APPENDIX

Backup Material for the Cost of Congestion to the Economy of the Portland Region

Prepared for:

PORTLAND BUSINESS ALLIANCE
Greater Portland's Chamber of Commerce

METRO

PORT OF PORTLAND
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Prepared by:

Economic Development Research Group

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APPENDIX A. TRANSPORTATION ROLE IN THE REGIONAL ECONOMY

This appendix presents additional tables of detail on the economic base of the region.

A-1 Backup for Table 2-1 Concentration of Industries in the Portland Area *(comparison to National Average)*

		Portland Employment (2002)		Location Quotient
		# of Jobs	% of Total	(Relative Concentration)
334	Computer & Electronic Products	36,087	2.8%	3.2
813	Professional, Civic, Other Organizations	60,835	4.7%	2.6
331	Primary Metal Manufacturing	6,308	0.5%	1.6
322	Paper Manufacturing	6,477	0.5%	1.6
511	Publishing Industries (except Internet)	10,802	0.8%	1.4
420	Wholesale Trade	59,554	4.6%	1.3
533	Franchising	302	0.0%	1.3
531	Real Estate	45,314	3.5%	1.2
321	Wood Products	5,560	0.4%	1.2
113	Forestry & Logging	1,363	0.1%	1.2
316	Leather & Allied Products	500	0.0%	1.2
524	Insurance Carriers & Related Activities	24,060	1.9%	1.1
711-713	Amusement & Recreation	28,752	2.2%	1.1
611	Educational Services	24,972	1.9%	1.1
339	Miscellaneous Manufacturing	6,590	0.5%	1.1
323	Printing & Related Support Activities	6,410	0.5%	1.1
111	Crop Production	15,043	1.2%	1.1
541-551	Professional Scientific, Technical, Services	106,392	8.2%	1.1
532	Rental & Leasing Services	8,342	0.6%	1.1
561	Administrative & Support Services	71,448	5.5%	1.0
230	Construction	82,595	6.4%	1.0
332	Fabricated Metal Products	12,168	0.9%	1.0
481-487	Transportation	30,454	2.4%	1.0
814	Private Households	15,696	1.2%	1.0
811-812	Repair, Maintenance, & Personal Services	42,475	3.3%	1.0
491-493	Warehousing & package delivery	16,184	1.3%	1.0
525	Funds, Trusts, & Other Financial Vehicles	1,815	0.1%	0.9
333	Machinery Manufacturing	8,864	0.7%	0.9
721-722	Accommodations, Eating & Drinking	83,058	6.4%	0.9
337	Furniture & Related Products	4,444	0.3%	0.9
621-624	Health Care & Social Services	113,088	8.8%	0.9
562	Waste Management & Remediation	2,468	0.2%	0.9
521-523	Monetary, Financial, & Credit Activity	32,875	2.5%	0.9
441-454	Retail Trade	124,514	9.6%	0.9
327	Nonmetallic Mineral Products	3,460	0.3%	0.9
513	Broadcasting	10,721	0.8%	0.9
512	Motion Picture & Sound Recording	2,778	0.2%	0.8
514	Internet & data process svcs	3,158	0.2%	0.8
326	Plastics & Rubber Products	5,011	0.4%	0.8
920	Government & non NAICS	133,859	10.4%	0.8
312	Beverage & Tobacco Products	1,200	0.1%	0.7
336	Transportation Equipment	9,818	0.8%	0.7
311	Food Products	8,796	0.7%	0.7
221	Utilities	2,668	0.2%	0.6

335	Electric Equipment, Appliances, etc.	1,939	0.2%	0.5
314	Textile Product Mills	727	0.1%	0.5
115	Support for Agriculture & Forestry	2,376	0.2%	0.4
212-213	Mining & Support Activities	1,299	0.1%	0.4
315	Apparel Manufacturing	1,113	0.1%	0.4
112	Animal Production	2,791	0.2%	0.3
325	Chemical Manufacturing	1,957	0.2%	0.3
324	Petroleum & Coal Products	242	0.0%	0.3
313	Textile Mills	481	0.0%	0.2
114	Fishing, Hunting & Trapping	152	0.0%	0.2
211	Oil & Gas Extraction	0	0.0%	0.0
	TOTAL	**1,290,355**	**100.0%**	

Source: EDR-LEAP database, compiled by IMPLAN from US Dept of Commerce Regional Economic Indicators Service, includes self-employed and contract labor in addition to wage and salary employment.

A-2 Backup for Report Figure 2-2
Forecast Value of Commodity Shipments by Transport Mode
(billions of US dollars, for the Portland-Vancouver region)

Mode	1997	2000	2010	2020	2030
Truck	$278	$371	$405	$575	$697
Rail	$37	$48	$45	$62	$74
Water	$22	$25	$26	$29	$31
Air	$3	$5	$6	$10	$13
Pipeline	$11	$9	$12	$12	$12
Total	$351	$458	$494	$688	$827

Source: Commodity Flow Forecast Update and Lower Columbia River Cargo Forecast[1]

Further Detail on Section 2.2 Inter-Regional Highway Corridors.
The Portland region has two major interstate highways serving long distance travel:

- The I-5 highway corridor is a major north-south spine for passenger and truck freight movement along the west coast from Mexico to Canada. The San Francisco – Portland – Seattle portion of the highway has very heavy long truck movements delivering goods and services between these cities.

- The I-84 highway corridor is a major east-west spine for passenger and truck freight movement from Portland through the Cascades to the central and eastern parts of the US.

Along both highways, trucks account for a disproportionately high portion of total vehicles (between 10% and 22%) -- which is far higher than the 5% average truck share in the metro area. Figures A-3 and A-4 show results of the national commodity flow survey, in terms of the flow of freight tons and number of daily trucks moving

[1] DRI-WEFA and BST Associates. 2002. Prepared for the Port of Portland, Metro, Oregon Department of Transportation, Port of Vancouver and the Regional transportation Council, p. 49

to, from and between counties within the Portland area. It shows that the I-5 and I-84 corridors indeed account for the largest share of total freight movement.

A-3. Tons of Freight Flow To, From & Within the Portland Area, 1998

A-4. Number of Daily Trucks Going To, From & Within the Portland Area, 1998 (avg. daily

Source: US DOT, FHWA, Freight Analysis Framework

Of course, there are many other key highway corridors that serve more localized access needs for the airport, seaport and major industrial areas, and thus are also critical for business. They include, among others:

- I-205
- Hwy 99
- Hwy 217
- Hwy 8 (Tulaltin Valley Hwy)
- Hwy 43
- Hwy 210 (Scholls Ferry Rd)
- US 26 (Sunset Hwy)
- Marine Drive

APPENDIX B. TRAVEL IMPACTS

B-1: Vehicle Hours of Delay at Key Corridors – Year 2000 (Peak PM Period, Average Weekday)

Key	Highway	Segment	Veh Hrs of Delay
1	I-5 North	Mill Plain Blvd in Vancouver WA to I-84	2,780.13
2	Marine Dr and US 30	NE 33rd Dr to NE 223rd Ave	400.83
3	I-84	I-5 to I-205	1,418.39
4	Troutdale Rd / SE 282nd Ave	I-84 to US 26 (Mt Hood Hwy)	36.77
5	SE Powell Blvd and SE Foster Rd	Ross Island Bridge to SE 174th at Powell, and SE Powell to SE Jenne Rd	807.21
6	Sellwood Bridge & SE Tacoma St / Johnson Creek Blvd	Hwy 43 to SE Harney St (at SE 45th)	153.52
7	Hwy 99E	Ross Island Bridge to Oregon City Bridge (downtown Oregon City)	996.37
8	Hwy 224	Hwy 99E to I-205	198.17
9	Sunnyside Rd and Hwy 212	I-205 to Hwy 212 (Sunnyside Rd) & Rock Creek to SE 232nd Dr (Hwy 212)	312.68
10	I-205	Stafford Rd Interchange to Hwy 212	846.72
11	Hwy 43	SW Bancroft St (South end of couplet) to I-205 in West Linn	447.14
12	I-5 South	Hwy 217 to Wilsonville interchange	862.74
13	Hwy 99W	I-5 to SW Cipole Rd in Tualatin	750.97
14	Hwy 217	Hwy 10 (Beaverton-Hillsdale Hwy) to I-5	870.40
15	Hwy 210 (Scholls Ferry Rd)	US 26 (Sunset Hwy) to SW 135th Ave in Tigard	397.76
16	Hwy 8 (Tualatin Valley Hwy)	Hwy 217 to SW 229th Ave	718.76
17	US 26 (Sunset Hwy)	I-405 to SW Skyline Blvd (Sylvan interchange)	500.20
18	US 30 (Saint Helens Rd)	NW Kittridge to NW 107th Ave (north of St Johns Bridge) in Linnton	109.17

Source: Metro, all figures are daily totals for 2-hour afternoon peak period

B-2 Further Detail on Delay Along Key Corridors - Year 2000

Corridor ID	Length (Miles)*	Total VMT	VMT with V/C >= 0.9	Veh Hours of Delay
1	18.67	133,419	41,531	2,780.13
2	45.78	68,201	9,895	400.83
3	10.21	114,251	51,946	1,418.39
4	13.20	9,361	221	36.77
5	30.73	71,976	27,620	807.21
6	5.42	9,956	7,233	153.52
7	21.79	87,101	33,674	996.37
8	5.82	19,177	4,267	198.17
9	13.04	28,490	10,472	312.68
10	19.49	146,812	39,240	846.72
11	20.84	45,259	22,275	447.14
12	16.87	167,573	27,030	862.74
13	11.48	45,404	35,323	750.97
14	9.87	81,005	29,788	870.40
15	12.78	29,174	14,707	397.76
16	11.70	47,712	37,570	718.76
17	4.35	48,476	27,098	500.20
18	8.34	22,380	8,784	109.17

B-3 Corresponding Breakdown for Year 2025 Planned Investment Scenario

Corridor ID	Length (Miles)*	Total VMT	VMT with V/C >= 0.9	Veh Hours of Delay	VHT increase over Year 2000	percent VHT increase over 2000
1	18.72	161,013	93,036	4,218.69	1,439	52%
2	47.50	94,049	54,789	965.18	564	141%
3	10.21	122,636	67,582	1,838.73	420	30%
4	13.20	16,093	4,624	167.27	130	355%
5	31.12	86,231	49,761	1,434.79	628	78%
6	5.36	12,915	11,154	506.18	353	230%
7	21.78	121,444	83,731	3,035.47	2,039	205%
8	8.30	32,936	23,670	485.58	287	145%
9	22.02	69,723	39,676	1,104.99	792	253%
10	19.49	181,718	113,560	3,592.79	2,746	324%
11	20.80	60,712	36,943	1,797.90	1,351	302%
12	17.01	226,954	190,912	5,579.77	4,717	547%
13	11.50	56,599	55,377	1,946.74	1,196	159%
14	11.14	104,063	82,032	1,813.66	943	108%
15	13.28	35,794	22,484	646.34	249	62%
16	11.98	52,310	48,443	781.48	63	9%
17	4.35	54,558	34,347	982.37	482	96%
18	8.34	34,037	26,713	520.24	411	377%

APPENDIX C. METHODOLOGY FOR CALCULATING ECONOMIC IMPACTS

The Transportation Economic Development Impact System (TREDIS) is a framework for evaluating regional economic impacts of transportation scenarios that affect both freight and passenger travel, both transit and road transport modes, and market access effects on competitiveness as well as travel time effects on existing travel. It uses accepted regional models to calculate economic impacts, and follows economic evaluation principals to distinguish impacts on the regional economy from transportation efficiency impacts. Elements of this system are shown in Figure C-1.

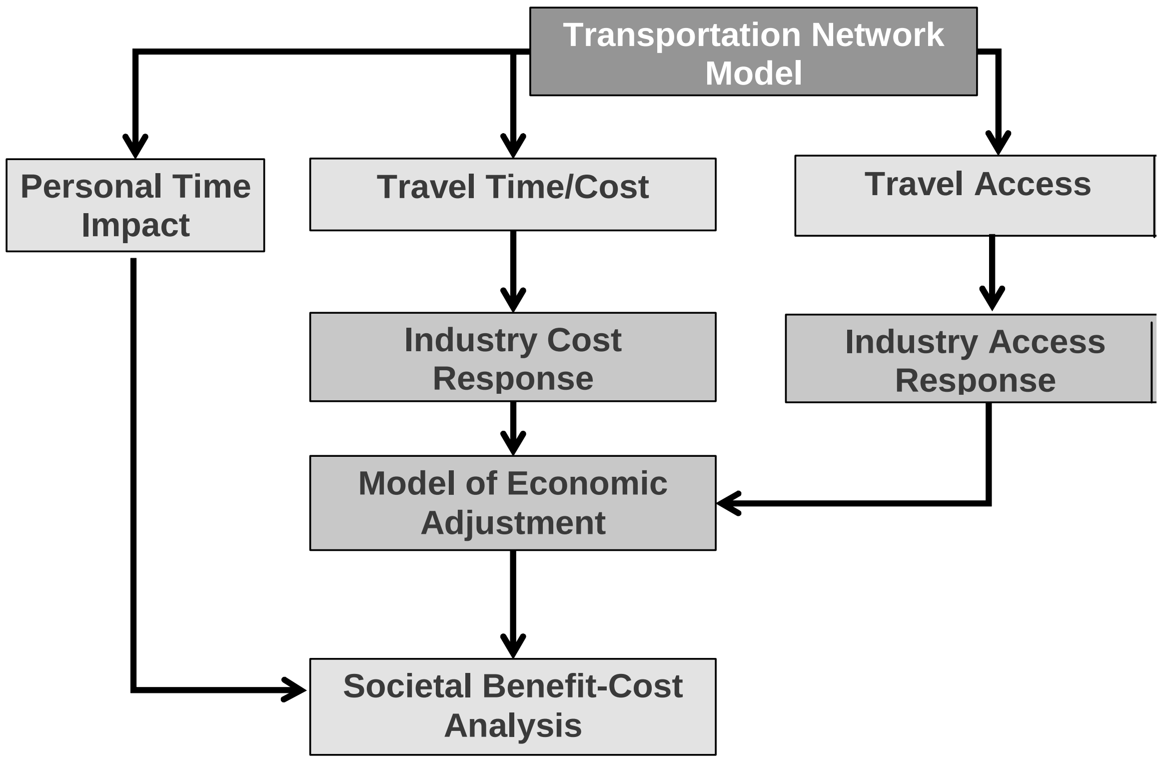
- Travel/Time Cost Impact -- The business (time and expense) operating cost savings and personal expense savings are determined from the transportation network forecasting model. They are then used in the economic analysis to calculate industry responses to those cost changes. This shows how those cost savings end up shifting spending patterns and prices, expanding business activity and investment and increasing employment for various industries. The economic analysis system also recognizes that some benefits are passed on as lower prices benefiting businesses outside of the region.

- Travel Access Impact – The access time impacts are determined from the transportation network forecasting model and then used in a geographic analysis system to calculate access effects on labor markets and product delivery market areas as well as access to intermodal transportation connections. The economic analysis then calculates how these access changes end up shifting productivity and regional competitiveness for attracting various manufacturing, service and office industries.

- Personal Time Impact – Personal time savings has a value that is fully considered in the calculation of total benefits to society. However, the personal time savings does not directly affect the flow of dollars in the economy, so it is excluded from the calculation of impact on the regional economy.

Figure C-1 shows how these three elements are considered in the TREDIS analysis.

C-1 Schematic Showing Elements of the Transportation Economic Development Impact System



For this study, the TREDIS framework combines information from a variety of components. It builds on results of Metro's regional transportation models to forecast traveler cost impacts and access time impacts of alternative scenarios. It uses the IMPLAN input-output model for the Portland region to calculate inter-industry relationships, applied together with industry cost response factors developed from studies by Economic Development Research Group. It uses the Local Economic Assessment Package to calculate competitiveness effects of access changes. It then applies accepted evaluation principals to distinguish impacts on the regional economy from transportation benefit/cost impacts. Additional information on this methodology is provided in the Appendix.

Framework Overview. TREDIS allows transportation planners to evaluate the full economic development impacts of transportation investments through a process involving three components:

(1) Translating Access and Cost Changes into Industry Impacts. The first components translates transportation model and analysis information into data useful for detailed economic analysis. This model collects and evaluates how changes in any highway, rail, air and/or port project may affect a combination of market access (within the region or to outside areas) and transportation costs. Both the access and the cost changes are calculated based on details of the spatial nature of the travel time and market access changes, and how they differentially affect combinations of specific modes and industries. It functions as a pre-processor that provides input to the core model.

(2) Industry Responses to Cost and Access Changes. The core model has three parts. (1) The first part is a cost response module that calculates how changes in businesses operating costs lead to local income and growth in affected industries, and also lead to provide cost savings and growth in other beneficiary industries. (2) The second part is a market access module to identify how changes in access to inter-modal terminals, international trade borders and ports, as well as expanded access to specialized worker skills, materials and customer markets, can lead to additional productivity and business growth over time. (3) The third part calculates losses, gains and shifts occurring as regional economies adjust over time.

(3) Impact/Benefit Accounting System. This final component processes information from the other modules in order to re-portray them in terms of various economic impact and economic benefit measures. It separates various elements of travel efficiency, cost savings, productivity and social benefit measures to portray benefits from the differing perspectives of federal, state and local agencies. It also separates impacts on income and business sales from the economic value of other social benefits that do not directly affect the flow of dollars in the economy.

Assumptions Regarding Calculation of Direct Economic Benefits. The "direct economic benefit" of congestion reduction is the dollar value of the time savings, cost savings and accident reduction savings for travelers. The components of direct economic benefit from congestion reduction are described below:

- **Reduction in the Cost of Time Delay.** High levels of congestion forecast for the Base Case lead to increasing travel time delays. These bring along costs for excess engine idling time, driver and passenger time, and truck freight delivery (loading dock and inventory staff) time. Reductions in congestion brought about by the Alternative Scenario will reduce these average time delays and thus save some of those costs. The value of time saved per hour per vehicle is calculated using the following factors:

Mode	Trip Purpose	Engine Idling Cost per hr. delay	Person Cost per hr. delay (A)	Delivery Cost per hr. delay
Pass Car/ Lt.Truck	On-the-Clock	$2.02	$26.68	$0.00
Pass Car/ Lt.Truck	Commute	$2.02	$13.34	$0.00
Pass Car/ Lt.Truck	Personal/Rec	$2.02	$13.34	$0.00
Freight Truck	On-the-Clock	$8.80	$35 .00	$0 - $48 (B)

(A) Driver and passenger time for business travel is valued at rates shown here; for personal and recreation travel it is valued at ½ of these rates. These rates are per person and must be multiplied by

the average number of persons per vehicle.
(B) varies by commodity; average of $20 is used here.
Source: FHWA, Highway Economic Requirements System and National Cooperative Highway Research Report 463, Economic Impacts of Congestion, National Academy Press, 2001.)

- **Reduction in Cost of Travel Time Variability.** When congestion becomes severe (i.e., traffic levels exceed 90% of road design capacity), the frequency of incident-related delays increases dramatically. Under those conditions, any minor accident, flat tire or engine stall can lead to dramatic backups and long-lasting slowdowns. This increases the unpredictability of travel times on affected routes. As such occurrences become common, many businesses adjust their delivery schedules to allow for this uncertainty. The result is further costs of the additional time built into delivery schedules. Reductions in congestion brought about by the Alternative Scenario will reduce this variability and make travel times more predictable, saving additional money for businesses.

  The "variability penalty factor" shown below is a multiplier put onto time delay costs to reflect variability in travel time. That factor varies depending on the extent of severe congestion along major travel corridors. It is lowest for the year 2000, highest for the Base Case and somewhat lower for the Alternative Scenario.

Scenario	Variability Penalty
2000	0.18
2025 FC	0.34
2025 PREF	0.27

Source: National Cooperative Highway Research Report 463, "Economic Impacts of Congestion", 2001 and Traffic Management Workshop, 2004: "Searching for Trip Time Reliability Benefits" by Matt Ensor.

- **Reduction in Cost of Excess Mileage to Avoid Congestion Bottlenecks.** High congestion delays and gridlock cause some drivers to use longer routes to avoid the congestion backups. Each additional vehicle-mile of travel due to congestion effects leads to a cost associated with additional vehicle fuel use and accident rates. Reductions in total vehicle-miles of travel brought about by the Alternative Scenario will bring benefits in the form of savings in these mileage and accident costs. The value assigned to changes in vehicle-miles of travel for cars and trucks is shown as follows:

Mode	Distance $ per mile	Accident$ per mile	Total $ per mile
Pass Car/ Lt.Truck	$0.26	$0.07	$0.35
Freight Truck	$1.34	$0.07	$1.43

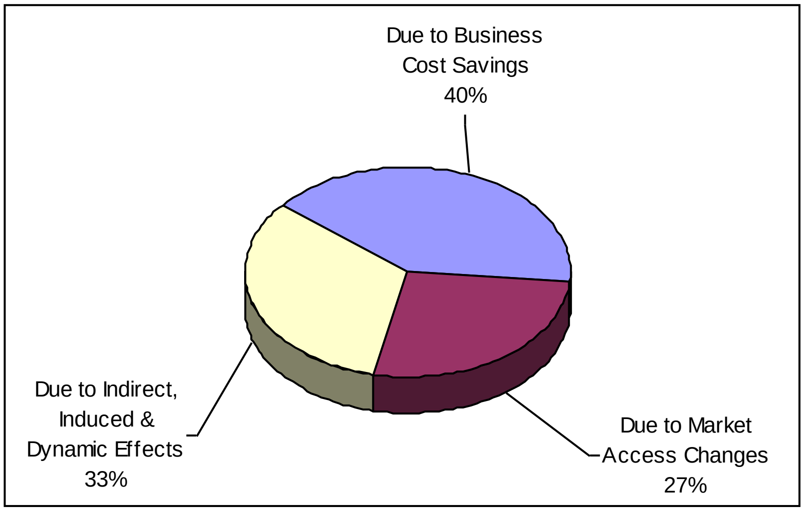
Source: FHWA, Highway Economic Requirements System, AAA (Your Driving Costs, 1997 edition); and ATA Trucking Information Services.

Allocation of Direct Economic Benefits to Households and Businesses. Every savings in miles and minutes of travel represents a benefit to households or to businesses. Those benefits accrue to these parties as follows:

- Travel expenses and driver/freight time savings for business travel generally accrues to businesses in the form of operating cost savings.
- Travel expense savings for commuting and for personal/recreation travel generally accrue directly to households as a cost of living savings.
- Commuting time savings tends to be reflected over the long term half in business wage rates (which represents a business cost savings) and half as a value of personal time savings (that has a dollar value although it does not directly affect the flow of dollars in the economy).
- Personal/recreation travel time savings also represents a benefit that can be valued in dollars but does not affect the flow of dollars in the economy.

The table below shows the relative roles of transportation costs, market access changes and other dynamics of the regional economy in affecting total economic impact on the regional economy of the Portland Metropolitan Area.

Distribution of Job Impacts from Implementing the Improved System I nstead of the Planned Investments Scenario for the Portland Metro Area



APPENDIX D. ADDITIONAL TABLES ON ANALYSIS OF COMPETITIVENESS

This appendix presents additional detail on regional strengths and weaknesses.

D-1 Employment Concentration: Comparison of Among Metro Regions

NAICS	Sector	Portland	Austin	Denver	Las Vegas	Phoenix	Salt Lake City	San Francisco	San Jose	Seattle
334	Computer & Electronic Products	3.2	4.3	0.5	0.1	2.3	1.2	1.4	3.6	1.0
813	Religious, Civic, Professional, Org.	2.6	1.0	0.6	0.5	1.3	0.8	1.6	5.1	0.6
331	Primary Metal Manufacturing	1.6	0.2	0.1	0.0	0.5	0.6	0.5	0.0	0.2
322	Paper Manufacturing	1.6	0.0	0.4	0.1	0.3	0.5	0.3	0.1	0.6
511	Publishing Industries (except Internet)	1.4	1.8	1.5	0.5	0.6	0.6	2.0	1.6	3.3
420	Wholesale Trade	1.3	1.2	1.2	0.7	1.1	1.2	0.9	0.5	1.1
533	Lessors of Nonfinancial Intangible Assets	1.3	0.5	2.5	1.2	5.1	1.8	1.6	0.5	0.8
531	Real Estate	1.2	1.0	1.5	1.6	1.5	1.4	1.3	1.0	1.3
321	Wood Products	1.2	0.4	0.3	0.4	0.8	0.5	0.1	0.3	0.8
113	Forestry & Logging	1.2	0.0	0.1	0.0	0.0	0.0	0.0	0.1	1.2
316	Leather & Allied Products	1.2	0.1	0.6	0.2	0.4	0.1	0.6	0.3	0.2
524	Insurance Carriers & Related Activities	1.1	1.2	1.2	0.7	1.2	1.2	1.0	1.0	1.1
711-713	Amusement & Recreation	1.1	0.8	1.2	1.8	1.0	1.3	1.3	1.3	1.3
611	Educational Services	1.1	0.7	0.9	0.3	0.6	0.8	1.0	0.8	0.9
339	Miscellaneous Manufacturing	1.1	1.3	0.9	1.0	0.6	3.1	0.8	1.0	1.0
323	Printing & Related Support Activities	1.1	0.7	0.9	0.6	0.7	1.3	0.7	0.5	0.9
111	Crop Production	1.1	0.4	0.1	0.0	0.3	0.1	0.2	0.0	0.1
541-551	Professional Scientific, Technical, Svcs	1.1	1.3	1.3	0.8	1.0	1.2	1.8	1.1	1.2
532	Rental & Leasing Services	1.1	0.8	1.3	1.6	1.4	1.2	1.2	0.9	1.1
561	Administrative & Support Services	1.0	1.1	1.1	1.2	1.6	1.1	0.9	0.9	0.9
230	Construction	1.0	1.1	1.4	1.7	1.4	1.0	0.9	1.0	1.0
332	Fabricated Metal Products	1.0	0.3	0.6	0.2	0.7	0.6	0.4	0.9	0.6
481-487	Transportation	1.0	0.5	1.0	1.2	0.9	1.3	1.0	0.4	1.0
814	Private Households	1.0	1.0	0.9	0.6	0.8	0.5	1.5	0.7	1.0
811-812	Repair, Maintenance, & Personal Svcs	1.0	0.9	1.1	0.9	1.0	1.0	1.0	0.9	1.0
491-493	Mail, package delivery & warehousing	1.0	0.5	1.2	0.7	1.0	1.1	1.1	0.7	0.9
525	Funds, Trusts, & Other Financial Vehicles	0.9	1.2	3.5	2.7	1.6	4.0	2.4	0.2	1.1
333	Machinery Manufacturing	0.9	0.5	0.4	0.1	0.4	0.6	0.4	0.2	0.5
721-722	Accommodations, Eating & Drinking	0.9	1.0	1.0	2.8	1.0	0.9	0.9	1.0	0.9
337	Furniture & Related Products	0.9	0.5	0.7	0.6	0.9	1.3	0.4	0.6	0.8
621-624	Health Care & Social Services	0.9	0.8	0.8	0.6	0.8	0.7	0.8	0.7	0.9
562	Waste Management & Remediation	0.9	0.7	1.9	1.0	0.7	1.5	1.1	0.9	0.8
521-523	Monetary, Financial, & Credit Activity	0.9	0.8	1.5	1.2	1.5	1.9	1.7	0.9	1.0
441-454	Retail Trade	0.9	0.9	0.9	1.0	1.0	1.0	0.8	0.9	1.0
327	Nonmetallic Mineral Products	0.9	1.1	1.1	1.2	1.0	0.8	0.5	0.7	0.8
513	Broadcasting	0.9	1.1	2.3	1.0	1.1	1.0	1.3	2.2	1.3
512	Motion Picture & Sound Recording	0.8	0.7	0.6	1.0	0.6	2.2	1.2	0.5	0.6
514	Internet & data process svcs	0.8	1.5	1.6	0.3	1.4	2.4	1.5	0.7	0.7
326	Plastics & Rubber Products	0.8	0.3	0.4	0.3	0.5	0.5	0.3	0.1	0.5
920	Government & non NAICS	0.8	1.5	0.9	0.7	0.8	1.0	0.9	1.4	1.1
312	Beverage & Tobacco Products	0.7	0.2	2.6	0.1	1.0	0.5	0.8	0.4	0.7
336	Transportation Equipment	0.7	0.1	0.5	0.0	0.9	0.4	0.3	0.2	3.4
311	Food Products	0.7	0.3	0.6	0.3	0.4	0.7	0.6	0.2	0.7
221	Utilities	0.6	0.4	0.7	1.1	1.1	0.8	0.9	0.5	0.3
335	Electric Equipment, Appliances, etc.	0.5	0.5	0.1	0.2	0.3	0.3	0.4	0.4	0.4
314	Textile Product Mills	0.5	0.1	0.5	0.2	0.3	0.5	0.2	0.1	0.6
115	Support for Agriculture & Forestry	0.4	0.1	0.2	0.0	0.3	0.1	0.1	0.0	0.2
212-213	Mining & Support Activities	0.4	0.8	0.8	0.2	0.5	1.0	0.2	0.5	0.2
315	Apparel Manufacturing	0.4	0.1	0.2	0.1	0.2	0.5	1.1	0.1	0.6
112	Animal Production	0.3	0.7	0.2	0.0	0.3	0.2	0.1	0.3	0.2
325	Chemical Manufacturing	0.3	0.5	0.2	0.2	0.3	0.7	0.8	0.1	0.3
324	Petroleum & Coal Products	0.3	0.1	0.6	0.0	0.1	0.6	3.8	0.0	0.4
313	Textile Mills	0.2	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.0
114	Fishing, Hunting & Trapping	0.2	0.0	0.1	0.0	0.2	0.2	0.3	0.4	3.2
211	Oil & Gas Extraction	0.0	0.3	2.8	0.0	0.5	0.2	0.1	0.1	0.3

Source: EDR-LEAP (Local Economic Assessment Package), utilizing data from BEA and IMPLAN. (Note: Employment measures based include self-employed, contract labor and government workers as well as regular wage and salary employees.)

D-2 Employment Growth: Comparison Among Metro Regions

NAICS	Sector	Portland	US	Austin	Denver	Las Vegas	Phoenix	Salt Lake City	San Francisco	San Jose	Seattle
111	Crop Production	3.1%	-2.9%	-5.9%	-6.8%	-4.6%	-0.4%	-11.9%	0.4%	-2.3%	-7.0%
112	Animal Production	11.0%	8.1%	13.6%	13.3%	-3.2%	-0.8%	1.3%	6.8%	13.3%	3.1%
113	Forestry & Logging	-26.5%	-4.9%	-56.3%	-17.1%	-100.0%	-45.2%	50.7%	-57.4%	-43.5%	1.8%
114	Fishing, Hunting & Trapping	-19.8%	12.3%	8.7%	3.6%	-100.0%	46.2%	-12.1%	4.2%	-2.9%	1.1%
115	Support for Agriculture & Forestry	-0.2%	1.1%	-5.0%	3.4%	-2.8%	-14.4%	-1.7%	-29.8%	-10.1%	-6.5%
211	Oil & Gas Extraction	-100.0%	-5.7%	-25.6%	-8.4%	-100.0%	21.0%	-16.6%	-34.4%	-50.3%	77.8%
212-213	Mining & Support Activities	-1.2%	2.9%	3.3%	-5.2%	-14.4%	-19.6%	-9.9%	-7.7%	-6.5%	-3.6%
221	Utilities	-10.9%	-4.9%	3.1%	-14.5%	-6.0%	5.5%	-14.5%	-4.3%	-21.4%	-16.3%
230	Construction	-0.8%	0.2%	-1.5%	6.3%	1.4%	4.1%	-3.8%	2.4%	1.2%	1.5%
311	Food Products	0.2%	0.4%	5.2%	1.5%	-0.6%	1.3%	2.1%	-3.4%	4.8%	-5.0%
312	Beverage & Tobacco Products	-3.2%	-0.6%	5.5%	1.7%	-0.9%	2.4%	-9.5%	4.5%	4.9%	3.2%
313	Textile Mills	-10.6%	-6.8%	-3.0%	5.2%	36.0%	-15.1%	7.6%	-3.3%	6.3%	-7.1%
314	Textile Product Mills	-7.7%	-4.4%	-11.2%	-1.4%	-7.7%	-10.5%	-15.9%	-3.5%	-4.4%	-4.0%
315	Apparel Manufacturing	-14.9%	-13.6%	-3.3%	-12.7%	3.5%	-5.6%	-0.2%	-17.9%	-6.4%	-11.0%
316	Leather & Allied Products	0.8%	-11.5%	22.2%	-25.5%	-18.5%	7.9%	-0.6%	-1.2%	15.4%	-23.2%
321	Wood Products	-4.1%	-3.8%	-11.4%	0.3%	5.2%	1.0%	-2.0%	-7.1%	0.2%	-12.7%
322	Paper Manufacturing	-3.2%	-3.6%	-7.4%	-4.8%	11.1%	5.8%	3.1%	-7.6%	-1.5%	1.6%
323	Printing & Related Support Activities	-5.1%	-3.6%	-0.6%	-3.4%	2.7%	-6.3%	-2.7%	-9.2%	-8.0%	-2.9%
324	Petroleum & Coal Products	-0.3%	-2.9%	12.4%	-0.4%	-100.0%	10.3%	0.5%	4.5%	0.5%	7.6%
325	Chemical Manufacturing	-5.9%	-4.5%	2.9%	-2.7%	4.6%	-11.4%	-4.1%	-5.5%	-4.0%	-0.8%
326	Plastics & Rubber Products	-4.7%	-3.0%	7.2%	-2.6%	3.5%	-4.0%	-7.7%	-4.0%	-16.4%	-2.0%
327	Nonmetallic Mineral Products	-3.4%	-2.6%	3.2%	1.9%	5.0%	-0.7%	-3.8%	-5.0%	-3.5%	-5.4%
331	Primary Metal Manufacturing	-4.3%	-4.8%	30.3%	-6.8%	-21.4%	-2.9%	-6.5%	-2.3%	9.6%	-5.2%
332	Fabricated Metal Products	-3.3%	-2.5%	-8.0%	-1.3%	-4.2%	3.5%	-0.8%	-8.9%	-8.2%	-1.9%
333	Machinery Manufacturing	-4.4%	-4.7%	-9.3%	-5.9%	9.1%	2.3%	4.8%	0.5%	-0.3%	-2.8%
334	Computer & Electronic Products	-4.8%	-5.3%	-5.8%	-4.1%	2.0%	-5.7%	-7.9%	-0.2%	-5.2%	-4.4%
335	Electric Equipment, Appliances, etc.	-0.1%	-5.3%	0.7%	-14.2%	12.6%	-8.2%	1.0%	-11.9%	-5.3%	5.0%
336	Transportation Equipment	-3.9%	-3.9%	-6.3%	-2.7%	-12.9%	-5.5%	-10.4%	-5.4%	-6.1%	-7.1%
337	Furniture & Related Products	3.1%	0.0%	6.2%	7.5%	10.1%	1.5%	1.4%	-0.5%	4.0%	3.8%
339	Miscellaneous Manufacturing	-1.8%	-2.0%	2.3%	-6.8%	9.0%	1.9%	0.1%	2.3%	0.9%	-0.8%
420	Wholesale Trade	-4.0%	-3.2%	8.1%	-1.3%	1.4%	-1.3%	-2.8%	-4.7%	-7.1%	-4.1%
441-454	Retail Trade	-1.7%	-0.3%	1.7%	-1.2%	4.6%	2.0%	-0.7%	-0.6%	-0.2%	0.1%
481-487	Transportation	0.1%	1.7%	2.6%	2.8%	10.0%	4.9%	1.5%	-2.0%	0.3%	1.6%
491-493	Mail, package delivery & warehousing	6.6%	6.4%	4.0%	7.1%	7.3%	6.9%	2.3%	2.9%	-1.3%	5.3%
511	Publishing Industries (except Internet)	3.7%	-6.0%	2.4%	-6.0%	-4.6%	-7.8%	-11.2%	-2.4%	-5.3%	11.1%
512	Motion Picture & Sound Recording	-11.1%	-4.4%	-12.6%	-12.1%	2.0%	-6.4%	4.0%	2.7%	7.4%	-11.4%
513	Broadcasting	2.6%	2.9%	5.9%	3.1%	7.7%	7.0%	-0.4%	1.5%	1.2%	4.5%
514	Internet & data process svcs	-0.3%	6.1%	3.3%	2.9%	-5.4%	18.2%	21.8%	-4.6%	-2.6%	-15.2%
521-523	Monetary, Financial, & Credit Activity	-0.1%	1.8%	6.7%	1.9%	8.0%	4.2%	8.1%	4.3%	2.3%	4.3%
524	Insurance Carriers & Related Activities	1.4%	-1.2%	-1.4%	0.2%	5.8%	2.1%	-0.6%	-1.7%	-4.8%	0.1%
525	Funds, Trusts & Ot. Fin. Vehicles	4.9%	12.3%	16.4%	17.1%	27.0%	10.3%	23.2%	21.6%	22.9%	10.5%
531	Real Estate	16.2%	9.7%	10.3%	22.5%	18.6%	20.2%	18.7%	13.9%	10.4%	10.4%
532	Rental & Leasing Services	7.2%	6.9%	7.0%	6.7%	9.0%	8.6%	12.4%	1.6%	-0.6%	4.6%
533	Franchises	-9.0%	-8.5%	-20.5%	-10.5%	-11.5%	13.5%	-14.9%	-8.4%	-1.8%	-14.3%
541-551	Professional Scientific, Technical Svcs	6.6%	7.0%	10.3%	6.3%	8.9%	6.5%	7.9%	8.9%	13.6%	6.5%
561	Administrative & Support Services	-1.2%	0.0%	-1.6%	-0.8%	6.2%	2.1%	4.0%	-7.2%	-9.8%	-2.3%
562	Waste Management & Remediation	3.9%	8.9%	19.5%	26.9%	28.1%	6.1%	12.4%	17.9%	17.4%	10.6%
611	Educational Services	2.2%	0.1%	9.5%	1.0%	2.8%	3.3%	-0.4%	1.7%	-1.3%	3.3%
621-624	Health Care & Social Services	4.7%	2.6%	4.5%	3.8%	6.6%	4.2%	3.0%	4.4%	7.2%	4.4%
711-713	Amusement & Recreation	9.0%	3.7%	6.6%	6.3%	6.0%	4.0%	7.4%	10.6%	6.8%	5.6%
721-722	Accommodations, Eating & Drinking	1.8%	2.3%	5.3%	2.5%	-2.8%	3.1%	2.3%	2.0%	1.2%	2.7%
811-812	Repair, Maintenance, & Personal Svcs	2.7%	3.8%	5.7%	4.0%	6.8%	6.2%	4.4%	2.6%	6.1%	3.9%
813	Religious, Civic, Professional, Org.	25.2%	1.4%	0.2%	-5.5%	6.5%	14.0%	-2.2%	12.9%	19.7%	-3.9%
814	Private Households	20.1%	10.1%	16.0%	16.0%	22.9%	14.6%	8.6%	19.6%	20.9%	18.4%
920	Government & Non-NAICS	3.5%	1.0%	0.0%	3.3%	4.7%	4.6%	1.9%	3.1%	2.9%	3.5%

Source: EDR-LEAP (Local Economic Assessment Package), utilizing data from BEA and IMPLAN. (Note: Employment measures based include self-employed, contract labor and government workers as well as regular wage and salary employees.)

Table D-3 Competitive Factors: Comparison Among Metro Regions

	Portland	Austin	Denver	Las Vegas	Phoenix
Cost Factors (as labeled)					
Average Labor Cost (per year in manufacturing)	$53,219	$61,342	$49,255	$43,553	$55,179
Average Electricity Cost ($/kWh)	$0.05	$0.06	$0.05	$0.09	$0.06
Average Total Tax Burden per Person ($ per year)	$575	$762	$729	$461	$460
Average Housing Cost ($ for a single family home)	$170,377	$128,880	$176,291	$139,500	$127,249
AverageRental Cost ($ per month)	$603	$621	$671	$648	$576
Market Factors (as labeled)					
Population (1000's)	1,927,881	1,249,763	2,157,756	1,375,765	3,251,876
Population Density (population per square mile)	799,016	593,961	1,302,649	173,900	317,203
Skilled Workers (% with bachelor's degree or higher)	28.74%	36.68%	34.00%	17.30%	25.13%
Labor Force Participation Rate (%)	69.20%	71.30%	71.93%	65.10%	63.68%
Transportation (avg. minutes, peak period)					
Access to Commercial Airport	29	40	45	11	20
Access to Freight Marine Port	22	243	782	297	425
Access to Rail Intermodal Loading	24	101	21	23	13
Technology (1-10)					
Broadband Access	8.3	8.5	9.8	6.0	9.6

(continued from above)	Portland	Salt Lake City	San Francisco	San Jose	Seattle
Cost Factors (as labeled)					
Average Labor Cost (per year in manufacturing)	$53,219	$49,146	$54,071	$69,094	$21,984
Average Electricity Cost ($/kWh)	$0.05	$0.05	$0.11	$0.10	$0.06
Average Total Tax Burden per Person ($ per year)	$575	$614	$541	$573	$504
Average Housing Cost ($ for a single family home)	$170,377	$160,038	$353,718	$449,461	$208,567
AverageRental Cost ($ per month)	$603	$582	$881	$1,093	$662
Market Factors (as labeled)					
Population (1000's)	1,927,881	968,858	4,123,740	2,442,980	3,053,750
Population Density (population per square mile)	799,016	1,130,514	4,420,287	1,354,503	618
Skilled Workers (% with bachelor's degree or higher)	28.74%	27.47%	38.51%	39.56%	32.38%
Labor Force Participation Rate (%)	69.20%	71.19%	65.76%	67.00%	69.29%
Transportation (avg. minutes, peak period)					
Access to Commercial Airport	29	24	26	14	35
Access to Freight Marine Port	22	791	17	28	19
Access to Rail Intermodal Loading	24	17	20	46	23
Technology (1-10)					
Broadband Access	8.3	9.7	10.0	9.9	9.1

Source: EDR-LEAP (Local Economic Assessment Package), utilizing data from BEA and IMPLAN.
(Note: Employment measures based include self-employed, contract labor and government workers as well as regular wage and salary employees.)

APPENDIX E: REGIONAL ECONOMIC IMPACT STUDIES

There are eight case studies that roughly parallel Portland, in the sense that they involve studies to document the severity of looming urban traffic congestion, and the economic benefits of taking action to address the problem. They are: Vancouver BC, Chicago, Atlanta, Milwaukee, Houston, Los Angeles, Seattle and Toronto. Each of the case studies of regional economic impacts is summarized in terms of five parts: (1) Organizations involved, (2) Issues addressed, (3) Study scope, and (4) Study Findings, and (5) Recommended Actions. Links to web resources for further information are also shown.

Case Study 1 – Vancouver, BC

"Economic Impact Analysis of Investment in a Major Commercial Transportation System for the Greater Vancouver Region", Greater Vancouver Gateway Council. 2003.

Organizations. The Greater Vancouver Gateway Council (GVGC) is an organization of port and transportation business leaders who are concerned with the continued performance of Greater Vancouver's multi-modal gateway facilities. However, the Gateway Council has also obtained broader formal involvement (as resource members) of public groups including the four western provincial governments, regional chambers of commerce, Vancouver Board of Trade, WESTAC (Western Transportation Advisory Council), and federal Department of Western Economic Diversification. The Gateway Council obtained a grant from the federal Department of Western Economic Diversification for a study of the region's marine, air, road and rail international gateways and the importance of addressing congestion that could constrain their future capacity to operate.

Issues. The Gateway Council had worked with B.C. Dept. Of Transport and the Greater Vancouver Transportation Authority (GVTA) to develop a proposal for the "Major Commercial Transportation System" – a set of 52 surface transportation (road, rail and transit) improvements intended to expand capacity and improve the functionality of the region's ports, gateways and freight transportation systems. Total cost of the proposed system, to be built over a 20 year period, would be $5 billion (2002 dollars). One of the interesting aspects of this plan was that it included expansion of rail rapid transit as a component of the commercial transportation system. The reasoning was that trucks are facing increasing congestion traveling to/from downtown and port areas, and it can be easier to shift cars off of the road (to transit) than it is to shift freight onto short distance rail.

Study Process. The Gateway Council organized a committee of the local business leaders, the regional transportation planning agency, provincial Transportation Department, and federal Department of Western Economic Diversification, to oversee a research study. The study measured the economic role of Vancouver International Airport, Vancouver's major marine ports, the railroad system and trucking industry in supporting the economy for Vancouver, BC and the rest of Western Canada. The study then focused on analysis of the regional economic development consequences of investment (vs. failure to invest) in road and rail system improvements needed to address rising traffic congestion and the insufficiency of existing infrastructure to sustain future growth of gateway transportation systems.

The analysis process centered on four elements: (a) a detailed traffic simulation model, (b) railroad facility supply/demand forecasting, (c) a four province set of input-output economic models, and (d) analysis and forecasting of the impact of infrastructure scenarios (base case and new investment scenarios) on future jobs and business growth.

Study Findings. The study found that traffic congestion is significantly raising costs for the regional transportation sector, and these costs are expected to exceed $800 million per year by the year 2021. The study found that the between 1999 and 2021, AM peak-hour road traffic in the Greater Vancouver region is expected to grow by 39% in terms of vehicle-trips, and Vehicle Hours Traveled (VHT) would increase by 54%. The average driver is expected to spend 10% more time due to longer delays and slower speeds.

The analysis of future scenarios about infrastructure investment showed that 7,000 - 16,000 jobs and $500 million - $1 billion of annual Gross Domestic Product are at stake and would be lost if the adequate infrastructure investments are not made. This information is now being used by local, provincial and federal agencies to help inform future planning and decision-making.

Recommended Actions. The report recommended implementation of a broad series of highway, arterial road, light rail, freight rail, bridge and tunnel projects to minimize future congestion costs and increase economic competitiveness.

Link for further info: http://www.gvgc.org/home.html (click on Infrastructure Plans)

Case Study 2 – Chicago, IL

The Chicago Metropolis Freight Plan -- (Ch.7) Assessing the Economic Impacts of Congestion Reduction Alternatives

Organizations. Chicago Metropolis 2020 is a membership organization of area business and civic leaders concerned with planning for the future of the metropolitan area. Metropolis 2020 was spun off of The Commercial Club of Chicago, and formally includes representatives from business, labor, civic, religious and governmental organizations. Half of the representatives on the Executive Council members of The Commercial Club of Chicago.

Issues. The group has focused on a series of 21st century issues facing the metropolitan area. A key issue was the fact that Greater Chicago, like many urban areas, it has been facing increasing traffic congestion, which has raised concerns about implications for future freight movement and economic competitiveness. The stakes are especially high in that region because it is a center of freight activity with nearly $1 trillion in freight flowing annually on roads in the region.

The group assembled a team of consultants to develop a study of "Transportation and Land Use – Freight." The idea was to examine broad issues of regional transportation and traffic congestion (considering passenger as well as freight movement), and also examine the particular issues facing freight movement.

Study Process. The objective of the study was to identify the different impacts and options for addressing traffic congestion (passenger and freight). The Chicago Metropolis 2020 plan recommended some key actions such as the creation of an efficient system of truck routes in cooperation with the State, regional, and local governments, developing a system of user fees on the most congested roads in the region to reduce delays and promote efficient use of the roads, and strengthening the arterial highways that are critical to freight movements.

The study focused on the expected economic impacts of potential road improvement and toll pricing strategies to reduce traffic congestion in the metropolitan area. The analysis process centered on four elements: (a) a detailed traffic simulation model, (b) a regional economic model, and (c) analysis and forecasting of the impact of infrastructure and policy scenarios (base case and new investment/pricing) on future jobs and business growth. Estimates of regional economic impacts in terms of jobs, earnings, and business sales were generated by evaluating how changes in traffic levels, speeds and costs would affect logistic costs for the area's industries and subsequent regional economic growth.

Study Findings. The study found that costs of congestion in the Chicago metropolitan area are having an increasingly significant impact on the regional economy. Congestion costs to Chicago area businesses, truckers and commuters were estimated at over $4 billion per year.

The user fees option itself was expected to reduce truck travel times by 5.5%, generating regional economic benefits of $2.1 billion per year in direct savings, $4.6 billion in increased sales and creation of over 9,300 jobs. The planned additions of lane-miles on key arterial roads along with other transportation improvements planned for the region over the next 25 years would reduce total truck travel time by 6%, generate annual savings of $3.9 billion in increased sales, and 17,314 new jobs. The study found that the recommendations for congestion-reducing interventions in the Chicago metropolitan region would have significant economic impacts as compared to a base case. The expected increase in business competitiveness from this plan stems from its mix of industries and their ability to reap high productivity benefits from transportation-related savings. As compared with the base case, business sales would increase by approximately $3.6 billion under the Metropolis Plan as result of direct travel-related savings. The total impact on business sales would be almost $4.0 billion greater as compared to a 'business as usual' setting.

Recommendations. The recommended action plan included:

- highway capacity expansion;
- implementation of user fees on highways;
- development of a more formal system of truck routes (in which road designs, regulations and signalization all facilitate improved truck movement);
- transit modernization to make public transportation more attractive;
- better use of existing rail infrastructure;
- reinforcing the use of expressways for long trips, for which they were originally intended, and the use of arterial streets for shorter trips.

Link for further info: http://www.chicagometropolis2020.org/10_40.htm

Case Study 3 – Atlanta, GA

Mobility 2030, Regional Transportation Plan of the Atlanta Regional Commission. 2004.

Organizations. The Atlanta Regional Commission (ARC) is the regional planning and intergovernmental coordination agency for ten counties in the metropolitan area, as well as the City of Atlanta. The Atlanta region is facing rapid growth with three of the fastest growing counties in the nation and an expected population of 6 million by 2030. This realization led the ARC to develop the Mobility 2030 plan in collaboration with other planning agencies including Georgia Dept. of Transportation (GDOT), Georgia Regional transportation Authority (GRTA), Metropolitan Atlanta Rapid Transit Authority (MARTA), county and city officials, advocacy groups, and the public. The aim of the plan was to adopt the strategies that would have the greatest impact on transportation system performance in the most cost-effective manner.

Issues. The innovative process followed included the development of a financially unconstrained Aspirations Plan, released in 2003, that was based on inputs from all jurisdictions and results from technical studies. This plan was then financially constrained and projects were prioritized for three time frames, short-term (2005-2010), mid-term (2011-2020), and long-term (2021-2030). The development of the final plan involved an extensive public participation process between 2002 and 2004, supported by stakeholder involvement in ten teams that addresses the different issues critical for development of the plan.

The Atlanta region is large in area and low in density, leading to important transportation challenges that need to be resolved. The Mobility 2030 plan focused on five major transportation systems in the region: the Freeway and Cross-Regional Arterial Road system, the Managed Lane/ High Occupancy Vehicle (HOV) system, the Regional Transit system, a system of Smart Corridors, and the Bicycle and Pedestrian Facility system, including air quality and environmental justice priorities for the region. Today, the Freeway and Arterial System handles about 94% of the total person trips in the region and accounts for the largest required capital expenditures.

Study Process. To estimate the transportation performance impact of the Mobility 2030 plan, the current travel times and congested lane-miles on different corridors were compared with three scenarios for 2030: a no-plan scenario, the Aspirations Plan ($74 billion), and the constrained plan ($523 billion). Capital expansion and improvements, travel demand management strategies, and bottleneck relief measures are key components of the Mobility 2030 recommendations.

Study Findings. The analysis revealed that over 2.5 million additional people and an additional 1.3 million jobs are forecast between 2000 and 2030. The freeway and arterial lane miles with more than two hours of daily delay are expected to increase from 39% to 69% of all freeway lane-miles by 2030 if nothing is done to improve flow in these corridors. In addition, the Atlanta region is one of the busiest freight distribution centers in the southeast and in the nation. The congestion problems in the region are further intensified because 92.7% percent of the freight moved through the Atlanta region is shipped via truck. Improving truck service to inter-modal hubs is a key planning need. While the study focused only on traffic delay measurement and not the economic development consequences, the economic severity of the problem and the need for corresponding action was quite clear.

Recommendations. The study recommended implementation of a series of actions including expansion of freeway and cross-regional arterial road systems, expanded implementation of managed "High Occupancy Vehicle" (HOV) lanes, expansion of the regional transit system and implementation of a system of "smart corridors" that have intelligent transportation systems installed for better monitoring and control.

Link for further info:
http://www.atlantaregional.com/transportationair/plandocumentation.html#RTP

Case Study 4 – Milwaukee, WI

The Economic Benefits of Transportation Investments, Transportation Development Association of Wisconsin, 2003.

Organizations. The Transportation Development Association of Wisconsin, a state-wide, nonprofit organization, which includes regional public agencies (such as county highway departments) and private sector members (transportation, construction and other businesses). TDA has a history of collaborating with Wisconsin Dept. of Transportation.

Issues. TDA Wisconsin worked together with staff of Wisconsin DOT to commission a study of the role of transportation industries in the economy and the economic impact of investing in additional transportation infrastructure. Part of the effort was documenting the economic activity and employment generated by the state's highway system, deepwater ports, aviation industry, transit, and freight railroads. However, the largest part of the effort was to assess how rising congestion, particularly in the Milwaukee metro area, would affect the state economy.

Study Process. The study used statewide and metro traffic models to evaluate the extent of traffic growth and traffic delay on roads, focusing on both state-wide and regional levels. It then applied an economic model to forecast the impacts on future economic competitiveness and growth.

Study Findings. The study found that new highway construction in Wisconsin has not kept up with rising travel demand. The costs of time delays and fuel consumption associated with congestion in the year 2000 were estimated to be $390 million just for Milwaukee and Waukesha counties (the Milwaukee metro area). Today, roadway congestion is a problem on 17% of the state's most critical roadways, but the Wisconsin Department of Transportation projects that congestion would affect almost one-third of key roadways by 2020. Given these facts, this study established the positive impacts of investing about $22 billion in Wisconsin's highway system as identified in the 2020 Wisconsin State Highway Plan, which would be $5.8 billion more than required to simply maintain current performance conditions over the next twenty years.

It was concluded that additional investment is expected to generate about $9.7 billion of macroeconomic benefit comprising travel cost and time savings for personal trips, and higher efficiency for businesses through on-the-clock time and money savings. The additional highway investment would bring in about 4,800 new jobs per year on average by reducing costs to businesses, and enabling them to increase output and to hire additional workers. This does not count additional jobs that would be supported by highway construction and routine maintenance activities.

Recommendations. The recommendations focused on need for highway and freeway system expansion in the Milwaukee metropolitan area.

Link for further info:
http://www.tdawisconsin.org/resources/pdfs/WITDAComplete.pdf

Case Study 5 – Houston, Dallas, San Antonio, and Austin, TX

Texas' Roadways — Texas' Future: A Look at the Next 25 Years of Roadway, Supply, Demand, Cost and Benefits, 2003

Organizations. The Governor's Business Council (GBC) in Texas is a non-partisan non-profit corporation that provides advice and counsel to the Governor of Texas on matters of economic development. Its members comprise leaders of small, medium, and large corporations, of both for-profit and non-profit status.

Issues. Rising levels of congestion in the four largest metropolitan areas of Texas were being indicated by the Texas Transportation Institute's Travel Time Index. The four metropolitan areas mentioned represent 68% of the population and 56% of vehicle travel, but over 95% of travel delays in the state. The problem is exacerbated by the fact that these same areas are expected to absorb 80% of the population growth over the next 25 years. It was recognized that the travel delays to passenger and freight transportation activity in those areas were threatening to restrict economic growth in the state. Concern was raided that continuation of the status quo would in fact lead to a future scenario with substantially restricted economic growth.

In the year 2000, the Travel Time Index (TTI) values in Houston, Dallas, San Antonio, and Austin ranged from 1.38 to 1.23. This group proposed that the state should adopt a 25-year goal of reducing the TTI in all areas to 1.15, which means that travel during peak periods should take no more than 15% longer than non-peak travel.

Study Process. The analysis identified alternative policy actions that could provide the congestion relief goals in the four metropolitan areas, as well as at the border. Three different scenarios for policy actions were developed. The study examined costs of congestion and costs of implementing alternative scenarios for congestion reduction.

Study Findings. Traffic congestion in the metropolitan areas of Houston, Dallas, San Antonio, and Austin over the last ten years alone was shown to represent $46 billion in increased fuel consumption and travel delays. Of these, Houston is the most congested in terms of the TTI index (1.38), though Dallas-Fort Worth faces the highest overall dollar costs of congestion. To maintain existing congestion levels alone would require $38.5 billion more than what is expected to be spent over the next 25 years. To meet the TTI scenario of 1.15, an annual addition of 1,500 lane-miles needs to be made to the road network in the metropolitan areas at a cost of $78.2 billion over the next 25 years (all costs in 2000 dollars).

The report estimated the cost to the average household in each of the scenarios, along with the benefits expected from reductions in travel delays and fuel consumption. The benefits in each case were found to be higher than the costs, and exclude additional benefits such as those from air quality improvements, and reduced stress. The analysis showed that an expenditure of $78 billion over 25 years to achieve a TTI value of 1.15 would yield over $500 billion in net benefits to the state. Every billion dollars of capital investment in the road network was also expected to generate about 38,000 jobs.

Recommendations. The recommendations focused on need for highway and freeway system expansion in the four metropolitan areas.

Link for further info: http://www.texasgbc.org/reports2.htm

Case Study 6 – Los Angeles, CA

Long Range Transportation Plan for Los Angeles County, LA County Metropolitan Transportation Authority, 2001.

Organizations. Over the period of 1998-2001, the Los Angeles County Metropolitan Transportation Authority worked with public and private groups to develop alternative scenarios for long-range investment in highways, rail transit and bus services within the region.

Issues. The Long Range Transportation Plan (LRTP) was designed to guide investment and determine financing over a 20-year period (2000-2020). There were four alternatives, involving different combinations of rail, bus and highway system investment within the region. Each alternative had a specific list of projects included. One scenarios had rail transit extensions to North Hollywood, East Side, Mid-City and Pasadena while other scenarios had lesser rail transit with more bus system expansion. All of the scenarios also had additional highway investments. The base case kept current rail, bus and highway systems with spending only as required to maintain those facilities.

Study Process. The study had two parts: (1) The first part was application of a regional transportation model covering both car, truck, bus and rail transit modes. The model was applied to calculate differences in usage, travel times and level of service for each mode under alternative scenarios. Reliability and accident rates were also evaluated. (2) The second part was application of a regional economic model to analyze the effects of project financing, project spending and project impacts on travel time and cost for businesses and households.

Study Findings. The study found that the improvement scenarios would cost $13-15 billion (in constant 1998 dollars), but lead to over $8 billion more personal income in the region by the year 2020, compared to the base case.

Recommendations. The study recommended implementation of rail transit system expansion in conjunction with freeway expansion as part of a balanced system of transportation investments aimed at maximizing economic development in the region.

Source: http://www.edrgroup.com/edr1/consulting/2_8/P007-054-Los-Angeles-MTA.shtml

Case Study 7 – Seattle, WA

FAST -- Freight Action Strategy for Everett-Seattle-Tacoma, 2004.

Organizations. To organize a cooperative effort addressing regional freight flow constraints, the Washington State DOT and the Puget Sound Regional Council collaborated the state's Freight Mobility Strategic Investment Board, the Transportation Improvement Board, as well as representatives from each of the major ports (Everett, Seattle and Tacoma), cities, counties, railroads and trucking association.

Issues. The focus of concern was the declining competitiveness associated with the region's three ports, and bottlenecks affecting freight movements on the I-5 and other key corridors. The objective was to address decline in competitiveness for the region's transportation gateways and associated industries, and develop a regional freight action plan.

Study Process. The collaboration process started in 1996, and led to a series of studies of the region's freight movement via rails, roads and shipping ports. These studies compiled data on the nature and regional importance of these freight movements, and examined ways to smoothen freight flows through the central Puget Sound region of Washington State. This led to the identification of priority projects needed to address bottlenecks to improve the efficiency of freight movement as well as safety for cars, trucks and trains. The collaboration group also meets periodically to evaluate progress and re-strategize. Starting in 2003, there were additional planning workshops which brought together public and private sector participants to discuss key issues and opportunities.

Study Findings. The economic research showed that Puget Sound ports have lost 11.9% of foreign market share bound for the US since 1998, and have lost competitiveness to the Port of Vancouver for Midwest-bound freight. It examined reasons for this loss and found that international shippers care about cost, reliability, and travel time for the total trip of their products, and choose routes that offer the best value for their customers. The conclusion was that moving freight efficiently into, through and around the Puget Sound region is critical to the region and national competitiveness. The study identified the need for intermodal connections among marine, rail, truck and air need to become more reliable and efficient, and for the entire region to become a less congested, more reliable, and more accessible transportation system. It found that the nearly 1 in 3 jobs in Washington relate to international trade and are dependent on the ports.

Recommendations. For Phase I, fifteen projects were identified that would help freight carried through road, rail and shipping ports to move more efficiently through the region. Projects include

- grade separations (overpasses) between arterial roads and railroad lines, intermodal rail yard access routes,

- truck access routes, and
- "intelligent transportation systems."

The projects were designed to improve regional safety as well as economic competitiveness. Most of the Phase I projects are underway or complete. Ten additional projects were added for phase II.

Link for further info: http://www.wsdot.wa.gov/mobility/fast/

Case Study 8 –Toronto, ON

Ministry of Transport Ontario (MTO): Ontario Strategic Transportation Directions (2002) and Central Ontario Freight Plan (2004).

Organizations. Transport Canada, and the Ministry of Transport Ontario (MTO) spearheaded the study, while approximately 120 organizations provided input.

Issues. The MTO initially conducted a study of *Strategic Transportation Directions,* which focused on opportunities to expand facilities and capacity using intelligent transportation systems. The MTO then supported the Central Ontario Smart Growth Panel in addressing gridlock issues and in attaining the government's vision for managing how communities grow. The Strategic Directions study identified the need for a separate *Freight Plan* and the smart growth panel supported this effort.

Key objectives addressed in the Strategic Transportation Directions process included:

- *Economic Development* -- supporting provincial and regional economic development, enhancing the economic competitiveness of Ontario's industries, and improving the efficiency of trade corridors and gateways.
- *Fiscal Management* -- maximizing use of existing facilities and developing innovative approaches to financing new and improved facilities.
- *Environmental Quality* -- supporting Smart Growth principles and promoting balanced transportation to reduce energy consumption and emissions.

Key needs addressed in the Freight Plan were :

- Need to examine and understand goods movement trends and issues, and how goods movement infrastructure is essential to economic development and competitiveness.
- Need to better relate information on urban freight flows relate into planning decisions, and integrate freight interests into the government planning processes.
- Need to look beyond just infrastructure solutions to examine policy, operations and the role of freight transport within firms.
- Need to recognize and address growth management and other quality-of-life goals for Ontario's communities

Study Process. The MTO initiated a process of stakeholder consultations together with a study to provide strategic directions for supporting freight activities in Central Ontario for the next ten to twenty years. It focused on integrating goods movement interests in government planning processes in support of policy development, and in enhancing private sector productivity. It had five components: (1) Quantify and place in perspective Ontario's economic competitiveness, and the importance of efficient goods movement to maintaining and enhancing this position; (2) Develop a quantitative and qualitative profile of the demographic and goods movement characteristics of Central Ontario, (3) Identify information that is needed to make sound decisions regarding goods movement strategies, (4) Identify issues of concern to stakeholders and (5) Develop a broad strategy with actions, priorities and long-term directions.

Study Findings. The study examined Central Ontario's economic competitive position in North America, and then analyzed the importance of efficient goods movement to maintaining and enhancing this position. This included an examination of trends in truck, air, rail, marine and pipeline goods movement and a profile of existing conditions in the transportation network. It also analyzes the economic, trade and demographic factors that influence the demand for goods movement today and in the future. The study also discussed issues and challenges that were raised by stakeholders.

Recommendations. There were three recommendations: (1) To establish ongoing private-public *partnerships* including a regional goods movement coordinating body. (2) Improve the process for planning, funding and decision-making with an integrated, region-wide economic development, land use and transportation strategy. Also, ensure that industrial lands and major employment sites are properly protected, and manage congestion for all road users through improved suburban development and recognition that changes are inevitable and should be accommodated. (3) Ensure the flow of goods movement in Central Ontario through a series of inter-related initiatives including:

- a strategic goods movement network with a regional truck route system
- improved incident management to mitigate the impacts of variability in congestion
- invest in solutions to improve incident management and investing in solutions to alleviate bottlenecks
- increase the service levels of existing transit services, promote other ways to get drivers out of their autos, and expand the higher-order transit network.

Links for further info:
Strategic Directions: www.itscanada.ca/english/documents/OntarioStrategicPlan.pdf
Freight Plan: http://www.itransconsulting.com/main/main.asp?type=Papers&sub=goods

APPENDIX F: CONGESTION MANAGEMENT PROJECTS

This appendix presents additional detail on selected infrastructure management and pricing projects and policies.

(1) Designated Freight Corridors.

The concept of "rationalizing" the region's transportation system refers to actions that optimize the placement and use of facilities and services. Usually this means allocating space and assigning priority for various types of vehicles (cars, buses, trucks, bicycles) and various types of trip purposes (commuting, freight movement, etc.) on relevant roads and corridors.

One form of rationalization is the development of transit priority routes where buses and streetcars are assigned special lanes and/or special priority for passing through signalized intersections or road crossings.

Another form of rationalization is the development of freight priority routes which are typically arterial streets where signs, road width, intersection geometrics, ramps and vehicle parking areas are all designed to facilitate truck movement. The designation of such routes and their design features can all serve to maximize the effectiveness of truck movement on those corridors while minimizing negative impacts on neighborhoods. In some cases, this may also include the development of grade separated truck and/or rail routes for access to ports or other intermodal freight terminals.

Examples span a range from truck routes along arterial streets to truck priority and truck-only routes:

- **Regional Truck Route System for Chicago.** The Chicago Freight Plan recommended development of a Regional Truck Route System to replace what had become a haphazard, inconsistent and poorly enforced set of truck routes in the metropolitan area. This new system would fill in gaps in the existing system, eliminate duplication where not required, and integrate the truck routes with the location of interchanges on the Illinois tollway system. Where full-time designation of truck routes is not feasible on some arterials due to loadings during peak commuting hours, there could be "time of day truck route designations." The recommendations also included development of a centralized comprehensive information source for truckers and trucking companies.

- **Puget Sound FAST Corridor – Port Access Routes.** The FAST Corridor includes a series of projects for improving freight flow. Besides road/railroad grade separations, it includes a set of port and rail yard access projects that are essentially truck routes to those facilities. Examples include: (a) Port of Tacoma Road which allows trucks to flow into and out of the Port of Tacoma while passing over SR509 and parallel railroad tracks; (b) S. Spokane Street Viaduct with widened lanes to improve the direct link used by 45% of the Port of Seattle's truck traffic to go between I-5 and the West Seattle freeway; and (c) Atlantic St. overpass and freeway ramps to separate ferry and freight traffic to the Port of Seattle terminals from local vehicle traffic.

- **Alameda Corridor.** The Alameda Corridor in southern Los Angeles County, California is a depressed, grade-separated route that provides truck-only roads and freight-only railroad tracks connecting the ports of Long Beach and Los Angeles to highways connecting to central Los Angeles. The configuration of the corridor circumvents more than 200 rail crossings via bridges, underpasses, overpasses and street improvements that separate freight trains from street traffic and passenger trains. The project's lynchpin is the Mid-Corridor Trench, which carries trucks and freight trains in an open trench that is 10 miles long, 33 feet deep and 50 feet wide.

- **Washington - Wenas Corridor Truck Routing.** This is an example of smaller scale truck routing that helps separate trucks from local street traffic. State Route 823 is the primary link between the City of Selah and surrounding areas including Yakima and Interstate 82. Planned improvements that will route truck traffic away from the congested downtown streets, and provide better access to the city's industrial areas.

- **World Trade Bridge, Laredo, TX.** Beginning in the 1980s, increasing trade volumes at the US-Mexico border crossing began to cause serious congestion in downtown Laredo near the Juarez-Lincoln Bridge. In 1991, representatives from Laredo, TX, Nuevo Laredo and Juarez, Mexico and other regional stakeholders convened to devise a solution. The favored plan was a "Truck-Only" bridge over the Rio Grand, which would separate heavy trucks from pedestrians and passenger cars through the port of entry. The project was funded in 1995 and the bridge, dubbed the "World Trade Bridge" opened to traffic in 2000.

***(2) Highway Pricing on Existing Roads*.**

Most of these projects involve the conversion of existing HOV (high occupancy vehicle) lanes to HOT (high occupancy toll) lanes. Examples:

- **California - HOT lanes on I-15 in San Diego.** San Diego's "Fastrak" pricing program was implemented in April 1999. Single Occupancy Vehicle drivers pay a toll each time they use the Interstate 15 HOV lanes. The unique feature of this pilot project is that tolls vary dynamically with the level of congestion on the HOV lanes. Toll collection are automated and the tolls can vary in 25-cent increments as often as every six minutes to help maintain free-flow traffic conditions on the HOV lanes. The tolls are used to fund an express bus service on the same corridor.

- **Texas - HOT Lanes on Two Radial Corridors in Houston (I-10) and US 290**). Houston's "QuickRide" Value Pricing Pilot Program consists of automated High Occupancy Toll (HOT) lanes on the Katy Freeway (I-10W) and the Northwest Freeway (US 290W). The Katy Freeway is a 13 mile route, serving over 219,000 vehicles per day and 28,585 person-trips per day. Its HOV lanes were converted to HOT lanes through the QuickRide program in 1998. The Northwest Freeway is a 15 mile route, serving over 235,000 vehicles per day, and over 20,500 person-trips per day. The QuickRide program was implemented on it in 1999. On both highways, Under this program, two-person carpools (HOV2) use the HOV lane for $2 per trip during peak hours, while larger carpools (HOV3+) and buses use the lane for free. Funding from FHWA has supported TxDOT and METRO in the continuing expansion of the QuickRide program.

- **Minnesota - HOT Lanes on I-394 in Minneapolis.** The I-394 "MnPASS Lanes" program was implemented in Spring, 2005. The project was funded and constructed through a public/private partnership involving the State of Minnesota and private firm Wilbur Smith Associates. The private firm has funded 20 percent of the project's estimated $10 million cost. Carpoolers and bus users have free access and priority use. Drivers of single occupant vehicles use the lanes on an as-needed basis by paying tolls that are automatically collected.

- **Colorado - HOT lanes on I-25/US 36 in Denver.** Seven miles of "Downtown Express" lanes on the North 1-25 highway are scheduled to open in December 2005.

- **California - Alameda County.** Interstate 880 in Alameda County is a major congested freeway with one high-occupancy vehicle (HOV) lane. In addition, it has three contiguous lanes in each direction for approximately 17 miles, from just south of Oakland to Fremont. This corridor connects the Port of Oakland and Oakland International Airport with high technology companies in Santa Clara and southern Alameda counties and with goods distribution centers to the east. Congestion is exacerbated by the fact that this corridor has the highest volume of truck traffic in the region. Due to reservations expressed by local officials, conversion of the HOV lane to a HOT lane has been stalled.

(3) Pricing on New Lanes.

These are projects in which new highway lanes are built specifically as HOT lanes. This allows them to have fully private funding. Examples:

- **California - Express Lanes on State Route 91 in Orange County.** The State Route 91 (SR 91) Express Lanes in Orange County, California opened as a four-lane toll facility in 1995. Today, the Express lanes capture 11% of total daily traffic. The lanes are located on a 10-mile section of one of the most heavily congested highways in the U.S. Toll revenues have been used to pay for construction and operating costs.

  As of November 1, 2001, tolls on the facility vary between $1.00 and $4.75, with the tolls set by time of day to reflect the level of congestion delay avoided in the adjacent free lanes, and to maintain free-flowing traffic conditions on the toll lanes. All vehicles must have a "FasTrak" transponder to travel on the express lanes. Vehicles with three or more occupants pay a reduced toll. In November 2002, average daily traffic on the Express Lanes was 26,000 vehicles per day, bringing in over $29 million of revenue. On average, 75 percent of the daily traffic is from high occupancy vehicles (HOVs), and 25 percent is from toll paying customers.

(4) Use of Toll Roads.

Unlike the preceding examples of tolls on only some lanes, these projects provide for time-of-day pricing and special truck pricing policies on toll roads. These policies can serve to encourage off-peak truck movements. Examples:

- **Florida - Variable tolls for Heavy Vehicles in Lee County**. The “LeeWay Program” was implemented in 1998 on two toll bridges crossing the Caloosahatchee River -- both primary commuter corridors in the area. The program involves giving toll discounts of 50% just before and just after the peak traffic periods to entice commuters out of peak hour travel and distribute traffic more uniformly over different times of the day. The two bridges, Midpoint Bridge and Cape Coral Bridge began as toll bridges, and the Leeway Program provides incentives for commuters to reduce their tolls.

- **New York and New Jersey -- Variable Tolls.** Variable tolls for trucks are available on the New Jersey Turnpike, NYNJ Port Authority Interstate Vehicle Crossings, and on the Hudson River Crossings in New York. All use the EZPass Program.

- **California - Peak pricing.** Variable pricing for peak periods has been implemented on the San Joaquin Hills Toll Road in Orange County, CA.

(5) Cordon Tolls.

The most extreme form of road pricing is the development of a "cordon" line around the most heavily congested part of an urban area, with a system of daily charges put on vehicles that enter the area. Typically, persons living inside the cordon area and government vehicles are excluded from the tolls. Examples:

- **London Commercial District Pricing.** Congestion pricing took effect in February, 2003. Between the hours of 7:00 am and 6:30 pm, drivers entering an area bounded by "Inner Ring Road" must pay £5.00 via cell phone text messaging or at sidewalk kiosks. Some users, such as seniors or local residents, are eligible for discounted rates. Weekly and monthly passes are also available at discounted rates. The toll is enforced using an advanced network of cameras that check license plates against a database of paid users.

  After several months of congestion pricing, London's Commission for Integrated Transport conducted a study of the program's impact. The study, completed in September, 2003, consisted of surveys of businesses and stakeholders from different business categories. It found that nearly 25% of survey participants supported the charge, a little over half held mixed views or were neutral, and the remaining quarter held a negative opinion of the charge. The greatest level of support was observed among courier services. Also supporting the study was large companies that adapted their travel and delivery schedules. The greatest level of opposition was found among convenience store owners and other small businesses. The study found that while the charge reduced congestion, resulting in shorter and more predictable travel times, events in the larger economy (a general economic slowdown, SARS outbreak and closures of key Tube lines) made it difficult to determine a precise economic impact.

- **Singapore Cordon Pricing**. Singapore, a city-state the size of Seattle, embarked implementing the famous "Area Licensing" scheme in 1975 specifically to control severe road congestion. This was a manual system of tolls for multiple entries into the restricted central zone. Electronic road pricing (ERP) became operational in Singapore in 1998, replacing the manual congestion pricing scheme. Studies found that the system has raised about US $1 billion per year and significantly reduced car travel, as well as inducing mode shift to public transport. However, critics indicate that some business activities and hence some congestion have merely moved to other locations outside of the cordon line.

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