Population Density and Reduced Road Congestion

Prepared at the Request of Kemper Freeman, Jr.

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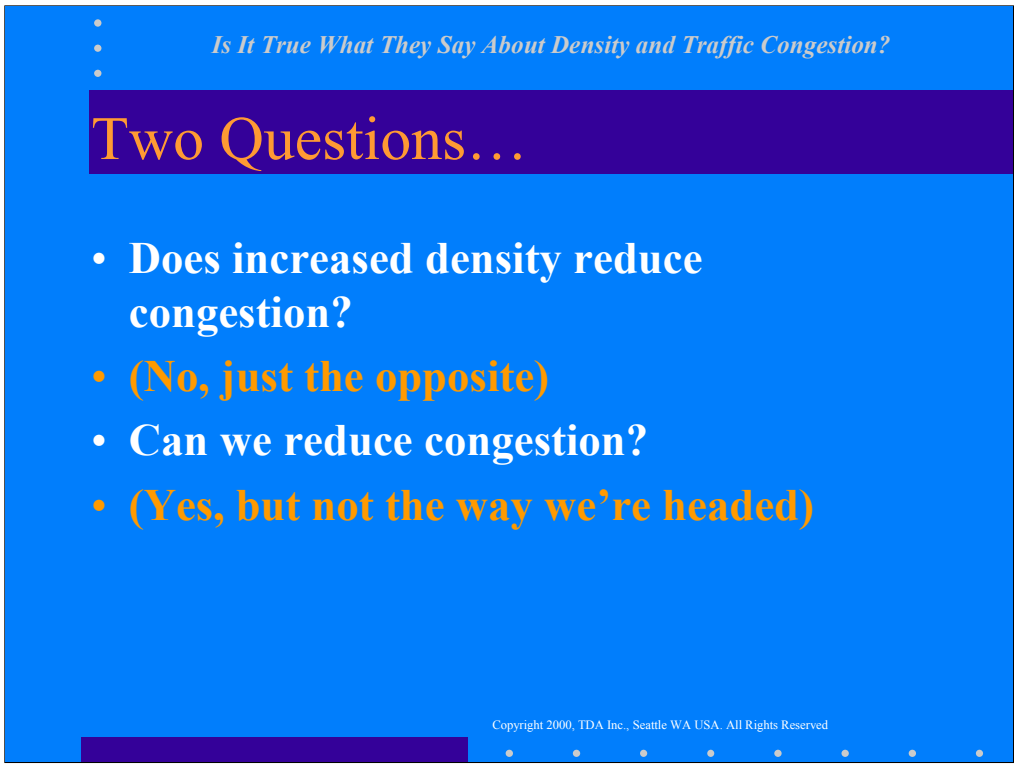
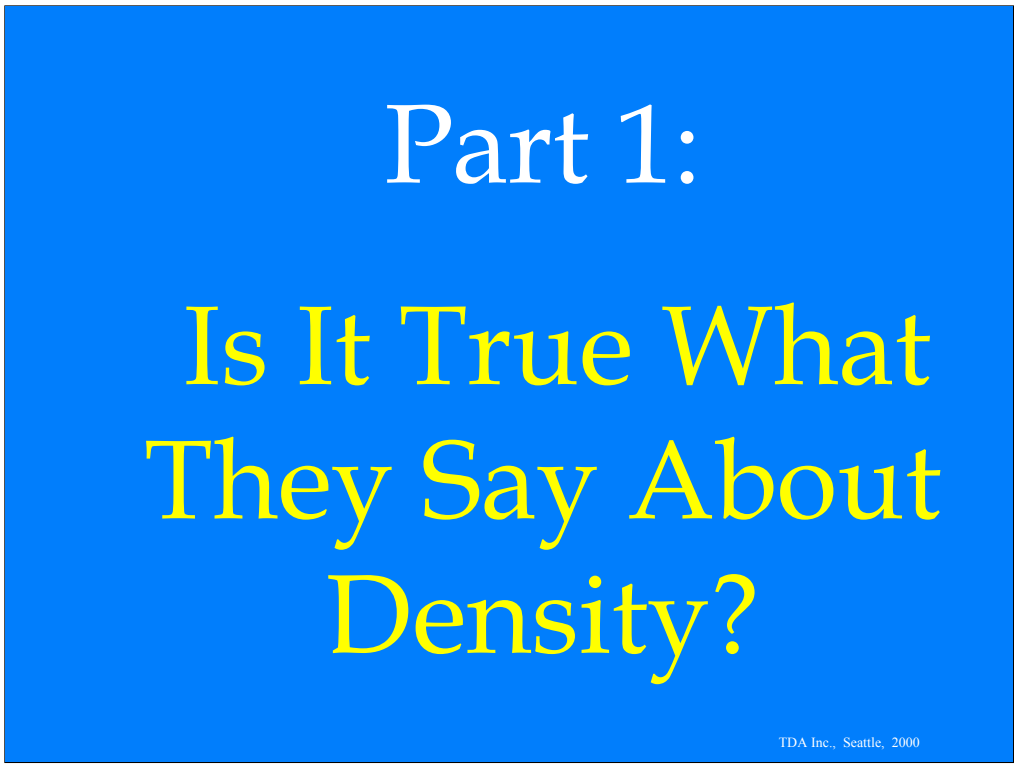
Prepared by:
William R. Eager, TDA Inc.

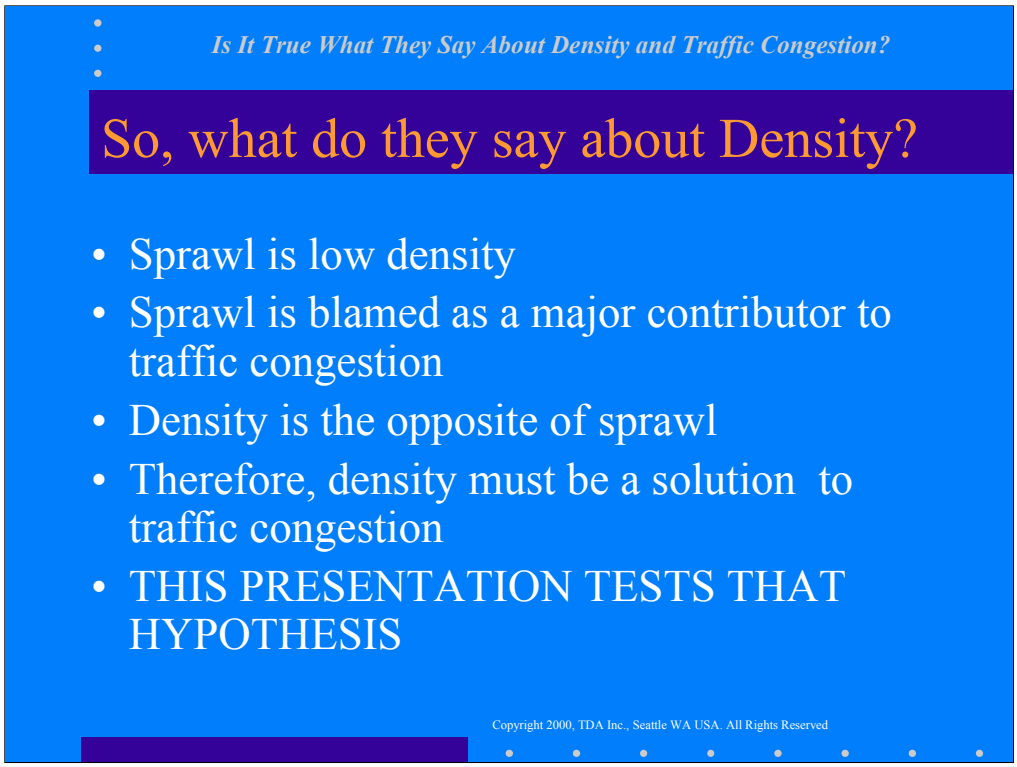
July 2001



This presentation answers these two central questions.



Part 1 of this presentation outlines the relationship between density and travel demand.



"Sprawl" is a pejorative term applied to large portions of our urban development. There is not consensus on what the word "sprawl" means when applied to urban development. To some it may refer to haphazard, leap-frog development or development of low quality. Low-density of use is generally included in any definition. One of the perceived results of "sprawl" or low-density development is increased traffic congestion. The corollary proposition is that if low-density causes congestion, then higher density must reduce traffic congestion. This theory is one of the foundation stones of many growth-management programs.

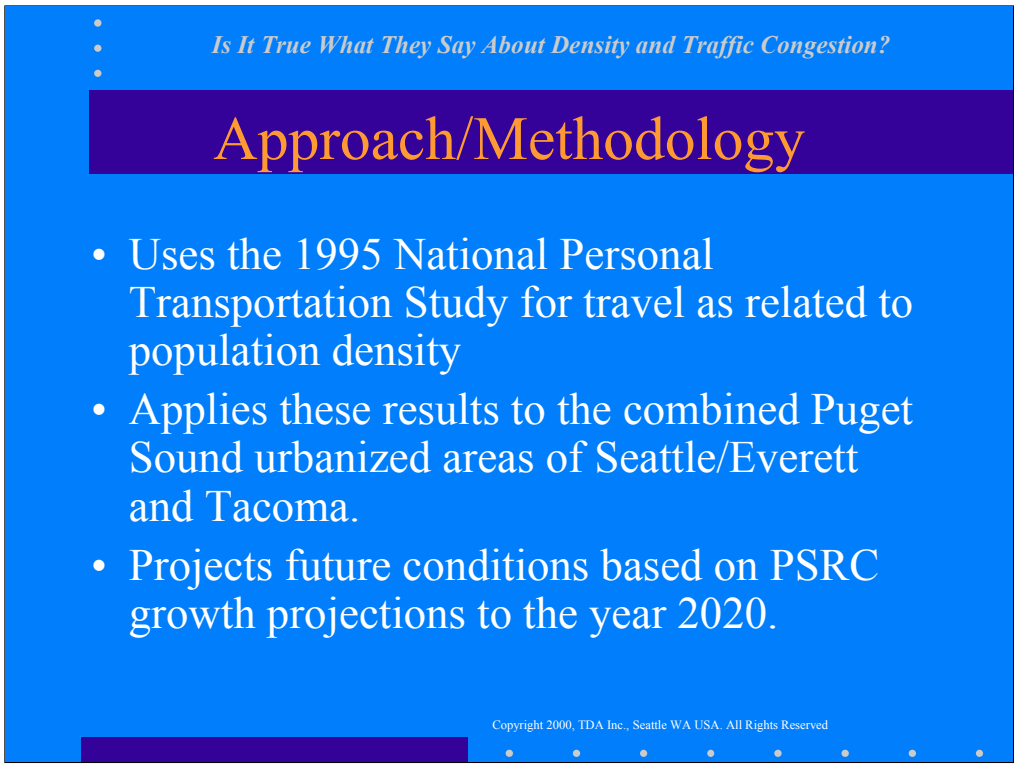
There may be reasons to reduce "sprawl" (depending on the definition) and there may be reasons why higher density is a good idea. *However, this presentation has a specific focus to test the hypothesis that higher density reduces traffic congestion. The results show that:*

- *<u>Growth</u> creates travel demand, <u>sprawl</u> doesn't*
- *Over realistic ranges, <u>density</u> doesn't make our travel woes go away*
- *Travel reductions would only come with densities far beyond political reality*

Data are from the National Personal Transportation Study, and are applied to the Puget Sound region as an example.

It's probably safe to say that we are not consistent in our use of the word "sprawl". No doubt many enjoy the personal freedom and quiet lifestyle of low-density neighborhoods – neighborhoods that others may refer to as "sprawl". To be more blunt, the Redmonds, Issaquahs, and Kents that urban planners vilify as "sprawl" in fact provide an affordable, thoroughly enjoyable lifestyle to most of their residents.

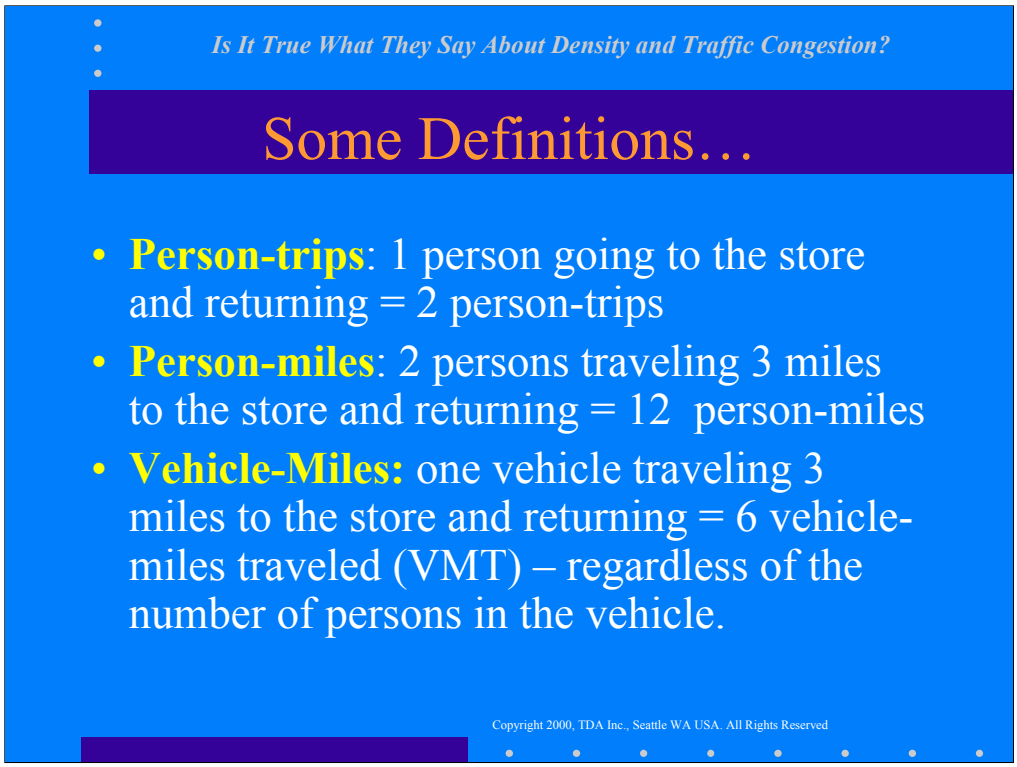
Low-density development is not uniquely American. It is a characteristic of contemporary urban development in Canada, Europe, and the Far East. Even Toronto, long the poster child of planned urban development, is now developing suburbs similar to those of U.S. metropolitan areas.



The National Personal Transportation Study (NPTS) is the nation's inventory of daily passenger travel; data comes from a large sample of households (44,000). The 1995 NPTS (latest available) was used for this analysis. It provides information on the amount of travel by mode and relates that to a large number of characteristics, including population density.

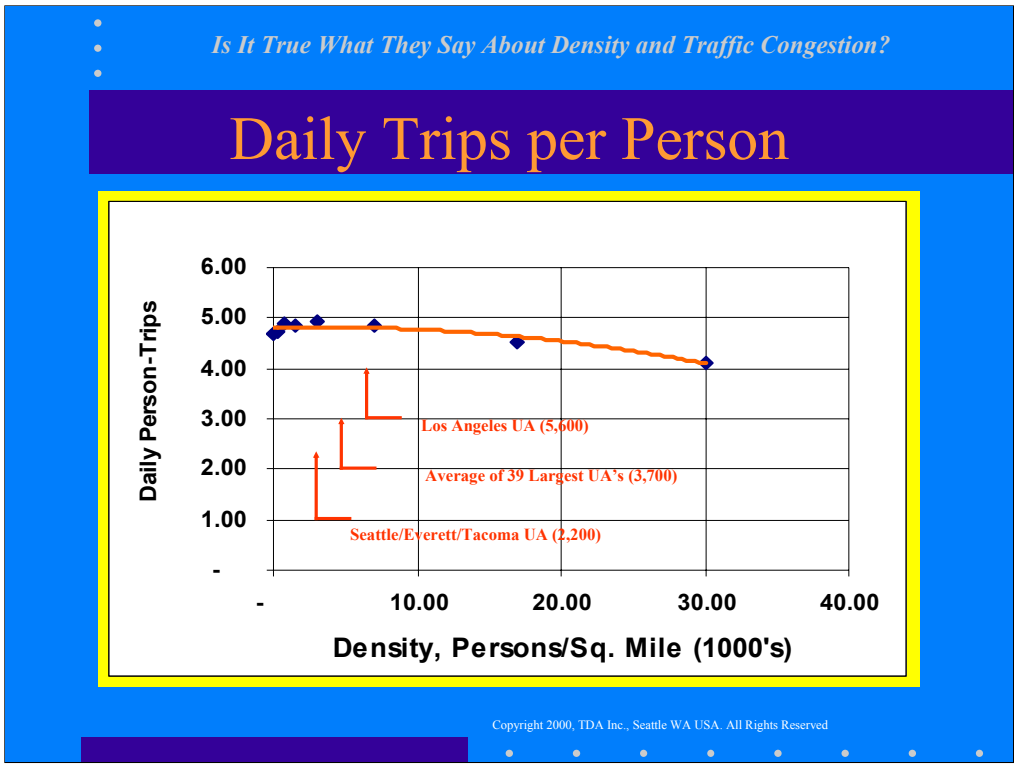
An "urbanized area" consists of a central place or places and adjacent urban fringe that together have a minimum residential population of at least 50,000 people and generally an overall population density of at least 1,000 people per square mile of land area. Together, the Seattle/Everett and Tacoma urbanized areas have a 2000 population of about 2.7 million persons; this is projected to grow to about 3.4 million by 2020.

The focus in this presentation is on differences in travel behavior among areas of differing population density. There are, no doubt, other variables that change along with density and which may also be affecting travel behavior. For example, higher densities may be associated with older urban areas, which in turn may have more of a transit orientation than newer areas.



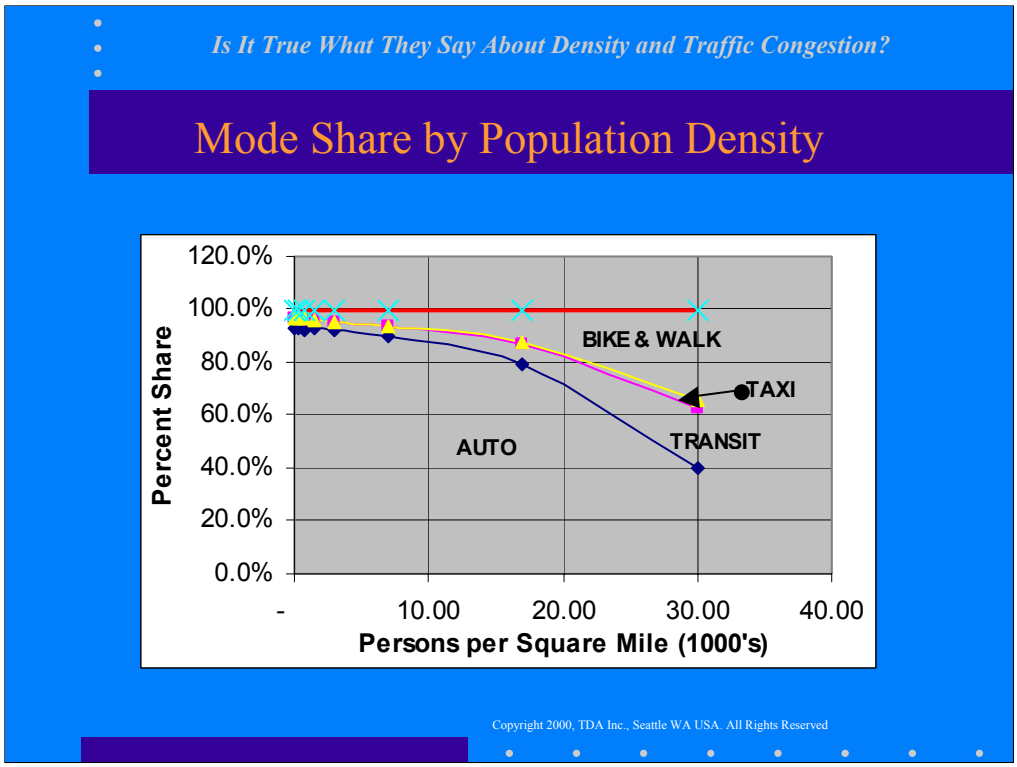
Person-trips and person-miles represent the market demand for personal travel. Vehicle-miles are dominated by automobile and truck travel and represent one of the results of the person-trip demand.

Subsequent slides will use these terms.



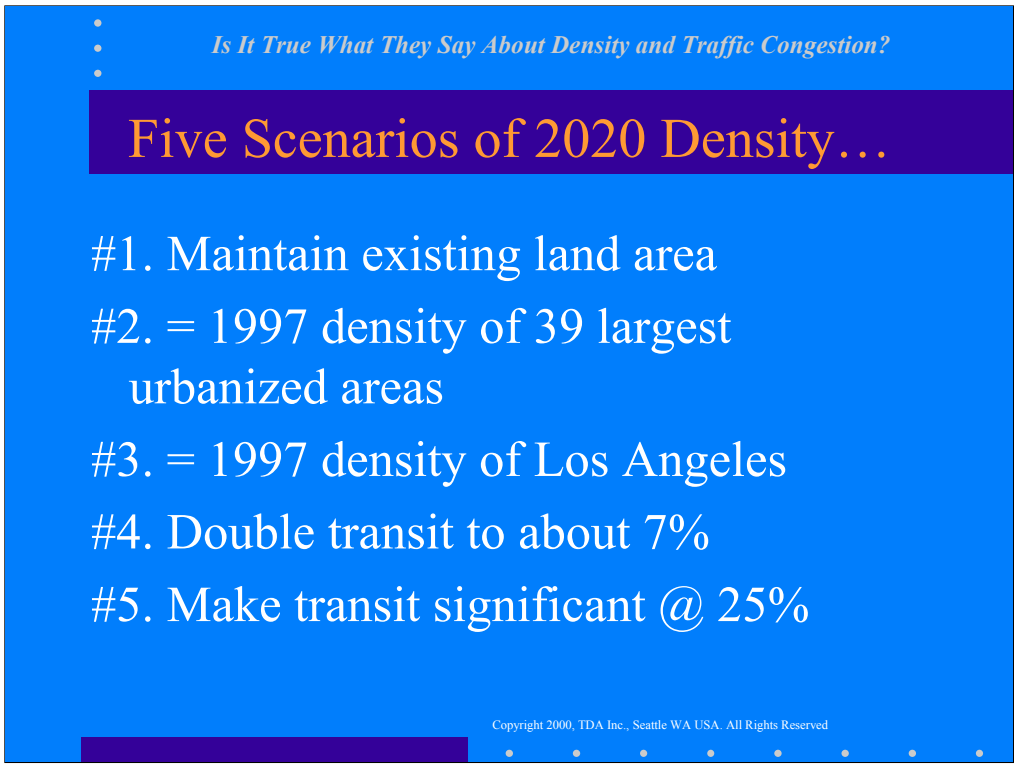
This chart shows that the total daily trips per person by all modes is relatively stable at just fewer than 5 daily trips for densities less than 10,000 persons per square mile. The figure does drop to about 4 trips per person per day at densities of 30,000 persons per square mile. Please recognize that most of urban America is at a density near the left end of this chart. As shown on the chart, the density of the Seattle/Everett/Tacoma urbanized area is about 2,200 persons per square mile. This is less than than the average density of the 39 largest urbanized areas in the U. S. (those with a population exceeding one million). Of surprise to many, Los Angeles is the highest density urbanized area in the U. S., even higher than New York. The borough of Manhattan, which many think of as "New York" is of high density with about 52,000 persons per square mile, but that is not representative of the entire urbanized area which includes the suburban areas in Long Island, New Jersey, and Connecticut. Obviously, in other metropolitan areas there will also be some locations of significantly higher density. For example, the highest density Census Tract in the Seattle area is a small (one fifth of a square mile) tract on Capital Hill, with a density of about 35,000 persons per square mile.

For those more accustomed to density measured by dwelling units per acre, rather than persons per square mile, a density of 10,000 persons per total square mile is roughly equivalent to 14 dwelling units per residential acre. For the Seattle/Everett and Tacoma urbanized area, the average density of 2,200 persons per total square mile is roughly equivalent to 3 dwelling units per residential acre.

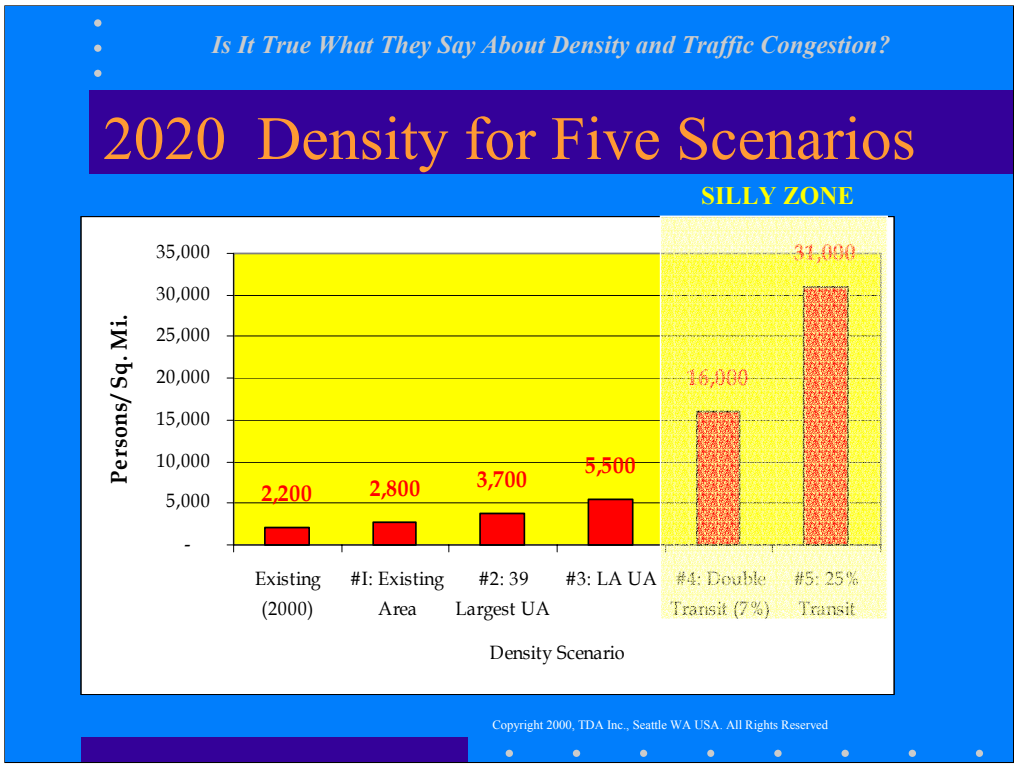


While the total number of person-trips per person is relatively constant over the wide range of densities, the mode by which those trips are made changes. As the chart shows, auto declines and transit, bike/walk and taxi increase with higher population densities.

Note that significant changes in mode of travel occur only at densities much higher than most of urban America. Note also that “bike and walk” travel increases more rapidly than does “transit”.



The next few pages discuss 5 scenarios of increasing density.

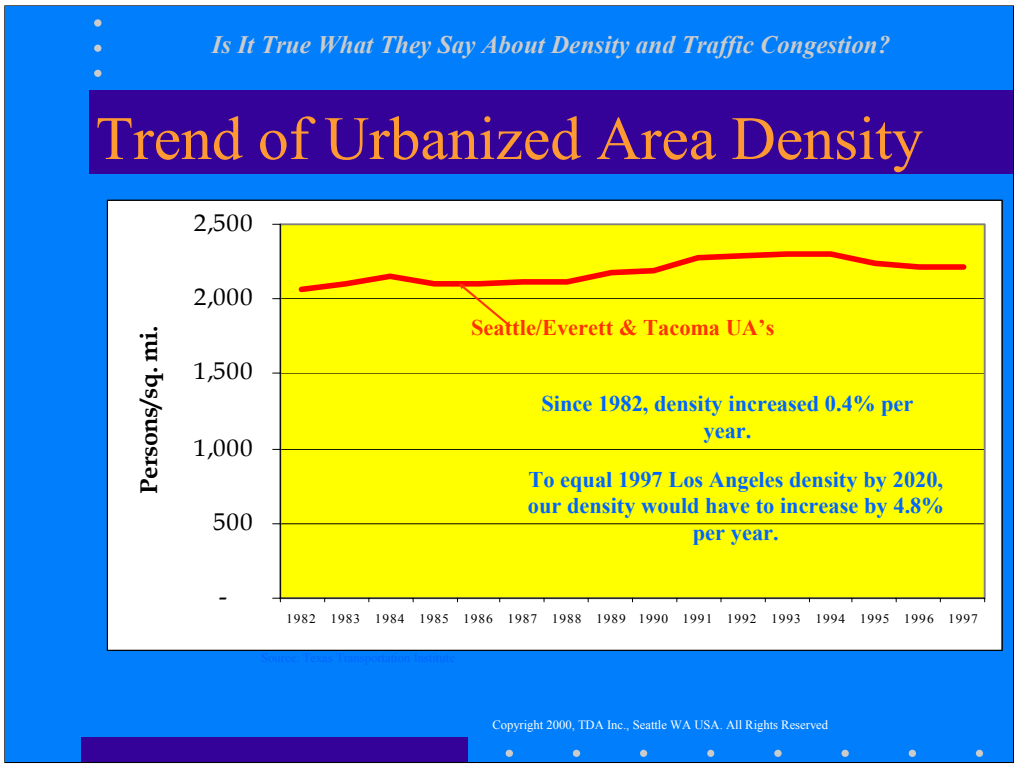


From a regional perspective, these last two scenarios are in a "silly zone". While it is conceivable that we will have small pockets of density this high, it is inconceivable to expect major portions of our region to reach levels of 16,000 persons per square mile or higher.

This is residential density of about 3 dwelling units per residential acre, which is roughly equivalent to 2,200 persons per total square mile.

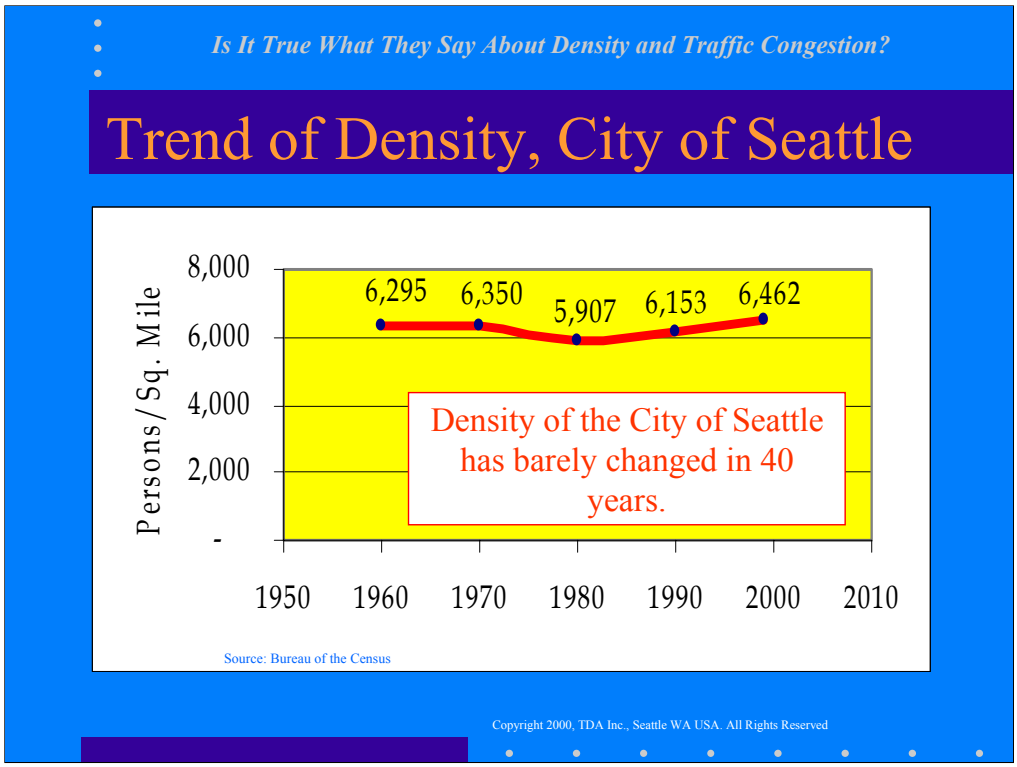
This is a residential development of 7 to 8 dwelling units per residential acre. This is roughly equivalent to 5,500 persons per total square mile.

This is a view of Victoria, the former capital city of Hong Kong. Its population density is 70,000 persons per square mile. The island of Hong Kong has an average density of 46,000 persons per square mile.



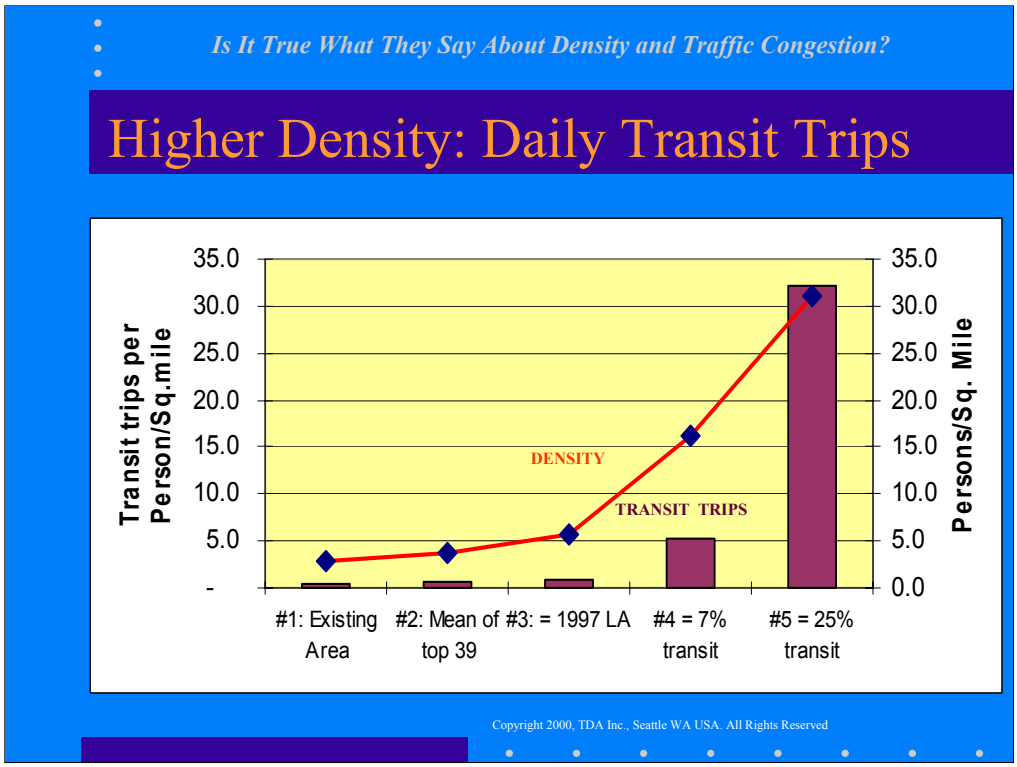
If this region is to increase density significantly, our recent past offers no encouragement. Between 1982 and 1997, density of the Seattle/Everett and Tacoma urbanized areas has increased an average of less than one-half of one percent per year. If the region were to reach the average density that the Los Angeles urbanized area had in 1997, density would have to increase by 4.8% per year, a rate 12 times higher than that of the recent past.

It should be pointed out that urbanized area density is affected by the continually changing boundaries as the area grows. There could be locations with increasing density counterbalanced by new additions of lower density. During the period shown, the population of the Seattle/Everett and Tacoma urbanized area increased by 37% and the land area increased by a smaller 28%.



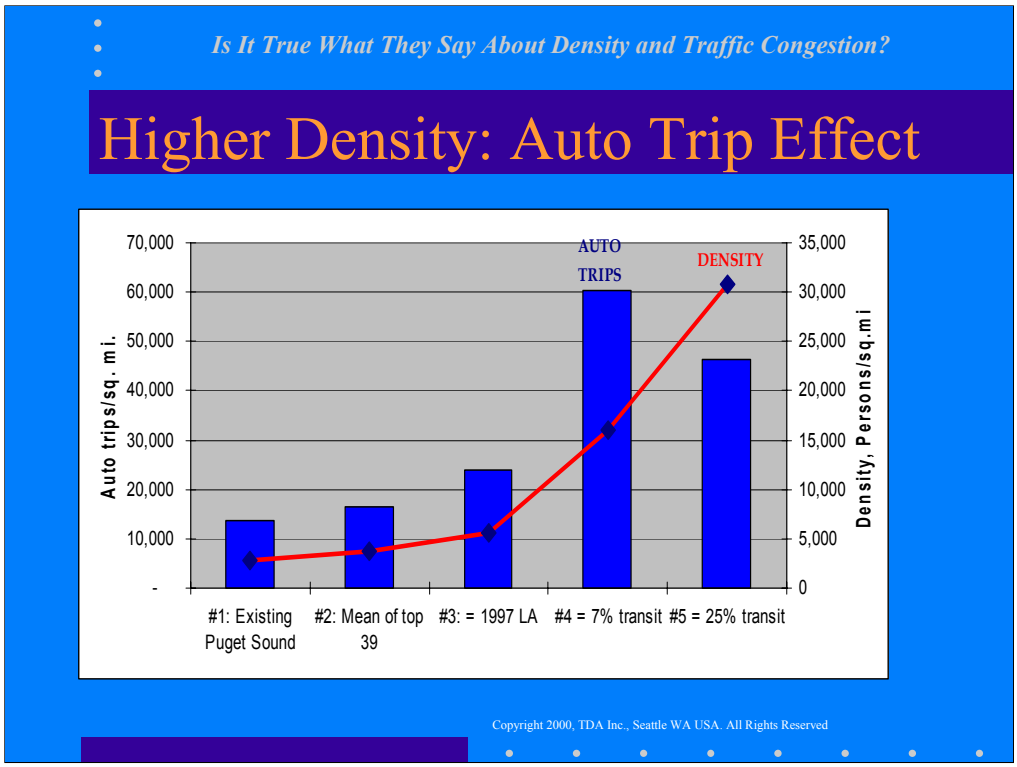
The population density of the City of Seattle, at about 6,000 persons per square mile, is higher than the average for the urbanized area. Between 1960 and 1990, the City's density declined slightly. By 1999, population of the City had increased slightly. The average annual growth rate over the 39 years shown is less that 1/10th of one percent per year. During this period, the City's land area decreased by 2% and the population increased by 5%.

(The figures for 1960 through 1990 are from the Census Bureau; the 1999 figure is from the City of Seattle)



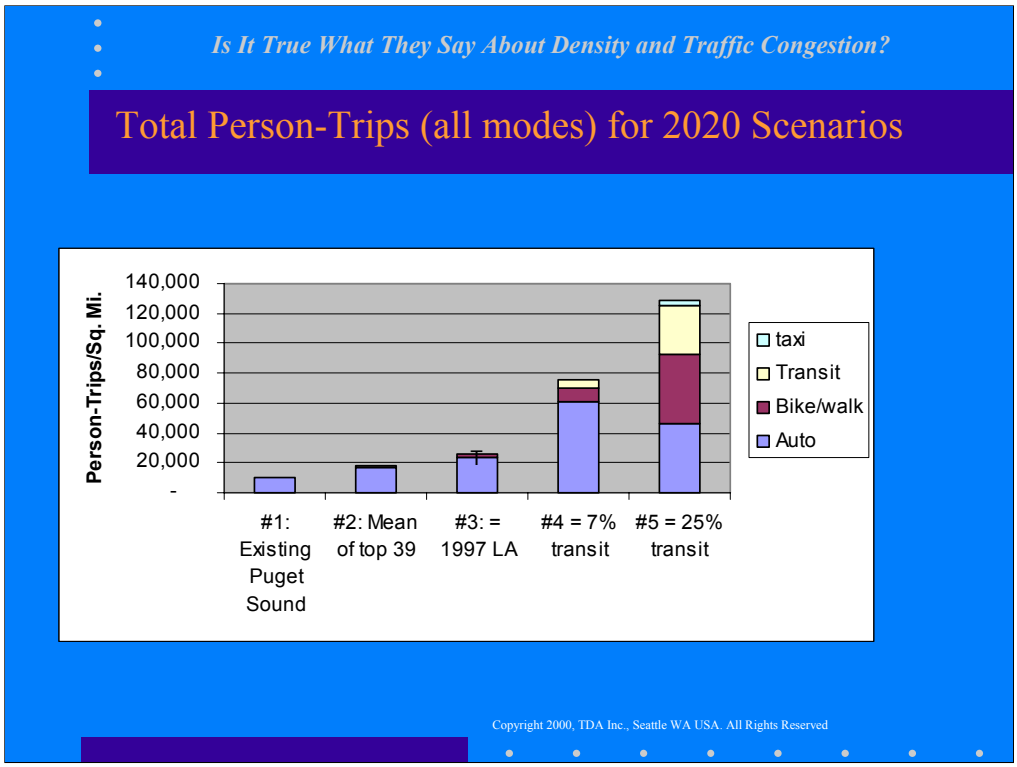
The bars show transit trips per square mile for each of the five density scenarios. The line shows the population density associated with each of the scenarios. At the left end of the scale (the first three scenarios), transit rides are increasing at about the same rate as density. At the higher densities (scenarios 4 and 5), transit ridership accelerates and increases faster than population density.

As mentioned in the text for the previous slide, changes in taxi and bike+walk follow a similar pattern.

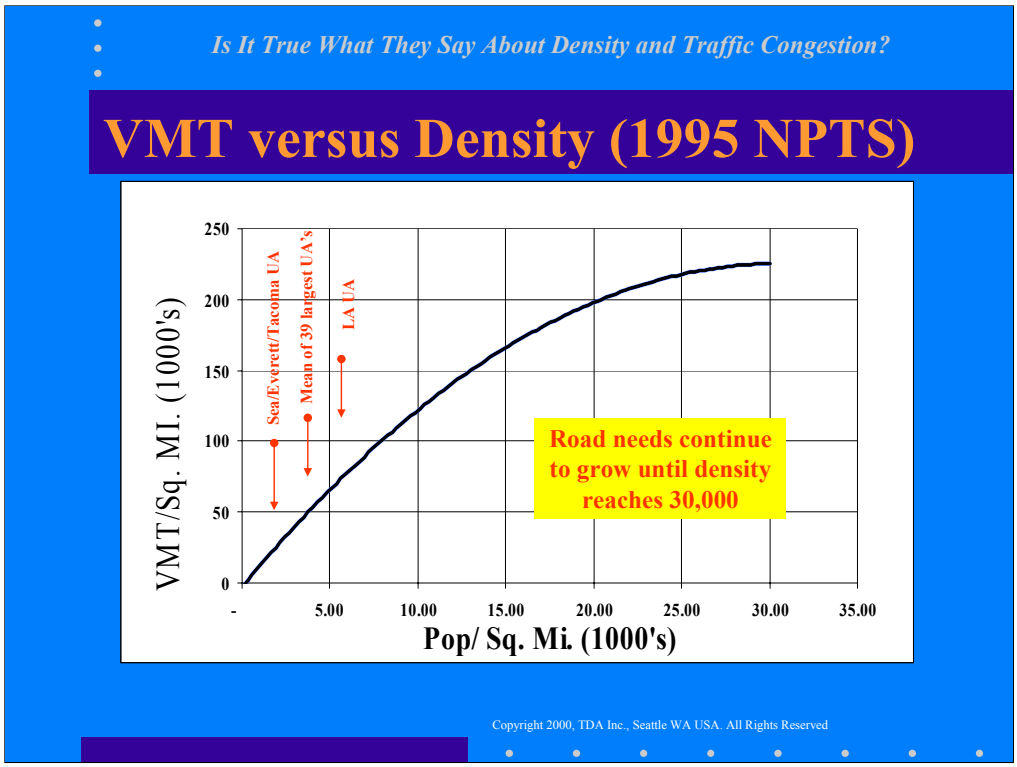


The bars show auto trips per square mile and the line shows the associated density of population. Here, the pattern is different than that for transit, taxi and bike+walk. Auto use grows with density, almost linearly, with the first 4 scenarios. Finally, the fifth scenario is at a density for which auto use begins to decline. However, auto trips per square mile at the highest density shown is still 3 ½ times that for the existing density of the Puget Sound urbanized areas.

HIGHER POPULATION DENSITY IS NOT A SOLUTION TO TRAFFIC CONGESTION. IN FACT, CONGESTION, AS MEASURED BY AUTO TRIPS PER SQUARE MILE, CONTINUES TO INCREASE UNTIL VERY HIGH POPULATION DENSITIES ARE REACHED. THESE HIGH POPULATION DENSITIES ARE NOT REALISTIC FOR ANY BUT VERY SMALL PORTIONS OF OUR REGION.

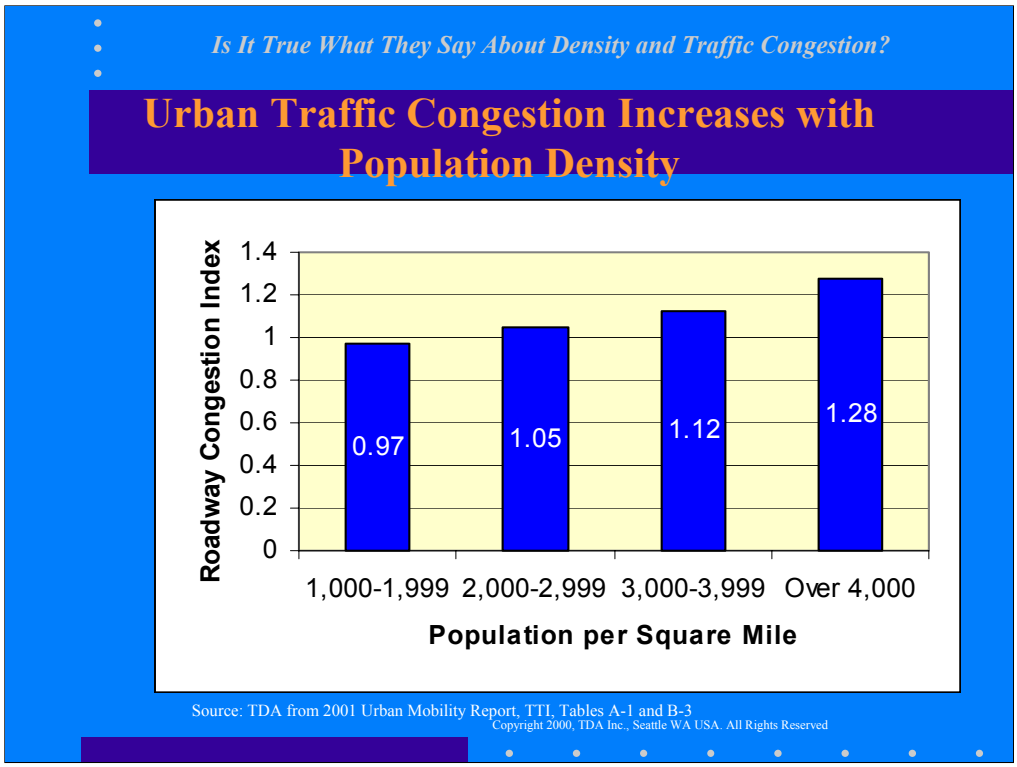


This shows the total person-trips, by all modes. It combines the two previous charts along with figures for taxi and bike/walk. Note that travel by modes other than the automobile becomes significant only at high densities (that is, densities exceeding 16,000 persons per square mile)

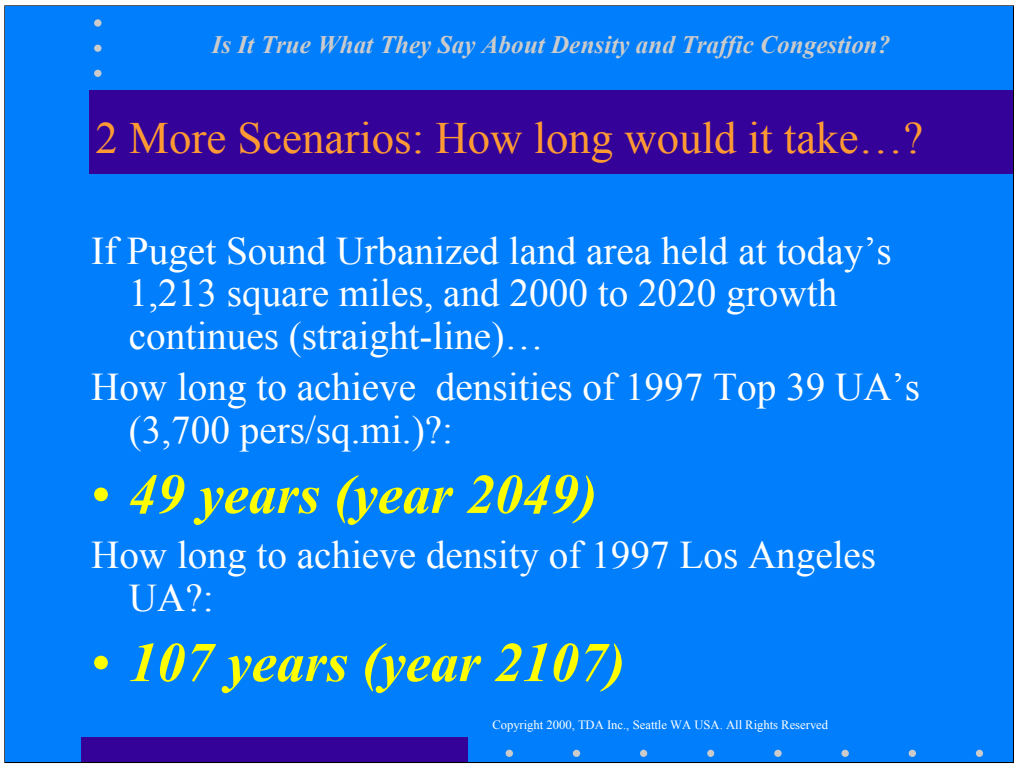


This shows that the density of vehicular travel (VMT per square mile) increases with population density. In fact, at the lower end of the curve where most of urban America is, the relationship is nearly a linear 1 to 1. That is, a doubling of population density roughly doubles the amount of vehicular travel in the same area.

Overall, the relationship shows that road needs continue to grow until density reaches at least 30,000 persons per square mile. (30,000 is the highest density grouping provided by the NPTS data).



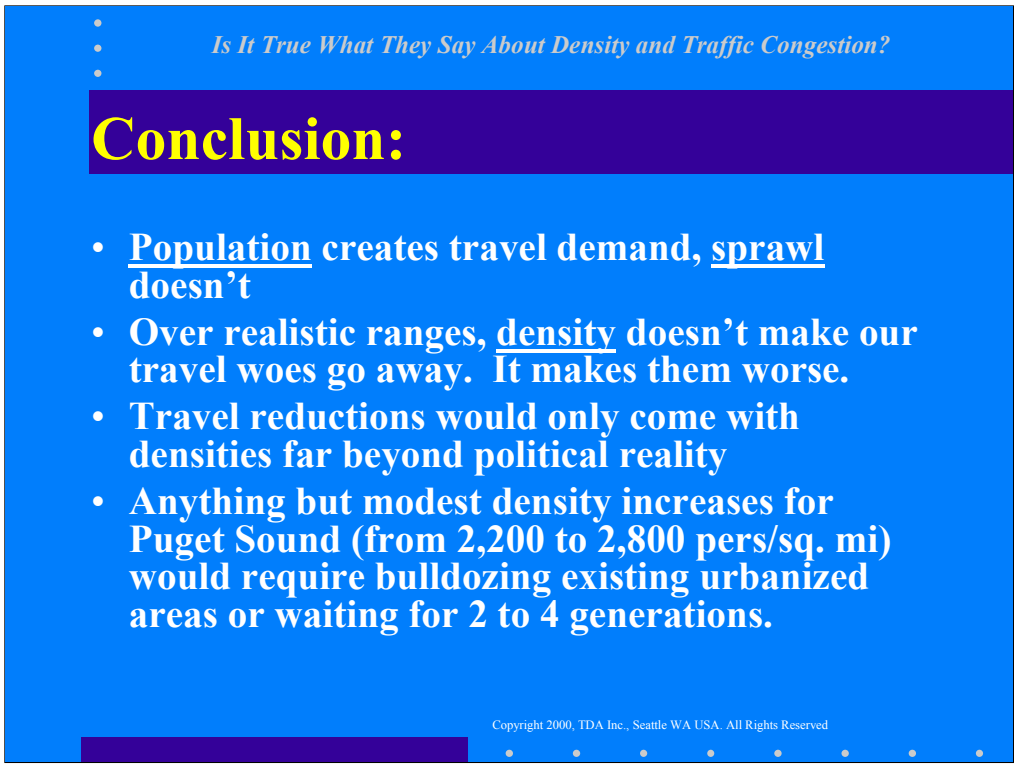
From another source (Texas Transportation Institute), this shows that traffic congestion increases with increasing population density in U.S. urbanized areas.



This adds two additional scenarios of higher density. Rather than considering only the year 2020, these look at how long it would take to achieve higher densities if the population growth rate is held constant. Specifically, this assumes that the PSRC 2000 to 2020 growth rate continues, as a straight-line (not compounding).

Under these assumptions, it would take 49 years to achieve the 1997 density of the 39 largest urbanized areas in the U. S. To achieve the 1997 density of the Los Angeles urbanized area would take 107 years. For obvious reasons, calculating the time period for even higher density scenarios wasn't worth the effort. Obviously, periods considerably beyond 100 years would be required.

For those who would say transit is a long-term proposition and that travel behaviors will shift toward transit in 100 years, a look back is needed. Today the annual number of transit trips in the U.S. is about the same as it was a century ago. This is in spite of a seven-fold increase in urban population – the market for transit. The massive transit investments of the past 35 years have done little to alter this long-term trend.



Over the range of densities appropriate to more than 95% of urban America, the number of people determine our transportation needs. These needs are largely independent of sprawl or density. Neither density nor sprawl will make our transportation problems go away. The side effects of auto travel - congestion and air pollution - occur with or without sprawl, and will require resolution by other means. There may be other reasons for higher densities, but we should not expect increased density to have a beneficial impact on our transportation needs. Reductions in auto travel per square mile begin only at densities well beyond political reality.

On the other hand, there probably is a lower density reality (which some would call sprawl) that will occur. If planned carefully, only streets of a more friendly scale would be needed within communities, with larger roads (freeways and principal arterials) needed only for intercommunity travel.

Where does this leave us?

- **We are not…**
  - **Defending sprawl**
  - **Denouncing density**
  - **Damning transit**
- **There will be growth**
- **There is a market for a range of densities**
- **Transit has an important role in key centers**
- **Major roadway capacity improvements will be needed, whatever the density**

Part 2:

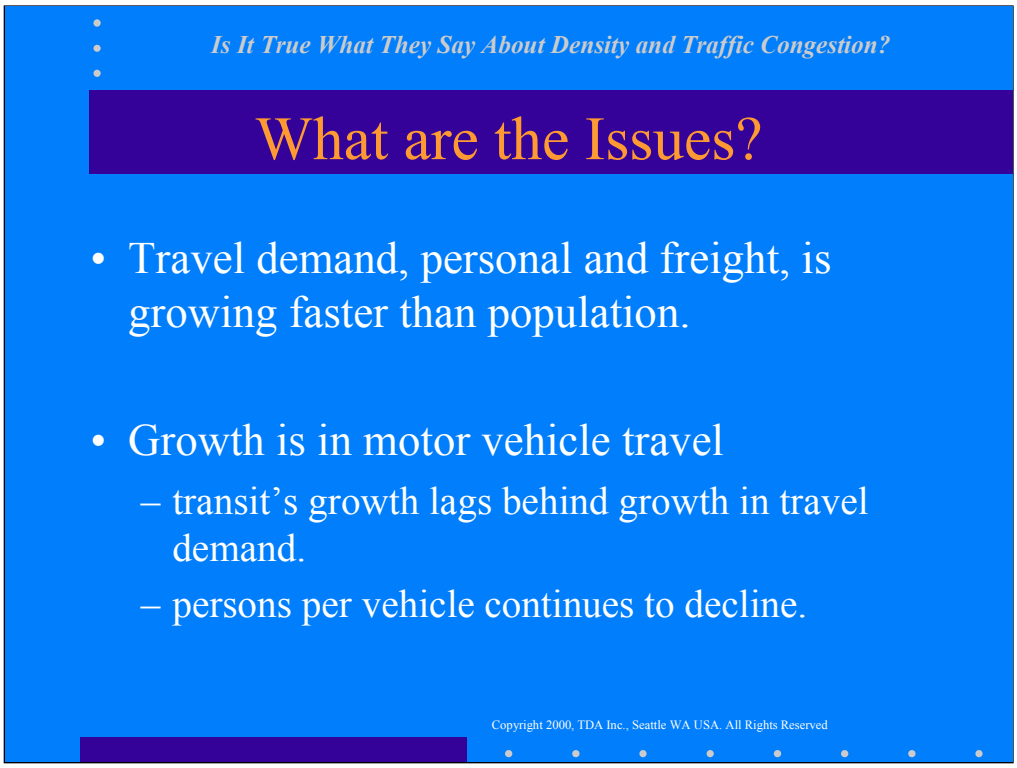
Is There Nothing We Can Do About Congestion?

TDA Inc., Seattle, 2000

This second part shows that we can do something about congestion.

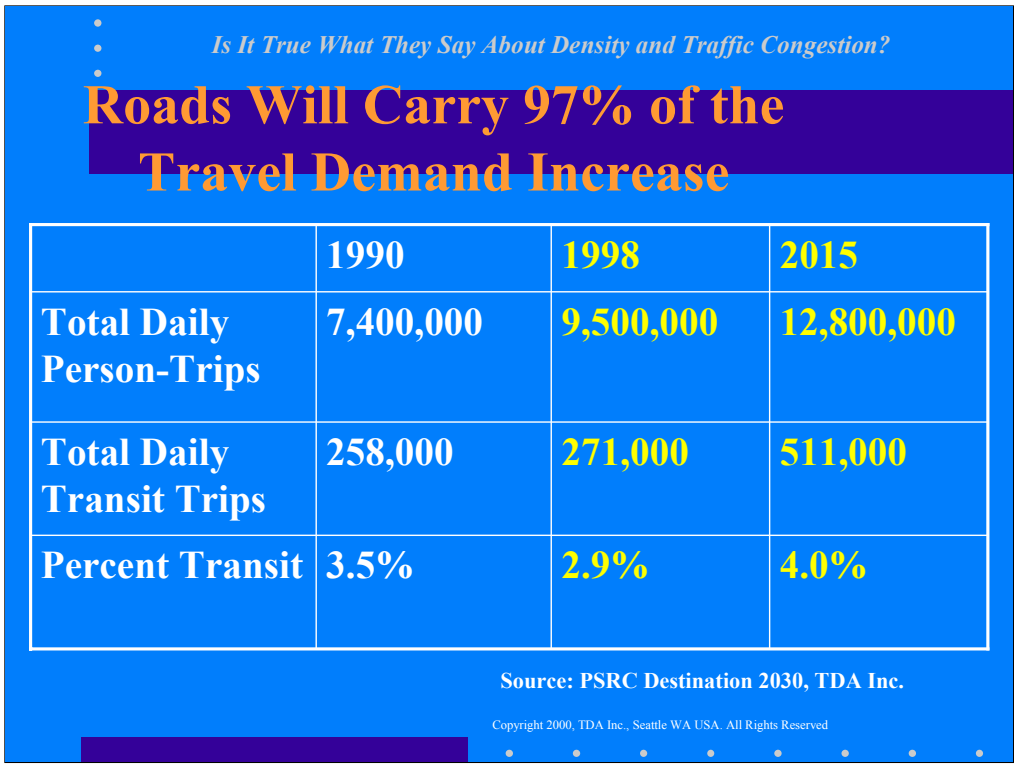
In the Puget Sound region, 97% of our daily person-trips are in private vehicles. Transit carries about 3% of daily trips. Even with completion of all the planned improvements, in year 2010 transit will still carry about 3% of daily trips. Yet the majority of transportation improvements planned for the region are for transit, and no congestion relief is promised.

This report outlines a program to reduce traffic congestion by 25% from today's level for this "other 97%", while increasing mobility. It would be done by the year 2010. While this report focuses on the three-county are of King, Pierce, and Snohomish Counties, the principles apply State-wide.



During the 1980s, person miles of travel increased at a rate several times higher than that of population for the Puget Sound Region. In the 1990s, this trend has continued (although at a somewhat slower rate). That means we can't blame all of the growing traffic congestion on new population. All of us are driving more and more.

This growth is in private vehicle travel. Transit's market share of urban travel continued to decline, both nationally and locally. Transit is important to some specific locations and some specific market segments. But in the big picture, transit is declining as an element of our transportation system. Also, in spite of all the efforts to encourage ridesharing, the average number of people per vehicle continues to decline.

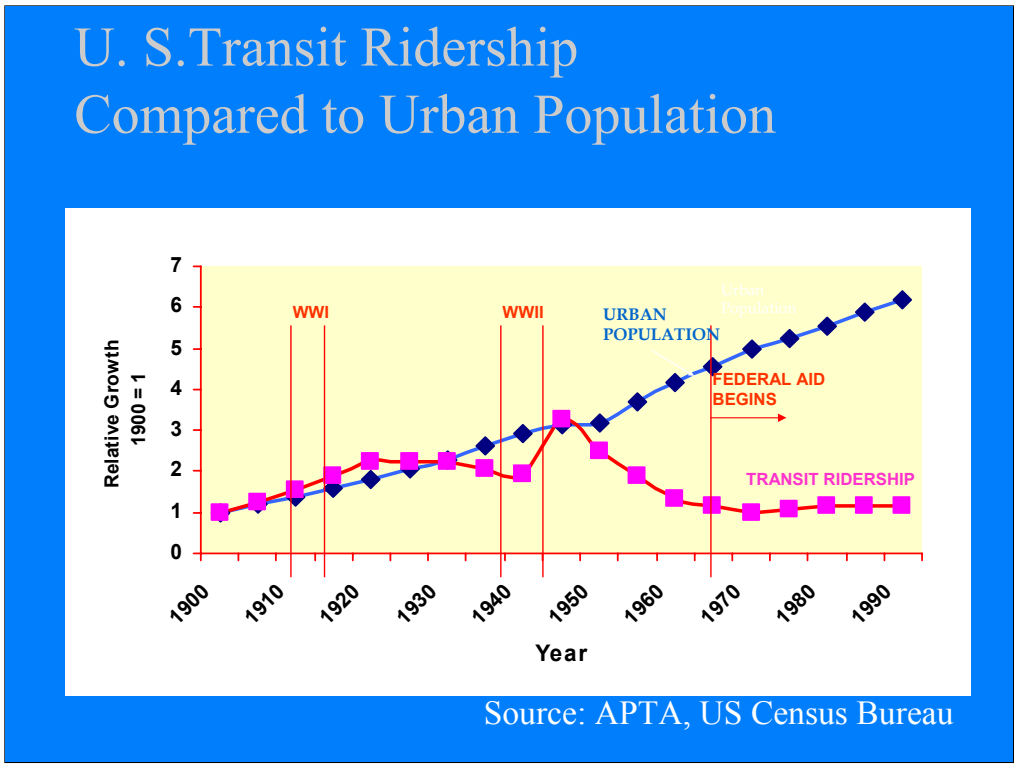


It's unrealistic to expect that transit will solve our congestion problems. In spite of the massive funding increases to transit over the last three decades in the U.S., there has been no favorable impact on congestion, with the exception of a few isolated locations.

This slide illustrates the three-county picture. Total person-trips per day are projected to increase from about 7.4 million in 1990 to about 11.8 million in 2010. In 1990, transit carried about 260,000 daily person-trips, or about 3.5% of the total daily person-trips. With some growth related to population increase and the Sound Transit program, transit ridership will increase by about 130,000 daily rides and bring the market share almost back to where it was in 1990.

Data for the year 1995 (the most recent year for which data were available), indicate that transit has lost share in the five years since 1990.

Even if Sound Transit were to achieve *double* its expected transit increase of 66,000, transit's market share would still be less than 4% of the daily total. In either case, transit is such a small part of the total that without additional transportation programs, congestion will increase. Transit's impact in holding back that increase will be nearly



This compares growth in U.S. transit ridership with growth in U.S. urban population since 1900. It shows that transit today carries about the same number of riders as in 1910; this in spite of a growth in urban population of about 7 times over the same period.

The first objective of Reduce Congestion Now would be to reduce year 2010 roadway congestion by 25% from today's congested levels.

The second objective is critical to the first -- the region's personal and freight mobility would be increased, without penalties such as those found in "congestion pricing" strategies.

The third objective has two elements: to boost the performance of our existing transportation investments and to reduce the cost of new transportation facilities.

The following pages detail the implications of these objectives.

Reduce Congestion Now requires:

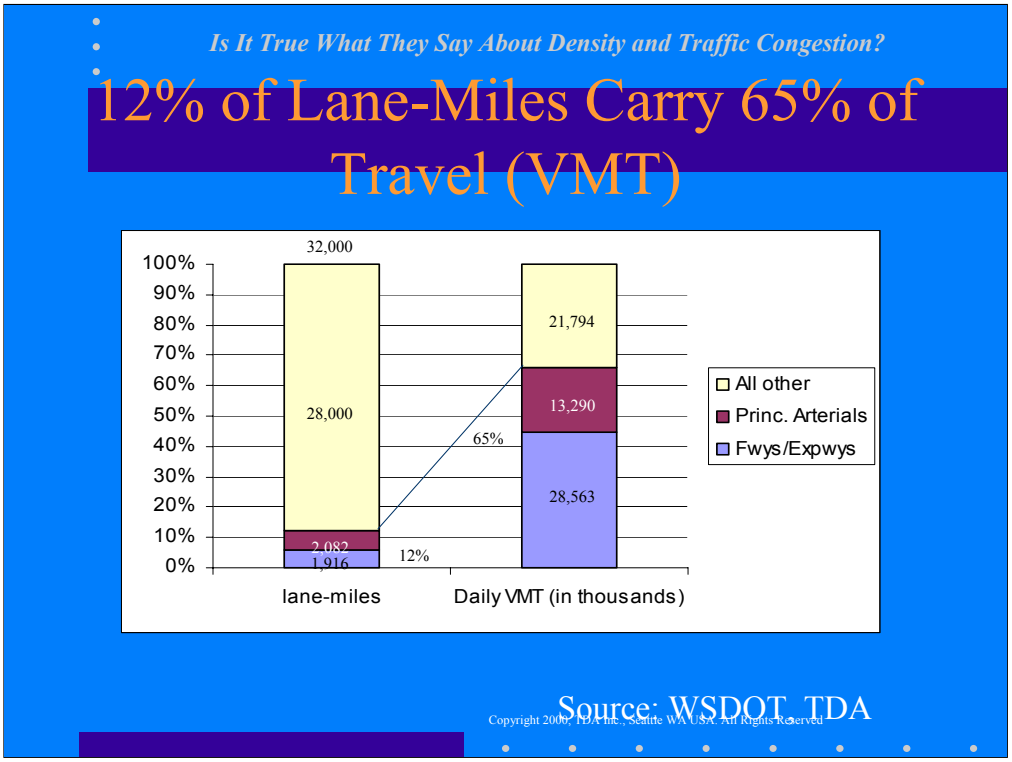
• completing the planned State Highway system. These are the new lanes included in WSDOT's 20-Year Action Plan under the financially constrained scenario (the facilities that could be completed with continuation of only the existing funding sources).

• continued improvement in the efficiency of our existing transportation investments with Intelligent Transportation Systems (ITS) programs. For example, the "FLOW" system on I-5, of which the ramp meter signals are a part, has significantly improved the efficiency of that facility.

• finally, we need to add another 4% to our total roadway lane-miles. These additions would be on the freeways/expressways and principal arterials only.

As is shown in the following graphic, the freeway/expressway and principal arterial categories of roadways are a small percentage of the total roadways, yet carry a very large part of the total travel. [Increasing the roadway total lane miles by 4% would increase the lane miles of freeways/expressways and arterials by 34%.]

*A lane-mile refers to one lane, a mile in length. For example, a six-lane road would have six lane-miles per mile.

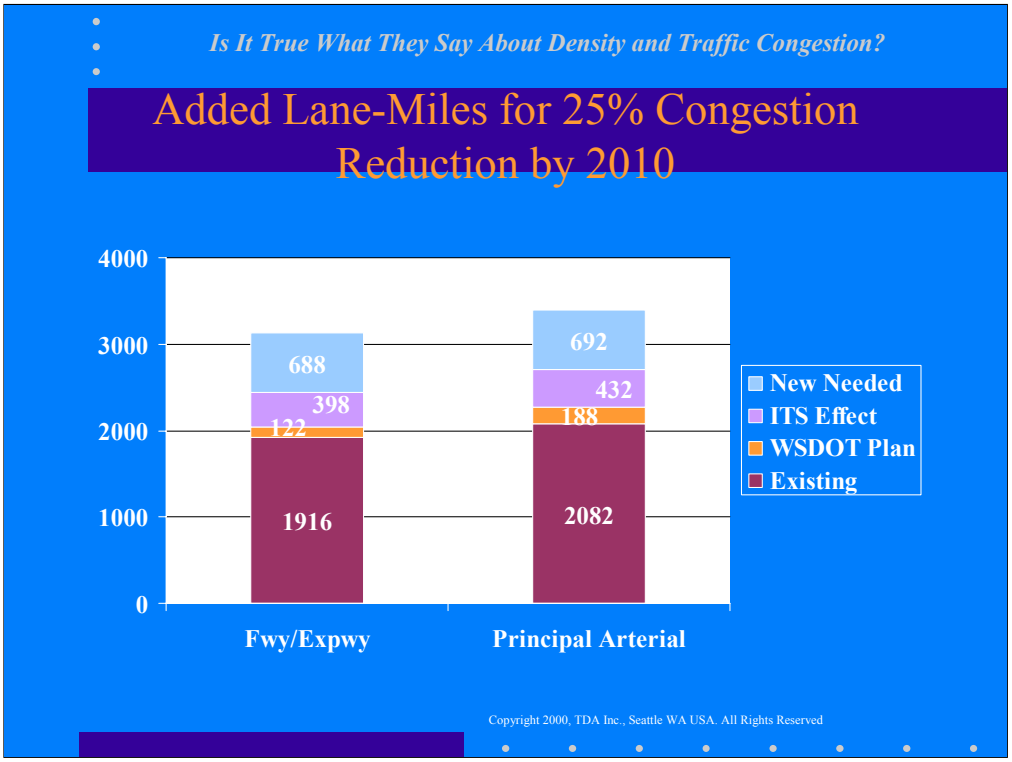


In the three-county area, there are a total of about 32,000 lane-miles of all types of roadways. These include local streets, collectors, principal arterials, and freeways/expressways. The latter categories, freeways/expressways and principal arterials, comprise only 12% of our total lane-miles.

The bar to the right shows vehicle miles traveled (VMT) for the three categories of roads (a car travelling one mile is one VMT).

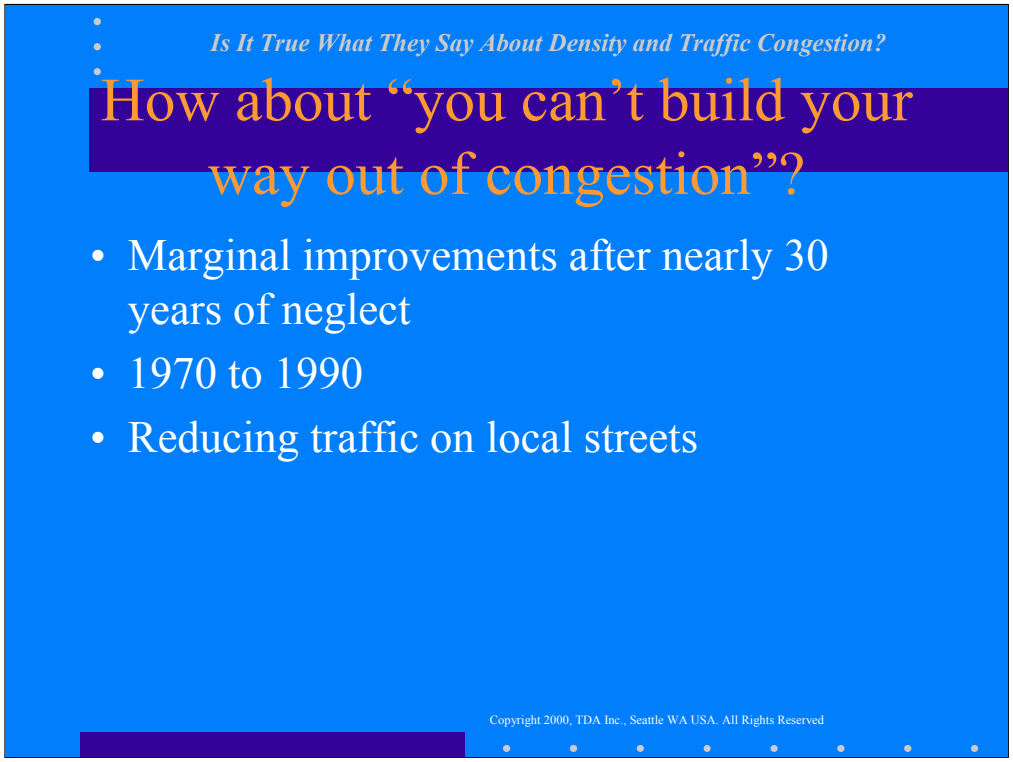
As the comparison shows, travel on freeways/expressways and principal arterials is out of proportion with their share of the lane-miles. Specifically, these 12% of the lane-miles carry about 65% of the daily VMT/. It is for this reason that Reduce Congestion Now focuses on additions to the freeways/

expressways and principal arterials. No additions to the local street system are proposed in Reduce Congestion Now.



This summarizes the additional lane-miles required for the 25% congestion reduction. For each of the roadway categories, the following are shown:

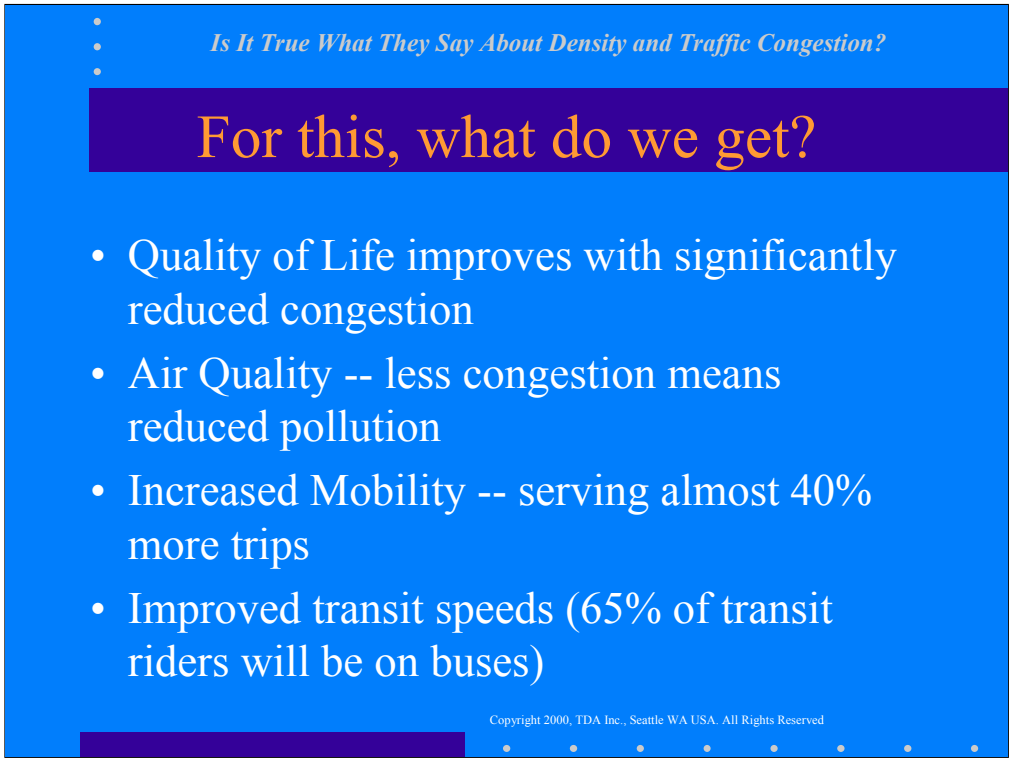
- At the bottom, the existing lane-miles are shown. For example, this shows 1,916 lane-miles for freeways and expressways.
- The next "slice" illustrates the relatively minor additions included in the State's 20-Year Plan (improvements under the financially constrained scenario).
- The third category is for the effect of ITS. These ITS programs don't actually add lane-miles, but boost the performance of existing lane-miles. Shown on the chart are the equivalent added lane-miles that would be required without ITS.
- Finally, an additional +/- 700 lane-miles of both freeways/expressways and principal arterials are needed to complete the Reduce Congestion Now program.



There is a myth that we cannot build our way out of congestion. We can't eliminate all of it, but can make a dramatic improvement. Others have.

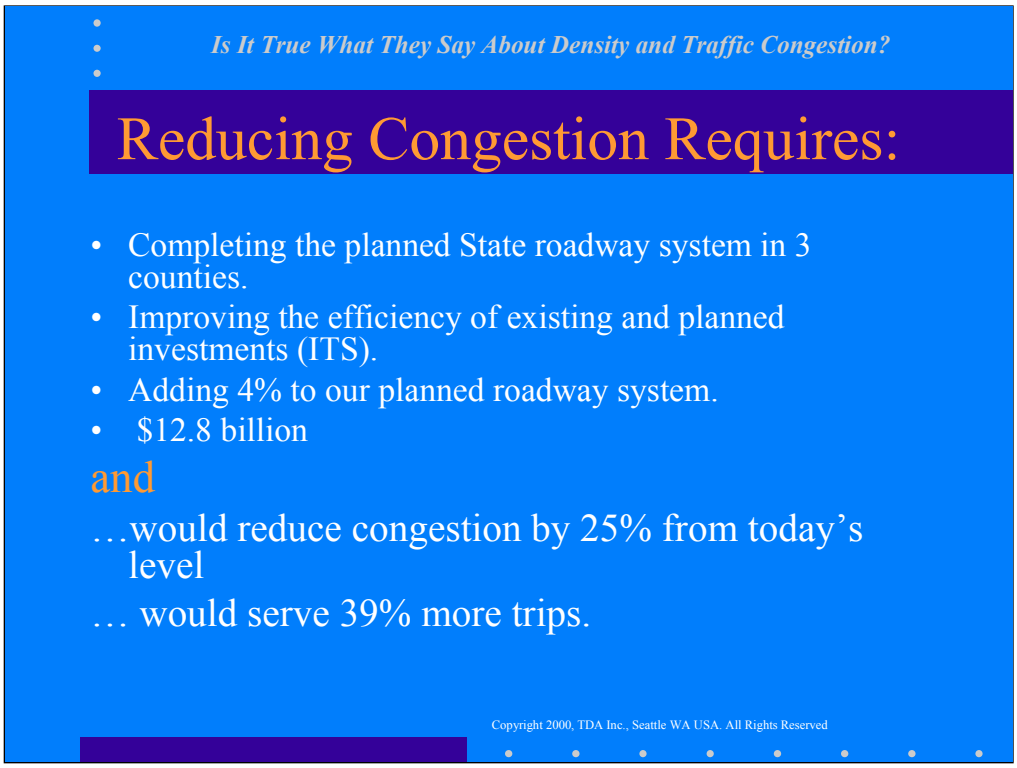
In the Puget Sound region, we finished our major road system in about 1970. The only addition since then has been I-90. If it were true that roads "just fill up with new traffic", why did we not see significant congestion until about 1990, 20 years later?

Now, after 20 years of neglect, would it be surprising that years of pent-up demand would quickly use new facilities. Some of this use of new arterial and freeway lanes would come from traffic that is now using neighborhood and other local streets because of lack of capacity in our major roadway system.



Probably most of us would feel that going back to the congestion levels of the early 1980's would be real progress. Compared to the 150% to 250% increase in congestion projected by the Metropolitan Transportation Plan, this reduction in congestion would save wasted fuel and reduce the resulting contribution to air pollution.

Not only would we be serving about 40% more motor vehicle trips, at a significantly reduced level of congestion, transit would benefit too. Even with Sound Transit's rail program, 65% of transit riders will be on buses. These buses will also enjoy the benefits of reduced congestion.



In summary, by adding 4% to our existing and future roadway system, at a cost of $5.2 to $12.8 billion, Reduce Congestion Now would:

- reduce congestion by 25% from today's level (this is equivalent to a 39% reduction from the projected year 2010 level)
- serve 39% more trips than exist today.