Environmental Impact of High Speed Rail in California

Objective Criteria

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The CA High Speed Rail Proposal

- Up to 800 mi of rail lines – 500 mi first phase San Francisco to LA/Anaheim, first segment Fresno Area
- 1000 passenger trains
- Speeds: p to 220 mph
- Up to 24 stations
- Headways as low as 5 min. in peak periods
- Fares: $100+ SF-LA (competitive with air)
- Ridership estimates: 40-80 M a year by 2030
- Costs – $43B (2008 est), for phase one only (2009) – could be double?

Source: CHSRA website, independent analyses
Environmental Impacts of HSR: Problems and Potential

- Lengthy environmental assessment process has identified a number of important environmental impacts:
  - Temporary, construction-related impacts
  - Unavoidable negative impacts on the natural and built environment
  - Potential for HSR to be an environmental asset
- Environmental Review will continue – segment by segment details including mitigation
<table>
<thead>
<tr>
<th>Anticipated Benefits</th>
<th>CHSRA Vision</th>
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<tbody>
<tr>
<td><strong>Transportation</strong></td>
<td><strong>Employment</strong></td>
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<tr>
<td>Congestion relief on freeways and at</td>
<td>Up to 100,000 construction-related jobs</td>
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<td>airports</td>
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<td>Faster travel between major metropolitan</td>
<td>Up to 450,000 permanent new jobs over 25 yrs</td>
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<td>areas</td>
<td>created by HSR economic growth</td>
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<td>Improved movement of people, goods and</td>
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<tr>
<td>services</td>
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<td><strong>Environmental Quality</strong></td>
<td><strong>Urban Vitality</strong></td>
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<td>Improved air quality</td>
<td>Revitalized communities, economic development</td>
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<td></td>
<td>around stations</td>
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<td>Improved energy efficiency: 1/3 energy</td>
<td>Transit- and pedestrian-oriented infill</td>
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<td>use of planes, 1/5 that of cars</td>
<td>development</td>
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<td>Reduced dependence on foreign oil: 12.7</td>
<td>Enhanced public safety due to separation of</td>
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<td>million barrels less per year</td>
<td>tracks and highways</td>
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<td>Reduced greenhouse gas emissions: 12</td>
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<td>billion pounds less per year</td>
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Source: [http://www.cahighspeedrail.ca.gov/project_vision.aspx](http://www.cahighspeedrail.ca.gov/project_vision.aspx)
Environmental Impacts of HSR

- Impacts on the natural environment, agriculture
- Impacts on the urban (“built”) environment

- Temporary – during construction
- Primary – direct impacts
- Secondary and tertiary impacts
- Cumulative impacts
Particular Concerns about Environmental Impacts Raised by Stakeholders

- Noise (>90dBA at high speeds) and visual intrusion of elevated structures and/or sound walls, fences in urban areas
- Access restrictions due to protection of ROW
- Impact on farming – severance, access restrictions
- Impact on parks, recreation areas (intrusion)
- Adverse effects of noise on wildlife
- Adverse effects on endangered and threatened species from noise, barriers, road kill
- Public acceptability, costs and timing of compact growth and transit feeders to support ridership and reduce traffic impacts

Air quality, GHG, energy issues are big for researchers & state agencies but do NOT appear to top the list for stakeholders
Temporary Impacts

- Disruption of circulation patterns during construction – can interfere with rail and road traffic
- Disruption, relocation of utilities
- Construction noise
- Construction emissions
- Runoff, water table impacts

Following best practices can generally keep impacts to manageable levels
Impacts on the Natural Environment

- Waterways, wetlands and nature preserves or biologically sensitive habitat areas affected
- Parklands lost, trails crossed
- Encroachment into areas of highly erodible or otherwise sensitive soils

Following existing ROW, elevation or undergrounding can avoid or minimize impacts; mitigation and compensation for added impact
Transportation and Utilities Impacts

- Permanent impacts on rail operations due to, e.g., loss or relocation of sidings
- Permanent changes to traffic circulation - increased circuity and delay due to protection of ROW
- Traffic and parking impacts around stations
  
  Design can mitigate or compensate for these impacts

  New multimodal terminals and feeders services – transit improvements for broad catchment area could be induced or added as traffic mitigation

Successful operation could reduce traffic congestion & need for expansion of roads, airports
Comparisons to Other Modes

- Alternatives to HSR – auto, air-- could improve performance over time – reducing benefits - or deteriorate further, increasing HSR’s relative attractiveness
  - Depends in part on technology (e.g., how fast vehicle emissions and energy use improve in air, auto modes; improvements in ATC and highway ops as well)
  - Also depends in part on public policy (e.g., willingness to widen highways, add runways – these are NOT very popular in CA – and to subsidize minor airports and their air services)
- Overall impact on transport is small because travel in the 50-500 mi length is small (note: highest ridership est. for 2030 is less than BART alone carries now)
Costs and Benefits Compared to What?

- Comparative environmental costs and savings depend on what is assumed to be happening in air and highway transport (the competition).
- What do we compare?
  - HSR construction compared to new construction of equivalent capacity for air and highway travel, e.g., widened roadways, more flights, more runways?
  - Effects of additional use with little or no capacity expansion and resulting congestion?
  - Assume other modes will produce technological advances that accommodate increased demand without deterioration in conditions?
  - Assume current subsidies and services will continue, e.g., subsidies to minor airports, subsidies to transit services?

Existing plans only help a little – not enough detail; assumptions and time horizons differ. SCENARIOS needed.
Air Pollution, GHG Emissions Impacts

- Depends in part on how electricity is generated
- Life cycle analysis – amount of concrete can make a difference!
- Other modes will be getting cleaner, more energy efficient
- Given small share of travel in HSR “range”, overall contribution is modest

Credit: Schipper, Kosinski and Deakin, 2011
Land Use Impacts

- Takings of homes and businesses – full and partial
- Loss of access to urban and rural parcels; severance
- Impacts on prime and unique farmland and farmland of statewide or local importance

As with transportation impacts, direct land use impacts can be avoided or minimized by choice of ROW, mitigated, compensated

Secondary impacts can be important – induced growth and change
Example: Protected and Unprotected Farmlands in Fresno County

• Much of the farmland in the County is not under agricultural protection agreements
• Will HSR spur further development into farmlands, or help create plans and impetus for more compact growth?
Urban Impacts

- Visual impacts of elevated structures, sound walls, other elements – can affect property values, enjoyment of open space
- Noise and vibration affects on built environment

BUT

- New opportunities for infill, higher densities around HSR stations
- New businesses, economic development to serve travelers
- Avoided, much larger negative impacts if highways must be widened or airports expanded
Example: The impact of a 60’ structure in an urban context.
Example: how a 60 ft. structure could be integrated into urban fabric
- mixed-use office buildings along the HSR corridor, acting as a visual and sound buffer
- space under the structure for parking
- pedestrian-oriented street design
Infill Development Potential – Fresno

- Underdeveloped block area (not including parking and buildings), 43%
- Right of way area, 34%
- Footprint area (existing buildings), 14%
- Parking lot area, 9%
Infill Examples

San Joaquin Light and Power Corporation Building

Infill development

Alexander Pantages Theater
Possible future BRT corridors connecting major employment and activity centers

BRT corridors should connect the major regional destinations (California State University, Fresno City College, Fresno International Airport, the River Park Shopping Centers, and the Fresno Pacific University) to the downtown.

Within the downtown, it is important that these bus routes connect the HSR station, the Amtrak station, the Community Medical Center and other important destinations.
Will Environmental Costs and Benefits Materialize?

- Many environmental costs are the result of construction of the rail lines – land takings, severance, access disruption, visual impacts -
- Some are the result of operating trains, whether or not they attract passengers – noise, a good part of the energy and emissions
- Still others depend on whether ridership materializes and extent to which it is diverted from other modes: air quality, energy, CO2 emissions avoidance, urban revitalization due to station area activity
- Public policy and technological advances both play important roles
Additional Questions with Environmental Consequences

- How use of rail ROW would affect ability to move more freight by rail
- How mitigation, segment by segment, will affect costs and impacts – e.g., if have to tunnel on Peninsula
- Longer term effects of global warming – e.g., flooding, storms affecting CA airports (could change cost functions
- Longer term effects of technological change – smart highways, better air traffic control,...
Summing Up

- Some environmental impacts are negative and unavoidable results of construction.
- Some depend on attracting riders to HSR from air and auto.
- Relative impact in part depends on how other modes—air, auto—develop over next several decades—technology and public policy.
- Relative impact also depends on whether cities and counties coordinate land use strategies with HSR investment—public policy and markets.