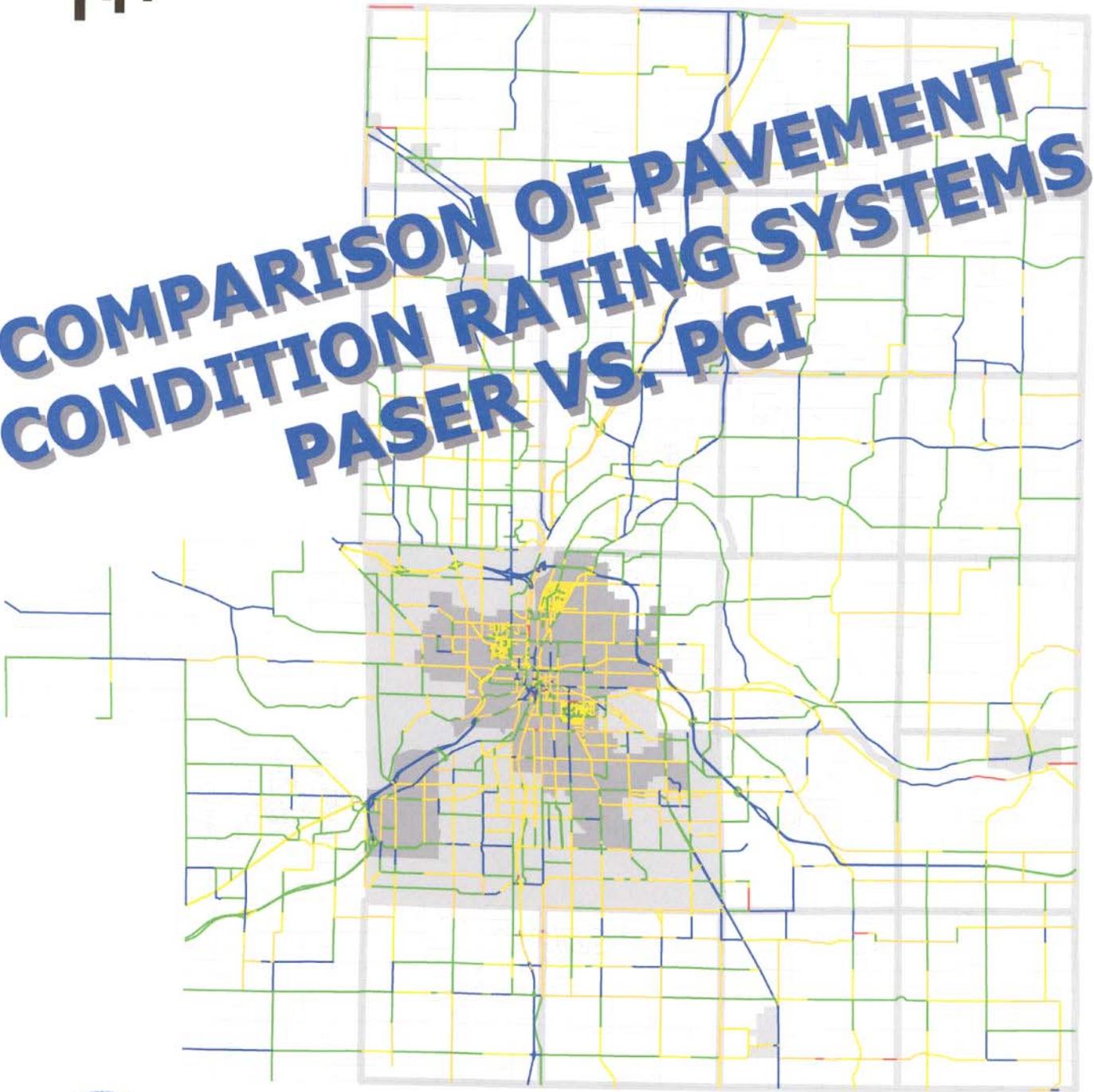




KENT COUNTY ROAD COMMISSION

COMPARISON OF PAVEMENT CONDITION RATING SYSTEMS PASER VS. PCI



Grand Valley Metropolitan Council
Established in 1990



KENT COUNTY
ROAD COMMISSION

Introduction

In November 2001, the Kent County Road Commission (KCRC) participated in a collaborative effort with the Michigan Department of Transportation (MDOT), and the Grand Valley Metropolitan Council (GVMC) to complete an assessment of the metropolitan areas' Federal Aid Network using the Pavement Surface Evaluation and Rating System (PASER). The County Road Association of Michigan (CRAM) and the Michigan Department of Transportation have been working together to assess the PASER system in both rural and urban counties. This project is the last in a series of five demonstration projects assembled by the two agencies in conjunction with other county road commissions. The objectives for these demonstration projects have included the following items:

- Evaluating the feasibility of using the PASER system on Michigan's road system
- Determining time and resources for conducting these surveys on the Federal Aid and Non-Federal Aid networks
- Evaluate procedures for mobile collection of road condition data using Geographic Information Systems (GIS) and Global Positioning Systems (GPS)
- Promotion of working relationships between government agencies involved in transportation asset management initiatives

In addition to the objectives listed above, KCRC's primary objective for participating was to thoroughly evaluate the PASER system as an alternative to the current Pavement Management System, MicroPAVER.

Background

In order to complete a thorough comparison of MicroPAVER's Pavement Condition Index methodology and the PASER system, some background into Kent County's Pavement Management Program is necessary. In the mid 1990s, the GVMC with cooperation from the KCRC and the cities of Grand Rapids, Walker, Wyoming, Kentwood, and Grandville, implemented the MicroPAVER Pavement Management System for the Federal Aid network in Kent County. MicroPAVER, developed by Dr. M.Y. Shahin and the US Army Corps of Engineers, utilizes a pavement inspection process that measures and inventories all existing distresses of a pavement network. These distresses include Alligator, Block and Edge cracking, Rutting, Bleeding, Potholes, Patches, and Shoving. The complete list of distresses is found on the Pavement Inspection form used by the Kent County Road Commission (see attachment 1). A random sampling method is used to identify segments to be inspected, as it is not necessary to gather distress data for the entire network of pavement. All data gathered from the inspection is loaded into the MicroPAVER software, and a PCI rating is then assigned to each corresponding pavement section, based upon a calculation of deduct values based from the entered distresses.

Due to the fact that Kent County has a significant number of miles on the Federal Aid system, pavement inspections are performed on 1/3 of the system each year. The

Lansing, Michigan-based consulting firm Soils and Materials Engineers (SME) was hired by the GVMC to perform these inspections.

In 2000, the Kent County Road Commission began implementation of MicroPAVER to inventory all the Local Roads within the townships of Kent County. For this operation, members of the KCRC's staff were trained to perform the pavement inspections. Again, due to the large number of miles on the pavement network, it was decided that 1/3 of the county's local roads would be inspected each year.

Methodology

The PASER methodology that has been developed for this project consisted of dividing the participating staff members of MDOT, KCRC, GVMC, and Michigan Technological University into four teams. Teams were provided with the Michigan Information Center's Framework layer loaded into the Maptitude software on laptop computers and a GPS device that displayed the team's location on the digital Framework map. The data gathering and entry process consisted of driving all the identified roads while giving a windshield rating of the pavement condition on a scale of 1 to 10, and entering the data on the laptop for that segment. Staff performing these surveys had been previously trained to look for various distresses that warrant certain ratings, and were provided with inspection manuals to aid in the designation of the PASER index.

For the PASER Analysis, the KCRC not only wanted to see how the PASER ratings compared to the PCI ratings of the County Primary system, but also to see how it compared with PCI ratings gathered from the Local Roads, as well. Therefore, the participants agreed that an additional 50 miles of Local Roads in Alpine Township would be rated in addition to the Federal Aid system. The roads in Alpine Township were chosen, due to the fact that they were recently inspected using the PCI methodology.

The first step in comparing data sets of PASER and PCI was to export the Framework GIS file from a Maptitude file into an ArcView Shapefile, as the PCI data for Kent County exists in this format. Then, an additional field "PCI_01" was added to the Framework table to enter the corresponding PCI for every segment on the County Primary system (637.82 miles) and the 49.35 miles of Local Roads in Alpine Township. Note, that there are more than 637.82 miles on the County Primary system, however, some roads that have maintenance agreements with other municipalities were excluded for this comparison. Primary Roads selected for this analysis can be viewed on Map 1(attachment 2) and Local Roads on Map 2 (attachment 3).

Analysis

Since the Framework data layer has both the PCI rating and PASER rating for each segment of road on the Kent County Primary and Alpine Local networks, the Planning Division of KCRC performed queries to calculate the number of miles in both the KCRC's Improvement Category Distribution and the PASER Asset Management Scale.

Charts 1 and 2 (pages 5 and 6) are examples of how KCRC distributes pavement condition ranges for each improvement category. These ranges have been developed by the Planning Division of the Kent County Road Commission, and have been applied to

network conditions for the past few years. The three categories, Maintain, Preserve, and Reconstruct aid the KCRC in the development of needs lists for future improvements and the Five-Year Primary Road Improvement Plan. PASER categories were also applied to this scale, based upon an equivalency table (Table 1) assembled by the University of Wisconsin, the developers of the PASER system (KCRC acknowledges Fernando de Melo y Silva of Michigan Technological University for providing this table).

Table 1

| WISLR PAVEMENT TABLE OF EQUALS | | | |
|--------------------------------|-----------------|-------------|--------------|
| PCI Based System | "Unpaved" Roads | Paved Roads | PASER RATING |
| | 0 – 29 | 0 – 25 | 1 |
| | 30 – 49 | 26 – 40 | 2 |
| | 50 – 70 | 41 – 49 | 3 |
| | 71 – 85 | 50 – 55 | 4 |
| | 86 – 100 | 56 – 64 | 5 |
| | | 65 – 70 | 6 |
| | | 71 – 79 | 7 |
| | | 80 – 85 | 8 |
| | | 86 – 94 | 9 |
| | | 95 - 100 | 10 |

As previously mentioned, a query of the data also produced charts of the PASER Asset Management Scale that was developed by the Genesee County Pilot team. Again, the WISLR equivalency table (Table 1) aided in applying breaks between categories for PCI ratings and the corresponding PASER ratings. Charts 3 through 6 (pages 7 through 10) represent the mileage distributions of the Kent County Primary network and the Alpine Township Local network as categorized by the Asset Management Scale.

Observations

In the analysis of the KCRC Improvement Category Distribution (Charts 1 and 2), it appears that the rating systems are quite similar, with the PCI system rating the roads less severely in the "Reconstruction" and "Maintain" categories. There was a somewhat significant increase in the "Reconstruction" category of the Local roads using the PASER system. However, when applying the PASER Asset Management Scale, the distribution categories seem quite different (Charts 3-6). The two categories that are affected most by the change in scale are the "No Maintenance" and "Reconstruction" categories, which are at each end of the Asset Management Scale. Using the Asset Management Scale, it is important to note that very few overall segments are identified as needing reconstruction, however, with the PCI method, about 13 % in both the local and primary systems indicate a need for reconstruction.

One possible reason for the major differences in the "No Maintenance" categories between PCI and PASER is the impact of a new surface treatment. For example, the PCI of a fresh sealcoat (chipseal) is 100. Using PASER, the highest possible rating for a new sealcoat is an 8. Therefore, this can account for some of the variance between the two systems, because KCRC applied approximately 30 miles of surface treatments on the Primary system and about 4 miles to the Local Roads in Alpine Township. Recent overlays might also account for the varying degrees of miles in similar fashion.

The impact of differing surface types and the corresponding rating procedures was an issue of note by KCRC. Initially, the University of Wisconsin established a specific procedure for rating “Sealcoat” roads because they perform much different from Asphalt and Gravel roads. The PASER Sealcoat Manual has been established to rate these kinds of roads on a scale of 1 to 5, with 5 being the best possible rating. The rationale behind applying a different scale for sealcoat and asphalt surfaces is due to the fact that these surfaces are not equal in terms of Service Life and Structural Capacity.

For this project, the procedure for rating roads that have a sealcoat over gravel surface was to apply an even numbered 2-8 rating. As mentioned earlier, these surface types (asphalt and sealcoat) are not equal, and for the case of the KCRC, the maintenance and rehabilitation on these two surfaces is much different. For example, if a road that has an asphalt surface were rated a 2, 3, or a 4, the Asset Management Scale would identify that segment to be in need of a major structural improvement or complete reconstruction. However, if a road that has a treated surface (sealcoat) is rated 2, 3, or 4 (or 2, 4, or 6 for this project), it is most commonly improved by applying another surface treatment. Therefore the Asset Management Scale that has been established needs to be adjusted to take in account for the difference in surface types.

Tables 2 and 3 (page 11) represent the statistical breakdown of the PCI ranges as distributed by the PASER index in miles. Again, the University of Wisconsin’s equivalency table was used to define the PCI ranges. Each PCI range has a corresponding PASER equivalency highlighted in yellow. Mileages in bold red text identify the most common PASER rating for each PCI range. It is important to note that for PASER index ratings of 1, 2, 9 and 10, the data shows almost no impact to the overall distribution. Overall, the comparison shows that in general, the PASER rating is less critical on severely deteriorated roads, and more critical on excellent roads than the PCI system.

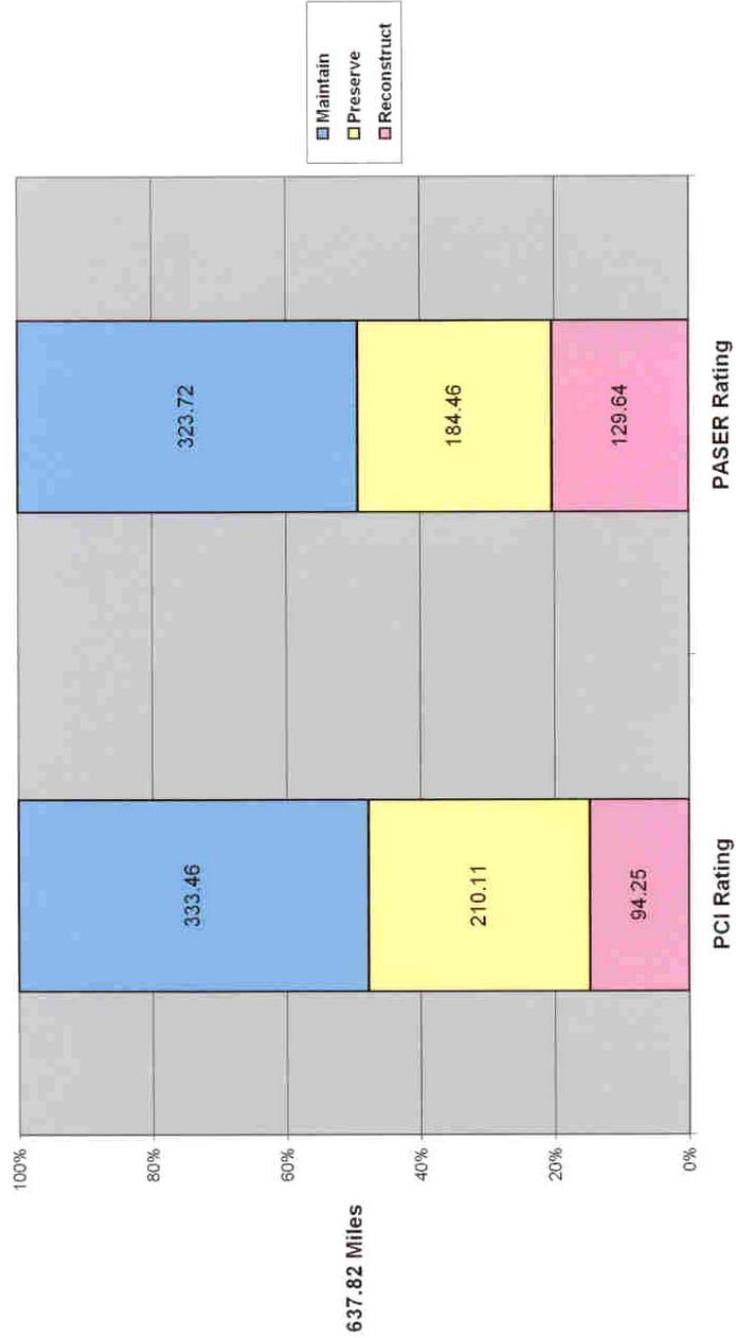
The overall length of time to complete the PASER survey on the Federal Aid system and the additional 50 miles of Local Alpine Township roads took only 4 days. As mentioned earlier, the complete Federal Aid system in the Grand Valley Metropolitan area using the PCI method is updated with new inspection data every 3 years.

Conclusions

The speed of the data collection using the PASER method does exceed the laborious task of gathering pavement distresses for MicroPAVER. Additionally, the cost and time involved in rating roads is considerably lower with PASER, as well. It may be possible with PASER to update the surface condition of every road under the jurisdiction of the KCRC annually. However, the data collected with PASER does not allow for further research as to the cause behind the surface rating. MicroPAVER provides staff with the ability to research the data for justification as to why a road segment has a certain rating. For this level of detail on the County Primary System, the additional cost and effort for using MicroPAVER is justified. However, the PASER system has merit for assessing surface conditions of the rural Local Road system, where considerable level of detail is not as necessary, and pavement surfaces vary.

Comparison of Pavement Condition Distribution by KCRC Improvement Category

Chart 1: Primary Roads - Kent County



| Condition Category | PCI Rating | PASER Rating |
|--------------------|------------|--------------|
| Maintain | 71 - 100 | 7 - 10 |
| Preserve | 46 - 70 | 5 - 6 |
| Reconstruct | 0 - 45 | 1 - 4 |

Comparison of Pavement Condition Distribution by KCRC Improvement Category

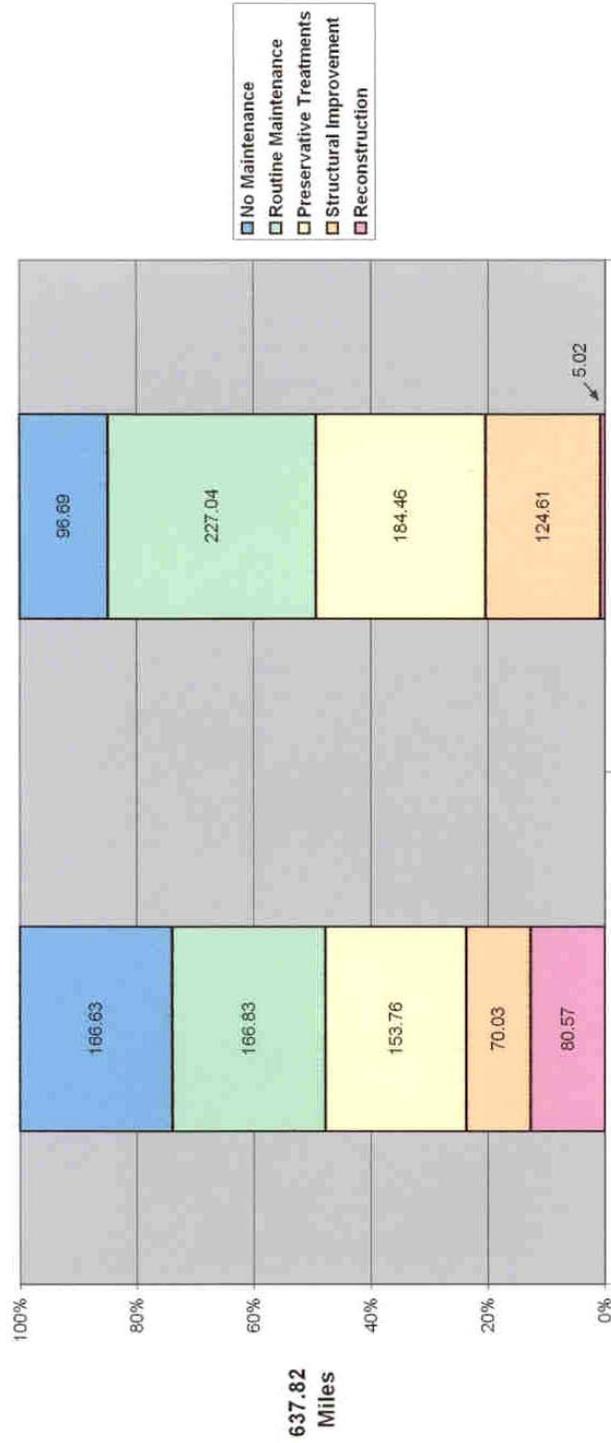
Chart 2: Local Roads - Alpine Township



| Condition Category | PCI Rating | PASER Rating |
|--------------------|------------|--------------|
| Maintain | 71 - 100 | 7 - 10 |
| Preserve | 46 - 70 | 5 - 6 |
| Reconstruct | 0 - 45 | 1 - 4 |

Comparison of Pavement Condition Distribution
by PASER Asset Management Scale

Chart 3: Primary Roads - Kent County



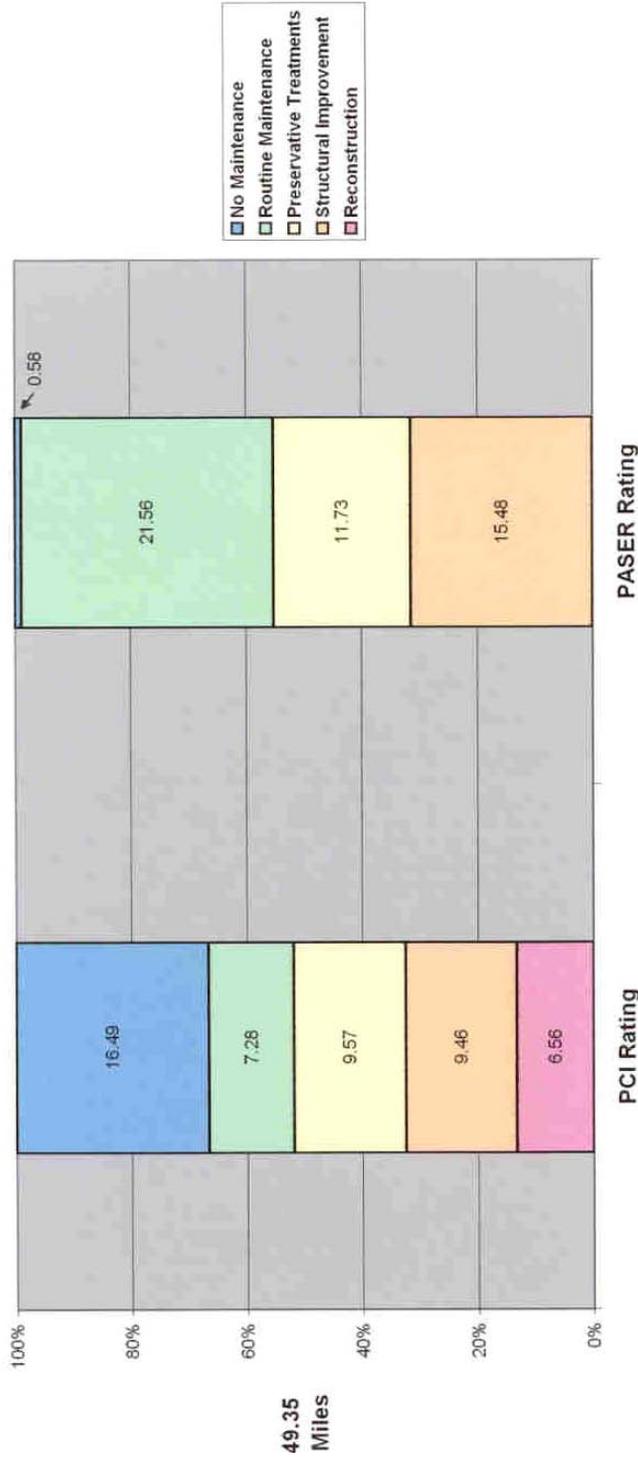
PASER Rating

PCI Rating

| Condition Category | PCI Rating | PASER Rating |
|-------------------------|------------|--------------|
| No Maintenance | 86 - 100 | 9 - 10 |
| Routine Maintenance | 71 - 85 | 7 - 8 |
| Preservative Treatments | 56 - 70 | 5 - 6 |
| Structural Improvement | 41 - 55 | 3 - 4 |
| Reconstruction | 0 - 40 | 1 - 2 |

Comparison of Pavement Condition Distribution
by PASER Asset Management Scale

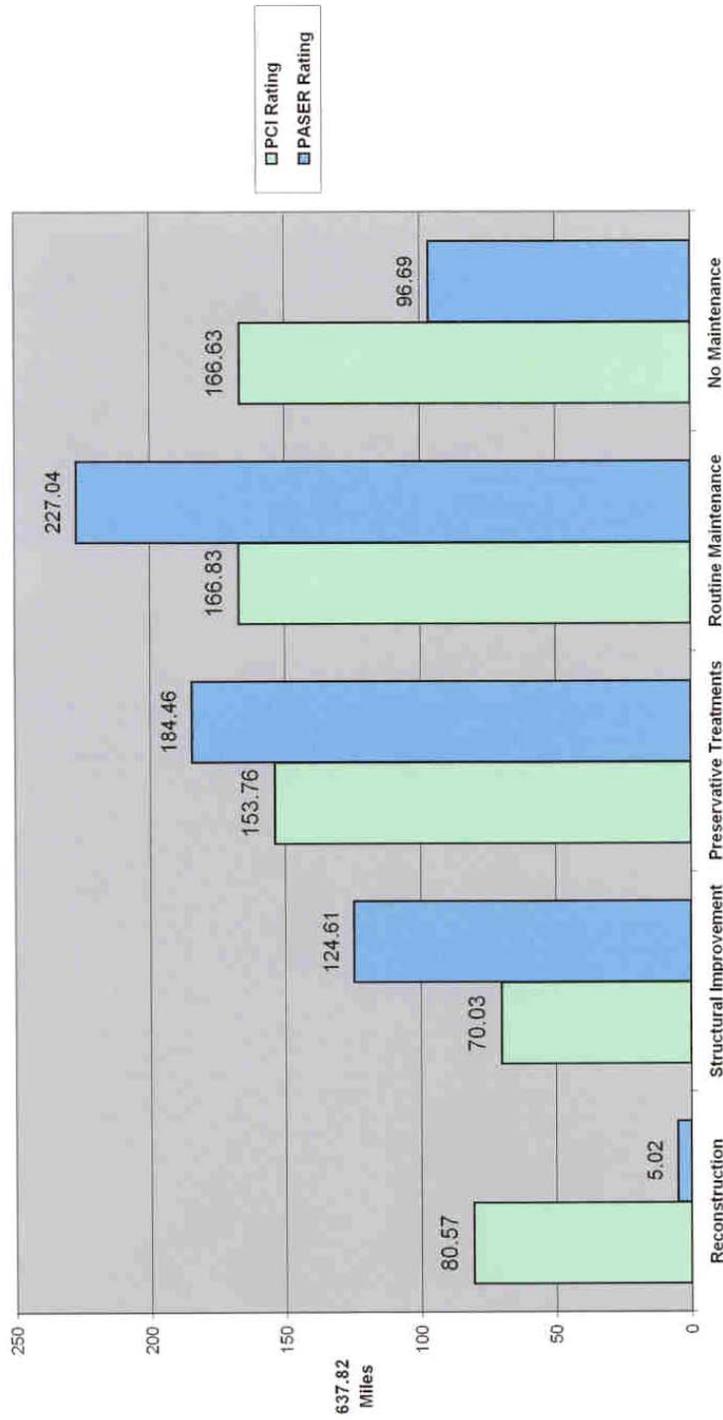
Chart 4: Local Roads - Alpine Township



| Condition Category | PCI Rating | PASER Rating |
|-------------------------|------------|--------------|
| No Maintenance | 86 - 100 | 9 - 10 |
| Routine Maintenance | 71 - 85 | 7 - 8 |
| Preservative Treatments | 56 - 70 | 5 - 6 |
| Structural Improvement | 41 - 55 | 3 - 4 |
| Reconstruction | 0 - 40 | 1 - 2 |

Comparison of Pavement Condition Rating Systems:
PASER Asset Management Scale

Chart 5: Primary Roads - Kent County

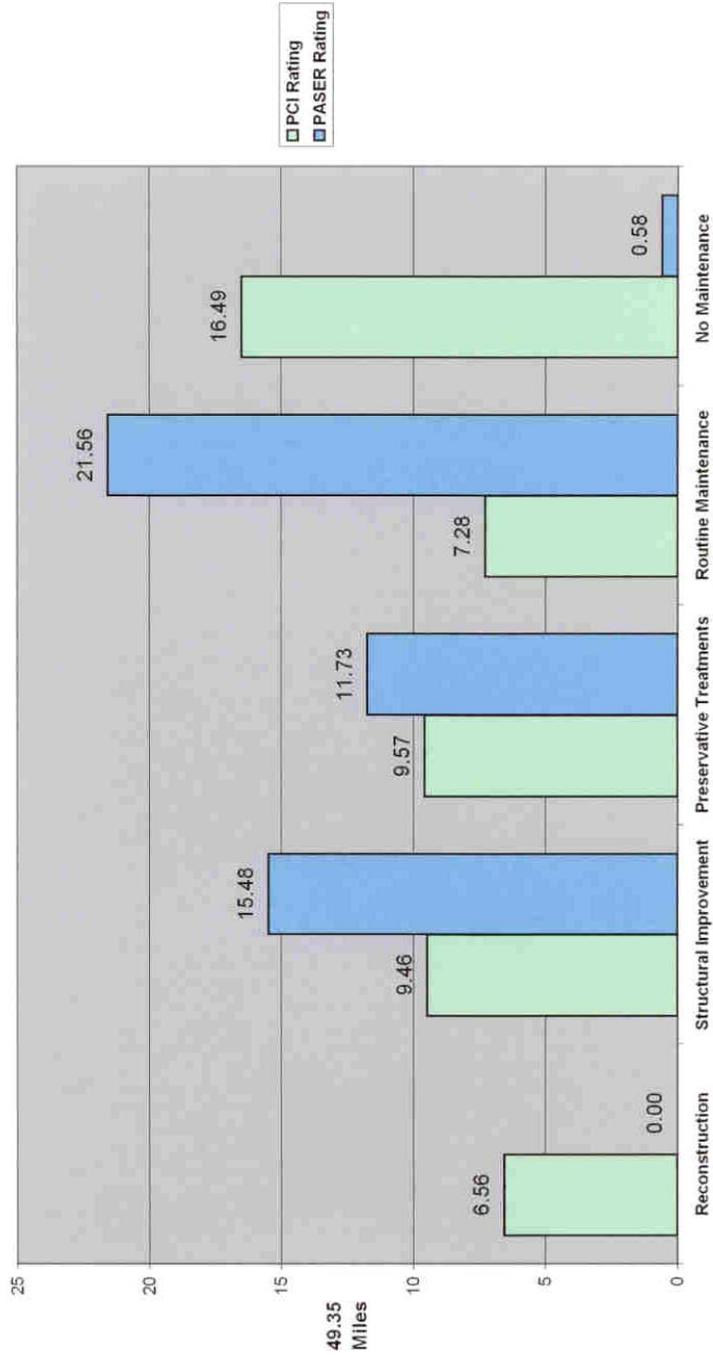


| Condition Category | PCI Rating | PASER Rating |
|-------------------------|------------|--------------|
| No Maintenance | 86 - 100 | 9 - 10 |
| Routine Maintenance | 71 - 85 | 7 - 8 |
| Preservative Treatments | 56 - 70 | 5 - 6 |
| Structural Improvement | 41 - 55 | 3 - 4 |
| Reconstruction | 0 - 40 | 1 - 2 |

637.82
Miles

Comparison of Pavement Condition Rating Systems:
PASER Asset Management Scale

Chart 6: Local Roads - Alpine Township



| Condition Category | PCI Rating | PASER Rating |
|-------------------------|------------|--------------|
| No Maintenance | 86 - 100 | 9 - 10 |
| Routine Maintenance | 71 - 85 | 7 - 8 |
| Preservative Treatments | 56 - 70 | 5 - 6 |
| Structural Improvement | 41 - 55 | 3 - 4 |
| Reconstruction | 0 - 40 | 1 - 2 |

Miles per PCI Range Distributed by PASER Rating Index

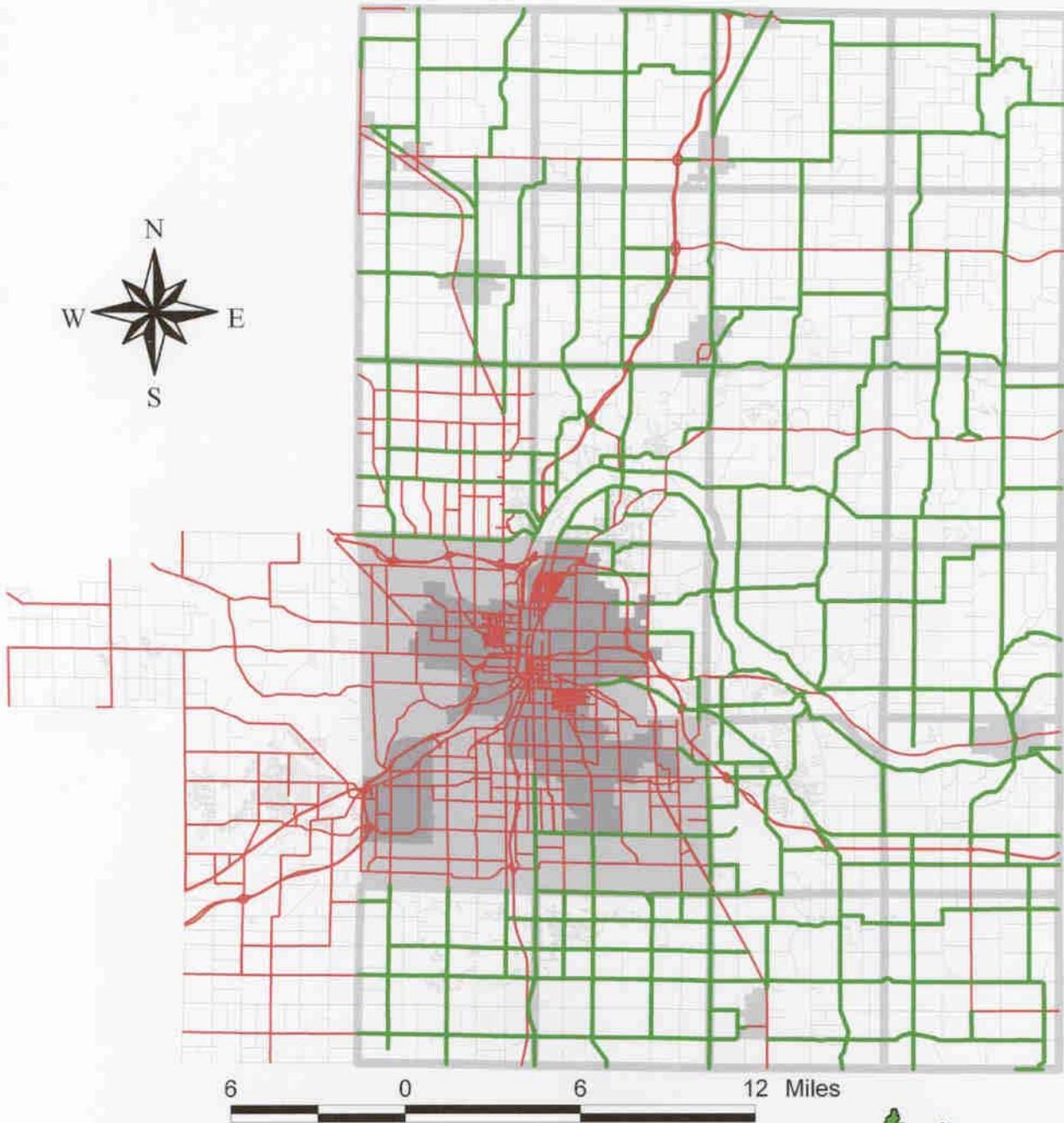
Table 2: Primary Roads - Kent County

| PCI Range | Total Miles | PASER Equivalent | PASER Rating Index | | | | | | | | | |
|---------------|---------------|------------------|--------------------|-------------|--------------|--------------|--------------|---------------|---------------|--------------|--------------|--------------|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 0 - 25 | 19.46 | 1 | 0.00 | 2.34 | 11.37 | 3.25 | 0.00 | 1.27 | 0.15 | 0.00 | 1.08 | 0.00 |
| 26 - 40 | 61.11 | 2 | 0.00 | 1.08 | 22.40 | 21.09 | 11.57 | 4.33 | 0.24 | 0.00 | 0.31 | 0.09 |
| 41 - 49 | 18.78 | 3 | 0.00 | 0.00 | 5.01 | 3.54 | 0.93 | 5.24 | 0.94 | 1.44 | 1.68 | 0.00 |
| 50 - 55 | 51.27 | 4 | 0.00 | 1.00 | 6.51 | 16.10 | 10.77 | 11.74 | 2.51 | 2.18 | 0.19 | 0.27 |
| 56 - 64 | 87.92 | 5 | 0.00 | 0.51 | 5.67 | 16.45 | 27.46 | 23.05 | 10.10 | 0.71 | 3.65 | 0.32 |
| 65 - 70 | 65.83 | 6 | 0.00 | 0.00 | 1.90 | 5.22 | 14.22 | 20.83 | 19.19 | 2.61 | 0.55 | 1.21 |
| 71 - 79 | 103.69 | 7 | 0.00 | 0.00 | 1.76 | 1.96 | 8.86 | 21.37 | 40.80 | 21.89 | 6.56 | 0.49 |
| 80 - 85 | 63.14 | 8 | 0.00 | 0.00 | 0.00 | 0.00 | 1.99 | 8.54 | 32.07 | 14.24 | 6.00 | 0.30 |
| 86 - 94 | 73.60 | 9 | 0.00 | 0.00 | 0.59 | 1.64 | 1.74 | 10.52 | 21.96 | 16.50 | 13.16 | 7.49 |
| 95 - 100 | 93.02 | 10 | 0.10 | 0.00 | 0.00 | 0.20 | 0.00 | 0.00 | 2.33 | 37.15 | 23.58 | 29.66 |
| totals | 637.82 | | 0.10 | 4.93 | 55.21 | 69.45 | 77.54 | 106.89 | 130.29 | 96.72 | 56.86 | 39.83 |

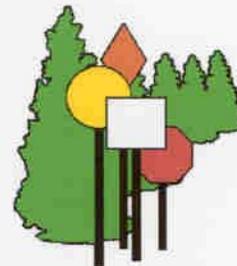
Table 3: Local Roads - Alpine Township

| PCI Range | Total Miles | PASER Equivalent | PASER Rating Index | | | | | | | | | |
|---------------|--------------|------------------|--------------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|-------------|-------------|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 0 - 25 | 1.07 | 1 | 0.00 | 0.00 | 1.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 26 - 40 | 5.49 | 2 | 0.00 | 0.00 | 3.99 | 1.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 41 - 49 | 7.20 | 3 | 0.00 | 0.00 | 4.11 | 1.00 | 1.00 | 0.00 | 0.00 | 1.09 | 0.00 | 0.00 |
| 50 - 55 | 2.27 | 4 | 0.00 | 0.00 | 0.27 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| 56 - 64 | 6.08 | 5 | 0.00 | 0.00 | 0.00 | 0.51 | 2.51 | 2.02 | 1.04 | 0.00 | 0.00 | 0.00 |
| 65 - 70 | 3.49 | 6 | 0.00 | 0.00 | 0.00 | 1.01 | 0.00 | 1.69 | 0.79 | 0.00 | 0.00 | 0.00 |
| 71 - 79 | 5.78 | 7 | 0.00 | 0.00 | 0.00 | 2.04 | 0.53 | 2.90 | 0.31 | 0.00 | 0.00 | 0.00 |
| 80 - 85 | 1.49 | 8 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.49 | 0.00 | 0.00 | 0.00 | 0.00 |
| 86 - 94 | 6.18 | 9 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.59 | 4.49 | 0.10 | 0.00 |
| 95 - 100 | 10.30 | 10 | 0.00 | 0.00 | 0.00 | 0.00 | 1.99 | 0.99 | 0.00 | 6.84 | 0.48 | 0.00 |
| totals | 49.35 | | 0.00 | 0.00 | 9.44 | 6.06 | 5.50 | 6.23 | 8.81 | 12.73 | 0.58 | 0.00 |

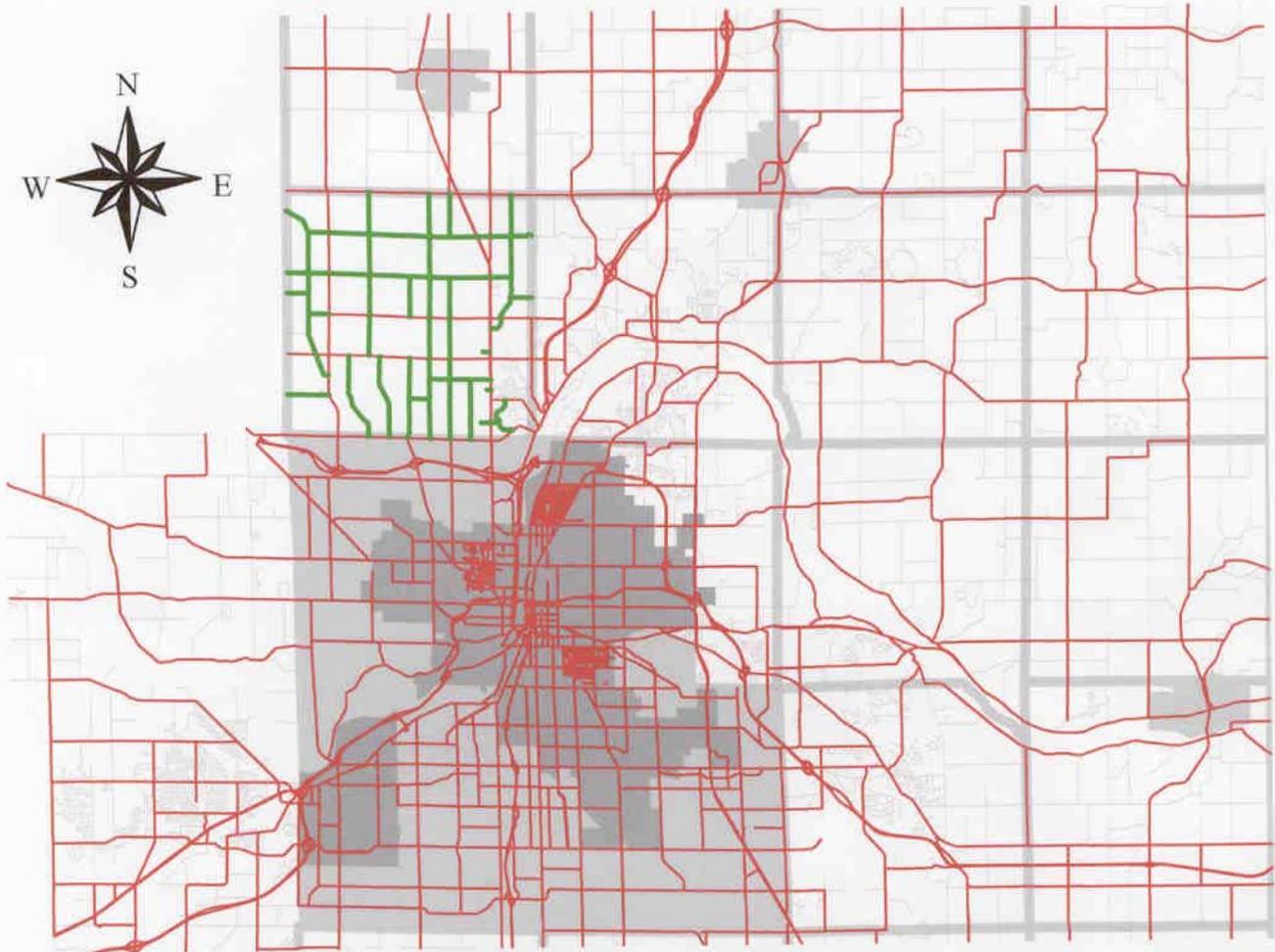
MAP 1: PASER SURVEY - 11/01 PRIMARY ROADS - KENT COUNTY



-  Primary Roads - Kent County
-  PASER Survey
-  Framework Roads



MAP 2: PASER SURVEY - 11/01 LOCAL ROADS - ALPINE TOWNSHIP



-  Local Roads - Alpine Township
-  PASER Survey
-  Framework Roads

