

Return on Investment for High Speed Rail

Climate Change, Air Quality Health Impacts, and other Benefits

D.C. Agrawal

*President, D.C. Agrawal Consulting, LLC
Princeton, New Jersey*



2011 Rail Conference

High Speed Rail Reduces Auto/Airplane Emissions

- High Speed Rail (HSR) reduces auto and air travel emissions through trip diversions to electric rail service
- Auto and Airplanes emit carbon monoxide (CO), carbon dioxide (CO₂), nitrous oxides (NO_x), Ozone, Volatile Organic Chemicals (VOCs) and small particulate matter less than 2.5 microns (PM_{2.5}) - all of which affect public health and impact Climate Change
 - CO₂ - Contributes to Global Warming & Climate Change
 - NO_x , CO, VOCs and PM_{2.5}
 - Affects several respiratory system diseases (i.e. asthma, bronchitis and others), resulting in higher health costs to society
 - Ozone - a major contributor to respiratory health problems at ground level and climate affects at higher levels.



HSR has Lower CO₂ Emissions vs. Auto and Air Travel

CO₂ Emissions per Passenger Mile

	Index	Actual Amount (lbs.)
HSR (<i>ICE Germany</i>)	100	0.11
Conventional Rail	200	0.22
Automobiles	480	0.53
Air travel	560	0.62

Source: Center for Clean Air Policy, Center for Neighborhood Technology

- HSR has lower emissions than conventional passenger rail
 - Due to electric power usage and higher load factors.
 - HSR emissions are even lower if electric power from non-fossil fuels
- Load factor assumptions critical for HSR's CO₂ emissions per passenger mile.



Financial Benefit of Lower HSR Carbon Emissions

- APTA has developed standards to help quantify transit and rail carbon emissions
 - Climate Registry has accepted such standards

APTA's Standards



- Carbon reductions result in carbon credits
 - Carbon credits can be traded on financial exchanges in Chicago and Europe.
 - If “cap and trade” or similar legislation enacted, carbon credit emissions estimated valued of \$50 - 100 per ton
- **Potential Impact:** California HSR's potential carbon reduction estimate:
 - 2.0 to 2.5 million tons per year. Estimate assumes higher CAFÉ standards
 - Results in \$100 -125 million dollars per year (at \$50 per ton).
 - \$4 to 5 billion over 40 year useful life of CA HSR investments



Economic Values for Lower Emissions' Health Benefits

- Economists have assigned values for the health benefits from lower emissions'
- NOx, CO, Ozone, Volatile Organic Carbons (VOC), and PM2.5 are known to cause chronic health issues including major respiratory issues
- Assigned values for CO, NOx, Ozone and PM2.5 Emissions:

Type	Economic Value
Mortality	\$6,400,000
Chronic Bronchitis	\$440,000
Acute Myocardial Infarction, Nonfatal (<i>varies with age</i>)	\$29,000 - \$230,000
Hospital Admissions (misc.)	\$10,000 - \$33,000



Emission Values Used for Environmental Regulations

- Economic impact of reduced air emissions have been incorporated in environmental regulations for stationary source emissions.
- Potential economic impact for common air emissions:

	Value (per ton)
Carbon Monoxide	\$13 - \$120
Volatile Organic Compounds (VOC)	\$2,100 – \$3,600
NOx	\$26,000 - \$49,000
PM2.5	\$260,000 - \$440,000



Health Benefits of HSR *just* from Reduced Auto Emissions

- California HSR plan (CA HSR) assumes 65 million riders, of which 79% diverted from auto travel. Assuming 250 miles per auto trip and 1.4 passengers per car, 9.1 billion annual car miles diverted to HSR
- Potential Health Benefits (solely from lower auto emissions):

	Benefits per Year
NOx	\$130 million
PM2.5	\$28 million
Hydrocarbons / VOC	\$8 million
Carbon Monoxide	\$4 million
TOTAL	\$170 million

- Over a 40 year useful life, the Present Value (PV) of benefits is \$6.8 billion
- However, actual PV probably higher, as health costs are increasing at a higher rate than CPI



Significant Non-Travel Financial Benefits from HSR

- Non-Travel Financial Benefits of HSR (over 40 year Useful Life) are very Significant
- The CA HSR case study (shown below) demonstrates such benefits:

	Benefits
Automobile trip diversions	
Climate Change Impact	\$4 - 5 billion
Health Impact	\$6 – 7 billion
Airplane trip diversions	
Further analysis needed	[\$[??] billion
TOTAL	> \$[10 – 12] billion



Additional Benefit: Reduced Air Delays

- Airport Cooperative Research Program (ACRP) 2010 Study: “Innovative Approaches to Addressing Aviation Capacity Issues in Coastal Mega-regions” estimates significant delay costs for the three major California airports (SF, LV and LAX)
 - \$1.3 billion per year in 2007
 - \$4.7 billion per year estimated for 2025
- Scratch planning estimate for California HSR - 39% diversion of existing 14.3 million air trips in SF, LV, LAX Corridor or 5.6 million trips per year.
- Using ACRP estimate of \$47 per trip cost for air delays (in terms of 2007 dollars), CA HSR will result in \$263 million per year in potential benefits
- \$10.5 billion benefit over 40 year useful life of CA HSR investments



Conclusions

- The Industry needs to capture non-travel benefits of high speed rail projects
- Clean Air benefits are real and can be quantified
- Non-Travel Benefits of High Speed Rail (Climate Change, Health Benefits and related Air Quality Benefits) are quite significant
- In addition, HSR has significant benefits due to reduced air-system congestion

