



# An Economic and Policy Analysis of the Introduction of High-Speed Rail in California: Phase I from the San Francisco Bay Area to Los Angeles and Anaheim

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# Focus of My Research

- Research Question:

Should Phase One of the California HSR System be built?

- Research Objective:

To analyze comparative capital construction cost Net Present Values for (1) HSR system & (2) airports / highways BAU alternative.



# California HSR: Background 1

- Created by CA's Proposition 1A (2008) to:
  - Build 800-mi. statewide HSR system
  - Link all major cities w/ 220 mph electric trains
- Phase 1 of HSR system (520 mi.) will go:
  - From San Francisco Bay area (N. end)
  - To Los Angeles / Anaheim (S. end)
- No operating subsidy planned
  - Required by the law to operate in the black
- CA HSR Authority's 2012 Draft Business Plan
  - Published Nov. 2011 w/ supporting docs
  - Details plans for Phase 1 of HSR system



# California HSR: Background 2

- Technology: Steel wheels on steel rails; electric
- Travel Times: L.A. to S.F. in 2h, 40m
- Ridership: 29.6 M – 43.9 M annually by 2040
- Route: Mostly dedicated HSR tracks, with many above- and below-grade crossings
- Stations: No more than 24 for Phases 1 & 2
- Funding Secured: \$9.95 B (CA) + \$3.3 B (USA)



# California HSR System Maps



Source: CHSRA 2012 DBP, p. 2-20



# California HSR System Maps



Source: CHSRA 2012 DBP, p. 2-20



Source: CHSRA 2012 DBP, p. 2-2



# Alternatives to HSR: Airports



Source: CHSRA 2012 DBP, p. 2-20



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# Alternatives to HSR: Highways



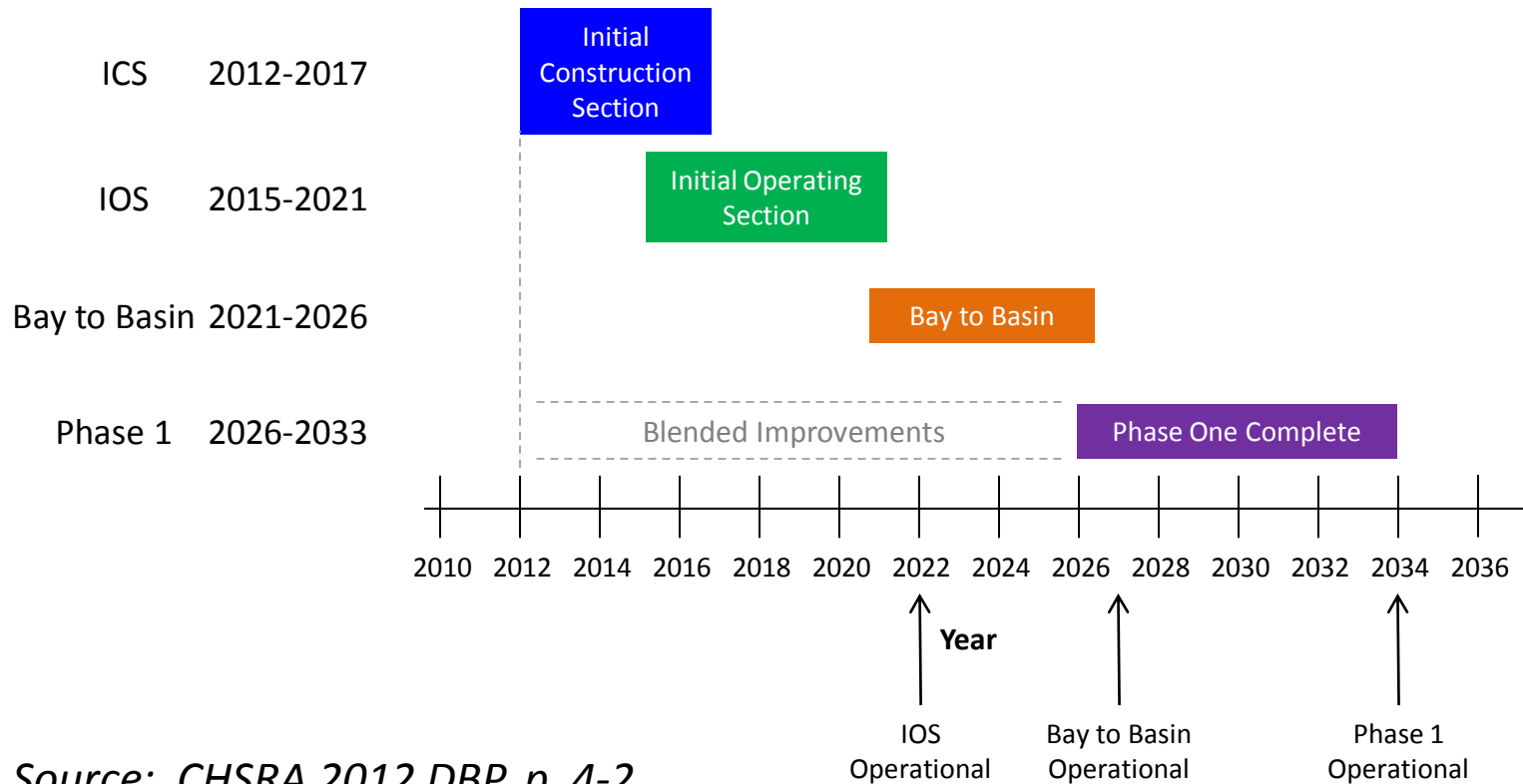
775 miles of highways could be expanded for the other ¾ of capacity.

Mostly I-5 would be expanded (but also parts of US-101, I-880, SR-152, I-80, I-580, SR-99, and SR-14).



# HSR Phase 1: Construction Timeline

## HSR Phase 1: Schedule by Section

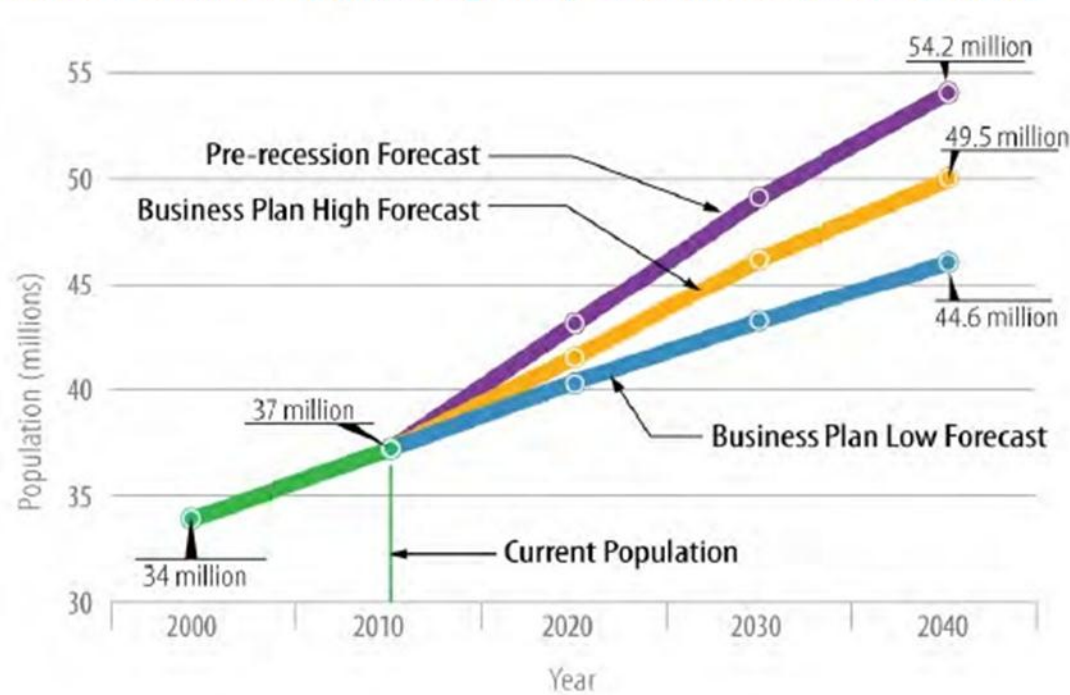


Source: CHSRA 2012 DBP, p. 4-2



# Rapidly Growing CA Population

Exhibit 6-2. California population growth, actual and Business Plan forecasts



The purple line shows the pre-recession population forecast. A more conservative post-recession forecast is assumed for the Business Plan High scenario, and an even lower forecast for the Business Plan Low scenario.

## Pop. Growth by 2040

Highest: **+17.2 M**

High: **+12.5 M**

Low: **+7.6 M**

Source: CHSRA 2012  
DBP, p. 6-5

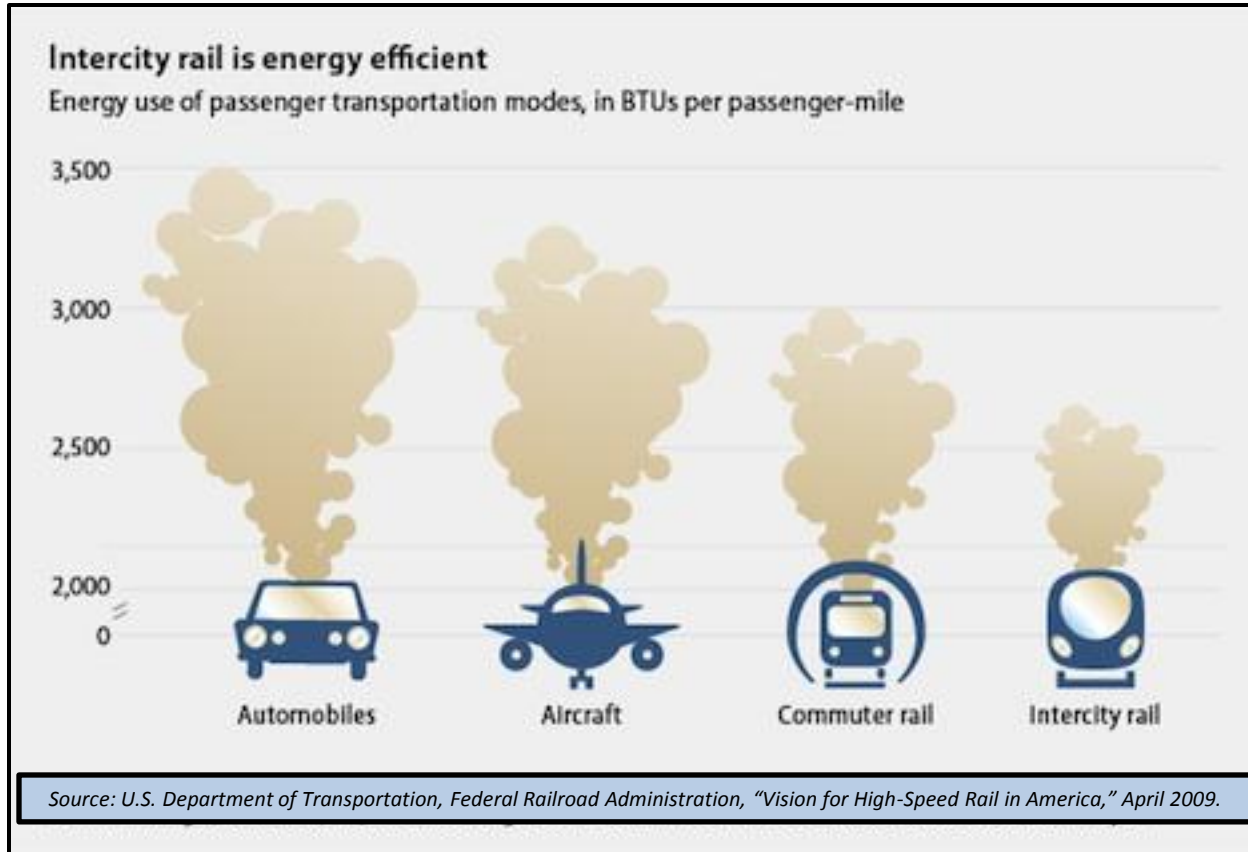


# CA HSR: Proposed Benefits

- Jobs: 800k – 900k job-years created
- Environment: abate 3M tons CO<sub>2</sub> / year
- Roads: 8 billion fewer VMT's / year
- Airports: Reduced congestion (esp. LAX, SFO)
- Time Saved: 146 million hours / year
- Value of Time Saved: \$ billions / year
- NPV: \$30.6 - \$39.8 B (CHSRA BCA, 2010-2080)



# Potential HSR Benefits: Energy





# CA HSR: Proposed Capital Costs

- 2008 HSR Cost Estimate: \$40 B (Phases 1 & 2)
- 2009 Air/Highway Estimate: \$100 B (Phase 1)
- 2011 HSR Update: \$98.1 - \$117.6 B (Phase 1)
- 2011 Air/Highway Estimate: \$171 B (Phase 1)

Transportation Alternative	Added Capacity	Required Investment (2010 \$B)	Required Investment (YOE \$B)
High-speed rail	Full Phase 1 San Francisco-Los Angeles/Anaheim 520 miles	65.0	98.5
Highways and airports	2,326 new lane-miles of highway 115 new airport gates 4 new runways	114.0	171.0
	<b>Proposed cost savings (\$)</b>	<b>49.0</b>	<b>72.5</b>
	<b>Proposed avoided cost increases (%)</b>	<b>75%</b>	<b>74%</b>



# Previous HSR Studies

- Numerous International & General Studies
  - World Bank, US PIRG, *Scientific American*, America 2050, Lincoln Institute for Land Policy, US DOT/FRA, *Rail Magazine*.
- California HSR Studies
  - Pro: CHSRA 2012 Draft Business Plan and supporting BCA and other contractor documents
  - Con: Legislative Analyst's Office, State Auditor's Office, Peer Review Group, Chamber of Commerce
- Few or no NPV analyses (esp. for comparative capital investment costs)



# Basic Research Methodology

- Compare capital construction costs for Option 1 (HSR) and Option 2 (air/hwy) using NPVs
- Option 1 (HSR):
  - Evaluate HSR for both IOS-S and IOS-N first
  - Evaluate HSR for both low-cost and high-cost
- Option 2 (air/hwy):
  - Create simulated cash-flow for air/hwy option
  - Adjust air/hwy option for 21-year time scale
  - Adjust highways for 0/2/4 lanes phasing (not 3)
  - Adjust airports for delay-based 3 phases



# Inputs and Sensitivity Analysis

- Rates Used:



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- Look at 2, 3, 4 & 6 highway lanes

<b>CHSRA 2012 Draft Business Plan</b>	<b>Capacity Needed</b>	<b>Cost (2010 \$)</b>	<b>Cost (YOE)</b>
Highway Component (75%)	2,326 lane-miles (3 lanes)	\$84.6 billion	\$126.9 billion
Airport Component (25%)	115 gates & 4 runways	\$29.7 billion	\$44.6 billion
<b>Total</b>		<b>\$114 billion</b>	<b>\$171 billion</b>



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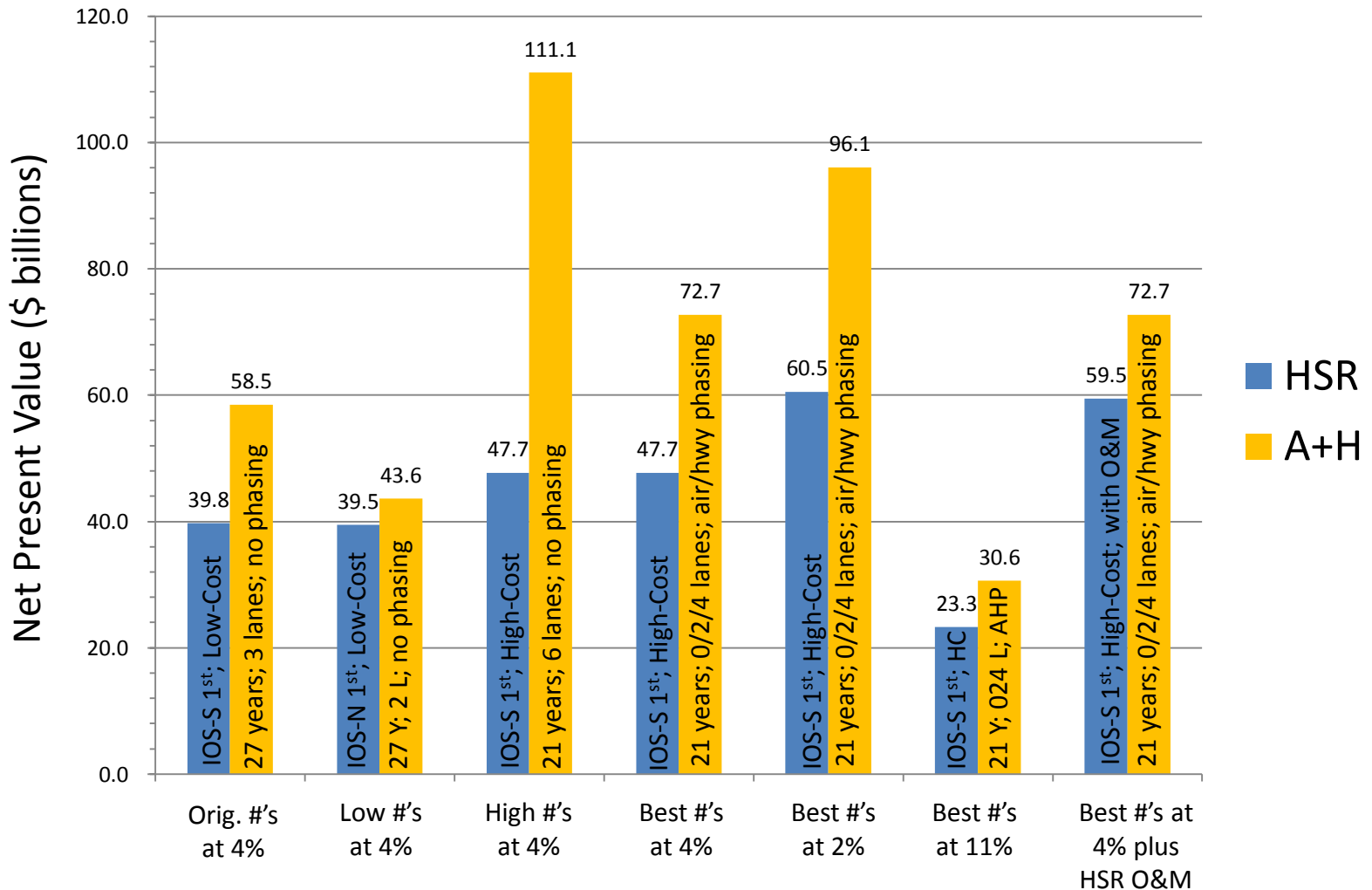
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- Examine adding O&M costs to HSR NPV for a “total cost” result, not just capital cost

# Key Research Findings

Notes: All discount rates are real; no project liquidation values included; capital costs only, except for HSR far-right.





# Key Research Findings

Transportation		Investment: Orig. NPV	Investment: Best NPV
Alternative	Added Capacity	(based on 2010 \$B)	(based on 2010 \$B)
High-Speed Rail	Full Phase 1	(39.78)	(47.69)
	San Francisco-Los Angeles/Anaheim	IOS-S First	as a proxy for missing
	520 miles		local infrastructure
Highways and Airports	1,000's of new lane-miles of highway	(58.49)	(72.69)
	115 new airport gates	3 hwy lanes only	0/2/4 hwy lanes
	4 new runways	no hwy/air phases	hwy/air both phased
	<b>Proposed cost savings (\$)</b>	<b>18.71</b>	<b>25.00</b>
	<b>Proposed cost savings (%)</b>	<b>47%</b>	<b>52%</b>

- Using best estimates (4% RDR), HSR saves \$25 B (52%)
  - Low vs. Low: HSR saves \$4 B (10%)
  - High vs. High: HSR saves \$63 B (133%)
- HSR still saves \$13 B (22%) with O&M for HSR only



# Implications of Findings

- Based on this analysis, CA should build HSR system
- Additional data would improve analysis:
  - Full HSR capital cost cash-flows for high-cost scenarios
  - Full HSR O&M cost cash-flows for all scenarios
  - Full HSR benefits / revenues cash-flows for all scenarios
  - Full air / highway cash-flows (independently verified)
- Further HSR / BAU analysis needed:
  - Current air / highway capacities & future needs
  - Detailed and realistic HSR funding options
  - HSR project management reforms
  - HSR benefits (economic, environmental, etc.)
  - Potential effects of tying in HSR system with AB32 (cap-and-trade)



# Questions?

