

Integrating Regional Economic Modeling with Transportation and Land Use:

The Use of TREDIS for High Speed Rail in California

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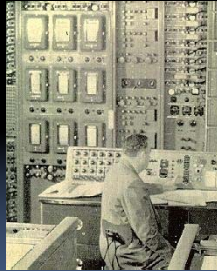
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Topics

1. Modeling Economic Development Effects
2. TREDIS - Concept of a Multi-modal, Multi-Regional Framework
3. California High Speed Train Study
4. Other Studies, Future Improvement

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1. Modeling Economic Development Effects

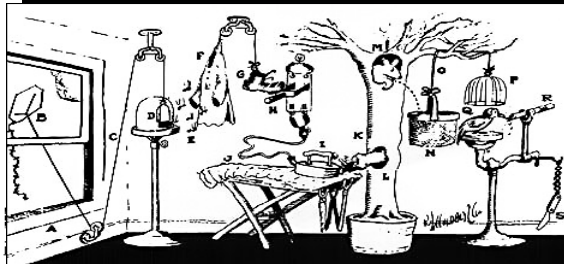
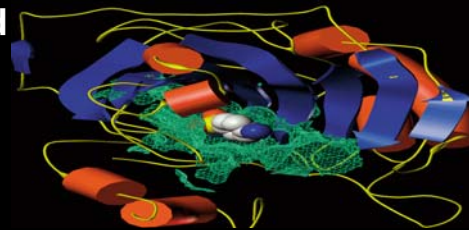


Will Model Building and the Computer Solve Our Economic Forecasting Problems?" (HRR, 1967)

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Concept of Computer Models

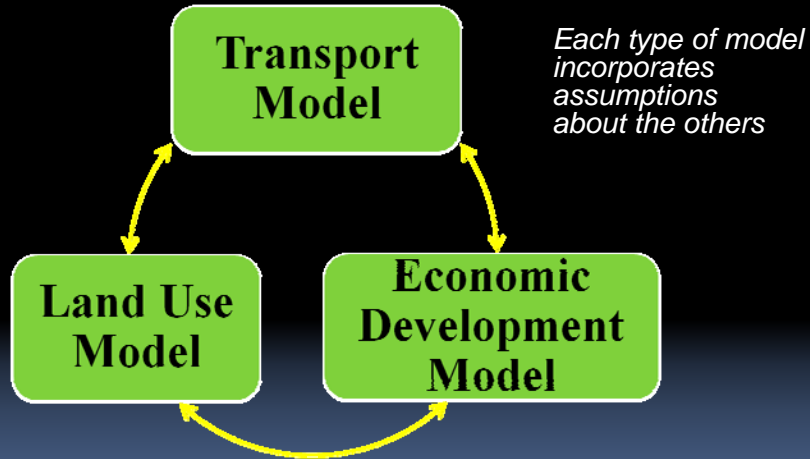
Take a complicated situation...



and represent it as "simplified" processes...

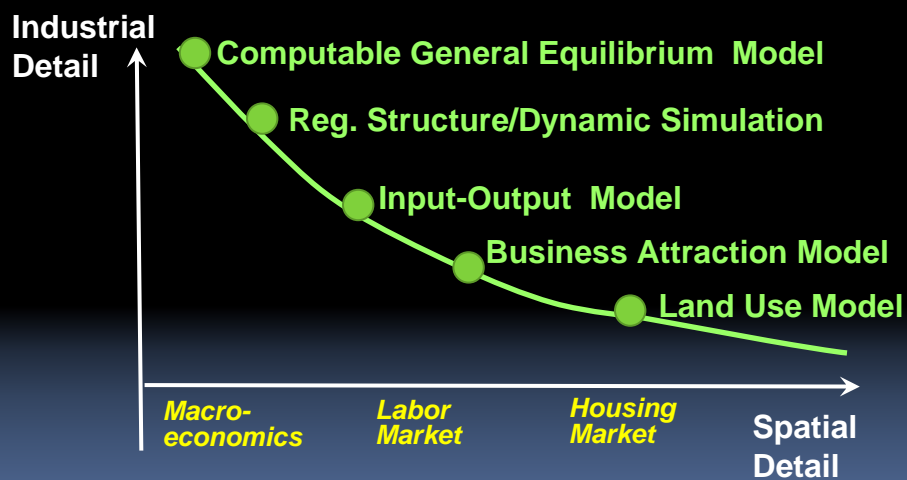
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Types of Models and Interactions



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Model Context: Tradeoffs



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Alternative Model Views (1)

MODELS	POSITIVE	NEGATIVE
Land Use/ Transport (<i>PECAS, MEPLAN, TELUM</i>)	Spatial zone and price detail, feedback effects	Economic industry detail, limited market responses
Computable General Equilibrium (<i>CGE</i>)	Multi-model, theoretical rigor	Simplify cost and response mechanisms

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Alternative Model Views (2)

MODELS	POSITIVE	NEGATIVE
Dynamic Development (<i>REMI, ASTRA</i>)	Labor, housing, population, wage responses	Theory vs. realism (<i>linear, gravity functions</i>)
Access Models	Market scale economies, supply chain connectivity, spatial spillover	Exogenous effects, not integrated into macro systems

→ Models to Predict the Economic Development Impact of Transportation Projects: Historical Experience and New Applications by G. Weisbrod, *Annals of Regional Science*, January 2008

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Economic Benefits -- from 2 Sources

Traditional Efficiency Perspective:

Improving Throughput – Δ Speed, Distance, Delay \rightarrow Saving Time and Expense for current travelers and existing businesses

Economic Development Perspective:

Improving Access /Connectivity – Δ market reach, modal interchange \rightarrow facilitating new job access, new business markets for products, services

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Economic Development Factors

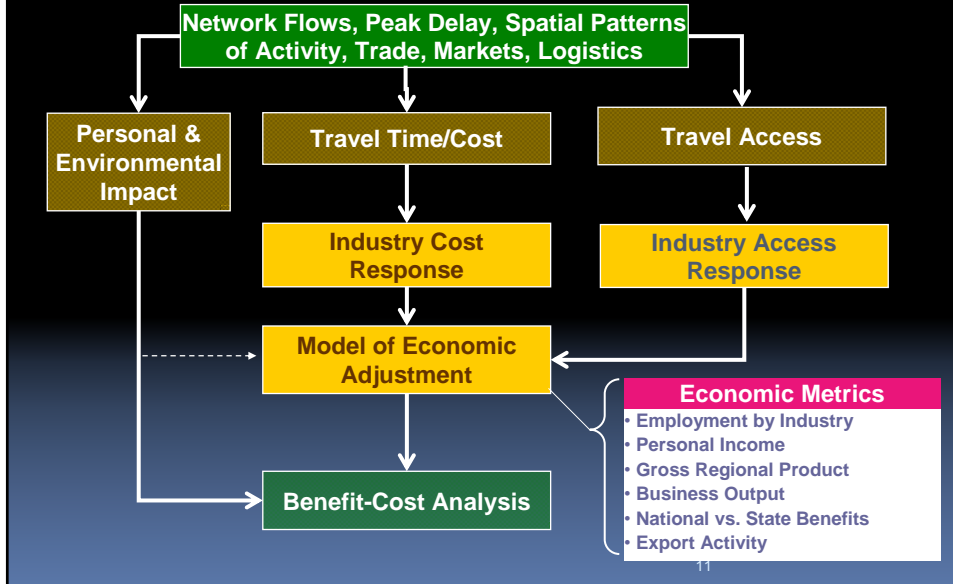
Affecting Productivity & Competitiveness

- **Market Access**
 - *Worker markets*
 - *Supplier markets*
 - *Customer markets*
- **Connectivity & Reliability**
 - *Airports, Marine ports, Inter-modal rail terminals,*
 - *Industrial Parks*
 - *Visitor Attractions*



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Need to Recognize Analysis Issues



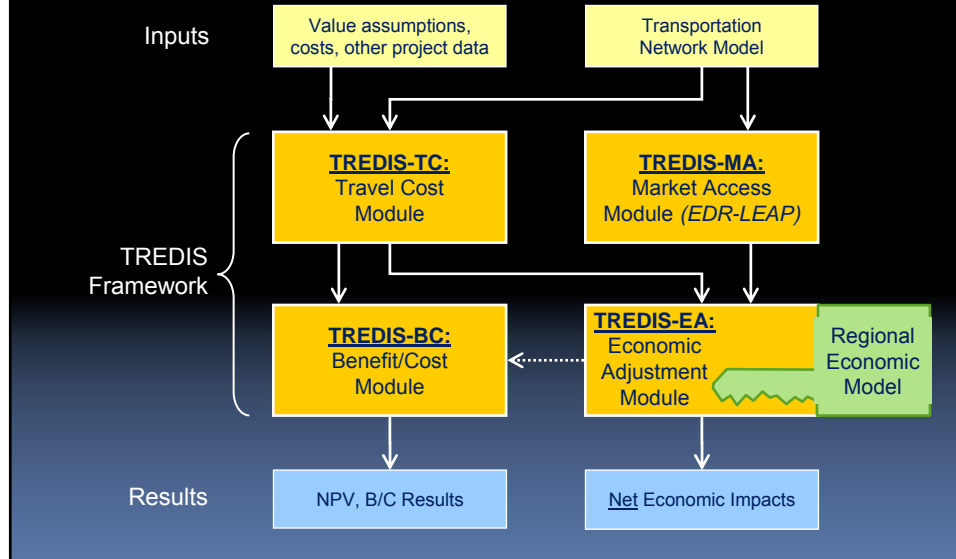
TREDIS® Transportation Economic Development Impact System

2. TREDIS – A Multi-Modal, Multi-Regional, Spatially-Aware Economic Framework

The screenshot shows the 'Project Definition (27)' window in the TREDIS software. It is divided into several sections for configuring a project:

- Select / Define Project:** A dropdown menu showing 'Boston Commuter Rail'.
- Edit Project Name:** A text field containing 'Boston Commuter Rail'.
- Study Region:** A grid of buttons for selecting geographic areas:
 - City Center:** Includes 'City Center linked areas' and buttons for 'Massachusetts - Suffolk County', 'Massachusetts - Essex County', and 'Massachusetts - Middlesex County'.
 - Suburban Area:** Includes 'Suburban Area linked areas' and buttons for 'Massachusetts - Essex County', 'Massachusetts - Suffolk County', and 'Massachusetts - Middlesex County'.
- Periods:** Input fields for 'Peak' and 'Off-peak'.
- Select State:** A dropdown menu set to 'MASSACHUSETTS'. Below it, a list of counties is shown: 'Massachusetts - Entire State', 'Massachusetts - Essex', 'Massachusetts - Middlesex', and 'Massachusetts - Suffolk'. An 'Assign Selected County' dropdown is also present.
- Travel Cost Method:** Radio buttons for 'System Calc' (selected) and 'User Defined'.
- Project Parameters:**
 - Project Start Year: 2007
 - Project Completion Year: 2010
 - Project Useful Life (Yrs): 30
 - Constant Dollar Year: 2000
- Adjust Fixed Factors:** A button at the bottom right.

TREDIS Components



TREDIS-TC

Calculates the direct user and non-user impacts from a change in travel patterns.

Travel Characteristics:

- Trips
- VMT
- VHT
- Congestion
- Passengers per veh.
- Crew per veh.
- Freight tons per veh.
- Commodity mix
- Tolls

Travel Cost Assumptions:

- Crew cost per hour
- Passenger cost per hour
- Freight costs per hour
- Reliability adjustments
- Operations cost (cong. vs. FF)
- Safety cost per VMT
- Environmental cost per VMT

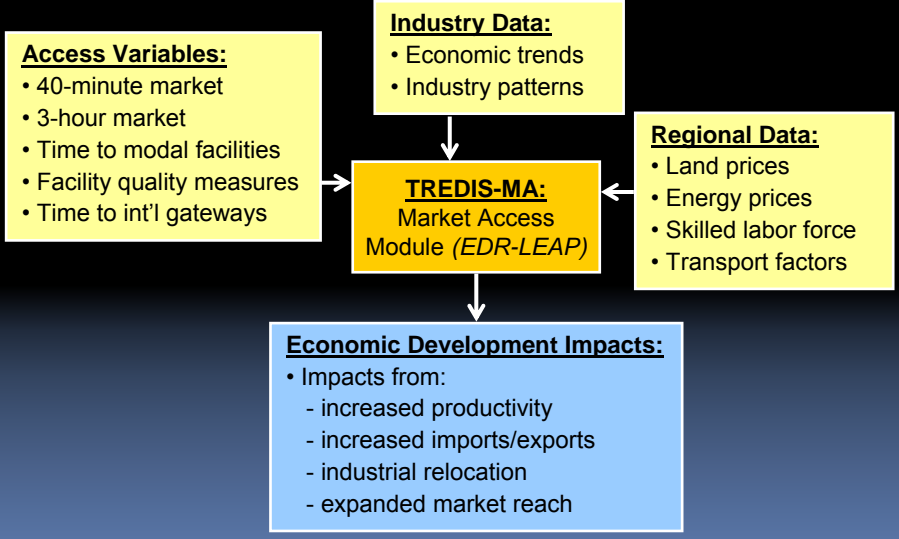
TREDIS-TC:
Travel Cost
Module

Direct User & Nonuser Impacts:

- Benefits itemized by:
 - user type (HH, Firm)
 - impact type (safety, oper., etc.)
 - mode (car, truck, bus, etc.)
 - trip purpose

TREDIS-MA

Estimates the economic development impacts from expanded access to markets.

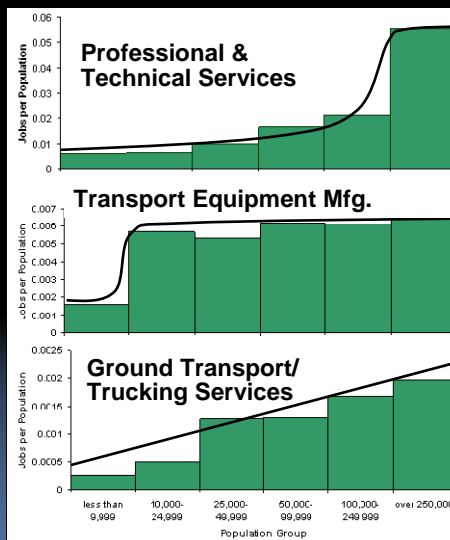


TREDIS Local Data

Affected Area: Washington County, OR			
Cost Factor		Unit of Measure	Value
Average Labor Cost		\$ per year (retail sector)	26,977
Average Cost of Electricity		\$ per kilowatt-hour	0.054
Average Total Tax Burden per Person		\$ per person per year	523
Average Housing Cost		\$ for a single family home	238,300
Average Rental Cost		\$ per month	933
Market Size Factor		Unit of Measure	Value
Area Population		number	487,548
Population Density		people per square mile	674
Skilled Workers		% of labor force with bachelor's degree or higher	34.5
Population within 40 minute drive time		number	725,875
Employment within 180 minute drive time		number	2,542,667
Transportation Access:Quality Factor	Facility Name	Unit of Measure	Value
Access to Commercial Airport	PORTLAND INTL	average travel time (minutes)	40
Annual Operations at Commercial Airport	PORTLAND INTL	takeoffs+landings per year	235,280
Access to Freight Marine Port	Portland, OR	average travel time (minutes)	28
Access to Rail Intermodal Facility	BNSF Portland Lake Yd TOFC/COFC	average travel time (minutes)	22
Access to International Land Border	Blaine, Wash.	average travel time (minutes)	280
Access to Airport with International Connections	PORTLAND INTL	average travel time (minutes)	40
Other Factors		Unit of Measure	Value
Broadband Access		Relative measure (10=best bandwidth/cost)	8

Non-Linear Effects: Market Size

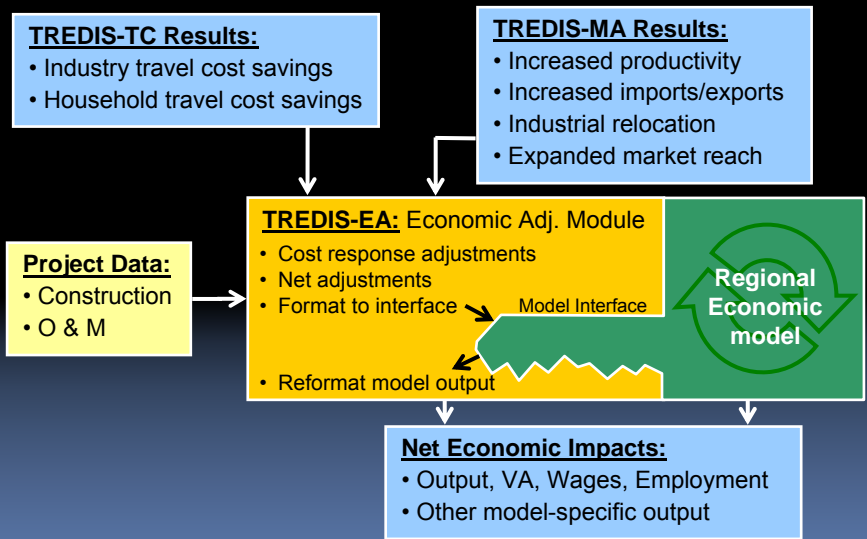
Industry Concentration by Market Size



Economic Development Research Group: Sources of Growth Studies, 2008

TREDIS-EA

Calculates net economic impacts from project using regional impact model



TREDIS-BC

Summarizes net project benefits vs. net project costs from different agency perspectives

TREDIS-TC Results:

- User impacts:
 - Travel time savings
 - Veh. operation cost savings
 - Freight logistics cost savings
 - Reduced accident costs
- Nonuser impact:
 - Environmental benefit

Travel Patterns:

- Mode switching
- Induced travel

TREDIS-MA Result:

- Increased productivity

TREDIS-EA Result:

- Regional income growth

TREDIS-BC:

Benefit/Cost Module

Project Costs:

- Construction
- O & M

NPVs, B/C ratios from different organizational perspectives



CALIFORNIA
High-Speed Rail Authority

3. California High Speed Train Environmental Impact Study



High Speed Train Alternatives



Issues in the EIS

Employment change from...

- attraction expansion of new businesses in California.
- changes in business location within California
- retail /services that follow shifts in residential location

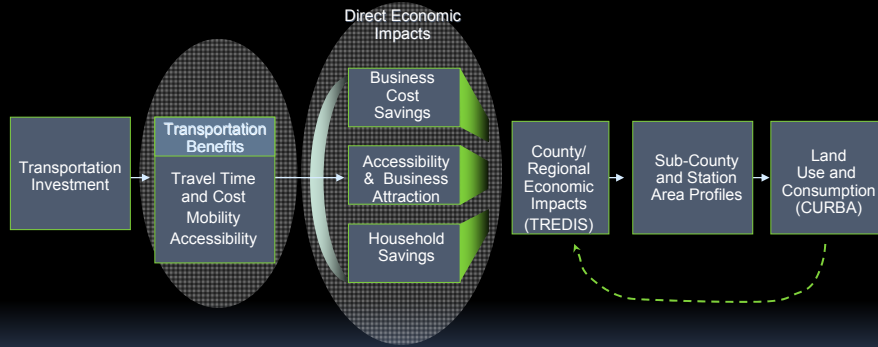
Population change from...

- business attraction, expansion, and spatial shift
- accessibility due to high-speed train (long commutes)
- densification and development patterns due to HST stations

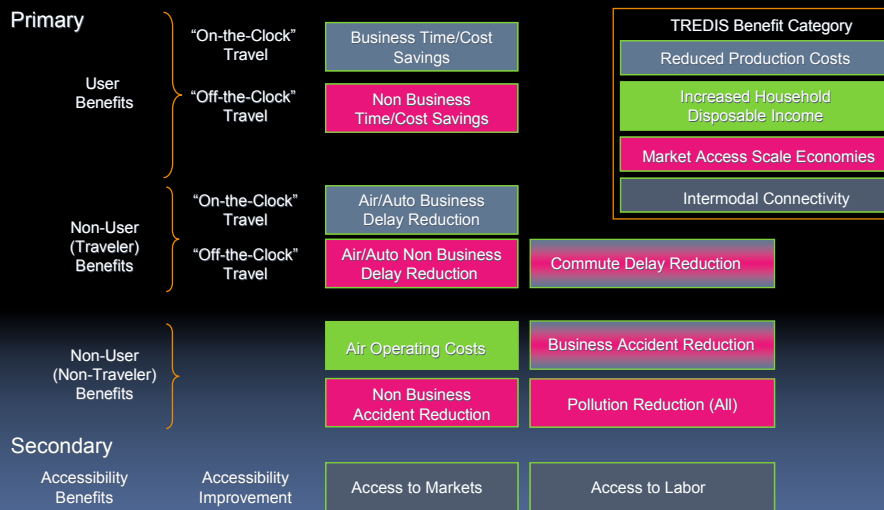
Land Use change from...

- consumption of undeveloped land for population & employment

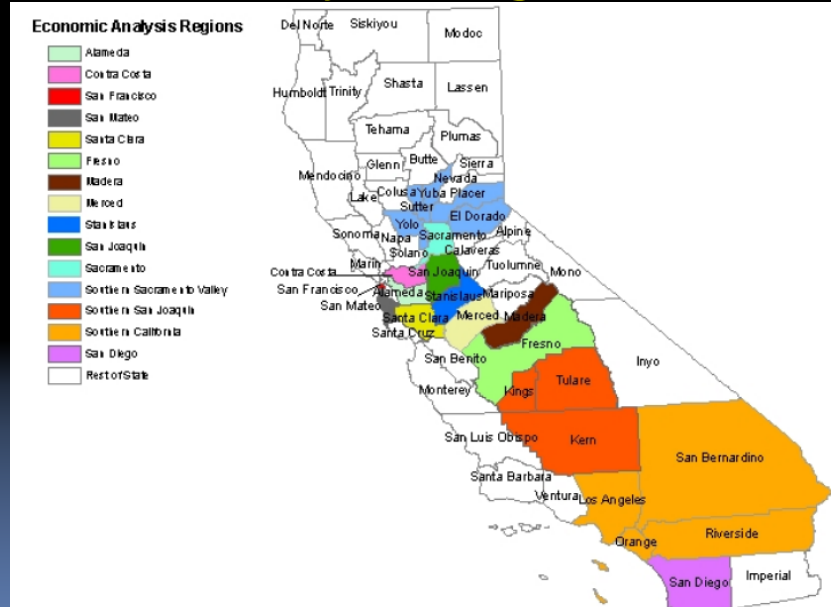
Growth Analysis



Direct Economic Impacts



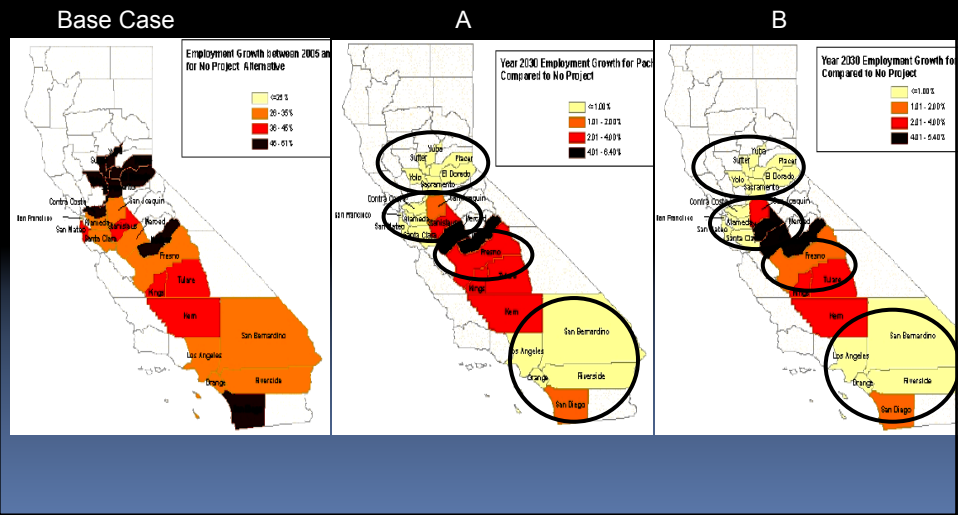
TREDIS Analysis Regions



TREDIS – Employment Growth

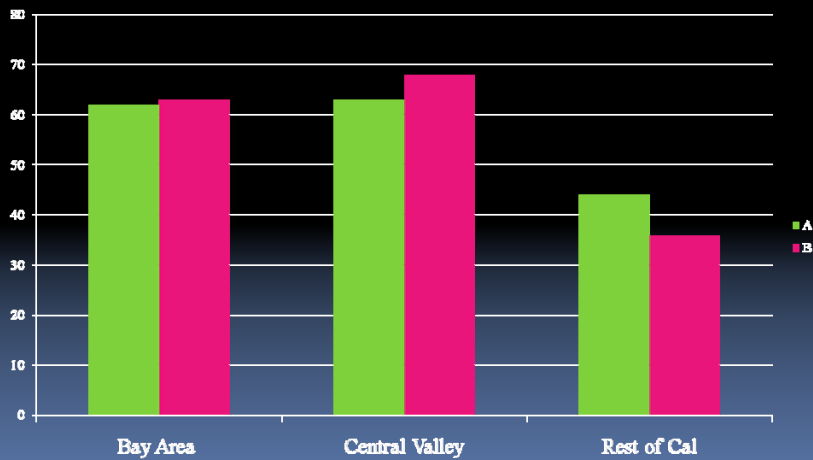
- Core Area – currently 4 million jobs
- Raises growth from 33.9% to 35.0%
- +320,000 jobs over 25 years

TREDIS Results - Employment Growth (to 2035)

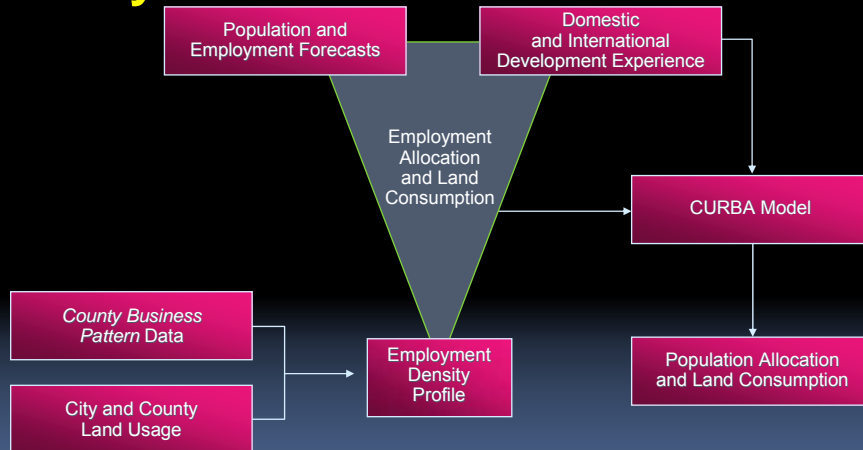


TREDIS Results: Industry Differences

Finance, Insurance, Real Estate & Business Services
% of Projected Job Growth to 2030



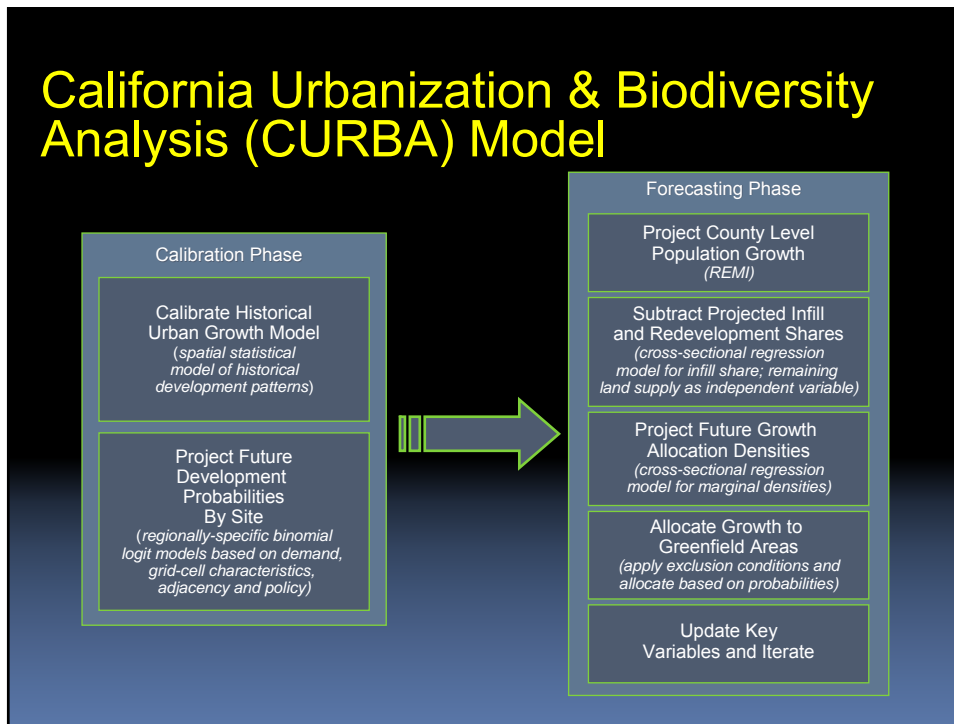
Post-TREDIS Urbanization Analysis



Station Area Development

- Station Areas – Divide Into Area Type (*downtown, urbanized infill, non-urban*)
- Apply emp growth profile for each type of area
- Findings --*Economies of Agglomeration* near HST stations (*commercial & office devel within ½ to 1 mile*)
- Time Lag for station area development
- Noticeable densification pattern
 - *Market forces, Regulation*

California Urbanization & Biodiversity Analysis (CURBA) Model



CURBA Farmland Lost

All Farmland Lost	Base Case	--A--	--B--
Alameda County	4,492	4,643 (3%)	4,492 (0%)
Contra Costa County	21,577	22,155 (3%)	21,889 (1%)
San Francisco County	0	0	0
San Mateo County	680	680 (0%)	697 (3%)
Santa Clara County	6,939	6,988 (1%)	7,235 (4%)
Study Area—Bay Area	33,688	34,466 (2%)	34,313 (2%)
Fresno County	40,293	43,639 (8%)	43,298 (7%)
Madera County	9,449	10,509 (11%)	10,495 (11%)
Merced County	25,882	27,468 (6%)	26,873 (4%)
Sacramento County	48,255	48,329 (0%)	48,937 (1%)
San Joaquin County	62,243	61,492 (-1%)	62,500 (0%)
Stanislaus County	16,215	16,126 (-1%)	18,637 (15%)
Study Area—Central Valley	202,337	207,564 (3%)	210,739 (4%)
Core Study Area	236,025	242,030 (3%)	245,052 (4%)

Land Consumption Efficiency

	No Project Alternative	A	B
Land Consumption (thousands of acres)	392.1	402	407
Job Growth (thousands of jobs)	2,241	2,337	2,343
Population Growth (thousands of people)	4,155	4,304	4,354
<i>Acres Consumed per New Job and Resident*</i>	<i>0.0613</i>	<i>0.0605</i>	<i>0.0608</i>
Efficiency Gain/Loss Relative to No Project Alternative	-	+1.3%	+0.8%

4. Other Studies; Future Improvement

TREDIS Case Study #1

- **Greater Vancouver Gateway Council:**
 - Analyzed the regional economic development consequences of investment (vs. failure to invest) in road and rail system improvements to address rising traffic congestion and limitations of sea and airport gateway infrastructure.



TREDIS Case Study #2

- **Chicago Metropolis 2020:**
 - Evaluated road and transit scenarios for change in traffic levels, impacts on access, and logistic costs for the area's industries and subsequent regional economic growth.



TREDIS Case Study #3

- **Portland Business Alliance**
 - Evaluated cost of congestion to the regional economy in terms of changes in business operations, household costs and market access, and implications for future economic productivity, competitiveness and growth.



TREDIS Case Study #4

- **Maine Long Range Plan**
 - Compared alternative investment programs and funding scenarios. Analyses used REMI and considered multiple travel modes.



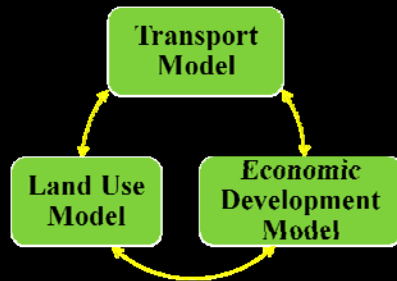
TREDIS Case Study #5

▪ Oregon Statewide Congestion

- Evaluated cost of congestion to the statewide economy and implications for future economic productivity, competitiveness and growth. Scenarios covered seasonal variations in driving conditions.



Future Directions



The right order for analysis –
First decide on the policy issue.

Then apply appropriate analysis tools, as needed to fit the policy issue.



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TRB Econ Devel Committee Links

www.tedcommittee.com

TREDIS

www.tredis.com