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16. Abstract

This report documents the construction of a Chemkrete modified asphaltic concrete field trial and presents first year performance data. Normal plant and roadway operations were maintained throughout the production of the Chemkrete modified mix. Initial binder testing, however, indicated the possibility of non-uniform blending of the Chemkrete addtive. An additional problem surfaced during production control and acceptance testing: stabilities below specification limits. While upon curing the mix attained stabilities greater than the control mix, the low initial stabilities may require changes to control and acceptance procedures.

Performance evaluations will be conducted on an annual basis and will include Pavement Condition Ratings, structural evaluation and the examination of binder properties (as extracted and recovered from roadway samples). Similar to initial production testing, the recovered binder from the first year's evaluation seems to indicate non-uniform blending of the Chemkrete additive. There was no other discernable difference in performance.

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CHEMKRETE MODIFIED ASPHALTIC CONCRETE FIELD TRIAL

CONSTRUCTION AND FIRST YEAR EVALUATION

by

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EXPERIMENTAL PROJECT PROGRAM
ASPHALT ADDITIVES

Research Report No. 179

Conducted by
LOUISIANA DEPARTMENT OF TRANSPORTATION
AND DEVELOPMENT
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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Background

From the late 1970's to the early 1980's Louisiana has directed much of its bituminous research effort in the area of asphalt additives. These efforts were initiated in response to a steadily decreasing quality aggregate supply in several districts. The associated problems were reflected by deteriorating mix properties and the higher costs to transport quality materials. A number of additives were examined in either the laboratory and/or field including sulphur, Styrelf 13 (a polymerized asphalt), latex, and Trinidad Lake Asphalt. Each of these products proclaimed mix enhancements such as increased strength and durability as reflected by fatigue resistance, improved temperature susceptiblity, resistance to deformation and resistance to water susceptibility. These additives were examined in dense graded asphaltic concrete in order to obtain better mix properties. Also, several of these additives were utilized to upgrade sand/asphalt mixes to take advantage of marginal sand materials prevalent in those districts where gravel was in short supply or non-existent.

In 1979, the Department was approached by representatives of Chem-Crete Corporation (later changed to Chemkrete when acquired by Lubrizol Corporation). They had developed an asphalt additive (soluble manganese) which, when blended with asphalt cements, would improve asphaltic concrete properties such as strength, temperature susceptibility and water susceptibility. The increased structural capacity of Chemkrete mixes due to the improved strength characteristics would allow for the use of non-quality aggregates such as sand. According to the literature successful projects utilizing desert sand had been constructed in the Middle East and Nigeria. On this basis it was decided to examine Chemkrete in the laboratory.

Laboratory Research Effort

In November 1979, a research study* was initiated to examine, in the laboratory, the physical characteristics of Chemkrete binder and sand/Chemkrete mixes. The binder was characterized by penetration (77°), viscosity (140, 275, 350°F), and ductility (77°F). Optimization of binder content for three distinct gradations (coarse to fine) was accomplished using the Marshall method. Also, mix properties such as retained strength, resistance to water, fundamental properties and strength-temperature susceptibility were examined.

The results of this study demonstrated that, upon curing, sand/ Chemkrete mixes could attain Marshall stabilities equal to or superior to Louisiana's dense-graded Type 1 asphaltic concrete (1200-pound stability) and that these mixes were able to withstand failure strains similar to conventional mixes at significantly higher failure stresses. Additionally, the Chemkrete mixes proved less water susceptible than control mixes.

Additional Considerations

On the basis of the research study findings a field trial was recommended utilizing a sand/Chemkrete mix as a base or binder course mix. Additionally, it was believed that the additive could be used in dense graded asphaltic concrete to either decrease section design thickness or provide a mix with increased strength characteristics. About this time, however, Chemkrete was experiencing problems in their field demonstration projects as modified sections displayed extensive cracking and ravelling. Generally these problems were traced to quality control and construction practices. Also, during

*Carey, D. E. and Paul, H. R., "Laboratory Evaluation of Modified Asphalt", Louisiana Department of Transportation and Development, January, 1981.

this time period the manganese concentration was reduced along with the use of softer grades of asphalt. Upon acquisition of the U. S. patents by Lubrizol in 1982, Chemkrete Technologies Inc. was formed as a wholly owned subsidiary. The product was additionally modified and the blended ratio of asphalt cement to Chemkrete was increased. The newer field trials did not experience the extensive cracking and ravelling of the earlier projects. With this in mind Louisiana decided to attempt a field trail.

In August 1983 a plan change was issued to an on-going contract to include the use of the Chemkrete additive for approximately 2.5 miles of a 10.2 mile reconstruction project. This report documents the construction of the Chemkrete field trial and presents first year performance data.

The reduction in design thickness for the Chemkrete section was attempted on the basis of two considerations: 1) to evaluate the manufacturer's claim of reduced section design due to the increase in strength associated with modified mix; and, 2) to take advantage of such reduction for economically equivalent designs. A plan view of the Chemkrete and control sections is provided in Figure. 2.

The plant was located in the town of Opelousas, Louisiana; this was approximately 22 miles from the La. 10 construction site.

Plant Operations

The original plans for this project called for the Chemkrete additive to be blended with a Texaco AC-20 in a storage tank at Port Neches, Texas. These plans, however, were not realized and the Chemkrete personnel provided a portable in-line volumetric proportioning device. This blending device meters both asphalt and modifier at the proper ratios using an air actuated control into an in-line blender prior to pumping into the plant asphalt working tank. Unfortunately, due to the locations and capacities of the pump at the plant, the control device was rendered useless. In order not to inconvenience the contractor by halting construction and after assurances from the manufacturer's representative that adequate blending could still be achieved, work continued using an alternative procedure. Using the known flow rate of the AC-20 from the tank truck, the Chemkrete was pumped at an appropriate rate through the in-line blender.

The first day's production produced an additional problem - that being approximately 10,000 gallons of AC-30 that was not utilized in the control sections. As the contractor had only one asphalt cement tank it was decided to blend Chemkrete with this material and evaluate it apart from the AC-20 section. About 700 gallons of Chemkrete was pumped into the working tank and circulated for 24 hours as recommended by Chemkrete personnel. The location of this material is annotated in Figure 2 and consisted of the majority of the first day's production.

No modifications or changes in production were necessary for the 400 ton per hour capacity dryer drum plant.

Materials and Mix Design

The source of coarse aggregate was a river gravel from Red Stick No. 1 (Bayville) while the sources for the coarse and fine sands were Trinity (Longville) and Mamou Pitt, respectively. Texaco supplied both the AC-30 and AC-20 asphalt cements from their plant at Port Neches, Texas. Perma-Tac antistrip agent from Dasch Oil and Chemical Company was utilized at a rate of 0.5% by weight of the asphalt cement according to specifications.

Job Mix Formulas for the control and Chemkrete sections are provided in Table 1. It should be noted that the Chemkrete mixes utilied the same JMF as the control mix wearing course.

Construction

Plant production of the Chemkrete modified asphaltic concrete began on September 2, 1983 and continued on September 8-9, 1983, under fair to cloudy skies with daytime temperatures in the mid nineties and nighttime temperatures in the high seventies. There were no modifications to normal plant or roadway procedures during the three days of production of the Chemkrete mix. Table 2 presents production data for the Chemkrete mix. Data for the conventional mix used as a control is also provided. It should be noted that the control wearing course was not placed until March 1984.

TABLE 1
PROJECT JOB MIX FORMULAS

Sequence No.	1	4	5	6
Mix Use	Binder	Wearing	Wearing	Wearing
Binder Type	AC-30	AC-30	AC-30+ Chemkrete	AC-20+ Chemkrete
Recommended Formula Percent Passing				
U. S. Sieve Size				
1-1/4"	100	100	100	100
1"	99	100	100	100
3/4"	94	97	97	97
1/2"	86	91	91	91
No. 4	57	57	57	57
No. 10	44	45	45	45
No. 40	28	28	28	28
No. 80	14	14	14	14
No. 200	7	7	7	7
%AC	5.0	5.5	5.5	5.5
% Crushed	80	80	80	80
Mix Temp.	300	300	300	300
Marshall Properties				
Specific Gravity	2.33	2.33	2.33	2.33
Theoretical Grav.	2.44	2.43	2.43	2.43
% Theoretical	95.5	95.9	95.9	95.9
% Voids	4.5	4.1	4.1	4.1
% V.F.A.	72.0	75.2	75.2	75.2
Marshall Stability	1400	1400	1400	1400
Flow	6	8	8	8

TABLE 2
PLANT PRODUCTION

Lot No.	Date Laid	Mix Type	Binder Type	Daily Tonnage
3	8/8/83	Binder	AC-30	1078
12	9/2/83	Wearing (Mod)	AC-30+Chemkrete	998
13	9/2/83	Wearing (Mod)	AC-20+Chemkrete	593
14	9/8/83	Wearing (Mod)	AC-20+Chemkrete	1523
15	9/9/83	Wearing (Mod)	AC-20+Chemkrete	925
18	3/9/84	Wearing	AC-30	1034
19	3/13/84	Wearing	AC-30	947

TABLE 3
PRODUCTION TEMPERATURES

	Lot 12	Lot 13	Lot 14	Lot 15
	310	300	310	265
	310	285	285	275
	295	285	295	270
	295	285	290	265
	280	285	310	280
			310	280
			280	275
			285	275
			305	280
			280	295
n	5	5	10	10
$\bar{x}$	298	288	295	276
s	13	7	13	9

Temperature control at the plant was generally maintained within the limits of the job mix formula (275 - 325°F). There were several truckloads during the last day of production (Lot 15) where low temperatures were observed as indicated in Table 3. This mix was, however, laid within allowable specification temperature limits (± 25°F of job mix formula tolerance limits).

Quality Control

Marshall properties and aggregate gradations were used for control testing during plant production according to specification. Based on the prior knowledge that the Chemkrete modified mix develops its strength over an extended curing period, additional Marshall specimens constructed at the plant were taken to the research laboratory for such tests. Table 4 contains the Marshall property data and Table 5 presents aggregate gradations and binder content attained from extracted loose mix samples. The lots representing the control sections are also included.

An anticipated concern was realized during the Marshall property testing; that the prior laboratory research had indicated an initial drop in binder viscosity upon addition of the Chemkrete additive. Also adding to this problem was the use of a softer asphalt. The direct consequence was observed in the reduction of Marshall stability at the plant. The mean stability for the conventional wearing course mix was 1383 lbs. (std dev = 118) while the Chemkrete modified mix had a mean of 1150 (std dev = 169) at the plant. Even though the cured specimens produced the expected higher stabilities the lower than specification stabilities (1200 lb. minimum) found at the plant will pose problems from the aspect of both mix control and acceptance. As payment is dictated by acceptance tests for mix stability, specification requirements may need to be adjusted for Chemkrete modified mixes should they be utilized beyond the experimental mode. Certainly, additional data would be have to be attained to promulgate such a change.

TABLE 4
MARSHALL TEST DATA FOR PLANT SPECIMENS

Chemkrete Modified Mix

Lot No.	Specimen Number	Stability (Lbs)	Flow (0.01 in)	Specific Gravity	Air (%)	VFA (%)
12	1	1179	9	2.34	3.7	77
	2*	1260	9	2.34	3.7	77
	3	1366	9	2.34	3.7	77
	4**	1650	9	2.35	3.3	79
13	1	1210	10	2.35	3.3	79
	2*	1660	9	2.36	2.9	81
	3	1436	11	2.35	3.3	79
	4**	1400	10	2.34	3.7	77
14	1	1228	9	2.34	3.7	77
	2***	2010	8	2.34	3.7	77
	3	1018	10	2.31	4.9	72
	4****	3020	9	2.31	4.9	72
	5	901	9	2.32	4.5	74
	6***	2280	8	2.32	4.5	74
	7	1138	10	2.35	3.3	79
	8****	2210	10	2.34	3.7	77
15	1	991	11	2.35	3.3	79
	2***	1610	10	2.35	3.3	79
	3	1037	9	2.35	3.3	79
	4****	2230	9	2.35	3.3	79
	5***	1700	9	2.37	2.5	84
	6****	2200	9	2.37	2.5	85
			Control Mix			
3	1	1184	-	2.32	4.9	70
	2	1238	-	2.33	4.5	72
	3	1265	-	2.31	5.3	68
	4	1125	-	2.33	4.5	72
18	1	1251	-	2.33	4.1	75
	2	1209	-	2.34	3.7	77
	3	1362	-	2.34	3.7	77
	4	1448	-	2.34	3.7	77
19	1	1585	-	2.34	3.7	77
	2	1368	-	2.33	4.1	75
	3	1448	-	2.36	2.9	81
	4	1389	-	2.34	3.7	77

* 4 Days cure at ambient temperature
** 1 week cure at 140°F
*** 2 week cure at 140°F
****4 week cure at 140°F

TABLE 5
EXTRACTED GRADATION AND BINDER CONTENT

Lot No.	3	12	13	14	15	18	19
Date Laid	8/8/83	9/2/83	9/2/83	9/8/83	9/9/83	3/9/84	3/13/84
Mix Type	B.C.	Mod W.C.	Mod W.C.	Mod W.C.	Mod W.C.	W.C.	W.C.
Gradation % Passing							
1-1/4"	100	100	100	100	100	100	100
1"	100	100	100	100	100	100	100
3/4"	98	98	97	98	100	98	97
1/2"	88	85	91	89	90	90	88
No. 4	54	55	55	60	57	60	54
No. 10	42	43	42	46	46	49	40
No. 40	24	26	26	27	31	28	24
No. 80	11	12	13	12	14	12	10
No. 200	6	6	7	6	8	8	6
Binder % (Weight)	4.9	5.4	5.5	5.1	5.9	5.2	5.4

The Marshall briquettes brought back to and tested at the research section indicate that, when cured, the Chemkrete mix does develop the additional strength associated with the additive. Generally the data follows the trend established in the earlier laboratory study with strengths levelling off in approximately two weeks. Figure 3 presents this relationship.

Fortunately the lower than anticipated plant stabilities did not pose a problem at the roadway. In fact when queried, roadway personnel, both department inspectors and contractor, replied that the Chemkrete modified mix was easier to lay and compact than the conventional mix. These results seem to be substantiated by the roadway core data as presented in Table 6.

In addition to normal quality control tests, several samples of the asphalt cement/Chemkrete binder were returned to the Department's materials laboratory to determine manganese content (manganese content being the Chemkrete identifier). The samples, tested according to procedures established by the manufacturer, registered manganese contents of 0.012 and 0.022. The manufacturer's representative indicated that the level of manganese should be approximately 0.1.

TABLE 6
ROADWAY DENSITIES AND PERCENT OF PLANT DENSITIES

Lot No.	3	12	13	14	15	18	19
Date Laid	8/8/83	9/2/83	9/2/83	9/8/83	9/9/83	3/9/84	3/9/84
Mix Type	B.C.	Mod W.C.	Mod W.C.	Mod W.C.	Mod W.C.	W.C.	W.C.
Specific Gravity	2.25	2.30	2.27	2.25	2.27	2.22	2.21
	2.23	2.27	2.28	2.23	2.22	2.19	2.25
	2.25	2.29	2.30	2.23	2.28	2.23	2.23
	2.23	2.28	2.29	2.29	2.28	2.24	2.23
	2.23	2.28	2.27	2.29	2.28	2.28	2.24
Mean	2.238	2.284	2.282	2.258	2.266	2.232	2.232
Std. Dev.	0.011	0.011	0.013	0.030	0.026	0.033	0.015
% of Plant	96.5	97.6	97.1	96.9	96.4	95.4	95.4

PERFORMANCE EVALUATION

Chemkretē modified and conventional asphaltic concrete sections were examined to evaluate performance characteristics from both a structural and serviceability aspect. Serviceability was monitored with a pavement condition rating (PCR) which incorporates Mays Ridemeter measurements for smoothness and different types of pavement distress such as bleeding, block, transverse and longitudinal cracking, corrugations, patching, rutting and ravelling. Each distress type is evaluated and assigned weighted deduct points based on severity and intensity of the distress. The sum total of deduct points forms a pavement distress rating, PDR, by subtracting from 100 percent, weighting and then combining with a weighted Mays reading in PSI in the following manner to provide the pavement condition rating.

$$PCR = [(100 - \text{Deduct Total Points})/4] + (\text{Mays PSI}) \times 5$$

(A perfect pavement score would be 50)

The Dynamic Deflection Determination System (Dynaflect) was used to evaluate the relative strengths of both the modified and conventional pavements. In addition, roadway cores were examined for further densification due to traffic and the quality of the asphalt cement. Performance evaluations were conducted at six sites on the project with each site encompassing approximately 200 feet. These sites were located as follows (also designated on Figure 2, page 6, by Site ID).

Site I.D.	Mix Type	Location
A	Modified W.C. (AC-30)	RL MP 5.5
B	Wearing Course	RL MP 0.3
C	Modified W.C. (AC-20)	RL MP 9.3
D	Modified W.C. (AC-20)	LL MP 9.1
E	Wearing Course	LL MP 1.05
F	Modified W.C. (AC-20)	LL MP 5.8

The project was evaluated in May 1984 and December 1984. The control section was not evaluated in May as it was newly constructed.

Pavement Condition Rating

The Pavement Condition Rating forms are provided in the Appendix and are summarized in Table 7. At this point in time there seems to be little difference in performance between the modified and conventional pavements. The Mays Ridemeter rating is perhaps slightly higher for the control section.

TABLE 7
PAVEMENT CONDITION RATING

Rating	PDR		MAYS		PCR	
Evaluation Date	5/84	12/84	5/84	12/84	5/84	12/84
Site ID						
A	24.7	23.0	4.0	3.9	44.7	42.5
B	-	23.4	-	4.3	-	44.9
C	24.3	23.5	3.8	4.0	43.3	43.5
D	24.3	22.2	3.7	3.7	42.8	40.7
E	-	23.4	-	4.1	-	43.9
F	23.8	22.6	3.9	4.1	43.3	43.1

Structural Evaluation

Dynaflect testing was accomplished at each site. A temperature deflection adjustment procedure was applied to each section, converting all deflections to their equivalent deflection at 60°F. Deflection data and corresponding structural number are included in Table 8. It is noted that an additional set of tests was accomplished during

TABLE 8
STRUCTURAL ANALYSIS

Dynaflect Property	Corrected Max Deflection			Percent Spread			Surface Curvature Index			Subgrade Modulus of Elasticity			Structural Number		
Date	5/84	12/84	6/85	5/84	12/84	6/85	5/84	12/84	6/85	5/84	12/84	6/85	5/84	12/84	6/85
Section															
A	.88	1.40	.88	77	79	78	.12	.12	.11	5500	3600	5333	3.7	3.4	3.8
B	–	.81	.54	–	80	77	–	.06	.06	–	5400	8567	–	4.2	4.6
C	.47	1.30	.47	80	72	78	.07	.15	.06	9000	4500	10500	5.0	2.7	4.8
D	1.34	1.10	.65	80	84	83	.08	.05	.04	6000	3800	6167	4.4	4.0	4.8
D	–	1.15	–	–	76	–	–	.10	–	–	3200	–	–	3.3	–
F	.99	1.71	1.02	74	76	79	.17	.17	.09	5200	4400	4600	3.4	2.7	3.7

the writing of this report due to the large drop in SN and elastic modulus between the May and December tests. The rebound in the values is indicative of the wet weather conditions affecting subgrade during the December evaluation; such seasonal variation has been observed before and is considered normal. The variation observed within the Chemkrete sections may be attributed to non uniformity of the Chemkrete blending at the plant. Additional deflection analysis with time will be used as a performance indicator.

Roadway Cores

One six-inch diameter roadway core was taken at each site during the evaluations. The cores were tested for density and then the asphalt cement was extracted. The binder content was determined and gradations were run on the aggregate samples. An Abson process was used to recover the binder for viscosity (140°F), penetration (77°F) and ductility (77°F) testing.

Densities and extraction analysis results are presented in Table 9. Additional compaction under traffic can be observed for both the Chemkrete and the control mixes although the Chemkrete modified mix has been densified to a greater extent. Total air voids based on a theoretically voidless mixture was an average 4.6 percent for the Chemkrete mix while the two control sections were 6.6 and 7.8 percent. Generally the extraction analysis showed both mixes to be within job mix formula limits; the exception being the No. 4 and No. 10 screens for the December 1984 sample from Site D. More noteworthy, however, was the binder content. The May 1984 evaluation found binder contents similar to those reported during construction. The December 1984 binder contents are lower in every case. These losses in binder content appear to be more than surface loss due to traffic. However, no signs of stripping were noted during the evaluation. Certainly binder content will bear closer examination during the second year evaluation.

TABLE 9
ROADWAY CORE ANALYSIS

Sample Site	A		B		C		D		E		F	
Evaluation Date	5/84	12/84	5/84	12/84	5/84	12/84	5/84	12/84	5/84	12/84	5/84	12/84
Specific Gravity	2.31	2.30	-	2.27	2.28	2.30	2.35	2.35	-	2.24	2.33	2.31
U. S. Sieve Size (% Passing)												
1-1/4"	100	100	-	100	100	100	100	100	-	100	100	100
1"	100	100	-	100	100	100	100	100	-	100	100	100
3/4"	100	100	-	100	99	94	100	94	-	95	92	100
1/2"	88	88	-	91	90	81	90	80	-	86	84	91
No. 4	53	53	-	62	63	52	54	49	-	54	54	54
No. 10	40	41	-	46	49	40	42	38	-	40	41	41
No. 40	22	29	-	28	31	27	28	26	-	26	26	27
No. 80	16	13	-	13	15	13	13	12	-	12	12	12
No. 200	8	7	-	7	8	7	7	6	-	8	7	7
%Binder Content	5.5	4.8	-	4.9	5.3	4.5	5.3	4.9	-	4.2	5.2	4.9
Viscosity 140°F)	25059	37394	-	47887	30052	73586	10361	25549	-	54911	25016	118265
Penetration (77°F)	31	28	-	23	27	22	41	31	-	19	29	13
Ductility (77°F)	26	14	-	14	21	9	134	30	-	12	31	7

Table 10 presents the properties of the recovered binder including results from loose mix and roadway cores sampled during construction. The properties obtained from binder recovered from construction loose mix and field cores was representative of mix placed for the particular lot containing each sample site. The viscosity, penetration and ductility data demonstrate peculiarities which will hopefully be better understood after additional evaluations. Sites A, C and F provide values which would be consistent with laboratory experience of the Chemkrete additive in that rather large increases in viscosity were observed. However, the variation among these sites is great. Also, logically the section containing the AC-30 plus Chemkrete, A, should have the highest viscosity. The lower than anticipated viscosity of Site D along with the variation at the other sites leads to the suspicion of inadequate blending at the plant. Such a supposition finds credence in the lower than anticipated manganese content found in the binder samples. Additional manganese testing will be included in the next field evaluation which will, in addition to other binder property testing, provide conclusive results.

It should be noted that the binder properties obtained from the control mix provided atypical results. Higher viscosities, lower penetrations and lower ductilities than normal were found. These properties may be due to a new crude source used by the refiner for which there is no track record. Again, it is hoped that the future evaluations will provide more information.

TABLE 10

BINDER PROPERTIES

Sample Site	A	B	C	D	E	F
Viscosity (140°F)						
Loose Mix	5451	-	2048	2048	-	1840
Field Core	3501	-	2077	2077	-	2066
May 84	25059	-	30052	10361	-	25016
December 84	37394	47887	73586	25549	54911	118265
Penetration (77°F)						
Loose Mix	57	-	88	88	-	87
Field Core	65	-	87	87	-	83
May 84	31	-	27	41	-	29
December 84	28	23	22	31	19	13
Ductility (77°F)						
Loose Mix	150+	-	150+	150+	-	150+
Field Core	150+	-	150+	150+	-	150+
May 84	26	-	21	134	-	31
December 84	14	14	9	30	12	7

ECONOMIC ANALYSIS

For this particular project the plan change involved an increase in cost of \$4.46/ton for the Chemkrete modified hot mix (from a bid of \$25.00/ton each for the planned 1.5-inch binder and 1.5-inch wearing course to \$29.46/ton for the 2-1/2-inch modified asphaltic concrete). This bid was accepted as very reasonable considering the base cost of the Chemkrete modifier was \$4.42/ton of mix (\$1200/ton of modifier x 5.5% A.C. x 6.67%). On balance, after a rebate for the conventional binder and wearing course a net savings was obtained due to the reduction in section thickness for the Chemkrete modified mix. Of course such economic parity (created by reduction of section design to counter the increase in materials cost) is predicated on equivalent performance over the life cycle of the pavement system.

While reduction in section design may achieve economic parity, consideration needs to be given to the other aspects of Chemkrete modified mix as claimed by the manufacturer. The increase in mix strength properties could be used in equivalent thickness design to produce a stronger material for systems such as urban interstate, or Chemkrete's improved temperature susceptibility characteristics could improve mix durability providing an increase in life cycle. To examine these aspects for equivalent design thickness from an economic viewpoint an annual cost comparison was evaluated. This analysis on a first cost only basis provided estimated life spans for equal annual costs. The bid prices from the La. 10 project were used assuming an 8.0 percent capital rate of return and no maintenance costs. According to this evaluation a Chemkrete mix would have to provide more than an additional three years of life for a conventional mix lasting ten years as follows:

MIX	FIRST COST ($/TON)	LIFE FOR EQUAL ANNUAL COST (YEARS)			
Type 1 Wearing Course	$25.00	4	6	8	10
Chemkrete Modifier Wearing Course	$29.46	4.9	7.5	10.2	13.0

An economic analysis of life cycle costs was also undertaken. Certainly such an examination can prove a useful management tool depending on the extent of hypothesis of maintenance data. Access to maintenance record keeping can provide excellent predictions. For the following scenario, a typical Louisiana design providing for 2-inches of hot mix over 8-1/2-inches of cement stabilized base was used. A records search indicated that such a system may have minor maintenance performed in years 7 through 9 with seal coat coming in year 10. A 1-1/2-inch overlay would be placed in year 15 with again some minor maintenance toward the end of the 20 year design. Allowing for this situation and the first cost analysis findings, the hypothetical scenario for a Chemkrete modified hot mix delays the maintenance actions for three years. For this evaluation first costs were converted to price per square yard. Considering an 8.0 percent rate of return the following results indicate that for this particular hypothesis the Chemkrete system would cost approximately $.02 per square yard, more on an annualized cost basis, than a conventional system:

Year	Conventional Mix Cost ($/Yd^2)	Conventional Mix Present Worth ($/Yd^2)	Chemkrete Modified Mix Cost ($/Yd^2)	Chemkrete Modified Mix Present Worth ($/Yd^2)
0	2.75	2.75	3.24	3.24
1				
2				
3				
4				
5				
6				
7	.05	.029		
8	.10	.054		
9	.25	.125		
10	.40	.185	.05	.023
11			.10	.043
12			.25	.099
13			.40	.147
14				
15	2.48	.782		
16				
17				
18			2.48	.621
19	.10	.023		
20	.15	.032		
Total Present Worth		3.98		4.17
Capital Recovery Factor		0.10185		0.10185
Uniform Annual Cost		.405		.425

CONCLUSIONS

1. Normal plant and roadway operations were maintained throughout production of the Chemkrete modified mix.

2. Initial testing indicated non-uniformity of blending of the Chemkrete material.

3. Normal control and acceptance testing may need modification to accommodate the inherent "curing" properties of the modified mix.

4. Greater than normal Marshall strengths were attained upon curing.

5. At this point in time there is no discernable difference in performance between the Chemkrete and control sections.

APPENDIX

PAVEMENT CONDITION RATING FORM FOR ASPHALT-SURFACED PAVEMENT

DISTRICT	03	PARISH	St Landrv	ROUTE	LA 10
CONTROL	219-07	SECTION	EB	SUBSECTION	A
LENGTH		C.S. LOG MILE	5.5	FUNCTIONAL CLASS	AC30 + Chemkrete
DATE	10 May 84	RATED BY	S. Kemp		

DISTRESS TYPE	WEIGHT FACTOR	SEVERITY LEVEL: LOW	MEDIUM	HIGH	EXTENT LEVEL: OCC	FREQ	EXT	DEDUCT POINTS (SEE BELOW)
		WEIGHT FACTOR			WEIGHT FACTOR			
BLEEDING	5	N/A .8	AGG/BIT .8	FREE BIT 1.0	<10%A .6	10%-30% .9	>30% 1.0	0
BLOCK / TRANSVERSE CRACKING	5	<1/8"W .4	1/8"-1" .7	> 1" 1.0	<20%L .5	20%-50% .7	>50% 1.0	0
CORRUGATIONS	5	NOTC. RIDE .4	DIS-COMFORT .8	SEVERE VIBRA. 1.0	<10%L .5	10%-30% .8	>30% 1.0	0
EDGE CRACKING	5	<1/4"W .4	>1/4" .7	MULT. >1/4" 1.0	<20%L .5	20%-50% .7	>50% 1.0	0
LONGITUDINAL JOINT CRACKING	5	SINGLE <1/8"W .4	MULT. <1/8"W SINGLE >1/8"W .7	MULT. CRACK. W/SPALL 1.0	<20%L .5	20%-50% .7	>50% 1.0	0
PATCH	15	SLIGHT DETER. .3	NOTC. RIDE .6	REPLACE 1.0	<10%L .6	10%-30% .8	>30% 1.0	0
POTHOLES	10	<6"W OR >6"W & <1"D .4	>6"W & 1-2"D .7	>6"W & >2"D 1.0	<20%L .5	20%-50% .8	>50% 1.0	0
RANDOM CRACKING	5	<1/8"W .4 x	1/8"-1" .7	> 1" 1.0	<20%L .5	20%-50% .7 x	>50% 1.0	1.4
RAVELING	10	-- AGGREGATE LOSS --- SLIGHT .3	MOD .6	SEVERE 1.0	<20%A .5	20%-50% .8	>50% 1.0	0
RUTTING 0 0 0 0 ,05	15	<1/4"D .3	1/4"-1" .7	>1" 1.0	<20%L .6	20%-50% .8	>50% 1.0	0
SETTLEMENT	5	NOTC. RIDE .5	DIS-COMFORT .7	DIP>6" 1.0	1/MI .5	2-4/MI .8	>4/MI 1.0	0
WHEEL PATH CRACKING	15	SINGLE/ INTMULT. <1/8"W .4	MULTI/ INTALL >1/8" .7	ALLIG >1/4" 1.0	<20% WPL .5	20%-50% .7	>50% 1.0	0

DEDUCT POINTS = DISTRESS WEIGHT FACTOR X SEVERITY WEIGHT X EXTENT WEIGHT FACTOR

TOTAL DEDUCT POINTS = 1.4
100 - TOTAL DEDUCT POINTS = 98.6

RURAL ROADS - PDR = (100 - TOTAL DEDUCT POINTS) / 4 = 24.65
MRR = (MAYS PSI) X 5 4 x 5 = ~~20.0~~

URBAN ROADS - PDR = (100 - TOTAL DEDUCT POINTS) / 5 = ______
MRR = (MAYS PSI) X 4 = ______

PAVEMENT CONDITION RATING = PDR + RR = 44.65

REMARKS : ______

PAVEMENT CONDITION RATING FORM FOR ASPHALT-SURFACED PAVEMENT

DISTRICT	03	PARISH	St Landry	ROUTE	LA 10
CONTROL	219-07	SECTION	EB	SUBSECTION	C
LENGTH		C.S. LOG MILE	9.3	FUNCTIONAL CLASS	AC20 + Chemkrete
DATE	10 May 84	RATED BY	S. Kemp		

DISTRESS TYPE	WEIGHT FACTOR	SEVERITY LEVEL LOW	MEDIUM	HIGH	EXTENT LEVEL OCC	FREQ	EXT	DEDUCT POINTS (SEE BELOW)
		WEIGHT FACTOR			WEIGHT FACTOR			
BLEEDING	5	N/A	AGG/BIT	FREE BIT	<10%A	10%-30%	>30%	0
		.8	.8	1.0	.6	.9	1.0	
BLOCK / TRANSVERSE CRACKING	5	<1/8"W	1/8"-1"	> 1"	<20%L	20%-50%	>50%	0
		.4	.7	1.0	.5	.7	1.0	
CORRUGATIONS	5	NOTC. RIDE	DIS-COMFORT	SEVERE VIBRA.	<10%L	10%-30%	>30%	0
		.4	.8	1.0	.5	.8	1.0	
EDGE CRACKING	5	<1/4"W	>1/4"	MULT. >1/4"	<20%L	20%-50%	>50%	0
		.4	.7	1.0	.5	.7	1.0	
LONGITUDINAL JOINT CRACKING	5	SINGLE <1/8"W	MULT. <1/8"W SINGLE >1/8"W	MULT. CRACK. W/SPALL	<20%L	20%-50%	>50%	1.4
		x .4	.7	1.0	.5	x .7	1.0	
PATCH	15	SLIGHT DETER.	NOTC. RIDE	REPLACE	<10%L	10%-30%	>30%	0
		.3	.6	1.0	.6	.8	1.0	
POTHOLES	10	<6"W OR >6"W & <1"D	>6"W & 1-2"D	>6"W & >2"D	<20%L	20%-50%	>50%	0
		.4	.7	1.0	.5	.8	1.0	
RANDOM CRACKING	5	<1/8"W	1/8"-1"	> 1"	<20%L	20%-50%	>50%	1.4
		x .4	.7	1.0	.5	x .7	1.0	
RAVELING	10	-- AGGREGATE LOSS --- SLIGHT	MOD	SEVERE	<20%A	20%-50%	>50%	0
		.3	.6	1.0	.5	.8	1.0	
RUTTING	15	<1/4"D	1/4"-1"	>1"	<20%L	20%-50%	>50%	0
0 0 0 0 0 0		.3	.7	1.0	.6	.8	1.0	
SETTLEMENT	5	NOTC. RIDE	DIS-COMFORT	DIP>6"	1/MI	2-4/MI	>4/MI	0
		.5	.7	1.0	.5	.8	1.0	
WHEEL PATH CRACKING	15	SINGLE/ INTMULT. <1/8"W	MULTI/ INTALL >1/8"	ALLIG >1/4"	<20% WPL	20%-50%	>50%	0
		.4	.7	1.0	.5	.7	1.0	

DEDUCT POINTS = DISTRESS WEIGHT FACTOR X SEVERITY WEIGHT X EXTENT WEIGHT FACTOR

TOTAL DEDUCT POINTS = 2.8

100 - TOTAL DEDUCT POINTS = 97.2

RURAL ROADS -

PDR = (100 - TOTAL DEDUCT POINTS) / 4 = 24.3

MRR = (MAYS PSI) X 5 5 x 3.8 = 19.0

URBAN ROADS -

PDR = (100 - TOTAL DEDUCT POINTS) / 5 = ______

MRR = (MAYS PSI) X 4 = ______

PAVEMENT CONDITION RATING = PDR + RR = 43.3

REMARKS : ______

PAVEMENT CONDITION RATING FORM FOR ASPHALT-SURFACED PAVEMENT

DISTRICT	03	PARISH	St Landry	ROUTE	LA 10
CONTROL	219-07	SECTION	WB	SUBSECTION	D
LENGTH		C.S. LOG MILE	9.1	FUNCTIONAL CLASS	AC20 + Chemkrete
DATE	10 May 84	RATED BY	S. Kemp		

DISTRESS TYPE	WEIGHT FACTOR	SEVERITY LEVEL LOW	MEDIUM	HIGH	EXTENT LEVEL OCC	FREQ	EXT	DEDUCT POINTS (SEE BELOW)
		WEIGHT FACTOR			WEIGHT FACTOR			
BLEEDING	5	N/A .8	AGG/BIT .8	FREE BIT 1.0	<10%A .6	10%-30% .9	>30% 1.0	0
BLOCK / TRANSVERSE CRACKING	5	<1/8"W .4	1/8"-1" .7	> 1" 1.0	<20%L .5	20%-50% .7	>50% 1.0	0
CORRUGATIONS	5	NOTC. RIDE .4	DIS-COMFORT .8	SEVERE VIBRA. 1.0	<10%L .5	10%-30% .8	>30% 1.0	0
EDGE CRACKING	5	<1/4"W .4	>1/4" .7	MULT. >1/4" 1.0	<20%L .5	20%-50% .7	>50% 1.0	0
LONGITUDINAL JOINT CRACKING	5	SINGLE <1/8"W X .4	MULT. <1/8"W SINGLE >1/8"W .7	MULT. CRACK. W/SPALL 1.0	<20%L .5	20%-50% X .7	>50% 1.0	1.4
PATCH	15	SLIGHT DETER. .3	NOTC. RIDE .6	REPLACE 1.0	<10%L .6	10%-30% .8	>30% 1.0	0
POTHOLES	10	<6"W OR >6"W & <1"D .4	>6"W & 1-2"D .7	>6"W & >2"D 1.0	<20%L .5	20%-50% .8	>50% 1.0	0
RANDOM CRACKING	5	<1/8"W .4X	1/8"-1" .7	> 1" 1.0	<20%L .5	20%-50% .7X	>50% 1.0	1.4
RAVELING	10	-- AGGREGATE LOSS --- SLIGHT .3	MOD .6	SEVERE 1.0	<20%A .5	20%-50% .8	>50% 1.0	0
RUTTING 0 0 0 0 0.05	15	<1/4"D .3	1/4"-1" .7	>1" 1.0	<20%L .6	20%-50% .8	>50% 1.0	0
SETTLEMENT	5	NOTC. RIDE .5	DIS-COMFORT .7	DIP>6" 1.0	1/MI .5	2-4/MI .8	>4/MI 1.0	0
WHEEL PATH CRACKING	15	SINGLE/ INTMULT. <1/8"W .4	MULTI/ INTALL >1/8" .7	ALLIG >1/4" 1.0	<20% WPL .5	20%-50% .7	>50% 1.0	0

DEDUCT POINTS = DISTRESS WEIGHT FACTOR X SEVERITY WEIGHT X EXTENT WEIGHT FACTOR

TOTAL DEDUCT POINTS = 2.8

100 - TOTAL DEDUCT POINTS = 97.2

RURAL ROADS -

PDR = (100 - TOTAL DEDUCT POINTS) / 4 = 24.3

MRR = (MAYS PSI) X 5   5 x 3.7 = 18.5

URBAN ROADS -

PDR = (100 - TOTAL DEDUCT POINTS) / 5 = ______

MRR = (MAYS PSI) X 4 = ______

PAVEMENT CONDITION RATING = PDR + RR = 42.8

REMARKS : ____________________

PAVEMENT CONDITION RATING FORM FOR ASPHALT-SURFACED PAVEMENT

DISTRICT	03	PARISH	St Landry	ROUTE	LA 10
CONTROL	219-07	SECTION	EB	SUBSECTION	A
LENGTH		C.S. LOG MILE	5.5	FUNCTIONAL CLASS	AC30 + Chemkrete
DATE	10 Dec 84	RATED BY	S. Kemp		

DISTRESS TYPE	WEIGHT FACTOR	SEVERITY LEVEL LOW / MEDIUM / HIGH (WEIGHT FACTOR)	EXTENT LEVEL OCC / FREQ / EXT (WEIGHT FACTOR)	DEDUCT POINTS (SEE BELOW)
BLEEDING	5	N/A / AGG/BIT / FREE BIT .8 / .8 / 1.0	<10%A / 10%-30% / >30% .6 / .9 / 1.0	0
BLOCK / TRANSVERSE CRACKING	5	<1/8"W / 1/8"-1" / > 1" .4 / .7 / 1.0	<20%L / 20%-50% / >50% .5 / .7 / 1.0	0
CORRUGATIONS	5	NOTC. RIDE / DIS-COMFORT / SEVERE VIBRA. .4 / .8 / 1.0	<10%L / 10%-30% / >30% .5 / .8 / 1.0	0
EDGE CRACKING	5	<1/4"W / >1/4" / MULT. >1/4" .4 / .7 / 1.0	<20%L / 20%-50% / >50% .5 / .7 / 1.0	0
LONGITUDINAL JOINT CRACKING	5	SINGLE <1/8"W / MULT. <1/8"W SINGLE >1/8"W / MULT. CRACK. W/SPALL .4 / .7 / 1.0	<20%L / 20%-50% / >50% .5 / .7 / 1.0	0
PATCH	15	SLIGHT DETER. / NOTC. RIDE / REPLACE .3 / .6 / 1.0	<10%L / 10%-30% / >30% .6 / .8 / 1.0	0
POTHOLES	10	<6"W OR >6"W & <1"D / >6"W & 1-2"D / >6"W & >2"D .4 / .7 / 1.0	<20%L / 20%-50% / >50% .5 / .8 / 1.0	0
RANDOM CRACKING	5	<1/8"W / 1/8"-1" / > 1" x .4 / .7 / 1.0	<20%L / 20%-50% / >50% .5 / .7 / x 1.0	2.0
RAVELING	10	-- AGGREGATE LOSS --- SLIGHT / MOD / SEVERE .3 / .6 / 1.0	<20%A / 20%-50% / >50% .5 / .8 / 1.0	0
RUTTING 0 0 -.05 .05 0	15	<1/4"D / 1/4"-1" / >1" .3 / .7 / 1.0	<20%L / 20%-50% / >50% .6 / .8 / 1.0	0
SETTLEMENT	5	NOTC. RIDE / DIS-COMFORT / DIP>6" .5 / .7 / 1.0	1/MI / 2-4/MI / >4/MI .5 / .8 / 1.0	0
WHEEL PATH CRACKING	15	SINGLE/INTMULT. <1/8"W / MULTI/INTALL >1/8" / ALLIG >1/4" x .4 / .7 / 1.0	<20% WPL / 20%-50% / >50% .5 / .7 / 1.0 x	6.0

DEDUCT POINTS = DISTRESS WEIGHT FACTOR X SEVERITY WEIGHT X EXTENT WEIGHT FACTOR

TOTAL DEDUCT POINTS = 8.0

100 - TOTAL DEDUCT POINTS = 92.0

RURAL ROADS -
PDR = (100 - TOTAL DEDUCT POINTS) / 4 = 23.0
MRR = (MAYS PSI) X 5 5 x 3.9 = 19.5

URBAN ROADS -
PDR = (100 - TOTAL DEDUCT POINTS) / 5 =
MRR = (MAYS PSI) X 4 =

PAVEMENT CONDITION RATING = PDR + RR = 42.5

REMARKS :

PAVEMENT CONDITION RATING FORM FOR ASPHALT-SURFACED PAVEMENT

DISTRICT	03	PARISH	St Landry	ROUTE	LA 10
CONTROL	219-07	SECTION	EB	SUBSECTION	B
LENGTH		C.S. LOG MILE	0.3	FUNCTIONAL CLASS	Control
DATE	10 Dec 84	RATED BY	S. Kemp		

DISTRESS TYPE	WEIGHT FACTOR	SEVERITY LEVEL LOW	MEDIUM	HIGH	EXTENT LEVEL OCC	FREQ	EXT	DEDUCT POINTS (SEE BELOW)
		WEIGHT FACTOR			WEIGHT FACTOR			
BLEEDING	5	N/A	AGG/BIT	FREE BIT	<10%A	10%-30%	>30%	
		.8	.8	1.0	.6	.9	1.0	0
BLOCK / TRANSVERSE CRACKING	5	<1/8"W	1/8"-1"	> 1"	<20%L	20%-50%	>50%	
		.4	.7	1.0	.5	.7	1.0	0
CORRUGATIONS	5	NOTC. RIDE	DIS- COMFORT	SEVERE VIBRA.	<10%L	10%-30%	>30%	
		.4	.8	1.0	.5	.8	1.0	0
EDGE CRACKING	5	<1/4"W	>1/4"	MULT. >1/4"	<20%L	20%-50%	>50%	
		.4	.7	1.0	.5	.7	1.0	0
LONGITUDINAL JOINT CRACKING	5	SINGLE <1/8"W	MULT. <1/8"W SINGLE >1/8"W	MULT. CRACK. W/SPALL	<20%L	20%-50%	>50%	
		.4	.7	1.0	.5	.7	1.0	0
PATCH	15	SLIGHT DETER.	NOTC. RIDE	REPLACE	<10%L	10%-30%	>30%	
		.3	.6	1.0	.6	.8	1.0	0
POTHOLES	10	<6"W OR >6"W & <1"D	>6"W & 1-2"D	>6"W & >2"D	<20%L	20%-50%	>50%	
		.4	.7	1.0	.5	.8	1.0	0
RANDOM CRACKING	5	<1/8"W	1/8"-1"	> 1"	<20%L	20%-50%	>50%	
		.4 X	.7	1.0	.5	.7	1.0 X	2.0
RAVELING	10	-- AGGREGATE LOSS --- SLIGHT	MOD	SEVERE	<20%A	20%-50%	>50%	
		.3	.6	1.0	.5	.8	1.0	0
RUTTING	15	<1/4"D	1/4"-1"	>1"	<20%L	20%-50%	>50%	
.05 .10 .05 .05 .10		.3X	.7	1.0	.6	.8	X.0	4.5
SETTLEMENT	5	NOTC. RIDE	DIS- COMFORT	DIP>6"	1/MI	2-4/MI	>4/MI	
		.5	.7	1.0	.5	.8	1.0	0
WHEEL PATH CRACKING	15	SINGLE/ INTMULT. <1/8"W	MULTI/ INTALL >1/8"	ALLIG >1/4"	<20% WPL	20%-50%	>50%	
		.4	.7	1.0	.5	.7	1.0	0

DEDUCT POINTS = DISTRESS WEIGHT FACTOR X SEVERITY WEIGHT X EXTENT WEIGHT FACTOR

TOTAL DEDUCT POINTS = 6.5

100 - TOTAL DEDUCT POINTS = 93.5

RURAL ROADS -

PDR = (100 - TOTAL DEDUCT POINTS) / 4 = 23.4

MRR = (MAYS PSI) X 5   5 x 4.3 = 21.5

URBAN ROADS -

PDR = (100 - TOTAL DEDUCT POINTS) / 5 = ______

MRR = (MAYS PSI) X 4 = ______

PAVEMENT CONDITION RATING = PDR + RR = 44.9

REMARKS : ______

PAVEMENT CONDITION RATING FORM FOR ASPHALT-SURFACED PAVEMENT

DISTRICT 03 PARISH St Landry ROUTE LA 10
CONTROL 219-07 SECTION EB SUBSECTION C
LENGTH ______ C.S. LOG MILE 9.3 FUNCTIONAL CLASS AC20 + Chemkrete
DATE 10 D3c 84 RATED BY S. Kemp

DISTRESS TYPE	WEIGHT FACTOR	SEVERITY LEVEL (LOW / MEDIUM / HIGH) WEIGHT FACTOR	EXTENT LEVEL (OCC / FREQ / EXT) WEIGHT FACTOR	DEDUCT POINTS (SEE BELOW)
BLEEDING	5	N/A .8; AGG/BIT .8; FREE BIT 1.0	<10%A .6; 10%-30% .9; >30% 1.0	0
BLOCK / TRANSVERSE CRACKING	5	<1/8"W .4 (x); 1/8"-1" .7; > 1" 1.0	<20%L .5 (x); 20%-50% .7; >50% 1.0	1.0
CORRUGATIONS	5	NOTC. RIDE .4; DIS-COMFORT .8; SEVERE VIBRA. 1.0	<10%L .5; 10%-30% .8; >30% 1.0	0
EDGE CRACKING	5	<1/4"W .4; >1/4" .7; MULT. >1/4" 1.0	<20%L .5; 20%-50% .7; >50% 1.0	0
LONGITUDINAL JOINT CRACKING	5	SINGLE <1/8"W .4; MULT. <1/8"W SINGLE >1/8"W .7; MULT. CRACK. W/SPALL 1.0	<20%L .5; 20%-50% .7; >50% 1.0	0
PATCH	15	SLIGHT DETER. .3; NOTC. RIDE .6; REPLACE 1.0	<10%L .6; 10%-30% .8; >30% 1.0	0
POTHOLES	10	<6"W OR >6"W & <1"D .4; >6"W & 1-2"D .7; >6"W & >2"D 1.0	<20%L .5; 20%-50% .8; >50% 1.0	0
RANDOM CRACKING	5	<1/8"W .4 (x); 1/8"-1" .7; > 1" 1.0	<20%L .5; 20%-50% .7; >50% 1.0 (x)	2.0
RAVELING	10	-- AGGREGATE LOSS --- SLIGHT .3; MOD .6; SEVERE 1.0	<20%A .5; 20%-50% .8; >50% 1.0	0
RUTTING 0 0 0 0 0	15	<1/4"D .3; 1/4"-1" .7; >1" 1.0	<20%L .6; 20%-50% .8; >50% 1.0	0
SETTLEMENT	5	NOTC. RIDE .5; DIS-COMFORT .7; DIP>6" 1.0	1/MI .5; 2-4/MI .8; >4/MI 1.0	0
WHEEL PATH CRACKING	15	SINGLE/ INTMULT. <1/8"W .4 (x); MULTI/ INTALL >1/8" .7; ALLIG >1/4" 1.0	<20% WPL .5 (x); 20%-50% .7; >50% 1.0	3.0

DEDUCT POINTS = DISTRESS WEIGHT FACTOR X SEVERITY WEIGHT X EXTENT WEIGHT FACTOR

TOTAL DEDUCT POINTS = 6.0
100 - TOTAL DEDUCT POINTS = 94.0

RURAL ROADS -
PDR = (100 - TOTAL DEDUCT POINTS) / 4 = 23.5
MRR = (MAYS PSI) X 5 5 x 4.0 = 20.0

URBAN ROADS -
PDR = (100 - TOTAL DEDUCT POINTS) / 5 = ______
MRR = (MAYS PSI) X 4 = ______

PAVEMENT CONDITION RATING = PDR + RR = 43.5

REMARKS : City installing new culverts on south side of roadway

PAVEMENT CONDITION RATING FORM FOR ASPHALT-SURFACED PAVEMENT

DISTRICT	03	PARISH	St Landry	ROUTE	LA 10
CONTROL	219-07	SECTION	WB	SUBSECTION	D
LENGTH		C.S. LOG MILE	9.1	FUNCTIONAL CLASS	AC20 + Chemkrete
DATE	10 Dec 84	RATED BY	S. Kemp		

DISTRESS TYPE	WEIGHT FACTOR	SEVERITY LEVEL LOW	MEDIUM	HIGH	EXTENT LEVEL OCC	FREQ	EXT	DEDUCT POINTS (SEE BELOW)
		WEIGHT FACTOR			WEIGHT FACTOR			
BLEEDING	5	N/A	AGG/BIT	FREE BIT	<10%A	10%-30%	>30%	
		.8	.8	1.0	.6	.9	1.0	0
BLOCK / TRANSVERSE CRACKING	5	<1/8"W	1/8"-1"	> 1"	<20%L	20%-50%	>50%	
		.4	.7	1.0	.5	.7	1.0	0
CORRUGATIONS	5	NOTC. RIDE	DIS-COMFORT	SEVERE VIBRA.	<10%L	10%-30%	>30%	
		.4	.8	1.0	.5	.8	1.0	0
EDGE CRACKING	5	<1/4"W	>1/4"	MULT. >1/4"	<20%L	20%-50%	>50%	
		.4	.7	1.0	.5	.7	1.0	0
LONGITUDINAL JOINT CRACKING	5	SINGLE <1/8"W	MULT. <1/8"W SINGLE >1/8"W	MULT. CRACK. W/SPALL	<20%L	20%-50%	>50%	
		.4	.7	1.0	.5	.7	1.0	0
PATCH	15	SLIGHT DETER.	NOTC. RIDE	REPLACE	<10%L	10%-30%	>30%	
		.3	.6	1.0	.6	.8	1.0	0
POTHOLES	10	<6"W OR >6"W & <1"D	>6"W & 1-2"D	>6"W & >2"D	<20%L	20%-50%	>50%	
		.4	.7	1.0	.5	.8	1.0	0
RANDOM CRACKING	5	<1/8"W	1/8"-1"	> 1"	<20%L	20%-50%	>50%	
		.4	.7	1.0	.5	.7	1.0	3.5
RAVELING	10	-- AGGREGATE LOSS --- SLIGHT	MOD	SEVERE	<20%A	20%-50%	>50%	
		.3	.6	1.0	.5	.8	1.0	0
RUTTING	15	<1/4"D	1/4"-1"	>1"	<20%L	20%-50%	>50%	
.05 0 0 0 .05		.3	.7	1.0	.5	.8	1.0	2.7
SETTLEMENT	5	NOTC. RIDE	DIS-COMFORT	DIP>6"	1/MI	2-4/MI	>4/MI	
		.5	.7	1.0	.5	.8	1.0	0
WHEEL PATH CRACKING	15	SINGLE/ INTMULT. <1/8"W	MULTI/ INTALL >1/8"	ALLIG >1/4"	<20% WPL	20%-50%	>50%	
		.4	.7	1.0	.5	.7	1.0	4.2

DEDUCT POINTS = DISTRESS WEIGHT FACTOR X SEVERITY WEIGHT X EXTENT WEIGHT FACTOR

TOTAL DEDUCT POINTS = 10.4

100 - TOTAL DEDUCT POINTS = 89.6

RURAL ROADS -
PDR = (100 - TOTAL DEDUCT POINTS) / 4 = 22.4
MRR = (MAYS PSI) X 5 5 x 3.7 = 18.5

URBAN ROADS -
PDR = (100 - TOTAL DEDUCT POINTS) / 5 = ______
MRR = (MAYS PSI) X 4 = ______

PAVEMENT CONDITION RATING = PDR + RR = 40.9

REMARKS : ______

PAVEMENT CONDITION RATING FORM FOR ASPHALT-SURFACED PAVEMENT

DISTRICT 03 PARISH St Landry ROUTE LA 10
CONTROL ~~219-07~~ SECTION WB SUBSECTION E
LENGTH ______ C.S. LOG MILE 1.05 FUNCTIONAL CLASS Control
DATE ~~10 Dec 84~~ RATED BY S. Kemp

DISTRESS TYPE	WEIGHT FACTOR	SEVERITY LEVEL LOW	MEDIUM	HIGH	EXTENT LEVEL OCC	FREQ	EXT	DEDUCT POINTS (SEE BELOW)
		WEIGHT FACTOR			WEIGHT FACTOR			
BLEEDING	5	N/A .8	AGG/BIT .8	FREE BIT 1.0	<10%A .6	10%-30% .9	>30% 1.0	0
BLOCK / TRANSVERSE CRACKING	5	<1/8"W .4	1/8"-1" .7	> 1" 1.0	<20%L .5	20%-50% .7	>50% 1.0	0
CORRUGATIONS	5	NOTC. RIDE .4	DIS-COMFORT .8	SEVERE VIBRA. 1.0	<10%L .5	10%-30% .8	>30% 1.0	0
EDGE CRACKING	5	<1/4"W .4	>1/4" .7	MULT. >1/4" 1.0	<20%L .5	20%-50% .7	>50% 1.0	0
LONGITUDINAL JOINT CRACKING	5	SINGLE <1/8"W .4	MULT. <1/8"W SINGLE >1/8"W .7	MULT. CRACK. W/SPALL 1.0	<20%L .5	20%-50% .7	>50% 1.0	0
PATCH	15	SLIGHT DETER. .3	NOTC. RIDE .6	REPLACE 1.0	<10%L .6	10%-30% .8	>30% 1.0	0
POTHOLES	10	<6"W OR >6"W & <1"D .4	>6"W & 1-2"D .7	>6"W & >2"D 1.0	<20%L .5	20%-50% .8	>50% 1.0	0
RANDOM CRACKING	5	<1/8"W .4X	1/8"-1" .7	> 1" 1.0	<20%L .5	20%-50% .7	>50% 1.0X	2.0
RAVELING	10	-- AGGREGATE LOSS --- SLIGHT .3	MOD .6	SEVERE 1.0	<20%A .5	20%-50% .8	>50% 1.0	0
RUTTING .05 .05 .05 .05 .05	15	<1/4"D .3X	1/4"-1" .7	>1" 1.0	<20%L .6	20%-50% .8	>50% 1.0X	4.5
SETTLEMENT	5	NOTC. RIDE .5	DIS-COMFORT .7	DIP>6" 1.0	1/MI .5	2-4/MI .8	>4/MI 1.0	0
WHEEL PATH CRACKING	15	SINGLE/ INTMULT. <1/8"W .4	MULTI/ INTALL >1/8" .7	ALLIG >1/4" 1.0	<20% WPL .5	20%-50% .7	>50% 1.0	0

DEDUCT POINTS = DISTRESS WEIGHT FACTOR X SEVERITY WEIGHT X EXTENT WEIGHT FACTOR

TOTAL DEDUCT POINTS = 6.5
100 - TOTAL DEDUCT POINTS = 93.5

RURAL ROADS - PDR = (100 - TOTAL DEDUCT POINTS) / 4 = 23.38
MRR = (MAYS PSI) X 5 5 x 4.1 = 20.5

URBAN ROADS - PDR = (100 - TOTAL DEDUCT POINTS) / 5 = ______
MRR = (MAYS PSI) X 4 = ______

PAVEMENT CONDITION RATING = PDR + RR = 43.9

REMARKS : ______________________

PAVEMENT CONDITION RATING FORM FOR ASPHALT-SURFACED PAVEMENT

DISTRICT 03	PARISH St Landry	ROUTE LA 10	
CONTROL 219-07	SECTION WB	SUBSECTION F	
LENGTH	C.S. LOG MILE 5.8	FUNCTIONAL CLASS AC20 + Chemkrete	
DATE 10 Dec 84	RATED BY S. Kemp		

DISTRESS TYPE	WEIGHT FACTOR	SEVERITY LEVEL LOW	MEDIUM	HIGH	EXTENT LEVEL OCC	FREQ	EXT	DEDUCT POINTS (SEE BELOW)
		WEIGHT FACTOR			WEIGHT FACTOR			
BLEEDING	5	N/A .8	AGG/BIT .8	FREE BIT 1.0	<10%A .6	10%-30% .9	>30% 1.0	0
BLOCK / TRANSVERSE CRACKING	5	<1/8"W .4	1/8"-1" .7	> 1" 1.0	<20%L .5	20%-50% .7	>50% 1.0	0
CORRUGATIONS	5	NOTC. RIDE .4	DIS-COMFORT .8	SEVERE VIBRA. 1.0	<10%L .5	10%-30% .8	>30% 1.0	0
EDGE CRACKING	5	<1/4"W .4	>1/4" .7	MULT. >1/4" 1.0	<20%L .5	20%-50% .7	>50% 1.0	0
LONGITUDINAL JOINT CRACKING	5	SINGLE <1/8"W .4	MULT. <1/8"W SINGLE >1/8"W .7	MULT. CRACK. W/SPALL 1.0	<20%L .5	20%-50% .7	>50% 1.0	0
PATCH	15	SLIGHT DETER. .3	NOTC. RIDE .6	REPLACE 1.0	<10%L .6	10%-30% .8	>30% 1.0	0
POTHOLES	10	<6"W OR >6"W & <1"D .4	>6"W & 1-2"D .7	>6"W & >2"D 1.0	<20%L .5	20%-50% .8	>50% 1.0	0
RANDOM CRACKING	5	<1/8"W .4x	1/8"-1" .7	> 1" 1.0	<20%L .5	20%-50% .7	>50% 1.0x	2.0
RAVELING	10	-- AGGREGATE LOSS --- SLIGHT .3	MOD .6	SEVERE 1.0	<20%A .5	20%-50% .8	>50% 1.0	0
RUTTING (0 .05 .05 .05 0)	15	<1/4"D .3x	1/4"-1" .7	>1" 1.0	<20%L .6	20%-50% .8	>50% 1.0x	4.5
SETTLEMENT	5	NOTC. RIDE .5	DIS-COMFORT .7	DIP>6" 1.0	1/MI .5	2-4/MI .8	>4/MI 1.0	0
WHEEL PATH CRACKING	15	SINGLE/ INTMULT. <1/8"W .4x	MULTI/ INTALL >1/8" .7	ALLIG >1/4" 1.0	<20% WPL .5x	20%-50% .7	>50% 1.0	3.0

DEDUCT POINTS = DISTRESS WEIGHT FACTOR X SEVERITY WEIGHT X EXTENT WEIGHT FACTOR

TOTAL DEDUCT POINTS = 9.5

100 - TOTAL DEDUCT POINTS = 90.5

RURAL ROADS - PDR = (100 - TOTAL DEDUCT POINTS) / 4 = 22.6

MRR = (MAYS PSI) X 5 5 x 4.1 = 20.5

URBAN ROADS - PDR = (100 - TOTAL DEDUCT POINTS) / 5 = _____

MRR = (MAYS PSI) X 4 = _____

PAVEMENT CONDITION RATING = PDR + RR = 43.1

REMARKS :