THE FUTURE OF TEXAS METROPOLITAN AREAS: NO ALTERNATIVES TO ROADWAYS

As traffic congestion has worsened, there has been an increased interest in transportation, mobility and access alternatives to the highway system, which principally relies on single-occupant personal vehicles (cars, pickups and sport utility vehicles). It has been argued that alternative strategies have the potential to reduce travel delay.

Two strategies are often suggested to reduce traffic congestion by transferring demand to walking, bicycling and transit:

- **Changing the Urban Form:** This strategy, referred to as "smart growth," would seek to improve coordination between transport and land use, and to limit urban sprawl. There are two related approaches: (1) A more compact urban area, and (2) improving the geographical balance of jobs and residences.

- **Transportation Choice:** This strategy attempts to expand transit service to provide transit as a choice to more urban residents (transportation choice).

This section reviews the experience with these alternatives and their potential to make a material contribution to the reduction of travel delay. As will be shown, ***there is no evidence that these alternatives offer the potential to materially reduce the increase in roadway travel demand***.

The Compact City

One potential approach for reducing traffic demand is to make the urban area more compact, by imposing urban growth boundaries or limiting low-density development ("smart growth" strategies). A more compact urban area, by definition, is more densely populated. Trip distances would generally be shorter in a more compact urban area, which proponents claim, would reduce traffic congestion and travel delay by shortening trips, with the expectation that material amounts of demand would be transferred to transit, walking and bicycling.

US urban areas are the least compact (least densely populated) in the world. As a result, there is a wealth of experience with the higher densities that more compact urban areas would bring. The highest density urban areas in the high-income world are in Western Europe and Asia.

Transit Market Shares: As would be expected, transit market shares are considerably higher in these more dense urban areas. In Western Europe, 26 percent of urban motorized travel is on public transit, 13 times the US rate of two percent.[1] In Asia, 42 percent of urban travel is by public transit, 21 times the US rate. The differences in transit market share are even more substantial than the differences in population density. Transit market shares in Europe are nearly 14 times that of the US, while urban densities are only four times as high. Transit market shares in Asia are more than 21 times that of the US, while population densities are only 10 times US levels (Table 1).

Table 1
International Transit Market Share & Urban Density

	Transit	Compared to US	Density	Compared to US
United States	2%	1.0	3,462	1.0
Western Europe	26%	13.0	14,245	4.1
Asia (Affluent)	42%	21.0	34,706	10.0

Sources: Calculated from Vivier and 2000 US Census. US data is for 2000; Western Europe and Asia data is for 1995.

However, the high transit market shares of Western Europe and Asia have not been achieved by making the urban area more dense, or by attracting market share from automobiles. Population densities have been declining markedly in Western European and Asian urban areas. From 1960 to 1990, US urban population densities declined 15 percent. Western European urban densities declined at nearly double that rate (28 percent), while Asian urban densities were down 17 percent. And, while population densities have been declining, virtually all major high-income urban areas have experienced significant transit market share declines. For example:

- Transit market shares have declined 15 percent in Tokyo-Yokohama and 20 percent in Osaka-Kobe-Kyoto over the past 25 years.[2] These two urban areas have the high-income world's largest transit systems and highest transit market shares.

- Market share data is available for nine Western European urban areas since 1980. Overall, the annual loss is 1.7 percent, with only one urban area (Zurich) experiencing an increase (0.2 percent annually). Paris, with the largest transit system in Western Europe experienced a nearly one-half decline in market share from 1960 to 1995.[3]

These declines are consistent with the US experience, where transit's share of work trips dropped from 12 percent in 1960 to 4.6 percent 2000 (down from 5.1 percent in 1990).[4] Since 1985, transit's overall share of urban travel has declined 2.5 percent annually.[5]

[1] Calculated from data in Jean Vivier, "Millennium Cities Database for Sustainable Mobility: Analyses and Recommendations," UITP (International Union of Public Transport), Brussels: May 2001 and US Census data. US density is for urban areas of over 1,000,000 in 2000.
[2] Calculated from data in *Japan Yearbook 2000* (http://www.stat.go.jp/english/data/nenkan/1431-10.htm).
[3] Calculated from data in Vivier (above) and Jeffrey R. Kenworthy, Felix B. Laube and others, *An International Sourcebook of Automobile Dependence in Cities: 1960-1990* (Boulder: University Press of Colorado), 1999.
[4] 2000 US Census.
[5] http://www.publicpurpose.com/ut-usptshare45.htm

Further, the higher population densities of Western European and Asian urban areas are far above any level that has been seriously proposed for smart growth strategies in the United States. For example, Portland (Oregon), with the nation's most aggressive land use policies now has a population density of only 3,540.[6] Portland would achieve a population density of less than 5,000 by 2040 under the present plan.[7] This is far short of Western Europe's 14,000 or Asia's 35,000, and well below the present US leader, Los Angeles, at 7,100. By comparison, the four largest Texas urban areas have population densities slightly lower than that of Portland, from 2,800 to 3,300.[8]

Further, even high densities in the United States produce far lower public transit market shares than in Western Europe or Asia. This is illustrated by comparing the highest density US urban areas with similar density areas in Japan, Western Europe and Canada (Table 2). The five most dense US urban areas have a transit market share less than one-quarter that of the European areas and less than one-half that of the Canadian area. This is in spite of the fact that the US densities for theses urban areas is higher than the Canadian areas. If New York is excluded,[9] the US share is one-ninth that of the European areas and one-fourth that of the Canadian areas.

And, even in the rare cases where population density is increasing, little or no gain is achieved in transit market share. Los Angeles is one of the few world urban areas with increasing population density, having risen approximately 50 percent from 1960 to 2000.[10] Yet, over that period, public transit's market share has declined more than 50 percent.[11] In fact, there appear to be no cases, in either the United States or elsewhere in the high-income world, where a material share of automobile market share has been transferred to public transit, regardless of density or density trends.

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[6] 2000 US Census, Oregon portion only.

[7] Calculated from data in Metro, *Region 2040: Recommended Alternative.*

[8] The 2000 US Census reports the following urbanized area densities: San Antonio 3,257, Houston 2,951, Dallas-Fort Worth 2,946, Austin 2,835 and the Rio Grande Valley 1,856 (McAllen and Brownsville urbanized areas).

[9] New York has by far the nation's highest transit market share, more than double that of any other urban area. Nearly 40 percent of transit ridership is in New York, which contains nearly 90 percent of the nation's census tracts with more than 50,000 population per square mile (2000 US Census).

[10] Virtually all major urban areas that have increased their population density are in the United States, where densities dropped to a much lower level than in Western Europe and Asia.

[11] Calculated from Kenworthy-Laube, Federal Highway Administration and National Transit Database.

Table 2 Comparison of Similar Density Urban Area Transit Shares: US, Japan, Europe & Canada		
Urban Area	Population per Square Mile	Public Transit Market Share
Paris	9,200	24.1%
Copenhagen	9,000	17.4%
Nagoya	7,600	24.6%
London & the Southeast	7,600	17.1%
Los Angeles	7,100	1.5%
Toronto	6,800	15.2%
San Francisco	6,100	4.5%
Ottawa	5,900	9.4%
San Jose	5,900	1.0%
Essen-Dusseldorf (Rhine-Ruhr)	5,800	11.2%
New York	5,300	10.9%
New Orleans	5,100	1.9%
Montreal	4,800	11.6%
Vancouver	4,200	6.5%
Exhibit: Portland	3,300	2.0%
Averages		
Japan & Western Europe	7,800	18.9%
Canada	4,300	8.5%
US Over 5,000 Density	5,900	4.0%
Without New York	6,100	2.2%
Transit share of transit and roadway passenger miles. Population density from http://www.demographia.com/db-intl-ua2001.htm Transit market share from Kenworthy & Laube, http://www.publicpurpose.com/ut-lonsemkt.htm, estimated from Texas Transportation Institute data, National Transit Database, Kenworthy. Portland shown for illustrative purposes because of its implementation of "compact city" policies.		

Travel Times: And, the greater reliance on public transit and more compact urban areas in Western European urban areas does not produce better travel times. On average, Western Europeans spend 27 percent to 36 percent more time commuting to work, depending on the size of urban area. Japan large urban area (over 5,000,000) commuter spend 48 percent more time traveling to work than in the United States. In Tokyo, which has by far the world's most extensive urban transit system, and where urban transit speeds are 50 percent faster than automobile speeds, the average commuter spends 46 minutes traveling, 82 percent above the large US urban area average (Table 3).[12]

Table 3 International Journey to Work Travel Times (Minutes)					
Size of Metropolitan Area	United States	Western Europe	Compared to US	Japan	Compared to US
5,000,000 & Over	25.3	34.5	36.4%	46.0	81.8%
2,500,000 to 4,999,999	23.6	30.0	27.2%	NA	
1,000,000 to 2,499,000	20.8	27.8	33.6%	NA	
Cases	39	19		3	
Source: http://www.publicpurpose.com/ut-intljtwtimesize.htm					

Traffic Congestion: Even so, however, higher densities are associated with more intense traffic congestion. Generally, the international evidence indicates that as densities rise, so also does vehicle mile traffic intensity, while average vehicle speeds decline. As a result, vehicle hour traffic intensity (daily vehicle hours per square mile) rises even more. Urban areas with more than 20,000 persons per square mile have vehicle hour traffic intensities seven times that of urban areas under 3,000. Urban areas between 10,000 and 19,999 persons per square mile, which includes a number of Western European cases, have vehicle hour traffic intensities four times that of urban areas under 3,000 (Table 4).[13]

In 1990, the five Texas urban areas had an average vehicle mile (Table 5)[14] traffic intensity of 52,283, which is slightly above average for urbanized areas below 3,000 population density (these areas range from average urbanized area densities in the five areas range from 1,900 to 3,300).

Table 4 Population Density and Traffic Intensity: 1990				
Density	Vehicle Mile Intensity	Average Speed	Vehicle Hour Intensity	Cases
20,000 & Over	153,590	15.2	11,373	7
10,000-19,999	118,000	19.3	6,187	11
5,000-9,999	98,111	24.2	4,183	10
3,000-4,999	69,510	30.0	2,340	13
Under 3,000	49,432	31.7	1,540	5
Average/Total	97,936	24.1	4,948	46
Source: Calculated from data in Kenworthy & Laube				

12 http://www.publicpurpose.com/ut-intljtwtimesize.htm
13 Calculated from data in Kenworthy & Laube.
14 Vehicle hour data not available.

Table 5 Vehicle Miles per Square Mile: Texas Urban Areas: 1990	
Austin	46,261
Dallas-Fort Worth	58,511
Houston	62,851
Rio Grande Valley*	37,856
San Antonio	55,938
Average	52,283
Source: Calculated from Texas Transportation Institute data. 1990 data used for international comparison. *Rio Grande Valley estimated using 2000 Brownsville/McAllen ratio.	

Further, higher densities are associated with higher Travel Time Index values (slower travel). Among urban areas with densities above 4,000, the Travel Time Index averages 1.51, while urban areas below 2,000 density average 1.23 (Table 6). Further, research for the United States Department of Transportation indicates that traffic volumes increase with density. The data indicates that areas with double the average urban density in the United States have traffic volumes that are approximately 1.9 times as great.[15] This indicates little reduction in traffic as a result of increasing densities (Figure 2).

Table 6 Travel Time Index By Population Density: 2000	
Density	TTI
4,000 & Over	1.51
3,000-3,999	1.39
2,000-2,999	1.32
Under 2,000	1.23
Source: Calculated for urban areas over 1,000,000 population from Texas Transportation Institute *2002 Urban Mobility Report*	

[15] Calculated from US Census Bureau data and Catherine E. Ross and Anne E. Dunning, "Land Use and Transportation Interaction: An Examination of the 1995 NPTS Data," *Searching for Solutions: Nationwide Personal Transportation Survey Symposium*, US Federal Highway Administration, October 29-31, 1997

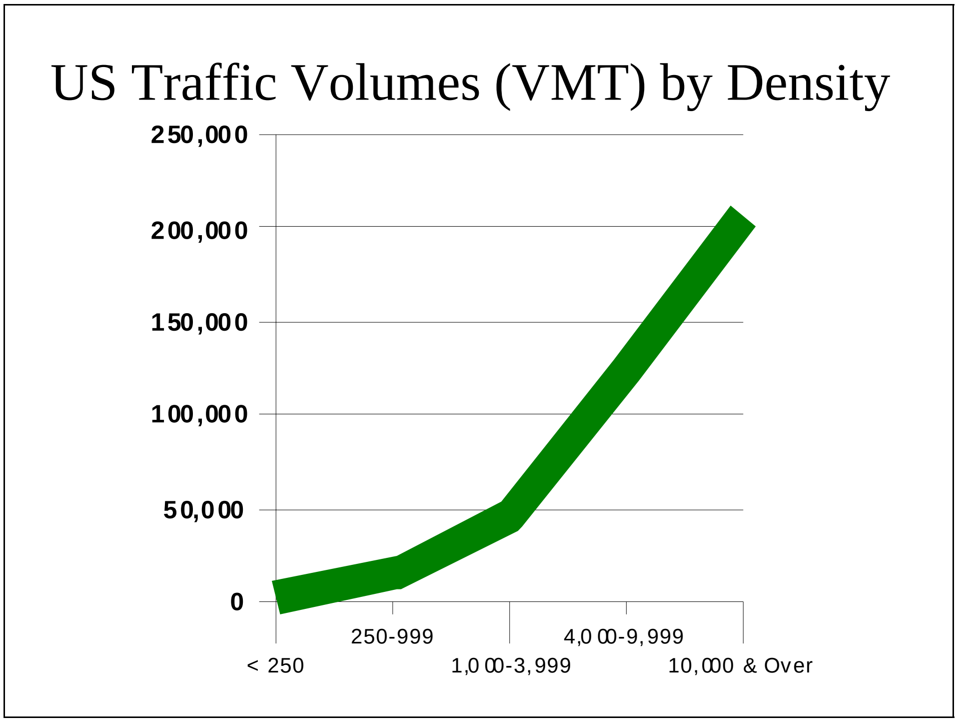

Figure 1

Finally, Portland's urban containment policies indicate no reduction in traffic intensity. Portland's *2040 Plan*, which outlines implementation strategies for its smart growth program, projected a traffic volume increase of 45 percent from 1990 to 2040. It appears that this figure is already close to achievement, as overall traffic volumes increased 40 percent from 1990 to 2000, though some of the increase was in the Vancouver, Washington area, which is outside the Portland urban growth boundary.

A more compact urban area is also associated with higher air pollution intensity. Generally, more severe air pollution classifications in the United States are associated with higher density urban areas (Figure 3).[16] This mirrors the international evidence, with air pollution production per square mile being lower where population densities are lower (Table 7). Generally, lower levels of air pollution area associated with higher speeds and smoother flowing traffic (Figure 4) that is typical of lower density areas.

[16] Randall O'Toole, "Dense Thinking," *Reason*, January 1999, based upon US Environmental Protection Agency data.

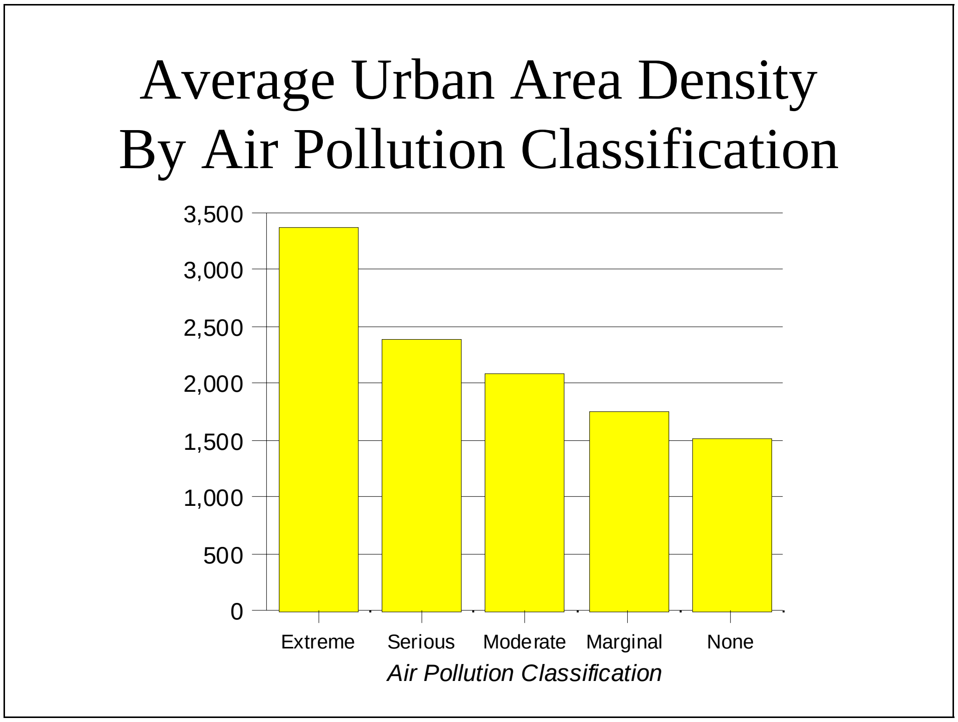

Figure 2

Table 7 Air Pollution Production by Population Density Annual Metric Tons/Square Mile			
Population per Square Mille	NOX	CO	VOC
20,000 & Over	420	2,362	451
10,000-19,999	166	790	151
4,000-9,999	116	1,018	117
Under 4,000	68	566	70
Source; http://www.demographia.com/db-intlapdens.htm.			

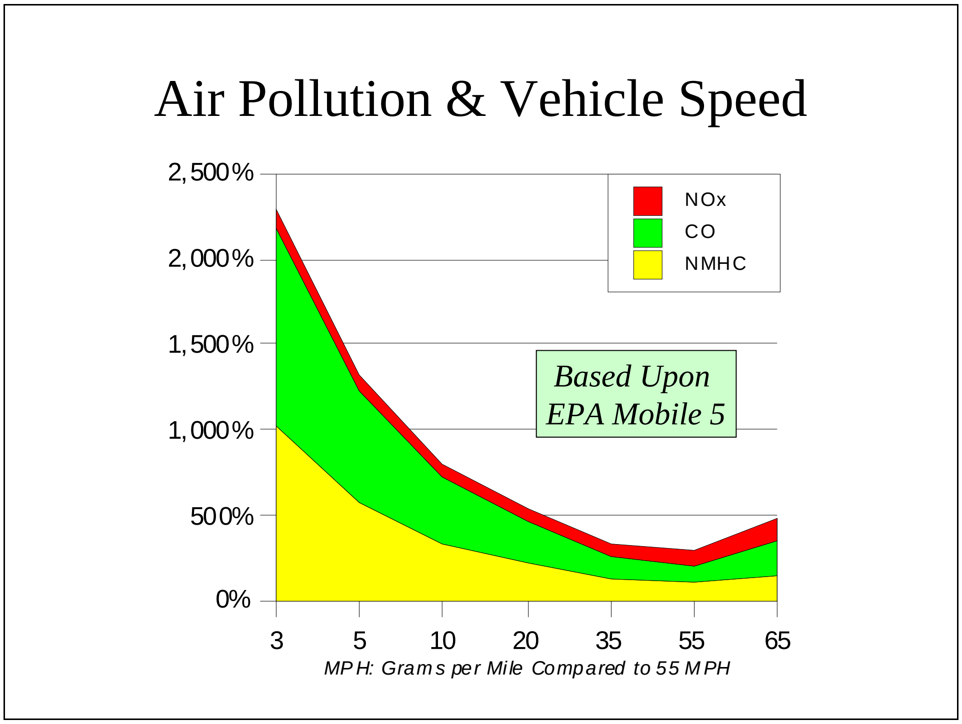

Figure 3

It is thus concluded that the higher densities in both United States and other high-income world nation urban areas produce greater traffic congestion and slower travel times.

Jobs-Housing Balance

Another proposed approach for reducing traffic congestion is to improve the geographical jobs-housing balance.

Local Area Jobs-Housing Balance: Walkability: The most frequently cited jobs-housing balance strategy is to seek a local area geographical balance so that more people walk, bicycle or use transit to get to work, which would presumably reduce traffic congestion and travel delay. The objective would be to develop an urban area in there are a similar number of jobs and worker residences in each neighborhood. A generic term for providing a local jobs-housing balance is "walkability," which is a major thrust of current planning practices, especially the "new urbanism, " which seeks to establish self contained new communities with mixed business and residential uses

Improving the local jobs-housing balance at the local level requires, at a minimum, that distances between jobs and housing be short enough to permit walking and bicycling. Western European and Asian urban areas rely to a much greater degree on walking and bicycling than US urban areas. In the United States and Canada, 8.6 percent of trips are by walking or by bicycle.[17] In Western European urban areas, 32.5 percent of trips are by walking or bicycle, nearly four times

[17] Calculated from Vivier.

the North American rate. Asian urban areas have an even greater rate, at 34.3 percent (Table 8).[18] A similar comparison is evident with respect to the work trip. In the United States, 3.0 percent of work trips in metropolitan areas over 1,000,000 were by bicycle or walking in 2000.[19] In Western Europe, the share for bicycles and walking was nearly five times as high, at 20.1 percent, while affluent Asian urban areas were more than four times as high, at 18.4 percent.[20] These much higher shares for bicycling and walking are consistent with what would be expected in the more compact (dense) urban form typical of Western Europe and Japan, in which jobs and housing are in closer proximity.

Table 8 Walk and Bike Trip Market Share and Density		
	Walk & Bicycle	Density
US & Canada	8.6%	3,181
Western Europe	32.5%	14,256
Asia	34.3%	34,733
Source: Calculated from US Census Bureau, Vivier and Kenworthy & Laube.		

Yet, international urban areas with greater "walkability" and higher bicycle market shares have *more* intense levels of traffic congestion than in the United States (Table 9).[21]

- In the more dense and walkable Western European urban areas, vehicle miles per square mile are higher than in the United States. Travel speeds are slower, so that vehicle hours per square mile are more than double that of urban areas in the United States (Table 6, above).

- In the much more dense and walkable Asian urban areas, vehicle miles per square mile are higher than in the United States. Travel speeds are slower, so that vehicle hours per square mile are 3.76 times that of urban areas in the United States.

Further, journey to work travel times are higher in more walkable Western Europe and Japan (Table 3, above). Thus, the international evidence indicates that greater walkability is *not* associated with lower levels of traffic congestion.

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18 Calculated from Vivier.
19 US Census.
20 Calculated from data in Kenworthy & Laube (1990 data) .
21 It would have bee preferable to use the Texas Transportation Institute Travel Time Index for comparisons, but this indicator is not available for urban areas outside the United States. Nonetheless, the traffic intensity indicator is strongly associated with the Travel Time Index. A linear regression analysis for the 40 US urban areas of more than 1,000,000 in 2000 indicates a 0.764 "r," within the 99 percent confidence level. Each 10,000 increase in traffic intensity is associated with 0.067 increase in the
Travel Time Index.

Table 9 Traffic Intensity: US, Western Europe and Asia				
United States	79,990	31.7	2,522	1.00
Western Europe	116,665	19.8	5,879	2.33
Asia	147,364	15.5	9,478	3.76
Source: Calculated from Kenworthy & Laube.				

Finally, attempts to create communities with a high short distance commute jobs-housing balance have generally been unsuccessful. This is illustrated by the experience in both the United Kingdom and Sweden.

- A number of new towns were built outside the London green belt after World War II. A principal purpose was to develop "self-contained" communities in which residents would work within the new towns (such as Milton Keynes and Stevanage). However, the jobs in the new towns attracted residents from communities throughout the London and Southeast, while residents of the new towns also commuted to a wide geographic area, including central London.[22]
- The city of Stockholm built a number of satellite communities with high concentrations of jobs and employment (such as Tensta and Vallingby), with the intention that residents would work in the local area, generally within walking distance of their residences or a short transit ride. In fact, however, barely 25 percent of residents today work in the local communities. Peter Hall noted that "the satellites failed in one important respect: they did not deliver the planned relationship of homes to jobs"[23]

Generally, there is limited "walkability" in US urban areas. Based upon small area planning zones[24] zones, there is an average variance of 65 percent between jobs and houses in these zones, meaning that there is, on balance a 0.35 balance between jobs and housing. The highest scoring (most balanced) metropolitan area was Buffalo, at 0.45,[25] while the lowest scoring area was Greensboro-Winston Salem-High Point, at 0.23.[26] The four largest Texas metropolitan areas scored from a high of 0.34 in Houston to a low of 0.27 in Dallas-Fort Worth (Table 10). There appears to be no relationship between the differences in walkability between metropolitan areas and the respective Travel Time Index values. [27]

[22] Mark Pennington, *Liberating the Land*, Institute of Economic Affairs, London: 2002.
[23] Peter Hall, *Cities in Civilization*, Pantheon Books, New York: 1998.
[24] Based upon Transportation Analysis Zones or equivalent from the 1990 Census Transportation Planning Package (http://www.demographia.com/db-jhbal1990walk.htm)
[25] A Walkability Index of 1.00 indicates that the number of jobs and resident workers in an area is equal. A 0.45 Walkability Index means that there is a 55 percent difference between workers and jobs (1.00 minus 0.55).
[26] http://www.demographia.com/db-jhbal1990walk.htm
[27] A linear regression analysis yields no statistically significant relationship between the Travel Time Index and the Walkability Index. Thus, at the national level, traffic levels do not appear to decline with an improvement in the jobs-housing balance. In fact, the most favorable Travel Time Index is achieved by urban areas that have the lowest Walkability Indexes.(http://www.demographia.com/db-jhbal1990walk.htm)

Table 10 Walkability Indexes: Texas Metropolitan Areas	
Austin	0.33
Houston	0.34
Dallas-Fort Worth	0.27
Rio Grande Valley	0.31
San Antonio	0.29
Average	0.31
National Average	0.35
Walkability Index of 1.00 = Perfect Jobs/Housing Balance Source: http://www.demographia.com/db-jhbal1990walk.htm	

Even sub-areas that are considered "walkable," yield a comparatively low Walkability Index. This is illustrated by two communities considered among the most walkable, the city of San Francisco and the borough of Manhattan, in New York City.

- The Manhattan local area Walkability Index was 0.42 in 1990. This comparatively low value is driven by the fact that there were approximately 2.75 jobs per resident worker in Manhattan. While Manhattan may be walkable for resident workers who have an excess of available jobs, it is not walkable to the many more people who work there, most of whom live outside the borough. Further, the mismatch of jobs and residences is also evident in household incomes of those who live and work in Manhattan. On average, there is a variance of 28.2 percent in income between resident workers and people who work in Manhattan.[28]

- In the city of San Francisco, the Walkability Index is a virtually the same as Manhattan, at 0.42. There is also a similar income variance of 27.6 percent.[29]

This indicates that the factor that makes a community walkable, at least from the perspective of residents, is a jobs-housing imbalance, with many more jobs than resident workers. Such an imbalance, of course, is not sustainable throughout the urban area, which necessarily has a general balance of jobs and workers.

"Walkability" can be achieved for a relative few who choose to live close to where they work, but various factors make its imposition through planning virtually impossible.

- **Labor markets are regional, not local:** A walkability based jobs-housing balance negates what is one of the greatest draws of the large modern urban area --- that it is a

[28] Calculated from US Census Transportation Planning Package for 1990 (http://www.demographia.com/db-nyc-jhb.htm)
[29] Calculated from US Census Transportation Planning Package for 1990 (http://www.demographia.com/db-jhb-sf.htm).

large regional market of jobs and workers. At average commute speeds, up to 780 square miles can be accessed by automobile, an area larger than that of most urban areas in the United States, and more than one-half the area of Houston or Dallas-Fort Worth. In one-hour the area accessible by automobile is greater than all urban areas except for New York. Employers are able to attract workers from throughout the urban area, while workers have a choice of jobs throughout the urban area. Metropolitan labor markets simply cannot be partitioned by urban planning as the failures in Stockholm and the United Kingdom indicate.

- **Multiple worker households:** Many households have more than one worker, which makes it difficult to locate housing close to the multiple jobs. The 2000 census data indicates that 51.3 percent of married couple families in metropolitan areas have more than one worker. In Austin, the figure is 57.7 percent, Dallas-Fort Worth 55.2 percent, Houston 51.6 percent and San Antonio 50.2 percent.

- **Not all jobs are the same:** For a jobs-housing balance to be effective, more would be needed than a simple statistical balance. The jobs would also need to be balanced with the skills and interests of the workers throughout the urban area. Thus to be effective, a jobs-housing balance would need to be a jobs-housing-skills-interest balance.

- **Job Mobility:** People tend to change jobs more often than they change residences, further complicating the potential for planning that would better match jobs to residences.

- **Proximity is not the principal job location factor:** Minimizing journey to work travel time is just one of many factors that households consider when they locate housing. It is quite common for workers in households to travel farther than necessary to live in housing or an environment that they prefer. For example, young middle income households will often locate in the far suburbs, where newer housing is less expensive, rather than reducing work trip travel time by living in closer housing that is less suited to their preferences. In fact, in the largest urban areas, from 400,000 jobs to 1,500,000 jobs are closer to the average worker's residence than the job actually filled.[30] The recently released American Housing Survey indicates that proximity to the work location was the principal neighborhood location factor for only 21 percent of households. Among households owning their own homes the figure was 12 percent.[31]

The evidence, both international and US, indicates virtually no potential for reducing traffic congestion through an improved jobs housing balance.

Sub-Regional Jobs-Housing Balance: Automobility: Theoretically, the automobile provides comparatively rapid mobility throughout large urban areas, which would imply that high jobs-housing balances would occur only at the metropolitan level. But data from the nation's largest urban area indicates a greater balance of jobs and residences at the sub regional level.

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[30] The 1995 Nationwide Personal Transportation Survey indicated that the average commute distance was 11.6 miles. At a job density of 1,000 per square mile (below the US urbanized area average), more than 400,000 jobs would be within 11.5 miles of the average employee's residence.
[31] US Census Bureau, *American Housing Survey 2001*.

For example, a New York metropolitan areas analysis indicates that outside the core county of New York (Manhattan) Regional Jobs-Housing Balance Index values of from 0.70 to 0.90 rates in the inner ring, middle ring and outer ring counties, well above the highest local area Walkability Index of 0.45 in Buffalo.

By comparison, the Regional Jobs-Housing Balance Index in the core county of New York (Manhattan) is substantially lower, at 0.36, with an excess of more than 57,000 jobs per square mile over resident workers. Areas outside the core are in much greater balance. Inner ring counties have a job deficit of 2,700 per square mile, while middle and outer ring counties have job deficits of less than 150 per square mile (Table 14). Further, 62 percent of work trip travel is within the same county and only eight percent is from other counties to the core county of New York (Manhattan), which is the high-income world's second largest business district (after Tokyo).[32]

This general pattern is repeated in large international urban areas. Central Paris has an excess of 33,000 jobs per square mile, while areas outside the central city (with more than 80 percent of employment) are in much greater balance, with average job deficits of under 500 per square mile.[33] The Tokyo central business district has an excess of 77,000 jobs per square mile.[34] In Tokyo, Paris and elsewhere this imbalance of jobs over residences creates intense traffic congestion and overcrowding of transit systems.[35]

Table 14
County Based Jobs-Housing Balance
New York Metropolitan Area

Development Ring	Jobs/Housing Balance Index	Excess Jobs per Square Mile
Core County (New York)	0.364	57,255
Inner Ring Counties	0.712	(2,697)
Middle Ring Counties	0.896	(120)
Outer Ring Counties	0.866	(51)
Total	0.789	10

Source: Calculated from 1990 Census Transportation Planning Package data

Texas: Like New York, Texas metropolitan areas exhibit core jobs-housing imbalance and higher levels of balance elsewhere. The urban cores (two mile radius) had an average Regional

[32] Parsons Brinckerhoff Quade and Douglas in Association with Cambridge Systematics and Nu Stats International, *Regional Travel-Household InterviewSurvey: Executive Summary*, report prepared for the New York Metropolitan Council and the North Jersey Transportation Planning Authority, February 2000, page 13.
[33] http://www.demographia.com/db-jhbalparis.htm (1999 data).
[34] Calculated from 2001 Japan Statistics Bureau and Statistics Center and 2000 census data.
[35] Tokyo has by far the high-income world's largest transit system, with approximately 2,000 miles of rail and ridership of 15 billion annually, 1.6 times the US total.

Jobs-Housing Index of 0.27, while the suburban counties areas averaged 0.79 in 1990 (Table 15). In each case, the Regional Jobs-Housing Balance Index was lowest in the core.

On average there is an excess of nearly 6,800 jobs per square mile in these cores, from approximately 700 in Brownsville to 13,000 and 14,000 in Houston and Dallas respectively. Outside the cores of [36] Texas metropolitan areas, there is generally an excess of workers over jobs, but the numbers are small, from an excess of 40 jobs to a deficit of 57 per square mile. This is exemplified by the Houston area, where core job excesses per square mile were 13,200, compared to a deficit of 23 in non-core areas (Figure 5). This substantial difference is due to the high concentration of core employment compared to the relative dispersal in other areas. In 1990, the two-mile radius core represented barely one percent of the urban land area in Houston (Figure 6).

The jobs to housing imbalance that occurs in the central areas places a significant burden on the highway system. At the same time, the high concentration of employment in the five central business districts attract the highest transit work trip market shares in the respective metropolitan areas. In the Houston, for example, 14 percent of core workers commuted by transit in 1990, while the Dallas figure was 10 percent.[37] Nonetheless, transit's contribution falls fare short of negating the jobs-housing imbalance. Transit commuting to the Houston core is approximately 2,000 per square mile compared to an excess of 13,200 jobs per square mile. In the Dallas core, there are 1,600 transit commuters per square mile compared to an excess of 14,200 jobs per square mile.

To achieve a balance of jobs and housing in the urban cores would require residential population densities of from 12,000 to 28,000 per square mile higher than present levels.[38] This is four to nine times average Texas urban area densities. There is no precedent in either the United States or elsewhere in the high-income world for core area population density increases of such a magnitude.

Because of the excess jobs over housing in core areas, policies that encourage core job growth are likely to exacerbate the traffic congestion problem. The more decentralized employment patterns characteristic of the rest of the metropolitan area are conducive to much more favorable jobs-housing balances.

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[36] Core county data excludes the 2 mile radius core.
[37] Calculated from Census Transportation Planning Package data.
[38] There are approximately two residents for every job in US urban areas.

Table 15 Sub-Regional Jobs-Housing Balance Largest Texas Metropolitan Areas				
Metropolitan Area	Jobs-Housing Balance		Excess Job Density	
	Core	Outside Core: County Average	Core	Outside Core County Range
Austin	0.20	0.73	5,916	-12 to -31
Dallas-Forth Worth: Dallas	0.09	0.66	14,206	+40 to -52
Dallas-Fort Worth: Fort Worth	0.06		6,028	
Houston	0.08	0.78	13,219	-1 to -57
Rio Grande Valley: Brownsville	0.65	0.76	686	-15 to -17
Rio Grande Valley: McAllen	0.65		1,071	
San Antonio	0.14	0.81	6,207	-4 to -41
Average	0.27	0.75	6,762	+40 to -527

Core: 2 mile radius
Source: Calculated from 1990 Census Transportation Planning Package.

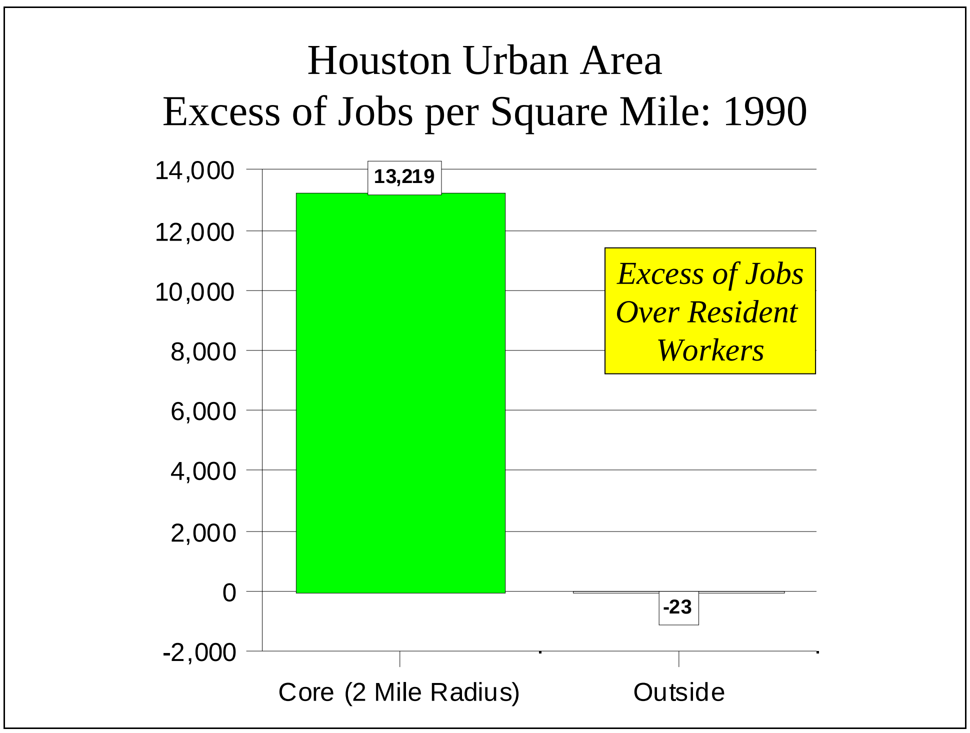

Figure 4

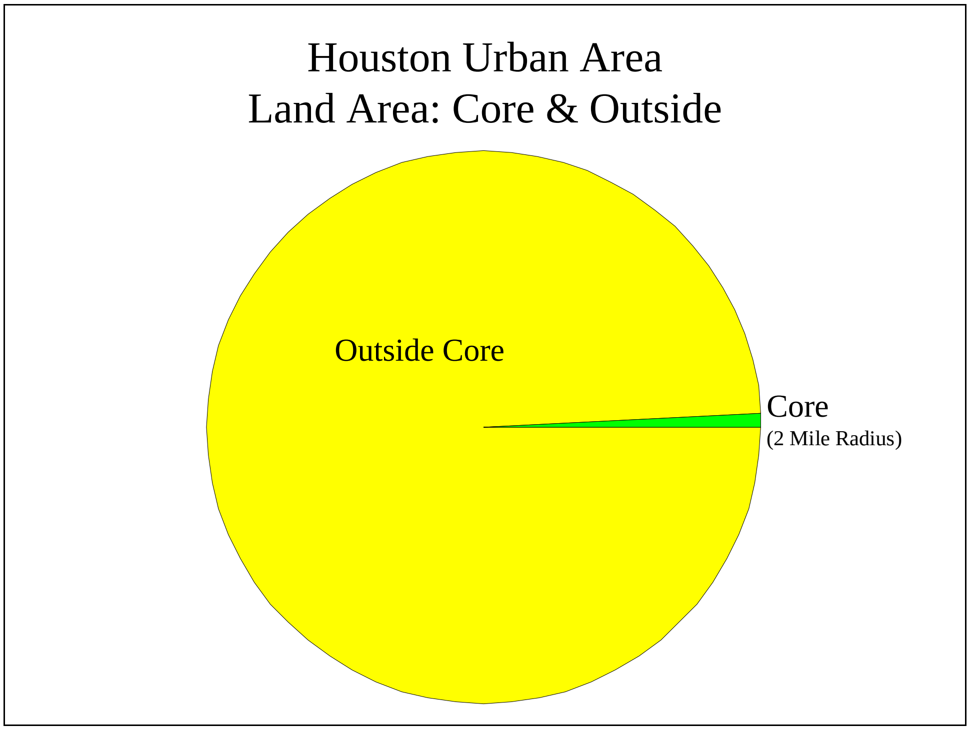

Figure 5

In the typical urban area with a concentrated core business area and sprawling suburban development (such as US and Western European urban areas), the pattern is for the greatest jobs-housing imbalances to occur in the core area, where there are many more jobs than resident workers. In the sprawling outer areas, there are generally job deficits, but they are thinly spread over a much wide area. The jobs in the non-core areas (averaging 80 percent or more of metropolitan employment), are generally not served by automobile competitive transit service (throughout the US[39] and Western Europe), and are principally reliant on the automobile.

But, in the final analysis, there is little potential for urban planning to improve the "jobs-housing" balance because location does not generally drive the employment decision. As an analyst put it in commenting on the failure of the new towns to achieve a jobs-housing balance (self-containment):

> *..short of imposing restrictions on freedom of movement …it is difficult to see how the goal of "self-containment" could ever have been achieved.*[40]

TRANSPORTATION CHOICE

Another approach to reducing traffic congestion through greater transit use would involve greatly expanding transit systems within today's urban areas. This concept, known as "transportation

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[39] The comparative lack of automobile competitive transit service between suburban locations in the Chicago and Portland, Oregon areas outline provided below.
[40] Mark Pennington, *Liberating the Land*, Institute of Economic Affairs, London: 2002.

choice," seeks to provide people with automobile competitive transit service. There is a strong evidence that people will ride auto-competitive transit service --- service that is convenient and time competitive with the automobile. For example:

- In Tokyo and Osaka, with far more extensive public transit systems than exist in either then United States or Western Europe, more than 50 percent of urban travel is on transit. As was noted above, transit travel times in Tokyo are superior to those of automobiles. The extensiveness of these transit systems, each with more than 1,000 miles of urban rail and 1,000 stations, makes it possible to make auto-competitive trips throughout these urban areas that sprawl geographically similar to Los Angeles and Phoenix..

- In Western European urban areas, such as Paris and Munich, one quarter or more of travel is on transit systems that are more extensive than in the United States, but less so than in the two large Japanese urban areas. In Western Europe, much travel to and within the urban core is on public transit. However, virtually all Western European urban areas have suburbanized substantially,[41] and travel by transit between destinations in the suburbs is generally not auto-competitive. As a result, transit is used principally by people who do not have access to automobiles for trips within the suburbs.

- The largest downtowns (central business districts) in the United States attract large public transit work trip market shares. For example, the Manhattan business district[42] had a nearly 75 percent transit work trip market share in 1990. Chicago's central business district attracted more than 50 percent of its workers by transit.

However, in most of the nation's urban areas --- the portions outside the largest downtown areas --- automobile competitive transit service simply does not exist. For example:

- A review of suburban to suburban commuting in the Chicago area, which has one of the nation's most extensive transit systems, found that work trip times on transit could average 2:40. This compares to an average automobile work trip travel time of less than 30 minutes. In the Chicago area, there is little automobile competitive transit service except to the downtown area, which represents less than five square miles out of 2,000 (0.25 percent) and less than 10 percent of employment.[43]

- A review of suburban commuting in the Portland area found that auto-competitive service is available to downtown from 70 percent of the urban area. However, less than five percent of residential locations were found to be within range of auto-competitive service to suburban locations.[44]

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[41] Among Western European central cities that had achieved 400,000 population by 1960 that were fully developed and have not expanded their boundaries, all have lost population.

[42] South of 59th Street.

[43] This analysis used the Regional Transportation Authority (http://tripsweb.rtachicago.com/) trip planner for work trips from the suburban Orland Mall area to approximately 60 suburban locations built into the trip planner.

[44] Wendell Cox, "The Illusion of Transit Choice," *Veritas* (Texas Public Policy Foundation), March 2002. This analysis classifies transit travel times 1.5 times that of the automobile as automobile competitive, a fairly liberal standard.

In the past few decades, a number of urban areas have built new rail systems, a principal purpose of which was to attract drivers from automobiles. These systems, however, have done little to expand automobile competitive service. They have been concentrated on the downtown markets that already are the destinations of most automobile competitive transit service. But, with downtowns representing 10 percent or less of metropolitan employment, the new rail systems have had little, if any, impact on traffic congestion. With respect to the metropolitan areas with new rail systems, it is estimated that personal vehicle (automobile and sport utility vehicle) work trip market shares have increased an average of 2.5 percent. The personal vehicle share of all trips in such metropolitan areas have remained the same, generally within a range of plus or minus 0.6 percent (Appendix C contains information on new rail systems and traffic congestion).

Further, virtually all of the major planned investments for new rail lines in the United States will reinforce the downtown oriented service design, largely because the downtowns represent the largest concentrations of destinations (most destinations in a small area). Transportation choice is largely limited to this comparatively small market.

Transit commuting to non-downtown locations is disproportionately by people who do not have access to automobiles. In 1990, the average downtown transit commuter had a household income within six percent of the metropolitan average. The average transit commuter to suburban locations had a household income 41 percent below average, and barely above poverty level.[45]

It would be very difficult for transit to capture a significant portion of future automobile demand. For example, the Texas Transportation Institute estimates that 213,000 new peak hour transit travelers would be required each year in the Dallas-Fort Worth area, just to stop the growth of traffic congestion. In fact, despite building three light rail branches and a commuter rail line, the metropolitan area *lost* transit work trip riders from 1990 to 2000. The other four Texas metropolitan areas indicate a similar large gap between transit commuter growth and the number of new commuters that would be required to maintain present levels of traffic congestion. At the 1990-2000 rate, it would require 690 years of transit commuter growth to equal the number of new transit riders required to stop traffic growth for a single year. The number of annual new transit riders required exceeds the total number of transit commuters in each case. Overall, the number of new transit commuters that would be required *each year* is 1.5 times the total number currently riding (Table 16).

Given these data, it is not surprising that virtually all new travel demand in Texas metropolitan areas (as is also the case across the nation) is projected by metropolitan planning organizations to be roadway, rather than transit. In all of the four largest metropolitan areas, approximately 99 percent of new travel demand will be roadway demand (Table 17).

[45] http://www.publicpurpose.com/ut-25cbd$.htm.

Table 16 Annual New Transit Commuters Required to Stop Traffic Growth and Annual Transit Commuting Rate					
Urban Area	<A> New Annual Transit Commuters Required to Stop Traffic Congestion Growth	<B> Annual New Transit Commuters: 1990-2000	<C> Years at Actual Annual Rate to Achieve Annual Requirement <A>	<D> Exhibit: Current Transit Commuters	<D> Compared to 2000 Total Commuters Required to Stop Traffic Congestion Growth <A>
Austin	22,500	331	68	16,700	1.3
Dallas-Fort Worth	106,500	-57	Note	45,800	2.3
Houston	69,500	164	424	68,200	1.0
Rio Grande Valley	5,000	-23	Note	700	7.1
San Antonio	27,000	-81	Note	20,200	1.3
Total	230,500	334	690	150,900	1.5
Note: Not calculable because transit commuter use declined. Source: Texas Transportation Institute *2002 Urban Mobility Report,* 2000 US Census.					

To substantially increase transit's market share so that material numbers of cars are taken off the road would require an exponential increase in auto-competitive transit service. This would be expensive. One review suggested that to develop a transit system that would provide auto-competitive service throughout the urban area could have an annual cost similar to a metropolitan area's total annual income.[46]

Thus, it is not feasible to provide transportation choice to all but a very small part of the urban travel market. As a result, transportation choice does not represent a strategy that can make a material contribution to reducing traffic congestion.

Table 17 Projected Annual Transportation Demand			
Metropolitan Area	Roadway Person Miles	Annual Increase in Transit Person Miles	Roadway Share
Austin (1994-2020)	1.875	0.018	99%
Dallas-Fort Worth (1995-2020)	4.340	0.031	99%
Houston (2000-2020)	2.800	0.024	99%
San Antonio (1995-2025)	1.073	0.007	99%
In Millions of Daily Person Miles Source: Calculated from Metropolitan transportation plans and National Transit Database.[47]			

The Role of Transit: Nonetheless, transit will continue to be an important strategy in the markets that it serves effectively, such as commuting to downtown Dallas and Houston (where

[46] Wendell Cox, "The Illusion of Transit Choice," *Veritas* (Texas Public Policy Foundation), March 2002.
[47] Assumes 1.4 vehicle occupancy.

transit market shares were approximately exceeded 10 percent in 1990), for inner-city residents who do not have access to automobiles. This report presumes that transit ridership will double over the next 25 years, from its one percent or less present market share.[48]

APPENDIX:
ROADWAYS AND "INDUCED TRAFFIC"

New and expanded roadways are likely to be a crucial element of any successful program, especially due to the inordinately high growth rates of Texas urban areas (above). There is a popular perception that building additional roadway capacity is fruitless, because new traffic demand will quickly fill up the expanded facilities. For example, a widely quoted study found that each 1.0 percent increase in freeway capacity was associated with a 0.9 percent increase in traffic volumes.[49] This study, however, dealt only with freeways and did not consider the impact of freeway expansion on other roadways (arterials and local streets). Generally, it can be expected that traffic will switch from slower speed to faster facilities when they are opened.

Federal Highway Administration research indicates that overall system impacts are considerably less.. DeCourla-Souza and Cohen found,[50] under a range of assumptions that freeway traffic tends to increase in response to new capacity, while arterial traffic tends to be reduced. A 50 percent increase in freeway capacity was found to induce an increase of from 4.9 percent to 11.5 percent in vehicle miles.

But they further found that the increase in capacity increased overall travel speeds substantially. In fact, the increased speeds were so significant that the new freeway capacity was found to produce from a *minus* 8.8 percent in vehicle hours (vehicle travel time) to an increase of 1.7 percent. (Table 18).[51]

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[48] http://www.publicpurpose.com/ut-usmet9399mkt.htm.
[49] Mark Hansen and Yuanlin Huang, "Road Supply and Traffic in California Urban Areas, *Transportation Research A*, 31: 205-218.
[50] Patrick DiCorla-Souza and Harry Cohen, "Accounting for Induced Travel in Evaluation of Urban Highway Expansion,", 1998 (www.fhwa.dot.gov/steam/doc.htm).
[51] Calculated from DiCorla-Souza and Cohen.

Table 18 Induced Traffic Impacts: DiCourla-Souza & Cohen				
Vehicle Miles	Low Congestion	Moderate Congestion	High Congestion	Average
Low Assumption	4.9%	7.2%	7.7%	6.6%
High Assumption	8.6%	11.5%	11.5%	10.5%
Average	6.7%	9.3%	9.6%	8.6%
Vehicle Hours	Low Congestion	Moderate Congestion	High Congestion	Average
Low Assumption	-8.8%	-7.6%	-6.5%	-7.6%
High Assumption	-4.3%	-0.2%	1.7%	-0.9%
Average	-6.5%	-3.9%	-2.4%	-4.3%

Source: Calculated from data in www.fhwa.dot.gov/steam/doc.htm

Low Assumption: Each 1.0 percent decrease in travel time increases demand by 0.5 percent.
High Assumption: Each 1.0 percent decrease in travel time increases demand by 1.0 percent.

Thus, there need be little concern that the provision of additional capacity will in and of itself materially increase the overall rate of increase in roadway travel demand.

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