APPENDIX A
SUMMARY OF PMIS SCORES: BEAUMONT, BROWNWOOD, BRYAN, DALLAS, EL PASO 2001–2009

Table A1. PMIS Condition Score Summary, 2009.

Condition Scores 2009		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	90–100	134,424	71.8	4,026	75.0	4,495	78.3	4,903	71.8	5,864	58.4	3,494	74.1
Good	70–89	26,454	14.1	645	12.0	740	12.9	1,080	15.8	1,693	16.9	627	13.3
Fair	50–69	16,801	9.0	395	7.4	374	6.5	579	8.5	1,007	10.0	326	6.9
Poor	35–49	5,202	2.8	125	2.3	81	1.4	183	2.7	600	6.0	181	3.8
Very Poor	1–34	4,312	2.3	179	3.3	52	0.9	88	1.3	876	8.7	90	1.9
Lane Miles Rated		187,193	100	5,370	100	5,742	100	6,833	100	10,040	100	4,717	100

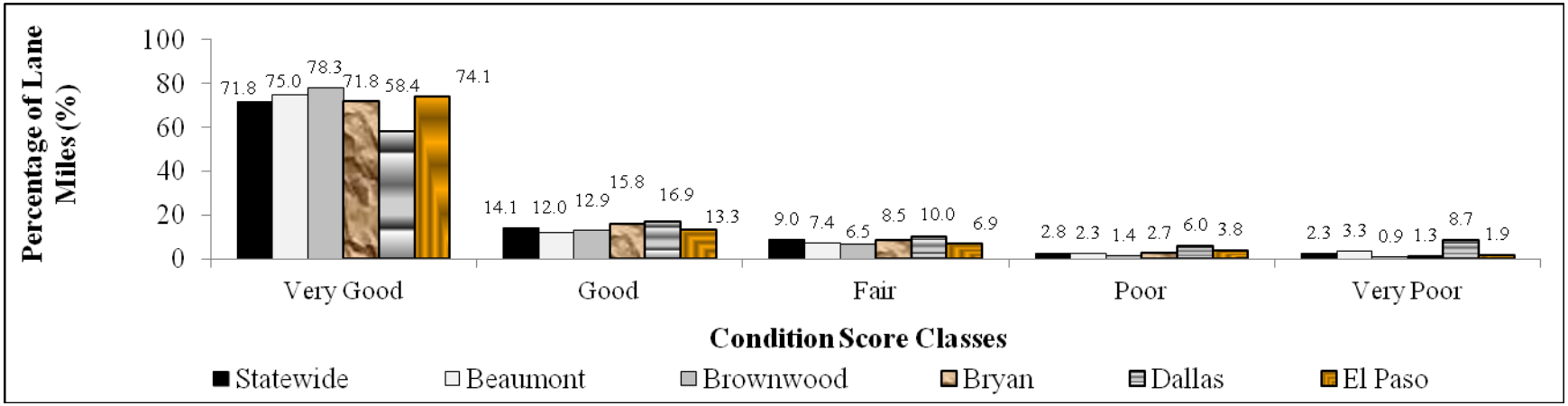


Figure A1. Percentage of Lane Miles Rated per Condition Score Class, 2009.

Table A2. PMIS Distress Score Summary, 2009.

Distress Scores 2009		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	90–100	147,009	78.3	4,402	82.0	4,618	80.4	5,624	82.3	7,788	77.6	3,950	83.7
Good	80–89	13,261	7.1	355	6.6	397	6.9	447	6.5	896	8.9	311	6.6
Fair	70–79	9,155	4.9	190	3.5	300	5.2	373	5.5	376	3.7	191	4.1
Poor	60–69	8,724	4.6	221	4.1	247	4.3	280	4.1	332	3.3	81	1.7
Very Poor	1–59	9,667	5.1	203	3.8	179	3.1	109	1.6	649	6.5	184	3.9
Lane Miles Rated		187,816	100	5,370	100	5,742	100	6,833	100	10,040	100	4,717	100

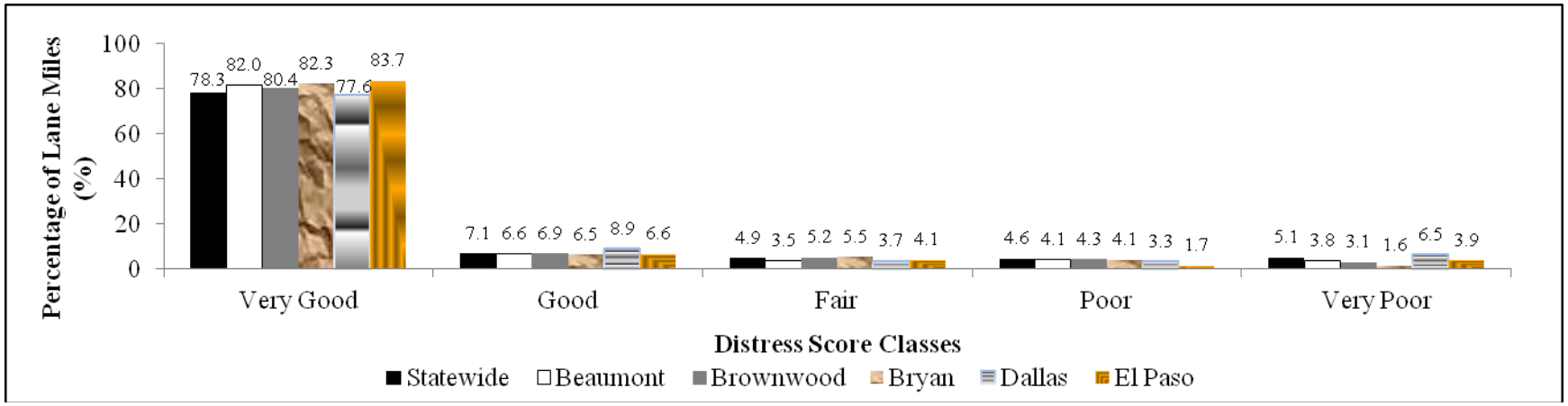


Figure A2. Percentage of Lane Miles Rated per Distress Score Class, 2009.

Table A3. PMIS Ride Score Summary, 2009.

Ride Scores 2009		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	4.0–5.0	46,758	25.0	1,815	33.8	948	16.5	1,606	23.5	1,428	14.2	1,189	25.2
Good	3.0–3.9	93,711	50.1	2,668	49.7	3,350	58.4	2,784	40.7	4,683	46.6	2,348	49.8
Fair	2.0–2.9	43,183	23.1	798	14.9	1,392	24.2	2,285	33.4	3,407	33.9	905	19.2
Poor	1.0–1.9	3,401	1.8	88	1.6	51	0.9	153	2.2	481	4.8	257	5.4
Very Poor	0.1–0.9	141	0.1	2	0.0	0	0.0	4	0.1	42	0.4	19	0.4
Lane Miles Rated		187,193	100	5,370	100	5,742	100	6,833	100	10,040	100	4,717	100

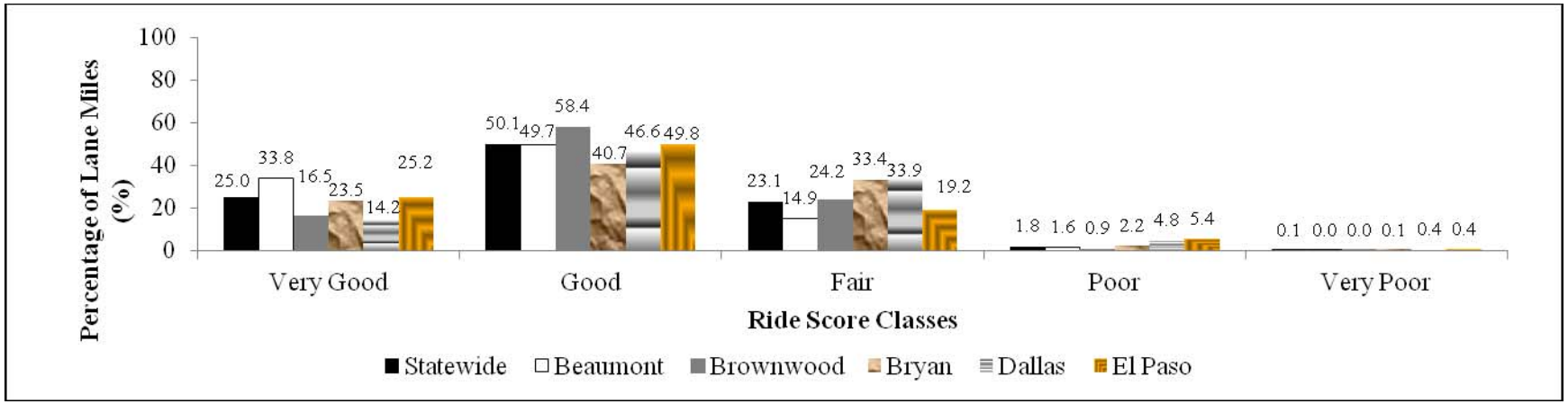


Figure A3. Percentage of Lane Miles Rated per Ride Score Class, 2009.

Table A4. PMIS Condition Score Summary, 2008.

Condition Scores 2008		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	90–100	143,946	77.8	3,886	74.7	4,653	80.9	4,390	65.4	5,308	53.9	3,311	70.4
Good	70–89	21,630	11.7	530	10.2	710	12.3	1,393	20.7	1,662	16.9	786	16.7
Fair	50–69	11,383	6.2	439	8.4	295	5.1	601	8.9	1,186	12.0	354	7.5
Poor	35–49	4,158	2.2	156	3.0	62	1.1	191	2.8	775	7.9	142	3.0
Very Poor	1–34	3,931	2.1	188	3.6	33	0.6	142	2.1	921	9.4	110	2.3
Lane Miles Rated		185,048	100	5,200	100	5,754	100	6,717	100	9,853	100	4,703	100

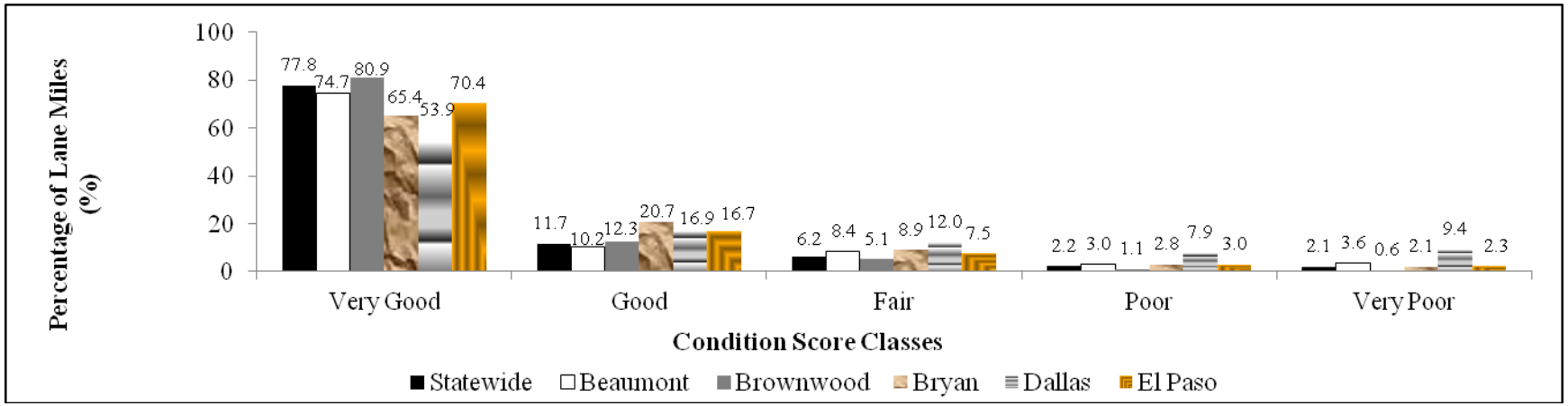


Figure A4. Percentage of Lane Miles Rated per Condition Score Class, 2008.

Table A5. PMIS Distress Score Summary, 2008.

Distress Scores 2008		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	90–100	158,879	85.5	4,251	81.7	4,760	82.7	4,976	74.1	7,861	79.8	3,726	79.2
Good	80–89	11,021	5.9	256	4.9	347	6.0	858	12.8	698	7.1	459	9.8
Fair	70–79	4,949	2.7	165	3.2	316	5.5	403	6.0	331	3.4	198	4.2
Poor	60–69	4,654	2.5	228	4.4	195	3.4	335	5.0	316	3.2	127	2.7
Very Poor	1–59	6,306	3.4	299	5.8	137	2.4	145	2.2	647	6.6	194	4.1
Lane Miles Rated		185,808	100	5,200	100	5,754	100	6,717	100	9,853	100	4,703	100

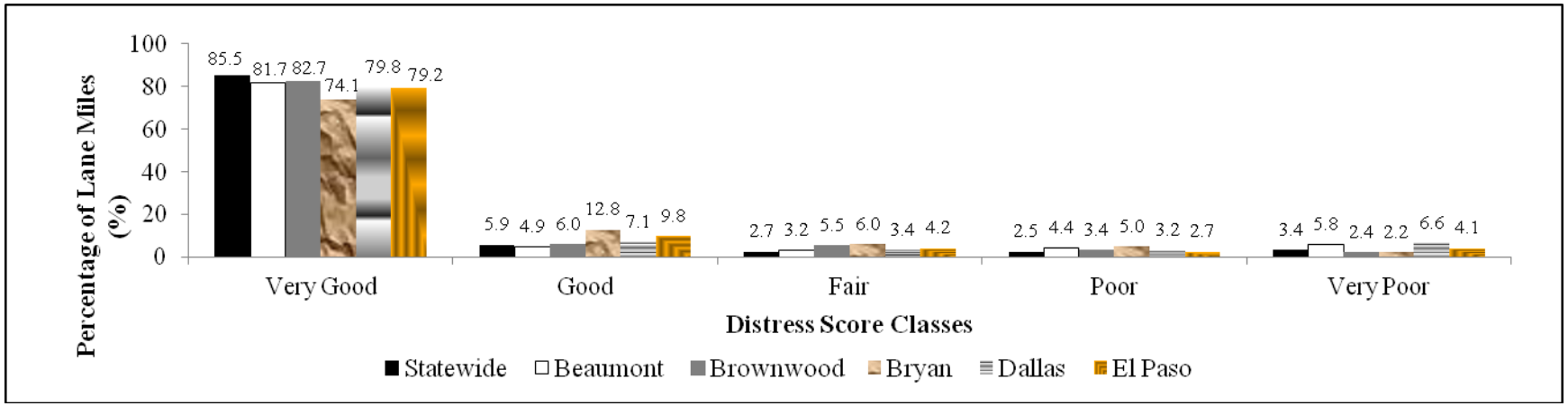


Figure A5. Percentage of Lane Miles Rated per Distress Score Class, 2008.

Table A6. PMIS Ride Score Summary, 2008.

Ride Scores 2008		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	4.0–5.0	46,481	24.3	1,526	29.4	819	14.2	1,763	26.3	692	7.0	1,073	22.8
Good	3.0–3.9	97,671	51.0	2,736	52.6	3,642	63.3	2,831	42.1	4,411	44.8	2,475	52.6
Fair	2.0–2.9	43,641	22.8	870	16.7	1,258	21.9	1,916	28.5	4,135	42.0	907	19.3
Poor	1.0–1.9	3,701	1.9	67	1.3	35	0.6	197	2.9	588	6.0	232	4.9
Very Poor	0.1–0.9	163	0.1	2	0.0	1	0.0	9	0.1	27	0.3	16	0.3
Lane Miles Rated		191,656	100	5,200	100	5,754	100	6,717	100	9,853	100	4,703	100

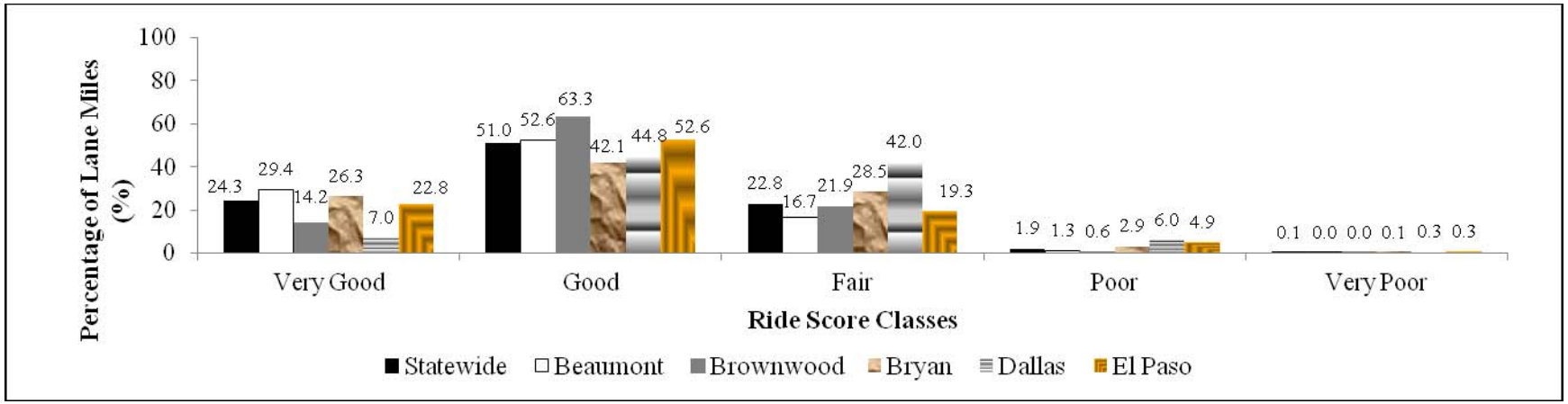


Figure A6. Percentage of Lane Miles Rated per Ride Score Class, 2008.

Table A7. PMIS Condition Score Summary, 2007.

Condition Scores 2007		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	90–100	144,174	78.1	4,075	76.9	4,567	79.9	4,780	71.2	5,755	57.9	3,636	78.2
Good	70–89	21,724	11.8	547	10.3	763	13.3	1,048	15.6	1,652	16.6	555	11.9
Fair	50–69	10,972	5.9	333	6.3	301	5.3	556	8.3	1,054	10.6	248	5.3
Poor	35–49	3,947	2.1	132	2.5	59	1.0	190	2.8	579	5.8	123	2.6
Very Poor	1–34	3,793	2.1	211	4.0	25	0.4	140	2.1	906	9.1	87	1.9
Lane Miles Rated		184,611	100	5,297	100	5,714	100	6,714	100	9,946	100	4,647	100

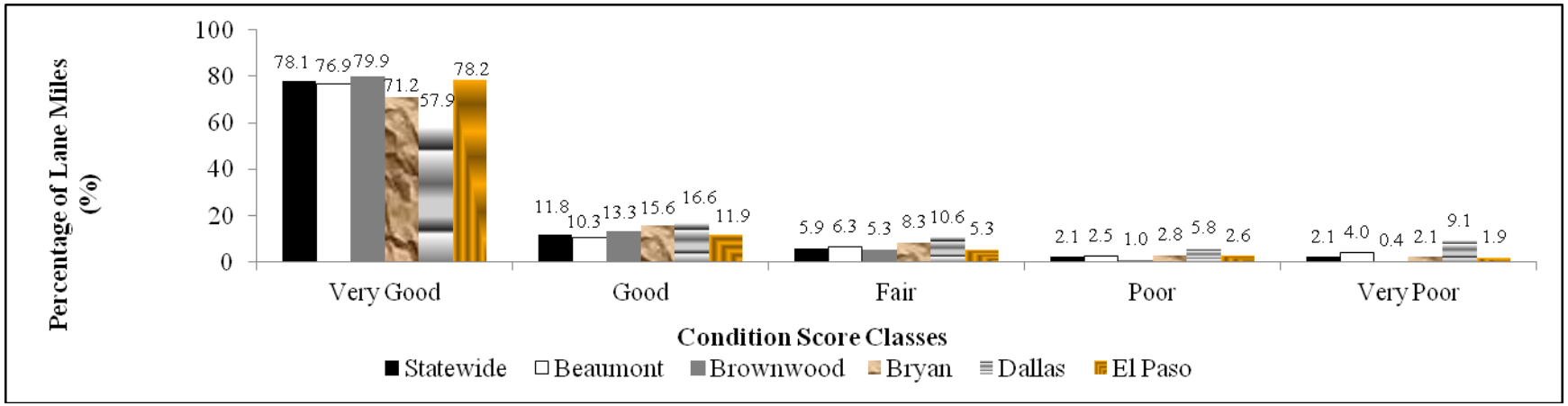


Figure A7. Percentage of Lane Miles Rated per Condition Score Class, 2007.

Table A8. PMIS Distress Score Summary, 2007.

Distress Scores 2007		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	90–100	159,041	85.9	4,498	84.9	4,697	82.2	5,543	82.6	7,403	74.4	4,054	87.2
Good	80–89	10,702	5.8	278	5.3	372	6.5	494	7.4	839	8.4	267	5.7
Fair	70–79	4,805	2.6	134	2.5	326	5.7	262	3.9	405	4.1	115	2.5
Poor	60–69	4,479	2.4	129	2.4	198	3.5	224	3.3	381	3.8	95	2.0
Very Poor	1–59	6,076	3.3	258	4.9	120	2.1	191	2.8	919	9.2	116	2.5
Lane Miles Rated		185,103	100	5,297	100	5,714	100	6,714	100	9,946	100	4,647	100

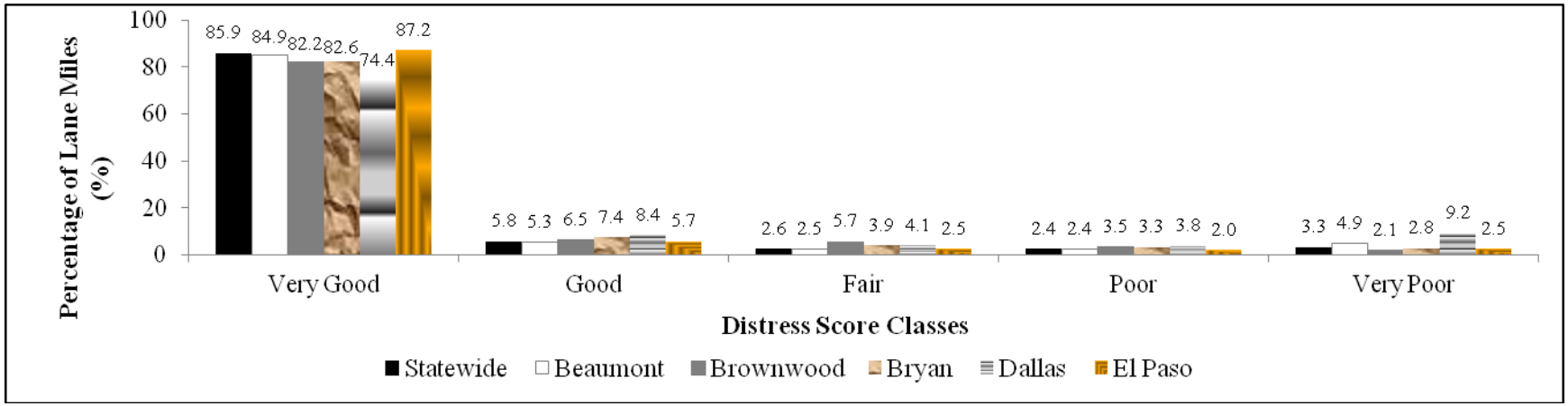


Figure A8. Percentage of Lane Miles Rated per Distress Score Class, 2007.

Table A9. PMIS Ride Score Summary, 2007.

Ride Scores 2007		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	4.0–5.0	45,125	24.4	1,604	30.3	990	17.3	1,719	25.6	1,316	13.2	891	19.2
Good	3.0–3.9	92,295	50.0	2,884	54.4	3,303	57.8	2,593	38.6	4,927	49.5	2,528	54.4
Fair	2.0–2.9	42,943	23.3	735	13.9	1,381	24.2	2,168	32.3	3,290	33.1	972	20.9
Poor	1.0–1.9	4,107	2.2	68	1.3	38	0.7	229	3.4	388	3.9	238	5.1
Very Poor	0.1–0.9	163	0.1	6	0.1	2	0.0	6	0.1	25	0.3	19	0.4
Lane Miles Rated		184,633	100	5,297	100	5,714	100	6,714	100	9,946	100	4,647	100

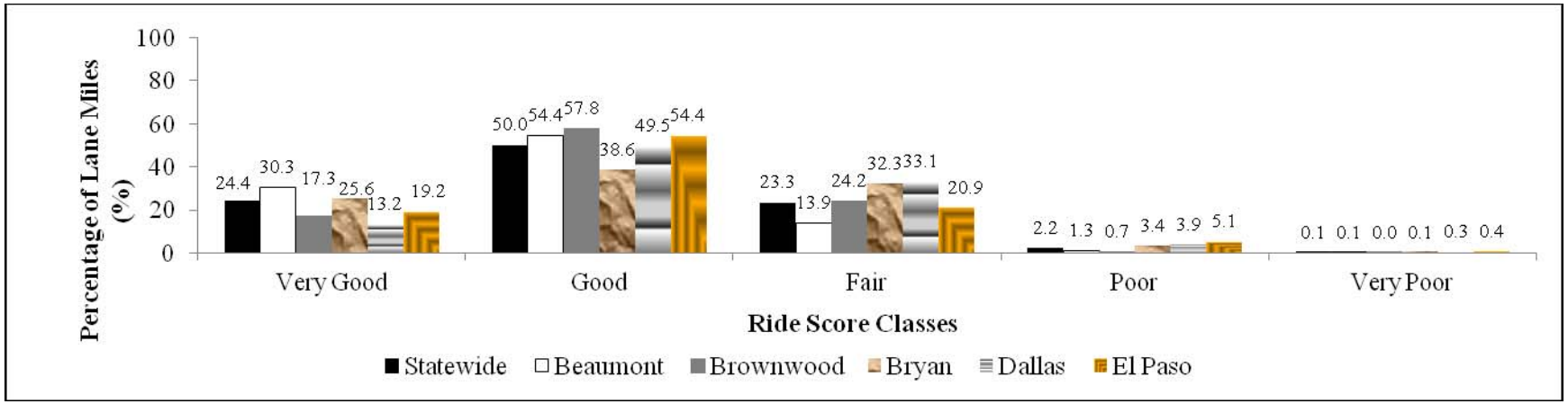


Figure A9. Percentage of Lane Miles Rated per Ride Score Class, 2007.

Table A10. PMIS Condition Score Summary, 2006.

Condition Scores 2006		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	90–100	133,943	73.0	3,916	71.9	4,588	79.5	4,179	63.0	5,493	56.0	2,840	66.4
Good	70–89	25,127	13.7	611	11.2	869	15.1	1,247	18.8	1,559	15.9	744	17.4
Fair	50–69	15,304	8.3	434	8.0	263	4.6	750	11.3	1,134	11.6	432	10.1
Poor	35–49	4,859	2.6	196	3.6	31	0.5	250	3.8	634	6.5	145	3.4
Very Poor	1–34	4,282	2.3	291	5.3	21	0.4	203	3.1	984	10.0	117	2.7
Lane Miles Rated		183,515	100	5,448	100	5,771	100	6,629	100	9,803	100	4,278	100

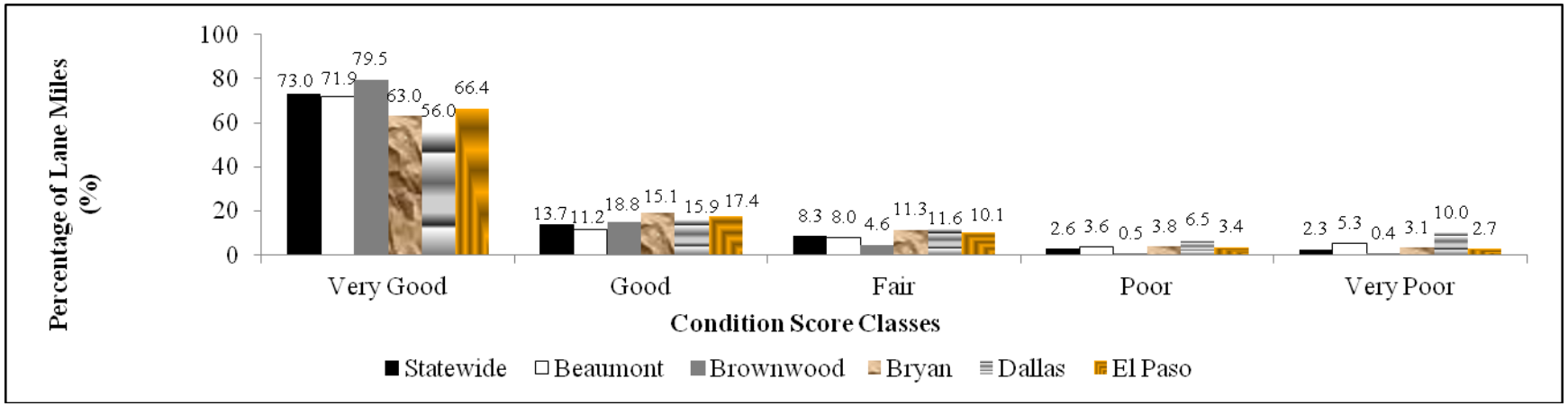


Figure A10. Percentage of Lane Miles Rated per Condition Score Class, 2006.

Table A11. PMIS Distress Score Summary, 2006.

Distress Scores 2006		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	90–100	147,011	79.7	4,452	81.7	4,712	81.6	4,929	74.3	7,245	73.9	3,549	82.9
Good	80–89	12,206	6.6	285	5.2	455	7.9	615	9.3	766	7.8	288	6.7
Fair	70–79	8,647	4.7	197	3.6	338	5.9	379	5.7	368	3.8	211	4.9
Poor	60–69	7,986	4.3	219	4.0	198	3.4	382	5.8	388	4.0	115	2.7
Very Poor	1–59	8,645	4.7	295	5.4	68	1.2	325	4.9	1,036	10.6	116	2.7
Lane Miles Rated		184,495	100	5,448	100	5,771	100	6,629	100	9,803	100	4,278	100

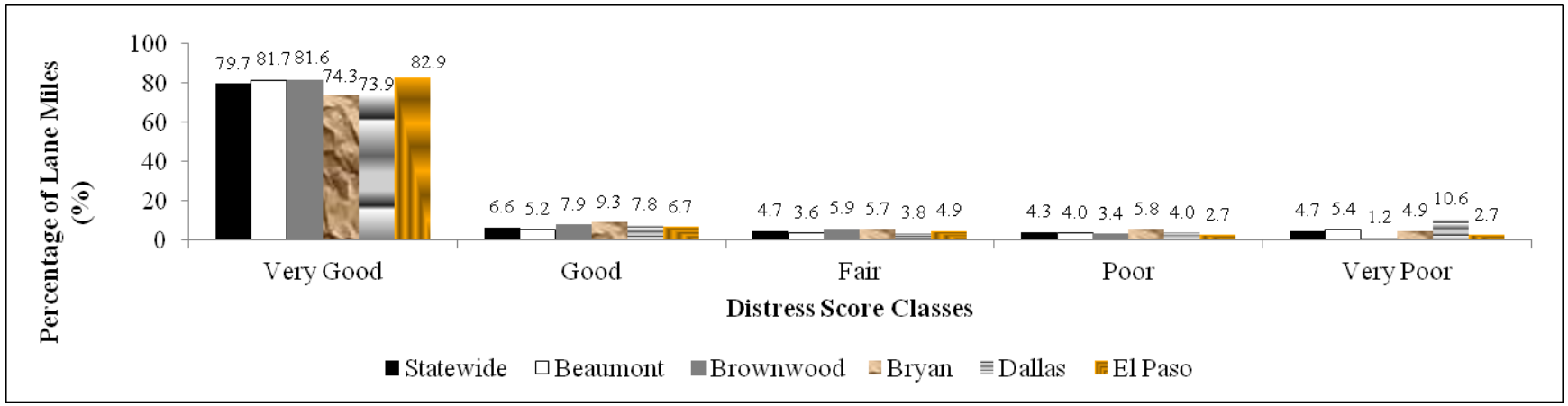


Figure A11. Percentage of Lane Miles Rated per Distress Score Class, 2006.

Table A12. PMIS Ride Score Summary, 2006.

Ride Scores 2006		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	4.0–5.0	43,619	23.7	1,287	23.6	976	16.9	1,588	24.0	1,230	12.5	572	13.4
Good	3.0–3.9	91,166	49.6	2,995	55.0	3,361	58.2	2,381	35.9	4,629	47.2	2,059	48.1
Fair	2.0–2.9	45,028	24.5	1,042	19.1	1,387	24.0	2,386	36.0	3,522	35.9	1,274	29.8
Poor	1.0–1.9	3,836	2.1	119	2.2	47	0.8	273	4.1	400	4.1	356	8.3
Very Poor	0.1–0.9	141	0.1	6	0.1	0	0.0	2	0.0	22	0.2	18	0.4
Lane Miles Rated		183,789	100	5,448	100	5,771	100	6,630	100	9,803	100	4,278	100

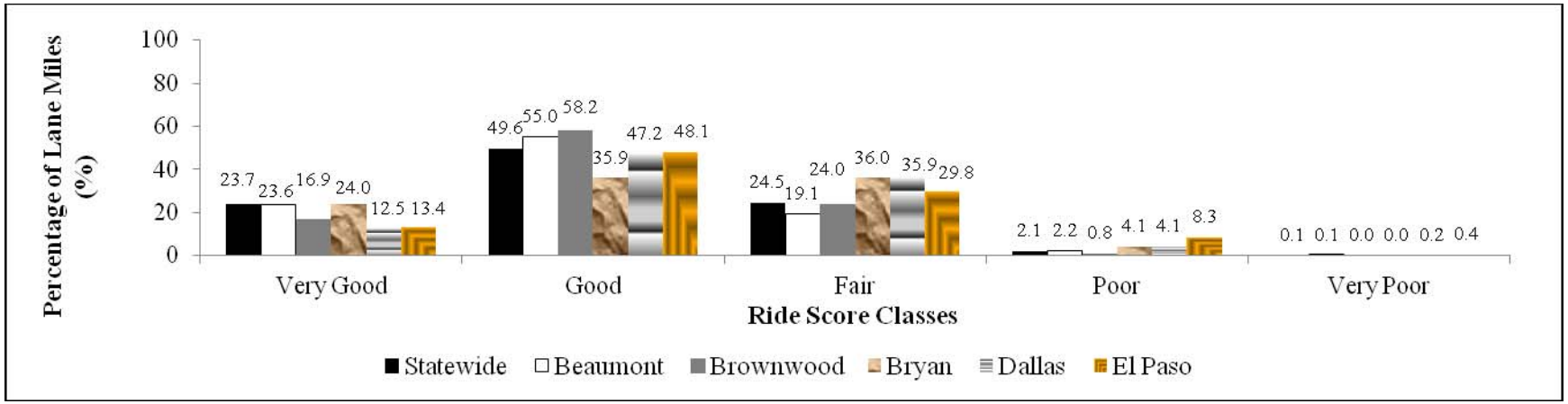


Figure A12. Percentage of Lane Miles Rated per Ride Score Class, 2006.

Table A13. PMIS Condition Score Summary, 2005.

Ride Scores 2005		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	90–100	136,189	74.1	3,844	69.1	4,668	80.9	4,860	72.1	6,182	63.9	3,059	67.6
Good	70–89	24,234	13.2	688	12.4	774	13.4	839	12.4	1,319	13.6	714	15.8
Fair	50–69	14,608	8.0	503	9.0	263	4.6	622	9.2	968	10.0	421	9.3
Poor	35–49	4,685	2.6	224	4.0	33	0.6	249	3.7	462	4.8	179	4.0
Very Poor	1–34	3,976	2.2	304	5.5	34	0.6	175	2.6	745	7.7	154	3.4
Lane Miles Rated		183,691	100	5,563	100	5,772	100	6,744	100	9,676	100	4,526	100

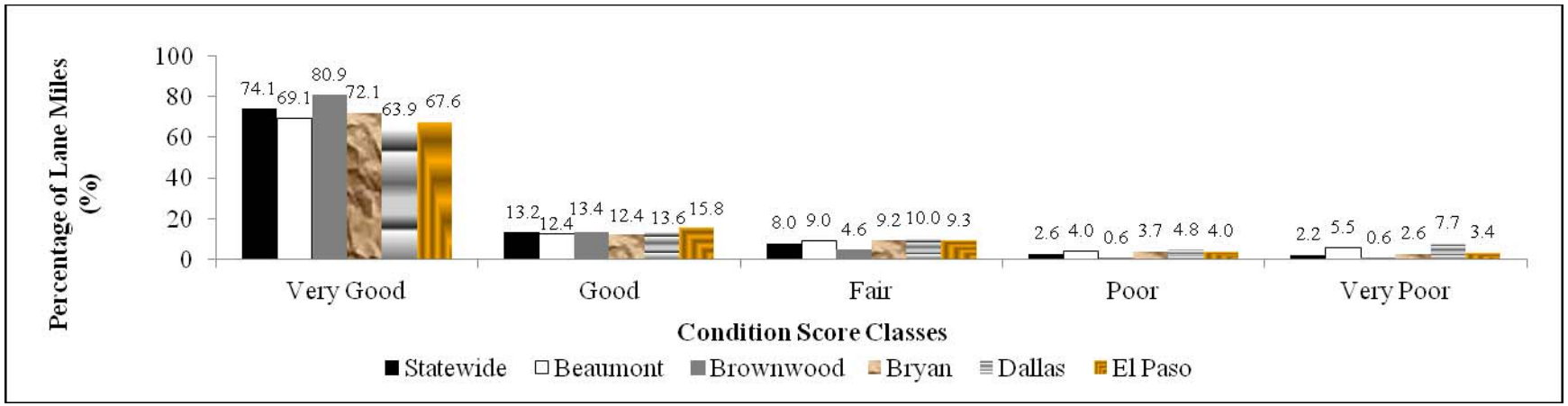


Figure A13. Percentage of Lane Miles Rated per Condition Score Class, 2005.

Table A14. PMIS Distress Score Summary, 2005.

Distress Scores 2005		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	90–100	147,715	80.1	4,377	78.7	4,773	82.7	5,531	82.0	7,591	78.4	3,680	81.3
Good	80–89	11,947	6.5	341	6.1	360	6.2	318	4.7	563	5.8	300	6.6
Fair	70–79	8,415	4.6	219	3.9	363	6.3	282	4.2	310	3.2	208	4.6
Poor	60–69	7,618	4.1	245	4.4	189	3.3	313	4.6	350	3.6	148	3.3
Very Poor	1–59	8,659	4.7	383	6.9	86	1.5	300	4.4	862	8.9	190	4.2
Lane Miles Rated		184,354	100	5,563	100	5,772	100	6,744	100	9,676	100	4,526	100

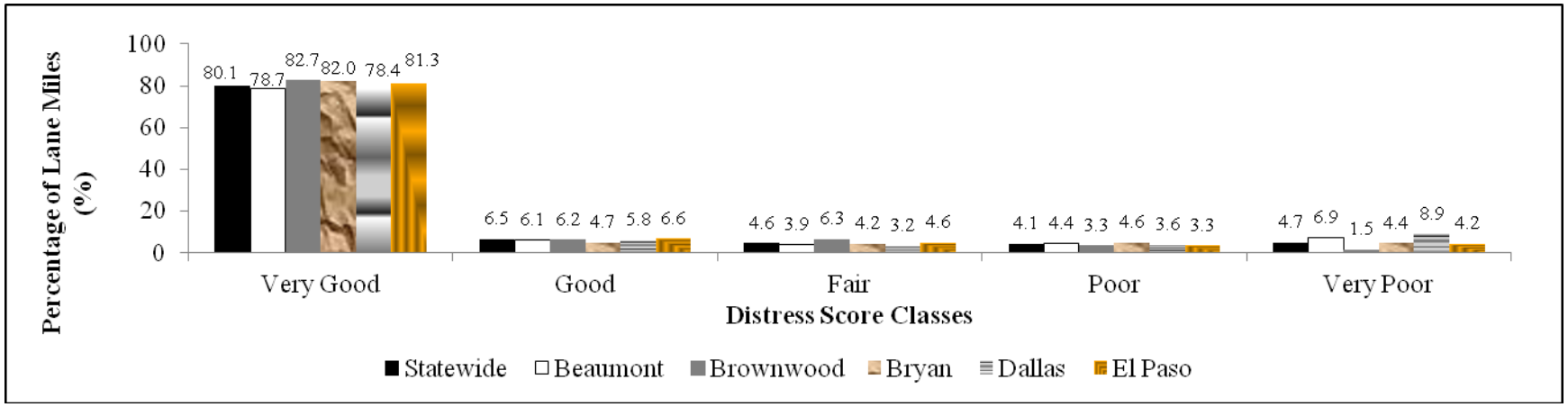


Figure A14. Percentage of Lane Miles Rated per Distress Score Class, 2005.

Table A15. PMIS Ride Score Summary, 2005.

Ride Scores 2005		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	4.0–5.0	43,943	23.9	1,015	18.2	1,135	19.7	1,750	26.0	1,603	16.6	704	15.6
Good	3.0–3.9	93,935	51.0	3,250	58.4	3,506	60.7	2,426	36.0	4,845	50.1	2,222	49.1
Fair	2.0–2.9	42,823	23.2	1,181	21.2	1,105	19.1	2,351	34.9	2,948	30.5	1,255	27.7
Poor	1.0–1.9	3,376	1.8	114	2.0	22	0.4	215	3.2	270	2.8	317	7.0
Very Poor	0.1–0.9	113	0.1	3	0.1	3	0.0	2	0.0	11	0.1	28	0.6
Lane Miles Rated		184,190	100	5,563	100	5,772	100	6,744	100	9,676	100	4,526	100

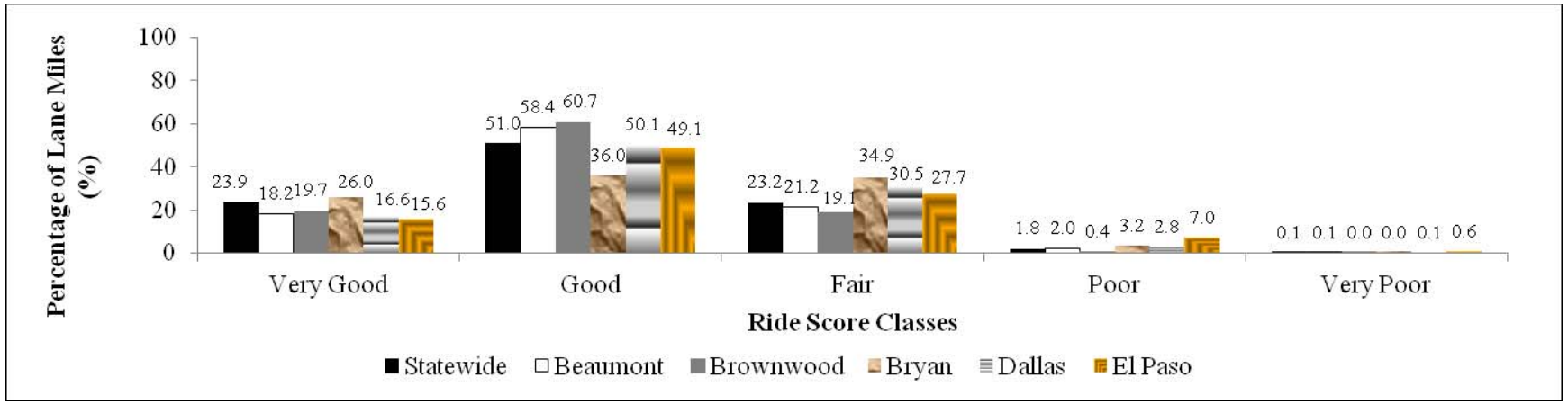


Figure A15. Percentage of Lane Miles Rated per Ride Score Class, 2005.

Table A16. PMIS Condition Score Summary, 2004.

Condition Scores 2004		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	90–100	134,663	73.6	3,815	71.0	4,853	84.0	4,892	72.5	5,479	61.0	3,368	74.1
Good	70–89	24,481	13.4	713	13.3	677	11.7	807	12.0	1,365	15.2	634	13.9
Fair	50–69	14,936	8.2	463	8.6	208	3.6	598	8.9	884	9.8	303	6.7
Poor	35–49	4,586	2.5	169	3.1	24	0.4	253	3.7	502	5.6	146	3.2
Very Poor	1–34	4,227	2.3	215	4.0	15	0.3	201	3.0	759	8.4	97	2.1
Lane Miles Rated		182,892	100	5,375	100	5,776	100	6,752	100	8,989	100	4,548	100

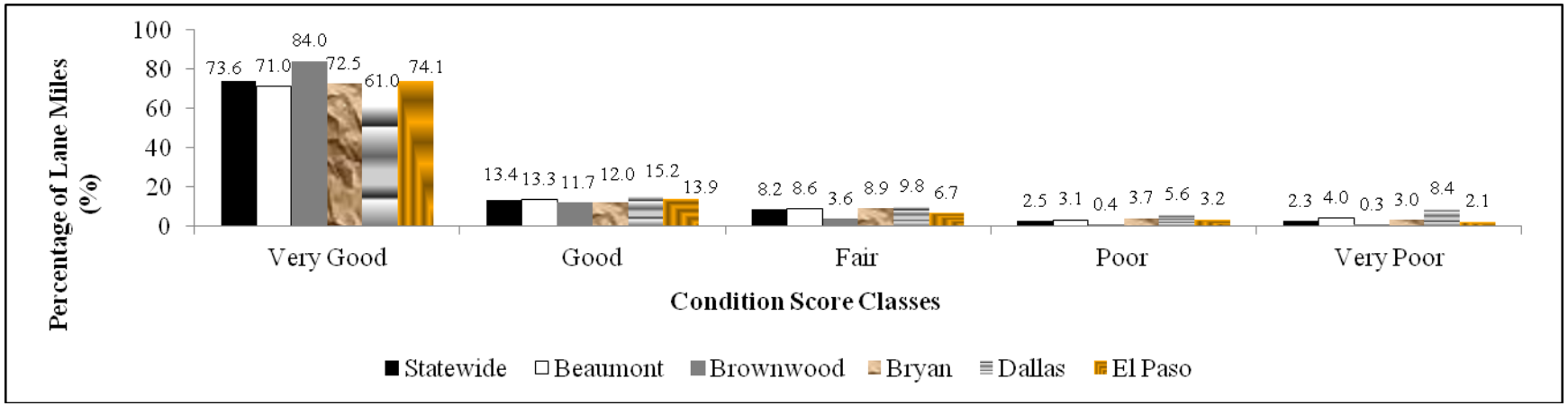


Figure A16. Percentage of Lane Miles Rated per Condition Score Class, 2004.

Table A17. PMIS Distress Score Summary, 2004.

Distress Scores 2004		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	90–100	144,579	78.8	4,292	79.8	4,938	85.5	5,345	79.2	6,699	74.5	3,733	82.1
Good	80–89	12,238	6.7	345	6.4	294	5.1	374	5.5	641	7.1	285	6.3
Fair	70–79	8,898	4.8	247	4.6	341	5.9	278	4.1	338	3.8	193	4.3
Poor	60–69	8,300	4.5	226	4.2	164	2.8	360	5.3	336	3.7	142	3.1
Very Poor	1–59	9,512	5.2	266	4.9	40	0.7	394	5.8	975	10.8	194	4.3
Lane Miles Rated		183,526	100	5,375	100	5,776	100	6,752	100	8,989	100	4,548	100

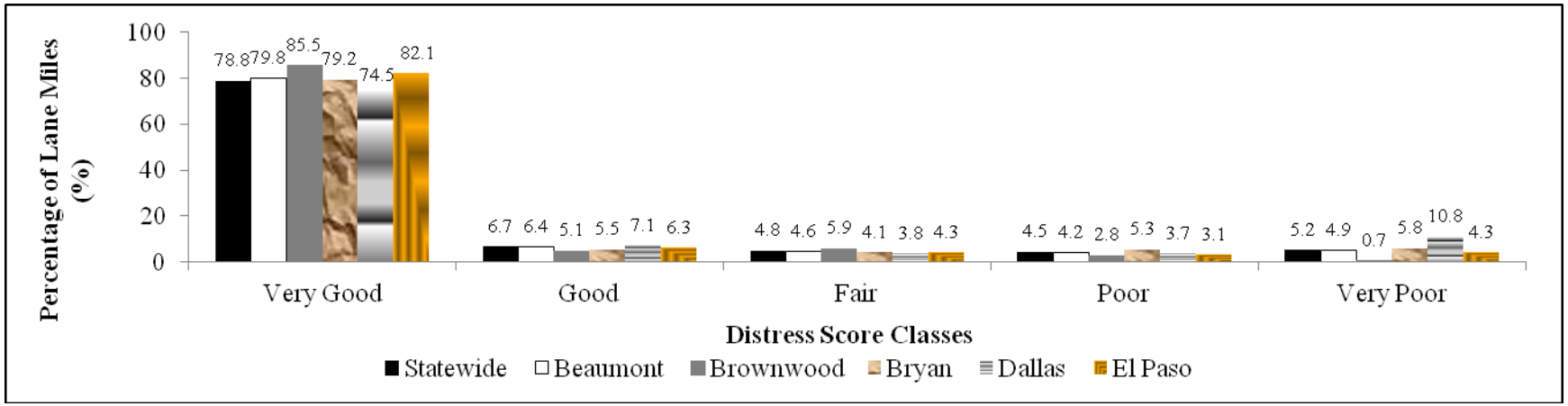


Figure A17. Percentage of Lane Miles Rated per Distress Score Class, 2004.

Table A18. PMIS Ride Score Summary, 2004.

Ride Scores 2004		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	4.0–5.0	47,592	25.7	959	17.8	1,270	22.0	1,933	28.6	1,283	14.3	1,096	24.1
Good	3.0–3.9	95,870	51.7	3,349	62.3	3,467	60.0	2,567	38.0	4,677	52.0	2,314	50.9
Fair	2.0–2.9	39,212	21.1	1,002	18.6	1,021	17.7	2,088	30.9	2,789	31.0	909	20.0
Poor	1.0–1.9	2,745	1.5	61	1.1	18	0.3	158	2.3	231	2.6	220	4.8
Very Poor	0.1–0.9	112	0.1	4	0.1	0	0.0	6	0.1	8	0.1	9	0.2
Lane Miles Rated		185,531	100	5,375	100	5,776	100	6,752	100	8,989	100	4,548	100

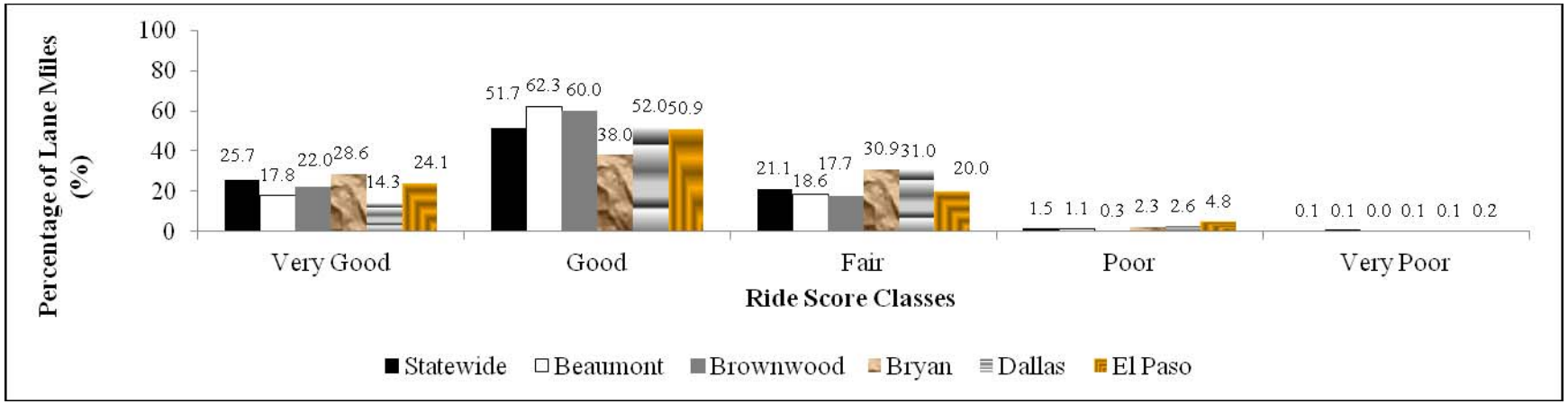


Figure A18. Percentage of Lane Miles Rated per Ride Score Class, 2004.

Table A19. PMIS Condition Score Summary, 2003.

Condition Scores 2003		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	90–100	128,427	70.7	3,063	57.1	4,611	81.3	5,013	73.0	4,858	55.1	3,211	71.1
Good	70–89	26,361	14.5	928	17.3	737	13.0	900	13.1	1,540	17.5	629	13.9
Fair	50–69	16,407	9.0	725	13.5	270	4.8	564	8.2	951	10.8	340	7.5
Poor	35–49	5,515	3.0	288	5.4	31	0.6	234	3.4	586	6.7	180	4.0
Very Poor	1–34	5,044	2.8	360	6.7	24	0.4	157	2.3	875	9.9	156	3.5
Lane Miles Rated		181,754	100	5,363	100	5,672	100	6,868	100	8,810	100	4,515	100

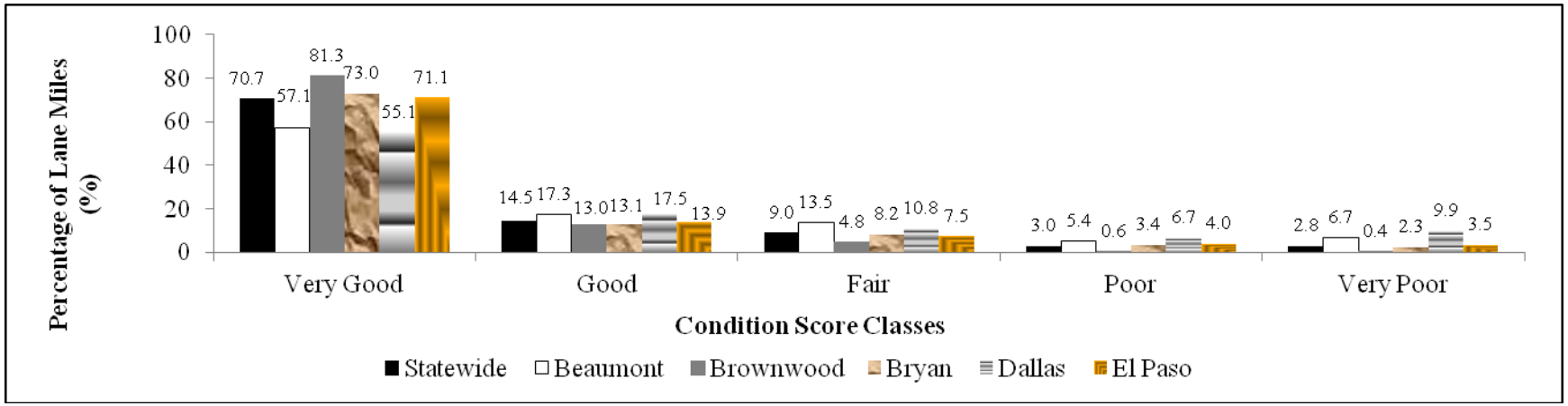


Figure A19. Percentage of Lane Miles Rated per Condition Score Class, 2003.

Table A20. PMIS Distress Score Summary, 2003.

Distress Scores 2003		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	90–100	139,750	76.6	3,556	66.3	4,707	83.0	5,560	81.0	6,031	68.5	3,758	83.2
Good	80–89	13,167	7.2	495	9.2	344	6.1	374	5.4	796	9.0	278	6.1
Fair	70–79	9,887	5.4	332	6.2	344	6.1	359	5.2	393	4.5	206	4.6
Poor	60–69	8,660	4.7	352	6.6	203	3.6	300	4.4	406	4.6	118	2.6
Very Poor	1–59	10,990	6.0	628	11.7	74	1.3	275	4.0	1,184	13.4	156	3.5
Lane Miles Rated		182,454	100	5,363	100	5,672	100	6,868	100	8,810	100	4,515	100

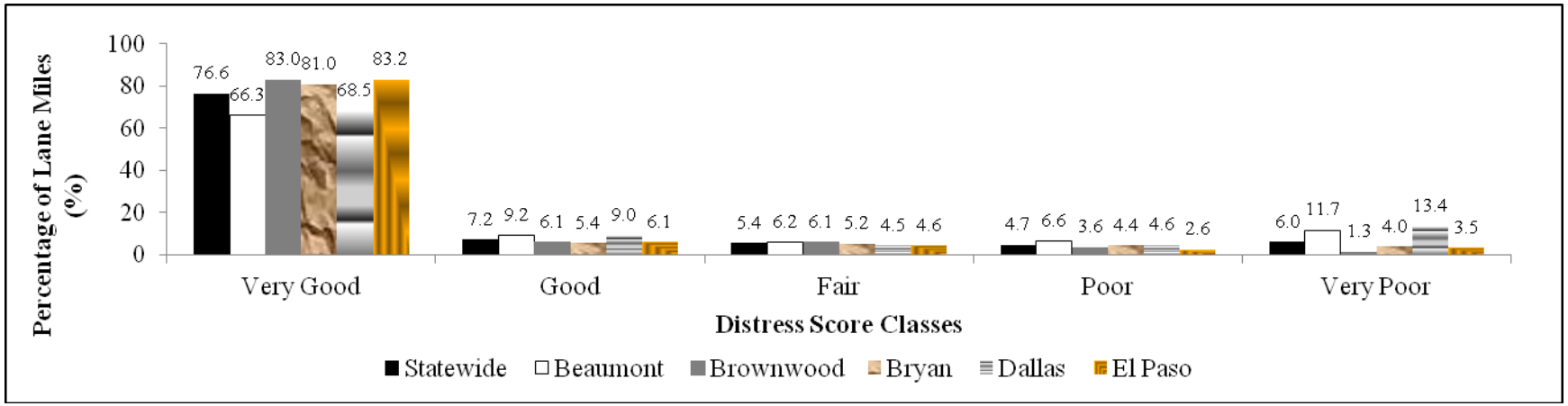


Figure A20. Percentage of Lane Miles Rated per Distress Score Class, 2003.

Table A21. PMIS Ride Score Summary, 2003.

Ride Scores 2003		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	4.0–5.0	38,478	21.1	684	12.8	926	16.3	1,785	26.0	970	11.0	565	12.5
Good	3.0–3.9	94,134	51.6	3,382	63.1	3,358	59.2	2,546	37.1	4,521	51.3	2,460	54.5
Fair	2.0–2.9	45,673	25.0	1,165	21.7	1,350	23.8	2,305	33.6	2,992	34.0	1,110	24.6
Poor	1.0–1.9	3,967	2.2	119	2.2	38	0.7	228	3.3	321	3.6	347	7.7
Very Poor	0.1–0.9	164	0.1	13	0.2	0	0.0	4	0.1	5	0.1	33	0.7
Lane Miles Rated		182,415	100	5,363	100	5,672	100	6,868	100	8,810	100	4,515	100

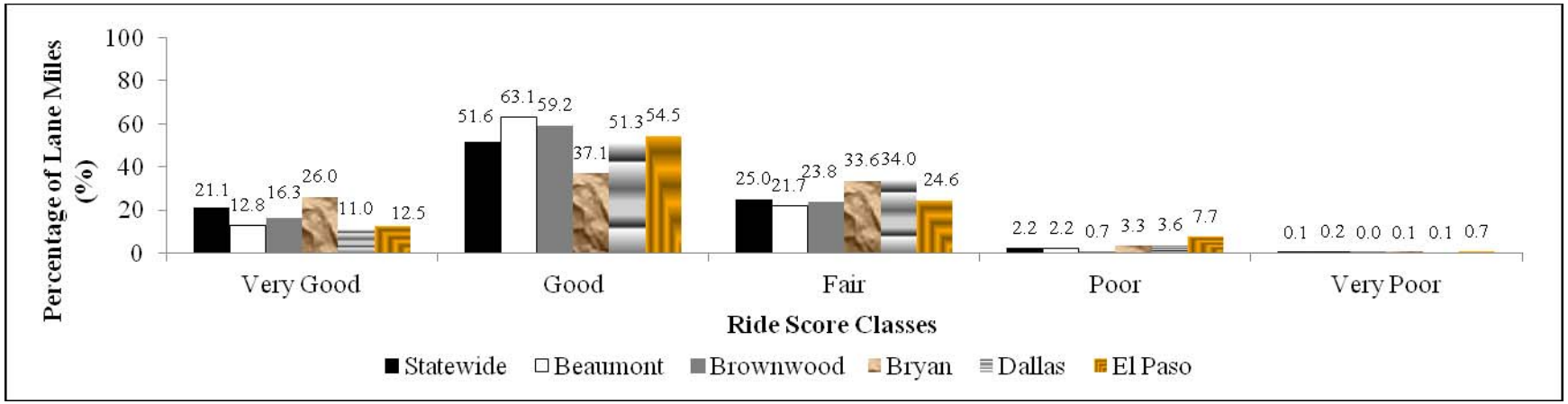


Figure A21. Percentage of Lane Miles Rated per Ride Score Class, 2003.

Table A22. PMIS Condition Score Summary, 2002.

Condition Scores 2002		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	90–100	124,631	69.2	3,487	62.7	4,375	75.6	4,668	71.1	4,208	46.7	2,624	58.7
Good	70–89	26,951	15.0	783	14.1	892	15.4	803	12.2	1,520	16.9	1,162	26.0
Fair	50–69	17,047	9.5	669	12.0	410	7.1	596	9.1	1,142	12.7	353	7.9
Poor	35–49	5,745	3.2	279	5.0	59	1.0	267	4.1	756	8.4	175	3.9
Very Poor	1–34	5,615	3.1	339	6.1	53	0.9	229	3.5	1,387	15.4	158	3.5
Lane Miles Rated		179,989	100	5,558	100	5,789	100	6,563	100	9,012	100	4,472	100

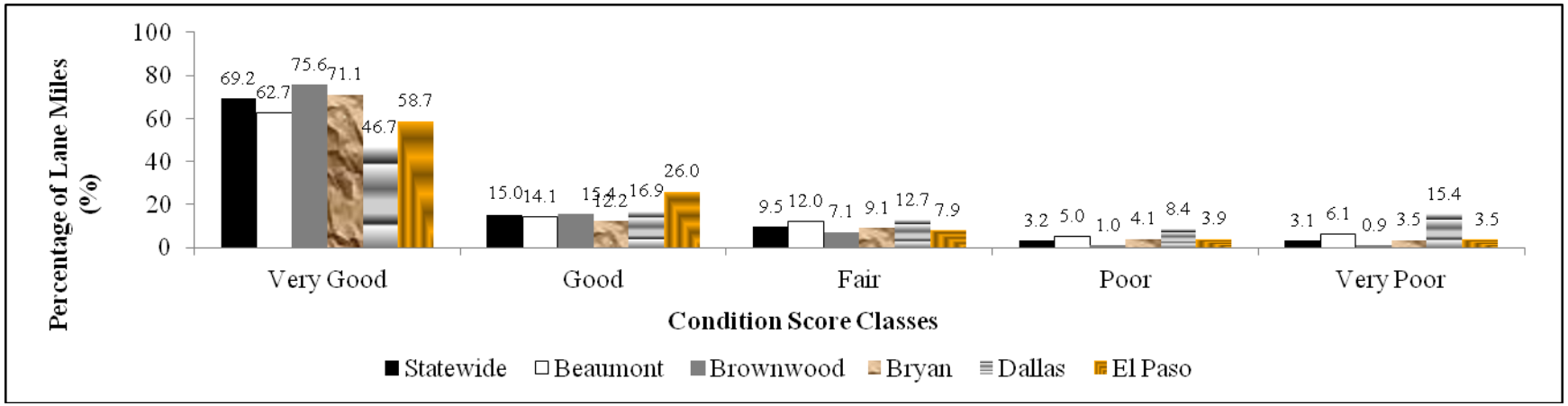


Figure A22. Percentage of Lane Miles Rated per Condition Score Class, 2002.

Table A23. PMIS Distress Score Summary, 2002.

Distress Scores 2002		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	90–100	135,995	75.3	3,963	71.3	4,503	77.8	5,205	79.3	5,566	61.8	2,948	65.9
Good	80–89	13,427	7.4	440	7.9	462	8.0	326	5.0	742	8.2	845	18.9
Fair	70–79	10,173	5.6	256	4.6	403	7.0	267	4.1	429	4.8	368	8.2
Poor	60–69	9,380	5.2	312	5.6	294	5.1	341	5.2	550	6.1	113	2.5
Very Poor	1–59	11,593	6.4	587	10.6	127	2.2	424	6.5	1,725	19.1	198	4.4
Lane Miles Rated		180,568	100	5,558	100	5,789	100	6,563	100	9,012	100	4,472	100

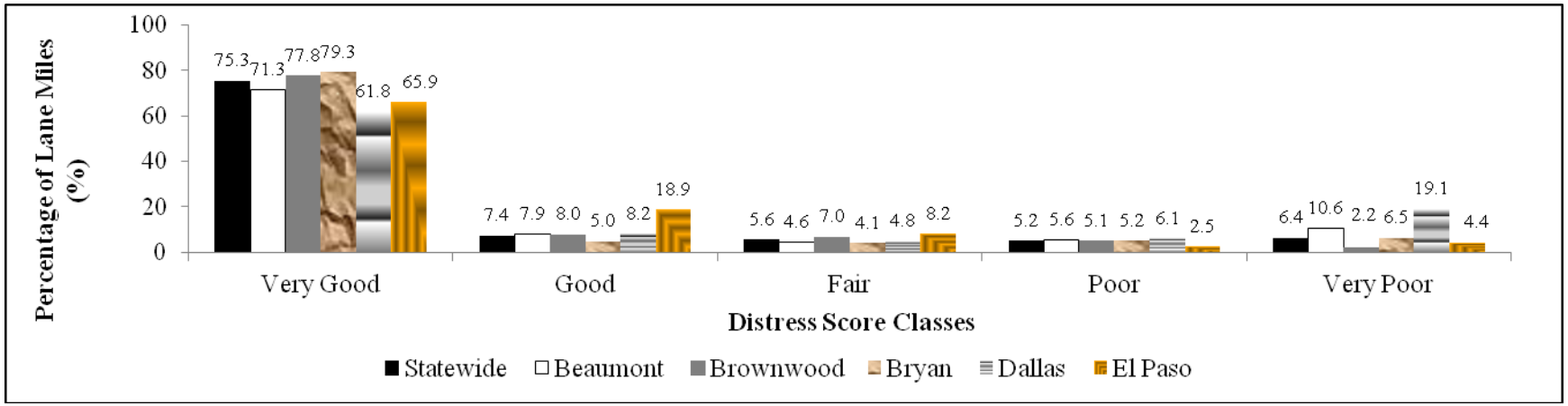


Figure A23. Percentage of Lane Miles Rated per Distress Score Class, 2002.

Table A24. PMIS Ride Score Summary, 2002.

Ride Scores 2002		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	4.0–5.0	38,163	20.4	622	11.2	569	9.8	1,442	22.0	650	7.2	686	15.3
Good	3.0–3.9	95,545	51.0	3,553	63.9	3,393	58.6	2,704	41.2	4,180	46.4	2,408	53.8
Fair	2.0–2.9	49,104	26.2	1,278	23.0	1,751	30.2	2,179	33.2	3,669	40.7	1,069	23.9
Poor	1.0–1.9	4,447	2.4	102	1.8	75	1.3	230	3.5	499	5.5	292	6.5
Very Poor	0.1–0.9	163	0.1	3	0.1	0	0.0	7	0.1	15	0.2	17	0.4
Lane Miles Rated		187,422	100	5,558	100	5,789	100	6,563	100	9,012	100	4,472	100

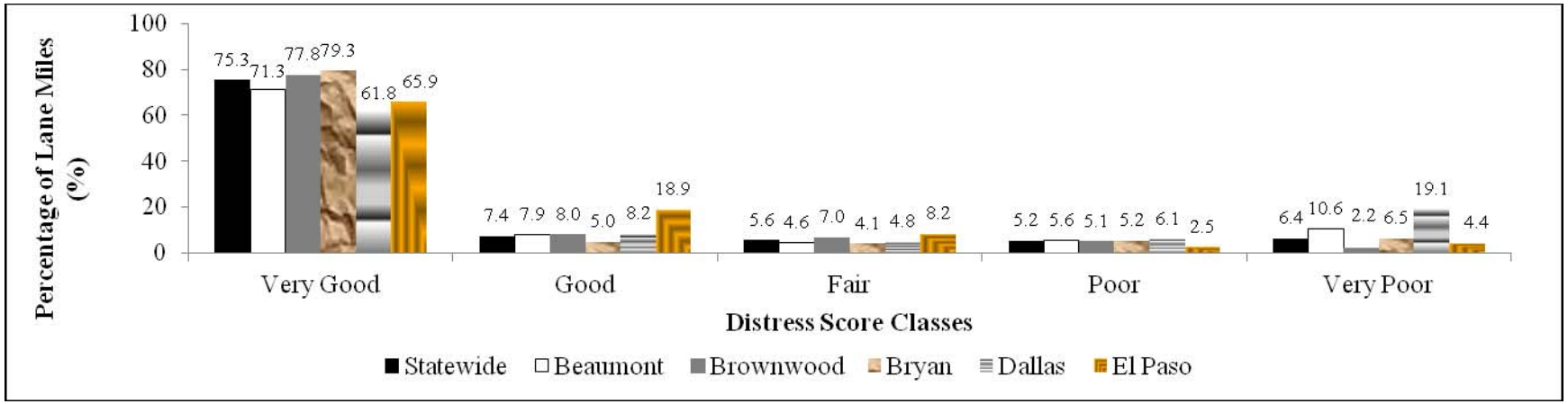


Figure A24. Percentage of Lane Miles Rated per Ride Score Class, 2002.

Table A25. PMIS Condition Score Summary, 2001.

Condition Scores 2001		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	90–100	123,500	69.1	3,523	65.2	4,629	79.8	4,648	69.5	3,976	44.5	3,175	69.2
Good	70–89	27,083	15.1	640	11.8	767	13.2	851	12.7	1,519	17.0	594	12.9
Fair	50–69	16,577	9.3	608	11.2	341	5.9	625	9.3	1,257	14.1	451	9.8
Poor	35–49	5,869	3.3	243	4.5	39	0.7	279	4.2	739	8.3	206	4.5
Very Poor	1–34	5,825	3.3	389	7.2	21	0.4	287	4.3	1,436	16.1	161	3.5
Lane Miles Rated		178,854	100	5,402	100	5,797	100	6,691	100	8,928	100	4,587	100

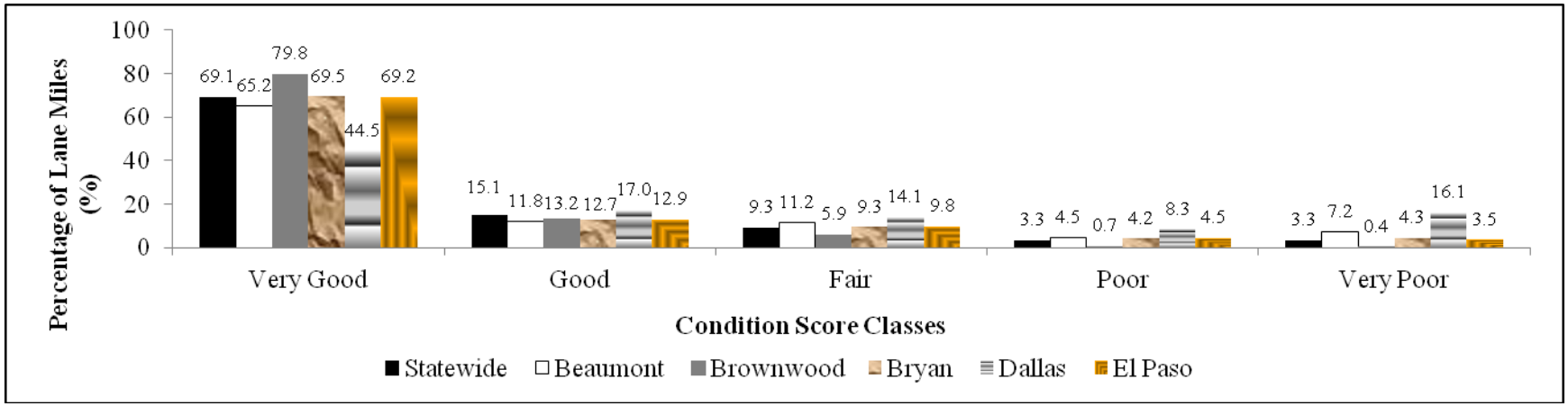


Figure A25. Percentage of Lane Miles Rated per Condition Score Class, 2001.

Table A26. PMIS Distress Score Summary, 2001.

Distress Scores 2001		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	90–100	136,180	75.8	4,041	74.8	4,742	81.8	5,277	78.9	5,247	58.8	3,634	79.2
Good	80–89	13,693	7.6	308	5.7	394	6.8	347	5.2	796	8.9	289	6.3
Fair	70–79	10,050	5.6	256	4.7	350	6.0	265	4.0	488	5.5	242	5.3
Poor	60–69	8,441	4.7	275	5.1	237	4.1	325	4.9	537	6.0	189	4.1
Very Poor	1–59	11,301	6.3	522	9.7	74	1.3	477	7.1	1,859	20.8	233	5.1
Lane Miles Rated		179,665	100	5,402	100	5,797	100	6,691	100	8,928	100	4,587	100

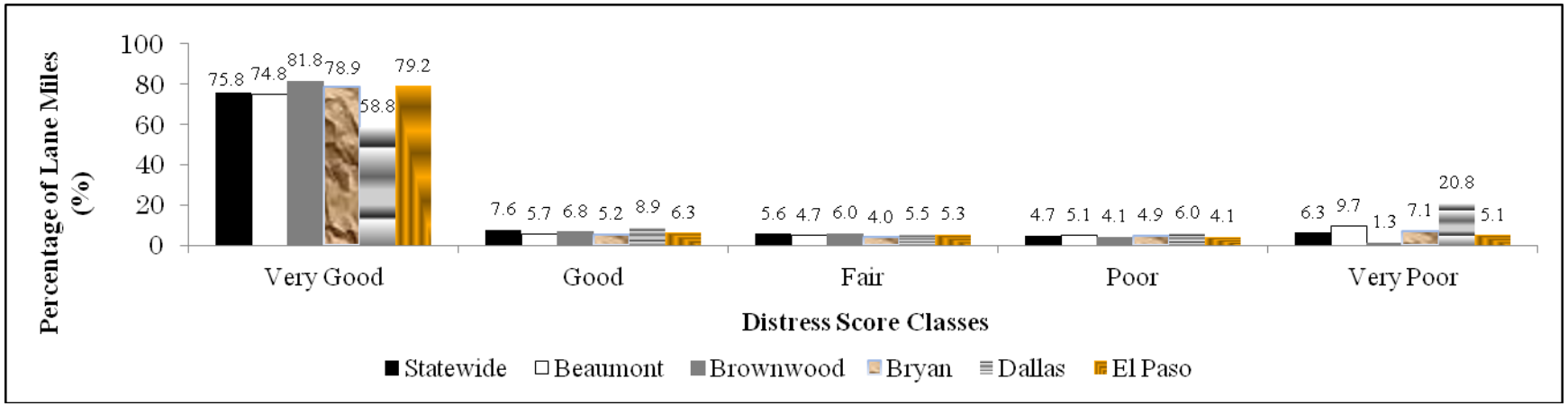


Figure A26. Percentage of Lane Miles Rated per Distress Score Class, 2001.

Table A27. PMIS Ride Score Summary, 2001.

Ride Scores 2001		Statewide Lane Miles		Beaumont Lane Miles		Brownwood Lane Miles		Bryan Lane Miles		Dallas Lane Miles		El Paso Lane Miles	
		Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage	Miles	Percentage
Very Good	4.0–5.0	37,911	21.0	682	12.6	721	12.4	1,401	20.9	627	7.0	651	14.2
Good	3.0–3.9	90,069	49.9	3,336	61.8	3,464	59.7	2,670	39.9	4,160	46.6	2,478	54.0
Fair	2.0–2.9	46,675	25.9	1,229	22.7	1,562	26.9	2,267	33.9	3,627	40.6	1,102	24.0
Poor	1.0–1.9	5,505	3.1	142	2.6	50	0.9	345	5.2	500	5.6	335	7.3
Very Poor	0.1–0.9	190	0.1	13	0.2	0	0.0	8	0.1	16	0.2	21	0.5
Lane Miles Rated		180,350	100	5,402	100	5,797	100	6,691	100	8,928	100	4,587	100

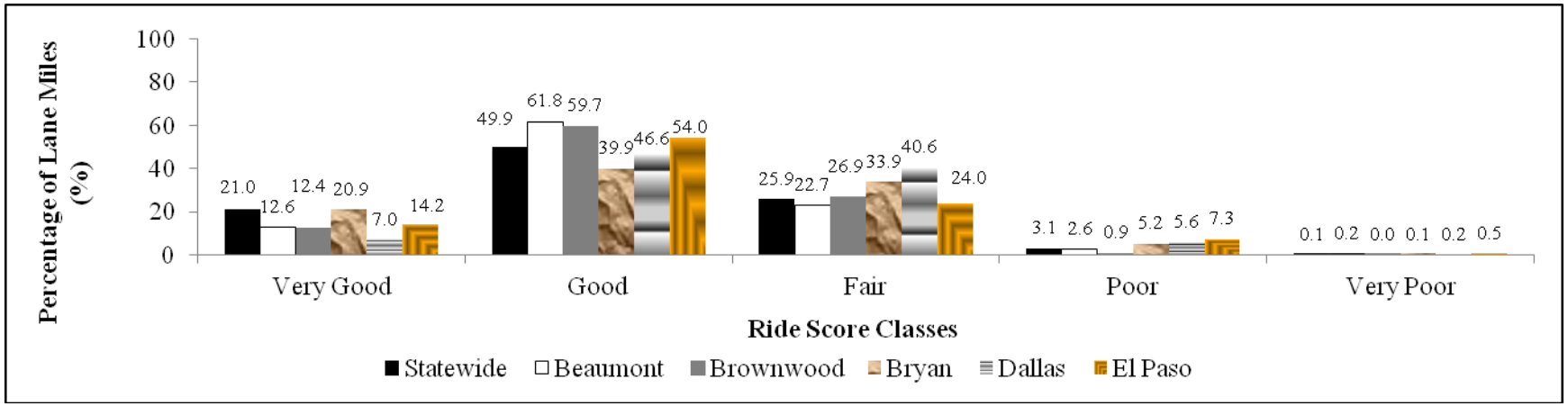


Figure A27. Percentage of Lane Miles Rated per Ride Score Class, 2001.

Table A28. PMIS Average Condition Score for Total Number of Miles Rated, El Paso District, 2001–2009.

Year	Statewide		Beaumont		Brownwood		Bryan		Dallas		El Paso	
	Average	Lane Miles	Average	Lane Miles	Average	Lane Miles	Average	Lane Miles	Average	Lane Miles	Average	Lane Miles
2001	84.6	178,853	83.7	5,402	90.0	5,797	86.7	6,691	72.1	8,928	84.0	4,587
2002	84.7	179,989	83.9	5,558	88.6	5,789	87.7	6,563	72.9	9,012	82.8	4,472
2003	85.3	181,753	82.0	5,363	90.5	5,672	89.2	6,868	78.9	8,810	84.8	4,515
2004	86.5	182,890	88.4	5,375	91.4	5,776	88.7	6,752	82.0	8,988	86.7	4,548
2005	86.7	183,676	86.6	5,563	90.3	5,772	88.7	6,744	83.2	9,676	84.1	4,526
2006	86.3	183,503	87.9	5,448	90.2	5,771	86.2	6,630	79.0	9,803	84.2	4,278
2007	87.9	184,602	90.4	5,297	92.4	5,714	89.1	6,714	80.7	9,946	88.5	4,647
2008	87.7	185,048	89.4	5,200	92.5	5,754	87.7	6,717	78.4	9,853	86.4	4,703
2009	85.91	187,194	90.2	5,370	89.0	5,742	89.70	6,833	81.08	10,040	86.5	4,717

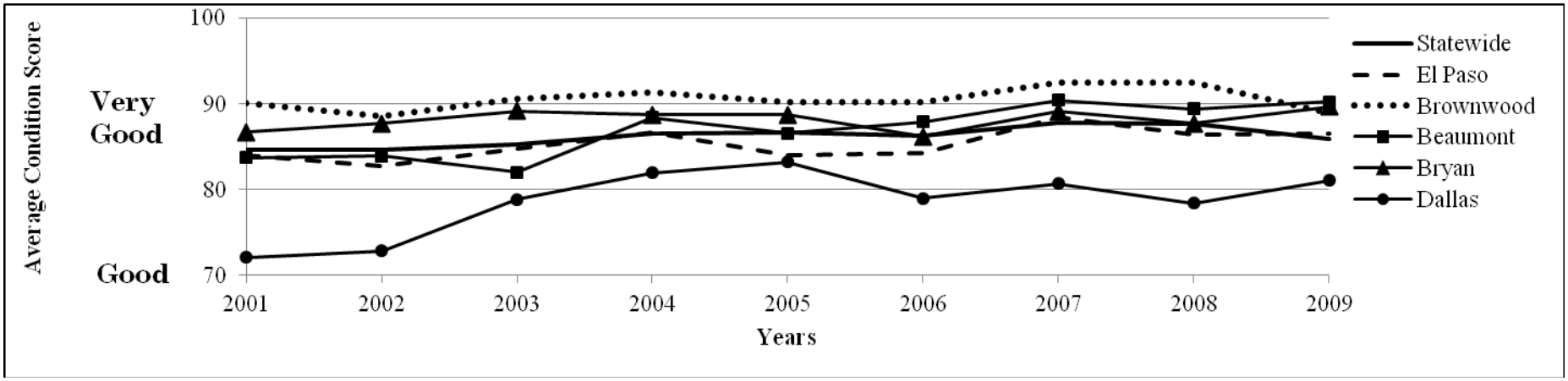


Figure A28. PMIS Average Condition Score per Year for El Paso District, 2001–2009.

Table A29. PMIS Average Distress Score for Total Number of Miles Rated, El Paso District, 2001–2009.

Year	Statewide		Beaumont		Brownwood		Bryan		Dallas		El Paso	
	Average	Lane Miles	Average	Lane Miles	Average	Lane Miles	Average	Lane Miles	Average	Lane Miles	Average	Lane Miles
2001	87.2	180,622	88.9	5,629	90.8	5,824	91.3	6,691	80.5	9,189	88.4	4,619
2002	86.9	181,146	88.5	5,609	89.5	5,791	91.7	6,563	81.5	9,278	87.3	4,522
2003	87.4	183,259	87.3	5,441	91.0	5,673	93.3	6,868	85.7	9,108	90.1	4,544
2004	88.2	184,316	92.6	5,504	91.9	5,779	92.2	6,752	88.2	9,376	89.5	4,579
2005	88.8	184,696	91.4	5,655	90.9	5,772	93.5	6,744	90.1	9,905	89.5	4,638
2006	88.7	185,239	92.7	5,584	90.9	5,775	91.7	6,630	88.6	10,104	90.5	4,370
2007	90.7	185,860	93.7	5,435	93.4	5,718	94.3	6,714	89.3	10,201	92.1	4,689
2008	90.6	186,887	92.5	5,294	93.2	5,766	92.1	6,717	91.5	10,325	90.0	4,818
2009	88.2	188,700	93.5	5,511	89.7	5,747	94.50	6,833	91.41	10,518	90.2	4,757

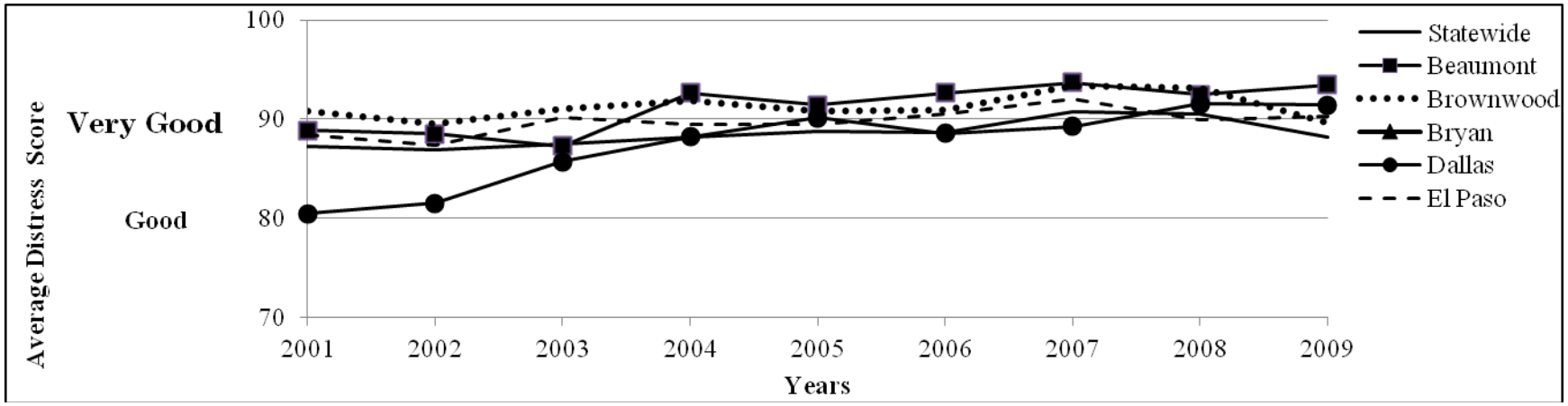


Figure A29. PMIS Average Distress Score per Year for El Paso District, 2001–2009.

Table A30. PMIS Average Ride Score for Total Number of Miles Rated, El Paso District, 2001–2009.

Year	Statewide		Beaumont		Brownwood		Bryan		Dallas		El Paso	
	Average	Lane Miles	Average	Lane Miles	Average	Lane Miles	Average	Lane Miles	Average	Lane Miles	Average	Lane Miles
2001	3.3	191,012	3.3	5,474	3.2	5,804	3.1	6,691	3.0	9,632	3.1	4,610
2002	3.3	191,983	3.3	5,608	3.2	5,798	3.2	6,563	3.0	9,648	3.2	4,493
2003	3.3	186,172	3.3	5,504	3.3	5,675	3.3	6,868	3.1	9,474	3.1	4,527
2004	3.4	188,731	3.4	5,494	3.4	5,796	3.3	6,752	3.2	9,509	3.3	4,604
2005	3.4	188,045	3.4	5,652	3.4	5,777	3.3	6,744	3.2	10,209	3.1	4,777
2006	3.4	188,247	3.4	5,572	3.3	5,866	3.2	6,630	3.1	10,164	3.1	4,333
2007	3.4	188,293	3.6	5,369	3.3	5,767	3.3	6,714	3.2	10,220	3.3	4,702
2008	3.4	195,891	3.5	5,500	3.3	7,520	3.3	6,717	3.0	10,193	3.3	4,730
2009	3.4	190,307	3.6	5,410	3.3	5,748	3.30	6,833	3.13	10,208	3.3	4,747

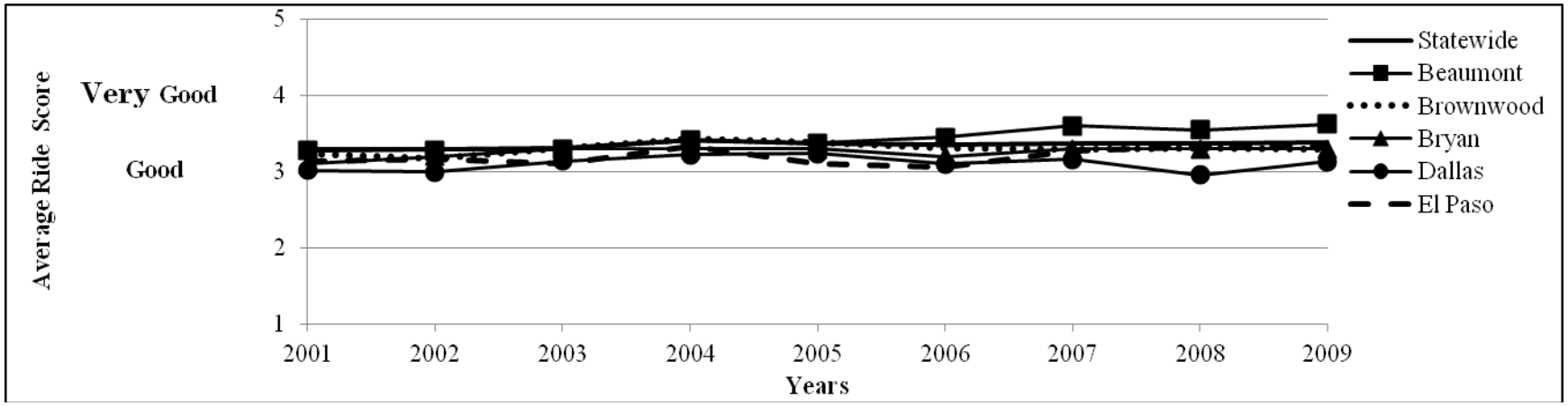


Figure A30. PMIS Average Ride Score per Year for El Paso District, 2001–2009.

BEAUMONT DISTRICT

Sub-Task 1.4: Compare District Priority Rankings and Repair Needs to PMIS Results

UTEP lead with the assistance of TTI and UTSA

1/31/2011

BEAUMONT DISTRICT

There are 5804 lane miles pavements in Beaumont District. Table A31 shows the number of lane miles for Beaumont District summarized by highway system.

Table A31. Lane Miles in Beaumont District.

Highway System	Lane Miles	Percentage (%)
Interstate Highways (IH)	402	6.9
United States Highways (US)	1088.5	18.8
State Highways (SH)	1573.4	27.1
Farm-to-Market (FM)	2542.7	43.8
Business Routes (BR)	42.6	0.7
Park Road (PR)	155	2.7
Principal Arterial Streets (PA)	–	–
Total	5804.2	100.0

Table A32 shows the treatments applied by the Beaumont District in 2007 and their corresponding PMIS category.

Table A32. Treatments Applied by Beaumont District (2007).

Fiscal Year DCIS	Type of Treatment Applied	Treatment Description
2007	PM	Clean and Seal Joints
		Grind Conc Pav, Seal Joint
		Overlay Existing Roadway
		Resurface Existing Roadway
		Seal Coat
	LR	Mill and In Lay Existing
		Overlay Existing Roadway
		Restore Existing Roadway
	MR	Mill and Overlay Existing
		Overlay Existing Main
		Overlay Existing Roadway
		Rehabilitate Existing Roadway
	HR	Rehabilitate Pavement

Table A33 shows the treatments applied by the Beaumont District in 2008 and their corresponding PMIS category.

Table A33. Treatments Applied by Beaumont District (2008).

Fiscal Year DCIS	Type of Treatment Applied	Treatment Description
2008	PM	Overlay Existing Roadway
		Seal Coat
		Repair Existing Pavement
	LR	Overlay Existing Roadway 000
		Overlay Existing Roadway 110
	MR	Mill and Overlay Existing 000
		Overlay Existing Roadway 000
		Overlay Existing Roadway 110
		Rehabilitate Existing RO 110
		Rehabilitate Existing RO 110

Table A34 shows the treatments applied by the Beaumont District in 2009 and their corresponding PMIS category.

Table A34. Treatments Applied by Beaumont District (2009).

Fiscal Year DCIS	Type of Treatment Applied	Treatment Description
2009	PM	Overlay Existing Roadway
		Seal Coat
	LR	Overlay Existing Roadway
	MR	Base Repair and Overlay
		Mill & Overlay Existing
		Overlay Existing Roadway
	HR	Overlay Existing Roadway
		Rehabilitate Existing Roadway
		Restore & Overlay Existing

Table A35 shows the treatments applied by the district from 2007 through 2009, their corresponding PMIS category, and the treatment class recommended by PMIS.

Table A35. Treatments Applied by Beaumont District (2007–2009).

Treatment	Beaumont	PMIS Recommendation				
		NN	PM	LRhb	MRhb	HRhb
(PM)	1602	1082	436	34	46	4
(LRhb)	213	158	33	6	14	2
(MRhb)	267	72	84	11	52	48
(HRhb)	51	29	6	–	8	8
Total	2133	1341	559	51	120	62

Findings of the Statistical Analyses

Findings of the statistical analysis conducted for the comparison of treatments applied in Beaumont District and PMIS treatment recommendations follows. Details of the analysis are in the appendices.

Condition, distress, and ride scores from 2001–2009 were analyzed using box plots to show quartiles and medians for each segment category. The purpose of this analysis was to show graphically the range of variation of the scores for each treatment category. For example, in Figure A31, the condition score of the sections recommended to receive Preventive Maintenance treatment has a median of 90 and a mean of about 85. From this box plot, it can also be concluded that 25 percent of the data are below a condition score of 76 and 75 percent are below a condition score of 99. The box plot of the lower portion of Figure A31 is labeled for a better interpretation of these graphs.

Tables were also prepared to show PMIS statistics for condition, distress, and ride scores (mean and standard deviation) for each treatment category. We also plot the evolution of treatment needs from 2001–2009 and conducted Mann-Whitney test to compare PMIS data to district data for each treatment category.

~~Summary of PMIS Scores and Treatment Needs~~

a. The average PMIS condition score for the total number of lane miles rated by the district, range between 82.0 as a minimum in 2003, and 90.4 as a maximum in 2007. Throughout the 2001–2009 analysis period, the percentage of lane miles with very good and good condition scores ranges between 74.4% in 2003, and 87.2% in 2007. In 2009, 87% of the total lane miles in Beaumont District show a condition score equal or greater than 70 (good or very good). A similar pattern is observed Texas statewide with 85% of the total lane miles in 2009 showing a condition score equal or greater than 70.

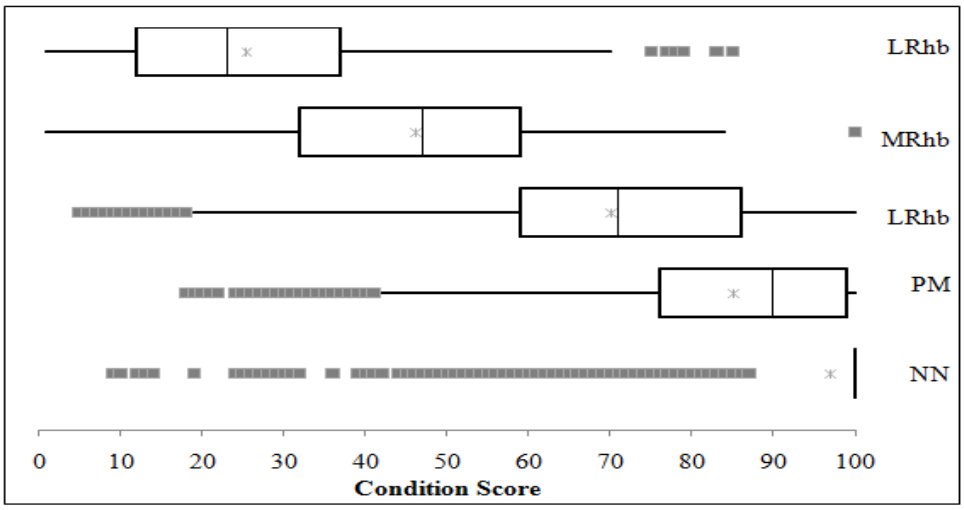
b. The average PMIS distress score for the total number of lane miles rated by district, range between 87.3 as a minimum in 2003, and 93.7 as a maximum in 2007. Throughout the analysis period 2001–2009, the percentage of lane miles with very good and good distress scores ranges between 75.6% in 2003 and 89.9% in 2007. In 2009, 89% of the total lane miles in Beaumont District show a distress score equal or greater than 80 (good or very

good). A similar pattern is observed Texas statewide with 85% of the total lane miles in 2009 showing a distress score equal or greater than 80.

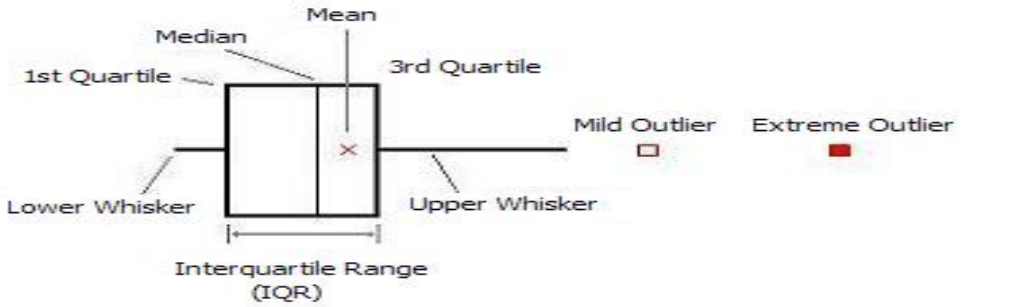
c. The average PMIS ride score for the total number of lane miles rated by the district, range between 3.3 as a minimum, and 3.6 as a maximum. Throughout the 2001–2009 analysis period, the percentage of lane miles with very good and good ride scores is ranges between 74.2% as a minimum in 2001, and 84.4% as a maximum in 2007. In 2009, 84% of the total lane miles in Beaumont District show a ride score equal or greater than 3.0 (good or very good). A similar pattern is observed Texas statewide with 70% of the total lane miles in 2009 showing a ride score equal or greater than 3.0.

d. The most prevalent PMIS treatment recommendation from 2001 through 2009 is Need Nothing. Sixty-one percent of the sections are in this treatment category. Twenty-six percent of sections fall in the Preventive Maintenance category while the remaining percentage is distributed between Light Rehabilitation, Medium Rehabilitation, and Heavy Rehabilitation (3.1%, 7.1%, and 2.4%, respectively). Table A36 shows a summary of the frequency, mean, and standard deviations for the PMIS condition score, distress score, and ride score for all pavements.

   Figures A31, A32, and A33 show the box plots with medians and quartiles for condition scores, distress, and ride scores of treatments recommended by PMIS.

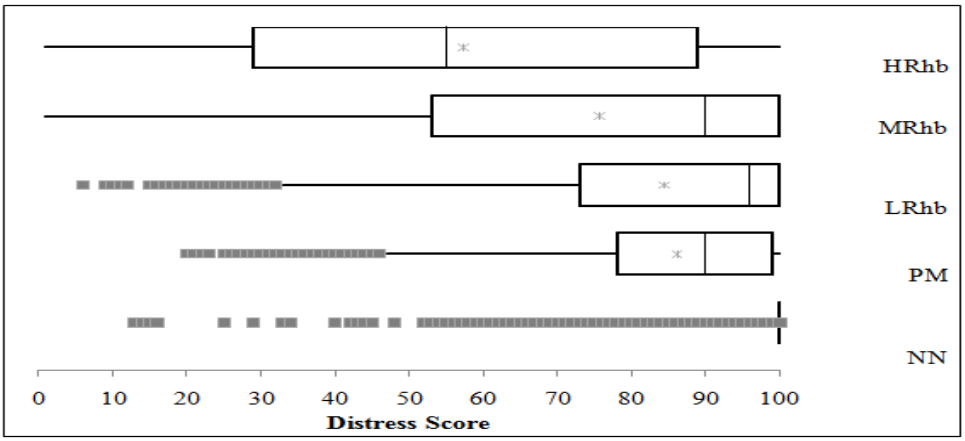


Treatment Category	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Need Nothing	9.0	100.0	100.0	100.0	100.0
Preventive Maintenance	18.0	76.0	90.0	99.0	100.0
Light Rehabilitation	5.0	59.0	71.0	86.0	100.0
Medium Rehabilitation	1.0	32.0	47.0	59.0	100.0
Heavy Rehabilitation	1.0	12.0	23.0	37.0	85.0



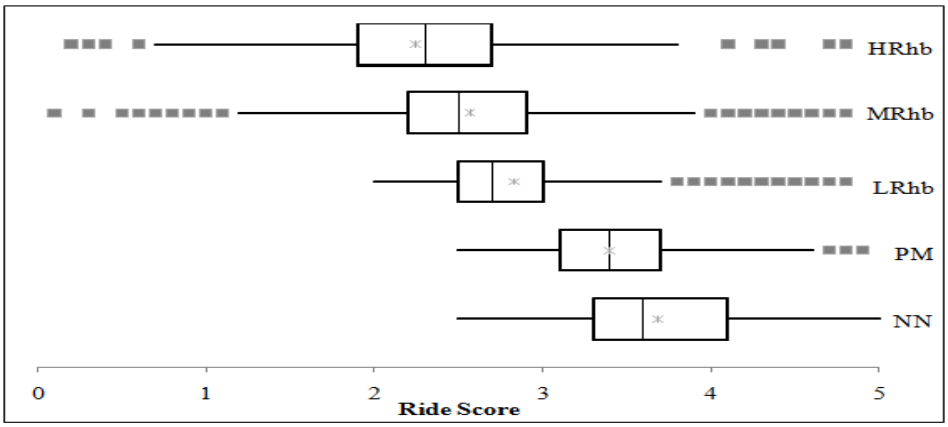
Whiskers extend to the furthest observations that are no more than 1.5 IQR from the edges of the box. Mild outliers are observations between 1.5 IQR and 3 IQR from the edges of the box. Extreme outliers are greater than 3 IQR from the edges of the box.

Figure A31. Box Plots for Condition Scores of Treatments Recommended by PMIS, Beaumont District, 2001–2009.



Treatment Category	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Need Nothing	13.0	100.0	100.0	100.0	100.0
Preventive Maintenance	20.0	78.0	90.0	99.0	100.0
Light Rehabilitation	6.0	73.0	96.0	100.0	100.0
Medium Rehabilitation	1.0	53.0	90.0	100.0	100.0
Heavy Rehabilitation	1.0	29.0	55.0	89.0	100.0

Figure A32. Box Plots for Distress Scores of Treatments Recommended by PMIS, Beaumont District, 2001–2009.



Treatment Category	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Need Nothing	2.5	3.3	3.6	4.1	5.0
Preventive Maintenance	2.5	3.1	3.4	3.7	4.9
Light Rehabilitation	2.0	2.5	2.7	3.0	4.8
Medium Rehabilitation	0.1	2.2	2.5	2.9	4.8
Heavy Rehabilitation	0.2	1.9	2.3	2.7	4.8

Figure A33. Box Plots for Ride Scores of Treatments Recommended by PMIS, Beaumont District, 2001–2009.

Table A36. PMIS Statistics for All Types of Pavements in Beaumont District (2001–2009).

Treatment Category	Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	61.4	87.7	8.58	98.1	6.9	3.7	0.6
Preventive Maintenance	26.1	85.0	16.01	86.1	15.3	3.4	0.4
Light Rehabilitation	3.1	70.1	22.50	84.4	22.0	2.8	0.5
Medium Rehabilitation	7.1	46.3	20.33	75.6	28.0	2.6	0.6
Heavy Rehabilitation	2.4	25.5	16.34	57.4	31.3	2.2	0.6

Total number of sections analyzed: 44531

e. The most prevalent PMIS treatment recommendation from 2001 through 2009 is Need Nothing. Sixty-two percent of the sections are in this treatment category. Thirty percent of sections fall in the Preventive Maintenance category while the remaining percentage is distributed between Light Rehabilitation, Medium Rehabilitation, and Heavy Rehabilitation (2.1%, 4.5%, and 1.2%, respectively). Table A37 shows a summary of the frequency, mean, and standard deviations for the PMIS condition score, distress score, and ride score for asphalt pavements.

Table A37. PMIS Statistics for Asphalt Pavements in Beaumont District (2001–2009).

Treatment Category	Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	62.3	97.4	7.76	98.0	6.9	3.4	0.4
Preventive Maintenance	29.9	85.0	16.03	86.1	15.3	2.7	0.5
Light Rehabilitation	2.1	70.7	16.19	87.1	16.3	2.8	0.6
Medium Rehabilitation	4.5	47.3	18.82	66.6	28.4	1.8	0.5
Heavy Rehabilitation	1.2	26.1	16.14	81.2	24.4	-	-

Total number of sections analyzed: 38601

f. The most prevalent PMIS treatment recommendation from 2001 through 2009 is Need Nothing. Forty-five percent of the sections are in this treatment category. Neither of the sections falls in the Preventive Maintenance category while the remaining percentage is distributed between Light Rehabilitation, Medium Rehabilitation, and Heavy Rehabilitation (1.7%, 27.6%, and 25.3%, respectively). Table A38 shows a summary of the frequency, mean, and standard deviations for the PMIS condition score, distress score, and ride score for CRCP.

Table A38. PMIS Statistics for CRCP in Beaumont District (2001–2009).

Treatment Category	Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	45.3	91.6	14.65	96.8	8.2	-	-
Preventive Maintenance	0.0	-	-	-	-	3.1	0.4
Light Rehabilitation	1.7	71.0	20.93	79.9	16.4	2.6	0.4
Medium Rehabilitation	27.6	49.6	19.35	74.9	21.0	2.6	0.4
Heavy Rehabilitation	25.3	21.8	12.98	35.3	21.9	-	-

Total number of sections analyzed: 916

g. The most prevalent PMIS treatment recommendation from 2001 through 2009 is Need Nothing. Fifty-seven percent of the sections are in this treatment category. Two percent of sections fall in the Preventive Maintenance category while the remaining percentage is distributed between Light Rehabilitation, Medium Rehabilitation, and Heavy Rehabilitation (10.4%, 23.8%, and 7.1%, respectively). Table A39 shows a summary of the frequency, mean, and standard deviations for the PMIS condition score, distress score, and ride score for JCP.

Table A39. PMIS Statistics for JCP in Beaumont District (2001–2009).

Treatment Category	Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	57.0	94.4	12.39	99.0	6.6	3.3	0.4
Preventive Maintenance	1.7	93.7	10.28	98.9	4.4	3.1	0.5
Light Rehabilitation	10.4	69.2	29.93	80.2	28.5	2.2	0.4
Medium Rehabilitation	23.8	44.1	22.33	88.8	23.0	2.6	0.5
Heavy Rehabilitation	7.1	27.0	18.14	41.1	22.2	-	-

Total number of sections analyzed: 5014

h. The Need Nothing treatment category was the most prevalent PMIS treatment recommendation in the Beaumont District maximum of 69% and minimum of 52% of lane miles considering all types of pavements. Preventive Maintenance ranges from 20% to 31%. Both Light Rehabilitation and Medium Rehabilitation range from 3% to 11% during the entire period of analysis, and Heavy Rehabilitation from 1% to 4%. Figure A34 shows the total PMIS treatment needs in Beaumont District.

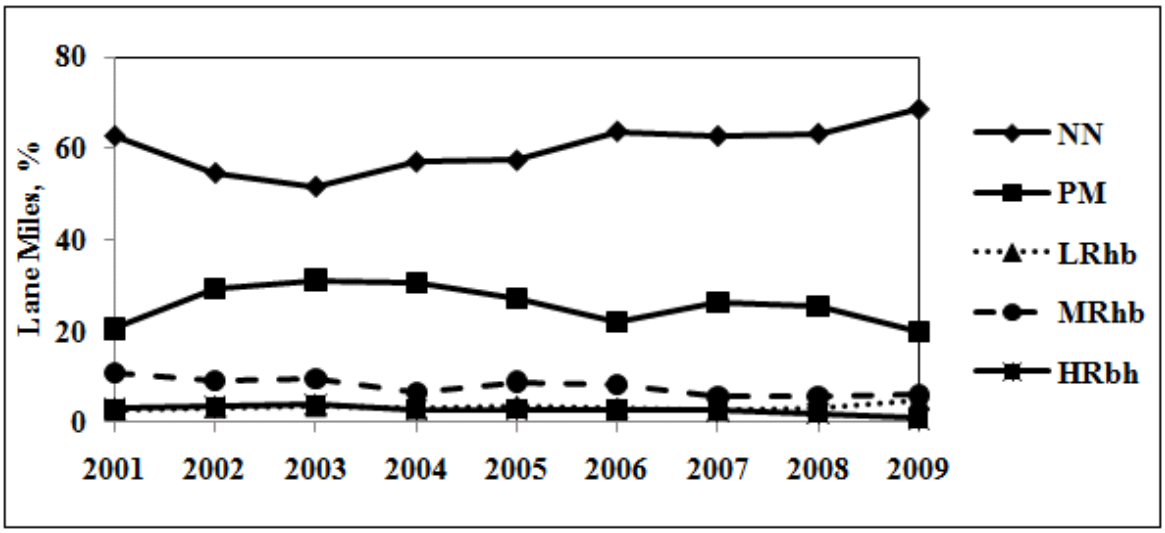


Figure A34. PMIS Treatment Needs in Beaumont District (All Types of Pavements).

i. The Need Nothing treatment category was the most prevalent PMIS treatment recommendation in the Beaumont District maximum of 69% and minimum of 52% of lane miles considering all types of pavements. Preventive Maintenance ranges from 24% to 37%. Both Light Rehabilitation and Medium Rehabilitation range from 1% to 7% during the entire period of analysis, and Heavy Rehabilitation is less than 2%. Figure A35 shows the total PMIS treatment needs in Beaumont District for asphalt pavements.

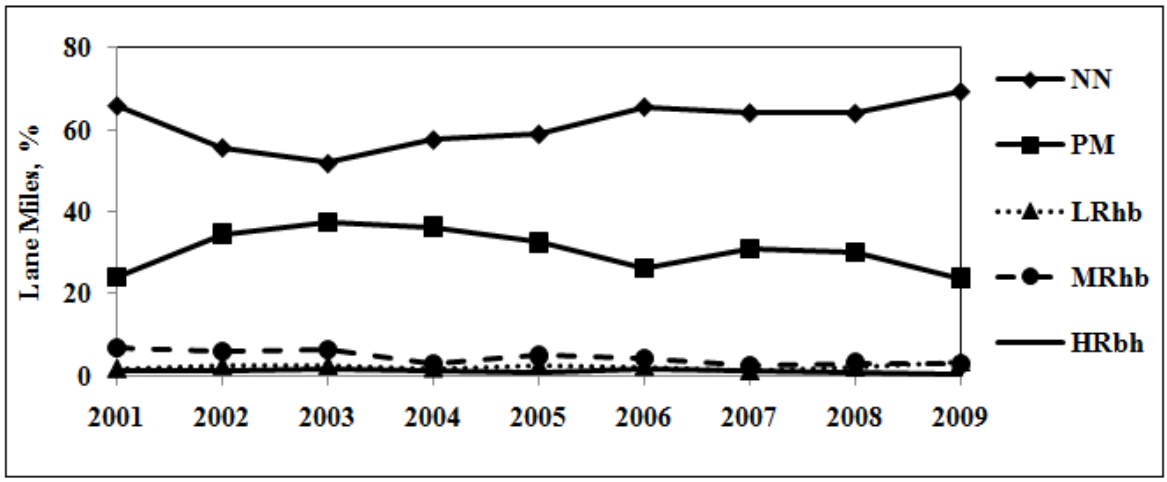


Figure A35. PMIS Treatment Needs for Asphalt Pavements in Beaumont District.

j. The Need Nothing treatment category was the most prevalent PMIS treatment recommendation in the Beaumont District maximum of 64% and minimum of 45% of lane miles considering all types of pavements. Preventive Maintenance is less than 3%. Light Rehabilitation ranges from 8% to 12%, Medium Rehabilitation ranges from 20% to 33% during the entire period of analysis, and Heavy Rehabilitation from 3% to 15%. Figure A36 shows the total PMIS treatment needs in Beaumont District.

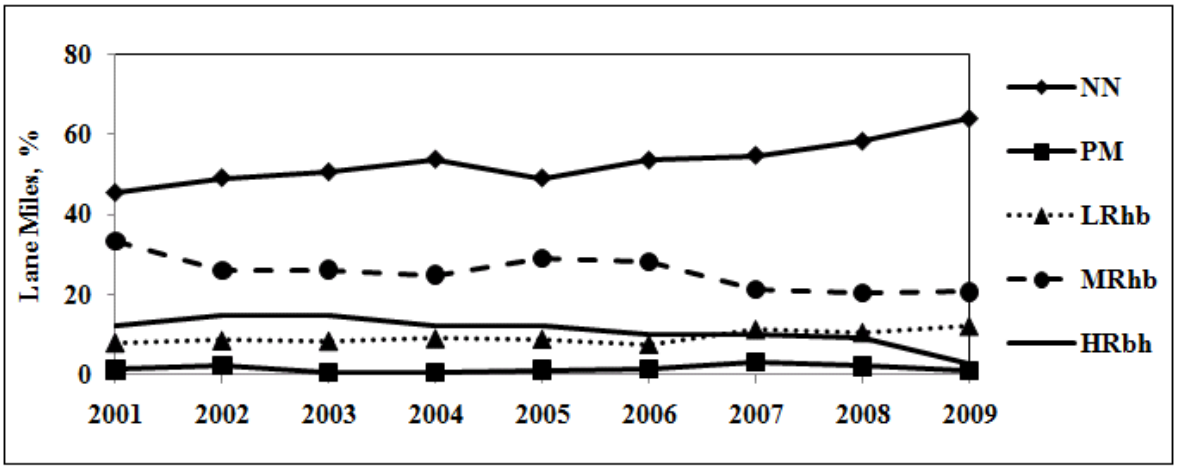


Figure A36. PMIS Treatment Needs for Concrete Pavements in Beaumont District.

PMIS Scores for Treatments Applied in Beaumont District

a. In 2009, 17 pavement sections received a district Heavy Rehabilitation in the Beaumont District. Forty-seven percent of these sections were recommended by PMIS for Heavy Rehabilitation, 29% for Medium Rehabilitation, 0% for Light Rehabilitation, and 12% for both Preventive Maintenance and Need Nothing. Table A40 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Heavy Rehabilitation treatment applied in Beaumont in 2009.

Table A40. PMIS Treatment Recommendations and Scores for HR Applied in Beaumont in 2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	11.8	100.0	-	100.0	-	4.2	0.4
Preventive Maintenance	11.8	41.0	7.1	48.5	14.8	3.0	0.2
Light Rehabilitation	0.0	-	-	-	-	-	-
Medium Rehabilitation	29.4	13.4	7.4	27.2	6.8	2.3	0.3
Heavy Rehabilitation	47.1	20.0	10.8	58.3	20.5	1.9	0.3

(*) A total of 17 pavement sections received a district Heavy Rehabilitation.

b. In 2009, 42 pavement sections received a district Medium Rehabilitation in the Beaumont District. Fourteen percent of these sections were recommended by PMIS for Medium Rehabilitation. Zero percent for Heavy Rehabilitation, 2% for Light Rehabilitation, 55% for Preventive Maintenance and about 29% for Need Nothing. Table A41 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Medium Rehabilitation treatment applied in Beaumont in 2009.

Table A41. PMIS Treatment Recommendations and Scores for MRhb Applied in Beaumont in 2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	28.6	89.9	15.6	99.2	2.3	3.4	0.6
Preventive Maintenance	54.8	68.7	16.5	81.1	14.3	3.0	0.4
Light Rehabilitation	2.4	49.0	-	69.0	-	2.7	-
Medium Rehabilitation	14.3	36.3	16.3	48.8	27.8	2.9	0.5
Heavy Rehabilitation	0.0	-	-	-	-	-	-

(*) A total of 42 pavement sections received a district Medium Rehabilitation.

c. In 2009, 113 pavement sections received a district Light Rehabilitation in the Beaumont District. Five percent of these sections were recommended by PMIS for Light Rehabilitation, 2% for Heavy Rehabilitation, 7% for Medium Rehabilitation, 14% for Preventive Maintenance, and about 72% for Need Nothing. Table A42 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Light Rehabilitation treatment applied in Beaumont in 2009.

Table A42. PMIS Treatment Recommendations and Scores for LRhb Applied in Beaumont in 2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	71.7	97.2	9.5	98.3	5.4	4.1	0.5
Preventive Maintenance	14.2	72.8	8.8	73.8	9.6	3.5	0.6
Light Rehabilitation	5.3	68.3	19.1	83.2	23.9	2.6	0.3
Medium Rehabilitation	7.1	44.8	21.7	65.6	30.8	2.6	0.3
Heavy Rehabilitation	1.8	25.0	22.6	30.5	16.3	2.8	0.6

(*) A total of 113 pavement sections received a district Light Rehabilitation.

d. In 2009, 407 pavement sections received a district Preventive Maintenance in the Beaumont District. Thirty-five percent of these sections were recommended by PMIS for Preventive Maintenance. Zero percent for Heavy Rehabilitation, 3% for Medium Rehabilitation, 2% for Light Rehabilitation and about 60% for Need Nothing. Table A43 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Preventive Maintenance applied in Beaumont in 2009.

Table A43. PMIS Treatment Recommendations and Scores for PM Applied in Beaumont in 2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	60.4	98.2	5.8	98.8	4.9	3.7	0.5
Preventive Maintenance	35.1	84.1	16.0	85.0	16.1	3.3	0.4
Light Rehabilitation	1.7	84.9	12.5	91.7	6.1	2.4	0.4
Medium Rehabilitation	2.7	50.2	17.8	74.5	30.6	2.6	0.3
Heavy Rehabilitation	0.0	-	-	-	-	-	-

(*) A total of 407 pavement sections received a district Preventive Maintenance.

e. In 2008, 94 pavement sections received a district Medium Rehabilitation in the Beaumont District. Thirteen percent of these sections were recommended by PMIS for Medium Rehabilitation. Twenty-three percent for Heavy Rehabilitation, 10% for Light Rehabilitation, 76% for Preventive Maintenance and about 20% for Need Nothing. Table A44 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Medium Rehabilitation treatment applied in Beaumont in 2008.

Table A44. PMIS Treatment Recommendations and Scores for MRhb Applied in Beaumont in 2008.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	20.2	95.9	9.0	97.6	6.2	3.6	0.5
Preventive Maintenance	75.8	79.7	12.5	81.6	12.4	3.6	0.4
Light Rehabilitation	9.7	67.5	11.5	91.5	11.4	2.7	0.1
Medium Rehabilitation	12.9	31.5	32.2	52.4	43.3	2.2	0.6
Heavy Rehabilitation	22.6	21.5	17.2	23.4	17.7	2.8	0.4

(*) A total of 94 pavement sections received Medium Rehabilitation.

f. In 2008, 62 pavement sections received a district Light Rehabilitation in the Beaumont District. Zero percent of these sections were recommended by PMIS for Light Rehabilitation. Zero percent for Heavy Rehabilitation, 0% for Medium Rehabilitation, 26% for Preventive Maintenance and about 74% for Need Nothing. Table A45 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Light Rehabilitation treatment applied in Beaumont in 2008.

Table A45. PMIS Treatment Recommendations and Scores for LRhb Applied in Beaumont in 2008.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	74.2	99.3	3.1	99.3	3.1	3.8	0.3
Preventive Maintenance	25.8	88.0	13.6	91.5	11.5	3.4	0.3
Light Rehabilitation	0.0	-	-	-	-	-	-
Medium Rehabilitation	0.0	-	-	-	-	-	-
Heavy Rehabilitation	0.0	-	-	-	-	-	-

(*) A total of 62 pavement sections received Light Rehabilitation.

g. In 2008, 671 pavement sections received a district Preventive Maintenance in the Beaumont District. Twenty-four percent of these sections were recommended by PMIS for Preventive Maintenance. Less than 1% for Heavy Rehabilitation, 2% for Medium Rehabilitation, 2% for Light Rehabilitation and about 72% for Need Nothing. Table A46 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Preventive Maintenance treatment applied in Beaumont in 2008.

Table A46. PMIS Treatment Recommendations and Scores for PM Applied in Beaumont in 2008.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	72.1	97.7	7.6	98.3	6.6	4.0	0.6
Preventive Maintenance	24.3	86.4	16.7	87.4	14.9	3.4	0.4
Light Rehabilitation	1.6	76.8	12.6	83.5	21.9	2.5	0.3
Medium Rehabilitation	1.5	49.4	18.1	60.5	31.5	2.7	0.5
Heavy Rehabilitation	0.4	5.0	-	27.7	5.9	1.8	-

(*) A total of 671 pavement sections received a district Preventive Maintenance.

h. In 2007, 134 pavement sections received a district Heavy Rehabilitation in the Beaumont District. Twenty-three percent of these sections were recommended by PMIS for Heavy Rehabilitation. Thirty percent for Medium Rehabilitation, less than 1% for Light Rehabilitation, and 8% for Preventive Maintenance, and 38% for Need Nothing. Table A47 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Heavy Rehabilitation treatment applied in Beaumont in 2007.

Table A47. PMIS Treatment Recommendations and Scores for HRhb Applied in Beaumont in 2007.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	38.1	87.3	17.2	95.0	11.3	3.5	0.5
Preventive Maintenance	8.2	84.4	14.4	85.5	16.0	3.4	0.4
Light Rehabilitation	0.7	52.5	12.8	59.0	-	2.7	-
Medium Rehabilitation	29.9	52.3	19.1	88.0	20.6	2.5	0.3
Heavy Rehabilitation	23.1	26.6	16.4	43.9	27.9	2.6	0.5

(*) A total of 134 pavement sections received a district Heavy Rehabilitation.

i. In 2007, 131 pavement sections received a district Medium Rehabilitation in the Beaumont District. Twenty-nine percent of these sections were recommended by PMIS for Medium Rehabilitation. Twenty-six percent for Heavy Rehabilitation, 3% for Light Rehabilitation, 11% for Preventive Maintenance and about 31% for Need Nothing. Table A48 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Medium Rehabilitation treatment applied in Beaumont in 2007.

Table A48. PMIS Treatment Recommendations and Scores for MRhb Applied in Beaumont in 2007.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	31.3	95.7	7.8	99.2	2.4	3.5	0.4
Preventive Maintenance	10.7	84.4	14.4	85.1	13.6	3.5	0.4
Light Rehabilitation	3.1	52.5	12.8	73.3	20.1	2.7	0.2
Medium Rehabilitation	29.0	52.3	19.1	90.4	18.8	2.5	0.3
Heavy Rehabilitation	26.0	26.6	16.4	44.9	27.5	2.6	0.5

(*) A total of 131 pavement sections received a district Medium Rehabilitation.

j. In 2007, 38 pavement sections received a district Light Rehabilitation in the Beaumont District. Zero percent of these sections were recommended by PMIS for Light Rehabilitation. Zero percent for Heavy Rehabilitation, 16% for Medium Rehabilitation, 3% for Preventive Maintenance and about 82% for Need Nothing. Table A49 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Light Rehabilitation treatment applied in Beaumont in 2007.

Table A49. PMIS Treatment Recommendations and Scores for LRhb Applied in Beaumont in 2007.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	81.6	89.3	21.4	99.2	2.5	3.8	0.5
Preventive Maintenance	2.6	60.0	-	60.0	-	3.7	-
Light Rehabilitation	0.0	-	-	-	-	-	-
Medium Rehabilitation	15.8	43.8	9.5	43.8	9.5	3.5	0.2
Heavy Rehabilitation	0.0	-	-	-	-	-	-

(*) A total of 38 pavement sections received a district Light Rehabilitation.

k. In 2007, 524 pavement sections received a district Preventive Maintenance in the Beaumont District. Twenty-five percent of these sections were recommended by PMIS for Preventive Maintenance. Less than 1% for Heavy Rehabilitation, 5% for Medium Rehabilitation, 3% for Light Rehabilitation and about 68% for Need Nothing. Table A50 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Preventive Maintenance treatment applied in Beaumont in 2007.

Table A50. PMIS Treatment Recommendations and Scores for PM Applied in Beaumont in 2007.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	67.2	97.2	7.5	97.6	7.2	3.7	0.6
Preventive Maintenance	24.8	92.3	12.4	93.0	11.6	3.3	0.4
Light Rehabilitation	3.1	80.5	15.5	90.8	13.2	2.8	0.5
Medium Rehabilitation	4.8	56.0	20.8	90.8	22.0	2.4	0.3
Heavy Rehabilitation	0.2	25.0	-	99.0	-	1.8	-

(*) A total of 524 pavement sections received a district Preventive Maintenance.

l. In 2007–2009, 51 pavement sections received a district Heavy Rehabilitation in the Beaumont District. Sixteen percent of these sections were recommended by PMIS for Heavy Rehabilitation, 16% for Medium Rehabilitation, 0% for Light Rehabilitation, and 12% for Preventive Maintenance, and 57% for Need Nothing. Table A51 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for district Heavy Rehabilitation treatment applied in Beaumont in 2007–2009.

Table A51. PMIS Treatment Recommendations and Scores for HRhb Applied in Beaumont in 2007–2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	56.9	88.1	16.9	91.3	13.9	3.6	0.5
Preventive Maintenance	11.8	69.0	26.7	74.2	23.2	3.3	0.5
Light Rehabilitation	0.0	-	-	-	-	-	-
Medium Rehabilitation	15.7	26.1	21.8	38.8	19.1	2.5	0.5
Heavy Rehabilitation	15.7	20.0	10.8	58.3	20.5	1.9	0.3

(*) A total of 51 pavement sections received a district Heavy Rehabilitation.

m. In 2007–2009, 267 pavement sections received a district Medium Rehabilitation in the Beaumont District. Twenty percent of these sections were recommended by PMIS for Medium Rehabilitation. Eighteen percent for Heavy Rehabilitation, 4% for Light Rehabilitation, 32% for Preventive Maintenance and about 27% for Need Nothing. Table A52 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for a district Medium Rehabilitation treatment applied in Beaumont in 2007–2009.

Table A52. PMIS Treatment Recommendations and Scores for MRhb Applied in Beaumont in 2007–2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	27.0	94.8	9.9	98.8	3.8	3.5	0.5
Preventive Maintenance	31.5	77.5	15.0	82.0	13.0	3.4	0.5
Light Rehabilitation	4.1	60.4	13.5	82.8	16.9	2.7	0.1
Medium Rehabilitation	19.5	47.3	22.4	79.8	30.1	2.5	0.4
Heavy Rehabilitation	18.0	25.1	16.6	38.6	26.7	2.6	0.5

(*) A total of 267 pavement sections received a district Medium Rehabilitation.

n. In 2007–2009, 231 pavement sections received a district Light Rehabilitation in the Beaumont District. Three percent of these sections were recommended by PMIS for Light Rehabilitation. One percent for Heavy Rehabilitation, 7% for Medium Rehabilitation, 16% for Preventive Maintenance and about 74% for Need Nothing. Table A53 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for a district Light Rehabilitation treatment applied in Beaumont in 2007–2009.

Table A53. PMIS Treatment Recommendations and Scores for LRhb Applied in Beaumont in 2007–2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
eed Nothing	74.2	98.2	7.1	98.8	4.4	4.0	0.5
Preventive Maintenance	15.5	79.8	13.9	81.9	14.1	3.5	0.5
Light Rehabilitation	2.8	68.3	19.1	83.2	23.9	2.6	0.3
Medium Rehabilitation	6.6	44.4	17.0	56.3	25.9	3.0	0.5
Heavy Rehabilitation	0.9	25.0	22.6	30.5	16.3	2.8	0.6

(*) A total of 213 pavement sections received a district Light Rehabilitation.

o. In 2007–2009, 1602 pavement sections received a district Preventive Maintenance in the Beaumont District. Twenty-seven percent of these sections were recommended by PMIS for Preventive Maintenance. Less than 1% for Heavy Rehabilitation, 3% for Medium Rehabilitation, 2% for Light Rehabilitation, and about 68% for Need Nothing. Table A54 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Preventive Maintenance treatment applied in Beaumont in 2007–2009.

Table A54. PMIS Treatment Recommendations and Scores for PM Applied in Beaumont in 2007–2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
eed Nothing	67.5	97.7	7.0	98.2	6.5	3.8	0.6
Preventive Maintenance	27.2	87.4	15.2	88.3	14.7	3.3	0.4
Light Rehabilitation	2.1	78.2	17.2	88.6	15.6	2.6	0.4
Medium Rehabilitation	2.9	52.0	19.7	80.3	28.6	2.6	0.4
Heavy Rehabilitation	0.2	22.8	12.2	45.5	36.0	2.3	0.6

(*) A total of 1602 pavement sections received a district Preventive Maintenance.

Hypothesis Tests to Compare PMIS Treatment Recommendations with Treatments Applied in the District

Hypothesis tests were performed to compare if the scores for PMIS treatment recommendations were statistically different than the scores for treatments applied in the district. A preliminary analysis of the score histograms by treatment category shows that they do not follow a normal distribution. Therefore, non-parametrical statistical tests were selected to perform the analysis.

Nonparametric tests are not completely free of assumptions about the data since they still require the data to be an independent random sample. Mann-Whiney nonparametric hypothesis test was used to determine whether the medians (η) of the PMIS scores were statistically different for PMIS treatment recommendations when compared to treatments applied by the district. The Mann-Whitney test does not require the data to come from normally distributed populations, but it does make the following assumptions: (a) the populations of interest have the same shape, and (b) the populations are independent.

The test is formulated as follow:

- Null hypothesis -> H_o: $\eta_1 = \eta_2$ (medians are equal).
- Alternative hypothesis -> H_a: $\eta_1 \neq \eta_2$ (medians are not equal).

The Mann-Whitney test uses the ranks of the sample data, instead of their specific values, to detect statistical significance. The test was performed at the 0.05 significance level. If the test's p-value is less than 0.05 then we reject the null hypothesis.

Tables A55, A56, A57, and A58 show the results of the two samples Mann-Whitney hypothesis testing when comparing scores for PMIS treatment recommendations and treatments applied by the Beaumont District. Analysis was conducted for Preventive Maintenance, Light Rehabilitation, Medium Rehabilitation, and Heavy Rehabilitation.

Table A55. Mann-Whitney Test Results for Preventive Maintenance Test Results for Beaumont in 2007–2009.

Year	Score	Medians		P-Value	Test Result
		PMIS	Beaumont		
2007	Condition Score	95	100	0.0000	Reject
	Distress Score	95	100	0.0000	Reject
	Ride Score	3.4	3.5	0.0765	Accept
2008	Condition Score	90	100	0.0000	Reject
	Distress Score	91	100	0.0000	Reject
	Ride Score	3.3	3.7	0.0000	Reject
2009	Condition Score	88	100	0.0000	Reject
	Distress Score	90	100	0.0000	Reject
	Ride Score	3.4	3.5	0.3741	Accept
2007–2009	Condition Score	90	100	0.0000	Reject
	Distress Score	91	100	0.0000	Reject
	Ride Score	3.4	3.6	0.000	Reject

PMIS-Beaumont: 1357-524 sections in 2007, 1299-671 sections in 2008, 1026-407 sections in 2009, 3682-1602 sections in total.

The PMIS condition score, distress score, and ride score medians for Preventive Maintenance are statistically different when comparing PMIS recommendations to treatments applied in Beaumont District from 2007–2009. Only in 2007 and 2009, we should accept the null hypothesis of equal means for ride score.

Table A56. Mann-Whitney Test Results for Light Rehabilitation for Beaumont in 2007–2009.

Year	Score	Medians		P-Value	Test Result
		PMIS	Beaumont		
2007	Condition Score	78	100	0.0000	Reject
	Distress Score	99	100	0.0545	Accept
	Ride Score	2.8	3.7	0.0000	Reject
2008	Condition Score	78	100	0.0000	Reject
	Distress Score	99	100	0.0001	Reject
	Ride Score	2.7	3.7	0.0000	Reject
2009	Condition Score	71	100	0.0000	Reject
	Distress Score	85	100	0.0000	Reject
	Ride Score	3.0	4.1	0.0000	Reject
2007–2009	Condition Score	78	100	0.0000	Reject
	Distress Score	95	100	0.0000	Reject
	Ride Score	2.8	3.8	0.0000	Reject

PMIS-Beaumont: 134-38 sections in 2007, 165-62 sections in 2008, 253-113 sections in 2009, 552-213 sections total.

The PMIS condition score, distress score, and ride score medians for Light Rehabilitation are statistically different when comparing PMIS recommendations to treatments applied in Beaumont District from 2007–2009. Only for 2007 data we should accept the null hypothesis of equal means for distress score.

Table A57. Mann-Whitney Test Results for Medium Rehabilitation for Beaumont in 2007–2009.

Year	Score	Medians		P-Value	Test Result
		PMIS	Beaumont		
2007	Condition Score	51	61	0.0000	Reject
	Distress Score	100	99	0.3879	Accept
	Ride Score	2.4	2.9	0.0000	Reject
2008	Condition Score	47	78	0.0000	Reject
	Distress Score	84	84	0.6763	Accept
	Ride Score	2.4	3.3	0.0000	Reject
2009	Condition Score	43	67	0.0000	Reject
	Distress Score	91	90	0.8697	Accept
	Ride Score	2.3	3.0	0.0000	Reject
2007-2009	Condition Score	47	72	0.0000	Reject
	Distress Score	95	90	0.4946	Accept
	Ride Score	2.4	3.0	0.0000	Reject

PMIS-Beaumont: 279-131 sections in 2007, 285-94 sections in 2008, 296-42 sections in 2009, 860-267 sections total.

The PMIS condition score, and ride score medians for Medium Rehabilitation are statistically different when comparing PMIS recommendations to treatments applied in Beaumont District from 2007–2009, while for the distress score, we should accept the null hypothesis that the

medians are statistically equal. When we run the test for 2007 data, we should reject the null hypothesis for condition score and ride score but accept it for distress score, and in 2008 we should reject the null hypothesis for condition score and ride score but accept it for distress score; also in 2009 we should reject the null hypothesis for condition score and ride score but accept it for distress score

Table A58. Mann-Whitney Test Results for Heavy Rehabilitation for Beaumont in 2007–2009.

Year	Score	Medians		P-Value	Test Result
		PMIS	Beaumont		
2007	Condition Score	26	94	0.0000	Reject
	Distress Score	49	99	0.0000	Reject
	Ride Score	2.3	3.7	0.0000	Reject
2008	Condition Score	-	-	-	-
	Distress Score	-	-	-	-
	Ride Score	-	-	-	-
2009	Condition Score	16	23	0.5122	Accept
	Distress Score	49	40	0.9277	Accept
	Ride Score	2.1	2.3	0.0512	Accept
2007-2009	Condition Score	23	77	0.0000	Reject
	Distress Score	49	81	0.0000	Reject
	Ride Score	2.2	3.3	0.0000	Reject

PMIS-Beaumont: 145-34 sections in 2007, 0-0 sections in 2008, 52-17 sections in 2009, 307-51 sections total.

PMIS condition score, distress score, and ride score medians for Heavy Rehabilitation are statistically different when comparing PMIS recommendations to treatments applied in Beaumont District from 2007–2009. Only in 2009, we should accept the null hypothesis of equal means for condition score, distress score, and ride score.

Budget Prioritization Analysis

A budget prioritization analysis of the PMIS sections recommended for treatment and treatments applied by the districts were performed. We requested the list of sections and budgets for the last 4 years for the purpose of comparing priority rankings.

PMIS candidate sections for treatment are ranked from the highest to the lowest cost-effectiveness ratio. Districts prioritize pavement sections when funds are constraint based on field inspections and local project conditions.

PMIS ranking for sections in which the district applied treatment were compared and discussed with the district. Tables A59 and A60 provide a list of the sections treated by the district for the Preventive Maintenance and Rehabilitation categories, respectively. The costs estimated by both the district and PMIS are shown for each project. Priority rankings according to PMIS are also displayed for the district treated sections.

A summary of the Preventive Maintenance and Rehabilitation total treatment cost was calculated for PMIS and the Beaumont District. Table A61 displays the total cost for each treatment type according to each source.

Table A59. Sections Applied with Preventive Maintenance Treatment, Beaumont District (2009).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
1	FM 2041	-	-	0.716	$ 19,320.00	-	-	1572	SEAL COAT
2	FM 3513	432+0.0	434+1.3	3.218	$ 161,665.00	$ 66,000.00	0.037	331	SEAL COAT
3	SH 0326	424+0.4	444+0.0	19.566	$ 1,084,084.00	$ 237,000.00	0.051	207	SEAL COAT
4	FM 0105	424+0.0	434+0.0	8.812	$ 459,034.00	$ 59,000.00	0.088	73	SEAL COAT
5	FM 1004	412-1.2	412+1.0	3.098	$ 75,473.00	$ 9,800.00	0.029	510	SEAL COAT
6	FM 1013	760+0.5	768+1.0	8.34	$ 230,572.00	$ 170,000.00	0.125	21	SEAL COAT
7	FM 2799	754-0.2	754+1.4	1.753	$ 128,025.00	$ 195,000.00	0.150	8	SEAL COAT
8	RE 255	758+0.0	758+1.5	1.522	$ 98,643.00	-	-	1572	SEAL COAT
9	SH 0062	-	-	1.106	$ 237,518.00	-	-	1572	SEAL COAT
10	SH 0063	746+0.0	752+0.0	6.237	$ 348,761.00	$ 14,000.00	0.042	274	SEAL COAT
11	FM 0365	742+1.0	752+1.2	10.099	$ 294,736.00	$ 55,000.00	0.096	53	SEAL COAT
12	FM 3514	760+0.0	760+1.8	1.636	$ 97,671.00	-	-	1572	SEAL COAT
13	SH 0082	-	-	0.825	$ 8,722.00	-	-	1572	SEAL COAT
14	SH 0087	502+1.0	510+0.0	6.85	$ 273,682.00	$ 31,000.00	0.059	172	SEAL COAT
15	SH 0326	446+0.0	450+0.0	4.227	$ 230,695.00	$ 80,000.00	0.126	20	SEAL COAT
16	US 090	900+1.1	902+1.1	2.26	$ 902,894.00	$ 90,000.00	0.046	244	SEAL COAT
17	FM 0770	460-0.7	462+0.0	2.694	$ 100,828.00	$ 128,000.00	0.047	231	SEAL COAT
18	FM 1960	704+0.0	706+1.5	2.153	$ 111,357.00	-	-	1572	SEAL COAT
19	FM 1960	706+1.5	712+1.7	6.003	$ 305,333.00	-	-	1572	SEAL COAT
20	SH 0146	438+1.3	442+1.5	4.064	$ 251,133.00	$ 45,000.00	0.030	474	SEAL COAT
21	US 059	462+0.0	466+0.5	4.822	$ 242,616.00	-	-	1572	SEAL COAT
22	RE0255	780+0.1	791+00	10.804	$ 387,743.00	-	-	1572	SEAL COAT
23	SH 0087	410+1.0	424+0.5	13.859	$ 577,399.00	-	-	1572	SEAL COAT
24	SH 0087	424+1.0	432+0.0	7.235	$ 441,051.00	$ 7,000.00	0.000	1540	SEAL COAT
25	SH 0087	464+00.0	466+01.0	3	$ 169,060.00	$ 28,000.00	0.150	7	SEAL COAT
26	SH 0087	-	-	0.474	$ 25,582.00	-	-	1572	SEAL COAT
27	SH 0087	-	-	1.12	$ 65,144.00	-	-	1572	SEAL COAT
28	FM 0105	434+0.0	436+1.0	3.094	$ 285,834.00	$ 100,000.00	0.102	48	SEAL COAT
29	FM 0105	456+1.0	458+1.5	2.417	$ 72,590.00	$ 95,000.00	0.062	151	SEAL COAT
30	FM 0105	460+0.0	462+0.1	2.203	$ 68,890.00	$ 10,000.00	0.057	179	SEAL COAT
31	FM 0105	-	-	0.315	$ 7,935.00	-	-	1572	SEAL COAT
32	FM 1130	768+1.5	772+0.5	3.013	$ 100,880.00	$ 165,000.00	0.099	50	SEAL COAT
33	FM 1132	762+0.5	764+0.0	1.645	$ 1.00	$ 40,000.00	0.036	360	SEAL COAT
34	FM 2802	758+0.0	766+1.0	9.03	$ 462,228.00	$ 320,000.00	0.052	199	SEAL COAT
35	SH 0062	-	-	0.185	$ 12,822.00	-	-	1572	SEAL COAT

Table A59. Sections Applied with Preventive Maintenance Treatment, Beaumont District (2009) (Continued).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
36	FM 0092	392+1.5	396+1.0	5.5	$ 317,480.00	$ 42,000.00	0.014	974	SEAL COAT
37	FM 1746	736-1.9	742+0.0	7.85	$ 419,397.00	$ 28,000.00	0.047	229	SEAL COAT
38	FM 1943	726+0.0	732+1.4	7.392	$ 191,116.00	$ 42,000.00	0.113	31	SEAL COAT
39	US 069	466+1.0	468+1.0	1.897	$ 122,181.00	$ 28,000.00	0.074	107	SEAL COAT
40	FM 0418	750+0.0	752+0.2	1.7	$ 73,175.00	$ 60,000.00	0.062	149	SEAL COAT
41	FM 1724	460+0.0	464+0.9	4.909	$ 152,166.00	$ 28,000.00	0.148	10	SEAL COAT
42	FM 1941	734+0.0	746+1.6	13.602	$ 410,192.00	$ 182,000.00	0.077	93	SEAL COAT
43	FM 1985	726+0.0	740+0.8	14.694	$ 274,308.00	$ 98,000.00	0.021	766	SEAL COAT
44	FM 2354	472+1.5	476+1.3	3.6	$ 88,659.00	$ 40,000.00	0.015	932	SEAL COAT
45	FM 2936	722+0.0	724+1.4	3.415	$ 84,082.00	$ 15,000.00	0.002	1453	SEAL COAT
46	IH 10	-	-	15.647	$ 600,720.00	-	-	1572	SEAL COAT
47	IH 10	-	-	2.4	$ 75,960.00	-	-	1572	SEAL COAT
48	FM 0092	424+1.5	428+0.5	2.81	$ 172,000.00	$ 252,000.00	0.050	215	SEAL COAT
49	FM 0420	736+0.0	738+1.5	3.819	$ 75,748.00	$ 420,000.00	0.034	389	SEAL COAT
50	FM 0770	426+0.0	440+1.0	15.049	$ 422,227.00	$ 101,600.00	0.066	2155	SEAL COAT
51	FM 0943	730+0.0	742+0.0	11.937	$ 226,624.00	$ 35,000.00	0.072	115	SEAL COAT
52	FM 1003	426-1.2	428+1.5	4.715	$ 100,918.00	-	-	1572	SEAL COAT
53	FM 1122	746+0.0	748+0.9	2.981	$ 78,371.00	$ 70,000.00	0.021	760	SEAL COAT
54	FM 3063	734+0.0	736+0.0	2.037	$ 50,883.00	$ 10,000.00	0.042	272	SEAL COAT
55	PR 74	-	-	0.918	$ 16,765.00	-	-	1572	SEAL COAT
56	US 069	514+0.0	514+2	3.3	$ 101,256.00	-	-	1572	SEAL COAT
57	US 069	-	-	0.463	$ 9,657.00	-	-	1572	SEAL COAT
58	US 096	-	-	3.252	$ 483,426.00	-	-	1572	SEAL COAT
59	FM 0082	758+0.0	764+0.0	5.854	$ 149,717.00	-	-	1572	SEAL COAT
60	FM 0105	-	-	0.747	$ 37,396.00	-	-	1572	SEAL COAT
61	FM 0363	-	-	1.057	$ 29,534.00	-	-	1572	SEAL COAT
62	FM 1005	390+0.0	400+0.5	10.329	$ 278,995.00	$ 57,000.00	0.028	537	SEAL COAT
63	FM 1007	760-1.5	764+0.5	6.426	$ 145,266.00	-	-	1572	SEAL COAT
64	FM 1013	756+0.0	760+0.5	4.364	$ 104,444.00	$ 14,000.00	-	1534	SEAL COAT
65	FM 1013	-	-	0.635	$ 16,016.00	-	-	1572	SEAL COAT
66	FM 1131	426-0.5	432+01	7.569	$ 140,130.00	$ 63,000.00	0.010	1108	SEAL COAT
67	FM 1408	762+0.0	766+1.4	5.259	$ 94,337.00	-	-	1572	SEAL COAT
68	FM 1738	376+0.0	380+0.3	4.178	$ 71,378.00	$ 7,000.00	0.000	1564	SEAL COAT
69	FM 252	386+0.0	394+1.5	9.253	$ 262,117.00	$ 7,000.00	0.014	979	SEAL COAT
70	FM 254	380+0.0	382+0.6	2.609	$ 47,641.00	$ 54,000.00	0.021	743	SEAL COAT

Table A59. Preventive Maintenance Sections (Beaumont District) (Continued).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
71	FM 2799	748+0.5	750+1.1	1.428	$ 66,131.00	-	-	1572	SEAL COATC
72	FM 2799	746+0.0	746+1.5	1.831	$ 39,131.00	$ 17,000.00	0.003	1385	SEAL COATC
73	FM 2938	418+0.0	420+1.5	3.499	$ 65,452.00	$ 52,000.00	0.060	160	SEAL COATC
74	RE 255	762+1.0	770+0.0	5.692	$ 199,478.00	$ 18,000.00	0.046	245	SEAL COATC
75	SH 0062	418+1.0	430+00.0	11.051	$ 307,491.00	$ 35,000.00	0.103	44	SEAL COATC
76	SH 0063	-	-	0.309	$ 7,440.00	-	-	1572	SEAL COATC
77	US 190	852+0.2	858+10	6.911	$ 386,583.00	$ 14,000.00	0.131	18	SEAL COATC
78	FM 0364	438+0.0	440+0.5	2.453	$ 63,371.00	-	-	1572	SEAL COATC
79	FM 0365	766+1.5	770+0.0	2.252	$ 88,562.00	$ 190,000.00	0.047	237	SEAL COATC
80	FM 0365	738+0.0	742+1.0	5.017	$ 114,757.00	$ 83,000.00	0.074	104	SEAL COATC
81	IH 10A, X	831+0.4	836+0.4	7.3	$ 174,532.00	-	-	1572	SEAL COATC
82	SH 0347	452+0.4	454+0.0	1.959	$ 40,057.00	$ 980,000.00	0.018	857	SEAL COATC
83	SS 215	766+0.0	766+1.6	1.232	$ 52,577.00	$ 302,000.00	0.043	270	SEAL COATC
84	US 090	906+1.4	914+1.5	8.163	$ 675,310.00	$ 452,000.00	0.043	265	SEAL COATC
85	FM 1009	732+0.0	738+0.0	5.26	$ 133,235.00	$ 259,000.00	0.023	687	SEAL COATC
86	FM 2518	424+0.0	428+1.0	5.129	$ 115,415.00	$ 20,000.00	0.002	1455	SEAL COATC
87	SH 0321	434+0.0	440+0.5	5.659	$ 217,242.00	$ 154,000.00	0.035	371	SEAL COATC
88	SL 573	426+0.0	428+0.2	2.245	$ 82,890.00	$ 498,000.00	0.059	173	SEAL COATC
89	US 059	-	-	1.253	$ 81,103.00	-	-	1572	SEAL COATC
90	US 059A,X	-	-	1.218	$ 48,924.00	-	-	1572	SEAL COATC
91	FM 0363	768+0.0	770+1.5	3.264	$ 84,507.00	-	-	1572	SEAL COATC
92	FM 0363	770+1.5	782+0.0	10.525	$ 264,095.00	$ 21,000.00	0.067	132	SEAL COATC
93	FM 253	772+1.5	774+0.7	1.367	$ 23,871.00	$ 16,000.00	0.013	998	SEAL COATC
94	FM 253	768+0.0	772+1.5	5.232	$ 101,324.00	$ 125,000.00	0.088	75	SEAL COATC
95	FM 2626	386+0.0	396+1.5	11.76	$ 224,880.00	$ 14,000.00	0.007	1227	SEAL COATC
96	FM 2829	408+0.0	410+0.0	1.997	$ 56,774.00	$ 7,000.00	0.015	956	SEAL COATC
97	FM 2939	766+0.0	770+0.0	3.794	$ 100,018.00	-	-	1572	SEAL COATC
98	SH 0063	796+01.5	799+0.5	1.913	$ 46,668.00	-	-	1572	SEAL COATC
99	SH 0087	440+1.0	448+1.4	8.556	$ 395,599.00	$ 8,000.00	0.006	1263	SEAL COATC
100	SP 272	-	-	0.747	$ 22,594.00	-	-	1572	SEAL COATC
101	US 190	-	-	0.108	$ 5,259.00	-	-	1572	SEAL COATC
102	US 190	-	-	0.295	$ 11,225.00	-	-	1572	SEAL COATC
103	FM 0105	442+0.0	448+1.5	7.453	$ 151,673.00	$ 150,000.00	0.029	514	SEAL COATC
104	FM 0105	450+0.5	454+1.0	4.791	$ 102,045.00	$ 467,500.00	0.062	150	SEAL COATC
105	FM 0105	-	-	0.463	$ 11,828.00	-	-	1572	SEAL COATC

Table A59. Preventive Maintenance Sections (Beaumont District) (Continued).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
106	FM 0408	770+0.0	772+1.2	3.134	$ 81,624.00	$ 76,000.00	0.027	569	SEAL COATC
107	FM 0736	-	-	0.06	$ 3,096.00	-	-	1572	SEAL COATC
108	FM 1006	442+0.0	444+1.0	3.013	$ 137,580.00	$1,006,000.00	0.148	9	SEAL COATC
109	FM 1006	-	-	2.284	$ 89,678.00	-	-	1572	SEAL COATC
110	FM 1131	438+0.0	440+0.9	3.005	$ 101,161.00	-	-	1572	SEAL COATC
111	FM 1442	434+0.0	438+0.5	4.515	$ 91,395.00	$ 480,000.00	0.125	23	SEAL COATC
112	FM 2177	442+0.0	442+1.5	1.764	$ 43,457.00	$ 30,000.00	0.059	171	SEAL COATC
113	FM 3247	444+0.0	446+0.0	2.017	$ 44,378.00	$ 20,000.00	0.013	1000	SEAL COATC
114	FM 0092	388+0.0	390+0.5	2.736	$ 71,365.00	$ 10,000.00	0.000	1553	SEAL COATC
115	FM 1013	748+1.5	754+0.5	5.243	$ 126,753.00	$ 7,000.00	0.055	185	SEAL COATC
116	FM 1014	734+0.0	734+1.1	1.175	$ 24,370.00	-	-	1572	SEAL COATC
117	FM 1746	742+0.5	746+1.7	5.733	$111,437.00	$ 44,000.00	0.038	320	SEAL COATC
118	FM 1943	734-0.2	748+1.9	16.166	$302,268.00	$ 168,000.00	0.028	526	SEAL COATC
119	FM 2097	384+0.0	386+1.8	3.82	$ 78,182.00	-	-	1572	SEAL COATC
120	FM 256	728+0.0	730+1.6	3.46	$ 62,658.00	$ 101,000.00	0.098	51	SEAL COATC
121	FM 3497	-	-	0.615	$ 23,347.00	-	-	1572	SEAL COATC
122	RE 255	732+0.0	742+1.1	11.038	$ 287,244.00	$ 35,000.00	0.021	751	SEAL COATC
123	US 069	478+1.0	486+1.5	8.553	$ 413,575.00	-	-	1572	SEAL COATC

Table A60. Sections Applied with Rehabilitation Treatments, Beaumont District (2009).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
1	RR 255	-	-	2.036	$ 984,524.00	-	-	1572	ADD SHOULDERS & LEFT TURN
2	US 287	702+0.0	712+1.5	11.312	$ 8,707,471.00	$ 7,000.00	0.010	1103	
3	SH 0073	-	-	0.303	$ 237,757.00	-	-	1572	BASE REPAIR AND OVERLAY
4	SH 0073	738+0.5	740+0.1	2.018	$ 1,037,510.00	$ 282,000.00	0.047	240	
5	IH 10	851+0.0	854+0.4	3.208	$ 499,811.00	$1,750,000.00	0.028	521	CLEAN AND SEAL JOINTS
6	US 069	514+0.0	514+2.1	2.976	$ 710,700.00	-	-	1572	GRIND CONC PAV, SEAL JOINT
7	US 069	-	-	0.473	$ 44,755.00	-	-	1572	
8	US 096	-	-	0.36	$ 68,593.00	-	-	1572	
9	US 069	-	-	0.727	$ 130,035.00	-	-	1572	
10	FM 1132	762+0.5	764+0.0	1.657	$ 525,420.00	$ 70,000.00	0.125	22	MILL & OVERLAY EXISTING
11	SH 0105	-	-	0.557	$ 338,959.00	-	-	1572	MILL AND INLAY EXISTING
12	US 069 R	500+0.6	502+1.5	2.655	$ 527,512.00	$ 42,000.00	0.136	17	
13	US 096	-	-	0.89	$ 771,143.00	-	-	1572	
14	US 190	836+1.4	838+1.0	1.442	$ 274,782.00	-	-	1572	
15	US 190	848+1.1	850+1.0	1.67	$ 595,506.00	$ 38,000.00	0.013	1014	
16	SH 0087	-	-	0.227	$ 106,146.00	-	-	1572	
17	US 190	-	-	0.36	$ 21,560.00	-	-	1572	
18	US 096	-	-	0.83	$ 835,709.00	-	-	1572	
19	US 069	488+0.0	490+1.0	2.933	$ 1,318,030.00	-	-	1572	MILL AND OVERLAY EXISTING
20	US 069	-	-	0.669	$ 125,030.00	-	-	1572	
21	SH 0124	456+0.0	460+0.0	3.709	$1,150,257.00	-	-	1572	
22	SH 0124	-	-	0.763	$ 345,449.00	-	-	1572	
23	FM 0770	454+1.0	456+1.0	2.348	$1,141,373.00	-	-	1572	
24	US 090	864+0.0	870+1.2	6.989	$3,857,787.00	-	-	1572	
25	US 096	378+0.0	382+1.7	5.393	$1,478,935.00	$ 20,000.00	0.084	82	
26	US 096	-	-	0.239	$ 54,699.00	-	-	1572	
27	SH 0012	778+1.0	782+0.6	2.251	$2,112,362.00	$ 196,400.00	0.074	105	
28	US 069	478+1.0	488+0.0	9.813	$2,898,852.00	-	-	1572	
29	US 096	-	-	14.4	$ 149,224.00	-	-	1572	MILLED SHOULDER TEXTURE
30	SH 0073	762+0.0	766+0.0	4.322	$ 55,614.00	$ 20,000.00	0.032	436	
31	IH 10	874+0.7	880+0.7	5.895	$4,632,792.00	$ 140,600.00	0.016	924	OVERLAY EXISTING MAIN
32	IH 10	-	-	0.61	$ 273,495.00	-	-	1572	
33	FM 0421	740+1.0	748+0.5	7.557	$1,471,613.00	-	-	1572	
34	SH 0105	764+1.0	772+0.2	7.214	$1,952,881.00	-	-	1572	
35	US 096	-	-	0.06	$ 15,530.00	-	-	1572	

Table A60. Sections Applied with Rehabilitation Treatments, Beaumont District (2009) (Continued).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
36	SH 0087	504+0.0	504+2.0	1.785	$ 494,540.00	-	-	1572	OVERLAY EXISTING ROADWAY
37	SH 0347	452+1.4	456+0.5	3.395	$ 1,897,121.00	$2,705,000.00	0.040	295	
38	SS 380	444+1.5	446+1.1	1.74	$ 1,406,680.00	-	-	1572	
39	US 069	542+0.3	544+0.0	1.598	$ 1,011,932.00	$20,000.00	0.001	1526	
40	FM 0770	450+1.0	454+0.0	3.106	$ 1,054,357.00	-	-	1572	
41	US 059	460+0.0	470+0.0	9.831	$ 5,923,605.00	-	-	1572	OVERLAY EXISTING ROADWAY
42	FM 0363	-	-	1.065	$ 176,827.00	-	-	1572	
43	FM 253	762+0.5	768+0.0	3.921	$ 773,790.00	-	-	1572	
44	US 096	390+1.5	392+1.5	2.16	$ 2,174,313.00	$870,000.00	0.059	168	
45	US 096	-	-	1.043	$ 764,077.00	-	-	1572	
46	FM 0363	768+0.0	770+1.5	4.58	$ 1,023,293.00	-	-	1572	OVERLAY EXISTING ROADWAY
47	SH 0063	776+0.2	788+0.5	12.195	$ 1,800,918.00	-	-	1572	
48	US 190	874+1.0	880+0.4	4.906	$ 1,280,850.00	$70,000.00	0.082	86	
49	US 069	458+0.5	460+0.5	2.084	$ 502,949.00	-	-	1572	
50	US 069	460+0.5	466+01.0	6.828	$ 1,403,262.00	-	-	1572	
51	US 069	-	-	1.087	$ 331,836.00	-	-	1572	OVERLAY EXISTING ROADWAY
52	US 190	822+1.0	836+1.0	14	$ 5,103,678.00	$63,000.00	0.189	3	
53	US 190	818+1.0	822+1.0	4.064	$ 2,061,767.00	$300,000.00	0.032	437	
54	FM 0418	750+00.5	752+0.2	1.688	$ 383,159.00	$60,000.00	0.062	149	
55	FM 0770	442+0.0	448+0.0	4.056	$ 1,210,664.00	$36,000.00	0.094	59	
56	FM 0787	722+0.0	726+1.8	5.718	$ 1,371,985.00	-	-	1572	
57	SH 0105	438+0.5	440+1.0	2.32	$ 352,828.00	-	-	1572	OVERLAY EXISTING ROADWAY
58	SH 0105	750+1.3	764+0.0	12.56	$ 1,927,398.00	-	-	1572	
59	IH 10	838+0.0	847+0.5	9.367	$ 5,280,111.00	$266,000.00	0.022	740	
60	SH 0073	768+0.0	772+1.4	4.282	$ 2,106,717.00	-	-	1572	
61	SH 0073	742+00.9	762+0.0	18.993	$ 4,097,310.00	$232,000.00	0.028	518	
62	SH 0073	-	-	1.115	$ 493,504.00	-	-	1572	OVERLAY EXISTING ROADWAY
63	SH 0082	454+0.0	456+0.0	1.904	$ 1,197,671.00	$36,000.00	0.157	6	
64	SH 0347	450+0.3	452+0.0	1.976	$ 1,619,236.00	$800,400.00	0.041	286	
65	US 069A, X	452+0.0	454+0.5	2.505	$ 1,001,623.00	-	-	1572	
66	US 069A, X	538+1.2	540+0.4	1.531	$ 228,403.00	-	-	1572	
67	FM 0105	438+1.0	442+0.0	2.826	$ 1,436,989.00	$120,000.00	0.019	828	OVERLAY EXISTING ROADWAY
68	FM 0105	-	-	0.089	$ 220,031.00	-	-	1572	
69	FM 0105	-	-	0.094	$ 74,436.00	-	-	1572	
70	FM 0562	466+0.0	474+0.0	8.232	$ 813,390.00	-	-	1572	

Table A60. Sections Applied with Rehabilitation Treatments, Beaumont District (2009) (Continued).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
71	FM 0563	460+0.0	462+1.5	3.471	$ 339,867.00	$ 30,000.00	0.017	873	OVERLAY EXISTING ROADWAY
72	FM 2354	466+0.0	472+1.0	6.729	$ 762,761.00	$ 10,000.00	0.016	927	
73	SH 0061	460+0.0	466+0.0	4.39	$ 814,457.00	$ 45,000.00	0.115	30	
74	SH 0065	722+0.0	736+1.7	15.544	$ 1,546,369.00	-	-	1572	
75	FM 0563	446+0.0	458+1.8	13.842	$ 1,452,262.00	$ 30,000.00	0.018	846	
76	FM 0770	448+0.1	450+0.0	2.112	$ 539,718.00	$ 20,000.00	0.020	800	
77	FM 1409	448+0.0	450+0.0	2.041	$ 531,627.00	$ 70,000.00	0.050	214	
78	FM 1725	434+0.0	436+0.7	2.667	$ 266,740.00	-	-	1572	
79	FM 2025	428+0.0	430+0.0	2.306	$ 255,983.00	$ 190,000.00	0.043	266	
80	IH 10	-	-	0.199	$ 76,011.00	-	-	1572	PROVIDE ADDITIONAL PAVED
81	FM 0770	460-0.7	462+0.0	2.7	$ 700,203.00	$ 114,000.00	0.047	231	
82	FM 1131	426-0.5	434+0.0	7.479	$ 2,569,366.00	$ 70,000.00	0.017	875	
83	FM 1078	774+0.0	776+1.2	3.148	$ 874,257.00	$ 57,000.00	0.094	58	
84	SH 0073	-	-	0.56	$ 1,230,047.00	-	-	1572	REHABILITATE EXISTING ROAD
85	IH 10	-	-	0.461	$ 4,828,486.00	-	-	1572	
86	IH 10	-	-	1.11	$ 4,966,339.00	-	-	1572	
87	SH 0087	478+1.0	480+0.5	1.9	$ 1,251,094.00	-	-	1572	
88	SH 0327	746+1.5	748+2.0	2.508	$ 1,058,619.00	$ 40,000.00	0.036	354	
89	FM 1006	444+0.0	446+0.0	1.683	$ 1,245,232.00	$ 792,000.00	0.148	9	
90	FM 1442	438+0.5	442+1.6	4.612	$ 2,694,261.00	$ 672,000.00	0.063	145	
91	SH 0105	734+1.5	738+1.3	3.773	$ 3,674,544.00	-	-	1572	
92	SH 0105	722+0.5	734+1.5	12.621	$ 10,941,440.00	-	-	1572	
93	IH 10	829+0.0	831+0.1	2.303	$ 9,511.00	$ 8,000.00	0.001	1522	REPAIR EXISTING PAVEMENT
94	IH 10	831+00.1	851+00.0	19.606	$ 224,409.00	$ 287,000.00	0.022	740	
95	US 069	516+0.5	518+0.7	2.279	$ 10,264.00	$ 313,000.00	0.011	1080	
96	US 069	518+0.7	522+0.6	4.099	$ 46,148.00	$ 634,000.00	0.034	393	
97	US 069	514+0.0	514+2.1	2.976	$ 955,167.00	-	-	1572	REPAIR JOINTS AND MOW ST
98	US 069	-	-	0.473	$ 32,983.00	-	-	1572	REPAIR JOINTS IN EXISTING
99	US 096	-	-	0.414	$ 61,575.00	-	-	1572	
100	US 069	-	-	0.727	$ 160,791.00	-	-	1572	
101	SH 0073	778+1.2	780+1.7	2.401	$ 1,849,579.00	-	-	1572	REPAIR PAVEMENT AND OVERLAY
102	SH 0073	-	-	0.611	$ 851,543.00	-	-	1572	
103	SP 380	-	-	0.488	$ 396,175.00	-	-	1572	REPAIR PAVEMENT, SEAL JOINT
104	US 069	-	-	0.389	$ 397,446.00	-	-	1572	
105	US 069	-	-	0.639	$ 938,118.00	-	-	1572	

Table A60. Sections Applied with Rehabilitation Treatments, Beaumont District (2009) (Continued).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
106	FM 1131	424+0.0	424+1.2	1.208	$ 1,104,127.00	$ 94,000.00	0.064	142	RESTORE & OVERLAY EXISTING
107	FM 0420	736+0.0	738+1.5	3.807	$ 657,757.00	$ 420,000.00	0.034	389	RESTORE EXISTING ROADWAY 110
108	FM 0421	736+0.0	740+0.5	4.748	$ 1,411,657.00	-	-	1572	
109	FM 1293	728+0.0	734+1.0	6.339	$ 1,126,384.00	-	-	1572	
110	FM 1136	434+0.5	436+3.3	4.474	$ 1,171,634.00	$ 203,000.00	0.111	33	
111	FM 1406	464+0.0	464+1.3	1.3	$ 48,184.00	$ 160,000.00	0.044	259	RESURFACE EXISTING ROADWAY
112	FM 1942	708+0.0	710+1.1	3.2	$ 118,860.00	$ 88,000.00	0.061	153	
113	FM 2799	754-1.8	754-0.2	1.516	$ 116,371.00	-	-	1572	
114	SH 0082	458+1.0	468+0.5	7.99	$ 294,415.00	$ 290,000.00	0.025	621	
115	FM 0787	696+0.0	708+0.5	12.2	$ 378,599.00	$ 10,000.00	0.006	1284	
116	FM 0834	722+1.0	726+0.0	3.088	$ 110,502.00	$ 20,000.00	0.011	1063	
117	SH 0321	452+0.5	454+0.5	2	$ 136,788.00	-	-	1572	
118	US 090	878+0.7	888+1.5	10.9	$ 451,750.00	$ 30,000.00	0.018	844	
119	RE0255	770+0.0	780+0.1	10.2	$ 418,886.00	-	-	1572	
120	SH 0087	432+1.0	436+0.0	3.1	$ 106,971.00	-	-	1572	
121	US 190	860+0.2	866+1.0	7.2	$ 308,093.00	-	-	1572	
122	FM 0092	390+1.0	392+0.5	1.67	$ 56,596.00	$ 21,000.00	0.023	689	
123	FM 0092	400+1.0	402+1.5	1.292	$ 67,587.00	-	-	1572	
124	FM 0092	408+1.5	412+0.0	2.681	$ 96365	-	-	1572	
125	FM 0092	-	-	0.51	$ 32961	-	-	1572	
126	US 069	454+1.0	460+0.5	6.07	$ 339250	$ 17500	0.025	624	
127	US 069	460+0.5	466+0.5	6.117	$ 334967	-	-	1572	
128	FM 0092	396+0.5	402+0.5	6.109	$ 203097	-	-	1572	RESURFACE EXISTING ROADWAY
129	FM 0092	402+1.5	408+1.5	5.945	$ 197644	$ 7000	0.026	611	
130	FM 3290	-	-	0.417	$ 30970	-	-	1572	
131	SH 0061	468+0.0	470+1.4	3.2	$ 109416	$ 42000	0.119	27	
132	IH 10	-	-	0.788	$ 106503	-	-	1572	SPOT LEVEL-UP & OVERLAY
133	IH 10	-	-	0.889	$ 175112	-	-	1572	
134	IH 10	-	-	3.013	$ 20122	-	-	1572	UPGRADE OBJECT MARKER
135	IH 10	-	-	15.255	$ 39834	-	-	1572	
136	IH 10	-	-	19.938	$ 55098	-	-	1572	

Table A61. Summary of Treatment Cost and Lane Miles, PMIS and Beaumont District (2009).

Treatment Type	Source	Treatment Cost	Percentage	Lane Miles
PM	PMIS	$ 9,368,500	15%	484
	District	$ 20,919,812	12%	571.019
Rehabilitation	PMIS	$ 51,210,000	85%	227.8
	District	$ 150,832,958	88%	557.935

BROWNWOOD DISTRICT

SUB-TASK 1.4: COMPARE DISTRICT PRIORITY RANKINGS AND REPAIR NEEDS TO PMIS RESULTS

UTEP lead with the assistance of TTI and UTSA
1/31/2011

BROWNWOOD DISTRICT

There are 6034 lane miles pavements in Brownwood District. All the pavements in the district are classified as asphalt pavements. Table A62 shows the number of lane miles for Brownwood District summarized by highway system.

Table A62. Lane Miles in Brownwood District.

Highway System	Lane Miles	Percentage (%)
Interstate Highways (IH)	168	2.8
United States Highways (US)	1640	27.2
State Highways (SH)	887	14.7
Farm-to-Market (FM)	3290	54.5
Business Routes (BR)	-	-
Park Road (PR)	49	0.8
Principal Arterial Streets (PA)	-	-
Total	6034	100.0

Table A63 shows the treatments applied by the district from 2007 through 2009, their corresponding PMIS category, and the treatment class recommended by PMIS for those sections. No visits to Brownwood were scheduled in 2009.

Table A63. Treatments Applied by Brownwood District (2007–2009).

Treatment	Brownwood	PMIS Recommendation				
		NN	PM	LRhb	MRhb	HRhb
Seal Coat (PM)	1204	232	101	52	18	1
Rehabilitation (LRhb)	27	18	9	-	-	
Mill and Overlay (MRhb)	18	6	12	-	-	-
Reconstruction (HRhb)	20	-	17	-	3	-
Total	1269	256	939	52	21	1

FINDINGS OF THE STATISTICAL ANALYSES

Findings of the statistical analysis conducted for the comparison of treatments applied in Brownwood District and PMIS treatment recommendations follows. Details of the analysis are in the appendices.

Condition, distress, and ride scores from 2001–2009 were analyzed using box plots to show quartiles and medians for each segment category. The purpose of this analysis was to show

graphically the range of variation of the scores for each treatment category. For example, in Figure A37, the condition score of the sections recommended to receive Preventive Maintenance treatment has a median of 99 and a mean of about 93. From this box plot, it can also be concluded that 25% of the data are below a condition score of 92 and 75% are below a condition score of 100. The box plot of the lower portion of Figure A37 is labeled for a better understanding of these graphs.

Tables were also prepared to show PMIS statistics for condition, distress, and ride scores (mean and standard deviation) for each treatment category. We also plot the evolution of treatment needs from 2001–2009 and conducted Mann-Whitney test to compare PMIS data to district data for each treatment category.

Summary of PMIS Scores and Treatment Needs

a. The average PMIS condition score for the total number of lane miles rated by the district ranges between 88.6 as a minimum in 2002 and 92.5 as a maximum in 2004. Throughout the 2001–2009 analysis period, the percentage of lane miles with very good and good condition scores is very high when compared to the other classes. In 2009, 91% of the total lane miles in Brownwood District show a condition score equal or greater than 70 (good or very good). A similar pattern is observed Texas statewide with 85% of the total lane miles in 2009 showing a condition score equal or greater than 70.

b. The average PMIS distress score for the total number of lane miles rated by district ranges between 89.5 as a minimum in 2002 and 93.4 as a maximum in 2007. Throughout the analysis period 2001–2009, the percentage of lane miles with very good and good distress scores is very high when compared to the other classes. In 2009, 87% of the total lane miles in Brownwood District show a distress score equal or greater than 80 (good or very good). A similar pattern is observed Texas statewide with 85% of the total lane miles in 2009 showing a distress score equal or greater than 80.

c. The average PMIS ride score for the total number of lane miles rated by the district ranges between 3.2 as a minimum in 2001 and 2002 and 3.4 as a maximum in 2004 and 2005. Throughout the 2001–2009 analysis period, the percentage of lane miles with very good and good ride scores is high when compared to the other classes. In 2009, 69% of the total lane miles in Brownwood District show a ride score equal or greater than 3.0 (good or very good). A similar pattern is observed Texas statewide with 70% of the total lane miles in 2009 showing a ride score equal or greater than 3.0.

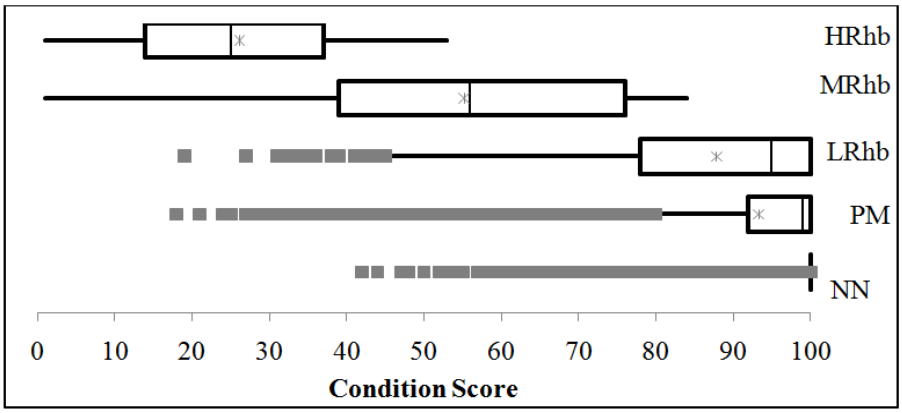
d. The most prevalent PMIS treatment recommendation from 2001 through 2009 is Need Nothing. Sixty percent of the sections are in this treatment category. Thirty-five percent of sections fall in the Preventive Maintenance category while the remaining 5% is distributed between Light Rehabilitation and Medium Rehabilitation (4% and 1%, respectively). There are no sections recommended for Heavy Rehabilitation. Table A64 shows a summary of the frequency, mean, and standard deviations for the PMIS condition score, distress score, and ride score for all pavements which are asphalt pavements.

Table A64. PMIS Statistics in Brownwood District (2001–2009).

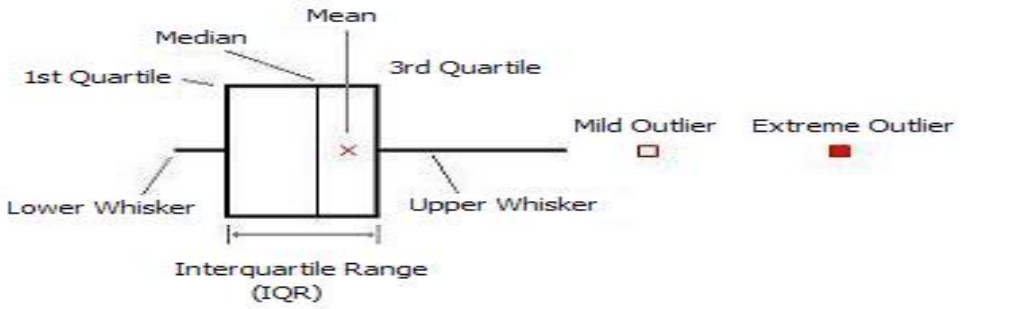
Treatment Category	Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	60	95.8	9.31	96.0	9.13	3.5	0.54
Preventive Maintenance	35	92.7	12.03	92.9	11.64	3.4	0.49
Light Rehabilitation	4	87.5	14.66	91.9	12.71	2.3	0.14
Medium Rehabilitation	1	56.5	20.53	79.7	25.53	2.2	0.59
Heavy Rehabilitation	0	26.4	15.26	89.0	17.83	1.4	0.47

A total of 81,140 asphalt pavement sections were analyzed.

Figures A37, A38, and A39 show the box plots with medians and quartiles for condition scores, distress, and ride scores of treatments recommended by PMIS.

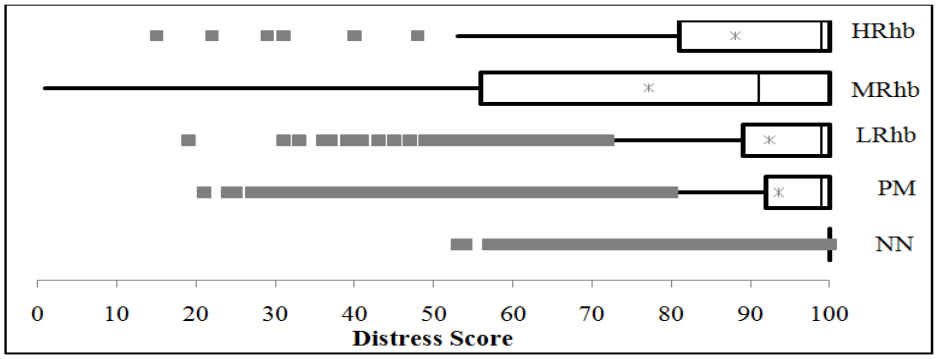


Treatment	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Need Nothing	42.0	100.0	100.0	100.0	100.0
Preventive Maintenance	18.0	92.0	99.0	100.0	100.0
Light Rehabilitation	19.0	78.0	95.0	100.0	100.0
Medium Rehabilitation	1.0	39.0	56.0	76.0	84.0
Heavy Rehabilitation	1.0	14.0	25.0	37.0	53.0



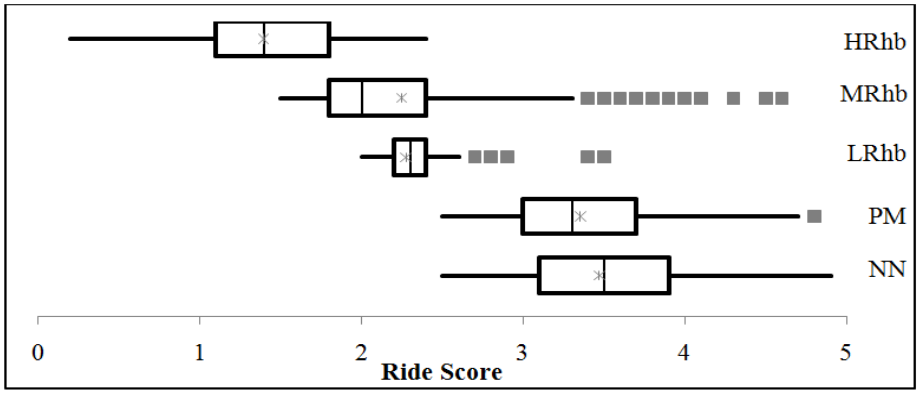
Whiskers extend to the furthest observations that are no more than 1.5 IQR from the edges of the box. Mild outliers are observations between 1.5 IQR and 3 IQR from the edges of the box. Extreme outliers are greater than 3 IQR from the edges of the box.

Figure A37. Box Plots for Condition Scores of Treatments Recommended by PMIS, Brownwood District, 2001–2009.



Treatment	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Need Nothing	53.0	100.0	100.0	100.0	100.0
Preventive Maintenance	21.0	92.0	99.0	100.0	100.0
Light Rehabilitation	19.0	89.0	99.0	100.0	100.0
Medium Rehabilitation	1.0	56.8	91.0	100.0	100.0
Heavy Rehabilitation	15.0	82.0	99.0	100.0	100.0

Figure A38. Box Plots for Distress Scores of Treatments Recommended by PMIS, Brownwood District, 2001–2009.



Treatment	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Need Nothing	2.5	3.1	3.5	3.9	4.9
Preventive Maintenance	2.5	3.0	3.3	3.7	4.8
Light Rehabilitation	2.0	2.2	2.3	2.4	3.5
Medium Rehabilitation	1.5	1.8	2.0	2.4	4.6
Heavy Rehabilitation	0.2	1.1	1.4	1.8	2.4

Figure A39. Box Plots for Ride Scores of Treatments Recommended by PMIS, Brownwood District, 2001–2009.

e. The Need Nothing treatment category was the most prevalent PMIS treatment recommendation in the Brownwood District (maximum of 68.3% and minimum of 60.1% of lane miles) from 2001 through 2004. Need Nothing treatment recommendation ranges from 49% to 30% of lane miles from 2005 through 2007. Preventive Maintenance was the most

prevalent PMIS treatment recommendation and it ranges from 60% to 64%. Preventive Maintenance has 49% in 2008 and 45% of lane miles in 2009.

PMIS treatment recommendation for Light Rehabilitation ranges from 6% to 3% of lane miles and Medium Rehabilitation from 1% to 3%. Heavy Rehabilitation is the least recommended treatment with less than 1%. Figure A40 shows the PMIS treatment needs for all sections, which are asphalt pavements, in Brownwood District from 2001 to 2009.

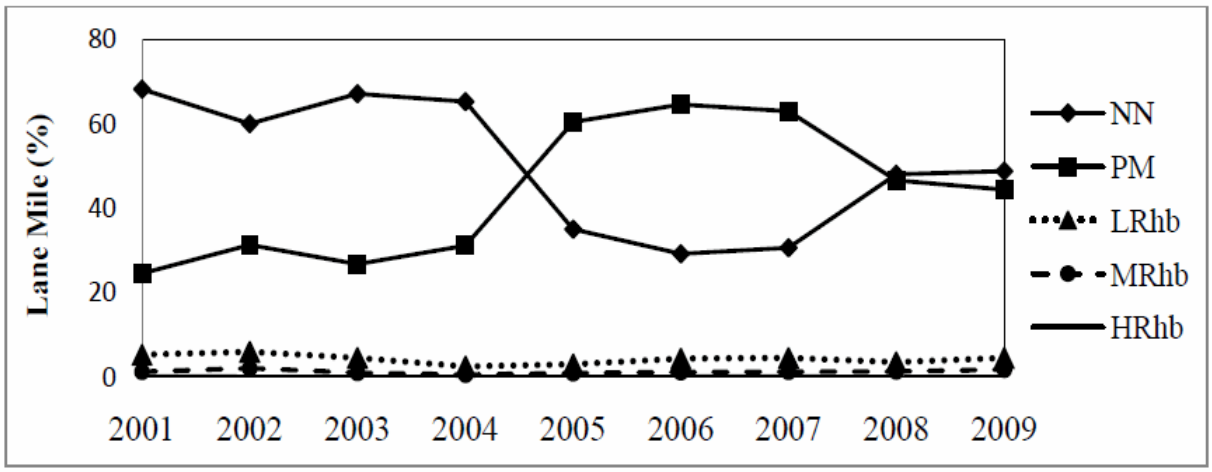


Figure A40. PMIS Treatment Needs in Brownwood District.

PMIS Scores for Treatments Applied in Brownwood District

a. In 2009, 20 pavement sections received a reconstruction treatment (HRhb) in the Brownwood District. Eighty-five percent of these sections were recommended by PMIS for Preventive Maintenance and the remaining 15% for Medium Rehabilitation. Table A65 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for reconstruction treatment applied in Brownwood in 2009.

Table A65. PMIS Treatment Recommendations and Scores for Reconstruction Treatment (HRhb) Applied in Brownwood in 2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	0	-	-	-	-	-	-
Preventive Maintenance	85	90.88	8.268	91.53	8.315	3.7	0.335
Light Rehabilitation	0	-	-	-	-	-	-
Medium Rehabilitation	15	27.67	7.371	31.00	7.810	3.3	0.551
Heavy Rehabilitation	0	-	-	-	-	-	-

(*) A total of 20 asphalt pavement sections received reconstruction.

b. In 2009, 18 pavement sections received a Mill and Overlay treatment (MRhb) in the Brownwood District. Sixty-seven percent of the sections were recommended by PMIS for Preventive Maintenance and the remaining 33% for Need Nothing. Table A66 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard

deviation for the condition score, distress score, and ride score for Mill and Overlay applied in Brownwood in 2009.

Table A66. PMIS Treatment Recommendations and Scores for Mill and Overlay (MRhb) Applied in Brownwood in 2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	33	99.50	0.837	99.67	0.816	3.9	0.479
Preventive Maintenance	67	77.67	12.183	80.50	9.803	3.3	0.289
Light Rehabilitation	0	-	-	-	-	-	-
Medium Rehabilitation	0	-	-	-	-	-	-
Heavy Rehabilitation	0	-	-	-	-	-	-

(*) A total of 18 asphalt pavement sections received Mill and Overlay.

c. In 2009, 23 pavement sections received a rehabilitation treatment (LRhb) in the Brownwood District. Seventy percent of these sections were recommended by PMIS for Need Nothing and the remaining 30% for Preventive Maintenance.

Table A67 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for rehabilitation applied in Brownwood in 2009.

Table A67. PMIS Treatment Recommendations and Scores for Rehabilitation (LRhb) Applied in Brownwood in 2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	70	92.69	11.853	93.25	11.573	3.6	0.384
Preventive Maintenance	30	86.43	8.059	86.43	8.059	3.2	0.326
Light Rehabilitation	0	-	-	-	-	-	-
Medium Rehabilitation	0	-	-	-	-	-	-
Heavy Rehabilitation	0	-	-	-	-	-	-

(*) A total of 23 asphalt pavement sections received rehabilitation.

d. In 2008, a total of 865 pavement sections received Seal Coat as a Preventive Maintenance treatment (PM) in the Brownwood District. No other treatment categories were applied by the district in this year. About 70% of the PMIS recommendations match with the Preventive Maintenance treatment applied by the district. Twenty percent of the sections were recommended by PMIS for Need Nothing. The remaining 10% of the sections were recommended by PMIS for Light Rehabilitation and Medium Rehabilitation (9% and 1%, respectively).

Table A68 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Seal Coat applied in Brownwood in 2008.

Table A68. PMIS Treatment Recommendations and Scores for Seal Coat (PM) Applied in Brownwood in 2008.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	20	92.97	11.532	93.18	11.530	3.5	0.453
Preventive Maintenance	70	92.14	12.778	92.33	12.616	3.2	0.423
Light Rehabilitation	9	86.99	15.613	88.97	15.003	2.3	0.154
Medium Rehabilitation	1	67.42	15.577	88.67	17.396	2.0	0.547
Heavy Rehabilitation	0	16.50	9.192	82.50	23.335	0.9	0.141

(*) A total of 865 asphalt pavement sections received a Seal Coat.

e. In 2007, 363 pavement sections received Seal Coat as a Preventive Maintenance treatment in the Brownwood District. About 81% of the PMIS recommendations match with the Preventive Maintenance treatment applied by the district. Sixteen percent of the sections were recommended by PMIS for Need Nothing and the remaining 3% were recommended for Light Rehabilitation and Medium Rehabilitation (2% and 1%, respectively). Rehabilitation was applied by the district in four sections, although PMIS recommended Preventive Maintenance or Need Nothing on those sections.

   Table A69 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Seal Coat applied in Brownwood in 2007.

Table A69. PMIS Treatment Recommendations and Scores for Seal Coat Applied in Brownwood for Asphalt Pavements in 2007.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	16	96.18	10.258	96.18	10.258	3.9	0.516
Preventive Maintenance	81	93.63	10.739	93.78	10.691	3.7	0.415
Light Rehabilitation	2	74.67	10.367	76.17	9.496	2.2	0.117
Medium Rehabilitation	1	56.00	11.747	75.50	16.763	1.8	0.100
Heavy Rehabilitation	0	-	-	-	-	-	-

(*) A total of 363 asphalt pavement sections received Seal Coat.

Evolution of PMIS Scores Due to Treatments Applied in the District

a. In 2009, the number of sections with a condition score below 90 decreases from 57% to 54%. The number of sections with a condition score above 90 (very good) increases 3% after treatments. Similar pattern is observed in the distress score. It is observed that there was an increase of 5% in the number of sections with a ride score above 4.0.

Tables A70, A71, and A72 show the frequency and cumulative frequency for the condition score, distress score, and ride score, respectively, for treatments applied in Brownwood in 2009.

Table A70. Evolution of Condition Scores for Treatments Applied in Brownwood in 2009.

Condition Score	2008			2009		
	Frequency	Cumulative Frequency	Cumulative Frequency (%)	Frequency	Cumulative Frequency	Cumulative Frequency (%)
0-10	0	0	0	1	1	2
10-20	0	0	0	2	3	5
20-30	2	2	3	4	7	11
30-40	1	3	5	3	10	16
40-50	0	3	5	1	11	18
50-60	2	5	8	5	16	26
60-70	5	10	16	5	21	34
70-80	5	15	25	4	25	41
80-90	20	35	57	8	33	54
90-100	26	61	100	28	61	100

Table A71. Evolution of Distress Score for Treatments Applied in Brownwood in 2009.

Distress Score	2008			2009		
	Frequency	Cumulative Frequency	Cumulative Frequency (%)	Frequency	Cumulative Frequency	Cumulative Frequency (%)
0-10	0	0	0	1	1	2
10-20	0	0	0	2	3	5
20-30	1	1	2	4	7	11
30-40	2	3	5	2	9	15
40-50	0	3	5	2	11	18
50-60	0	3	5	5	16	26
60-70	5	8	13	5	21	34
70-80	6	14	23	4	25	41
80-90	19	33	54	7	32	52
90-100	28	61	100	29	61	100

Table A72. Evolution of Ride Scores for Treatments Applied in Brownwood in 2009.

Ride Score	2008			2009		
	Frequency	Cumulative Frequency	Cumulative Frequency (%)	Frequency	Cumulative Frequency	Cumulative Frequency (%)
0.1-1	0	0	0	0	0	0
1-2	0	0	0	0	0	0
2-3	7	7	11	6	6	10
3-4	46	53	87	44	50	82
4-5	8	61	100	11	61	100

b. In 2008, there was an increase of 2% for condition score clusters above 50. Similar pattern is observed in the distress score. It is also observed that there are 42 more sections with a ride score above 3.0.

Tables A73, A74, and A75 show the frequency and cumulative frequency for the condition score, distress score, and ride score, respectively, for the treatments applied in Brownwood in 2008.

Table A73. Evolution of Condition Scores for Treatments Applied in Brownwood in 2008.

Condition Score	2007			2008		
	Frequency	Cumulative Frequency	Cumulative Frequency (%)	Frequency	Cumulative Frequency	Cumulative Frequency (%)
0-10	1	1	< 0.5	1	1	< 0.5
10-20	0	1	< 0.5	2	3	< 0.5
20-30	2	3	< 0.5	1	4	< 0.5
30-40	3	6	1	3	7	1
40-50	8	14	2	13	20	2
50-60	15	29	3	22	42	5
60-70	50	79	9	52	94	11
70-80	87	166	20	85	179	21
80-90	81	247	29	80	259	31
90-100	598	845	100	586	845	100

Table A74. Evolution of Distress Scores for Treatments Applied in Brownwood in 2008.

Distress Score	2007			2008		
	Frequency	Cumulative Frequency	Cumulative Frequency (%)	Frequency	Cumulative Frequency	Cumulative Frequency (%)
0-10	0	0	0	0	0	0
10-20	0	0	0	1	1	< 0.5
20-30	1	1	< 0.5	2	3	< 0.5
30-40	2	3	< 0.5	3	6	1
40-50	7	10	1	12	18	2
50-60	13	23	3	20	38	5
60-70	51	74	9	52	90	11
70-80	79	153	18	77	167	20
80-90	76	229	27	82	249	29
90-100	616	845	100	596	845	100

Table A75. Evolution of Ride Scores for Treatments Applied in Brownwood in 2008.

Ride Score	2007			2008		
	Frequency	Cumulative Frequency	Cumulative Frequency (%)	Frequency	Cumulative Frequency	Cumulative Frequency (%)
0.1-1	2	2	0	0	0	0
1-2	15	17	2	14	14	2
2-3	346	363	43	307	321	38
3-4	433	796	94	495	816	97
4-5	49	845	100	29	845	100

c. In 2007, the number of sections with a condition score below 90 increases from 21% to 30%. Similar pattern is observed in the distress score. In the ride score, it is observed that 19% of sections were above 4.0.

Tables A76, A77, and A78 show the frequency and, cumulative frequency for the condition score, distress score, and ride score, respectively, for treatments applied in Brownwood in 2007.

Table A76. Evolution of Condition Scores for Treatments Applied in Brownwood in 2007.

Condition Score	2006			2007		
	Frequency	Cumulative Frequency	Cumulative Frequency (%)	Frequency	Cumulative Frequency	Cumulative Frequency (%)
0-10	0	0	0	0	0	0
10-20	0	0	0	1	1	0
20-30	0	0	0	2	3	1
30-40	0	0	0	2	5	1
40-50	4	4	1	7	12	3
50-60	6	10	3	14	26	7
60-70	20	30	8	26	52	14
70-80	23	53	15	28	80	22
80-90	25	78	21	30	110	30
90-100	285	363	100	253	363	100

Table A77. Evolution of Distress Scores for Treatments Applied in Brownwood in 2007.

Distress Score	2006			2007		
	Frequency	Cumulative Frequency	Cumulative Frequency (%)	Frequency	Cumulative Frequency	Cumulative Frequency (%)
0-10	0	0	0	0	0	0
10-20	0	0	0	1	1	0
20-30	0	0	0	2	3	1
30-40	0	0	0	2	5	1
40-50	2	2	1	6	11	3
50-60	5	7	2	15	26	7
60-70	22	29	8	25	51	14
70-80	20	49	14	27	78	21
80-90	27	76	21	28	106	29
90-100	287	363	100	257	363	100

Table A78. Evolution of Ride Scores for Treatments Applied in Brownwood in 2007.

Ride Score	2006			2007		
	Frequency	Cumulative Frequency	Cumulative Frequency (%)	Frequency	Cumulative Frequency	Cumulative Frequency (%)
0.1-1	0	0	0	0	0	0
1-2	4	4	1	4	4	1
2-3	36	40	11	41	45	12
3-4	249	289	80	249	294	81
4-5	74	363	100	69	363	100

Hypothesis Tests to Compare PMIS Treatment Recommendations with Treatments Applied in the District

Hypothesis tests were performed to compare if the scores for PMIS treatment recommendations were statistically different than the scores for treatments applied in the district. A preliminary analysis of the score histograms by treatment category shows that they do not follow a normal distribution. Therefore, non-parametrical statistical tests were selected to perform the analysis.

Nonparametric tests are not completely free of assumptions about the data since they still require the data to be an independent random sample. Mann-Whiney nonparametric hypothesis test was used to determine whether the medians (η) of the PMIS scores were statistically different for PMIS treatment recommendations when compared to treatments applied by the district. The Mann-Whitney test does not require the data to come from normally distributed populations, but it does make the following assumptions: (a) the populations of interest have the same shape, and (b) the populations are independent.

The test is formulated as follow:

- Null hypothesis -> H_o: $\eta_1 = \eta_2$ (medians are equal).
- Alternative hypothesis -> H_a: $\eta_1 \neq \eta_2$ (medians are not equal).

The Mann-Whitney test uses the ranks of the sample data, instead of their specific values, to detect statistical significance. The test was performed at the 0.05 significance level. If the test's p-value is less than 0.05 then we reject the null hypothesis.

Tables A79, A80, A81, and A82 show the results of the two samples Mann-Whitney hypothesis testing when comparing scores for PMIS treatment recommendations and treatments applied by the Brownwood District. Analysis was conducted for Preventive Maintenance, Light Rehabilitation, Medium Rehabilitation, and Heavy Rehabilitation.

Table A79. Mann-Whitney Test Results for Preventive Maintenance for Brownwood in 2007–2009.

Year	Score	Medians		p-value	Test Result
		PMIS	Brownwood		
2007	Condition Score	99	100	0.4360	Accept
	Distress Score	99	100	0.3720	Accept
	Ride Score	3.30	3.80	0.0000	Reject
2008	Condition Score	100	100	0.0001	Reject
	Distress Score	100	100	0.0009	Reject
	Ride Score	3.30	3.20	0.0000	Reject
2007–2009	Condition Score	99	100	0.1024	Accept
	Distress Score	100	100	0.2650	Accept
	Ride Score	3.3	3.4	0.7428	Accept

Note: PMIS-Brownwood: 3431-362 sections in 2007, 2591-846 sections in 2008, 8473-1208 in 2007–2009.

For Preventive Maintenance, results of the Mann-Whitney tests using 2007–2009 data show that we should accept the null hypothesis of equal medians for the condition, distress and ride score at the 0.05 p-value significant level. However, analyzing individual years, the null hypothesis of equal means was rejected for condition, distress, and ride score in 2008, and for ride score in 2007.

Table A80. Mann-Whitney Test Results for Light Rehabilitation for Brownwood in 2007–2009.

Year	Score	Medians		p-value	Test Result
		PMIS	Brownwood		
2007	Condition Score	95	95	0.346	Accept
	Distress Score	98	97.5	0.669	Accept
	Ride Score	2.30	3.30	0.001	Reject
2009	Condition Score	91	95	0.8911	Accept
	Distress Score	99	95	0.0905	Accept
	Ride Score	2.30	3.50	0.0000	Reject
2007–2009	Condition Score	92	95	0.9009	Accept
	Distress Score	99	95	0.1397	Accept
	Ride Score	2.30	3.50	0.0000	Reject

Note: PMIS-Brownwood: 267-4 sections in 2007, 268-23 sections in 2009, 749-27 in 2007–2009.

For Light Rehabilitation, results of the Mann-Whitney tests using data from 2007–2009 show that we should accept the null hypothesis of equal medians for the condition score and distress score at 0.05 p-value significant level.

Table A81. Mann-Whitney Test Results for Medium Rehabilitation Brownwood in 2007–2009.

Year	Score	Medians		p-value	Test Result
		PMIS	Brownwood		
2009	Condition Score	44	94	0.0000	Reject
	Distress Score	60	94	0.0056	Reject
	Ride Score	2.20	3.65	0.0000	Reject
2007–2009	Condition Score	51	94	0.0000	Reject
	Distress Score	85	94	0.0819	Accept
	Ride Score	2.20	3.65	0.0000	Reject

Note: PMIS-Brownwood: 99-18 sections in 2009, 250-18 sections in 2007–2009.

For Medium Rehabilitation, results of the Mann-Whitney tests using data from 2007–2009 show that we should reject the null hypothesis of equal medians for the condition score and ride score at 0.05 p-value significant level. The PMIS condition score, and ride score medians for Medium

Rehabilitation are statistically different when comparing PMIS recommendations to treatments applied in Brownwood District from 2007–2009.

Table A82. Mann-Whitney Hypothesis Test Results for Heavy Rehabilitation for Brownwood in 2007–2009.

Year	Score	Medians		p-value	Test Result
		PMIS	Brownwood		
2009	Condition Score	26	70	0.0052	Reject
	Distress Score	100	70	0.0006	Reject
	Ride Score	1.50	3.70	0.000	Reject
2007–2009	Condition Score	23	70	0.0001	Reject
	Distress Score	99	70	0.0003	Reject
	Ride Score	1.40	3.70	0.000	Reject

Note: PMIS-Brownwood: 18-20 sections in 2009, 50-20 sections in 2007–2009.

For Heavy Rehabilitation, results of the Mann-Whitney tests show that we should reject the null hypothesis of equal medians at 0.05 p-value significant level. The PMIS condition score, distress score, and ride score medians for Heavy Rehabilitation are not equal when comparing PMIS recommendations to treatments applied in Brownwood District from 2007–2009.

Table A83. Pavement Sections Selected in Brownwood District to Illustrate Discrepancies in Treatment Selection.

PMIS											BROWNWOOD DISTRICT	
FISCAL YEAR	SIGNED HIGHWAY	BRM	ERM	AADT CURRENT	TRUCK AADT PCT	CUM ADT ORIG SURFACE QTY	CONDITION SCORE	RIDE SCORE	DISTRESS SCORE	TREATMENT ABREV.	TREATMENT Applied by the District	District Reason
2007	FM1030	0378 +01.0	0378 +01.5	160	46.8	905200	19	2.1	20	MRhb	PM	Low ADT, Rural, Not High Priority, Seal Coat.
2007	FM1030	0378 +00.0	0378 +00.5	240	37.3	1949100	23	1.9	28	MRhb	PM	
2007	FM1030	0376 +01.5	0378 +00.0	240	37.3	1949100	46	1.8	59	MRhb	PM	
2007	FM1030	0378 +00.5	0378 +01.0	160	46.8	905200	55	2.3	55	LRhb	PM	
2008	FM1176	0348 -00.2	0348 +00.0	910	4.6	5179350	58	1.9	69	MRhb	PM	Near railroad therefore causing ride to be low. In house forces will maintain. Low ADT, Seal Coat.
2008	FM1176	0348 +00.5	0348 +01.0	190	8.6	1456350	77	1.8	100	MRhb	PM	
2008	FM1176	0348 +01.5	0350 +00.0	190	8.6	1456350	99	2.2	100	LRhb	PM	
2008	FM1176	0348 +00.0	0348 +00.5	910	4.6	6000600	75	2.4	90	LRhb	PM	
2008	FM1770	0422 +01.5	0422 +01.7	380	29.4	2361550	48	2.2	49	LRhb	PM	Low ADT, Rural, Not High Priority, Seal Coat.
2008	FM1770	0422 +00.5	0422 +01.0	270	35	1357800	78	2.4	78	LRhb	PM	
2008	FM1770	0422 +01.0	0422 +01.5	380	29.4	2565950	95	2.1	100	LRhb	PM	
2008	FM2302	0328 +01.0	0328 +01.5	110	10	627800	83	2.3	83	LRhb	PM	Low ADT, Rural, Not High Priority, Seal Coat.
2008	FM2302	0328 +01.5	0330 +00.0	110	10	627800	96	2.3	96	LRhb	PM	
2008	FM3099	0264 +01.0	0264 +01.5	1050	18.9	7617550	52	2.4	62	LRhb	PM	Had a lot of spot repair prior to seal coat and that is why the score was low. Structure is ok.
2008	FM3099	0266 +01.6	0266 +02.1	1050	18.9	5967750	61	2.3	78	LRhb	PM	
2008	FM0567	0344 +00.5	0344 +01.0	70	8.9	573050	85	2.4	85	LRhb	PM	Low ADT, Rural, Not High Priority, Seal Coat.
2008	FM0567	0344 +00.0	0344 +00.5	70	8.9	580350	90	2	100	LRhb	PM	
2008	FM0567	0342 +01.0	0342 +01.5	70	8.9	580350	98	2.4	98	LRhb	PM	
2008	FM0567	0342 +01.5	0344 +00.0	70	8.9	580350	100	2.4	100	LRhb	PM	
2008	FM0569	0300 +01.5	0302 +00.0	110	8.2	529250	96	2.4	96	LRhb	PM	Low ADT, Rural, Not High Priority, Seal Coat.
2008	FM0588	0320 +01.0	0320 +01.5	210	6.2	1073100	66	2.1	69	LRhb	PM	
2008	FM0588	0322 +00.0	0322 +00.5	210	6.2	1073100	100	2.4	100	LRhb	PM	
2008	FM0589	0476 +00.5	0476 +01.0	120	8.4	839500	95	2.1	100	LRhb	PM	
2008	FM0589	0474 +01.0	0474 +01.5	120	8.4	839500	100	2.3	100	LRhb	PM	
2008	FM0701	0270 +00.5	0270 +00.7	170	26.8	1164350	73	2.2	74	LRhb	PM	
2008	FM0701	0262 +00.5	0262 +01.0	150	27.9	959950	88	2.3	88	LRhb	PM	
2009	IH0020	0363 +00.0	0363 +00.1	8850	41.4	50837200	10	3.4	10	MRhb	HRhb	361-364 Some sections were very bad with low distress score so we did a reconstruct. It had failure and fatigue cracking. We removed HMA, reworked base, and added 15″ HMA. Existing structure was not adequate for traffic.
2009	IH0020	0363 +00.1	0363 +00.6	8850	41.4	50837200	12	2.9	14	MRhb	HRhb	
2009	IH0020	0361 +00.0	0361 +00.6	8840	41.4	49900975	20	3.8	20	MRhb	HRhb	
2009	IH0020	0363 +00.6	0363 +00.9	8850	41.4	50837200	24	3.3	24	MRhb	HRhb	
2009	IH0020	0362 +00.0	0362 +00.2	8850	41.4	50837200	26	4.1	26	MRhb	HRhb	
2009	IH0020	0362 +00.4	0363 +00.0	8850	41.4	50837200	26	3.4	26	MRhb	HRhb	
2009	IH0020	0363 +00.6	0363 +00.9	8850	41.4	50837200	36	3.4	36	MRhb	HRhb	
2009	IH0020	0363 +00.1	0363 +00.6	8850	41.4	50837200	46	3.8	46	PM	HRhb	

Table A83. Pavement Sections Selected in Brownwood District to Illustrate Discrepancies in Treatment Selection (Continued).

PMIS											BROWNWOOD DISTRICT	
FISCAL YEAR	SIGNED HIGHWAY	BRM	ERM	AADT CURRENT	TRUCK AADT PCT	CUM ADT ORIG SURFACE QTY	CONDITION SCORE	RIDE SCORE	DISTRESS SCORE	TREATMENT ABREV.	TREATMENT Applied by the District	District Reason
2009	IH0020	0362 +00.2	0362 +00.4	8850	41.4	50837200	55	3.2	56	MRhb	HRhb	361-364 Some sections were very bad with low distress score so we did a reconstruct. It had failure and fatigue cracking. We removed HMA, reworked base, and added 15" HMA. Existing structure was not adequate for traffic.
2009	IH0020	0361 +00.6	0362 +00.0	8850	41.4	50837200	67	4.1	67	PM	HRhb	
2009	IH0020	0363 +00.0	0363 +00.1	8850	41.4	50837200	74	4.1	74	PM	HRhb	
2009	IH0020	0362 +00.2	0362 +00.4	8850	41.4	50837200	82	4	82	PM	HRhb	
2009	IH0020	0360 +00.6	0361 +00.0	8840	41.4	49890025	86	3.6	86	PM	HRhb	
2009	IH0020	0361 +00.6	0362 +00.0	8850	41.4	50837200	89	4.1	89	PM	HRhb	
2009	IH0020	0361 +00.0	0361 +00.6	8840	41.4	49900975	91	3.9	91	PM	HRhb	
2009	IH0020	0362 +00.0	0362 +00.2	8850	41.4	50837200	93	4	93	PM	HRhb	
2009	IH0020	0360 +00.0	0360 +00.6	8840	41.4	49890025	94	3.3	94	PM	HRhb	
2009	IH0020	0362 +00.4	0363 +00.0	8850	41.4	50837200	96	3.9	96	PM	HRhb	
2009	IH0020	0360 +00.6	0361 +00.0	8840	41.4	49890025	99	3.5	99	PM	HRhb	This was a PM. We milled and overlaid with 2" of hot mix. There were some failures, ruts and fatigue cracking. Failures and fatigue cracking were repaired prior to overlay.
2009	IH0020	0360 +00.0	0360 +00.6	8840	41.4	49890025	99	3.2	100	PM	HRhb	
2007	SH0016	0342 -01.4	0342 -01.0	6920	12.7	45340300	45	2.4	84	MRhb	PM	We did level-up and applied a seal coat.
2007	SH0016	0356 +00.5	0356 +01.0	6140	13	35346600	64	2.6	99	LRhb	PM	
2007	SH0016	0414 +00.0	0414 +00.5	3000	17.7	18359500	49	2.4	59	MRhb	PM	
2007	SH0016	0388 +01.0	0388 +01.3	1300	20	6825500	32	3.8	32	MRhb	PM	
2007	SH0016	0340 +00.0	0340 +00.1	1550	18.6	11351500	78	2.3	100	MRhb	PM	
2008	US0180	0474 +01.5	0476 +00.0	9500	33.1	59965850	46	2.3	96	MRhb	PM	Bad ride. Level-up and seal coat.
2008	US0183	0300 +00.5	0300 +01.0	6200	13.6	33915800	29	2.6	44	MRhb	PM	Repair failures, fill in ruts, and seal coat.
2009	US0067	0574 +01.5	0576 +00.0	5500	11.4	0	53	3	59	PM	PM	This was a PM job with 2" Mill and Overlay. Localized repairs were made prior to seal coat.
2009	US0067	0574 +00.5	0574 +01.0	5500	11.4	0	64	3.1	67	PM	PM	
2009	US0067	0574 +00.5	0574 +01.0	5500	11.4	0	65	3.8	65	PM	PM	
2009	US0067	0576 +00.0	0576 +00.5	5500	11.4	0	67	3.5	67	PM	PM	
2009	US0067	0574 +01.5	0576 +00.0	5500	11.4	0	74	3.2	75	PM	PM	
2009	US0067	0574 +01.0	0574 +01.5	5500	11.4	0	74	3.4	74	PM	PM	
2009	US0067	0576 +00.0	0576 +00.5	5500	11.4	0	81	3.6	81	PM	PM	
2009	US0067	0574 +01.0	0574 +01.5	5500	11.4	0	90	3.2	91	PM	PM	
2009	US0067	0572 +01.2	0574 +00.0	5500	11.4	0	92	3.8	92	PM	PM	
2009	US0067	0572 +01.2	0574 +00.0	5500	11.4	0	96	3.8	96	PM	PM	This is a reconstruction. Rework existing pavement, add new flexible base and 2CST. The section was sealed recently to hold together. It is hard to see the distress and therefore the structure was worse than it shows.
2009	US0084	0598 +01.0	0598 +01.5	2200	26.5	0	52	3.3	52	PM	LRhb	
2009	US0084	0600 +00.5	0600 +01.0	2200	26.5	0	54	3.4	54	MRhb	LRhb	
2009	US0084	0600 +01.5	0602 +00.0	1950	25.6	0	54	3.4	54	MRhb	LRhb	
2009	US0084	0600 +00.0	0600 +00.5	2200	26.5	0	88	2.7	90	PM	LRhb	

Budget Prioritization Analysis

PMIS ranking for sections in which the district applied treatment in 2009 were compared and discussed with the Brownwood District. The sections proposed by the Brownwood District were selected according to the following criteria: condition score, functional class, and average daily traffic (ADT).

Tables A84 and A85 provide a list of the sections treated by the district for the Preventive Maintenance and Rehabilitation categories, respectively. The costs estimated by both the district and PMIS are shown for each project. Priority rankings according to PMIS are also displayed for the district treated sections. As can be noted from the ranks, the sections treated by the district were not given priority according to PMIS. The discrepancies between the district and PMIS priorities were discussed with the district engineer from the Brownwood District. The supporting prioritization decisions are summarized in the last column of the tables.

Table A86 presents the sections prioritized by PMIS according to the ranking of the sections' cost-effectiveness ratio. Brownwood's District engineer provided explanations supporting the district decisions for not treating the sections proposed by PMIS. These are summarized in the table.

Table A84. Sections Applied with Preventive Maintenance Treatment, Brownwood District (2009).

Section	HWY	BRM	ERM	Lane Miles	Treatment	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	District reason for prioritization given PMIS ranking
1	SH 0279	340+0.145	340+1.047	1.5	Seal Coat	$ 23,759	$ -	-	-	Seal coats were applied based on timing even if pavement is in good shape.
2	SH 0279	332+0.851	340+0.145	7.3	Seal Coat	$213,686	$ -	-	-	Seal coats were applied based on timing even if pavement is in good shape.
3	SH 0279	332+0.096	332+0.871	1	Seal Coat	$ 23,433	$ -	-	-	Seal coats were applied based on timing even if pavement is in good shape.
4	FM 1850	448-0.052	450+0.901	2.9	Seal Coat	$ 65,281	$ 4,000	0.108	149	Seal coats were applied based on timing even if pavement is in good shape.
5	FM 0583	318+0.002	328+1.375	11.4	Seal Coat	$224,686	$ 40,000	0.044	492	Seal coats were applied based on timing even if pavement is in good shape.
6	FM 2940	452-0.034	456+1.733	5.6	Seal Coat	$126,110	$ 17,000	0.002	1076	Seal coats were applied based on timing even if pavement is in good shape.
7	FM 3254	342-0.689	342-0.027	0.7	Seal Coat	$ 30,103	$ 14,000	0.029	690	Seal coats were applied based on timing even if pavement is in good shape.
8	US 0084	510+0.000	518+1.833	10	Seal Coat	$763,433	$ 20,000	0.209	19	Seal coats were applied based on timing even if pavement is in good shape.
9	US 0084	518+1.833	530+0.975	11	Seal Coat	$589,848	$ 30,000	0.214	16	Seal coats were applied based on timing even if pavement is in good shape.
10	US 0084	530+0.975	532+1.032	3.2	Seal Coat	$113,247	$ -	-	-	Seal coats were applied based on timing even if pavement is in good shape.
11	SH 0206	350+0.217	354+0.326	6.1	Seal Coat	$109,367	$ 64,000	0.062	341	Seal coats were applied based on timing even if pavement is in good shape.
12	FM 2707	320+0.607	322+1.242	1.3	Seal Coat	$ 20,914	$ 43,000	0.019	816	Seal coats were applied based on timing even if pavement is in good shape.
13	SH 0153	354+0.000	364+1.577	12	Seal Coat	$300,304	$ -	-	-	Seal coats were applied based on timing even if pavement is in good shape.
14	FM 0567	342-0.021	344+0.177	2.5	Seal Coat	$ 41,761	$ 95,000	0.039	542	Seal coats were applied based on timing even if pavement is in good shape.
15	FM 1176	334-0.036	340+1.075	6.8	Seal Coat	$123,526	$ 19,000	0.129	107	Seal coats were applied based on timing even if pavement is in good shape.
16	FM 1176	346+1.246	352+0.759	6.3	Seal Coat	$115,768	$179,000	0.060	346	Seal coats were applied based on timing even if pavement is in good shape.
17	FM 1176	358+1.230	364+0.000	4.6	Seal Coat	$ 83,022	$ 66,000	0.059	354	Seal coats were applied based on timing even if pavement is in good shape.
18	FM 1770	418+0.000	422+1.669	5.7	Seal Coat	$106,051	$ 47,000	0.143	78	Seal coats were applied based on timing even if pavement is in good shape.
19	FM 2302	328-0.050	330+0.027	2.1	Seal Coat	$ 39,439	$ 23,000	0.028	693	Seal coats were applied based on timing even if pavement is in good shape.

Table A84. Sections Applied with Preventive Maintenance Treatment, Brownwood District (2009) (Continued).

Section	HWY	BRM	ERM	Lane Miles	Treatment	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	District reason for prioritization given PMIS ranking
20	FM 0567	344+0.177	344+1.434	1.4	Seal Coat	$ 23,220	$ 52,000	0.039	542	Seal coats were applied based on timing even if pavement is in good shape.
21	FM 0590	332-0.015	346+0.030	12.9	Seal Coat	$242,295	$ 60,000	0.123	119	Seal coats were applied based on timing even if pavement is in good shape.
22	FM 0573	332-0.035	344+0.000	11.9	Seal Coat	$230,149	$ 10,000	0.031	649	Seal coats were applied based on timing even if pavement is in good shape.
23	FM 0587	334+0.918	336+0.674	2.2	Seal Coat	$ 42,923	$ 20,000	0.110	146	Seal coats were applied based on timing even if pavement is in good shape.
24	FM 0588	318+0.981	322+1.237	4.7	Seal Coat	$ 81,364	$ 30,000	0.103	162	Seal coats were applied based on timing even if pavement is in good shape.
25	FM 0589	474-0.034	478+0.278	4.3	Seal Coat	$ 84,274	$ 54,000	0.079	256	Seal coats were applied based on timing even if pavement is in good shape.
26	FM 0588	316-0.026	318+0.982	2.5	Seal Coat	$ 59,573	$ -	-	-	Seal coats were applied based on timing even if pavement is in good shape.
27	FM 2318	318+1.991	322+1.459	4	Seal Coat	$ 81,135	$ -	-	-	Seal coats were applied based on timing even if pavement is in good shape.
28	FM 2318	314-0.020	318+1.991	5.5	Seal Coat	$139,266	$ 5,000	0.085	234	Seal coats were applied based on timing even if pavement is in good shape.
29	FM 2921	484+0.062	490+0.565	6.6	Seal Coat	$150,297	$123,000	0.228	10	Seal coats were applied based on timing even if pavement is in good shape.
30	FM 3200	328-0.035	332+0.535	4.4	Seal Coat	$ 83,409	$ -	-	-	Seal coats were applied based on timing even if pavement is in good shape.
31	FM 2945	450+1.355	458+1.283	7.5	Seal Coat	$410,279	$ 20,000	0.137	95	Seal coats were applied based on timing even if pavement is in good shape.
32	SH 0112	288-0.057	294+2.285	8.7	Seal Coat	$217,588	$ 88,000	0.112	141	Seal coats were applied based on timing even if pavement is in good shape.
33	SH 0006	366+0.275	378+0.000	10.5	Seal Coat	$286,504	$ 85,000	0.238	5	Seal coats were applied based on timing even if pavement is in good shape.
34	US 0183	320+0.236	328+0.211	8.5	Seal Coat	$203,959	$ 25,000	0.180	28	Seal coats were applied based on timing even if pavement is in good shape.
35	FM 0374	454+1.148	456+0.637	1	Seal Coat	$ 28,127	$ 30,000	0.047	457	Seal coats were applied based on timing even if pavement is in good shape.
36	FM 0374	452+0.779	454+0.870	0.6	Seal Coat	$ 16,716	$ 3,000	0.034	601	Seal coats were applied based on timing even if pavement is in good shape.

Table A84. Sections Applied with Preventive Maintenance Treatment, Brownwood District (2009) (Continued).

Section	HWY	BRM	ERM	Lane Miles	Treatment	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	District reason for prioritization given PMIS ranking
37	FM 0008	476-0.030	478+1.693	4	Seal Coat	$102,776	$ 20,000	0.051	419	Seal coats were applied based on timing even if pavement is in good shape.
38	FM 0569	296-0.029	302+0.607	7	Seal Coat	$132,814	$ 29,000	0.148	66	Seal coats were applied based on timing even if pavement is in good shape.
39	FM 0569	302+0.612	308+1.560	7	Seal Coat	$139,544	$ 5,000	0.105	157	Seal coats were applied based on timing even if pavement is in good shape.
40	FM 0583	316-0.049	318+0.002	0.6	Seal Coat	$ 28,421	$ 5,000	0.009	945	Seal coats were applied based on timing even if pavement is in good shape.
41	FM 1864	456+1.265	458+0.882	1.2	Seal Coat	$ 34,551	$ -	-	-	Seal coats were applied based on timing even if pavement is in good shape.
42	FM 1852	286+1.576	290+1.128	3.2	Seal Coat	$ 61,219	$ 17,000	0.137	95	Seal coats were applied based on timing even if pavement is in good shape.
43	FM 3265	454+0.000	454+0.955	1	Seal Coat	$ 18,378	$ 5,000	0.028	701	Seal coats were applied based on timing even if pavement is in good shape.
44	FM 0580	506+1.691	516+1.715	10.5	Seal Coat	$218,376	$ -	-	-	Seal coats were applied based on timing even if pavement is in good shape.
45	SL 0257	508-0.022	508+1.333	1.3	Seal Coat	$ 82,134	$ 85,000	0.106	154	Seal coats were applied based on timing even if pavement is in good shape.
46	US 0281	408+1.893	410+0.306	1	Seal Coat	$ 20,344	$ -	-	-	Seal coats were applied based on timing even if pavement is in good shape.
47	US 0190	442+0.595	442+0.595	0.1	Seal Coat	$238,791	$ -	-	-	Seal coats were applied based on timing even if pavement is in good shape.
48	US 0190	434+0.000	442+0.595	8.8	Seal Coat	$215,086	$ -	-	-	Seal coats were applied based on timing even if pavement is in good shape.
49	FM 0765	426+0.000	438+1.609	14	Seal Coat	$304,410	$ -	-	-	Seal coats were applied based on timing even if pavement is in good shape.
50	FM 0765	438+1.609	452+0.670	12.7	Seal Coat	$237,348	$ 25,000	0.142	79	Seal coats were applied based on timing even if pavement is in good shape.
51	FM 1851	402+0.320	408+0.000	4.6	Seal Coat	$ 96,754	$ 5,000	0.092	204	Seal coats were applied based on timing even if pavement is in good shape.
52	FM 3293	448-0.022	450+0.152	2.2	Seal Coat	$ 41,054	$ -	-	-	Seal coats were applied based on timing even if pavement is in good shape.
53	FM 0572	486-0.016	502+1.951	17.8	Seal Coat	$358,144	$ -	-	-	Seal coats were applied based on timing even if pavement is in good shape.
54	FM 0218	476+0.000	490+0.922	15.2	Seal Coat	$295,424	$ 8,000	0.047	461	Seal coats were applied based on timing even if pavement is in good shape.
55	FM 0500	378+0.726	388+0.763	10.1	Seal Coat	$191,976	$159,000	0.220	13	Seal coats were applied based on timing even if pavement is in good shape.
56	SH 1006	400+1.832	412+1.796	12.1	Seal Coat	$301,905	$102,000	0.096	191	Seal coats were applied based on timing even if pavement is in good shape.

Table A84. Sections Applied with Preventive Maintenance Treatment, Brownwood District (2009) (Continued).

Section	HWY	BRM	ERM	Lane Miles	Treatment	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	District reason for prioritization given PMIS ranking
57	SH 0016	430+0.389	436+0.000	4.2	Seal Coat	$ 98,880	$ -	-	-	Seal coats were applied based on timing even if pavement is in good shape.
58	US 0180	472+0.797	474+0.872	2.5	Seal Coat	$107,944	$210,000	0.125	112	Seal coats were applied based on timing even if pavement is in good shape.
59	US 0180	480+1.571	478+0.438	3.9	Seal Coat	$212,888	$128,000	0.093	203	Seal coats were applied based on timing even if pavement is in good shape.
60	FM 0576	462+0.353	472+0.577	10.6	Seal Coat	$215,074	$ 35,000	0.159	49	Seal coats were applied based on timing even if pavement is in good shape.
61	FM 0576	472+1.240	480+0.281	7.1	Seal Coat	$158,518	$ 42,000	0.190	25	Seal coats were applied based on timing even if pavement is in good shape.
62	US 0183	300+0.587	300+1.333	1	Seal Coat	$ 54,230	$150,000	0.056	380	Seal coats were applied based on timing even if pavement is in good shape.
63	US 0183	300+0.459	300+0.587	0.5	Seal Coat	$ 9,632	$ -	-	-	Seal coats were applied based on timing even if pavement is in good shape.
64	FM 0701	262+0.000	270+0.694	8.7	Seal Coat	$168,848	$ 46,000	0.068	307	Seal coats were applied based on timing even if pavement is in good shape.
65	FM 0578	266+0.144	272+1.028	7	Seal Coat	$150,302	$ 40,000	0.148	65	Seal coats were applied based on timing even if pavement is in good shape.
66	FM 1032	462-0.032	466+0.299	4.3	Seal Coat	$ 74,276	$ 49,000	0.090	213	Seal coats were applied based on timing even if pavement is in good shape.
67	FM 1287	258+0.000	262+0.103	4.1	Seal Coat	$109,155	$ 17,000	0.045	472	Seal coats were applied based on timing even if pavement is in good shape.
68	FM 1852	276-0.039	286+1.576	11.6	Seal Coat	$223,510	$ 91,000	0.173	32	Seal coats were applied based on timing even if pavement is in good shape.
69	FM 1853	276-0.037	286+0.000	9.5	Seal Coat	$180,223	$ 25,000	0.139	87	Seal coats were applied based on timing even if pavement is in good shape.
70	FM 2408	454+0.000	456+0.241	2.2	Seal Coat	$ 43,807	$ 2,000	0.014	879	Seal coats were applied based on timing even if pavement is in good shape.
71	FM 3253	260-0.025	264+0.862	4.9	Seal Coat	$ 91,519	$ 40,000	0.161	47	Seal coats were applied based on timing even if pavement is in good shape.
72	FM 3099	264-0.001	266+1.701	4.1	Seal Coat	$ 75,488	$ 75,000	0.235	6	Seal coats were applied based on timing even if pavement is in good shape.
73	RR 0009	350-0.024	350+1.267	0	Seal Coat	$ 35,870	$ -	-	-	Seal coats were applied based on timing even if pavement is in good shape.
74	RR 0010	352-0.043	352+1.027	0	Seal Coat	$ 41,211	$ -	-	-	Seal coats were applied based on timing even if pavement is in good shape.
75	FM 2806	456+0.000	458+0.998	0	Seal Coat	$ 68,570	$ -	-	-	Seal coats were applied based on timing even if pavement is in good shape.

Table A85. Sections Applied with Rehabilitation Treatment, Brownwood District (2009).

Section	HWY	BRM	ERM	Lane Miles	Treatment	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	District reason for prioritization given PMIS ranking
1	US 0281	412+2.136	418+0.000	1.6	Gr, Base, Surface, Signals, Illum, C&G	$ 1,131,594	$ 60,000	0.106	153	Signal project with left and right turn lanes added at the signal. Seal coat entire project.
2	IH 0020	360+0.954	362+0.155	5.2	Reconst. Existing roadway	$ 3,980,084	$ 160,000	0.025	727	IH 0020 is a high priority road and sections are in bad shape.
3	IH 0020	362+0.155	363+0.944	6.1	Reconst. Existing roadway	$ 4,307,350	$ 358,000	0.111	144	IH 0020 is a high priority road and sections are in bad shape.
4	US 0067	572+1.209	576+0.559	7	Mill and Overlay	$ 1,562,249	$ 100,000	0.136	98	Cracking problem. Coring verified that the cracking was limited to the top 2 inches.
5	US 0084	596+0.614	596+1.428	1	Rehab Pavement	$ 363,746	$ 85,000	0.029	678	Cracking and rutting. Seal coats were applied in the past to keep the road from deteriorating. ARRA money was used to rehabilitate the roadway.
6	US 0084	596+1.428	606+0.543	9.7	Rehab Pavement	$ 4,241,698	$ 270,000	0.096	190	Cracking and rutting. Seal coats were applied in the past to keep the road from deteriorating. ARRA money was used to rehabilitate the roadway.
7	FM 3533	0	-	-	New FM Road	$ 664,615	$ -	0.000	-	This is a new road, so it had not been ranked in PMIS.

Table A86. Prioritized PMIS Sections Based on Ranking and District Reason for Not Treating Section, Brownwood District (2009).

PMIS Rank	HWY	BRM	ERM	District reason for not choosing sections prioritized by PMIS
1	SH0006	0344 +01.0	0344 +01.6	Sections were already addressed in September 2010.
2	FM2657	0384 +00.0	0384 +00.5	Work is programmed for fiscal year 2013 since there is not enough money available for rehabilitation projects.
3	FM0679	0306 +00.0	0306 +00.6	Maintenance forces will maintain. Low average daily traffic (ADT).
4	FM1476	0326 -01.2	0326 -00.7	Section is scheduled for in house maintenance. Low priority due to its low ADT.
5	SH0006	0368 +01.5	0370 +00.0	Section has already received maintenance.
7	US0283	0344 +00.5	0344 +01.0	Section had a lot of failures, therefore it has already received treatment. Although it is a low ADT road, it is given priority because it is a US highway.
8	SH0006	0374 +01.0	0374 +01.5	Section has received maintenance.
11	SH0006	0374 +00.5	0374 +01.0	Section has received maintenance.
12	SH0006	0370 +00.0	0370 +00.5	Section has received maintenance.
14	US0283	0344 +00.0	0344 +00.5	Section had a lot of failures, therefore it has already received treatment. Although it is a low ADT road, it is given priority because it is a US highway.
15	SH0006	0372 +00.0	0372 +00.5	Section has received maintenance.
20	US0283	0342 +01.5	0344 +00.0	Section had a lot of failures, therefore it has already received treatment. Although it is a low ADT road, it is given priority because it is a US highway.
21	US0283	0346 +01.0	0346 +01.5	Section had a lot of failures, therefore it has already received treatment. Although it is a low ADT road, it is given priority because it is a US highway.
22	US0283	0338 +01.5	0340 +00.0	Section had a lot of failures, therefore it has already received treatment. Although it is a low ADT road, it is given priority because it is a US highway.
23	US0283	0348 +00.5	0348 +01.0	Section had a lot of failures, therefore it has already received treatment. Although it is a low ADT road, it is given priority because it is a US highway.
1109	US0067	0598 +01.5	0600 +00.0	Section has a seal coat scheduled for this year due to time from last treatment.

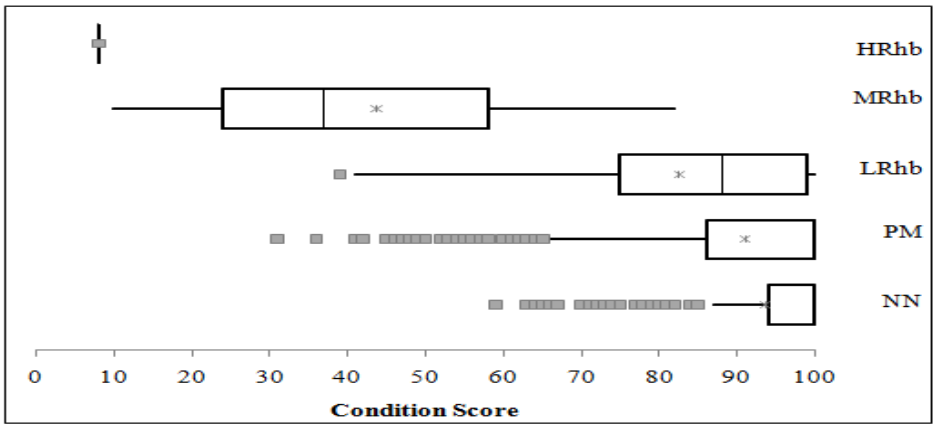
A summary of the Preventive Maintenance and Rehabilitation total treatment cost was calculated for PMIS and the Brownwood District. The district spent a total of $26,985,546 for the treatment of sections in the 2009 fiscal year. For the same sections prioritized by the district, PMIS estimated a cost of $14,825,000. Table A87 displays the total cost for each treatment type according to each source. Differences in the budgets may be due to out-of-date PMIS unit cost or local conditions.

Table A87. Summary of Treatment Cost and Lane Miles, Brownwood District (2009).

Treatment Type	Source	Treatment Cost	Percentage	Lane Miles
Preventive Maintenance	PMIS	$ 4,465,000	30%	333.6
	District	$ 10,734,210	40%	419.8
Rehabilitation	PMIS	$ 10,360,000	70%	182.4
	District	$ 16,251,336	60%	30.6

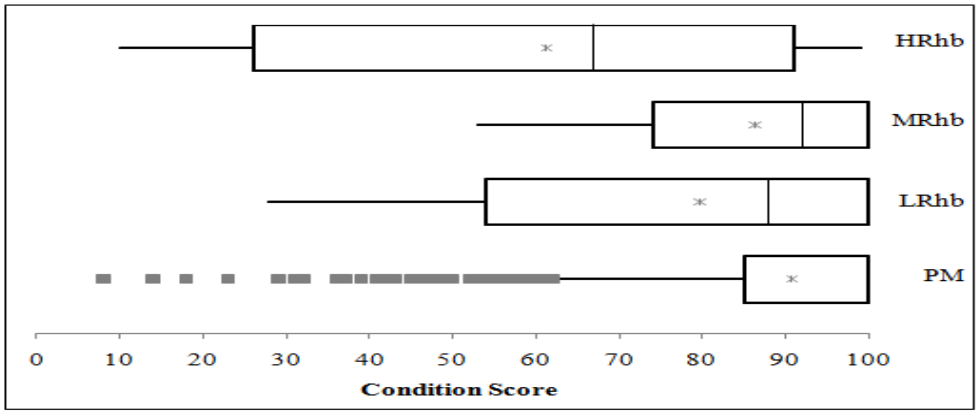
Concluding Remarks

a. Statistical analysis shows that there is not relationship between the PMIS condition scores for treatments applied by the district and treatments recommended by PMIS. Figures A41 and A42 show box plots by treatment category for the PMIS condition scores from 2007 through 2009 for treatments recommended by PMIS and for treatments applied by the district, respectively.



Treatment Category	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Need Nothing	59	94	100	100	100
Preventive Maintenance	31	86	100	100	100
Light Rehabilitation	39	75.8	88.5	99.0	100
Medium Rehabilitation	10	25.5	37	61.3	82
Heavy Rehabilitation	8	8	8	8	8

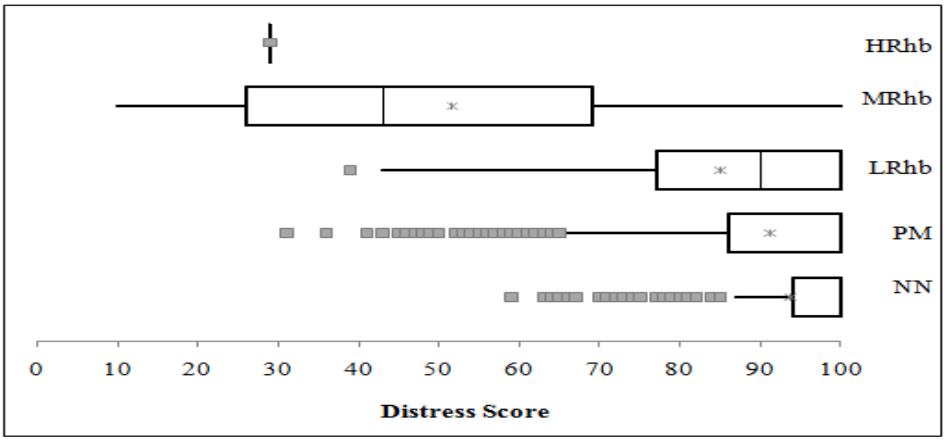
Figure A41. Box Plots for Condition Scores of Treatments Recommended by PMIS, Brownwood District, 2007–2009.



Treatment Category	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Need Nothing	-	-	-	-	-
Preventive Maintenance	8	85	100	100	100
Light Rehabilitation	28	62	88	99.5	100
Medium Rehabilitation	53	74	94	100	100
Heavy Rehabilitation	10	26	70.5	91.5	99

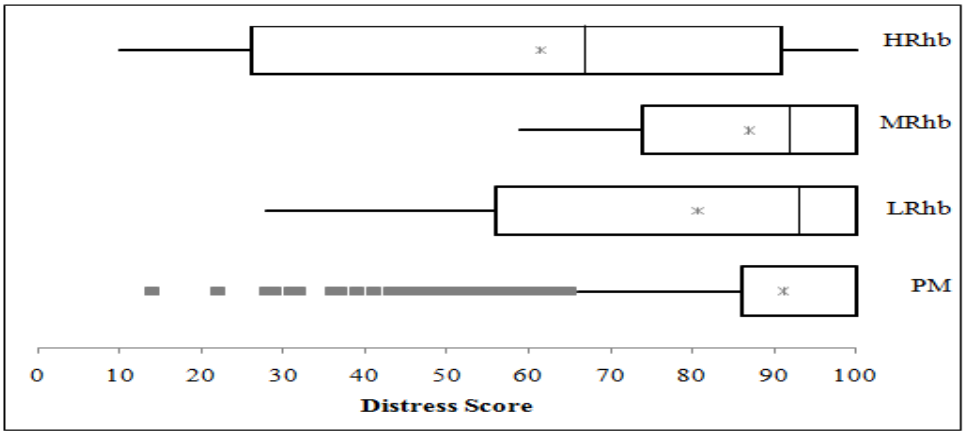
Figure A42. Box Plots for Condition Scores of Treatments Applied by Brownwood District, 2007–2009.

b. There is not relationship between PMIS distress scores for treatments applied by the district and treatments recommended by PMIS. Figures A43 and A44 shows the box plots by treatment category for the PMIS distress scores from 2007 through 2009 for treatments recommended by PMIS and for treatments applied by the district, respectively.



Treatment Category	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Need Nothing	59	94	100	100	100
Preventive Maintenance	31	86	100	100	100
Light Rehabilitation	39	77.8	90.5	100	100
Medium Rehabilitation	10	27.5	43.5	75	100
Heavy Rehabilitation	29	29	29	29	29

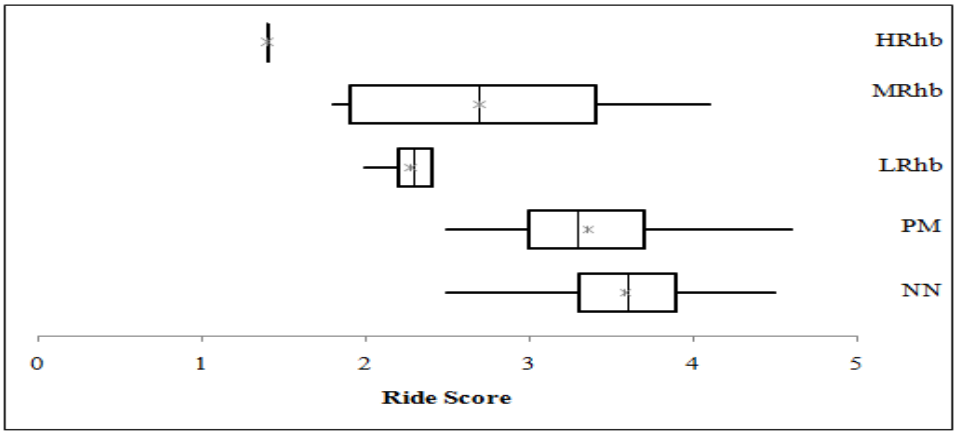
Figure A43. Box Plots for Distress Scores of Treatments Recommended by PMIS, Brownwood District, 2007–2009.



Treatment Category	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Need Nothing	-	-	-	-	-
Preventive Maintenance	14	86	100	100	100
Light Rehabilitation	28	63	93	99.5	100
Medium Rehabilitation	59	74.3	94	100	100
Heavy Rehabilitation	10	26	70.5	91.5	100

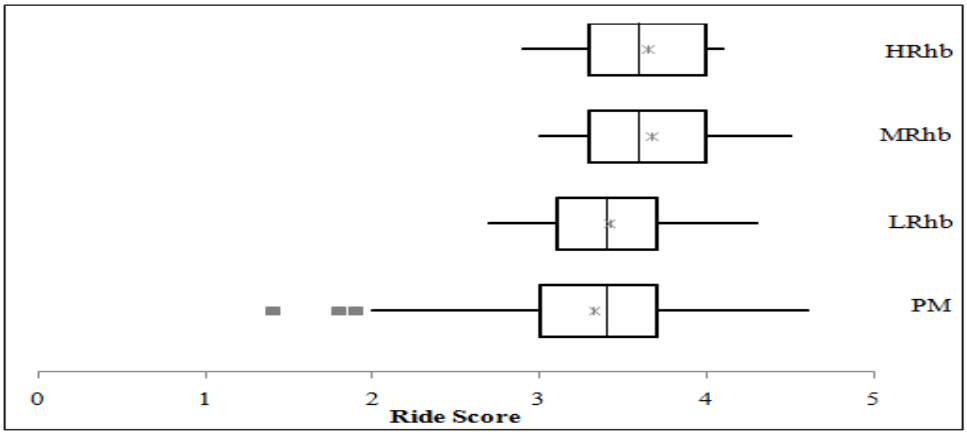
Figure A44. Box Plots for Distress Scores of Treatments Applied by the Brownwood District, 2007–2009.

c. Ride scores for treatments applied by the district do not show any correlation with ride scores for treatments recommended by PMIS. Figures A45 and A46 show the box plots by treatment category for the PMIS ride scores from 2007 through 2009 for treatments recommended by PMIS and for treatments applied by the district, respectively.



Treatment Category	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Need Nothing	2.5	3.3	3.6	3.9	4.5
Preventive Maintenance	2.5	3.0	3.3	3.7	4.6
Light Rehabilitation	2.0	2.2	2.3	2.4	2.4
Medium Rehabilitation	1.8	1.9	2.7	3.4	4.1
Heavy Rehabilitation	1.4	1.4	1.4	1.4	1.4

Figure A45. Box Plots for Ride Scores of Treatments Recommended by PMIS, Brownwood District, 2007–2009.



Treatment	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Need Nothing	-	-	-	-	-
Preventive Maintenance	1.4	3.0	3.4	3.7	4.6
Light Rehabilitation	2.7	3.2	3.4	3.7	4.3
Medium Rehabilitation	3.0	3.3	3.7	4.0	4.5
Heavy Rehabilitation	2.9	3.4	3.7	4.0	4.1

Figure A46. Box Plots for Ride Scores of Treatments Applied by Brownwood District, 2007–2009.

d. The Brownwood District budget prioritization process shows sections ranked top by PMIS but not addressed by the district were included in maintenance or rehabilitation programs in later fiscal years. Other sections recommended for treatment by PMIS were not considered for funding by the district because of very low traffic or low priority functional class. Brownwood District does not use grouping of sections adjacent to a top-priority section as a strategy for applying treatments. Only sections that satisfy their criteria for prioritization are addressed. Brownwood uses a preventive maintenance approach to preserve its roadways. Time from last treatment is taken into consideration. If section is due for treatment, preventive maintenance measures are taken even if section is in good shape.

BRYAN DISTRICT

SUB-TASK 1.4: COMPARE DISTRICT PRIORITY RANKINGS AND REPAIR NEEDS TO PMIS RESULTS

UTEP lead with the assistance of TTI and UTSA
1/31/2011

BRYAN DISTRICT

There are 6870 lane miles pavements in Bryan District. Table A88 shows the number of lane miles for Bryan District summarized by highway system.

Table A88. Lane Miles in Bryan District.

Highway System	Lane Miles	Percentage (%)
Interstate Highways (IH)	448.4	6.5
United States Highways (US)	867.4	12.6
State Highways (SH)	1574.2	22.9
Farm-to-Market (FM)	3854.4	56.1
Business Routes (BR)	104.2	1.5
Park Road (PR)	27.2	0.4
Principal Arterial Streets (PA)	0.0	0.0
Total	6869.8	100.0

Table A89 shows the treatments applied by the Bryan District in 2007 and their corresponding PMIS category.

Table A89. Treatments and Descriptions Applied by Bryan District (2007).

Fiscal Year DCIS	Applied Treatment Abbreviation	Treatment Description
2007	PM	Seal Coat
	MRhb	Restore Existing pavement
	HRhb	Grading,Struc,Base,Surface

Table A90 shows the treatments applied by the Bryan District in 2008 and their corresponding PMIS category.

Table A90. Treatments and Descriptions Applied by Bryan District (2008).

Fiscal Year DCIS	Applied Treatment Abbreviation	Treatment Description
2008	PM	Seal Coat
	LRhb	Planning & HMA Overlay
	MRhb	PLN, CONC PAV REPR, SEAL, HMA & PFC
	HRhb	Grading,Struc,Base,Surface

Table A91 shows the treatments applied by the Bryan District in 2009 and their corresponding PMIS category.

Table A91. Treatments and Descriptions Applied by Bryan District (2009).

Fiscal Year DCIS	Type of Pavement	Treatment Description
2009	PM	Seal Coat
	PM	HMA Overlay
	MRhb	Restore Existing Road
	HRhb	Rehabilitation Of Existing Road

Table A92 shows the treatments applied by the district from 2007 through 2009, their corresponding PMIS category, and the treatment class recommended by PMIS.

Table A92. Treatments and Descriptions Applied by Bryan District (2007–2009).

Applied Treatment	Bryan	PMIS Recommendation				
		NN	PM	LRhb	MRhb	HRhb
Planning & HMA Overlay (LRhb)	1459	702	478	141	71	67
Restore Existing pavement, PLN, CONC PAV REPR, SEAL, HMA & PFC, Restore Existing Road (MRhb)	33	16	6	2	2	7
Grading,Struc,Base,Surface, Rehabilitation Of Existing Road (HRhb)	171	44	28	28	28	43
Planning & HMA Overlay (LRhb)	167	39	46	31	34	17
Total	1912	804	559	202	136	211

FINDINGS OF THE STATISTICAL ANALYSES

Findings of the statistical analysis conducted for the comparison of treatments applied in Bryan District and PMIS treatment recommendations follows. Details of the analysis are in the appendices.

Condition, distress and ride scores from 2001–2009 were analyzed using box plots to show quartiles and medians for each segment category. The purpose of this analysis was to show graphically the range of variation of the scores for each treatment category. For example, in Figure A47, the condition score of the sections recommended to receive Preventive Maintenance treatment has a median of 90 and a mean of about 87. From this box plot, it can also be concluded that 25% of the data are below a condition score of 81 and 75% are below a condition

score of 99. The box plot of the lower portion of Figure A47 is labeled for a better understanding of these graphs.

Tables were also prepared to show PMIS statistics for condition, distress, and ride scores (mean and standard deviation) for each treatment category. We also plot the evolution of treatment needs from 2001–2009 and conducted Mann-Whitney test to compare PMIS data to district data for each treatment category.

~~Summary of PMIS Scores and Treatment Needs~~

a. The average PMIS condition score for the total number of lane miles rated by the district ranges between 86.2 as a minimum in 2006 and 89.7 as a maximum in 2009. Throughout the 2001–2009 analysis periods, the percentage of lane miles with very good and good condition scores is range between 82% as a minimum in 2006 and 88% as a maximum in 2009. In 2009, 88% of the total lane miles in Bryan District show a condition score equal or greater than 70 (good or very good). A similar pattern is observed Texas statewide with 85% of the total lane miles in 2009 showing a condition score equal or greater than 80.

b. The average PMIS distress score for the total number of lane miles rated by district ranges between 91.3 as a minimum in 2001 and 94.5 as a maximum in 2009. Throughout the analysis period 2001–2009, the percentage of lane miles with very good and good distress scores is range between 84% as a minimum in 2006 and 98% as a maximum in 2001. In 2009, 89% of the total lane miles in Bryan District show a distress score equal or greater than 80 (good or very good). A similar pattern is observed Texas statewide with 85% of the total lane miles in 2009 showing a distress score equal or greater than 80.

c. The average PMIS ride score for the total number of lane miles rated by the district ranges between 3.1 as a minimum and 3.3 as a maximum. Throughout the 2001–2009 analysis period, the percentage of lane miles with very good and good ride scores ranges between 60% as a minimum in 2006 and 68% as a maximum in 2008. In 2009, 64% of the total lane miles in Bryan District show a ride score equal or greater than 3.0 (good or very good). A similar pattern is observed Texas statewide with 70% of the total lane miles in 2009 showing a ride score equal or greater than 3.0.

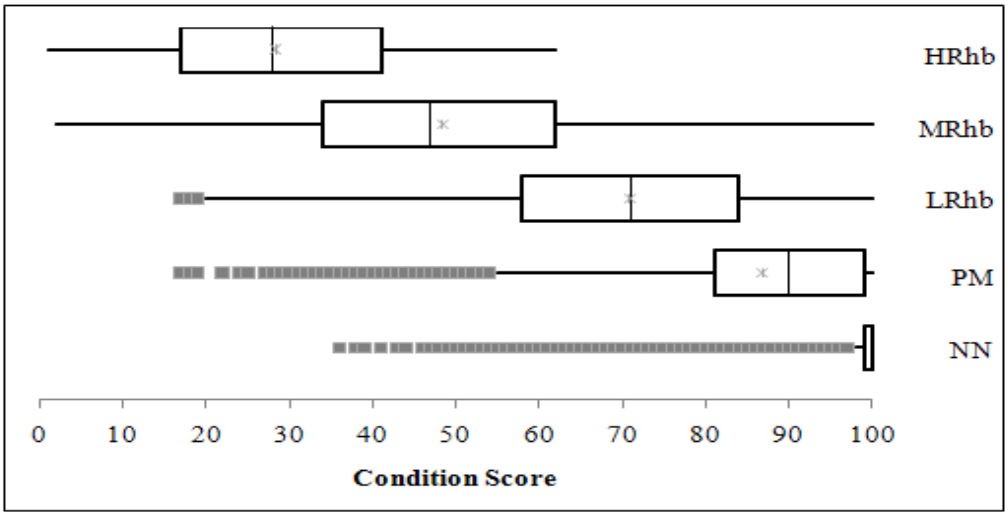
d. The most prevalent PMIS treatment recommendation from 2001 through 2009 is Need Nothing. Fifty-eight percent of the sections are in this treatment category. Twenty-five percent of sections fall in the Preventive Maintenance category while the remaining percentage is distributed between Light Rehabilitation, Medium Rehabilitation, and Heavy Rehabilitation (9%, 7%, and 1%, respectively). Table A93 shows a summary of the frequency, mean, and standard deviations for the PMIS condition score, distress score, and ride score for all pavements.

Table A93. PMIS Statistics for all Types of Pavements in Bryan District (2001–2009).

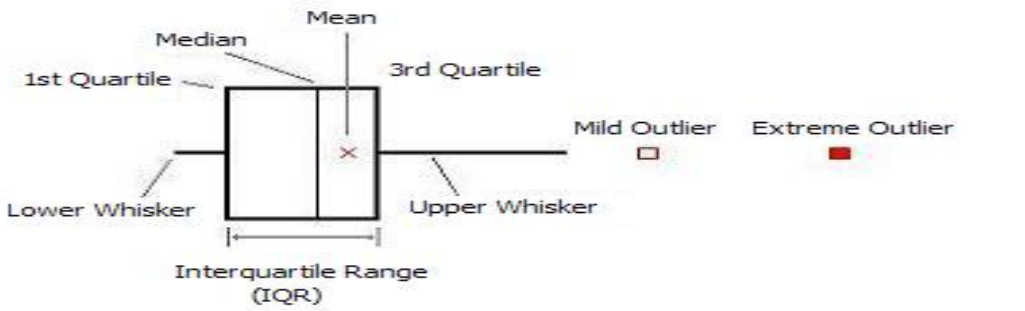
Treatment Category	Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	58.4	97.0	7.8	97.9	6.7	3.6	0.6
Preventive Maintenance	24.9	81.1	17.7	82.2	17.5	3.3	0.6
Light Rehabilitation	8.9	70.6	19.5	85.1	18.9	2.3	0.3
Medium Rehabilitation	6.6	41.7	21.0	61.1	31.9	2.3	0.6
Heavy Rehabilitation	1.2	26.0	15.6	67.5	30.7	1.8	0.9

Total number of sections analyzed: 102465.

Figures A47, A48, and A49 show the box plots with medians and quartiles for condition scores, distress, and ride scores of treatments recommended by PMIS.

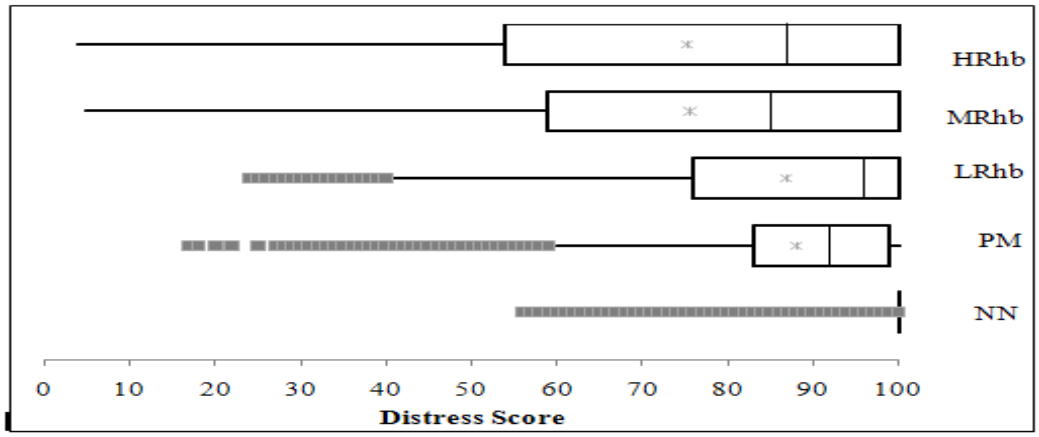


Treatment Category	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Need Nothing	36.0	99.0	100.0	100.0	100.0
Preventive Maintenance	17.0	81.0	90.0	99.0	100.0
Light Rehabilitation	17.0	58.0	71.0	84.0	100.0
Medium Rehabilitation	2.0	34.0	47.0	62.0	100.0
Heavy Rehabilitation	1.0	17.0	28.0	41.0	62.0



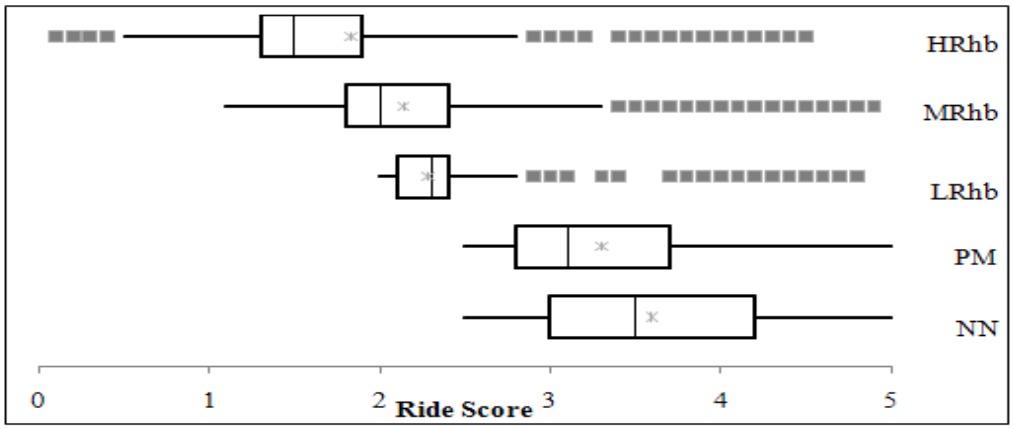
Whiskers extend to the furthest observations that are no more than 1.5 IQR from the edges of the box. Mild outliers are observations between 1.5 IQR and 3 IQR from the edges of the box. Extreme outliers are greater than 3 IQR from the edges of the box.

Figure A47. Box Plots for Condition Scores of Treatments Recommended by PMIS, Bryan District, 2001–2009.



Treatment Category	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Need Nothing	56.0	100.0	100.0	100.0	100.0
Preventive Maintenance	17.0	83.0	92.0	99.0	100.0
Light Rehabilitation	24.0	76.0	96.0	100.0	100.0
Medium Rehabilitation	5.0	59.0	85.0	100.0	100.0
Heavy Rehabilitation	4.0	55.0	87.0	100.0	100.0

Figure A48. Box Plots for Distress Scores of Treatments Recommended by PMIS, Bryan District, 2001–2009.



Treatment Category	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Need Nothing	2.5	3.0	3.5	4.2	5.0
Preventive Maintenance	2.5	2.8	3.1	3.7	5.0
Light Rehabilitation	2.0	2.1	2.3	2.4	4.8
Medium Rehabilitation	1.1	1.8	2.0	2.4	4.9
Heavy Rehabilitation	0.1	1.3	1.5	1.9	4.5

Figure A49. Box Plots for Ride Scores of Treatments Recommended by PMIS, Bryan District, 2001–2009.

e. The most prevalent PMIS treatment recommendation from 2001 through 2009 is Need Nothing. Fifty-eight percent of the sections are in this treatment category. Twenty-five percent of sections fall in the Preventive Maintenance category while the remaining percentage is distributed between Light Rehabilitation, Medium Rehabilitation, and Heavy Rehabilitation (9%, 7%, and 1%, respectively). Table A94 shows a summary of the

frequency, mean, and standard deviations for the PMIS condition score, distress score, and ride score for asphalt pavements.

Table A94. PMIS Statistics for Asphalt Pavements in Bryan District (2001–2009).

Treatment Category	Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	58.3	97.0	7.8	97.9	6.7	3.6	0.6
Preventive Maintenance	25.2	81.1	17.7	82.2	17.5	3.3	0.6
Light Rehabilitation	8.9	70.5	19.5	85.1	18.9	2.3	0.3
Medium Rehabilitation	6.5	41.5	20.8	60.9	31.9	2.3	0.6
Heavy Rehabilitation	1.1	24.3	15.1	72.0	29.9	1.5	0.5

Total number of sections analyzed: 101265.

f. The most prevalent PMIS treatment recommendation from 2001 through 2009 is Need Nothing. Seventy-three percent of the sections are in this treatment category. Neither of the sections falls in the Preventive Maintenance category while the remaining percentage is distributed between Light Rehabilitation, Medium Rehabilitation, and Heavy Rehabilitation (8%, 3%, and 17%, respectively). Table A95 shows a summary of the frequency, mean, and standard deviations for the PMIS condition score, distress score, and ride score for CRCP pavements.

Table A95. PMIS Statistics CRCP Pavements in Bryan District (2001–2009).

Treatment Category	Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	72.5	95.5	9.6	96.4	9.0	4.1	0.5
Preventive Maintenance	0.0	-	-	-	-	-	-
Light Rehabilitation	7.5	79.8	12.4	79.9	12.4	4.1	0.3
Medium Rehabilitation	2.7	78.2	14.7	88.4	12.6	3.2	0.5
Heavy Rehabilitation	17.3	37.0	14.4	37.1	14.4	3.9	0.4

Total number of sections analyzed: 943.

g. The most prevalent PMIS treatment recommendation from 2001 through 2009 is Medium Rehabilitation. Forty-six percent of the sections are in this treatment category. Thirty-nine percent of sections fall in the Need Nothing category while the remaining percentage is distributed between Preventive Maintenance, Light Rehabilitation, and Heavy Rehabilitation (1%, 12%, and 2%, respectively). Table A96 shows a summary of the frequency, mean, and standard deviations for the PMIS condition score, distress score, and ride score for joint pavements.

Table A96. PMIS Statistics for JCP Pavements in Bryan District (2001–2009).

Treatment Category	Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	38.9	86.0	14.8	100.0	0.2	3.0	0.4
Preventive Maintenance	1.2	99.3	0.6	100.0	0.0	3.3	0.2
Light Rehabilitation	12.1	84.9	15.1	87.7	15.5	2.8	0.3
Medium Rehabilitation	46.3	47.2	25.7	65.3	32.0	2.1	0.4
Heavy Rehabilitation	1.6	39.0	22.1	43.3	22.5	3.0	0.3

Total number of sections analyzed: 257.

h. The Need Nothing treatment category was the most prevalent PMIS treatment recommendation in the Bryan District maximum of 74% and minimum of 43% of lane miles considering all types of pavements. Preventive Maintenance ranges from 10% to 43%. Both Light Rehabilitation and Medium Rehabilitation range from 4% to 7% during the entire period of analysis, and Heavy Rehabilitation less than 2%. Figure A50 shows the total PMIS treatment needs in Bryan District for all types of pavements.

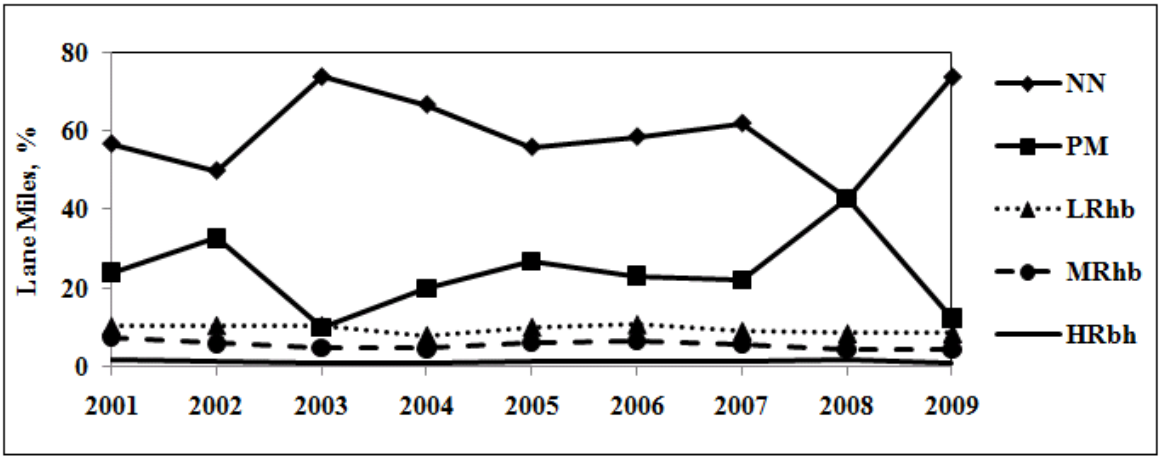


Figure A50. PMIS Treatment Needs in Bryan District (All Types of Pavements).

i. The Need Nothing treatment category was the most prevalent PMIS treatment recommendation in the Bryan District maximum of 74% and minimum of 43% of lane miles considering all types of pavements. Preventive Maintenance ranges from 10% to 43%. Both Light Rehabilitation and Medium Rehabilitation range from 4% to 11% during the entire period of analysis, and Heavy Rehabilitation is less than 2%. Figure A51 shows the total PMIS treatment needs in Bryan District for asphalt pavements.

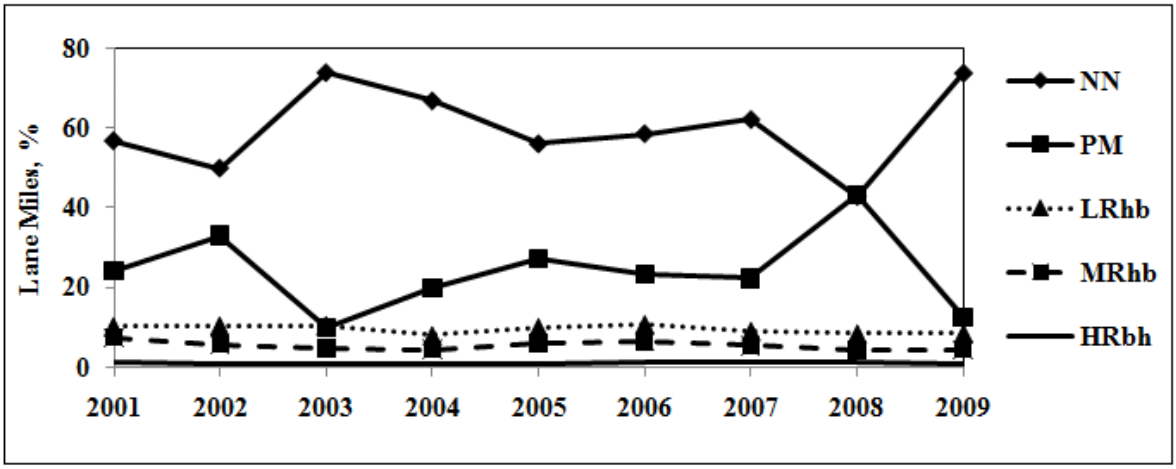


Figure A51. PMIS Treatment Needs for Asphalt Pavements in Bryan District.

j. The Need Nothing treatment category was the most prevalent PMIS treatment recommendation in the Bryan District maximum of 71% and minimum of 52% of lane miles considering all types of pavements. Preventive Maintenance is less than 2%. Light Rehabilitation ranges from 2% to 16%, Medium Rehabilitation ranges from 7% to 33% during the entire period of analysis, and Heavy Rehabilitation from 0% to 26%. Figure A52 shows the total PMIS treatment needs in Bryan District for concrete pavements.

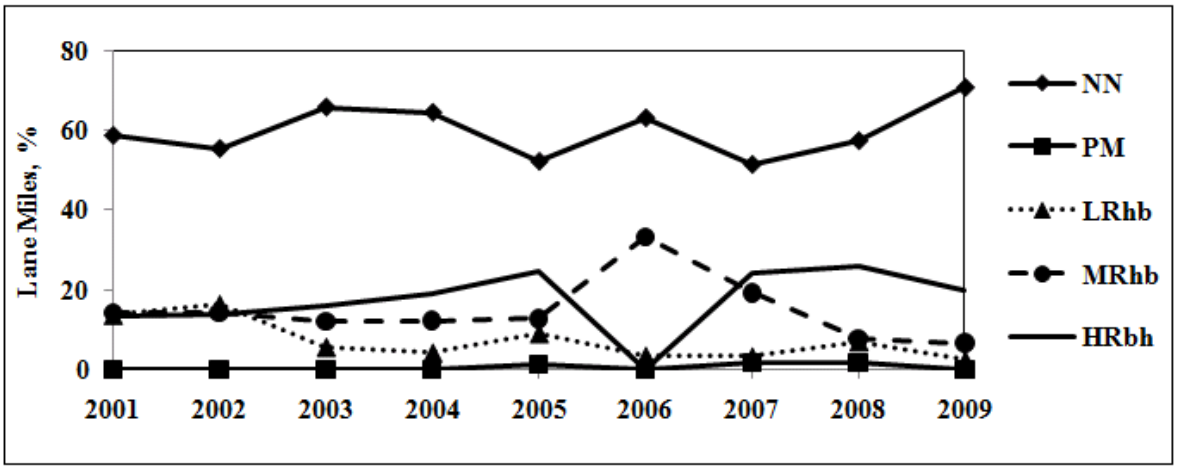


Figure A52. PMIS Treatment Needs for CRCP Pavements in Bryan District.

~~PMIS Scores for Treatments Applied in Bryan District~~

a. In 2009, 73 pavement sections received a district Heavy Rehabilitation in the Bryan District. Twenty-three percent of these sections were recommended by PMIS for Heavy Rehabilitation, 27% for Medium Rehabilitation, 22% for Light Rehabilitation, and 14% for both Preventive Maintenance and Need Nothing. Table A97 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Heavy Rehabilitation treatment applied in Bryan in 2009.

Table A97. PMIS Treatment Recommendations and Scores for Heavy Rehabilitation Treatment Applied in Bryan in 2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	13.7	85.1	31.1	87.5	28.0	3.8	0.8
Preventive Maintenance	13.7	70.0	22.0	74.7	20.6	3.3	1.0
Light Rehabilitation	21.9	50.2	23.6	65.7	19.9	2.1	0.3
Medium Rehabilitation	27.4	38.8	16.7	60.4	19.4	1.9	0.4
Heavy Rehabilitation	23.3	56.8	38.9	70.6	31.0	3.0	1.3

(*) A total of 73 pavement sections received Heavy Rehabilitation treatment.

b. In 2009, 41 pavement sections received a district Medium Rehabilitation in the Bryan District. Twenty-two percent of these sections were recommended by PMIS for Medium Rehabilitation, 0% for Heavy Rehabilitation, 46% for Light Rehabilitation, 29% for Preventive Maintenance, and about 2% for Need Nothing. Table A98 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Medium Rehabilitation treatment applied in Bryan in 2009.

Table A98. PMIS Treatment Recommendations and Scores for Medium Rehabilitation Treatment Applied in Bryan in 2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	2.4	97.0	0	97.0	0	3.9	0
Preventive Maintenance	29.3	78.4	20.30	79.6	21.12	2.8	0.18
Light Rehabilitation	46.3	51.2	14.11	70.8	15.53	2.1	0.15
Medium Rehabilitation	22.0	34.4	10.57	71.7	17.80	1.7	0.11
Heavy Rehabilitation	-	-	-	-	-	-	-

(*) A total of 41 pavement sections received Medium Rehabilitation treatment.

c. In 2009, 537 pavement sections received a district Preventive Maintenance in the Bryan District. Forty-nine percent of these sections were recommended by PMIS for Preventive Maintenance, 5% for Heavy Rehabilitation, 4% for Medium Rehabilitation, 6% for Light Rehabilitation, and about 37% for Need Nothing. Table A99 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Preventive Maintenance treatment applied in Bryan in 2009.

Table A99. PMIS Treatment Recommendations and Scores for Preventive Maintenance Treatment Applied in Bryan in 2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	37.1	95.2	7.70	95.7	7.41	3.6	0.59
Preventive Maintenance	48.6	87.5	13.29	88.5	12.36	3.4	0.55
Light Rehabilitation	5.8	75.2	17.28	89.1	11.33	2.4	0.53
Medium Rehabilitation	3.7	47.0	19.30	82.3	18.92	2.0	0.37
Heavy Rehabilitation	4.8	54.2	30.77	75.3	23.59	2.6	1.02

(*) A total of 537 pavement sections received a Preventive Maintenance treatment.

d. In 2008, 42 pavement sections received a district Heavy Rehabilitation in the Bryan District. Zero percent of these sections were recommended by PMIS for Heavy Rehabilitation, 10% for Medium Rehabilitation, 7% for Light Rehabilitation, 26% for Preventive Maintenance, and 57% for Need Nothing. Table A100 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Heavy Rehabilitation treatment applied in Bryan in 2008.

Table A100. PMIS Treatment Recommendations and Scores for Heavy Rehabilitation Treatment Applied in Bryan in 2008.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	57.1	92.3	9.11	97.8	5.77	3.3	0.51
Preventive Maintenance	26.2	69.8	26.29	73.5	26.86	3.4	0.78
Light Rehabilitation	7.1	47.3	8.39	49.7	12.42	2.2	0.17
Medium Rehabilitation	9.5	46.0	22.06	69.0	34.99	2.7	0.41
Heavy Rehabilitation	-	-	-	-	-	-	-

(*) A total of 42 pavement sections received Heavy Rehabilitation treatment.

e. In 2008, 76 pavement sections received a district Medium Rehabilitation in the Bryan District. Seven percent of these sections were recommended by PMIS for Medium Rehabilitation, 47% for Heavy Rehabilitation, 4% for Light Rehabilitation, 8% for Preventive Maintenance, and about 34% for Need Nothing. Table A101 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Medium Rehabilitation treatment applied in Bryan in 2008.

Table A101. PMIS Treatment Recommendations and Scores for Medium Rehabilitation Treatment Applied in Bryan in 2008.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	34.2	91.3	18.61	91.7	18.04	3.5	0.61
Preventive Maintenance	7.9	58.7	18.18	60.5	18.02	3.4	0.86
Light Rehabilitation	3.9	30.7	7.77	33.0	9.85	2.1	0.23
Medium Rehabilitation	6.6	41.4	34.25	48.6	30.66	2.7	0.77
Heavy Rehabilitation	47.4	73.5	24.01	75.0	22.12	3.8	0.86

(*) A total of 76 pavement sections received Medium Rehabilitation.

f. In 2008, 33 pavement sections received a district Light Rehabilitation in the Bryan District. Six percent of these sections were recommended by PMIS for Light Rehabilitation, 21% for Heavy Rehabilitation, 6% for Medium Rehabilitation, 18% for Preventive Maintenance, and about 49% for Need Nothing. Table A102 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Light Rehabilitation treatment applied in Bryan in 2008.

Table A102. PMIS Treatment Recommendations and Scores for Light Rehabilitation Treatment Applied in Bryan in 2008.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	48.5	94.8	14.23	94.8	14.23	3.1	0.62
Preventive Maintenance	18.2	79.2	16.02	79.2	16.02	2.7	0.13
Light Rehabilitation	6.1	73.0	24.04	73.0	24.04	3.4	1.56
Medium Rehabilitation	6.1	56.5	27.58	63.5	37.48	2.2	0.42
Heavy Rehabilitation	21.2	72.7	11.37	72.7	11.37	3.5	1.18

(*) A total of 33 pavement sections received Light Rehabilitation treatment.

g. In 2008, 374 pavement sections received a district Preventive Maintenance in the Bryan District. Seventeen percent of these sections were recommended by PMIS for Preventive Maintenance, 3% for Heavy Rehabilitation, 3% for Medium Rehabilitation, 7% for Light Rehabilitation, and about 70% for Need Nothing. Table A103 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Preventive Maintenance Seal Coat treatment applied in Bryan in 2008.

Table A103. PMIS Treatment Recommendations and Scores for Preventive Maintenance Treatment Applied in Bryan in 2008.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	70.3	94.9	10.07	96.0	8.66	3.3	0.57
Preventive Maintenance	17.1	87.3	14.76	89.2	13.46	3.1	0.59
Light Rehabilitation	7.0	79.3	15.85	93.7	10.17	2.4	0.25
Medium Rehabilitation	2.9	54.4	17.20	81.0	18.20	2.1	0.38
Heavy Rehabilitation	2.7	74.5	23.32	90.7	11.36	3.2	0.96

(*) A total of 374 pavement sections received a Preventive Maintenance.

h. In 2007, 52 pavement sections received a district Heavy Rehabilitation in the Bryan District. Zero percent of these sections were recommended by PMIS for Heavy Rehabilitation, 19% for Medium Rehabilitation, 23% for Light Rehabilitation, 48% for Preventive Maintenance, and 10% for Need Nothing. Table A104 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Heavy Rehabilitation treatment applied in Bryan in 2007.

Table A104. PMIS Treatment Recommendations and Scores for Heavy Rehabilitation Treatment Applied in Bryan in 2007.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	9.6	88.2	16.84	90.8	16.36	3.2	0.73
Preventive Maintenance	48.1	73.9	14.39	74.5	14.15	3.2	0.38
Light Rehabilitation	23.1	51.5	14.14	63.3	18.61	2.2	0.12
Medium Rehabilitation	19.2	68.0	24.82	97.9	3.67	1.9	0.30
Heavy Rehabilitation	-	-	-	-	-	-	-

(*) A total of 52 pavement sections received Heavy Rehabilitation treatment.

i. In 2007, 54 pavement sections received a district Medium Rehabilitation in the Bryan District. Twenty-six percent of these sections were recommended by PMIS for Medium Rehabilitation, 13% for Heavy Rehabilitation, 11% for Light Rehabilitation, 19% for Preventive Maintenance, and about 32% for Need Nothing. Table A105 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Medium Rehabilitation treatment applied in Bryan in 2007.

Table A105. PMIS Treatment Recommendations and Scores for Medium Rehabilitation Treatment Applied in Bryan in 2007.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	31.5	95.9	6.86	100.0	0.00	3.0	0.59
Preventive Maintenance	18.5	43.4	14.83	45.5	14.87	2.7	0.70
Light Rehabilitation	11.1	43.7	21.53	58.8	23.81	2.2	0.15
Medium Rehabilitation	25.9	33.2	15.14	54.5	24.20	2.1	0.31
Heavy Rehabilitation	13.0	20.4	8.50	40.7	17.45	1.9	0.08

(*) A total of 54 pavement sections received Medium Rehabilitation treatment.

j. In 2007, 547 pavement sections received a district Preventive Maintenance in the Bryan District. Twenty-eight percent of these sections were recommended by PMIS for Preventive Maintenance, 6% for Heavy Rehabilitation, 7% for Medium Rehabilitation, 15% for Light Rehabilitation, and about 44% for Need Nothing. Table A106 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Preventive Maintenance treatment applied in Bryan in 2008.

Table A106. PMIS Treatment Recommendations and Scores for Preventive Maintenance Treatment Applied in Bryan in 2007.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	43.9	94.6	10.33	95.8	8.91	3.4	0.59
Preventive Maintenance	28.0	82.2	14.68	83.3	13.76	3.7	0.70
Light Rehabilitation	15.4	65.7	15.53	80.3	16.64	2.2	0.15
Medium Rehabilitation	7.3	45.8	15.02	74.7	19.58	1.9	0.31
Heavy Rehabilitation	5.5	90.3	22.00	92.5	8.44	4.2	1.80

(*) A total of 547 pavement sections received a Preventive Maintenance treatment.

k. In 2007-2009, 167 pavement sections received a district Heavy Rehabilitation in the Bryan District. Ten percent of these sections were recommended by PMIS for Heavy Rehabilitation, 20% for Medium Rehabilitation, 19% for Light Rehabilitation, 28% for Preventive Maintenance, and 23% for Need Nothing. Table A107 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Heavy Rehabilitation treatment applied in Bryan in 2007–2009.

Table A107. PMIS Treatment Recommendations and Scores for Heavy Rehabilitation Treatment Applied in Bryan in 2007–2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	23.4	89.9	17.9	94.3	16.0	3.4	0.6
Preventive Maintenance	27.5	72.1	19.1	74.3	18.8	3.3	0.7
Light Rehabilitation	18.6	50.4	18.9	63.2	18.9	2.2	0.2
Medium Rehabilitation	20.4	48.2	23.4	72.4	24.8	2.0	0.4
Heavy Rehabilitation	10.2	56.8	38.9	70.6	31.0	3.0	1.3

(*) A total of 167 pavement sections received Heavy Rehabilitation treatment.

l. In 2007–2008, 171 pavement sections received a district Medium Rehabilitation in the Bryan District. Sixteen percent of these sections were recommended by PMIS for Medium Rehabilitation, 25% for Heavy Rehabilitation, 16% for Light Rehabilitation, 16% for Preventive Maintenance, and about 26% for Need Nothing. Table A108 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Medium Rehabilitation treatment applied in Bryan in 2007–2009.

Table A108. PMIS Treatment Recommendations and Scores for Medium Rehabilitation Treatment Applied in Bryan in 2007–2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	25.7	93.2	15.0	95.0	14.4	3.3	0.6
Preventive Maintenance	16.4	61.7	23.5	63.3	23.5	2.9	0.5
Light Rehabilitation	16.4	47.4	16.3	64.2	20.4	2.2	0.2
Medium Rehabilitation	16.4	35.1	18.1	59.0	24.5	2.1	0.5
Heavy Rehabilitation	25.1	64.8	29.7	69.4	24.8	3.5	1.1

(*) A total of 171 pavement sections received Medium Rehabilitation treatment.

m. In 2007–2009, 33 pavement sections received a district Light Rehabilitation in the Bryan District. Six percent of these sections were recommended by PMIS for Light Rehabilitation, 21% for Heavy Rehabilitation, 6% for Medium Rehabilitation, 18% for Preventive Maintenance, and about 49% for Need Nothing. Table A109 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Light Rehabilitation treatment applied in Bryan in 2007–2009.

Table A109. PMIS Treatment Recommendations and Scores for Light Rehabilitation Treatment Applied in Bryan in 2007–2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	48.5	94.8	14.2	94.8	14.2	3.1	2.5
Preventive Maintenance	18.2	79.2	16.0	79.2	16.0	2.7	2.5
Light Rehabilitation	6.1	73.0	24.0	73.0	24.0	3.4	2.3
Medium Rehabilitation	6.1	56.5	27.6	63.5	37.5	2.2	1.9
Heavy Rehabilitation	21.2	72.7	11.4	72.7	11.4	3.5	2.3

(*) A total of 33 pavement sections received Light Rehabilitation treatment.

n. In 2007–2009, 1459 pavement sections received a district Preventive Maintenance in the Bryan District. Thirty-three percent of these sections were recommended by PMIS for Preventive Maintenance, 5% for Heavy Rehabilitation, 5% for Medium Rehabilitation, 10% for Light Rehabilitation, and about 48% for Need Nothing. Table A110 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Preventive Maintenance treatment applied in Bryan in 2007–2009.

Table A110. PMIS Treatment Recommendations and Scores for Preventive Maintenance Applied in Bryan in 2007–2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	48.1	94.9	9.5	95.8	8.4	3.5	0.6
Preventive Maintenance	32.8	85.8	14.1	86.9	13.2	3.4	0.6
Light Rehabilitation	9.7	70.3	16.9	84.7	15.5	2.3	0.3
Medium Rehabilitation	4.9	47.5	16.9	77.8	19.2	2.0	0.3
Heavy Rehabilitation	4.6	73.4	28.9	85.3	18.3	3.4	1.1

(*) A total of 1459 pavement sections received a Preventive Maintenance treatment.

~~Hypothesis Tests to Compare PMIS Treatment Recommendations with Treatments Applied in the District~~

Hypothesis tests were performed to compare if the scores for PMIS treatment recommendations were statistically different than the scores for treatments applied in the district. A preliminary analysis of the score histograms by treatment category shows that they do not follow a normal distribution. Therefore, non-parametrical statistical tests were selected to perform the analysis.

Nonparametric tests are not completely free of assumptions about the data since they still require the data to be an independent random sample. Mann-Whitney nonparametric hypothesis test was used to determine whether the medians (η) of the PMIS scores were statistically different for PMIS treatment recommendations when compared to treatments applied by the district. The Mann-Whitney test does not require the data to come from normally distributed populations, but

it does make the following assumptions: (a) the populations of interest have the same shape, and (b) the populations are independent.

The test is formulated as follow:

- Null hypothesis -> H_o: $\eta_1 = \eta_2$ (medians are equal)
- Alternative hypothesis -> H_a: $\eta_1 \neq \eta_2$ (medians are not equal)

The Mann-Whitney test uses the ranks of the sample data, instead of their specific values, to detect statistical significance. The test was performed at the 0.05 significance level. If the test's p-value is less than 0.05 then we reject the null hypothesis.

Tables A111, A112, A113, and A114 show the results of the two samples Mann-Whitney hypothesis testing when comparing scores for PMIS treatment recommendations and treatments applied by the Bryan District. Analysis was conducted for Preventive Maintenance, Light Rehabilitation, Medium Rehabilitation, and Heavy Rehabilitation.

Table A111. Mann-Whitney Test Results for Preventive Maintenance for Bryan in 2007–2009.

Year	Score	Medians		P-Value	Test Result
		PMIS	Bryan		
2007	Condition Score	90	90	0.7336	Accept
	Distress Score	90	94	0.0000	Reject
	Ride Score	3.4	3.2	0.0000	Reject
2008	Condition Score	92	99	0.0000	Reject
	Distress Score	94	100	0.0000	Reject
	Ride Score	3.2	3.1	0.0001	Reject
2009	Condition Score	89	94	0.0000	Reject
	Distress Score	90	96	0.0000	Reject
	Ride Score	3.6	3.3	0.0000	Reject
2007–2009	Condition Score	90	95	0.0000	Reject
	Distress Score	92	97	0.0000	Reject
	Ride Score	3.3	3.2	0.0000	Reject

PMIS-Bryan: 1509-548 sections in 2007, 2874-376 sections in 2008, 842-561 sections in 2009, 5225-1485 sections in total.

For Preventive Maintenance, results of the Mann-Whitney tests show a statistical difference for PMIS condition score, distress score, and ride score medians when comparing PMIS recommendations to treatments applied in Bryan District from 2007–2009.

Table A112. Mann-Whitney Test Results for Light Rehabilitation for Bryan in 2007–2009.

Year	Score	Medians		P-Value	Test Result
		PMIS	Bryan		
2007	Condition Score	-	-	-	-
	Distress Score	-	-	-	-
	Ride Score	-	-	-	-
2008	Condition Score	73	90	0.0001	Reject
	Distress Score	92	90	0.6087	Accept
	Ride Score	2.3	2.7	0.0000	Reject
2009	Condition Score	-	-	-	-
	Distress Score	-	-	-	-
	Ride Score	-	-	-	-
2007–2009	Condition Score	75	90	0.0005	Reject
	Distress Score	97	90	0.2521	Accept
	Ride Score	2.3	2.7	0.0000	Reject

PMIS-Bryan: 0-0 sections in 2007, 589-36 sections in 2008, 0-0 sections in 2009, 1834-36 sections total.

The PMIS condition score, and ride score medians for Light Rehabilitation show a statistical difference when comparing PMIS recommendations to treatments applied in Bryan District from 2007–2009. For the distress score, we should accept the null hypothesis that the medians can be considered statistically equal.

Table A113. Mann-Whitney Test Results Medium Rehabilitation for Bryan in 2007–2009.

Year	Score	Medians		P-Value	Test Result
		PMIS	Bryan		
2007	Condition Score	52	42	0.5198	Accept
	Distress Score	96	60	0.0004	Reject
	Ride Score	2.0	2.5	0.0000	Reject
2008	Condition Score	48	86	0.0000	Reject
	Distress Score	91	86	0.8408	Accept
	Ride Score	1.9	3.5	0.0000	Reject
2009	Condition Score	53	51	0.9634	Accept
	Distress Score	100	74	0.0000	Reject
	Ride Score	2.2	2.2	0.0949	Accept
2007–2009	Condition Score	52	58	0.0000	Reject
	Distress Score	95	72	0.0000	Reject
	Ride Score	2.0	2.7	0.0000	Reject

PMIS-Bryan: 386-54 sections in 2007, 300-78 sections in 2008, 322-44 sections in 2009, 1008-176 sections total.

The PMIS condition score, distress score and ride score medians for Medium Rehabilitation are statistically different when comparing PMIS recommendations to treatments applied in Bryan District from 2007–2009.

Table A114. Mann-Whitney Test Results for Heavy Rehabilitation for Bryan in 2007–2009.

Year	Score	Medians		P-Value	Test Result
		PMIS	Bryan		
2007	Condition Score	26	70	0.0000	Reject
	Distress Score	90	82	0.1409	Accept
	Ride Score	1.5	2.7	0.0000	Reject
2008	Condition Score	25	90	0.0000	Reject
	Distress Score	87	99	0.0022	Reject
	Ride Score	1.4	3.0	0.0000	Reject
2009	Condition Score	28	51	0.0000	Reject
	Distress Score	92	70	0.0165	Reject
	Ride Score	1.5	2.2	0.0000	Reject
2007–2009	Condition Score	26	66	0.000	Reject
	Distress Score	89	81	0.2025	Accept
	Ride Score	1.5	2.7	0.0000	Reject

PMIS-Bryan: 105-53 sections in 2007, 124-42 sections in 2008, 92-74 sections in 2009, 321-169 sections total.

The PMIS condition score, and ride score medians for Heavy Rehabilitation are statistically different when comparing PMIS recommendations to treatments applied in Bryan District from 2007–2009. For the distress score, using data from 2007–2009, we should accept the null hypothesis that the medians are statistically equal.

Budget Prioritization Analysis

A budget prioritization analysis of the PMIS sections recommended for treatment and treatments applied by the districts were performed. We requested the list of sections and budgets for the last 4 years for the purpose of comparing priority rankings.

PMIS candidate sections for treatment are ranked from the highest to the lowest cost-effectiveness ratio. Districts prioritize pavement sections when funds are constraint based on field inspections and local project conditions.

PMIS ranking for sections in which the district applied treatment were compared and discussed with the district. Tables A115 and A116 provide a list of the sections treated by the district for the Preventive Maintenance and Rehabilitation categories, respectively. The costs estimated by both the district and PMIS are shown for each project. Priority rankings according to PMIS are also displayed for the district treated sections.

A summary of the Preventive Maintenance and Rehabilitation total treatment cost was calculated for PMIS and the Bryan District. Table A117 displays the total cost for each treatment type according to each source.

Table A115. Sections Applied with Preventive Maintenance Treatment, Bryan District (2009).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
1	SH 6	-	-	-	$ 42400	-	-	1934	SEAL COAT
2	SH 21	0632 +02.3	0632 +03.0	0.7	$ 75200	-	-	1934	
3	SH 21	0632 +02.3	0632 +02.5	0.2	$ 477000	-	-	1934	
4	SH 30	0628 +01.0	0632 +00.9	3.7	$ 120588	-	-	1934	
5	OSR	0614 +01.5	0622 +00.5	7.1	$ 154000	$ 10000	0.115	124	
6	OSR	0612 +00.0	0616 +00.0	4	$ 114694	-	-	1934	
7	FM 60	0628 +00.0	0630 +00.7	2.6	$ 538000	$ 30000	0.049	2295	SEAL COAT
8	FM 974	0616 +01.5	0618 +00.5	1	$ 19400	$ 30000	0.132	76	
9	FM 974	0618 +00.0	0624 +01.0	7	$ 158808	$ 30000	0.132	76	
10	FM 2154	0624 +01.0	0636 +01.0	12	$ 373000	$ 10000	0.024	4052	
11	FM 159	0424 +00.5	0426 +01.5	3	$ 66423	$ 240000	0.036	912	
12	FM 159	0422 +00.0	0424 +00.5	2.4	$ 85000	$ 50000	0.086	279	
13	FM 1179	0404 +00.0	0406 +01.5	3.5	$ 81000	$ 60000	0.097	296	
14	FM 2038	0620 +01.5	0622 +01.4	1.9	$ 41639	$ 12000	0.090	243	SEAL COAT
15	FM 1687	0610 +01.0	0612 +01.0	1.9	$ 40342	-	-	1934	
16	FM 1687	0612 +00.0	0612 +01.5	1.5	$ 40000	-	-	1934	
17	FM 974	0626 +01.5	0634 +00.0	6.5	$ 126736	$ 15000	0.068	497	
18	FM 974	-	-	-	$ 120543	-	-	1934	
19	FM 2038	-	-	-	$ 122501	-	-	1934	
20	SH 30	0622 +01.5	0626 +00.0	2.3	$ 86021	$ 5000	0.285	259	
21	FM 2776	0402 +00.0	0406 +01.1	5.1	$ 117000	$ 30000	0.082	332	
22	FM 2818	0406 +00.0	0410 +00.0	4.2	$ 228000	$ 30000	0.051	685	SEAL COAT
23	SH 21	-	-	-	$ 740896	-	-	1934	
24	FM 60	0614 +00.0	0622 +00.5	8.5	$ 274100	$ 160000	0.127	1869	
25	RR 4	0432 +00.0	0434 +01.3	3.2	$ 91200	$ 40000	0.024	1271	
26	FM 908	0596 +00.0	0604 +00.1	8.1	$ 173549	$ 38000	0.010	3035	
27	FM 166	0606 +01.5	0614 +01.7	8.2	$ 184000	$ 116000	0.034	953	
28	FM 1361	0612 +01.0	0620 +00.3	7.2	$ 147839	$ 24000	0.029	1086	
29	FM 696	0594 +01.4	0602 +00.0	5.9	$ 126435	$ 130000	0.047	724	SEAL COAT
30	US 84	0740 +00.0	0740 +01.0	1	$ 24917	-		1934	
31	US 84	0742 +00.3	0750 +00.0	7.7	$ 699818	$ 10000	0.001	6794	
32	US 84	-	-	-	$ 15000	-	-	1934	
33	US 84	-	-	-	$ 57851	-	-	1934	
34	FM 489	0632 +00.0	0636 +01.5	5.4	$ 157768	$ 65000	0.054	2812	
35	FM 27	0610 +01.5	0612 +00.5	1	$ 25900	$ 230000	0.017	1401	
36	FM 488	0326 +01.0	0328 +04.5	5.5	$ 124518	-	-	1934	

Table A115. Sections Applied with Preventive Maintenance Treatment, Bryan District (2009) (Continued).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
37	IH 45	-	-	-	$ 18400	-	-	1934	SEAL COAT
38	FM 246	0330 +00.5	0334 +01.5	5	$ 115200	$ 270000	0.115	126	
39	FM 489	0624 +00.0	0624 +00.2	0.2	$ 88754	$ 10000	0.071	265	
40	FM 489	0630 +01.0	0632 +00.5	1.5	$ 27479	$ 60000	0.036	2809	
41	FM 489	0628 +01.0	0630 +01.5	2.4	$ 50800	$ 5000	0.066	636	
42	FM 1366	0340 +00.0	0340 +01.0	0.9	$ 12144	$ 72000	0.031	1034	
43	FM 1364	0338 +00.0	0338 +00.5	0.5	$ 22364	$ 40000	0.023	1291	
44	SP 114	0616 +00.0	0616 +00.7	-	$ 24000	-	-	1934	SEAL COAT
45	FM 1073	0618 +00.0	0618 +00.9	0.8	$ 17486	-	-	1934	
46	PR 64	-	-	-	$ 39936	-	-	1934	
47	PR 64	-	-	-	$ 78300	-	-	1934	
48	SH 30	0634 +00.5	0640 +00.5	6	$ 244090	-	-	1934	
49	SH 90	0428 +00.0	0432 +00.9	4.9	$ 186159	$ 20000	0.035	920	
50	SH 105	0642 +00.6	0646 +01.0	3	$ 90761	$ 20000	0.008	1643	
51	SH 105	0656 +00.0	0668 +00.0	11.4	$ 716000	$ 90000	0.052	669	SEAL COAT
52	FM 39	0412 +00.0	0426 +00.9	-	$ 442900	-	-	1934	
53	FM 3090	0430 +00.5	0432 +01.7	3.2	$ 89000	$ 228000	0.013	1519	
54	FM 379	0636 +00.0	0636 +01.5	1.5	$ 21000	$ 10000	0.044	778	
55	FM 1748	-	-	-	$ 31000	-	-	1934	
56	FM 379	0636 +00.5	0636 +01.5	1	$ 14000	$ 10000	0.044	778	
57	FM 2562	0416 +01.5	0420 +00.7	3	$ 65270	$ 45000	0.044	4297	SEAL COAT
58	FM 3455	0426 +00.0	0427 +00.1	1.4	$ 35100	$ 15000	0.018	1392	
59	US 79	0422 +00.5	0424 +00.0	1.5	$ 51871	$ 10000	0.043	1403	
60	SH 7	0632 +00.5	0640 +01.5	9	$ 220900	$ 10000	0.072	5615	
61	LP 208	0622 +00.0	0622 +00.5	-	$ 10200	-	-	1934	
62	SH 7	0618 +00.9	0624 +00.5	4.6	$ 195900	$ 10000	0.010	5574	
63	FM 542	0346 +00.0	0360 +01.0	15.1	$ 319003	$ 480000	0.031	1272	SEAL COAT
64	FM 39	0374 +00.5	0382 +00.0	7.4	$ 187300	-	-	1934	
65	FM 1511	0360 +00.0	0366 +00.5	6.3	$ 139349	$ 40000	0.025	3631	
66	FM 3178	0646 +00.0	0651 +00.0	5	$ 127500	$ 60000	0.041	4549	
67	FM 811	0372 +00.0	0377 +00.0	4.7	$ 108900	$ 26000	0.034	2921	
68	FM 1511	0366 +00.0	0370 +00.1	4	$ 83600	$ 95000	0.027	3632	
69	FM 977	0622 +00.0	0630 +00.4	8.4	$ 216700	$ 135000	0.079	1036	
70	FM 1147	0368 +00.0	0371 +00.0	2.9	$ 65900	$ 28000	0.034	3296	

Table A115. Sections Applied with Preventive Maintenance Treatment, Bryan District (2009) (Continued).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
71	FM 1119	0374 +00.0	0382 +01.0	8.9	$ 203000	$ 165000	0.083	3265	SEAL COAT
72	FM 3501	0626 +00.0	0626 +00.5	0.5	$ 14100	-	-	1934	
73	FM 745	0632 -00.1	0633 +00.0	0.5	$ 10300	$ 8000	0.014	1488	
74	SH 21	0690 +00.5	0694 +00.6	4.1	$ 180800	-	-	1934	
75	US 190	-	-	-	$ 86424	-	-	1934	
76	LP 160	-	-	-	$ 11300	-	-	1934	
77	SH 75	0400 +01.0	0406 +01.0	6	$ 128300	-	-	1934	
78	FM 978	0640 +00.0	0644 +00.0	3.9	$ 81591	$ 6000	0.034	3147	SEAL COAT
79	FM 247	0382 +00.0	0388 +00.0	5.9	$ 136900	$ 157000	0.222	167	
80	IH 45	0140 +00.0	0142 +00.0	2	$ 183600	-	-	1934	
81	IH 45	0140 +00.0	0140 +00.7	0.7	$ 22900	-	-	1934	
82	IH 45	0142 +00.0	0146 +00.0	4	$ 110600	$ 80000	0.010	4736	
83	FM 2346	0382 +00.0	0388 +00.6	6.5	$ 156700	-	-	1934	
84	FM 1372	-	-	-	$ 107908	-	-	1934	
85	FM 1372	0638 +00.0	0642 +01.5	5.5	$ 155400	$ 110000	0.121	3423	SEAL COAT
86	FM 1452	-	-	-	$ 96247	-	-	1934	
87	FM 1452	0646 -01.8	0646 +00.5	1	$ 107300	-	-	1934	
88	FM 2158	0384 +00.0	0389 +00.1	5	$ 107646	$ 63000	0.054	656	
89	FM 2548	0654 +00.0	0660 +00.7	6.6	$ 160100	$ 36000	0.043	4267	
90	SH 36	0524 +00.0	0528 +01.0	5	$ 348073	-	-	1934	
91	SH 36	0524 +00.0	0528 +01.0	5	$ 190630	-	-	1934	
92	US 79	0530 +00.0	0534 +01.0	5	$ 400100	$ 20000	0.018	6765	SEAL COAT
93	US 79	-	-	-	$ 128600	-	-	1934	
94	US 79	-	-	-	$ 303700	-	-	1934	
95	US 77	0412 +00.0	0424 +00.5	12.5	$ 645300	$ 80000	0.209	6511	
96	FM 1963	0388 +01.6	0390 +01.2	1.2	$ 26200	$ 74000	0.092	1123	
97	FM 487	0592 +00.5	0594 +00.8	2.1	$ 59782	$ 22000	0.072	2786	
98	FM 487	0592 -00.2	0592 +00.5	0.7	$ 36300	-	-	1934	
99	FM 485	0584 +00.0	0590 +00.0	6	$ 167200	$ 25000	0.042	2666	SEAL COAT
100	FM 485	0576 +01.5	0584 +00.5	7	$ 151128	$ 10000	0.058	808	
101	FM 486	0502 +00.0	0504 +00.0	2	$ 39900	-	-	1934	
102	FM 486	-	-	-	$ 95500	-	-	1934	
103	FM 486	-	-	-	$ 40813	-	-	1934	
104	FM 486	0510 +00.0	0510 +01.0	1	$ 24679	$ 60000	0.036	2726	
105	FM 486	0514 +01.5	0516 +00.5	1	$ 28500	$ 150000	0.018	2737	

Table A115. Sections Applied with Preventive Maintenance Treatment, Bryan District (2009) (Continued).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
106	FM 486	0516 +00.5	0520 +00.0	3.5	$ 61642	-	-	1934	SEAL COAT
107	FM 486	0518 +01.5	0524 +00.0	3.1	$ 70300	$ 5000	0.164	2746	
108	FM 437	0580 +00.0	0582 +01.5	3.5	$ 89500	$ 60000	0.118	308	
109	FM 437	0584 +00.5	0588 +00.0	3.5	$ 79300	-	-	1934	
110	FM 2027	0388 +00.0	0390 +00.0	2	$ 33878	$ 5000	0.142	3965	
111	FM 487	0578 +01.5	0588 +01.5	10	$ 210624	$ 30000	0.071	2766	
112	FM 908	0582 +00.0	0590 +00.0	6.1	$ 137956	-	-	1934	
113	FM 1445	0388 +00.0	0396 +00.6	8.8	$ 230000	$ 29000	0.077	3551	SEAL COAT
114	FM 1600	0406 +00.0	0408 +00.0	2.5	$ 49314	-	-	1934	
115	FM 1600	0398 -00.1	0398 +00.5	0.6	$ 15265	$ 38000	0.010	1491	
116	FM 1600	-	-	-	$ 65900	-	-	1934	
117	FM 2095	0582 +00.0	0588 +01.5	7.5	$ 75800	$ 65000	0.118	4005	
118	FM 2095	0594 +01.5	0596 +00.5	1	$ 19000	$ 15000	0.125	4022	
119	FM 908	0580 +00.0	0580 +01.0	1	$ 13800	$ 265000	0.027	2990	
120	FM 485	0576 +00.0	0578 +00.0	2	$ 47157	$ 5000	0.058	808	SEAL COAT
121	FM 2269	0392 +00.0	0402 +00.1	10	$ 282000	$ 50000	0.169	4114	
122	FM 2116	0414 +00.0	0416 +00.5	2.5	$ 64242	-	-	1934	
123	FM 1915	0400 -00.6	0400 +00.5	1.1	$ 31100	$ 48000	0.028	3876	
124	SH 14	0386 +00.0	0388 +01.6	3.6	$ 165494	-	-	1934	
125	US 79	0490 +01.1	0496 +00.0	5	$ 218052	$ 36000	0.015	6673	
126	US 79	0472 +00.0	0480 +00.5	8.5	$ 380105	-	-	1934	
127	FM 485	-	-	-	$ 30300	-	-	1934	SEAL COAT
128	SH 7	0610 +00.0	0618 +00.9	9	$ 354987	$ 40000	0.142	82	
129	FM 46	0600 +00.0	0602 +00.0	2	$ 36628	$ 15000	0.065	330	
130	FM 46	0612 +00.0	0616 +00.0	4	$ 87000	$ 30000	0.091	2147	
131	FM 937	0370 +00.0	0374 +01.5	5.5	$ 126900	$ 55000	0.082	3043	
132	FM 979	0602 +01.0	0612 +01.7	10.7	$ 200393	$ 90000	0.118	3177	
133	FM 1940	0614 +00.0	0626 +01.9	13.8	$ 270257	$ 244000	0.131	488	
134	FM 1940	-	-	-	$ 99800	-	-	1934	SEAL COAT
135	FM 2159	0378 +00.0	0386 +00.6	8.5	$ 163837	$ 243000	0.124	1294	
136	FM 979	0616 +00.0	0620 +00.0	4	$ 130000	$ 25000	0.042	3180	
137	FM 2293	0606 +01.0	0610 +00.0	2.9	$ 78000	-	-	1934	
138	FM 2413	0376 +00.0	0376 +00.4	0.4	$ 7714	-	-	1934	
139	FM 2446	0608 +00.0	0622 +00.0	14	$ 364200	$ 25000	0.045	750	
140	FM 979	0626 +01.5	0630 +01.4	3.9	$ 75172	-	-	1934	

Table A115. Sections Applied with Preventive Maintenance Treatment, Bryan District (2009) (Continued).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
141	FM 2549	0396 +01.5	0404 +00.1	6.3	$ 104000	$ 78000	0.057	4284	SEAL COAT
142	SH 19	0420 +00.0	0424 +01.5	5.4	$ 696100	-	-	1934	
143	SH 30	0658 +00.0	0670 +00.5	12.5	$ 516600	-	-	1934	
144	US 190	0744 +00.0	0748 +01.5	5.5	$ 236789	-	-	1934	
145	FM 247	0398 +00.0	0402 +00.5	4.5	$ 107039	-	-	1934	
146	FM 247	0402 +00.5	0408 +00.1	5.5	$ 170400	$ 77000	0.032	2527	
147	SH 150	0670 +00.0	0670 +01.2	1.2	$ 30017	$ 40000	0.023	986	
148	FM 1374	0404 +01.0	0422 +00.1	17	$ 382478	$ 50000	0.078	3469	SEAL COAT
149	IH 45	0123 +00.5	0125 +00.0	1.5	$ 29000	$ 30000	0.008	4614	
150	FM 405	0676 +00.0	0684 +00.6	8.6	$ 204230	$ 75000	0.020	2618	
151	FM 2929	-	-	-	$ 146948	-	-	1934	
152	FM 1375	0672 +00.0	0672 +00.5	0.5	$ 67600	-	-	1934	
153	FM 1791	-	-	-	$ 159600	-	-	1934	
154	FM 2628	0664 +00.0	0666 +01.4	3.4	$ 95000	$ 87000	0.091	349	
155	FM 2296	0404 +00.0	0404 +00.5	0.5	$ 4700	-	-	1934	SEAL COAT
156	FM 2989	0654 +00.0	0654 +00.5	0.5	$ 9200	-	-	1934	
157	FM 2989	0654 +00.0	0660 +00.0	6	$ 143266	$ 15000	0.073	4474	
158	FM 2821	0664 +00.0	0670 +00.3	6.2	$ 270000	$ 116000	0.075	1931	
159	FM 3411	0668 +00.0	0670 +00.3	2.3	$ 64400	-	-	1934	
160	US 290	0656 +00.5	0664 +01.0	8.5	$ 1091088	-	-	1934	
161	US 290	0682 +00.0	0687 +00.0	5.1	$ 20901	-	-	1934	
162	US 290	0674 +00.3	0674 +01.8	1.5	$ 372959	-	-	1934	SEAL COAT
163	FM 109	0446 +00.0	0452 +00.0	4.7	$ 115873	-	-	1934	
164	SH 237	0446 -02.0	0448 +00.0	2.1	$ 55112	-	-	1934	
165	PR 12	0632 -00.2	0633 +00.0	0.3	$ 47000	$ 8000	0.015	1444	
166	FM 1155	0440 +00.0	0444 +01.5	5.5	$ 130000	-	-	1934	
167	FM 1155	0444 +01.0	0452 +00.5	7.5	$ 190400	-	-	1934	
168	FM 2502	0444 +00.0	0452 +01.5	9.5	$ 237298	$ 50000	0.087	4242	
169	FM 2502	0452 +01.5	0453 +00.0	0.2	$ 6000	$ 6000	0.062	4249	SEAL COAT
170	FM 577	0442 +00.0	0442 +01.0	1	$ 37000	-	-	1934	
171	FM 577	-	-	-	$ 188600	-	-	1934	
172	FM 2621	0434 +00.0	0441 +00.0	6.7	$ 155000	$ 16000	0.028	4339	
173	FM 1935	0432 +00.0	0435 +00.0	2.9	$ 63800	-	-	1934	
174	FM 594	0438 +00.0	0441 +00.0	2.6	$ 56000	$ 10000	0.052	1000	

Table A116. Sections Applied with Rehabilitation Treatments, Bryan (2009).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
1	US 190	-	-	-	$ 188473	-	-	1934	ADD LEFT-TURN LANE
2	US 190	-	-	-	$ 124377	-	-	1934	
3	SH 36	-	-	-	$ 157432	-	-	1934	
4	US 79	-	-	-	$ 104961	-	-	1934	
5	US 79	-	-	-	$ 113716	-	-	1934	ADD LEFT-TURN LANE
6	US 77	-	-	-	$ 288360	-	-	1934	
7	US 79	-	-	-	$ 298519	-	-	1934	
8	FM 485	-	-	-	$ 26231	-	-	1934	
9	SH 47	-	-	-	$ 989786	-	-	1934	CONSTRUCT GRADE SEPARATION
10	IH 45	-	-	-	$ 7846745	-	-	1934	CONVERT FRT RD TO ONE-WAY OPERATION
11	IH 45	-	-	-	$ 13777980	-	-	1934	
12	FM 1915	-	-	-	$ 130000	-	-	1934	CULVERT REPLACEMENT
13	FM 2447	-	-	-	$ 298618	-	-	1934	GRADING, STRUCTURE, BASE AND SURFACE
14	FM 2562	0414 +00.0	0418 +00.0	4	$ 970000	$ 90000	0.232	3	
15	FM 60	0608 +00.0	0614 -01.3	7.6	$ 1870333	$ 86000	0.120	1644	
16	US 190	0744 +00.0	0748 +01.5	5.5	$ 4725502	-	-	1934	
17	US 84	0750 +00.5	0758 +00.0	7.4	$ 3825480	-	-	1934	
18	US 84	-	-	-	$ 1791082	-	-	1934	GRADING, STRUCTURES, BASE AND SURFACE
19	FM 80	-	-	-	$ 243759	-	-	1934	
20	FM 488	0318 +00.0	0322 +01.0	5	$ 1032000	$ 650000	0.114	801	
21	FM 1451	0342 +00.5	0349 +00.1	6	$ 1854430	$ 636000	0.079	578	
22	FM 80	0346 +00.0	0352 +01.0	6.9	$ 2547521	$ 1233000	0.050	861	GRADING, STRUCTURES, BASE AND SURFACE
23	SH 7	0624 +00.0	0624 +01.5	1.5	$ 1216072	$ 20000	0.128	5584	
24	FM 39	0388 +01.0	0396 +02.0	9	$ 3423978	$ 50000	0.143	2074	
25	FM 247	0392 +00.0	0398 +00.0	6	$ 2350000	$ 165000	0.160	2503	
26	SH 21	-	-	-	$ 976131	-	-	1934	GRADING, STRUCTURES, BASE AND SURFACE
27	FM 489	-	-	-	$ 132000	-	-	1934	
28	SH 6	0554 +01.0	0556 +00.5	1.5	-	-	-	1934	
29	FM 1644	0402 +00.5	0404 +00.7	2.2	$ 450000	$ 6000	0.051	3696	
30	FM 1155	0432 +01.5	0434 +01.0	1.4	$ 1060000	$ 286000	0.023	1297	
31	FM 912	0628 +00.0	0631 +00.0	2.8	$ 1725000	$ 700000	0.016	1526	GRADING, STRUCTURES, BASE AND SURFACE
32	FM 2447	0444 +01.5	0453 +00.0	6.8	$ 1718605	$ 404000	0.157	761	
33	FM 2447	-	-	-	$ 318858	-	-	1934	
34	SH 21	-	-	-	$ 1059977	-	-	1934	HMA OVERLAY
35	FM 60	0632 +01.0	0632 +01.5	0.5	$ 408170	$ 150000	0.002	2310	HMA OVERLAY

Table A116. Sections Applied with Rehabilitation Treatments, Bryan District (2009) (Continued).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
36	FM 60	0634 +01.1	0634 +01.6	0.5	$ 234864	$ 20000	0.011	2320	HMA OVERLAY
37	FM 1179	0410 +01.5	0412 +00.8	1.3	$ 420000	$ 30000	0.096	1569	
38	FM 2347	0424 +01.5	0426 +00.9	1.4	-	$ 210000	0.053	4183	
39	IH 45	0172 +00.5	0174 +00.5	2	$ 1750872	$ 560000	0.005	4931	
40	FM 60	-	-	-	-	-	-	1934	INSTALL CONT TWO-WAY LEFT-TURN LANE
41	US 84	-	-	-	-	-	-	1934	
42	FM 1688	-	-	-	-	-	-	1934	INSTALL LEFT-TURN LANE
43	US 84	-	-	-	-	-	-	1934	
44	US 84	-	-	-	-	-	-	1934	
45	FM 80	-	-	-	-	-	-	1934	
46	SH 75	-	-	-	-	-	-	1934	
47	US 79	-	-	-	-	-	-	1934	INSTALL LEFT-TURN LANE
48	US 77	-	-	-	-	-	-	1934	
49	US 77	-	-	-	-	-	-	1934	
50	FM 1331	-	-	-	-	-	-	1934	
51	FM 486	-	-	-	-	-	-	1934	
52	FM 486	-	-	-	-	-	-	1934	INSTALL LEFT-TURN LANE
53	FM 1696	-	-	-	-	-	-	1934	
54	IH 45	-	-		$ 1529900	-	-	1934	
55	US 79	-	-	-	$ 152542	-	-	1934	
56	SH 36	0546 +01.0	0552 +01.0	6	-	$ 40000	0.015	6007	ONE COURSE SURFACE TREATMENT AND HMA OVERLAY
57	US 190	-	-	-	$ 5754589	-	-	1934	PAVEMENT REPAIRS AND HMA INLAY
58	IH 45	0164 +00.5	0165 +00.7	1.2	$ 563000	-	-	1934	PLANNING AND HMA OVERLAY
59	IH 45	0152 +00.3	0164 +00.0	11.9	$ 1773000	-	-	1934	
60	IH 45	0152 +00.3	0156 +00.5	4.3	$ 236902	-	-	1934	
61	IH 45	0117 +00.5	0120 +00.1	2.6	$ 519639	$ 30000	0.012	1864	
62	IH 45	0101 +00.0	0117 +00.0	16	$ 675124	$ 150000	0.022	1781	
63	IH 45	-	-	-	$ 865604	-	-	1934	
64	FM 2038	-	-	-	-	-	-	1934	PROVIDED ADDITIONAL PAVED SURF WIDTH
65	FM 80	-	-	-	-	-	-	1934	
66	FM 244	-	-	-	-	-	-	1934	
67	FM 3090	-	-	-	-	-	-	1934	
68	FM 230	-	-	-	$ 1877985	-	-	1934	
69	FM 1486	-	-	-	-	-	-	1934	

Table A116. Sections Applied with Rehabilitation Treatments, Bryan District (2009) (Continued).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
70	SH 6	-	-	-	-	-	-	1934	RECONSTRUCT ENTRANCE AND EXIT RAMPS
71	FM 39	0368 +00.0	0368 +00.5	0.5	$ 270000	-	-	1934	REHAB EXISTING ROAD
72	SH 21	-	-	-	$ 560000	-	-	1934	
73	US 190	-	-	-	$ 428025	-	-	1934	
74	SH 21	-	-	-	$ 157235	-	-	1934	
75	FM 2154	0628 +00.5	0636 +01.5	9	$ 3407920	-		1934	
76	FM 2154	0618 +01.0	0620 +00.5	1.2	$ 1003269	$ 230000	0.051	1189	REHABILITATE EXISTING ROAD
77	FM 2038	-	-	-	$ 1811449	-	-	1934	
78	SH 6	0616 +00.5	0620 +00.0	6.5	$ 2117247	-	-	1934	
79	SH 105	-	-	-	$ 764446	-	-	1934	REPLACE EXISTING BRIDGE FACILITY
80	FM 1687	-	-	-	$ 600000	-	-	1934	RESTORATION OF EXISTING ROAD
81	FM 489	0626 +00.0	0630 +01.5	5.4	$ 1656700	$ 5000	0.066	636	
82	FM 485	0604 +00.0	0610 +00.0	5.9	$ 489895	-	-	1934	
83	FM 362	0424 +00.0	0428 +01.0	5	$ 1100000	-	-	1934	RESTORE EXISTING PAVEMENT
84	FM 80	0354 +00.0	0360 +01.5	7.5	$ 2002589	$ 565000	0.079	1026	RESTORE EXISTING ROAD
85	FM 542	0364 +01.5	0368 +00.2	2.7	$ 747234	$ 146000	0.084	2874	
86	FM 1644	0384 +00.5	0394 +01.5	11	$ 2967600	$ 290000	0.196	164	
87	FM 39	-	-	-	-	-	-	1934	ROW ACQ.

Table A117. Summary of Treatment Cost and Lane Miles, PMIS and Bryan District.

Treatment Type	Source	Treatment Cost	Percentage	Lane Miles
PM	PMIS	$ 7,579,400	13%	408.5
	District	$ 25,546,888	21%	682.4
Rehabilitation	PMIS	$ 51,344,000	87%	475.4
	District	$ 94,481,726	79%	176

DALLAS DISTRICT

SUB-TASK 1.4: COMPARE DISTRICT PRIORITY RANKINGS AND REPAIR NEEDS TO PMIS RESULTS

UTEP lead with the assistance of TTI and UTSA
1/31/2011

DALLAS DISTRICT

There are 9043 lane miles pavements in Dallas District. Table A118 shows the number of lane miles for Dallas District summarized by highway system.

Table A118. Lane Miles in Dallas District.

Highway System	Lane Miles	Percentage (%)
Interstate Highways (IH)	1838.6	20.3
United States Highways (US)	1399.2	15.5
State Highways (SH)	2205.2	24.4
Farm-to-Market (FM)	3382.8	37.4
Business Routes (BR)	208.0	2.3
Park Road (PR)	-	-
Principal Arterial Streets (PA)	9.6	0.1
Total	9043.4	100.0

Table A119 shows the treatments applied by the Dallas District in 2007 and their corresponding PMIS category.

Table A119. Treatments and Description Applied by Dallas District (2007).

Fiscal Year DCIS	Applied Treatment Abbreviation	Applied Description
2007	PM	Base Repair
		Base Repair at Various Locations
		Microsurface
		Seal Coat
	LRhb	Base Repair and Level-Up
		FDRCP
		Base Repair and Overlay
	MRhb	Base Repair and Overlay (Ultra Thin Hot Mix Wearing Course)
		Base Repair and Overlay
		Restoration of Westbound Travel Lanes
	HRhb	Rehabilitate Freeway Main lanes
		Rehabilitation of Existing Roadway and Ramps
		Rehabilitate Freeway Main lanes

Table A120 shows the treatments applied by the Dallas District in 2008 and their corresponding PMIS category.

Table A120. Treatments and Descriptions Applied by Dallas District (2008).

Fiscal Year DCIS	Applied Treatment Abbreviation	Applied Description
2008	PM	Seal Coat
	LRhb	FDRCP
		Base Repair and Level-Up
	MRhb	Mill and Inlay
		Mill, Level-Up, and Overlay
		Base Repair and Overlay
		Base Repair and Overlay

Table A121 shows the treatments applied by the Dallas District in 2009 and their corresponding PMIS category.

Table A121. Treatments and Descriptions Applied by Dallas District (2009).

Fiscal Year DCIS	Applied Treatment Abbreviation	Applied Description
2009	PM	Seal Coat
	LRhb	FDRCP
	MRhb	FDRCP and Overlay
		Mill, Repair, and Overlay
		Pavement Repair and Overlay
		CTB and Overlay FR
	HRhb	Plane and Overlay

Table A122 shows the treatments applied by the district from 2007 through 2009, their corresponding PMIS category, and the treatment class recommended by PMIS.

Table A122. Treatments and Descriptions Applied by Dallas District (2007–2009).

Treatment	Dallas	PMIS Recommendation				
		NN	PM	LRhb	MRhb	HRhb
Seal Coat, Base Repair (PM)	1716	626	706	161	182	41
Base Repair and Level-Up, FDRCP (LRhb)	267	115	28	14	59	51
Mill and Overlay (MRhb)	294	43	134	43	51	23
Plane and Overlay, Rehabilitate (HRhb)	79	15	17	3	34	10
Total	2356	799	885	221	326	125

FINDINGS OF THE STATISTICAL ANALYSIS

Findings of the statistical analysis conducted for the comparison of treatments applied in Dallas District and PMIS treatment recommendations follows. Details of the analysis are in the appendices.

Summary of PMIS Scores and Treatment Needs

a. The average PMIS condition score for the total number of lane miles rated by the district range between 72.1 as a minimum in 2001 and 83.2 as a maximum in 2005. Throughout the 2001–2009 analysis periods, the percentage of lane miles with very good and good condition scores is between 61.6% as a minimum in 2001 and 77.5% as a maximum in 2005. In 2009, 75% of the total lane miles in Dallas District show a condition score equal or greater than 70 (good or very good). A dissimilar pattern is observed Texas statewide with 85% of the total lane miles in 2009 showing a condition score equal or greater than 70.

b. The average PMIS distress score for the total number of lane miles rated by district range between 80.5 as a minimum in 2001 and 91.5 as a maximum in 2008. Throughout the analysis period 2001–2009, the percentage of lane miles with very good and good distress scores is between 67.9% as a minimum in 2001 and 86.6% as a maximum in 2008. In 2009, 86.5% of the total lane miles in Dallas District show a distress score equal or greater than 80 (good or very good). A similar pattern is observed Texas statewide with 85% of the total lane miles in 2009 showing a distress score equal or greater than 80.

c. The average PMIS ride score for the total number of lane miles rated by the district range between 3.0 as a minimum and 3.2 as a maximum. Throughout the 2001–2009 analysis period, the percentage of lane miles with very good and good ride scores is between 52.0% as a minimum in 2008 and 66.4% as a maximum in 2004 and 2005. In 2009, 61% of the total lane miles in Dallas District show a ride score equal or greater than 3.0 (good or very good). A dissimilar pattern is observed Texas statewide with 70% of the total lane miles in 2009 showing a ride score equal or greater than 3.0.

d. The most prevalent PMIS treatment recommendation from 2001 through 2009 is Need Nothing. Forty-two percent of the sections are in this treatment category. Thirty percent of sections fall in the Preventive Maintenance category while the remaining percentage is distributed between Light Rehabilitation, Medium Rehabilitation, and Heavy Rehabilitation (9.2%, 14.3%, and 4.3%, respectively). Table A123 shows a summary of the frequency, mean, and standard deviations for the PMIS condition score, distress score, and ride score for all pavements.

Table A123. PMIS Statistics for all Types of Pavements in Dallas District (2001–2009).

Treatment Category	Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	42.0	96.4	8.7	98.3	6.4	3.49	0.48
Preventive Maintenance	30.3	87.7	15.7	89.6	14.5	3.36	0.54
Light Rehabilitation	9.2	71.0	23.2	83.7	22.3	2.66	0.51
Medium Rehabilitation	14.3	49.6	23.5	75.3	29.5	2.51	0.53
Heavy Rehabilitation	4.3	28.9	16.9	64.3	29.7	2.20	0.73

Total number of sections analyzed: 129455.

e. The most prevalent PMIS treatment recommendation from 2001 through 2009 is Preventive Maintenance. Forty percent of the sections are in this treatment category. Twenty-five percent of sections fall in the Need Nothing category while the remaining percentage is distributed between Light Rehabilitation, Medium Rehabilitation, and Heavy Rehabilitation (7.7%, 12.0%, and 3.5%, respectively).Table A124 shows a summary of the frequency, mean, and standard deviations for the PMIS condition score, distress score, and ride score for asphalt pavements.

Table A124. PMIS Statistics for Asphalt Pavements in Dallas District (2001–2009).

Treatment Category	Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	36.9	96.9	7.4	98.2	5.7	3.5	0.5
Preventive Maintenance	39.9	87.9	15.4	89.5	14.3	3.4	0.5
Light Rehabilitation	7.7	69.7	19.1	85.5	18.1	2.4	0.3
Medium Rehabilitation	12.0	47.6	21.6	69.2	29.0	2.5	0.6
Heavy Rehabilitation	3.5	25.4	14.8	75.7	26.4	1.8	0.5

Total number of sections analyzed: 95479.

f. The most prevalent PMIS treatment recommendation from 2001 through 2009 is Need Nothing. Seventy percent of the sections are in this treatment category. Neither of the sections falls in the Preventive Maintenance category while the remaining percentage is distributed between Light Rehabilitation, Medium Rehabilitation, and Heavy Rehabilitation (4.3%, 17.5%, and 8.4%, respectively).Table A125 shows a summary of the frequency, mean, and standard deviations for the PMIS condition score, distress score, and ride score for concrete pavements.

Table A125. PMIS Statistics for CRCP Pavements in Dallas District (2001–2009).

Treatment Category	Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	69.8	96.8	7.1	98.9	4.6	3.5	0.4
Preventive Maintenance	-	-	-	-	-	-	-
Light Rehabilitation	4.3	77.3	14.3	80.4	12.9	3.4	0.4
Medium Rehabilitation	17.5	66.8	16.8	94.3	12.5	2.7	0.4
Heavy Rehabilitation	8.4	36.6	14.7	49.9	25.4	3.0	0.6

Total number of sections analyzed: 15542.

g. The most prevalent PMIS treatment recommendation from 2001 through 2009 is Need Nothing. Forty-five percent of the sections are in this treatment category. Six percent of sections fall in the Need Nothing category while the remaining percentage is distributed between Preventive Maintenance, Light Rehabilitation, and Heavy Rehabilitation (21.0%, 23.4%, and 4.9%, respectively). Table A126 shows a summary of the frequency, mean, and standard deviations for the PMIS condition score, distress score, and ride score for joint pavements.

Table A126. PMIS Statistics for Joint Pavements in Dallas District (2001–2009).

Treatment Category	Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	44.8	93.7	13.9	98.2	10.0	3.4	0.5
Preventive Maintenance	5.8	83.2	21.6	91.0	18.8	3.2	0.4
Light Rehabilitation	21.0	72.4	30.2	80.9	29.4	3.1	0.4
Medium Rehabilitation	23.4	44.1	26.7	79.4	32.4	2.3	0.4
Heavy Rehabilitation	4.9	30.6	22.4	43.6	26.1	2.6	0.5

Total number of sections analyzed: 18434.

h. The Need Nothing treatment category was the most prevalent PMIS treatment recommendation in the Dallas District maximum of 48% and minimum of 23% of lane miles considering all types of pavements. Preventive Maintenance ranges from 23% to 36%. Both Light Rehabilitation and Medium Rehabilitation range from 10% to 24% during the entire period of analysis, and Heavy Rehabilitation less than 7%. Figure A53 shows the total PMIS treatment needs in Dallas District.

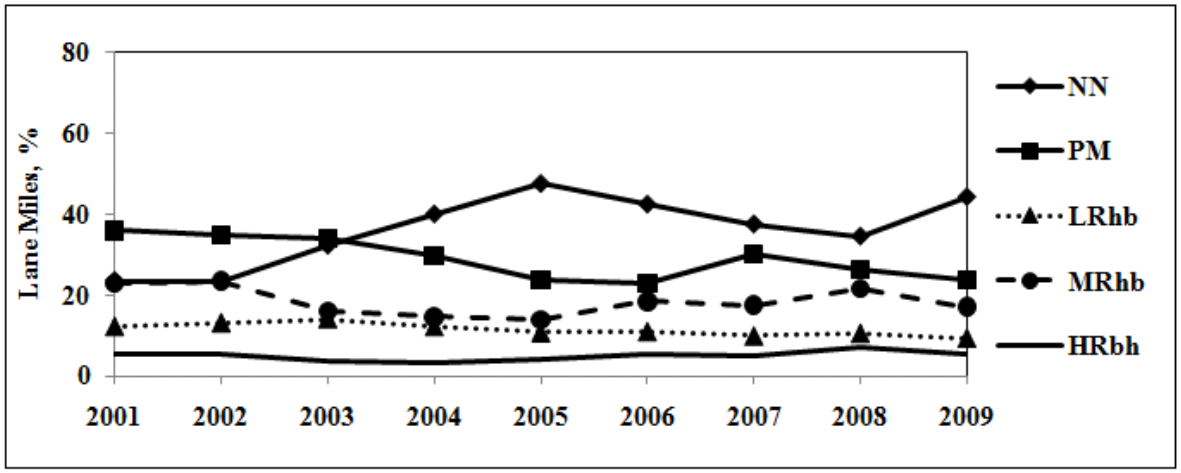


Figure A53. PMIS Treatment Needs in Dallas District (All Types of Pavements).

i. The Preventive Maintenance treatment category was the most prevalent PMIS treatment recommendation in the Dallas District maximum of 51% and minimum of 34% of lane miles considering asphalt pavements. Need Nothing ranges from 13% to 46%. Both Light Rehabilitation and Medium Rehabilitation range from 7% to 22% during the entire period of analysis, and Heavy Rehabilitation less than 6%. Figure A54 shows the total PMIS treatment needs in Dallas District for asphalt pavements.

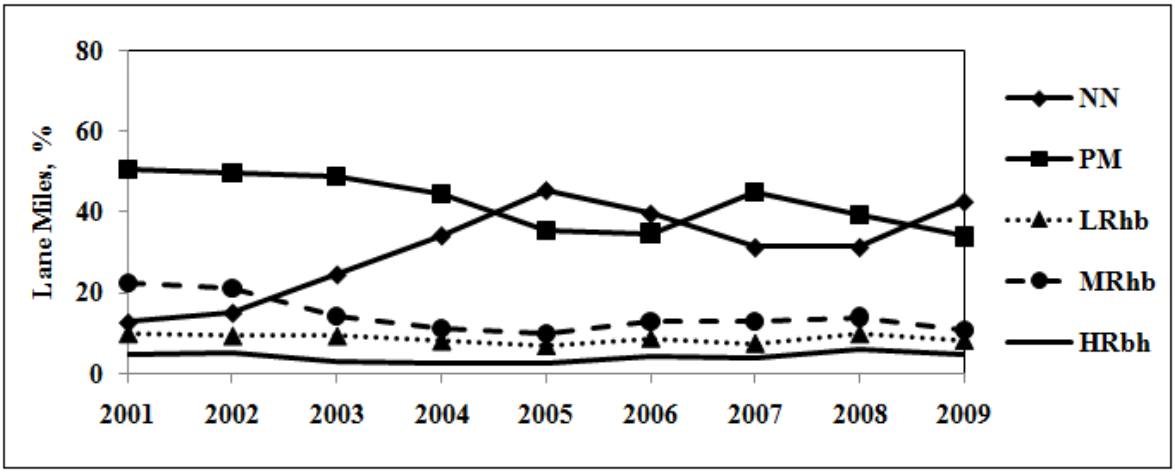


Figure A54. PMIS Treatment Needs for Asphalt Pavements in Dallas District.

j. The Need Nothing treatment category was the most prevalent PMIS treatment recommendation in the Dallas District maximum of 52% and minimum of 41% of lane miles considering concrete pavements. Preventive Maintenance is less than 5%. Light Rehabilitation ranges from 12% to 25%, Medium Rehabilitation ranges from 20% to 36% during the entire period of analysis, and Heavy Rehabilitation from 5% to 10%. Figure A55 shows the total PMIS treatment needs in Dallas District for concrete pavements.

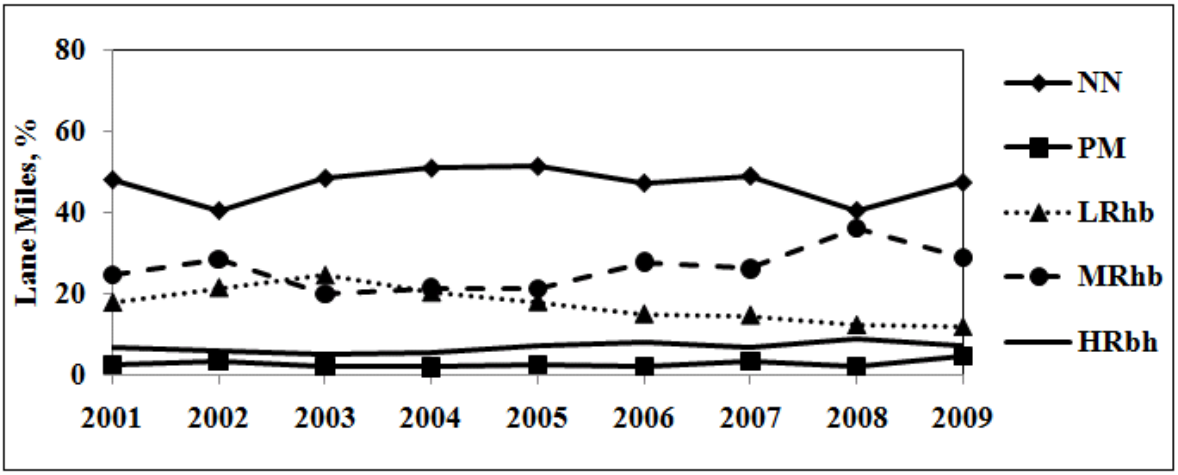


Figure A55. PMIS Treatment Needs for Concrete Pavements in Dallas District.

PMIS Scores for Treatments Applied in Dallas District

a. In 2009, 30 pavement sections received a district Heavy Rehabilitation in the Dallas District. Thirty percent of these sections were recommended by PMIS for Heavy Rehabilitation, 50% for Medium Rehabilitation, 0% for Light Rehabilitation, 20% for Preventive Maintenance, and 0% for Need Nothing. Table A127 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Mill and Overlay treatment applied in Dallas in 2009.

Table A127. PMIS Treatment Recommendations and Scores for Heavy Rehabilitation Applied in Dallas in 2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	0.0	-	-	-	-	-	-
Preventive Maintenance	20.0	78.5	5.2	82.0	4.1	3.1	0.1
Light Rehabilitation	0.0	-	-	-	-	-	-
Medium Rehabilitation	50.0	57.7	10.3	81.9	8.7	2.7	0.2
Heavy Rehabilitation	30.0	33.2	13.2	80.3	23.8	2.2	0.2

(*) A total of 30 pavement sections received Plane and Overlay.

b. In 2009, 106 pavement sections received a district Medium Rehabilitation in the Dallas District. Twenty-six percent of these sections were recommended by PMIS for Medium Rehabilitation, 5% for Heavy Rehabilitation, 27% for Light Rehabilitation, 40% for Preventive Maintenance, and about 2% for Need Nothing. Table A128 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for FDRCP and Overlay, CTB and Overlay FR, Mill, Repair, and Overlay treatment applied in Beaumont in 2009.

Table A128. PMIS Treatment Recommendations and Scores for Medium Rehabilitation Applied in Dallas in 2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	1.9	97.0	4.2	97.0	4.2	3.0	0.1
Preventive Maintenance	39.6	88.3	16.9	89.1	16.9	2.9	0.3
Light Rehabilitation	27.4	62.0	22.3	76.1	23.1	2.2	0.2
Medium Rehabilitation	26.4	24.4	24.6	48.6	32.0	1.9	0.4
Heavy Rehabilitation	4.7	22.8	12.2	73.6	23.1	1.6	0.3

(*) A total of 106 pavement sections received FDRCP and Overlay, CTB and Overlay FR, Mill, Repair, and Overlay.

c. In 2009, 12 pavement sections received a district Light Rehabilitation in the Dallas District. Eight percent of these sections were recommended by PMIS for Light Rehabilitation, 58% for Heavy Rehabilitation, 33% for Medium Rehabilitation, 0% for Preventive Maintenance and Need Nothing. Table A129 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for FDRCP treatment applied in Dallas in 2009.

Table A129. PMIS Treatment Recommendations and Scores for Light Rehabilitation Applied in Dallas in 2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	0.0	-	-	-	-	-	-
Preventive Maintenance	0.0	-	-	-	-	-	-
Light Rehabilitation	8.3	91.0	-	91.0	-	3.4	-
Medium Rehabilitation	33.3	64.5	4.2	97.0	3.6	2.6	0.1
Heavy Rehabilitation	58.3	34.1	10.8	70.9	20.7	2.3	0.1

(*) A total of 12 pavement sections received FDRCP.

d. In 2009, 629 pavement sections received Seal Coat Preventive Maintenance in the Dallas District. Forty-two percent of these sections were recommended by PMIS for Preventive Maintenance, 4% for Heavy Rehabilitation, 11% for Medium Rehabilitation, 7% for Light Rehabilitation, and about 36% for Need Nothing. Table A130 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Seal Coat treatment applied in Dallas in 2009.

Table A130. PMIS Treatment Recommendations and Scores for Preventive Maintenance Applied in Dallas in 2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	36.4	95.6	10.1	99.0	4.0	3.4	0.5
Preventive Maintenance	41.5	92.6	10.6	95.2	8.6	3.2	0.5
Light Rehabilitation	6.7	67.3	12.4	85.4	15.1	2.3	0.2
Medium Rehabilitation	11.4	52.1	18.2	87.6	18.9	2.3	0.4
Heavy Rehabilitation	4.0	24.9	14.9	79.0	21.0	1.8	0.4

(*) A total of 629 pavement sections received a Seal Coat.

e. In 2008, 75 pavement sections received Mill Level-Up and Overlay Medium Rehabilitation in the Dallas District. Nine percent of these sections were recommended by PMIS for Medium Rehabilitation, 5% for Heavy Rehabilitation, 12% for Light Rehabilitation, 56% for Preventive Maintenance, and about 17% for Need Nothing. Table A131 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Mill Level-Up and Overlay treatment applied in Dallas in 2008.

Table A131. PMIS Treatment Recommendations and Scores for Medium Rehabilitation in Dallas in 2008.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	17.3	96.5	5.2	99.8	0.6	3.2	2.5
Preventive Maintenance	56.0	92.7	10.5	95.2	7.5	3.3	2.5
Light Rehabilitation	12.0	76.3	20.6	82.3	16.8	2.6	2.2
Medium Rehabilitation	9.3	57.1	19.2	90.0	12.4	2.5	2.1
Heavy Rehabilitation	5.3	31.3	11.2	91.5	11.1	1.9	1.5

(*) A total of 75 pavement sections received Mill Level-Up and Overlay.

f. In 2008, 33 pavement sections received a district Light Rehabilitation in the Dallas District. Three percent of these sections were recommended by PMIS for Light Rehabilitation, 0% for Heavy Rehabilitation, 24% for Medium Rehabilitation, 12% for Preventive Maintenance, and about 61% for Need Nothing. Table A132 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Base Repair and Level-Up, FDRCP treatment applied in Dallas in 2008.

Table A132. PMIS Treatment Recommendations and Scores for Light Rehabilitation Applied in Dallas in 2008.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	60.6	93.5	11.0	99.8	1.1	3.5	0.7
Preventive Maintenance	12.1	90.8	6.2	95.8	7.2	3.1	0.2
Light Rehabilitation	3.0	100.0	-	100.0	-	3.3	-
Medium Rehabilitation	24.2	42.5	27.5	71.3	41.9	2.5	0.4
Heavy Rehabilitation	0.0	-	-	-	-	-	-

(*) A total of 33 pavement sections received Base Repair and Level-Up, FDRCP.

g. In 2008, 574 pavement sections received Seal Coat Preventive Maintenance in the Dallas District. Forty percent of these sections were recommended by PMIS for Preventive Maintenance, less than 2% for Heavy Rehabilitation, 10% for Medium Rehabilitation, 12% for Light Rehabilitation, and about 36% for Need Nothing. Table A133 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Seal Coat treatment applied in Dallas in 2008.

Table A133. PMIS Treatment Recommendations and Scores for Preventive Maintenance Applied in Dallas in 2008.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	36.4	98.3	5.7	98.8	5.2	3.6	0.5
Preventive Maintenance	40.1	89.1	14.8	89.9	14.3	3.3	0.6
Light Rehabilitation	12.4	72.1	16.3	88.6	14.5	2.3	0.3
Medium Rehabilitation	9.6	52.2	22.3	71.1	26.2	2.6	0.8
Heavy Rehabilitation	1.6	29.4	16.8	78.8	28.4	1.6	0.6

(*) A total of 574 pavement sections received a Seal Coat.

h. In 2007, 49 pavement sections received a district Heavy Rehabilitation in the Dallas District. Two percent of these sections were recommended by PMIS for Heavy Rehabilitation, 39% for Medium Rehabilitation, 6% for Light Rehabilitation, 22% for Preventive Maintenance, and 31% for Need Nothing. Table A134 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Rehabilitation of Existing Roadway and Ramps, Rehabilitate Freeway Main Lanes treatment applied in Dallas in 2007.

Table A134. PMIS Treatment Recommendations and Scores for Heavy Rehabilitation Applied in Dallas in 2007.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	30.6	98.3	4.2	99.7	0.8	3.5	0.3
Preventive Maintenance	22.4	84.9	14.4	86.0	13.8	3.5	0.3
Light Rehabilitation	6.1	96.7	5.8	100.0	0.0	3.3	0.3
Medium Rehabilitation	38.8	37.9	20.3	40.1	19.3	3.5	0.6
Heavy Rehabilitation	2.0	5.0	-	11.0	-	2.3	-

(*) A total of 49 pavement sections received Rehabilitation of Existing Roadway and Ramps, Rehabilitate Freeway Main Lanes.

i. In 2007, 113 pavement sections received Base Repair and Overlay Medium Rehabilitation in the Dallas District. Fourteen percent of these sections were recommended by PMIS for Medium Rehabilitation, 12% for Heavy Rehabilitation, 4% for Light Rehabilitation, 44% for Preventive Maintenance, and about 25% for Need Nothing. Table A135 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Base Repair and Overlay treatment applied in Dallas in 2007.

Table A135. PMIS Treatment Recommendations and Scores for Medium Rehabilitation Applied in Dallas in 2007.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	24.8	98.6	2.9	99.0	2.3	3.9	0.4
Preventive Maintenance	44.2	94.7	5.6	94.7	5.6	4.1	0.3
Light Rehabilitation	4.4	80.2	10.6	82.4	9.6	3.3	0.3
Medium Rehabilitation	14.2	59.9	18.1	68.9	21.4	3.3	0.6
Heavy Rehabilitation	12.4	23.4	18.5	24.6	18.1	3.1	0.3

(*) A total of 113 pavement sections received Base Repair and Overlay.

j. In 2007, 222 pavement sections received Base Repair and Level-Up, FDRCP Light Rehabilitation in the Dallas District. Five percent of these sections were recommended by PMIS for Light Rehabilitation, 20% for Heavy Rehabilitation, 21% for Medium Rehabilitation, 11% for Preventive Maintenance, and about 43% for Need Nothing. Table A136 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Base Repair and Level-Up, FDRCP treatments applied in Dallas in 2007.

Table A136. PMIS Treatment Recommendations and Scores for Light Rehabilitation Applied in Dallas in 2007.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	42.8	90.9	19.7	93.5	17.8	3.4	0.3
Preventive Maintenance	10.8	88.8	17.6	92.3	16.3	3.1	0.3
Light Rehabilitation	5.4	64.3	23.2	80.0	21.7	2.8	0.3
Medium Rehabilitation	21.2	52.2	27.9	81.7	32.3	2.5	0.4
Heavy Rehabilitation	19.8	35.6	20.7	51.5	25.5	2.7	0.5

(*) A total of 222 pavement sections received Base Repair and Level-Up, FDRCP.

k. In 2007, 513 pavement sections received Seal Coat, Base Repair Preventive Maintenance in the Dallas District. Forty-two percent of these sections were recommended by PMIS for Preventive Maintenance, less than 2% for Heavy Rehabilitation, 11% for Medium Rehabilitation, 9% for Light Rehabilitation, and about 37% for Need Nothing. Table A137 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Seal Coat, Base Repair treatment applied in Dallas in 2007.

Table A137. PMIS Treatment Recommendations and Scores for Preventive Maintenance Applied in Dallas in 2007.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	36.6	99.3	2.6	99.7	1.5	3.6	0.5
Preventive Maintenance	41.9	90.3	13.6	92.8	12.1	3.3	0.5
Light Rehabilitation	9.4	79.9	20.3	91.5	14.5	2.8	0.6
Medium Rehabilitation	10.7	48.8	21.3	75.1	30.1	2.5	0.5
Heavy Rehabilitation	1.4	22.4	16.0	74.1	35.3	1.8	0.8

(*) A total of 513 pavement sections received a Seal Coat, Base Repair.

l. In 2007–2009, 79 pavement sections received Plane and Overlay, Rehabilitate Freeway Main Lanes, Rehabilitation of Existing Roadway and Ramps as Heavy Rehabilitation in the Dallas District. Thirteen percent of these sections were recommended by PMIS for Heavy Rehabilitation, 43% for Medium Rehabilitation, 4% for Light Rehabilitation, 22% for Preventive Maintenance, and 19% for Need Nothing. Table A138 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Plane and Overlay, Rehabilitate Freeway Main Lanes, Rehabilitation of Existing Roadway and Ramps treatments applied in Dallas in 2007–2009.

Table A138. PMIS Treatment Recommendations and Scores for Heavy Rehabilitation Applied in Dallas in 2007–2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	19.0	98.3	4.2	99.7	0.8	3.5	0.3
Preventive Maintenance	21.5	82.6	12.2	84.6	11.4	3.4	0.3
Light Rehabilitation	3.8	96.7	5.8	100.0	0.0	3.3	0.3
Medium Rehabilitation	43.0	46.6	19.2	58.5	26.1	3.1	0.6
Heavy Rehabilitation	12.7	30.4	15.3	73.4	31.4	2.2	0.2

(*) A total of 79 pavement sections received Plane and Overlay, Rehabilitate Freeway Main Lanes, Rehabilitation of Existing Roadway and Ramps.

m. In 2007–2009, 294 pavement sections received FDRCP, Mill, Level-Up, and Overlay as Medium Rehabilitation in the Dallas District. Seventeen percent of these sections were recommended by PMIS for Medium Rehabilitation, 8% for Heavy Rehabilitation, 15% for Light Rehabilitation, 46% for Preventive Maintenance, and about 15% for Need Nothing. Table A139 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for FDRCP, Mill, Level-Up, and Overlay treatments applied in Dallas in 2007–2009.

Table A139. PMIS Treatment Recommendations and Scores for Medium Rehabilitation Applied in Dallas in 2007–2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	14.6	97.9	3.8	99.2	2.1	3.6	0.5
Preventive Maintenance	45.6	92.1	11.9	93.1	11.2	3.4	0.6
Light Rehabilitation	14.6	67.1	21.9	78.1	20.7	2.4	0.4
Medium Rehabilitation	17.3	40.0	27.8	60.7	30.5	2.4	0.8
Heavy Rehabilitation	7.8	24.7	16.0	46.9	33.9	2.6	0.8

(*) A total of 294 pavement sections received FDRCP, Mill, Level-Up, and Overlay.

n. In 2007–2009, 267 pavement sections received Base Repair and Level-Up, FDRCP as Light Rehabilitation in the Dallas District. Five percent of these sections were recommended by PMIS for Light Rehabilitation, 19% for Heavy Rehabilitation, 22% for Medium Rehabilitation, 11% for Preventive Maintenance, and about 43% for Need Nothing. Table A140 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Base Repair and Level-Up, FDRCP treatments applied in Dallas in 2007–2009.

Table A140. PMIS Treatment Recommendations and Scores for Light Rehabilitation Applied in Dallas in 2007–2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	43.1	91.3	18.5	94.6	16.4	3.4	0.4
Preventive Maintenance	10.5	89.1	16.4	92.8	15.3	3.1	0.3
Light Rehabilitation	5.2	68.7	24.2	82.2	20.8	2.9	0.3
Medium Rehabilitation	22.1	51.7	27.0	81.3	32.7	2.5	0.4
Heavy Rehabilitation	19.1	35.4	19.5	54.2	25.6	2.7	0.5

(*) A total of 267 pavement sections received Base Repair and Level-Up, FDRCP.

o. In 2007–2009, 1716 pavement sections received Seal Coat, Base Repair as Preventive Maintenance in the Dallas District. Forty-one percent of these sections were recommended by PMIS for Preventive Maintenance, less than 3% for Heavy Rehabilitation, 11% for Medium Rehabilitation, 9% for Light Rehabilitation, and about 37% for Need Nothing. Table A141 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for Seal Coat, Base Repair treatments applied in Dallas in 2007–2009.

Table A141. PMIS Treatment Recommendations and Scores for Preventive Maintenance in Dallas in 2007–2009.

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	36.5	97.6	7.2	99.2	3.9	3.5	0.5
Preventive Maintenance	41.1	90.8	13.1	92.8	12.0	3.3	0.5
Light Rehabilitation	9.4	73.2	17.3	88.6	14.8	2.5	0.4
Medium Rehabilitation	10.6	51.1	20.4	78.8	25.9	2.5	0.6
Heavy Rehabilitation	2.4	25.5	15.3	78.1	24.8	1.7	0.5

(*) A total of 1716 pavement sections received a Seal Coat, Base Repair.

~~Hypothesis Tests to Compare PMIS Treatment Recommendations with Treatments Applied in the District~~

Hypothesis tests were performed to compare if the scores for PMIS treatment recommendations were statistically different than the scores for treatments applied in the district. A preliminary analysis of the score histograms by treatment category shows that they do not follow a normal distribution. Therefore, non-parametrical statistical tests were selected to perform the analysis.

Nonparametric tests are not completely free of assumptions about the data since they still require the data to be an independent random sample. Mann-Whitney nonparametric hypothesis test was used to determine whether the medians (η) of the PMIS scores were statistically different for PMIS treatment recommendations when compared to treatments applied by the district. The Mann-Whitney test does not require the data to come from normally distributed populations, but

it does make the following assumptions: (a) the populations of interest have the same shape, and (b) the populations are independent.

The test is formulated as follow:

- Null hypothesis -> H_0: $\eta_1 = \eta_2$ (medians are equal).
- Alternative hypothesis -> H_a: $\eta_1 \neq \eta_2$ (medians are not equal).

The Mann-Whitney test uses the ranks of the sample data, instead of their specific values, to detect statistical significance. The test was performed at the 0.05 significance level. If the test's p-value is less than 0.05 then we reject the null hypothesis.

Tables A142, A143, A144, and A145 show the results of the two samples Mann-Whitney hypothesis testing when comparing scores for PMIS treatment recommendations and treatments applied by the Dallas District. Analysis was conducted for Preventive Maintenance, Light Rehabilitation, Medium Rehabilitation, and Heavy Rehabilitation.

Table A142. Mann-Whitney Test Results for Preventive Maintenance for Dallas in 2007–2009.

Year	Score	Medians		P-Value	Test Result
		PMIS	Dallas		
2007	Condition Score	96	100	0.0000	Reject
	Distress Score	98	100	0.0000	Reject
	Ride Score	3.3	3.3	0.0036	Reject
2008	Condition Score	98	99	0.1342	Accept
	Distress Score	99	100	0.5886	Accept
	Ride Score	3.2	3.2	0.2985	Accept
2009	Condition Score	95	98	0.6524	Accept
	Distress Score	97	100	0.0000	Reject
	Ride Score	3.3	3.1	0.0000	Reject
2007–2009	Condition Score	97	99	0.2830	Accept
	Distress Score	99	100	0.0000	Reject
	Ride Score	3.3	3.2	0.0000	Reject

PMIS-Dallas: 3016-513 sections in 2007, 2624-574 sections in 2008, 2372-629 sections in 2009, 8012-1716 sections in total.

The PMIS distress score, and ride score medians for Preventive Maintenance are statistically different when comparing PMIS recommendations to treatments applied in Dallas District from 2007–2009, while for the condition score, we should accept the null.

Table A143. Mann-Whitney Test Results for Light Rehabilitation for Dallas in 2007–2009.

Year	Score	Medians		P-Value	Test Result
		PMIS	Dallas		
2007	Condition Score	73	83	0.0897	Accept
	Distress Score	92	100	0.0017	Reject
	Ride Score	2.6	3.0	0.0000	Reject
2008	Condition Score	72	93	0.0005	Reject
	Distress Score	97	100	0.0000	Reject
	Ride Score	2.5	3.2	0.0000	Reject
2009	Condition Score	75	47	0.0008	Reject
	Distress Score	96	90	0.2203	Accept
	Ride Score	2.6	2.4	0.2736	Accept
2007–2009	Condition Score	73	84	0.0247	Reject
	Distress Score	95	100	0.0008	Reject
	Ride Score	2.6	3.0	0.0000	Reject

PMIS-Dallas: 931-222 sections in 2007, 1012-33 sections in 2008, 917-12 sections in 2009, 2860-267 sections total.

The PMIS condition score, distress score, and ride score medians for Light Rehabilitation are statistically different when comparing PMIS recommendations to treatments applied in Dallas District from 2007–2009.

Table A144. Mann-Whitney Test Results for Medium Rehabilitation for Dallas in 2007–2009.

Year	Score	Medians		P-Value	Test Result
		PMIS	Dallas		
2007	Condition Score	53	93	0.0000	Reject
	Distress Score	91	94	0.1354	Accept
	Ride Score	2.4	3.9	0.0000	Reject
2008	Condition Score	53	93	0.0000	Reject
	Distress Score	99	99	0.1009	Accept
	Ride Score	2.4	3.1	0.0000	Reject
2009	Condition Score	53	69	0.0001	Reject
	Distress Score	98	89	0.0000	Reject
	Ride Score	2.4	2.4	0.5252	Accept
2007–2009	Condition Score	53	90	0.0000	Reject
	Distress Score	97	94	0.0660	Accept
	Ride Score	2.4	3.1	0.0000	Reject

PMIS-Dallas: 1628-113 sections in 2007, 1986-75 sections in 2008, 1617-106 sections in 2009, 5231-294 sections total.

The PMIS condition score, and ride score medians for Medium Rehabilitation are statistically different when comparing PMIS recommendations to treatments applied in Dallas District from

2007–2009, while for the distress score, we should accept the null hypothesis that the medians are statistically equal.

Table A145. Mann-Whitney Test Results for Heavy Rehabilitation for Dallas in 2007–2009.

Year	Score	Medians		P-Value	Test Result
		PMIS	Dallas		
2007	Condition Score	26	84	0.0000	Reject
	Distress Score	65	87	0.0137	Reject
	Ride Score	2.1	3.5	0.0000	Reject
2008	Condition Score	-	-	-	-
	Distress Score	-	-	-	-
	Ride Score	-	-	-	-
2009	Condition Score	28	58	0.0000	Reject
	Distress Score	75	83	0.0911	Accept
	Ride Score	2.1	2.6	0.0000	Reject
2007–2009	Condition Score	27	66	0.0000	Reject
	Distress Score	76	84	0.0456	Reject
	Ride Score	2.1	3.1	0.0000	Reject

PMIS-Dallas: 489-49 sections in 2007, 0-0 sections in 2008, 557-30 sections in 2009, 1724-79 sections total.

The PMIS condition score, distress score, and ride score medians for Heavy Rehabilitation are statistically different when comparing PMIS recommendations to treatments applied in Dallas District from 2007–2009.

Budget Prioritization Analysis

A budget prioritization analysis of the PMIS sections recommended for treatment and treatments applied by the districts were performed. We requested the list of sections and budgets for the last 4 years for the purpose of comparing priority rankings.

PMIS candidate sections for treatment are ranked from the highest to the lowest cost-effectiveness ratio. Districts prioritize pavement sections when funds are constraint based on field inspections and local project conditions.

PMIS ranking for sections in which the district applied treatment were compared and discussed with the district. Tables A146 and A147 provide a list of the sections treated by the district for the Preventive Maintenance and Rehabilitation categories, respectively. The costs estimated by both the district and PMIS are shown for each project. Priority rankings according to PMIS are also displayed for the district treated sections.

A summary of the Preventive Maintenance and Rehabilitation total treatment cost was calculated for PMIS and the Dallas District. Table A148 displays the total cost for each treatment type according to each source.

Table A146. Sections Applied with Preventive Maintenance Treatment, Dallas District (2009).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
1	BS 78-D	226+0.0	228+0.6	2.6	$ 70,224.00	$ 48,400.00	0.044	1139	SEALCOAT
2	BS 78-E	238+0.0	238+1.0	1	$ 30,260.00	$ 40,000.00	0.017	2658	SEALCOAT
3	BS 78-F	242+0.0	244+0.5	2.3	$ 64,298.00	$ 129,000.00	0.044	1137	SEALCOAT
4	BS 78-G	248+0.0	248+1.1	1.1	$ 31,118.75	$ 100,000.00	0.023	2223	SEALCOAT
5	FM 1173	552+0.0	562+1.0	9.3	$ 286,066.65	$ -	-	-	SEALCOAT
6	FM 1190	566+0.0	566+1.1	1.1	$ 31,607.00	$ -	-	-	SEALCOAT
7	FM 1377	228+0.0	238+1.5	11.2	$ 320,557.00	$ 126,000.00	0.078	464	SEALCOAT
8	FM 1394	324+0.5	332+1.5	9.1	$ 162,371.24	-	-	-	SEALCOAT
9	FM 1394	332+1.5	338+0.0	3	$ 162,312.24	-	-	-	SEALCOAT
10	FM 148	280+1.0	290+1.8	10.7	$ 267,189.50	$ 245,000.00	0.104	238	SEALCOAT
11	FM 1830	240+0.0	244+1.5	5.5	$ 163,199.45	$ 162,000.00	0.097	276	SEALCOAT
12	FM 2258	574+0.0	576+0.6	2.6	$ 54,540.20	$ 88,000.00	0.159	48	SEALCOAT
13	FM 2450	222+0.0	232+1.5	11.4	$ 299,161.00	$ 372,000.00	0.188	27	SEALCOAT
14	FM 246	326+0.0	326+1.0	1.4	$ 30,270.60	$ 40,000.00	0.030	1760	SEALCOAT
15	FM 2514	598-1.8	598+0.7	0.7	$ 67,245.30	$ 78,000.00	0.029	1794	SEALCOAT
16	FM 3133	602+0.0	606+0.9	4.9	$ 122,996.50	$ 40,000.00	0.048	1034	SEALCOAT
17	FM 3194	322+0.0	326+1.4	5.4	$ 143,760.78	-	-	-	SEALCOAT
18	FM 455	564+0.0	590+0.6	26.4	$ 909,803.00	$ 550,000.00	0.099	267	SEALCOAT
19	FM 455	620+0.5	626+0.7	5.4	$ 152,406.50	$ 40,000.00	0.049	996	SEALCOAT
20	FM 548	272+1.8	272+4.5	2.7	$ 159,065.80	-	-	-	SEALCOAT
21	FM 639	586+0.0	592+0.4	6.5	$ 110,910.24	$ 57,000.00	0.066	656	SEALCOAT
22	FM 639	600-1.8	602+0.0	0.6	$ 110,910.24	$ 22,000.00	0.066	655	SEALCOAT
23	FM 641	606+0.0	608+1.3	3.3	$ 89,286.96	-	-	-	SEALCOAT
24	FM 739	609+0.0	608+2.9	0.4	$ 71,525.00	$ 60,000.00	0.018	2534	SEALCOAT
25	FM 813	586+0.0	600+1.0	15.4	$ 233,072.38	$ 715,200.00	0.133	110	SEALCOAT
26	FM 813	600+1.0	606+0.4	5.4	$ 233,131.38	$ 80,000.00	0.116	173	SEALCOAT
27	FM 916	578+0.0	582+0.9	5	$ 109,232.92	$ 115,000.00	0.127	127	SEALCOAT
28	SH 121	228+0.0	240+1.5	13.6	$ 282,872.85	$ 20,000.00	0.034	1533	SEALCOAT
29	SH 289	236+0.0	238+1.5	3.4	$ 213,632.15	$ 200,000.00	0.041	1233	SEALCOAT
30	SH 31	600+0.0	610+0.0	18.3	$ 564,972.64	$ 38,000.00	0.015	2780	SEALCOAT

Table A146. Sections Applied with Preventive Maintenance Treatment, Dallas District (2009) (Continued).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
31	SH 31	610+0.0	620+1.0	19.2	$ 639,312.64	$ 144,000.00	0.086	359	SEALCOAT
32	SH 342	284+1.5	288+0.5	3	$ 139,862.60	-	-	-	SEALCOAT
33	SH 78	248+1.0	258+1.0	10	$ 141,005.70	$ 47,000.00	0.046	1082	SEALCOAT
34	SH 78	258+0.5	264+0.5	6.1	$ 141,067.25	-	-	-	SEALCOAT
35	US 80	666+0.0	672+0.0	17.6	$ 243,180.58	$ 19,200.00	0.035	1501	SEAL COAT
36	BS 289D	234+0.0	236+1.9	3.9	$ 81,469.10	$ 381,000.00	0.183	31	SEALCOAT
37	BU 175D	286+0.0	288+0.3	2.4	$ 103,105.26	$ 15,000.00	0.049	988	SEALCOAT
38	BU 175E	640+0.0	644+0.0	2.5	$ 127,650.75	-	-	-	SEALCOAT
39	FM 1129	298+0.0	308+5.1	11.5	$ 366,033.41	-	-	-	SEALCOAT
40	FM 1181	598+1.0	608+0.0	9.2	$ 172,802.15	$ 53,000.00	0.160	47	SEALCOAT
41	FM 1181	608+0.0	612+1.0	5	$ 172,802.15	-	-	-	SEALCOAT
42	FM 1182	606-1.9	698+0.3	4.1	$ 87,049.37	$ 63,000.00	0.205	21	SEALCOAT
43	FM 1183	600+0.0	606+0.2	6.1	$ 157,020.84	$ 226,000.00	0.094	290	SEALCOAT
44	FM 1385	224+0.0	236+0.4	12.3	$ 278,635.90	-	-	-	SEALCOAT
45	FM 1387	576+0.0	582+0.4	6.6	$ 147,649.95	$ 10,000.00	0.009	3216	SEALCOAT
46	FM 1578	322-1.9	322+0.0	1.9	$ 38,595.55	$ 135,000.00	0.083	400	SEALCOAT
47	FM 1827	230+0.0	240+0.5	10.5	$ 173,083.40	$ 139,000.00	0.085	370	SEALCOAT
48	FM 1946	590+0.0	590+1.0	1	$ 25,960.50	$ 20,000.00	0.051	961	SEALCOAT
49	FM 2153	566+0.0	570+1.8	5.8	$ 124,479.90	$ 5,000.00	0.032	1622	SEALCOAT
50	FM 2194	610+0.0	616+0.0	5.4	$ 170,922.80	$ 5,000.00	0.092	303	SEALCOAT
51	FM 2578	270+0.0	280+1.2	11.3	$ 243,615.35	$ 370,000.00	0.073	527	SEALCOAT
52	FM 2786	594+0.0	596+0.8	0.8	$ 110,450.70	$ 34,000.00	0.069	607	SEALCOAT
53	FM 2862	606+0.0	608+1.3	3.3	$ 89,536.10	$ 10,000.00	0.105	231	SEALCOAT
54	FM 3356	224+0.0	226+0.9	2.9	$ 69,678.40	$ 25,000.00	0.073	529	SEALCOAT
55	FM 428	590+0.0	592+1.8	3.8	$ 85,633.10	$ 3,000.00	0.025	2028	SEALCOAT
56	FM 429	278+0.0	286+2.1	10	$ 226,846.60	-	-	-	SEALCOAT
57	FM 455	592-1.2	598+0.0	4.3	$ 153,529.40	-	-	-	SEALCOAT
58	FM 460	266+0.0	266+1.1	1.1	$ 23,569.98	$ 33,000.00	0.078	470	SEALCOAT
59	FM 545	600+0.0	608+3.2	11.1	$ 420,037.60	$ 271,000.00	0.098	313	SEALCOAT
60	FM 549	256+0.0	258+0.0	2	$ 58,334.40	$ 120,000.00	0.033	1597	SEALCOAT

Table A146. Sections Applied with Preventive Maintenance Treatment, Dallas District (2009) (Continued).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
61	FM 55	310+0.0	314+0.4	4.3	$ 136,150.47	$ 169,000.00	0.073	522	SEALCOAT
62	FM 55	316-1.3	324+1.2	10.1	$ 136,150.47	$ 407,000.00	0.105	232	SEALCOAT
63	FM 55	326-0.3	330+1.2	5.5	$ 136,150.47	-	-	-	SEALCOAT
64	FM 660	286+0.5	298+1.1	12.4	$ 219,185.50	$ 339,000.00	0.145	75	SEALCOAT
65	FM 664	584+0.0	604+0.1	0	$ 301,320.00	-	-	-	SEALCOAT
66	FM 667	314+0.0	324+0.5	10.1	$ 148,864.88	$ 301,000.00	0.081	417	SEALCOAT
67	FM 667	326-0.9	328+2.0	4.9	$ 148,864.88	$ 105,000.00	0.084	387	SEALCOAT
68	FM 744	590+0.0	592+1.5	3.5	$ 131,820.47	$ 95,000.00	0.067	645	SEALCOAT
69	FM 744	592+1.5	594+1.5	1.9	$ 131,820.47	$ 57,000.00	0.051	955	SEALCOAT
70	FM 744	596+0.0	606+1.0	10.7	$ 131,820.47	$ 164,000.00	0.100	266	SEALCOAT
71	FM 744	608-0.3	612+0.8	5.4	$ 131,820.47	-	-	-	SEALCOAT
72	FM 75	234+0.0	238+0.0	4	$ 102,021.20	$ 80,000.00	0.081	419	SEALCOAT
73	FM 85	598+0.0	610+0.0	10.8	$ 314,221.60	$ 111,000.00	0.069	616	SEALCOAT
74	FM 85	610+0.0	612+1.0	3	$ 92,182.74	-	-	-	SEALCOAT
75	FM 85	612+1.0	616+0.0	1.5	$ 92,182.74	-	-	-	SEALCOAT
76	FM 90	286+0.0	288+0.0	2	$ 106,454.69	$ 15,000.00	0.079	451	SEALCOAT
77	FM 90	288+0.0	294+1.0	6.9	$ 106,393.69	$ 95,000.00	0.082	409	SEALCOAT
78	SH 205	268+0.0	274+0.0	5.8	$ 286,324.75	-	-	-	SEALCOAT
79	SH 309	308+0.5	318+1.8	11.4	$ 370,436.30	$ 455,000.00	0.081	422	SEALCOAT
80	SH 5	242+1.5	246+1.0	5.6	$ 104,039.00	$ 792,500.00	0.029	1809	SEALCOAT
81	US 175	608+0.0	618+0.0	36.3	$ 758,338.50	$ 60,000.00	0.022	2258	SEALCOAT
82	US 175	618+0.0	628+0.5	30.8	$ 1,082,838.50	$ 329,000.00	0.029	1774	SEALCOAT
83	BU 287R	582+0.0	586+1.5	5.9	$ 410,668.75	$ 55,400.00	0.051	958	SEALCOAT
84	FM 1140	258+0.0	260+0.4	2.4	$ 88,778.00	$ 110,000.00	0.063	699	SEALCOAT
85	FM 1384	554+0.0	558+0.9	5.2	$ 176,520.50	$ 15,000.00	0.026	1953	SEALCOAT
86	FM 1388	278+0.0	284+1.3	7.3	$ 254,424.50	$ 453,000.00	0.173	37	SEALCOAT
87	FM 1493	296+0.0	298+0.2	2.3	$ 69,632.00	$ 52,000.00	0.084	380	SEALCOAT
88	FM 156	248+0.0	256+0.0	7.4	$ 728,789.75	-	-	-	SEAL COAT
89	FM 1603	606+0.0	612+0.5	6.6	$ 233,709.75	$ 42,000.00	0.029	1790	SEALCOAT
90	FM 2164	224+0.0	232+0.0	8.1	$ 309,505.00	$ 58,000.00	0.053	918	SEALCOAT

Table A146. Sections Applied with Preventive Maintenance Treatment, Dallas District (2009) (Continued).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
91	FM 3163	564+0.0	566+0.6	2.8	$ 92,480.50	$ 30,000.00	0.103	241	SEALCOAT
92	FM 3524	580+0.1	580+1.7	1.6	$ 66,712.00	$ 22,000.00	0.067	646	SEALCOAT
93	FM 407	554+0.0	560+0.5	6.5	$ 305,092.37	$ 20,000.00	0.115	179	SEALCOAT
94	FM 407	562-1.2	570+0.5	9.7	$ 305,092.37	$ 72,000.00	0.042	1199	SEALCOAT
95	FM 416	616+0.2	624+1.5	9.4	$ 351,591.50	$ 129,000.00	0.080	429	SEALCOAT
96	FM 429	274-0.7	278+0.0	4.8	$ 171,496.50	$ 52,000.00	0.054	889	SEALCOAT
97	FM 455	604+0.0	620+0.5	16.9	$ 573,842.50	$ 645,000.00	0.154	56	SEAL COAT AND PAVEMENT MARKINGS
98	FM 546	238+0.8	248+1.0	10.8	$ 358,002.50	$ 515,000.00	0.094	287	
99	FM 547	238+0.0	244+1.9	7.9	$ 279,885.00	$ 285,000.00	0.103	242	
100	FM 548	256+1.5	264+0.7	7.2	$ 260,486.00	$ 167,000.00	0.090	324	SEALCOAT, STRIPING
101	FM 551	254+0.5	256+1.4	2.9	$ 21,917.00	$ 135,000.00	0.165	42	SEALCOAT
102	FM 636	614+0.0	626+1.0	12.7	$ 433,001.50	$ 387,000.00	0.119	164	SEALCOAT
103	FM 642	324+0.0	332+1.0	8.8	$ 303,471.50	$ 68,000.00	0.074	521	SEALCOAT
104	FM 740	254+0.0	260+0.0	8.1	$ 108,413.87	$ 2,459,000.00	0.039	1359	SEAL COAT AND PAVEMENT MARKINGS
105	FM 740	260+0.5	264+0.0	2	$ 108,413.87	$ 265,000.00	0.051	957	
106	FM 876	294+0.0	298+1.5	5.5	$ 154,212.75	$ 164,200.00	0.121	151	SEALCOAT
107	FM 876	298+1.5	302+1.0	3.3	$ 154,212.75	$ 50,000.00	0.106	227	SEALCOAT
108	FM 986	260+0.0	264+4.5	8.6	$ 302,571.50	$ 553,000.00	0.092	307	SEALCOAT
109	SH 22	600+0.0	616+0.0	15.3	$ 1,403,058.75	$ 224,400.00	0.050	977	SEALCOAT
110	SH 22	616+0.0	624+0.0	7.8	$ 749,558.75	-	-	-	SEALCOAT
111	SH 309	308+0.5	318+1.8	11.4	$ 282,436.50	$ 455,000.00	0.081	422	SEALCOAT
112	SH 31	624+1.0	634+0.5	18.4	$ 336,094.00	$ 1,394,800.00	0.104	235	SEALCOAT
113	SH 31 R	638+0.5	644+1.7	6.7	$ 341,681.75	$ 72,600.00	0.006	3431	SEALCOAT
114	SH 34	314+0.3	322+1.0	8.5	$ 429,704.00	$ 207,000.00	0.049	1004	SEALCOAT
115	SH 34	322+0.5	326+0.0	4.1	$ 293,285.62	$ 520,800.00	0.057	824	SEALCOAT
116	SH 34	324+1.4	340+0.0	13.5	$ 293,285.62	$ 89,000.00	0.131	7823	SEALCOAT
117	SH 34	340+0.0	350+1.6	11.7	$ 595,580.44	$ 165,400.00	0.144	78	SEALCOAT
118	SH 34	352+0.0	370+0.9	19.6	$ 595,580.44	$ 324,600.00	0.092	305	SEALCOAT
119	SH 34	372-0.3	370+0.9	0.8	$ 595,580.44	-	-	-	SEALCOAT
120	US 287	496+0.5	506+0.0	37.4	$ 1,666,809.50	$ 513,800.00	0.060	757	SEALCOAT

Table A146. Sections Applied with Preventive Maintenance Treatment, Dallas District (2009) (Continued).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
121	US 380	600+0.0	604+0.7	4.8	$ 1,766,602.00	$ 266,000.00	0.015	2813	SEALCOAT
122	US 77	308+0.0	314+0.0	5.3	$ 620,024.75	$ 9,000.00	0.043	1169	SEALCOAT
123	US 77	314+0.0	328+0.0	14.5	$ 620,024.75	$ 114,000.00	0.035	1512	SEALCOAT
124	FM 2449	552+0.0	562+1.7	11.9	-	$ 161,800.00	0.114	185	SEALCOAT
125	BU 287R	-	-	0	$ 116,584.50	-	-	-	SEALCOAT
126	SH 78	-	-	0	$ 515,499.50	-	-	-	SEALCOAT
127	FM 1895	-	-	0	$ 20,664.08	-	-	-	SEALCOAT
128	FM 1193	-	-	0	$ 12,846.30	-	-	-	SEALCOAT
129	FM 66	-	-	0	$ 10,597.66	-	-	-	SEALCOAT
130	IH 20	-	-	0	$ 279,966.20	-	-	-	SEALCOAT
131	FM 664	-	-	0	$ 255,907.50	-	-	-	SEALCOAT
132	FM 984	-	-	0	$ 160,302.86	-	-	-	SEALCOAT
133	FM 984	-	-	0	$ 160,302.86	-	-	-	SEALCOAT
134	FM 985	-	-	0	$ 162,125.32	-	-	-	SEALCOAT
135	IH 20	-	-	0	$ 363,926.35	-	-	-	SEALCOAT
136	IH 35W	-	-	0	$ 619,480.35	-	-	-	SEALCOAT
137	IH 35W	-	-	0	$ 613,741.50	-	-	-	SEALCOAT
138	US 175	-	-	0	$ 203,259.18	-	-	-	SEALCOAT
139	SH 31	-	-	0	$ 204,916.86	-	-	-	SEALCOAT
140	US 175	596+0.7	608+0.0	44	$ 462,288.32	$ 68,400.00	0.078	469	SEALCOAT
141	US 287	-	-	0	$ 92,382.50	-	-	-	SEALCOAT

Table A147. Sections Applied with Rehabilitation Treatments, Dallas (2009).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
1	FM 1173	552+0.0	562+1.0	10.9	$ 180,640.76	$ 90,000.00	0.038	1406	BASE REPAIR
2	FM 156	248+0.0	256+0.0	7.4	$ 1,590,784.02	-	-	-	BASE, REPAIR, AND OVERLAY
3	FM 2281	246+0.0	246+1.7	3.4	$ 240,925.00	$ 36,000.00	0.025	2071	REHABILITATION OF AN EXISTING ROAD
4	FM 2450	222+0.0	232+1.5	11.4	$ 181,296.80	$ 372,000.00	0.188	27	BASE REPAIR
5	FM 2478	234+1.5	238+0.4	3	$ 396,123.98	$ 580,000.00	0.031	1655	BASE REPAIR AND LEVEL-UP
6	FM 2933	230+1.0	236+1.6	6.6	$ 783,293.11	$ 8,000.00	0.026	1973	
7	FM 3163	564+0.0	566+0.6	2.8	$ 92,450.91	$ 30,000.00	0.103	241	
8	FM 3286	598+0.0	600+0.0	1.9	$ 258,261.39	-	-	-	
9	FM 3364	242+0.0	244+0.7	2.7	$ 438,716.69	-	-	-	
10	FM 3537	588+0.0	590+2.0	4.1	$ 517,062.53	$ 643,000.00	0.025	2060	
11	FM 455	564+0.0	576+1.0	12.9	$ 402,829.36	$ 275,000.00	0.099	267	
12	FM 720	574+0.0	582+1.4	9.8	$ 94,512.64	$ 232,000.00	0.087	345	
13	FM 982	242+1.5	246+0.5	3	$ 433,234.67	-	-	-	
14	IH 20	467+0.3	477+0.0	27.7	$ 10,979,645.26	$ 5,286,000.00	0.037	1440	OVERLAY AND PAV REP
15	IH 20 L	502+0.5	513+0.7	11.2	$ 4,428,732.45	-	-	-	PVT REPAIR, OVERLAY, PVT MARKINGS
16	IH 30	54+0.0	58+0.0	16	$ 376,338.00	$ 3,453,700.00	0.047	1061	FULL-DEPTH REPAIR
17	IH 30	64+0.0	79+0.3	56	$ 80,495.00	$10,475,000.00	0.023	2188	FULL-DEPTH CONCRETE REPAIR
18	IH 35	471+0.5	482+0.5	43.4	$ 156,428.73	$ 1,290,000.00	0.029	1766	BASE REPAIR
19	IH 35E	389+0.0	395+0.0	17.2	$ 62,387,238.54	$ 1,730,400.00	0.056	831	GR, STRS, CONC PAVEMENT OVERLAY
20	IH 45	216+0.0	220+0.0	16	$ 5,995,333.08	$ 336,000.00	0.103	246	REWORK BASE,PAV REP MILL, OVERLAY
21	LP 12	626+0.0	624+0.0	3.8	$ 2,381,899.37	$ 14,400.00	0.041	1275	OVERLAY, FDRCP, MDN, SHLDR, DRAIN
22	SH 205	248+0.0	252+0.0	2.9	$ 239,716.60	$ 62,000.00	0.029	1772	MICROSURFACE AND PAVEMENT MARKINGS
23	SH 205	252+0.0	254+1.0	3	$ 308,601.39	$ 75,000.00	0.017	2621	
24	SH 205	258+0.0	268+0.0	8.2	$ 704,301.72	$ 174,000.00	0.030	1714	
25	SH 66	596+0.0	596+1.3	2	$ 411,186.00	$ 900,000.00	0.041	1265	FULL-DEPTH REP PAV & PAV MARKINGS

Table A147. Sections Applied with Rehabilitation Treatments, Dallas (2009) (Continued).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
26	SH 78	276+0.0	280+0.0	7.3	$ 457,969.00	$ 1,875,600.00	0.111	202	FULL-DEPTH CONCRETE REPAIR
27	US 175	596+0.7	608+0.0	44	$ 1,514,621.20	$ 68,400.00	0.078	469	FULL-DEPTH REPAIR
28	US 75	232+0.5	242+0.0	38	$ 1,956,745.49	$ 36,000.00	0.014	2831	SEAL SHLDR,PVT REP,OV-UTHMWC,STRIPE
29	US 80	661-0.4	662+0.0	5.6	$ 509,398.00	$ 861,200.00	0.065	680	FULL-DEPTH REPAIR
30	FM 1126	304+0.0	310+0.5	6.7	$ 3,557,677.53	$ 62,000.00	0.070	579	FLEXIBLE PAVEMENT REPAIR & OVERLAY
31	FM 1126	316+3.1	326+0.4	7.2	$ 2,698,692.04	-	-	-	FLEXIBLE PAVEMENT REPAIR & OVERLAY
32	FM 1171	566+0.5	570+0.0	3.4	$ 24,323,917.59	$ 253,000.00	0.044	1138	GR,STRS,BASE,CRCP,PVMT MKGS,SIGNS
33	FM 1171	570+0.0	572+0.0	3.3	$ 334,381.26	$ 1,101,500.00	0.038	1401	FULL-DEPTH CONCRETE REPAIR
34	FM 1382	274+0.3	276+1.0	5.4	$ 1,730,444.30	-	-	-	MILL, LEVEL-UP, AND OVERLAY
35	FM 1382	282+0.5	286+0.5	7.3	$ 1,091,383.26	$ 322,000.00	0.042	1200	MILL AND INLAY
36	FM 2551	246+1.6	248+1.6	2.1	$ 978,393.88	-	-	-	BASE REPAIR AND LEVEL-UP
37	FM 428	568+0.0	576+1.0	9	$ 1,786,703.60	-	-	-	BASE RPR,ACP OVERLAY,PVMT MRKS
38	FM 982	240+0.0	242+1.5	3.5	$ 7,173,041.43	$ 185,000.00	0.138	99	GRD, DRAINAGE, PVM, SIGN & MRKS
39	IH 35	465+0.5	471+0.5	15.2	$ 376,786.00	$ 123,000.00	0.094	286	FULL-DEPTH CONCRETE REPAIR
40	IH 35W	69+0.4	68+0.1	1.2	$ 221,695.38	-	-	-	FULL-DEPTH CONCRETE REPAIR
41	SH 31	620+1.5	622+0.5	1	$ 1,297,361.52	$ 250,000.00	0.036	1477	REHAB OF EXISTING RD & TRAF SIGNALS
42	US 377	244+0.5	246+1.8	5.8	$ 619,387.08	$ 96,600.00	0.156	54	FULL-DEPTH CONCRETE REPAIR
43	BI 45-J	282+0.0	284+0.2	2.3	$ -	$ 362,000.00	0.056	851	MILL,REPAIR,SEAL AND OVERLAY
44	FM 1126	310+0.5	316+3.1	8.6	$ 4,221,149.33	$ 103,000.00	0.176	34	FLEXIBLE PAVEMENT REPAIR & OVERLAY
45	FM 1173	552+0.0	562+1.0	10.9	$ 4,716,241.87	$ 90,000.00	0.038	1406	PAV SURF
46	FM 1389	274+0.0	280+0.7	6.7	$ 2,178,894.53	$ 239,000.00	0.240	11	PAV SURF
47	FM 1836	620+1.0	624+1.0	3.8	$ 1,875,930.22	$ 127,000.00	0.143	79	PAV SURF
48	FM 639	586+0.0	592+0.4	6.5	$ 3,066,086.76	$ 57,000.00	0.066	656	FLEXIBLE PAVEMENT REPAIR & OVERLAY
49	FM 660	284-1.9	284-0.9	1	$ -	$ 115,000.00	0.057	806	MILL,REPAIR, AND OVERLAY
50	IH 35A, X	471+0.5	482+0.5	21.4	$ 4,161,098.60	-	-	-	CEMENT TREATED BASE AND OVERLAY

Table A147. Sections Applied with Rehabilitation Treatments, Dallas (2009) (Continued).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
51	IH 35E	418+0.5	421+0.4	11.6	$ 377,986.91	$ 2,805,000.00	0.022	2286	REP
52	SH 114	614+1.4	620+0.1	16.3	-	$ 1,263,600.00	0.085	368	PLANE,ACP,PV MK,RIP RAP,DITCH CLEAN
53	SH 114	620+0.1	620+1.1	4	-	$ 305,000.00	0.039	1341	PLANE,ACP,PV MK,RIP RAP,DITCH CLEAN
54	SH 289	238+1.5	242+0.5	3	$ 22,092,961.18	$ 75,000.00	0.023	2181	GR.,STRS,BASE AND PAVEMENT
55	SH 289	242+0.5	242+1.8	1.3	$ 12,953,791.99	$ 135,000.00	0.027	1920	GR., STRS, BASE AND PAVE
56	SH 78	276+0.0	280+0.0	7.3	-	$ 1,875,600.00	0.111	202	ACP OVERLAY,FDRCP,PAV MRKS
57	FM 148	270+0.5	272+1.5	3	-	$ 130,000.00	0.106	225	HOT MIX OVERLAY, BASE AND PAV MRKS
58	BI 45-G	294+0.0	296+0.05	3.1	-	$ 937,000.00	0.067	644	MILL,REPAIR AND OVERLAY
59	FM 2450	222+0.0	232+1.5	11.4	-	$ 372,000.00	0.188	27	BASE REPAIR
60	FM 455	564+0.0	572+0.5	8.5	-	$ 55,000.00	0.084	384	BASE REPAIR
61	FM 455	564+0.5	566+0.5	2	-	$ 15,000.00	0.084	384	GRADING, PVMT, PVMT MARKINGS
62	FM 455	566+0.5	568+0.5	2	-	$ 5,000.00	0.062	719	GRADING, PVMT, PVMT MARKINGS
63	IH 35	-	-	0	$ 240,817.00	-	-	-	CEMENT TREATED BASE AND OVERLAY
64	SH 31	-	-	0	$ 855,158.48	-	-	-	REHAB OF EXISTING ROAD & TRAFF SIG
65	US 287	-	-	0	$ 981,870.13	-	-	-	REHAB OF EXISTING ROAD & TRAFF SIG
66	SP 33	-	-	0	$ 24,442.60	-	-	-	BASE REPAIR AND LEVEL-UP
67	FM 983	-	-	0	-	-	-	-	MILL,REPAIR,OVERLAY
68	FM 75	-	-	0	$ 1,967,512.36	-	-	-	REMOVE PAV,GR,DRNG,STRS & CONS 2-LN
69	SP 482	-	-	0	$ 184,269.24	-	-	-	PLANE, ACP OVERLAY, PVMT MKGS
70	SH 183	-	-	0	$ 256,564.84	-	-	-	PLACE, ACP OVERLAY, PVMT MKGS
71	FM 2933	-	-	0	$ 61,249.28	-	-	-	BASE REPAIR AND LEVEL-UP
72	IH 35E	-	-	0	$ 314,871.97	-	-	-	PLANE, OVERLAY,PAVEMENT MARKING
73	SH 34	-	-	0	$ 3,155,257.44	-	-	-	GRADING, BASE AND PAVING
74	FM 51	-	-	0	$ 36,982.11	-	-	-	MICROSURFACING
75	FM 428	-	-	0	-	-	-	-	GRADING, PVMT, PVMT MARKINGS

Table A147. Sections Applied with Rehabilitation Treatments, Dallas (2009) (Continued).

Section	HWY	BRM	ERM	Lane Miles	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	Treatment
76	SH 183	-	-	-	$ 517,334.00	-	-	-	PLANE, ACP OVERLAY, PVMT. MKGS
77	FM 3504	-	-	-	$ 74,465.00	-	-	-	REHABILITATION OF AN EXISTING ROAD
78	SH 198	-	-	-	$ 6,970,336.22	-	-	-	GR STRS & SURF
79	FM 407	-	-	-	$ 72,068.00	-	-	-	FULL-DEPTH CONCRETE REPAIR
80	FM 598	-	-	-	$ -	-	-	-	GRADING, STRUCTURES, BASE & SURFACING
81	SH 190	-	-	-	$ 757,742.50	-	-	-	REHABILITATION OF EXISTING ROAD
82	SH 289	-	-	-	$ 750,764.97	-	-	-	BASE REPAIR AND LEVEL-UP
83	US 67	-	-	-	$ 4,909,030.64	-	-	-	HMAC OVERLAY
84	VA	-	-	-	$ 637,064.55	-	-	-	FULL-DEPTH CONCRETE PAVEMENT REPAIR
85	VA	-	-	-	$ -	-	-	-	FULL DEPTH CONCRETE REPAIR
86	VA	-	-	-	$ 1,001,905.34	-	-	-	MICROSURFACING
87	VA	-	-	-	$ 2,393,117.20	-	-	-	BASE REPAIR

Table A148. Summary of Treatment Cost and Lane Miles, PMIS and Dallas District.

PRWKREAS	Source	PRAMTNEE	Percentage	Lane Miles
PM	PMIS	$ 9,584,000	3%	573.4
	District	$ 37,197,347	14%	981.7
Rehabilitation	PMIS	$ 270,845,500	97%	1031.9
	District	$ 226,495,612	86%	588

EL PASO DISTRICT

SUB-TASK 1.4: COMPARE DISTRICT PRIORITY RANKINGS AND REPAIR NEEDS TO PMIS RESULTS

UTEP lead with the assistance of TTI and UTSA
1/31/2011

EL PASO DISTRICT

There are 4514 lane miles in the El Paso District. Eighty-three percent of the road network in El Paso District is composed of asphalt pavements and 17% of concrete pavements. Table A149 shows the number of lane miles for El Paso District summarized by TxDOT highway systems.

Table A149. Lane Miles in El Paso District.

Highway System	Lane Miles	Percentage (%)
Interstate Highways (IH)	825	18.3
United States Highways (US)	1108	24.5
State Highways (SH)	1160	25.7
Farm-to-Market (FM)	1345	29.8
Business Routes (BR)	68	1.5
Park Road (PR)	8	0.2
Total	4514	100.0

Several meetings were conducted with El Paso District personnel between August and December in 2009. District personnel provided a list of treatments applied from 2001 through 2009. Table A150 shows the treatments applied by the district from 2007 through 2009, their corresponding PMIS category, and the treatment class recommended by PMIS for those sections.

Table A150. Treatments Applied by El Paso District (2007–2009).

Treatment	El Paso	PMIS Recommendation				
		NN	PM	LRhb	MRhb	HRhb
Seal Coat (PM)	139	26	48	16	26	23
Two Coarse Surface Treatment (PM)	20	18	-	-	2	-
Overlay (PM)	128	58	40	-	22	8
Total	287	102	88	16	50	31

According to the El Paso District personnel, the PMIS condition score is used as an initial reference to plan a field survey and further evaluate candidate sections for treatment. The pavement engineer uses PMIS treatment recommendations as a reference but not to directly determine what treatment should be applied.

FINDINGS OF THE STATISTICAL ANALYSIS

Findings of the statistical analysis conducted for the comparison of treatments applied in El Paso District and PMIS treatment recommendations follows. Details of the analysis are in the appendices.

Condition, distress, and ride scores from 2001–2009 were analyzed using box plots to show quartiles and medians for each segment category. The purpose of this analysis was to show graphically the range of variation of the scores for each treatment category. For example, in Figure A56, the condition score of the sections recommended to receive Preventive Maintenance treatment has a median of 91 and a mean of about 86. From this box plot, it can also be concluded that 25% of the data are below a condition score of 80 and 75% are below a condition score of 98. The box plot of the lower portion of Figure A56 is labeled for a better understanding of these graphs.

Tables were also prepared to show PMIS statistics for condition, distress, and ride scores (mean and standard deviation) for each treatment category. We also plot the evolution of treatment needs from 2001–2009 and conducted Mann-Whitney test to compare PMIS data to district data for each treatment category.

Summary of PMIS Scores and Treatment Needs

a. The average PMIS condition score for the total number of lane miles rated by the district ranges between 82.8 as a minimum in 2002 and 88.5 as a maximum in 2007. Throughout the 2001–2009 analysis period the percentage of lane miles with very good and good condition scores is very high when compared to the other classes. In 2009, 87% of the total lane miles in El Paso District show a condition score equal or greater than 70 (good or very good condition). A similar pattern is observed statewide.

b. The average PMIS distress score for the total number of lane miles rated by district ranges between 87.3 as a minimum in 2002 and 92.1 as a maximum in 2007. Throughout the 2001–2009 analysis periods, the percentage of lane miles with very good and good distress scores is very high when compared to the other classes. In 2009, 90% of the total lane miles in El Paso District show a distress score equal or greater than 80 (good or very good). A similar pattern is observed Texas statewide with 85% of the total lane miles in 2009 showing a distress score equal or greater than 80.

c. The average PMIS ride score for the total number of lane miles rated by the district ranges between 3.1 as a minimum in 2001, 2003, 2005, and 2006, and 3.3 is a maximum in 2004, 2007, 2008, and 2009. Throughout the analysis period 2001–2009, the percentage of lane miles with very good and good ride scores is high when compared to the other classes. In 2009, 71% of the total lane miles in El Paso District show a ride score equal or greater than 3.0 (good or very good). A similar pattern is observed statewide.

d. The most prevalent PMIS treatment recommendation is Need Nothing considering all types of pavements from 2001 through 2009 (36357 sections). Fifty-seven percent of the sections are in this treatment category. Twenty-four percent of sections fall in the Preventive Maintenance category, while the remaining 18% is distributed between Light Rehabilitation, Medium Rehabilitation, and Heavy Rehabilitation (7%, 7%, and 4%, respectively).

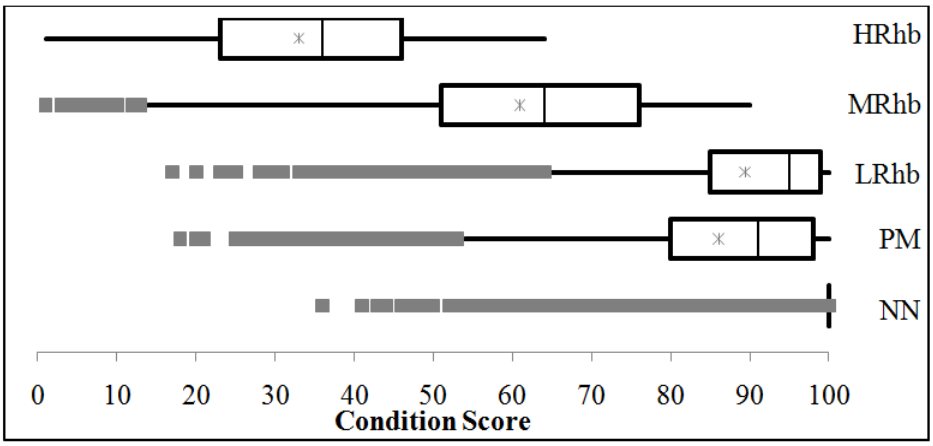
Table A151 shows a summary of the frequency, mean, and standard deviations for the PMIS condition score, distress score, and ride score for all pavement types.

Table A151. PMIS Statistics for All Types of Pavements in El Paso District (2001–2009).

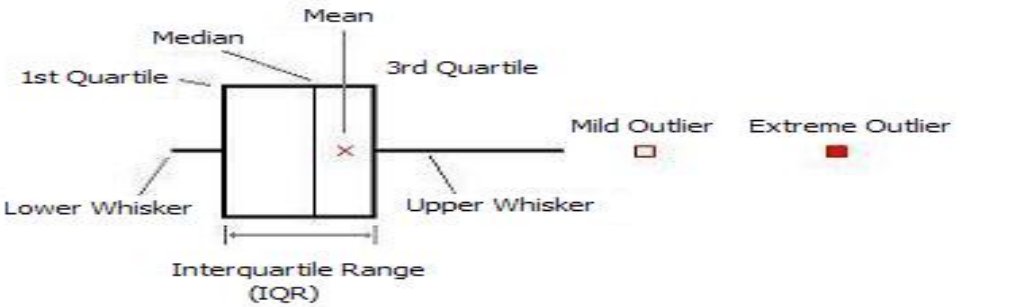
Treatment Category	Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	57	97.7	7.23	98.6	5.62	3.6	0.52
Preventive Maintenance	24	86.1	15.08	87.3	14.06	3.4	0.48
Light Rehabilitation	7	89.4	13.57	93.8	11.15	2.3	0.37
Medium Rehabilitation	7	60.9	17.29	86.3	19.90	2.2	0.62
Heavy Rehabilitation	4	33.0	14.66	80.3	24.86	1.7	0.86

Total number of sections analyzed: 36357.

Figures A56, A57, and A58 show the box plots with medians and quartiles for condition scores, distress, and ride scores of treatments recommended by PMIS.

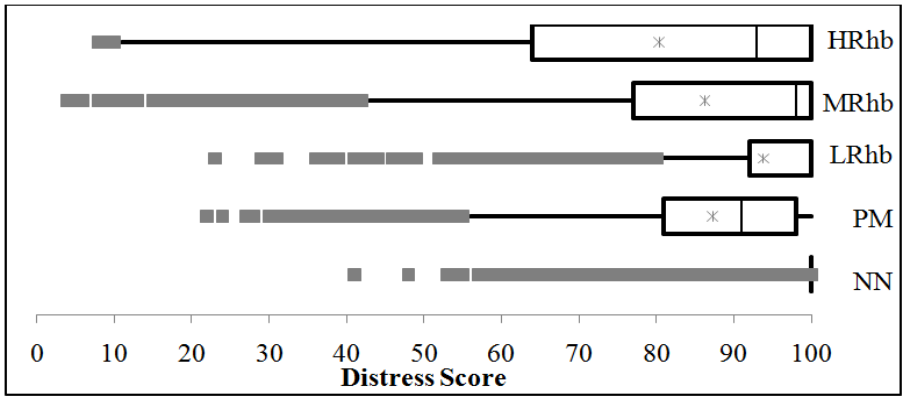


Treatment	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Need Nothing	36.0	100.0	100.0	100.0	100.0
Preventive Maintenance	18.0	80.0	91.0	98.0	100.0
Light Rehabilitation	17.0	85.0	95.0	99.0	100.0
Medium Rehabilitation	1.0	51.0	64.0	76.0	90.0
Heavy Rehabilitation	1.0	23.0	36.0	46.0	64.0



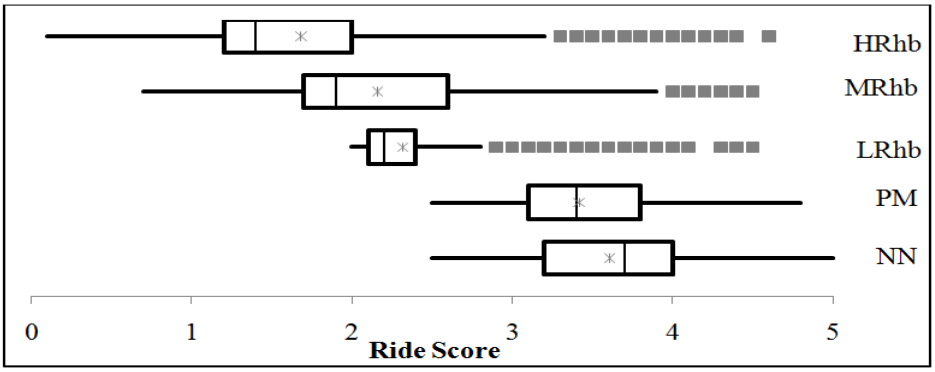
Whiskers extend to the furthest observations that are no more than 1.5 IQR from the edges of the box. Mild outliers are observations between 1.5 IQR and 3 IQR from the edges of the box. Extreme outliers are greater than 3 IQR from the edges of the box.

Figure A56. Box Plots for Condition Scores of Treatments Recommended by PMIS, El Paso District, 2001–2009.



Treatment	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Need Nothing	41.0	100.0	100.0	100.0	100.0
Preventive Maintenance	22.0	81.0	91.0	98.0	100.0
Light Rehabilitation	23.0	92.0	100.0	100.0	100.0
Medium Rehabilitation	4.0	77.0	98.0	100.0	100.0
Heavy Rehabilitation	8.0	64.0	93.5	100.0	100.0

Figure A57. Box Plots for Distress Scores of Treatments Recommended by PMIS, El Paso District, 2001–2009.



Treatment	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Need Nothing	2.5	3.2	3.7	4.0	5.0
Preventive Maintenance	2.5	3.1	3.4	3.8	4.8
Light Rehabilitation	2.0	2.1	2.2	2.4	4.5
Medium Rehabilitation	0.7	1.7	1.9	2.6	4.5
Heavy Rehabilitation	0.1	1.2	1.4	2.0	4.6

Figure A58. Box Plots for Ride Scores of Treatments Recommended by PMIS, El Paso District, 2001–2009.

e. For asphalt pavements, the most prevalent PMIS treatment recommendation from 2001 through 2009 is Need Nothing. Fifty-three percent of the sections are in this treatment category. Twenty-eight percent of sections fall in the Preventive Maintenance category while the remaining 20% is distributed between Light Rehabilitation, Medium Rehabilitation, and Heavy Rehabilitation (8%, 8%, and 4%, respectively).

Table A152 shows a summary of the frequencies, mean, and standard deviations for the condition score, distress score, and ride score for asphalt pavement types.

Table A152. PMIS Statistics for Asphalt Pavements in El Paso District (2001–2009).

Treatment Category	Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	53	97.7	7.11	98.6	5.60	3.6	0.53
Preventive Maintenance	28	86.1	15.08	87.3	14.06	3.4	0.48
Light Rehabilitation	8	89.9	13.57	94.5	10.81	2.2	0.17
Medium Rehabilitation	8	61.0	17.05	85.6	20.28	2.1	0.62
Heavy Rehabilitation	4	32.1	14.77	86.3	20.10	1.4	0.47

Total number of sections analyzed: 31450.

f. For concrete pavements, the most prevalent PMIS treatment recommendation from 2001 through 2009 is Need Nothing. Eighty-eight percent are in this treatment category. There are no sections in the Preventive Maintenance category, and the remaining 13% is distributed between Light Rehabilitation, Medium Rehabilitation, and Heavy Rehabilitation (4%, 5%, and 4%, respectively).

Table A153 shows a summary of the frequencies, mean, and standard deviations for the condition score, distress score, and ride score for concrete pavement types.

Table A153. PMIS Statistics for Concrete Pavements in El Paso District (2001–2009).

Treatment Category	Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	88	97.4	7.7	98.7	5.69	3.8	0.42
Preventive Maintenance	0	-	-	-	-	-	-
Light Rehabilitation	4	82.7	11.7	83.9	11.13	3.5	0.35
Medium Rehabilitation	4	59.9	19.8	93.8	12.67	2.5	0.44
Heavy Rehabilitation	4	38.4	12.8	45.3	20.80	3.4	0.61

Total number of sections analyzed: 4906.

g. The Need Nothing treatment category was the most prevalent PMIS treatment recommendation in the El Paso District (maximum of 64% and minimum of 23% of lane miles) considering all types of pavements. The exception was in 2002 in which Preventive Maintenance was the most prevalent recommended treatment (50%) followed by Need Nothing (30%); the other years Preventive Maintenance ranges from 16% to 34%. Both Light Rehabilitation and Medium Rehabilitation range from 7% to 10% during the entire period of analysis, and Heavy Rehabilitation from 3% to 5%. Figure A59 shows the total PMIS treatment needs in El Paso District.

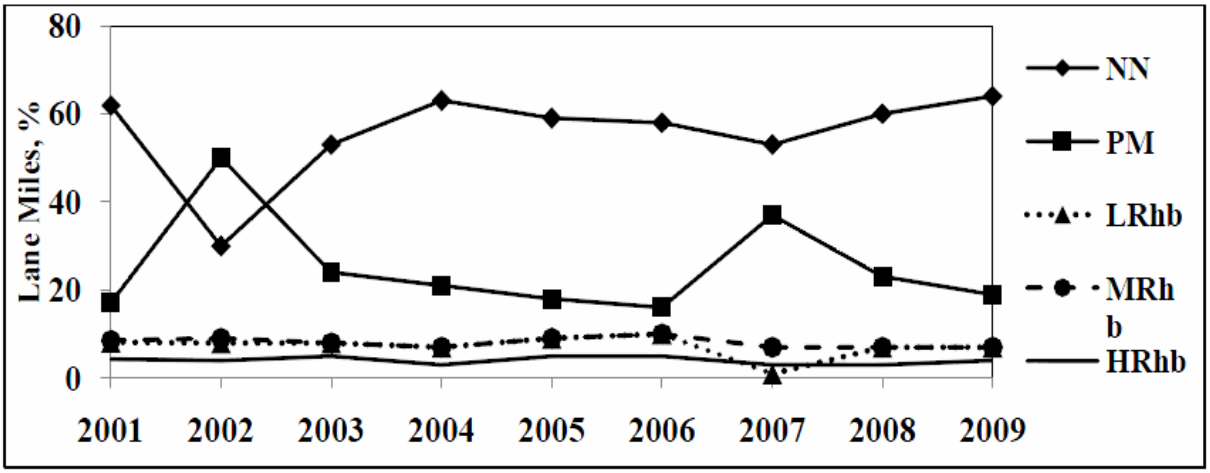


Figure A59. Total PMIS Treatment Needs in El Paso District (All Types of Pavements).

h. For asphalt pavements, the Need Nothing treatment category was the most prevalent PMIS treatment recommendation in the El Paso District (maximum of 61% and minimum of 24% of lane miles). The exception was in 2002 in which Preventive Maintenance was the most prevalent recommended treatment (56%) followed by Need Nothing (24%); the other years Preventive Maintenance ranges from 18% to 41%. Both Light Rehabilitation and Medium Rehabilitation range from 6% to 11%. Heavy Rehabilitation ranges from 3% to 5%. Figure A60 shows PMIS treatment needs for asphalt pavements in El Paso District.

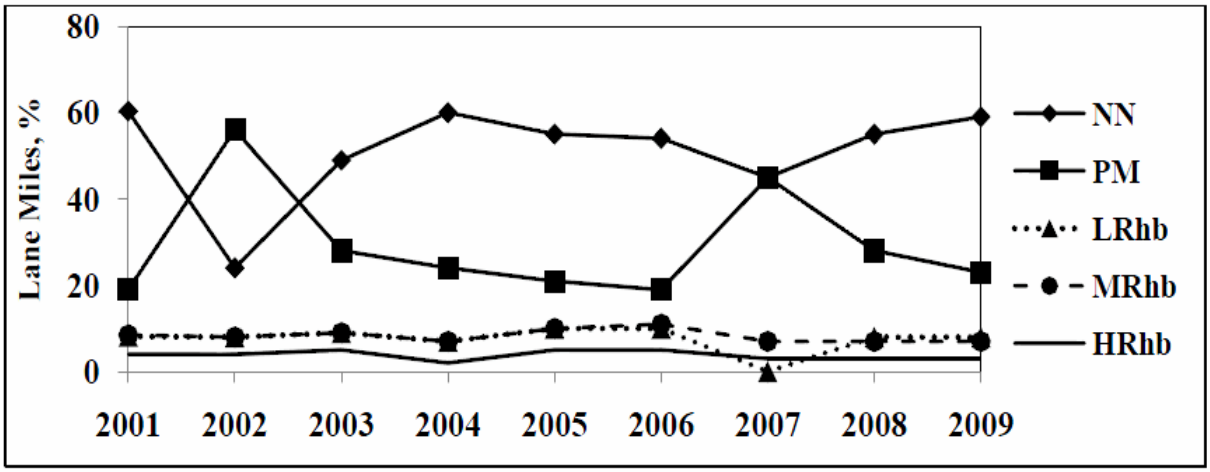


Figure A60. PMIS Treatment Needs for Asphalt Pavements in El Paso District.

i. For concrete pavements, the Need Nothing treatment category was the most prevalent PMIS treatment recommendation in the El Paso District (maximum of 88% and minimum of 76% of lane miles). No Preventive Maintenance treatments are recommended. Both Light Rehabilitation and Heavy Rehabilitation range from 2% to 8%, and Medium Rehabilitation ranges from 5% to 12%. Figure A61 shows the PMIS treatment needs for concrete pavements in El Paso District.

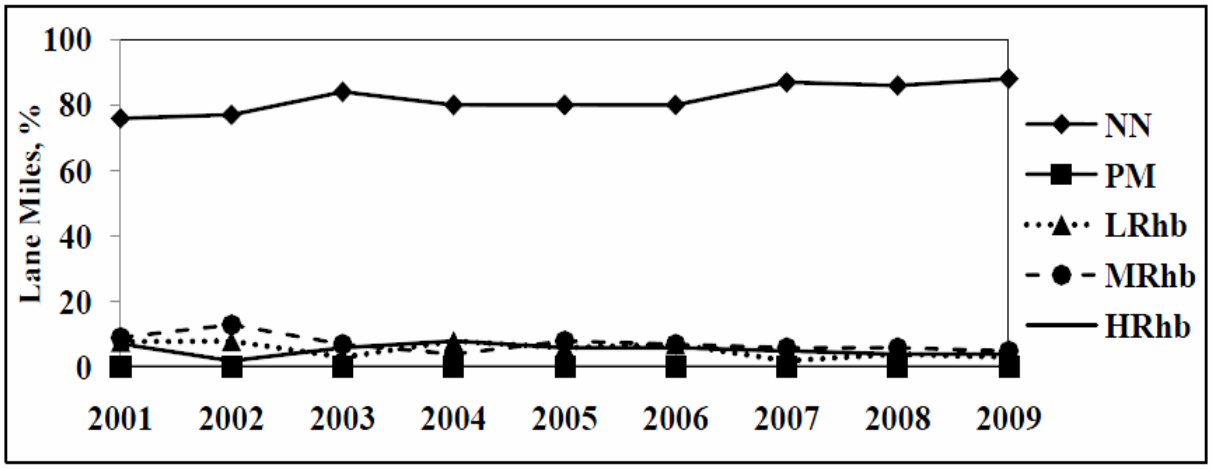


Figure A61. PMIS Treatment Needs for Concrete Pavements in El Paso District.

PMIS Scores for Treatments Applied in El Paso District

a. From 2007 through 2009, a total of 287 pavement sections received Preventive Maintenance treatment in the El Paso District. No other treatments were applied by the district in the last three years. The Preventive Maintenance treatments applied by the district were compared to the PMIS treatment recommendations. About 31% of the PMIS recommendations match with the Preventive Maintenance treatment applied by the district. Thirty-six percent of the sections were recommended by PMIS for Need Nothing but received Preventive Maintenance. The remaining 33% of the sections were recommended by PMIS for Light Rehabilitation, Medium Rehabilitation, and Heavy Rehabilitation (5%, 17%, and 11%, respectively). Table A154 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for all pavement types.

Table A154. PMIS Treatment Recommendations and Scores for Treatments Applied in El Paso for All Pavement Types (2007–2009).

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	36	97.1	7.43	97.4	7.19	3.6	0.47
Preventive Maintenance	31	76.1	16.47	76.7	16.62	3.5	0.45
Light Rehabilitation	5	89.9	13.96	93.8	13.68	2.2	0.16
Medium Rehabilitation	17	59.2	13.84	80.0	15.66	2.3	0.57
Heavy Rehabilitation	11	31.5	13.12	78.2	19.71	1.5	0.52

(*) A total of 287 pavement sections received Preventive Maintenance.

b. In asphalt pavements, the El Paso District only applied Preventive Maintenance treatments from 2007 through 2009. A total of 265 asphalt pavement sections received Preventive Maintenance treatments. About 33% of the PMIS recommendations match with the Preventive Maintenance treatment applied by the district. Thirty percent of the sections were recommended by PMIS for Need Nothing but received Preventive Maintenance treatments. The remaining 37% of the sections were recommended by PMIS for Light Rehabilitation, Medium Rehabilitation, and Heavy Rehabilitation (6%, 19%, and 12%, respectively).

Table A155 shows a summary of the frequency of PMIS treatment recommendations, mean, and standard deviation for the condition score, distress score, and ride score for the asphalt pavement sections.

Table A155. PMIS Treatment Recommendations and Scores for Treatments Applied in El Paso for Asphalt Pavements (2007–2009).

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	30	96.6	7.97	96.6	7.98	3.5	0.46
Preventive Maintenance	33	76.1	16.47	76.7	16.62	3.5	0.45
Light Rehabilitation	6	89.9	13.96	93.8	13.68	2.2	0.16
Medium Rehabilitation	19	59.2	13.84	80.0	15.66	2.3	0.57
Heavy Rehabilitation	12	31.5	13.12	78.2	19.71	1.5	0.52

(*) A total of 265 asphalt pavement sections received Preventive Maintenance.

c. In concrete pavements, the El Paso District only applied Preventive Maintenance treatments from 2007 through 2009. A total of 22 pavement sections received Preventive Maintenance. All the sections were recommended by PMIS for Need Nothing but received Preventive Maintenance.

Table A156 shows a summary of the PMIS treatment recommendations, mean, and standard deviations for the condition score, distress score, and ride score of the PMIS treatment categories for the concrete pavement sections.

Table A156. PMIS Treatment Recommendations and Scores for Treatments Applied in El Paso for Concrete Pavements (2007–2009).

Treatment Category (*)	PMIS Frequency (%)	Condition Score		Distress Score		Ride Score	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Need Nothing	100	99.0	4.69	100	0	3.9	0.35
Preventive Maintenance	0	-	-	-	-	-	-
Light Rehabilitation	0	-	-	-	-	-	-
Medium Rehabilitation	0	-	-	-	-	-	-
Heavy Rehabilitation	0	-	-	-	-	-	-

(*) A total of 22 concrete pavement sections received Preventive Maintenance.

Evolution of PMIS Scores Due to Treatments Applied in the District

a. In 2009, there was an improvement in the condition and distress scores due to treatments applied by the district. The number of sections with a condition score below 70 decreases from 15% to 7%. The number of sections with a condition score above 90 (very good) increases 13% after treatments. Similar pattern is observed in the distress score which values are the same as the condition score. In the ride score, it is observed that there was an increase

of 32% in the number of sections above 4.0. No appearance for the ride score values less than 3.0 in both 2008 and 2009.

Tables A157, A158, and A159 show the frequency and cumulative frequency for the condition score, distress score, and ride score, respectively, for treatments applied in El Paso in 2009.

Table A157. Evolution of Condition Scores for Treatments Applied in El Paso in 2009.

Condition Score	2008			2009		
	Frequency	Cumulative Frequency	Cumulative Frequency (%)	Frequency	Cumulative Frequency	Cumulative Frequency (%)
0-10	0	0	0	0	0	0
10-20	0	0	0	0	0	0
20-30	0	0	0	0	0	0
30-40	3	3	7	0	0	0
40-50	0	3	7	1	1	2
50-60	1	4	10	1	2	5
60-70	2	6	15	1	3	7
70-80	2	8	20	1	4	10
80-90	7	15	37	6	10	24
90-100	26	41	100	31	41	100

Table A158. Evolution of Distress Score for Treatments Applied in El Paso in 2009.

Distress Score	2008			2009		
	Frequency	Cumulative Frequency	Cumulative Frequency (%)	Frequency	Cumulative Frequency	Cumulative Frequency (%)
0-10	0	0	0	0	0	0
10-20	0	0	0	0	0	0
20-30	0	0	0	0	0	0
30-40	3	3	7	0	0	0
40-50	0	3	7	1	1	2
50-60	1	4	10	1	2	5
60-70	2	6	15	1	3	7
70-80	2	8	20	1	4	10
80-90	7	15	37	6	10	24
90-100	26	41	100	31	41	100

Table A159. Evolution of Ride Scores for Treatments Applied in El Paso in 2009.

Ride Score	2008			2009		
	Frequency	Cumulative Frequency	Cumulative Frequency (%)	Frequency	Cumulative Frequency	Cumulative Frequency (%)
0.1-1	0	0	0	0	0	0
1-2	0	0	0	0	0	0
2-3	2	2	5	0	0	0
3-4	32	34	83	21	21	51
4-5	7	41	100	20	41	100

b. In 2008, there was an improvement in the condition and distress scores due to treatments applied by the district. The number of sections with a condition score below 60 decreases from 41% to 28%. The number of sections with a condition score above 90, which is considered very good condition, increases 4% after treatments. Similar pattern is observed in the distress score where the number of sections below 70 decreases from 45% to 21%. In the ride score, it is observed that there was an improvement of 9% in the number of sections between 2.0 and 3.0.

Tables A160, A161, and A162 show the frequency and cumulative frequency for the condition score, distress score, and ride score, respectively, for the treatments applied in El Paso in 2008

Table A160. Evolution of Condition Scores for Treatments Applied in El Paso in 2008.

Condition Score	2007			2008		
	Frequency	Cumulative Frequency	Cumulative Frequency (%)	Frequency	Cumulative Frequency	Cumulative Frequency (%)
0-10	1	1	1	0	0	0
10-20	6	7	7	2	2	2
20-30	5	12	13	6	8	8
30-40	7	19	20	2	10	11
40-50	9	28	29	9	19	20
50-60	11	39	41	8	27	28
60-70	12	51	54	21	48	51
70-80	4	55	58	10	58	61
80-90	9	64	67	2	60	63
90-100	31	95	100	35	95	100

Table A161. Evolution of Distress Scores for Treatments Applied in El Paso in 2008.

Distress Score	2007			2008		
	Frequency	Cumulative Frequency	Cumulative Frequency (%)	Frequency	Cumulative Frequency	Cumulative Frequency (%)
0-10	0	0	0	0	0	0
10-20	0	0	0	0	0	0
20-30	0	0	0	0	0	0
30-40	1	1	1	0	0	0
40-50	3	4	4	3	3	3
50-60	10	14	15	4	7	7
60-70	29	43	45	13	20	21
70-80	2	45	47	13	33	35
80-90	6	51	54	15	48	51
90-100	44	95	100	47	95	100

Table A162. Evolution of Ride Scores for Treatments Applied in El Paso in 2008.

Ride Score	2007			2008		
	Frequency	Cumulative Frequency	Cumulative Frequency (%)	Frequency	Cumulative Frequency	Cumulative Frequency (%)
0.1-1	7	7	7	2	2	2
1-2	34	41	43	32	34	36
2-3	31	72	76	30	64	67
3-4	23	95	100	31	95	100
4-5	0	95	100	0	95	100

c. In 2007, there was an improvement in the condition and distress scores due to treatments applied by the district. The number of sections with a condition score below 80 decreases from 55% to 14%. The number of sections with a condition score above 90, which is considered very good condition, increases 37% after treatments. Similar pattern is observed in the distress score where the number of sections below 70 decreases from 12% to 0% and the number of sections above 90 increases 36%. In the ride score, it is observed that there was an increase of 10% in the number of sections above 4.0.

Tables A163, A164, and A165 show the frequency and cumulative frequency for the condition score, distress score, and ride score, respectively, for treatments applied in El Paso in 2007.

Table A163. Evolution of Condition Scores for Treatments Applied in El Paso in 2007.

Condition Score	2006			2007		
	Frequency	Cumulative Frequency	Cumulative Frequency (%)	Frequency	Cumulative Frequency	Cumulative Frequency (%)
0-10	0	0	0	0	0	0
10-20	0	0	0	0	0	0
20-30	1	1	1	0	0	0
30-40	4	5	5	0	0	0
40-50	6	11	12	0	0	0
50-60	17	28	29	3	3	3
60-70	6	34	36	2	5	5
70-80	18	52	55	8	13	14
80-90	5	57	60	9	22	23
90-100	38	95	100	73	95	100

Table A164. Evolution of Distress Scores for Treatments Applied in El Paso in 2007.

Distress Score	2006			2007		
	Frequency	Cumulative Frequency	Cumulative Frequency (%)	Frequency	Cumulative Frequency	Cumulative Frequency (%)
0-10	0	0	0	0	0	0
10-20	0	0	0	0	0	0
20-30	0	0	0	0	0	0
30-40	0	0	0	0	0	0
40-50	1	1	1	0	0	0
50-60	8	9	9	0	0	0
60-70	2	11	12	0	0	0
70-80	14	25	26	4	4	4
80-90	15	40	42	2	6	6
90-100	55	95	100	89	95	100

Table A165. Evolution of Ride Scores for Treatments Applied in El Paso in 2007.

Ride Score	2006			2007		
	Frequency	Cumulative Frequency	Cumulative Frequency (%)	Frequency	Cumulative Frequency	Cumulative Frequency (%)
0.1-1	0	0	0	0	0	0
1-2	13	13	14	9	9	9
2-3	32	45	47	15	24	25
3-4	42	87	92	54	78	82
4-5	8	95	100	17	95	100

Hypothesis Tests to Compare PMIS Treatment Recommendations with Treatments Applied in the District

Hypothesis tests were performed to compare if the scores for PMIS treatment recommendations were statistically different than the scores for treatments applied in the district. A preliminary analysis of the score histograms by treatment category showed that they did not follow a normal distribution. Therefore, non-parametrical statistical tests were selected to perform the analysis.

A nonparametric hypothesis test does not require the population's distribution to be characterized by certain parameters. For example, many tests rely on the assumption that the population follows a normal distribution with parameters μ and σ. Nonparametric tests do not make this assumption, so they are useful when the data is strongly non-normal and resistant to transformation. Nonparametric tests are not completely free of assumptions about the data since they still require the data to be an independent random sample.

Mann-Whiney nonparametric hypothesis test was used to determine whether the medians (η) of the PMIS scores were statistically different for PMIS treatment recommendations when compared to treatments applied by the district. The Mann-Whitney test does not require the data to come from normally distributed populations, but it does make the following assumptions: (a) the populations of interest have the same shape, and (b) the populations are independent. The test is formulated as follow:

- Null hypothesis -> H_o: $\eta_1 = \eta_2$ (medians are equal)
- Alternative hypothesis -> H_a: $\eta_1 \neq \eta_2$ (medians are not equal)

The Mann-Whitney test uses the ranks of the sample data, instead of their specific values, to detect statistical significance. The test was performed at the 0.05 significance level. If the test's p-value is less than 0.05 then we reject the null hypothesis.

Table A166 shows the results of Mann-Whitney hypothesis testing when comparing scores for PMIS treatment recommendations and treatments applied by the El Paso District from 2007 through 2009. Only Preventive Maintenance treatments were applied during this period of time.

Results of the Mann-Whitney tests shows that we should reject the null hypothesis of equal medians at the 0.05 p-value significant level. The PMIS condition score, distress score, and ride score medians are statistically different when comparing PMIS recommendations to Preventive Maintenance treatments applied in El Paso District.

Table A166. Mann-Whitney Test Results for Preventive Maintenance for El Paso in 2007–2009.

Year	Score	Medians		P-Value	Test Result
		PMIS	El Paso		
2007	Condition Score	99	100	0.019	Reject
	Distress Score	99	100	0.000	Reject
	Ride Score	3.40	3.40	0.640	Accept
2008	Condition Score	88	70	0.011	Reject
	Distress Score	88	91	0.074	Accept
	Ride Score	3.40	2.40	0.000	Reject
2009	Condition Score	88	100	0.000	Reject
	Distress Score	90	100	0.000	Reject
	Ride Score	3.60	3.95	0.000	Reject
2007–2009	Condition Score	93	99	0.000	Reject
	Distress Score	94	100	0.000	Reject
	Ride Score	3.50	3.40	0.001	Reject

PMIS-El Paso: 1422-124 sections in 2007, 883-93 in 2008, 752-50 sections in 2009, 3057-267 sections total.

ANALYSIS OF DISCREPANCIES IN TREATMENT SELECTION

Individual pavement sections with discrepancies between the treatments recommended by PMIS and the treatments applied were analyzed with district personnel. Tables A167 and A168 show a summary of the asphalt and concrete sections selected for further analysis. Criteria used to select these sections include functional class, level of traffic, pavement type, and PMIS scores. Pavement sections with high condition score and low ride score, or low condition score but high ride score also were considered when selecting these sections.

Table A167. Flexible Pavement Sections Selected to Illustrate Discrepancies in Treatment Selection.

PMIS											El Paso District	
FISCAL YEAR	SIGNED HIGHWAY ID	BRM	ERM	AADT CURRENT	TRUCK AADT PCT	CUM ADT ORIG SURFACE QTY	CONDITION SCORE	RIDE SCORE	DISTRESS SCORE	TREAT. ABREV	TREATMENT Applied by the District	District Reason
2009	FM0034	0368 +00.0	0368 +00.5	70	6.4	744600	42	1.3	90	HRhb	PM	Heavy traffic, heavy load. Boarder fence maintenance caused the distresses
2009	FM0034	0368 +00.5	0368 +01.0	70	6.4	744600	70	1.7	99	MRhb	PM	
2009	FM0034	0368 +01.0	0368 +01.5	70	6.4	744600	23	0.8	99	HRhb	PM	
2009	FM0034	0370 +00.0	0370 +00.6	70	6.4	744600	36	1.1	100	HRhb	PM	
2009	FM0170	0136 +01.0	0136 +01.5	100	6	587650	70	1.8	90	MRhb	PM	Low traffic
2009	FM0170	0144 +01.0	0144 +01.5	100	6	587650	58	1.5	100	MRhb	PM	
2009	FM0170	0146 +00.5	0146 +01.0	100	6	587650	36	1.1	100	HRhb	PM	
2009	FM0170	0146 +01.5	0148 +00.0	100	6	587650	46	1.3	100	HRhb	PM	
2009	FM0170	0148 +00.0	0148 +00.5	100	6	587650	31	1	100	HRhb	PM	
2009	FM0170	0148 +00.5	0148 +01.0	100	6	587650	46	1.3	100	HRhb	PM	
2009	FM0170	0148 +01.0	0148 +01.5	100	6	587650	52	1.4	100	HRhb	PM	
2009	FM0170	0148 +01.5	0150 +00.0	100	6	587650	35	1.1	97	HRhb	PM	
2009	FM0170	0150 +00.0	0150 +00.5	100	6	587650	64	1.6	99	MRhb	PM	
2009	FM0170	0150 +00.5	0150 +01.0	100	6	587650	22	0.8	94	HRhb	PM	
2009	FM0170	0150 +01.0	0150 +01.5	100	6	587650	31	1	100	HRhb	PM	
2009	FM0170	0150 +01.5	0152 +00.0	100	6	587650	31	1	100	HRhb	PM	
2009	FM0170	0152 +00.0	0152 +00.5	100	6	587650	40	1.2	97	HRhb	PM	
2009	FM0170	0152 +00.5	0152 +01.0	100	6	587650	45	1.3	97	HRhb	PM	
2009	FM0170	0152 +01.0	0152 +01.5	100	6	587650	63	1.6	99	MRhb	PM	
2009	FM0170	0152 +01.5	0154 +00.0	100	6	587650	64	1.6	100	MRhb	PM	
2009	FM0170	0154 +00.0	0154 +00.5	100	6	587650	64	1.6	99	MRhb	PM	
2009	FM0170	0154 +01.5	0156 +00.0	270	5.4	1974650	58	1.5	100	MRhb	PM	
2009	FM0170	0156 +00.0	0156 +00.5	270	5.4	1974650	64	1.6	100	MRhb	PM	
2009	FM0170	0156 +00.5	0156 +01.0	270	5.4	1974650	70	1.7	99	MRhb	PM	
2009	FM0170	0158 +00.5	0158 +01.0	270	5.4	1974650	23	0.8	100	HRhb	PM	
2009	FM0170	0158 +01.0	0158 +01.5	270	5.4	1974650	58	1.5	100	MRhb	PM	
2009	FM0170	0160 +00.0	0160 +00.5	270	5.4	1974650	46	1.3	100	HRhb	PM	
2009	FM0170	0184 +00.5	0184 +01.0	110	11.8	1204500	67	1.7	94	MRhb	PM	
2009	FM0170	0194 +00.5	0194 +01.0	110	11.8	1204500	64	1.6	100	MRhb	PM	
2009	FM0170	0202 +00.0	0202 +00.5	110	11.8	1204500	64	1.6	100	MRhb	PM	
2009	FM0170	0202 +01.0	0202 +01.5	110	11.8	1204500	58	1.5	100	MRhb	PM	
2009	FM0192	0058 +00.0	0058 +00.5	190	5.5	1095000	58	1.5	100	MRhb		Heavy traffic, heavy load. Boarder fence maintenance caused the distresses
2009	FM0192	0058 +00.5	0058 +01.0	190	5.5	1095000	65	1.7	91	MRhb		
2009	FM0192	0060 +00.0	0060 +00.5	90	6.1	452600	69	1.7	98	MRhb		
2009	FM0192	0062 +01.0	0062 +01.5	90	6.1	485450	58	1.5	100	MRhb		
2009	FM0192	0064 +00.0	0064 +00.5	40	7.5	397850	64	1.6	100	MRhb		
2009	FM0192	0064 +01.5	0066 +00.0	40	7.5	397850	58	1.6	90	MRhb	PM	
2009	FM0192	0068 +00.0	0068 +00.5	40	7.5	397850	34	1.1	95	HRhb	PM	
2009	FM0192	0070 +01.0	0070 +01.5	70	6.4	536550	54	1.5	94	MRhb	PM	
2007	FM0259	0010+01.0	0010+01.2	10500	19.9	54312000	34	2	100	HRhb	PM	
2007	FM1112	0432+00.0	0432+00.5	1720	4.9	9205300	22	1.8	47	HRhb	PM	Low traffic
2009	FM1281	0030 +00.0	0030 +00.5	20000	18.1	119647000	53	2.4	100	HRhb		Sealing of cracks
2009	FM1281	0030 +00.5	0030 +01.0	22000	17.9	131031350	61	2.6	94	MRhb		
2007	FM2637	0024+00.0	0024+00.5	190	23.1	795700	100	2.3	100	LRhb	PM	Low traffic, Near a gas station, Pump lines have bumps that affect ride
2006	SH0020	0322+00.5	0322+01.0	24500	5.2	108040000	56	2.7	79	MRhb	PM	Material failure
2006	SH0020	0322+01.5	0324+00.0	22000	5.3	103477500	77	3.3	77	MRhb	PM	
2006	SH0054	0368+01.0	0368+01.5	180	13.3	883300	46	1.3	100	HRhb	PM	Pavement sections have bumps. Only a Seal Coat was applied to fix distresses but not Ride Score
2006	SH0054	0368+01.5	0370+00.0	180	13.3	883300	35	1.1	98	HRhb	PM	

Table A168. Concrete Pavement Sections Selected to Illustrate Discrepancies in Treatment Selection.

PMIS										El Paso District	
FISCAL YEAR	SIGNED HIGHWAY ID	BRM	AADT CURRENT	TRUCK AADT PCT	CUM ADT ORIG SURFACE QTY	CONDITION SCORE	RIDE SCORE	DISTRESS SCORE	TREAT. ABREV	TREATMENT Applied by the District	District Reason
2009	IH0010 L	90	7050	58.9	36494525	17	3.7	17	HRhb	PM	Transition zone from asphalt to concrete.
2009	IH0010 L	91	7050	58.9	36494525	52	4.1	52	HRhb	PM	Most of IH0010 is in good shape, Finishing of joints was not very well so it caused problems. Pavement sections have some concrete patches. Lack of maintenance, and spalled cracks were not fixed.
2009	IH0010 L	92	7050	58.9	36494525	37	4.4	37	HRhb	PM	
2009	IH0010 L	94	7050	58.9	36494525	23	3.9	23	HRhb	PM	
2009	IH0010 L	98	7050	58.9	36494525	45	4	45	HRhb	PM	
2009	IH0010 L	98	7050	58.9	36494525	50	3.8	50	HRhb	PM	
2009	IH0010 L	98	7050	58.9	36494525	47	3.7	47	HRhb	PM	
2009	IH0010 L	99	7050	58.9	36494525	53	3.7	53	HRhb	PM	
2009	IH0010 L	105	7050	58.9	37850500	56	3.7	56	HRhb	PM	
2009	IH0010 R	91	7050	58.9	36494525	16	4.3	16	HRhb	PM	
2009	IH0010 R	102	7050	58.9	36494525	48	3.7	48	HRhb	PM	
2009	SL0375 L	25	7335	18.8	27820300	9	3.5	9	HRhb	PM	Most of SL0375 is in good shape, need to analyze site, distress Score is lowered because of aggregate patches.
2009	SL0375 L	35	7175	18.9	32412000	55	4	55	HRhb	PM	
2009	SL0375 L	40	16000	11.6	114434800	100	2.9	84	MRhb	PM	Most of SL0375 is in good shape.
2009	SL0375 R	45	16000	4.3	113423750	92	4.5	92	LRhb	PM	Most of SL0375 is in good shape.
2009	IH0010 R	0009+00.5	-	-	-	45	3.7	45	HRhb	PM	Error in PMIS data due to duplicate rating distresses.

Budget Prioritization Analysis

A budget prioritization analysis of the PMIS and El Paso District candidate sections for treatment was performed. We requested budgets for the last 4 years. Fiscal year 2009 was used for the purpose of comparing priority rankings. PMIS ranking for sections in which the district applied treatment were compared and discussed with the district engineer.

PMIS candidate sections for treatment are ranked from the highest to the lowest cost-effectiveness ratio. On the other hand, sections selected by the El Paso District used the following criteria, in order of priority, to select roadways for a construction project: condition score (below 70), distress, and ride score (distress score is given priority over ride score), time to last treatment applied, ADT and speed limit and budget. Decisions also depend on the location of the road segment (urban or rural).

A budget comparison was first performed between the cost of the district treated sections in the 2009 fiscal year and the cost of treatment estimated by PMIS of the same sections. We also checked with the district if sections recommended by PMIS for treatment in 2009 were let in 2010 or considered in future maintenance and rehabilitation programs (2011–2013). The projects were grouped into two categories: preventive maintenance and rehabilitation.

Tables A169 and A170 provide a list of the El Paso sections and the costs estimated by both the district and PMIS for Preventive Maintenance and Rehabilitation projects, respectively. The priority rankings according to PMIS are also displayed for these sections. The discrepancies between the district and PMIS priorities were discussed with the El Paso District engineer. The district based their prioritization decisions on the reasoning presented in the last column of the tables.

Table A171 presents the sections ranked by PMIS according to the cost-effectiveness ratio. El Paso's District engineer provided explanations supporting the district decisions for not treating the sections proposed by PMIS the same year. These are summarized in the table.

Table A169. Sections Applied with Preventive Maintenance Treatment, El Paso District (2009).

Section	HWY	TRM From	TRM From Displ	TRM To	TRM To Displ	Lane Miles	Treatment	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	District reason for prioritization given PMIS ranking
1	US 0062	0120	0.8	0128	1.5	12.5	MILL AND OVERLAY	$4,579,104	$201,600	0.116	76	Control section was clustered to one project (sections 1 & 2)
2	US 0062	0114	1.35	0120	0.8	5.1	MILL AND INLAY	$1,842,746	$91,000	0.009	1111	Control section was clustered to one project (sections 1 & 2)
3	US00 62	0028	0.7	0042	1.32	29.5	OVERLAY	$9,713,335	$1,713,000	0.152	41	-
4	US 0062	0042	1.32	0044	0.9	3.8	OVERLAY	$1,010,789	$74,800	0.081	109	-
5	LP0 375	0048	0.59	0047	0.98	4.4	OVERLAY	$487,907	$68,400	0.063	187	Control section was clustered to one project (sections 5 & 6)
6	LP 0375	0056	0.96	0048	0.59	16.8	OVERLAY	$7,826,621	$1,159,800	0.212	13	Control section was clustered to one project (sections 5 & 6)
7	SH00 17	0452	1.92	0454	0.66	1.2	SEAL COAT	$76,393	$84,000	0.064	180	Section was clustered to one project of seal coats
8	US 0067	0934	0.17	0948	1.19	15.5	SEAL COAT	$1,279,055	$28,000	0.088	96	-
9	US 0067	0948	1.32	0966	0.36	17.4	SEAL COAT	$1,101,081	-	0.000	-	-
10	RM 1703	0430	0.0	0432	1.93	0.0	SEAL COAT	$207,080	-	0.000	-	-
11	SH00 54	0326	1.9	0332	1.97	6.0	SEAL COAT	$322,976	-	0.000	-	-
12	FM1110	0036	0.11	0036	1.1	1.2	OVERLAY WITH ARRA FUNDS	$299,900	$30,000	0.060	204	Extra available money permitted project for deteriorating section

Table A170. Sections Applied with Rehabilitation Treatments, El Paso District (2009).

Section	HWY	TRM From	TRM From Displ	TRM To	TRM To Displ	Lane Miles	Treatment	District Cost	PMIS Cost	Highest C/E Ratio	PMIS Rank	District reason for prioritization given PMIS ranking
1	SP 0148	0054	0.0	0054	1.44	0	MILL AND OVERLAY	$351,113	-	0.0000	-	-
2	LP 0375	0023	0.32	0023	0.72	3	OVERLAY, MILL AND INLAY	$514,213	$223,000	0.1301	69	-
3	LP 0375	0023	0.72	0024	0.64	3.8	OVERLAY, MILL AND INLAY	$762,307	$187,000	0.1388	63	-
4	LP 0375	0058	0.067	0059	0.807	4	MILL AND INLAY WITH ARRA FUNDS	$1,736,970	$84,000	0.0371	551	Section is a continuation of section 5 project in the Preventive Maintenance category. Other factors include date of last treatment and forecast of poor pavement condition.
5	FM 2529	0310	0.0	0312	0.938	3	OVERLAY, MILL AND INLAY WITH ARRA FUNDS	$596,778	$45,000	0.0789	118	-
6	US 0067	0908	1.787	0916	1.169	7.9	OVERLAY AND BASE REPAIR WITH ARRA FUNDS	$2,377,159	$12,000	0.0655	171	-
7	US 0062	0020	1.272	0022	0.392	6.7	MILL AND INLAY	$1,786,738	$640,800	0.0765	126	-
8	US 0062	0022	0.392	0023	0.0	1	MILL AND INLAY	$1,250,000	$150,000	0.0271	756	Control section was clustered to one project (sections 7 & 8). Section was due for treatment given the date of last treatment.
9	IH 0010	0020	0.141	0023	0.815	15	MILL AND INLAY	$954,126	$3,768,500	0.0074	1185	Control section was clustered to one project (sections 9 & 10). Section was due for treatment given the date of last treatment.
10	IH 0010	0023	0.815	0032	0.054	34	MILL AND INLAY	$1,496,151	$2,042,500	0.0490	334	-

Table A171. Prioritized PMIS Sections Based on Ranking and District Reason for Not Treating Section, El Paso District (2009).

PMIS Rank	HWY	BRM	ERM	District reason for not choosing sections prioritized by PMIS
1	US0067	0906 +01.2	0906 +01.7	Sections are being addressed at this moment.
2	US0067	0908 +00.0	0908 +00.5	Sections are being addressed at this moment.
3	FM1905	0014 -00.5	0014 +00.0	Section is not in severe bad condition, but a seal coat and overlay may be considered.
4	US0067	0906 +01.7	0908 +00.0	Sections are being addressed at this moment.
5	FM1905	0014 -01.0	0014 -00.5	Section is not in severe bad condition, but a seal coat and overlay may be considered.
10	FM1109	0348 +00.5	0348 +01.0	Section is not under district jurisdiction anymore.
11	FM1109	0350 +00.0	0350 +00.5	Section is not under district jurisdiction anymore.
12	SH0054	0382 +00.5	0384 +00.0	Section is already scheduled for rehabilitation.
13	SL0375	0053 +00.0	0053 +00.5	Section is already in the 2009 project list.
14	SH0118	0440 +01.5	0442 +00.0	Scores are low, but traffic is not too high.
15	SL0375	0051 +00.2	0051 +00.7	Section is already in the 2009 project list.
16	SH0118	0438 +01.5	0440 +00.0	Scores are low, but traffic is not too high.
17	SH0118	0438 +00.5	0438 +01.0	Scores are low, but traffic is not too high.
18	SH0118	0438 +01.0	0438 +01.5	Scores are low, but traffic is not too high.
19	FM1109	0348 +01.0	0348 +01.5	Section is not under district jurisdiction anymore.
20	SH0118	0438 +00.0	0438 +00.5	Scores are low, but traffic is not too high.
1429	US0385	0510 +00.5	0510 +01.0	Section is in very good shape. Time to last treatment is about 15 years ago, but low ADT cannot justify treatment.
1430	SH0054	0344 +00.0	0344 +00.5	Section had lanes widened and a seal coat applied about 5 to 6 years ago, so should be in good shape.
1431	US0062	0138 +00.0	0138 +00.5	Section had an overlay done about two years ago, so it is in good shape.

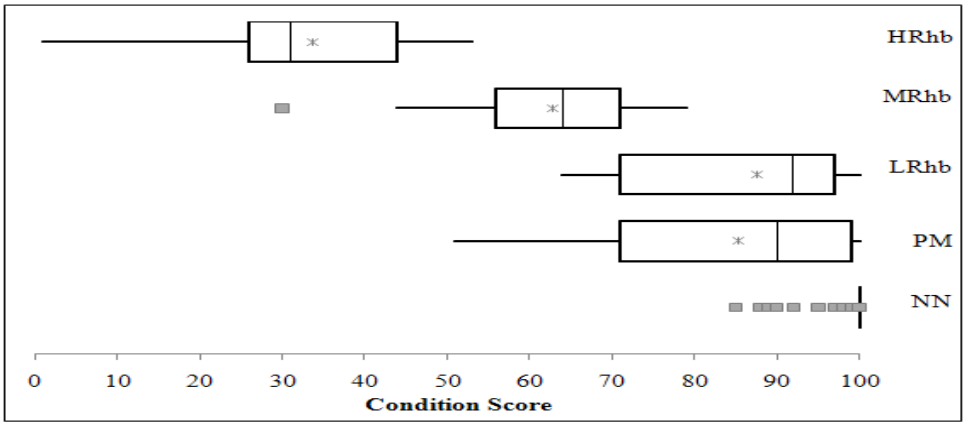
A summary of the Preventive Maintenance and Rehabilitation total budget was calculated for PMIS and the El Paso District. The district spent a total of $40,572,542 in 2009. PMIS estimated a cost of $48,222,900. Table A172 displays a summary of the analysis. Although the total money spent by the district and cost estimated by PMIS for the 2009 fiscal year are very similar, there are discrepancies in cost between both sources for each treatment category. Differences in the budgets may be due to out-of-date PMIS unit cost or local conditions.

Table A172. Summary of Treatment Cost and Lane Miles, El Paso District (2009).

Treatment Type	Source	Treatment Cost	Percentage	Lane Miles
Preventive Maintenance	PMIS	$ 6,712,900	14%	366.1
	District	$ 28,746,988	71%	113.4
Rehabilitation	PMIS	$ 41,510,000	86%	324.2
	District	$ 11,825,554	29%	78.4

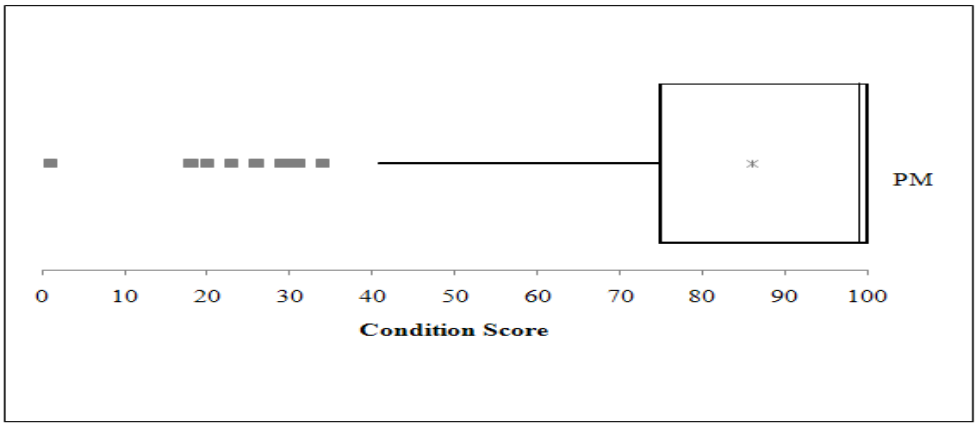
Concluding Remarks

a. Statistical analysis shows that there is not relationship between the PMIS condition scores for treatments applied by the district and treatments recommended by PMIS. Figures A62 and A63 show the box plots by treatment category for the PMIS condition scores from 2007 through 2009 for treatments recommended by PMIS and for treatments applied by the district, respectively.



Treatment Category	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Need Nothing	85	100	100	100	100
Preventive Maintenance	51	72.3	90	99	100
Light Rehabilitation	64	75.5	92.5	97.3	100
Medium Rehabilitation	30	56.5	64.5	71	79
Heavy Rehabilitation	1	26.8	32.5	43.8	53

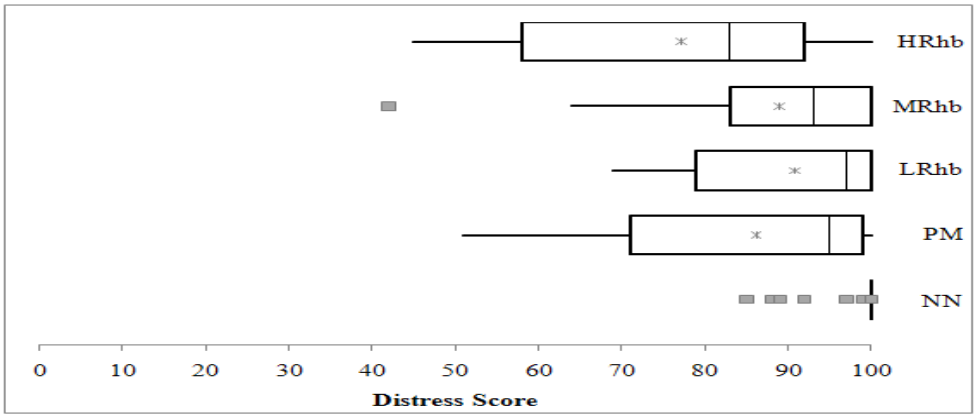
Figure A62. Box Plots for Condition Scores of Treatments Recommended by PMIS, El Paso District, 2007–2009.



Treatment Category	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Need Nothing	-	-	-	-	-
Preventive Maintenance	1	75	99	100	100
Light Rehabilitation	-	-	-	-	-
Medium Rehabilitation	-	-	-	-	-
Heavy Rehabilitation	-	-	-	-	-

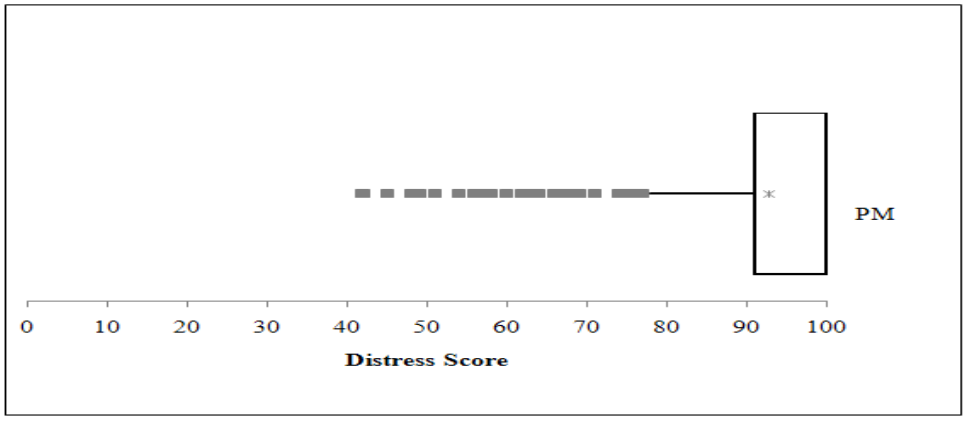
Figure A63. Box Plots for Condition Scores of Treatments Applied in El Paso District, 2007–2009.

b. There is not relationship between PMIS distress scores for treatments applied by the district and treatments recommended by PMIS. Figures A64 and A65 shows the box plots by treatment category for the PMIS distress scores from 2007 through 2009 for treatments recommended by PMIS and for treatments applied by the district, respectively.



Treatment Category	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Need Nothing	85	100	100	100	100
Preventive Maintenance	51	72.3	95.5	99	100
Light Rehabilitation	69	80.5	97	100	100
Medium Rehabilitation	42	83.8	93.5	99.8	100
Heavy Rehabilitation	45	60.5	83.5	90.8	100

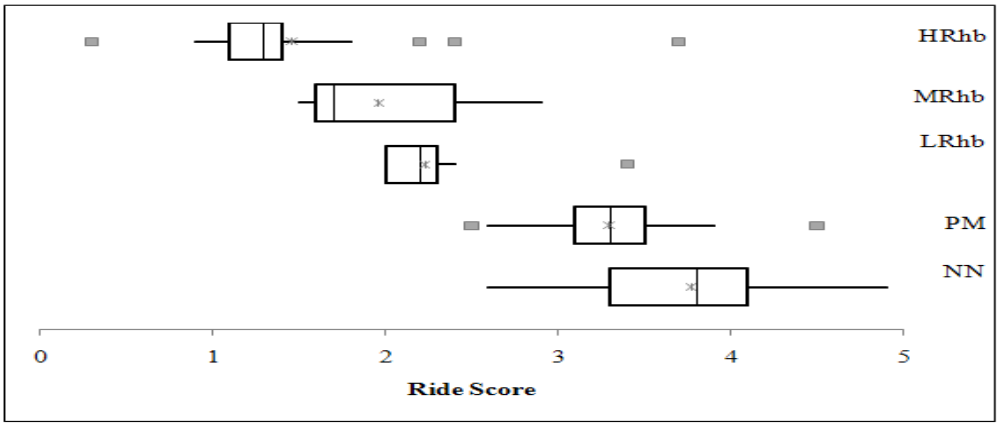
Figure A64. Box Plots for Distress Scores of Treatments Recommended by PMIS, El Paso District, 2007–2009.



Treatment Category	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Need Nothing	-	-	-	-	-
Preventive Maintenance	42.0	91.0	100.0	100.0	100.0
Light Rehabilitation	-	-	-	-	-
Medium Rehabilitation	-	-	-	-	-
Heavy Rehabilitation	-	-	-	-	-

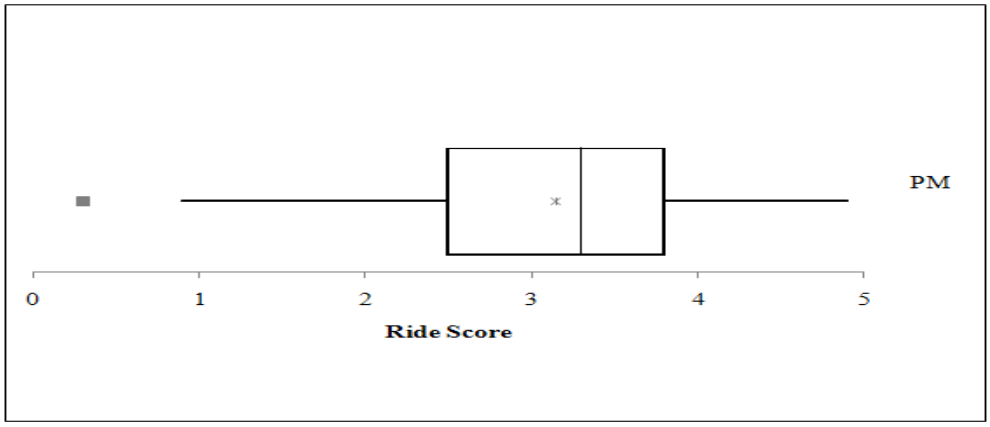
Figure A65. Box Plots for Distress Scores of Treatments Applied in El Paso District, 2007–2009.

c. The median for the ride scores for the Preventive Maintenance treatments applied by the district is 3.3, and is close to the median of Preventive Maintenance treatments recommended by PMIS. The third quartile of the ride scores is also close (3.8 versus 3.5). Figures A66 and A67 show the box plots by treatment category for the PMIS ride scores from 2007 through 2009 for treatments recommended by PMIS and for treatments applied by the district, respectively.



Treatment Category	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Need Nothing	2.6	3.4	3.8	4.1	4.9
Preventive Maintenance	2.5	3.1	3.4	3.5	4.5
Light Rehabilitation	2.0	2.0	2.2	2.3	3.4
Medium Rehabilitation	1.5	1.6	1.8	2.4	2.9
Heavy Rehabilitation	0.3	1.1	1.3	1.4	3.7

Figure A66. Box Plots for Ride Scores of Treatments Recommended by PMIS, El Paso District, 2007–2009.



Treatment Category	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Need Nothing	-	-	-	-	-
Preventive Maintenance	0.3	2.5	3.3	3.8	4.9
Light Rehabilitation	-	-	-	-	-
Medium Rehabilitation	-	-	-	-	-
Heavy Rehabilitation	-	-	-	-	-

Figure A67. Box Plots for Ride Scores of Treatments Applied in El Paso District, 2007–2009.

d. A comparison of PMIS prioritization results to treatment priorities set by districts show that pavement condition and type of distresses are important but the functional classification, level of traffic, and location are also relevant factors when allocating limited funds among sections. In many cases, sections ranked top by PMIS but not funded by the district were included in maintenance or rehabilitation programs in later fiscal years. Other sections recommended for treatment by PMIS were not considered for funding by a district because of very low traffic. It was also mentioned that treatment recommendations for 0.5 mile sections are not cost-effective and districts prefer to let longer sections. A 0.5 mile section not ranked on top by PMIS received treatment because was adjacent to a top-priority PMIS section also ranked high by district.