

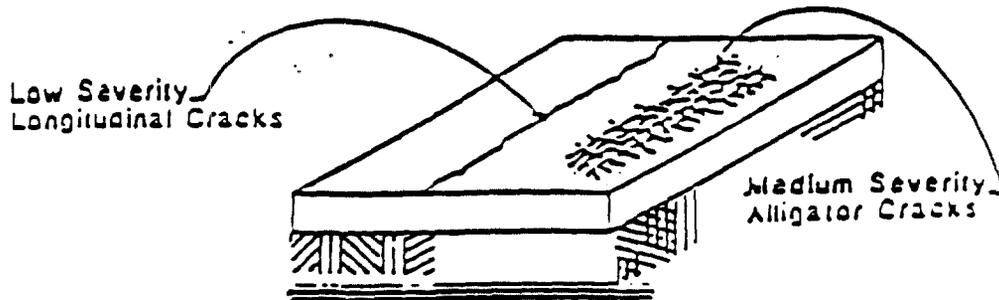
the following costs:

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.

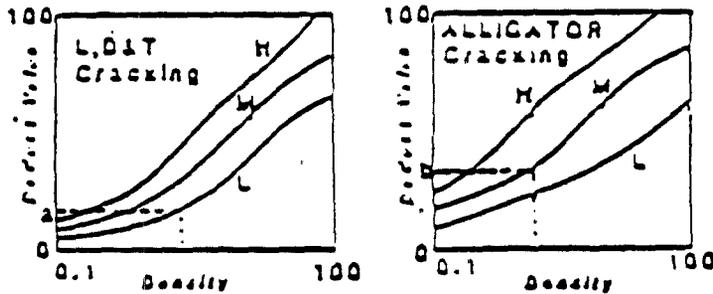
Chapter 4: Conclusions

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.

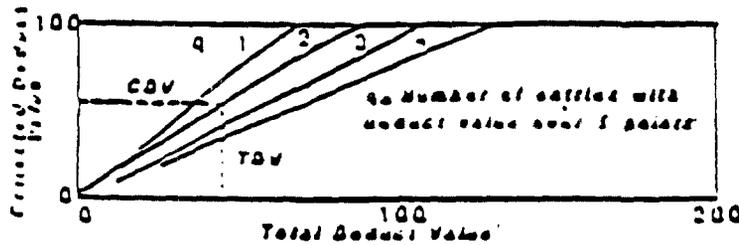


- * Step 2 Determine deduct values.



- * 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 — PCI —

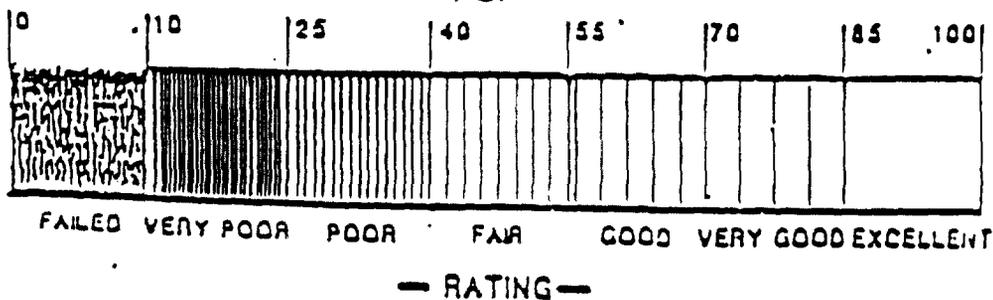
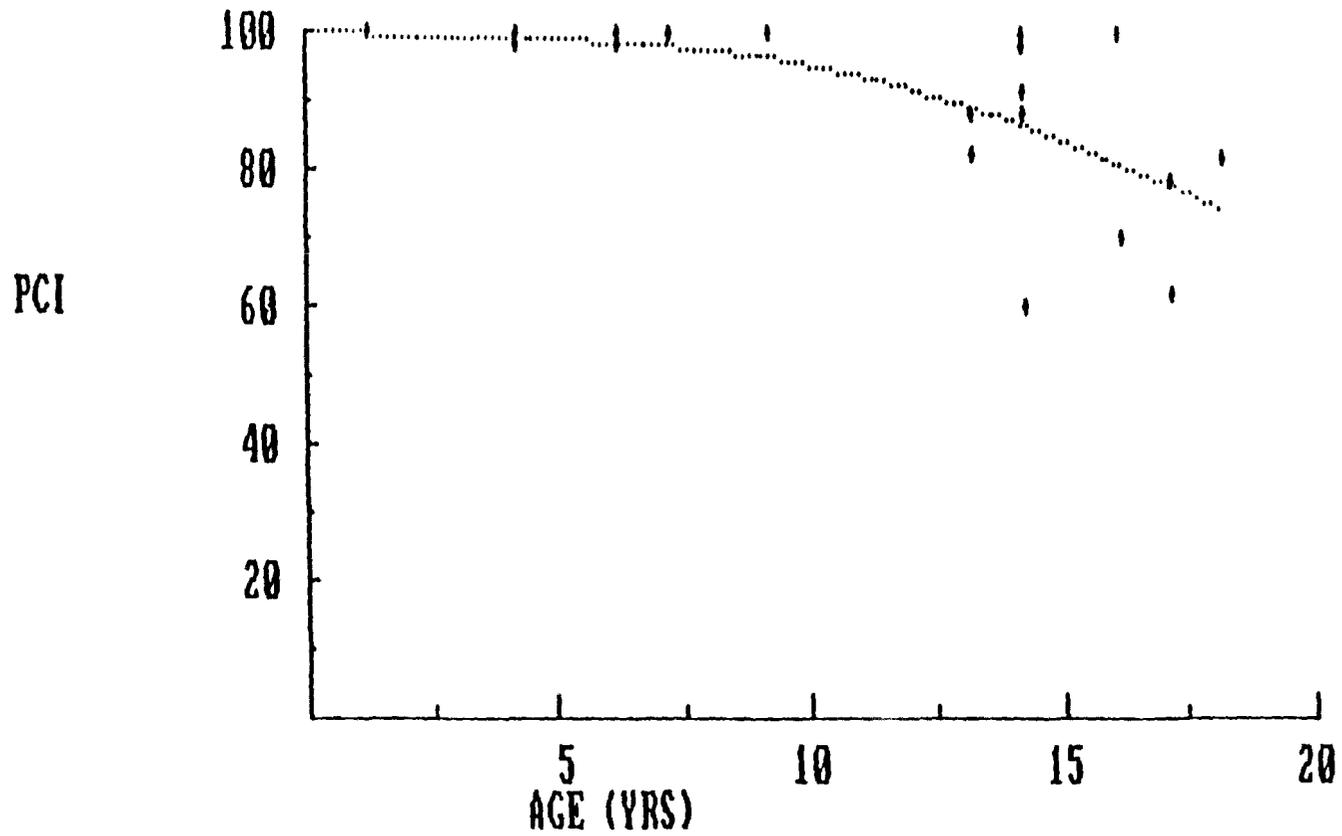


Figure 1 - Pavement Condition Index

Computation Procedure

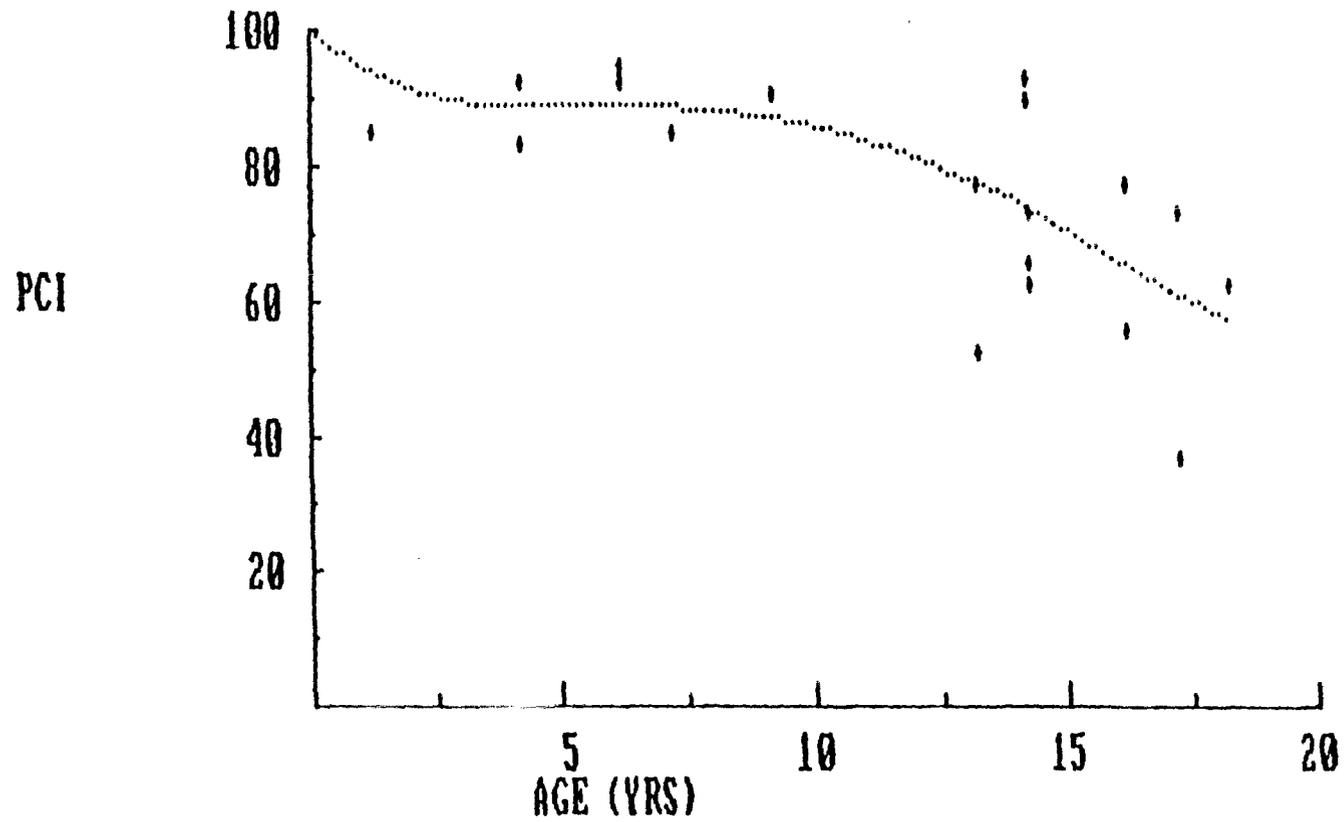
CONSTRAINED 4TH DEGREE CURVE FOR HACZL84



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

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

CONSTRAINED 4TH DEGREE CURVE FOR PACZL84



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

Figure 3: Deterioration of PCI with age - Patched areas

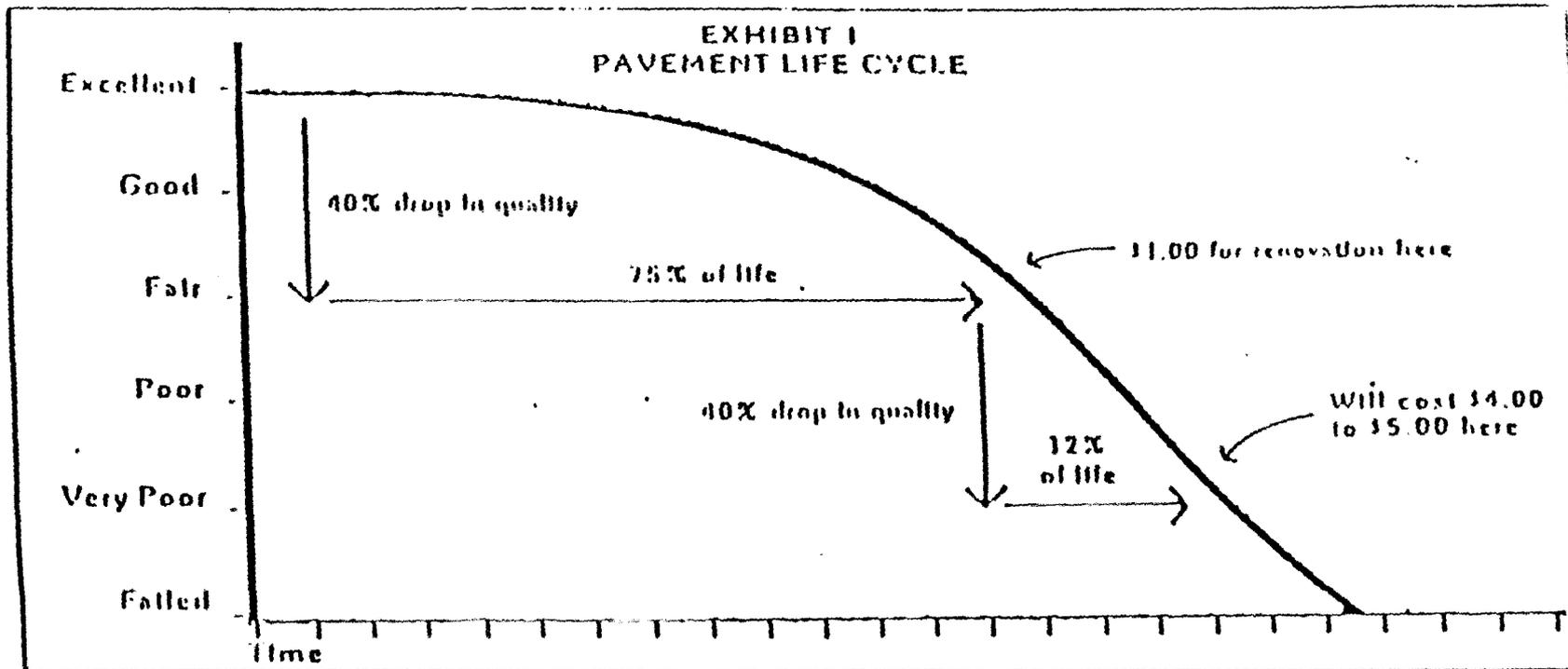
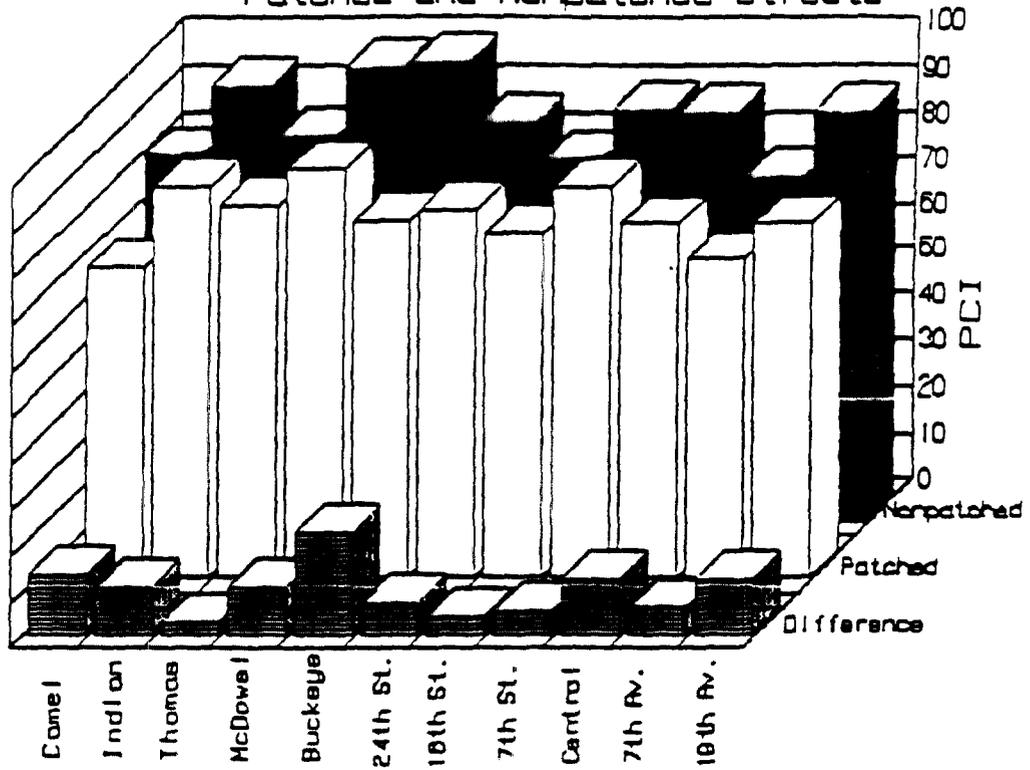


Figure 4: Renovation costs vs. pavement condition (Reprinted from APVA Reporter, November, 1903).

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



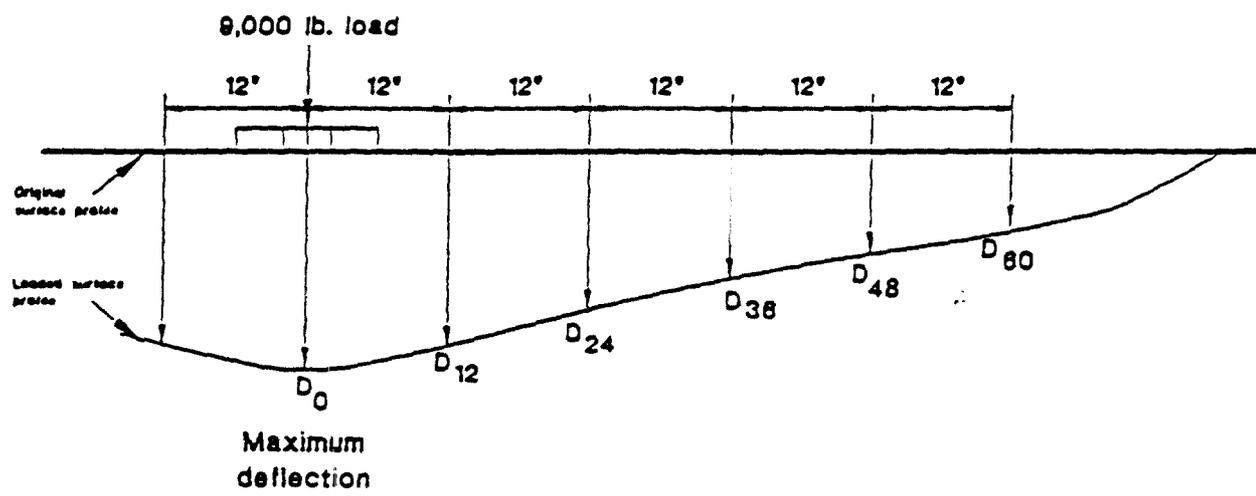
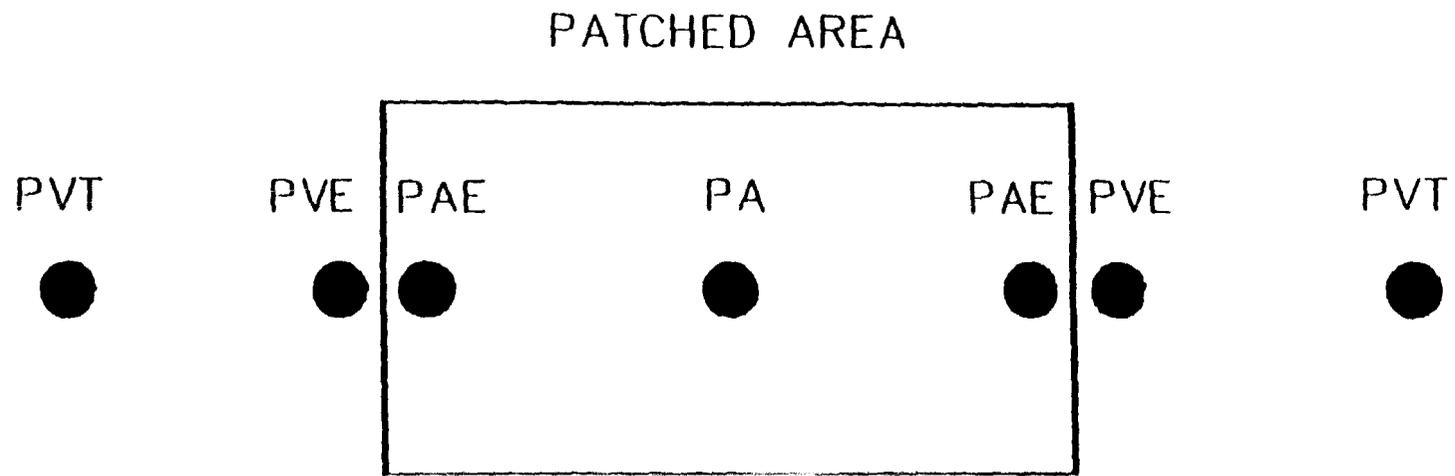


Figure 6. Deflection Basin and Sensor Locations



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

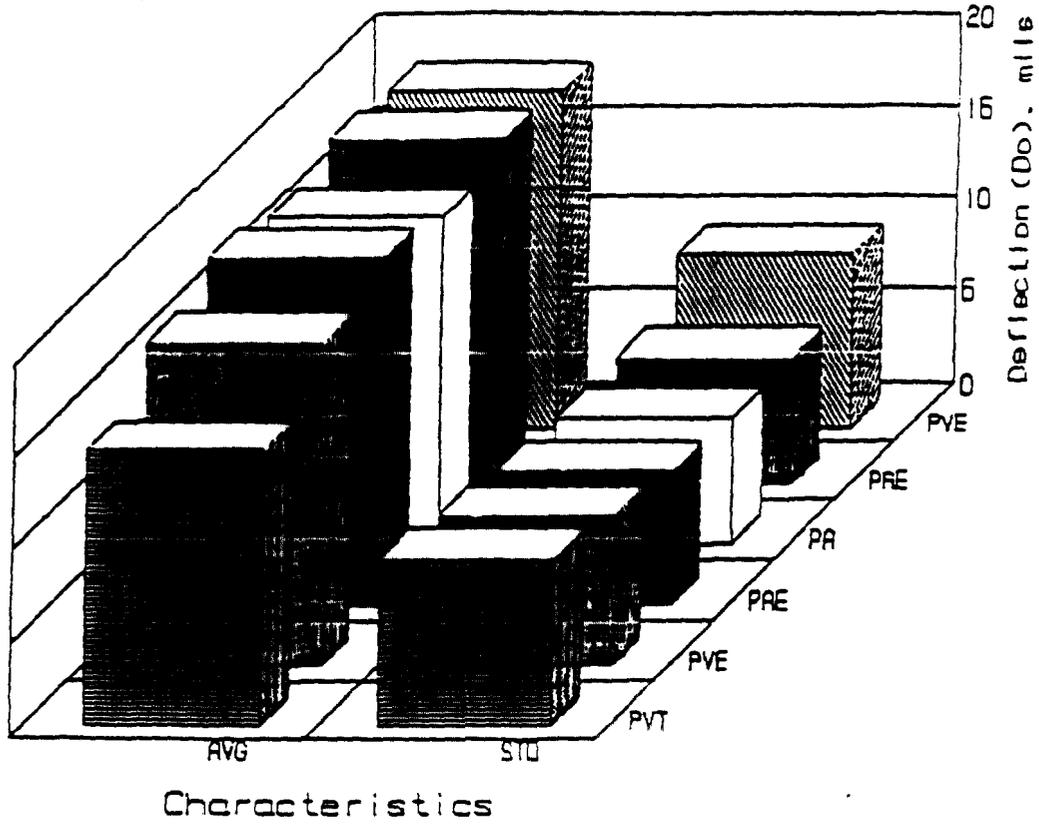


Table 1: Summary of PCI Results for Each Section

Branch	Section Number	Last Maintenance		PCI	
		Year	Type	Patched	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
McDowell	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

Street	Section	Overlay Thickness		Average Thickness	
		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 School	9	0.0	0.0		
	10	5.1	2.0	2.55	1.00
Thomas Road	11	3.2	2.2		
	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 Road	19	0.0	0.0		
	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

Street	Section	Overlay Thickness		Average Thickness	
		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		

**SOUTHWEST GAS VS. CITY OF PHOENIX
BRIEF SUMMARY**

The City of Phoenix, Arizona instituted a surcharge fee in 1987 for cutting into new street pavement (surcharge fee). The local gas company, Southwest Gas Corporation, filed suit against the City of Phoenix charging that the surcharge fee was excessive and unlawful. The ensuing litigation produced extensive documentation regarding the basis of the fee. Public Works staff reviewed the court documentation obtained from the City of Phoenix and found notable support for implementation of a surcharge fee

The following are excerpts from the court documents which provide highlights and notable findings. It includes excerpts from the affidavits of M. Y. Shahin, Ph.D., P.E., president of ERES International, Inc. who conducted the street deterioration studies for Phoenix and Burlington, Vermont. He is an expert in the field of pavement design as demonstrated by his extensive experience described in his June 1990 affidavit. Dr. Shahin's affidavits restate the findings of the studies showing that utility cuts produce damage to pavement regardless of the quality of the restoration.

Excerpts are also taken from documents prepared by Phoenix's legal counsel addressing the ability of the city to impose the fee. The documents assert that the surcharge bears a reasonable relationship to the legitimate governmental interest to preserve the streets and is a proper exercise of the City's police power. Also, the franchise fee is consideration for the grant of franchise only and is not intended to compensate the City for any and all costs associated with Southwest's use of the streets

EXCERPTS FROM COURT DOCUMENTS

- March 1987 The Council of the City of Phoenix enacted Ordinance G-2977 adding a subsection which provides in part: "It is the intent of this ordinance to avoid the cutting of new street pavement, or newly overlaid pavement. In the event that a street opening in new pavement cannot be avoided, a surcharge fee to cover damages and early deterioration is assessed".
- June 1990 **AFFIDAVIT OF JAMES E. MC CARTY**
American Society of Civil Engineers published a Manual of Improved Practice titled "Accommodation of Utility Plant within the Rights of Way of Urban Streets and Highways." Study recommended prohibiting cuts in new pavement and penalty fees for any cuts permitted during the prohibited period.
- June 1990 **AFFIDAVIT OF M. Y. SHAHIN Ph.D., P.E., PRESIDENT OF ERES INTERNATIONAL, INC.**
His experience includes pavement design for Victoria Regional Airport, Texas; Fairbanks International Airport, Alaska; Reno International Airport,

Nevada; Dulles International Airport, Washington, D.C.; all domestic airports in Saudi Arabia and Kuwait International Airport; development of Pavement Management Systems for the San Francisco Bay Area Metropolitan Transportation Center; and Development of standard pavement section design and pavement cut specifications for the City of Forth Worth, Texas.

“Inherent in the PCI procedures is 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 lack of experienced operators, inadequate compaction machines, inadequate soil moisture, etc. Consequently, pavements are penalized based on the patch severity level.”

Analysis of the pavement deflection testing data indicated that deflections within and around patches were averaged 25% greater than the non-patched areas.

“The results of ERES International’s study in the City of Phoenix suggests that the pavement performance and the service life is directly effected by the presence of pavement cut patches. This effect was approximated by a reductio 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 for maintaining patched pavements compared to non-patched pavement. The City’s pavement cut surcharge fee does not recover the cost associated with pavement cut patching and is therefore too low.”

June 1990

RESPONSE IN OPPOSITION TO PLAINTIFF’S MOTION FOR SUMMARY JUDGEMENT AND DEFENDANT’S CROSS-MOTION FOR PARTIAL SUMMARY JUDGEMENT ON ISSUE NO. 3: VALIDITY OF FEES

“The City certainly has a legitimate governmental interest in preserving the structural integrity of the City’s infrastructure. The surcharge bears a reasonable relationship to that governmental interest and is therefore a proper exercise of the City’s police power.

Municipalities all over the country have enacted ordinances limiting the right to cut new pavement or charging fees for doing so. (For example: Rochester, New York; Springfield, Illinois; Allentown, Pennsylvania) Many other municipalities simply ban cuts in roads less than three years old and require strict permitting and inspection procedures. Ann Arbor, Michigan has a pavement cut permitting process with a fee that varies based on the length of the cut, the type of cut and the type of pavement and bans street cuts on pavement less than three years old. Fort Wayne, Indiana also bars pavement

cuts to new pavement less than five years old and bars cuts on reconstructed pavement less than three years old, except in emergencies. Fort Wayne also charges fees on a sliding scale based upon the age of the roadway.

The pavement cut surcharge fee enacted by the City of Phoenix is a mainstream approach to the problem of reduced pavement life and increased maintenance costs resulting from frequent pavement cuts on urban roadways. A rational basis for the ordinance clearly exists.”

June 1990

DEFENDANT’S REPLY IN SUPPORT OF CROSS-MOTION FOR PARTIAL SUMMARY JUDGEMENT ON ISSUE NO. 1: IMPAIRMENT OF FRANCHISE RIGHT

“The franchise fee is consideration only for the grant of the franchise only and is not intended to compensate the City for any and all costs associated with Southwest’s use of City streets, nor does it bar the City from ever enacting ordinances that impose additional costs upon Southwest.”

“The goal of the pavement cut surcharge is to protect the structural integrity of City streets. The ordinance was intended to deter pavement cuts in newly laid pavement and create an incentive for better planning: utility lines should be coordinated with street construction and laid before paving, because cutting the pavement reduces the useful life of the streets. The ordinance has had this effect: utilities are coordinating more, and cutting pavement less.”

“Southwest was not given carte blanche to use the streets. Instead, as explicitly set forth in the franchise, the franchise right is subject to further regulation by the City in the interest of public welfare.”

March 1991

AFFIDAVIT OF M. Y. SHAHIN, Ph.D., P.E.

“Based on Dr. Hudson’s repetitive attacks upon the integrity of the Phoenix Study, he apparently failed to understand that the purpose of the Phoenix Study was not to evaluate patches performed by Southwest Gas or by any other specific utility. The objective of the study was to evaluate the effect of existing utility cut patches in the City of Phoenix on pavement performance.”

“The PCI analysis in the Phoenix Study eliminates pavements older than 20 years because modern design methodology utilized by most state highway departments and utilized by the City of Phoenix use a design life of 20 years.”

“Dr. Hudson’s opinion that the full deflection basin rather than the point of maximum deflection should have been used in the deflection study is without any basis. Because of the discontinuities in the utility patches use of the maximum deflection point is appropriate. The deflection basin does not mean

very much when the deflection measurements involve two discontinuous materials, which is always the case with patches. Additionally, the Asphalt Institute method referred to by Dr. Hudson in (his) Affidavit utilizes only the point of maximum deflection, the same as that utilized by the Phoenix Study”

March 1991 DEFENDANT’S REPLY IN SUPPORT OF CROSS-MOTION FOR PARTIAL SUMMARY JUDGEMENT ON ISSUE NO. 2: INTERFERENCE WITH STATE REGULATION OF PUBLIC SERVICE CORPORATIONS

“The fact that the plan review fee, inspection fee and pavement cut surcharge fee may impose a financial burden on Southwest does not render those ordinances invalid.”

“All utility companies operating in the City’s right of way are notified in advance of street construction or overlay projects on major and collector streets. Utility companies are asked for input regarding conflicts with the City’s street maintenance programs, and the City alters its schedule to accommodate the needs of the utility companies.”

“SOUTHWEST HAS IGNORED THE STATE LEGISLATURE’S EXPRESS DELEGATION OF POLICE POWER AUTHORITY TO MUNICIPALITIES TO REGULATE THE USE AND OCCUPANCY OF LOCAL STREETS”

“THERE IS INSUFFICIENT EVIDENCE IN THE RECORD TO ESTABLISH THAT THE CHALLENGED FEES IMPOSE A PROHIBITIVE COST ON THE EXTENSION OF GAS SERVICE TO NEW CUSTOMERS.”

“(Southwest) has the right to pass along the pavement cut surcharge fee to its new customers. For its own competitive reasons, Southwest has apparently chosen not to do so.”

March 1991 REPLY IN SUPPORT OF DEFENDANT’S CROSS-MOTION FOR PARTIAL SUMMARY JUDGEMENT ON ISSUE NO. 3: VALIDITY OF FEES

“Despite months of discovery, numerous depositions and the production of thousands of pages of documents, Southwest failed to prove that the revenue generated by the challenged fees is disproportionate to the cost of regulation.”

April 1992 Settlement agreement reached in which parties agree to the continued assessment of the pavement surcharge fee, not to be challenged for the life of the franchise agreement

JAN 19 1969

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CITY ATTORNEY

SETTLEMENT AGREEMENT

This Settlement Agreement (hereinafter "Agreement") is made and entered into at Phoenix, Arizona, by and between Southwest Gas Corporation, a California corporation, and the City of Phoenix, a body politic and corporate.

RECITALS

WHEREAS, on July 8, 1969, the Mayor and City Council of the City of Phoenix, Arizona, approved and set for election Ordinance S-4817, granting Arizona Public Service Company, its successors and assigns, among other things, the right, privilege and franchise to construct, install, operate and maintain a gas distribution plant and system within the City of Phoenix and additions thereto for twenty-five (25) years;

WHEREAS, a majority of the qualified electors residing within the City of Phoenix, voting at special election on August 19, 1969, approved Ordinance S-4817 and, on September 10, 1969, the Arizona Public Service Company duly accepted the said franchise;

WHEREAS, on May 30, 1984, the Arizona Corporation Commission issued Decision No. 54057, authorizing Arizona Public Service Company to sell and Southwest Gas Corporation to purchase all of the gas-related assets, rights and interests of Arizona Public Service Company, including the gas distribution plant and system in the City of Phoenix and Arizona Public Service Company's right and franchise to construct, install, operate and maintain that plant and system;

WHEREAS, effective November 1, 1984, Southwest Gas Corporation purchased all of the gas-related assets, rights and interests of Arizona Public Service Company;

WHEREAS, thereafter, the Mayor and the Council of the City of Phoenix approved the transfer of the franchise from Arizona Public Service Company to Southwest Gas Corporation;

WHEREAS, pursuant to the said franchise, Southwest Gas Corporation pays a franchise fee of two percent (2%) of the gross receipts from Southwest Gas Corporation's sales at retail of natural gas for use within the City of Phoenix for residential and commercial purposes as shown by Southwest Gas Corporation's billing records;

WHEREAS, by Ordinance G-2977, the City of Phoenix assesses Southwest Gas Corporation, in addition to the franchise fee, a "pavement surcharge fee" for cuts in any City pavement that is thirty (30) months or less old;

WHEREAS, the City of Phoenix assesses Southwest Gas Corporation an "inspection" fee;

WHEREAS, the City of Phoenix assesses Southwest Gas Corporation, in addition to the franchise, pavement surcharge and inspection fees, a permit fee;

WHEREAS, on November 23, 1988, Southwest Gas Corporation caused to be served on the City of Phoenix a Notice of Claim setting forth its claims that the pavement surcharges and inspection fees were excessive and unlawful;

WHEREAS, on December 2, 1988, Southwest Gas Corporation served a further Notice of Claim setting forth its claim that the permit fees were excessive and unlawful;

WHEREAS, on April 24, 1989, Southwest Gas Corporation filed suit against the City of Phoenix alleging the pavement surcharge, inspection and permit fees were excessive and unlawful;

WHEREAS, the City of Phoenix subsequently filed its Answer denying the allegations that the said fees were excessive and unlawful and litigation ensued, including extensive discovery by both parties and the filing of numerous motions and cross-motions for summary judgment; and,

WHEREAS, the parties now desire to settle this litigation;

AGREEMENT

NOW, THEREFORE, for and in consideration of the mutual undertakings, covenants, releases and agreements of the parties contained herein, and other good and sufficient consideration, the receipt of which is hereby acknowledged, it is hereby agreed between Southwest Gas Corporation and the City of Phoenix as follows:

1.0 PAYMENTS. The City of Phoenix agrees to pay to the order of Southwest Gas Corporation, by City warrant, the sum of One Hundred Fifty Thousand dollars (U.S. \$150,000.00) on or before the Effective Date of this Agreement as defined in Section 9.0 hereof.

2.0 RELEASE BY CITY. The City of Phoenix releases Southwest Gas Corporation, its successors, assigns, directors, officers, attorneys, employees, agents, and representatives, from any and all liabilities, claims, demands and other obligations to pay pavement surcharge, inspection and permit fees with respect to pavement cuts, inspections and plan reviews occurring between November 1, 1984 and the Effective Date of this Agreement, for which the City of Phoenix has assessed Southwest Gas Corporation or its predecessor a pavement surcharge, inspection and/or permit fee and which assessments have been paid. Notwithstanding the foregoing, the City of Phoenix does not release Southwest Gas Corporation from any obligation to pay further pavement surcharge, inspection and permit fees for pavement cuts, inspection and plan reviews occurring between November 1, 1984 and the Effective Date of this Agreement, where, in rendering the bill to Southwest Gas Corporation for these fees, the City made a clerical error in stating the amount the City had then calculated to be due.

3.0 DISMISSAL BY SOUTHWEST GAS CORPORATION. In consideration of the payments, undertakings, covenants and agreements of the City of Phoenix contained in this Agreement, Southwest Gas Corporation agrees to file with the Arizona Superior Court a joint stipulation to dismiss without prejudice Maricopa County Cause CV 89-11051, said cause being captioned as Southwest Gas Corporation, a California corporation vs. City of Phoenix, a body politic and corporate. The parties further

stipulate and agree that the said stipulation shall request the Arizona Superior Court to vacate all prior rulings and orders entered in the said cause and that the order to be presented to the Court with the said stipulation shall so provide. The parties agree that the stipulation and order to be presented to the Court shall take the form attached as Exhibits A and B to this Agreement and incorporated herein by this reference.

4.0 RELEASE BY SOUTHWEST GAS CORPORATION. Southwest Gas Corporation hereby releases the City of Phoenix, its mayor, council, boards, divisions, departments, sections, attorneys, employees, agents and representatives from any and all liabilities, claims, demands and other obligations arising from or in any manner related to those pavement surcharge, inspection and permit fees assessed by the City of Phoenix against Southwest Gas Corporation and its predecessor from November 1, 1984 through the Effective Date of this Agreement.

5.0 COVENANT NOT TO SUE OF SOUTHWEST GAS CORPORATION. Southwest Gas Corporation covenants that between, on the one hand, the Effective Date of this Agreement and, on the other hand, the termination of the currently existing franchise contract of the City of Phoenix and Southwest Gas Corporation or July 8, 1994, whichever occurs earlier, it will not initiate suit against the City of Phoenix on the following bases: (1) that the currently existing pavement surcharge, inspection and permit fees impair the current franchise contract of the City of Phoenix and Southwest Gas Corporation and (2) that the current existing