City of Lynnwood, Washington
Pavement Condition Report

Prepared For:

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Introduction

As a subcontractor to Perteet, Inc. (Perteet), Applied Pavement Technology, Inc. (APTech) evaluated City of Lynnwood, Washington (City) roadways to provide the City with updated pavement condition data for use in its Pavement Management System (PMS). APTech used its automated data collection van to drive the roadways and collect data, and engineers summarized the type, severity, and extent of distress in accordance with ASTM Specification D6433-20, *Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys* for each road segment. The distress information was imported into the City PMS where Pavement Condition Index (PCI) values were calculated. This report documents the completion of the work and summarizes findings.

Inventory

The City had a mature PMS database with a complete roadway network definition at the project outset. Perteet provided the roadway network shape file to APTech to guide the pavement condition data collection. Based on information in the PMS database the City maintains about 100 centerline miles of roads. Figure 1 shows a map of the City streets color-coded by PCI. A legend to the PCI colors and condition categories is provided in the lower right corner of the figure.

Note that throughout this document references to condition categories are in accordance with PCI and the ASTM D-6433 standard. Cartegraph's OMS reports pavement conditions in terms of Overall Condition Index (OCI), which is a combination of the PCI and the International Roughness Index (IRI). This report references PCI only as an indicator of the existing conditions, and the reported values should not be confused with the OCI reported from the PMS (which, like the PCI, is on a 0 to 100 scale). Typically, these numbers are very close, but may not be the same depending on the weighting value used for IRI in calculation of the OCI. Condition categories may also be different, because default OMS condition categories are different than the ASTM standard and are user-definable. The PCI is a more broadly used standard and is the basis for recommendations in this report.

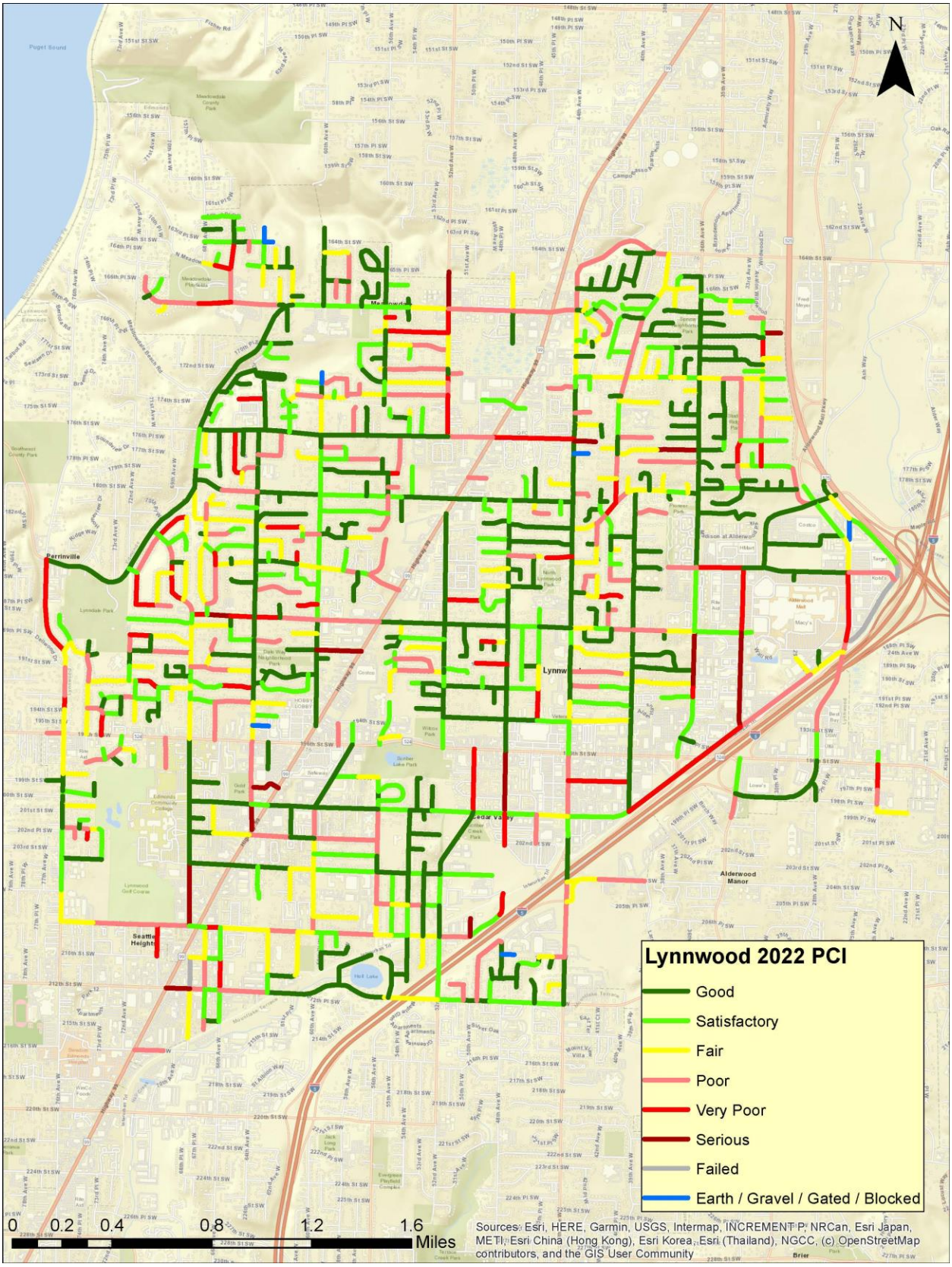

Figure 1. Map of Lynnwood streets showing PCI categories.

APTech's survey confirmed that all the paved network area was Asphalt Concrete (AC)-surfaced, that three sections were gravel-surfaced, and two sections were earth (grass)-surfaced.

Field Data Collection

APTech mobilized its Enhanced Data Gathering Equipment (EDGE; shown in figure 2) automated data collection van to Lynnwood, Washington to survey all paved city streets. Laser Crack Measurement System (LCMS) technology collected downward-facing pavement line-scan laser data providing a 3D image of the pavement surface for distress detection. The van also measured transverse profile (rutting), longitudinal profile (IRI or roughness), and forward and rearward facing right-of-way (ROW) images. Data for one lane was collected in a single pass at approximate roadway speed, and there was no need for traffic control. All data was both spatially and linearly referenced using on-board equipment for location accuracy.

Figure 2. APTech's EDGE data collection vehicle.

Condition Assessment

After completion of data collection all data was returned to APTech's office for post-processing and distress surveys using workstation software. Trained staff used proprietary software to locate and record the type, severity, and extent of distress. An example screen shot from the workstation software is provide in figure 3. As noted previously, distress definitions are in accordance with the requirements of ASTM Specification D6433-20.

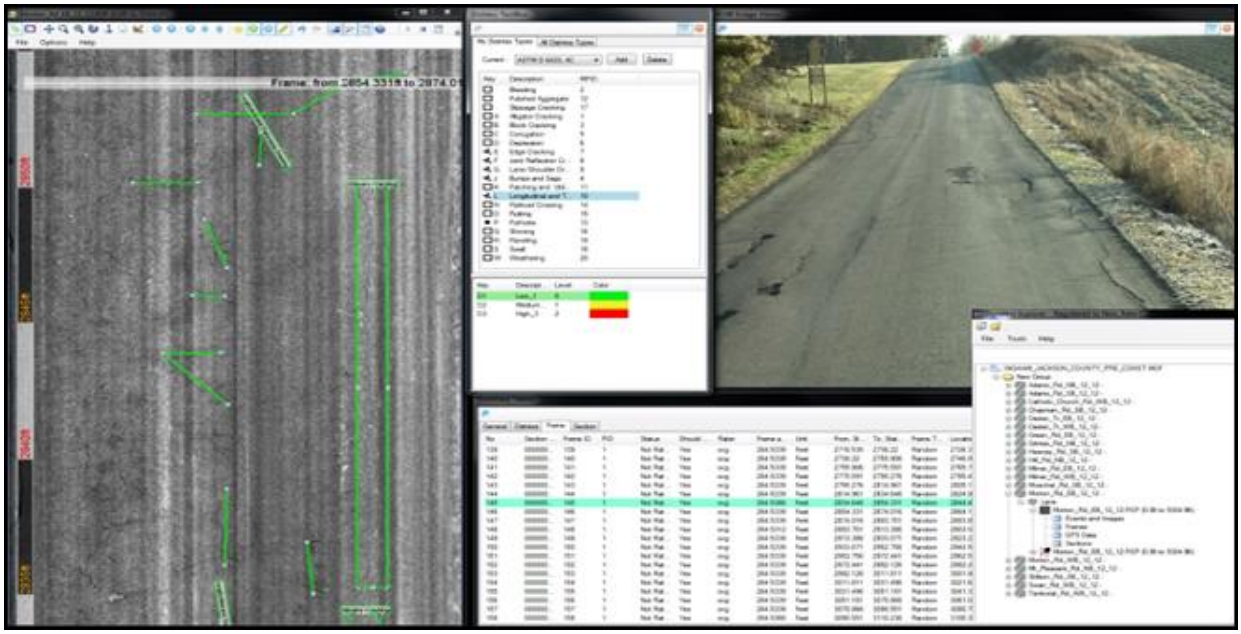

Figure 3. Distress survey workstation example.

Once the distresses were identified and summarized by roadway segment, they were imported into the PMS for calculation of the PCI. The PCI method was developed to provide a systematic procedure for rating pavements, with the output being a numerical indication of the overall pavement condition. A PCI score includes components that address structural integrity, surface condition, ride quality, and environmental effects. The final calculated PCI score is a number from 0 to 100, with 100 representing a pavement in excellent condition. A subjective correlation of the PCI ratings to overall pavement conditions is shown in figure 4.

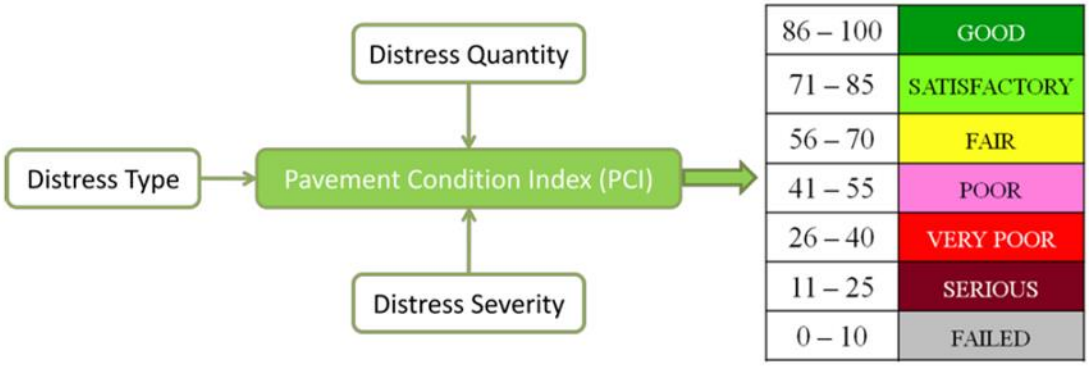

Figure 4. Pavement condition range classifications.

At the end of this process PCI values were available for all city road segments. These are available in the City's OMS database.

Findings

From APTech's condition survey, the City street network has an overall area-weighted average PCI of 72, corresponding to a Satisfactory condition category. This is shown in figure 5. Figure 6 provides a bar chart showing the percentage of roadway network area in each PCI condition category. This figure shows that 73 percent of the roadway network area is in Fair or better condition, and 57 percent of the network area is above a PCI value of 70. This is a notable result since pavements with a PCI greater than 70 are considered good candidates for cost-effective preservation treatments. Use of preservation approaches may be expected to slow the deterioration of streets at a reduced cost.

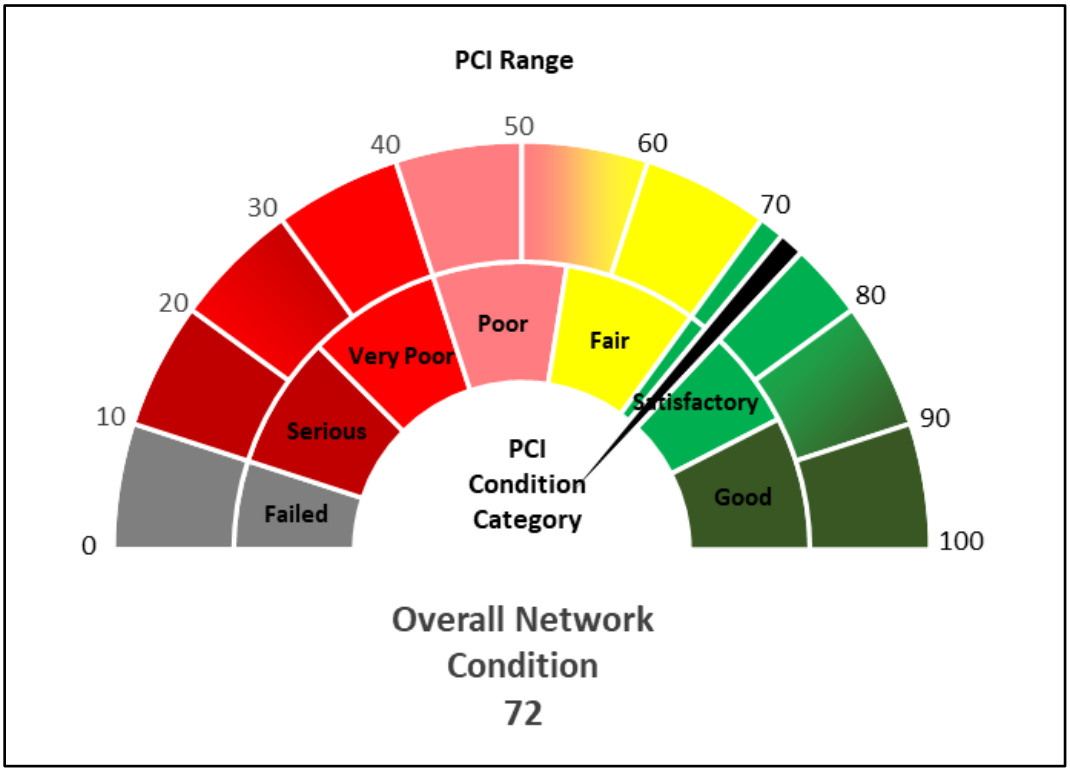

Figure 5. Lynnwood pavement condition dashboard.

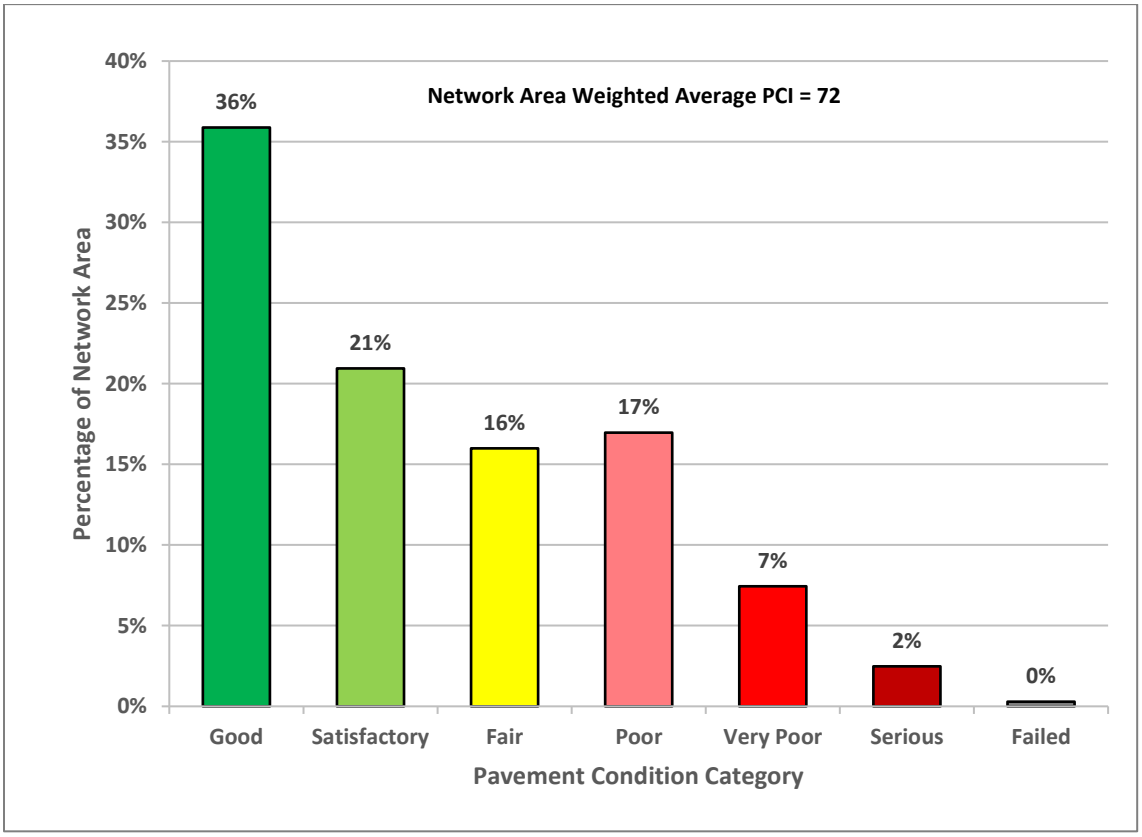

Figure 6. Distribution of area by condition category.

Figure 7 provides a breakdown of percentage of network area by functional classification, also showing the area-weighted average PCI by functional classification. The City network is composed of principal arterial, minor arterial, collector, and residential roads. The residential road network makes up a large majority (52 percent) of the network area and has an average PCI of 73. The principal arterial roadways make up the least area (6 percent) and have the lowest average PCI at 65. Minor arterials and collectors make up 22 and 20 percent of the network area, and have average PCI's of 72 and 70, respectively. The City performance goals are unknown, but this information would appear to indicate that funds should be directed to principal arterial roadways to improve conditions, while preservation and maintenance approaches may support the needs of the other functional classifications.

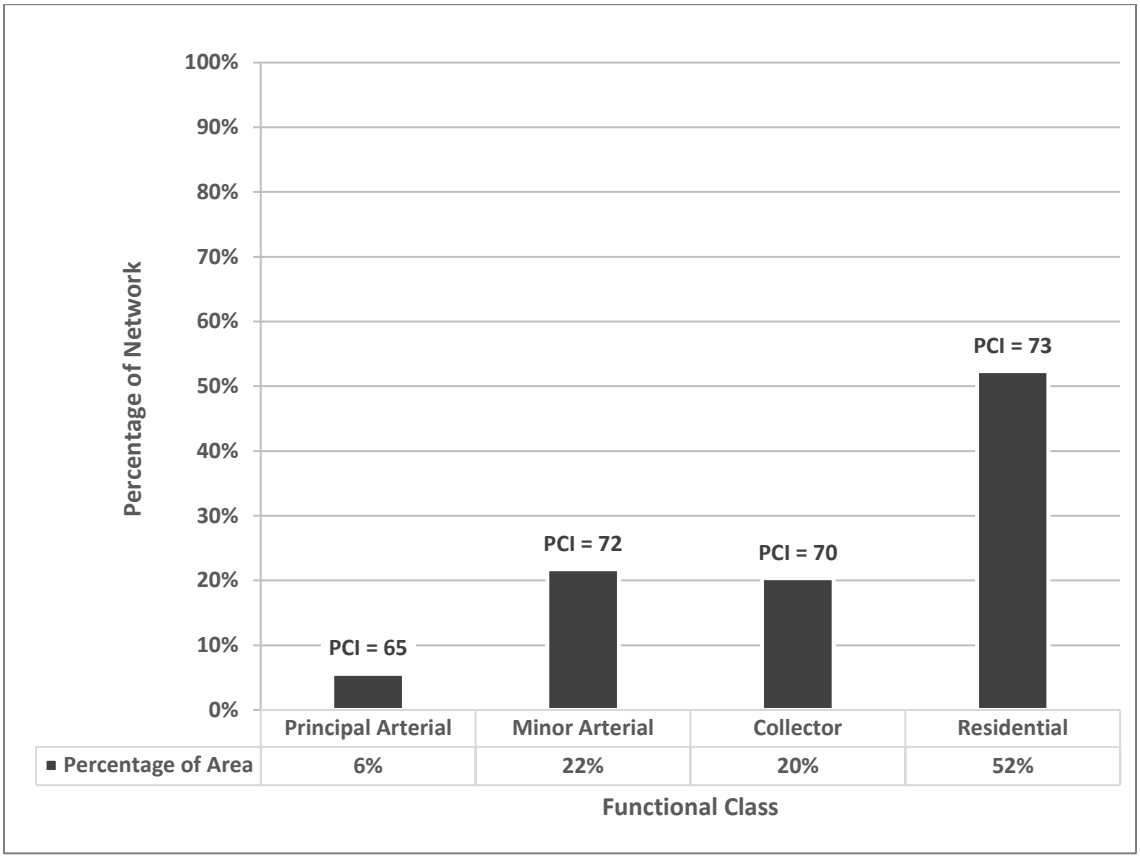

Figure 7. Functional class percentages and PCI results.

Further examining pavement conditions by functional class, figures 8, 9, 10, 11, and 12 show the distribution of condition for all roads, principal arterial roads, minor arterial roads, collector roads, and residential roads, respectively. Figure 9 shows that 54 percent of the principal arterial roads are in the Poor and Very Poor condition category and would benefit from some dedicated funding to improve the average condition of this road group. Figures 10 and 11 show that 25 percent of the minor arterial roads and 31 percent of the collector roads are in Poor or worse condition, which might be considered another high priority. In general, public perception of roads in the residential group will typically allow slightly lower PCI values, so an option the City could consider is maintaining these roads with maintenance and preservation approaches to support funding of major repairs in the upper functional classifications.

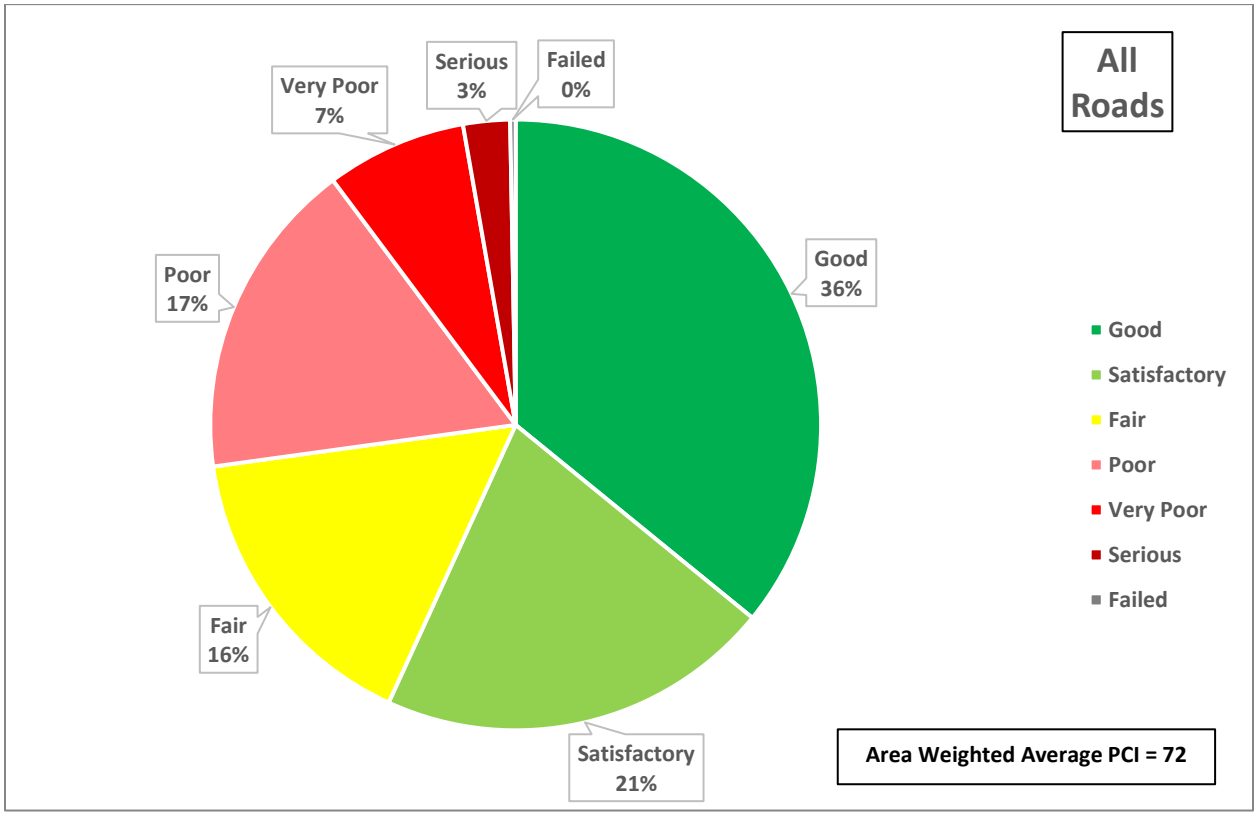

Figure 8. Percentage by condition category for all roads.

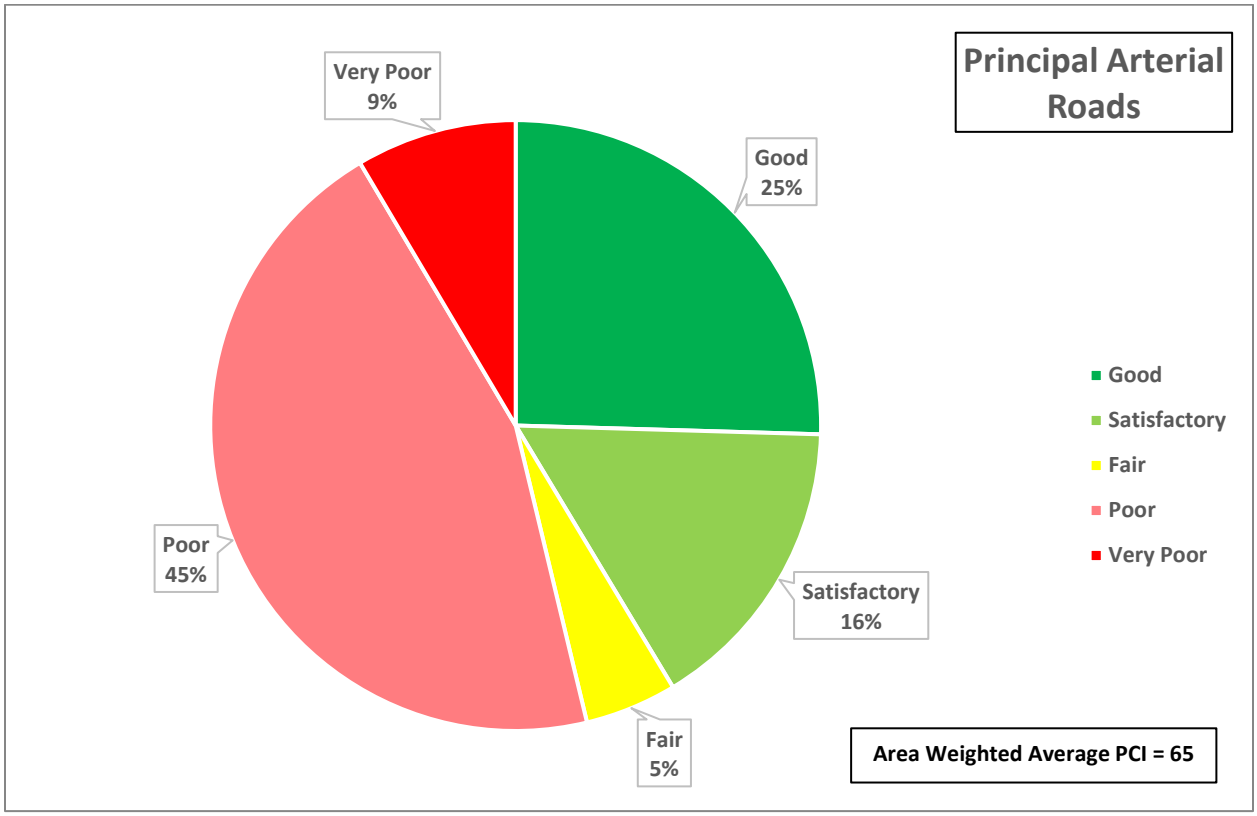

Figure 9. Percentage by condition category for principal arterial roads.

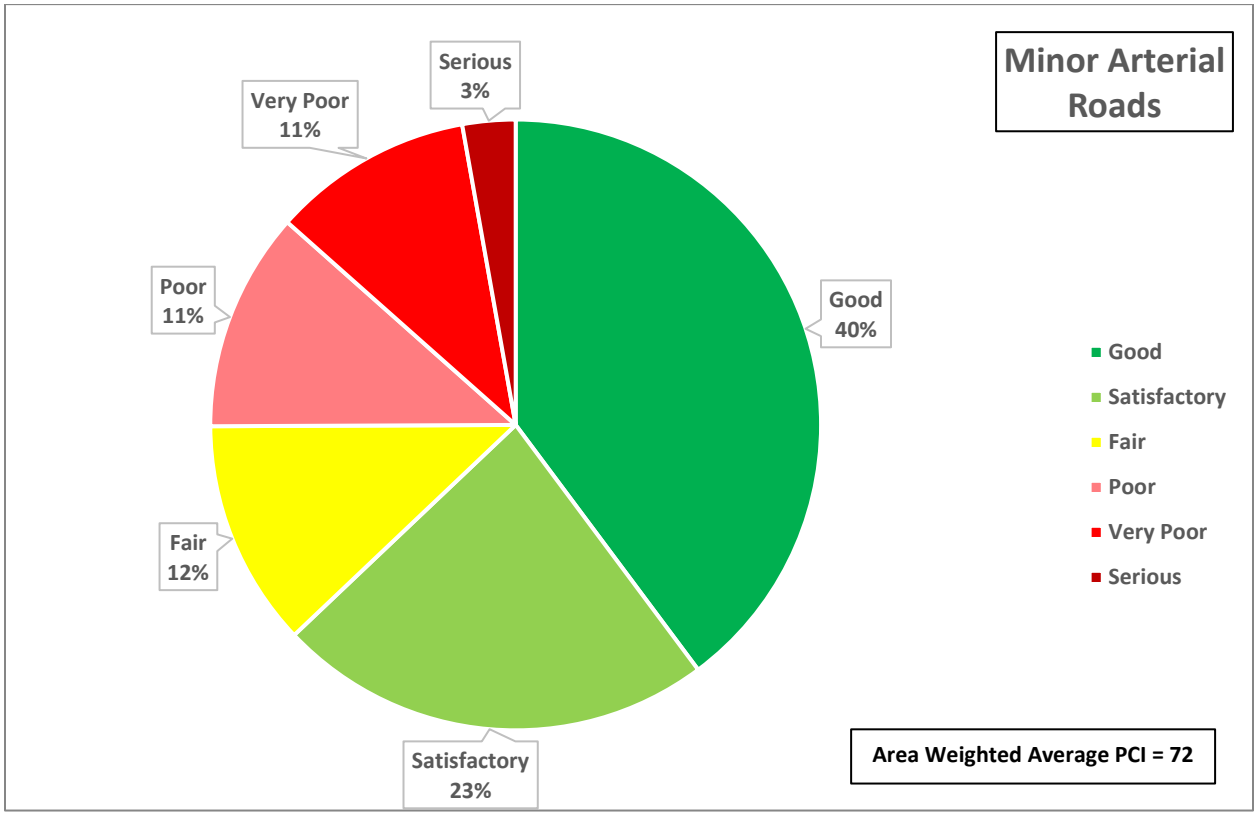

Figure 10. Percentage by condition category for minor arterial roads.

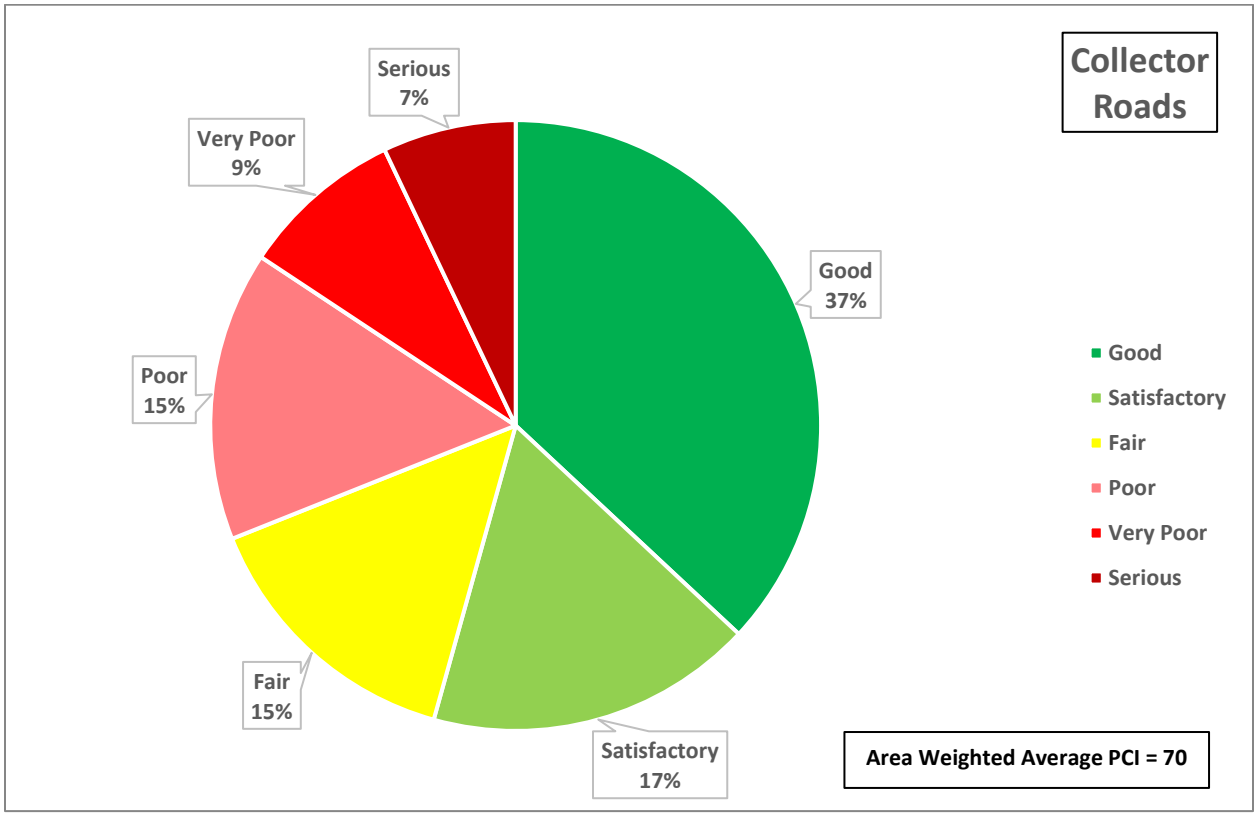

Figure 11. Percentage by condition category for collector roads.

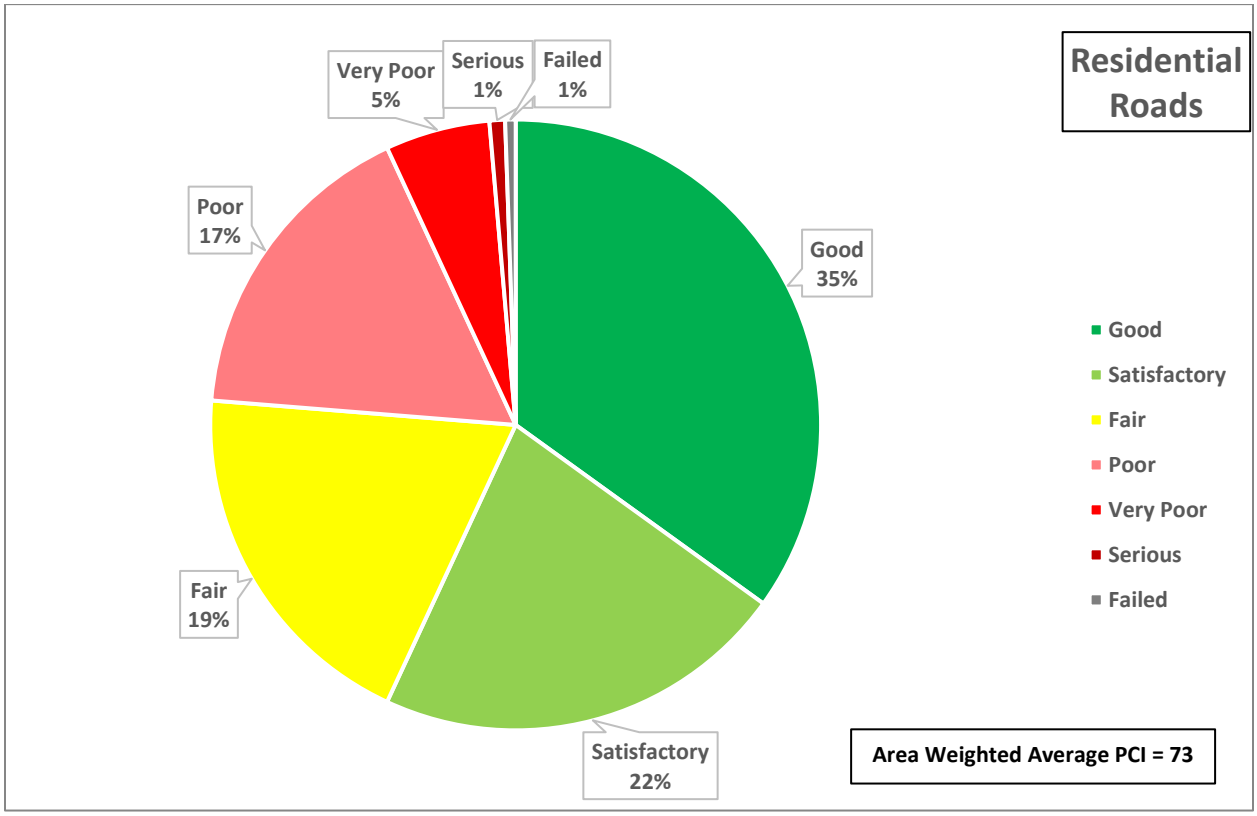

Figure 12. Percentage by condition category for residential roads.

Conclusion

As part of its Pavement Management System update APTech collected condition data for the City of Lynnwood roadway network in 2022. The condition survey found that the City roadway network has an overall area-weighted average PCI of 72, which is in the Satisfactory condition category. The City maintains roads in four functional classifications: principal arterial, minor arterial, collector, and residential. The residential roads make up a large majority of the network and have the best overall average PCI at 73. The principal arterial roads make up the smallest percentage of the roadway network and have the lowest area-weighted average PCI at 65. Based on these conditions, the City may consider using maintenance and preservation approaches to extend the performance of the local roads cost-effectively, allowing funding to be applied to the principal arterial roads to improve their overall average PCI.

When making such value decisions it is important to recognize the economics of the system. Roads that are in Very Poor or worse condition will cost more to repair, rehabilitate, or reconstruct than roads in good condition. It can also be said that once roads are in Very Poor or worse condition, the cost to repair them will be high next year, and the next, and so on. In contrast, roads in good condition can be preserved inexpensively, but if left to deteriorate the cost to repair them will increase over time and add to the more expensive burden of roads in worse condition. For this reason, it makes economic sense to preserve roads using lower cost treatments than it does to let them deteriorate and pay more to repair them later.