APPENDICES

APPENDIX A: FRAMEWORK DOCUMENTS

A-1.1-1.12 Oregon Transportation Plans and Policies
A-1.13 Transportation Performance Measures Compendium
A-1.14 Synthesis of Oregon Plans
A-1.15 Oregon Policies lacking Adequate Performance Measures
A-2 Performance Measure Evaluation Criteria

Appendix A-1.1 **TEA-21 and Oregon Benchmarks**

TEA-21 Planning Elements: Metropolitan and State Planning
A. Support the economic vitality of the US, states, and metropolitan areas, especially by enabling global competitiveness, productivity, and efficiency
B. Increase the safety and security of the transportation system for motorized and non-motorized users.
C. Increase the accessibility and mobility options available to people and for freight.
D. Protect and enhance the environment, promote energy conservation, and improve quality of life.
E. Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight
F. Promote efficient system management and operations
G. Emphasize the preservation of the existing transportation system.

2003 Oregon Benchmarks: Progress Board
68a. Travel delay per capita per year in the Portland area
68b. Travel delay per capita per year in urbanized areas other than Portland.
70. %Oregonians commuting by means other than a SOV during peak hours
71. VMT per capita in metropolitan areas for local, non-commercial trips.
72a. Percent of state roads in fair or better condition
72b. Percent of county roads in fair or better condition
75. Percent of time air is healthy to breathe

Appendix A-1.2

Transportation Planning Rule

Policy Themes	Objectives	Policies		Per capita VMT in Oregon metropolitan areas for local, non-commercial trips (0035 (4)(a-c)) (Oregon Benchmark)	Number of Parking Spaces per capita in MPO area (0045(5)(c))	Mode share (alternative modes & SOV) (0035 (5)(d))	Per capita vehicle hours travelled (VMH) (0035 (5)(d))	Per capita vehicle trips (0035 (5)(d))	Measures of accessibility by alternative modes (0035(5)(d))	Percent non-SOV commuters during peak-hour (0035(5)(d); Oregon Benchmark)		Hours of travel delay per capita per year (Oregon Benchmark)	Percent of roads in fair or better condition (Oregon Benchmark)	Percent of time that the air is healthy to breathe for all Oregonians (Oregon Benchmark)
Overall Goal: To promote the development of safe, convenient and economic transportation systems that are designed to reduce reliance on the automobile so that the air pollution, traffic and other livability problems faced by urban areas in other parts of the country might be avoided.														
The transportation system shall avoid principal reliance on any one mode of transportation and shall reduce principal reliance on the automobile. (660-012-0035(3)(e))	In MPO areas, regional and local TSPs shall be designed ... for reducing automobile vehicle miles traveled per capita for the MPO area. (660-012-0035(4))	Local governments shall adopt land use and subdivision regulations ...to support transit in urban areas (0045(4))		X										
		Local governments shall .. provide for safe and convenient pedestrian, bicycle and vehicular circulation...;direct routes for pedestrians and bicycles ..;avoid ..levels of traffic..which might discourage pedestrian or bicycle travel.(0045(3))		X										
		..Local governments shall .. allow transit-oriented developments...; implement demand management program..; implement **parking plan**..; require ..developments to provide ..transit stop...(0045(5))		X	X									
		Local governments shall identify improvements to facilitate bicycle and pedestrian trips, ...to provide for more direct, convenient and safer bicycle or pedestrian travel within and between residential areas and neighborhood activity centers.(0045(6))		X										
		Local governments shall establish standards for local streets and accessways that minimize pavement width and total right-of-way..(0045(7))		X										
	Alternative standards may used in metropolitan areas in place of VMT reduction standard in 0035(4) .....(660-012-0035(5))	Strategies may include land use plan designations, densities and design standards (0035(2))		X		X	X	X	X	X				
		Implement new transportation demand measures (0035(2))		X		X	X	X	X	X				
		Significant expansion in transit service (0035(2))		X		X	X	X	X	X				
		Review and manage major roadway improvements (0035(2))		X		X	X	X	X	X				

Appendix A-1.2

Transportation Planning Rule

Policy Themes	Objectives	Policies		Per capita VMT in Oregon metropolitan areas for local, non-commercial trips (0035 (4)(a-c)) (Oregon Benchmark)	Number of Parking Spaces per capita in MPO area (0045(5)(c))	Mode share (alternative modes & SOV) (0035 (5)(d))	Per capita vehicle hours travelled (VMH) (0035 (5)(d))	Per capita vehicle trips (0035 (5)(d))	Measures of accessibility by alternative modes (0035(5)(d))	Percent non-SOV commuters during peak-hour (0035(5)(d); Oregon Benchmark)		Hours of travel delay per capita per year (Oregon Benchmark)	Percent of roads in fair or better condition (Oregon Benchmark)	Percent of time that the air is healthy to breathe for all Oregonians (Oregon Benchmark)
The transportation system shall support urban and rural development by providing types and levels of transportation facilities and services appropriate to serve the land uses identified in the acknowledged comprehensive plan (660-012-0035(3)(a))	Access control measures consistent with limiting development on rural lands to rural uses and densities (0045(2)(a))													
The transportation system shall be consistent with state and federal standards for protection of air, land and water quality including the State Implementation Plan under the Federal Clean Air Act and the State Water Quality Management Plan. (660-012-0035(3)(b))														X
The transportation system shall minimize adverse economic, social, environmental and energy consequences (660-012-0035(3)(c))														X
The transportation system shall minimize conflicts and facilitate connections between modes of transportation (660-012-0035(3)(d))														
The transportation system plan shall identify transportation needs...including needs of the transportation disadvantaged (0030(1)(b)														
The transportation system plan shall identify transportation needs...including needs for movement of goods and services to support industrial and commercial development (0030(1)(c))	Local governments shall ..protect transportation facilities, corridors and sites for their identified functions (0045(2))	Standards to protect future operation of roads, transitways and major transit corridors (0045(2)(b))												X
		Measures to protect public use airports (0045(2)(c))											X	

Oregon Transportation Plan

Policy Themes	Policies	Minimum Standards or Levels-of-Service	% of mileage of the NHS for which there has been no decrease in average travel speed from 1995 levels	%Oregonians commuting less than 30 mins	% Oregonians who commute during peak hours by other than SOV (OR Benchmark)	%Oregonians living in communities that meet minimum levels of service for public transportation	%Oregonians in communities with daily scheduled intercity air, bus, van/shuttle or rail service	%urban arterials and local collectors in urban areas that have adequate pedestrian and bicycle facilities	Vehicle miles traveled per capita in metropolitan areas per year	Transportation related deaths and major injuries per 100,000 population	%infrastructure that is classified as "fair or better" or "sufficient" (pavement, bridges, publicly owned transportation vehicles and facilities, runways)	%involved citizens satisfied and informed	Amount of transportation funding as %OTP 20-yr plan needs.	%Oregonians living where air meets air quality stds (Benchmark)	Miles of scenic byways	%regional and local governments with acknowledged transportation system plans	Heavy and light vehicle payments to the Highway Fund as % of amount in Cost Responsibility Study
		accessibility and mobility							land use	safety	maintenance, preservation of infrastructure	Public Involvement	Finance	Air Quality	Aesthetic Values - Tourism	Planning	Finance
OTP Policy and System Elements																	
1. Characteristics of the System: to enhance Oregon's comparative economic advantage and quality of life by providing a transportation system with these characteristics	1A. Balance	X							X								
	1B. Efficiency								X								X
	1C. Accessibility	X	X	X	X	X	X	X	X								
	1D. Environmental Responsibility													X			
	1E. Connectivity Among Places	X															
	1F. Connectivity Among Modes and Carriers	X															
	1G. Safety									X							
	1H. Financial Stability												X				
2. Livability: Develop a multimodal transportation system that provides access to the entire state, supports acknowedged and comprehensive land use plans, is sensitive to regional differences, and supports livability in urban and rural areas.	2A. Land Use								X								
	2B. Urban Accessibility			X					X								
	2C. Relationship of Interurban and Urban Mobility								X								
	2D. Facilities for Pedestrians and Bicyclists								X								
	2E. Minimum Levels of Service	X															
	2F. Rural Mobility			X													
	2G. Regional Differences																
	2H. Aesthetic Values														X		
3. Economic Development: Promote the expansion and diversification of Oregon's economy through the efficient movement of goods, services and passengers in a	3A. Balanced and Efficient Freight System																
	3B. Linkages to Markets										X						
	3C. Expand System Capacity																
	3D. Intermodal Hubs																
	3E. Tourism														X		
4. Implementation: Implement the Transportation Plan by creating a stable but flexible financing system, by using good mgt practices, by supporting transp. research and technology, by working cooperatively.	4A. Adequate Funding												X				
	4B. Efficient and Effective Improvements												X				
	4C. Cost/Benefit Relationships																X
	4D. Flexibility												X				
	4E. Achieve State Goals																
	4F. Equity																X
	4G. Management Practices										X						
	4H. Research and Technology Transfer																
	4I. State Responsibilities															X	
	4J. MPO and Other Regional Responsibilities															X	
	4K. Local Government Responsibilities															X	
	4L. Federal and Indian Tribal Govt. Relationships																
	4M. Private/Public Partnering																
	4N. Public Participation											X					
	4O. Public Information and Education											X					

Oregon Highway Plan

Policy Themes	Policies	Minimum Standards or Levels-of-Service	% Special Transportation Areas where highway mobility (v/c) meets standard	Highway v/c ratio within a Special Transportation Area (for corridor planning)	% Freight System Lane Miles Meeting Mobility Standards During Peak Hours	# and % of Accidents Involving Trucks	% Customers Reporting Favorable Perception of Scenic Byways	OR Scenic Byway Committee Rating	% Bridges on Lifeline Route with Satisfactory Seismic Rating	# Bridges on Lifeline Routes with Satisfactory Rating	% OR Residents Whose Lifeline System Defined and Evaluated	% OR Residents Whose Lifeline System Access Meets Bridge Rating Standards	% Highway Lane Miles Meeting Mobility Standards	% miles on limited-access highways in urban areas that do not meet highway mobility stds	% state expenditures saved through cost-sharing and other partnership arrangements	Net Benefit of Off-System Improvements	# Route Miles With Potential for Interjurisdictional Transfer	# and % of Potential Total of Route Miles Transferred	Deaths Due to Motor Vehicle Crashes	% of Occupants Using Safety Restraints	# Deaths Due to Alcohol and Drug-Related Crashes	# of Accidents With fatality/serious injury	Annual % Reduction in Fatal and Injury Crashes	# of Newly Constructed At-Grade Crossings	# of At-Grade Crossings Eliminated or Replaced With Grade-Separated	% of identified obstacles to freight movements that are eliminated	% or # Intermodal Connectors Improved	% Oregonians Who Commute To and From Work During Peak Hours Not in SOV	Vehicle Miles Traveled Per Capita In Metro Areas	% Total Person Miles of Travel Made in HOV	% VMT Reduction Due to HOV Lanes	% Oregonians Who Commute To and From Work in SOV	Inventory # of Park-and -Ride Spaces within and adjacent to State Hwy ROW	Miles of State Hwys w/ Up-To-Date natural resource Maps relative to total miles needing mapping	# Culverts Retrofitted For Salmon	% Customers By Region Reporting Favorable or Better Perception of Hwy System for aesthetics, safety and performance
Oregon Highway Plan, 1999																																		
1. System Definition: To maintain the safe and efficient movement of people and goods and contribute to the health of Oregon's local, regional, and statewide economies and liveability of its communities	1A. State Highway Classification System: to guide priorities for system investment and management																																	
	1B. Land Use and Transportation: coordinate to maintain mobility and safety, foster compact devlopment, transp. alternatives, liveability, economic competitiveness		X	X																														
	1C. State Highway Freight System: balance and maintain efficient movement on major truck freight routes				X	X																												
	1D. Scenic Byways: preserve, enhance, consider aesthetics with safety and performance						X	X																										
	1E. Lifeline Routes:secure network to facilitate emergency services and rapid economic recovery after disaster								X	X	X	X																						
	1F. Highway Mobility Standards: maintain mobility												X	X																				
	1G. Major Improvements: improve system efficiency and management before adding capacity.																																	
2. System Management: To develop, operate and maintain highway and road system for functionality, integrity, mobility and accessibility, system efficiency and safety.	2A. Partnerships: establish cooperative partnerships for more efficient and effective use of limited resources														X																			
	2B. Off-System Improvements: finance development, enhancement and maintenance of local transp. systems															X																		
	2C. Interjurisdictional Transfers: to increase efficiencies in operation and maintenance....																X	X																
	2D. Public Involvement: ensure public have input into proposed actions affecting state highway system																																	
	2E. Intelligent Transportation Systems: to improve system efficiency and safety in cost-effective manner																																	
	2F. Traffic Safety: improve safety using engineering, education, enforcement and emergency medical services					X														X	X	X	X	X										
	2G. Rail and Highway Compatibility: reduce and prevent conflicts between railroad and highway users																								X	X								

Oregon Highway Plan

Policy Themes	Policies	Minimum Standards or Levels-of-Service	% Special Transportation Areas where highway mobility (v/c) meets standard	Highway v/c ratio within a Special Transportation Area (for corridor planning)	% Freight System Lane Miles Meeting Mobility Standards During Peak Hours	# and % of Accidents Involving Trucks	% Customers Reporting Favorable Perception of Scenic Byways	OR Scenic Byway Committee Rating	% Bridges on Lifeline Route with Satisfactory Seismic Rating	# Bridges on Lifeline Routes with Satisfactory Rating	% OR Residents Whose Lifeline System Defined and Evaluated	% OR Residents Whose Lifeline System Access Meets Bridge Rating Standards	% Highway Lane Miles Meeting Mobility Standards	% miles on limited-access highways in urban areas that do not meet highway mobility stds	% state expenditures saved through cost-sharing and other partnership arrangements	Net Benefit of Off-System Improvements	# Route Miles With Potential for Interjurisdictional Transfer	# and % of Potential Total of Route Miles Transferred	Deaths Due to Motor Vehicle Crashes	% of Occupants Using Safety Restraints	# Deaths Due to Alcohol and Drug-Related Crashes	# of Accidents With fatality/serious injury	Annual % Reduction in Fatal and Injury Crashes	# of Newly Constructed At-Grade Crossings	# of At-Grade Crossings Eliminated or Replaced With Grade-Separated	% of identified obstacles to freight movements that are eliminated	% or # Intermodal Connectors Improved	% Oregonians Who Commute To and From Work During Peak Hours Not in SOV	Vehicle Miles Traveled Per Capita In Metro Areas	% Total Person Miles of Travel Made in HOV	% VMT Reduction Due to HOV Lanes	% Oregonians Who Commute To and From Work in SOV	Inventory # of Park-and -Ride Spaces within and adjacent to State Hwy ROW	Miles of State Hwys w/ Up-To-Date natural resource Maps relative to total miles needing mapping	# Culverts Retrofitted For Salmon	% Customers By Region Reporting Favorable or Better Perception of Hwy System for aesthetics, safety and performance
Oregon Highway Plan, 1999																																				
3. Access Management: To ensure safe and efficient highways, statewide movements of goods and services, enhance community livability, and support planned development patterns, which recognizing the needs of motor vehicles, transit, pedestrians and bicyclists.	3A. Classification and Spacing Stds: manage intersections & approach roads to assure safe and efficient operation of state hwys																																			
	3B. Medians: maange and place for efficiency and safety of hwys, influence and support land use patterns																																			
	3C. Interchange Access Management Areas: plan and manage grade-separated interchange areas																																			
	3D. Deviations: manage deviations from adopted access mgt standards and policies																																			
	3E. Appeals																																			
4. Travel Alternatives: To optimize the overall efficiency and utility of the state highway system through the use of alternative modes and travel demand strategies	4A. Efficiency of Freight Movement: improve efficiency of freight movement and access to intermodal connections				X																					X	X								
	4B. Alternative Passenger Modes: support alternative passenger transportation systems where travel demand, land use, and other factors indicate potential for successful alternative passenger modes																											X	X							
	4C. High-Occupancy Vehicle (HOV) Facilities																													X	X					
	4D. Transportation Demand Management: invest in TDM strategies - reduce peak period SOV travel, move demand out of peak period, improve flow of traffic; investigate toll and congestion-based pricing; support rideshire programs.				X								X	X																	X					
	4E. Park-and-Ride Facilities																															X				
5. Environmental and Scenic Resources: To protect and enhance the natural and built environment throughout the process of constructing, operating, and maintaining the state highway system.	5A. Environmental Resources: design, construct, operate and maintain state hwy system to maintain or improve the natural and built environment including air quality, fish passage and habitat, wildlife habitat...water quality, noise levels, revegetation, wetland wildlife habitat mitigation banking.																																	X	X	
	5B. Scenic Resources: use best mgt practices to protect and enhance scenic resources						X	X																												X

Appendix A-1.5 **Bicycle and Pedestrian Component of OTP**

Policy Themes	Policies		Minimum Standards or Levels-of-Service	# Projects that Meet Criteria for Accommodating Bicyclists and Pedestrians	# Bikeway and Walkway Projects Meet Adopted Criteria	Miles of Rural State Highways Suitable for Bicycling	Miles of Urban State Highways that Accommodate Pedestrians and Bicyclists	# person trips by bicycling and walking	secure bicycle storage available at all employment and shopping centers, park and rids, passenger terminals and recreation destinations
								minimum standard	minimum standard
Bicycle and Pedestrian Component, 1995									
To provide safe, accessible and convenient bicycling and walking facilities and to support and encourage increased levels of bicycling and walking.	Provide bikeway and walkway systems that are integrated with other transportation systems			X	X	X	X	X	
	Create a safe, convenient and attractive bicycling and walking environment								X
	Develop education programs that improve bicycle and pedestrian safety								

Policy Themes			Selected Measures for Minimum Standards or Levels-of-Service	Peak period Service Frequency for all routes of no less than 1/2 hr	Off-peak service frequency for all routes of no less than 1 hr	Replace vehicles when they reach the manufacturer's retirement age	Provide dial a ride services to general public on weekdays	provide at least 1.7 annual hours per capita of public transportation	provide at least one accessible vehicle for every 40 hrs of service	Provide one backup vehicle for every 3.5 vehicles	establish ridematching and demand mgt. programs in communities of 5,000 where there are employers with 500 or more workers	provide accessible ride to anyone requesting service	provide phone access to scheduling system at least 40 hrs weekly M-F	respond to service requests within 24 hrs	provide hourly service to major communities within Willamette Valley in conjunction with passenger rail service	provide daily round trip connections to market areas of 50,000 population more than 70 miles from Portland	Provide daily round trip service for areas with population of 2,500 located 20 miles or more from nearest city with larger population	Provide reliable service with on-time arrivals within 15 mins of published schedules	increase passenger speeds from 79 to 110 mph in high-volume ridership areas
				large communities and urban areas			communities > 25,000			communities > 2,500	communities of 2,500 within 20 miles of urban core	rural and frontier communities			intercity bus and rail				
GOAL 1: Purpose of Public Transportation System -- provide mobility alternatives to meet daily medical, employment, educational, business and leisure needs without dependence on SOV transportation. Enhance livability and economic opportunities for all Oregonians; lessen transporation impact on environment; provide services in coordinated, integrated and efficient manner.	***Policy 1A: Urban Access, Rural Access, Basic Mobility*** -- provide urban areas with access to jobs and add capacity to regional transportation system; provide intermodal connections between urban and statewide transportation systems. Provide access to rural and frontier areas, connections to other parts of state and all parts of the community; be economical, convenient to use. Provide basic level of mobility to meet essential travel needs, including ability to travel conveniently, economically, safely and securely to meet medical, employment, educational,	Strategy 1A.1. Work with local governments to promote development and use of public transportation, bicycle and pedestrian services.					x												
		Strategy 1A.2. Work with local governments to identify and seek funding for high priority public transportation projects.																		
		Strategy 1A.3. Promote the development of interurban bus and rail passenger services to improve linkages among urban areas and achieve land use goals.																		
		Strategy 1A.4. Encourage adequate and efficient public transportation for access to emplomen, shopping and other commerce, medical care, housing and leisure activities, including access for the transportation disadvantaged.		x	x		x		x		x	x			x	x	x	x	
	Policy 1B: Environmental Protection -- The public transportation system should be designed, operated and maintained to lessen the impact on air and water quality, the natural environment and energy consumption.	Strategy 1B.1. Minimize transporation energy consumption through improved public transportation vehicle efficiencies, use of clean burning fuels, and increased use of fuel efficient modes including rail, transit, transportation demand management, bicycle and walking.				x														
		Strategy 1B.2. Carry out requirements of federal and state clean air standards consistent with the long-term air quality goals of the Oregon Benchmarks.				x														
	Policy 1C: Economic Prosperity -- Strengthen economic opportunities by providing travel options that increase access to jobs.			x			x				x	x			x	x	x	x	
	Policy 1D: Land Use -- The public transportation system and local land use planning should be complementary and coordinated. Be both responsive to and facilitate implementation of land use laws.	Strategy 1D.1. Encourage public transportation projects that support compact or in-fill development or mixed use projects.																		
		Strategy 1D.1. Promote the development of interurban bus and rail passenger services to improve linkages among urban areas and achieve land use goals.													x	x	x		x
	Policy 1E. Reduce Highway Demand -- The public transportation system, especially in urbanized areas and large cities, should function as an integral component of and reduce pressure on the overall transportation system.	Strategy 1E.1. Use demand management and transportation system management techniques that reduce peak period SOV travel and VMT, spread traffic volumes away from peak period and improve traffic flow. Including HOV lanes with express transit service, carpools, parking management, peak period pricing, ramp metering, traveler information systems, incident management, bicycling and walking modes, telecommuting, and flexible hour work scheduling.																		
GOAL 2: Components of the Public Transportation System -- statewide, well-maintained and managed, safe and	***Policy 2A. Urban, Small City and Rural Public Transportation Systems*** -- In urbanized areas and large cities, serve as alternative to SOV to provide mobility, access employment, reduce congestion and maintain air quality. Use	Strategy 2A.1. Encourage adequate public transportation for access to employment, shopping and other commerce, medical care, housing and leisure activities, including access for the transportation disadvantaged.		x	x		x		x		x	x	x		x	x	x	x	

Policy Themes			Selected Measures for Minimum Standards or Levels-of-Service	Peak period Service Frequency for all routes of no less than 1/2 hr	Off-peak service frequency for all routes of no less than 1 hr	Replace vehicles when they reach the manufacturer's retirement age	Provide dial a ride services to general public on weekdays	provide at least 1.7 annual hours per capita of public transportation	provide at least one accessible vehicle for every 40 hrs of service	Provide one backup vehicle for every 3.5 vehicles	establish ridematching and demand mgt. programs in communities of 5,000 where there are employers with 500 or more workers	provide accessible ride to anyone requesting service	provide phone access to scheduling system at least 40 hrs weekly M-F	respond to service requests within 24 hrs	provide hourly service to major communities within Willamette Valley in conjunction with passenger rail service	provide daily round trip connections to market areas of 50,000 population more than 70 miles from Portland	Provide daily round trip service for areas with population of 2,500 located 20 miles or more from nearest city with larger population	Provide reliable service with on-time arrivals within 15 mins of published schedules	increase passenger speeds from 79 to 110 mph in high-volume ridership areas
				large communities and urban areas			communities > 25,000			communities > 2,500	communities of 2,500 within 20 miles of urban core	rural and frontier communities			intercity bus and rail				
pleasant to use. Be hierarchical with type of service based on population and density. Elements should work together to accommode unique needs of different regions of state according to their population, density, form and function. To ensure coordination and efficiency, provide single unified public transporation system. Integrate systems for special needs and general public. TDM projects should not be restricted to metropolitan areas.	light rail, fixed-route bus and demand responsive tranit, rideshare matching and TDM services, as well as taxi, special needs transportation services and other alternatives. In small cities and towns, at a minimum serve the transportation disadvantaged with rideshare, volunteer programs, taxis or minibus services. Rideshare matching and TDM services should be available in communities of 10,000, and in communities of 5,000 where there are large employers with a base of at least 500 employees who are not covered by a regional program. All places of 10,000 people or more should have demand response service.	Strategy 2A.2. Implement the public transportation requirements of the Americans with Disabilities Act of 1990.				X		X			X								
		Strategy 2A.3. Promote development of transit centers that are safe, near residential areas, and easily accessible to pedestrians and bicyclists.		X																
		Strategy 2A.4. Define appropriate minimum levels of service for public transportation.		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		Strategy 2A.5. Encourage modal alternatives to the automobile.		X	X															
		Strategy 2A.6. Pursue revision of regulatory systems to stimulate the provision of transportation services by private companies in rural areas.																		
	Policy 2B. Intercity Bus and Rail Systems -- The intercity bus and rail system should operate to provide a well-coordinated unified network which enables Oregonians and visitors to access services and activities as identified in the minimum levels of service section. The passenger rail system should provide service through Oregon's main regional and interstate corridors. The passenger bus element should complement rail service by augmenting train schedules, providing feeder service, and serving the bulk of intercity travel needs to communities outside of rail corridors.	Strategy 2B.1. Promote the growth of intercity bus, rail passenger and commuter air services to link all areas of the state with national and international transportation facilities.													X	X	X	X	X
		Strategy 2B.2. Promote the development of interurban bus and rail passenger services to improve linkages among urban areas and achieve land use goals.													X	X	X	X	X
		Strategy 2B.3. Implement the public transportation requirements of the Americans with Disabilities Act of 1990.							X			X								
		Strategy 2B.4. Consider acquiring and upgrading low-density rail lines where current owners are seeking to sell or abandon them.																		
		Strategy 2B.5. Preseve corridors for future public transportation development.																		
		Strategy 2B.6. Facilitate development and operation of transportation hubs with statewide, interstate and international functions. Encourage development of a system of passenger facilities throughout the state that expedites transfers between modes, routes and carriers.																X	X
GOAL 3: Management and Financing of the Public Transportation System-- The public transportation system should be planned, operated, managed and financed cooperatively by public and private organizations representing statewide, regional and local interests.	Policy 3A. State Role -- development of a framework for decision making and coordination among transporation agencies, providing leadership over statewide issues and concerns, building consensus among different regions and transportation organizations, assisting with funding and providing technical assistance. The state, in partnership with others, should develop and maintain intercity bus and rail service contingent on the availability of adequate funding.	Stategy 3A.1. Broaden ODOT's research responsibility to include research for all modes.																		

Policy Themes			Selected Measures for Minimum Standards or Levels-of-Service	Peak period Service Frequency for all routes of no less than 1/2 hr	Off-peak service frequency for all routes of no less than 1 hr	Replace vehicles when they reach the manufacturer's retirement age	Provide dial a ride services to general public on weekdays	provide at least 1.7 annual hours per capita of public transportation	provide at least one accessible vehicle for every 40 hrs of service	Provide one backup vehicle for every 3.5 vehicles	establish ridematching and demand mgt. programs in communities of 5,000 where there are employers with 500 or more workers	provide accessible ride to anyone requesting service	provide phone access to scheduling system at least 40 hrs weekly M-F	respond to service requests within 24 hrs	provide hourly service to major communities within Willamette Valley in conjunction with passenger rail service	provide daily round trip connections to market areas of 50,000 population more than 70 miles from Portland	Provide daily round trip service for areas with population of 2,500 located 20 miles or more from nearest city with larger population	Provide reliable service with on-time arrivals within 15 mins of published schedules	increase passenger speeds from 79 to 110 mph in high-volume ridership areas
				large communities and urban areas			communities > 25,000			communities > 2,500	communities of 2,500 within 20 miles of urban core	rural and frontier communities			intercity bus and rail				
interests.																			
	Policy 3B. State Financing -- State financial support for public transportation should be reliable, flexible and stable, based on level of service factors, linked to state objectives and financial resources. The state, in partnership with others, should continue to seek development of new financing mechanisms that contribute to the overall financial adequacy of the public transportation system.																		
	Policy 3C. Public Transportation Facilities and Equipment Management System (PTMS) -- ODOT in cooperation with affected local and regional governments, will develop and maintain a PTMS. The PTMS will supply data and other information to help guide public transportation planning, decision making and financing.	Strategy 3C.1 Develop, establish and implement management systems, as appropriate.																	
		Strategy 3C.2. Provide management training and technology sharing for public and private transportation providers and operators.																	
	Policy 3D. Projects serving Statewide Functions -- The state should participate with local governments and other organizations to develop the public transportation system. The level of ODOT's support should be greater for projects serving a state level or statewide public transportation function or need.	Strategy 3D.1. Form partnerships to develop and maintain intercity public transportation services that link small communities and rural areas to basic goods and services, appropriate to community size and the availability of resources.																	

OTP Rail Component

Policy Themes	Policies		Minimum Standards or Levels-of-Service	Availability of modal choices	Ease of use	Relative Costs	Proximity to Service	Frequency of Service	Reliable on-time arrivals within 15 mins of published schedules	Increase passenger speeds up to 110-125 mph on existing mainline trackes	Coordinate intercity bus and local transit with intercity rail for timely and convenient connections	Major intermodal rail/truck facilities should exist on rail mainlines with a service area of 150 miles	Branch rail lines allowing a min. speed of 25 mph
									minimum level of service				
Rail Component, 2001													
OTP Goal 1, Policy 1B- Efficiency: Assure provision of an efficient transportation system; one that is (1) fast and economic for users, (2) users face prices that reflect the full costs of their transportation choices; and (3) transportation investment decisions maximize the full benefits of the system	Preserve corridors for future transportation development. Obtain ROWs for multimodal transportation system improvements								X	X			X
OTP Goal 1 - Policy 1C- Accessibility: To promote a transportation system that is reliable and accessible to all potential users, including the transportation disadvantaged	Cooperatively define acceptable levels of accessibility through standards for minimum levels of service and system design for passenger and freight for all modes.			X	X	X	X	X	X				
OTP Goal 1, Policy 1E - Connectivity among Places: To identify and develop a statewide transportation system of corridors and facilities that ensures appropriate access to all areas of the state, nation and the world	Develop and promote service in statewide transportation corridors by the most appropriate mode including intercity bus, truck, rail, passenger vehicle and bicycle										X		
OTP Goal 1, Policy 1G - Safety: To improve continually the safety of all facets of statewide transportation for system users including operators, passengers, pedestrians, receipients of goods and service, and property owners	Promote high safety and compliance standards for operation, construction and maintenance of the rail system												
OTP Goal 2, Policy 2E - Minimum Levels of Service: To define and assure minimum levels of service to connect all areas of the state	Define minimum levels of service for all modes and all potential users		X						X	X	X	X	X
OTP Goal 2, Policy 2F - Rural Mobility: To facilitate the movement of goods and services and to improve access in rural areas	Facilitate the movement of goods and services and improve access in rural areas												
	Acquire and upgrade low-density rail lines where current owners are seeking to seel or abandon them												
OTP Goal 3, Policy 3A - Balanced and Efficient Freight System: To promote a balanced freight transportation system that takes advantage of the inherent efficiencies of each mode	Identify level of support for freight transportation												
	Provide more efficient railroad service at railroad crossings and yard areas through grade separations and alternative motor vehicle circulation routes.												
OTP Goal 3, Policy 3B - Linkage to Markets: To assure effective transportation linkages for goods and passengers to attract a larger share of international and interstate trade to the state	Promote retention of rail service and ROWs											X	
OTP Goal 3, Policy 3C - Expanding System Capacity: expand capacity of freight industry by facilitating increased cooperation among transportation providers.	Remove barriers to convenient and efficient shipping by rail by promoting track sharing, interlining, and shared use of terminals.												
OTP Goal 3, Policy 3D - Intermodal Hubs: To promote intermodal freight and passenger hubs to enhance competitiveness, improve rural access and promote efficient transportation	Support Portland's role as a major freight hub for goods transported by air, highway, rail, barge and ship, and recognize other areas as main connectors for multimodal system.											X	
OTP Goal 4, Policy 4G - Management Practices: To manage effectively existing transportation infrastructure and services before adding new facilities	Control access to state highways, minimizing rail crossings and controlling incompatible land use around airports												
	Freight Rail												
Integrate rail freight considerations into the State's land use planning process	Recognize social, economic and environmental importance of rail freight												
	Enhance and protect existing rail freight service through land use zoning												
	Minimize conflicts between railroad operations and other urban activities												

OTP Aviation Component

Policy Themes	Objectives and Policies		Minimum Standards or Levels-of-Service	Availability of Airport with commercial service where population is greater than 50,000 and further than 70 miles from nearest other airport	Minimum of three round trips per day of 19 passengers between Portland/West Coast hubs and other areas of Oregon.	Availability of airport service to areas with population > 25000, central urban area > 15000, more than 50 miles from other commercial air and more than 100 miles from metro area
				minimum service level		
Aviation Component, 2000						
Preservation	Preserve Oregon's system of airports and its current level of service					
Protection	Protect airports from incompatible land uses					
Safety	Maintain Oregon's public-use airports in a safe operating condition, and ensure role in emergency response system					
Economic Development	Increase understanding of economic importannce of air transportation system					
Intermodal Accessibility	Integrate airport system with surface transportation modes and allow for choice of modes for movement of people and goods					
Environment	Comply with state and federal environmental laws					
Modernization and Capacity	Support airport modernization					
	Support airport system to meet future demands					
Funding	Establish state funding program for system public-use airports					
	Solicit federal funding support					
Advocacy and technical assistance	Provide advocacy and technical assistance					
	Facilitate intergovernmental coordination, and cooperation					
	Providing planning framework for integrated airport system					
State-owned airport mgt	Continue operation of airports in state ownership					
OTP Goal 2, Policy 2E - Minimum Levels of Service: define and assure minimum levels of service to connect all areas of the state				**X**	**X**	**X**
OTP Goal 2, Policy 2F - Rural Mobility: Facilitate the movement of goods and services and improve access in rural areas						
OTP Goal 3, Policy 3B - Linkages to Markets: assure effective transportation linkages for goods and passengers to attract a larger share of international and interstate trade to the state.						
OTP Goal 3, Policy 3D - Intermodal Hubs: provide intermodal freight and passenger transportation hubs to enhance competitiveness, improve rural access and promote efficient transportation						
OTP Goal 3, Policy 3E - Tourism: support tourism and access to recreational destinations						

Portland Metropolitan Regional Transportation Plan 2000

Policy Themes	REF: 2000 Regional Transportation Plan (incl. Appx. 1.2), August 10, 2000, Metro Regional Services. REF: The Portland Region: How are we doing?, March 2003, Metro Regional Services.	Minimum motor vehicle levels of service	4. Average Weekday Person Trips	4. Average Weekday Work Trips	4. Average Weekday Non-Work Trips	12. Average Home-Based Work Trip Length	4-8. Vehicle Miles of Travel per capita and VMT/capita change	1. Total lane miles (freeway, arterial)	2. Total Lane Miles Added	3. Average Weekday Total Auto Person Trips	9. SOV percent of person trips	10. Non-SOV percent of person trips (shared ride, walk, bike, transit)	11. Average weekday motor vehicle average trip length (miles)	12. Auto occupancy	15. Average Motor Vehicle Speed	14. Average Motor Vehicle Travel Time	17. % of Freeway Miles Experiencing Congestion	17. % of Arterial Street Miles Experiencing Congestion (System Performance)	19. Total Motor Vehicle Hours of Delay	20. Motor Vehicle Hours of Delay on Freeway	20. Motor Vehicle Hours of Delay on Arterial Streets	21. Total Roadway Capacity Miles (freeway, arterial)	1, 2. Walk Trips and Walk Percent of Person Trips	1, 2. Bike Trips and Bike percent of Person trips	1. Average Weekday Transit Trips	2. Average weekday transit revenue hours	3. Transit % of Person trips	5. % of Households within 1/4-mile of Transit	6. % of Jobs within 1/4-mile of Transit	1. Average weekday Total Truck Trips (Freight System Performance)	2. Average weekday Total Truck Average Trip Length (miles)	4. Two hour PM truck hours	5, 6. Two-Hour Peak Period Truck Vehicle Hours of Delay	3. Two-Hour Peak Period Average Truck Travel Time	7. Lane miles added to freight network	8. Freight Network miles	9, 10. Congested Freight Network miles	Total transit time compared with auto travel time during off-peak hours (pg. 1-38)	Total transit time on regional bus routes compared with total auto travel time (pg. 1-38)	Avg Annual regional transportation capital needs	Annual capital spending	Air Quality: number of days exceeding the standard	Air quality: comparison of metropolitan regions: summer days ozone violation of Clean Air Act
		overall system performance						motor vehicle system performance																alternative mode performance, including transit							Freight system performance													
Public Process																																												
Public Involvement																																												
Intergovernmental Coordination																																												
Connecting Land Use																																												
Urban Form												X												X	X	X	X	X	X	X								X	X				
Consistency Between Land-use and Transportation Planning						X						X			X			X	X	X	X			X	X	X	X	X	X	X								X	X				
Equal Access and Safety																																												
Barrier-Free Transportation																										X			X	X														
Interim Special Needs Transportation																										X			X	X														
Interim Job Access and Reverse Commute Policy																																												
Transportation Safety and Education																																												
Protecting the Environment																																												
Natural Environment																																												
Water Quality																																												
Clean Air																																											X	X
Energy Efficiency																																												
Designing the Transportation System		X																																										
Regional Street Design						X	X	X	X														X							X	X									X	X			
Local Street Design						X	X					X												X	X	X	X	X	X	X	X								X	X			
Regional Motor Vehicle System							X	X	X							X	X	X	X	X	X			X	X	X			X	X													
Regional Public Transportation System							X					X														X	X	X	X	X								X	X				
Public Transportation System Awareness and Education																										X	X	X															
Public Transportation Safety and Environmental Impacts																																												
Regional Public Transportation Performance						X																																		X	X			
Regional Freight System																																				X	X	X	X	X	X	X	X			
Regional Freight System Investments																																												
Regional Bicycle System Connectivity																																												
Regional Bicycle System Mode Share and Accessibility							X					X													X																			
Regional Pedestrian System																								X																			
Pedestrian Mode Share												X												X																			
Regional Pedestrian Access and Connectivity																																												
Managing the Transportation System																																												
Transportation System Management			X	X	X	X	X	X	X				X		X	X							X							X	X	X										
Regional Transportation Demand Management											X	X		X			X	X	X	X	X		X	X	X	X	X	X	X				X	X									
Regional Parking Management																																													
Peak Period Pricing																																												
Implementing the Transportation System																																												
Transportation Funding																																												
2040 Growth Concept Implementation																																												
Transportation System Maintenance and Preservation																																												
Transportation Safety																																												

Rogue Valley Council of Governments Metropolitan Planning Organization

Policy Themes	Objectives and Policies	REF: RVMPO 2001-2003 RTP 25 April 02	Per Capita Vehicle Trips	Per Capita Vehicle Miles of Travel	Number of Lane-Miles of New Roadway Construction	% of Population Within 1/4 Mile of Transit Route	% of Population Within Service Area for Lift Service	Transit Ridership-Frequency and Hours	Amount of Paratransit Services	% Collector and Arterials Accommodating Bicyclists	% Collectors and Arterials With Sidewalks	Intrusion into Existing Neighborhoods	Street System Connectivity	Access Restrictions	Capital Improvement Costs for existing infrastructure	Use of Abandoned ROW	Maximize use of I-5 Inter-Urban Travel	Minimize Impact on Air Quality	Minimize Impact on Ag and Forest Land and Open Spaces	Minimize ROW Impacts	Accident Data by Mode	Accident Data by Trip Purpose	Impact on User Safety	% of Lane-Miles on Collector and Arterials Not Congested	Per Capita Vehicle Hours Traveled	% of Trips by Purpose by Time	%total daily trips by transit and by bicycles+walking	%mixed use DUs in new development	%mixed use employment in new development	Alternative transportation funding
		Chap. 4	reduce reliance on auto			provide access to alternative modes of transportation						impact on nbhds/ communities			efficient utilization of exist infrastructure			environ-sensitive transportation			maximize safety of transportation			maximize efficiency of transportation						
		Chap. 18				alt. meas				alt. meas																	alt. meas to TPR VMT requirement			
Multi Modal		Chap.3																												
Plan for, develop, and maintain a multi-modal transportation system that will address existing and future needs for transportation of people and goods in the region, recognizing the importance of the street network to most surface travel modes.	Design a transportation system for the future (2015 and beyond) that learns from and builds on the past.																													X
	Provide for smoother traffic flow and less congestion, particularly as it relates to commuter transportation												X	X										X						
	Create an integrated and linked network of arterial and collector streets that serves the mobility and multimodal travel needs of the region and consider network-wide improvements (i.e. beltways, bypasses, new interchanges, transportation demand management methods, etc.) to sustain acceptable levels of service and anticipate future needs.				X			X		X	X		X		X									X						
	Explore innovative alternative travel modes and fuel sources in order to reduce single occupany vehicles, vehicle miles traveled, and reliance on fossil fuels.		X	X														X												
	Improve accessibility, availability, efficiency, and viability of public and private mass transportation systems for all users (including disabled, elderly, and children)					X	X	X	X						X										X	X	X			
	Improve bicycle and pedestrian access and viability.									X	X																X			
	Provide for intermodal connections, present and future															X	X													
	Ensure the safety of all current and future travel modes for all																				X	X	X							
	Make the transportation system accessible to all users.						X		X	X	X																			
	Ensure that the existing elements of the multi-modal transportation system are conserved through maintenance and preservation, sustained system operations and equipment replacement scheduling, all through utilization of sound fiscal planning				X										X	X														X
	Ensure the provision of adequate intercity travel modes and facilities.																X													
Community Character and Environment		Chap.3																												
Develop a Plan that builds on the character of the community, is sensitive to the environment, and enhances quality of life.	Provide transportation systems that minimize air, water, and noise pollution while maintaining/enhancing surrounding environment																	X		X										
	Provide transportation systems that emphasize and encourage compact, interrelated, pedestrian and transit-friendly development and revitalization.		X	X		X							X						X							X	X	X	X	
	Maintain the integrity of and minimize impacts to neighborhoods and local business communities while addressing regional transportation needs.											X		X						X										
	Preserve, where possible, agricultural and forest land.													X					X	X										

Rogue Valley Council of Governments Metropolitan Planning Organization

Policy Themes	Objectives and Policies	REF: RVMPO 2001-2003 RTP 25 April 02	Per Capita Vehicle Trips	Per Capita Vehicle Miles of Travel	Number of Lane-Miles of New Roadway Construction	% of Population Within 1/4 Mile of Transit Route	% of Population Within Service Area for Lift Service	Transit Ridership-Frequency and Hours	Amount of Paratransit Services	% Collector and Arterials Accommodating Bicyclists	% Collectors and Arterials With Sidewalks	Intrusion into Existing Neighborhoods	Street System Connectivity	Access Restrictions	Capital Improvement Costs for existing infrastructure	Use of Abandoned ROW	Maximize use of I-5 Inter-Urban Travel	Minimize Impact on Air Quality	Minimize Impact on Ag and Forest Land and Open Spaces	Minimize ROW Impacts	Accident Data by Mode	Accident Data by Trip Purpose	Impact on User Safety	% of Lane-Miles on Collector and Arterials Not Congested	Per Capita Vehicle Hours Traveled	% of Trips by Purpose by Time	%total daily trips by transit and by bicycles+walking	%mixed use DUs in new development	%mixed use employment in new development	Alternative transportation funding
		Chap. 4	reduce reliance on auto			provide access to alternative modes of transportation						impact on nbhds/ communities			efficient utilization of exist infrastructure			environ-sensitive transportation			maximize safety of transportation			maximize efficiency of transportation						
		Chap. 18				alt. meas				alt. meas																	alt. meas to TPR VMT requirement			
Public Process		Chap.3																												
Provide an open, objective, and credible process for planning and developing a transportation system that complies with state and federal regulations	Provide a process to involve citizens in planning the transportation system --ensuring plans address public values and have the flexibility to respond to changing needs																													
	Educate and involve the public and policy makers in developing our transportation system - including changing how we as a community travel.																													
	Develop policies and procedures that encourage cooperation and coordination of all jurisdictions within the study area to ensure the success in developing and implementing the Plan																													
	Coordinate the planning for existing and future development with the planning of the transportation system.																													
Financial		Chap.3																												
Develop a plan that can be funded and that reflects responsible stewardship of public	Develop innovative and sound funding policies to implement the Plan																													X
	Ensure that the costs of planned improvements are commensurate with the benefits																													

Lane Council of Governments TRANSPLAN

Policy Themes	REF: Transplan: The Eugene-Springfield Transportation System, Dec 2001	Parkings spaces per capita	Congested Miles of travel (% of total VMT)	Roadway Congestion Index	Network Vehicle Hours of Delay (Daily)	% Transit Mode Share on Congested Corridors	Internal VMT (no commercial vehicles)	Internal VMT/Capita	Average Trip Length (miles)	% Person Trips Under 1 Mile	Walk Mode Share	Bike Mode Share	Transit Mode Share	Shared Ride (2 or more) Mode Share	Drive Alone Mode Share	% Non-Auto Trips	Person Trips per Auto Trip	Average Fuel Efficiency (VMT/Gal.)	CO Emissions (Weekday Tons)	Acres of zoned nodal development	% of dwelling units built in nodes	% of New "Total" Employment in Nodes	% of Roadway Miles with Sidewalks	Ratio of Bikeway to Arterial &Collector Miles	% of Roadways in Fair or Better Condition	% of Hhds Within 1/4 Mile of a Transit Stop	Transit Service Hours per Capita	% HHlds w/Access to 10-minute Transit Service	% Emp w/Access to 10-min Transit Service	Bikeway Miles	Priority Bikeway Miles	Arterial and Collector Miles	Arterial and Collector Miles (excluding fwys)
Goals			Traffic Congestion Measures				VMT and Trip Length Measures				Mode Choice Measures							Environmental		Land Use			Transportation System Measures											
Integrate LU & Trans for livability, quality of life and reduced reliance on auto			s	s	s		s	s	s	s	s	s	s	s	s	s	s			s	s	s	s	s	s	s	s	s	s	s	s	s	s
Provide a Transportation System that is:																																		
a) Balanced,						s	s	s	s	s	s	s	s	s	s	s	s			s	s	s	s	s		s	s	s	s	s	s	s	s	s
b) Accessible,						s			s	s	s	s	s	s	s	s	s			s	s	s	s	s		s	s	s	s	s	s	s	s	s
c) Efficient,			X	X	X	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s
d) Safe,									s	s	s	s	s	s	s	s	s		s	s	s	s	s			s	s	s	s	s	s	s	s	s
e) Interconnected,						s	s	s	s	s	s	s	s	s	s	s	s						s	s		s	s	s	s	s	s	s	s	s
f) Environmentally responsible,									s	s	s	s	s	s	s	s	s	X	X	s	s	s	s	s		s	s	s	s	s	s	s	s	s
g) Supportive of responsible and sustainable development						s			s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s
h) Responsive to community needs and neighborhood impacts						s			s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s
i) Economically viable and financially stable.						s			s	s	s	s	s	s	s	s	s	s	s						s									
Land Use																																		
Apply Nodal Development in selected areas									X	X										X	X	X					s		s	s				
Support for Nodal Development																				X	X	X												
Provide for Transit-Supportive Land Use Patterns						s	s	s	s	s	s	s	X	s	s	s	s										X		X	X				
Require Multi-Modal Improvements in New Development							s	s	s	s	X	X	X	X	X	X	X						X	X		X	X	X	X	X	X	X		
Implement of Nodal Development per LCDC Requirement																				X	X	X												
TDM																																		
Expand Existing TDM Programs			s	s	s		s	s	s	s	X	X	X	X	X	X	X																	
Increase Parking Management Strategies		X									s	s	s	s	s	s	s																	
Implement Congestion Management			X	X	X	X																												
TSI System-Wide																																		
Protect and Manage Transportation Infrastructure			X	X	X	X	X	X	s	s	s	s	s	s	s	s	s			s	s	s	s	s	s	s	s	s	s	s	s	s		
Develop and Promote Intermodal Connectivity							s	s															s	s							s			
Preserve Corridors																																		
Support Enhancement of Neighborhood Livability			s	s	s	s			s	s	s								s															
TransPlan Project List adopted for Metro Plan purposes																																		

X indicates primary measures;
s indicates secondary.

Lane Council of Governments TRANSPLAN

Policy Themes	REF: Transplan: The Eugene-Springfield Transportation System, Dec 2001	Parkings spaces per capita	Congested Miles of travel (% of total VMT)	Roadway Congestion Index	Network Vehicle Hours of Delay (Daily)	% Transit Mode Share on Congested Corridors	Internal VMT (no commercial vehicles)	Internal VMT/Capita	Average Trip Length (miles)	% Person Trips Under 1 Mile	Walk Mode Share	Bike Mode Share	Transit Mode Share	Shared Ride (2 or more) Mode Share	Drive Alone Mode Share	% Non-Auto Trips	Person Trips per Auto Trip	Average Fuel Efficiency (VMT/Gal.)	CO Emissions (Weekday Tons)	Acres of zoned nodal development	% of dwelling units built in nodes	% of New "Total" Employment in Nodes	% of Roadway Miles with Sidewalks	Ratio of Bikeway to Arterial &Collector Miles	% of Roadways in Fair or Better Condition	% of Hhds Within 1/4 Mile of a Transit Stop	Transit Service Hours per Capita	% HHlds w/Access to 10-minute Transit Service	% Emp w/Access to 10-min Transit Service	Bikeway Miles	Priority Bikeway Miles	Arterial and Collector Miles	Arterial and Collector Miles (excluding fwys)
Goals			Traffic Congestion Measures				VMT and Trip Length Measures				Mode Choice Measures							Environmental		Land Use			Transportation System Measures											
TSI Roadway																																		
Address Mobility and Safety for all Modes			X	X	X	s	X	s																								s	s
Use motor vehicle level of service stds to maintain performance			s	s	s																												
Promote or Develop Coordinated Roadway Network							X		s	s																							
Preserve Roadway safety and operations thru Access Mgmt			s	s	s																												
TSI Transit																																	
Improve Transit Facilities to increase accessibility for all includ. disadv.						s							X			s	s									s	s	s	s				
Establish Bus Rapid Transit						s							X			s	s									s	s	s	s				
Implement Transit/High-Occupancy Vehicle Priority						X							X			s	s									s	s	s	s				
Expand Park-and-Ride Facilities		s											X			s	s									s	s	s	s				
TSI Bicycle																																	
Construct/Improve Bikeway System & Support Facilities												X												X						X	X		
Require Bikeways on Arterials and Collectors												X												X									
Require Bikeway Connections to New Development												X												X						X	X		
Implement Priority Bikeways												X																					
TSI Pedestrian																																	
Integrate pedestrian envir. with adj. landuse for safety, comfort, convenience							s	s	s	X	X	s	s	s	s																		
Provide Continuous and Direct Routes							s	s	s	s	X																						
Construct Sidewalks along Arterials and Collectors											X												X										
TSI Goods Movement																																	
Support Reasonable and Reliable travel times for Freight Movement			X	X	X	s																											
TSI Other Modes																																	
Support Public Investment in Eugene Airport and limit incompatible landuse																																	
Support Rail-Related Infrastructure Improvements																																	
Support Improvements to Passenger Rail & Inter-city Bus Facilities																																	
Finance																																	
Support Adequate Funding			s	s	s																							X				X	X
Operate and maintain transp. Facilities to reduce need for more expensive future repair																									X								
Prioritization of State and Federal Revenue for safety and major capacity problems			X	X	X	s																										s	s
Require New Development to Pay for its Impact																																	
Give short-term priority to investments that support mixed-use ped-friendly development											s	s	s	s	s	s															X		

X indicates primary measures;
s indicates secondary.

Salem-Keizer Metropolitan Planning Organization (Mid-Willamette Valley Council of Governments)

Policy Themes	Objectives	Policies	*(No Performance Measures Specified) Quantities used to describe Trends*	% of workers walking to work (pg. 6-2; Census))	% of trips made by pedestrians (pg. 6-3)	Funding $$ Requested for Pedestrian Projects	% of workers riding a bicycle to work (pg. 7-5, Census)	% of trips made by bicycles (pg.7-1)	% of Regional Bicycle System constructed (pg.7-5)	% of bike lockers rented (pg 7-6)	# gross tons shipped by rail (pg 8-6)	# passengers boarding/ detraining at Salem Railroad Station.(pg 11-7)	# commuters participating in carpools, buspools, vanpools (pg 13-8)	# parking spaces reserved for carpools and vanpools (pg 13-8)	# parking spaces per capita (pg. 13-10)	# park and ride facilities (pg. 13-12)	automobile volume /capacity (pg 13-17, 8-11)	peak period transit volume/ capacity (pg. 13-17)	% of workers using public transportation (pg 14-3)	# of transit trips (pg 14-3)	% fleet that is accessible (pg 14-5)	# paratransit trips per year (pg 14-5)	#aircraft operations at McNary Field (pg 9-5)	# train-pedestrian incidents (pg 8-10)	# lbs of intermodal cargo loaded (pg 12-2)	REF: SKATS. RTSP 2002 Interim Update; Adopted May 28, 2002.
OVERALL GOAL: "To provide an adequate level of mobility on the regional transportation system while maintaining or improving our overall quality of life."																										Chap 2
Pedestrian Element																										Chap 6
A continuous network of safe, convenient, and accessible pedestrian facilities to and within regional activity centers and major transit facilities.	To ensure a viable system of pedestrian facilities of regional significance	Pedestrian issues shall be included in the prioritization of projects for allocation of all regional funds.				X																				
		Support continuation of current (or equivalent) federal, state, and local funding sources to construct or improve pedestrian facilities in the region.				X																				
		Encourage the timely repair and maintenance of existing pedestrian facilities in regionally significant settings.				X																				
		Ensure that all pedestrian facilities are accessible and constructed in accordance with ADA standards, including reasonable grades and adequate clearances.																								
A substantial increase in the percentage of trips made by walking for all trip purposes in the region.	Encourage local land use patterns, densities, and designs that decrease trip lengths and that support walking as a practical and attractive transportation mode	Support an urban design that adequately considers pedestrian needs.		X	X																					
		Encourage the delineation of safe pedestrian ways, emphasizing separation from vehicular areas using planting strips, crosswalks, and increased lighting where appropriate.		X	X																					
	Encourage appropriate linkages with other alternative modes of transportation, including public transit and bicycling.	Support the incorporation of multimodal connections and modal balance into regional transportation facilities.				X																				
Bicycle Element																										Chap 7
An identified system of regional bicycle facilities within the Salem-Keizer urban area.	Establish a system of regional bicycle facilities within the Salem-Keizer urban area that provides an adequate level of service to meet regional bicycling mobility needs.	The Bicycle System Element of the Regional Transportation Systems Plan shall designate the bicycle system of regional significance the Regional Bicycle System (RBS) within the Salem-Keizer urban area.																								
	Develop and maintain an accurate and up-to-date inventory of the RBS in order to respond to the changing needs of the bicycling public in the region.	The RBS facilities inventory shall be included in the Bicycle System Element of the RTSP and up-dated on a regular basis to maintain currency and accuracy.																								
A safe system of regional bicycle facilities within the Salem-Keizer urban area.	Design a system of regional bicycle facilities that enhances safety by improving compatibility among bicycles and other transportation modes.	All bicycle facilities on the Regional Bicycle System shall be constructed in accordance with ODOT bicycle facility standards where applicable.																								
		Project designs that accommodate bicycle facilities within the roadway rights-of-way shall be implemented on the Regional Bicycle System where practicable.																								
	Provide for well maintained Regional Bicycle System facilities that afford a safe environment and reduce potential hazards to the traveler.	Jurisdictions are encouraged to adopt routine maintenance standards and practices that ensure smooth, clean,and safe conditions on the RBS facilities.																								
		Local jurisdictional support of volunteer community services and programs that assist in the provision of adequate maintenance service on RBS facilities.																								

No performance measures provided;
Quantities shown are used by SKATS for description of trends

Salem-Keizer Metropolitan Planning Organization (Mid-Willamette Valley Council of Governments)

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	to the traveler.	Bicycle safety devices such as bicycle proof drain grates, rubberized or concrete pads at railroad crossings,and appropriate signage shall be utilized on RBS facilities wherever practicable.																								
	Achieve greater public awareness of safe bicycling and motoring practices, procedures, and skills.	The development and implementation of region wide bicycle safety and education programs aimed at all are encouraged in order to improve bicycle skills, increase the observance of traffic laws, and enhance the overall safety of the traveling public in the region.																								
		Encourage jurisdictions to monitor and analyze bicycle accident data to formulate ways to improve bicycle safety.																								
A continuous and direct system of regional bicycle facilities in the Salem-Keizer urban area that adequately responds to the transportation needs and desires of bicyclists.	Establish a continuous and direct system of regional bicycle facilities that adequately responds to the regional transportation needs of bicyclists in the Salem-Keizer urban area.	Designate a continuous and direct system of regional bicycle facilities in the Bicycle System Element of the SKATS Regional Transportation Systems Plan.					X	X	X																	
		Identify facility improvements necessary to ensure a direct and continuous network of bicycle facilities on the Regional Bicycle System.																								
	Establish a Regional Bicycle System that provides access to regional activity centers and other major destinations.	Designate a continuous and direct system of regional bicycle facilities that provides access to regional activity centers and other major destinations.					X	X	X																	
		Identify necessary facility improvements on the Regional Bicycle System to ensure adequate bicycle access to regional activity centers and other major destinations.					X	X																		
A constructed system of regional bicycle facilities within the Salem-Keizer urban area.	Construct the bicycle facilities necessary to implement the established Regional Bicycle System by the year 2025.	Affected jurisdictions shall include bicycle facilities on all newly constructed regional arterials.																								
		Affected jurisdictions shall include bicycle facilities as part of major improvementprojects identified as part of RBSunless significant constraints can be demonstrated.																								
	Adequately fund the construction of the bicycle infrastructure and supporting facilities necessary to complete the established Regional Bicycle System by the year 2025.	Support continuation of current (or equivalent) federal, state, and local funding mechanisms to implement regional and local bicycle facilities and amenities within the Salem-Keizer urban area.																								
		SKATS and local jurisdictions shall cooperatively seek additional revenue sources as necessary to ensure timely completion of the bicycle facilities that comprise the RBS.																								
	Ensure multimodal equity by incorporating bicycle facilities into the planning, design, construction, and maintenance activities associated with roadways identified as part of the RBS.	Needed projects on the RBS shall be fully integrated into the evaluation and selection process associated with the development of the Region's Transportation Improvement Program (TIP).																								
A coordinated system of regional bicycle facilities in the SKATS area.	Integrate the Regional Bicycle System facilities with other transportation modes.	The Regional Bicycle System shall provide bicycle access to public transit transfer node(s), park-and-ride sites, and other major transportation centers such as regional airport terminals and passenger railroad stations.					X	X	X																	
		Regional bicycle planning efforts shall be coordinated with other transportation service providers to assure the opportunity for intermodal connectivity.																								
		Support the continuation of the "Bikes On Buses" Program for all public transit routes.																								

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	Ensure a continuing, comprehensive, and cooperative planning process that provides for the efficient and timely implementation of the Regional Bicycle System Plan.	Coordinate bicycle system planning and development efforts in the Salem-Keizer urban area with federal, state, and local agencies, as well as other public and private transportation providers.																								
		Prepare, adopt, and update a Bicycle System Element of the Regional Transportation Systems Plan that is consistent with federal and state guidelines and developed through a continuous, comprehensive, and cooperative transportation planning process, including thorough public review.																								
		Ensure that the portions of the Local Transportation Systems Plans dealing with bicycling are consistent with the Regional Bicycle System Plan through recurring Plan review.																								
		Coordinate roadway improvement projects in the region with recommended bicycle system needs to take advantage of cost sharing opportunities (i.e., resurfacing, widening, upgrading, etc.).																								
	Provide for an open and ongoing public involvement process that ensures full participation and input into the planning process associated with the development of the Bicycle System Element of the Regional Transportation Systems Plan.	Establish a region wide public participation process that ensures timely public notice, adequate information and appropriate opportunities for public input regarding all improvement projects affecting the Regional Bicycle System.																								
	Provide a network of supporting facilities and amenities designed to enhance the Regional Bicycle System and encourage the use of bicycling as a practical transportation mode.	Encourage the development and implementation of a system of supportive bicycle facilities and amenities (i.e., bicycle parking, storage, showers, system maps, etc.) within the Salem-Keizer urban area.								X																
		Encourage the development of adequate internal bicycle circulation systems at major regional activity centers.																								
		Encourage the implementation of consistent bicycle signage throughout the SKATS area.																								
Aviation System Element																										Chap 9
A regional aviation system that provides an adequate level of facilities and services to meet the needs	Encourage the provision of appropriate regional aviation system operations and facilities adequate to serve the demand associated with the residents and	Support appropriate, cost-effective improvements to the region's aviation and related facilities based on sound economic analysis.																					X			
		Support efforts to renew commercial airline service for the SKATS area as demand and financial considerations warrant																					X			
A regional aviation facility that can accommodate commercial operations as passenger demand increases	Retain the capability to support commercial airline operations as potential ridership increases	Support maintenance efforts that will preserve the region's general aviation facility in a manner that makes resumption of commercial aviation activities viable																								
A regional aviation facility with adequate multimodal access	Ensure adequate multimodal access to the regional aviation facility	Support development of an appropriate multimodal transportation infrastructure that provides adequate access to the regional aviation facility.																								
Maritime System Element																										Chap 10
None	None	None																								
Rail System Element																										Chap 11

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A regional rail system that provides an adequate level of service to passenger and freight rail consumers within the SKATS area.	Support the provision of rail service within the SKATS area that adequately addresses service demands of both passengers and freight	Encourage continued and improved rail service to and from the SKATS area.									X	X															
		Promote the enhancement of intercity passenger rail service to provide an option to workers commuting along the I-5 corridor										X															
	Promote the development and maintenance of an adequate infrastructure and facility system to support continued and improved rail service in the SKATS area.	Encourage the continued improvement of the region's existing rail infrastructure and facilities.																									
		Encourage the development and implementation of adequate infrastructure and facilities to address the needs of both passenger and freight movements in the region.																									
A safe system of regional rail transport serving the SKATS area	Support efforts to maintain and improve regional rail transportation safety by complying with federal and state rail safety standards.	Encourage improvements to the regional transportation system that enhance rail safety as well as safety between railroads and other transportation modes.																									
Efficient use of existing regional rail transporation infrastructure.	Promote the maximization of efficient use of existing regional rail transportation infrastructure	Encourage actions that maximize efficient use of existing rail infrastructure and improved service levels to address SKATS area rail transportation needs.																									
Staged infrastructure upgrades as part of the High Speed Rail Corridor Project	Support provisions of rail-related infrastructure upgrades as part of the High Speed Rail Corridor Project	Encourage infrastructure upgrades needed for the successful implementation of the High Speed Rail Project.																									
Preserve rail rights-of-way for transportation-related uses where viable	Reserve all regional rail corridor rights-of-way for transporation-related uses where viable	Designate all regional rail corridor rights-of-way as "Transportation Corridor Preserves" pending results of alignment specific suitability studies.																									
Multimodal connectivity to regional passenger rail terminal	Support improved multimodal access to regional passenger rail terminal.	Promote infrastructure upgrades to the regional passenger rail terminal.																									
		Develop and promote intercity and intracity public transportation system connections to the regional passenger rail terminal.																									
Transportation System Efficiency Element																											Chap 13
A program of transportation system efficiency management strategies and actions implemented on the regional transportation system in the Salem-Keizer urban area.	Establish a program of transportation systems efficiency management strategies and actions to be implemented on the regional transportation system.	The Regional Transportation Systems Efficiency Management Element (RTSEME) of the Regional Transportation Systems Plan (RTSP) shall establish a program of transportation systems efficiency management strategies and actions to be implemented incrementally on the regional transportation system over the 20-year planning horizon.																									
		The strategies and actions contained in the RTSEME shall be evaluated and updated on a recurring basis in order to respond to the changing mobility needs of residents and businesses in the Salem-Keizer area.																									
	Support Transportation Systems Efficiency Management (TSEM) strategies and actions on the regional transportation system that provide the greatest level of mobility for residents and businesses in the Salem-Keizer area.	Support the continued allocation of regional funds to successfully implement the Regional Rideshare Program.											X	X													
		Cooperatively seek additional revenue sources to ensure the development and implementation of TSEM strategies and actions that provide cost-effective transportation alternatives to the single-occupant vehicle and peak period travel demand.																									

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A regional transportation system that maximizes the safe and efficient utilization of existing and planned transportation capacity and infrastructure	Maximize the efficient use of existing and planned regional transportation capacity and infrastructure	Promote the implementation of Transportation Demand Management (TDM) strategies and programs in the Salem-Keizer area to reduce both reliance on the single-occupant vehicle as well as peak period vehicle demand on the regional transportation system.																								
		Promote the implementation of Transportation Systems Management (TSM) and Congestion Management System (CMS) strategies and actions to improve the operating efficiency of the existing regional transportation infrastructure in the Salem-Keizer area.															X	X								
		Implement TSEM strategies and actions in lieu of major widening projects on roadways identified as part of the regional transportation system unless significant constraints or insufficient improvements in service levels can be demonstrated.																								
		Support the efforts of implementing jurisdictions to adequately maintain and maximize the useful service life of the existing regional transportation infrastructure																								
A balanced regional transportation system that affords the residents and businesses in the Salem-Keizer area a range of viable modal options for the movement of people and	Provide a regional transportation system that employs a variety of viable modes to facilitate options in personal and commercial travel choices.	Promote the design and development of a regional transportation system infrastructure that incorporates vehicle, transit, walking, bicycling, and rideshare modes														X									
		Promote the development of land use patterns and architectural designs that facilitate multimodal travel options.																								
		Identify transportation system improvements that effectively accommodate and enhance the use of a variety of modal options.																								
A public well informed about the availability, cost, and tradeoffs of transportation and travel behavior choices in the Salem-Keizer area.	Encourage public education and information programs and activities that increase public awareness of the available transportation and travel choice options in the Salem-Keizer area.	Support the development and provision of public educational opportunities and informational materials in order to increase public awareness of transportation efficiency and travel choice options available in the SKATS region																								
For the Regional Parking Supply		Where practicable, existing on-street parking will be removed from the regional system in preference to acquiring new rights-of-way for the addition of travel lanes. Efforts shall be made to mitigate the impacts of such removals in those areas where abutting properties have no ability to provide their own supply of adequate offstreet parking or where on-street parking is needed to support an existing business district													X										
		An adequate supply of carpool and vanpool parking spaces should be provided in the region to accommodate the demand for such parking. The provision of spaces shall have preference over those intended for general purpose uses.												X												
		Jurisdictions within the region should provide for the restriction of overflow parking impacts in residential areas through the use of residential parking permit programs and other means as appropriate.																								

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		New development in the region should provide sufficient access to an appropriate supply of off-street parking subject to the standards established by the local jurisdictions within the region. Those jurisdictions are encouraged to developparking maximums that clearly reflect an intent to effectively manage the overall parking supply.																								
		Major regional activity centers should be effectively accessible by transit, bicycles,and pedestrians; should provide priority spaces for carpools when practicable; and should meet their parking requirements through a combination of shared, leased and new off-street parking opportunities, as well as automobile demand reduction strategies.																								
		Local jurisdictions within the region are encouraged to allow owners and lessees of nonresidential properties to satisfy off-street parking requirements by implementing plans that provide for and promote the increased use of modes of travel other than the automobile by both employees and customers.																								
Regional Public Transportation Element																										Chap 14
Develop and maintain a public transit system that is conveniently accessible to all Salem-Keizer urban area residents	Provide transit service throughout the urbanized portions of the Salem-Keizer area.	Ensure, as practicable, that all residents and major employers in the Salem-Keizer area have transit service within 1/4 mile walking distance.																								
Develop and maintain a public transportation system that provides convenient access for a variety of trip destinations and purposes	Provide a diverse system of transit routes that ensures convenient accessibility to destinations throughout the urban area with a minimum of transfers	Support the development and implementation of a public transit route system and support facilities that effectively combine appropriate elements of radial, feeder/trunk and circumferential service.																								
	Provide a convenient system of transfer opportunities witin the urban area to facilitate timely and convenient access to a wide variety of destinations																									
Develop and maintain a public transportation system that serves travel needs over a variety of times of day and days of the week	Provide transit service for area residents that operates over an appropriately diverse time frame.	Support prudent, incremental extensions in the hours and days of operation of the transit system.																								
Facilitate increasing levels of ridership on the public transit system	Increase overall daily ridership of the transit system	Support effective marketing and responsiveness to consumer needs of transit services in the region.																								
		Include transit operations in the design of street infrastructure and land use developments wherever practicable.																								

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	Increase the percentage of journey to work trips made by transit in the Salem-Keizer area.	Support the implementation of region wide transportation system efficiency management strategies and activities (such as employer subsidized bus pass programs) that encourage the diversion of commute trips away from the single occupant vehicle onto the public transportation system.																	X	X						
Develop and maintain a system of public transit routes that provides efficient, competitive service in the regional	Provide an efficient and convenient system of public transit services in the regional travel corridors	Encourage preferential transit treatments, transit-related facility improvements, and appropriate transit-supportive land uses and development along the regional transit corridors.																							
		Support incremental increases in the frequency and capacity of service in the regional transit corridors as warranted by demand.																							
Develop and maintain affordable transit service throughout the urban area	Develop and implement funding strategies that provide adequate, long-term, stable revenue source(s) for the public transportation system	Support regional efforts to identify and implement transit funding strategies and programs that will provide adequate, long-term, stable revenue source(s) for the public transportation system.																							
	To maintain a system of transit fares that balance the need for passenger revenues with the goal of maximizing ridership	Support ongoing review and analysis of farebox revenues, ridership levels, and service costs to optimize the transit fare structure.																	**X**	**X**						
ADA/Elderly-Related Services: Convenient, economical and safe transportation services for the disabled and elderly residents of the Salem-Keizer area	Consistent with the adopted Salem Area Transit District (SATD) Americans With Disabilities Act (ADA) Transit Plan Update, provide transportation services which adequately meet the needs of the elderly and disabled populations in the region.	Support the continued development and implementation of accessible fixed-route and appropriate complementary paratransit services which are identified in the adopted SATD ADA Transit Plan as updated.																			**X**	**X**				
Intercity Bus and Rail Service: An integrated transportation system that provides convenient service in the interregional and interstate corridors.		Support public and private efforts to develop and implement appropriate expansions of bus and rail service, including commuter rail, between the Salem-Keizer area and locations outside the region.																							
Roads and Highways Element																									Chap 15
An adequate system of regional highway facilities to serve the vehicular movements of people and goods into, out of, across, and through the Salem-Keizer urban area	Establish a system of regional highway facilities within the Salem-Keizer urban area the Regional Road System that adequately serves the "regional" vehicular movements of people and goods.	Identify, designate, and adopt as part of the RTSP the facilities that comprise the highway system of regional significance for the Salem-Keizer Urban area.																							
	Establish and maintain an accurate, up-to-date inventory of the characteristics of the Regional Road System	The Regional Road System facility inventory shall be updated on an ongoing basis to maintain currency and accuracy.																							

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An adequate level of mobility on the regional highway system for all users	Ensure adequate levels of service on the Regional Road System for the "regional" movement of people and goods	Capacity deficiency shall be considered to exist where the Level of Service (LOS) in the peak periods on a regional highway facility exceeds the E/F boundary (volume to capacity ratio > 1.0). Regional highway facilities approaching capacity deficiency shall be defined as those facilities operating within the LOS E range (volume to capacity ratio from 0.88 to 0.99) in the peak periods.															X										
		Recognize that the mobility standard for State operated facilities will be held to ODOT standards, as defined in the current Oregon Transportation Plan. As such, these may be different from the standards for the rest of the regional road system.																									
		The RTSP shall identify prudent investments necessary to improve capacity deficient segments of the Regional Road System. Capacity deficient segments for which a preferred solution cannot be identified at this time shall be considered an "outstanding issue" location or area requiring further study. Improvements on facilities that are approaching capacity deficiency that add capacity, improve the safety and/or operation of a facility, or otherwise meet the goals, objectives, and policies of the RTSP may also be recommended in the RTSP.																									
		The improvements of facilities at LOS F should be designed to provide operating characteristics within the LOS D (peak period) range, unless circumstances warrant a lesser degree of improvement.															X										
A safe system of regional highway facilities within the Salem-Keizer urban area	Maximize the safety of the Regional Highway System wherever practicable	Safety issues shall be considered a priority when comparing alternative projects for inclusion in the RTSP.																									
		Prudent investments necessary to improve current safety problems shall be identified in the regional TIP.																									
		All locations of bicycle and pedestrian accidents on the Regional Road System should be evaluated for potential safety improvements.																									
Preserve the existing facilities that comprise the regional highway system	The preservation of the existing Regional Road System should be given priority over building new facilities	Improvements related to the maintenance and preservation of existing regional facilities shall be considered a high priority.																									
		The costs associated with maintaining the existing Regional Road System at an acceptable condition shall be determined and addressed prior to the allocation of funds for new construction in the RTSP.																									
An efficient system of regional highway facilities within the Salem-Keizer urban area	Maximize the efficiency of existing and planned Regional Road System facilities wherever practicable	The Regional Road System shall utilize existing facilities and rights-of-way, using Transportation System Efficiency Management techniques to improve traffic flows to the extent practicable.																									
		Access management strategies shall be employed where appropriate on major regional arterials and above to improve safety and facilitate through-traffic flow.																									
A regional highway system that minimizes adverse neighborhood, environmental, and energy	The Regional Road System should serve to protect and minimize adverse impacts on neighborhoods and environments	In cooperation with local jurisdictions, actions to provide sufficient mobility on the regional system and/or discourage through trips on local streets will be considered in order to minimize neighborhood infiltration by "regional" travel movements.																									

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impacts associated with regional travel demand	wherever practicable	The design and construction of new regional transportation facilities shall minimize disruption to neighborhoods.																									
	The projects and programs included in the RTP should reduce regional ambient air pollutants, as required. Highway projects in the plan should be designed to not increase localized pollutants, as required, and further reduce localized pollutants whenever practicable.	The Regional Road System and recommended improvements included in the Highway Element of the RTSP shall meet the require-ments stipulated in the Clean Air Act Amendments (CAAA) of 1990 and the Oregon State Conformity Rule (OAR Section 340-20-700, et. seq.)																									
	The Regional Road System should minimize adverse effects on environmentally sensitive areas such as wetlands and endangered species habitat(s)	Analysis of potential future highway facilities shall consider potential impacts to environmentally sensitive areas. Facilities that avoid those areas shall be encouraged.																									
		The planning and construction of future highway facilities shall meet the requirements of applicable federal, state, and local environmental legislation.																									
		Facility modernization and construction improvements shall include measures for environmental remediation, where necessary.																									
	The Regional Road System should minimize adverse effects on water quality in the Salem-Keizer urban area.	Potential impacts from increased surface runoff associated with facility modernization and construction improvements shall be evaluated when comparing alternative projects for inclusion in the RTSP.																									
		Facility modernization and construction improvements shall be in compliance with all federal, state, and local water quality regulations.																									
An integrated system of regional highway facilities in the Salem-Keizer area	Integrate the Regional Road System with other transportation modes	Improvements to the Regional Road System shall be integrated with other modes where practicable to assure the opportunity for both multi and intermodal connectivity and efficiency.																									
	Integrate the Regional Road System with current and projected land uses	Regional Road System facilities and the land uses they provide access to should be functionally compatible, both currently and in the future.																									
	Ensure continuity and connectivity of the Regional Road System	The Regional Road System shall provide connectivity and continuity of travel between regional ingress and egress points and major regional destinations and activity centers to minimize out-of-direction travel and circuitous routing.																									
Regional Goods Movement Element																											Chap 8
Efficient and coordinated transport of goods into, out of, within and through the SKATS area	Provide a system of efficient and coordinated transport of goods into, out of, within, and through the region	Support continued public and private efforts to develop and enhance the efficiency of the SKATS area's goods movement transportation systems.									X						X							X			
Safe transport of goods into, out of, within, and through the SKATS area	Support private, ODOT, PUC, and law enforcement commercial vehicle safety programs (all modes)	Support private, ODOT, PUC, and law enforcement commercial vehicle safety programs (all modes).																							X		

No performance measures provided;
Quantities shown are used by SKATS for description of trends

Salem-Keizer Metropolitan Planning Organization (Mid-Willamette Valley Council of Governments)

Policy Themes	Objectives	Policies	*(No Performance Measures Specified) Quantities used to describe Trends*	% of workers walking to work (pg. 6-2; Census))	% of trips made by pedestrians (pg. 6-3)	Funding $$ Requested for Pedestrian Projects	% of workers riding a bicycle to work (pg. 7-5, Census)	% of trips made by bicycles (pg.7-1)	% of Regional Bicycle System constructed (pg.7-5)	% of bike lockers rented (pg 7-6)	# gross tons shipped by rail (pg 8-6)	# passengers boarding/ detraining at Salem Railroad Station.(pg 11-7)	# commuters participating in carpools, buspools, vanpools (pg 13-8)	# parking spaces reserved for carpools and vanpools (pg 13-8)	# parking spaces per capita (pg. 13-10)	# park and ride facilities (pg. 13-12)	automobile volume /capacity (pg 13-17, 8-11)	peak period transit volume/ capacity (pg. 13-17)	% of workers using public transportation (pg 14-3)	# of transit trips (pg 14-3)	% fleet that is accessible (pg 14-5)	# paratransit trips per year (pg 14-5)	#aircraft operations at McNary Field (pg 9-5)	# train-pedestrian incidents (pg 8-10)	# lbs of intermodal cargo loaded (pg 12-2)		REF: SKATS. RTSP 2002 Interim Update; Adopted May 28, 2002.
A goods movement system that provides a competitive advantage for SKATS area shippers whenever possible	Maximize modal options that facilitate nonpredatory competition between SKATS area commercial transportation providers	Identify and support appropriate development and expansion in services offered by commercial transportation providers.																									
Maximize access to viable, economical, alternative modes for SKATS area shippers	Provide efficient access to a range of viable, economical, alternative modes of transportation for SKATS area commercial needs	Ensure adequate goods movement system carrying capacities to adequately serve current and future needs of SKATS area shippers and transportation providers.									X																
Maximize SKATS area's exposure to international marketplace	Improve SKATS area's global goods movement capability	Support efforts to increase the range and breadth of transportation services offered in the SKATS area that have, or directly connect to, an international component.																									
Minimize negative impacts assoicated with the regional goods movement system	Reduce negative noise, emission, and safety impacts associated with goods movement related activities within the SKATS area	Encourage use of noise overlay zones in areas adjacent to air and ground transportation corridors.																									
		Clearly identify, and enforce the use of, truck routes within the SKATS area.																									
		Control, where appropriate, the operations of commercial activities so as to minimize disruption to residential land uses and peak hour arterial flows.																									
Regional Intermodal Element																											Chap 12
An integrated regional system of intermodal transportation options for SKATS area shippers	Ensure adequate intermodal opportunities to SKATS area shippers as part of the regional transportation system	Support continued improvements to provide efficient access to intermodal facilities servicing SKATS area shippers.																							X		
		Encourage efforts to maximize intermodal goods movement routing options within the region.																									
Maximize SKATS area intermodal efficiency	Provide enhanced intermodal efficiency within the region	Support appropriate development of needed intermodal freight transfer facilities in the SKATS area.																									
An integrated regional system of intermodal transportation options for	Ensure adequate intermodal opportunities to SKATS area travelers as part of the regional transportation system	Promote efficient and convenient access to intermodal facilities servicing SKATS area passengers										X															
		Maximize connectivity of intermodal travel options within the region																									
Maximize SKATS area intermodal efficiency	Provide enhanced intermodal efficiency within the region	Encourage development of consolidated intermodal passenger facilities in the SKATS area																									

No performance measures provided;
Quantities shown are used by SKATS for description of trends

	Source									Transportation Plan Policy Area										Data Type				PM Characteristic				System				
Performance Measure	NCHRP 446	NCHRP 398	TTI Urban Mobility	OTP	TransPlan	Metro RTP	SKATS	RV RTP	Other	Accessibility	Mobility	Economic Vitality	Quality of Life	Environmental Sustainability	Safety and Security	Efficiency and Affordability	System Preservation	Environmental Justice	Balance \ Adaptability	LUT Compatability	Land Use \ Econonic \ Demographic \ Environmental \ Data	Transport Sytem Data	Travel Model \ Travel Survey	Attitudinal Survey	Benchmark? (Objective)	Forecastable?	Plan Implementation (output)	Market Response (outcome)	Land Use or Combined Land Use \ Transport Measure	Highway	Transit	Ped\Bike	Air	Freight - Truck, Rail, Ship, Air
Average travel time from facility to destination (by mode)	x									1	2					7							x		x	x		x		x	x	x		
Average travel time from facility to major highway network	x									1	2					7							x		x	x		x		x				
Average travel time between intermodal facility and rail	x									1	2					7						x	x		x	x		x						x
Perceived deficiencies	x									1	2													x										
Percent of transit demand-response trip requests met	x									1	2											x			x		x				x			
Frequency of transit service	x									1	2											x			x		x				x			
Percent use of walking and bicycling for commute trips (or all trips)	x									1	2			5									x		x	x		x				x		
Percent of State residents aware of intermodal opportunities	x									1		3												x	x		x							x
Percent of wholesale and retail sales in the significant economic centers served by unrestricted (10-ton) market artery routes	x									1		3										x			x		x		x					x
Number of shipping establishments per 1,000 businesses	x									1		3									x				x		x							x
Employee-related percent of employers who have relocated for transportation reasons.	x									1		3												x	x			x	x					
Percent of employers that cite difficulty in accessing desired labor supply due to transportation.	x									1		3												x	x			x	x					
Flow time in minutes as it compares to the number of connecting transfers	x									1						7		9				x	x					x			x			
Number of projects (area and population) accessible to designated development centers	x									1						7					x	x					x		x					
Percent of transfers between modes to be under 'X' minutes and 'N' feet	x									1						7		9				x	x		x		x	x			x			
Worktrips completed per vehicle hour or commute travel	x									1			4			7									x	x		x		x				
Percent of region's mobility-impaired who can reach specific activities by public transportation or by walking/wheelchair	x									1			4								x	x	x		x			x	x			x		
Average number of hours spent traveling	x									1			4										x		x	x		x	x					
Customer perception of quality of transit service	x									1			4											x				x			x			
Accessibility index (STEAM?)	x									1													x			x		x	x					
Average trip length	x									1													x			x		x	x					
Number of miles with intelligent transportation service	x									1												x					x							
Number of new rest areas constructed v. planned	x									1												x			x		x			x				
Number of Trunk System lane miles planned v. completed	x									1												x			x		x							
Total freeway lane-miles (or per capita or per measure of regional business volume or per square mile or truck VMT)	x									1												x			x		x			x				x
Total freeway lane-miles in acceptable condition (or per capita or per measure of regional business volume or per square mile or truck VMT)	x									1												x			x		x			x				x
Mode split by facility or route	x									1				5		7							x			x		x			x	x		
Overall mode split	x									1				5									x			x		x			x	x		
Percent of users with option of more than one modal choice	x									1												x	x			x	x		x					
User identification of access issues	x									1														x			x							
Existence of railroad electrification	x									1											x	x					x							x
Air transportation capacity	x									1												x			x		x					x		
Airport improvement and cost scheduled at airports	x									1												x					x					x		
Airports within a 30-minute drive of agricultural centers capable of supporting twin engine piston powered aircraft	x									1		3										x					x					x		
Amount of scheduled service between major cities	x									1		3										x			x		x					x		
Number of cities over 1 million population served directly by nonstop commercial airline flights from airports in state	x									1		3										x			x		x					x		
Percent of aviation community reached through aviation service programs	x									1		3										x					x					x		
Percent of general aviation needs funded	x									1		3										x			x		x					x		
Percent of manufacturing industries within 30 miles of interstate or four lane highway	x									1		3									x	x			x		x		x					x
Availability of real-time cargo information	x									1		3										x					x							x
Capacity of package express carriers	x									1		3									x						x							x
Number of package express carriers	x									1		3									x						x							x
Percent of goods moved with option of more than one modal choice	x									1		3									x	x					x							x
Average circuity for truck trips of selected O-D pattern	x									1		3										x						x	x					x
Bridge weight limits	x									1		3										x			x		x							x
Geometrics of connector link	x									1		3										x					x							x
Number of overload permits rejected due to structural capacity deficiency	x									1		3										x					x							x
Number of structures with vertical (or horizontal) clearance less than X ft.	x									1		3										x					x							x
Number of truck-days of highway closure on major freight routes	x									1		3										x					x							x
Percent of truck highway bridges sufficient in load capacity, vertical and horizontal clearance	x									1		3										x					x							x

	Source									Transportation Plan Policy Area										Data Type				PM Characteristic				System				
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Percentage of highway system with bridges that structurally deficient or functionally obsolete	x									1		3										x			x		x						x
Sufficiency rating (percent bridges meeting federal sufficiency rating)	x									1		3										x			x		x						x
Amount of turning radius from major highway to intermodal facility	x									1		3										x					x						x
Average distance to intermodal terminals from different community shipping points	x									1		3										x	x				x		x				x
Capacity of intermodal terminals	x									1		3										x			x		x						x
Number of intermodal facilities	x									1		3										x			x		x						x
Number of T.E.U.'s (10'x 21') (or railroad cars or containers) that can be stored on the premises of the intermodal facility	x									1		3										x			x		x						x
Number of trucks that can be loaded with bulk material per hour of loading time	x									1		3										x					x						x
Number of intermodal facilities that agency assists in development	x									1		3										x					x						x
Number of ports with railroad connections	x									1		3										x					x						x
Percent of population that can reach specified services by transit, bicycle, or walk	x									1											x		x		x	x		x	x		x		
Existence of handicap access to all areas	x									1												x					x						
Percent of elderly and disabled persons with special transit service available	x									1											x	x			x		x			x			
Percent of transit dependent population served	x									1											x	x			x		x		x	x			
Percent of transit facilities accessible to handicapped	x									1												x			x		x			x			
Connectivity deficiency	x									1								9				x	x					x					
Transfer distance	x									1								9				x					x						
Number of counties in State with county-wide transit systems	x									1												x			x		x			x			
Number of transit systems in State	x									1												x			x		x			x			
Percent of population with access to (or within 'X' miles of) transit (or fixed route transit) service	x									1											x	x			x		x		x	x			
Percent of rural population with access to transit service	x									1											x	x					x		x	x			
Percent of urban and rural areas with direct access to passenger rail and bus service	x									1											x	x					x			x			
Percent of workforce that can reach worksite in transit within one hour, and with no more than two transfers	x									1											x		x					x	x	x			
Access time to passenger facility	x									1												x					x			x			
Percent of total transit trip time spent out of vehicle	x									1													x		x	x		x		x			
Route spacing	x									1												x			x		x			x			
Route-miles (or seat-miles or passenger miles) of transit service (or per capita or per employee or per licensed driver)	x									1											x	x			x		x			x			
Availability of intermodal ticketing and luggage transfer	x									1												x					x			x			
Existence of information services and ticketing	x									1												x					x			x			
Transfer distance at passenger facility	x									1												x					x			x			
Number of pick up and discharge areas for passengers	x									1												x					x			x			
Percent of rail station parking lots with mid-day spaces available	x									1												x						x		x			
Parking spaces available loading/unloading by autos	x									1												x					x			x			
Parking spaces per passenger	x									1												x						x		x			
Utilization rate of parking spaces during daily peak hours for bus, rail, park and ride or other passenger terminal lots	x									1												x			x			x		x			
Percent of population within 5 miles or 10 minutes of state-aided public roads	x									1											x	x			x		x		x	x			
Number of miles of non-motorized facilities	x									1				5								x			x		x				x		
Minimum layover times at airports or passenger terminals	x									1												x			x		x					x	
Percent jobs within 45 minutes of airports	x									1											x	x			x		x		x			x	
Tonnage moved on various transportation components (by mode)	x										2	3										x						x					x
Traffic at border crossings	x										2	3										x						x					x
Cost/benefit of existing facility v. new construction	x										2					7			10		x	x			x								
Average speed	x										2					7						x	x		x	x		x					
Total travel time (by mode)	x										2					7							x			x		x		x	x	x	
Delay time at primary commercial airports	x										2					7						x						x				x	
Origin-destination travel times (by mode)	x										2					7							x			x		x		x	x	x	
Average daily traffic per freeway lane	x										2					7						x	x			x		x					
Number of people provided service at travel information centers	x										2					7						x						x					
Line haul speed	x										2					7						x						x					x
Average processing time for shipments at intermodal terminals	x										2					7						x			x			x					x
Average transfer time/delays	x										2					7						x					x						x

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Delay of trucks at facility per ton-mile	x										2					7						x			x			x					x
Delay of trucks at facility per VMT	x										2					7						x			x			x					x
Freight carrier (or local shippers) appraisal of quality of highway service in terms of travel time/speed, delay, circuity, scheduling convenience	x										2					7								x				x					x
Facility usage by mode (V/C)	x										2					7						x			x	x		x		x	x	x	x
Average commuting time for urban population	x										2					7						x	x		x	x		x		x	x	x	
Cost of an intermodal trip as a percent of cost of auto use	x										2					7					x				x		x						
Percent of workers who work at home because of transportation cost or level of service	x										2					7							x					x					
Average wait time to board transit (or between modes)	x										2					7						x			x			x			x		
V/C for bicycle and pedestrian facilities	x										2					7						x			x			x				x	
Lost time due to congestion	x										2		4										x		x	x		x					
Customer perception of satisfaction with commute time	x										2		4											x				x					
Travel time between major cities	x										2												x					x					
Delay due to incidents	x										2											x			x			x					
Delay per VMT (by mode)	x										2												x		x			x		x	x		
Interference of movement at grade crossings—delay time and speed	x										2											x						x					
Intersection LOS	x										2											x	x		x			x		x			
LOS	x										2											x	x		x			x		x			
Number and percent of lane-miles congested	x										2											x	x		x	x		x		x			
Percent of highways not congested during peak hours	x										2											x	x		x			x		x			
Percent of VMT at LOS 'X'	x										2											x	x		x	x		x		x			
Percent of VMT which occurs on facilities with V/C greater than 'X'	x										2											x	x		x	x		x		x			
Percentage of time average speed is below threshold value	x										2											x	x		x	x		x		x			
Queuing of vehicles (including rail) and its relationship to overall delays	x										2											x						x		x			
Reserve capacity	x										2											x			x	x		x		x			
Travel time under congested conditions	x										2											x	x		x	x		x		x			
V/C ratio	x										2											x	x		x	x		x		x			
VMT by congestion level	x										2											x	x		x	x		x		x			
Average daily traffic	x										2											x	x		x	x		x		x			
Total VMT	x										2											x	x		x	x		x		x			
VHT per capita	x										2										x	x	x		x	x		x		x			
VHT per employee	x										2										x	x	x		x	x		x		x			
VMT growth rate relative to population, employment	x										2										x	x	x		x	x		x		x			
VMT per capita	x										2										x	x	x		x	x		x		x			
VMT per employee	x										2										x	x	x		x	x		x		x			
VMT within urban areas	x										2											x	x		x	x		x		x			
Fluctuations in traffic volumes	x										2												x					x		x			
Minute variation in trip time	x										2												x					x		x	x		
Percentage of scheduled departures that do not leave within a specified time limit	x										2											x						x			x		
Percentage on-time performance	x										2											x			x			x			x		
Travel time contours	x										2											x	x			x		x		x	x		
Mode split	x										2											x	x		x	x		x			x	x	
Percent of change in mode splits	x										2												x		x	x		x			x	x	
Modal Interchange	x										2												x					x		x	x	x	
Number of users of intermodal transfer facilities	x									1						7							x					x				x	x
Transfer time between modes	x										2												x					x			x		
LOS at intersections serving facility	x										2											x						x		x			
LOS on facility access roads	x										2											x						x		x			
Time to access intermodal facilities	x										2											x	x					x		x	x		
V/C on facility access roads	x										2											x						x		x			
Customer perception of ease of travel through highway construction areas	x										2													x				x		x			
Customer perception of time it takes to drive through highway construction areas	x										2													x				x		x			
Customer perception of time it takes to travel to places people/goods need to go	x										2													x				x		x			
Dollar value of projects that improve travel time on key routes	x										2										x	x					x		x	x			x

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Capacity restrictions	x										2											x							x	x			x
Delay per ton-mile traveled (by mode)	x										2											x						x					x
Miles of freight routes with adequate capacity	x										2											x					x						x
Percent lane-miles which are truck priority (or excluded)	x										2											x					x						x
Ton-miles of rail freight into/through metropolitan areas	x										2											x						x					x
Ton-miles traveled by congestion level	x										2											x			x	x		x					x
Truck delivery and loading interference with street traffic	x										2											x						x					x
Truck VMT by light duty, heavy duty, and through trips	x										2											x				x		x					x
Customs delays	x										2											x											x
Dwell time at intermodal facilities	x										2											x											x
Frequency of delays at intermodal facilities	x										2											x											x
Tons of commodity undergoing intermodal transfer	x										2											x											x
Truck turnaround time at intermodal terminals	x										2											x											x
Average cost (or speed) for a sample of shipments	x										2											x			x			x					x
Number of dockage days at seaports	x										2											x											x
In-vehicle travel time	x										2											x						x		x	x		
PMT by congestion level	x										2											x			x	x		x		x			
Proportion of persons delayed	x										2												x					x		x			
Number non-work trips	x										2												x			x		x		x			
Passenger-trips per household	x										2												x					x		x			
PHT	x										2											x	x		x	x		x		x	x		
PMT per capita	x										2											x	x		x	x		x		x	x		
PMT per worker	x										2										x		x		x	x		x		x	x		
Vehicle-trips per household	x										2												x		x	x		x		x			
Percent of passengers traveling under five miles made by means other than SOV	x										2												x		x	x		x		x	x		
Percent of workers who work at home	x										2												x					x					
Percent trips with transit advantage	x										2											x									x		
Mobility index (person-miles (or ton-miles) of travel/vehicle-miles of travel (PMT/VMT) times average speed)	x										2											x			x	x		x		x			
Percent lane miles of recreational routes operating below LOS D	x										2											x			x	x		x		x			
Vehicle ownership, demand per licensed driver (or worker)	x										2											x			x	x		x		x			
Number of commuters using transit park and ride facilities	x										2											x	x		x	x		x			x		
Number of demand response trip requests	x										2											x						x			x		
Number of public transportation trips	x										2											x	x		x	x		x			x		
On-time performance of transit	x										2											x			x						x		
Passengers per capita within urban service area	x										2											x			x	x		x			x		
Bicycles per boarding	x										2											x						x			x	x	
Property damage accidents/vehicle miles traveled	x											3			6							x			x			x		x			
Percent of region's unemployed or poor that cite transportation access as a principal barrier to seeking employment	x											3	4					9						x				x	x				
Direct jobs supported (or created)	x											3									x							x					
Economic costs of accidents	x											3			6						x	x			x					x			
Economic costs of congestion	x											3									x	x			x					x			
Economic costs of fatalities	x											3									x	x			x					x	x	x	
Economic costs of lost time	x											3									x	x			x								
Economic costs of pollution	x											3									x	x			x								
(Transport Costs as) Percent of state gross product	x											3									x				x								
Indirect jobs supported (or created)	x											3									x				x								
Business volume by commodity group	x											3									x												x
Economic indicator for goods movement	x											3									x												x
Market share of international or regional trade by mode	x											3									x				x			x					x
Percent increase in intermodal facilities use	x											3									x												x
Percent of manufacturers/shippers have relocated for transportation purposes	x											3											x					x	x				x
Price index for selected local delivery service	x											3											x										x
Tonnage originating and terminating	x											3									x												x

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Economic indicator for people movement	x											3																					
Number of cruise embarkations	x											3										x											
Percent of population that perceives that its environment has become more 'livable' over the past year with regard to ability to access desired activities	x												4	5										x									
Sprawl: difference between change in urban household density and suburban household density	x												4	5							x						x	x					
Customer perception of satisfaction with air quality	x												4	5										x			x						
Number of days that Pollution Standard Index is in unhealthful range	x												4	5							x												
Number of urban areas (or population in areas) classified as nonattainment status	x												4	5							x												
Tons of pollution (or vehicle emissions) generated	x												4	5									x		x	x		x		x			
Number of noise receptor sites above threshold	x												4	5							x				x								
Number of residences exposed to noise in excess of established thresholds	x												4	5				9			x				x				x				
Percent of population exposed to levels of highway noise above 60 decibels	x												4	5				9			x				x				x	x			
Customer perception of amount of salt used on trunk highways	x												4	5										x				x		x			
Customer perception of satisfaction with transportation decisions which impact the environment	x												4	5										x				x					
Number of archeological and historical sites that are not satisfactorily addressed in project development before construction begins	x												4	5							x												
Customer perception of safety while in travel system	x												4		6									x				x					
Percent of population which perceives that response time by police, fire, rescue or emergency services has become better or worse, and whether that is due to transportation factors	x												4		6									x				x	x				
Accidents (or injuries or fatalities)/PMT	x												4		6							x	x		x			x		x			
Accidents (or injuries or fatalities)/VMT	x												4		6							x	x		x			x		x			
Customer perception of promises kept on project completion	x												4			7								x				x					
Customer perception of satisfaction with completed projects	x												4			7								x				x					
Customer perception of satisfaction with involvement in pre-project planning	x												4					9						x				x					
Compliance with affirmative action goals	x												4					9			x				x								
Number of accidents involving hazardous waste	x													5	6								x					x					x
Average fuel consumption per trip for selected trips (or shipments)	x													5		7							x		x	x		x		x			x
Modal Interchange [[??]]	x													5		7																	
Air quality rating	x													5							x				x			x					
Amount of recycled material used in road construction	x													5							x						x		x				
Amount of salt used on roadways [[output measure?]]	x													5							x						x		x				
Amount of salt used per VMT [[output measure?]]	x													5							x						x		x				
Average miles per gallon (MPG)	x													5									x		x			x		x			
Constraints to utilization due to noise (hours of operation)	x													5																			
Constraints to utilization due to water (dredge fill permits)	x													5																			
Environmentally friendly partnership projects per year	x													5							x												
Fuel consumption per PMT	x													5									x		x	x		x	x	x			x
Fuel consumption per ton-mile traveled	x													5									x		x	x		x	x	x			x
Fuel consumption per VMT	x													5									x		x	x		x	x	x			x
Fuel usage	x													5									x		x	x		x	x	x			x
Highway emissions levels within non-attainment areas	x													5							x	x			x	x		x	x				
Number and miles of 'nature' routes [[??]]	x													5																			
Number of environmental problems to be taken care of with existing commitments	x													5																			
Number of pipeline spills	x													5											x								
Number of transportation control measures (TCMs) accomplished v. planned	x													5											x		x			x	x	x	
Percent of region which is developed	x													5							x				x				x				
Percent of vehicles using alternative fuels	x													5								x			x			x		x			
Public transportation passenger-miles/ total vehicle-miles	x													5								x	x		x	x		x		x			
The degree to which pipeline spills and accidents are minimized	x													5	6																		
Tons of greenhouse gases generated	x													5							x				x	x		x					
VMT/speed relationships	x													5											x	x		x					
Percentage of state truck highway system rated good or better	x														6		8					x											x
Ratio of number of transit incidents to investment in transit security	x														6	7						x								x			
Accident rate, deaths, injury, property loss by type of corridor	x														6							x			x								
Alcohol-related fatal accidents/all fatal accidents	x														6							x			x								

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Average accident cost per trip	x														6							x	x		x			x		x			
Fatality (or injury) rate of accidents	x														6																	
Hazard index (calculated based on accidents per VMT by severity)	x														6										x							
National rank for accident, injury, fatality rates	x														6							x			x			x		x			
Number of accidents per capita	x														6						x	x			x			x		x			
Number of accidents per intermodal movement	x														6							x			x			x		x			
Number of accidents per per ton-mile traveled	x														6							x			x			x					x
Number of accidents per trip	x														6							x			x			x		x			
Number of accidents per VMT	x														6							x			x			x		x			
Number of accidents per year	x														6							x			x			x		x			
Accident risk index ('Safety Index')	x														6							x			x					x			
Number of high accident (or hazardous) locations	x														6							x			x			x		x			
Number of safety related improvements	x														6							x			x		x			x			
Average duration of incidents	x														6							x			x			x		x			
Response time to incidents	x														6							x			x		x			x			
Number of safety related complaints	x														6									x				x		x			
Number of Statewide traffic accidents (or injuries or fatalities)	x														6							x			x			x		x			
Accidents related to bridge characteristics	x														6							x						x		x			
Customer satisfaction with snow/ice removal	x														6									x				x		x			
Number of highway miles driven at high accident locations	x														6							x			x	x		x		x			
Percent highway miles built to target design and operational standards to handle traffic at a steady 55 mph rate	x														6							x			x		x			x			
Percent of vehicle crashes on highway system where roadway related conditions were listed as a contributing factor	x														6							x			x			x		x			
Roadway sections not meeting safety standards	x														6							x			x		x			x			
Number (or percent) of highway miles driven above speed limit	x														6							x						x		x			
Number (or percent) of motorists driving under the influence of alcohol or drugs	x														6							x						x		x			
Number of accidents in which speed or traffic violation is a factor	x														6							x						x		x			
Percent of drivers complying with seat belt law	x														6								x					x		x			
Construction fatalities/dollars of construction cost (or per 100 highway related crew)	x														6							x			x			x		x			
Number of accidents occurring in highway construction zones	x														6							x						x		x			
Average response time for emergency services	x														6						x				x					x			
Percentage of emergency road calls that get through to state highway agency	x														6							x											
Accidents (or injuries or fatalities) per 1,000 vehicles at park and ride lot	x														6							x								x			
Crime at rest areas and other facilities	x														6						x												
Lighting and security staff at parking areas	x														6						x												
Percentage of parking areas that are secured	x														6						x									x			
Accidents at major intermodal crossings	x														6							x						x		x			x
Exposure (AADT and daily trains) factor for rail crossings	x														6							x			x			x		x			x
Grade crossing safety improvements (MI)	x														6							x											x
Number of fatalities and injuries occurring on the rail system	x														6																		x
Railroad/highway at-grade crossings	x														6																		x
Crimes per 1,000 passengers	x														6						x	x						x					
Number of intercity bus and rail accidents	x														6															x			
Transit accidents (or injuries or fatalities)/PMT	x														6							x			x			x			x		
Transit accidents (or injuries or fatalities)/VMT	x														6							x			x			x			x		
Number of commercial vehicle safety inspections performed [[output measure?]]	x														6										x		x						x
Number of commercial vehicles weighed (by fixed and portable scales) [[output measure?]]	x														6										x		x						x
Percent of commercial vehicles that pass safety inspections	x														6										x			x					x
Percent of commercial vehicles weighed that are overweight (by fixed and portable scales)	x														6										x			x					x
Percent of traffic on regional highway which is heavy truck	x														6							x			x	x		x					x
Bicycle accidents (or injuries or fatalities) per bicycle-mile of travel	x														6							x			x			x			x		
Joint-use bicycle crossings	x														6																x		
Number of pedestrian accidents (or injuries or fatalities)	x														6							x			x			x			x		
Use of safety equipment by bicyclists	x														6							x									x		

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Accidents (or injuries or fatalities) caused by air transportation	x														6							x										x	
Accidents (or injuries or fatalities) caused by waterborne transportation	x														6							x										x	
Number of airports where weather information is collected for dissemination to pilots	x														6							x										x	
Number of landing areas inspected	x														6							x										x	
Number of weather products provided to pilots on computer weather terminals	x														6																	x	
Percentage of airports that meet federal and State planning and design standards	x														6																	x	
Shipping accidents occurring on waterways	x														6																		x
Total annual attendance at pilot safety seminars	x														6																	x	
Maintenance cost of connector link	x															7	8																
Dollar value of flexible federal funding programmed for non-highway projects	x															7					x				x		x				x	x	
Percent variances between actual versus predicted DOT revenues	x															7					x												
Private cost for transportation system	x															7						x			x								
Public cost for transportation system	x															7						x			x								
Total public expenditures on modal systems (freight v. passenger)	x															7						x			x		x						
Administrative costs as a percent of total program	x															7						x			x								
Administrative, engineering and construction cost/person- (or ton)mile (owner cost)	x															7																	
All engineering costs/construction funds	x															7																	
Average cost per lane-mile constructed	x															7						x			x								
Construction Productivity Index (Cost of contract lettings, utilities, real estate acquisition, construction, change orders, and cost overruns DIVIDED BY staff costs, consultant contracts, and design construction change orders)	x															7						x											
Cost per percentage point increase in lane miles rates fair or better on pavement condition	x															7						x			x	x		x				x	
Data center costs as percentage of total program	x															7						x			x								
Dollar allotment and percent of department funds consumed by overhead	x															7						x			x								
Dollar allotment and percent of funds going to non-engineering activities	x															7						x			x								
Dollar allotment and percent of trunk highway funds going to construction	x															7						x			x					x			
Number and dollar value of projects jointly funded	x															7						x											
Number and dollar value of projects that improve travel time on key routes	x															7						x											
Partnership benefits (to taxpayers and partners)	x															7						x											
Percent cost of re-work	x															7						x			x								
Percentage increase in final amount paid for completed construction over original contract amount	x															7						x			x								
Proportion of infrastructure investment from private sources	x															7						x			x								
Savings to taxpayers/public from partnerships	x															7					x				x								
Unprogrammed construction costs as a percentage of total construction costs	x															7						x			x		x						
Infrastructure maintenance expense	x															7						x			x		x						
Operational cost per toll transaction	x															7						x			x		x						
Additional costs per trip (user fees)	x															7						x	x		x			x					
Average cost per mile	x															7			10			x	x		x			x					
Average cost per trip	x															7			10			x	x		x			x					
Insurance costs	x															7							x					x					
Reduced costs per trip (subsidies)	x															7							x					x					
Use cost/person-mile (user cost)	x															7							x					x					
Value of fuel savings	x															7							x					x					
Vehicle operating cost reductions	x															7							x					x					
Average days to complete driver licensing or vehicle registration transactions	x															7						x			x					x			
Percent of invoices processed within five days of receipt	x															7					x				x					x			
Percentage increase in number of days required for completed construction contracts over original contract days	x															7					x												
Units of work completed per hour worked [[output measure?]]	x															7					x												
Hours of incident related delay on highway system	x															7						x											
Speed limits and difference between modes	x															7						x			x		x	x		x	x	x	
Number of projects applying technology developed or available in last 'X' years	x															7																	
Percent of error free data in IMS database	x															7																	
Percent of projects rated good to excellent in quality audits	x															7						x			x								
Percent projects requiring few or no significant change orders due to plan errors	x															7						x			x								

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Percent projects with no premature maintenance problems	x															7						x			x								
Percentage of information and data exchanged between intrastate agencies	x															7					x												
Transactions completed per motor vehicle division employee	x															7					x	x			x								
Vehicle-miles traveled per highway department employees	x															7					x	x			x					x			
Number of toll transactions	x															7						x								x			
Percent of highway tolls pre-paid	x															7						x								x			
Percent of lane miles with toll pricing	x															7						x								x			
Performance of State roads based on HPMS ratings	x															7						x			x					x			
Ton/miles per gallon of fuel	x															7						x						x					x
V/C by route	x										2					7						x	x		x	x		x		x			
VMT per mile of roadway	x															7						x	x		x	x		x					
Management/employee satisfaction communication of agency goals	x															7								x									
Management/employee satisfaction with diversity efforts	x															7								x									
Management/employee satisfaction with progress toward targeted focus area	x															7								x									
Percent of customers satisfied with licensing and registration process	x															7								x									
Overall mode splits	x															7							x		x	x		x		x	x	x	
Number of users of intermodal facilities	x															7						x											
Percent of intermodal connecting points and facilities accurately placed on a map	x															7						x											
Additional revenue earned by producers when shipping via rail	x															7						x											x
Average transfer costs	x															7						x											x
Cost by commodity	x															7						x											x
Cost per fuel-mile as it compares to cost per air (or water or rail) mile	x															7						x											x
Cost per ton of freight shipped	x															7						x											x
Cost per ton-mile by mode	x															7						x											x
Rail freight revenue versus operating expenses	x															7					x	x											x
Ratio of oversize/overweight permit fees collected to dollar value of damage caused	x															7					x	x			x								x
Revenue per ton-mile by mode	x															7						x			x								x
Shipping cost per shipment	x															7																	x
Customs and administrative processing time	x															7																	x
Hours of access lost	x															7																	x
Tons transferred per hour	x															7						x			x								x
Mode split (by ton-mile)	x															7						x			x			x					x
Number of carloads shipped/received on rail project lines	x															7																	x
Number of restricted routes, additional mileage, increased costs	x															7																	x
Percentage of street traffic delivered off-peak	x															7						x			x			x		x			x
Productivity and utility by mode	x															7																	x
Proportion of freight traffic at facility on portion of network	x															7																	x
Regional truck VMT per unit of regional economic activity/output	x															7					x	x			x								x
Change in commute travel person-miles and vehicle-miles per telecommuting occasion	x															7							x					x					
Demand service elasticities for auto v. transit	x															7															x		
Demand service elasticities for work v. non-work	x															7															x		
Percent of work trips that are SOV	x															7							x		x	x		x		x			
Percentage of all trips made by bicycling and walking	x															7																	
Tourist/recreation area utility by mode	x															7																	
Average vehicle occupancy	x															7						x	x		x	x		x		x			
Cost per vehicle for parking fees	x															7						x											
Percent of vehicles using high-occupancy lanes	x															7							x		x	x		x		x			
Percent of workers who have free parking at employment sites	x															7							x							x			
Percent of workers who have paid parking at employment sites	x															7							x							x			
VMT/PMT	x															7							x		x	x		x		x			
Cost passenger in rural areas	x															7						x			x						x		
Cost per passenger for urban transit systems	x															7						x			x						x		
Cost per PMT for urban transit systems	x															7						x			x						x		
Cost per PMT in rural areas	x															7						x			x						x		

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Cost per revenue-mile for urban transit systems	x															7						x			x								x
Cost per revenue-mile in rural areas	x															7						x			x								x
Cost per VMT for urban transit systems	x															7						x			x								x
Cost per VMT in rural areas	x															7						x			x								x
Fare recovery rate of urban transit systems	x															7						x			x			x					x
Grant dollars per transit trip	x															7						x			x			x					x
Total transit operating expenditures per transit-mile	x															7						x			x			x					x
Intercity rail and bus service ridership	x															7						x											x
PMT on intercity rail and bus service	x									1						7						x											x
Riders at maximum load point	x															7																	x
Ridership per VMT in rural areas	x															7									x			x					x
Rural service passengers	x															7						x			x			x					x
Transit passengers per capita	x															7					x	x			x	x		x					x
Transit peak-load factor	x															7						x			x	x		x					x
Transit riders per gallon of fuel	x															7						x			x			x					x
Transit riders per revenue-mile	x															7						x			x	x		x					x
Transit riders per route-mile	x															7						x			x	x		x					x
Transit riders per VMT	x															7						x			x	x		x					x
Transit ridership per capita	x															7					x	x			x	x		x					x
Transit ridership to capacity ratio	x															7						x			x	x		x					x
Number of peak period transit vehicles	x															7						x					x						x
Revenue vehicle hours per transit employee	x															7						x			x		x						x
Average cost for vehicle on ferry system	x															7						x			x			x		x			x
Enplanements per aviation system employee	x															7						x			x			x		x			x
Alignment (number of curves/grades defined as excessive by HPMS)	x																8					x							x				
Distribution of miles in PSC intervals	x																8					x							x				
Highway performance based on HPMS	x																8					x			x				x				
Maintenance condition as measured against departmental standards	x																8					x			x				x				
Percent of roadway/bridge system below standard condition	x																8					x			x				x				
Percent of VMT on roads with deficient ride quality	x																8					x			x			x					
Age distribution of transit vehicles	x																8					x			x		x			x			
Capacity/Remaining useful life index	x																8					x			x					x			
Present serviceability rating	x																8					x			x					x			
Remaining service life of transit vehicles	x																8					x			x					x			
Distress extent/severity by type (pavement)	x																8					x			x				x				
Distress index	x																8					x			x				x				
Joint condition	x																8					x							x				
New composite index incorporating roughness and distress (pavement)	x																8					x			x				x				
Pavement quality index	x																8					x			x				x				
Percent of lane-miles by pavement condition	x																8					x			x				x				
Percentage of highway mainline pavement rated good or better	x																8					x			x				x				
Remaining life of pavement	x																8					x							x				
Roughness/ride index (IRI)	x																8					x			x				x				
Rut depth	x																8					x							x				
Skid/friction	x																8					x							x				
Tons of asphalt placed by maintenance crews	x																8					x							x				
Accidents related to bridge characteristics [[Safety Measure?]]	x														6							x							x				
Backlog of repairs by different priority categories (bridges)	x																8					x							x				
Deck chloride content (bridges)	x																8					x							x				
Element condition state distributions (Pontis) (bridges)	x																8					x							x				
Paint distress (bridges)	x																8					x							x				
Percentage of highway mainline bridges rated good or better	x														6		8					x			x				x				
Railings below standard (bridges)	x																8					x							x				
Scour criticality (bridges)	x																8					x											

	Source									Transportation Plan Policy Area											Data Type				PM Characteristic				System				
Performance Measure	NCHRP 446	NCHRP 398	TTI Urban Mobility	OTP	TransPlan	Metro RTP	SKATS	RV RTP	Other	Accessibility	Mobility	Economic Vitality	Quality of Life	Environmental Sustainability	Safety and Security	Efficiency and Affordability	System Preservation	Environmental Justice	Balance \ Adaptability	LUT Compatability	Land Use \ Econonic \ Demographic \ Environmental \ Data	Transport Sytem Data	Travel Model \ Travel Survey	Attitudinal Survey	Benchmark? (Objective)	Forecastable?	Plan Implementation (output)	Market Response (outcome)	Land Use or Combined Land Use \ Transport Measure	Highway	Transit	Ped\Bike	Air	Freight - Truck, Rail, Ship, Air
Steel bridges with section loss in a member (bridges)	x																8					x							x				
Miles of roadway not useable by certain traffic because of design or condition deficiencies	x																8					x			x					x			
Pavement condition on links to intermodal facilities	x																8					x											x
Percent of road system carrying unrestricted loads year round	x																8					x			x								x
Miles of highway rated 'good' or 'fair' for bicycle travel	x																8					x			x						x		
Miles of rail line acquired and rehabilitated for rail service	x																8					x			x								x
Miles of track in operation (by FRA rating)	x																8					x			x								x
Miles of track not useable by certain traffic because of design or condition deficiencies	x																8					x			x								x
Track condition	x																8					x											x
Track-miles abandoned	x																8					x			x								x
Track-miles under threat of abandonment	x																8					x			x								x
Miles between road calls for transit vehicles	x																8					x			x					x			
Miles to be dredged	x																8					x			x								
Number of state owned navigational aids	x																8					x											
Runway resurfacing frequency (airports)	x																8					x			x								
Backlog of repairs by different priority categories	x																8					x											
Customer perception of amount of work being done to improve system	x																8					x		x				x					
Customer perception of condition of system	x																8					x		x				x					
Hours (or days) out of service (for roads or bridges or transit equipment or airports)	x																8					x								x			
Missed trips due to operation failures	x																8					x											
Number of deficiencies corrected vs. number remaining	x																8					x											
Number of Right-of-Way parcels acquired	x																8					x											
System condition	x																8					x											
Maintenance hours	x																8					x											
Number of bridges let to contract for repair (or replacement)	x																8					x											
Number of lane miles let to contract for capacity improvements	x																8					x											
Number of lane miles let to contract for resurfacing	x																8					x											
Number of projects certified ready for construction	x																8					x											
Number of transit (or rail or aviation or intermodal) projects funded (capital and operating)	x																8					x								x			x
Percent of contracts planned for letting that were actually let	x																8					x											
State (or federal) construction (or maintenance) grants issued	x																8					x											
Agency and user cost of doing nothing or cost-benefit of MR&R (Pontis) (bridges)	x																8				x	x											
Current average maintenance costs	x																8					x											
Expenditures for freight rail	x																8					x											x
Expenditures to retire deficiencies	x																8					x											
Net present value of future transit vehicle (or facility or bridge or pavement), equipments and facility capital, operating and maintenance costs	x																8					x								x			
Non-motorized expenditures	x																8					x			x								
Percent of budget allocated to system preservation activities	x																8					x											
Congested Miles of Travel (% of total VMT)					x						2											x	x		x	x		x		x			
Network Vehicles Hours of Delay (daily)					x						2											x	x		x	x		x		x			
% Transit Mode Share on Congested Corridors					x					1	2											x	x		x	x		x		x			
Internal VMT (no commercial vehicles)					x					1												x	x			x		x		x			
Internal VMT/Capita					x					1						7						x	x		x	x		x		x			
Average Trip Length (miles)					x					1						7							x		x	x		x					
% Person Trips Under 1 mile					x					1				5									x		x	x		x					
Walk Trips					x					1				5									x			x		x			x		
Shared Ride (2 or more)					x					1				5									x			x		x		x			
Drive Alone					x					1													x			x		x		x			
Person Trips per Auto Trip					x											7							x		x	x		x		x			
Average Fuel Efficiency (VMT/Gal.)					x									5		7							x		x			x		x			
CO Emissions (Weekday Tons)					x									5									x		x			x		x			
% of dwelling units built in nodes*					x					1											x				x			x	x				
% of New "Total" Employment in Nodes*					x					1											x				x			x	x				

Performance Measures Compendium

	Source									Transportation Plan Policy Area										Data Type				PM Characteristic				System				
Performance Measure	NCHRP 446	NCHRP 398	TTI Urban Mobility	OTP	TransPlan	Metro RTP	SKATS	RV RTP	Other	Accessibility	Mobility	Economic Vitality	Quality of Life	Environmental Sustainability	Safety and Security	Efficiency and Affordability	System Preservation	Environmental Justice	Balance \ Adaptability	LUT Compatability	Land Use \ Econonic \ Demographic \ Environmental \ Data	Transport Sytem Data	Travel Model \ Travel Survey	Attitudinal Survey	Benchmark? (Objective)	Forecastable?	Plan Implementation (output)	Market Response (outcome)	Land Use or Combined Land Use \ Transport Measure	Highway	Transit	Ped\Bike	Air	Freight - Truck, Rail, Ship, Air
% of Roadway miles with Sidewalks					x					1												x			x		x					
Ratio of Bikeway to Arterial and Collector Miles					x					1						7						x			x		x				x	
% of Roadways in Fair or Better Condition					x												8					x			x	x	x					
% of Households Within ¼ Mile of a Transit Stop					x					1											x	x			x	x		x	x				
Transit Service Hours per Capita					x					1						7					x	x			x		x			x			
% Households with Access to 10 min Transit Service					x					1											x	x			x	x	x	x	x	x			
% Employment with Access to 10 min Transit Service					x					1											x	x			x	x	x	x	x	x			
Bikeway Miles				x	x					1												x			x		x				x		
Percent Non-Auto Trips					x					1													x		x	x		x					
Percent Transit Mode Share on Congested Corridors					x					1	2												x		x	x		x		x			
Priority Bikeway Miles					x					1												x			x		x				x		
Acres of zoned nodal development					x					1															x		x						
Percent of dwelling units built in nodes					x					1																		x					
Percent of New "Total" Employment in Nodes					x					1																		x					
Arterial and Collector Miles (exclud. Frwys)					x						2											x			x		x		x				
avg. peak hr. travel times-selected regional destinations (all modes)					x					1	2																						
consistency with local, state, federal plans / regulations					x																												
Costs & benefits distribution among community members *					x													8															
Economic Development Policy, Goals					x							3																					
miles of system exceeding LOS standard					x						2																						
modal shares by trip purpose					x					1									10			x	x					x					
net change in # of parking spaces/capita/planning period					x															11													
number of intersections above LOS standard					x						2																						
Ozone - precursors (tons per year)					x									5																			
safety (accidents by mode, and/or other accident measure(s))					x										6																		
Total person trips/vehicles to major destinations (discrete list)					x					1						7																	
total system-wide annual fuel consumption					x									5		6						x	x										
transit & auto travel times in major corridors					x					1	2																				x		
travel time by mode by corridor					x					1	2																						
vehicle (or person) trips < 1/2 mile by trip purpose					x					1										11									x			x	
visual & aesthetic impacts					x								4																				
VMT by LOS (specify: peak hours, other?)					x						2												x										
PM-10 (tons per year)					x									5																			
total vehicle trips per capita					x					1																							
Average Home-Based Work Trip Length						x				1													x					x					
Average Weekday Non-Work Trips						x				1													x					x					
Average Weekday Person Trips						x				1													x					x					
Average Weekday Work Trips						x				1													x					x					
% of Arterial Street Miles Experiencing Congestion (System Performance)						x					2												x	x				x					
% of Freeway Miles Experiencing Congestion						x					2												x	x				x					
% of Households within 1/4-mile of Transit Route						x				1									10	11		x	x					x					
% of Jobs within 1/4-mile of Transit						x				1									10	11		x	x			x	x	x			x			
Average Weekday Transit Trips						x				1													x	x		x	x	x			x		
Avergae Motor Vehicle Travel Time						x					2													x		x	x	x					
Avergage Motor Vehicle Speed						x					2													x		x	x	x					
AWD Total Truck Average Trip Lenth (miles)						x				1														x		x	x	x					x
AWD Total Truck Trips						x				1														x		x	x	x					x
Bike Trips					x	x				1				5										x		x	x	x			x		
Comparison of Motor Vehicle Volumes						x					2												x	x			x	x					
Comparison of Selected Transit Volumes						x					2												x			x	x						
Motor vVehicle Hours of Delay on Arterial Streets						x					2													x		x	x	x					
Motor vVehicle Hours of Delay on Freeway						x					2													x		x	x	x					
Total Motor Vehicle Hours of Delay						x					2													x		x	x	x					
Transit Trips						x				1				5									x	x		x	x	x			x		

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Performance Measure	NCHRP 446	NCHRP 398	TTI Urban Mobility	OTP	TransPlan	Metro RTP	SKATS	RV RTP	Other	Accessibility	Mobility	Economic Vitality	Quality of Life	Environmental Sustainability	Safety and Security	Efficiency and Affordability	System Preservation	Environmental Justice	Balance \ Adaptability	LUT Compatability	Land Use \ Econonic \ Demographic \ Environmental \ Data	Transport Sytem Data	Travel Model \ Travel Survey	Attitudinal Survey	Benchmark? (Objective)	Forecastable?	Plan Implementation (output)	Market Response (outcome)	Land Use or Combined Land Use \ Transport Measure	Highway	Transit	Ped\Bike	Air	Freight - Truck, Rail, Ship, Air
Two-Hour Peak Period Average Truck Travel Time						x					2	3											x			x		x					x
Two-Hour Peak Period Truck Vehicle Hours of Delay						x					2	3											x			x		x					x
Vehicle Miles of Travel						x				1													x			x		x					
Person Trips						x				1													x			x		x					
Total Lane Miles						x					2											x			x	x				x			
Freeway lane-miles						x					2											x			x	x	x			x			
Arterial lane-miles						x					2											x			x	x	x			x			
Total Lane Miles Added (from 1994)						x					2											x			x	x	x						
AWD Total Auto Person Trips						x										7							x			x		x					
AWD Total VMT (no trucks or externals)						x										7						x	x			x		x					
AWD VMT/Capita (no trucks or externals)						x										7					x	x	x		x	x		x					
Change in AWD VMT/Capita from 1994						x										7					x	x	x		x	x		x					
AWD VMT/Employee (no trucks or externals)						x										7					x	x	x		x	x		x					
AWD VMT/Employee change from 1994						x										7					x	x	x		x	x		x					
Single Occupant Vehicle (SOV) Percent of Person Trips						x										7							x		x	x		x					
Non-SOV Percent of Person Trips (shared ride, walk, bike, transit)						x										7							x			x		x					
AWD Motor Vehicle Average Trip Length (miles)						x										7							x		x	x		x	x				
Home-Based-Work Average Trip Length (miles)						x										7							x		x	x		x					
Auto Occupancy						x										7						x	x		x	x		x					
PM 2-HR Motor Vehicle Average Travel Time (minutes)						x					2											x				x		x					
PM 2-HR Average Motor Vehicle Travel Speed (miles per hour)						x					2											x				x		x					
Total Miles in Network						x																x					x						
Freeway Miles						x					2											x					x						
Arterial Miles						x					2											x					x						
PM 2-HR Total Congested miles (v/c >0.9) (percentage of total miles in network)						x					2											x				x		x					
Freeway (percentage of freeway miles in network)						x					2								10			x					x						
Arterial (percentage of arterial miles in network)						x					2								10			x					x						
PM 2-HR Motor Vehicle Hours						x					2											x	x			x		x					
PM 2-HR Motor Vehicle Hours of Delay (time accrued above v/c > 0.9)						x					2											x	x			x		x					
PM 2-HR Percent Motor Vehicle Hours of Delay						x					2											x	x			x		x					
Freeway (percentage of total motor vehicle hours)						x																x				x		x	x				
Arterial (percentage of total motor vehicle hours)						x																x				x		x	x				
Total Roadway Capacity-Miles						x																x			x		x		x				
Freeway/Highway cap-mi						x																x			x		x		x				
Arterial cap-mi						x																x			x		x		x				
AWD Truck Average Trip Length (miles)						x																	x			x							x
PM 2-HR Truck Average Travel Time (minutes)						x					2												x			x		x					x
PM 2-HR Truck Hours						x					2												x			x		x					x
PM 2-HR Truck Vehicle Hours of Delay (time accrued above v/c > 0.9)						x					2												x			x		x					x
PM 2-HR Percent Truck Hours of Delay						x					2												x			x		x					x
Lane Miles Added to Freight Network (from 1994)						x																x			x		x						x
Freight Network Miles						x																x					x						x
PM 2-HR Congested Freight Network Miles						x					2											x				x		x					x
PM 2-HR Percent Congested Freight Network Miles						x					2											x				x		x					x
AWD Total Transit Trips (originating riders)						x				1												x	x			x		x					
AWD Transit Revenue Hours						x				1												x				x	x			x			
Transit Percent of Person Trips						x										7							x			x		x					
AWD Originating Riders Per Revenue Hour						x										7						x				x		x					
Total Walk Trips** (does not include walk trips to transit)						x				1													x			x		x			x		
Walk Percent of Person Trips						x										7							x			x		x			x		
Total Bike Trips***						x				1													x			x		x			x		
Bike Percent of Person Trips						x										7							x			x		x			x		
% of Population Within 1/4 Mile of Transit Route								x		1											x	x				x	x	x	x		x		
% of Population Within Service Area for Lift Service								x		1								9			x	x				x	x	x	x		x		

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Collector and Arterials Accommodating Bicyclists								x		1												x					x			x		
Number of Lane-Miles of New Roadway Construction								x		1	2											x					x					
Per Capita Vehicle Miles of Travel								x		1											x		x			x		x				
Per Capita Vehicle Trips								x		1											x		x			x		x				
Access Restrictions								x		1												x					x						
Amount of Paratransit Services								x		1								9				x					x			x			
Capital Improvements								x								7						x					x						
Collectors and Arterials With Sidewalks								x		1					6							x					x			x			
Intrusion into Existing Neighborhoods								x					4	5							x						x		x	x			
Street System Connectivity								x		1												x					x			x			
Transit Ridership-Frequency and Hours								x		1												x	x				x	x			x		
Percent of trips accessible by non-auto modes within x% max. time difference									x	1									10				x			x					x	x	
VMT - weighted Network LOS under various "de-linking" scenarios									x	1									10				x			x		x					
Unoccupied Seat-Miles of Travel (Vehicle Occupancy / Average Vehicle Capacity)*Miles of Travel									x										10			x				x		x		x	x		
Percent of regional trips on the links carrying x greatest O-D pairs.									x										10				x			x		x					
Percent of regional trips on the x greatest volume links									x										10				x			x		x					
Percent of regional trips on the x greatest volume river crossings									x										10				x			x		x					
Percent of regional trips on the x greatest volume structures									x										10				x			x		x					
Distribution of emergency services (police, fire, hospitals) across rivers, other barriers									x						6				10		x						x		x				
Population-weighted average access time to nearest trauma center									x						6						x												
Average Transit OVTT									x	1												x	x							x			
Percent of of Roadway miles with Sidewalks				x						1					6							x			x		x		x		x		
Percent of of Roadways in Fair or Better Condition				x													8					x			x		x		x				
Ratio of Bikeway to Arterial and Collector Miles				x						1												x			x		x				x		
Percent of Employment with Access to 10 min Transit Service				x						1											x	x			x		x	x	x		x		
Percent of Households with Access to 10 min Transit Service				x						1											x	x			x		x	x	x		x		
Percent of of Households Within ¼ Mile of a Transit Stop				x						1											x	x			x		x	x	x		x		
Number of and Percent of of Accidents Involving Trucks				x											6							x											x
Number of and Percent of of Potential Total of Route Miles Transferred				x												7					x	x			x		x			x			
Percent of Freight System Lane Miles Meeting Mobility Standards During Peak Hours				x							2											x			x			x		x			x
Percent of STAs where v/c meets standard				x							2											x			x			x	x	x			
Net Benefit of Off-System Improvements				x								3																					
Number of Bridges on Lifeline Routes with Satisfactory Rating				x											6							x			x					x			
Number of Culverts Retrofitted For Salmon				x											6							x			x								
Number of of Accidents With F/SI per Million Vehicle Miles Traveled				x											6							x			x			x		x			
Number of of At-Grade Crossings Eliminated or Replaced With Grade-Separated				x											6							x			x		x			x			x
Number of of Newly Constructed At-Grade Crossings				x											6							x			x		x			x			x
Number of Route Miles With Potential for Interjurisdictional Transfer				x												7						x			x		x			x			
Number of State Hwys w/ Up-To-Date NR Maps				x						1												x			x					x			
Percent of Bridges on Lifeline Route with Satisfactory Seismic Rating				x											6							x			x					x			
Percent of Customers By Region Reporting Favorable or Better Perception of Hwy System				x									4											x	x					x			
Percent of Customers Reporting Favorable Perception of Scenic Byways				x									4											x	x					x			
Percent of Highway Lane Miles Meeting Mobility Standards				x							2											x								x			
Percent of or Number of Intermodal Connectors Improved				x						1												x											
Percent of OR Residents Whose Lifeline System Access Meets Bridge Rating Standards				x								3	4								x	x			x				x				
Percent of OR Residents Whose Lifeline System Defined and Evaluated				x								3	4								x	x			x				x				
Percent of Oregonians Who Commute To and From Work in SOV				x										5								x	x		x	x		x		x			
Percent of Oregonians Who Comute To and From Work During Peak Hours Not in SOV				x										5								x	x		x	x		x			x	x	
Percent of Total Person Miles of Travel Made in HOV				x										5								x	x		x	x		x			x	x	
Percent of VMT Reduction Due to HOV Lanes				x										5									x		x	x		x		x			
Annual Percent of Reduction in Fatal and Injury Crashes				x											6							x			x			x		x			
Percent of of Occupants Using Safety Restraints				x											6							x	x		x			x		x			
Number of of Park-and -Ride Spaces W/I State Hwy ROW				x						1												x			x			x					
OR Scenic Byway Committee Rating				x									4									x			x								

	Source									Transportation Plan Policy Area										Data Type				PM Characteristic				System				
Performance Measure	NCHRP 446	NCHRP 398	TTI Urban Mobility	OTP	TransPlan	Metro RTP	SKATS	RV RTP	Other	Accessibility	Mobility	Economic Vitality	Quality of Life	Environmental Sustainability	Safety and Security	Efficiency and Affordability	System Preservation	Environmental Justice	Balance \ Adaptability	LUT Compatability	Land Use \ Econonic \ Demographic \ Environmental \ Data	Transport Sytem Data	Travel Model \ Travel Survey	Attitudinal Survey	Benchmark? (Objective)	Forecastable?	Plan Implementation (output)	Market Response (outcome)	Land Use or Combined Land Use \ Transport Measure	Highway	Transit	Ped\Bike	Air	Freight - Truck, Rail, Ship, Air
Number of Deaths Due to Alcohol and Drug-Related Crashes				x											6							x			x			x		x			
Number of Deaths Due to Motor Vehicle Crashed				x											6							x			x			x		x			
Projects Meeting Criteria for Accommodating Bicyclists and Pedestrians				x						x												x			x						x		
Bikeway and Walkway Projects Meeting Adopted Criteria				x						x												x			x						x		
Miles of Rural State Highways Suitable for Bicycling				x						x												x									x		
Miles of Urban State Highways Accommodate Pedestrians and Bicyclists				x						x												x							x		x		
Availability of modal choices				x						x												x		x						x	x		
Ease of use				x						x														x						x	x		
Relative Cost				x						x											x		x						x	x		
Proximity to Service				x						x													x				x		x	x		
Frequency of Service				x						x												x					x			x		
Mode split at major destinations (discrete list)					x											7						x	x			x		x				
auto occupancy-average system-wide					x									5		7						x	x		x	x		x				
Vehicle trips per capita					x											7							x		x	x		x				
auto VMT per capita (define parameters)					x											7							x		x	x		x				
miles of system exceeding LOS standard					x						2											x				x		x				
transit & auto travel times in major corridors					x						2											x				x						
avg. peak hr. travel times-selected regional destinations (all modes)					x						2											x				x		x				
net change in # of parking spaces/capita/planning period					x																	x						x				
Capital costs - includes construction (all modes, by mode) *					x																	x										
Costs & benefits distribution among community members *					x													1			x	x										
average trip length (system-wide) by trip purpose (8)					x											7			10				x		x	x		x				
average trip length by functional class (6)					x											7			10				x		x	x		x				
vehicle hours of delay					x						2											x	x		x	x		x				
transit, auto, bicycle and ped travel times in major corridors					x						2												x			x		x		x	x	
peak hr. travel times-selected regional destinations (by mode) Time Contour Maps					x						2											x	x			x		x				
Average personal/user travel cost of transportation system **					x											7						x	x					x				
Intrazonal trips & trips to neighboring TAZs					x					1										11			x			x		x	x		x		
percentage of total land by plan designation within metro UGB w/in 1/4, 1/2 mile of transit (by service frequency)					x					1										11	x	x			x		x		x		x		
% of residences w/in 1/4 mile of transit (by service frequency), w/in 1/2 mile of bike system and w/in 1/2 mile of convenience commercial					x					1										11	x	x			x		x		x		x	x	
% of employment w/in 1/4 mile of transit (by service frequency), w/in 1/2 mile of bike system and w/in 1/2 mile of convenience commercial					x					1										11	x	x			x		x		x		x	x	
% of residences w/in 1 mile of maj. employment ctrs. (discrete list)					x					1										11	x				x				x				
modal shares					x					1									10			x	x			x		x						
Mode split at major destinations (discrete list) at TAZ level					x					1									10			x	x			x		x						
total vehicle trips per capita					x					1												x	x			x		x						
auto VMT per capita (define parameters)					x					1						6						x	x		x	x		x	x				
net change in # of parking spaces/capita/planning period					x															11		x			x		x		x				
CO (tons per year)					x									5								x	x		x	x		x					
Ozone - precursors (tons per year)					x									5								x	x		x	x		x					
PM-10 (tons per year)					x									5								x			x	x		x					
visual & aesthetic impacts					x								4	5										x				x					
open space/wetlands/ natural areas removed					x								4	5							x	x			x			x					
impacts upon significant cultural features - historic, archaeological, churches, cemeteries					x								4	5							x												
water quality performance measure(s) (Impervious Surface)					x									5							x												
Measure of Cost vs. Revenue available					x											7					x	x			x								
Capital costs - includes construction (all modes, by mode) *					x											7					x	x					x						
Operating, maintenance & preservation costs (all modes, by mode)					x											7	8				x	x					x						
Administrative capacity / costs (policy level) **					x											7					x	x					x						
Supportive of Sustainable Development					x																			x			x						
OMP Cost / Capital Cost Ratio					x											7					x				x		x						
$ per PMT					x											7					x				x			x					
Number of Local Intersections per Square Mile					x					1	2											x			x		x		x				

Performance Measures Compendium

	Source									Transportation Plan Policy Area										Data Type				PM Characteristic				System				
Performance Measure	NCHRP 446	NCHRP 398	TTI Urban Mobility	OTP	TransPlan	Metro RTP	SKATS	RV RTP	Other	Accessibility	Mobility	Economic Vitality	Quality of Life	Environmental Sustainability	Safety and Security	Efficiency and Affordability	System Preservation	Environmental Justice	Balance \ Adaptability	LUT Compatability	Land Use \ Econonic \ Demographic \ Environmental \ Data	Transport Sytem Data	Travel Model \ Travel Survey	Attitudinal Survey	Benchmark? (Objective)	Forecastable?	Plan Implementation (output)	Market Response (outcome)	Land Use or Combined Land Use \ Transport Measure	Highway	Transit	Ped\Bike	Air	Freight - Truck, Rail, Ship, Air
Elasticity of Accessibility w/r/t Fuel Price					x														10				x									
Reserve Capacity of System					x						2											x						x					
% of Trips that could be accommodated on other modes in emergency					x														10			x	x		x					x		x	
Amount of Travel in Excess of User's "Ideal" Amount of Travel					x					1	2													x				x					
Number of Activity/Goods Opportunities within User's Time/Cost Budget					x					1											x		x					x					
Quality of Activity/Goods Avaialble within User's Time/Cost Budget					x					1											x		x					x					
Percentage of person trips within defined nonauto to auto time difference					x																	x	x		x	x		x					
Percentage of person trips with travel time advantage for non-DA vehicles					x					1												x	x		x	x		x					
Peak / Non-Peak travel time ratios					x						2											x			x	x		x					
Noise Exposure Index (dBa times # Households exposed to transportation noise levels in excess of x dBa)					x										6			9			x	x						x	x				
Households exposed to CO concentrations in excess of x ppm					x										6			9			x					x		x	x				
Differences in Multi-Modal Accessibility by S-E group					x					1								9			x					x							
Differences in Noise Exposure by S-E group					x													9			x					x							
Average travel time / cost to work by S-E group					x					1								9			x		x			x		x					
Difference is CO exposure by S-E group					x													9			x					x	x						
Non-Auto Accessibility for Persons age 12 - 18					x					1													x				x						
Non-Auto Accessibility for Persons age 65+					x					1													x										
Differences in Accessibility to Community Resources and Amenities by S-E Group					x					1											x		x			x		x					
Roadway Congestion Index			x								2											x			x	x		x	x				
Travel Rate Index			x								2											x			x	x		x	x				
Travel Time Index			x								2											x			x	x		x	x				
Travel Delay			x								2											x			x	x		x	x				
Buffer Index: ((95%ile min/mile - mean min/mile)/mean min/mile)*100%			x								2											x			x	x		x	x				
Travel Rate		x									2											x			x	x		x	x				
Delay Rate		x									2											x			x	x		x	x				
Total Delay		x									2											x			x	x		x	x				
Relative Delay Rate		x									2											x			x	x		x	x				
Delay Ratio		x									2											x			x	x		x	x				
Congested Travel : Congested vehicle-miles		x									2											x			x	x		x	x				
Accessibility: sum of objective fullment opportunities within x minutes travel time		x								1													x		x			x	x				
Speed Reduction Index: ratio of decline of speeds from free-flow conditions		x									2											x			x			x	x				
Congestion Severity Index		x									2											x			x			x	x				
Lane-mile duration index		x									2											x						x	x				
Peak 1-Hr Percent of Peak 2-Hr and Daily Traffic (a measure of reserve capacity)									x		2											x						x	x				
Ratio of Population or Employment Density to Street Intersection Density									x											11	x	x					x		x		x			
TOTAL NUMBER OF MEASURES										180	176	59	37	65	93	195	72	18	22	10	126	504	205	36	372	208	150	362	57	224	151	55	20	133

Synthesis of all State and MPO Performance Measures

Performance Measures	Source	Transportation Policy Area											
		1. Accessibility	2. Mobility	3. Economic Vitality	4. Quality of Life	5. Sustainability	6. Safety and Security	7. Affordability	8. System Preservation	9. Environmental Justice	10. Balance	11. Adaptability	12. Land Use Compatibility
VEHICLE TRAVEL													
4. Average Weekday Person Trips	METRO	1											
4. Average Weekday Work Trips	METRO	1											
4. Average Weekday Non-Work Trips	METRO	1											
% of Trips by Purpose by Time	RVCOG										10		
Per capita vehicle trips	TPR										10		
Per Capita Vehicle Trips	RVCOG										10		
3. Average Weekday Total Auto Person Trips	METRO	1											
Person Trips per Auto Trip	LCOG					5							
Per capita VMT in Oregon metropolitan areas for local, non-commercial trips	TPR										10		
Per capita VMT in Oregon metropolitan areas for local, non-commercial trips	Benchmark										10		
Internal VMT/Capita	LCOG										10		
Internal VMT (no commercial vehicles)	LCOG										10		
Vehicle Miles Traveled Per Capita In Metro Areas	OHP										10		
4-8. Vehicle Miles of Travel per capita and VMT/capita change	METRO	1									10		
Vehicle miles traveled per capita in metropolitan areas per year	OTP										10		12
Per Capita Vehicle Miles of Travel	RVCOG										10		
Arterial and Collector Miles	LCOG										10		
Arterial and Collector Miles (excluding fwys)	LCOG										10		
Number of Lane-Miles of New Roadway Construction	RVCOG										10		
2. Total Lane Miles Added	METRO	1											
1. Total lane miles (freeway, arterial)	METRO	1											
Parkings spaces per capita	LCOG										10		
Number of Parking Spaces per capita in MPO area	TPR										10		
AUTO OCCUPANCY													
Drive Alone Mode Share	LCOG										10		
9. SOV percent of person trips	METRO	1											
% Oregonians Who Commute To and From Work in SOV	OHP										10		
% Oregonians Who Commute To and From Work During Peak Hours Not in SOV	OHP					5					10	11	
Percent non-SOV commuter during peak-hour	TPR										10		
% Oregonians who commute during peak hours by other than SOV	OTP	1	2										
% Oregonians who commute during peak hours by other than SOV	Benchmark	1	2										
10. Non-SOV percent of person trips (shared ride, walk, bike, transit)	METRO										10	11	
Shared Ride (2 or more) Mode Share	LCOG					5					10		
12. Auto occupancy	METRO												
Mode share (alternative modes & SOV)	TPR										10		
% Total Person Miles of Travel Made in HOV	OHP										10		
% VMT Reduction Due to HOV Lanes	OHP										10		
BICYCLE AND PEDESTRIAN ELEMENTS													
Availability of modal choices	OTP-Rail										10		
Measures of accessibility by alternative modes	TPR	1											
# Projects that Meet Criteria for Accommodating Bicyclists and Pedestrians	OTP-Bike/Ped										10		
# Bikeway and Walkway Projects Meet Adopted Criteria	OTP-Bike/Ped										10		

Synthesis of all State and MPO Performance Measures

Performance Measures	Source	Transportation Policy Area											
		1. Accessibility	2. Mobility	3. Economic Vitality	4. Quality of Life	5. Sustainability	6. Safety and Security	7. Affordability	8. System Preservation	9. Environmental Justice	10. Balance	11. Adaptability	12. Land Use Compatibility
% Non-Auto Trips	LCOG										10		
Walk Mode Share	LCOG										10		
1, 2. Walk Trips and Walk Percent of Person Trips	METRO										10	11	
Bike Mode Share	LCOG										10		
# person trips by bicycling and walking	OTP-Bike/Ped										10		
1, 2. Bike Trips and Bike percent of Person trips	METRO										10	11	
%total daily trips by transit and by bicycles+walking	RVCOG										10		
Ratio of Bikeway to Arterial &Collector Miles	LCOG										10		
Bikeway Miles	LCOG										10		
Priority Bikeway Miles	LCOG										10		
% Collector and Arterials Accommodating Bicyclists	RVCOG										10		
Miles of Rural State Highways Suitable for Bicycling	OTP-Bike/Ped										10		
Miles of Urban State Highways that Accommodate Pedestrians and Bicyclists	OTP-Bike/Ped										10		
%urban arterials and local collectors in urban areas that have adequate pedestrian and bicycle facilities	OTP	1	2										
% Collectors and Arterials With Sidewalks	RVCOG										10		
% of Roadway Miles with Sidewalks	LCOG										10		
Secure bicycle storage available at all employment and shopping centers, park and rids, passenger terminals and recreation destinations	OTP-Bike/Ped										10		
Inventory # of Park-and -Ride Spaces within and adjacent to State Hwy ROW	OHP										10		12
TRANSIT ELEMENTS													
%Oregonians living in communities that meet minimum levels of service for public transportation	LCOG										10		12
Coordinate intercity bus and local transit with intercity rail for timely and convenient connections	OTP-Rail		2								10		
Transit Mode Share	METRO	1									10	11	
1. Average Weekday Transit Trips	METRO	1									10	11	
3. Transit % of Person trips	OTP	1	2										
5. % of Households within 1/4-mile of Transit	METRO										10		12
% of Households Within 1/4 Mile of a Transit Stop	LCOG	1											12
% of Population Within 1/4 Mile of Transit Route	RVCOG	1											12
% HHlds w/Access to 10-minute Transit Service	LCOG	1											12
% of Population Within Service Area for Lift Service	RVCOG	1	2		4					9	10		
Transit Service Hours per Capita	LCOG										10		
2. Average weekday transit revenue hours	METRO	1										11	
Transit Ridership-Frequency and Hours	RVCOG	1	2								10		
Amount of Paratransit Services	RVCOG	1	2		4					9	10		
%Oregonians in communities with daily scheduled intercity air, bus, van/shuttle or rail service	OTP	1	2								10		12
Total transit time compared with auto travel time during off-peak hours	METRO	1	2										
Total transit time on regional bus routes compared with total auto travel time	METRO	1	2										
FREIGHT ELEMENTS													
Major intermodal rail/truck faciltiies should exist on rail mainlines with a service area of 150 miles	OTP-Rail			3							10		
7. Lane miles added to freight network	METRO			3									
8. Freight Network miles	METRO	1		3									
1. Average weekday Total Truck Trips (Freight System Performance)	METRO			3									
Ease of use (rail)	OTP-Rail	1											

Synthesis of all State and MPO Performance Measures

Performance Measures	Source	Transportation Policy Area											
		1. Accessibility	2. Mobility	3. Economic Vitality	4. Quality of Life	5. Sustainability	6. Safety and Security	7. Affordability	8. System Preservation	9. Environmental Justice	10. Balance	11. Adaptability	12. Land Use Compatibility
Relative Costs (rail)	OTP-Rail	1						7					
Frequency of Service (rail)	OTP-Rail	1											
AIR ELEMENT													
Availability of Airport with commercial service where population is greater than 50,000 and further than 70 miles from nearest other airport	OTP-Air	1									10		
Availability of airport service to areas with population > 25000, central urban area > 15000, more than 50 miles from other commercial air and more than 100 miles from metro area	OTP-Air	1									10		
COMMUNITY													
%Oregonians living where air meets air quality stds (Benchmark)	OTP					5							
Percent of time that the air is healthy to breathe for all Oregonians	TPR				4								
Percent of time that the air is healthy to breathe for all Oregonians	Benchmark				4								
Air quality: comparison of metropolitan regions: summer days ozone violation of Clean Air Act	METRO				4								
Air Quality: number of days exceeding the standard	METRO				4								
Minimize Impact on Air Quality	RVCOG				4	5							
CO Emissions (Weekday Tons)	LCOG					5							
Average Fuel Efficiency (VMT/Gal.)	LCOG					5							
# Culverts Retrofitted For Salmon	OHP					5							
Miles of scenic byways	OTP				4								
% Customers Reporting Favorable Perception of Scenic Byways	OHP				4								
OR Scenic Byway Committee Rating	OHP				4								
Miles of State Hwys w/ Up-To-Date natural resource Maps relative to total miles needing mapping	OHP					5							
Minimize ROW Impacts	RVCOG				4	5							12
Intrusion into Existing Neighborhoods	RVCOG				4								12
Minimize Impact on Ag and Forest Land and Open Spaces	RVCOG				4	5							
CONNECTIVITY													
% of identified obstacles to freight movements that are eliminated	OHP	1	2										
% or # Intermodal Connectors Improved	OHP	1	2										
Maximize use of I-5 Inter-Urban Travel	RVCOG							7	8		10		
Street System Connectivity	RVCOG	1											12
CONGESTION													
21. Total Roadway Capacity Miles (freeway, arterial)	METRO	1											
Per Capita Vehicle Hours Traveled	RVCOG	1	2										
Per capita vehicle hours travelled (VMH)	TPR		2								10		
Roadway Congestion Index	LCOG	1											
Congested Miles of travel (% of total VMT)	LCOG	1											
% Highway Lane Miles Meeting Mobility Standards	OHP		2										
17. % of Arterial Street Miles Experiencing Congestion (System Performance)	METRO	1	2										
17. % of Freeway Miles Experiencing Congestion	METRO	1	2										
% miles on limited-access highways in urban areas that do not meet highway mobility stds	OHP		2										
% of Lane-Miles on Collector and Arterials Not Congested	RVCOG	1											
Hours of travel delay per capita per year	Benchmark		2										
Network Vehicle Hours of Delay (Daily)	LCOG	1	2										
Minimum motor vehicle levels of service	METRO	1	2										

Synthesis of all State and MPO Performance Measures

Performance Measures	Source	Transportation Policy Area											
		1. Accessibility	2. Mobility	3. Economic Vitality	4. Quality of Life	5. Sustainability	6. Safety and Security	7. Affordability	8. System Preservation	9. Environmental Justice	10. Balance	11. Adaptability	12. Land Use Compatibility
15. Average Motor Vehicle Speed	METRO		2										
14. Average Motor Vehicle Travel Time	METRO	1	2										
19. Total Motor Vehicle Hours of Delay	METRO	1	2										
20. Motor Vehicle Hours of Delay on Freeway	METRO	1	2										
20. Motor Vehicle Hours of Delay on Arterial Streets	METRO	1	2										
% of mileage of the NHS for which there has been no decrease in average travel speed from 1995 levels	OTP	1											
3. Two-Hour Peak Period Average Truck Travel Time	METRO	1	2										
4. Two hour PM truck hours	METRO												
5, 6. Two-Hour Peak Period Truck Vehicle Hours of Delay	METRO												
9, 10. Congested Freight Network miles	METRO	1	2										
% Freight System Lane Miles Meeting Mobility Standards During Peak Hours	OHP		2										
% Transit Mode Share on Congested Corridors	LCOG	1											
Reliable on-time arrivals within 15 mins of published schedules (rail)	OTP-Rail		2										
Increase passenger speeds up to 110-125 mph on existing mainline trackes (rail)	OTP-Rail		2										
Branch rail lines allowing a min. speed of 25 mph	OTP-Rail		2										
Minimum of three round trips per day of 19 passengers between Portland/West Coast hubs and other areas of Oregon (air)	OTP-Air		2										
PUBLIC ATTITUDES													
%involved citizens satisfied and informed	OTP									9			
% Customers By Region Reporting Favorable or Better Perception of Hwy System for aesthetics, safety and performance	OHP				4					9			
SYSTEM CONDITION													
Percent of roads in fair or better condition	Benchmark								8				
% of Roadways in Fair or Better Condition	LCOG								8				
%infrastructure that is classified as "fair or better" or "sufficient" (pavement, bridges, publicly owned transportation vehicles and facilities, runways)	OTP								8				
Capital Improvement Costs for existing infrastructure	RVCOG							7	8				
LAND USE INTEGRATION													
% Special Transportation Areas where highway mobility (v/c) meets standard	OHP												12
Highway v/c ratio within a Special Transportation Area (for corridor planning)	OHP												12
6. % of Jobs within 1/4-mile of Transit	METRO			3							10		12
% Emp w/Access to 10-min Transit Service	LCOG			3							10		12
% mixed use employment in new development	RVCOG			3									12
% of New “Total” Employment in Nodes	LCOG												12
Average Trip Length (miles)	LCOG		2										12
12. Average Home-Based Work Trip Length	METRO	1											
11. Average weekday motor vehicle average trip length (miles)	METRO												12
% Person Trips Under 1 Mile	LCOG												12
%Oregonians commuting less than 30 mins to work	OTP	1	2										12
%mixed use DUs in new development	RVCOG												12
Acres of zoned nodal development	LCOG												12
% of dwelling units built in nodes	LCOG												12
Proximity to Service (rail)	OTP-Rail												12

Synthesis of all State and MPO Performance Measures

Performance Measures	Source	Transportation Policy Area											
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Use of Abandoned ROW	RVCOG								8		10		12
FINANCES													
Alternative transportation funding	RVCOG							7			10		
Annual capital spending	METRO							7	8				
Avg Annual regional transportation capital needs	METRO							7					
Amount of transportation funding as %OTP 20-yr plan needs.	OTP							7			10		
% state expenditures saved through cost-sharing and other partnership arrangements	OHP							7					
Heavy and light vehicle payments to the Highway Fund as % of amount in Cost Responsibility Study	OTP							7					
Net Benefit of Off-System Improvements	OHP							7					
# Route Miles With Potential for Interjurisdictional Transfer	OHP							7					
# and % of Potential Total of Route Miles Transferred	OHP							7					
SAFETY													
% Bridges on Lifeline Route with Satisfactory Seismic Rating	OHP						6						
# Bridges on Lifeline Routes with Satisfactory Rating	OHP						6						
% OR Residents Whose Lifeline System Defined and Evaluated	OHP						6						
% OR Residents Whose Lifeline System Access Meets Bridge Rating Standards	OHP						6						
Transportation related deaths and major injuries per 100,000 population	OTP						6						
# and % of Accidents Involving Trucks	OHP						6						
Deaths Due to Motor Vehicle Crashes	OHP						6						
% of Occupants Using Safety Restraints	OHP						6						
# Deaths Due to Alcohol and Drug-Related Crashes	OHP						6						
# of Accidents With fatality/serious injury	OHP						6						
Annual % Reduction in Fatal and Injury Crashes	OHP						6						
Accident Data by Mode	RVCOG						6						
Accident Data by Trip Purpose	RVCOG						6						
Impact on User Safety	RVCOG						6						
# of Newly Constructed At-Grade Crossings	OHP		2				6						
# of At-Grade Crossings Eliminated or Replaced With Grade-Separated	OHP		2				6						
%regional and local governments with acknowledged transportation system plans	OTP												
TOTAL NUMBER of MEASURES		53	38	7	14	11	16	12	7	4	65	7	26

Transportation Plan Policies Currently Lacking Adequate PMs

	Source						Policy Topic Classification											
Policy	TPR	OTP	TransPlan	Metro RTP	SKATS	RV RTP	Accessibility	Mobility	Economic Vitality	Quality of Life	Environmental Sustainability	Safety and Security	Efficiency and Affordability	System Preservation	Environmental Justice	Balance \ Adaptability	LUT Compatability	**Comment**
Reduce Reliance on the Automobile	x						x									x	x	VMT per Capita has been the main transporation planning PM in Oregon. However, it is a better measure of estimated automobile USE than automobile RELIANCE, and it has been found to be more closely linked to economic activity than demographics.
Balanced System: accommodate multiple modes within corridors, provide choices		x	x													x		There are many aspects to "balance" -- modal choices, allocation of resources, balanced network, weighing conflicting goals, etc
Efficiency: take advantage of inherent efficiencies of each mode; don't optimize cost effectiveness of one mode at the expense of another; "most appropriate mode"		x											x					
Multimodal Accessibility: measured by availability of modal choices, ease of use, relative cost, proximity to service, and frequency of service		x					x											Plans currently have PM's to measure some specific elements of accessibility. Warrants further research.
Enhance the aesthetic value of transportation corridors		x								x								"Eye of the Beholder" -- must elicit subjective public response
Connectivity policies; within and between modal systems		x	x				x											Some PM's, like intersection density, touch on this. Further research needed.
Support Compact, Mixed-Use Development to reduce travel demand		x	x	x													x	Many PM's measure travel demand, a secondary measure that is influenced by numerous non-land use factors. There are few Oregon PM's that directly measure the 'fit' or 'support' between transportation and land use.
Economically Viable, Financially Stable System			x										x					
Maintain the integrity of and minimize impacts to neighborhoods and local business communities while addressing regional transportation needs.			x	x		x				x					x			Numerous aspects -- noise, pollution, safety (actual and perceived)
Barrier-Free Transportation; Accessibility for Everyone		x		x			x								x			We find PM's for specific components, such as paratransit services, but not broader measures of accessibility for mobility impaired people..
Provide access to jobs and services for low-income people				x											x			
Protect the natural environment		x		x	x	x					x							Many PM's related to emissions and noise. Few relating to visual impacts and physical segmentation of spaces.
Protect water quality				x							x							
Reduce Consumption of Resources				x							x							Some related to energy use, need PM's regarding other resources
Design streets with a modal orientation that reflects the function and character of the surrounding land uses.				x					x	x							x	Metro RTP contains a land use / street design table and narrative guidelines. The City of Portland ASCP may offer additional insights.
The Regional Road System shall provide connectivity and continuity of travel between regional ingress and egress points and major regional destinations and activity centers to minimize out-of-direction travel and circuitous routing.					x		x		x				x					

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Ensure adequate goods movement system carrying capacities to adequately serve current and future needs of area shippers and transportation providers.					x			x	x									
Encourage efforts to maximize intermodal goods movement routing options within the region.					x		x		x									
Safety issues shall be considered a priority when comparing alternative projects for inclusion in the RTSP.					x							x						Oregon plans presently lack PM's to deal with safety and security in a comprehensive way.
Prudent investments necessary to improve current safety problems shall be identified in the regional TIP.					x							x						
Ensure that the costs of planned improvements are commensurate with the benefits.						x							x					Few Oregon PM's currently assess full costs and benefits.

Performance Measures Compendium

	Source									Transportation Plan Policy Area										Data Type				PM Characteristic				System				
Performance Measure	NCHRP 446	NCHRP 398	TTI Urban Mobility	OTP	TransPlan	Metro RTP	SKATS	RV RTP	Other	Accessibility	Mobility	Economic Vitality	Quality of Life	Environmental Sustainability	Safety and Security	Efficiency and Affordability	System Preservation	Environmental Justice	Balance \ Adaptability	LUT Compatability	Land Use \ Econonic \ Demographic \ Environmental \ Data	Transport Sytem Data	Travel Model \ Travel Survey	Attitudinal Survey	Benchmark? (Objective)	Forecastable?	Plan Implementation (output)	Market Response (outcome)	Land Use or Combined Land Use \ Transport Measure	Highway	Transit	Ped\Bike	Air	Freight - Truck, Rail, Ship, Air
Average travel time from facility to destination (by mode)	x									1	2					7							x		x	x		x		x	x	x		
Average travel time from facility to major highway network	x									1	2					7							x		x	x		x		x				
Average travel time between intermodal facility and rail	x									1	2					7						x	x		x	x		x						x
Perceived deficiencies	x									1	2													x										
Percent of transit demand-response trip requests met	x									1	2											x			x		x			x				
Frequency of transit service	x									1	2											x			x		x			x				
Percent use of walking and bicycling for commute trips (or all trips)	x									1	2			5									x		x	x		x			x			
Percent of State residents aware of intermodal opportunities	x									1		3												x	x		x							x
Percent of wholesale and retail sales in the significant economic centers served by unrestricted (10-ton) market artery routes	x									1		3										x			x		x		x					x
Number of shipping establishments per 1,000 businesses	x									1		3									x				x		x							x
Employee-related percent of employers who have relocated for transportation reasons.	x									1		3												x	x			x	x					
Percent of employers that cite difficulty in accessing desired labor supply due to transportation.	x									1		3												x	x			x	x					
Flow time in minutes as it compares to the number of connecting transfers	x									1						7		9				x	x					x			x			
Number of projects (area and population) accessible to designated development centers	x									1						7					x	x					x		x					
Percent of transfers between modes to be under 'X' minutes and 'N' feet	x									1						7		9				x	x		x		x	x			x			
Worktrips completed per vehicle hour or commute travel	x									1			4			7									x	x		x		x				
Percent of region's mobility-impaired who can reach specific activities by public transportation or by walking/wheelchair	x									1			4								x	x	x		x			x	x			x		
Average number of hours spent traveling	x									1			4										x		x	x		x	x					
Customer perception of quality of transit service	x									1			4											x				x			x			
Accessibility index (STEAM?)	x									1													x			x		x	x					
Average trip length	x									1													x			x		x	x					
Number of miles with intelligent transportation service	x									1												x					x							
Number of new rest areas constructed v. planned	x									1												x			x		x		x					
Number of Trunk System lane miles planned v. completed	x									1												x			x		x							
Total freeway lane-miles (or per capita or per measure of regional business volume or per square mile or truck VMT)	x									1												x			x		x							x
Total freeway lane-miles in acceptable condition (or per capita or per measure of regional business volume or per square mile or truck VMT)	x									1												x			x		x			x				x
Mode split by facility or route	x									1				5		7							x			x		x			x	x		
Overall mode split	x									1				5									x			x		x			x	x		
Percent of users with option of more than one modal choice	x									1												x	x			x	x		x					
User identification of access issues	x									1														x			x							
Existence of railroad electrification	x									1											x	x					x							x
Air transportation capacity	x									1												x			x		x					x		
Airport improvement and cost scheduled at airports	x									1												x					x					x		
Airports within a 30-minute drive of agricultural centers capable of supporting twin engine piston powered aircraft	x									1		3										x					x					x		
Amount of scheduled service between major cities	x									1		3										x			x		x					x		
Number of cities over 1 million population served directly by nonstop commercial airline flights from airports in state	x									1		3										x			x		x					x		
Percent of aviation community reached through aviation service programs	x									1		3										x					x					x		
Percent of general aviation needs funded	x									1		3										x			x		x					x		
Percent of manufacturing industries within 30 miles of interstate or four lane highway	x									1		3									x	x			x		x		x					x
Availability of real-time cargo information	x									1		3										x					x							x
Capacity of package express carriers	x									1		3									x						x							x
Number of package express carriers	x									1		3									x						x							x
Percent of goods moved with option of more than one modal choice	x									1		3									x	x					x							x
Average circuity for truck trips of selected O-D pattern	x									1		3										x						x	x					x
Bridge weight limits	x									1		3										x			x		x							x
Geometrics of connector link	x									1		3										x					x							x
Number of overload permits rejected due to structural capacity deficiency	x									1		3										x					x							x
Number of structures with vertical (or horizontal) clearance less than X ft.	x									1		3										x					x							x
Number of truck-days of highway closure on major freight routes	x									1		3										x					x							x
Percent of truck highway bridges sufficient in load capacity, vertical and horizontal clearance	x									1		3										x					x							x

Performance Measures Compendium

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Percentage of highway system with bridges that structurally deficient or functionally obsolete	x									1		3										x			x		x						x
Sufficiency rating (percent bridges meeting federal sufficiency rating)	x									1		3										x			x		x						x
Amount of turning radius from major highway to intermodal facility	x									1		3										x					x						x
Average distance to intermodal terminals from different community shipping points	x									1		3										x	x				x		x				x
Capacity of intermodal terminals	x									1		3										x			x		x						x
Number of intermodal facilities	x									1		3										x			x		x						x
Number of T.E.U.'s (10'x 21') (or railroad cars or containers) that can be stored on the premises of the intermodal facility	x									1		3										x			x		x						x
Number of trucks that can be loaded with bulk material per hour of loading time	x									1		3										x					x						x
Number of intermodal facilities that agency assists in development	x									1		3										x					x						x
Number of ports with railroad connections	x									1		3										x					x						x
Percent of population that can reach specified services by transit, bicycle, or walk	x									1											x		x		x	x		x	x		x		
Existence of handicap access to all areas	x									1												x					x						
Percent of elderly and disabled persons with special transit service available	x									1											x	x			x		x				x		
Percent of transit dependent population served	x									1											x	x			x		x		x		x		
Percent of transit facilities accessible to handicapped	x									1												x			x		x				x		
Connectivity deficiency	x									1								9				x	x					x					
Transfer distance	x									1								9				x			x		x						
Number of counties in State with county-wide transit systems	x									1												x			x		x				x		
Number of transit systems in State	x									1												x			x		x				x		
Percent of population with access to (or within 'X' miles of) transit (or fixed route transit) service	x									1											x	x			x		x		x		x		
Percent of rural population with access to transit service	x									1											x	x					x		x		x		
Percent of urban and rural areas with direct access to passenger rail and bus service	x									1											x	x					x				x		
Percent of workforce that can reach worksite in transit within one hour, and with no more than two transfers	x									1											x		x					x	x		x		
Access time to passenger facility	x									1												x					x				x		
Percent of total transit trip time spent out of vehicle	x									1													x		x	x		x			x		
Route spacing	x									1												x			x		x				x		
Route-miles (or seat-miles or passenger miles) of transit service (or per capita or per employee or per licensed driver)	x									1											x	x			x		x				x		
Availability of intermodal ticketing and luggage transfer	x									1												x					x				x		
Existence of information services and ticketing	x									1												x					x				x		
Transfer distance at passenger facility	x									1												x					x				x		
Number of pick up and discharge areas for passengers	x									1												x					x				x		
Percent of rail station parking lots with mid-day spaces available	x									1												x						x			x		
Parking spaces available loading/unloading by autos	x									1												x					x				x		
Parking spaces per passenger	x									1												x						x			x		
Utilization rate of parking spaces during daily peak hours for bus, rail, park and ride or other passenger terminal lots	x									1												x			x			x			x		
Percent of population within 5 miles or 10 minutes of state-aided public roads	x									1											x	x			x		x		x	x			
Number of miles of non-motorized facilities	x									1				5								x			x		x				x		
Minimum layover times at airports or passenger terminals	x									1												x			x		x					x	
Percent jobs within 45 minutes of airports	x									1											x	x			x		x		x			x	
Tonnage moved on various transportation components (by mode)	x										2	3										x						x					x
Traffic at border crossings	x										2	3										x						x					x
Cost/benefit of existing facility v. new construction	x										2					7			10		x	x			x								
Average speed	x										2					7						x	x		x	x		x					
Total travel time (by mode)	x										2					7							x			x		x		x	x	x	
Delay time at primary commercial airports	x										2					7						x						x				x	
Origin-destination travel times (by mode)	x										2					7							x			x		x		x	x	x	
Average daily traffic per freeway lane	x										2					7						x	x			x		x		x			
Number of people provided service at travel information centers	x										2					7						x						x					
Line haul speed	x										2					7						x						x					x
Average processing time for shipments at intermodal terminals	x										2					7						x			x			x					x
Average transfer time/delays	x										2					7						x					x						x

Performance Measures Compendium

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Delay of trucks at facility per ton-mile	x										2					7						x			x			x					x
Delay of trucks at facility per VMT	x										2					7						x			x			x					x
Freight carrier (or local shippers) appraisal of quality of highway service in terms of travel time/speed, delay, circuity, scheduling convenience	x										2					7								x				x					x
Facility usage by mode (V/C)	x										2					7						x			x	x		x		x	x	x	x
Average commuting time for urban population	x										2					7						x	x		x	x		x		x	x	x	
Cost of an intermodal trip as a percent of cost of auto use	x										2					7					x				x		x						
Percent of workers who work at home because of transportation cost or level of service	x										2					7							x					x					
Average wait time to board transit (or between modes)	x										2					7						x			x			x			x		
V/C for bicycle and pedestrian facilities	x										2					7						x			x			x				x	
Lost time due to congestion	x										2		4										x		x	x		x					
Customer perception of satisfaction with commute time	x										2		4											x				x					
Travel time between major cities	x										2												x					x					
Delay due to incidents	x										2											x			x			x		x	x		
Delay per VMT (by mode)	x										2												x		x			x		x	x		
Interference of movement at grade crossings—delay time and speed	x										2											x						x					
Intersection LOS	x										2											x	x		x			x		x			
LOS	x										2											x	x		x			x		x			
Number and percent of lane-miles congested	x										2											x	x		x	x		x		x			
Percent of highways not congested during peak hours	x										2											x	x		x			x		x			
Percent of VMT at LOS 'X'	x										2											x	x		x	x		x		x			
Percent of VMT which occurs on facilities with V/C greater than 'X'	x										2											x	x		x	x		x		x			
Percentage of time average speed is below threshold value	x										2											x	x		x	x		x		x			
Queuing of vehicles (including rail) and its relationship to overall delays	x										2											x						x		x			
Reserve capacity	x										2											x			x	x		x		x			
Travel time under congested conditions	x										2											x	x		x	x		x		x			
V/C ratio	x										2											x	x		x	x		x		x			
VMT by congestion level	x										2											x	x		x	x		x		x			
Average daily traffic	x										2											x	x		x	x		x		x			
Total VMT	x										2											x	x		x	x		x		x			
VHT per capita	x										2										x	x	x		x	x		x		x			
VHT per employee	x										2										x	x	x		x	x		x		x			
VMT growth rate relative to population, employment	x										2										x	x	x		x	x		x		x			
VMT per capita	x										2										x	x	x		x	x		x		x			
VMT per employee	x										2										x	x	x		x	x		x		x			
VMT within urban areas	x										2											x	x		x	x		x		x			
Fluctuations in traffic volumes	x										2												x					x		x			
Minute variation in trip time	x										2												x					x		x	x		
Percentage of scheduled departures that do not leave within a specified time limit	x										2											x						x			x		
Percentage on-time performance	x										2											x			x			x			x		
Travel time contours	x										2											x	x			x		x		x	x		
Mode split	x										2											x	x		x	x		x			x	x	
Percent of change in mode splits	x										2												x		x	x		x			x	x	
Modal Interchange	x										2												x					x		x	x	x	
Number of users of intermodal transfer facilities	x									1						7							x					x				x	x
Transfer time between modes	x										2												x					x			x		
LOS at intersections serving facility	x										2											x						x		x			
LOS on facility access roads	x										2											x						x		x			
Time to access intermodal facilities	x										2											x	x					x		x	x		
V/C on facility access roads	x										2											x						x		x			
Customer perception of ease of travel through highway construction areas	x										2													x				x		x			
Customer perception of time it takes to drive through highway construction areas	x										2													x				x		x			
Customer perception of time it takes to travel to places people/goods need to go	x										2													x				x		x			
Dollar value of projects that improve travel time on key routes	x										2										x	x					x			x			x

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Capacity restrictions	x										2											x							x	x			x
Delay per ton-mile traveled (by mode)	x										2											x						x					x
Miles of freight routes with adequate capacity	x										2											x					x						x
Percent lane-miles which are truck priority (or excluded)	x										2											x					x						x
Ton-miles of rail freight into/through metropolitan areas	x										2											x						x					x
Ton-miles traveled by congestion level	x										2											x			x	x		x					x
Truck delivery and loading interference with street traffic	x										2											x						x					x
Truck VMT by light duty, heavy duty, and through trips	x										2											x				x		x					x
Customs delays	x										2											x											x
Dwell time at intermodal facilities	x										2											x											x
Frequency of delays at intermodal facilities	x										2											x											x
Tons of commodity undergoing intermodal transfer	x										2											x											x
Truck turnaround time at intermodal terminals	x										2											x											x
Average cost (or speed) for a sample of shipments	x										2											x			x			x					x
Number of dockage days at seaports	x										2											x											x
In-vehicle travel time	x										2											x						x		x	x		
PMT by congestion level	x										2											x			x	x		x		x			
Proportion of persons delayed	x										2												x					x		x			
Number non-work trips	x										2												x			x		x		x			
Passenger-trips per household	x										2												x					x		x			
PHT	x										2											x	x		x	x		x		x	x		
PMT per capita	x										2											x	x		x	x		x		x	x		
PMT per worker	x										2										x		x		x	x		x		x	x		
Vehicle-trips per household	x										2												x		x	x		x		x			
Percent of passengers traveling under five miles made by means other than SOV	x										2												x		x	x		x		x	x		
Percent of workers who work at home	x										2												x					x					
Percent trips with transit advantage	x										2											x									x		
Mobility index (person-miles (or ton-miles) of travel/vehicle-miles of travel (PMT/VMT) times average speed)	x										2											x			x	x		x		x			
Percent lane miles of recreational routes operating below LOS D	x										2											x			x	x		x		x			
Vehicle ownership, demand per licensed driver (or worker)	x										2											x			x	x		x		x			
Number of commuters using transit park and ride facilities	x										2											x	x		x	x		x			x		
Number of demand response trip requests	x										2											x						x			x		
Number of public transportation trips	x										2											x	x		x	x		x			x		
On-time performance of transit	x										2											x			x						x		
Passengers per capita within urban service area	x										2											x			x	x		x			x		
Bicycles per boarding	x										2											x						x			x	x	
Property damage accidents/vehicle miles traveled	x											3			6							x			x			x		x			
Percent of region's unemployed or poor that cite transportation access as a principal barrier to seeking employment	x											3	4					9						x				x	x				
Direct jobs supported (or created)	x											3									x							x					
Economic costs of accidents	x											3			6						x	x			x					x			
Economic costs of congestion	x											3									x	x			x					x			
Economic costs of fatalities	x											3									x	x			x					x	x	x	
Economic costs of lost time	x											3									x	x			x								
Economic costs of pollution	x											3									x	x			x								
(Transport Costs as) Percent of state gross product	x											3									x				x								
Indirect jobs supported (or created)	x											3									x				x								
Business volume by commodity group	x											3									x												x
Economic indicator for goods movement	x											3									x												x
Market share of international or regional trade by mode	x											3									x				x			x					x
Percent increase in intermodal facilities use	x											3									x												x
Percent of manufacturers/shippers have relocated for transportation purposes	x											3											x					x	x				x
Price index for selected local delivery service	x											3											x										x
Tonnage originating and terminating	x											3									x												x

Performance Measures Compendium

	Source									Transportation Plan Policy Area										Data Type				PM Characteristic				System				
Performance Measure	NCHRP 446	NCHRP 398	TTI Urban Mobility	OTP	TransPlan	Metro RTP	SKATS	RV RTP	Other	Accessibility	Mobility	Economic Vitality	Quality of Life	Environmental Sustainability	Safety and Security	Efficiency and Affordability	System Preservation	Environmental Justice	Balance \ Adaptability	LUT Compatability	Land Use \ Economic \ Demographic \ Environmental \ Data	Transport Sytem Data	Travel Model \ Travel Survey	Attitudinal Survey	Benchmark? (Objective)	Forecastable?	Plan Implementation (output)	Market Response (outcome)	Land Use or Combined Land Use \ Transport Measure	Highway	Transit	Ped\Bike	Air	Freight - Truck, Rail, Ship, Air
Economic indicator for people movement	x											3																					
Number of cruise embarkations	x											3										x											
Percent of population that perceives that its environment has become more 'livable' over the past year with regard to ability to access desired activities	x												4	5										x									
Sprawl: difference between change in urban household density and suburban household density	x												4	5							x						x	x					
Customer perception of satisfaction with air quality	x												4	5										x			x						
Number of days that Pollution Standard Index is in unhealthful range	x												4	5							x												
Number of urban areas (or population in areas) classified as nonattainment status	x												4	5							x												
Tons of pollution (or vehicle emissions) generated	x												4	5									x		x	x		x					
Number of noise receptor sites above threshold	x												4	5							x				x								
Number of residences exposed to noise in excess of established thresholds	x												4	5				9			x				x				x				
Percent of population exposed to levels of highway noise above 60 decibels	x												4	5				9			x				x				x	x			
Customer perception of amount of salt used on trunk highways	x												4	5										x				x		x			
Customer perception of satisfaction with transportation decisions which impact the environment	x												4	5										x				x					
Number of archeological and historical sites that are not satisfactorily addressed in project development before construction begins	x												4	5							x												
Customer perception of safety while in travel system	x												4		6									x				x					
Percent of population which perceives that response time by police, fire, rescue or emergency services has become better or worse, and whether that is due to transportation factors	x												4		6									x				x	x				
Accidents (or injuries or fatalities)/PMT	x												4		6							x	x		x			x		x			
Accidents (or injuries or fatalities)/VMT	x												4		6							x	x		x			x		x			
Customer perception of promises kept on project completion	x												4			7								x				x					
Customer perception of satisfaction with completed projects	x												4			7								x				x					
Customer perception of satisfaction with involvement in pre-project planning	x												4					9						x				x					
Compliance with affirmative action goals	x												4					9			x				x								
Number of accidents involving hazardous waste	x													5	6							x						x					x
Average fuel consumption per trip for selected trips (or shipments)	x													5		7						x			x	x		x		x			x
Modal Interchange [[??]]	x													5		7																	
Air quality rating	x													5							x				x			x					
Amount of recycled material used in road construction	x													5							x						x		x				
Amount of salt used on roadways [[output measure?]]	x													5							x						x		x				
Amount of salt used per VMT [[output measure?]]	x													5							x						x		x				
Average miles per gallon (MPG)	x													5									x		x			x		x			
Constraints to utilization due to noise (hours of operation)	x													5																			
Constraints to utilization due to water (dredge fill permits)	x													5																			
Environmentally friendly partnership projects per year	x													5							x												
Fuel consumption per PMT	x													5									x		x	x		x		x	x		x
Fuel consumption per ton-mile traveled	x													5									x		x	x		x		x	x		x
Fuel consumption per VMT	x													5									x		x	x		x		x	x		x
Fuel usage	x													5									x		x	x		x		x	x		x
Highway emissions levels within non-attainment areas	x													5							x	x			x	x		x		x			
Number and miles of 'nature' routes [[??]]	x													5																			
Number of environmental problems to be taken care of with existing commitments	x													5																			
Number of pipeline spills	x													5											x								
Number of transportation control measures (TCMs) accomplished v. planned	x													5											x		x			x	x	x	
Percent of region which is developed	x													5							x				x				x				
Percent of vehicles using alternative fuels	x													5								x			x			x		x			
Public transportation passenger-miles/ total vehicle-miles	x													5								x	x		x	x		x		x	x		
The degree to which pipeline spills and accidents are minimized	x													5	6																		
Tons of greenhouse gases generated	x													5							x				x	x		x					
VMT/speed relationships	x													5											x	x		x					
Percentage of state truck highway system rated good or better	x														6		8					x											x
Ratio of number of transit incidents to investment in transit security	x														6	7						x								x			
Accident rate, deaths, injury, property loss by type of corridor	x														6							x			x								
Alcohol-related fatal accidents/all fatal accidents	x														6							x			x								

Performance Measures Compendium

	Source									Transportation Plan Policy Area											Data Type				PM Characteristic				System				
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Average accident cost per trip	x														6							x	x		x			x		x			
Fatality (or injury) rate of accidents	x														6																	
Hazard index (calculated based on accidents per VMT by severity)	x														6										x							
National rank for accident, injury, fatality rates	x														6							x			x			x				
Number of accidents per capita	x														6						x	x			x			x		x			
Number of accidents per intermodal movement	x														6							x			x			x		x			
Number of accidents per per ton-mile traveled	x														6							x			x			x					x
Number of accidents per trip	x														6							x			x			x		x			
Number of accidents per VMT	x														6							x			x			x		x			
Number of accidents per year	x														6							x			x			x		x			
Accident risk index ('Safety Index')	x														6							x			x					x			
Number of high accident (or hazardous) locations	x														6							x			x			x		x			
Number of safety related improvements	x														6							x			x		x			x			
Average duration of incidents	x														6							x			x			x		x			
Response time to incidents	x														6							x			x		x			x			
Number of safety related complaints	x														6									x				x		x			
Number of Statewide traffic accidents (or injuries or fatalities)	x														6							x			x			x		x			
Accidents related to bridge characteristics	x														6							x						x		x			
Customer satisfaction with snow/ice removal	x														6									x				x		x			
Number of highway miles driven at high accident locations	x														6							x			x	x		x		x			
Percent highway miles built to target design and operational standards to handle traffic at a steady 55 mph rate	x														6							x			x		x			x			
Percent of vehicle crashes on highway system where roadway related conditions were listed as a contributing factor	x														6							x			x			x		x			
Roadway sections not meeting safety standards	x														6							x			x		x			x			
Number (or percent) of highway miles driven above speed limit	x														6							x						x		x			
Number (or percent) of motorists driving under the influence of alcohol or drugs	x														6							x						x		x			
Number of accidents in which speed or traffic violation is a factor	x														6							x						x		x			
Percent of drivers complying with seat belt law	x														6								x					x		x			
Construction fatalities/dollars of construction cost (or per 100 highway related crew)	x														6							x			x			x		x			
Number of accidents occurring in highway construction zones	x														6							x						x		x			
Average response time for emergency services	x														6						x				x					x			
Percentage of emergency road calls that get through to state highway agency	x														6							x											
Accidents (or injuries or fatalities) per 1,000 vehicles at park and ride lot	x														6							x								x			
Crime at rest areas and other facilities	x														6						x												
Lighting and security staff at parking areas	x														6						x												
Percentage of parking areas that are secured	x														6						x									x			
Accidents at major intermodal crossings	x														6							x						x		x			x
Exposure (AADT and daily trains) factor for rail crossings	x														6							x			x			x		x			x
Grade crossing safety improvements (MI)	x														6							x											x
Number of fatalities and injuries occurring on the rail system	x														6																		x
Railroad/highway at-grade crossings	x														6																		x
Crimes per 1,000 passengers	x														6						x	x						x					
Number of intercity bus and rail accidents	x														6															x			
Transit accidents (or injuries or fatalities)/PMT	x														6							x			x			x			x		
Transit accidents (or injuries or fatalities)/VMT	x														6							x			x			x			x		
Number of commercial vehicle safety inspections performed [[output measure?]]	x														6										x		x						x
Number of commercial vehicles weighed (by fixed and portable scales) [[output measure?]]	x														6										x		x						x
Percent of commercial vehicles that pass safety inspections	x														6										x			x					x
Percent of commercial vehicles weighed that are overweight (by fixed and portable scales)	x														6										x			x					x
Percent of traffic on regional highway which is heavy truck	x														6							x			x	x		x					x
Bicycle accidents (or injuries or fatalities) per bicycle-mile of travel	x														6							x			x			x			x		
Joint-use bicycle crossings	x														6																x		
Number of pedestrian accidents (or injuries or fatalities)	x														6							x			x			x			x		
Use of safety equipment by bicyclists	x														6							x									x		

Performance Measures Compendium

	Source									Transportation Plan Policy Area											Data Type				PM Characteristic				Land Use or Combined Land Use \ Transport Measure	System				
Performance Measure	NCHRP 446	NCHRP 398	TTI Urban Mobility	OTP	TransPlan	Metro RTP	SKATS	RV RTP	Other	Accessibility	Mobility	Economic Vitality	Quality of Life	Environmental Sustainability	Safety and Security	Efficiency and Affordability	System Preservation	Environmental Justice	Balance \ Adaptability	LUT Compatability	Land Use \ Econonic \ Demographic \ Environmental \ Data	Transport Sytem Data	Travel Model \ Travel Survey	Attitudinal Survey	Benchmark? (Objective)	Forecastable?	Plan Implementation (output)	Market Response (outcome)		Highway	Transit	Ped\Bike	Air	Freight - Truck, Rail, Ship, Air
Accidents (or injuries or fatalities) caused by air transportation	x														6							x										x	
Accidents (or injuries or fatalities) caused by waterborne transportation	x														6							x										x	
Number of airports where weather information is collected for dissemination to pilots	x														6							x										x	
Number of landing areas inspected	x														6							x										x	
Number of weather products provided to pilots on computer weather terminals	x														6																	x	
Percentage of airports that meet federal and State planning and design standards	x														6																	x	
Shipping accidents occurring on waterways	x														6																		x
Total annual attendance at pilot safety seminars	x														6																	x	
Maintenance cost of connector link	x															7	8																
Dollar value of flexible federal funding programmed for non-highway projects	x															7					x				x		x				x	x	
Percent variances between actual versus predicted DOT revenues	x															7					x												
Private cost for transportation system	x															7						x			x								
Public cost for transportation system	x															7						x			x								
Total public expenditures on modal systems (freight v. passenger)	x															7						x			x		x						
Administrative costs as a percent of total program	x															7						x			x								
Administrative, engineering and construction cost/person- (or ton)mile (owner cost)	x															7																	
All engineering costs/construction funds	x															7																	
Average cost per lane-mile constructed	x															7						x			x								
Construction Productivity Index (Cost of contract lettings, utilities, real estate acquisition, construction, change orders, and cost overruns DIVIDED BY staff costs, consultant contracts, and design construction change orders)	x															7						x											
Cost per percentage point increase in lane miles rates fair or better on pavement condition	x															7						x			x	x		x			x		
Data center costs as percentage of total program	x															7						x			x								
Dollar allotment and percent of department funds consumed by overhead	x															7						x			x								
Dollar allotment and percent of funds going to non-engineering activities	x															7						x			x								
Dollar allotment and percent of trunk highway funds going to construction	x															7						x			x						x		
Number and dollar value of projects jointly funded	x															7						x											
Number and dollar value of projects that improve travel time on key routes	x															7						x											
Partnership benefits (to taxpayers and partners)	x															7						x											
Percent cost of re-work	x															7						x			x								
Percentage increase in final amount paid for completed construction over original contract amount	x															7						x			x								
Proportion of infrastructure investment from private sources	x															7						x			x								
Savings to taxpayers/public from partnerships	x															7					x				x								
Unprogrammed construction costs as a percentage of total construction costs	x															7						x			x		x						
Infrastructure maintenance expense	x															7						x			x		x						
Operational cost per toll transaction	x															7						x			x		x						
Additional costs per trip (user fees)	x															7						x	x		x			x					
Average cost per mile	x															7			10			x	x		x			x					
Average cost per trip	x															7			10			x	x		x			x					
Insurance costs	x															7							x					x					
Reduced costs per trip (subsidies)	x															7							x					x					
Use cost/person-mile (user cost)	x															7							x					x					
Value of fuel savings	x															7							x					x		x			
Vehicle operating cost reductions	x															7							x					x					
Average days to complete driver licensing or vehicle registration transactions	x															7						x			x					x			
Percent of invoices processed within five days of receipt	x															7					x				x					x			
Percentage increase in number of days required for completed construction contracts over original contract days	x															7					x												
Units of work completed per hour worked [[output measure?]]	x															7					x												
Hours of incident related delay on highway system	x															7						x											
Speed limits and difference between modes	x															7						x			x		x	x			x	x	x
Number of projects applying technology developed or available in last 'X' years	x															7																	
Percent of error free data in IMS database	x															7																	
Percent of projects rated good to excellent in quality audits	x															7						x			x								
Percent projects requiring few or no significant change orders due to plan errors	x															7						x			x								

Performance Measures Compendium

	Source									Transportation Plan Policy Area											Data Type				PM Characteristic				System				
Performance Measure	NCHRP 446	NCHRP 398	TTI Urban Mobility	OTP	TransPlan	Metro RTP	SKATS	RV RTP	Other	Accessibility	Mobility	Economic Vitality	Quality of Life	Environmental Sustainability	Safety and Security	Efficiency and Affordability	System Preservation	Environmental Justice	Balance \ Adaptability	LUT Compatability	Land Use \ Econonic \ Demographic \ Environmental \ Data	Transport Sytem Data	Travel Model \ Travel Survey	Attitudinal Survey	Benchmark? (Objective)	Forecastable?	Plan Implementation (output)	Market Response (outcome)	Land Use or Combined Land Use \ Transport Measure	Highway	Transit	Ped\Bike	Air	Freight - Truck, Rail, Ship, Air
Percent projects with no premature maintenance problems	x															7						x			x								
Percentage of information and data exchanged between intrastate agencies	x															7					x												
Transactions completed per motor vehicle division employee	x															7					x	x			x								
Vehicle-miles traveled per highway department employees	x															7					x	x			x					x			
Number of toll transactions	x															7						x								x			
Percent of highway tolls pre-paid	x															7						x								x			
Percent of lane miles with toll pricing	x															7						x								x			
Performance of State roads based on HPMS ratings	x															7						x			x					x			
Ton/miles per gallon of fuel	x															7						x						x					x
V/C by route	x										2					7						x	x		x	x		x		x			
VMT per mile of roadway	x															7						x	x		x	x		x					
Management/employee satisfaction communication of agency goals	x															7								x									
Management/employee satisfaction with diversity efforts	x															7								x									
Management/employee satisfaction with progress toward targeted focus area	x															7								x									
Percent of customers satisfied with licensing and registration process	x															7								x									
Overall mode splits	x															7							x		x	x		x		x	x	x	
Number of users of intermodal facilities	x															7						x											
Percent of intermodal connecting points and facilities accurately placed on a map	x															7						x											
Additional revenue earned by producers when shipping via rail	x															7						x											x
Average transfer costs	x															7						x											x
Cost by commodity	x															7						x											x
Cost per fuel-mile as it compares to cost per air (or water or rail) mile	x															7						x											x
Cost per ton of freight shipped	x															7						x											x
Cost per ton-mile by mode	x															7						x											x
Rail freight revenue versus operating expenses	x															7					x	x											x
Ratio of oversize/overweight permit fees collected to dollar value of damage caused	x															7					x	x			x								x
Revenue per ton-mile by mode	x															7						x			x								x
Shipping cost per shipment	x															7																	x
Customs and administrative processing time	x															7																	x
Hours of access lost	x															7																	x
Tons transferred per hour	x															7						x			x								x
Mode split (by ton-mile)	x															7						x			x			x					x
Number of carloads shipped/received on rail project lines	x															7																	x
Number of restricted routes, additional mileage, increased costs	x															7																	x
Percentage of street traffic delivered off-peak	x															7						x			x			x		x			x
Productivity and utility by mode	x															7																	x
Proportion of freight traffic at facility on portion of network	x															7																	x
Regional truck VMT per unit of regional economic activity/output	x															7					x	x			x								x
Change in commute travel person-miles and vehicle-miles per telecommuting occasion	x															7							x					x					
Demand service elasticities for auto v. transit	x															7															x		
Demand service elasticities for work v. non-work	x															7															x		
Percent of work trips that are SOV	x															7							x		x	x		x		x			
Percentage of all trips made by bicycling and walking	x															7																	
Tourist/recreation area utility by mode	x															7																	
Average vehicle occupancy	x															7						x	x		x	x		x		x			
Cost per vehicle for parking fees	x															7						x											
Percent of vehicles using high-occupancy lanes	x															7							x		x	x		x		x			
Percent of workers who have free parking at employment sites	x															7							x							x			
Percent of workers who have paid parking at employment sites	x															7							x							x			
VMT/PMT	x															7							x		x	x		x		x			
Cost passenger in rural areas	x															7						x			x						x		
Cost per passenger for urban transit systems	x															7						x			x						x		
Cost per PMT for urban transit systems	x															7						x			x						x		
Cost per PMT in rural areas	x															7						x			x						x		

Performance Measures Compendium

Performance Measure	Source									Transportation Plan Policy Area											Data Type				PM Characteristic					System				
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Cost per revenue-mile for urban transit systems	x															7						x			x						x			
Cost per revenue-mile in rural areas	x															7						x			x						x			
Cost per VMT for urban transit systems	x															7						x			x						x			
Cost per VMT in rural areas	x															7						x			x						x			
Fare recovery rate of urban transit systems	x															7						x			x			x			x			
Grant dollars per transit trip	x															7						x			x			x			x			
Total transit operating expenditures per transit-mile	x															7						x			x			x			x			
Intercity rail and bus service ridership	x															7						x									x			x
PMT on intercity rail and bus service	x									1						7						x									x			x
Riders at maximum load point	x															7															x			
Ridership per VMT in rural areas	x															7									x			x			x			
Rural service passengers	x															7						x			x			x			x			
Transit passengers per capita	x															7					x	x			x	x		x			x			
Transit peak-load factor	x															7						x			x	x		x			x			
Transit riders per gallon of fuel	x															7						x			x			x			x			
Transit riders per revenue-mile	x															7						x			x	x		x			x			
Transit riders per route-mile	x															7						x			x	x		x			x			
Transit riders per VMT	x															7						x			x	x		x			x			
Transit ridership per capita	x															7					x	x			x	x		x			x			
Transit ridership to capacity ratio	x															7						x			x	x		x			x			
Number of peak period transit vehicles	x															7						x					x				x			
Revenue vehicle hours per transit employee	x															7						x			x		x				x			
Average cost for vehicle on ferry system	x															7						x			x			x		x				x
Enplanements per aviation system employee	x															7						x			x			x		x				x
Alignment (number of curves/grades defined as excessive by HPMS)	x																8					x							x				
Distribution of miles in PSC intervals	x																8					x							x				
Highway performance based on HPMS	x																8					x			x				x				
Maintenance condition as measured against departmental standards	x																8					x			x				x				
Percent of roadway/bridge system below standard condition	x																8					x			x				x				
Percent of VMT on roads with deficient ride quality	x																8					x			x			x					
Age distribution of transit vehicles	x																8					x			x		x				x			
Capacity/Remaining useful life index	x																8					x			x						x			
Present serviceability rating	x																8					x			x						x			
Remaining service life of transit vehicles	x																8					x			x						x			
Distress extent/severity by type (pavement)	x																8					x			x				x				
Distress index	x																8					x			x				x				
Joint condition	x																8					x							x				
New composite index incorporating roughness and distress (pavement)	x																8					x			x				x				
Pavement quality index	x																8					x			x				x				
Percent of lane-miles by pavement condition	x																8					x			x				x				
Percentage of highway mainline pavement rated good or better	x																8					x			x				x				
Remaining life of pavement	x																8					x							x				
Roughness/ride index (IRI)	x																8					x			x				x				
Rut depth	x																8					x							x				
Skid/friction	x																8					x							x				
Tons of asphalt placed by maintenance crews	x																8					x							x				
Accidents related to bridge characteristics [[Safety Measure?]]	x														6							x							x				
Backlog of repairs by different priority categories (bridges)	x																8					x							x				
Deck chloride content (bridges)	x																8					x							x				
Element condition state distributions (Pontis) (bridges)	x																8					x							x				
Paint distress (bridges)	x																8					x							x				
Percentage of highway mainline bridges rated good or better	x														6		8					x			x				x				
Railings below standard (bridges)	x																8					x							x				
Scour criticality (bridges)	x																8					x											

Performance Measures Compendium

	Source									Transportation Plan Policy Area										Data Type				PM Characteristic				System				
Performance Measure	NCHRP 446	NCHRP 398	TTI Urban Mobility	OTP	TransPlan	Metro RTP	SKATS	RV RTP	Other	Accessibility	Mobility	Economic Vitality	Quality of Life	Environmental Sustainability	Safety and Security	Efficiency and Affordability	System Preservation	Environmental Justice	Balance \ Adaptability	LUT Compatability	Land Use \ Econonic \ Demographic \ Environmental \ Data	Transport Sytem Data	Travel Model \ Travel Survey	Attitudinal Survey	Benchmark? (Objective)	Forecastable?	Plan Implementation (output)	Market Response (outcome)	Land Use or Combined Land Use \ Transport Measure	Highway	Transit	Ped\Bike	Air	Freight - Truck, Rail, Ship, Air
Steel bridges with section loss in a member (bridges)	x																8					x							x				
Miles of roadway not useable by certain traffic because of design or condition deficiencies	x																8					x			x					x			
Pavement condition on links to intermodal facilities	x																8					x											x
Percent of road system carrying unrestricted loads year round	x																8					x			x								x
Miles of highway rated 'good' or 'fair' for bicycle travel	x																8					x			x						x		
Miles of rail line acquired and rehabilitated for rail service	x																8					x			x								x
Miles of track in operation (by FRA rating)	x																8					x			x								x
Miles of track not useable by certain traffic because of design or condition deficiencies	x																8					x			x								x
Track condition	x																8					x											x
Track-miles abandoned	x																8					x			x								x
Track-miles under threat of abandonment	x																8					x			x								x
Miles between road calls for transit vehicles	x																8					x			x						x		
Miles to be dredged	x																8					x			x								
Number of state owned navigational aids	x																8					x											
Runway resurfacing frequency (airports)	x																8					x			x								
Backlog of repairs by different priority categories	x																8					x											
Customer perception of amount of work being done to improve system	x																8					x		x				x					
Customer perception of condition of system	x																8					x		x				x					
Hours (or days) out of service (for roads or bridges or transit equipment or airports)	x																8					x								x			
Missed trips due to operation failures	x																8					x											
Number of deficiencies corrected vs. number remaining	x																8					x											
Number of Right-of-Way parcels acquired	x																8					x											
System condition	x																8					x											
Maintenance hours	x																8					x											
Number of bridges let to contract for repair (or replacement)	x																8					x											
Number of lane miles let to contract for capacity improvements	x																8					x											
Number of lane miles let to contract for resurfacing	x																8					x											
Number of projects certified ready for construction	x																8					x											
Number of transit (or rail or aviation or intermodal) projects funded (capital and operating)	x																8					x								x			x
Percent of contracts planned for letting that were actually let	x																8					x											
State (or federal) construction (or maintenance) grants issued	x																8					x											
Agency and user cost of doing nothing or cost-benefit of MR&R (Pontis) (bridges)	x																8				x	x											
Current average maintenance costs	x																8					x											
Expenditures for freight rail	x																8					x											x
Expenditures to retire deficiencies	x																8					x											
Net present value of future transit vehicle (or facility or bridge or pavement), equipments and facility capital, operating and maintenance costs	x																8					x								x			
Non-motorized expenditures	x																8					x			x								
Percent of budget allocated to system preservation activities	x																8					x											
Congested Miles of Travel (% of total VMT)					x						2											x	x		x	x		x		x			
Network Vehicles Hours of Delay (daily)					x						2											x	x		x	x		x		x			
% Transit Mode Share on Congested Corridors					x					1	2											x	x		x	x		x		x			
Internal VMT (no commercial vehicles)					x					1												x	x			x		x		x			
Internal VMT/Capita					x					1						7						x	x		x	x		x		x			
Average Trip Length (miles)					x					1						7							x		x	x		x					
% Person Trips Under 1 mile					x					1				5									x		x	x		x					
Walk Trips					x					1				5									x			x		x			x		
Shared Ride (2 or more)					x					1				5									x			x		x		x			
Drive Alone					x					1													x			x		x		x			
Person Trips per Auto Trip					x											7							x		x	x		x		x			
Average Fuel Efficiency (VMT/Gal.)					x									5		7							x		x			x		x			
CO Emissions (Weekday Tons)					x									5									x		x			x		x			
% of dwelling units built in nodes*					x					1											x				x			x	x				
% of New "Total" Employment in Nodes*					x					1											x				x			x	x				

Performance Measures Compendium

Performance Measure	Source									Transportation Plan Policy Area										Data Type				PM Characteristic				System				
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% of Roadway miles with Sidewalks					x					1											x			x		x						
Ratio of Bikeway to Arterial and Collector Miles					x					1						7					x			x		x				x		
% of Roadways in Fair or Better Condition					x												8				x			x	x	x						
% of Households Within ¼ Mile of a Transit Stop					x					1										x	x			x	x		x	x					
Transit Service Hours per Capita					x					1						7				x	x			x		x				x			
% Households with Access to 10 min Transit Service					x					1										x	x			x	x	x	x	x		x			
% Employment with Access to 10 min Transit Service					x					1										x	x			x	x	x	x	x		x			
Bikeway Miles				x	x					1											x			x		x					x		
Percent Non-Auto Trips					x					1												x		x	x		x						
Percent Transit Mode Share on Congested Corridors					x					1	2											x		x	x		x			x			
Priority Bikeway Miles					x					1											x			x		x				x			
Acres of zoned nodal development					x					1														x		x							
Percent of dwelling units built in nodes					x					1																	x						
Percent of New "Total" Employment in Nodes					x					1																	x						
Arterial and Collector Miles (exclud. Frwys)					x						2										x			x		x		x					
avg. peak hr. travel times-selected regional destinations (all modes)					x					1	2																						
consistency with local, state, federal plans / regulations					x																												
Costs & benefits distribution among community members *					x													8															
Economic Development Policy, Goals					x							3																					
miles of system exceeding LOS standard					x						2																						
modal shares by trip purpose					x					1									10			x	x					x						
net change in # of parking spaces/capita/planning period					x															11													
number of intersections above LOS standard					x						2																						
Ozone - precursors (tons per year)					x									5																			
safety (accidents by mode, and/or other accident measure(s))					x										6																		
Total person trips/vehicles to major destinations (discrete list)					x					1						7																	
total system-wide annual fuel consumption					x									5		6						x	x										
transit & auto travel times in major corridors					x					1	2																			x			
travel time by mode by corridor					x					1	2																						
vehicle (or person) trips < 1/2 mile by trip purpose					x					1										11									x		x		
visual & aesthetic impacts					x								4																				
VMT by LOS (specify: peak hours, other?)					x						2												x										
PM-10 (tons per year)					x									5																			
total vehicle trips per capita					x					1																							
Average Home-Based Work Trip Length						x				1													x					x					
Average Weekday Non-Work Trips						x				1													x					x					
Average Weekday Person Trips						x				1													x					x					
Average Weekday Work Trips						x				1													x					x					
% of Arterial Street Miles Experiencing Congestion (System Performance)						x					2											x	x					x					
% of Freeway Miles Experiencing Congestion						x					2											x	x					x					
% of Households within 1/4-mile of Transit Route						x				1									10	11	x	x						x		x			
% of Jobs within 1/4-mile of Transit						x				1									10	11	x	x			x	x		x		x			
Average Weekday Transit Trips						x				1												x	x		x	x		x		x			
Avergae Motor Vehicle Travel Time						x					2												x		x	x		x					
Avergage Motor Vehicle Speed						x					2												x		x	x		x					
AWD Total Truck Average Trip Lenth (miles)						x				1													x		x	x		x					x
AWD Total Truck Trips						x				1													x		x	x		x					x
Bike Trips					x	x				1				5									x		x	x		x		x			
Comparison of Motor Vehicle Volumes						x					2											x	x			x		x	x				
Comparison of Selected Transit Volumes						x					2											x				x		x		x			
Motor vVehicle Hours of Delay on Arterial Streets						x					2												x			x		x	x				
Motor vVehicle Hours of Delay on Freeway						x					2												x			x		x	x				
Total Motor Vehicle Hours of Delay						x					2												x			x		x					
Transit Trips						x				1				5								x	x		x	x		x		x			

Performance Measures Compendium

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Two-Hour Peak Period Average Truck Travel Time						x					2	3											x			x		x					x
Two-Hour Peak Period Truck Vehicle Hours of Delay						x					2	3											x			x		x					x
Vehicle Miles of Travel						x				1													x			x		x					
Person Trips						x				1													x			x		x					
Total Lane Miles						x					2											x			x	x				x			
Freeway lane-miles						x					2											x			x	x	x			x			
Arterial lane-miles						x					2											x			x	x	x			x			
Total Lane Miles Added (from 1994)						x					2											x			x	x	x						
AWD Total Auto Person Trips						x										7							x			x		x					
AWD Total VMT (no trucks or externals)						x										7						x	x			x		x					
AWD VMT/Capita (no trucks or externals)						x										7					x	x	x		x	x		x					
Change in AWD VMT/Capita from 1994						x										7					x	x	x		x	x		x					
AWD VMT/Employee (no trucks or externals)						x										7					x	x	x		x	x		x					
AWD VMT/Employee change from 1994						x										7					x	x	x		x	x		x					
Single Occupant Vehicle (SOV) Percent of Person Trips						x										7							x		x	x		x					
Non-SOV Percent of Person Trips (shared ride, walk, bike, transit)						x										7							x			x		x					
AWD Motor Vehicle Average Trip Length (miles)						x										7							x		x	x		x	x				
Home-Based-Work Average Trip Length (miles)						x										7							x		x	x		x					
Auto Occupancy						x										7						x	x		x	x		x					
PM 2-HR Motor Vehicle Average Travel Time (minutes)						x					2											x				x		x					
PM 2-HR Average Motor Vehicle Travel Speed (miles per hour)						x					2											x				x		x					
Total Miles in Network						x																x					x						
Freeway Miles						x					2											x					x						
Arterial Miles						x					2											x					x						
PM 2-HR Total Congested miles (v/c >0.9) (percentage of total miles in network)						x					2											x				x		x					
Freeway (percentage of freeway miles in network)						x					2								10			x					x						
Arterial (percentage of arterial miles in network)						x					2								10			x					x						
PM 2-HR Motor Vehicle Hours						x					2											x	x			x		x					
PM 2-HR Motor Vehicle Hours of Delay (time accrued above v/c > 0.9)						x					2											x	x			x		x					
PM 2-HR Percent Motor Vehicle Hours of Delay						x					2											x	x			x		x					
Freeway (percentage of total motor vehicle hours)						x																x				x		x					
Arterial (percentage of total motor vehicle hours)						x																x				x		x					
Total Roadway Capacity-Miles						x																x			x		x						
Freeway/Highway cap-mi						x																x			x		x						
Arterial cap-mi						x																x			x		x						
AWD Truck Average Trip Length (miles)						x																	x			x							x
PM 2-HR Truck Average Travel Time (minutes)						x					2												x			x		x					x
PM 2-HR Truck Hours						x					2												x			x		x					x
PM 2-HR Truck Vehicle Hours of Delay (time accrued above v/c > 0.9)						x					2												x			x		x					x
PM 2-HR Percent Truck Hours of Delay						x					2												x			x		x					x
Lane Miles Added to Freight Network (from 1994)						x																x			x		x						x
Freight Network Miles						x																x					x						x
PM 2-HR Congested Freight Network Miles						x					2											x				x		x					x
PM 2-HR Percent Congested Freight Network Miles						x					2											x				x		x					x
AWD Total Transit Trips (originating riders)						x				1												x	x			x		x					
AWD Transit Revenue Hours						x				1												x				x	x			x			
Transit Percent of Person Trips						x										7							x			x		x			x		
AWD Originating Riders Per Revenue Hour						x										7						x				x		x			x		
Total Walk Trips** (does not include walk trips to transit)						x				1													x			x		x				x	
Walk Percent of Person Trips						x										7							x			x		x				x	
Total Bike Trips***						x				1													x			x		x				x	
Bike Percent of Person Trips						x										7							x			x		x				x	
% of Population Within 1/4 Mile of Transit Route								x		1											x	x				x	x	x	x		x		
% of Population Within Service Area for Lift Service								x		1								9			x	x				x	x	x	x		x		

Performance Measures Compendium

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Collector and Arterials Accommodating Bicyclists								x		1												x					x			x		
Number of Lane-Miles of New Roadway Construction								x		1	2											x					x					
Per Capita Vehicle Miles of Travel								x		1											x		x			x		x				
Per Capita Vehicle Trips								x		1											x		x			x		x				
Access Restrictions								x		1												x					x					
Amount of Paratransit Services								x		1								9				x					x			x		
Capital Improvements								x								7						x					x					
Collectors and Arterials With Sidewalks								x		1					6							x					x			x		
Intrusion into Existing Neighborhoods								x					4	5							x						x		x			
Street System Connectivity								x		1												x					x		x			
Transit Ridership-Frequency and Hours								x		1												x	x				x	x			x		
Percent of trips accessible by non-auto modes within x% max. time difference									x	1									10				x			x					x	x	
VMT - weighted Network LOS under various "de-linking" scenarios									x	1									10				x			x		x					
Unoccupied Seat-Miles of Travel (Vehicle Occupancy / Average Vehicle Capacity)*Miles of Travel									x										10			x				x		x		x	x		
Percent of regional trips on the links carrying x greatest O-D pairs.									x										10				x			x		x					
Percent of regional trips on the x greatest volume links									x										10				x			x		x					
Percent of regional trips on the x greatest volume river crossings									x										10				x			x		x					
Percent of regional trips on the x greatest volume structures									x										10				x			x		x					
Distribution of emergency services (police, fire, hospitals) across rivers, other barriers									x						6				10		x						x		x			
Population-weighted average access time to nearest trauma center									x						6						x											
Average Transit OVTT									x	1												x	x							x		
Percent of of Roadway miles with Sidewalks				x						1					6							x			x		x		x		x		
Percent of of Roadways in Fair or Better Condition				x													8					x			x		x		x			
Ratio of Bikeway to Arterial and Collector Miles				x						1												x			x		x				x	
Percent of Employment with Access to 10 min Transit Service				x						1											x	x			x		x	x	x		x		
Percent of Households with Access to 10 min Transit Service				x						1											x	x			x		x	x	x		x		
Percent of of Households Within ¼ Mile of a Transit Stop				x						1											x	x			x		x	x	x		x		
Number of and Percent of of Accidents Involving Trucks				x											6							x										x
Number of and Percent of of Potential Total of Route Miles Transferred				x												7					x	x			x		x			x		
Percent of Freight System Lane Miles Meeting Mobility Standards During Peak Hours				x							2											x			x			x		x			x
Percent of STAs where v/c meets standard				x							2											x			x		x	x	x	x			
Net Benefit of Off-System Improvements				x								3																					
Number of Bridges on Lifeline Routes with Satisfactory Rating				x											6							x			x				x				
Number of Culverts Retrofitted For Salmon				x											6							x			x								
Number of of Accidents With F/SI per Million Vehicle Miles Traveled				x											6							x			x			x		x			
Number of of At-Grade Crossings Eliminated or Replaced With Grade-Separated				x											6							x			x		x			x			x
Number of of Newly Constructed At-Grade Crossings				x											6							x			x		x			x			x
Number of Route Miles With Potential for Interjurisdictional Transfer				x												7						x			x		x			x			
Number of State Hwys w/ Up-To-Date NR Maps				x						1												x			x					x			
Percent of Bridges on Lifeline Route with Satisfactory Seismic Rating				x											6							x			x					x			
Percent of Customers By Region Reporting Favorable or Better Perception of Hwy System				x									4											x	x					x			
Percent of Customers Reporting Favorable Perception of Scenic Byways				x									4											x	x					x			
Percent of Highway Lane Miles Meeting Mobility Standards				x							2											x								x			
Percent of or Number of Intermodal Connectors Improved				x						1												x											
Percent of OR Residents Whose Lifeline System Access Meets Bridge Rating Standards				x								3	4								x	x			x				x				
Percent of OR Residents Whose Lifeline System Defined and Evaluated				x								3	4								x	x			x				x				
Percent of Oregonians Who Commute To and From Work in SOV				x										5								x	x		x	x		x		x			
Percent of Oregonians Who Comute To and From Work During Peak Hours Not in SOV				x										5								x	x		x	x		x			x	x	
Percent of Total Person Miles of Travel Made in HOV				x										5								x	x		x	x		x			x	x	
Percent of VMT Reduction Due to HOV Lanes				x										5									x		x	x		x		x			
Annual Percent of Reduction in Fatal and Injury Crashes				x											6							x			x			x		x			
Percent of of Occupants Using Safety Restraints				x											6							x	x		x			x		x			
Number of of Park-and -Ride Spaces W/I State Hwy ROW				x						1												x			x			x					
OR Scenic Byway Committee Rating				x									4									x			x								

Performance Measures Compendium

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Number of Deaths Due to Alcohol and Drug-Related Crashes				x											6							x			x			x		x			
Number of Deaths Due to Motor Vehicle Crashed				x											6							x			x			x		x			
Projects Meeting Criteria for Accommodating Bicyclists and Pedestrians				X						x												x			x						x		
Bikeway and Walkway Projects Meeting Adopted Criteria				X						x												x			x						x		
Miles of Rural State Highways Suitable for Bicycling				X						x												x									x		
Miles of Urban State Highways Accommodate Pedestrians and Bicyclists				X						x												x							x		x		
Availability of modal choices				X						x												x		x						x	x		
Ease of use				X						x														x						x	x		
Relative Cost				X						x											x		x						x	x		
Proximity to Service				X						x													x				x		x	x		
Frequency of Service				X						x												x					x			x			
Mode split at major destinations (discrete list)					x											7						x	x			x		x					
auto occupancy-average system-wide					x									5		7						x	x		x	x		x					
Vehicle trips per capita					x											7							x		x	x		x					
auto VMT per capita (define parameters)					x											7							x		x	x		x					
miles of system exceeding LOS standard					x						2											x				x		x	x				
transit & auto travel times in major corridors					x						2											x				x				x			
avg. peak hr. travel times-selected regional destinations (all modes)					x						2											x				x		x					
net change in # of parking spaces/capita/planning period					x																	x						x					
Capital costs - includes construction (all modes, by mode) *					x																	x											
Costs & benefits distribution among community members *					x													1			x	x											
average trip length (system-wide) by trip purpose (8)					x											7			10				x		x	x		x					
average trip length by functional class (6)					x											7			10				x		x	x		x					
vehicle hours of delay					x						2											x	x		x	x		x					
transit, auto, bicycle and ped travel times in major corridors					x						2												x			x		x		x	x		
peak hr. travel times-selected regional destinations (by mode) Time Contour Maps					x						2											x	x			x		x					
Average personal/user travel cost of transportation system **					x											7						x	x					x					
Intrazonal trips & trips to neighboring TAZs					x					1										11			x			x		x	x		x		
percentage of total land by plan designation within metro UGB w/in 1/4, 1/2 mile of transit (by service frequency)					x					1										11	x	x			x		x		x		x		
% of residences w/in 1/4 mile of transit (by service frequency), w/in 1/2 mile of bike system and w/in 1/2 mile of convenience commercial					x					1										11	x	x			x		x		x		x	x	
% of employment w/in 1/4 mile of transit (by service frequency), w/in 1/2 mile of bike system and w/in 1/2 mile of convenience commercial					x					1										11	x	x			x		x		x		x	x	
% of residences w/in 1 mile of maj. employment ctrs. (discrete list)					x					1										11	x				x				x				
modal shares					x					1									10			x	x			x		x					
Mode split at major destinations (discrete list) at TAZ level					x					1									10			x	x			x		x					
total vehicle trips per capita					x					1												x	x			x		x					
auto VMT per capita (define parameters)					x					1						6						x	x		x	x		x	x				
net change in # of parking spaces/capita/planning period					x															11		x			x		x		x				
CO (tons per year)					x									5								x	x		x	x		x					
Ozone - precursors (tons per year)					x									5								x	x		x	x		x					
PM-10 (tons per year)					x									5								x			x	x		x					
visual & aesthetic impacts					x								4	5										x				x					
open space/wetlands/ natural areas removed					x								4	5							x	x			x			x					
impacts upon significant cultural features - historic, archaeological, churches, cemeteries					x								4	5							x												
water quality performance measure(s) (Impervious Surface)					x									5							x												
Measure of Cost vs. Revenue available					x											7					x	x			x								
Capital costs - includes construction (all modes, by mode) *					x											7					x	x					x						
Operating, maintenance & preservation costs (all modes, by mode)					x											7	8				x	x					x						
Administrative capacity / costs (policy level) **					x											7					x	x					x						
Supportive of Sustainable Development					x																			x			x						
OMP Cost / Capital Cost Ratio					x											7					x				x		x						
$ per PMT					x											7					x				x			x					
Number of Local Intersections per Square Mile					x					1	2											x			x		x		x				

Performance Measures Compendium

	Source									Transportation Plan Policy Area										Data Type				PM Characteristic				System				
Performance Measure	NCHRP 446	NCHRP 398	TTI Urban Mobility	OTP	TransPlan	Metro RTP	SKATS	RV RTP	Other	Accessibility	Mobility	Economic Vitality	Quality of Life	Environmental Sustainability	Safety and Security	Efficiency and Affordability	System Preservation	Environmental Justice	Balance \ Adaptability	LUT Compatability	Land Use \ Econonic \ Demographic \ Environmental \ Data	Transport Sytem Data	Travel Model \ Travel Survey	Attitudinal Survey	Benchmark? (Objective)	Forecastable?	Plan Implementation (output)	Market Response (outcome)	Land Use or Combined Land Use \ Transport Measure	Highway	Transit	Ped\Bike	Air	Freight - Truck, Rail, Ship, Air
Elasticity of Accessibility w/r/t Fuel Price					x														10				x									
Reserve Capacity of System					x						2											x						x					
% of Trips that could be accommodated on other modes in emergency					x														10			x	x		x					x		x	
Amount of Travel in Excess of User's "Ideal" Amount of Travel					x					1	2													x			x						
Number of Activity/Goods Opportunities within User's Time/Cost Budget					x					1											x		x					x					
Quality of Activity/Goods Avaialble within User's Time/Cost Budget					x					1											x		x					x					
Percentage of person trips within defined nonauto to auto time difference					x																	x	x		x	x		x					
Percentage of person trips with travel time advantage for non-DA vehicles					x					1												x	x		x	x		x					
Peak / Non-Peak travel time ratios					x						2											x			x	x		x					
Noise Exposure Index (dBa times # Households exposed to transportation noise levels in excess of x dBa)					x										6			9			x	x						x	x				
Households exposed to CO concentrations in excess of x ppm					x										6			9			x					x		x	x				
Differences in Multi-Modal Accessibility by S-E group					x					1								9			x					x							
Differences in Noise Exposure by S-E group					x													9			x					x							
Average travel time / cost to work by S-E group					x					1								9			x		x			x		x					
Difference is CO exposure by S-E group					x													9			x					x	x						
Non-Auto Accessibility for Persons age 12 - 18					x					1													x				x						
Non-Auto Accessibility for Persons age 65+					x					1													x										
Differences in Accessibility to Community Resources and Amenities by S-E Group					x					1											x		x			x		x					
Roadway Congestion Index			x								2											x			x	x		x	x				
Travel Rate Index			x								2											x			x	x		x	x				
Travel Time Index			x								2											x			x	x		x	x				
Travel Delay			x								2											x			x	x		x	x				
Buffer Index: ((95%ile min/mile - mean min/mile)/mean min/mile)*100%			x								2											x			x	x		x	x				
Travel Rate		x									2											x			x	x		x	x				
Delay Rate		x									2											x			x	x		x	x				
Total Delay		x									2											x			x	x		x	x				
Relative Delay Rate		x									2											x			x	x		x	x				
Delay Ratio		x									2											x			x	x		x	x				
Congested Travel : Congested vehicle-miles		x									2											x			x	x		x	x				
Accessibility: sum of objective fullment opportunities within x minutes travel time		x								1													x		x			x	x				
Speed Reduction Index: ratio of decline of speeds from free-flow conditions		x									2											x			x			x	x				
Congestion Severity Index		x									2											x			x			x	x				
Lane-mile duration index		x									2											x						x	x				
Peak 1-Hr Percent of Peak 2-Hr and Daily Traffic (a measure of reserve capacity)									x		2											x						x	x				
Ratio of Population or Employment Density to Street Intersection Density									x											11	x	x					x		x		x			
TOTAL NUMBER OF MEASURES										180	176	59	37	65	93	195	72	18	22	10	126	504	205	36	372	208	150	362	57	224	151	55	20	133

APPENDIX B: PROGRAMS FOR CALCULATING PERFORMANCE MEASURES

Appendix B.1 – R Script to Calculate Mobility Measures

calculate_mobility_measures.R

Author: Brian Gregor
Contact: brian.j.gregor@odot.state.or.us
Date: 09/26/05
Revisions:

Read in data and define variables

Read in network data

```
Links.Lk__ <- read.table("eug_netdata_rev_names.txt", header=TRUE)
rownames(Links.Lk__) <- paste(Links.Lk__$Inode, Links.Lk__$Jnode,
sep="-")
Capacities.Lk__ <- read.table("EUG_CAPS.TXT", header=TRUE)
rownames(Capacities.Lk__) <- paste(Capacities.Lk__$inode,
Capacities.Lk__$jnode, sep="-")
```

Join the capacities data to the link data and calculate volume to capacity ratios

```
Links.Lk__$Cap <-
Capacities.Lk__[rownames(Links.Lk__),"link_cap_per_day"]
Links.Lk__$VcA <- Links.Lk__$AdtA / Links.Lk__$Cap
Links.Lk__$VcB <- Links.Lk__$AdtB / Links.Lk__$Cap
```

Define link types

```
# Link types classify all functional classes of interest
Lt <- c(1, 2, 3, 4, 5, 6, 7, 8)
names(Lt) <- c("Freeway", "Principal Arterial", "Major Arterial",
"Minor Arterial",
               "Major Collector", "Neighborhood Collector", "Local",
               "Freeway Ramp")
```

Only keep data of these link types

```
Links.Lk__ <- Links.Lk__[Links.Lk__$Type %in% Lt,]
```

Add IncidentDelayRatio to the dataframe

```
Links.Lk__$InciDlyRatio <- rep(NA, nrow(Links.Lk__))
Links.Lk__$InciDlyRatio[Links.Lk__$Type %in% c(1,8)] <- 2.4
Links.Lk__$InciDlyRatio[Links.Lk__$Type %in% 2:7 ] <- 1.1
```

Define several standard parameters

```
# Vehicle occupancy
VehOcc <- 1.25

# Working days
WorkDays <- 250

# Population
Population <- 235000
```

Define functions to calculate measures

Define a function to calculate recurring vehicle hours of delay (VHD) by link

parameter: Delay.Lk - vector of link delay

parameter: Vol.Lk - vector of traffic volume by network link

return: RecurVhd.Lk - vector of vehicle-hours of recurring delay per link

```
calcRecurVhd <- function(Delay.Lk, Vol.Lk){
     RecurVhd.Lk <- Delay.Lk * Vol.Lk / 60
     RecurVhd.Lk
     }
```

Define a function to calculate recurring and incident vehicle hours of delay (VHD) by link

parameter: Delay.Lk - vector of link delay

parameter: Vol.Lk - vector of ADT by network link

parameter: InciDlyRatio.Lk - vector of ratios of incident delay to recurring delay

return: TotVhd.Lk - vector of total minutes of recurring and incident delay per link

```
calcTotVhd <- function(Delay.Lk, Vol.Lk, InciDlyRatio.Lk){
     TotVhd.Lk <- Delay.Lk * (1 + InciDlyRatio.Lk) * Vol.Lk / 60
     TotVhd.Lk
     }
```

Define a function to calculate link vehicle miles traveled (VMT)

parameter: Length.Lk - link length in miles

parameter: Vol.Lk - link volume in vehicles

return: Vmt.Lk - link vehicle miles traveled

```
calcVmt <- function(Length.Lk, Vol.Lk){
     Vmt.Lk <- Length.Lk * Vol.Lk
     Vmt.Lk
     }
```

Define a function to calculate annual person delay

parameter: TotVhd.Lk - vector of total vehicle hours of delay

parameter: VehOcc - average vehicle occupancy

parameter: WorkDays - number of work days per year

return: TotPhd.Lk - number of annual person hours of delay per year

```
calcTotPhd <- function(TotVhd.Lk, VehOcc, WorkDays){
     TotPhd.Lk <- TotVhd.Lk * VehOcc * WorkDays
     TotPhd.Lk
     }
```

Define a function to calculate average speed by link type

parameter: Length.Lk - link length in miles

parameter: Vol.Lk - link traffic volume

parameter: Time.Lk - link travel time in minutes

parameter: Type.Lk - link type

return: AveSpeed.Lt - average speed by link type

```
calcAveTypeSpeed <- function(Length.Lk, Vol.Lk, Time.Lk, Type.Lk){
     Vmt.Lk <- calcVmt(Length.Lk, Vol.Lk)
     Speed.Lk <- 60 * Length.Lk / Time.Lk
     VmtWtSpeed.Lk <- Speed.Lk * Vmt.Lk
     SumVmtWtSpeed.Lt <- tapply(VmtWtSpeed.Lk, Type.Lk, sum)
     SumVmt.Lt <- tapply(Vmt.Lk, Type.Lk, sum)
     AveSpeed.Lt <- SumVmtWtSpeed.Lt / SumVmt.Lt
     AveSpeed.Lt
     }
```

Define a function to calculate travel rate index by link type (freeflow comparison)

parameter: Length.Lk - link length in miles

parameter: Vol.Lk - link traffic volume

parameter: Time.Lk - link travel time in minutes

parameter: Ffs.Lk - link free flow speed

parameter: Type.Lk - link type

return: AveTri.Lt - average travel rate index by link type

```
calcAveTypeTri1 <- function(Length.Lk, Vol.Lk, Delay.Lk, Ffs.Lk,
Type.Lk){
     Vmt.Lk <- calcVmt(Length.Lk, Vol.Lk)
     FfsTime.Lk <- 60 * Length.Lk / Ffs.Lk
     RecurCongTime.Lk <- FfsTime.Lk + Delay.Lk
     Tri.Lk <- RecurCongTime.Lk / FfsTime.Lk
     VmtWtTri.Lk <- Tri.Lk * Vmt.Lk
     SumVmtWtTri.Lt <- tapply(VmtWtTri.Lk, Type.Lk, sum)
     SumVmt.Lt <- tapply(Vmt.Lk, Type.Lk, sum)
```

```
     AveTri.Lt <- SumVmtWtTri.Lt / SumVmt.Lt
     AveTri.Lt
     }
```

Define a function to calculate travel rate index by link type (LOS D/E comparison)

parameter: Length.Lk - link length in miles

parameter: Vol.Lk - link traffic volume

parameter: Time.Lk - link travel time in minutes

parameter: Ffs.Lk - link free flow speed

parameter: Type.Lk - link type

return: AveTri.Lt - average travel rate index by link type

```
calcAveTypeTri2 <- function(Length.Lk, Vol.Lk, Delay.Lk,
                    DelayDe.Lk, Ffs.Lk, Type.Lk){
     Vmt.Lk <- calcVmt(Length.Lk, Vol.Lk)
     FfsTime.Lk <- 60 * Length.Lk / Ffs.Lk
     RecurCongTime.Lk <- FfsTime.Lk + Delay.Lk
     DeTime.Lk <- RecurCongTime.Lk - DelayDe.Lk
     Tri.Lk <- RecurCongTime.Lk / DeTime.Lk
     VmtWtTri.Lk <- Tri.Lk * Vmt.Lk
     SumVmtWtTri.Lt <- tapply(VmtWtTri.Lk, Type.Lk, sum)
     SumVmt.Lt <- tapply(Vmt.Lk, Type.Lk, sum)
     AveTri.Lt <- SumVmtWtTri.Lt / SumVmt.Lt
     AveTri.Lt
     }
```

Define a function to calculate travel time index by link type (freeflow comparison)

parameter: Length.Lk - link length in miles

parameter: Vol.Lk - link traffic volume

parameter: Time.Lk - link travel time in minutes

parameter: Ffs.Lk - link free flow speed

parameter: Type.Lk - link type

return: AveTri.Lt - average travel rate index by link type

```
calcAveTypeTti1 <- function(Length.Lk, Vol.Lk, Delay.Lk, Ffs.Lk,
                         InciDlyRatio.Lk, Type.Lk){
     Vmt.Lk <- calcVmt(Length.Lk, Vol.Lk)
     TotDelay.Lk <- Delay.Lk * (1 + InciDlyRatio.Lk)
     FfsTime.Lk <- 60 * Length.Lk / Ffs.Lk
     TotCongTime.Lk <- FfsTime.Lk + TotDelay.Lk
     Tti.Lk <- TotCongTime.Lk / FfsTime.Lk
     VmtWtTti.Lk <- Tti.Lk * Vmt.Lk
     SumVmtWtTti.Lt <- tapply(VmtWtTti.Lk, Type.Lk, sum)
     SumVmt.Lt <- tapply(Vmt.Lk, Type.Lk, sum)
     AveTti.Lt <- SumVmtWtTti.Lt / SumVmt.Lt
     AveTti.Lt
```

```
}
```

Define a function to calculate travel time index by link type (LOS D/E comparison)

parameter: Length.Lk - link length in miles

parameter: Vol.Lk - link traffic volume

parameter: Time.Lk - link travel time in minutes

parameter: Ffs.Lk - link free flow speed

parameter: Type.Lk - link type

return: AveTri.Lt - average travel rate index by link type

```
calcAveTypeTti2 <- function(Length.Lk, Vol.Lk, Delay.Lk, DelayDe.Lk,
Ffs.Lk,
                    InciDlyRatio.Lk,  Type.Lk){
Vmt.Lk <- calcVmt(Length.Lk, Vol.Lk)
TotDelay.Lk <- Delay.Lk * (1 + InciDlyRatio.Lk)
FfsTime.Lk <- 60 * Length.Lk / Ffs.Lk
RecurCongTime.Lk <- FfsTime.Lk + Delay.Lk
TotCongTime.Lk <- FfsTime.Lk + TotDelay.Lk
DeTime.Lk <- RecurCongTime.Lk - DelayDe.Lk
Tti.Lk <- TotCongTime.Lk / DeTime.Lk
VmtWtTti.Lk <- Tti.Lk * Vmt.Lk
SumVmtWtTti.Lt <- tapply(VmtWtTti.Lk, Type.Lk, sum)
SumVmt.Lt <- tapply(Vmt.Lk, Type.Lk, sum)
AveTti.Lt <- SumVmtWtTti.Lt / SumVmt.Lt
AveTti.Lt
}
```

Conduct tests of measures

```
attach(Links.Lk__)
```

Calculate average annual delay per person for two reference speeds and two network scenarios

Scenario A - with Ferry Street Bridge Link

```
# Freeflow reference speed all Links
# Calculate daily vehicle hours of delay
ARecurVhdFreeflow.Lk <- calcRecurVhd(DlyFfsA, AdtA)
ATotVhdFreeflow.Lk <- calcTotVhd(DlyFfsA, AdtA, InciDlyRatio)
# Calculate annual person hours of delay
ARecurAnnPhdFreeflow.Lk <- calcTotPhd(ARecurVhdFreeflow.Lk, VehOcc,
WorkDays)
ATotAnnPhdFreeflow.Lk <- calcTotPhd(ATotVhdFreeflow.Lk, VehOcc,
WorkDays)
# Calculate annual hours of delay per capita
AAnnRecurDlyCapFreeflow <- sum(ARecurAnnPhdFreeflow.Lk) / Population
AAnnTotDlyCapFreeflow <- sum(ATotAnnPhdFreeflow.Lk) / Population
```

```
# Freeflow reference speed freeway and principal arterial links
# Calculate daily vehicle hours of delay
ARecurVhdFreeflow.Lk <- calcRecurVhd(DlyFfsA[Type %in% c(1,2)],
AdtA[Type %in% c(1,2)])
ATotVhdFreeflow.Lk <- calcTotVhd(DlyFfsA[Type %in% c(1,2)],
                        AdtA[Type %in% c(1,2)], InciDlyRatio[Type %in%
c(1,2)])
# Calculate annual person hours of delay
ARecurAnnPhdFreeflow.Lk <- calcTotPhd(ARecurVhdFreeflow.Lk, VehOcc,
WorkDays)
ATotAnnPhdFreeflow.Lk <- calcTotPhd(ATotVhdFreeflow.Lk, VehOcc,
WorkDays)
# Calculate annual hours of delay per capita
AAnnRecurDlyCapFreeflow2 <- sum(ARecurAnnPhdFreeflow.Lk) / Population
AAnnTotDlyCapFreeflow2 <- sum(ATotAnnPhdFreeflow.Lk) / Population

# Moderate flow reference speed for all links
# Calculate daily vehicle hours of delay
ARecurVhdModflow.Lk <- calcRecurVhd(DlyDeA, AdtA)
ATotVhdModflow.Lk <- calcTotVhd(DlyDeA, AdtA, InciDlyRatio)
# Calculate annual person hours of delay
ARecurAnnPhdModflow.Lk <- calcTotPhd(ARecurVhdModflow.Lk, VehOcc,
WorkDays)
ATotAnnPhdModflow.Lk <- calcTotPhd(ATotVhdModflow.Lk, VehOcc, WorkDays)
# Calculate annual hours of delay per capita
AAnnRecurDlyCapModflow <- sum(ARecurAnnPhdModflow.Lk) / Population
AAnnTotDlyCapModflow <- sum(ATotAnnPhdModflow.Lk) / Population

# Moderate flow reference speed for freeway and principal arterial
links
# Calculate daily vehicle hours of delay
ARecurVhdModflow.Lk <- calcRecurVhd(DlyDeA[Type %in% c(1,2)], AdtA[Type
%in% c(1,2)])
ATotVhdModflow.Lk <- calcTotVhd(DlyDeA[Type %in% c(1,2)],
                   AdtA[Type %in% c(1,2)], InciDlyRatio[Type %in%
c(1,2)])
# Calculate annual person hours of delay
ARecurAnnPhdModflow.Lk <- calcTotPhd(ARecurVhdModflow.Lk, VehOcc,
WorkDays)
ATotAnnPhdModflow.Lk <- calcTotPhd(ATotVhdModflow.Lk, VehOcc, WorkDays)
# Calculate annual hours of delay per capita
AAnnRecurDlyCapModflow2 <- sum(ARecurAnnPhdModflow.Lk) / Population
AAnnTotDlyCapModflow2 <- sum(ATotAnnPhdModflow.Lk) / Population
```

Scenario B - without Ferry Street Bridge Link

```
# Freeflow reference speed all Links
# Calculate daily vehicle hours of delay
BRecurVhdFreeflow.Lk <- calcRecurVhd(DlyFfsB, AdtB)
BTotVhdFreeflow.Lk <- calcTotVhd(DlyFfsB, AdtB, InciDlyRatio)
# Calculate annual person hours of delay
BRecurAnnPhdFreeflow.Lk <- calcTotPhd(BRecurVhdFreeflow.Lk, VehOcc,
WorkDays)
BTotAnnPhdFreeflow.Lk <- calcTotPhd(BTotVhdFreeflow.Lk, VehOcc,
WorkDays)
```

```
# Calculate annual hours of delay per capita
BAnnRecurDlyCapFreeflow <- sum(BRecurAnnPhdFreeflow.Lk) / Population
BAnnTotDlyCapFreeflow <- sum(BTotAnnPhdFreeflow.Lk) / Population

# Freeflow reference speed freeway and principal arterial links
# Calculate daily vehicle hours of delay
BRecurVhdFreeflow.Lk <- calcRecurVhd(DlyFfsB[Type %in% c(1,2)],
AdtB[Type %in% c(1,2)])
BTotVhdFreeflow.Lk <- calcTotVhd(DlyFfsB[Type %in% c(1,2)],
                         AdtB[Type %in% c(1,2)], InciDlyRatio[Type %in%
c(1,2)])
# Calculate annual person hours of delay
BRecurAnnPhdFreeflow.Lk <- calcTotPhd(BRecurVhdFreeflow.Lk, VehOcc,
WorkDays)
BTotAnnPhdFreeflow.Lk <- calcTotPhd(BTotVhdFreeflow.Lk, VehOcc,
WorkDays)
# Calculate annual hours of delay per capita
BAnnRecurDlyCapFreeflow2 <- sum(BRecurAnnPhdFreeflow.Lk) / Population
BAnnTotDlyCapFreeflow2 <- sum(BTotAnnPhdFreeflow.Lk) / Population

# Moderate flow reference speed for all links
# Calculate daily vehicle hours of delay
BRecurVhdModflow.Lk <- calcRecurVhd(DlyDeB, AdtB)
BTotVhdModflow.Lk <- calcTotVhd(DlyDeB, AdtB, InciDlyRatio)
# Calculate annual person hours of delay
BRecurAnnPhdModflow.Lk <- calcTotPhd(BRecurVhdModflow.Lk, VehOcc,
WorkDays)
BTotAnnPhdModflow.Lk <- calcTotPhd(BTotVhdModflow.Lk, VehOcc, WorkDays)
# Calculate annual hours of delay per capita
BAnnRecurDlyCapModflow <- sum(BRecurAnnPhdModflow.Lk) / Population
BAnnTotDlyCapModflow <- sum(BTotAnnPhdModflow.Lk) / Population

# Moderate flow reference speed for freeway and principal arterial
links
# Calculate daily vehicle hours of delay
BRecurVhdModflow.Lk <- calcRecurVhd(DlyDeB[Type %in% c(1,2)], AdtB[Type
%in% c(1,2)])
BTotVhdModflow.Lk <- calcTotVhd(DlyDeB[Type %in% c(1,2)],
                    AdtB[Type %in% c(1,2)], InciDlyRatio[Type %in%
c(1,2)])
# Calculate annual person hours of delay
BRecurAnnPhdModflow.Lk <- calcTotPhd(BRecurVhdModflow.Lk, VehOcc,
WorkDays)
BTotAnnPhdModflow.Lk <- calcTotPhd(BTotVhdModflow.Lk, VehOcc, WorkDays)
# Calculate annual hours of delay per capita
BAnnRecurDlyCapModflow2 <- sum(BRecurAnnPhdModflow.Lk) / Population
BAnnTotDlyCapModflow2 <- sum(BTotAnnPhdModflow.Lk) / Population
```

Calculate Travel Time Index

```
UmsType <- 1 * (Type %in% c(1,2))

# calculate TTI for Scenario A freeflow speed, all classes
calcAveTypeTti1(Length, AdtA, DlyFfsA, Ffs, InciDlyRatio, rep(1,
length(Length)))
```

```
# calculate TTI for Scenario A freeflow speed, freeway and principal
arterial
calcAveTypeTti1(Length, AdtA, DlyFfsA, Ffs, InciDlyRatio, UmsType)
# calculate TTI for Scenario A modflow speed, all classes
calcAveTypeTti2(Length, AdtA, DlyFfsA, DlyDeA, Ffs, InciDlyRatio,
rep(1, length(Length)))
# calculate TTI for Scenario A modflow speed, freeway and principal
arterial
calcAveTypeTti2(Length, AdtA, DlyFfsA, DlyDeA, Ffs, InciDlyRatio,
UmsType)

# calculate TTI for Scenario B freeflow speed, all classes
calcAveTypeTti1(Length, AdtB, DlyFfsB, Ffs, InciDlyRatio, rep(1,
length(Length)))
# calculate TTI for Scenario B freeflow speed, freeway and principal
arterial
calcAveTypeTti1(Length, AdtB, DlyFfsB, Ffs, InciDlyRatio, UmsType)
# calculate TTI for Scenario B modflow speed, all classes
calcAveTypeTti2(Length, AdtB, DlyFfsB, DlyDeB, Ffs, InciDlyRatio,
rep(1, length(Length)))
# calculate TTI for Scenario B modflow speed, freeway and principal
arterial
calcAveTypeTti2(Length, AdtB, DlyFfsB, DlyDeB, Ffs, InciDlyRatio,
UmsType)
```

Appendix B.2 – R Script to Set Up TCI Calculations

tci_setup.R

Author: Brian Gregor
Date: 9/26/05
Contact: brian.j.gregor@odot.state.or.us

Description

This script prepares the workspace and file directories for calculating the Travel Cost Index and related measures. The script needs to be executed at the top level of a JEMnR model structure.

Load generic JEMnR functions

```
codeLoc <- "rcode"
source(paste(codeLoc, "/jemnrFunctions.R", sep=""))
attach(fun) #Attach function list fun to workspace
```

Make tci directory if doesn't exist

```
if(!file.exists("tci")) dir.create("tci")
if(!file.exists("tci/graphics")) dir.create("tci/graphics")
```

Load Variable Definitions

```
# Define income group abbreviation
Ic <- c("lowInc", "midInc", "highInc")

# Define zone abbreviation and limit to internal zones
load("inputs/RData/districts.RData")
externalZones <- districts$zone[districts$zone<100]
zoneNames <- districts$zone
Zo <- as.character(zoneNames)
IsInternal <- !(Zo %in% as.character(externalZones))
Zi <- Zo[IsInternal]; rm(IsInternal)

# Define trip purpose abbreviation
# The purposes for this study (now) are limited to the home-based trips
# They exclude nonhome-based trips, school trips and college trips
Pr <- c("hbw", "hbs", "hbr", "hbo")

# Define the travel modes
```

```
Md <- c("driveAlone", "drivePass", "pass", "busWalk", "parkAndRideBus",
"bike", "walk")

# Define time and cost coefficients to convert logsums into time and
cost equivalents
IvTimeCoeff.Pr <- c(hbw=-0.03528, hhs=-0.02275, hhr=-0.02275, hho=-
0.02275)
OpCostCoeff.PrIc <- rbind(
               hbw=c(lowInc=-0.5417, midInc=-0.5417, highInc=-0.5417),
               hbs=c(lowInc=-0.4033, midInc=-0.4033, highInc=-0.4033),
               hbr=c(lowInc=-0.4033, midInc=-0.4033, highInc=-0.4033),
               hbo=c(lowInc=-0.4033, midInc=-0.4033, highInc=-0.4033))

# Define bike and walk access utility coefficients
BikeAccessCoeff.Pr <- c(hbw=-3.217, hbs=-1.839, hbr=-1.839, hbo=-1.839)
WalkAccessCoeff.Pr <- c(hbw=-4.389, hbs=-2.532, hbr=-2.532, hbo=-2.532)
```

Calculate and Save the Size Variables for each Trip Purpose

```
# Load the utility descriptions
sizeVarUtils <- readUtils("inputs/sizeVarUtils.csv")
verifyVarName("sizeVarUtils",varDictionary)

# Load function for calculating the size variables and saving them to
disk
source("rcode/tci/calc_size_vars.R")

for(pr in Pr){
     for(ic in Ic){
          CombinedPrIc <- paste(pr, ic, sep="")
          calcSizeVars(CombinedPrIc)
          }
     }
```

Calculate utilities and logsums

```
for(pr in Pr){
      accessUtilities(pr)
      }
for(pr in Pr){
      accessLogSum(pr)
      }
```

Appendix B.3 – R Script to Calculate Reference Zone and Market Baskets

calc_reference_attractions.R

Author: Brian Gregor
Date: 9/26/05
Contact: brian.j.gregor@odot.state.or.us

Description

This script identifies a reference zone for the travel cost index and related measures and computes the reference market place attractions.

The reference zone is identified as the TAZ that has the most attractions within it's market area. The log sums of the JEMnR access utilities are used to identify market areas. These measure the composite cost of travel between zones and are calculated in JEMnR for each trip purpose and income group. The reference zone is identified as the zone that has greatest market attractions, subject to limits of transit availability and presence of households. Attraction scores are calculated by dividing the market attractions for each zone by the maximum market attractions for all zones. This is done for each trip purpose and income group. The results are summed for each zone to get a total score. Since there are three income groups and four trip purposes, the maximum score is 12. Reference market baskets are calculated for each combination of income and trip purpose. Market baskets are calculated for each TAZ by calculating the percentage of trip attractions to each TAZ and placing this vector of values in order of descending log sums. Then a cumulative sum of the percentages is calculated and the zones whoses values add to 50% are identified. This is the market area for the TAZ. The market basket for the TAZ is calculated by summing the size terms from the destination choice model for TAZs in the market area. The reference market basket is calculated as the mean of the market baskets for all zones.

Define a function that calculates zonal market access scores and market baskets

This function is applied to each TAZ by trip purpose and income group the steps are: * Calculate the percent of trips going to each zone * Order the percent of trips by the order of the log sums * Calculate the cumulative sums of the percents * Identify the zones that sum to 50% * Sum the size terms for those zones to get values for calculating the market basket * Identify zones that have a log sum of one or greater * Sum the size terms in

those zones to get values for calculation reference zone scores :Parameter: Trips.Zi - A vector of trips from a production zone to attraction zones :Parameter: SizeVar.Zi - A vector of size variables :Parameter: LogSum.Zi - A vector of logsums from a production zone to attraction zones :Parameter: PctBreak - A percentage of trips to be the criteria for determining a market area :Return: TripAttractions - The total of size variables to be used for calculating market basket :Return: ScoreAttractions - The total of size variables to be used for calculating scores

```
calcMarketAccess <- function(Trips.Zi, SizeVar.Zi, LogSum.Zi,
PctBreak=50){
     TripPct.Zi <- 100 * Trips.Zi / sum(Trips.Zi)
     LogsumOrder <- rev(order(LogSum.Zi))
     TripPctCumSum <- cumsum(TripPct.Zi[LogsumOrder])
     MarketZones <- names(TripPctCumSum)[TripPctCumSum <= PctBreak]
     TripAttractions <- sum(SizeVar.Zi[MarketZones])
     ScoreAttractions <- sum(SizeVar.Zi[LogSum.Zi > 1])
     c(TripAttractions, ScoreAttractions)
     }
```

Calculate market attractions and logsums for each trip purpose, income group and zone

Iterate through each trip purpose and income group and call calcMarketAccess for each TAZ. Create arrays of values by zone, income group and trip purpose. TripAttractions.ZiIcPr is an array containing the values of total size terms that is used to calculate reference market baskets. ScoreAttractions.ZiIcPr is an array containing the values of total size terms used to identify the reference zone. The abbreviations after the period in the names of these arrays indicates their dimensionality. Zi is a vector of the names of TAZs that are internal to the model. Ic is a vector of the names of income groups. Pr is a vector of the names of trip purposes.

```
# Create arrays to store trip attractions and score attractions
TripAttractions.ZiIcPr <- array(0, dim=c(length(Zi), length(Ic),
length(Pr)),
                        dimnames=list(Zi,Ic,Pr))
ScoreAttractions.ZiIcPr <- array(0, dim=c(length(Zi), length(Ic),
length(Pr)),
                        dimnames=list(Zi,Ic,Pr))


# Begin iteration by trip purpose
for(pr in Pr){

     # Load trip distribution matrices for each income group
     for(ic in Ic){
          DistFileName <- paste("tripdist/", pr, ic, "Dist.Rdata",
sep="")
          load(DistFileName)
          rm(DistFileName)
          }
```

```
     # Load size variable matrices for each income group
     for(ic in Ic){
          SizeVarFileName <- paste("sizevars/SizeVar", pr, ic,
".RData", sep="")
          load(SizeVarFileName)
          rm(SizeVarFileName)
          }

     # Load log sums
     # Unlike trip distribution data, the logsums for all income groups
     # are contained in one list.
     LogsumFileName <- paste("access/", "logSum", pr, ".Rdata", sep="")
     load(LogsumFileName)
     rm(LogsumFileName)

     # Calculate Accessibility of Market Areas by Income Group and Zone

     # Create a matrices to store the market area logsums, times and
costs for a purpose
     TripAttractions.ZiIc <- matrix(0, length(Zi), length(Ic),
dimnames=list(Zi, Ic))
     ScoreAttractions.ZiIc <- matrix(0, length(Zi), length(Ic),
dimnames=list(Zi, Ic))

     for(ic in Ic){

          # Get trip matrix trim off external TAZs
          TripsObjName <- paste(pr, ic, "Dist", sep="")
          Trips.ZoZo <- get(TripsObjName) ; rm(TripsObjName)
          dimnames(Trips.ZoZo) <- list(Zo, Zo) # Zo is vector of names
of all zones
          Trips.ZiZi <- Trips.ZoZo[Zi,Zi] ; rm(Trips.ZoZo)

          # Get size data matrix and trim off external TAZs
          SizeVarObjName <- paste("sizeVar", pr, ic, sep="")
          SizeVar.ZoZo <- get(SizeVarObjName); rm(SizeVarObjName)
          dimnames(SizeVar.ZoZo) <- list(Zo, Zo)
          SizeVar.ZiZi <- SizeVar.ZoZo[Zi,Zi] ; rm(SizeVar.ZoZo)

          # Get log sum data matrix and trim off external TAZs
          LogSumObjName <- paste("logSum", pr, sep="")
          LogSum.ZoZo <- get(LogSumObjName)[[ic]] ; rm(LogSumObjName)
          dimnames(LogSum.ZoZo) <- list(Zo, Zo)
          LogSum.ZiZi <- LogSum.ZoZo[Zi,Zi] ; rm(LogSum.ZoZo)

          # For each TAZ, calculate trip attractions and score
attractions
          MarketValues <- matrix(0, length(Zi), 2, dimnames=list(Zi,
c("Attractions", "Logsum")))
          for(zi in Zi){
               MarketValues[zi,] <- calcMarketAccess(Trips.ZiZi[zi,],
SizeVar.ZiZi[zi,],
                                    LogSum.ZiZi[zi,])
               }

          # Assign values to TripAttractions.ZiIc and
ScoreAttractions.ZiIc
```

```
          TripAttractions.ZiIc[,ic] <- MarketValues[,1]
          ScoreAttractions.ZiIc[,ic] <- MarketValues[,2]
          rm(MarketValues)
          }

     # Assign values for a purpose to TripAttractions.ZiIcPr and
ScoreAttractions.ZiIcPr
     TripAttractions.ZiIcPr[,,pr] <- TripAttractions.ZiIc ;
rm(TripAttractions.ZiIc)
     ScoreAttractions.ZiIcPr[,,pr] <- ScoreAttractions.ZiIc ;
rm(ScoreAttractions.ZiIc)

     # End iteration by trip purpose
     }
```

Find the Reference Zone

The reference zone is the zone which has transit available, has at least 10 households low, middle and high income households, and has the greatest number of attractions in the market area.

```
# Calculate a total score for each TAZ
MaxAttractions <- apply(ScoreAttractions.ZiIcPr, c(2,3), function(x)
max(x))
NormScoreAttractions.ZiIcPr <- sweep(ScoreAttractions.ZiIcPr, c(2,3),
       MaxAttractions, "/")
AttractionScore.Zi <- apply(NormScoreAttractions.ZiIcPr, 1, sum)

# Select zones that have at least 10 households and has transit service
# Load household data
load("pregen/whiazAry.RData")
Hh.ZoIc <- t(apply(whiazAry, c(3,5), sum))
rownames(Hh.ZoIc) <- Zo
Hh.ZiIc <- Hh.ZoIc[Zi,]
rm(whiazAry, Hh.ZoIc)
Hh.ZiIc <- t(apply(Hh.ZiIc, 1, function(x) c(x[1] + x[2], x[3], x[4])))
colnames(Hh.ZiIc) <- Ic
HasEnoughHh <- apply(Hh.ZiIc >= 10, 1, all)
# Identify available internal zones where transit is available
tAvail <-  read.csv("inputs/tAvail.csv")
tAvail <- tAvail[order(tAvail$taz),]
tAvail <- as.logical(tAvail$tAvail)
TransitAvailable <- tAvail
names(TransitAvailable) <- Zo
TransitAvailable <- TransitAvailable[Zi]
# Select the zones that have enough households and transit is available
AttractionScoreQualified.Zi <- AttractionScore.Zi[HasEnoughHh &
TransitAvailable]

# Identify the zone with the maximum score from the qualified zones
ReferenceZone <- names(AttractionScoreQualified.Zi)[
          which(AttractionScoreQualified.Zi ==
max(AttractionScoreQualified.Zi))]
```

Find the Reference market baskets

The reference market baskets are the mean of the market baskets calculated for each zone.

```
ReferenceAttractions <- apply(TripAttractions.ZiIcPr, c(2,3), mean)
```

Save the results

```
save(TripAttractions.ZiIcPr, file="tci/TripAttractions.ZiIcPr.RData")
save(AttractionScore, file="tci/AttractionScore.RData")
save(AttractionScoreQualified.Zi,
file="tci/AttractionScoreQualified.Zi.RData")
save(ReferenceZone, file="tci/ReferenceZone.RData")
save(ReferenceAttractions, file="tci/ReferenceAttractions.RData")
```

Appendix B.4 – R Script to Calculate the Transportation Cost Index, Percent of Market Accessible by Non-Auto Modes, and Auto Dependence Index

calc_tci.R

Author: Brian Gregor
Date: 9/26/05
Contact: brian.j.gregor@odot.state.or.us

Description

This script calculates the travel cost index (TCI), percent of market accessible by non-auto travel modes, and auto dependence index.

Load the reference data

```
# Identify the path to the model run where the reference data is stored
ReferenceDirectory <- ""
# Load the reference zone
load(paste(ReferenceDirectory, "tci/ReferenceZone.RData", sep=""))
# Load the reference attractions
load(paste(ReferenceDirectory, "tci/ReferenceAttractions.RData",
sep=""))
```

Define functions used in the script

Define a function to calculate cost to travel to market place

This function is applied to each TAZ by trip purpose and income group the steps are: * Put zones in order of ascending cost. This is used to define the market place for the zone. The costs used for this purpose may be different than the costs used to calculate average market access costs. For example, the average cost for all modes might be used to define the market place, but the market access cost might be calculated for a particular mode. * Calculate the cumulative sum of size variables for the zones in the ascending cost order. * Identify the market place as the set of zones that have size variables equal to the reference market basket. * Calculate a weighted average of travel costs. :Parameter: SizeVar.Zi - A vector of size variables :Parameter: AveCost.Zi - A vector of costs to use for placing zones in order of cost :Parameter: Cost.Zi - The vector of costs to use for calculating the average market cost :Parameter: RefAttr - The reference market basket for the trip

purpose and income group :Return: AveMarketCost - The average cost to access the market basket

```
calcAveMarketCost <- function(SizeVar.Zi, AveCost.Zi, Cost.Zi,
RefAttr){
     CostOrder <- order(AveCost.Zi)
     AttrCumSum <- cumsum(SizeVar.Zi[CostOrder])
     MarketZones <- names(AttrCumSum)[AttrCumSum <= RefAttr]
     AveMarketCost <- sum(Cost.Zi[MarketZones] *
SizeVar.Zi[MarketZones]) /
                      sum(SizeVar.Zi[MarketZones])
     AveMarketCost
     }
```

Define a function to calculate the average cost for non-auto modes to travel to market place

This function is applied to each TAZ by trip purpose and income group the steps are: * Put zones in order of ascending cost. * Calculate the cumulative sum of size variables for the zones in the ascending cost order. * Identify the market place as the set of zones that have size variables equal to the reference market basket. * Identify the minimum non-auto cost to each zone. * Calculate the non-auto market access cost as a weighted average of the minimum non-auto costs. :Parameter: SizeVar.Zi - A vector of size variables :Parameter: AveCost.Zi - A vector of costs to use for placing zones in order of cost :Parameter: ModeCost.ZiMd - The matrix of costs by zone and mode to use for calculating the average non-auto market access cost :Parameter: RefAttr - The reference market basket for the trip purpose and income group :Return: NonAutoMarketCost - The average non-auto cost to access the market basket

```
calcNonAutoMarketCost <- function(SizeVar.Zi, AveCost.Zi,
ModeCost.ZiMd, RefAttr){
     CostOrder <- order(AveCost.Zi)
     AttrCumSum <- cumsum(SizeVar.Zi[CostOrder])
     MarketZones <- names(AttrCumSum)[AttrCumSum <= RefAttr]
     NonAutoMarketCosts.ZiMd <- ModeCost.ZiMd[MarketZones,
                                    c("busWalk", "parkAndRideBus",
"bike", "walk")]
     NonAutoMarketCosts.ZiMd[is.infinite(NonAutoMarketCosts.ZiMd)] <-
NA
     MinNonAutoCosts.Zi <- apply(NonAutoMarketCosts.ZiMd, 1,
function(x)
                               min(x, na.rm=TRUE))
     NonAutoMarketCost <- sum(MinNonAutoCosts.Zi *
SizeVar.Zi[MarketZones]) /
                           sum(SizeVar.Zi[MarketZones])
     NonAutoMarketCost
     }
```

Define a function to calculate the average cost for auto modes to travel to market place

This function is applied to each TAZ by trip purpose and income group the steps are: * Put zones in order of ascending cost. * Calculate the cumulative sum of size variables for the zones in the ascending cost order. * Identify the market place as the set of zones that have size variables equal to the reference market basket. * Identify the average auto cost to each zone. * Calculate the auto market access cost as a weighted average of the average auto costs. :Parameter: SizeVar.Zi - A vector of size variables :Parameter: AveCost.Zi - A vector of costs to use for placing zones in order of cost :Parameter: ModeCost.ZiMd - The matrix of costs by zone and mode to use for calculating the average auto market access cost :Parameter: RefAttr - The reference market basket for the trip purpose and income group :Return: AveMarketCost - The average auto cost to access the market basket

```
calcAutoMarketCost <- function(SizeVar.Zi, AveCost.Zi, ModeCost.ZiMd,
RefAttr){
     CostOrder <- order(AveCost.Zi)
     AttrCumSum <- cumsum(SizeVar.Zi[CostOrder])
     MarketZones <- names(AttrCumSum)[AttrCumSum <= RefAttr]
     AutoMarketCosts.ZiMd <- ModeCost.ZiMd[MarketZones,
                                    c("driveAlone", "drivePass",
"pass")]
     MeanAutoCosts.Zi <- apply(AutoMarketCosts.ZiMd, 1, function(x)
mean(x, na.rm=TRUE))
     AutoMarketCost <- sum(MeanAutoCosts.Zi * SizeVar.Zi[MarketZones])
/
                           sum(SizeVar.Zi[MarketZones])
     AutoMarketCost
     }
```

Define a function to calculate percent of market place accessible by non-auto modes

This function is applied to each TAZ by trip purpose and income group the steps are: * Put zones in order of ascending cost. * Calculate the cumulative sum of size variables for the zones in the ascending cost order. * Identify the market place as the set of zones that have size variables equal to the reference market basket. * Identify the zones in the market place that are accessible by non-auto modes * Sum the size variables in the zones that are accessible by non-auto modes * Divide by the sum of size variables for all zones in the market place :Parameter: SizeVar.Zi - A vector of size variables :Parameter: AveCost.Zi - A vector of costs to use for placing zones in order of cost :Parameter: AltPractical.ZiMd - A matrix identifying the zones that are accessible by each mode :Parameter: RefAttr - The reference market basket for the trip purpose and income group :Return: PctAltCoverage - The percentage of the market basket that is accessible by alternate modes

```
calcModeMarketPct <- function(SizeVar.Zi, AveCost.Zi,
AltPractical.ZiMd, RefAttr){
     CostOrder <- order(AveCost.Zi)
     AttrCumSum <- cumsum(SizeVar.Zi[CostOrder])
     MarketZones <- names(AttrCumSum)[AttrCumSum <= RefAttr]
     AltMarketSet.ZiMd <- AltPractical.ZiMd[MarketZones,]
```

```
     AltMarket.Md <- apply(AltMarketSet.ZiMd, 2, function(x)
sum(SizeVar.Zi[MarketZones][x]))
     NonAutoMarketSet.Zi <- apply(AltMarketSet.ZiMd, 1, function(x)
any(x))
     NonAutoMarket <- sum(SizeVar.Zi[MarketZones][NonAutoMarketSet.Zi])
     AltMarket.Md <- c(AltMarket.Md, allNonAuto=NonAutoMarket)
     PctAltCoverage <- 100 * AltMarket.Md /
sum(SizeVar.Zi[MarketZones])
     PctAltCoverage
     }
```

Calculate the measures for each zone, mode, income and purpose

Make an array which identifies zones impractical to reach by non-auto modes of travel

This is used in the subsequent calculations that loop through purpose and income but only has to be done once.

```
AltImpractical.ZiZiMd <- array(FALSE, dim=c(length(Zi), length(Zi), 4),
                          dimnames=list(Zi, Zi, Md[4:7]))
# Load trip distance and time data
load("inputs/RData/tripDist.Rdata")
dimnames(tripDist) <- list(Zo,Zo)
tripDist.ZiZi <- tripDist[Zi,Zi]
BikeTime.ZiZi <- 60 * tripDist.ZiZi / 10
WalkTime.ZiZi <- 60 * tripDist.ZiZi / 3
load("inputs/RData/ivTimepeakbusWalk.RData")
dimnames(ivTimepeakbusWalk) <- list(Zo,Zo)
BusWalkTime.ZiZi <- ivTimepeakbusWalk[Zi,Zi]; rm(ivTimepeakbusWalk)
load("inputs/RData/ivTimepeakparkAndRideBus.RData")
dimnames(ivTimepeakparkAndRideBus) <- list(Zo,Zo)
BusPnRTime.ZiZi <- ivTimepeakparkAndRideBus[Zi,Zi];
rm(ivTimepeakparkAndRideBus)
load("inputs/RData/ivTimepeakdriveAlone.RData")
dimnames(ivTimepeakdriveAlone) <- list(Zo,Zo)
AutoTime.ZiZi <- ivTimepeakdriveAlone[Zi,Zi]; rm(ivTimepeakdriveAlone)
# Impractical trips are those that take longer than 30 minutes and are
# 30 minutes longer than corresponding auto trips
AltImpractical.ZiZiMd[,,"bike"] <- (BikeTime.ZiZi > 30) |
                                   (BikeTime.ZiZi > 30 + AutoTime.ZiZi)
AltImpractical.ZiZiMd[,,"walk"] <- (WalkTime.ZiZi > 30) |
                                   (WalkTime.ZiZi > 30 + AutoTime.ZiZi)
AltImpractical.ZiZiMd[,,"busWalk"] <- (BusWalkTime.ZiZi > 30) |
                                   (BusWalkTime.ZiZi > 30 +
AutoTime.ZiZi)
AltImpractical.ZiZiMd[,,"parkAndRideBus"] <- (BusPnRTime.ZiZi > 30) |
                                   (BusPnRTime.ZiZi > 30 +
AutoTime.ZiZi)
# Convert NA values (no bus service) to TRUE
AltImpractical.ZiZiMd[is.na(AltImpractical.ZiZiMd)] <- TRUE
# Convert into array of zones that are practical to reach by alt modes
```

```
AltPractical.ZiZiMd <- !AltImpractical.ZiZiMd ;
rm(AltImpractical.ZiZiMd)
```

Begin iteration by trip purpose

```
for(pr in Pr){

     # Define Arrays to Store Results
     AveMarketCost.ZiIc <- array(0, dim=c(length(Zi), length(Ic)),
                          dimnames=list(Zi, Ic))
     BestMarketCost.ZiIc <- array(0, dim=c(length(Zi), length(Ic)),
                          dimnames=list(Zi, Ic))
     CompMarketCost.ZiIc <- array(0, dim=c(length(Zi), length(Ic)),
                          dimnames=list(Zi, Ic))
     AveMarketCost.ZiMdIc <- array(0, dim=c(length(Zi), length(Md),
length(Ic)),
                          dimnames=list(Zi, Md, Ic))
     NonAutoMarketCost.ZiIc <- array(0, dim=c(length(Zi), length(Ic)),
                          dimnames=list(Zi, Ic))
     AutoMarketCost.ZiIc <- array(0, dim=c(length(Zi), length(Ic)),
                          dimnames=list(Zi, Ic))
     AltMarketCoverage.ZiMdIc <- array(0, dim=c(length(Zi), 5,
length(Ic)),
                          dimnames=list(Zi, c(Md[4:7], "allNonAuto"),
Ic))

# Begin iteration by income group
     for(ic in Ic){

          # Load the size variable data and assign to SizeVar.ZiZi
          SizeVarFileName <- paste("sizevars/SizeVar", pr, ic,
".RData", sep="")
          load(SizeVarFileName) ; rm(SizeVarFileName)
          SizeVarObjName <- paste("sizeVar", pr, ic, sep="")
          SizeVar.ZoZo <- get(SizeVarObjName)
          rm(list=ls()[ls()==SizeVarObjName]) ; rm(SizeVarObjName)
          dimnames(SizeVar.ZoZo) <- list(Zo, Zo)
          SizeVar.ZiZi <- SizeVar.ZoZo[Zi,Zi] ; rm(SizeVar.ZoZo)

          # Identify the reference market attractions
          RefAttr <- ReferenceAttractions[ic,pr]

          # Initialize an array to hold all the mode utility data
          ModesExpUtils.ZiZiMd <- array(0, dim=c(length(Zi),
length(Zi), length(Md)),
                              dimnames=list(Zi, Zi, Md))

          # Populate the array with the mode utility data
          for(md in Md){

               # Load the array of zone to zone utilities and assign to
Util.ZiZi
               if(md == "bike"){
                    ExpUtil.ZiZi <- exp(BikeAccessCoeff.Pr[pr] * 60 *
tripDist.ZiZi / 10)
                    }
```

```
               if(md == "walk"){
                    ExpUtil.ZiZi <- exp(WalkAccessCoeff.Pr[pr] * 60 *
tripDist.ZiZi / 3)
                    }
               if((md != "bike") & (md != "walk")) {
                    ModeUtilFileName <- paste("access/util", md, ic,
pr, ".Rdata", sep="")
                    load(ModeUtilFileName) ; rm(ModeUtilFileName)
                    ModeUtilObjName <- paste("util", md, ic, pr,
sep="")
                    ExpUtil.ZoZo <- get(ModeUtilObjName)
                    rm(list=ls()[ls()==ModeUtilObjName]) ;
rm(ModeUtilObjName)
                    dimnames(ExpUtil.ZoZo) <- list(Zo, Zo)
                    ExpUtil.ZiZi <- ExpUtil.ZoZo[Zi,Zi] ;
rm(ExpUtil.ZoZo)
                    }

               # Add the mode matrix to the array
               ModesExpUtils.ZiZiMd[,,md] <- ExpUtil.ZiZi ;
rm(ExpUtil.ZiZi)
               }

          # Correct problem with utility for short walk and bike trips
          # Setting everything greater than 1 to 1 makes a minimum
          # trip time of approximately X minutes
          ModesExpUtils.ZiZiMd[ModesExpUtils.ZiZiMd > 0.99] <- 0.99

          # Calculate the dollar cost corresponding to the utilities
          ModesCosts.ZiZiMd <- log(ModesExpUtils.ZiZiMd) /
OpCostCoeff.PrIc[pr,ic]

          # Calculate the mode probabilities for all modes
          ModeProbs.ZiZiMd <- sweep(ModesExpUtils.ZiZiMd, c(1,2),
                                    apply(ModesExpUtils.ZiZiMd, c(1,2),
sum), "/")

          # Calculate the best cost among the modes
          BestCosts.ZiZi <- apply(ModesCosts.ZiZiMd, c(1,2),
function(x) min(x, na.rm=TRUE))

          # Calculate the composite cost of all modes
          CompCosts.ZiZi <- log(apply(ModesExpUtils.ZiZiMd, c(1,2),
sum)) / OpCostCoeff.PrIc[pr,ic]

          # Calculate the average cost across all modes
          AveCosts.ZiZi <- apply(ModesCosts.ZiZiMd * ModeProbs.ZiZiMd,
c(1,2),
                                 function(x) sum(x, na.rm=TRUE))

          # Clean up memory
          rm(ModeProbs.ZiZiMd); gc()

          # Calculate the mode probabilities for just the non-auto
modes
          AltModeProbs.ZiZiMd <- sweep(ModesExpUtils.ZiZiMd[,,4:7],
c(1,2),
```

```
                                    apply(ModesExpUtils.ZiZiMd[,,4:7],
c(1,2), sum), "/")

          # Calculate the average cost across non-auto modes
          AveAltCosts.ZiZi <- apply(ModesCosts.ZiZiMd[,,4:7] *
AltModeProbs.ZiZiMd, c(1,2),
                                function(x) sum(x, na.rm=TRUE))

          # Clean up memory
          rm(AltModeProbs.ZiZiMd); gc()

          # Calculate the mode probabilities for just the auto modes
          AutoModeProbs.ZiZiMd <- sweep(ModesExpUtils.ZiZiMd[,,1:3],
c(1,2),
                                    apply(ModesExpUtils.ZiZiMd[,,1:3],
c(1,2), sum), "/")

          # Calculate the average cost across auto modes
          AveAutoCosts.ZiZi <- apply(ModesCosts.ZiZiMd[,,1:3] *
AutoModeProbs.ZiZiMd, c(1,2),
                                function(x) sum(x, na.rm=TRUE))

          # Clean up memory
          rm(AutoModeProbs.ZiZiMd); gc()

          # Calculate best cost to access market place
          BestMarketCost.Zi <- numeric(length(Zi))
          names(BestMarketCost.Zi) <- Zi
          for(zi in Zi){
               BestMarketCost.Zi[zi] <-
calcAveMarketCost(SizeVar.ZiZi[zi,],
                    BestCosts.ZiZi[zi,], BestCosts.ZiZi[zi,], RefAttr)
               }

          BestMarketCost.ZiIc[,ic] <- BestMarketCost.Zi;
rm(BestMarketCost.Zi)

          # Calculate composite cost to access market place
          CompMarketCost.Zi <- numeric(length(Zi))
          names(CompMarketCost.Zi) <- Zi
          for(zi in Zi){
               CompMarketCost.Zi[zi] <-
calcAveMarketCost(SizeVar.ZiZi[zi,],
                    CompCosts.ZiZi[zi,], CompCosts.ZiZi[zi,], RefAttr)
             }

          CompMarketCost.ZiIc[,ic] <- CompMarketCost.Zi;
rm(CompMarketCost.Zi)

          # Calculate average cost to access market place
          AveMarketCost.Zi <- numeric(length(Zi))
          names(AveMarketCost.Zi) <- Zi
          for(zi in Zi){
               AveMarketCost.Zi[zi] <-
calcAveMarketCost(SizeVar.ZiZi[zi,],
                         AveCosts.ZiZi[zi,], AveCosts.ZiZi[zi,],
RefAttr)
```

```
               }

          AveMarketCost.ZiIc[,ic] <- AveMarketCost.Zi;
rm(AveMarketCost.Zi)

          # Calculate average cost to access market place by mode
          AveMarketCost.ZiMd <- matrix(0, length(Zi), length(Md),
dimnames=list(Zi,Md))
          for(zi in Zi){
               for(md in Md){
                    AveMarketCost.ZiMd[zi,md] <-
calcAveMarketCost(SizeVar.ZiZi[zi,],
                         AveCosts.ZiZi[zi,], ModesCosts.ZiZiMd[zi,,md],
RefAttr)
                    }
               }

          AveMarketCost.ZiMdIc[,,ic] <- AveMarketCost.ZiMd;
rm(AveMarketCost.ZiMd)

          # Calculate non-auto market costs
          NonAutoMarketCost.Zi <- numeric(length(Zi))
          names(NonAutoMarketCost.Zi) <- Zi
          ModesCostsInfToNa.ZiZiMd <- ModesCosts.ZiZiMd

ModesCostsInfToNa.ZiZiMd[is.infinite(ModesCostsInfToNa.ZiZiMd)] <- NA
          for(zi in Zi){
               NonAutoMarketCost.Zi[zi] <-
calcNonAutoMarketCost(SizeVar.ZiZi[zi,],
                    AveCosts.ZiZi[zi,], ModesCostsInfToNa.ZiZiMd[zi,,],
RefAttr)
               }
          rm(ModesCostsInfToNa.ZiZiMd)

          NonAutoMarketCost.ZiIc[,ic] <- NonAutoMarketCost.Zi;
rm(NonAutoMarketCost.Zi)

          # Calculate auto market times
          AutoMarketCost.Zi <- numeric(length(Zi))
          names(AutoMarketCost.Zi) <- Zi
          for(zi in Zi){
               AutoMarketCost.Zi[zi] <-
calcAutoMarketCost(SizeVar.ZiZi[zi,],
                    AveCosts.ZiZi[zi,], ModesCosts.ZiZiMd[zi,,],
RefAttr)
               }

          AutoMarketCost.ZiIc[,ic] <- AutoMarketCost.Zi;
rm(AutoMarketCost.Zi)


          # Calculate market proportions accessible by non-auto modes
          AltMarketCoverage.ZiMd <- matrix(0, length(Zi), 5,
               dimnames=list(Zi,c(Md[4:7], "allNonAuto")))
          for(zi in Zi){
               AltMarketCoverage.ZiMd[zi,] <-
calcModeMarketPct(SizeVar.ZiZi[zi,],
```

```
                    AveAltCosts.ZiZi[zi,], AltPractical.ZiZiMd[zi,,],
RefAttr)
                    }

          AltMarketCoverage.ZiMdIc[,,ic] <- AltMarketCoverage.ZiMd;
rm(AltMarketCoverage.ZiMd)

          # Clean up memory
          rm(ModesExpUtils.ZiZiMd, ModesCosts.ZiZiMd)

     # Save the results for each income group
     save(BestMarketCost.ZiIc,
          file=paste("tci/", pr, "BestMarketCost.ZiIc.RData", sep=""))
     save(CompMarketCost.ZiIc,
          file=paste("tci/", pr, "CompMarketCost.ZiIc.RData", sep=""))
     save(AveMarketCost.ZiIc,
          file=paste("tci/", pr, "AveMarketCost.ZiIc.RData", sep=""))
     save(AveMarketCost.ZiMdIc,
          file=paste("tci/", pr, "AveMarketCost.ZiMdIc.RData", sep=""))
     save(NonAutoMarketCost.ZiIc,
          file=paste("tci/", pr, "NonAutoMarketCost.ZiIc.RData",
sep=""))
     save(AutoMarketCost.ZiIc,
          file=paste("tci/", pr, "AutoMarketCost.ZiIc.RData", sep=""))
     save(AltMarketCoverage.ZiMdIc,
          file=paste("tci/", pr, "AltMarketCoverage.ZiMdIc.RData",
sep=""))

     # End loop through income groups
     }

# Clean up memory
rm(BestMarketCost.ZiIc, CompMarketCost.ZiIc, AveMarketCost.ZiIc,
     AveMarketCost.ZiMdIc, NonAutoMarketCost.ZiIc, AutoMarketCost.ZiIc,
     AltMarketCoverage.ZiMdIc)
gc()

# End loop through purposes
}
```

Combine the results into arrays by purpose

```
BestMarketCost.ZiIcPr <- array(0, dim=c(length(Zi), length(Ic),
length(Pr)),
                                    dimnames=list(Zi,Ic,Pr))
for(pr in Pr){
      FileName <- paste("tci/", pr, "BestMarketCost.ZiIc.RData",
sep="")
      load(FileName)
      BestMarketCost.ZiIcPr[,,pr] <- BestMarketCost.ZiIc
      rm(BestMarketCost.ZiIc)
      save(BestMarketCost.ZiIcPr,
file="tci/BestMarketCost.ZiIcPr.RData")
      }
```

```
CompMarketCost.ZiIcPr <- array(0, dim=c(length(Zi), length(Ic),
length(Pr)),
                                    dimnames=list(Zi,Ic,Pr))
for(pr in Pr){
      FileName <- paste("tci/", pr, "CompMarketCost.ZiIc.RData",
sep="")
      load(FileName)
      CompMarketCost.ZiIcPr[,,pr] <- CompMarketCost.ZiIc
      rm(CompMarketCost.ZiIc)
      save(CompMarketCost.ZiIcPr,
file="tci/CompMarketCost.ZiIcPr.RData")
      }

AveMarketCost.ZiIcPr <- array(0, dim=c(length(Zi), length(Ic),
length(Pr)),
                                    dimnames=list(Zi,Ic,Pr))
for(pr in Pr){
      FileName <- paste("tci/", pr, "AveMarketCost.ZiIc.RData", sep="")
      load(FileName)
      AveMarketCost.ZiIcPr[,,pr] <- AveMarketCost.ZiIc
      rm(AveMarketCost.ZiIc)
      save(AveMarketCost.ZiIcPr, file="tci/AveMarketCost.ZiIcPr.RData")
      }

AveMarketCost.ZiMdIcPr <- array(0, dim=c(length(Zi), length(Md),
length(Ic), length(Pr)),
                                    dimnames=list(Zi,Md,Ic,Pr))
for(pr in Pr){
      FileName <- paste("tci/", pr, "AveMarketCost.ZiMdIc.RData",
sep="")
      load(FileName)
      AveMarketCost.ZiMdIcPr[,,,pr] <- AveMarketCost.ZiMdIc
      rm(AveMarketCost.ZiMdIc)
      save(AveMarketCost.ZiMdIcPr,
file="tci/AveMarketCost.ZiMdIcPr.RData")
      }

NonAutoMarketCost.ZiIcPr <- array(0, dim=c(length(Zi), length(Ic),
length(Pr)),
                                    dimnames=list(Zi,Ic,Pr))
for(pr in Pr){
      FileName <- paste("tci/", pr, "NonAutoMarketCost.ZiIc.RData",
sep="")
      load(FileName)
      NonAutoMarketCost.ZiIcPr[,,pr] <- NonAutoMarketCost.ZiIc
      rm(NonAutoMarketCost.ZiIc)
      save(NonAutoMarketCost.ZiIcPr,
file="tci/NonAutoMarketCost.ZiIcPr.RData")
      }

AutoMarketCost.ZiIcPr <- array(0, dim=c(length(Zi), length(Ic),
length(Pr)),
                                    dimnames=list(Zi,Ic,Pr))
for(pr in Pr){
      FileName <- paste("tci/", pr, "AutoMarketCost.ZiIc.RData",
sep="")
      load(FileName)
```

```
      AutoMarketCost.ZiIcPr[,,pr] <- AutoMarketCost.ZiIc
      rm(AutoMarketCost.ZiIc)
      save(AutoMarketCost.ZiIcPr,
file="tci/AutoMarketCost.ZiIcPr.RData")
      }

AltMarketCoverage.ZiMdIcPr <- array(0, dim=c(length(Zi), 5, length(Ic),
length(Pr)),
                                    dimnames=list(Zi,c(Md[4:7],
"allNonAuto"),Ic,Pr))
for(pr in Pr){
      FileName <- paste("tci/", pr, "AltMarketCoverage.ZiMdIc.RData",
sep="")
      load(FileName)
      AltMarketCoverage.ZiMdIcPr[,,,pr] <- AltMarketCoverage.ZiMdIc
      rm(AltMarketCoverage.ZiMdIc)
      save(AltMarketCoverage.ZiMdIcPr,
file="tci/AltMarketCoverage.ZiMdIcPr.RData")
      }
```

Summarize the aternative mode market coverage

```
#Extract the average value that was computed
AltMarketCoverage.ZiIcPr <- AltMarketCoverage.ZiMdIcPr[,5,,]
```

Calculate averages by income group and purpose

The number of trips produced by income group and purpose will be used to aggregate tci measures

Load trip data by purpose and aggregate to zone and income group level

```
# Load trip production data
load("tripgen/hbwTripProdAry.RData")
load("tripgen/hbsTripProdAry.RData")
load("tripgen/hbrTripProdAry.RData")
load("tripgen/hboTripProdAry.RData")

# Aggregate trips to income group level
hbwTripProd.ZiIc <- t(apply(apply(hbwTripProdAry, c(5,3), sum), 1,
     function(x) c(x[1] + x[2], x[3], x[4])))[Zo %in% Zi,]
dimnames(hbwTripProd.ZiIc) <- list(Zi, Ic)
rm(hbwTripProdAry)

# Aggregate hbs trips
hbsTripProd.ZiIc <- t(apply(apply(hbsTripProdAry, c(5,3), sum), 1,
     function(x) c(x[1] + x[2], x[3], x[4])))[Zo %in% Zi,]
dimnames(hbsTripProd.ZiIc) <- list(Zi, Ic)
rm(hbsTripProdAry)

# Aggregate hbr trips
hbrTripProd.ZiIc <- t(apply(apply(hbrTripProdAry, c(5,3), sum), 1,
```

```
     function(x) c(x[1] + x[2], x[3], x[4])))[Zo %in% Zi,]
dimnames(hbrTripProd.ZiIc) <- list(Zi, Ic)
rm(hbrTripProdAry)

# Aggregate hbo trips
hboTripProd.ZiIc <- t(apply(apply(hboTripProdAry, c(5,3), sum), 1,
     function(x) c(x[1] + x[2], x[3], x[4])))[Zo %in% Zi,]
dimnames(hboTripProd.ZiIc) <- list(Zi, Ic)
rm(hboTripProdAry)

# Put all the trips into an array
TripProd.ZiIcPr <- array(0, dim=c(length(Zi), length(Ic), length(Pr)),
          dimnames=list(Zi,Ic,Pr))
TripProd.ZiIcPr[,,"hbw"] <- hbwTripProd.ZiIc
TripProd.ZiIcPr[,,"hbs"] <- hbsTripProd.ZiIc
TripProd.ZiIcPr[,,"hbr"] <- hbrTripProd.ZiIc
TripProd.ZiIcPr[,,"hbo"] <- hboTripProd.ZiIc
```

Calculate proportions by income and purpose

```
TripProd.ZiPr <- apply(TripProd.ZiIcPr, c(1,3), sum)
TripProd.ZiIc <- apply(TripProd.ZiIcPr, c(1,2), sum)
TripProd.Zi <- apply(TripProd.ZiIcPr, 1, sum)
TripProdIncProp.ZiIcPr <- sweep(TripProd.ZiIcPr, c(1,3), TripProd.ZiPr,
"/")
TripProdPurProp.ZiIcPr <- sweep(TripProd.ZiIcPr, c(1,2), TripProd.ZiIc,
"/")
TripProdIncPurProp.ZiIcPr <- sweep(TripProd.ZiIcPr, 1, TripProd.Zi,
"/")
```

Calculate best market cost by purpose and income

```
BestMarketCost.ZiIc <- apply(BestMarketCost.ZiIcPr *
TripProdPurProp.ZiIcPr,
                             c(1,2), sum)
BestMarketCost.ZiPr <- apply(BestMarketCost.ZiIcPr *
TripProdIncProp.ZiIcPr,
                             c(1,3), sum)
BestMarketCost.Zi <- apply(BestMarketCost.ZiIcPr *
TripProdIncPurProp.ZiIcPr,
                             1, sum)
```

Calculate composite market cost by purpose and income

```
CompMarketCost.ZiIc <- apply(CompMarketCost.ZiIcPr *
TripProdPurProp.ZiIcPr,
                             c(1,2), sum)
CompMarketCost.ZiPr <- apply(CompMarketCost.ZiIcPr *
TripProdIncProp.ZiIcPr,
                             c(1,3), sum)
CompMarketCost.Zi <- apply(CompMarketCost.ZiIcPr *
TripProdIncPurProp.ZiIcPr,
                             1, sum)
```

Calculate average market cost by purpose and income

```
AveMarketCost.ZiIc <- apply(AveMarketCost.ZiIcPr *
TripProdPurProp.ZiIcPr,
                            c(1,2), sum)
AveMarketCost.ZiPr <- apply(AveMarketCost.ZiIcPr *
TripProdIncProp.ZiIcPr,
                            c(1,3), sum)
AveMarketCost.Zi <- apply(AveMarketCost.ZiIcPr *
TripProdIncPurProp.ZiIcPr,
                            1, sum)
```

Calculate transportation cost index (tci) from averages

The TCI is calculated from the average market cost

```
Tci.ZiIc <- sweep(AveMarketCost.ZiIc, 2,
AveMarketCost.ZiIc[ReferenceZone,], "/")
Tci.ZiPr <- sweep(AveMarketCost.ZiPr, 2,
AveMarketCost.ZiPr[ReferenceZone,], "/")
Tci.Zi <- AveMarketCost.Zi / AveMarketCost.Zi[ReferenceZone]
```

Calculate transportation cost index (tci) from best costs

The TCI2 calculates the TCI using the minimum market access cost

```
Tci2.ZiIc <- sweep(BestMarketCost.ZiIc, 2,
BestMarketCost.ZiIc[ReferenceZone,], "/")
Tci2.ZiPr <- sweep(BestMarketCost.ZiPr, 2,
BestMarketCost.ZiPr[ReferenceZone,], "/")
Tci2.Zi <- BestMarketCost.Zi / BestMarketCost.Zi[ReferenceZone]
```

Calculate transportation cost index (tci) from composite costs

The TCI3 calculates the TCI using the composite market access cost

```
Tci3.ZiIc <- 1 / sweep(CompMarketCost.ZiIc, 2,
CompMarketCost.ZiIc[ReferenceZone,], "/")
Tci3.ZiPr <- 1 / sweep(CompMarketCost.ZiPr, 2,
CompMarketCost.ZiPr[ReferenceZone,], "/")
Tci3.Zi <- 1 / (CompMarketCost.Zi / CompMarketCost.Zi[ReferenceZone])
```

Calculate average auto market cost by purpose and income

```
AutoMarketCost.ZiIc <- apply(AutoMarketCost.ZiIcPr *
TripProdPurProp.ZiIcPr,
                            c(1,2), sum)
AutoMarketCost.ZiPr <- apply(AutoMarketCost.ZiIcPr *
TripProdIncProp.ZiIcPr,
                            c(1,3), sum)
```

```
AutoMarketCost.Zi <- apply(AutoMarketCost.ZiIcPr *
TripProdIncPurProp.ZiIcPr,
                           1, sum)
```

Calculate average non-auto market cost by purpose and income

```
NonAutoMarketCost.ZiIc <- apply(NonAutoMarketCost.ZiIcPr *
TripProdPurProp.ZiIcPr,
                           c(1,2), sum)
NonAutoMarketCost.ZiPr <- apply(NonAutoMarketCost.ZiIcPr *
TripProdIncProp.ZiIcPr,
                           c(1,3), sum)
NonAutoMarketCost.Zi <- apply(NonAutoMarketCost.ZiIcPr *
TripProdIncPurProp.ZiIcPr,
                           1, sum)
```

Calculate average alternative mode market coverage

```
AltMarketCoverage.ZiIc <- apply(AltMarketCoverage.ZiIcPr *
TripProdPurProp.ZiIcPr,
                           c(1,2), sum)
AltMarketCoverage.ZiPr <- apply(AltMarketCoverage.ZiIcPr *
TripProdIncProp.ZiIcPr,
                           c(1,3), sum)
AltMarketCoverage.Zi <- apply(AltMarketCoverage.ZiIcPr *
TripProdIncPurProp.ZiIcPr,
                           1, sum)
```

Calculate ratio of non-auto time to auto time

```
NonAutoCostRatio.ZiIcPr <- NonAutoMarketCost.ZiIcPr /
AutoMarketCost.ZiIcPr
NonAutoCostRatio.ZiIc <- NonAutoMarketCost.ZiIc / AutoMarketCost.ZiIc
NonAutoCostRatio.ZiPr <- NonAutoMarketCost.ZiPr / AutoMarketCost.ZiPr
NonAutoCostRatio.Zi <- NonAutoMarketCost.Zi / AutoMarketCost.Zi
```

Calculate regional averages

Load district designations

```
load("inputs/RData/districts.RData")
District.Zo <- districts$ugb
names(District.Zo) <- districts$zone
District.Zi <- District.Zo[Zi] ; rm(District.Zo)
District.Zi <- as.character(District.Zi)
Di <- unique(District.Zi)
```

Calculate intra-district proportions

```
TripProd.Di <- tapply(TripProd.Zi, District.Zi, sum)
TripProdDi.Zi <-  TripProd.Di[match(District.Zi, names(TripProd.Di))]
```

```
TripProdDiProp.Zi <- TripProd.Zi / TripProdDi.Zi

TripProd.DiIc <- apply(TripProd.ZiIc, 2, function(x) tapply(x,
District.Zi, sum))
TripProdDi.ZiIc <- apply(TripProd.DiIc, 2, function(x)
x[match(District.Zi, names(x))])
TripProdDiProp.ZiIc <- TripProd.ZiIc / TripProdDi.ZiIc

TripProd.DiPr <- apply(TripProd.ZiPr, 2, function(x) tapply(x,
District.Zi, sum))
TripProdDi.ZiPr <- apply(TripProd.DiPr, 2, function(x)
x[match(District.Zi, names(x))])
TripProdDiProp.ZiPr <- TripProd.ZiPr / TripProdDi.ZiPr
```

Calculate best market time by district

```
BestMarketCost.Di <- tapply(TripProdDiProp.Zi * BestMarketCost.Zi,
District.Zi, sum)
BestMarketCost.DiIc <- apply(TripProdDiProp.ZiIc * BestMarketCost.ZiIc,
2, function(x)
                              tapply(x, District.Zi, sum))
BestMarketCost.DiPr <- apply(TripProdDiProp.ZiPr * BestMarketCost.ZiPr,
2, function(x)
                              tapply(x, District.Zi, sum))
```

Calculate composite market time by district

```
CompMarketCost.Di <- tapply(TripProdDiProp.Zi * CompMarketCost.Zi,
District.Zi, sum)
CompMarketCost.DiIc <- apply(TripProdDiProp.ZiIc * CompMarketCost.ZiIc,
2, function(x)
                              tapply(x, District.Zi, sum))
CompMarketCost.DiPr <- apply(TripProdDiProp.ZiPr * CompMarketCost.ZiPr,
2, function(x)
                              tapply(x, District.Zi, sum))
```

Calculate average market time by district

```
AveMarketCost.Di <- tapply(TripProdDiProp.Zi * AveMarketCost.Zi,
District.Zi, sum)
AveMarketCost.DiIc <- apply(TripProdDiProp.ZiIc * AveMarketCost.ZiIc,
2, function(x)
                              tapply(x, District.Zi, sum))
AveMarketCost.DiPr <- apply(TripProdDiProp.ZiPr * AveMarketCost.ZiPr,
2, function(x)
                              tapply(x, District.Zi, sum))
```

Calculate transportation cost index (tci) by district

The TCI is calculated from the average market cost

```
Tci.DiIc <- sweep(AveMarketCost.DiIc, 2,
AveMarketCost.ZiIc[ReferenceZone,], "/")
```

```
Tci.DiPr <- sweep(AveMarketCost.DiPr, 2,
AveMarketCost.ZiPr[ReferenceZone,], "/")
Tci.Di <- AveMarketCost.Di / AveMarketCost.Zi[ReferenceZone]
```

Calculate tci2 by district

The TCI2 calculates the TCI using the minimum market access cost

```
Tci2.DiIc <- sweep(BestMarketCost.DiIc, 2,
BestMarketCost.ZiIc[ReferenceZone,], "/")
Tci2.DiPr <- sweep(BestMarketCost.DiPr, 2,
BestMarketCost.ZiPr[ReferenceZone,], "/")
Tci2.Di <- BestMarketCost.Di / BestMarketCost.Zi[ReferenceZone]
```

Calculate tci3 by district

The TCI3 calculates the TCI using the composite market access cost

```
Tci3.DiIc <- 1 / sweep(CompMarketCost.DiIc, 2,
CompMarketCost.ZiIc[ReferenceZone,], "/")
Tci3.DiPr <- 1 / sweep(CompMarketCost.DiPr, 2,
CompMarketCost.ZiPr[ReferenceZone,], "/")
Tci3.Di <- 1 / (CompMarketCost.Di / CompMarketCost.Zi[ReferenceZone])
```

Calculate average auto market cost by district

```
AutoMarketCost.Di <- tapply(TripProdDiProp.Zi * AutoMarketCost.Zi,
District.Zi, sum)
AutoMarketCost.DiIc <- apply(TripProdDiProp.ZiIc * AutoMarketCost.ZiIc,
2, function(x)
                            tapply(x, District.Zi, sum))
AutoMarketCost.DiPr <- apply(TripProdDiProp.ZiPr * AutoMarketCost.ZiPr,
2, function(x)
                            tapply(x, District.Zi, sum))
```

Calculate average non-auto market cost by district

```
NonAutoMarketCost.Di <- tapply(TripProdDiProp.Zi *
NonAutoMarketCost.Zi, District.Zi, sum)
NonAutoMarketCost.DiIc <- apply(TripProdDiProp.ZiIc *
NonAutoMarketCost.ZiIc, 2, function(x)
                            tapply(x, District.Zi, sum))
NonAutoMarketCost.DiPr <- apply(TripProdDiProp.ZiPr *
NonAutoMarketCost.ZiPr, 2, function(x)
                            tapply(x, District.Zi, sum))
```

Calculate average alternative mode market coverage by district

```
AltMarketCoverage.Di <- tapply(TripProdDiProp.Zi *
AltMarketCoverage.Zi, District.Zi, sum)
```

```
AltMarketCoverage.DiIc <- apply(TripProdDiProp.ZiIc *
AltMarketCoverage.ZiIc, 2, function(x)
                              tapply(x, District.Zi, sum))
AltMarketCoverage.DiPr <- apply(TripProdDiProp.ZiPr *
AltMarketCoverage.ZiPr, 2, function(x)
                              tapply(x, District.Zi, sum))
```

Calculate ratio of non-auto time to average time by district

```
NonAutoCostRatio.DiIc <- NonAutoMarketCost.DiIc / AutoMarketCost.DiIc
NonAutoCostRatio.DiPr <- NonAutoMarketCost.DiPr / AutoMarketCost.DiPr
NonAutoCostRatio.Di <- NonAutoMarketCost.Di / AutoMarketCost.Di
```

Save the results

```
# Best market cost
save(BestMarketCost.ZiIc, file="tci/BestMarketCost.ZiIc.RData")
save(BestMarketCost.ZiPr, file="tci/BestMarketCost.ZiPr.RData")
save(BestMarketCost.Zi, file="tci/BestMarketCost.Zi.RData")
save(BestMarketCost.DiIc, file="tci/BestMarketCost.DiIc.RData")
save(BestMarketCost.DiPr, file="tci/BestMarketCost.DiPr.RData")
save(BestMarketCost.Di, file="tci/BestMarketCost.Di.RData")

# Composite market cost
save(CompMarketCost.ZiIc, file="tci/CompMarketCost.ZiIc.RData")
save(CompMarketCost.ZiPr, file="tci/CompMarketCost.ZiPr.RData")
save(CompMarketCost.Zi, file="tci/CompMarketCost.Zi.RData")
save(CompMarketCost.DiIc, file="tci/CompMarketCost.DiIc.RData")
save(CompMarketCost.DiPr, file="tci/CompMarketCost.DiPr.RData")
save(CompMarketCost.Di, file="tci/CompMarketCost.Di.RData")

# Average market cost
save(AveMarketCost.ZiIc, file="tci/AveMarketCost.ZiIc.RData")
save(AveMarketCost.ZiPr, file="tci/AveMarketCost.ZiPr.RData")
save(AveMarketCost.Zi, file="tci/AveMarketCost.Zi.RData")
save(AveMarketCost.DiIc, file="tci/AveMarketCost.DiIc.RData")
save(AveMarketCost.DiPr, file="tci/AveMarketCost.DiPr.RData")
save(AveMarketCost.Di, file="tci/AveMarketCost.Di.RData")

# Travel Cost Index
save(Tci.ZiIc, file="tci/Tci.ZiIc.RData")
save(Tci.ZiPr, file="tci/Tci.ZiPr.RData")
save(Tci.Zi, file="tci/Tci.Zi.RData")
save(Tci.DiIc, file="tci/Tci.DiIc.RData")
save(Tci.DiPr, file="tci/Tci.DiPr.RData")
save(Tci.Di, file="tci/Tci.Di.RData")

# Travel Cost Index 2
save(Tci2.ZiIc, file="tci/Tci2.ZiIc.RData")
save(Tci2.ZiPr, file="tci/Tci2.ZiPr.RData")
save(Tci2.Zi, file="tci/Tci2.Zi.RData")
save(Tci2.DiIc, file="tci/Tci2.DiIc.RData")
save(Tci2.DiPr, file="tci/Tci2.DiPr.RData")
save(Tci2.Di, file="tci/Tci2.Di.RData")
```

```
# Travel Cost Index 3
save(Tci3.ZiIc, file="tci/Tci3.ZiIc.RData")
save(Tci3.ZiPr, file="tci/Tci3.ZiPr.RData")
save(Tci3.Zi, file="tci/Tci3.Zi.RData")
save(Tci3.DiIc, file="tci/Tci3.DiIc.RData")
save(Tci3.DiPr, file="tci/Tci3.DiPr.RData")
save(Tci3.Di, file="tci/Tci3.Di.RData")

# Average non-auto market cost
save(NonAutoMarketCost.ZiIc, file="tci/NonAutoMarketCost.ZiIc.RData")
save(NonAutoMarketCost.ZiPr, file="tci/NonAutoMarketCost.ZiPr.RData")
save(NonAutoMarketCost.Zi, file="tci/NonAutoMarketCost.Zi.RData")
save(NonAutoMarketCost.DiIc, file="tci/NonAutoMarketCost.DiIc.RData")
save(NonAutoMarketCost.DiPr, file="tci/NonAutoMarketCost.DiPr.RData")
save(NonAutoMarketCost.Di, file="tci/NonAutoMarketCost.Di.RData")

# Average auto market cost
save(AutoMarketCost.ZiIc, file="tci/AutoMarketCost.ZiIc.RData")
save(AutoMarketCost.ZiPr, file="tci/AutoMarketCost.ZiPr.RData")
save(AutoMarketCost.Zi, file="tci/AutoMarketCost.Zi.RData")
save(AutoMarketCost.DiIc, file="tci/AutoMarketCost.DiIc.RData")
save(AutoMarketCost.DiPr, file="tci/AutoMarketCost.DiPr.RData")
save(AutoMarketCost.Di, file="tci/AutoMarketCost.Di.RData")

# NonAutoCostRatio
save(NonAutoCostRatio.ZiIcPr, file="tci/NonAutoCostRatio.ZiIcPr.RData")
save(NonAutoCostRatio.ZiIc, file="tci/NonAutoCostRatio.ZiIc.RData")
save(NonAutoCostRatio.ZiPr, file="tci/NonAutoCostRatio.ZiPr.RData")
save(NonAutoCostRatio.Zi, file="tci/ANonAutoCostRatio.Zi.RData")
save(NonAutoCostRatio.DiIc, file="tci/NonAutoCostRatio.DiIc.RData")
save(NonAutoCostRatio.DiPr, file="tci/NonAutoCostRatio.DiPr.RData")
save(NonAutoCostRatio.Di, file="tci/ANonAutoCostRatio.Di.RData")

# Alternative mode market coverage
save(AltMarketCoverage.ZiIcPr,
file="tci/AltMarketCoverage.ZiIcPr.RData")
save(AltMarketCoverage.ZiIc, file="tci/AltMarketCoverage.ZiIc.RData")
save(AltMarketCoverage.ZiPr, file="tci/AltMarketCoverage.ZiPr.RData")
save(AltMarketCoverage.Zi, file="tci/AltMarketCoverage.Zi.RData")
save(AltMarketCoverage.DiIc, file="tci/AltMarketCoverage.DiIc.RData")
save(AltMarketCoverage.DiPr, file="tci/AltMarketCoverage.DiPr.RData")
save(AltMarketCoverage.Di, file="tci/AltMarketCoverage.Di.RData")
```

Appendix B.5 – R Script to Plot TCI, Percent Non-Auto Market Coverage, and ADI

plot_tci_measures.R

Author: Brian Gregor
Date: 9/26/05
Contact: brian.j.gregor@odot.state.or.us

Description

This script generates a variety of plots and maps of the tci related measures.

Load the results

```
# Reference data
load("tci/MarketAttractions.ZiIcPr.RData")
load("tci/MarketLogSums.ZiIcPr.RData")
load("tci/AttractionScore.RData")
load("tci/AttractionScoreTransit.RData")
load("tci/ReferenceZone.RData")
load("tci/ReferenceAttractions.RData")

# Best market cost
load("tci/BestMarketCost.ZiIc.RData")
load("tci/BestMarketCost.ZiPr.RData")
load("tci/BestMarketCost.Zi.RData")
load("tci/BestMarketCost.DiIc.RData")
load("tci/BestMarketCost.DiPr.RData")
load("tci/BestMarketCost.Di.RData")

# Composite market cost
load("tci/CompMarketCost.ZiIc.RData")
load("tci/CompMarketCost.ZiPr.RData")
load("tci/CompMarketCost.Zi.RData")
load("tci/CompMarketCost.DiIc.RData")
load("tci/CompMarketCost.DiPr.RData")
load("tci/CompMarketCost.Di.RData")

# Average market cost
load("tci/AveMarketCost.ZiIc.RData")
load("tci/AveMarketCost.ZiPr.RData")
load("tci/AveMarketCost.Zi.RData")
load("tci/AveMarketCost.DiIc.RData")
load("tci/AveMarketCost.DiPr.RData")
load("tci/AveMarketCost.Di.RData")
```

```
# Travel Cost Index
load("tci/Tci.ZiIc.RData")
load("tci/Tci.ZiPr.RData")
load("tci/Tci.Zi.RData")
load("tci/Tci.DiIc.RData")
load("tci/Tci.DiPr.RData")
load("tci/Tci.Di.RData")

# Travel Cost Index 2
load("tci/Tci2.ZiIc.RData")
load("tci/Tci2.ZiPr.RData")
load("tci/Tci2.Zi.RData")
load("tci/Tci2.DiIc.RData")
load("tci/Tci2.DiPr.RData")
load("tci/Tci2.Di.RData")

# Travel Cost Index 3
load("tci/Tci3.ZiIc.RData")
load("tci/Tci3.ZiPr.RData")
load("tci/Tci3.Zi.RData")
load("tci/Tci3.DiIc.RData")
load("tci/Tci3.DiPr.RData")
load("tci/Tci3.Di.RData")

# Average non-auto market cost
load("tci/NonAutoMarketCost.ZiIc.RData")
load("tci/NonAutoMarketCost.ZiPr.RData")
load("tci/NonAutoMarketCost.Zi.RData")
load("tci/NonAutoMarketCost.DiIc.RData")
load("tci/NonAutoMarketCost.DiPr.RData")
load("tci/NonAutoMarketCost.Di.RData")

# Average auto market cost
load("tci/AutoMarketCost.ZiIc.RData")
load("tci/AutoMarketCost.ZiPr.RData")
load("tci/AutoMarketCost.Zi.RData")
load("tci/AutoMarketCost.DiIc.RData")
load("tci/AutoMarketCost.DiPr.RData")
load("tci/AutoMarketCost.Di.RData")

# Alternative mode market coverage
load("tci/AltMarketCoverage.ZiIcPr.RData")
load("tci/AltMarketCoverage.ZiIc.RData")
load("tci/AltMarketCoverage.ZiPr.RData")
load("tci/AltMarketCoverage.Zi.RData")
load("tci/AltMarketCoverage.DiIc.RData")
load("tci/AltMarketCoverage.DiPr.RData")
load("tci/AltMarketCoverage.Di.RData")

# NonAutoCostRatio
load("tci/NonAutoCostRatio.ZiIcPr.RData")
load("tci/NonAutoCostRatio.ZiIc.RData")
load("tci/NonAutoCostRatio.ZiPr.RData")
load("tci/ANonAutoCostRatio.Zi.RData")
load("tci/NonAutoCostRatio.DiIc.RData")
load("tci/NonAutoCostRatio.DiPr.RData")
```

```
load("tci/ANonAutoCostRatio.Di.RData")
```

Load mapping data and functions

```
# load required libraries
library("maptools")
library("RColorBrewer")

# identify location of data
ShapesDirectory <- "C:/medfordmodel/gis"

# read in the taz data shapefile
TazFile <- paste(ShapesDirectory, "TAZ.shp", sep="/")
TazShape <- read.shape(TazFile)

# extract the attribute data
TazData <- TazShape$att.data

# convert to polygon file for mapping
TazPoly <- Map2poly(TazShape, TazShape$att.data$TAZ)

# make an index vector to the taz
TazIndex <- as.character(TazData$TAZ)

# get the location of the reference zone
TazCentroids.ZiXy <- get.Pcent(TazShape)
rownames(TazCentroids.ZiXy) <- TazIndex
RefZoneCent <- TazCentroids.ZiXy[ReferenceZone,]

# write a function to plot taz values as a coropleth map
coropleth <- function(geo=TazPoly, data, DataIndex=TazIndex,
palette="Blues", breaks,
                        LegendSize=1, PlotRef=TRUE,
LegendOffset=c(1,1),
                        LegendTitle=NULL, RefColor="red", ...){
     DataCut <- cut(data[DataIndex], breaks, include.lowest=TRUE,
labels=FALSE)
     ColorPalette <- brewer.pal(length(breaks)-1, palette)
     colors <- ColorPalette[DataCut]
     plot(geo, col=colors, xaxt="n", yaxt="n", border=NA, ...)
     if(PlotRef) points(RefZoneCent[1], RefZoneCent[2], pch=1,
col=RefColor, cex=2, lwd=2)
     LegendText <- paste(breaks[1:(length(breaks)-1)],
breaks[2:length(breaks)], sep=" - ")
     if(LegendSize != 0){
          legend(720000*LegendOffset[1], 277100*LegendOffset[2],
legend=LegendText,
               title=LegendTitle, cex=LegendSize, fill=ColorPalette)
          }
     if(PlotRef){
       points(619220, 150140, pch=1, col=RefColor, cex=2, lwd=2)
       text(623250, 150140, "Reference Zone", pos=4)
       }
     }

# Make names for household income groups and trip types for plotting
```

```
IcNames <- c("Low Income", "Mid Income", "High Income")
names(IcNames) <- Ic
PrNames <- c("Work", "Shopping", "Recreation", "Other")
names(PrNames) <- Pr
```

Plot histograms and maps of various measures

Plot histograms and map of attraction scores

```
# Set up plot layout, map will go on top and histogram on bottom
nf <- layout(matrix(c(1,2),nrow=2), widths=4, heights=c(3,1))
# Calculate log of scores and set -Inf to -14
AttractionScore2 <- log(AttractionScore)
AttractionScore2[is.infinite(AttractionScore2)] <- -14
# Set margins for 1st plot
Opar <- par(mar=c(1,1,2.25,1))
# Plot map of scores
coropleth(TazPoly, AttractionScore2, TazIndex, "RdYlBu",
     breaks=c(-14, seq(-10, 0, 2), 0.5, 1, 2, 3, 4),
     main="", LegendOffset=c(1.05,1), LegendTitle="log(score)",
     RefColor="red")
# Add plot title
# mtext("Geographic and Frequency Distributions of Attraction Scores",
line=1, cex=1.15)
# Set margins for 2nd plot
par(mar=c(4,5,1,1))
# Plot histogram of scores, using the same breaks and colors as the map
HistData <- rep(AttractionScore2, rowSums(Hh.ZiIc))
hist(HistData, xlab="", ylab="",
     breaks=c(-14, seq(-10, 0, 2), 0.5, 1, 2, 3, 4),
     col=brewer.pal(11, "RdYlBu"), main="", freq=FALSE)
mtext("Household\nFrequency", side=2, line=2.25)
mtext("log(score)", side=1, line=2)
# Save the plot and restore the graphics parameters
savePlot(filename="tci/graphics/attraction_scores")
par(Opar)
```

Plot household histograms of average market costs for all purposes and incomes

```
# Define breaks and limits for histograms
Breaks <- seq(0, 3, 0.25)
Xlim <- c(0,3)
# Set up plot layout, map will go on top and histogram on bottom
nf <- layout(matrix(1:12,nrow=4))
Opar <- par(mar=c(2,2,1,1), oma=c(2,3,2,1))
# Iterate through all purposes and incomes and plot histograms
for(ic in Ic){
     for(pr in Pr){
          HistData <- rep(AveMarketCost.ZiIcPr[,ic,pr], Hh.ZiIc[,ic])
          hist(HistData, xlab="", xlim=Xlim, breaks=Breaks, axes=FALSE,
          ylab="", col="skyblue", main=NULL, freq=FALSE, ylim=c(0,2.5))
          axis(1, at=seq(0,2.5,0.5))
          if(ic == "lowInc") mtext(PrNames[pr], side=2, line=3)
```

```
          if(pr == "hbw") mtext(IcNames[ic], side=3, line=1)
          }
     }
par(Opar)
savePlot(filename="tci/graphics/hist_ave_cost_by_income_purpose")
```

Plot maps of average market costs for all purposes and incomes

```
# Set up plot layout, map will go on top and histogram on bottom
nf <- layout(matrix(1:12,nrow=4))
Opar <- par(mar=c(0.5,0.5,0.5,0.5), oma=c(1,2.5,2.5,1))
# Iterate through all purposes and incomes and plot histograms
for(ic in Ic){
     for(pr in Pr){
          if((ic == "highInc") & (pr == "hbw")){
               coropleth(TazPoly, AveMarketCost.ZiIcPr[,ic,pr],
TazIndex, "RdYlBu",
               breaks=c(seq(0, 2, 0.25), 3, 4.5), LegendSize=0.75,
PlotRef=FALSE,
               main="", LegendOffset=c(1.014, 1.012))
          } else {
               coropleth(TazPoly, AveMarketCost.ZiIcPr[,ic,pr],
TazIndex, "RdYlBu",
               breaks=c(seq(0, 2, 0.25), 3, 4.5), LegendSize=0,
PlotRef=FALSE,
               main="")
          }
          if(ic == "lowInc") mtext(PrNames[pr], side=2, line=1.75)
          if(pr == "hbw") mtext(IcNames[ic], side=3, line=1)
          }
     }
par(Opar)
savePlot(filename="tci/graphics/map_ave_cost_by_income_purpose")
```

Plot household histograms of TCI values by purpose for each mode aggregregation type

```
# Define a vector of data aggregation types
Ag <- c("Tci.ZiPr", "Tci2.ZiPr", "Tci3.ZiPr")
names(Ag) <- c("Average", "Minimum", "Composite")
# Define breaks and limits for histograms
Breaks <- seq(0, 6, 0.5)
Xlim <- c(0,6)
# Set up plot layout, map will go on top and histogram on bottom
nf <- layout(matrix(1:12,nrow=4))
Opar <- par(mar=c(2,2,1,1), oma=c(2,3,2,1))
# Iterate through all purposes and incomes and plot histograms
for(ag in names(Ag)){
     for(pr in Pr){
          HistData <- rep(get(Ag[ag])[,pr], rowSums(Hh.ZiIc))
          HistData <- HistData[(HistData > 0) & (HistData < 6)]
          hist(HistData, xlab="", breaks=Breaks, xlim=Xlim,
ylim=c(0,1.75),
          ylab="", col="skyblue", main=NULL, freq=FALSE, axes=FALSE)
```

```
          axis(1, at=seq(0,6,1))
          if(ag == "Average") mtext(PrNames[pr], side=2, line=3)
          if(pr == "hbw") mtext(ag, side=3, line=1)
          }
     }
par(Opar)
savePlot(filename="tci/graphics/hist_tci_by_modeagg_purpose")
```

Plot household histograms of TCI values by income for each mode aggregregation type

```
windows(6, 4.5)
# Define a vector of data aggregation types
Ag <- c("Tci.ZiIc", "Tci2.ZiIc", "Tci3.ZiIc")
names(Ag) <- c("Average", "Minimum", "Composite")
# Define breaks and limits for histograms
Breaks <- seq(0, 6, 0.5)
Xlim <- c(0,6)
# Set up plot layout, map will go on top and histogram on bottom
nf <- layout(matrix(1:9,nrow=3))
Opar <- par(mar=c(2,2,1,1), oma=c(2,3,2,1))
# Iterate through all purposes and incomes and plot histograms
for(ag in names(Ag)){
     for(ic in Ic){
          HistData <- rep(get(Ag[ag])[,ic], Hh.ZiIc[,ic])
          HistData <- HistData[(HistData > 0) & (HistData < 6)]
          hist(HistData, xlab="", breaks=Breaks, xlim=Xlim,
ylim=c(0,1.75),
          ylab="", col="skyblue", main=NULL, freq=FALSE, axes=FALSE)
          axis(1, at=seq(0,6,1))
          if(ag == "Average") mtext(IcNames[ic], side=2, line=3)
          if(ic == "lowInc") mtext(ag, side=3, line=1)
          }
     }
par(Opar)
savePlot(filename="tci/graphics/hist_tci_by_modeagg_income")
dev.off()
```

Plot maps of TCI values by aggregation type by incomes

```
windows(6, 4.5)
# Define a vector of data aggregation types
Ag <- c("Tci.ZiIc", "Tci2.ZiIc", "Tci3.ZiIc")
names(Ag) <- c("Average", "Minimum", "Composite")
# Set up plot layout, map will go on top and histogram on bottom
nf <- layout(matrix(1:9,nrow=3))
Opar <- par(mar=c(0.5,0.5,0.5,0.5), oma=c(1,2.5,2.5,1))
# Iterate through all purposes and incomes and plot histograms
for(ag in names(Ag)){
     for(ic in Ic){
          MapData <- get(Ag[ag])[,ic]
          if((ic == "lowInc") & (ag == "Composite")){
               coropleth(TazPoly, MapData, TazIndex, "RdYlBu",
```

```
               breaks=c(seq(0.25, 2, 0.25), 3, 6, 12, 36),
LegendSize=0.75, PlotRef=FALSE,
               main="", LegendOffset=c(1.011, 1.02))
          } else {
               coropleth(TazPoly, MapData, TazIndex, "RdYlBu",
               breaks=c(seq(0.25, 2, 0.25), 3, 6, 12, 36),
LegendSize=0, PlotRef=FALSE,
               main="")
          }
          if(ag == "Average") mtext(IcNames[ic], side=2, line=1.75)
          if(ic == "lowInc") mtext(ag, side=3, line=1.75)
          }
     }
par(Opar)
savePlot(filename="tci/graphics/map_tci_by_modeagg_income")
dev.off()
```

Plot maps of TCI values by aggregation type by purpose

```
# Define a vector of data aggregation types
Ag <- c("Tci.ZiPr", "Tci2.ZiPr", "Tci3.ZiPr")
names(Ag) <- c("Average", "Minimum", "Composite")
# Set up plot layout, map will go on top and histogram on bottom
nf <- layout(matrix(1:12,nrow=4))
Opar <- par(mar=c(0.5,0.5,0.5,0.5), oma=c(1,2.5,2.5,1))
# Iterate through all purposes and incomes and plot histograms
for(ag in names(Ag)){
     for(pr in Pr){
          MapData <- get(Ag[ag])[,pr]
          MapData[MapData < 0] <- 35
          if((pr == "hbw") & (ag == "Composite")){
               coropleth(TazPoly, MapData, TazIndex, "RdYlBu",
               breaks=c(seq(0.25, 2, 0.25), 3, 6, 12, 36),
LegendSize=0.75, PlotRef=FALSE,
               main="", LegendOffset=c(1.02, 1.02))
          } else {
               coropleth(TazPoly, MapData, TazIndex, "RdYlBu",
               breaks=c(seq(0.25, 2, 0.25), 3, 6, 12, 36),
LegendSize=0, PlotRef=FALSE,
               main="")
          }
          if(ag == "Average") mtext(PrNames[pr], side=2, line=1.75)
          if(pr == "hbw") mtext(ag, side=3, line=1.75)
          }
     }
par(Opar)
savePlot(filename="tci/graphics/map_tci_by_modeagg_purpose")
```

Plot histograms of alternative mode market coverage by purpose and income

```
# Set up breaks and limits for plotting
Breaks <- c(0,10,20,30,40,50,60,70,80,90,100)
Xlim <- c(0,100)
```

```
# Set up plot layout, map will go on top and histogram on bottom
nf <- layout(matrix(1:12,nrow=4))
Opar <- par(mar=c(2,2,1,1), oma=c(2,3,2,1))
# Iterate through all purposes and incomes and plot histograms
for(ic in Ic){
     for(pr in Pr){
          HistData <- rep(AltMarketCoverage.ZiIcPr[,ic,pr],
Hh.ZiIc[,ic])
          hist(HistData, xlab="", xlim=Xlim, breaks=Breaks, axes=FALSE,
          ylab="", col="skyblue", ylim=c(0,0.07), main=NULL,
freq=FALSE)
          axis(1, at=seq(0, 100, 20))
          if(ic == "lowInc") mtext(PrNames[pr], side=2, line=3)
          if(pr == "hbw") mtext(IcNames[ic], side=3, line=1)
          }
     }
savePlot(filename="tci/graphics/hist_nonauto_percent_by_income_purpose"
)
# Restore graphics parameters
par(Opar)
```

Map alternative mode market coverage by purpose and income

```
# Set up plot layout, map will go on top and histogram on bottom
nf <- layout(matrix(1:12,nrow=4))
Opar <- par(mar=c(0.5,0.5,0.5,0.5), oma=c(1,2.5,2.5,1))
# Iterate through all purposes and incomes and plot histograms
for(ic in Ic){
     for(pr in Pr){
          if((ic == "highInc") & (pr == "hbw")){
               coropleth(TazPoly,
round(AltMarketCoverage.ZiIcPr[,ic,pr],0), TazIndex, "RdYlBu",
               breaks=seq(0,100,10), LegendSize=0.75, PlotRef=FALSE,
               main="", LegendOffset=c(1.02, 1.012))
          } else {
               coropleth(TazPoly,
round(AltMarketCoverage.ZiIcPr[,ic,pr],0), TazIndex, "RdYlBu",
               breaks=seq(0,100,10), LegendSize=0, PlotRef=FALSE,
               main="")
          }
          if(ic == "lowInc") mtext(PrNames[pr], side=2, line=1.75)
          if(pr == "hbw") mtext(IcNames[ic], side=3, line=1.75)
          }
     }
par(Opar)
savePlot(filename="tci/graphics/map_nonauto_percent_by_income_purpose")
```

Plot histograms of non-auto cost ratio by purpose and income

```
# Set up breaks and limits for plotting
 Breaks <- seq(0, 275, 25)
 Xlim <- c(0, 275)
 # Set up plot layout, map will go on top and histogram on bottom
 nf <- layout(matrix(1:12,nrow=4))
 Opar <- par(mar=c(2,2,1,1), oma=c(2,3,2,1))
```

```
 # Iterate through all purposes and incomes and plot histograms
 for(ic in Ic){
      for(pr in Pr){
           HistData <- rep(NonAutoCostRatio.ZiIcPr[,ic,pr],
Hh.ZiIc[,ic])
           hist(HistData, xlab="", xlim=Xlim, breaks=Breaks,
axes=FALSE,
           ylab="", col="skyblue", ylim=c(0,0.025), main=NULL,
freq=FALSE)
           axis(1, at=seq(0, 250, 50))
           if(ic == "lowInc") mtext(PrNames[pr], side=2, line=3)
           if(pr == "hbw") mtext(IcNames[ic], side=3, line=1)
           }
      }

savePlot(filename="tci/graphics/hist_nonauto_auto_cost_ratio_by_income_
purpose")
 # Restore graphics parameters
 par(Opar)
```

Map non-auto cost ratio by purpose and income

```
# Set up plot layout, map will go on top and histogram on bottom
nf <- layout(matrix(1:12,nrow=4))
Opar <- par(mar=c(0.5,0.5,0.5,0.5), oma=c(1,2.5,2.5,1))
# Iterate through all purposes and incomes and plot histograms
for(ic in Ic){
     for(pr in Pr){
          if((ic == "highInc") & (pr == "hbw")){
               coropleth(TazPoly,
round(NonAutoCostRatio.ZiIcPr[,ic,pr],0), TazIndex, "RdYlBu",
               breaks=seq(0, 275,25), LegendSize=0.75, PlotRef=FALSE,
               main="", LegendOffset=c(1.02, 1.012))
          } else {
               coropleth(TazPoly,
round(NonAutoCostRatio.ZiIcPr[,ic,pr],0), TazIndex, "RdYlBu",
               breaks=seq(0, 275,25), LegendSize=0, PlotRef=FALSE,
               main="")
          }
          if(ic == "lowInc") mtext(PrNames[pr], side=2, line=1.75)
          if(pr == "hbw") mtext(IcNames[ic], side=3, line=1.75)
          }
     }
par(Opar)
savePlot(filename="tci/graphics/map_nonauto_auto_cost_ratio_by_income_p
urpose")
```

Set up districts reference vectors

```
Districts.Zo <- districts$ugb
names(Districts.Zo) <- districts$zone
DiNames <- c("Outside UGB", "Eagle Point", "Central Point", "Medford",
"Jacksonville",
          "Phoenix", "Talent", "Ashland")
names(DiNames) <- unique(Districts.Zo)
```

```
Districts.Zi <- Districts.Zo[Zi] ; rm(Districts.Zo)
```

Plot comparisons of travel cost indices by UGB

```
# Set up graphic parameters
Opar <- par(mfrow=c(2,2), mar=c(2,3,2,2), oma=c(1,1,2.25,1))
#Barplot of average market costs by district
BarCenter <- barplot(Tci.Di, xlab="", ylab="Travel Cost Index",
col=brewer.pal(8, "Pastel1"),
     main=NULL, axisnames=FALSE)
mtext("Average Market Cost", side=1, line=0.5, cex=1)
mtext("TCI", side=2, line=2.5)
text(as.vector(BarCenter), 0.1, labels=DiNames, srt=90, pos=4,
offset=0)
#Barplot of auto market costs by district
BarCenter <- barplot(Tci2.Di, xlab="", ylab="Travel Cost Index",
col=brewer.pal(8, "Pastel1"),
     main=NULL, axisnames=FALSE)
mtext("TCI", side=2, line=2.5)
mtext("Minimum Market Cost", side=1, line=0.5, cex=1)
text(as.vector(BarCenter), 0.2, labels=DiNames, srt=90, pos=4,
offset=0)
#Barplot of non-auto market costs by district
BarCenter <- barplot(Tci3.Di, xlab="", ylab="Travel Cost Index",
col=brewer.pal(8, "Pastel1"),
     main=NULL, axisnames=FALSE)
mtext("Composite Market Cost", side=1, line=0.5, cex=1)
mtext("TCI", side=2, line=2.5)
text(as.vector(BarCenter), 0.075, labels=DiNames, srt=90, pos=4,
offset=0)
# mtext("Comparison of TCI Values by Calculation Method and UGB",
outer=TRUE, line=1, cex=1.15)
savePlot(filename="tci/graphics/district_tci")
# Restore graphics parameters
par(Opar)
```

Plot alternative mode coverage

```
windows(6.5, 4)
# Set up graphic parameters
Opar <- par(mar=c(2,3,2,2), oma=c(1,1,1,1))
 # Barplot of alternative mode market coverage
BarCenter <- barplot(AltMarketCoverage.Di, xlab="", ylab="",
col=brewer.pal(8, "Pastel1"),
      main=NULL, axisnames=FALSE, ylim=c(0,100))
mtext("Percent", side=2, line=2.5)
text(as.vector(BarCenter), 5, labels=DiNames, srt=90, pos=4, offset=0)
savePlot(filename="tci/graphics/district_alt_mode_coverage")
# Restore graphics parameters
par(Opar)
dev.off()
```

Plot non-auto to auto cost ratio

```
windows(6.5, 4)
# Set up graphic parameters
Opar <- par(mar=c(2,3,2,2), oma=c(1,1,1,1))
# Barplot of ratio of non-auto market cost to auto market cost
BarCenter <- barplot(NonAutoCostRatio.Di, xlab="", ylab="",
col=brewer.pal(8, "Pastel1"),
     main=NULL, axisnames=FALSE)
mtext("Ratio", side=2, line=2.5)
text(as.vector(BarCenter), 5, labels=DiNames, srt=90, pos=4, offset=0)
# mtext("Alternative Mode Coverage and Cost Ratio", outer=TRUE, line=1,
cex=1.15)
savePlot(filename="tci/graphics/district_nonauto_auto_cost")
# Restore graphics parameters
par(Opar)
dev.off()
```

Appendix – B.6 R Script to Calculate Road Network Concentration Index

calculate_rnci.R

Author: Brian Gregor
Contact: brian.j.gregor@odot.state.or.us
Date: 09/26/05
Revisions:

Read in data and define variables

Read in network data

```
Links <- read.table("eug_netdata_rev_names.txt", header=TRUE)
rownames(Links) <- paste(Links$Inode, Links$Jnode, sep="-")
Capacities <- read.table("EUG_CAPS.TXT", header=TRUE)
rownames(Capacities) <- paste(Capacities$inode, Capacities$jnode,
sep="-")
```

Join the capacities data to the link data and calculate volume to capacity ratios

```
Links$Cap <- Capacities[match(rownames(Links),
rownames(Capacities)),"link_cap_per_day"]
Links$VcA <- Links$AdtA / Links$Cap
Links$VcB <- Links$AdtB / Links$Cap
```

Define link types

```
Lt <- c(1, 2, 3, 4, 5, 6, 7, 8, 9)
names(Lt) <- c("Freeway", "Principal Arterial", "Major Arterial",
"Minor Arterial",
               "Major Collector", "Neighborhood Collector", "Local",
               "Freeway Ramp", "Connector")
```

Define functions to calculate and plot

Define a function to calculate the RNCI

parameter: LinkAdt - a vector of link traffic volumes
parameter: LinkLanes - a vector of the number of lanes for each link

return: Rnci - a value of the road network concentration index

```
calcRnci <- function(LinkAdt, LinkLanes){
     LaneVol <- sort(LinkAdt / LinkLanes)
     PctLaneVol <- cumsum(LaneVol)/sum(LaneVol)
     PctEqVol <-
cumsum(rep(1,length(LaneVol)))/(sum(rep(1,length(LaneVol))))
     Rnci <- (sum(PctEqVol)-sum(PctLaneVol))/sum(PctEqVol)
     Rnci
     }
```

Define a function to plot a Lorenz curve

parameter: LinkAdt - a vector of link traffic volumes

parameter: LinkLanes - a vector of the number of lanes for each link

return: none

```
plotRnci <- function(LinkAdt, LinkLanes, ...){
     LaneVol <- sort(LinkAdt / LinkLanes)
     Xvals <- 100 * (1:length(LaneVol)/length(LaneVol))
     Yvals <- 100 * cumsum(LaneVol)/sum(LaneVol)
     Rnci <- round(calcRnci(LinkAdt, LinkLanes), 2)
     plot(Xvals, Yvals, type="l", lwd=2,
          xlab="Percent of Links", ylab="Percent of Lane Volume", ...)
     lines(Xvals, Xvals, lty=2, lwd=2)
     text(0, 80, labels=paste("RNCI =", Rnci), pos=4, cex=1.25)
     legend(0, 100, legend=c("Pct of Total Lane Volume", "Line of
Equality"),
          lty=c(1,2), lwd=2, bty="n")
     }
```

Produce pdf plots of several RNCI comparisons

Plot RNCI for each functional class comparing scenarios A and B

```
pdf("FerryStCompare.pdf", width=10, height=7)
OldPar <- par(mfrow=c(1,2), oma=c(1,1,4,1))
for(lt in Lt[c(1:6,8)]){
     LinkAdtALt <- Links$AdtA[Links$Type == lt]
     LinkAdtBLt <- Links$AdtB[Links$Type == lt]
     Lanes <- Links$Lanes[Links$Type == lt]
     plotRnci(LinkAdtALt, Lanes, main="With Ferry St. Bridge")
     plotRnci(LinkAdtBLt, Lanes, main="Without Ferry St. Bridge")
     mtext(paste(names(Lt)[Lt == lt], "Road Network Concentration
Index"),
          line=1, outer=TRUE, cex=2)
     }
par(OldPar)
dev.off()
```

Plot RNCI for each functional class comparing area types

```
pdf("AreaTypeCompare.pdf", width=10, height=7)
```

```
OldPar <- par(mfrow=c(1,2), oma=c(1,1,4,1))
for(lt in Lt[2:6]){
     LinkAdtALt <- Links$AdtA[Links$Type == lt & Links$AreaType == 1]
     LinkAdtBLt <- Links$AdtA[Links$Type == lt & Links$AreaType == 2]
     LanesALt <- Links$Lanes[Links$Type == lt & Links$AreaType == 1]
     LanesBLt <- Links$Lanes[Links$Type == lt & Links$AreaType == 2]
     plotRnci(LinkAdtALt, LanesALt, main="Low Connectivity")
     plotRnci(LinkAdtBLt, LanesBLt, main="High Connectivity")
     mtext(paste(names(Lt)[Lt == lt], "Road Network Concentration
Index"),
          line=1, outer=TRUE, cex=2)
     }
par(OldPar)
dev.off()
```

Calculate and plot aggregate values for arterials and collectors by area types

```
pdf("ArtCollAreaTypeCompare.pdf", width=10, height=7)
OldPar <- par(mfrow=c(1,2), oma=c(1,1,4,1))
IsArterial <- Links$Type %in% c(2,3,4)
IsCollector <- Links$Type %in% c(5,6)
LinkAdtA <- Links$AdtA[IsArterial & Links$AreaType == 1]
LanesA <- Links$Lanes[IsArterial & Links$AreaType == 1]
LinkAdtB <- Links$AdtB[IsArterial & Links$AreaType == 2]
LanesB <- Links$Lanes[IsArterial & Links$AreaType == 2]
plotRnci(LinkAdtA, LanesA, main="Low Connectivity")
plotRnci(LinkAdtB, LanesB, main="High Connectivity")
mtext("Average Arterial Road Network Concentration Index",
     line=1, outer=TRUE, cex=2)

LinkAdtA <- Links$AdtA[IsCollector & Links$AreaType == 1]
LanesA <- Links$Lanes[IsCollector & Links$AreaType == 1]
LinkAdtB <- Links$AdtB[IsCollector & Links$AreaType == 2]
LanesB <- Links$Lanes[IsCollector & Links$AreaType == 2]
plotRnci(LinkAdtA, LanesA, main="Low Connectivity")
plotRnci(LinkAdtB, LanesB, main="High Connectivity")
mtext("Average Collector Road Network Concentration Index",
     line=1, outer=TRUE, cex=2)
par(OldPar)
dev.off()
```

Calculate a composite RNCI based on capacities

```
pdf("CompositeAreaTypeCompare.pdf", width=10, height=7)
OldPar <- par(mfrow=c(1,2), oma=c(1,1,4,1))
IsMajor <- Links$Type %in% c(2, 3, 4, 5, 6)
plotRnci(Links$AdtA[IsMajor & Links$AreaType == 1], Links$Cap[IsMajor &
Links$AreaType == 1],
          main="Low Connectivity")
plotRnci(Links$AdtB[IsMajor & Links$AreaType == 2], Links$Cap[IsMajor &
Links$AreaType == 2],
          main="High Connectivity")
```

```
mtext("Capacity Weighted Average Arterial and Collector\nRoad Network
Concentration Index",
     line=0, outer=TRUE, cex=2)
par(OldPar)
dev.off()
```

Make Metafiles for Report

Plot RNCI for each functional class comparing scenarios A and B

```
for(lt in Lt[c(1:6,8)]){
     FileName <- paste("FerryStComp", lt, ".emf", sep="")
     win.metafile(FileName, width=10, height=7)
     OldPar <- par(mfrow=c(1,2), oma=c(1,1,4,1))
     plotRnci(Links$AdtA[Links$Type == lt], Links$Lanes[Links$Type ==
lt],
          main="With Ferry St. Bridge")
     plotRnci(Links$AdtB[Links$Type == lt], Links$Lanes[Links$Type ==
lt],
          main="Without Ferry St. Bridge")
     mtext(paste(names(Lt)[Lt == lt], "Road Network Concentration
Index"),
          line=1, outer=TRUE, cex=1.5)
     par(OldPar)
     dev.off()
     }
```

Plot RNCI for each functional class comparing area types

```
for(lt in Lt[2:6]){
     FileName <- paste("AreaTypeComp", lt, ".emf", sep="")
     win.metafile(FileName, width=10, height=7)
     OldPar <- par(mfrow=c(1,2), oma=c(1,1,4,1))
     LinkAdtALt <- Links$AdtA[Links$Type == lt & Links$AreaType == 1]
     LinkAdtBLt <- Links$AdtA[Links$Type == lt & Links$AreaType == 2]
     LanesALt <- Links$Lanes[Links$Type == lt & Links$AreaType == 1]
     LanesBLt <- Links$Lanes[Links$Type == lt & Links$AreaType == 2]
     plotRnci(LinkAdtALt, LanesALt, main="Low Connectivity")
     plotRnci(LinkAdtBLt, LanesBLt, main="High Connectivity")
     mtext(paste(names(Lt)[Lt == lt], "Road Network Concentration
Index"),
          line=1, outer=TRUE, cex=1.5)
     par(OldPar)
     dev.off()
     }
```

Calculate and plot aggregate values for arterials and collectors by area types

```
win.metafile("ArterialAreaTypeComp.emf", width=10, height=7)
OldPar <- par(mfrow=c(1,2), oma=c(1,1,4,1))
IsArterial <- Links$Type %in% c(2,3,4)
IsCollector <- Links$Type %in% c(5,6)
```

```
LinkAdtA <- Links$AdtA[IsArterial & Links$AreaType == 1]
LanesA <- Links$Lanes[IsArterial & Links$AreaType == 1]
LinkAdtB <- Links$AdtB[IsArterial & Links$AreaType == 2]
LanesB <- Links$Lanes[IsArterial & Links$AreaType == 2]
plotRnci(LinkAdtA, LanesA, main="Low Connectivity")
plotRnci(LinkAdtB, LanesB, main="High Connectivity")
mtext("Average Arterial Road Network Concentration Index",
     line=1, outer=TRUE, cex=1.5)
par(OldPar)
dev.off()

win.metafile("CollectorAreaTypeComp.emf", width=10, height=7)
OldPar <- par(mfrow=c(1,2), oma=c(1,1,4,1))
LinkAdtA <- Links$AdtA[IsCollector & Links$AreaType == 1]
LanesA <- Links$Lanes[IsCollector & Links$AreaType == 1]
LinkAdtB <- Links$AdtB[IsCollector & Links$AreaType == 2]
LanesB <- Links$Lanes[IsCollector & Links$AreaType == 2]
plotRnci(LinkAdtA, LanesA, main="Low Connectivity")
plotRnci(LinkAdtB, LanesB, main="High Connectivity")
mtext("Average Collector Road Network Concentration Index",
     line=1, outer=TRUE, cex=1.5)
par(OldPar)
dev.off()
```

Calculate a composite RNCI based on capacities

```
win.metafile("CompositeAreaTypeComp.emf", width=10, height=7)
OldPar <- par(mfrow=c(1,2), oma=c(1,1,4,1))
IsMajor <- Links$Type %in% c(2, 3, 4, 5, 6)
plotRnci(Links$AdtA[IsMajor & Links$AreaType == 1], Links$Cap[IsMajor &
Links$AreaType == 1],
     main="Low Connectivity")
plotRnci(Links$AdtB[IsMajor & Links$AreaType == 2], Links$Cap[IsMajor &
Links$AreaType == 2],
     main="High Connectivity")
mtext("Capacity Weighted Average Arterial and Collector\nRoad Network
Concentration Index",
     line=0, outer=TRUE, cex=1.5)
par(OldPar)
dev.off()
```

APPENDIX C: EXPERT PANEL RESPONSES AND RECOMMENDATIONS ON PERFORMANCE MEASURES

Summary: Performance Measures – Expert Panel Conference Call
April 19, 2004

Attendees:

Expert Panel: Tim Lomax, Ken Dueker, Susan Handy, Mike Meyer, Doug Hunt
Others: Brian Gregor (ODOT), Alan Kirk (ODOT), Caroline Gassaway (ODOT) Bud Reiff (LCOG), Tom Schwetz (LCOG), Paul Thompson (LCOG), Susan Payne (LCOG),

PERFORMANCE MEASURES THAT SHOULD BE AVOIDED OR USED WITH CAUTION:

"Average" measures

- Lose richness of underlying data
- Often meaningless when aggregated over entire region
- May be insensitive to changes
- Can be developed as a roll-up measure when aggregating over selected geographic area

Public Opinion/Customer surveys

- Not useful if measure only what people approve of
- Focus instead on what people are dissatisfied with
- More useful if repeated over time to view trends
- Most useful if connected with a numerical measure

Traditional congestion indices

- Inadequate: Free flow speed comparison with actual travel speed
- Better: Most efficient travel speed compared with actual speed

Important characteristics of a useful measure:

- Context
- Comparable over time
- Comparable over regions
- Applicable to subareas and corridors
- Both forecastable and measurable measures are needed
- Can be rolled-up to broader aggregations
- Understandable link to the policies or goals
- Winnowed from a large set of potential measures to an essential set – there may be many PM's for internal use, but only a few essential ones communicated to policy makers and the public
- Matched to the audience – agency, decision-makers, public
- Matched to the intention of the policy.

PARTICULARLY USEFUL PERFORMANCE MEASURES:

Population and Employment

- Track over time by TAZ and other small functional areas
- Use to validate land use model

Safety

- Fatalities over time

Accessibility

- Household employment opportunities within a certain distance
- Disaggregate by population groups for e.g., environmental justice

Congestion / Mobility

- Hours of congestion
- Not v/c ratios and LOS – not understandable by public
- The Urban Mobility Report documentation can provide useful insights into how congestion can be conveyed to the public.

Reliability

- See Tim Lomax's work
  (Note: We are investigating ideas in TTI and Cambridge Systematics "Selecting Travel Reliability Measures" May 2003)
- Important issue for freight, transit or road systems
- Relates to variability – small variability implies more reliable
- Correlated to congestion, but more important to customers perception of performance
- Cannot forecast adequately yet
- Possibly need to include probability of incidents when modeling reduced capacity

Accessibility

- *Chandra Bhat (TXDOT, report* **4938-3?**
  http://www.utexas.edu/research/ctr/pdf_reports/index.html
  - By TAZ, trip purpose, time of day, mode – aggregated along any of the dimensions

  (Note: We are investigating possibility of disaggregating along socio-economic dimensions, as well)
- Change in consumer surplus of travel by population segment – Doug Hunt
  - Transformed into $ equivalents
  - Examines equity issues both spatially and by population segment
  - Insight into the *benefits* of travel improvements, balances the discussion.
  - Difficult for public to understand
  - *See papers by Jim Ryan*

(Note to Doug: We have found descriptions of how these ideas have been applied in the Sacramento models. Can you guide us to other recent research in this area?)

- Market basket of activities and choices
    1. Measure cost of accessibility over time or change in the market basket over time
    2. Issue of whether one basket for all or different baskets for different population groups.

MEASURES OF INTEREST TO OREGON PM TAC

Reliance on Automobile

- Dependence implies not having a choice
- Possibility of using multiple scenarios to test for reliance on the auto under variety of different futures
- Use perhaps accessibility by different modes – equal transit and auto accessibility implies low dependence on car. Compare at different times of day, by different socio-economic groups.
- Accessibility measures often don't include factors such as frequency that is important in determining patronage of the system. Ridership trends showing faster growth in transit than in auto use is what is important.
- VMT measures *use of the auto*, not reliance
- VMT affected by economy more than by population change.
- Is the policy to provide the option of choice or try to change behaviour? FOCUS on the intention and design the measure to match.
- Walking and transit accessibilities would measure how well land use patterns serve to reduce reliance on automobile.

Balance

- *Ken Dueker's paper on transportation investment in Portland RTP*
    - *$ investment per mode by number of forecast trips*
- Could range from relative investment by mode to balance of who benefits from investment.
- Similar issue to affirmative action debate – investment could be proportional to the number of trips by mode, or could be skewed to compensate for past inadequacies.
- Need monitoring over time to measure effect of policies.
    - Extensive monitoring before and after policy enactment in Australia and NZ to see if benefits accrued following investment *(Michael Meyers, International PM Scan trip)*
- Develop measures for desired goal of balanced modes – determine how to get to that goal. Monitor to track progress and provide feedback loop.

Economic Vitality

- Influenced by mobility, accessibility and reliability which are first in the causal path
- Important to measure in context with other cities
- Oregon II model will be able to investigate this by looking at production costs and cost of exports as affected by transportation changes. But, effects will be very small.
- Simplistic approach is to relate it to improvements in freight movement on the designated freight network
- Accessibility measures to look at market size changes due to changes in the transportation system as they affect retail businesses

Safety and Security

- Assign societal cost to crashes; use to assess cost/benefit.
- How to forecast future fatalities and injuries for use in long range planning?
- University of Arizona -- forecasting at TAZ level using population, schools, driveway access etc.
- Trends are useful especially when linked to policies implemented – Vic Roads monitoring fatalities since 1970, linking trend with policies

- **"Performance Measures to Improve Transportation Systems: Second National Conference**. TRB is sponsoring the Performance Measures to Improve Transportation Systems: Second National Conference on August 22-24, 2004, in Irvine, CA." http://gulliver.trb.org/news/blurb_detail.asp?id=2469 --- this conference will include a paper from TSA on security measures
- Mostly treated as dealing with recovery from, not protection against catastrophes.
- Redundancy – availability of alternative modes and networks when key links go out; perhaps balance measures might apply here.

Quality of Life

- Defined as a set of desirable characteristics of region set by policy makers; score card of how transportation affects these.
- Direct impact of transportation with access to parks, green space.

Summary of Expert Panel Comments on Proposed Performance Measures

General Comments:

- The TCI-based measures are particularly useful because they measure opportunities rather than actual behavior, and are sensitive to land use policies and improvements for non-automobile modes. *(note: another panelist expressed a preference for the "behavior" measures)*
- The challenge is to explain these measures in a clear and simple way, and to show how they fit together and complement each other to provide an overall assessment of the transportation plan. Do they all get equal weight?
- A measure of safety is still needed, perhaps some combination of number of crashes or "safety cost to society" would be very useful.

Comments on Specific Measures:

Urban Mobility

- Useful to show changes over time, but not to measure mobility at any particular point in time.
- It is more a measure of road network congestion than urban mobility.
- The use of free-flow conditions as the standard by which delay is measured is not realistic.
- Need a clearer articulation of the role mobility measures play in the planning process and a stronger justification than "leverage a great deal of research and development".
- The results may differ from those published in the Urban Mobility Report for many reasons, including the area covered, types of roads included, etc.

Transportation Cost Index

- This is a form of accessibility measure, but that overcomes some of the issues with other forms. The "market basket" concept is useful, but the process of deriving it and explaining it in generally understandable terms are at least as difficult as "regular" accessibility measures.
- The choice of reference TAZ seems critical, but the methodology is not well-specified. Should do sensitivity analysis, comparing the results for different reference TAZ's.
- Instead of "travel opportunities", the notion of "activity opportunities" puts the emphasis back on the travel goal – activities at the destinations.
- "Weighted travel costs" requires much more definition / explanation. Weighted by modal size term in the utility function? Does this method bias the resulting cost information to any one particular mode?
- Need to emphasize / describe the role of travel time in the cost results.

- This measure is best used to determine the relative transportation cost burden to different income groups, which is done at the disaggregate level.
- Rather than average travel costs, it would be interesting to see the distribution of travel costs; for example, how many zones have costs above some specified level?
- This measure might be more useful to show changes over time rather than average transportation costs at any particular point in time.

Percent of Market Basket Accessible by Non-Auto Modes

- The point about this being a more direct measure of automobile dependence than VMT is important and could be more clearly articulated.
- Why is the "ratio of travel time to activity time" important for setting the threshold for public transportation relative to auto transit time?
- How is the proportion of households for which bicycling is considered to be a viable travel choice determined?
- How does this measure handle intermodal trips that include both a bicycle collection/distribution trip and a line-haul transit trip? *(note: this is an important emerging market in Oregon urban areas, but not yet dealt with in Oregon MPO models, estimated from 1994 survey data.)*

Auto Dependence Index

- The aggregated regional index is not very informative, and will probably not change very much from year to year. A better measure would be, for example, the percentage of TAZ's that are auto dependent, perhaps weighted by TAZ households or population.
- What are the effects of *(arbitrary)* TAZ size on the calculation of walk/bike accessibility?

Freight Delay Costs

- This is an important measure, but it is not clear what is recommended. Are these just total delay costs? Weighted averages?
- Is this just for truck movements, or is rail included? *(note: While the Oregon MPO model do not include the rail mode, the Statewide model does.)*

Road Network Concentration Index

- This is a measure of network redundancy and, although security related, is also common sense in terms of developing an effective network.
- Needs further explanation. If the "Gini" coefficient is aggregated for the entire region, this measure will not be very useful. Will be more useful if calculated by corridor, subregion, or functional classification.