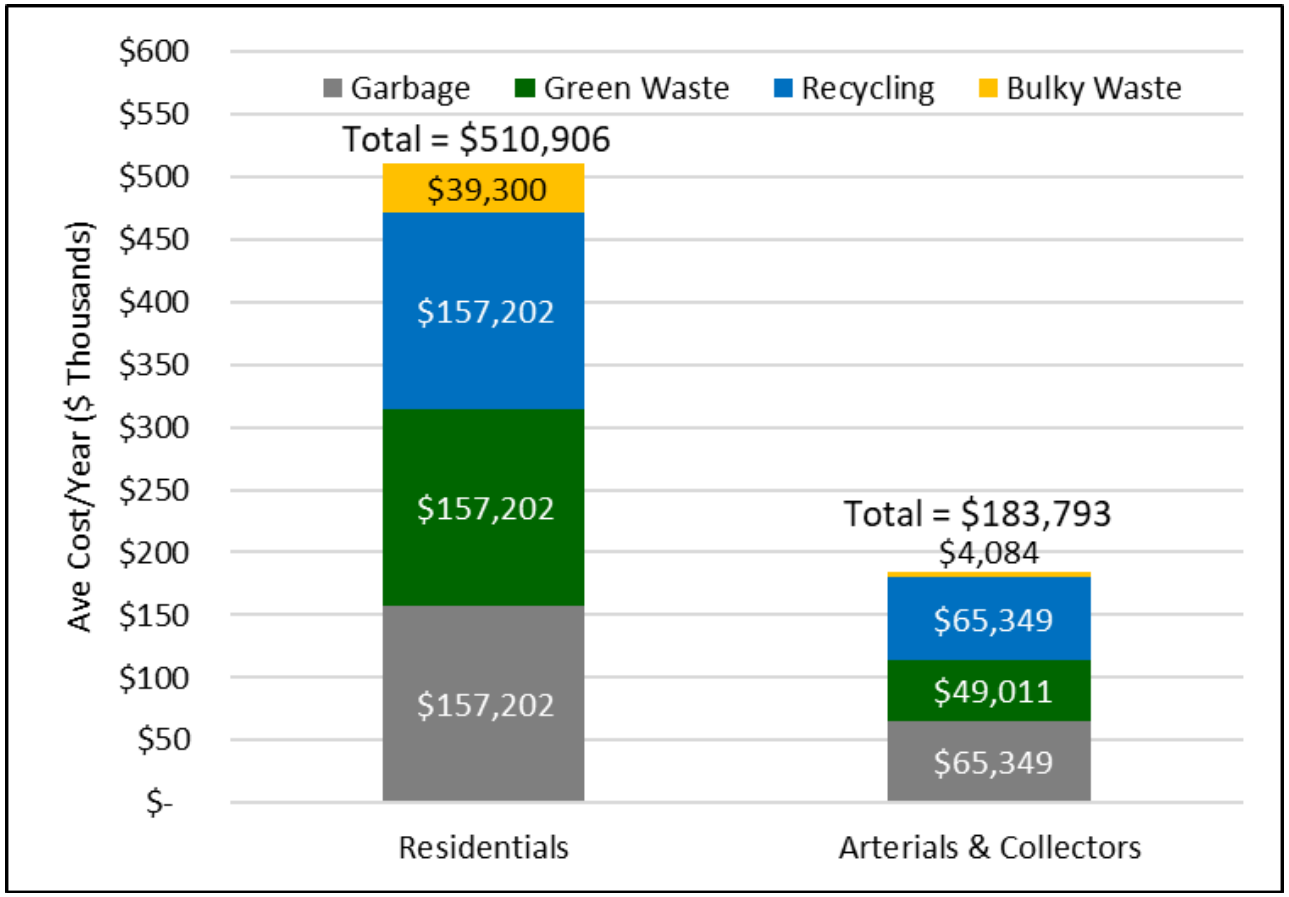
- Residentials = 10.1%
- Arterials/Collectors = 6.1%

<u>Year 5</u>

Impact (% Life Reduced) = 300 ESALs/2,855 = 10.5%

Equivalent Cost for One Year = 10.5% x $5M = $525,000

WASTE VEHICLE IMPACT CASE STUDY : FINANCIAL IMPACT



Average Cost of Pavement Damage per year:

- Residentials ~ $511K
- Arterials/Collectors ~ $184K

WHAT ABOUT HEAVY CONSTRUCTION VEHICLES?

- Cause approximately the same amount of damage in ESALs as a typical waste vehicle
- Construction of residential/non-residential units requires 20 round trips to project site
  - Equipment
  - Materials
  - General home appliances
- Average route distance of 2.5 miles

PROPOSED HEAVY CONSTRUCTION VEHICLE IMPACT FEE

Based on the Study, the fee would be $1.19/sf for residential/non-residential units

- 1,800 sf Single Family Home Fee = $2,126
- 800 sf Multi-Family Residential Fee = $952

CASE STUDY: SUMMARY

- 10.1% of a **residential** street's pavement life is consumed each year by waste vehicles. This corresponds to an average damage cost of $510,906 per year.

- 6.2% of an **arterial or collector** street's pavement life is consumed each year by waste vehicles. This equates to an average damage cost of $183,963 per year.

- Proposed Heavy Construction Vehicle Impact Fee:
  - $1.19/sf for residential/non-residential units

- Any implemented fee structures should include an inflation factor

HEAVY VEHICLE IMPACT STUDY : TYPICAL FEE RANGES

Agency	Criteria	Fee	Reference
Anaheim	Single Family Unit	$2,029 per unit	City of Anaheim 2020
	Multi-Family	$1,297 per unit	
	Commercial/Industrial	-	
Citrus Heights	Single Family Unit	$1,434.12 per unit	City of Citrus Heights 2021
	Multi-Family	$1,312.74 per unit	
	Commercial/Industrial	$4.45 per sf	
San Bruno	Single Family Unit	$4,615 per unit	Economic & Planning Systems, Inc., 2019
	Multi-Family	$2610 per unit	
	Commercial/Industrial	$6.95 per sf	
San Francisco	Single Family Unit	-	City of San Francisco 2021
	Multi-Family	$9.95 per sf	
	Commercial/Industrial	$19.48 per sf	
San Mateo	Single Family Unit	$5003.76 per unit	City of San Mateo 2021
	Multi-Family	$3,071.42 per unit	
	Commercial/Industrial	$5.40 per sf	
Santa Cruz County	Single Family Unit	$697 per mile	NCE 2015
	Multi-Family		
	Commercial/Industrial	-	
Saratoga	Single Family Unit	$0.77 per $100 valuation	CSG Consultants 2007
	Multi-Family		
	Commercial/Industrial	-	

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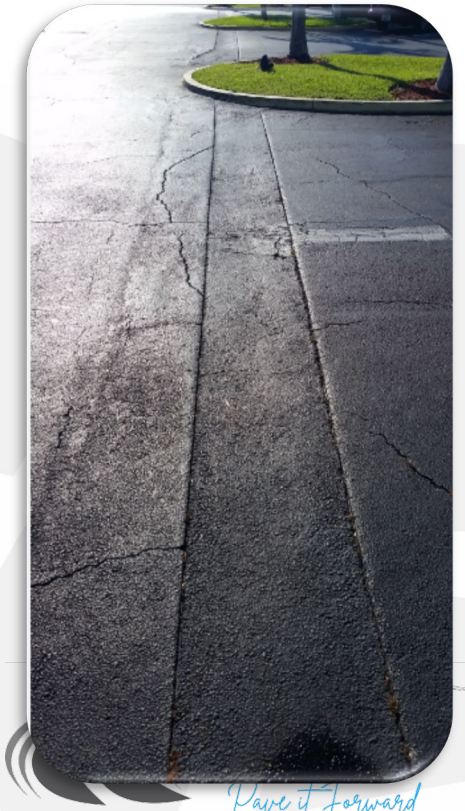
UTILITY CUT IMPACT STUDY: QUESTIONS

- Question 1: How do utility cuts affect pavement performance?

- Question 2: If pavement performance is reduced, what is the corresponding financial impact?



UTILITY CUT IMPACT STUDY: PROJECT OUTLINE

HISTORICAL EVALUATION

Functional Deterioration

Data Harvesting from PMS
- Inspection History
- Maintenance History

Analysis
- No-Cut and Cut PCI Comparison
- Reduction in Service Life Calculation and Comparison

Fee Calculation

FIELD EVALUATION

SITE SELECTION

Functional Deterioration

Field Data Collection
- Distress Survey

Analysis
- PCI Calculation and Comparison
- Reduction in Service Life Calculation and Comparison

Fee Calculation

Structural Deterioration

Field Data Collection
- Deflection Testing
- Coring

Analysis
- Deflection Comparison
- Overlay Design and Comparison

Fee Calculation

FEE SCHEDULE DEVELOPMENT

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UTILITY CUT IMPACT STUDY: HISTORICAL EVALUATION PROCESS

Fuctional Class		Aeterials/Collectors			Residentials		
Cut/No-Cut		Cut		No-Cut	Cut		No-Cut
Cut Size		Large Cut	Small Cut		Large Cut	Small Cut	
Age-Group, Yrs	0-5						
	6-10						
	11-15						
	16-20						
	>20						

Average PCI for available data set

AGE GROUP

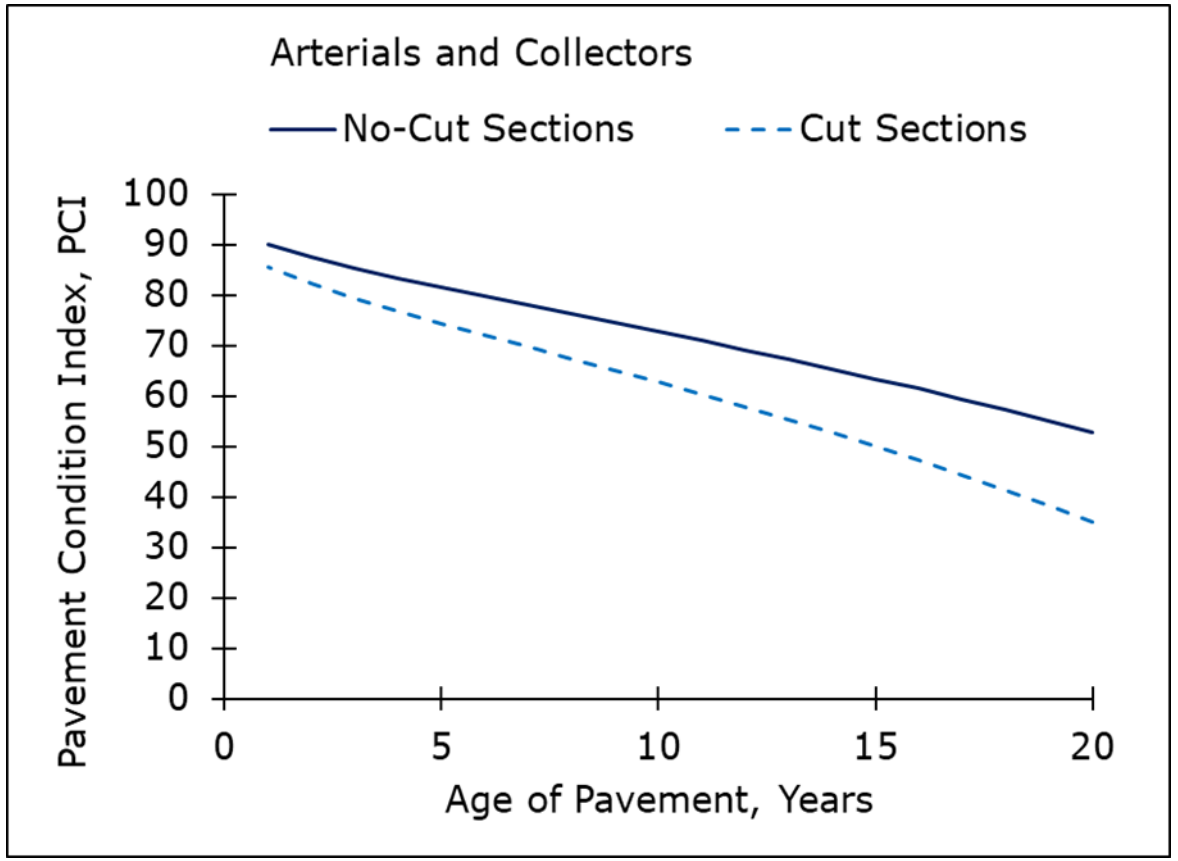
SMALL CUT | LARGE CUT

NO-CUT | CUT

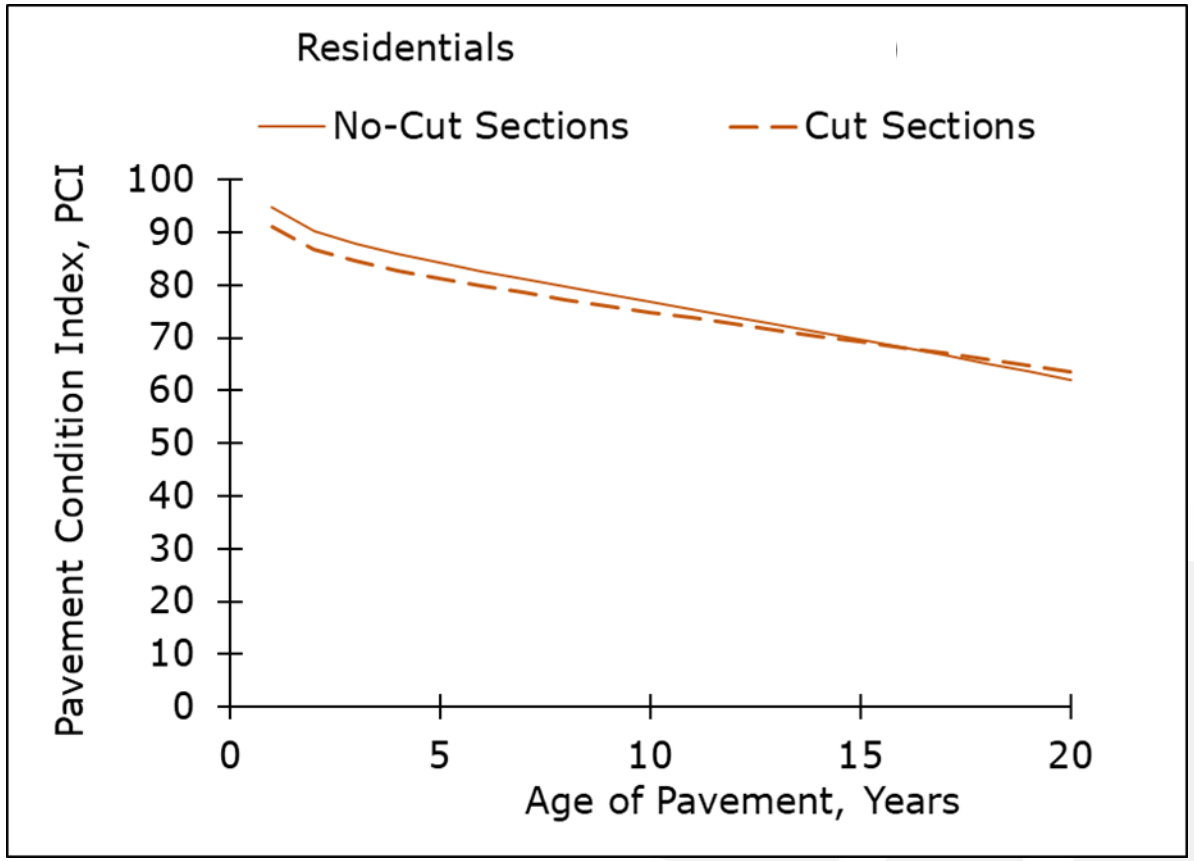
ARTERIAL/COLLECTOR | RESIDENTIAL

INSPECTION DISTRESS DATA ⟷ M&R HISTORY DATA

UTILITY CUT IMPACT CASE STUDY: HISTORICAL EVALUATION -DETERIORATION CURVES



Cuts sections deteriorate more rapidly than no-cut sections within all age groups

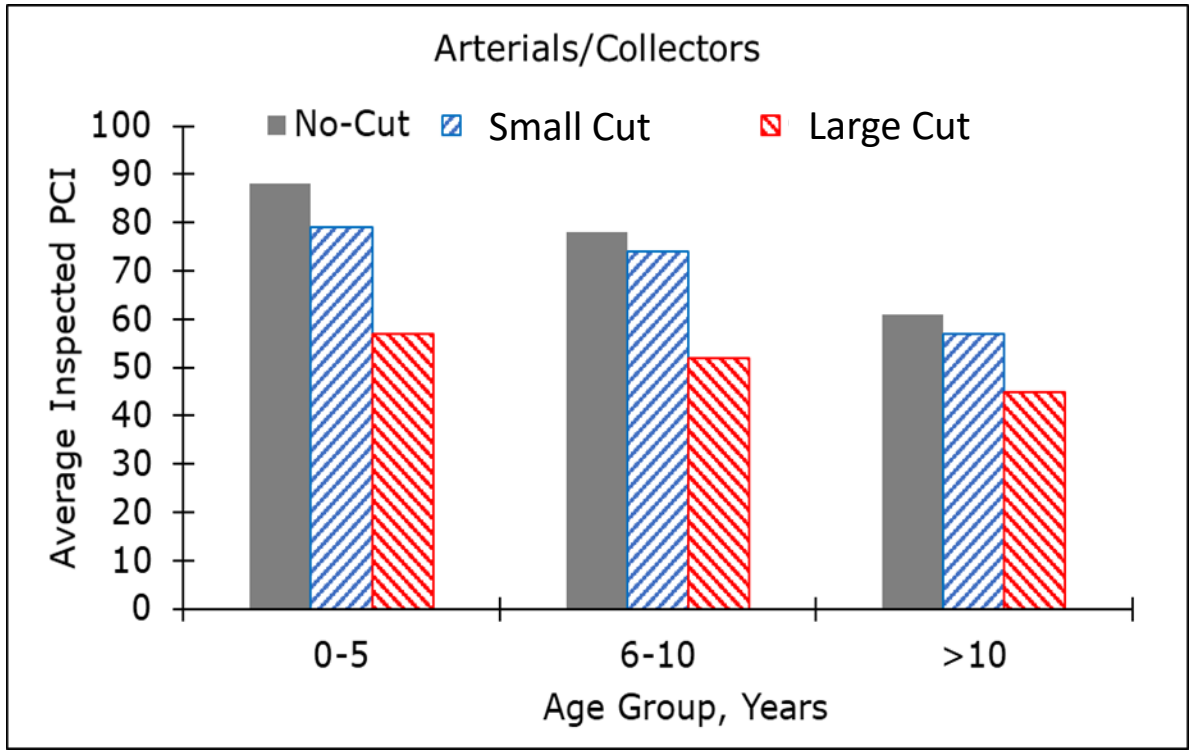


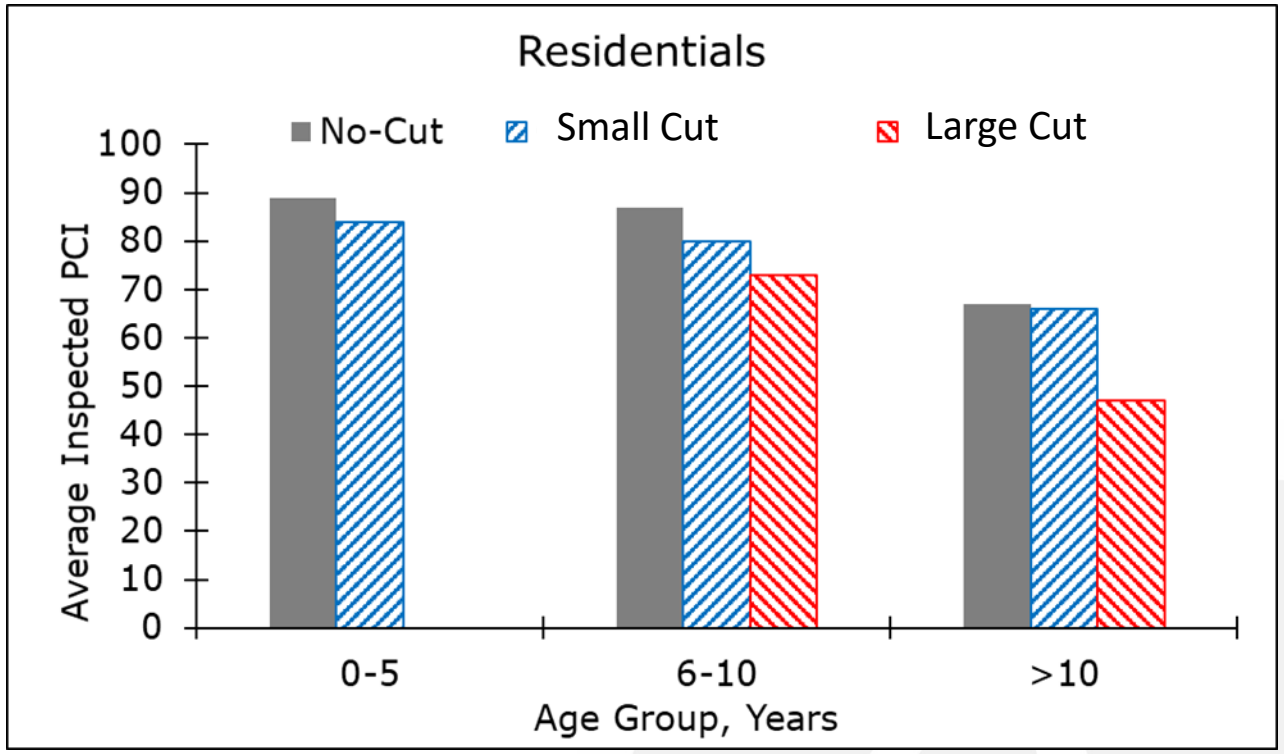
Cuts sections deteriorate more rapidly than no-cut sections for pavements less than 15 years old

Pavement with cuts deteriorate faster

UTILITY CUT IMPACT CASE STUDY: HISTORICAL EVALUATION- CUT VS NO-CUT PCI

DETERIORATION BY FUNCTIONAL CLASS, AGE GROUP, AND CUT SIZE





Newer pavements and large cuts show greater deterioration

UTILITY CUT IMPACT CASE STUDY: HISTORICAL EVALUATION- CUT VS NO-CUT PCI

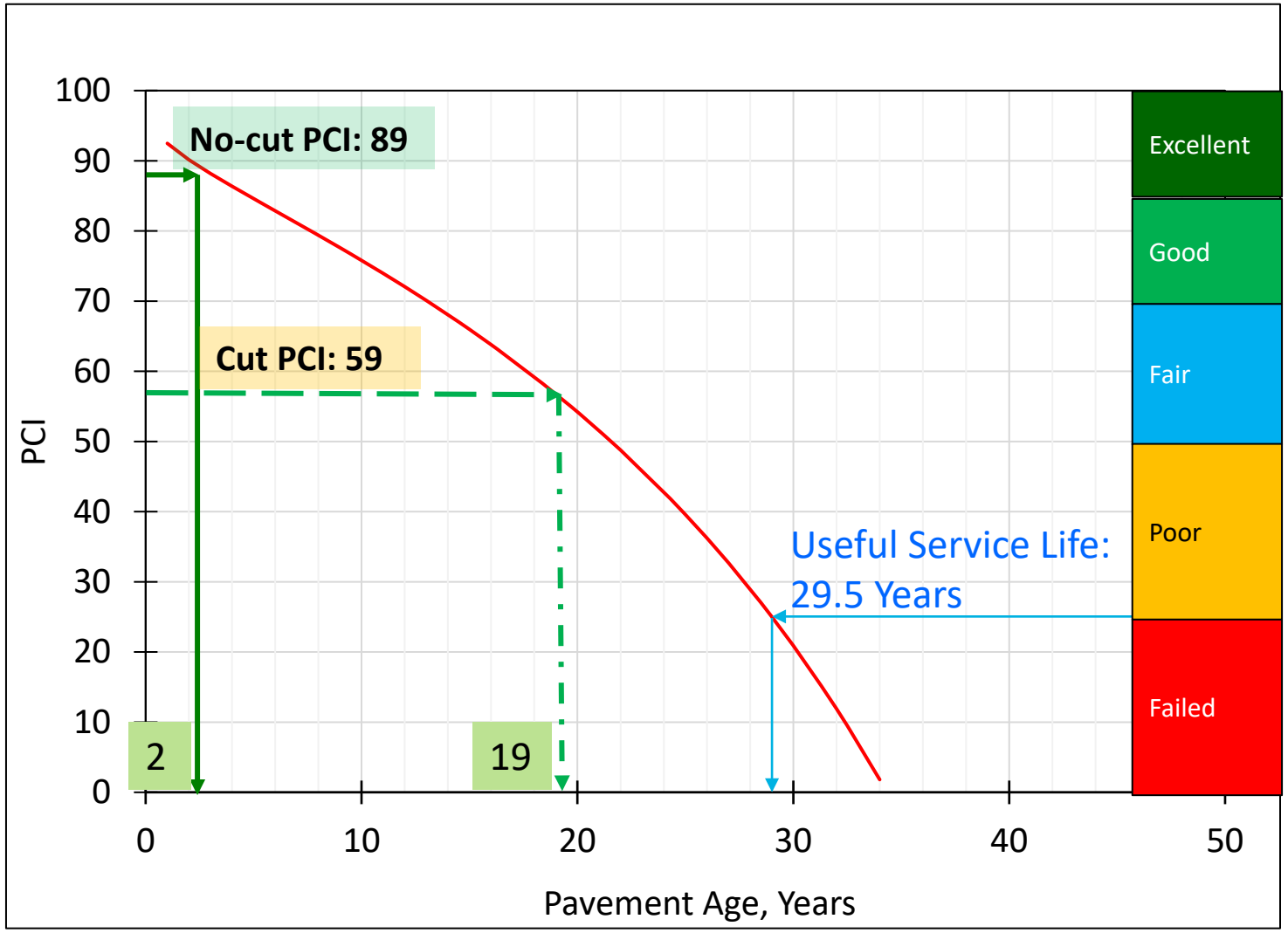
What does 30% Reduction in PCI Mean?

Condition Category	PCI Range	No-Cut Section PCI
Excellent	85-100	90
Very Good/Good	70-84	80
Fair	50-69	60
Poor	25-49	35
Failed	0-24	

PCI_Sections with Large Cuts
85-100
70-84
63 56 50-69
42 25-49
24 0-24

- Large Cut is Critical in Pavement Deterioration
- Drops in Condition Category

UTILITY CUT IMPACT CASE STUDY: HISTORICAL EVALUATION- REDUCTION IN SERVICE LIFE



Example
FC: Arterials/Collectors

Age Group: < 10 years
Cut Size: Large

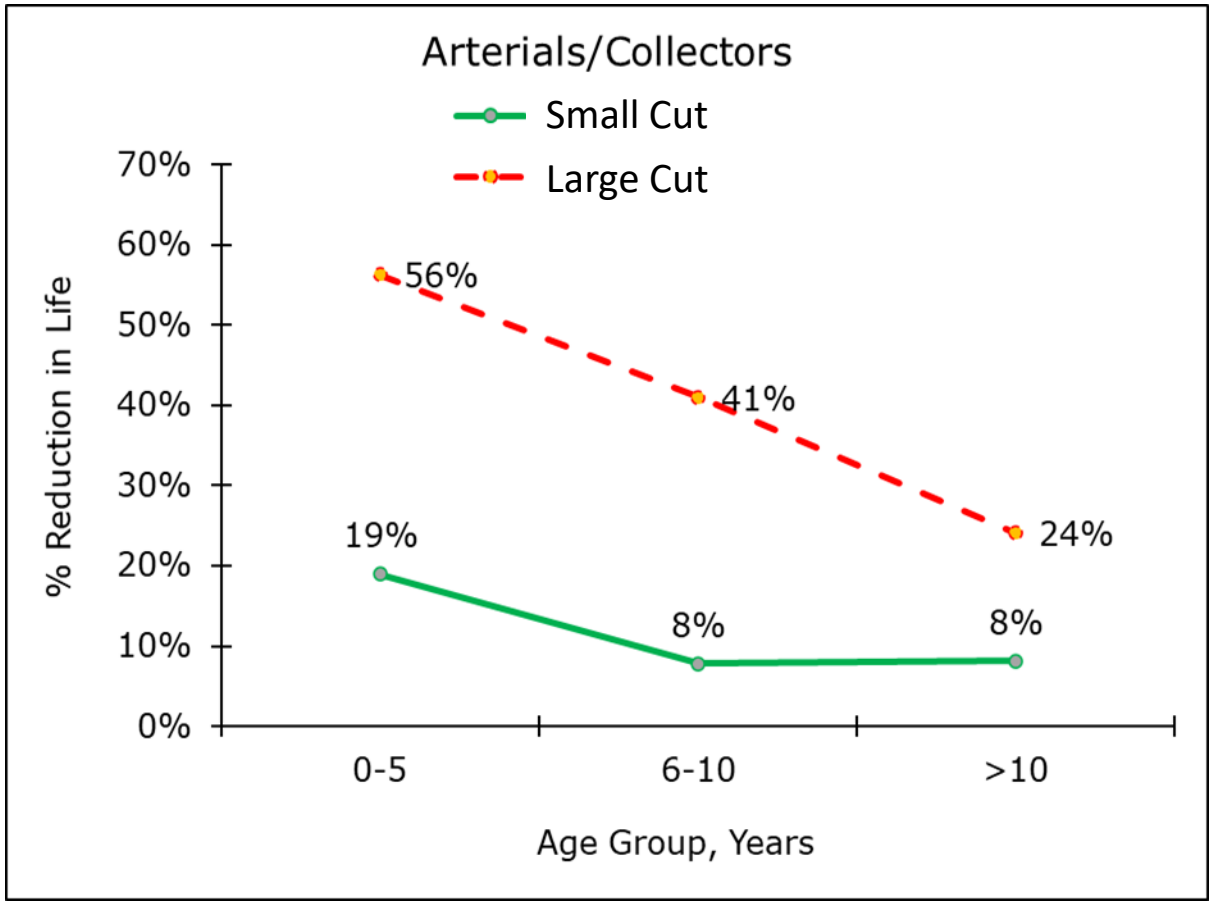
Equivalent Years of Life Reduced: 19-2 = 17

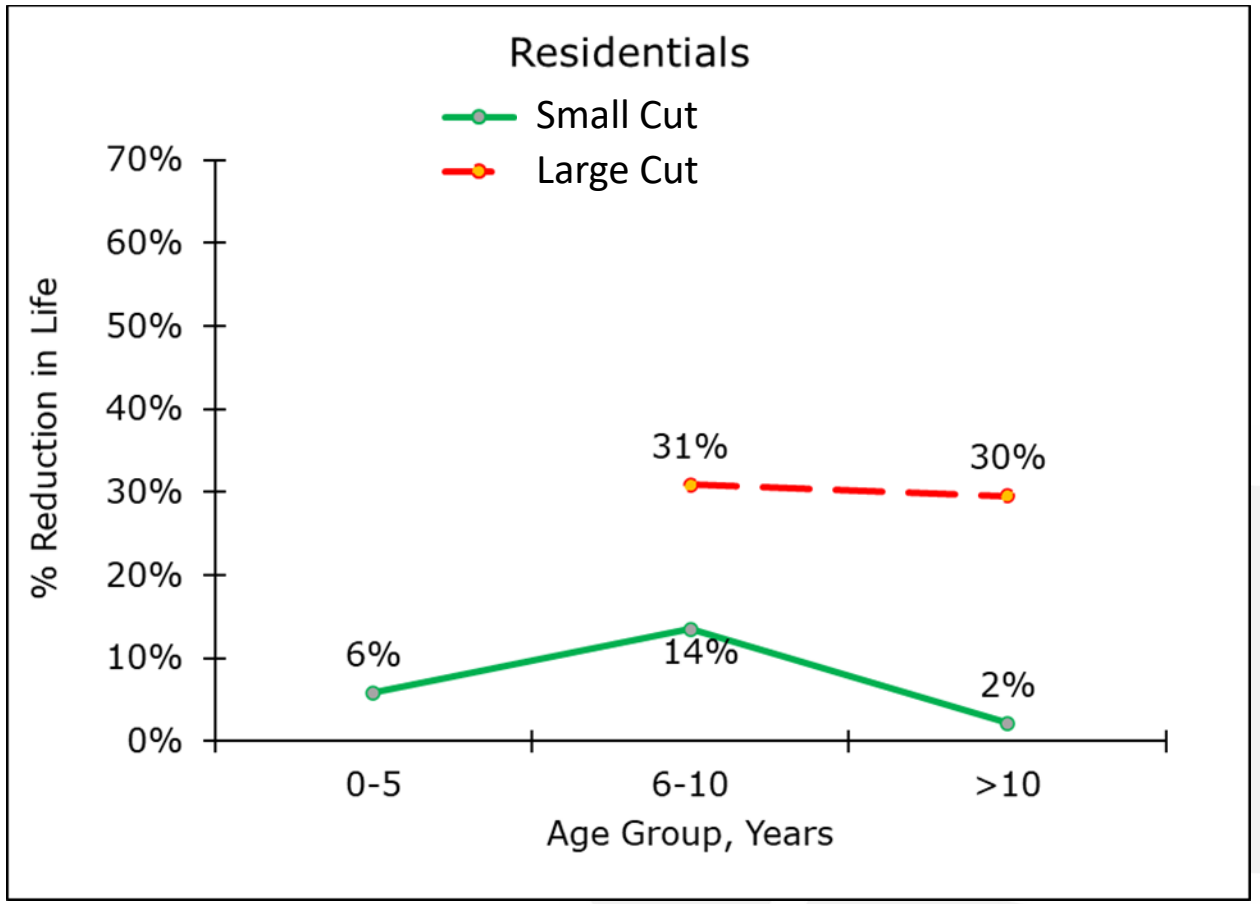
% Reduction in Functional Life: 17/29.5 = 58%

The analysis was performed for each combination (FC/Age Group/Cut Size)

UTILITY CUT IMPACT CASE STUDY: HISTORICAL EVALUATION- REDUCTION IN SERVICE LIFE

IMPACT OF AGE AND CUT SIZE





1. % Reduction in Life is higher when the pavement is new
2. The bigger the cut, the greater the % Reduction in Life

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UTILITY CUT IMPACT CASE STUDY: HISTORICAL EVALUATION- FEE DEVELOPMENT

% Reduction in Pavement Life			
Functional Class	Age Group	Cut Area (% of Section Area)	
		Small Cut	Large Cut
Arterials/ Collectors	<10 years	25%	55%
	≥10 years	10%	25%
Residential	<10 years	15%	40%
	≥10 years	2%	35%

Treatment Type: Mill and Overlay Unit Cost

Arterials/Collectors: $6.25/SF
Residentials: $5.25/SF

Fee, $/SF= Unit Cost * % Reduction in Pavement Life

Fees, $/SF			
Functional Class	Age Group	Functional Evaluation	
		Small Cut	Large Cut
Arterials/ Collectors	<10 years	$ 2.50	$ 4.00
	≥ 10 years	$ 1.50	$ 2.50
Residentials	<10 years	$ 1.50	$ 3.00
	≥ 10 years	$ 1.00	$ 2.50

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UTILITY CUT IMPACT STUDY: FIELD EVALUATION PROCESS

If No PMS Database

FIELD EVALUATION

SITE SELECTION

Functional Deterioration

Field Data Collection
- Distress Survey

Analysis
- PCI Calculation and Comparison
- Reduction in Service Life Calculation and Comparison

Fee Calculation

Structural Deterioration

Field Data Collection
- Deflection Testing
- Coring

Analysis
- Deflection Comparison
- Overlay Design and Comparison

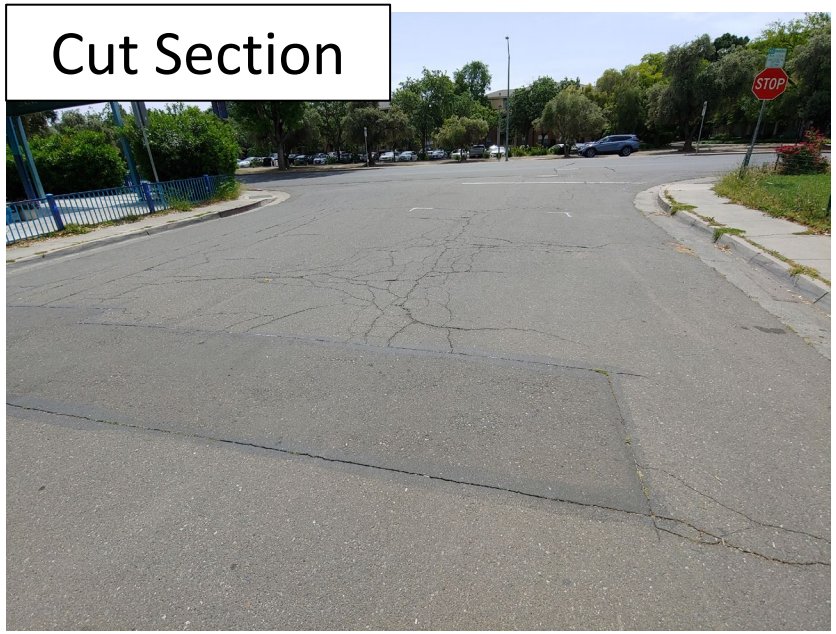
Fee Calculation

UTILITY CUT IMPACT STUDY: FIELD EVALUATION- SITE SELECTION

PAIR OF SECTIONS OF SAME LENGTH FOR EACH SITE

No Cut Section

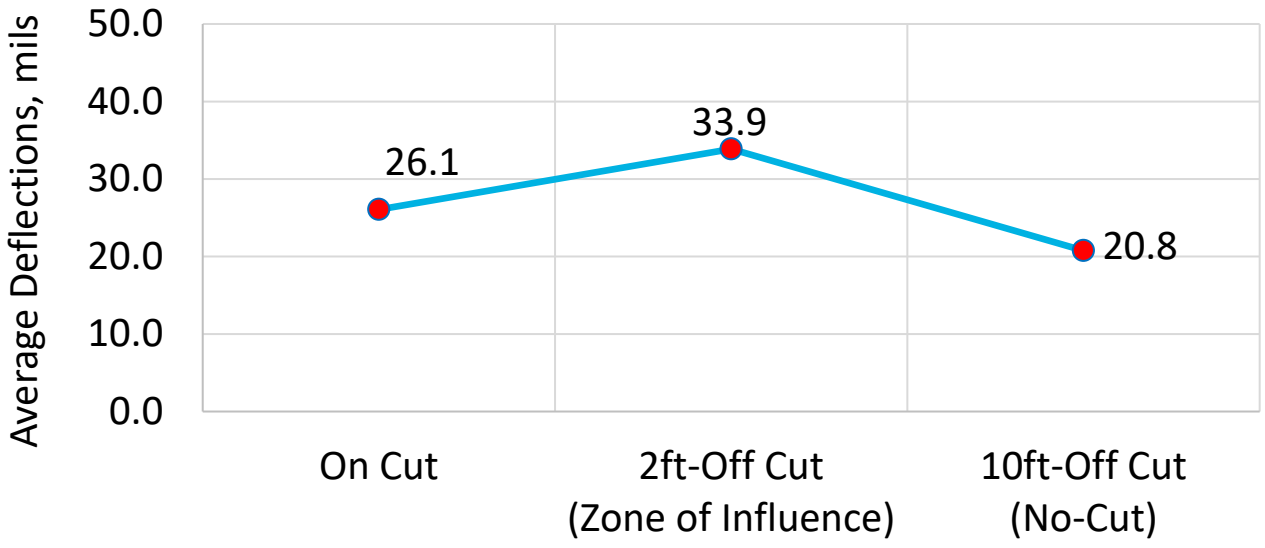
Cut Section



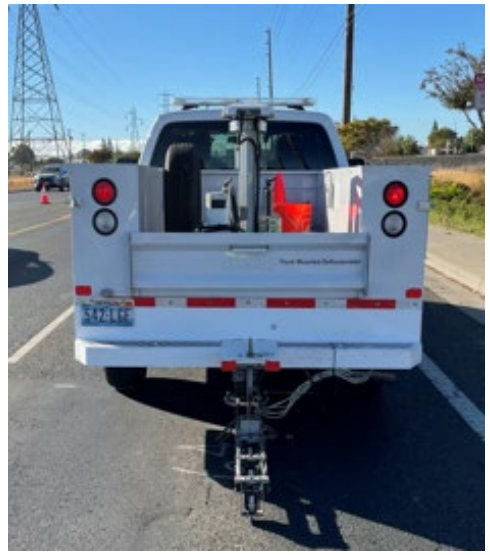
UTILITY CUT IMPACT STUDY: FIELD EVALUATION – STRUCTURAL DETERIORATION

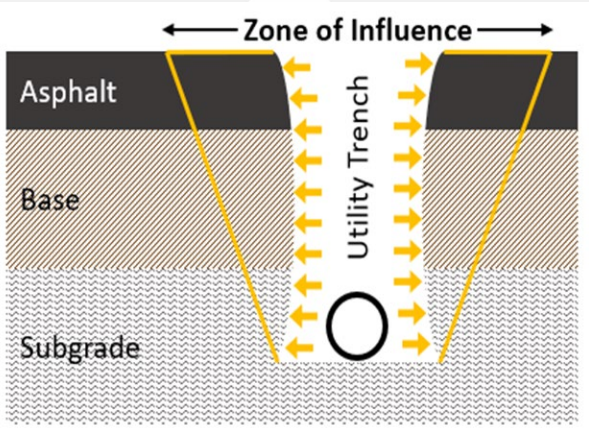
- Falling Weight Deflectometer is an impact load device
- Delivers an impulse load to pavement
- Measures the resultant deflection
- Higher the deflection, weaker the pavement

- Drops on the "Cut"
- Drops 2-ft away from the "Cut": **Zone of Influence**
- Drops more than 10-ft away from the "Cut": **No-Cut Section**



Deflection is higher/pavement is weaker near the Cut



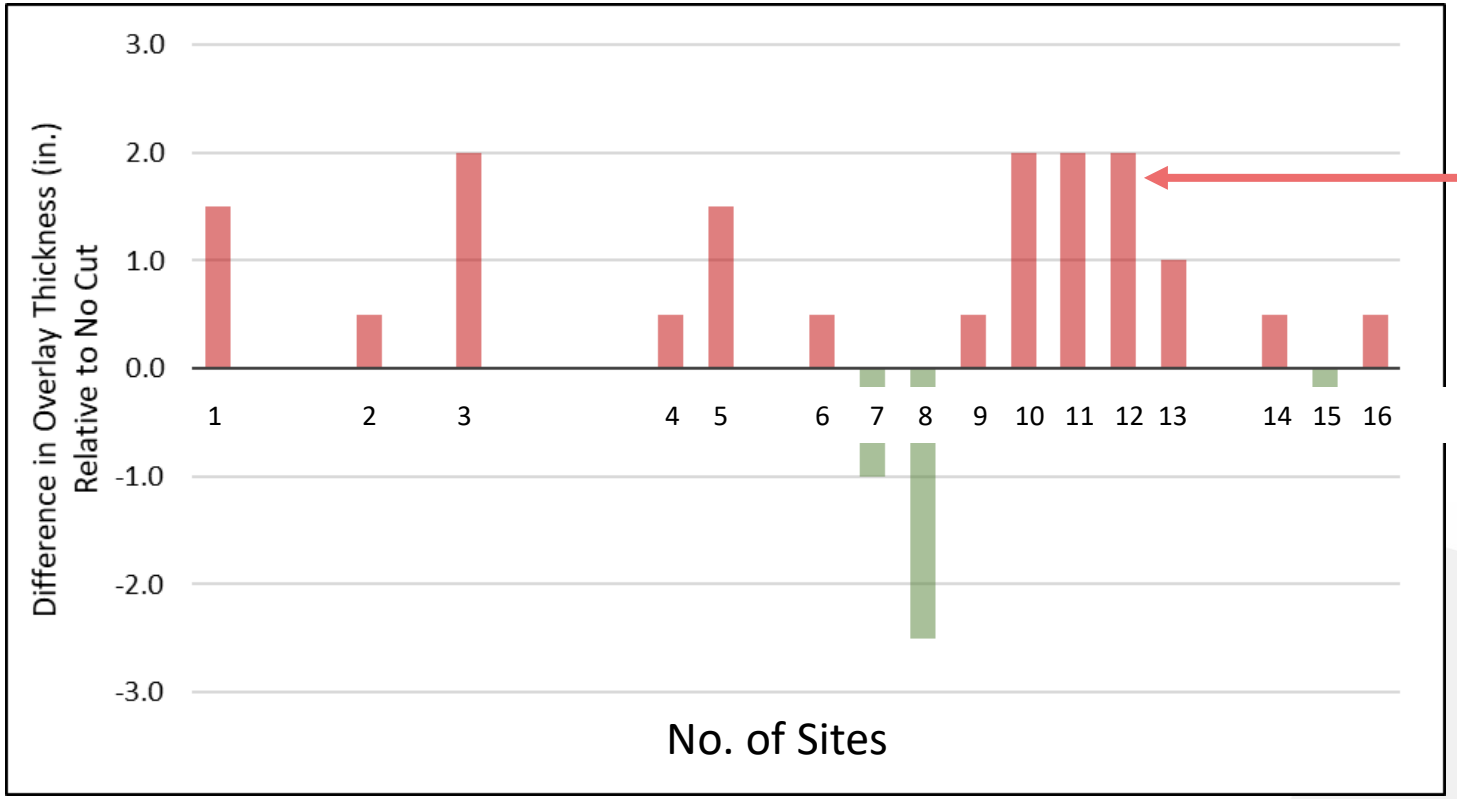


UTILITY CUT IMPACT CASE STUDY: FIELD EVALUATION – STRUCTURAL DETERIORATION

OVERLAY THICKNESS DESIGN USING DEFLECTION DATA AND CORE DATA

OVERLAY THICKNESS COMPARISON

(CUT VS NO-CUT SECTION FOR EACH SITE)



81% of sites exhibit structural damage

19% of sites exhibit structural improvement

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UTILITY CUT IMPACT CASE STUDY: FIELD EVALUATION – FEE DEVELOPMENT

MAXIMUM DAMAGE COST OF

STRUCTURAL EVALUATION

OVERLAY THICKNESS COST

FUNCTIONAL EVALUATION

COST EQUIVALENT OF REDUCED FUNCITIONAL LIFE

Site ID	FC	STRUCTURAL EVALUATION	FUNCTIONAL EVALUATION	Max Damage Cost ($/SF)
		Thicker Overlay Cost ($/SF)	Cost Equivalent of Reduced Life ($/SF)	
Mace	A	$ 2.47	$ 3.17	$ 3.17
Fst	A	$ -	$ 0.41	$ 0.41
5th	A	$ -	$ 0.37	$ 0.37
John	A	$ -	$ -	$ -
Anderson	A	$ -	$ 0.88	$ 0.88
Covell 1	A	$ -	$ 0.74	$ 0.74
Covell 3	A	$ 1.28	$ 1.00	$ 1.28
Covell 2	A	$ -	$ 1.50	$ 1.50
2nd	C	$ -	$ 0.20	$ 0.20
Oak	C	$ 2.98	$ 0.47	$ 2.98
Hamel	C	$ -	$ 0.10	$ 0.10
Sycamore	C	$ 2.40	$ 0.61	$ 2.40
Calaveras	C	$ 1.24	$ -	$ 1.24
Marina	C	$ 2.98	$ 0.20	$ 2.98
Chiles	C	$ 1.24	$ 0.49	$ 1.24
14th	C	$ 1.24	$ -	$ 1.24
Drake	R	$ 1.13	$ 2.08	$ 2.08
S Campus	R	$ 1.13	$ 1.06	$ 1.13
Tamarack	R	$ -	$ 0.35	$ 0.35
Brown	R	$ 2.70	$ 0.30	$ 2.70
Wake	R	$ 2.70	$ 0.29	$ 2.70
Pine	R	$ 1.65	$ -	$ 1.65
Colby	R	$ -	$ 0.36	$ 0.36
Willow	R	$ -	$ 0.07	$ 0.07

RECOMMENDED DAMAGE FEE SCHEDULE

Functional Class	PCI	Recommended Damage Fee ($/SF)	
		Avg	Max
Arterial	All	$ 1.04	$ 3.17
Collector & Residential	> 70	$ 1.14	$ 2.08
	< 70	$ 1.51	$ 2.98

CUT-OFF PCI WAS DECIDED BASED ON STATISTICAL ANALYSIS

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UTILITY CUT IMPACT CASE STUDY: FEE IMPLEMENTATION (LARGE CUT)

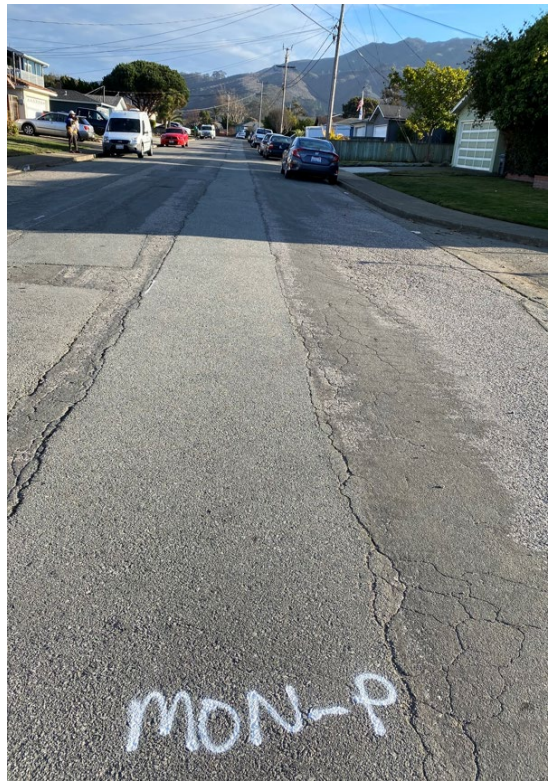
Residentials
Age Group: 0-10 Years

If Area of Cut ≥ 10% of section area or block area
Total Recovery Fee = $/SF x Total Section or Block Area

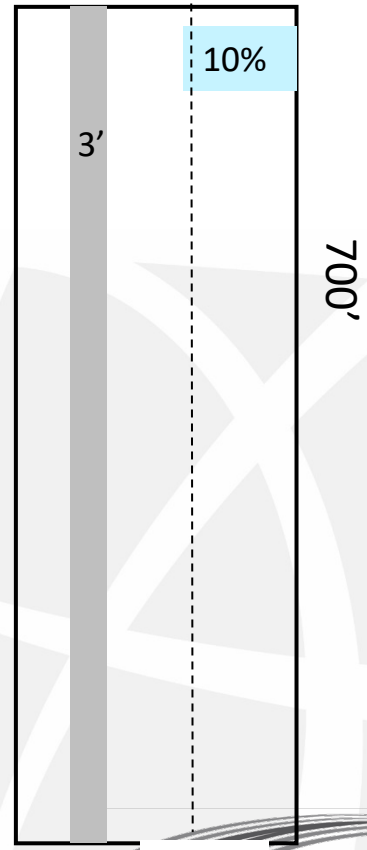
$3*(700*30) = $63,000

Reina Del mar

Rosita Rd



Montezuma Dr



UTILITY CUT IMPACT CASE STUDY: SUMMARY

- Pavements with cuts deteriorate faster.
- Large cuts (>10% of section area) show PCI drops of 30%.
- Utility cuts do more damage to new pavements (<10 years)
- Reduces pavement life by 33%.

Fee, $/SF			
Functional Class	Age Group	Cut Area (% of Section Area)	
		Small Cut	Large Cut
Arterials/ Collectors	<10 years	$ 2.50	$ 4.00
	≥10 years	$ 1.50	$ 2.50
Residential	<10 years	$ 1.50	$ 3.00
	≥10 years	$ 1.00	$ 2.50

Information Needed
Functional Class
Age of the pavement
Area of the section
Area of the cut

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UTILITY CUT IMPACT STUDY: TYPICAL FEE RANGES

Agency	Criteria	Fee Range, $/SF
Davis (2022) (Preliminary Fee Schedule) *Developed by NCE*	Functional Class and PCI	$1.04 - $1.51
Anaheim (2022) (Implementation in Progress) *Developed by NCE*	PCI	$3.60 - $11.60
Ukiah (2021) (Implementation in Progress) *Developed by NCE*	Functional Class, Size of Cut, Age of Pavement	$0.50 - $4.25
Pacifica (2021) *Developed by NCE*	Functional Class, Size of Cut, Age of Pavement	$0.50 - $4.00
City and County of San Francisco (1998)	Age of Pavement	$1.00 - $3.50
Sacramento County (1999), Elk Grove (2020), Santa Cruz (2003)	Trench Depth, Functional Class, PCI, Type of Cut	$1.80 - $3.90 (Longitudinal Cut and Trench Depth <4ft)
		$2.36 - $7.80 (Transverse Cut and Trench Depth <4ft)
		$1.80 - $5.91 (Longitudinal Cut and Trench Depth >4ft)
		$3.60 - $11.82 (Transverse Cut and Trench Depth >4ft)
Sacramento (1997) *2022 Under revision by NCE*	Type of Cut, Pavement Age	$1.00 - $3.50 (Longitudinal Cut)
		$2.00 - $7.00 (Transverse Cut)
Santa Ana (1999)	Functional Class and Age of Pavement	$6.21-$13.68
Los Angeles (2018)	Functional Class	$8.24-$19.44

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NEXT STEPS

- **Waste Truck Fee** – During franchise agreement negotiations, City's solid waste hauler agreed to pay some fees related the study findings
- **Heavy Construction Vehicle and Utility Cut Fee** – Recommendation/discussion w/Council at Fee Schedule Adoption w/justifiable fee reductions and implemented
- **Impact Fee Projections**:
  - Waste Truck Fee – up to $465,000 yearly
  - Heavy Constr. Truck Fee - $10,000 to $60,000 yearly*
  - Utility Cut Fee - $100,000 to $200,000 yearly*

  **Based on level of development/utility work*

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RECOMMENDATION FEE REDUCTIONS

- Fees can be lowered for development(s) if justifiable w/Council policy
- Adopted fee modifications:
  - ADUs under 750 sf would not be charged. Over 750 sf would not be charged if constructed with new/expanded main unit that has paid fees, as needed
  - Partially/fully credit Utility Cut fees for developments paving road frontage
  - Reduce Utility Cut Fee to $500 for sewer lateral repairs not requiring a Lateral Compliance Certificate

WHAT ARE THE CHALLENGES?

- Consider
  - Ensuring a reliable dataset with good historical data
  - Documentation of Agency's historical practices
  - Comparison with other agencies
  - Legal challenges depending on state laws

Discussion and Questions ?