Public transport competitiveness: Implications for emerging urban areas

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ABSTRACT: Broad transport access throughout metropolitan labor markets improves urban economic efficiency and is a principal pre-requisite for improving per capita incomes. Yet, transport planners have few tools to measure employment access. This is less of a problem in the high-income world, where high automobile ownership availability places most jobs within reach. However, in middle and lower income areas, transport access tends to be more limited because automobile ownership is far more limited and public transport systems are less comprehensive in their geographical coverage. Because resources for system development and operation are limited, it is important that indicators be developed to measure the labor market efficiency of urban transport systems. Characteristics from 99 urban areas around the world are compared, observations are provided and provisional measures are proposed for evaluating the access provided by urban transport systems (road and public transport).

ABSTRACT: L'amélioration du développement économique et du revenu per capita dans les « unités urbaines » avant tout nécéssite un réseau de transports (équipements de voirie et services de transport collectif) accessible au plus grand nombre. Cependant, les organismes d'aménagement des transports sont munis de très peu d'outils pour évaluer l'accès à l'emploi. Ce problème est moins étendu dans un environnement à revenus élevés où la plupart des emplois est à la portée de la majorité grâce à la vulgarisation de la voiture. Par contre, dans les agglomérations à revenus faibles, la mobilité a tendance à être plus limitée à cause de la pauvreté du parc automobile et de la couverture géographique réduite du système de transports en commun. Etant donnée la faiblesse des moyens de développement et de mise en œuvre, il est nécessaire que des indicateurs soient identifiés pour calculer l'efficacité des systèmes de transports, en vue d'optimiser l'efficience du marché du travail. On compare tout d'abord les caractéristiques de 99 agglomérations à travers le monde; on tire alors des observations et on propose des mesures à titre provisoire afin d'évaluer l'accessibilité pourvue par les systèmes de transports intra-urbains.

1. INTRODUCTION

Research by Remy Prud'homme and Chang-Woon Lee others has offered a "city productivity thesis" to the effect that the economic efficiency of urban areas increases as the size of the labor market (number of jobs) accessible to residents in a particular increment of time. Yet, urban planning has developed few tools to measure the level of access provided by the urban transport system. This is not so much of a problem with respect to automobiles and cycles, because geographical access can be generally estimated from network speeds, because users can reach virtually any destination directly. But, public transport is more difficult, because not all destinations are served and many trips require transfers. The urban planning models and trip building features on internet sites could be modified to provide such outputs.

This paper reviews elements of transport from 99 urban areas around the world and suggests a provisional urban access/mobility index (Employment Access Index) that could be further developed with the models that already exist.

2. INCOME, ACCESS AND MOBILITY

An econometric analysis of data from the 99 urban areas (89 from the UITP *Millennium Cities Database* and 10 additional urban areas from the United States, listed in Table 15) indicates that average gross product per capita is strongly related to at least two factors --- (1) the extent of economic

freedom (as measured by the Heritage Foundation "Index of Economic Freedom," Johnson & Sheehy, 1996) and the amount of travel. Both of these independent variables were significant at the 99 percent level of confidence, and had high elasticities the overall "R squared was 0.736 (Table 1).

- The "Index of Economic Freedom" was the most significant independent variable. This index, which ranges from 1 to 5, categorizes the liberality of markets, with a lower score indicating greater economic freedom. The Index of Economic Freedom was associated with higher gross products per capita. At the mean of 2.42, the elasticity was –2.375 (the negative elasticity results from lower scores representing greater economic freedom).
- The second most significant independent variable was annual kilometers traveled (by any means), which was associated with higher gross product per capita. The elasticity at the mean was 0.921.
- Public transport market share (based upon passenger kilometers) was significant at nearly the 95 percent level of confidence and was negatively associated with gross product per capita. It had a weaker -0.283 elasticity at the mean.
- Higher population was weakly associated with higher income, but was not statistically significant.
- Higher population density was negatively but weakly associated with higher income, but was not statistically significant.
- Public transport service intensity was negatively but weakly associated with higher income, but was not statistically significant.

Table 1. Relationship between gross product per capita and other factors

Independent Variable	Coefficient	Probability	Elasticity at Mean
Intercept	31869		
Population	0.000153	0.1907	0.106
Density	-0.0916	0.4139	-0.291
Public Transport %	-7163	0.0508	-0.283
Annual Travel	0.589	<0.0001	0.921
Economic Freedom	-6321	<0.0001	-2.375
PT Intensity	-0.000558	0.3552	-0.054

Dependent Variable: Gross Product per Capita (PPP)
99 observations
R2= 0.736

This analysis is consistent with the "city-productivity thesis," above. All of this suggests that urban transport planning should focus on maximizing mobility and access to provide the greater labor market access, and greater average incomes. It also confirms, even more strongly, that fact that more liberal economic regimes are conducive to greater affluence.

3. REVIEW OF DATA

The sample of 99 urban areas was divided into geographical and income categories. Urban areas with gross products per capita (1995, purchasing power parity) of above $15,000 were classified as high-income, those with $5,000 to 14,999 were classified as middle-income and those below $5,000 were classified as low-income. The average gross products ranged from a high of $32,870 in the United States to $3,180 in low-income Africa.

3.1 Demographics

The middle-income and low-income urban areas had approximately twice the population of the high-income areas, while the densities ranged from three to four times that of the high-income areas (Table 2).

Table 2. Urban Area Demographics

Urban Areas	Population (000,000)	Density	Gross Product/ Capita
HIGH-INCOME	3.3	3,704	$25,957
Europe	2.1	4,505	$23,922
Canada	2.3	1,885	$22,580
United States	3.8	1,292	$32,870
Asia	10.4	10,806	$20,833
Australasia	2.0	1,522	$20,860
MIDDLE-INCOME	7.2	11,526	$10,057
Europe	3.7	8,138	$12,175
Americas	9.3	8,089	$8,833
Asia	8.2	15,287	$10,800
Africa	5.3	11,607	$8,100
LOW-INCOME	5.9	15,069	$3,300
Asia	8.3	20,222	$3,180
Africa	2.1	6,480	$3,500

3.2 Economic Freedom

Overall, the higher-income urban areas score highest on the Index of Economic Freedom (a lower score indicates more economic freedom). High-income urban areas have an index of 2.05, compared to 3.07 for middle-income urban areas and 3.66 for low-income urban areas. The high-income urban areas of Asia scored the highest in economic freedom, strongly influenced by the market economies of Singapore and Hong Kong. The United States, Canada and Western Europe followed closely. The middle-income urban areas scored

similarly by geography. The least economically free economies were in low-income Asia, which scored slightly less favorably than low-income Africa (Table 3 and Figure 1).

Table 3: Economic freedom index

Urban Areas	Index
HIGH-INCOME	2.05
Europe	2.18
Canada	2.00
United States	1.90
Asia	1.93
Australasia	2.03
MIDDLE-INCOME	3.07
Europe	3.06
Americas	3.19
Asia	3.00
Africa	3.03
LOW-INCOME	3.66
Asia	3.78
Africa	3.45

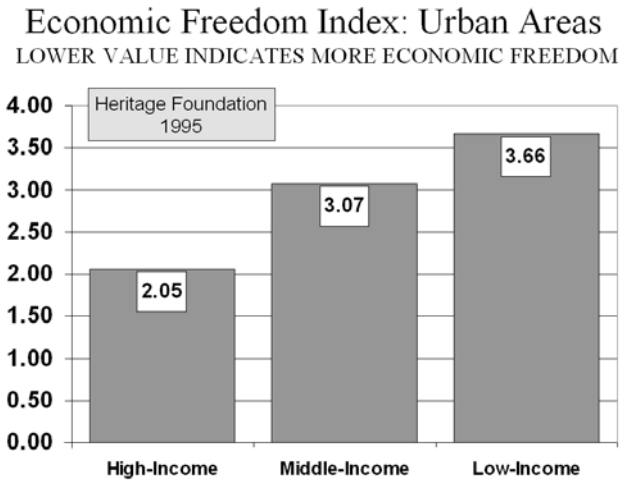

Figure 1

3.3 Annual Travel

The high-income urban areas had average annual travel rates more than double that of the middle-income urban areas. By far the highest travel rates were in the United States, while the lowest high-income world travel rates were in Asia. Low-income urban areas had overall travel rates approximately 30 percent of the high-income urban areas.

The differences were much more pronounced, however, with respect to average annual travel by automobile. Travel in the high-income urban areas was 3.4 times that of the middle-income areas, and 6.8 times that of the low-income areas. Road speeds averaged 40 km/h in high-income areas, compared to 28 kilometers per hour in middle-income areas and 27 kilometers per hour in low-income areas (Table 4).

Table 4. Annual Travel

Urban Areas	All Urban Travel (PKM)	Automobile Travel (PKM)
HIGH-INCOME	12,254	10,918
Europe	8,027	6,418
Canada	9,653	8,707
United States	20,874	20,475
Asia	7,990	4,361
Australasia	12,542	11,566
MIDDLE-INCOME	5,839	3,177
Europe	6,742	3,473
Americas	6,102	2,828
Asia	5,750	3,602
Africa	4,742	2,445
LOW-INCOME	3,619	1,636
Asia	3,254	1,653
Africa	4,228	1,606

3.3 Roadway Traffic Intensity

Despite lower automobile usage rates, the middle-income urban areas had nearly the same traffic intensity of the higher-income areas, at 49,000 daily vehicle kilometers of travel per square kilometer, compared to 53,000 for the high-income areas (Table 5). The low-income areas were far below, at 18,000. Roadway traffic intensities were lower in the less dense Australasian and United States urban areas, at 30,000 and 39,000 respectively. This compares to the average of 45,000 in Canada and 63,000 in Western Europe. This illustrates the fact that, while per capita usage of automobiles falls as densities rise, the net impact is generally to increase traffic densities. The highest high-income traffic densities were in the Asian urban areas, at 65,000, which also exhibited the much higher public transport market shares and densities In the United States, Department of Transportation research indicates that traffic volumes tend to increase at a rate of more than 0.7 relative to density differences (calculated from Ross and Dunning).

Slightly higher traffic intensities were noted in the middle-income Asian urban areas. Seoul had the highest traffic intensity, at 166,000 vehicle kilometers per square kilometer. This data is limited to personal vehicles, and excludes trucks, which comprise a much larger share of traffic in more dense urban areas and urban areas with middle-income and low-income. As a result, the automobile only traffic intensities in lower density Australasia and the United States are closer to those of Western Europe and especially Asia than they would be if all traffic were included (US Department of

Transportation research indicates that the average large truck occupies nearly four times the urban road space of an automobile, see Cox, 2001).

Table 5: Vehicle kilometer traffic intensity

Urban Areas	Daily Vehicle Kilometers per Square Kilometer
HIGH-INCOME	52,599
Europe	63,280
Canada	44,877
United States	39,451
Asia	64,875
Australasia	29,821
MIDDLE-INCOME	49,038
Europe	50,959
Americas	37,016
Asia	65,991
Africa	27,005
LOW-INCOME	18,042
Asia	24,070
Africa	7,994

Average roadway travel speeds were higher in the high-income urban areas. On average, traffic moves at nearly 40 kilometers per hour in high-income urban areas, with the highest speeds recorded in the United States, Canada and Australasia. It is likely that the lower Australasian speeds are the result of lower motorway densities than occur in the United States and, to a lesser degree, Canada. Middle-income urban area speeds were approximately 28 kilometers per hour, while low-income urban area speeds averaged 27 kilometers per hour

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Table 6: Speed and vehicle hour traffic intensity

Urban Areas	Average Roadway Speed	Daily Vehicle Hours/ Square Kilometer
HIGH-INCOME	39.9	1,319
Europe	33.1	1,913
Canada	44.5	1,008
United States	51.4	767
Asia	31.9	2,037
Australasia	42.2	707
MIDDLE-INCOME	27.7	1,772
Europe	30.1	1,694
Americas	28.7	1,291
Asia	24.0	2,746
Africa	32.0	845
LOW-INCOME	26.9	672
Asia	21.5	1,119
Africa	35.7	224

Higher roadway speeds in Australasia and the United States result in the lowest traffic intensity when measured in vehicle hours per square kilometer among the high-income urban areas. Vehicle hour intensities in middle-income urban areas are nearly as high as in the high-income urban areas. Low-income urban areas have far lower vehicle hour intensities. Vehicle hour intensity and speed are particularly important because more intense levels of air pollution are associated with slower speeds and the stop and go traffic that leads to longer travel times (Table 6).

3.4 Work Trip Travel Distance

The lower population densities would lead to the expectation that average work trip lengths would be substantially longer in the high-income urban areas, however, the low and middle income work trip lengths were only 1/3 less (Table 7). High-income urban areas had average work trip lengths of 13.0 kilometers, compared to 9.5 kilometers for middle-income urban areas and 9.1 kilometers for low-income urban areas. This means that, on average, virtually hundreds of thousands and in some cases, millions of jobs are “passed” by workers every day as they travel to the employment that matches their needs with that of their employers. This casts doubt on the popular notion that urban planners can achieve a “jobs-housing” balance (in the United States, for example, a national census surveys indicated that approximately four-fifths of employees locate their residences for principal reasons other than proximity to their employment (U.S. Census Bureau, 2002).

Table 7. Work trip travel distance

Urban Areas	Kilometers
HIGH-INCOME	13.0
Europe	9.4
Canada	12.6
United States	19.5
Asia	11.1
Australasia	13.1
MIDDLE-INCOME	9.5
Europe	7.7
Americas	10.1
Asia	8.9
Africa	11.9
LOW-INCOME	9.1
Asia	6.1
Africa	14.2

3.5 Public Transport Market Share

Public transport market share was the highest in the low-income areas, at 54 percent (measured in passenger kilometers). The public transport market share of middle-income areas averaged 45.5 percent, while high-income areas averaged 15.3 percent

(Table 8). The (high-income) United States was by far the lowest, at 1.9 percent. However, significantly understates the United States public transport market share because it does not include ridership on the separate school systems that are unique to Canada and the USA (USA data is not available by urban area and Canadian data is sparse). Annual school bus travel (passenger kilometers) is more than double that of public transport in the United States. It is therefore likely that the actual public transport market share in the United States is between 5.0 and 6.0 percent (some ridership is outside urban areas).

Table 8. Public transport market share

Urban Areas	Share of Person Kilometers
HIGH-INCOME	15.3%
Europe	20.0%
Canada	9.8%
United States	1.9%
Asia	45.4%
Australasia	7.8%
MIDDLE-INCOME	45.5%
Europe	48.5%
Americas	53.7%
Asia	37.4%
Africa	48.4%
LOW-INCOME	54.0%
Asia	49.2%
Africa	62.0%

3.6 Public Transport Service Level

Public transport service intensity was the greatest in the middle and low-income areas, with vehicle kilometers per square kilometer of from three to early four times that of the high-income areas (Table 9). Low income Asia had six times the service intensity of the high-income urban areas and more than 50 times that of the United States. Middle-income urban areas in the Americas, Europe and Asia had generally higher transit service intensity than anywhere other than low-income Asia.

Measured against the standard of Hong Kong (which has the highest public transport service intensity of any high-income urban area), the low-income areas had an index of 0.219, compared to 0.140 in the middle-income areas and 0.048 in the high-income areas (Canada, Australasia and the United States all had indexes of below 0.020). Manila's jitney based public transport system was the only one among the 99 with a higher public transport service intensity than Hong Kong (1.857). Only three other urban areas, Moscow, Mexico City and Bogota (in order) had indexes of more than 0.600 compared to the Hong Kong.

3.7 Public Transport Expenditures

Public transport costs as a share of gross product were more than twice as high in low-income urban areas as in high-income areas. Middle-income urban areas spent 1.7 times as much of their gross products on public transport compared to high-income areas (Table 10). Higher income urban areas have the highest expenditures, at $282 per capita annually. High-income urban areas in Europe spend the most, at $317 per capita, while low income Asian urban areas spend the least, at $56.

Table 9. Public transport service levels

Urban Areas	Annual Vehicle Kilometers per Square Kilometer (000,000)	Compared to Hong Kong
HIGH-INCOME	359.4	0.048
Europe	454.7	0.061
Canada	122.8	0.016
United States	37.9	0.005
Asia	1,350.0	0.180
Australasia	83.3	0.011
MIDDLE-INCOME	1,054.8	0.140
Europe	1,155.9	0.154
Americas	1,406.1	0.187
Asia	978.7	0.130
Africa	598.0	0.080
LOW-INCOME	1,645.1	0.219
Asia	2,184.7	0.291
Africa	745.8	0.099

The differences in public transport expenditures are much greater when weighted by market shares. A productivity index was developed to measure public transport expenditures per point of market share compared to that of high-income Asia, where public transport market shares remain by far the highest among affluent areas.

In the United States, where public transport operating conditions are the least favorable, and where productivity has declined more than 60 percent since 1970 (Cox, 2003), expenditures per point of market share were more than 10 times that of high-income Asia. This suggests that if United States spending levels were raised to European levels, present productivity rates would increase public transports market share to less than six percent in the United States, some 60 percent short of the European market share. If United States productivity had been maintained at 1970 levels, its

international cost productivity would have been higher than Australasia and lower than Canada.

High-income European and Canadian urban areas spent approximately three times as much as high-income Asian urban areas. At the same time, middle-income and low-income urban areas spent less than the high-income Asian urban areas (30 percent and 73 percent respectively).

Table 10. Public transport expenditures

Urban Areas	Public Transport Cost/Gross Product	Public Transport Expenditures/ Capita (US$)	Index: Cost per Point of Market Share
HIGH-INCOME	1.09%	$282	3.27
Europe	1.32%	$317	2.81
Canada	0.81%	$183	3.32
United States	0.48%	$164	10.11
Asia	1.23%	$256	1.00
Australasia	0.87%	$181	4.13
MIDDLE-INCOME	1.79%	$180	0.70
Europe	1.65%	$201	0.74
Americas	2.10%	$186	0.61
Asia	0.98%	$106	0.50
Africa	3.27%	$265	0.97
LOW-INCOME	2.45%	$81	0.27
Asia	1.75%	$56	0.20
Africa	3.61%	$126	0.36

United States data for 10 urban areas in *Millennium Cities Database*

3.8 Public Transport Revenue Recovery and Subsidies

Public transport revenue recovery (fares and commercial revenues as a percentage of total costs) was also highest in the low-income areas, at 1.51, compared to 0.95 in the middle-income areas and 0.55 in the high-income areas. But there was a significant exception to the high subsidy levels of high-income public transport systems. High-income Asian urban areas had public transport revenue recovery rates averaging 1.22.

Ho Chi Minh City, Manila, Riyadh and Bogota (in order) had the highest revenue recovery, all above 2.00 of total costs. Each of these urban areas relies principally on private transport carriers. By far the lowest recovery rates were in the United States, at below 0.30. If the dedicated school transport services were included, this rate would fall to perhaps 20 percent (Table 11).

Public transport subsidies are the highest in high-income Europe, the United States and middle-income Africa.

3.9 Observations

At the theoretical level, the high-income Asian urban areas represent the best model for low-income and middle-income urban areas to emulate if they are to provide improved access through public transport strategies. The Asian areas have the highest public transport market shares of high-income urban areas. There would appear to be two principal reasons for this. First; the Asian areas generally have extensive grade separated public transport systems that are able to provide service that is competitive with the automobile. Part of this competitiveness is due to the lower roadway speeds that result from the high levels of traffic congestion. However, middle-income and low-income urban areas are already intensely developed and are not likely to be able to afford high quality grade separated systems. Affordable, expedited public transport should probably be limited to priority treatment for buses and smaller public transport vehicles at grade.

But perhaps just as important is that the high-income Asian urban areas have public transport systems that are largely commercial. This lack of reliance on public subsidies reduces the influence of political interests on public transport and is an important factor in keeping unit costs low.

Table 11. Public transport revenue recovery and subsidies

Urban Areas	Revenue Recovery Ratio	Public Transport Subsidies/ Capita (US$)
HIGH-INCOME	0.550	$127
Europe	0.586	$131
Canada	0.546	$83
United States	0.298	$115
Asia	1.222	$0
Australasia	0.527	$86
MIDDLE-INCOME	0.953	$9
Europe	0.641	$72
Americas	1.330	$0
Asia	0.992	$1
Africa	0.610	$104
LOW-INCOME	1.509	$0
Asia	1.564	$0
Africa	1.419	$0

4. PROVISIONAL EMPLOYMENT ACCESS INDEX

Elements of this data were combined into a provisional labor market access/mobility index (Employment Access Index) by estimating the percentage of urban area jobs accessible by roads and public transport, using average speeds and

resulting radii. A travel time of 45 minutes was used, which is similar to average work trip travel times in Hong Kong, Tokyo and Osaka, 1.5 those of Europe and nearly double those of the USA. The resulting percentage figures were then combined into an overall Employment Access Index weighted by the road/public transport market shares.

4.1 Automobile Employment Access Index

Generally, road access reaches the overwhelming majority of jobs in all of the urban areas (Table 12). The middle-income Americas had the lowest road access-mobility index at 0.83, and high-income Asia is estimated to have an index of 0.89. All other areas were estimated to be above 0.90.

Table 12. Employment access index: Automobile

Urban Areas	Auto Access Index: 45 Minutes	Automobile Access: Jobs (000)
HIGH-INCOME	0.96	1,325
Europe	0.98	949
Canada	1.00	1,098
United States	0.95	1,489
Asia	0.89	3,489
Australasia	0.92	702
MIDDLE-INCOME	0.94	2,986
Europe	1.00	2,033
Americas	0.83	3,053
Asia	0.97	3,908
Africa	1.00	1,763
LOW-INCOME	1.00	2,426
Asia	1.00	3,538
Africa	1.00	572

However, the large variation in automobile availability renders such mobility in lower and middle-income urban areas of little use to the majority of people, who are more dependent upon public transport.

4.2 Public Transport Employment Access Index

It is more difficult to estimate the geographical extent of access and mobility for public transport services. The author has previously estimated that in Portland, Oregon, with one of North America's most comprehensive public transport systems, approximately 5 percent of the trip pairs are within 40 minutes of one another on public transport during the morning and evening peak periods (many higher speed public transport services are provided only during peak periods), where automobile competitiveness was defined as 1.5 times the travel time of the automobile (Cox, 2002). A more liberal figure of 15 percent was assumed in calculating the public transport Employment Access Index. It was assumed that public transport trips would require an additional 15 minutes for access and waiting time. The actual waiting time and percentage of destinations accessible by the public transport system could vary between urban areas (Table 13).

4.3 Combined Employment Access Index

The automobile and public transport indices were combined into an overall Employment Access Index, weighted by the market share of each. The high-income urban areas had an average overall Employment Access Index of 0.87, indicating that 87 percent of the jobs in the area could be reached in 45 minutes from the urban core. The highest indexes were in Canada and the United States, due to higher overall roadway speeds and greater reliance on the faster roadways (as opposed to public transport). High-income Europe and Australasia were slightly lower. The overall Employment Access Index for middle-income urban areas was 0.57, slightly lower than the 0.61 of low-income urban areas. Based upon the strong association between travel and income, it would seem likely that improving the Employment Access Index in middle-income and lower-income urban areas would result in higher incomes. These results also support the "city productivity thesis" to the extent that urban efficiency increases as the accessibility to labor markets increase (Table 14).

Table 13. Employment access index: Public transport

Urban Areas	Public Transport Access Index: 45 Minutes	Public Transport Access Jobs (000)
HIGH-INCOME	0.27	226
Europe	0.45	266
Canada	0.16	117
United States	0.02	47
Asia	0.26	803
Australasia	0.28	96
MIDDLE-INCOME	0.12	274
Europe	0.20	382
Americas	0.06	162
Asia	0.09	290
Africa	0.19	296
LOW-INCOME	0.27	475
Asia	0.22	675
Africa	0.35	141

An Employment Access Index could empower rider and taxpayer interest groups and transport planners to better design systems to serve the public,

especially those who must rely on public transport. This is especially important in middle-income and low-income urban areas where automobile access is more limited. In such urban areas, to the extent that automobile competitiveness can be produced by the public transport system, economic productivity can be expected to improve. At the same time, a more competitive public transport system is likely to dilute the strong trend toward automobile ownership. Many people purchase automobiles as soon as they can afford them (or even before) where public transport service does not take them where they need to go. On the other hand, some households will find it desirable and possible to avoid automobile ownership if the public transport system renders it unnecessary. But that requires a public transport system designed principally to meet the needs of customers --- something that requires strong and effective measures of its effectiveness with respect to access and mobility throughout the urban area

While it cannot be expected that public transport will provide automobile competitive service throughout the modern, sprawling urban area, there is no question but that better designed systems based upon an Employment Access Index could provide access and mobility to more of the area, not just to the central business district and within the dense urban core.

Table 14: Employment access index: Combined

Urban Areas	Employment Access Index
HIGH-INCOME	0.87
Europe	0.87
Canada	0.92
United States	0.93
Asia	0.60
Australasia	0.87
MIDDLE-INCOME	0.57
Europe	0.61
Americas	0.42
Asia	0.64
Africa	0.61
LOW-INCOME	0.61
Asia	0.62
Africa	0.60

SUSTAINABILITY

The high-income world data also suggests the importance of financial sustainability. High-income world public transport market shares are by far the highest in the Asian urban areas where, generally, public transport is profitable.

Reliance on public subsidies could well make public transport unsustainable. In many high-income urban areas where public transport is highly subsidized, there are frequent funding crises, service reductions and fare increases. These tend to result in lower public transport ridership and contribute to the downward trend in public transport market share.

Thus, low-income and middle-income urban areas are likely to be more successful in providing public transport if they can avoid public subsidy to the greatest extent possible. This obviously means that lower cost mobility improvements are generally to be favored over those with higher costs. In a number of high-income urban areas outside Asia, there has been a strong trend toward competitive approaches that reduce subsidy levels. Perhaps the most successful program has been that of London's bus system, which has resulted in approximately a 50 percent reduction in costs per vehicle kilometer over a period of 15 years. The result is that subsidies have been reduced to an even greater degree, service levels have been increased and the most recent data (fiscal year 2003) indicates that ridership is at the highest level since 1969. Similar success has been achieved in locations as diverse as Stockholm, Copenhagen, San Diego Auckland, Perth and Adelaide. In Stockholm, virtually all of the public transport system is routinely subjected to competition, including buses, trams, metro and suburban rail services.

CONCLUSIONS

It would thus appear that low-income and middle-income urban areas are more likely to be successful in developing effective public transport systems by implementing strategies that, among other things, rely on:

- Analysis that is based upon measures of access and mobility that are focused on serving customers. This paper has suggested a provisional indicator that could be used.
- Service approaches that are financial sustainable --- that are supported by commercial revenue sources, especially fares paid by users.

The most important element contributing to per capita urban gross products (and per capita incomes) is the extent to which markets operate (economic freedom). That, of course, is well outside the purview of urban and transport planners.

Table 15: Urban areas in analysis

HIGH-INCOME ($15,000+)	MIDDLE-INCOME ($5,000-$14,999)	LOW-INCOME (Less than $5,000)

Table 15: Urban areas in analysis		
HIGH-INCOME ($15,000+)	MIDDLE-INCOME ($5,000-$14,999)	LOW-INCOME (Less than $5,000)
EUROPE Amsterdam Barcelona Berlin Berne Bologna Brussels Copenhagen Dusseldorf Frankfurt Geneva Glasgow Graz Hamburg Helsinki London Lyon Madrid Manchester Marseille Milan Munich Nantes Newcastle Oslo Paris Prague Rhein-Ruhr Rome Stockholm Stuttgart Vienna Zurich CANADA Calgary Montreal Ottawa Toronto Vancouver UNITED STATES Atlanta Austin Charlotte Chicago Cincinnati Dallas-Fort Worth Denver Houston Indianapolis Kansas City Los Angeles Minneapolis-St. Paul New York Phoenix Portland San Diego San Francisco Seattle Tampa-St. Petersburg Washington	EUROPE Athens Budapest Cracow Moscow AMERICAS Bogota Curitiba Mexico City Rio de Janeiro Santiago Sao Paulo ASIA Bangkok Beijing Jakarta Kuala Lampur Riyadh Seoul Shanghai Taipei Tehran AFRICA Cairo Cape Town Johannesburg Tunis	ASIA Chennai Guangzhou Ho Chi Minh City Manila Mumbai AFRICA Abidjan Dakar Harrare

Table 15: Urban areas in analysis		
HIGH-INCOME ($15,000+)	MIDDLE-INCOME ($5,000-$14,999)	LOW-INCOME (Less than $5,000)
ASIA Hong Kong Osaka Sapporo Singapore Tel Aviv Tokyo AUSTRALASIA Brisbane Melbourne Perth Sydney Wellington		

References

Cox, W, *Freight Rail's Potential to Alleviate Traffic Congestion,* Texas Public Policy Institute (San Antonio, 2001).

Cox, W "The Illusion of Transit Choice," *Veritas*, March 2002.

Cox, W "Competitive Participation in US Public Transport: Special Interests versus the Public Interest," Paper presented to the 8th Inernational Conference on Competition and Ownership in Land Passenger Transport (Thredbo 8), Rio de Janeiro, 2003.

International Union of Public Transport, *Millenium Cities Databse, 2001*.

Johnson, Bryan T. and Thomas P. Sheehy, *1996 Index of Economic Freedom,* Heritage Foundation (Washington, 1996).

Prud'homme Remy and Chang-Woon Lee, "Size, Sprawl, Speed and the Efficiency of Cities," Obervatoire de l'Économic et des Institutions Locals (Paris, 1998).

Ross, Catherine 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.

United States Census Bureau, *2001 Supplemental Survey*, 2002.