

Urban Form and Green House Gas (GHG) Emissions

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Background

- **Global Climate Change & Control Measures by International Agencies**
 - In 1988, Intergovernmental Panel on Climate Change (IPCC) was established by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP)
 - The Kyoto Protocol (1992) is intended to alleviate greenhouse gas (GHG) concentrations in the atmosphere at a more acceptable level.
 - The Clinton Administration of the United States once adopted the 1993 Climate Change Action Plan, which intended to bring GHG emissions to 1990 levels by the year 2000.
- **California Climate Bills (GHG)**
 - AB 32 (2006): reduce GHG emissions to 1990 levels by the year 2020.
 - SB 375 (2008): Regional Transportation Plan (RTP) & Sustainable Communities Strategy (SCS). SCS includes general location of land uses, residential densities, and building intensities as a land use element of the RTP.

Background (cont'd)

- **Sustainable Communities Strategy (SCS)**
 - Encourages smart growth and sustainable development (transit oriented development; mixed use development, provision of housing opportunities near job centers, and job opportunities in housing-rich communities; focus of growth along transit corridors and nodes to utilize available capacity)
 - If SCS still can not meet the emission reduction targets, an alternative planning strategy (APS) should be prepared and would propose alternative development patterns, infrastructure, or additional transportation measures or policies to reduce the target emissions.
 - The best case scenario is that the regional SCS might be properly aligned with the current local planning efforts to improve sustainability and livability through the local general plans.

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Purpose

- **Measures and assesses the impacts of urban form scenarios on the regional greenhouse gas (GHG) emissions (measured in vehicle miles of travel (VMT)) using the modeling approach.**
- **Discusses the locally “optimal” and “acceptable” urban form to achieve the regional GHG emission reductions target.**

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Current Regional Planning Efforts: Integration

- Transportation (Federal)
- Air Quality (Federal)
- Housing (State)
- Land Use (State)

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Current Regional Planning Efforts: Integration

- **Transportation (Federal)**
 - Federal-Aid Highway Act (1962) & Urban Mass Transportation Act (1964): federal transportation funds were distributed with participation of cities or regions. The Federal-Aid Highway Act of 1962 required, as a condition attached to federal transportation financial assistance, that transportation projects in urbanized areas of 50,000 or more in population be based on a continuing, comprehensive, urban transportation planning process undertaken cooperatively by the states and local governments (U.S DOT, 1988).
 - The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) brought several innovative ideas into the regional planning practice to effectively deal with transportation planning and policy. The key elements of ISTEA are as follows: 1) MPOs can have stronger roles and responsibilities than before. 2) long-range plans must evaluate a variety of scenarios. In this scenario building, public participation and their opinions are very important. ⁶

Current Regional Planning Efforts: Integration

- **Air Quality (Federal)**

- As part of the federal transportation funding requirements, the RTP should conform to the regional emission requirements. The Clean Air Act (CAA) was introduced in 1990, and it intends to reduce smog and air pollution by establishing air quality standards and planning requirements for various air pollutants.
- The CAA requires federally supported highway and transit project activities to meet federal air quality requirements. Under the U.S. Department of Transportation (DOT)
- The MPO's Regional Transportation Plan (RTP) needs to pass regional emission analysis test.

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Current Regional Planning Efforts: Integration

- **Housing (State)**

- The regional housing needs allocation (RHNA) is intended to improve the affordability of residents through the RHNA process and the resulting local housing element update for several decades.
- The regional housing needs allocation (RHNA) process establishes minimum housing development capacity that cities and counties are to make available via their land use powers to accommodate growth within a short-term planning period.
- RHNA numbers are assigned by four income categories as guideposts for each community to develop a mix of housing types for all economic segments of the population. The process is also known as "fair share" planning.

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Current Regional Planning Efforts: Integration

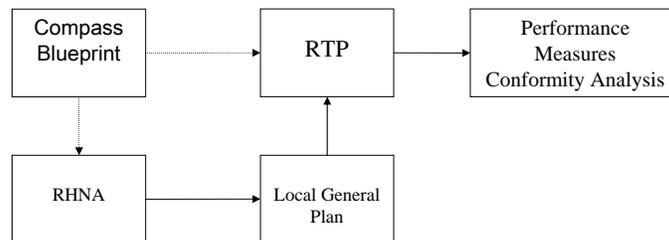
- **Land Use (State)**

- The regional blueprint planning program is introduced to help Metropolitan Planning Organizations (MPOs) to develop alternative growth scenarios. The program would be used to utilize previously unallocated federal funding, as well as improving the comprehensive level of transportation/land use planning.
- The Regional Blueprint Planning Program is a voluntary, discretionary grant program that provides seed funding to MPOs to conduct regional blueprint planning.
- The program contributes to the vision of improved quality of life within California by addressing future growth on a twenty-year horizon through the integration of transportation, housing, land use, environmental resources, other infrastructure, and services.

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Current Regional Planning Efforts: Integration

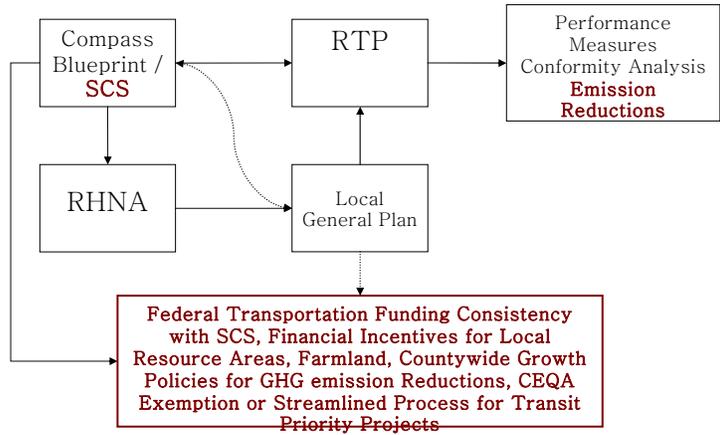
Relationship of Major Plans and Programs: Before SB375



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Current Regional Planning Efforts: Integration

Relationship of Major Plans and Programs: After SB375



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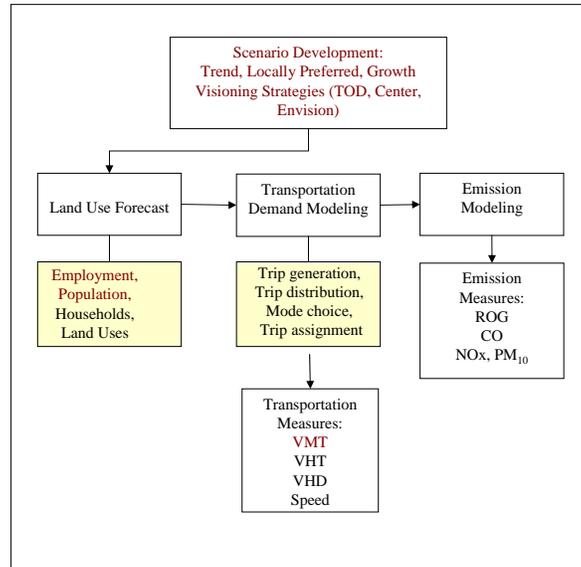
Study Area



	2003	2035	Change	% Change
Population	17,593	23,993	6,400	36%
Households	5,549	7,666	2,117	38%
Employment	7,540	10,277	2,737	36%

* Unit: Thousands

Data & Methods: RTP Modeling Procedures



Scenario Development

- **Trend Scenario:** Technical projection that provides a best estimate of future growth based on past trends
- **Locally Preferred Scenario:** the most likely growth and growth distribution of the region & reflecting the current general plan as a desired future of the communities' forms
- **TOD Scenario:** resulted from assigning greater housing and employment capacity to areas around transit stations
- **Center Scenario:** intended to focus development in employment centers (10 jobs per acre or 10,000 jobs for each TAZ) and existing cities
- **Envision Scenario:** reflects an aggressive application of the Compass visioning principles; growth toward centers, transit areas, *mixed-use development*

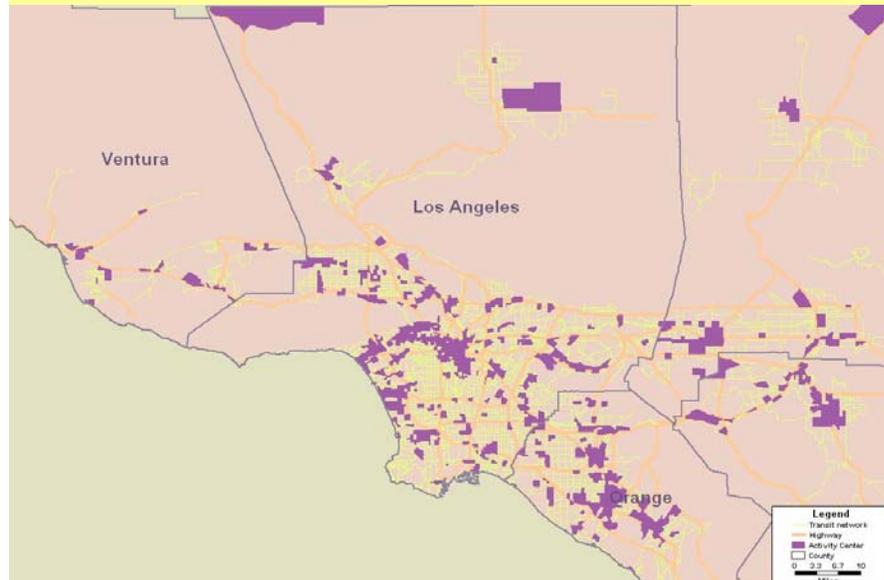
Transit Station and Network



Employment Center 2003



Employment Center 2035



Land Use Scenarios and Spatial Measure

- Hoover index examines the trends and degrees of population and employment concentration and dispersion at different levels of geography.
- The index computes the portion of population and employment that would have to be redistributed to achieve equal distribution.

$$H = 50 \sum_{i=1}^r |p_i - a_i|$$

* Source: *Plane and Rogerson (1994)*

Scenarios: County Share of Regional Population Forecasts

	2003	2035					Difference in (2003- 2035Trend)	Range of 2035 County Share
		Trend	LP	TOD	Center	Envision		
Imperial	1%	1%	1%	2%	2%	2%	0%	1%-2%
Los Angeles	57%	51%	51%	53%	52%	51%	-6%	51% - 53%
Orange	17%	15%	16%	15%	15%	14%	-2%	14% - 16%
Riverside	10%	15%	15%	14%	14%	16%	5%	14% - 16%
San Bernardino	11%	13%	13%	13%	13%	13%	2%	13% - 13%
Ventura	5%	4%	4%	5%	5%	4%	-1%	4%-5%
Region	100%	100%	100%	100%	100%	100%	0%	

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Scenarios: County Share of Regional Employment Forecasts

	2003	2035					Difference in (2003- 2035Trend)	Range of 2035 County Share
		Trend	LP	TOD	Center	Envision		
Imperial	1%	1%	1%	1%	1%	1%	0%	1%-1%
Los Angeles	58%	49%	49%	50%	51%	50%	-9%	49% - 51%
Orange	21%	19%	20%	19%	19%	18%	-2%	18% - 20%
Riverside	8%	14%	13%	13%	13%	14%	6%	13% - 14%
San Bernardino	8%	12%	12%	12%	12%	12%	4%	12% - 12%
Ventura	4%	5%	4%	4%	4%	4%	1%	4%-5%
Region	100%	100%	100%	100%	100%	100%	0%	

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**Results: Hoover Concentration Index for 2003 Land Use vs. 2035
Alternative Land Use Scenarios**

	Population			Employment		
	RSA	CSA	TAZ	RSA	CSA	TAZ
2003	77.9	83.1	87.5	81.2	85.1	88.7
Trend	75.4	81.4	86.1	76.8	81.0	85.5
LP	74.0	79.7	84.8	77.2	82.1	86.1
TOD	77.7	82.5	86.9	77.9	82.5	87.3
Center	77.6	82.4	86.9	78.4	82.8	87.5
Envision	76.2	82.4	87.2	78.5	83.2	88.1
Number of Observations	56	302	4,109	56	302	4,109

* Hoover Concentration Index of Population and Employment
Using Three Different Levels of Geography in the Southern California Region: (TAZ, RSA, CSA)
TAZ (Transportation Analysis Zone), RSA (Regional Statistical Area), CSA (Community Statistical Areas)

Results: 2003 TAZ Population



Results: 2035 TAZ Population (Trend)



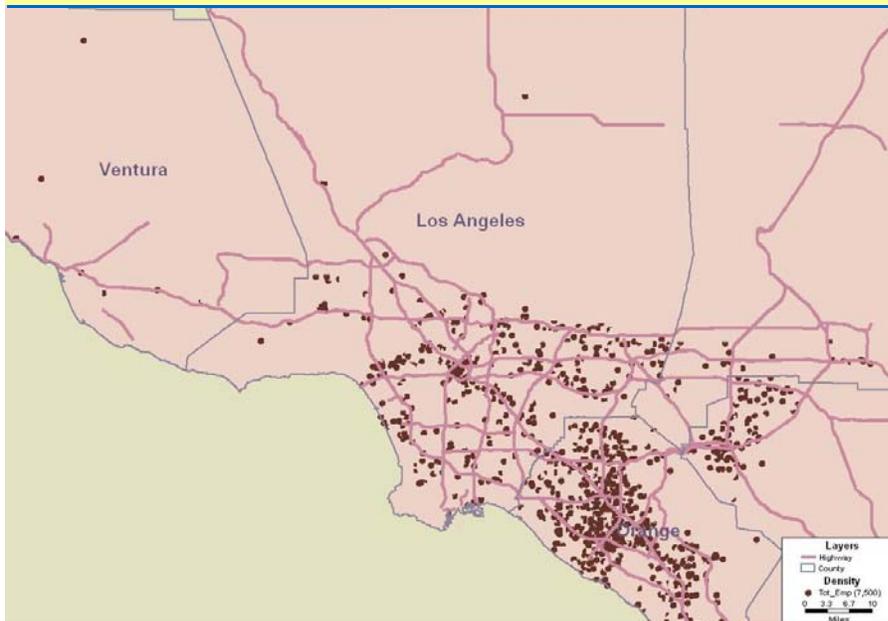
Results: 2035 TAZ Population (LP)



Results: 2035 TAZ Population (Envision)



Results: 2003 TAZ Employment



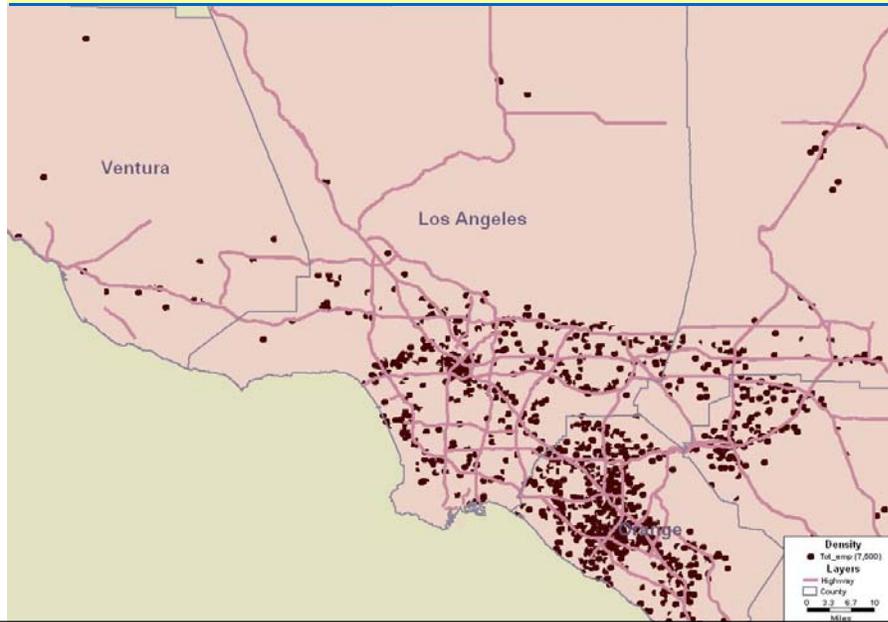
Results: 2035 TAZ Employment (Trend)



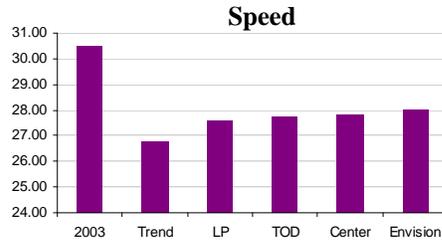
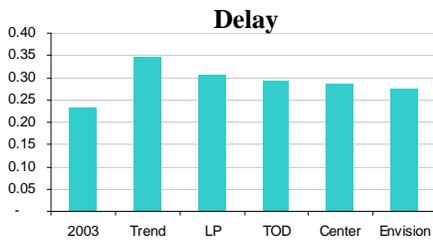
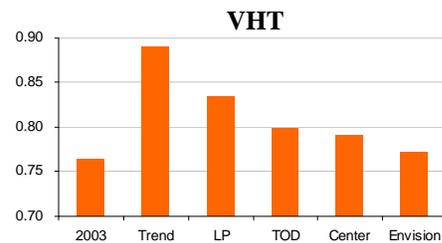
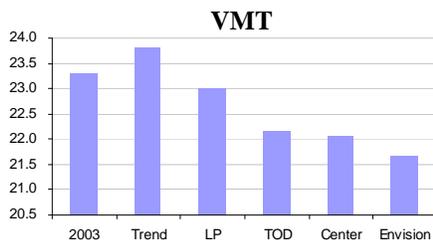
Results: 2035 TAZ Employment (LP)



Results: 2035 TAZ Employment (Envision)

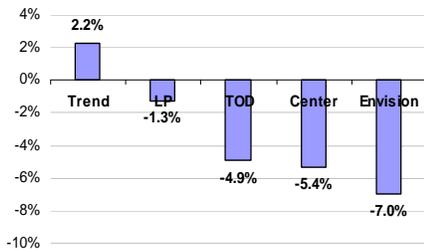


Results: VMT and Other Mobility Measures

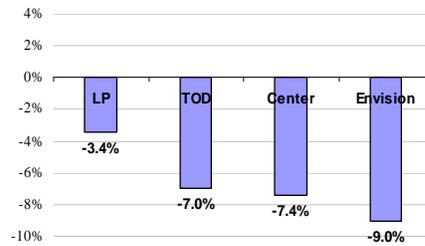


Results: Base Year vs. Business as Usual

Base Year (2003) Approach:
% difference of per capita VMT from 2003



Business as Usual (Trend) Approach:
% difference of per capita VMT from Trend



* Note: The Median percentage change in Vehicle Kilometers of Travel (VKT) for 30 years is -1.4% (Rodier, 2008)

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Conclusion

- There is an overall deconcentration (sprawl) pattern of the County level population and employment from Los Angeles County to Riverside and San Bernardino Counties between 2003 and 2035. There is little difference among land use forecast scenarios. Below the county level, land use forecast scenarios (TOD, Center, and Envision) tend to show the concentration pattern relative to the Trend and LP scenarios.
- Four major transportation performance measures of Trend are worse than other 4 scenarios (LP, TOD, Center, Envision). Envision scenario shows the best transportation performance & reduces the most GHG emissions (measured in VMT). The current modeling practice reasonably measures the impacts of land use forecast scenarios on GHG emissions (measured in VMT).

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Conclusion

- The Envision Scenario might represent the optimal urban form among five land use forecast scenarios. The more realistic & optimal VMT reduction target would be somewhere between trend locally preferred scenario and envision scenario. The moderate VMT reduction targets could be met via SCS, and locally acceptable.
- There must be an incremental effort of local jurisdictions to incorporate the selected number of diverse emission reduction sensitive land use policies based on existing general plan for successful implementation of SB375.

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Conclusion

- Ongoing modeling practice improvement:
 - Emission modeling (CO₂)
 - Land Use Model (PECAS)
 - Activity Based model
 - Local Sustainability Planning Model

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Thank You