The Land Use Connection

In the 1940s and 1950s, transportation policy was clear — build more roads and highways to accommodate the growing number of vehicles and demand for safer, more convenient access to more territory. The Interstate Highway Act of 1956 provided federal funds to support highway construction, and gas taxes were levied to fund state road construction (In Oregon, almost 60% of the state's transportation funding comes from gas taxes).[75] Time between destinations and the cost of travel decreased.[76]

Because travel by car was easy, residential, commercial, and industrial areas could be segregated through zoning to prevent incompatible activities. As a matter of public policy, infrastructure (sewers, water, power) was extended to new developments, and regulations supporting vehicular access (provision for parking, road widths, paving, etc.) were instituted. More vehicular trips ensued, driven by spreading suburbs. Today, in the Willamette Basin, nearly 25% of workers work in a different county than the one in which they reside, the supply of workers and jobs within counties being unbalanced.[77] Figure 86 shows the major commuting flows.

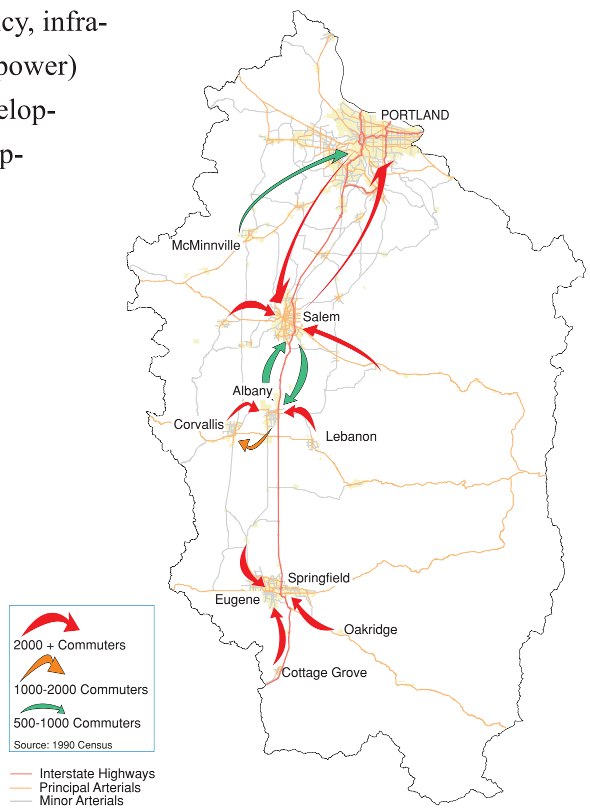


Figure 86. *Major workday commuting routes within the WRB. Nearly 250,000 (25%) of Willamette Basin workers work in counties other than those in which they reside. Only Multnomah and Marion Counties have more jobs than resident workers.*[77]

Although road transportation capacity has increased, it has not kept pace with demand. As accessibility increases, land use changes to take advantage of the increased capacity for trips. Managing automobile congestion requires public policy oriented toward managing growth which in turn is influenced by public acceptance of densification, mixed use development, and alternative modes of transport.

In 1991, with the passage by Congress of the Intermodal Surface Transportation Efficiency Act (ISTEA), alternative transportation systems were acknowledged by the federal government as important. ISTEA allows state and local governments considerable flexibility in building facilities that serve transportation modes other than automobiles. In Oregon, the Land Conservation and Development Commission (LCDC) developed policies that require transportation choices be made available and integrated with land use plans that address compact urban growth (Goal 12, Oregon's Statewide Planning Goals, see p. 72). Aggressive goals for reducing per capita automobile travel were set. In the metropolitan Portland area, the 2040 Growth Concept depends heavily on alternative transportation modes including light rail, pedestrian accessibility, bicycle trails, and bus routes, in concert with nodal and mixed use urban development.[75] Figure 87 shows the trend in daily vehicle miles traveled (DVMT) in Oregon from 1979 to 1996.

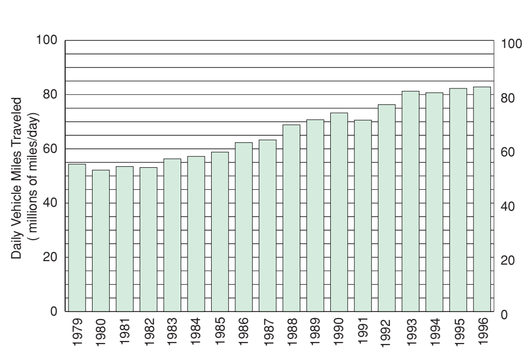


Figure 87. *Daily vehicle miles traveled (DVMT) in Oregon. In 1990, about 58% of these miles were within the Willamette Basin, with approximately 21 DVMT per capita.*[75]

Costs

Road construction is expensive. As an example of road building costs, efforts underway at this writing to widen I-5 through Salem will cost about \$17-18 million (1995 dollars) per mile.[78] Capital expansion of the state highway system over the next 20 years is estimated at \$1.9 billion, far exceeding the anticipated revenues of \$436 million. In the Portland metropolitan area, the cost for new multi-modal city and county road projects over the next 20 years is estimated at \$1.3 billion while the cost for expanding the transit system is \$1.1 billion.[75]

Maintenance is also expensive, as is road removal. In the 1980s, the U.S. Forest Service (USFS) and Bureau of Land Management (BLM) began to reduce their road network by closing under-utilized roads in an attempt to decrease maintenance costs and environmental damage caused by precipitation runoff and earth slides along road cuts. Figure 88 shows a marked decrease in 1985 of approximately 40,000 miles of certified public roads, attributed by the Oregon Department of Transportation (ODOT) to USFS road closures. The decrease in 1994 was due to a drop in BLM-reported mileage.

Mapping the Road Network

ODOT works with the United States Geological Survey (USGS), the counties, and other agencies to develop maps of roads in Oregon. The map opposite shows roads by functional classification, a process by which streets and highways are grouped into classes according to the character of service they provide. For example, large cities generate many trips, and so are often connected by arterial highways, whereas individual farms are connected to villages by local roads. A functional classification also considers the degree of access to property and travel mobility, expressed in operating speed or trip travel time. Local roads emphasize the land access function, whereas arterials emphasize a high level of mobility. The three main functional classifications, arterials, collectors and local roads, are further stratified by their service requirements as well as by whether they form subsystems in rural, urbanized, or small urban areas. Thus, "arterials" are divided into principal arterials (which are further divided into interstate highways and other principal arterials), and minor arterials; collectors are subdivided into major and minor collector roads.[80] ODOT includes, in this mapping, a category entitled "unidentified/unknown" into which are placed road-like structures that have been located from aerial photographs and have not yet been field-identified. This category may include 4-wheel drive tracks and trails.

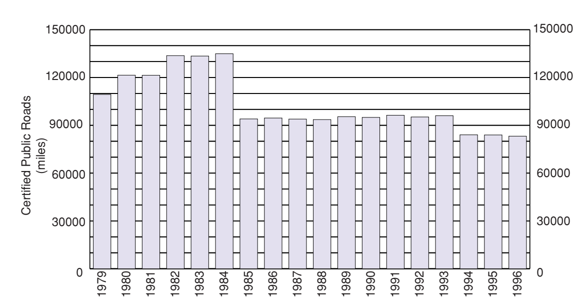
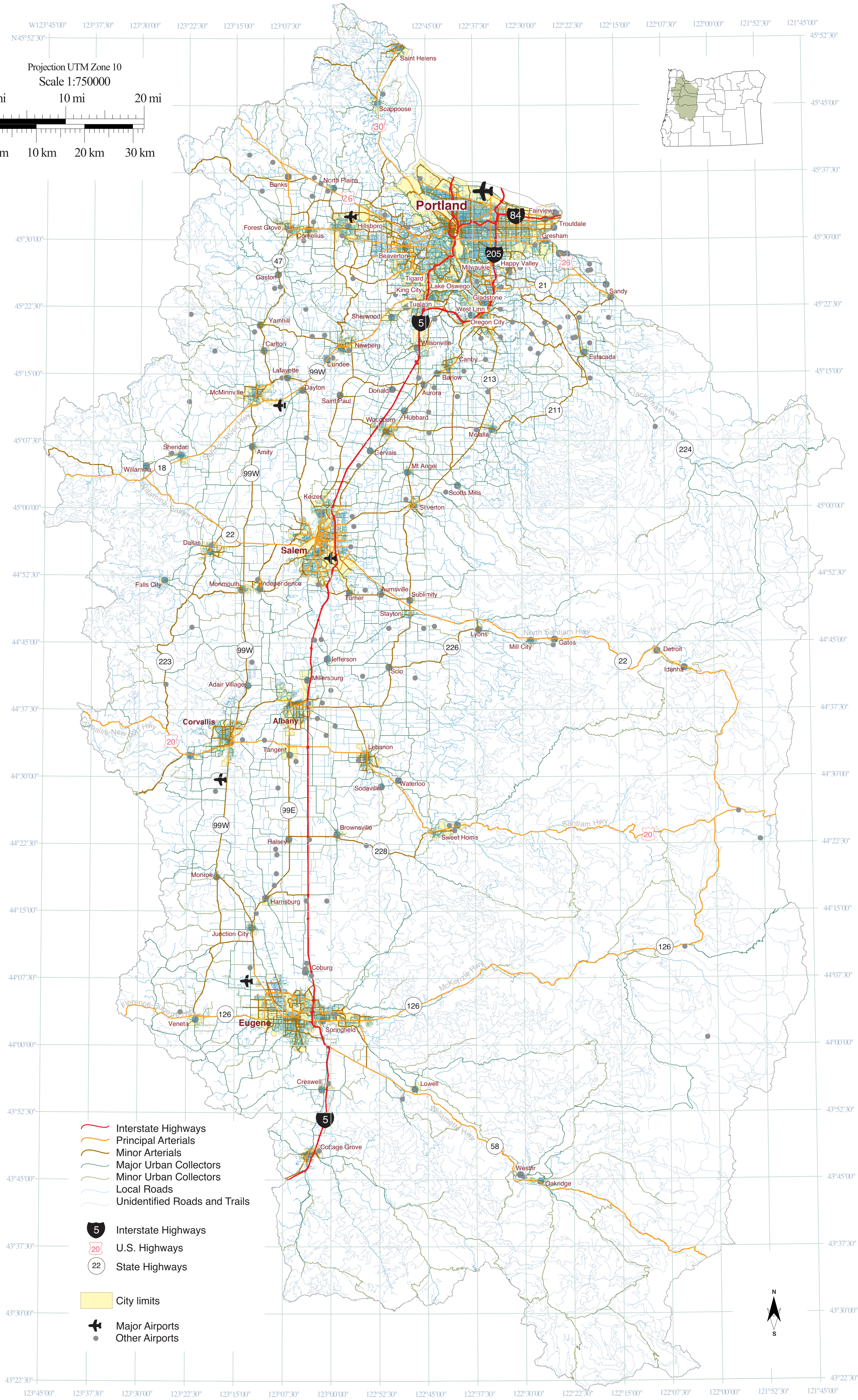


Figure 88. *Trends in public road miles in Oregon. In 1996, there were 83,189 miles of certified public roads in Oregon.*[79]

ODOT also compiles road statistics, reporting the total road miles certified open to travel by 2-wheel drive passenger vehicles as "certified public miles." The data used in this compilation are remitted to ODOT by various agencies. This data base differs from the functional classification data base in that not all roads that have been functionally classified are publicly accessible. Also, the data are gathered independently and are not correlated. Additionally, these data sets do not include all of the USFS and BLM roads. As will be shown in the following section, there are many more miles of roads in the WRB than are displayed in the map opposite or in the count of certified mileage.

Map 16. Transportation Networks[81]



Road Density

S. Payne J. Goicochea Duclos

Introduction

In the WRB, ODOT functional roads, routinely used by the public for daily transport, measure 23,222 miles (37,373 km). If "unidentified roads and trails" are included, the total ODOT-mapped network measures 35,817 miles (57,642 km) in length. Comparison with other data sources shows there are additional roads in the WRB that are not included in the ODOT description. These appear, by their location, to be logging roads on public and private lands. While these roads may not be either routinely open to the public as thoroughfares or maintained for public access, many are used by hunters, recreationalists, and others working in forests. Some of these roads provide motorized access for ski lift maintenance, fire protection, and other activities.

Map 17, opposite, is a compilation of road maps obtained from a variety of sources: ODOT, BLM, and USFS (Mt. Hood, Willamette, and Umpqua National Forests). The total roads length in this combined network is 44,049 miles (70,890 km). A hierarchy was established to define which of the overlapping maps took precedence. Data obtained from the agency with jurisdiction over the land were accepted as definitive. Thus, for example, in the Mt. Hood National Forest, the roads mapped by the USFS were assumed to be most complete. BLM not only mapped roads in the checkerboard federal lands under Bureau management but also included roads on private lands within the checkerboard pattern. Since the ODOT map was sparser, the BLM data base was used for these lands. While these data bases represent the most complete recent description of road patterns from the different agencies, work continues to refine their descriptions. Close examination of the composite road network map shows discontinuities in roads across the different boundaries. These reflect differences in surveying, mapping, and precision by the various agencies. The noticeable difference in road density and road continuity at the valleys/foothills interface of the BLM and ODOT maps suggests that not all roads are included in this compilation, and that Map 17 underestimates actual total road length in the WRB.

Road density is a measure of the linear length of roads within a specified unit of area. The definition of the area used in the measure is critical to the density computation. Table 24 lists the road densities computed for each source used in the compilation of the road network map. Measured over these large areas, road density varies by about 20-26% around the mean basin density of 3.8 mi/mi². Figure 89 shows road density computed on a 1 mi² grid. Values range from 0 mi/mi² in wilderness areas to 64.7 mi/mi² in downtown Portland. This latter figure reflects the small city blocks found in that city. Road density within city limits generally exceeds 10 mi/mi².

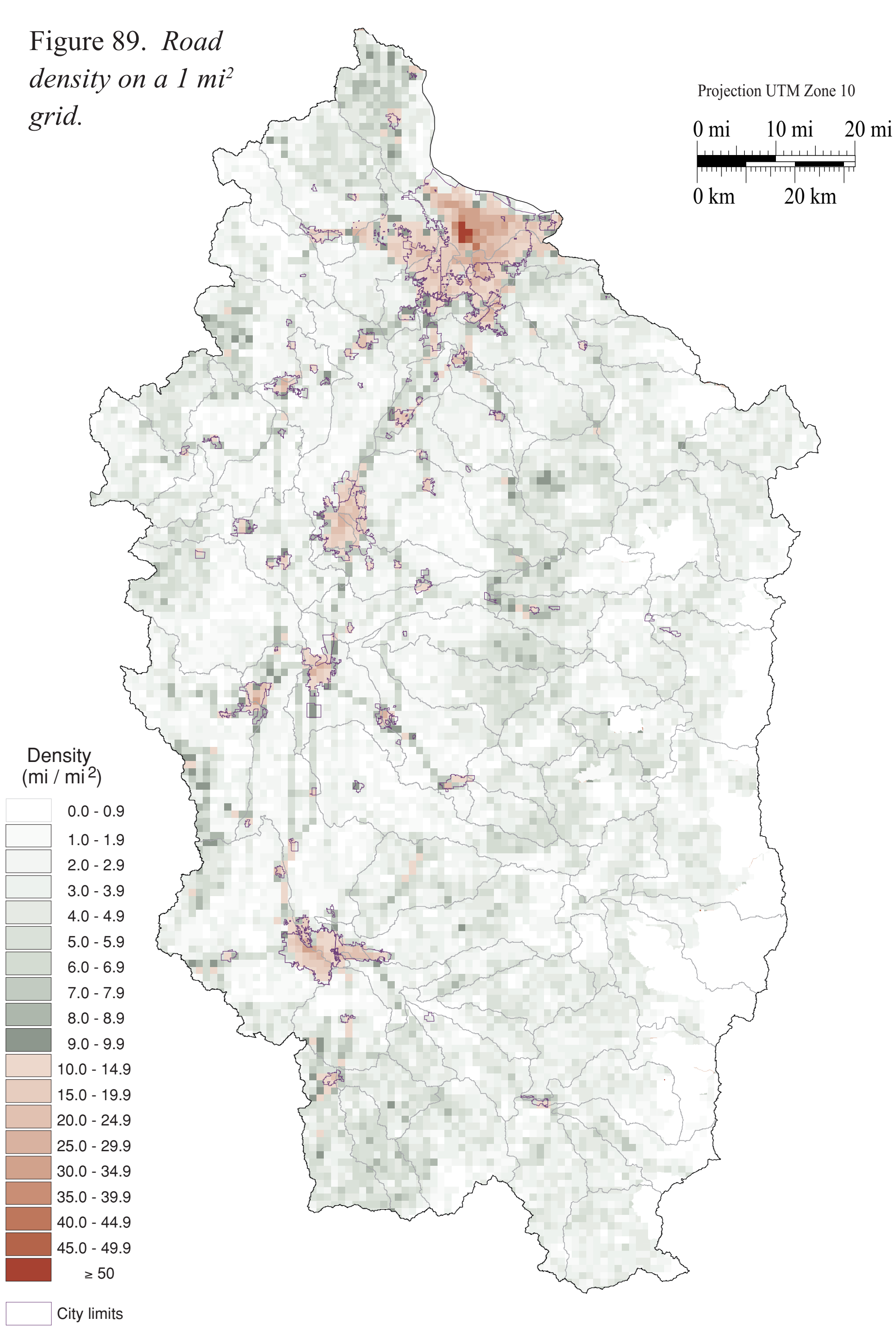
Area	Road density (mi/mi²)	Road density (km/km²)
Willamette River Basin	3.8	2.4
Valley floor (ODOT)	4.3	2.7
BLM and private checkerboard lands	4.8	3.0
Mt Hood National Forest	3.4	2.1
Willamette National Forest	3.2	2.0
Umpqua National Forest	3.0	1.9

Table 24. *Average road densities in specified areas of the Willamette River Basin. Densities computed using roads shown in Map 17.*

Figure 90 shows road density computed in fifth field HUCs. The legend is organized in steps of a half standard deviation about the mean. The lighter colors indicate HUCs with lower than average road densities (e.g., those containing a large wilderness area), while the darker colors indicate those with denser road networks (e.g., those containing major cities). The least dense fifth field HUC is Horse Creek in the McKenzie River Watershed at 0.6 mi/mi²; the most dense is Johnson Creek in the Metro area at 13.9 mi/mi².

While roads are essential for transportation of products and people, they affect landscape and ecosystem functioning in several important ways. Because compacted road surfaces are highly impervious and often intercept subsurface water flow by cutting toe slopes, both the volume and the rate of runoff are increased by road development. Runoff carries vehicle pollutants from the roads into adjacent drains and thence to streams. Further, intercepted, shallow flow across roads may increase water temperature. Blocked road culverts can cause road washouts which move sediment into nearby waterways. (These impacts may contribute to regulatory listing of streams for adverse water quality known as 303(d) listing.) Roads fragment wildlife habitat and create hazards and barriers to the movement of some wildlife species. Weeds and plant diseases may be imported into remote areas along roads (e.g., the virus afflicting Port Orford cedars in western Oregon).

Figure 89. *Road density on a 1 mi² grid.*



Unit Equivalences

mi/mi²	km/km²
1.0	0.62
5.0	3.11
10.0	6.21
20.0	12.4
50.0	31.1

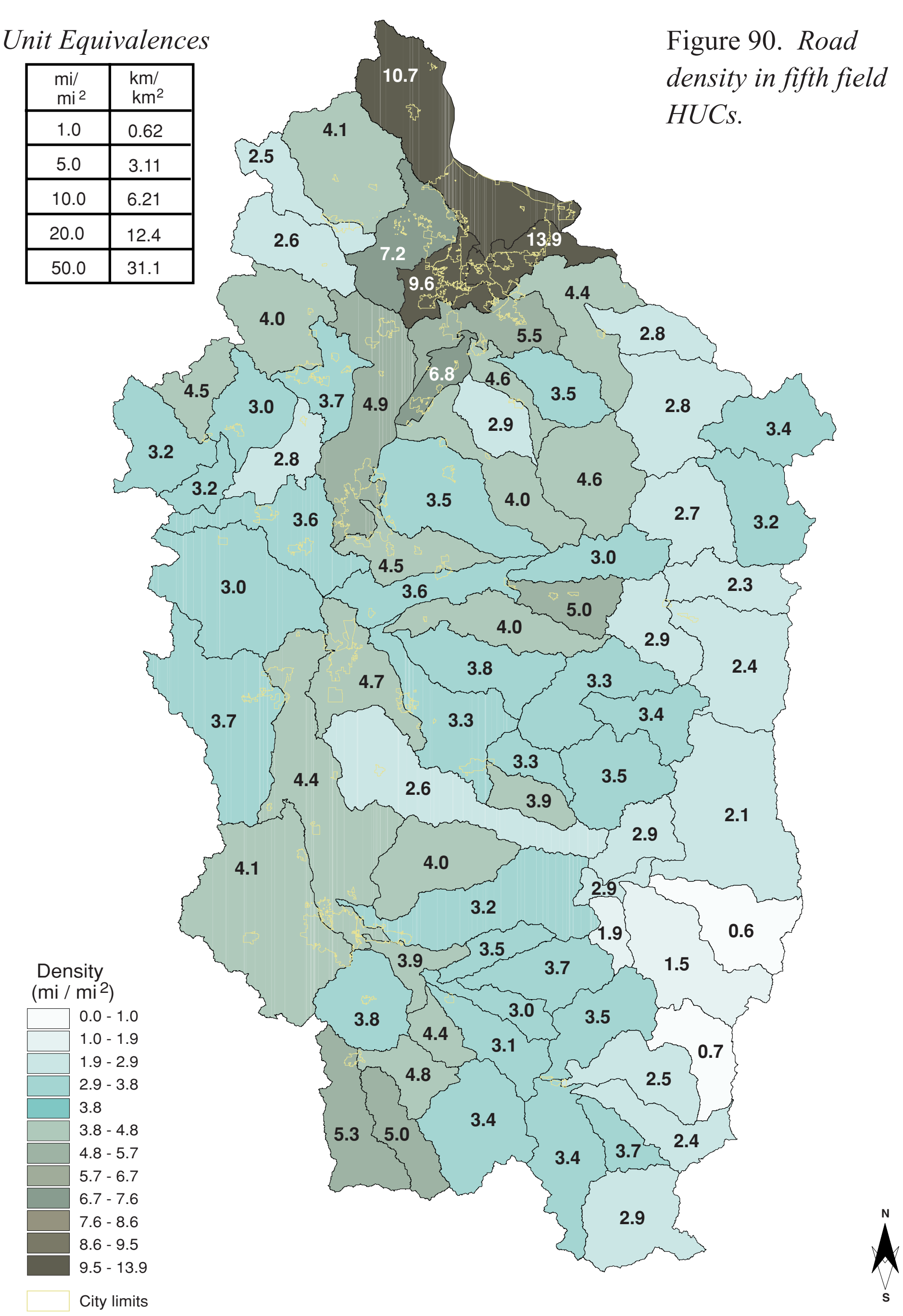


Figure 90. *Road density in fifth field HUCs.*

Map 17. Road Network [81-85]