

Council Meeting Date: February 10, 2016

AGENDA ITEM COVER SHEET

Subject/Title: Report and Action on the City's Transportation Improvement Plan (TIP)

Item Summary: This report is the product of several years of work involving the community, transportation committee, and the elected body. The purpose of the TIP was to create a plan to address the condition of the city's roads in a systematic and financially prudent manner.

Financial Impact/Financial Information:

- 2016 - \$25, 560 for Engineering and Design
- 2017 – 2017 - See report

Comments/Recommendation:

- It is staff's recommendation to have the City Council approve and accept the TIP.
- There is a companion item on the City Council agenda authorizing the expenditure of \$25,500 from the capital fund in order to conduct the design and engineering in 2016, for the subsequent road projects identified in the TIP for 2017.

Attachments

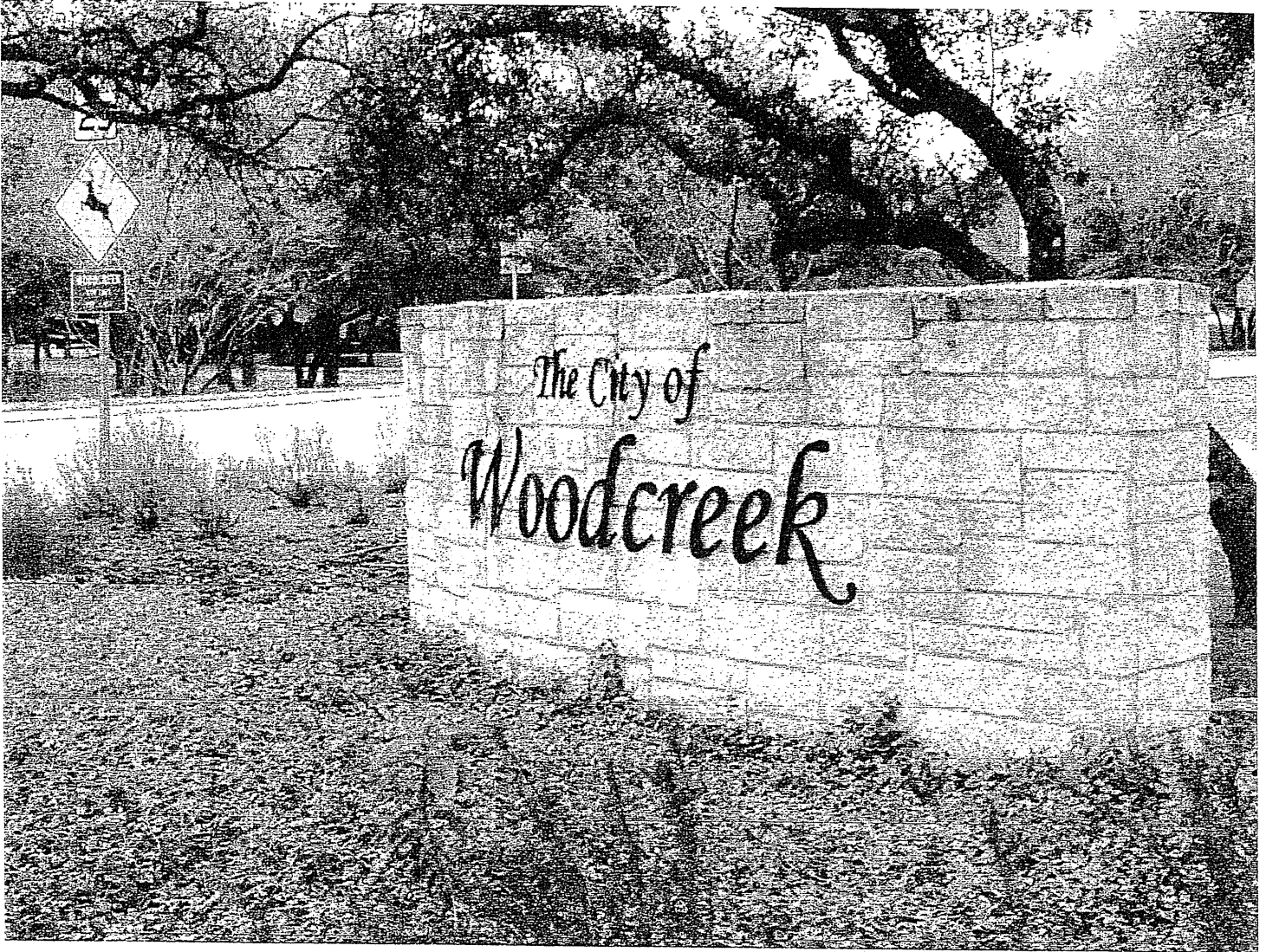
- City of Woodcreek Transportation Improvement Plan prepared by Engineer Dan Rogers and dated and stamped January 26, 2016

Submitted By:

Paul E. Brandenburg

City Manager

City of Woodcreek
Transportation Improvement Plan



Prepared by:
Dan Rogers
January 26, 2016



David A. Rogers

Purpose: The City of Woodcreek (City) has an extensive road network (network) that has been maintained at City expense. The network was constructed in conjunction with the Woodcreek Subdivision. As the network has aged, the maintenance expense has increased to the point that it consumes a substantial portion of the City budget. In order to proactively control future maintenance expenses, the City has contracted with Dan Rogers of Rogers Design Services to develop a long range Transportation Improvement Plan (TIP).

The City is aware that much of the maintenance effort to date is directly related to the modest pavement structure and drainage facilities provided by the Subdivision developer. By improving pavement structure and drainage facilities, network maintenance expenses can be reduced. The purpose of this TIP development effort is to determine what combination of maintenance and repair on the network will provide the better financial outlook for future City network maintenance expenditures. In addition, the study considered other network improvements that should be considered as part of this effort.

Process: Mr. Rogers collected data on all the roads in the network. Data was collected related to road condition, drainage features, and safety features. The data collection sheets are included in this document as an appendix. After collecting this data, Mr. Rogers reported the results of the findings to the Transportation Committee (the Committee) at a meeting on 12/1/14. Based on the discussion at this meeting, there were several recommendations that began to be implemented into the TIP. Mr. Rogers developed a preliminary plan for network improvements and shared it with the committee at the meeting on 1/12/15. Based on comments received at this meeting, Mr. Rogers updated the plan, and submitted it to the Committee on 2/9/15. The Committee agreed with the revisions and directed Mr. Rogers to develop a draft TIP including the preliminary plan for network improvements for review and discussion at the Committee meeting of 3/16/15. Based on comments at the meeting of 3/16/15, Mr. Rogers updated the TIP. After reviewing the TIP, the Committee transmitted the TIP to the City Council for review and approval.

Findings: Based on field data collected, the following findings and recommendations were developed:
Roadway Geometrics / Safety data: Of the 33 roads in the network, 18 appear to have a potential fixed object in the clear zone; 8 appear to have sight distance deficiencies at intersections, and 7 appear to have stopping sight distance deficiencies. I recommend that the Committee and the City develop a set of design criteria based on the roadway functional classification. The committee has already developed a classification system for the network and developing criteria related to that designation is recommended. After developing these criteria, I recommend taking steps to resolve the deficiencies as feasible. Where fixed objects are currently located in the clear zone of a road, The City should consider developing policy of how to address that related to both the existing condition and related to proposed conditions. If the object is a tree, the City should determine if the object warrants removal, protection, or notification. The City should develop policies related to new and replacement mailbox structures that accommodate break-away features if they are in the clear zone of the roadway. Where intersection sight distances are restricted by vegetation that is in ROW, the vegetation should be cleared to allow proper sight distance. The City should consider developing policy to regulate the use of certain types of landscaping in locations where that landscaping might create a safety issue in the future. Where

stopping sight distance is deficient for the roadway, the City should determine what alternative resolutions are available including notification and other speed reduction strategies.

Pavement Condition data: There is a need for maintenance on many of the roads in the network; however the roads are in relatively good shape from a structural standpoint. Much of the maintenance relates to substandard drainage, and as drainage issues are resolved, maintenance costs will decrease from current levels. In addition, some maintenance costs are related to substandard pavement structure. As roadways are repaired, if there are substandard pavement structures, they should be improved.

The Committee has identified four roads as falling under the classification of collectors including Woodcreek Drive, Brookhollow Drive, Brookmeadow Drive, and Champions Circle. Sixteen roads were classified as local roads, and fifteen roads were classified as ultra low volume roads. A Roadway Classification Map is included as an appendix to this TIP.

It is the desire of the Committee that the collector roads (Woodcreek Drive, Brookhollow Drive, Brookmeadow Drive, and Champions Circle) be upgraded to a Hot Mix Asphaltic Concrete Pavement (HMACP) surface. As commonly implemented, this would be a 2" thick mat over the existing roadway. Previous studies have identified that the flexible base (flex base) used in Woodcreek Drive is 2.5" to 3" thick. This is much lower than usual. It would be common to have 6" of flex base on a roadway with this level of traffic. Accordingly, the TIP recommends reconstructing the existing roadway on Woodcreek to address this deficiency prior to installing HMACP. In addition, drainage of Woodcreek should also be considered and repaired as part of the construction effort. Since the cost of an HMACP overlay is high, it is prudent to determine the thickness of the other two roads that are candidates for the HMACP overlay. If the pavement structures are found to be deficient, that should be resolved as part of the construction of that road. The TIP has an allowance for additional testing, but does not provide for any additional reconstruction (other than Woodcreek). If the testing reveals that additional reconstruction is required, the TIP should be updated to reflect that.

The Committee indicated a preference to develop a TIP based on the following approach: There are three ways to approach improvements.

- A silver approach would provide for the minimum level of maintenance needed to maintain the network as-is. It would not include addressing any drainage or structural issues.
- A gold approach would provide for a silver level of maintenance, but would also include addressing structural and drainage deficiencies as part of the effort. Only those deficiencies that be expected to reduce long term maintenance costs will be implemented. Improvements will be measured with respect to providing the most "bang for the buck".
- A platinum approach will provide for a silver level of maintenance and would also address structural and drainage deficiencies. All deficiencies would be addressed regardless of benefit and cost implications. Improvements will not be measured with respect to cost and benefits, but will be implemented on a network wide basis.

Based on discussions with the Committee, it was determined that the gold approach was the best for the City. This approach would provide for an HMACP surface on the four collector level roadways, and a chip and seal surface on all other roadways. Improvements to the pavement structure on the collectors would be provided to protect the investment into the HMACP surface. In addition, drainage improvements would be implemented as part of the construction effort. The drainage improvements would be implemented on both collectors as part of the construction project and on the local roads as part of the maintenance efforts.

\$50,000 - 25,000

\$117,240 → contigency reserve

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Based on feedback from the Committee, the preference is for providing construction/reconstruction by a contractor every other year (even years starting in 2016). In the odd years, starting in 2017, the City would contract with Hays County to procure county-force based maintenance services. Additionally, in odd years funds are proposed to be set aside for development of construction and drainage plans for use in the successive years. The duration of the TIP was set to occur over a 12 year cycle. This approach will accomplish all the goals related to implementation of a gold plan in 12 years. The average annual cost of implementation is \$141K. The odd (maintenance) years have an average annual cost of \$93K, and the even years have an average annual cost of \$209K. It is projected that after this TIP is completed, the annual maintenance expense will be reduced to \$50K to \$60K per year with little to no additional construction needed. The summary of annual expense allocations is detailed in the following table:

Table 1 – Proposed Annual Allocations and Expenses

Allocation /Year	Maintenance	HMACP Overlay	Drainage	Safety	Construction Total	Engineering/ investigation	Contingency	Total Annual Expense
Allocation	100%	0%	0%	0%				
2016	\$11,000	\$0	\$0	\$0	\$11,000	\$25,500	\$0	\$36,500
Allocation	11%	75%	11%	2%				
2017	\$20,000	\$130,500	\$19,500	\$4000	\$174,000	\$10,000	\$18,000	\$202,000
Allocation	95%	0%	0%	5%				
2018	\$72,081			\$4000	\$76,081	\$26,440	\$9,852	\$112,373
Allocation	9%	79%	9%	2%				
2019	\$20,000	\$168,000	\$20,000	\$4000	\$212,000	\$10,000	\$21,800	\$243,800
Allocation	95%	0%	0%	5%				
2020	\$79,337			\$4000	\$83,337	\$26,600	\$10,594	\$120,530
Allocation	9%	82%	9%	0%				
2021	\$20,000	\$182,000	\$20,000		\$222,000	\$10,000	\$23,200	\$255,200
Allocation	100%	0%	0%	0%				
2022	\$76,752				\$76,752	\$25,000	\$10,175	\$111,927
Allocation	9%	82%	9%	0%				
2023	\$20,000	\$181,500	\$20,000		\$221,500	\$10,000	\$23,150	\$254,650
Allocation	100%	0%	0%	0%				

(4)

2024	\$73,058				\$73,058	\$25,000	\$9,806	\$107,864
Allocation	12%	77%	12%	0%				
2025	\$20,000	\$132,000	\$20,000		\$172,000	\$10,000	\$18,200	\$200,200
Allocation	100%	0%	0%	0%				
2026	\$74,241		\$0		\$74,241	\$0	\$8,136	\$82,377
Allocation	84%		16%	0%				
2027	\$52,735		\$10,000		\$62,735	\$0	\$0	\$62,735

In table 1, the proposed annual expense and related allocation breakdown per expense category are summarized for each year from 2016 through 2026. By year 2027 under this plan, all Local and Collector functional classes of road will have been improved to include drainage and surfacing improvements as indicated. After these improvements are in place, the annual maintenance expense will be reduced to something on the order of the expenses shown in year 2026. This should be the expectation for maintenance expenses for the foreseeable future. The basis of the costs identified in Table 1 is shown in Table 2:

Table 2 – Proposed Annual Expenses

Activity	L	W	Unit cost	Exp
2016				
Design Engineering for 2016				\$25,000
Pavement boring on Champions Cir and Brookmeadow				\$500
2017				
Brookhollow from Woodcreek to Augusta	HMACP	4350	20	1.5 \$130,500
Drainage				\$19,500
Maintenance				\$20,000
Contract Administration / Construction Inspection				\$10,000



Activity	L	W	Unit cost	Exp
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Contingency (10%)				\$18,000
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total allocation				\$198,000
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2018

Augusta Drive from Brookhollow to Brookhollow	Chip Seal	3700	18	0.73	\$48,618
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Augusta Lane	Chip Seal	1500	18	0.73	\$19,710
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Jack Miller	Crack Seal	620	18	0.15	\$1,674
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Overbrook Ct	Crack Seal	770	18	0.15	\$2,079
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Design Engineering					\$25,000
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Utility investigation (36 lots @ \$40/lot)					\$1,440
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Contingency (10%)					\$9,852
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total allocation					\$108,373
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2019

Woodcreek from Champions Circle to Brookhollow	reconstruct	2400	20	2	\$96,000
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Woodcreek from Champions Circle to Brookhollow	HMACP	2400	20	1.5	\$72,000
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Drainage					\$20,000
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Maintenance					\$20,000
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Contract Administration / Construction Inspection					\$10,000
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Contingency (10%)					\$21,800
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total allocation					\$239,800
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	Activity	L	W	Unit cost	Exp
2020					
Augusta Drive from Brookhollow to end	Chip Seal	2400	18	0.73	\$31,536
Dolittle Dr	Chip Seal	2800	18	0.73	\$36,792
Jack Miller	Chip Seal	620	18	0.73	\$8,147
Wilson Circle	crack Seal	1060	18	0.15	\$2,862
Design Engineering					\$25,000
Utility investigation (40 lots @ \$40/lot)					\$1,600
Contingency (10%)					\$10,594
total allocation					\$116,530
2021					
Woodcreek from Brookhollow to Champions Circle	reconstruct	2600	20	2	\$104,000
Woodcreek from Brookhollow to Champions Circle	HMACP	2600	20	1.5	\$78,000
Drainage					\$20,000
Maintenance					\$20,000
Contract Administration / Construction Inspection					\$10,000
Contingency (10%)					\$23,200
total allocation					\$255,200



Activity	L	W	Unit cost	Exp
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2022

Westwood Dr from Brookhollow to Pebblebrook	Chip Seal	1060	18	0.73	\$13,928
Pebblebrook from end to end	Chip Seal	2070	18	0.73	\$27,200
Stonehouse from woodcreek to end	Chip Seal	800	18	0.73	\$10,512
Treemont Trace from Woodcreek to end	Chip Seal	600	16	0.73	\$7,008
Par Circle	Chip Seal	350	16	0.73	\$4,088
Par View	Chip Seal	1200	16	0.73	\$14,016
Design Engineering					\$25,000
Utility investigation (0 lots @ \$40/lot)					\$0
Contingency (10%)					\$10,175
total allocation					\$111,927

2023

Champions from Woodcreek to Overlook	HMACP	1950	20	1.5	\$58,500
Brookmeadow	HMACP	4100	20	1.5	\$123,000
Drainage					\$20,000
Maintenance					\$20,000
Contract Administration / Construction Inspection					\$10,000
Contingency (10%)					\$23,150
total allocation					\$254,650



Activity	L	W	Unit cost	Exp
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2024

Cypress Point	Chip Seal	1700	18	0.73	\$22,338
Deerfield	Chip Seal	1200	18	0.73	\$15,768
Country Lane	Chip Seal	1400	18	0.73	\$18,396
Shady Grove	Chip Seal	1260	18	0.73	\$16,556
Design Engineering					\$25,000
Utility investigation (0 lots @ \$40/lot)					\$0
Contingency (10%)					\$9,806
total allocation					\$107,864

2025

Champions from Overlook to Champions CT	HMACP	3400	20	1.5	\$102,000
Champions CT	HMACP	1000	20	1.5	\$30,000
Drainage					\$20,000
Maintenance					\$20,000
Contract Administration / Construction Inspection					\$10,000
Contingency (10%)					\$18,200
total allocation					\$200,200

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Activity L W Unit cost Exp

2026

Canyon Creek	Chip Seal	1960	18	0.73	\$25,754
Palmer Lane	Chip Seal	1750	18	0.73	\$22,995
Wilson Circle	Chip Seal	1060	18	0.73	\$13,928
Wildwood Circle	Chip Seal	880	18	0.73	\$11,563
Spalding Circle	Chip Seal	400	15	0.73	\$4,380
McGregor Circle	Chip Seal	250	15	0.73	\$2,738
Design Engineering					\$0
Utility investigation (0 lots @ \$40/lot)					\$0
Contingency (10%)					\$8,136
total allocation					\$89,494

2027

Annual Chip Seal	\$48,160
Annualized Chip Seal expense based on 10 year occurrence	\$52,735

Assumptions/notes:

1. All costs were developed on a baseline 1/1/2015 budget.
2. Reconstruction costs were based on statewide averages.
3. County force expenses were based on data provided by Hays County.
4. Over the life of the TIP, costs will rise and fall. As the changes in price affect the implementation schedule, the TIP should be updated to reflect those revisions.

SUMMARY

A program based on maintenance and improvement of transportation facilities should include the following components:

Roadway Classification: It is critical to planning to separate infrastructure by purpose. Local roads provide access while collector roads collect traffic from local roads and connect to arterials. It is recommended that City streets be classified as Low Volume Local, Local, and Collector. For the purposes of this study, Brookhollow Drive, Woodcreek Drive, Brookmeadow Drive, and Champions Circle have been designated as Collector facilities. No criteria to segregate Low Volume Local from Local have been established. The City should develop these criteria as part of further transportation improvement efforts.

Safety: It is recommended that the City develop and adopt policies addressing potential safety hazards in City ROW, including: fixed objects – mailboxes, landscaping structures, large trees, etc.; landscaping – Maintenance required to maintain clear intersections, installation of new landscaping in intersection sight triangles. In areas where these safety concerns are not readily resolved, warning signage may be warranted.

Maintenance: All local and low volume local facilities are programmed to have maintenance over the 10 year transportation plan. Maintenance efforts will include overlaying the road with a seal coat (or chip seal), sealing cracks, re-establishing pavement edge (where the edge of pavement is eroding), and potentially widening the facility to an acceptable minimum width. This maintenance is presumed to be performed by Hays County forces. Minimum roadway acceptable widths will need to be defined as part of the roadway classification effort. As the classification process has not been completed, no widening efforts have been included in maintenance efforts. In addition, there is no current plan for drainage improvements related to maintenance efforts. However, there are drainage improvements needed on several of the Low Volume Local and Local roads. It is recommended that the City consider adding City wide drainage maintenance and improvement to the Transportation Plan efforts.

Improvement: City streets identified as Collectors are programmed to have improvements including restoration of minimum width, restoration of roadway crown, improved drainage features, warranted safety improvements, development of a pavement structure (with strength sufficient for expected traffic volumes), and Hot Mix Asphaltic Concrete Pavement overlay. In order to accomplish these improvements, the City will need to contract with an Engineer to develop construction plans, assist with contract procurement, and confirm contract compliance. The engineer should address safety, drainage, and roadway design elements as part of the design. As part of this design effort, additional geotechnical investigations and pavement design efforts will likely be required. The current approach to improvements is based on beginning improvement efforts in locations where water line restoration has been completed. Woodcreek Drive has need for maintenance and improvement. Apparently, there is a water line located longitudinally in Woodcreek Drive that will need to be restored. Improvements to Woodcreek Drive have been delayed in the program in order to allow water line restoration prior to roadway reconstruction. While the current state of Woodcreek Drive is not optimal, if waterline restoration can be accomplished within the three years currently identified, no interim maintenance should be needed. However, if improvements to Woodcreek Drive are delayed by waterline improvements, this assumption may need review.

The City has committed substantial resources to studying the roadway network. This Transportation Plan has been developed as part of that effort. Moving forward, the City should review this plan, propose any revisions desired, and then begin Plan implementation. Implementation will require the development of Transportation Facility Policy. The effort to develop and implement appropriate policy will reduce City risk and provide a safer transportation network. Policy issues to address include Safety policies, Drainage

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policies, and Maintenance policies. In addition to policy development, the City will need to monitor the progress of this plan and adjust the plan as unforeseen issues arise and affect the Plan.

TA 17.3
SUMMARY OF HAYS COUNTY ROAD STANDARDS*

Average Daily Traffic (one-way trips)**	Not more than 100	101-1000	1001-2500	2501-5000	5001-15000	More than 15000
Functional Classification	Country Lane	Local Street	Minor Collector	Major Collector	Minor Arterial	Major Arterial
Design Speed	25 mph	25 mph	35 mph	45 mph	55mph	
Number of Lanes	2	2	2	2	4	All elements
ROW Width	50'	60'	60'	70'	100'	including
Width of Traveled way	18'	20'	22'	24'	48'	geometric
Width of Shoulders	2'	4'	5'	6'	8'	layout and
Minimum Centerline Radius	200'	300'	375'	675'	975'	cross-section
Minimum Tangent Length between Reverse Curves or Compound Curves	50'	100'	150'	300'	500'	shall be approved
Minimum Radius for Edge of Pavement at Intersections	25'	25'	25'	25'	25'	by the
Intersection Street Angle	80-100	80-100	80-100	80-100	80-100	Road Director
Maximum Grade:	11%	11%	10%	9%	8%	on a case-by-case
Minimum Street Centerline Offset at Adjacent Intersections	125'	125'	125'	125'	125'	basis.
Minimum Stopping Sight Distance	175'	175'	250'	350'	550'	
Minimum Intersection Sight Distance	250'	250'	350'	450'	550'	
Ditch Foreslope Grade	4:01	4:01	5:01	5:01	6:01	
Ditch Backslope Grade	3:01	3:01	4:01	4:01	4:01	
Minimum Cul-de-sac ROW Radius	60'	65'	65'	65'	65'	
Minimum Cul-de-sac Pavement Radius	35'	45'	45'	45'		
Notes:						
) Any deviation from these standards must be the subject of an approved variance.						
) Lots that are restricted by plat note to one single-family residence shall be presumed to generate 10 one-way trips per day. Average daily traffic for all other lots shall be determined on a case-by-case basis by the Road Director.						
) Occasional short runs between intersections may exceed the amounts shown, but maximum grades through intersections may not exceed the amounts shown.						
) The entire side ditch shall be totally contained within the road right-of-way or a dedicated drainage easement. Guardrails will be required.						
) No cul-de-sac shall have a cross slope that exceeds 6 percent.						
) Revegetation of disturbed areas within new road rights of way is required where the ditch depth exceeds 8' - 0" from the edge of shoulder to bottom of ditch on Country Lanes and Local Streets, -0" from edge of shoulder to bottom of ditch on Minor Collectors, and 4'-0" from edge of shoulder to bottom of ditch on Major Collectors and Minor Arterials.						
) Individual driveway entrances, if not shown on the approved construction plans, must be approved by the Road Director. Maximum spacing between commercial driveways or curb cuts is 150 ft.						
) Safety-end treatments required on all driveways. (Minimum 6:1 slope)						
) All design standards may be modified on a case-by-case basis as each project merits depending upon topography and other pertinent features. This is to include possible wider ROWs when assigned backslashes will not fit within standard ROW.						
) Utility construction & design, if intended to be underground, will need to be coordinated with the County Road Dept. If placement of utilities is to be in County ROW, an additional 10' of ROW will be required.						
) No road and drainage construction may begin until a set of construction and drainage plans have been approved by the County Road Department.						
) Seventy-Two (72) hours before construction is to begin a preconstruction meeting is required to be held. Contact the County Road Department for scheduling information.						

CITY OF WOODCREEK, TEXAS STREET EVALUATION

Submitted to:

Department of Public Works

City of Woodcreek, Texas



4201 Freidrich Lane, Suite 110

Austin, Texas 78744

REPORT NO. AP-12-16841

October 27, 2014

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1. INTRODUCTION

Road deterioration is a constant force that causes road quality to decline based on constant traffic and environmental loads. HVJ Associates, Inc. (HVJ) was contracted to conduct pavement ratings and evaluate the current needs of the City of Woodcreek, Texas. All pavements sections in the City have been evaluated using HVJ pavement condition rating procedures [Ref. 1]. The following project tasks have been completed:

- Collect visual condition survey data on all street sections within the maintenance responsibility of the City of Woodcreek, Texas to obtain individual pavement distress ratings for determining an overall Pavement Condition Rating (PCR).
- Provide condition assessment report with summary statistics of our findings.
- Estimate maintenance and rehabilitation costs.

Based on the City maintenance responsibility and Google Earth, it is estimated that the City of Woodcreek is composed of approximately 85 sections and approximately 10 centerline miles. HVJ staff completed a 100% visual pavement condition survey of the City of Woodcreek maintained streets to determine the Pavement Condition Rating (PCR) of each section. The surveys were conducted by trained HVJ staff using the HVJ condition survey procedures used in multiple Texas cities. Surveys will provide the City with information regarding the current condition of the streets and the potential repairs that will need to be performed. HVJ's assessment included in this report of the streets within the system will improve the City's ability to estimate future repair requirements, plan maintenance and rehabilitation programs and to estimate street funding needs. The City of Woodcreek network average condition assessment score yielded a value of 83 on a scale of 0 to 100.

2. PAVEMENT NETWORK INVENTORY

Currently the City of Woodcreek street inventory consists of approximately 10 centerline miles, which are maintained by the city. The pavement network inventory was based on the city website and a field visit with city staff. Based on the listing, HVJ Associates, Inc. identified and surveyed 159 street sections. Based on the field surveys and length estimations from Google Earth, the following network inventory was determined; quantities, functional classification area, number of sections, and section length:

Quantities

Table 1: Inventory Quantities

Item	Collector	Local	Total
Total Center Line Miles	2.0	8.0	10.0
Total Lane Miles	4.0	16.0	20.0

3. VISUAL CONDITION SURVEYS

Visual pavement condition surveys were collected the on September 26, 2014. Trained field raters used the pavement rating process to perform the field surveys of each individual street segment. The number of lanes and roadway width were collected and measured for each segment, as well.

All surveys were performed in accordance with the HVJ Visual Condition Survey Guidelines (Ref 1). The city network predominantly has flexible streets with a few areas patched with rigid Portland cement concrete (PCC), thus the following distresses were evaluated:

Flexible or Composite Pavements

- Wheelpath Rutting
- Fatigue (Alligator) Cracking
- Transverse Cracking
- Longitudinal Cracking
- Pavement Failures (Patches and Potholes)
- Utility Cut Patches,
- Edge Cracking
- Raveling (Weathering) and
- Ride Quality

For each of the individual pavement distresses identified for flexible pavements, the surveyor rates severity and extent. The following is a typical description from the Condition Survey Rating Guide for surface deterioration distress:

Alligator cracking is a series of interconnecting cracks caused by fatigue failure of the asphalt pavement under repeated traffic loading. The cracks initiate at the bottom of the asphalt surface and propagate to the surface, initially as one or more longitudinal parallel cracks. After repeated traffic loading, the cracks interconnect; and form many-sided, sharp angled pieces which are usually less than 1 ft. on the longest side. Alligator cracking commonly occurs in areas subjected to repeated traffic loading, such as the wheel paths. The distress is rated based on its severity and extent within a length of pavement. Rate the most prevalent severity level.

- Severity: Based on the worst alligator cracking encountered, the severity is defined as follows:
- Slight – Fine, longitudinal cracks running parallel to each other with none or only a few interconnecting cracks. Most cracks are less than 1/4" wide.
- Moderate – Progression of cracks into chicken wire or alligator skin pattern. Cracks may be up to 1/2" wide but pieces are still intact.
- Extreme – Further progression of cracking in such a way that widths are generally more than 1/2" wide. Cracks may be spalled, or flaked, at the edges. Pavement pieces may be loosened, shift or rock under traffic, or may be missing.
- Extent: Estimate the extent of surface deterioration in the worst area of the segment.
- Localized – 1-15% of section length is affected.
- Intermittent – 16-30% of section length is affected.
- Prevalent – > 30% of section length is affected.

The rater selects the appropriate description entry based on the severity and extent present.

Table 2: Severity and Extent Levels

SEVERITY	EXTENT		
	Localized 1-15%	Intermittent 16-30%	Prevalent >30%
Slight	1	2	3
Moderate	4	5	6
Extreme	7	8	9

Once all the data are recorded for each distress, the information is used to calculate the current pavement condition rating (PCR values).

Calculation of PCR

Based on the level of severity and extent of each distress identified as present on the street, a number of deduct points are assigned. The summation of these deduct points is subtracted from a perfect score of 100 to estimate the current pavement condition rating (PCR). This PCR value provides a relative condition assessment for each pavement section. The deduction points assigned to each distress at each severity/extent level are provided in Appendix A.

The pavement condition rating (PCR) value provides a uniform and systematic method to describe the overall condition of a street's pavement. The following is are the ranges are typically used for Collector and Local streets.

Table 3: PCR Ranges for Local and Minor Collector Sections

Collector	Condition	Local
0-50	Very Poor	0-30
51-65	Poor	31-50
66-80	Fair	51-65
81-90	Good	66-80
91-100	Very Good	81-100

The PCR value is on a scale of 0 to 100, with a newly constructed pavement having a score of 100, while a score of 0 indicates a pavement with many severe distress conditions.

Pavement Condition Rating (PCR) Distribution

The current average network PCR score for the City of Woodcreek is 83 indicating an overall good condition. The overall distribution of PCR ratings for local sections is provided in Table 4 and Figure 1. The overall distribution of PCR ratings for collector streets is provided in Table 5 and Figure 2. While these statistics show a majority of the pavements are in good condition, there are poor and very poor streets, which currently need rehabilitation. Also, the pavements which are in fair condition will continue to deteriorate at an increased rate if rehabilitation is not performed.

Table 4: PCR Distribution for Local Streets in Centerline Miles

Condition	PCR Range	Local-HMAC	% of TOTAL
Very Poor	0-30	0.0	0.0%
Poor	31-50	0.3	3.7%
Fair	51-65	0.4	5.2%
Good	66-80	2.5	30.4%
Very Good	81-100	4.9	60.7%
TOTAL		8.1	

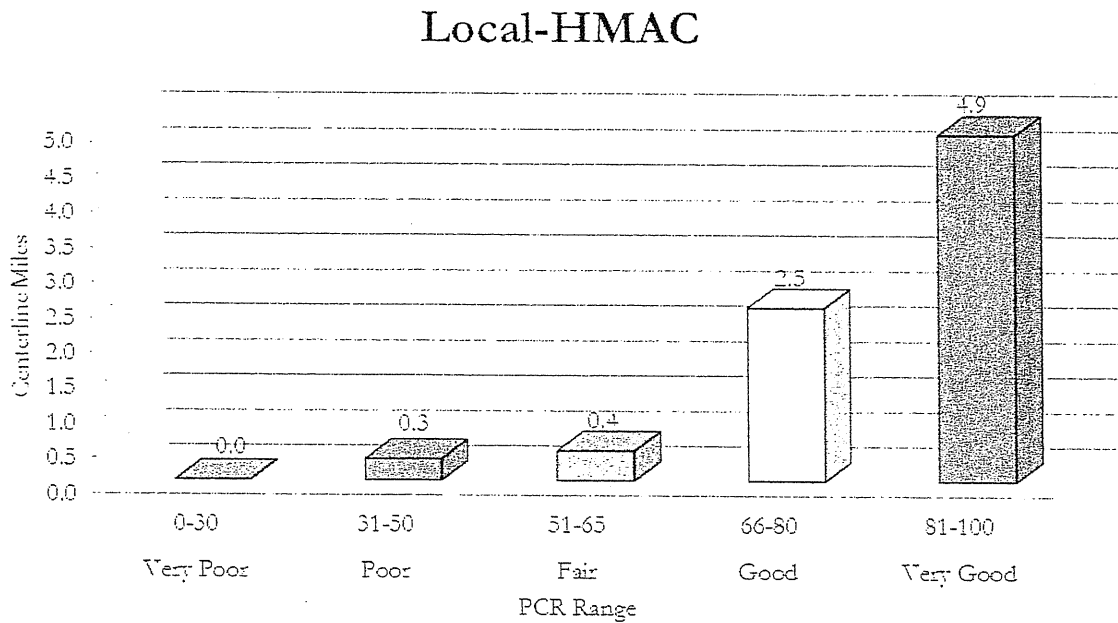


Figure 1: PCR Distribution for Local Streets

Streets classified at Collectors include, Brookhollow Dr., and Woodcreek Dr.

Table 5: PCR Distribution for Minor Collectors in Centerline Miles

Condition	PCR Range	Collector-HMAC	% of TOTAL
Very Poor	0-50	0.0	0.0%
Poor	51-65	0.0	0.0%
Fair	66-80	0.2	12.2%
Good	81-90	1.1	55.8%
Very Good	91-100	0.6	32.0%
TOTAL		1.9	

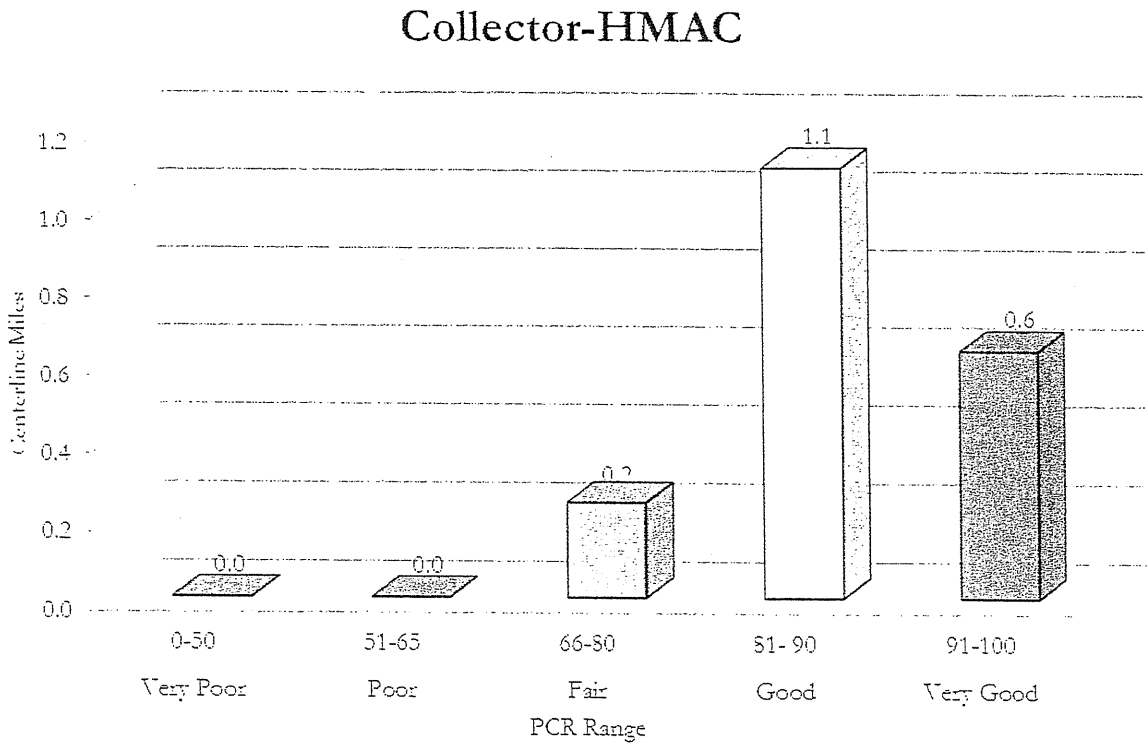


Figure 2: PCR Distribution for Collectors

4. MAINTENANCE, REHABILITATION & RECONSTRUCTION PLANS

MR&R Estimate Methodology

The visual condition survey PCR value is used to assign a recommended repair method for each street section within the street network of the City of Woodcreek based on the individual distresses. Projects should be evaluated on a detailed level prior to repairs/reconstruction. Due to funding availability, Hot Mix Asphalt Concrete (HMAC) surface is not a viable reconstruction option and therefore HVJ recommends a two-course and one-course surface treatment be used in the case of reconstruction of collector and local reconstruction, respectively. Additionally, a one-course treatment is recommended as a treatment option for the streets in poor condition that have not yet reached the very poor, reconstruction stage. Edge cracking and fatigue cracking were the major distresses noted throughout the city. It is recommended that before any treatment is performed, crack sealing and edge repair be performed to protect the integrity of the repairs.

Previous Repairs performed by the City include reconstruction and resurfacing.

The final recommended repair for each segment is selected based on the existing PCR score and the pavement functional classification (Collector or Local) using the following assignments for the City of Woodcreek.

A summary of the individual scores and recommended treatments can be found in Appendix B.

Table 6: Flexible Pavement Repair Table Based on Pavement Condition Rating (PCR) Score

PCR Range	Treatment Category	Improved PCR After Funding of Treatment
HMAC Minor Collector		
0-50	RECONSTRUCTION WITH TWO-COURSE SURFACE TREATMENT & EDGE REPAIR	100
51-65	CRACK SEAL AND ONE-COURSE SURFACE TREATMENT AND EDGE REPAIR	100
66-80	CRACK SEAL AND EDGE REPAIR	95
81- 90	CRACK SEAL	90
91-100	DO NOTHING	n/a
HMAC Local		
0-30	RECONSTRUCTION WITH TWO-COURSE SURFACE TREATMENT & EDGE REPAIR	100
31-50	CRACK SEAL AND ONE-COURSE SURFACE TREATMENT AND EDGE REPAIR	100
51-65	CRACK SEAL AND EDGE REPAIR	95
66-80	CRACK SEAL	85
81-100	DO NOTHING	n/a

Existing Strength Values

Non-destructive deflection testing was also performed on all streets in the City of Woodcreek to evaluate the relative strength of the existing pavement layers. These measurements provide relative information regarding variations in the subgrade soil and the existing flexible base and asphalt pavement layers. HVJ tested at 200 ft. spacing along the collector streets Brookhollow Dr. and Woodcreek Dr. and every 400 ft. on the remaining local streets with at least one point per street.

Deflection profiles and a summary of the average subgrade (W1) and surface (W7) deflection values for each street are included in Appendix C.

Woodcreek and Brookhollow Drives indicated surface modulus values of 70,000 to 74,300 psi for the asphalt surface, a base modulus of 25,500 to 47,000 psi for the flexible base and a subgrade modulus of 29,600 to 37,200 psi. The surface and base moduli fall within the typical ranges for the material types. The subgrade modulus indicates a very strong subgrade giving good support to the pavement layers above. Outputs from the analysis program MODULUS are given in Appendix D.

The remaining local streets demonstrate a relatively high level of variation in the deflection along the existing pavement on most of the streets which can be due to a number of conditions, such as: varying cross section thickness and layer materials, varying depth of the harder limestone layer, weak areas in the underlying subgrade, existing pavement cracking, etc. Analysis of the average surface and subgrade deflections in comparison to Brookhollow and Woodcreek indicate that the majority of the streets demonstrate comparable characteristics to the main streets. The exceptions to this are Canyon Cir., Elmbrook, Garrison Trl., Palmer, Woodview Ct., and Brookside (PCC section) which show higher subgrade deflections and Canyon Cir., Country Ct., Elmbrook, Garrison Trl., and Wildwood Cir. which demonstrate higher surface deflections indicating weaker areas. A summary of the average subgrade (W1) and surface (W7) deflection values for each street are included in Appendix C.

5. CONCLUSIONS AND RECOMMENDATIONS

Based on the rated condition, post repair PCR and the classification (collector or local) of the sections, HVJ has assigned a priority ranking to each street with 1 being the highest priority. It is recommended that repairs be done on a street by street basis, or by combining multiple nearby smaller streets to potentially aid in the reduction of construction mobilization and cost. Recommended priority by street is shown in Appendix B.

6. REFERENCES

1. *Street Surface Condition and Inventory Rating Guidelines*

APPENDIX A
DEDUCTION VALUES

Table A-1 PCR Deduct Values for Determining Pavement Condition Rating (PCR) Score

Surface Type	Distress Type	Deduct Values by Distress Type and Distress Severity / Extent Level ^A								
		1	2	3	4	5	6	7	8	9
Flexible	Ride	6	4	2	0	0				
	Rutting	0	2	5	5	7	10	10	12	15
	Raveling	5	8	10	10	12	15	15	18	20
	Edge Cracking	2	3	4	3	4	3	4	5	6
	Alligator Cracking	5	10	15	10	15	20	15	20	25
	Pavement Failure Patches	0	2	5	5	7	10	7	15	20
	Utility Cut Patches	0	2	5	5	7	10	7	15	20
	Transverse / Longitudinal Cracking – Not Sealed	2	3	4	3	4	3	4	5	6
	Transverse / Longitudinal Cracking – Partially Sealed	1	2	3	2	3	4	3	4	5
	Transverse / Longitudinal Cracking – Sealed	0	1	2	1	2	3	2	3	4

A. Distress Severity/Extent Level Key

Severity	Extent		
	Localized 1-15%	Intermittent 16-30%	Prevalent >30%
Slight	1	2	3
Moderate	4	5	6
Extreme	7	8	9

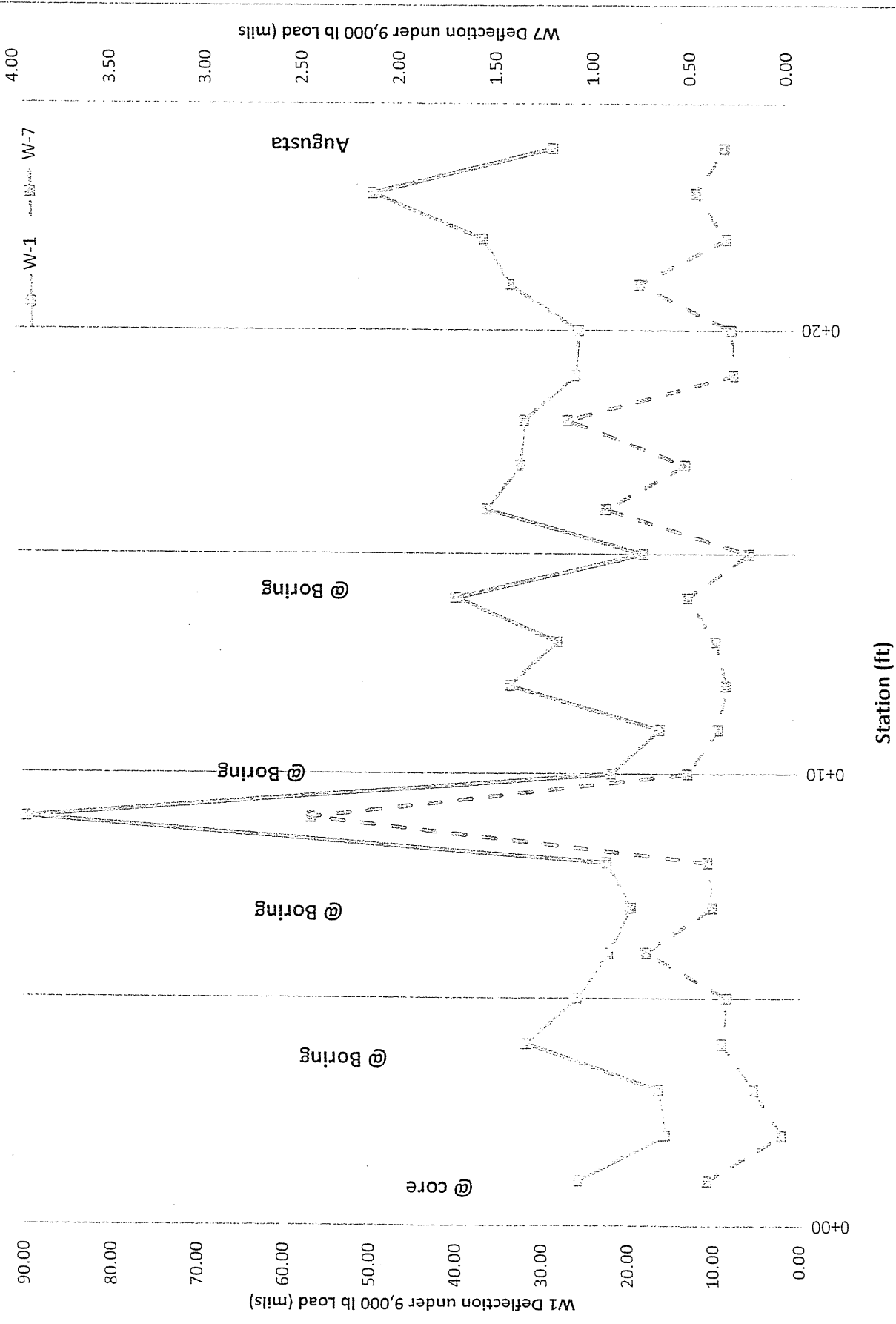
APPENDIX B
Pavement Condition Scores by Block

Street	From	To	PCR CLASS	TREATMENT	Priority
Augusta Dr.	End	Brookhollow Dr.	95 L	Do Nothing	
Augusta Dr.	Brookhollow Dr.	Augusta Ln.	98 L	Do Nothing	
Augusta Dr.	Augusta Ln.	Brookmeadow Dr.	98 L	Do Nothing	
Augusta Dr.	Brookmeadow Dr.	Augusta Ln.	98 L	Do Nothing	
Augusta Dr.	Augusta Ln.	Brookhollow Dr.	82 L	Do Nothing	
Augusta Ln.	Augusta Dr.	Augusta Dr.	75 L	Crack Seal	11
Brookhollow Spur	Woodcreek Dr.	Brookhollow Dr.	92 C	Do Nothing	
Brookhollow Dr.	Woodcreek Dr.	Brookhollow Spur	90 C	Do Nothing	
Brookhollow Dr.	Brookhollow Spur	Westwood Dr.	82 C	Crack Seal	
Brookhollow Dr.	Westwood Dr.	Overbrook Ct.	86 C	Crack Seal	
Brookhollow Dr.	Overbrook Ct.	Par Cir.	87 C	Crack Seal	16
Brookhollow Dr.	Par Cir.	Augusta Dr.	88 C	Crack Seal	
Brookhollow Dr.	Augusta Dr.	Jack Miller Dr.	93 C	Do Nothing	
Brookhollow Dr.	Jack Miller Dr.	Country Ln.	87 C	Crack Seal	
Brookhollow Dr.	Country Ln.	Augusta Dr.	85 C	Crack Seal	
Brookmeadow Dr.	Augusta Dr.	Shady Grove Ln.	95 L	Do Nothing	
Brookmeadow Dr.	Shady Grove Ln.	Brookside Dr.	90 L	Do Nothing	
Brookmeadow Dr.	Brookside Dr.	Elmbrook Dr.	93 L	Do Nothing	
Brookmeadow Dr.	Elmbrook Dr.	Villa Meadow	97 L	Do Nothing	
Brookmeadow Dr.	Villa Meadow	SH 12	95 L	Do Nothing	
Brookside Dr.-N	Brookmeadow Dr.	End	86 L	Do Nothing	
Brookside Dr.-S	Brookmeadow Dr.	End	80 L	Crack Seal	19
Canyon Cir.	Canyon Creek Dr.	End	74 L	Crack Seal	10
Canyon Creek Dr.	Champions Cir.	Garrison Trail	83 L	Do Nothing	
Canyon Creek Dr.	Garrison Trail	Woodview Ct.	83 L	Do Nothing	
Canyon Creek Dr.	Woodview Ct.	Woodridge Cir.	81 L	Do Nothing	
Canyon Creek Dr.	Woodridge Cir.	Canyon Cir.	83 L	Do Nothing	
Canyon Creek Dr.	Canyon Cir.	End	83 L	Do Nothing	
Champion Ct.	Champions Cir.	End	82 L	Do Nothing	
Champions Cir.	Woodcreek Dr.	Overlook Ct.	95 L	Do Nothing	
Champions Cir.	Overlook Ct.	Palmer Ln.	95 L	Do Nothing	
Champions Cir.	Palmer Ln.	Palmer Ln.	97 L	Do Nothing	
Champions Cir.	Palmer Ln.	Canyon Creek Dr.	96 L	Do Nothing	
Champions Cir.	Canyon Creek Dr.	Fallbrook Cir.	93 L	Do Nothing	
Champions Cir.	Fallbrook Cir.	Champions Ct.	95 L	Do Nothing	
Champions Cir.	Champions Ct.	Tremont Trce	97 L	Do Nothing	
Champions Cir.	Tremont Trce	Woodcreek Dr.	97 L	Do Nothing	
Country Ct.	Country Ln.	End	85 L	Do Nothing	
Country Ln.	Brookhollow Dr.	Country Ct.	87 L	Do Nothing	
Country Ln.	Country Ct.	End	74 L	Crack Seal	17
Cypress Point	Woodcreek Dr.	Cypress Point	70 L	Crack Seal	
Cypress Point	Cypress Point	Cypress Point	62 L	Crack Seal	
Cypress Point	Cypress Point	Cypress Point	85 L	Do Nothing	12
Cypress Point	Cypress Point	End	70 L	Crack Seal	

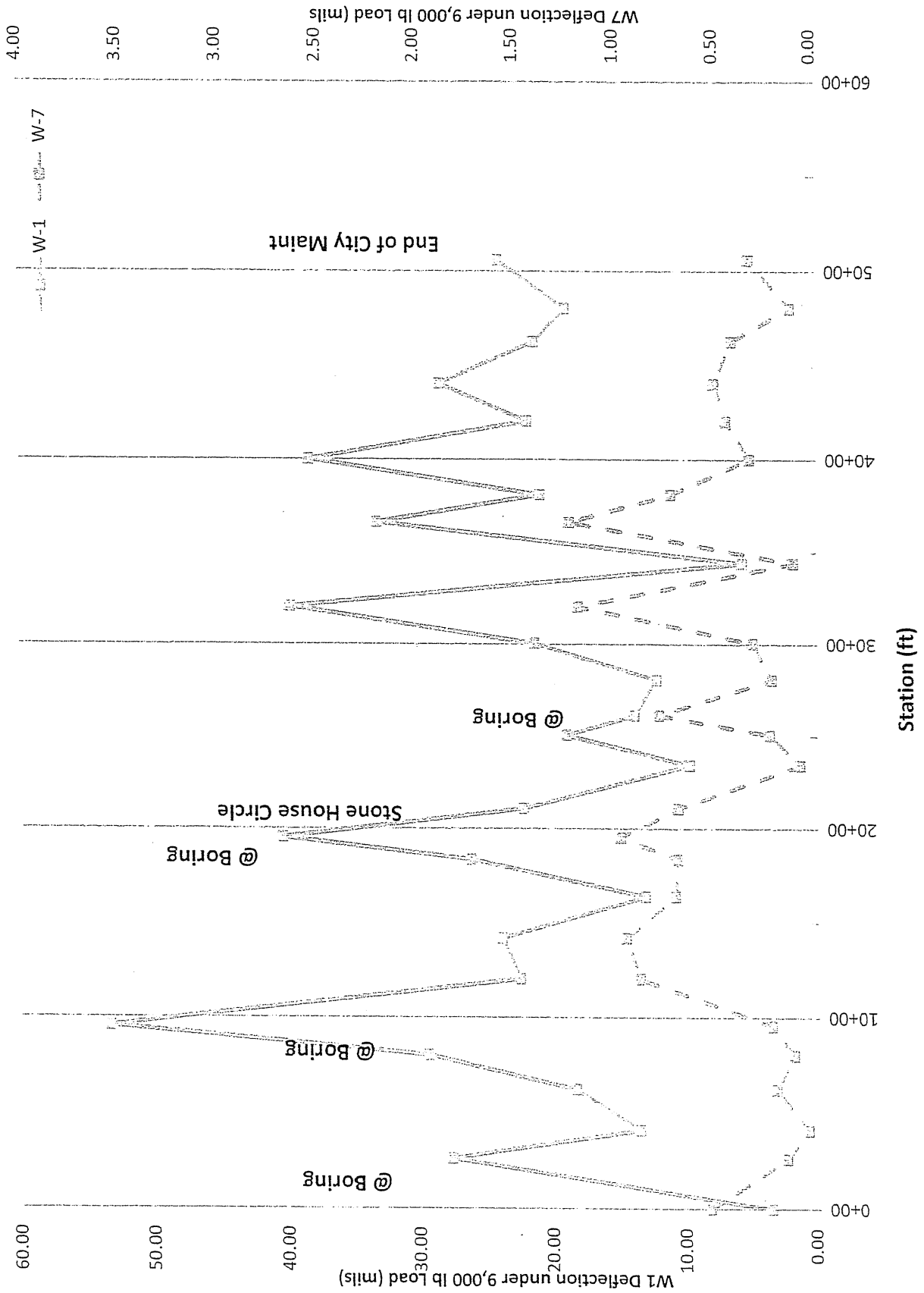
Street	From	To	PCR CLASS	TREATMENT	Priority
Deerfield Dr.	Woodcreek Dr.	End	97 L	Do Nothing	
Doolittle Dr. South	Cypress Point	Jack Miller Dr.	39 L	Crack seal and One-Course Surface Treatment with Edge Repair	3
Doolittle Dr. North	Jack Miller	Wildwood Cir.	75 L	Crack Seal	
Elmbrook Dr.	Brookmeadow Dr.	End	85 L	Do Nothing	
Garrison Trail	Canyon Creek Dr.	End	80 L	Crack Seal	15
Jack Miller Dr.	Doolittle Dr	Brookhollow Dr.	59 L	Crack Seal and Edge Repair	1
McGregor Cir.	Spalding Cir.	End	78 L	Crack Seal	13
Overbrook Ct.	Brookhollow Dr.	End	58 L	Crack Seal and Edge Repair	1
Overlook Ct.	Champions Cir.	Overlook Ct.	72 L	Crack Seal	
Overlook Ct.	End	End	74 L	Crack Seal	8
Palmer Ln.	Champions Cir.	Wilson Cir.	85 L	Do Nothing	
Palmer Ln.	Wilson Cir.	Champions Cir.	85 L	Do Nothing	
Par Cir.	Brookhollow Dr.	End	79 L	Crack Seal	14
Par View Dr.	Woodcreek Dr.	End	74 L	Crack Seal	9
Pebblebrook Ln.-E	End	Westwood Dr.	70 L	Crack Seal	
Pebblebrook Ln.-W	Westwood Dr.	End	73 L	Crack Seal	7
Shady Grove Ln.-S	Brookmeadow Dr.	End	77 L	Crack Seal	
Shady Grove Ln.-N	Brookmeadow Dr.	End	98 L	Do Nothing	12
Spalding Cir.	Wilson Cir.	McGregor Cir.	88 L	Do Nothing	
Spalding Cir.	McGregor Cir.	End	76 L	Crack Seal	18
Stonehouse Cir.	Woodcreek Dr.	End	70 L	Crack Seal	6
Tremont Trace	Champions Cir.	End	68 L	Crack Seal	5
Westwood Dr.	Pebblebrook Ln.	Brookhollow Dr.	77 L	Crack Seal	12
Wildwood Cir.	Doolittle Dr	Doolittle Dr.	81 L	Do Nothing	
Wilson Cir.	Palmer Ln.	Spalding Cir.	65 L	Crack Seal and Edge Repair	
Wilson Cir.	Spalding Cir.	End	74 L	Crack Seal	2
Woodcreek Dr	SH 12	Deerfield Dr.	98 C	Do Nothing	
Woodcreek Dr	Deerfield Dr.	Par View Dr.	97 C	Do Nothing	
Woodcreek Dr	Par View Dr.	Stonehouse Cir.	95 C	Do Nothing	
Woodcreek Dr	Stonehouse Cir.	Brookhollow Dr.	78 C	Crack Seal and Edge Repair	
Woodcreek Dr	Brookhollow Dr.	Brookhollow Dr.	96 C	Do Nothing	4
Woodcreek Dr	Brookhollow Dr.	Pro Ln.	87 C	Crack Seal	
Woodcreek Dr	Pro Ln.	Champions Cir.	93 C	Do Nothing	
Woodcreek Dr	Champions Cir.	Cypress Point	74 C	Crack Seal and Edge Repair	
Woodridge Cir.	Canyon Creek Dr.	End	78 L	Crack Seal	13
Woodview Ct.	Canyon Creek Dr.	End	81 L	Do Nothing	

APPENDIX C
Deflection Profiles

Brookhollow Drive Deflections



Woodcreek Drive Deflections



Local Street	Average Subgrade Deflection (W7), mils
Augusta Dr.	0.62
Augusta Ln.	0.42
Brookhollow Dr.	0.55
Brookmeadow	0.52
Brookside Dr.	0.52
Brookside Dr. PCC	12.54
Canyon Cir.	1.02
Canyon Creek	0.65
Champions Cir.	0.51
Champions Ct.	0.22
Country Ct.	0.60
Country Ln.	0.42
Cypress Point	0.44
Deerfield	0.47
Dolittle Dr.	0.36
Elmbrook	1.18
Garrison Trl.	0.76
Jack Miller	0.25
McGregor Cir	0.79
Overbrook	0.43
Overlook	0.65
Palmer Ln.	0.82
Par Cir.	0.47
Par View	0.53
Pebblebrook	0.48
Shady Grove	0.32
Spalding Cir.	0.60
Stonehouse Cir.	0.41
Tremont Trace	0.35
Westwood	0.37
Wildwood Cir.	0.38
Wilson Cir.	0.65
Woodbridge Cir.	0.37
Woodcreek Dr.	0.49
Woodview Ct.	0.81

Local Street	Average Surface Deflection (W1), mils
Augusta Dr.	27.69
Augusta Ln.	22.67
Brookhollow Dr.	29.63
Brookmeadow	16.70
Brookside Dr.	41.45
Brookside Dr. PCC	28.87
Canyon Cir.	54.33
Canyon Creek	30.12
Champions Cir.	26.15
Champions Ct.	25.25
Country Ct.	65.55
Country Ln.	26.26
Cypress Point	17.00
Deerfield	26.71
Dolittle Dr.	42.29
Elmbrook	46.04
Garrison Trl.	45.41
Jack Miller	35.11
McGregor Cir	42.86
Overbrook	41.74
Overlook	26.40
Palmer Ln.	17.70
Par Cir.	41.40
Par View	29.68
Pebblebrook	24.88
Shady Grove	29.04
Spalding Cir.	43.81
Stonehouse Cir.	29.45
Tremont Trace	23.73
Westwood	24.65
Wildwood Cir.	49.37
Wilson Cir.	38.26
Woodbridge Cir.	43.79
Woodcreek Dr.	22.87
Woodview Ct.	33.21

APPENDIX D
MODULUS Outputs

BROOKHOLLOW DRIVE

(Version 6.0)

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT)														
Station	Load (lbs)	Measured Deflection (mils):					Calculated Moduli values (ksi):					Poisson Ratio Values		
		R1	R2	R3	R4	R5	R6	R7	SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	ERR/Sens	Dpth to Bedrock
0.000	9,047	25.88	7.31	2.74	1.37	1.10	0.87	0.48	100.0	20.5	0.0	57.2	13.38	91.1 *
600.000	8,971	31.36	10.06	4.70	2.70	0.90	0.47	0.39	50.0	18.4	0.0	41.2	23.52	212.8 *
800.000	8,993	25.56	8.93	3.78	1.82	0.74	0.49	0.36	100.0	21.7	0.0	51.1	19.19	140.6 *
1000.000	8,565	20.78	10.96	6.34	4.35	2.30	1.27	0.74	50.0	55.7	0.0	25.7	5.50	56.4 *
1200.000	8,982	19.14	6.78	3.16	1.93	1.12	0.64	0.43	100.0	34.3	0.0	53.5	5.39	55.7 *
1300.000	8,982	21.89	8.19	4.89	3.22	1.57	0.86	0.45	50.0	37.1	0.0	35.5	5.75	52.3 *
1400.000	8,982	88.97	16.29	8.94	5.50	3.49	3.39	2.49	50.0	10.0	0.0	17.0	22.61	59.3 *
1600.000	8,817	20.90	10.81	5.82	3.27	1.26	0.65	0.54	50.0	40.6	0.0	33.0	21.97	102.4 *
1800.000	9,014	15.64	6.22	3.50	2.18	0.95	0.57	0.39	50.0	53.0	0.0	49.4	8.39	59.5 *
2000.000	9,047	33.13	9.79	3.37	1.35	0.71	0.47	0.35	100.0	15.0	0.0	50.1	19.59	90.6 *
2400.000	8,960	38.85	10.45	5.37	3.61	1.55	0.91	0.54	50.0	15.1	0.0	33.4	9.49	55.9 *
2800.000	8,916	35.09	12.98	6.78	4.47	2.60	1.46	0.95	74.9	20.3	0.0	24.6	4.34	64.3
3000.000	9,025	31.55	12.77	6.43	3.39	1.45	0.82	0.55	50.0	21.5	0.0	22.5	16.14	85.0 *
3200.000	9,059	31.23	15.15	8.32	4.56	2.17	1.33	1.16	100.0	26.2	0.0	30.3	10.86	61.7 *
3400.000	8,938	24.81	12.02	7.27	4.36	1.12	0.53	0.29	100.0	29.5	0.0	30.6	42.92	300.0 *
3800.000	9,004	32.55	9.37	4.69	2.87	1.52	1.04	0.78	86.3	18.5	0.0	37.9	8.02	52.1
4000.000	8,982	35.47	11.53	5.32	2.78	0.94	0.51	0.32	100.0	15.1	0.0	38.3	27.15	300.0 *
4200.000	9,025	48.39	15.51	6.36	2.12	0.70	0.61	0.48	100.0	10.0	0.0	33.3	37.48	59.1 *
4400.000	8,905	26.99	8.55	4.61	2.74	1.03	0.46	0.32	50.0	23.1	0.0	42.3	18.32	94.9 *
Mean:		32.01	10.72	5.39	3.08	1.43	0.91	0.63	74.3	25.5	0.0	37.2	16.84	73.3
Std. Dev:		15.86	2.89	1.73	1.17	0.74	0.68	0.51	24.4	13.2	0.0	11.2	10.86	31.1
Var Coeff(%):		49.54	26.95	32.09	37.92	51.32	73.93	79.90	32.9	51.5	0.0	30.2	64.47	40.4

District:
 County :
 Highway/Road:

Pavement: 0.75
 Base: 6.00
 Subbase: 0.00
 Subgrade: 66.52 (by DB)

Thickness (in)
 R1: 0.75
 R2: 6.00
 R3: 0.00
 R4: 66.52 (by DB)

MODULI RANGE (psi)
 Minimum 50,000
 Maximum 100,000
 Subgrade 10,000

Poisson Ratio Values
 H1: v = 0.38
 H2: v = 0.35
 H3: v = 0.00
 H4: v = 0.40

WOODCREEK DRIVE

(Version 6.0)

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT)

District:

County :

Highway/Road:

Thickness(in)

2.75

3.00

0.00

Subgrade: 48.45(User Input)

MODULI RANGE(psi)

Minimum

50,000

10,000

5,000

Maximum

100,000

150,000

Poisson Ratio Values

H1: v = 0.38

H2: v = 0.35

H3: v = 0.00

H4: v = 0.40

Station	Load (lbs)				Measured Deflection (mils):				Calculated Moduli values (ksi):				Absolute Dpth to	
	R1	R2	R3	R4	R5	R6	R7	R7	SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	ERR/Sens	Bedrock
1204.000	8,993	22.29	10.13	5.40	3.13	1.64	1.16	0.89	55.3	44.5	0.0	26.5	12.04	49.4
1418.000	8,927	23.47	12.08	6.63	4.04	2.07	1.37	0.95	77.0	47.9	0.0	21.2	12.18	50.1
1640.000	8,763	12.56	6.31	3.72	2.33	1.24	0.84	0.69	100.0	135.5	0.0	37.0	13.66	53.8 *
1836.000	9,004	25.99	12.93	8.23	5.62	2.81	1.33	0.70	88.7	10.0	0.0	17.2	12.94	54.1 *
1953.000	9,047	40.44	12.69	5.18	2.99	1.92	1.43	0.99	50.0	10.0	0.0	25.6	20.49	69.8 *
2108.000	8,960	21.92	12.47	7.59	4.58	1.72	0.98	0.69	100.0	59.9	0.0	20.0	13.01	46.7 *
2506.000	9,004	18.77	7.28	3.27	1.44	0.28	0.10	0.22	100.0	16.2	0.0	54.0	55.53	76.4 *
2613.000	8,905	13.51	7.35	4.71	3.53	2.41	1.50	0.78	100.0	150.0	0.0	29.9	24.57	66.5 *
3005.000	9,036	21.22	6.22	2.67	1.56	0.88	0.43	0.31	52.3	19.4	0.0	52.3	12.17	53.9 *
3204.000	9,004	39.62	18.16	9.22	5.46	3.05	1.73	1.19	50.0	17.7	0.0	15.2	12.91	53.6 *
3663.000	8,916	32.71	13.49	9.00	6.05	3.04	1.76	1.22	50.0	37.5	0.0	16.2	18.12	53.4 *
3812.000	8,697	19.96	8.66	4.86	3.17	1.70	0.98	0.70	50.0	62.0	0.0	27.9	15.19	57.3 *
4003.000	8,982	38.08	17.53	7.85	3.37	0.91	0.44	0.32	66.6	10.0	0.0	22.0	26.11	62.2 *
4206.000	8,839	21.18	10.95	5.72	2.83	0.85	0.48	0.43	100.0	25.3	0.0	29.0	17.93	54.9 *
4406.000	9,004	28.24	9.10	4.70	2.83	1.33	0.77	0.50	50.0	17.5	0.0	31.6	13.32	47.3 *
4629.000	9,004	21.06	10.09	5.79	3.33	1.35	0.73	0.41	87.8	41.1	0.0	26.5	11.07	46.5 *
5060.000	9,014	23.78	5.88	3.06	1.70	0.58	0.46	0.32	51.8	15.7	0.0	51.8	21.40	49.4 *
Mean:		24.99	10.67	5.74	3.41	1.63	0.97	0.67	70.0	47.0	0.0	29.6	18.39	53.6
Std. Dev:		8.33	3.68	2.06	1.37	0.84	0.50	0.31	22.6	42.1	0.0	12.4	10.63	7.0
Var Coeff(%) :		33.34	34.53	35.84	40.31	51.27	51.32	46.75	32.2	89.6	0.0	41.8	57.82	13.1

