ESTIMATED PAVEMENT CUT SURCHARGE FEES

FOR THE

CITY OF ANAHEIM, CALIFORNIA

ARTERIAL HIGHWAY AND LOCAL STREETS

BASED ON AN AFFECTED:
12 FOOT LANE WIDTH FOR ARTERIAL HIGHWAY STREETS
AND AN
18 FOOT HALF PAVEMENT WIDTH FOR LOCAL STREETS

DECEMBER 8, 1994

PREPARED BY:
IMS, INFRASTRUCTURE MANAGEMENT SERVICES, INC.
1101 CALIFORNIA AVENUE, SUITE 100
CORONA, CALIFORNIA 91719
(909) 273-3420

ESTIMATED PAVEMENT CUT SURCHARGE FEES FOR ARTERIAL HIGHWAY AND LOCAL STREETS BASED ON AN ASSUMED AFFECTED PAVEMENT WIDTH OF 12 FEET AND 18 FEET RESPECTIVELY

Specifically at the request of the City of Anaheim, an estimated pavement cut surcharge fee (EPCSF) based on an assumed affected 12 foot lane width is calculated below for arterial highway streets. The estimated fees listed are calculated based on the methodology used in the "Estimated Pavement Cut Surcharge Fee for the City of Anaheim, California, Arterial Highway and Local Streets", December 8, 1994, report. However, an affected pavement width of 12 feet is used rather than an affected width of 33 feet.

$$\textit{EPCSF per lineal ft} = \frac{\textit{Value of Reduced Life} * \textit{Area Affected}}{\textit{1 Lineal Foot}}$$

and,

$$\textit{Area Affected} = \textit{Pavement Width Affected} * \textit{Lineal Feet Cut}$$

so,

$$\textit{Area Affected} = 12\ ft * 1\ ft$$

$$\textit{Area Affected} = 12\ SF$$
$$= 1.33\ SY$$

Therefore,

$$\textit{EPCSF per lineal ft} = \frac{\$7.70\ /\ SY * 1.33\ SY}{\textit{1 Lineal Foot}}$$

$$\textit{EPCSF per lineal ft} = \$10.24$$

The following table lists estimated pavement cut surcharge fees for pavements from less than 1 year old up to less than 20 years old, in one year increments, based on the calculation methodology used above:

ESTIMATED PAVEMENT CUT SURCHARGE FEES FOR ARTERIAL HIGHWAY STREETS IN THE CITY OF ANAHEIM, CALIFORNIA BASED ON AN ASSUMED AFFECTED PAVEMENT WIDTH OF 12 FEET

Pavement Age (Years)	Life Reduction (Years)	Value of Reduced Life ($/SY)	EPCSF ($ per Lineal Foot)
<1	4.50	7.70	10.24
<2	4.27	7.30	9.71
<3	4.05	6.93	9.22
<4	3.82	6.53	8.68
<5	3.60	6.16	8.19
<6	3.37	5.76	7.66
<7	3.15	5.39	7.17
<8	2.92	4.99	6.64
<9	2.70	4.62	6.14
<10	2.47	4.22	5.61
<11	2.25	3.85	5.12
<12	2.02	3.45	4.59
<13	1.80	3.08	4.10
<14	1.57	2.68	3.56
<15	1.35	2.31	3.07
<16	1.12	1.92	2.55
<17	0.90	1.54	2.05
<18	0.67	1.15	1.53
<19	0.45	0.77	1.02
<20	0.22	0.38	0.51

Specifically at the request of the City of Anaheim, an estimated pavement cut surcharge fee (EPCSF) based on an assumed affected half pavement width of 18 feet is calculated below for local streets:

$$EPCSF\ per\ lineal\ ft = \frac{Value\ of\ Reduced\ Life * Area\ Affected}{1\ Lineal\ Foot}$$

and,

$$Area\ Affected = Pavement\ Width\ Effected * Lineal\ Feet\ Cut$$

so,

$$Area\ Affected = 18\ ft * 1\ ft$$

$$Area\ Affected = 18\ SF$$
$$= 2\ SY$$

Therefore,

$$EPCSF\ per\ lineal\ ft = \frac{\$4.49\ /\ SY * 2\ SY}{1\ Lineal\ Foot}$$

$$EPCSF\ per\ lineal\ ft = \$8.98$$

The following table lists estimated pavement cut surcharge fees for pavements from less than 1 year old up to less than 35 years old, in one year increments, based on the calculation methodology used above:

ESTIMATED PAVEMENT CUT SURCHARGE FEES FOR LOCAL STREETS IN THE CITY OF ANAHEIM, CALIFORNIA BASED ON AN ASSUMED AFFECTED PAVEMENT WIDTH OF 18 FEET

Pavement Age (Years)	Life Reduction (Years)	Value of Reduced Life ($/SY)	EPCSF ($ per Lineal Foot)
<1	7.87	4.49	8.98
<2	7.64	4.35	8.70
<3	7.42	4.23	8.46
<4	7.20	4.10	8.20
<5	6.97	3.97	7.94
<6	6.74	3.84	7.68
<7	6.52	3.72	7.44
<8	6.29	3.59	7.18
<9	6.07	3.46	6.92
<10	5.84	3.33	6.66
<11	5.62	3.20	6.40
<12	5.40	3.08	6.16
<13	5.17	2.95	5.90
<14	4.95	2.82	5.64
<15	4.72	2.69	5.38
<16	4.50	2.57	5.14
<17	4.27	2.43	4.86
<18	4.05	2.31	4.62
<19	3.82	2.18	4.36
<20	3.60	2.05	4.10
<21	3.37	1.92	3.84
<22	3.15	1.80	3.60
<23	2.92	1.66	3.32
<24	2.70	1.54	3.08
<25	2.47	1.41	2.82

<26	2.25	1.26	2.58
<27	2.02	1.15	2.30
<28	1.80	1.03	2.06
<29	1.57	0.89	1.78
<30	1.35	0.77	1.54
<31	1.12	0.64	1.28
<32	0.90	0.51	1.02
<33	0.67	0.38	0.76
<34	0.45	0.26	0.52
<35	0.22	0.13	0.26

THE EFFECTS OF UTILITY CUT PATCHING ON PAVEMENT PERFORMANCE IN PHOENIX, ARIZONA

Project 499
City of Phoenix, AZ

7/18/90

ERES International

Table of Contents

Introduction 1

Chapter 1: Pavement Condition Survey and Deflection Testing 2
- Pavement Condition Index Rating 2
  - Selecting and Surveying Representative Test Sections 3
  - Analysis of the PCI Survey Results 3
- Deflection Testing and Analysis of Results 3

Chapter 2: Overlay Design Requirements 5

Chapter 3: Cost Analysis 6
- Method 1 - Non-patched Pavements 6
  - Overlay Cost 6
  - Manhole and Sewer Alignment 7
  - Curb Replacement Costs 7
- Method 1 - Patched Pavements 8
  - Overlay Cost 8
  - Manhole and Sewer Alignment 8
  - Curb Replacement Costs 8
- Method 2 9
  - Overlay Cost 9
  - Milling Costs 9
  - Total Cost 9

Chapter 4: Conclusions 11

References 12

Appendix A A1-A100

Appendix B B1-B50

Appendix C C1-C84

Introduction

This report discusses the results of an investigation conducted by ERES International, Inc. (EI), for the City of Phoenix, to assess the effects of utility cut patching on the pavements' life span, and performance. Fifty street sections, each approximately one half mile long, were selected from the City Center. Two adjacent 150 ft pavement units were selected from each sections where one of the units had utility cut patches while the adjacent unit did not. The surface condition was quantified using the Pavement Condition Index (PCI) method. The structural adequacy of the patched and non-patched pavement, was evaluated using a Falling-Weight-Deflectometer (FWD). Pavement deflections were measured inside, and outside the patches. Based on the available data, a cost analysis was conducted, to quantify the rehabilitation cost incurred by the city, due to utility cut patching.

Chapter 1: Pavement Distress Condition Survey and Deflection Testing

This chapter presents the results of the pavement distress condition survey and deflection testing conducted to determine the effect of utility cut patching on pavement performance and structural adequacy. The pavement distress condition survey was performed using the Pavement Condition Index (PCI) method. The PCI decrease over time was used to measure the difference in performance between utility patched and non-patched pavements. Deflection testing was conducted using the Falling-Weight-Deflectometer (FWD). The maximum deflection under a normalized load of 9000 lbf was used to compare the structural adequacy of the utility patched and non-patched pavements. A pavement is structurally adequate if it is able to carry traffic safely for the design period.

The PCI and FWD testing procedures are briefly described below and the results presented.

Pavement Condition Index Rating Procedure

The Pavement Condition Index (PCI) survey method was developed by the U.S. Army Corps of Engineers to provide a systematic method of measuring pavement distresses and quantifying their effect on pavement performance. The PCI is a numerical indicator of the pavement condition which ranges from 0 to 100 with 100 being excellent. The PCI is computed based on the amount and severity of the pavement's existing distress. For flexible pavements, nineteen (19) distresses have been identified. Curves have been developed, reflecting the relative effects of each distress on the quality and structural integrity of the pavement and the surface operational condition. The number of penalty points associated with the type and severity of each distress, are called deduct values. Figure 1 summarizes the PCI rating procedure, while the detailed procedure and actual charts are available through the U.S. Army Corps of Engineers, CERL Technical Report M-294 (Ref 1).

Selecting and Surveying Representative Test Sections

The PCI survey was designed to provide a paired experiment of PCI values for patched vs. non-patched pavements. Eleven (11) streets were selected at random from the center the city of Phoenix. Each street was divided into one or more 300 ft. sections. Two adjacent 150 ft. pavement units were selected from each section; one of the units has utility curb patching and the other did not.

The detailed results of the PCI survey are presented in Appendix A, and summarized in Table 1. Inherent in the PCI procedure the fact that patches, regardless of their quality, are points of discontinuity in the pavement structure. Planes of weakness, and soil disturbance are created at the patch edges due to the cutting action. Usually, proper compaction to restore the lost density is not obtained for reasons such as: 1) lack of experienced operators, 2) inadequate compaction machines, 3) inadequate soil moisture etc... Consequently, pavements are penalized based on the patch severity level (e.g. a good patch is rated low severity).

Analysis of the PCI Survey Results

A pavement may be considered failed, when it can no longer be economically maintained without the need for major rehabilitation, such as an overlay. Considering that a typical pavement design life is 20 years, the sections were grouped into families, patched and non-patched, having an age of 20 years or less. The analysis revealed that, for the non-patched areas, a terminal PCI of 69 is obtained at the age of 20 years (see Figure 2). However, the patched sections would be expected to attain such a value in about 15.5 years, therefore shortening the expected pavement life by 4.5 years (see Figure 3). Therefore, to maintain the pavement in economic condition, rehabilitative measures must be undertaken when the PCI reaches the value of 69 which is 20 years for non-patched, and 15.5 years for utility patched pavements. Allowing the pavement to deteriorate beyond this PCI value, would result in a rapid increase in restoration costs. This concept is illustrated in Figure 4, adopted from the report published by the American Public Work Association (Ref 2).

Individual sections PCI values are presented in Table 1. It can be seen that, in general, the patched sections had lower PCI values. This difference is more evident when compared to the average PCI

per street for the patched and non-patched sections. In this case, the PCI values for the patched areas were as much as 22 points lower than the non-patched (see Table 2 & Figure 5), thereby indicating a faster deterioration rate.

Deflection Testing and Analysis of Results

The pavement deflections were measured using an Falling-Weight-Deflectometer. The FWD is a non-destructive testing machine, capable of delivering an impulse load, similar in magnitude and duration to a moving truck wheel load. The pavement's deflections are measured using seven velocity transducers, one of which is located in the center of the load plate (See Figure 6). The operation is controlled by an on-board computer, and the data are stored on a magnetic tape.

Three load levels were used at each test location, 6,000, 9,000, and 15,000 lbs. and, the 9,000 lbf. load was selected as the design load. The testing was performed in the wheel path (i.e., 18" to 24" from the edge of the pavement) at approximately 25 ft. intervals except where patches were encountered. In such a case, five locations were tested, two on the outside boundaries of the patch (PVE), two on the inside edges (PAE), and one in the middle of the patch (PA), (see Figure 7). Detailed NDT data are presented in Appendixes B and C.
The measured deflections are indicative of the pavement strength with lower deflections reflecting a stronger structure. Note that, while bearing in mind the variability in materials and construction, a certain degree of uniformity in the measured deflections is desired, indicating a uniform foundation support for any future strengthening by overlays. Generally, patches have a direct effect on this uniformity, since they are considered points of discontinuity, with adverse effects on future pavement performance. It is doubtful that, even with a structural overlay, the discontinuity effects will be corrected. It is impossible in this case to quantify the exact effects of the patches since they are a function of the patchs' type and size, age relative to the pavement, material used, construction procedure, climate, etc...

The structural indicator for the purpose of this analysis, was the maximum deflection under the load plate (Do). This measure is

capable of providing an assessment of the pavement strength and the approximate remaining life. An increase in the magnitude of the deflections is coupled with an increase in the critical strains and stresses in the pavement's layers, resulting in an accelerated fatigue failure. Hence, the use of structurally designed overlays to reduce the deflections, and extend the life of the pavement.

The data analysis of the deflection data indicated that on the average, the deflections within and around the patched areas were about 25% greater than the non-patched sections (see Table 3 and Figure 8).

Chapter 2: Overlay Design Requirements

The overlay thickness requirements for each section was determined using the Asphalt Institute method (MS-17)(Ref 3). For the sake of comparison, thicknesses were determined for both, patched and non-patched sections. The maximum deflections produced at the 9000 lbs. load level were used as input to the design. Other required input are:

1. The seasonal adjustment factor, which is the ratio of the deflection taken during the most critical time of the year to that measured at the time of testing. Considering the time of the testing (April, 1990), and the minimal variation in seasons in the Phoenix area, a factor of 1.0 was used.

2. The temperature adjustment factor, used to normalize the measured deflections to 70°F. The mean 5-day temperature was obtain from the "Phoenix Water Conservation & Resources Division" which was used to calculate the adjustment factor for each test section.

3. Traffic counts for the tested sections, obtained from the City of Phoenix, along with a rough estimate of the percent trucks using the streets. For design purposes, it was assumed that 10% of the traffic is trucks, and the traffic growth factor is 2%.

4. Pavement layers thicknesses for each section; for the most part were available or reasonably estimated based on information supplied by the City of Phoenix personnel.

The design deflection used in the analysis is computed using the relation:

$$(Do)_{design} = (X + S) \cdot C \cdot F$$

where

X = Mean pavement deflection, mils.,
S = Standard deviation of deflections, mils.,
C = Seasonal adjustment factor,
F = Temperature adjustment factor.

A computerized version of the Asphalt Institute method (MS-17),

CP-4, was utilized to expedite the design process. The results are shown in Table 4, where it can be seen that, on the average, the patched sections required about an extra 1¼ in. of overlay relative to their non-patched counterparts. The reported answers reflect a 20 year design period.

Chapter 3: Cost Analysis

Based on the results obtained in chapter 2, and considering the direct and indirect costs associated with an overlay, a cost analysis was prepared. Such costs will include manhole and sewer alignment and curb replacement. This approach assumes that no reconstruction will be necessary if the PCI is kept above 69 utilizing properly scheduled maintenance.

The curb reveal is assumed to be 6 inches and the curbing will not be replaced unless future overlay thicknesses exceed this value. Manholes and sewers adjustments will be completed prior to each overlay. Prices may vary with local, contractors and construction procedures. For the sake of illustration some realistic figures, based on national averages, were assumed and summarized as follows:

1. Asphalt patch material cost $38/ton, in place.
2. Asphalt patch material weigh 150 lbs/ft^3.
3. Manhole and sewer cost $2,500/mile.
4. Curbing costs are $147,840/mile, in place.

In addition, the street width was assumed to be 33 ft. wide and, based on the results obtained in chapter 2, an overlay of 2 in. is required for the nonpatched areas, while a 3.2 in. overlay is required for the patched.

Accordingly, the cost of each component can be calculated as follows:

Total Cost = Overlay + Manhole & Sewer + Curb

1. Overlay Cost (Non-patched):

Material cost = Quantity * Cost, therefore, for a 2 in. overlay;

Quantity = Overlay Thick x Lane Width x 5,280 ft/mile
= 2/12 ft. x 33 ft. x 5,280 ft / mile
= 29,040 cu.ft./ mile
= 2,178 tons / mile

Material Cost = 2,178 x $38 / ton

= $82,764 / mile

Yearly C = Overlay Cost / Design Life
= 82,764 / 20 years
= 4,138.2 $ / mile/year

2. Manhole and Sewer Alignment (Non-patched):

Cost = Cost per mile / Design life
= $2,500 / mile / 20 yrs
= $125 / mile / year

3. Curb Replacement Costs (Non-patched):

This cost will be accrued when curbing becomes necessary due to the increased pavement thickness. Assuming that the curb height is 6 inches, the replacement of the curbing will be required approximately, every third overlay, giving a service life of 60 years (assuming each overlay will last 20 years). accordingly, the associated costs are computed as follows:

Curb Cost = Cost per mile / Design life
= $147,840 / mile / (20 yrs. x 3)
= $2,464 / mile / yr.

Therefore, the total yearly cost for a road that is one mile long, 33 ft. wide, and requiring a 2 inch overlay will be:

Total Cost = 4,138.2 + 125 + 2,464 (Nonpatched)
= $6,727.2/mile/yr.

However, patched pavements have a life expectancy of 15.5 years compared to 20 years for the nonpatched. In addition, a patched pavement will require a 3.2 in. overlay, thereby reducing the life of the curbes to about 31 years instead of 60 years. Applying these considerations, the yearly cost of a patched pavement can be computed as follows:

1. Overlay Cost (Patched):

Material cost = Quantity x Cost

Therefore, for a 3.2 in. overlay;

Yearly Cost = 3.2/12 x 33 x 5,280 x .075 x 38 / 15.5 yrs
= $8,543.39/mile/yr.

2. Manhole and Sewer Alignment (Patched)

Cost = $2,500/mile / 15.5 yrs
= $161.29/mile/year

3. Curb Replacement Costs (Patched):

Curb Cost = $147,840/mile / (15.5 yrs. x 2)
= $4,769/mile/yr.

Therefore, the total yearly cost for a patched road that is one mile long, 33 ft. wide, and requiring a 3.2 inch overlay will be:

Total Cost = 8,543.39 + 161.29 + 4,769
(Patched) = $13,473.68/mile/yr.

To assess the city's cost, the total number of lane miles was obtained from the City of Phoenix Streets and Traffic Department, with a guesstimate of the percent patching in the streets. The numbers utilized for this analysis are 872 lane miles with 95% patching, and the average yearly cost is computed as follows:

Total Cost = (# of miles).[%Patch. (13473.68) + %Nonpatch. (6727.2)]
= 872 . [0.95(13473.68) + 0.05(6727.2)]
= $11,454,902/year

Cost to the City = $11,454,902 - (872 x 6727.2)
= $5,588,784/year (6,409 $/yr/mile)

Bear in mind that the above number is based on an approximate street width of 33 ft. and the assumed costs per mile. If different numbers are deemed more feasible, simply follow the outlined steps and substitute the new numbers in the formulae. In addition, to calculate the cost per square yard of patching, use the following relation:

Cost per yd^2
of patching = Total Cost per mile x % Patches per mile

It should be emphasized that the reported figures do not include

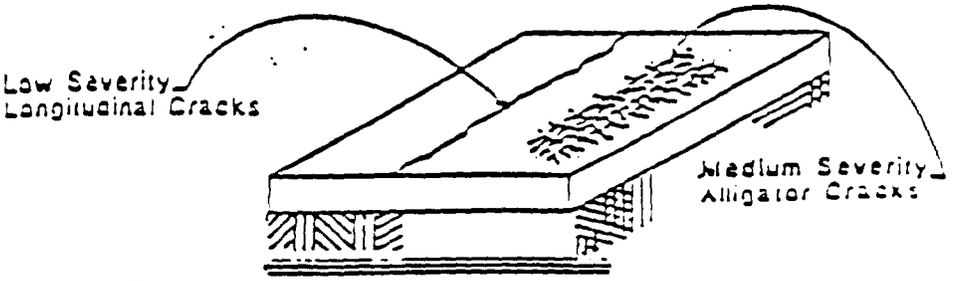
the following costs:

1. Administrative and planning costs associated with patching,
2. Grinding or repatching as preparation for the overlay, and
3. Costs associated with excavations in the sidewalks or the green belt area.
4. Users' costs in terms of comfort and delays.

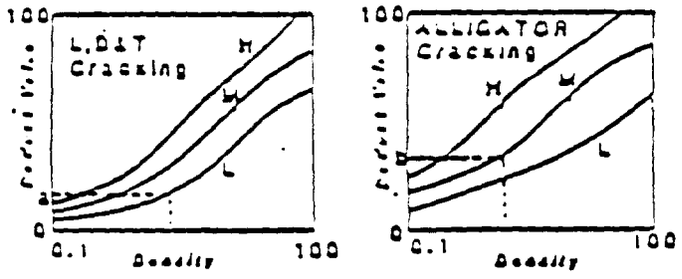
Chapter 4: Conclusions

The results obtained from this study suggest that the pavement performance and service life is directly affected by the presence of utility cut patching. This effect was approximated by a reduction factor of 1.29 applied to the patched pavements. This life reduction coupled with the increased overlay thickness required by the higher deflections in the patched areas, resulted in doubling the cost of pavement maintenance to the city. The cost of maintaining the patched pavements was calculated to be approximately ~~$5,000 per mile per year vs $2,500~~ double the cost for the non-patched pavements.

* Step 1 Inspect sample units to determine type, quantity and severity level of pavement distresses.

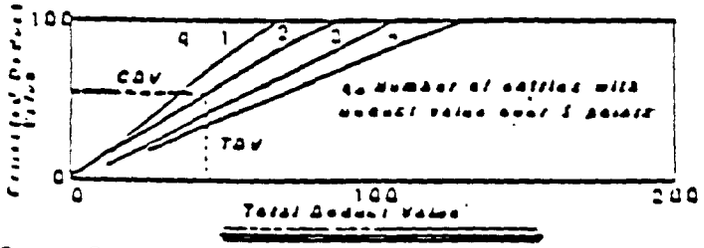


* Step 2 Determine deduct values.



* Step 3 Compute Total Deduct Value, TDV= a+b

* Step 4 Adjust Total Deduct Value.



* Step 5 Compute Pavement Condition Index, PCI=100−CDV, for each sample unit inspected.

* Step 6 Determine Pavement Condition Rating

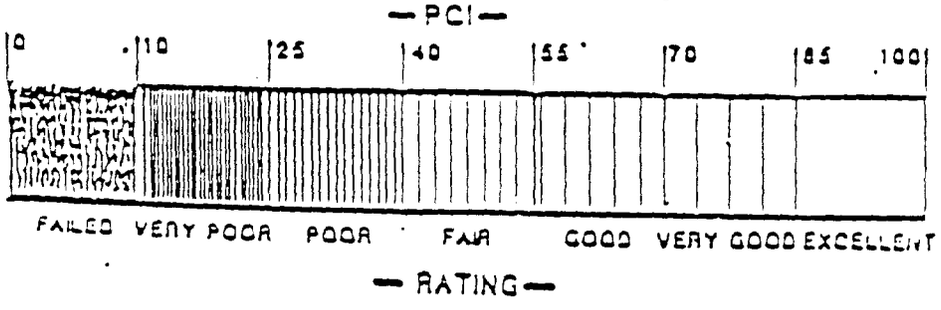
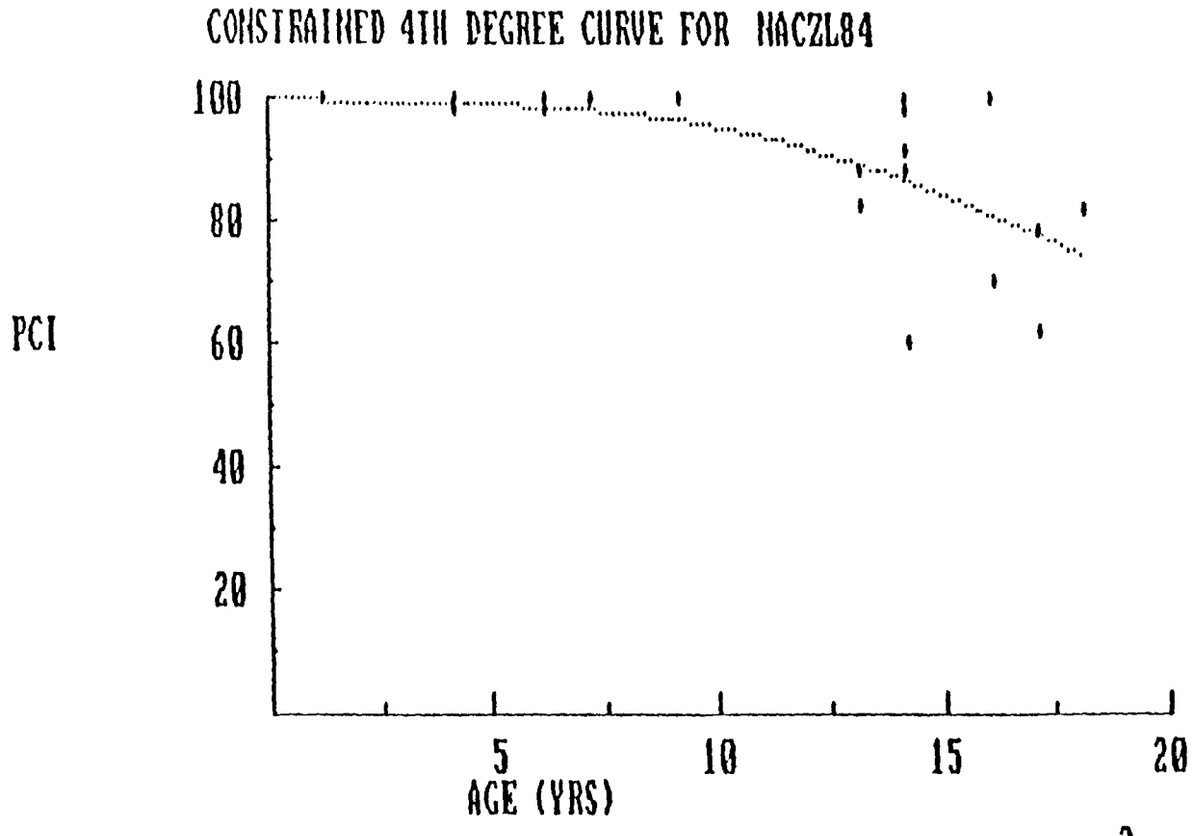
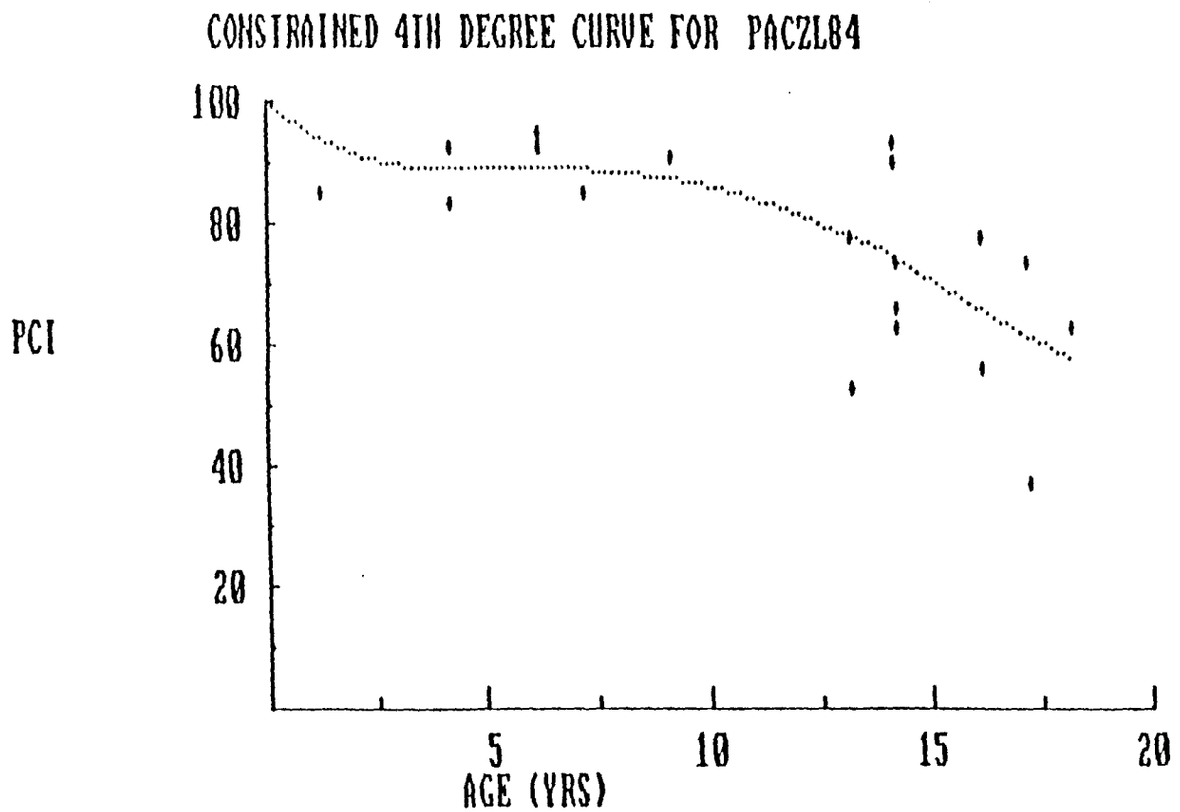


Figure 1 - Pavement Condition Index Computation Procedure



$$PCI = .1000000E+03 - .3914851E+00\,X + .1382533E+00\,X^{2} - .1787302E-01\,X^{3} + .4031232E-03\,X^{4}$$

Figure 2: Deterioration of PCI with age - Non-Patched areas



$$PCI = .1000000E+03 - .5905301E+01\,X + .1152435E+01\,X^{2} - .8980522E-01\,X^{3} + .2053284E-02\,X^{4}$$

Figure 3: Deterioration of PCI with age - Patched areas

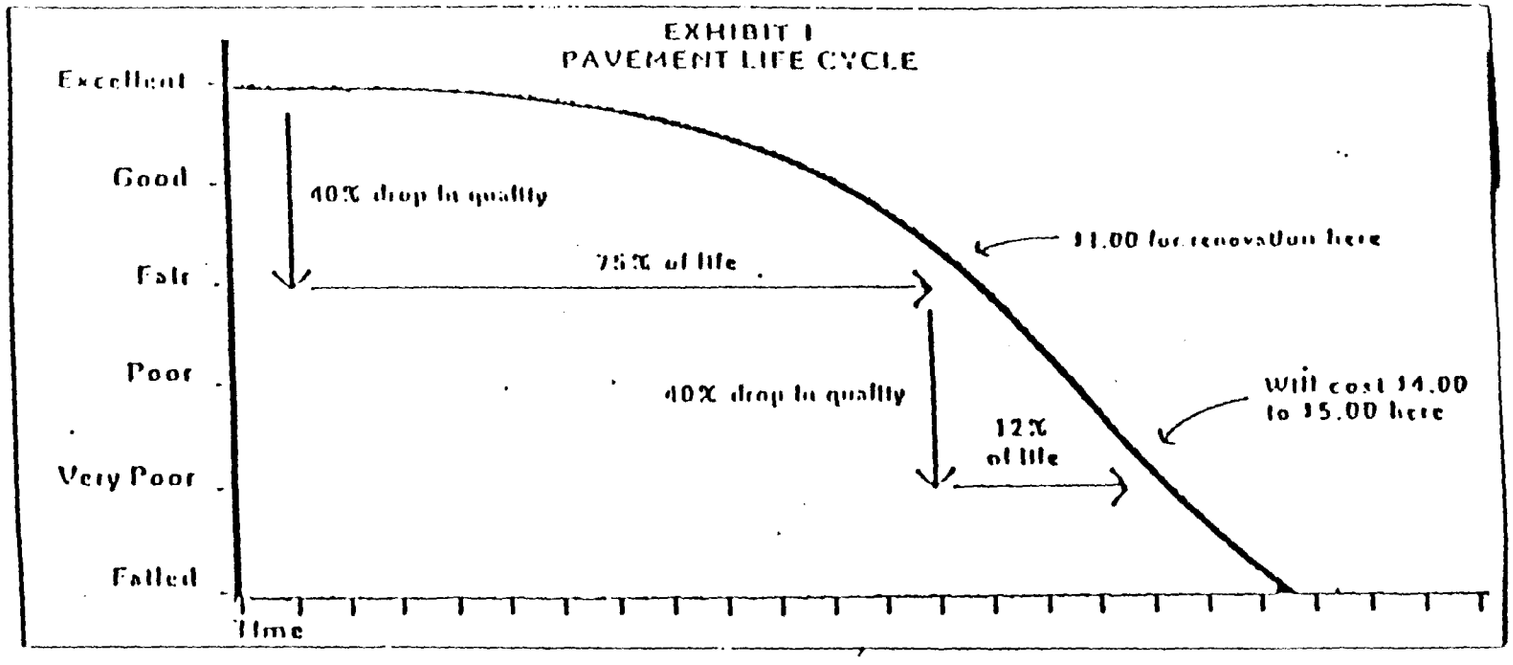
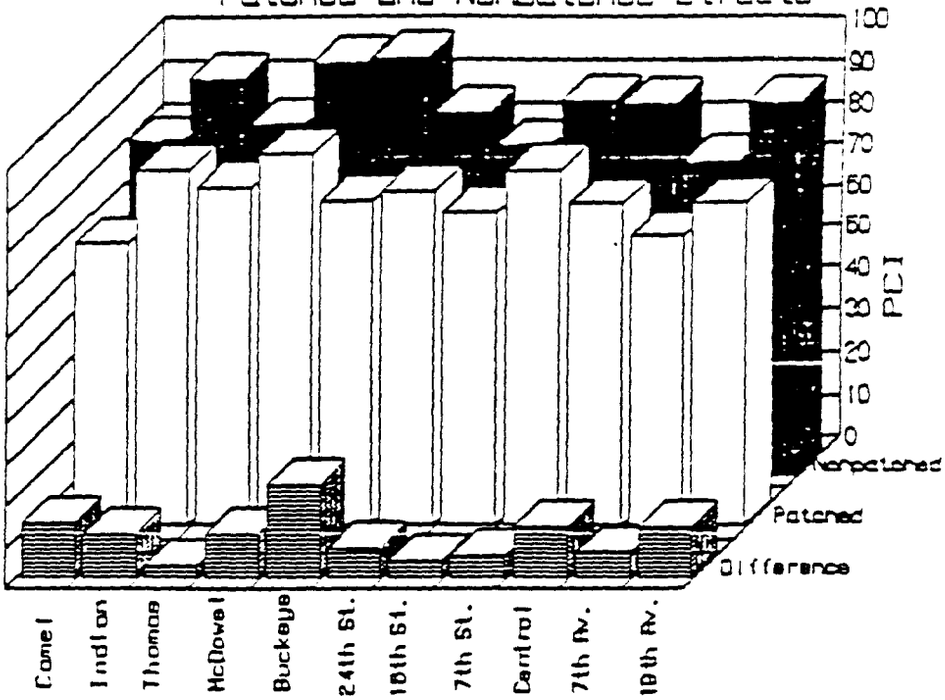


Figure 4: Renovation costs vs. pavement condition (Reprinted from APWA Reporter, November, 1983).

Figure 5: Comparison of the PCI Values for Patched and Nonpatched Streets



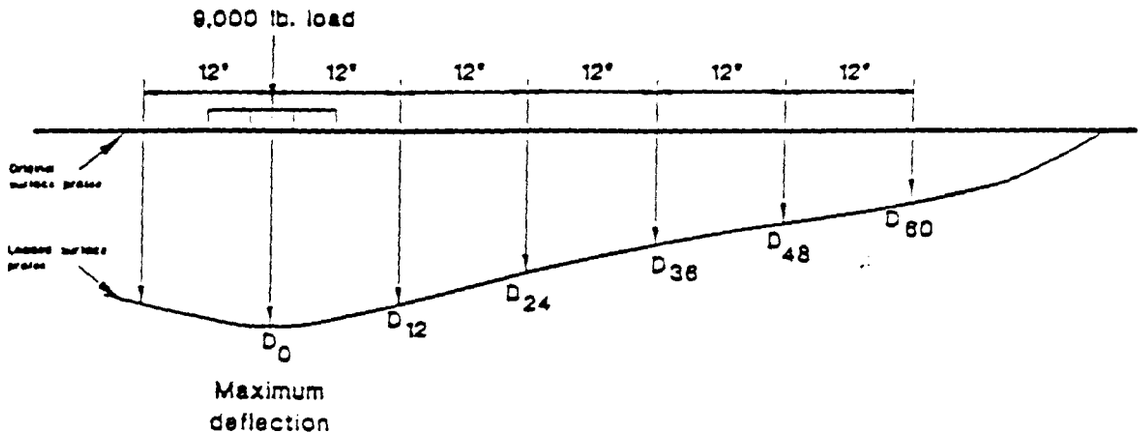
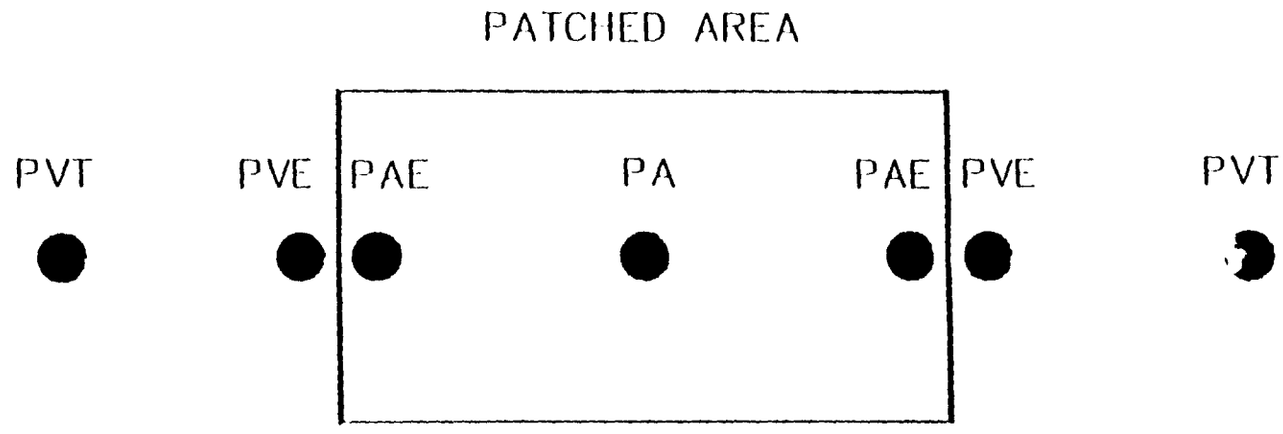


Figure 6. Deflection Basin and Sensor Locations



PVT — Pavement
PVE — Pavement Edge
PAE — Edge of Patch
PA — Center of Patch

Figure 7 - Locations of Deflection Testing in and Around the Patch

Figure 8: Effect of Patching on Deflections

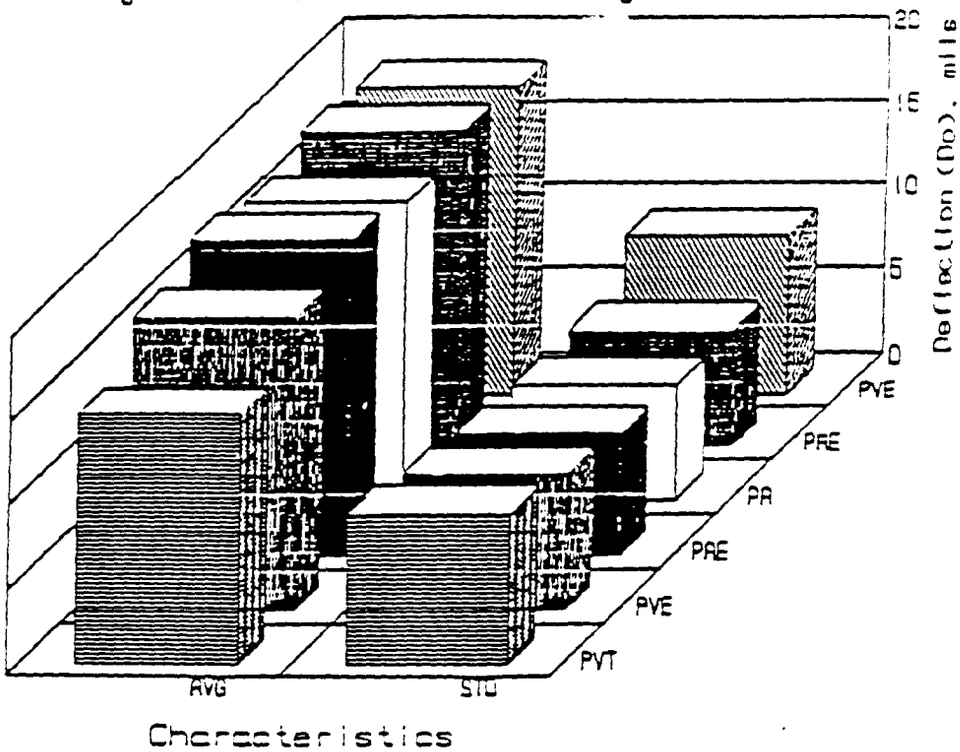


Table 1: Summary of PCI Results for Each Section

Branch	Section Number	Last Maintenance Year	Last Maintenance Type	PCI Patched	PCI Non-Patched
Camelback	1	1987	Chip Seal	87	86
	2	1987	Chip Seal	61	67
	3	1984	Chip Seal	63	82
	4	1984	Chip Seal	74	79
	5	1984	Chip Seal	37	62
	6	1977	Construction	53	83
	7	1984	Chip Seal	74	89
	8	1984	Chip Seal	90	92
Indian School	9	1981	Construction	91	100
	10	1984	Chip Seal	78	89
Thomas Road	11	1986	Chip Seal	74	77
	12	1976	Construction	94	100
	13	1976	Construction	90	99
	14	1988	Chip Seal	93	97
	15	1983	1in. Overlay	89	77
	16	1983	1in. Overlay	79	71
	17	1984	Chip Seal	63	60
	18	1984	Chip Seal	66	92
McDow Road	19	1984	Construction	93	99
	20	1989	Construction	85	100
	21	1987	Chip Seal	89	97
	22	1983	Construction	85	100
	23	1984	Construction	95	100
Buckeye	24	*	*	78	100
24th Street	25	1986	Chip Seal	84	100
	26	1986	Chip Seal	93	99
	27	1986	Chip Seal	81	86
	28	1986	Chip Seal	75	77
	29	1986	Chip Seal	65	73
16th Street	30	1986	Chip Seal	80	84
	31	1986	Chip Seal	74	82
	32	1988	Chip Seal	81	82
	33	1986	Chip Seal	82	76
	34	1978	Chip Seal	56	70

* No information is available.

Table 1 (con't.): Summary of PCI Results for Each Section

Branch	Section Number	Last Maintenance		PCI	
		Year	Type	Patched	Non-Patched
7th Street	35	1985	1in. Overlay	78	80
	36	1985	1in. Overlay	92	91
	37	1985	1in. Overlay	85	99
Central Avenue	38	1987	Chip Seal	83	87
	39	1987	Chip Seal	87	80
	40	1983	1in. Overlay	60	100
7th Avenue	41	1983	Chip Seal	51	43
	42	1983	Chip Seal	73	60
	43	1984	Chip Seal	76	86
	44	1984	Chip Seal	83	79
	45	1984	Chip Seal	73	77
	46	1984	Chip Seal	77	77
	47	1987	Chip Seal	40	77
	48	1987	Chip Seal	79	98
19th Avenue	49	1986	Chip Seal	87	88
	50	1984	Chip Seal	67	90

Table 2: Summary of PCI Results for Each Branch

Branch	Average PCI		
	Patched	NonPatched	Difference
Camelback	67	80	13
Indian School	85	95	10
Thomas Road	81	84	3
McDowel	89	99	10
Buckeye	78	100	22
24th Street	80	87	7
16th Street	75	79	4
7th Street	85	90	5
Central Avenue	77	89	12
7th Avenue	69	75	6
19th Avenue	77	89	12

Table 3: Comparison of the Deflections Between Patched and Nonpatched Pavements

Test Location	Deflections, mils.			
	Minimum	Maximum	Average	Std. Dev.
PVT	4.29	71.32	14.66	8.79
PVE	5.40	49.72	17.28	7.86
PAE	1.59	37.33	18.63	7.25
PA	1.59	33.48	17.63	6.89
PAE	1.59	31.56	18.75	6.93
PVE	4.92	53.51	18.22	9.25

PVT Test is on the pavement, away from the patch.
PVE Test is on the pavement, on the outside edge of the patch.
PAE Test is on the inside edge of the patch.
PA Test is at the center of the patch.

Table 4: Overlay Thickness Requirements for Patched and Nonpatched Pavements

		Overlay Thickness		Average Thickness	
Street	Section	Patched	NonPatched	Patched	NonPatched
Camelback	1	1.7	0.0		
	2	2.2	0.0		
	3	7.3	2.9		
	4	4.5	3.2		
	5	3.6	0.0		
	6	0.0	0.0		
	7	3.8	0.0		
	8	0.0	0.0	2.89	0.76
Indian	9	0.0	0.0		
School	10	5.1	2.0	2.55	1.00
Thomas	11	3.2	2.2		
Road	12	0.0	0.0		
	13	0.0	0.0		
	14	6.4	0.0		
	15	2.4	0.0		
	16	9.6	10.1		
	17	5.1	2.6		
	18	3.1	0.0	3.73	1.86
McDow	19	0.0	0.0		
Road	20	0.8	0.0		
	21	6.4	6.7		
	22	0.0	0.0		
	23	0.0	0.0	1.44	1.34
Buckeye	24	*	*	*	*
24th Street	25	3.9	5.6		
	26	4.7	2.3		
	27	2.2	5.2		
	28	4.5	3.5		
	29	3.9	6.5	3.84	4.62

* No information is available.

Table 4 (con't.): Overlay Thickness Requirements for Patched and Nonpatched Pavements

		Overlay Thickness		Average Thickness	
Street	Section	Patched	NonPatched	Patched	NonPatched
16th Street	30	3.7	2.6		
	31	4.6	4.4		
	32	•	•		
	33	•	•		
	34	2.9	0.0	3.73	3.50
7th Street	35	0.0	2.1		
	36	3.8	0.0		
	37	2.9	0.0	2.23	0.70
Central Avenue	38	3.0	4.6		
	39	0.0	0.0		
	40	7.0	5.5	3.33	3.37
7th Avenue	41	3.9	6.2		
	42	2.6	0.0		
	43	3.7	0.0		
	44	5.8	0.0		
	45	5.2	2.4		
	46	1.4	0.0		
	47	2.4	7.2		
	48	3.6	0.0	3.58	1.98
19th Avenue	49	3.8	0.0		
	50	4.1	4.1	3.95	2.05
	Average	3.17	1.96		
	Std. Dev.	2.28	2.61		