

PAVEMENT MANAGEMENT: SEATTLE

PAVEMENT TYPES AND CONDITION

As of 2010, Seattle has an inventory of 3,952 lane-miles (12-ft) of street pavements. The busiest streets, arterials, account for approximately 1,540 lane-miles of the system. Arterials are the city’s most critical connectors and are the principal means by which people and goods move about the city. The remaining 2,412 lane-miles are non-arterials, which carry lower volumes, but nonetheless serve a variety of users. Most non-arterials are residential, but some also support commerce and industry in areas such as the Greater Duwamish, Ballard, the International District, and First Hill. These totals do not include alleys or parking lots, where no inventory information is available. SDOT manages its pavements by regularly assessing condition, analyzing budget needs, performing routine and preventive maintenance, and undertaking [major paving projects](#).

INVENTORY OF SEATTLE STREET SURFACES

SDOT’s pavement engineers use lane-miles (area) and centerline miles (length) to report pavement inventory figures. SDOT uses a twelve-foot wide lane to calculate lane-mile area. A two-lane, 24-foot wide street that is one mile long is two lane-miles; and a four-lane, 48-foot street that is one mile long is four lane-miles. Centerline miles are simply the length measured along the roadway centerline. The following tables show Seattle’s street surface inventory measured in lane-miles and centerline miles.

Pavement Type and MTC Identifier	Arterial (lm)	Arterial Fraction	Non-arterial (lm)	Non-arterial Fraction	TOTAL (lm)	FRACTION
Asphalt Flexible (AC or AC/AC)	123	8.0%	567	23.5%	690	17.5%
Rigid Concrete (PCC)	540	35.1%	1,268	52.6%	1,808	45.7%
Composite (AC/PCC)	870	56.5%	8	0.3%	878	22.2%
Bituminous Surface Treatment (ST)	7	0.4%	549	22.8%	556	14.1%
Gravel (GR)	0	0.0%	8	0.3%	8	0.2%
Other (O)	< 0.5 lm	< 0.1%	12	0.5%	12	0.3%
TOTAL	1,540	100.0%	2,412	100.0%	3,952	100.0%

Pavement Type - Arterial and Non-arterial, by Length						
Pavement Type and MTC Identifier	Arterial (c/l mi)	Arterial Fraction	Non-arterial (c/l mi)	Non-arterial Fraction	TOTAL (c/l mi)	FRACTION
Asphalt Flexible (AC or AC/AC)	51	10.4%	271	22.8%	322	19.2%
Rigid Concrete (PCC)	189	38.6%	593	50.0%	782	46.6%
Composite (AC/PCC)	246	50.2%	4	0.3%	250	14.9%
Bituminous Surface Treatment (ST)	4	0.8%	308	26.0%	312	18.6%
Gravel (GR)	0	0.0%	6	0.5%	6	0.4%
Other (O)	< 0.1 c/l mi	< 0.1%	5	0.4%	5	0.3%
TOTAL	490	100.0%	1,187	100.0%	1,677	100.0%

By area, almost half of Seattle’s streets are constructed of jointed [Portland cement concrete rigid pavement \(PCC\)](#). Concrete pavements suffer minimal environmental degradation in Seattle’s mild climate. They are long lived, particularly in lightly loaded non-arterial applications.

A little over fifteen percent of the street network is [asphalt flexible pavement \(AC or AC/AC\)](#), which is built by placing lifts of hot mix asphalt on a crushed aggregate base. Locally and in modern times, this is probably the most common urban pavement construction.

Approximately twenty percent of streets are built of [composite pavement \(AC/PCC\)](#), which is either jointed concrete, brick, or sheet top that has been topped with a layer of hot mix asphalt. They are referred to as composite pavements because of the combination of flexible (asphalt) and rigid (concrete or brick) materials. The asphalt surfacing improves ride, but it adds minimal structure and needs to be renewed every 10 to 20 years to address reflective cracking.

Another fifteen percent or so of the system is [chip seal \(BST or bituminous surface treatment\)](#). The chip seal streets are almost all non-arterial. Most are north of 85th Street and at the southern border of the City, areas annexed from King County post-1940. They were converted in the 1960's and 1970's from gravel roads to a low-cost surface of flexible cold mix asphalt with an oil and gravel weathering course – the chip seal. Chip seal streets need to be patched and resealed on a regular basis renew the surface and seal the pavement structure against water intrusion. Chip seal streets typically lack sidewalks and formal drainage systems.

Finally, there is a small inventory, less than one percent of the system, surfaced with [gravel \(GR\)](#) or a [historic/decorative surface such as setts or pavers \(O\)](#).

The University of Washington’s Pavement Interactive website has information on the [history and evolution of pavement construction](#).

PAVEMENT CONDITION RATING

SDOT uses the Metropolitan Transportation Commission (MTC) pavement management system and rating methodology to track the condition of Seattle’s streets. The MTC rating method is based on the Pavement Condition Index (PCI) rating procedure developed by the US Army Corps of Engineers in the 1970’s and described in ASTM standard D6433. It provides engineers and decision-makers with a rational, objective measure of street condition. The procedure was designed to be repeatable and well-correlated with the judgment of experienced pavement engineers.

The PCI method measures the occurrence of several pavement distress types and assigns a PCI score based upon the density (area affected) and severity of the observed distress. Structural, environmental and other types of pavement distresses are captured in this process. The PCI scale ranges between 100 and 0. A PCI of 100 represents a pavement completely free of distress; a PCI of 0 corresponds to a pavement that has failed completely and can no longer be driven safely at the designed speed. Pavement Condition Ratings (PCRs) are associated with ranges of PCI. Table 1 shows the range of PCI values to which each rating corresponds based on the ASTM D6433 scale.

PAVEMENT CONDITION RATINGS AND PAVEMENT CONDITION INDEX RANGES

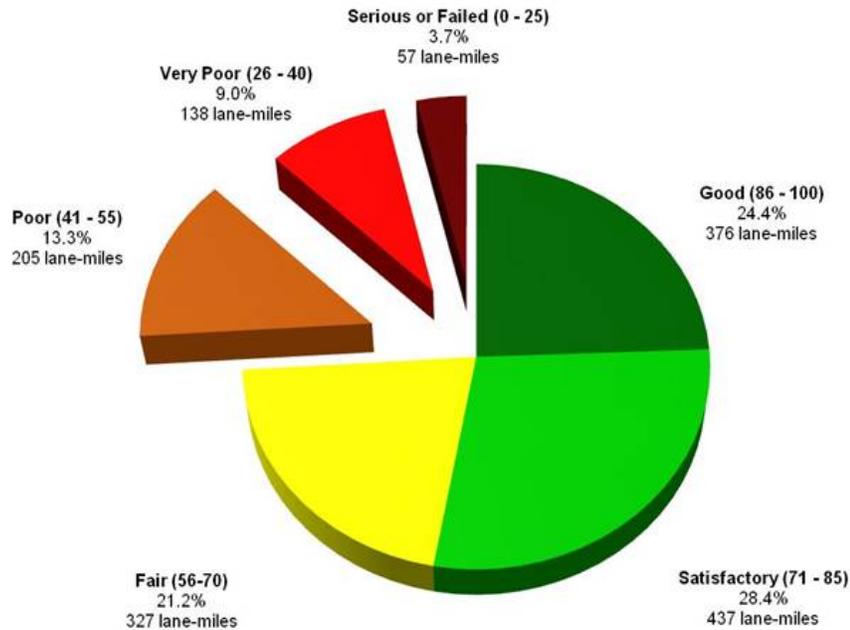
Pavement Condition Rating (PCR)	Pavement Condition Index (PCI)
Good	86-100
Satisfactory	71-85
Fair	56-70
Poor	41-55
Very Poor	26-40
Serious / Failed	0-25

Streets in “Fair” condition or above generally require only routine or preventive maintenance. When pavements reach a condition level of “Poor”, they show notable deterioration and may be candidates for major maintenance or preservation work such as an asphalt overlay, select concrete panel replacement, or diamond grinding. Streets in “Very Poor” condition or below have typically deteriorated to the point where potholes and other structural distress are widespread, and the pavement needs to be completely reconstructed.

ARTERIAL PAVEMENT CONDITION

Seattle's arterial streets are in good condition overall, but there is a large and persistent backlog of deferred maintenance that has accumulated over decades of underinvestment in pavement renewal. The condition of Seattle's arterial streets as measured in 2010 is shown in the chart below.

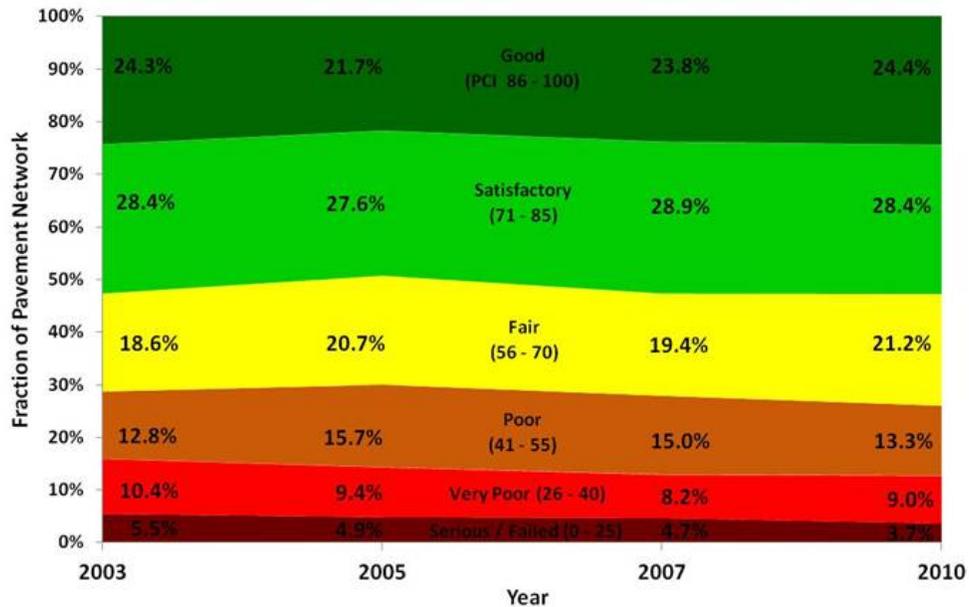
Seattle Arterial Pavement Condition in 2010, by PCI and PCR



A large fraction (74%) of Seattle's arterial pavement system is in serviceable condition ("Fair" or better) and requires only routine or preventive maintenance at this time. However, approximately a quarter of the network (26%, "Poor" or below) shows a current pavement rehabilitation need, either major maintenance or reconstruction. Delaying repairs on streets where pavement condition indicates a need creates deferred maintenance. Deferred maintenance is work that is postponed to a future budget cycle, or until funds are available. As maintenance is deferred, the opportunity to apply global, life extending pavement treatments is forfeited and the ultimate cost of rehabilitation multiplies by a factor of four to seven. Seattle has a significant backlog of deferred arterial street maintenance, approximately 400 lane-miles. In 2010 dollars, it is estimated that it would cost \$578 million to address all of those deferred street rehabilitation needs.

The increase in funding for paving that came with the 2007 Bridging the Gap transportation levy has allowed SDOT to begin rehabilitate some of Seattle's busiest streets. Conditions on principal arterials, the city's busiest, have improved measurably, from an average PCI of 70 in 2007 to 74 in 2010. However, arterial street rehabilitation efforts, overall, have been closely paced by systematic deterioration. The figure below shows Seattle's arterial pavement condition as measured in 2003, 2005, 2007 and 2010.

Seattle Arterial Pavement Condition 2003 to 2010, by PCI and PCR



Arterial Average Pavement Condition Index (PCI)			
2003	2005	2007	2010
67.5	66.5	68.3	68.8

Click on image to view larger

Regular pavement condition assessments allow SDOT select the type and timing of maintenance to maximize its effectiveness. When selecting streets each year to be paved, the engineers consider:

- street condition
- cost and cost effectiveness of treatment (weighing preservation opportunities against full street reconstruction)
- traffic volume (including transit, freight, pedestrian and bicycle)
- grants and other leveraged funding opportunities
- utility coordination and grouping locations for efficiency
- citizen complaints and claims
- equity and geographic balance across the city

Facing a large backlog of deferred maintenance, SDOT must make difficult choices between streets with similar paving needs. Emphasis is placed on the busiest arterial streets and timing maintenance so that, over the long term, street repair dollars reach the greatest number of users. All paving projects include installation curb ramps at intersections, bringing street crossings into compliance with current American Disabilities Act (ADA) standards. Projects also incorporate funded Complete Streets elements and drainage infrastructure upgrades to comply with the City's Stormwater Code.

NON-ARTERIAL PAVEMENT CONDITION

With such a large backlog of needs on the busiest arterial streets, Seattle has little funding left over for pavement condition rating or paving on the 2,412 lane-mile non-arterial street network. SDOT has no funded program to

assess non-arterial street condition. The base level of service SDOT is funded to provide on non-arterials is spot repair for safety. Pothole Ranger crews make pothole patch type repairs when they are called in by citizens. As of 2012, SDOT has two small spot non-arterial paving programs that allow paving crews rehabilitate about 0.3 lane-miles per year. That amount of paving is negligible in scale to the system, but it does allow the Department to address a few critical non-arterial locations used by buses and industry, or around hospitals and other locations with heavy pedestrian traffic crossing the street.

PAVEMENT CONDITION REPORT (2003)

In 2003, SDOT reorganized its pavement management section and issued a report on the condition of Seattle's streets. The information presented on this webpage shows how SDOT's pavement management effort has evolved since that original report.