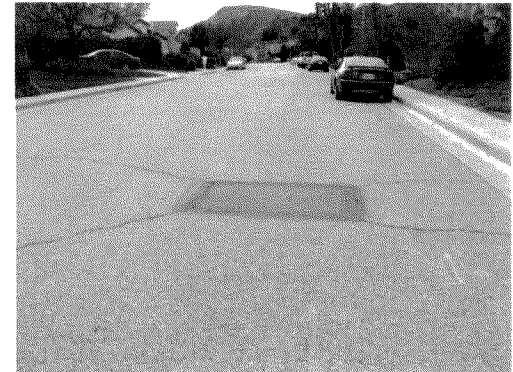


Transmittal #1
Street Damage Restoration Fee Study



City of Los Angeles
Department of General Services
Bureau of Street Services
Shahin and Associates
May 2017

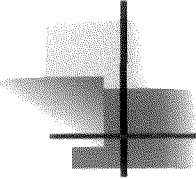


SDRF Update

Study Objective

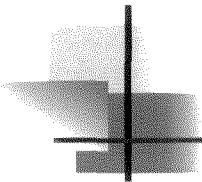
To Update the 1996 Street Damage Restoration Fees





Presentation Organization

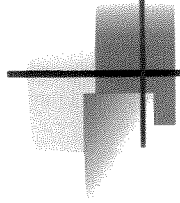
1. Random Selection of Pavement sections (Test Sites)
2. Functional (Condition) Testing and Analysis
3. Structural Testing and Analysis
4. Determination of Annual Damage due to Utility Cut Patching
5. Determination of Street Damage Restoration Fees (SDRF)
6. Conclusions and Recommendations



1. Section Selection

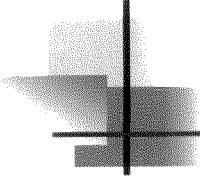
Google Earth, along with BOE utility database were used extensively to validate candidate sections as follows :

- A referenced patch in the BOE database has to be seen in Google Earth.
- There is enough pavement without utility cut patching adjacent to the PAT area to allow for the establishment of the CTL.
- The PAT and CTL areas can't be located in intersections or turning lanes to ensure they are subjected to the same traffic.



PAT and CTL Pavement Areas





Section Selection (Stratified Random Criterion)

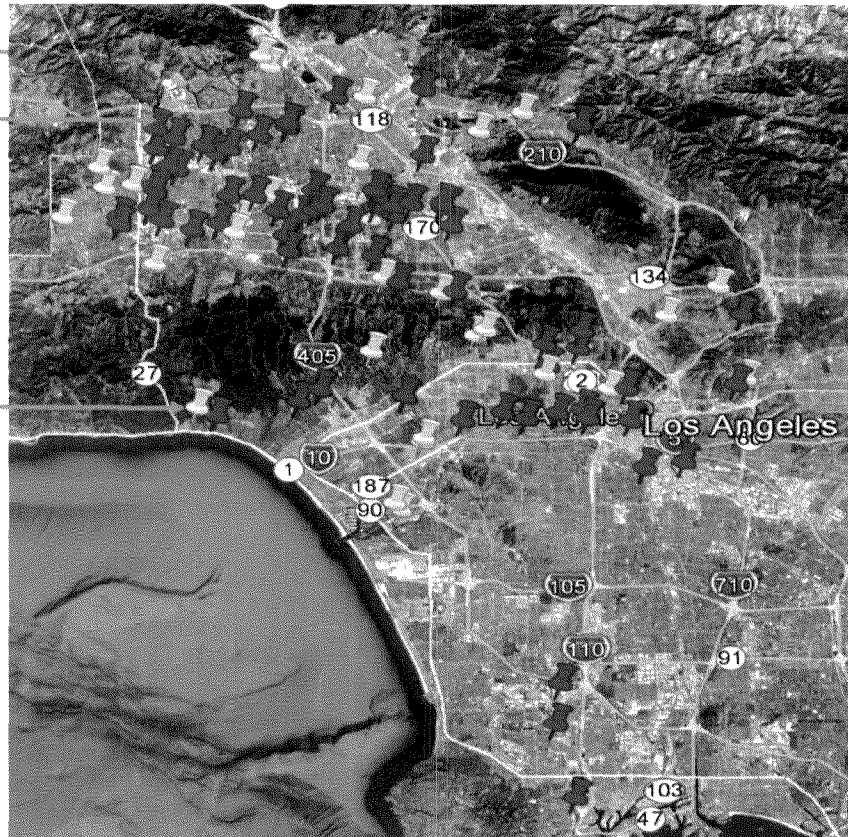
Pavement Sections were randomly selected from stratified groups to insure:

- Sections are from different pavement age groups to allow for the development of the deterioration curve.
- Utility cut patch has been in the pavement long enough to allow for the patch to have its effect on pavement performance.
- Different utility companies are adequately represented.

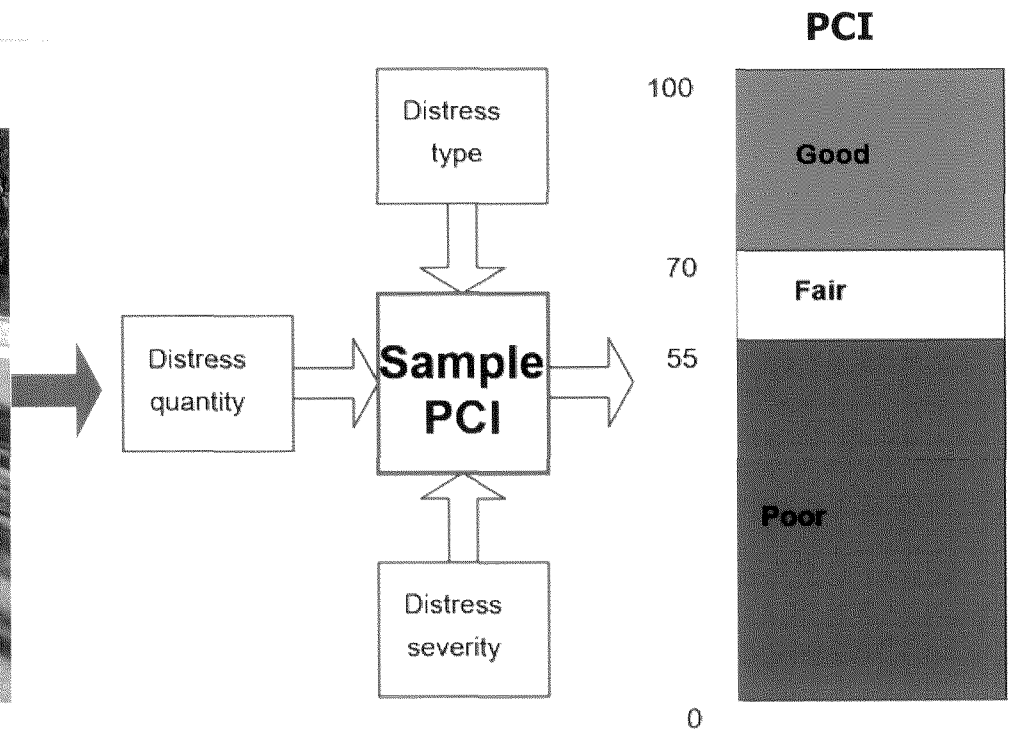
Map of Selected Sections

**Select
Sections**

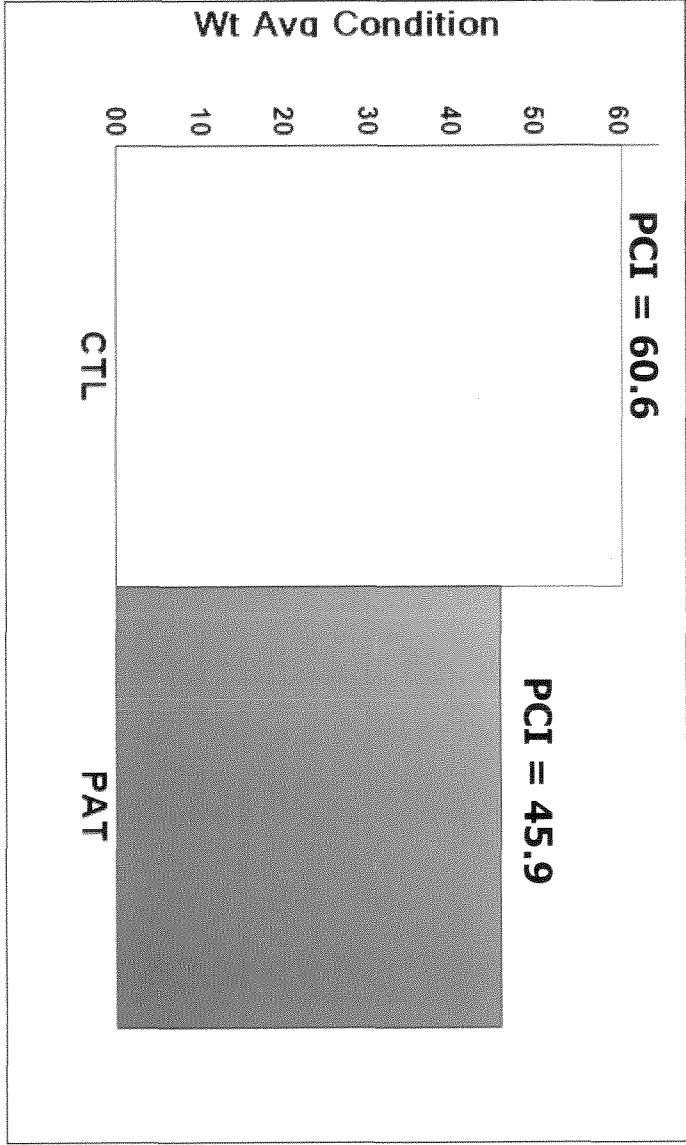
**Local
Sections**



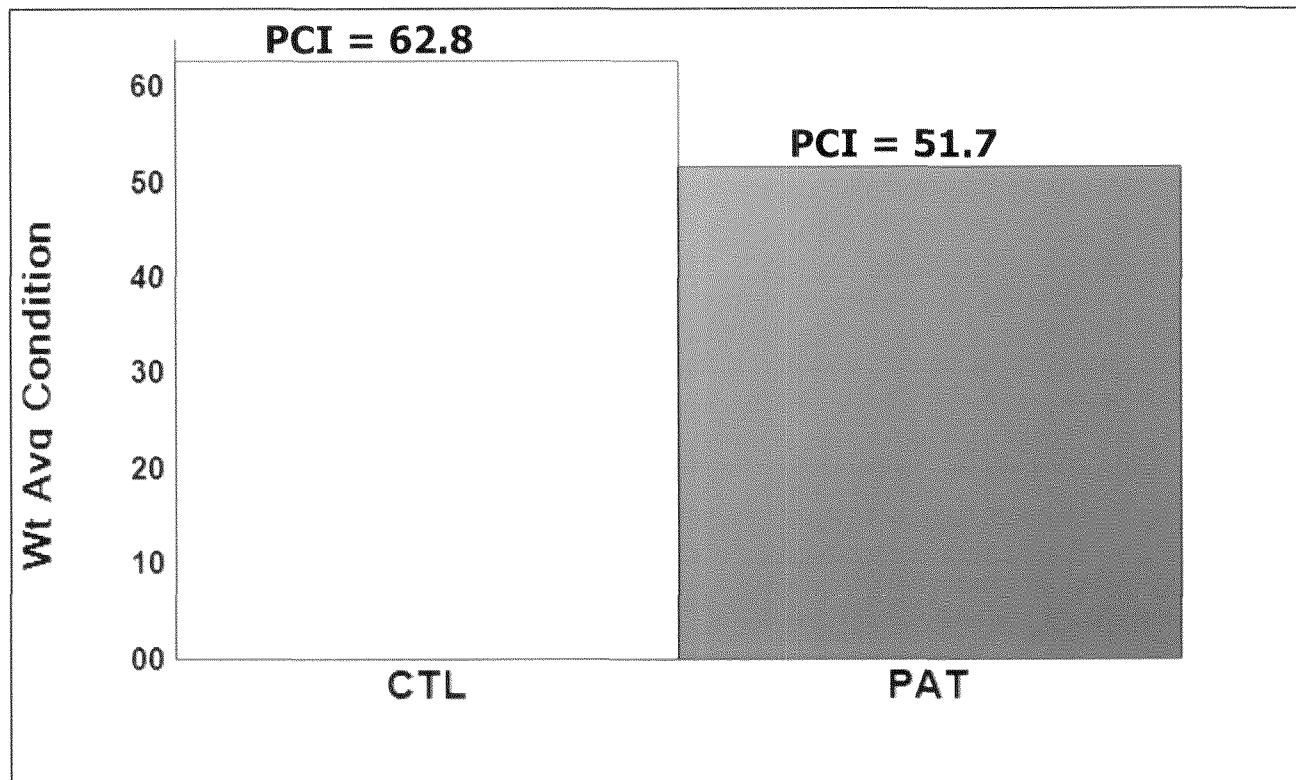
2. Functional (Condition) Inspection

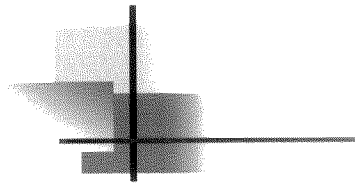


Local Sites

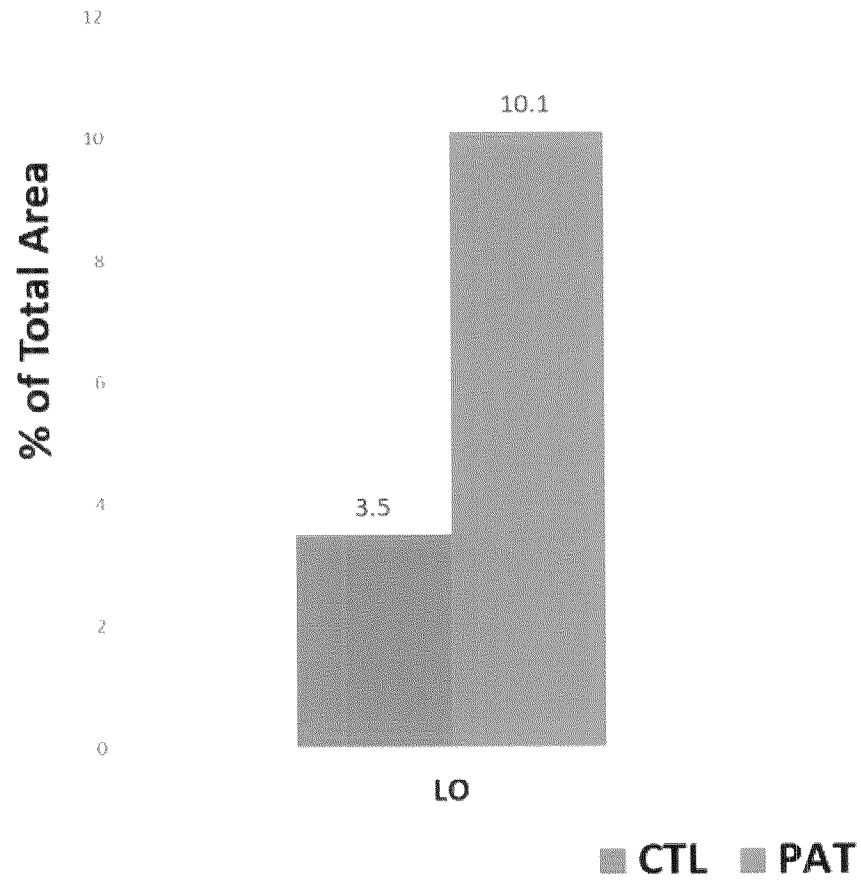


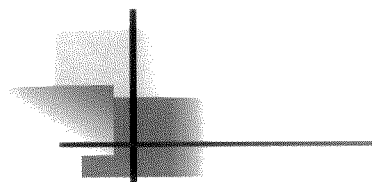
Select Sites



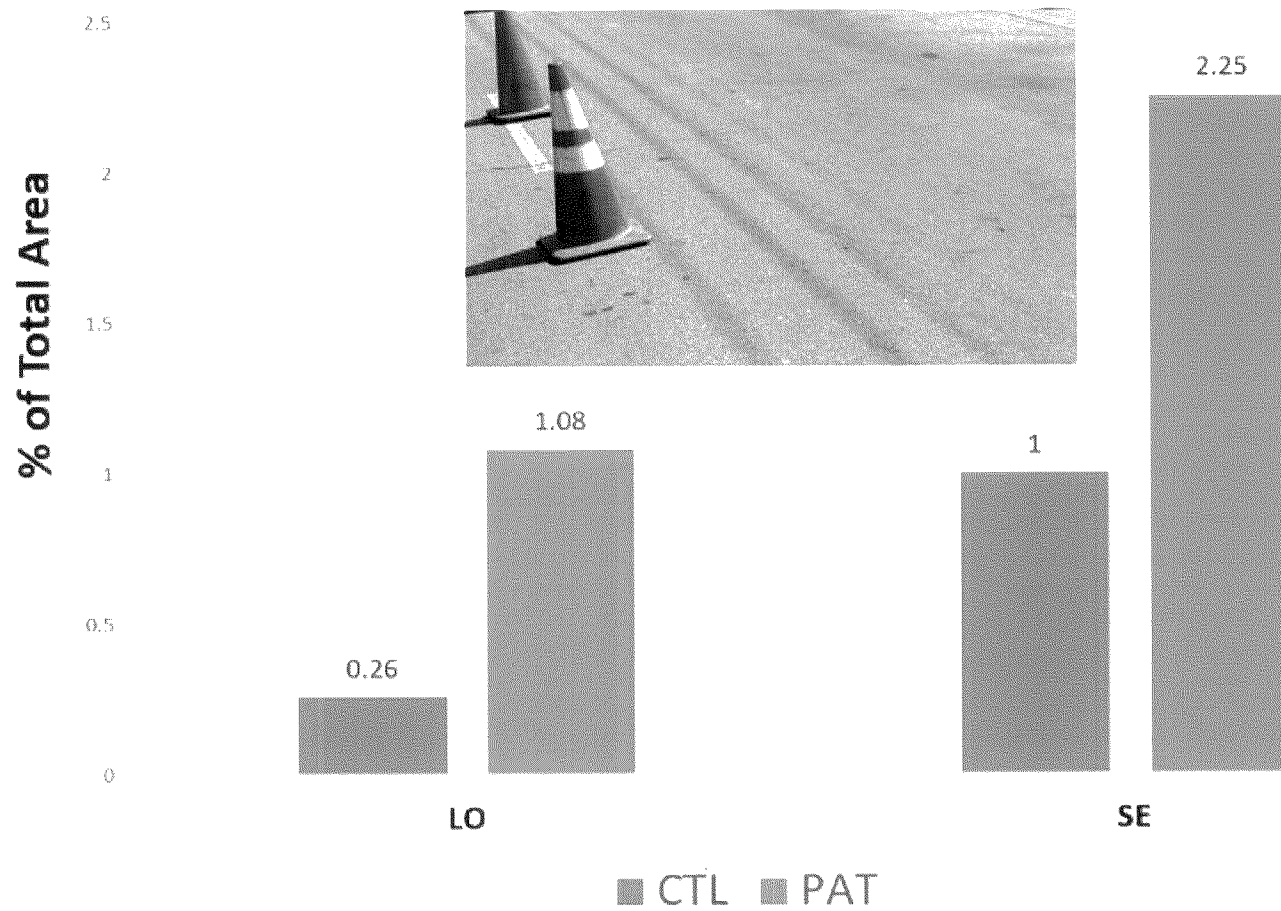


Alligator Cracking



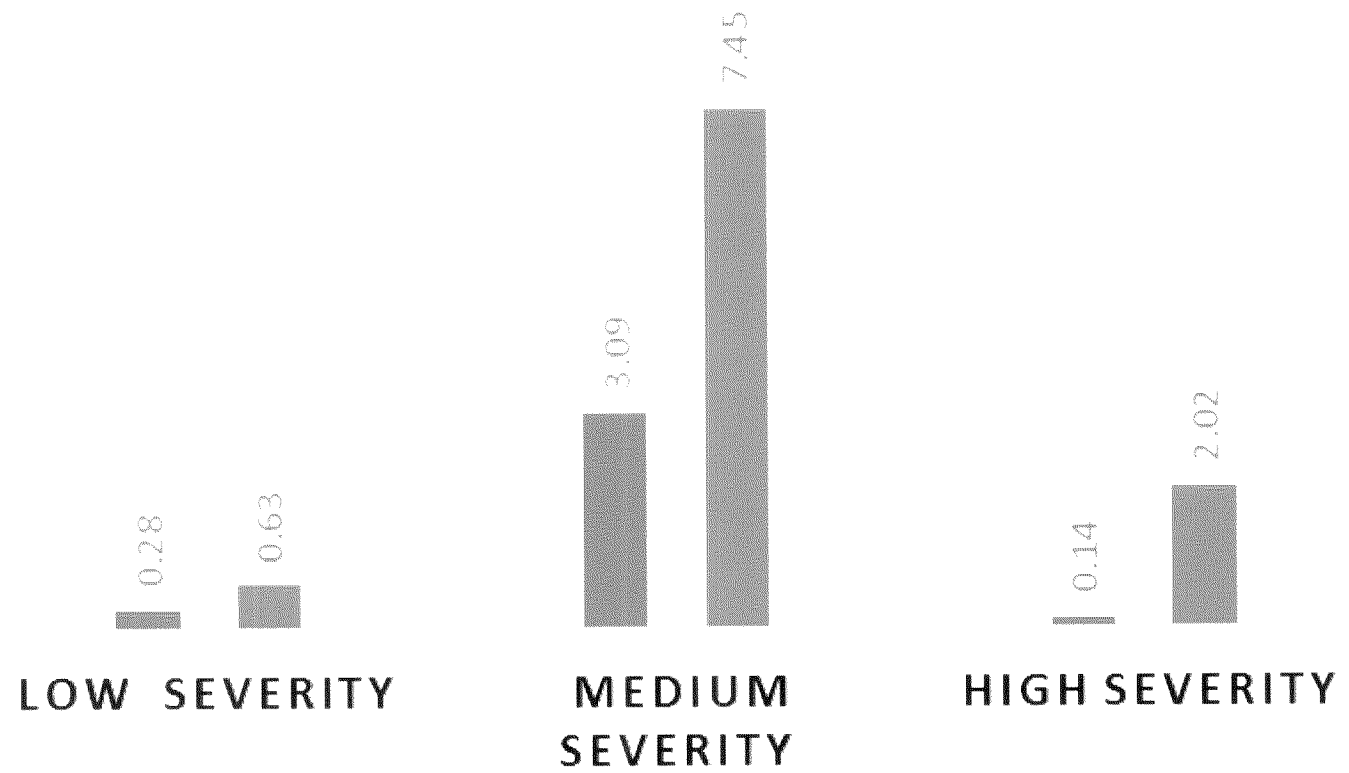


Rutting

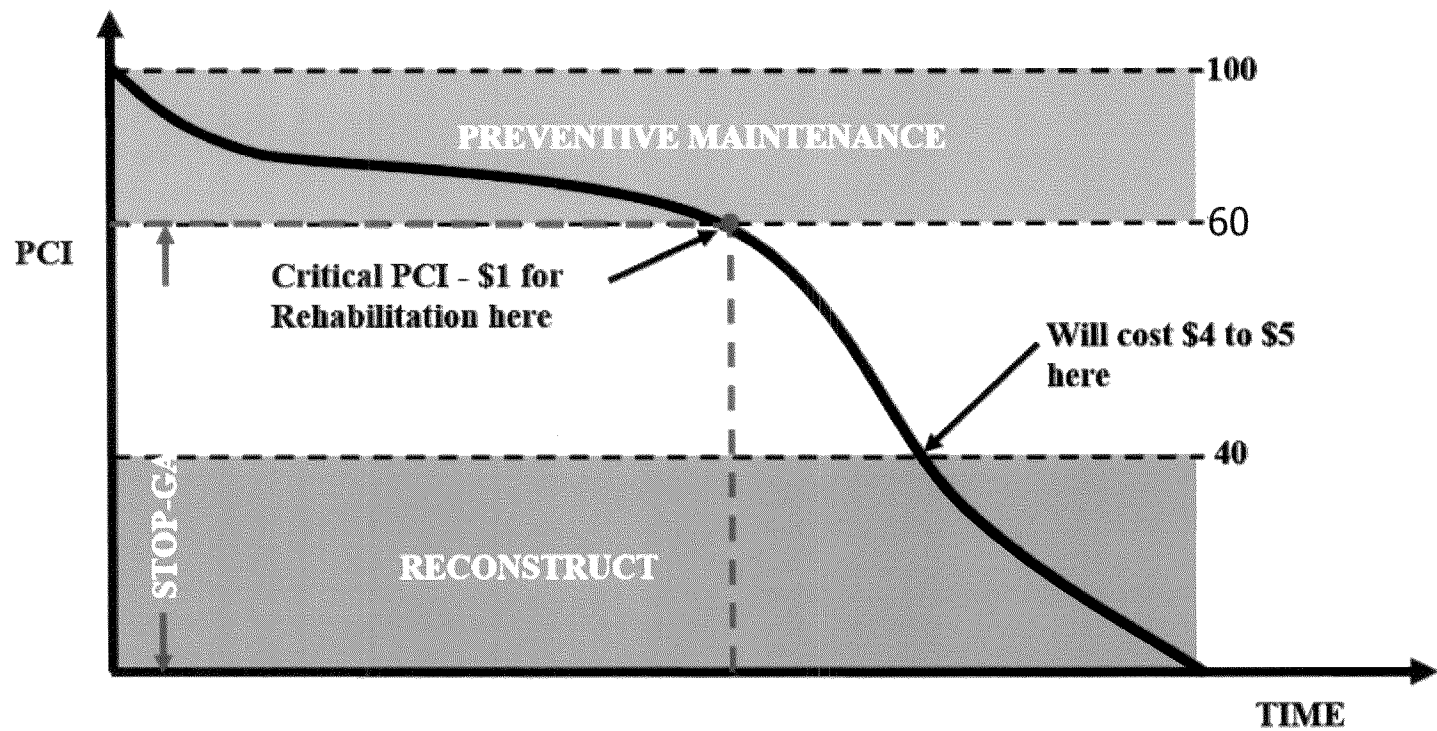


LOCAL - ALLIGATOR CRACKING - % AREA BY SEVERITY LEVEL

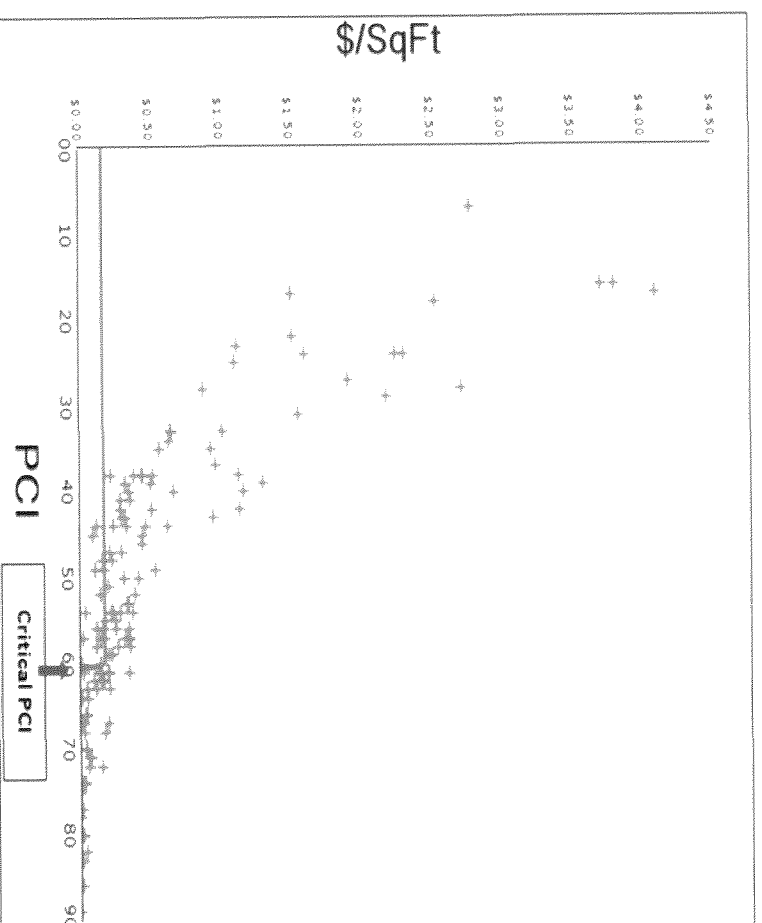
■ CTL ■ PAT



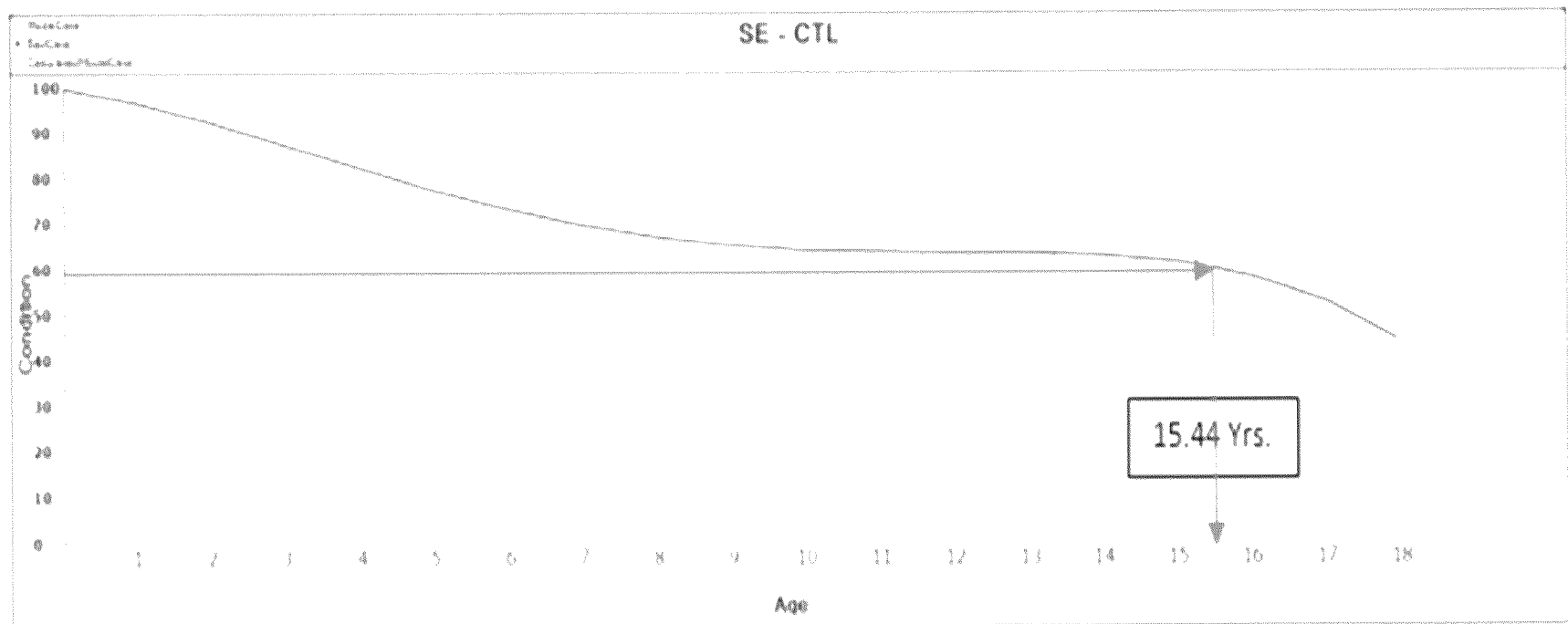
Critical PCI

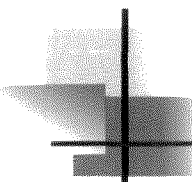


Unit Cost of Preventive Maintenance vs. PCI



PCI Family Model for Select – CTL Sites





Functional (Condition) Pavement Life at PCI =60

	CTL	PAT	Loss in Functional Life
Local Roads	18.25 Yrs.	6.48 Yrs.	64%
Select Roads	15.44 Yrs.	5.29 Yrs.	66%

3. Structural Testing Program

Falling Weight Deflectometer:

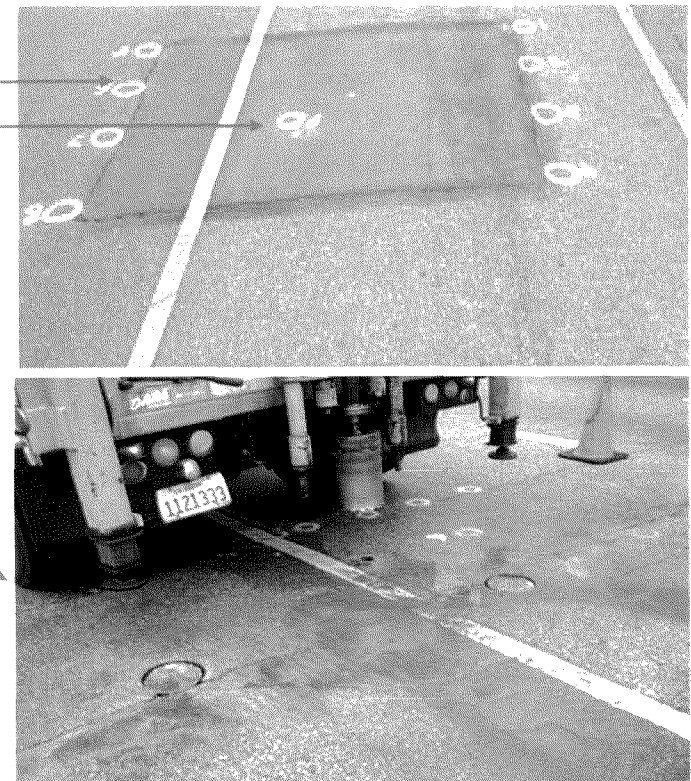
- Eight deflections adjacent to patch joint
- One deflection in patch center
- Eight deflections in the Control area

Cores were taken:

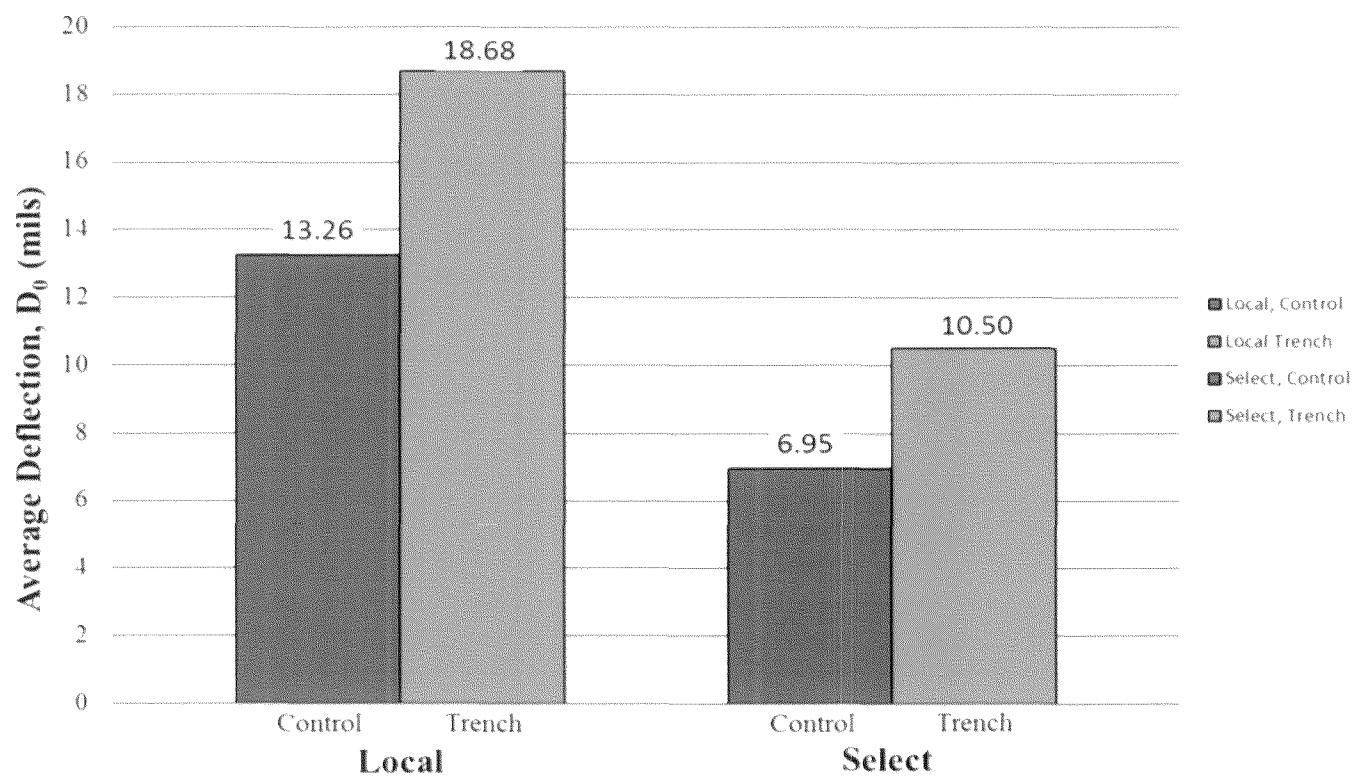
- In the trench
- Outside the trench
- In the Control area

Piezocone Penetration Testing:

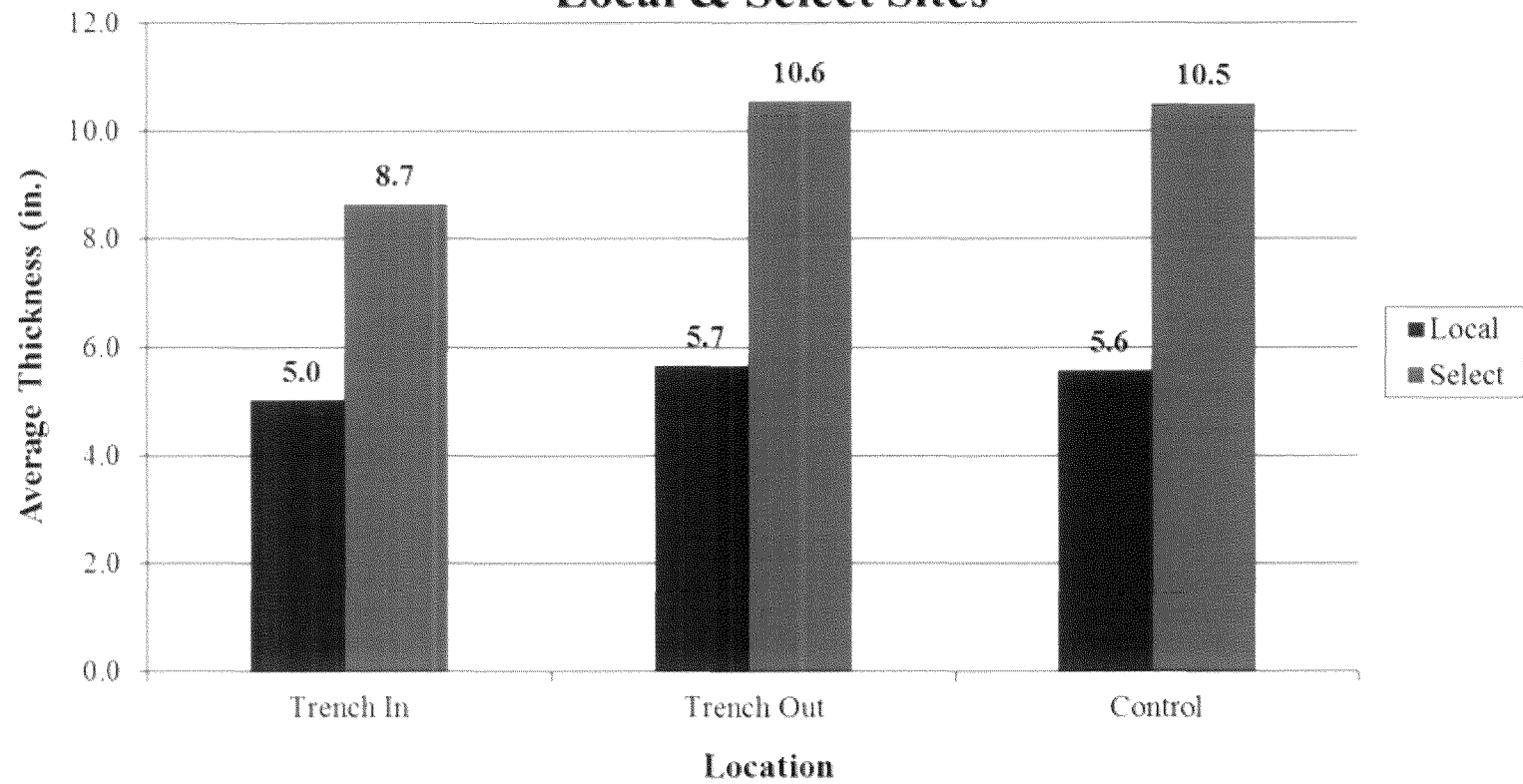
- In the trench
- Outside the trench
- In the Control area



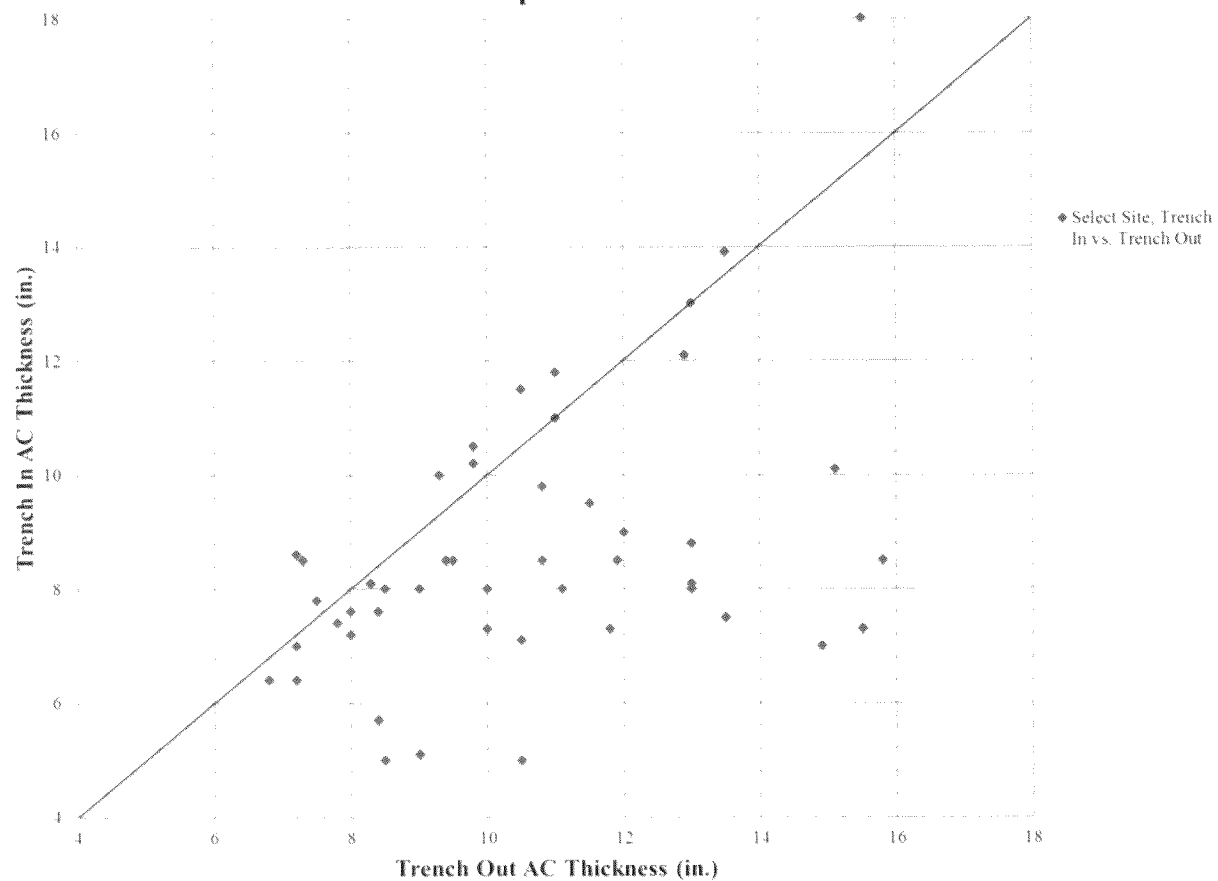
Average Normalized Deflection, D_0 (mils) for Local & Select Sites



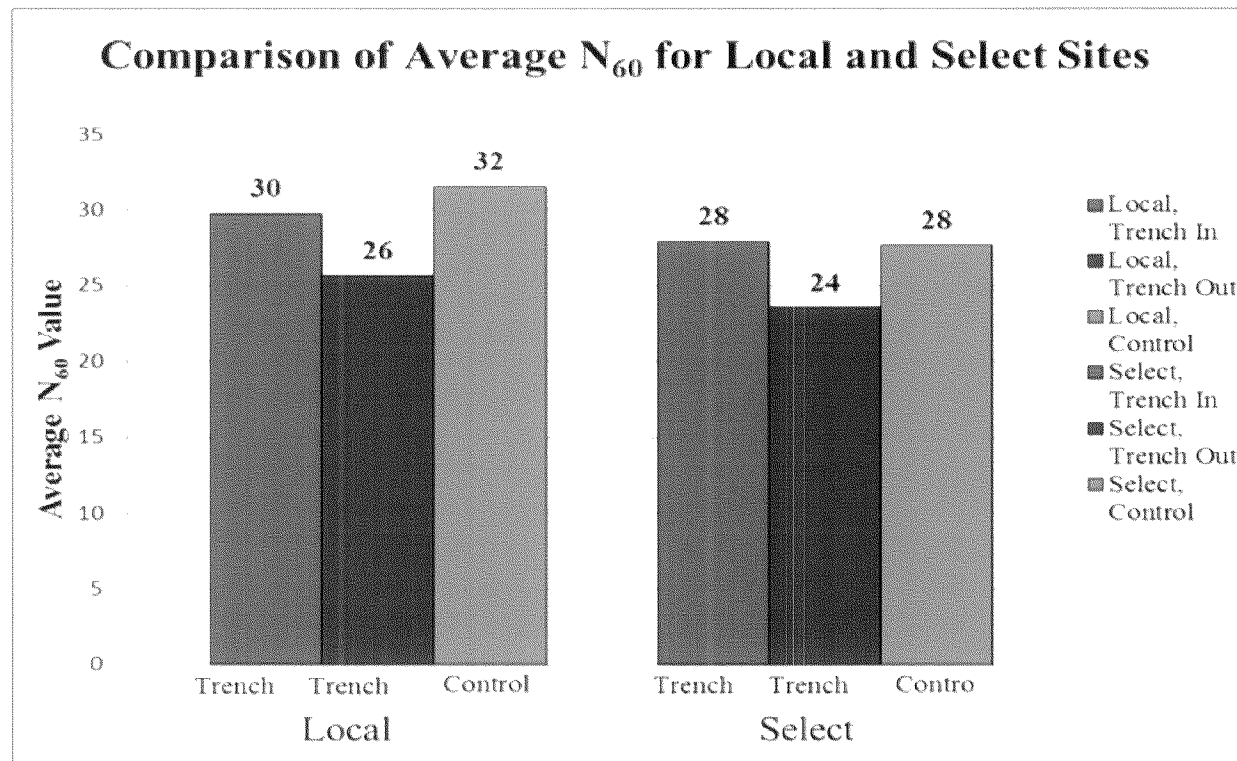
Comparison of Average Pavement Thickness Between Local & Select Sites



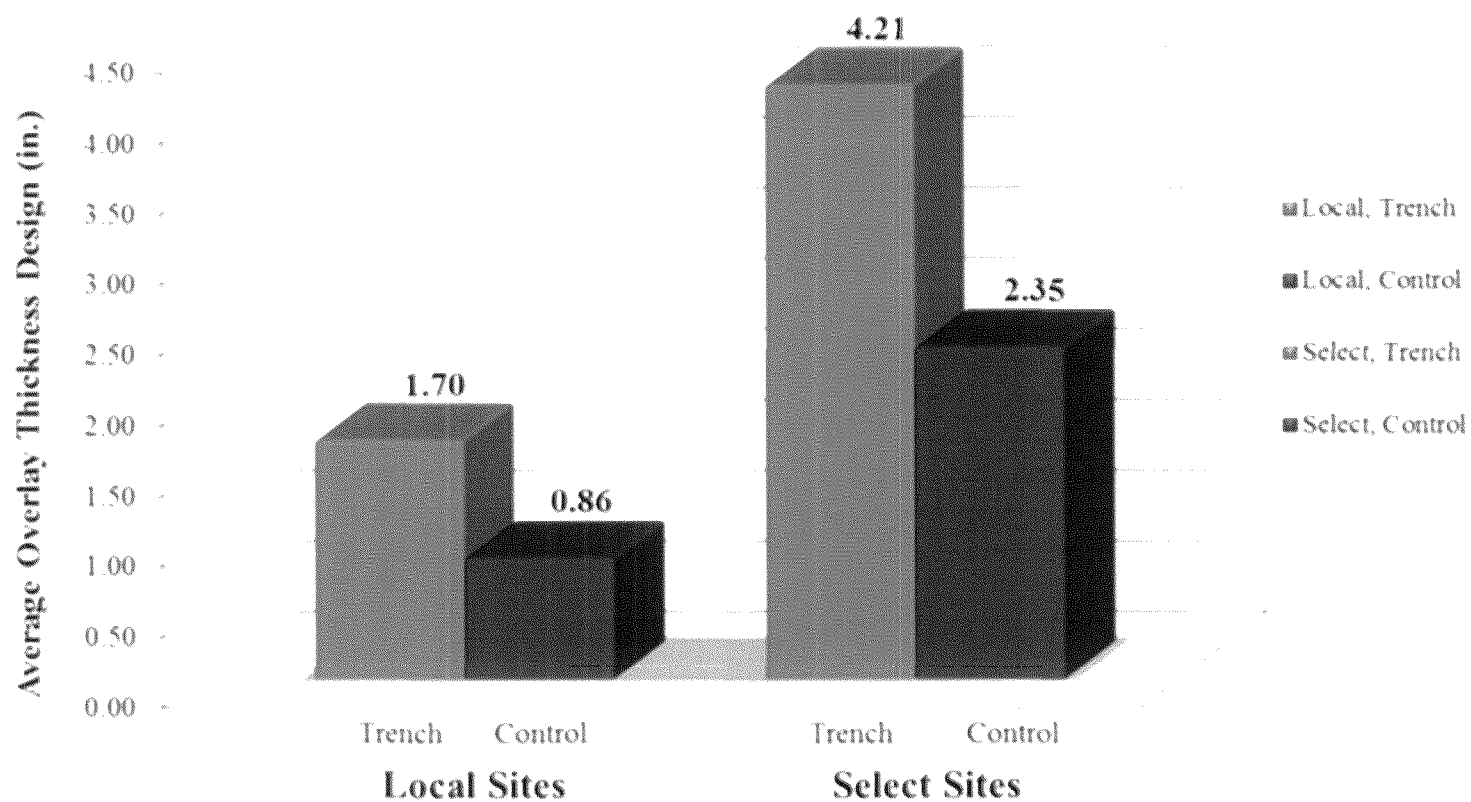
AC Thickness Distribution Trench In vs. Respective Trench Out for Select Sites

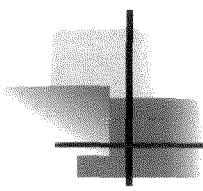


Comparison of Relative Soil Strength



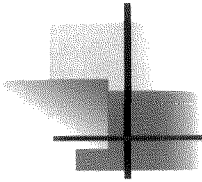
Average Overlay Thickness Design Required For Local & Select Sites





Loss in Structural Life due to Utility Cut Patching

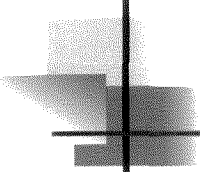
	Mean Life Ratio	Loss in Structural Life
local Streets	0.45	55%
Select Streets	0.47	53%



4. Calculation of Annual Damage due to Utility Cuts

Used same approach as 1996 study;

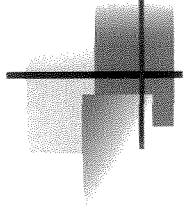
- $\text{Total Cost} = \text{Overlay} + \text{Manhole Alignment} + \text{Milling} + \text{Profiling}$
- $\text{Average Yearly Cost} = \text{Total Cost} / \text{Pavement Life}$



Unit Costs for Annual Damage Calculations

The following unit costs are Direct Costs
Provided by BOE based on Actual Bidding Costs:

- Asphalt Concrete Cost/ ton, \$ = 100.00
- Manhole Alignment/ Each, \$ = 1000.00
- Average Manholes/ mile = 5.00
- Cold Plane/ SF/ in, \$ = 0.35
- 6 Ft Profile near gutter/ SF, \$ = 1.00



Annual Damage due to Utility Cuts

	Functional and Structural Effects	Functional Effect Only	Structural Effect Only
Local	\$82.74M	\$40.59M	\$18.71M
Select	\$154.89M	\$74.22M	\$29.12M
Total	\$237.63M	\$114.81M	\$47.83M

5. Calculation of Utility Cut Fees

- Determine Average Utility Cut Width of Influence

Width of Influence

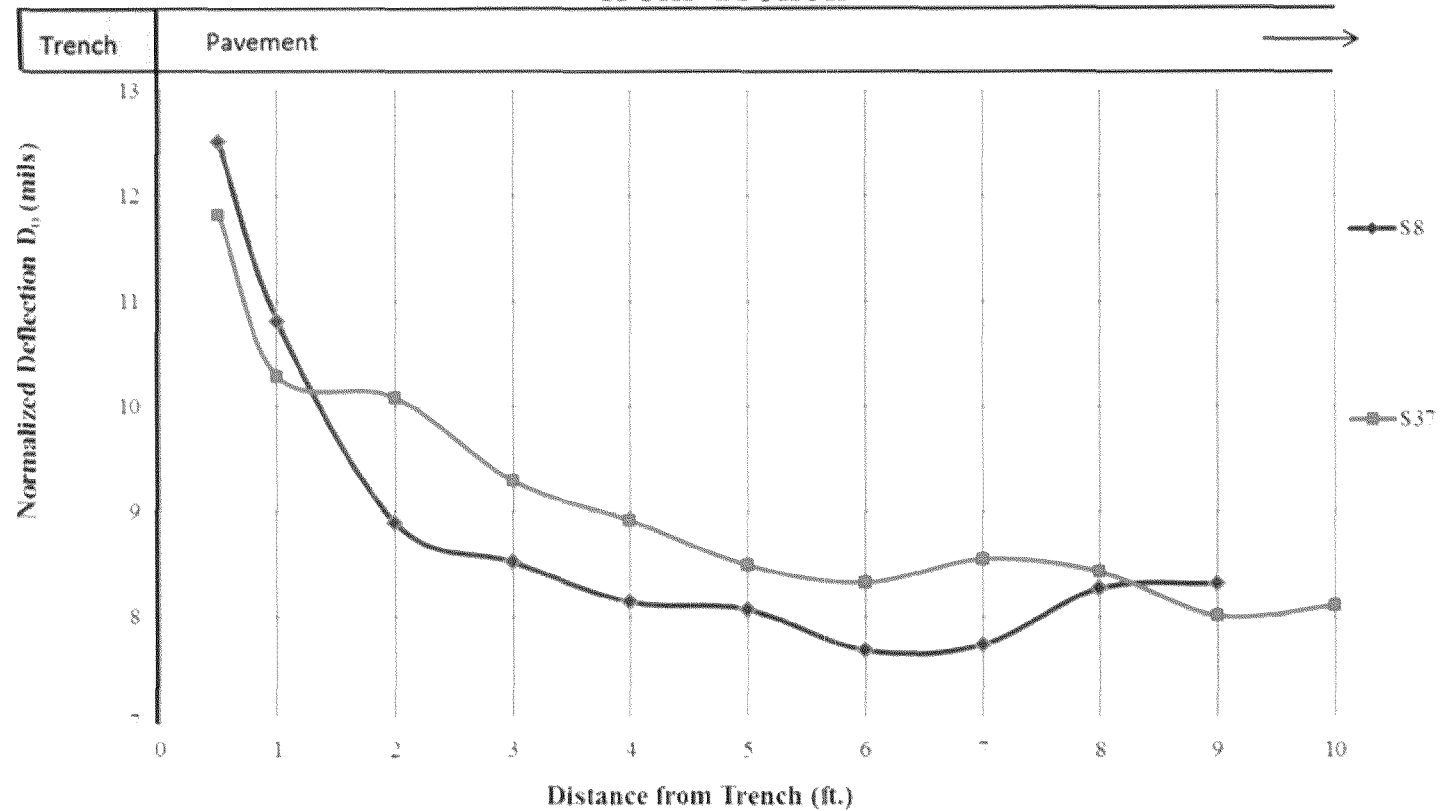


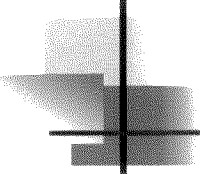
- Determine Annual SF of Utility Cuts – Last 5 Year Average from BoE Database:
 - Local = 799,594 SF
 - Select = 760,443 SF

Utility Cut Patching Width of Influence



Deflection D_0 (Normalized to 9 kips & 68°F) vs. Distance from Trench

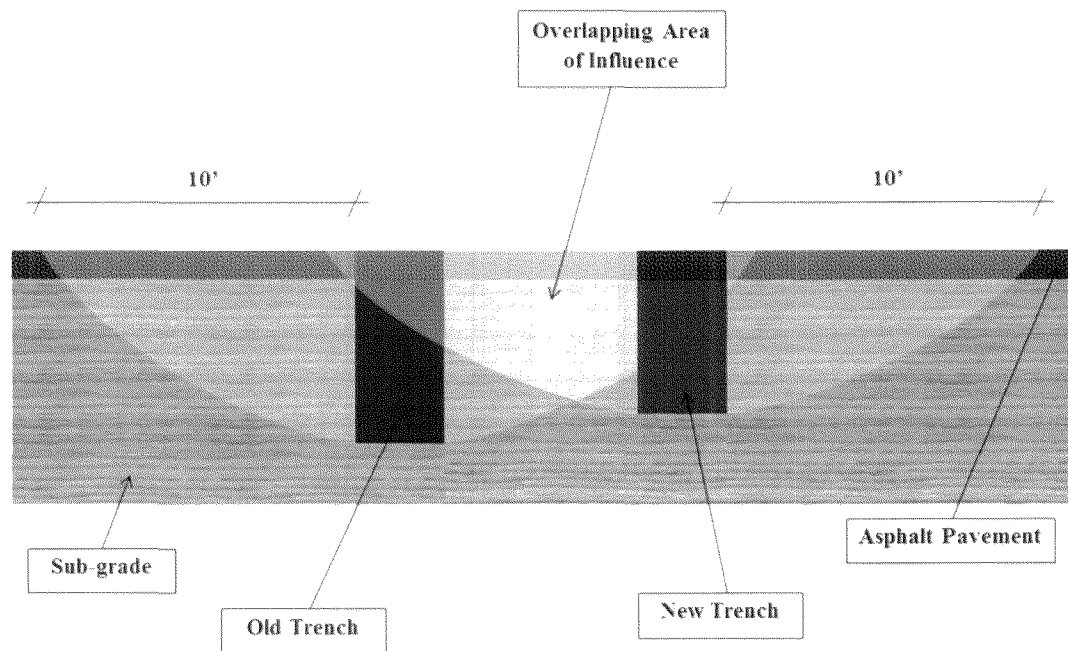


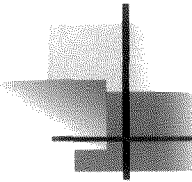


Width of Influence Testing Results

- The deflection ratio around the edge of the patch compared to away from the patch ranges from 1.25 to 2.74 with an average of 1.59.
- The Utility Cut Patch Width of influence ranges from 2.5 ft. to 10.0 ft. with an average of about 5 ft.

Sketch of Overlapping Area of Influence under pavement.





Street Damage Restoration Fees (SDRF)

Functional and Structural Effects

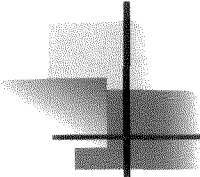
	0 ft. Width of Influence	2 ft. Width of Influence	5 ft. Width of Influence
Local	\$103.48	\$37.77	\$16.80
Select	\$203.69	\$82.80	\$40.58

Functional Only

	0 ft. Width of Influence	2 ft. Width of Influence	5 ft. Width of Influence
Local	\$50.76	\$18.53	\$8.24
Select	\$97.60	\$39.68	\$19.44

Structural Only

	0 ft. Width of Influence	2 ft. Width of Influence	5 ft. Width of Influence
Local	\$23.40	\$8.54	\$3.80
Select	\$38.30	\$15.57	\$7.63



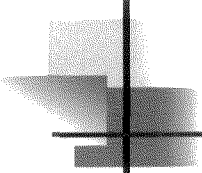
6. Conclusions – Functional (Condition) Testing

- **The PCI of the CTL areas is significantly higher than the PAT areas:**
 - **Local sites - 15 points.**
 - **Select Sites - 11 points.**

- **The pavement life to a PCI of 60 of the CTL areas is significantly higher than the PAT areas:**
 - **Local sites - 11.8 years.**
 - **Select Sites - 10.2 years.**

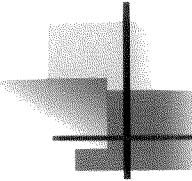
- **The percent loss in pavement life of the PAT vs the CTL areas was calculated as:**
 - **Local sites - 64%**
 - **Select Sites - 66%**

- **There is a higher percent of load related distresses (Alligator cracking and Rutting) in PAT vs CTL areas. Most of the differences are at the medium and high severity levels of the distresses.**



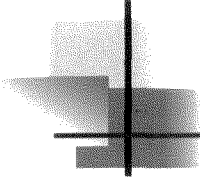
Conclusions – Structural Testing

- **The loss in structural life was estimated at 55% for Local sites and 53% for Select sites.**
- **The average overlay design thickness for the PAT areas is about twice as much as that needed for the CTL areas.**
- **The deflection ratio around the edge of the patch compared to away from the patch ranges from 1.25 to 2.74 with an average of 1.59.**
- **The weakened width around the patch (measured perpendicular to patch joint) varies from 2.5ft to 10ft. with an average of 5.2 ft.**
- **The average pavement thickness at the center of the patch is lower than around the patch.**



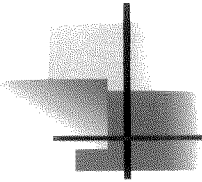
Minimum Annual Damage and Patching Fees

	Local Streets	Select Streets
Min. Annual Damage	\$40.59M	\$74.22M
Minimum Patching Fees (5 ft. width of influence)	\$8.24 per SF	\$19.44 per SF



Comparison of CTL and PAT Test Results Local Streets

	Difference in Pavement Life, years	% Loss in Pavement life	Pavement Deflection Ratio: Trench Edge/CTL	Annual Damage, \$
1996	6	18	1.2	3.5 M (6.5 M with 3% inflation)
2017	11.77	64	1.41	82.7 M



Comparison of CTL and PAT Test Results Select Streets

	Difference in Pavement Life, years	% Loss in Pavement life	Pavement Deflection Ratio: Trench Edge/CTL	Annual Damage, \$
1996	8.5	34	1.22	12.9 M (24 M with 3% inflation)
2017	10.15	66	1.51	154.9 M