

What's on the Long Term Horizon For Railroads?

MSU Railway Management Program

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Transport Concepts

<http://www.tgaassoc.com>

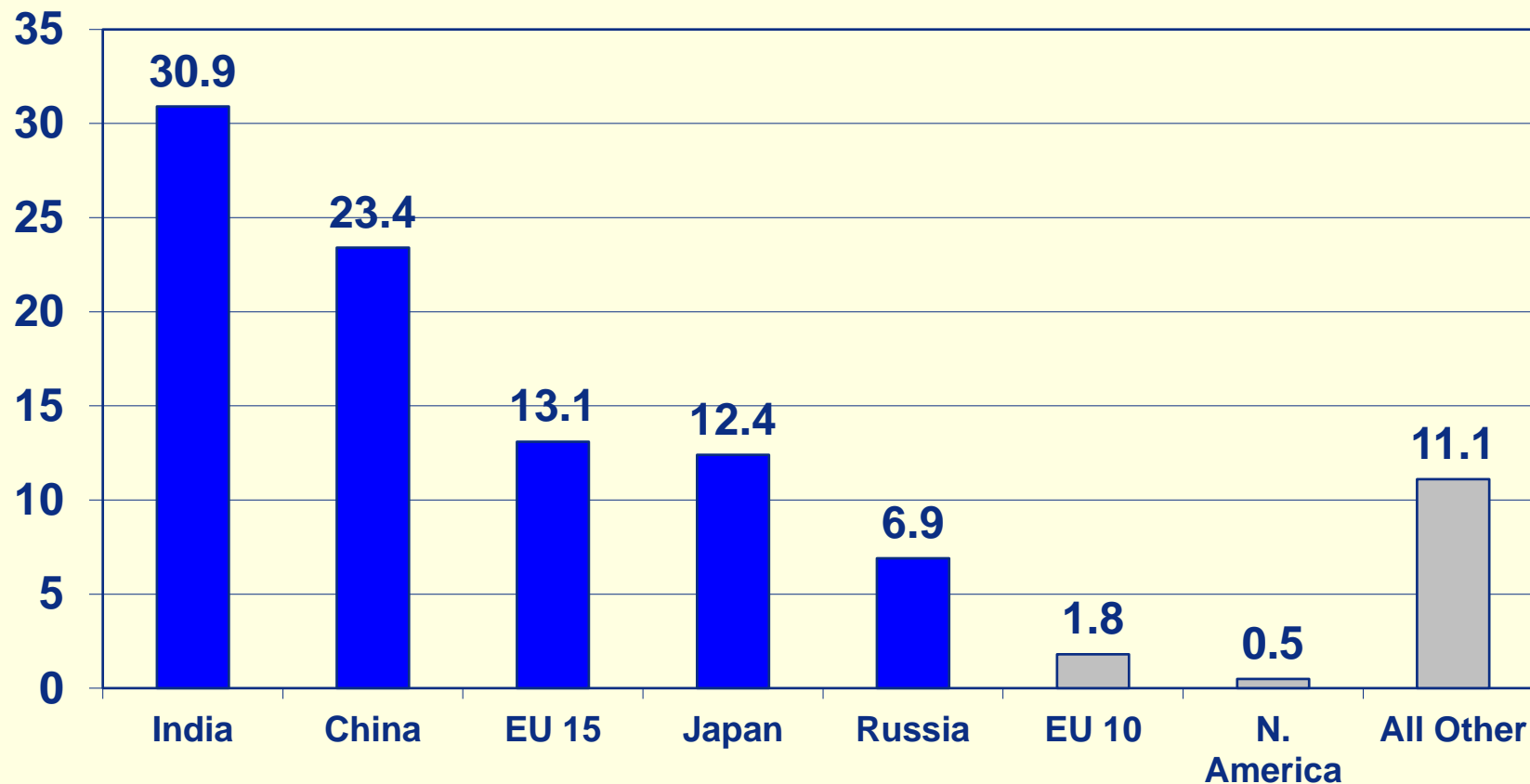
The Railroad Picture

- What are “railroads” (outside of US Class Is)?
- Where have they been?
- Where are they going? Gross forecast to set the scene.
- Major innovations:
 - Technology (“Hard”)
 - Policy (“Soft”)
- The major challenges.

Concentrated Passenger Traffic

(Percentage of World Passenger-Km) 2005

Percent

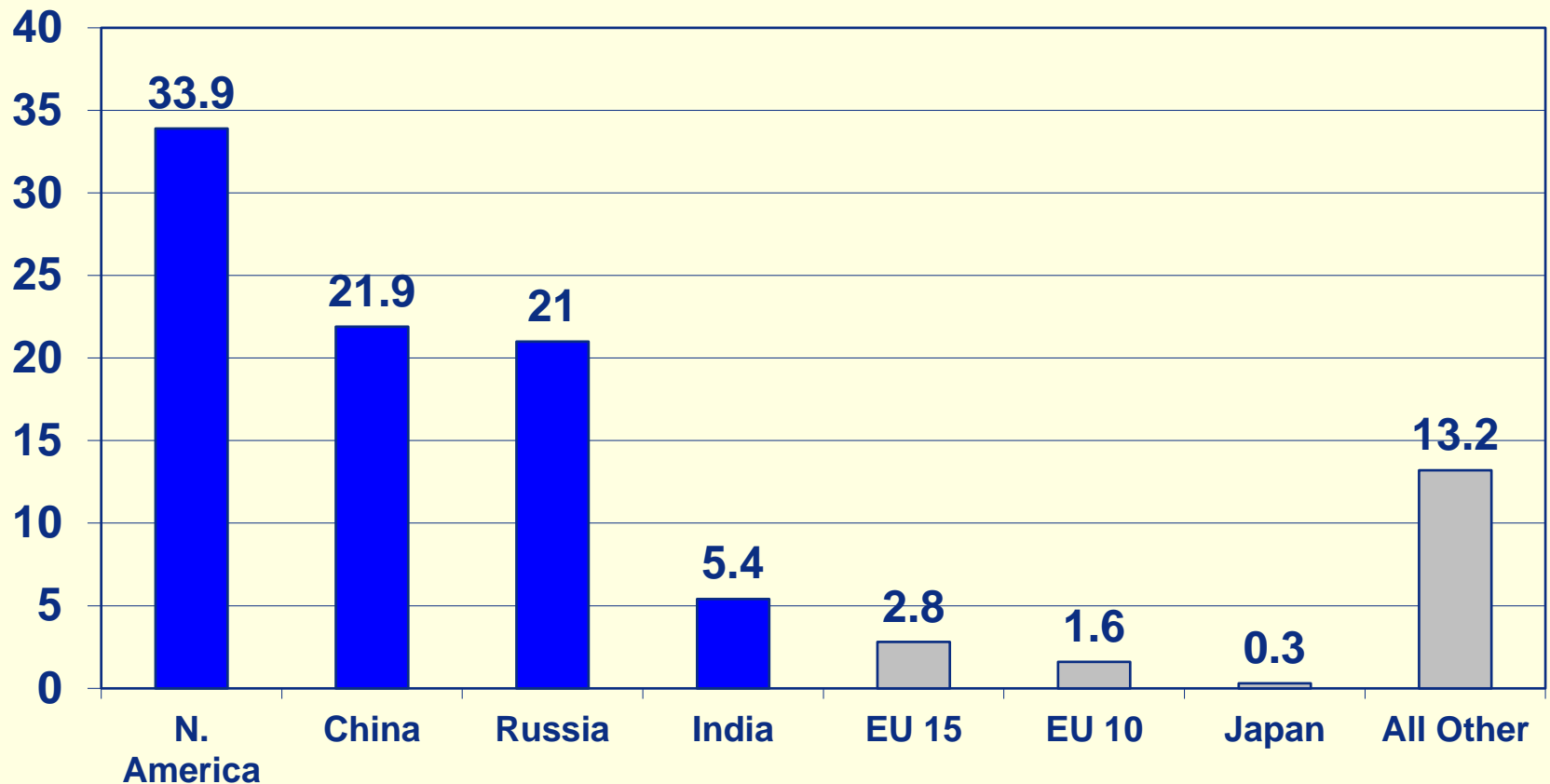


Top 5: 87%

Freight Traffic Even More Concentrated

(Percentage of World Tonne-Km) 2005

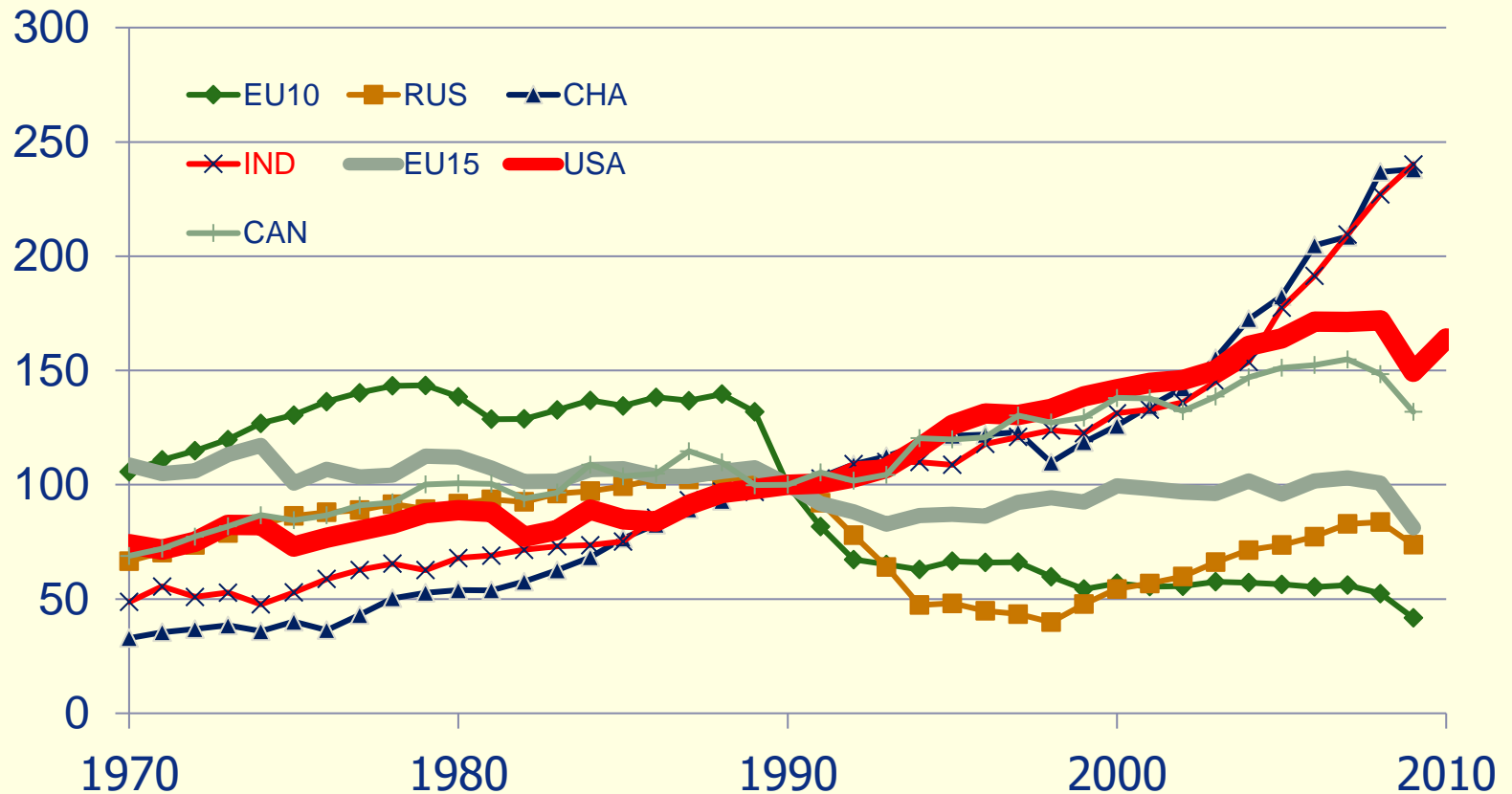
Percent



Top 4: 82%. Top 6: 87%

Freight Traffic Trends

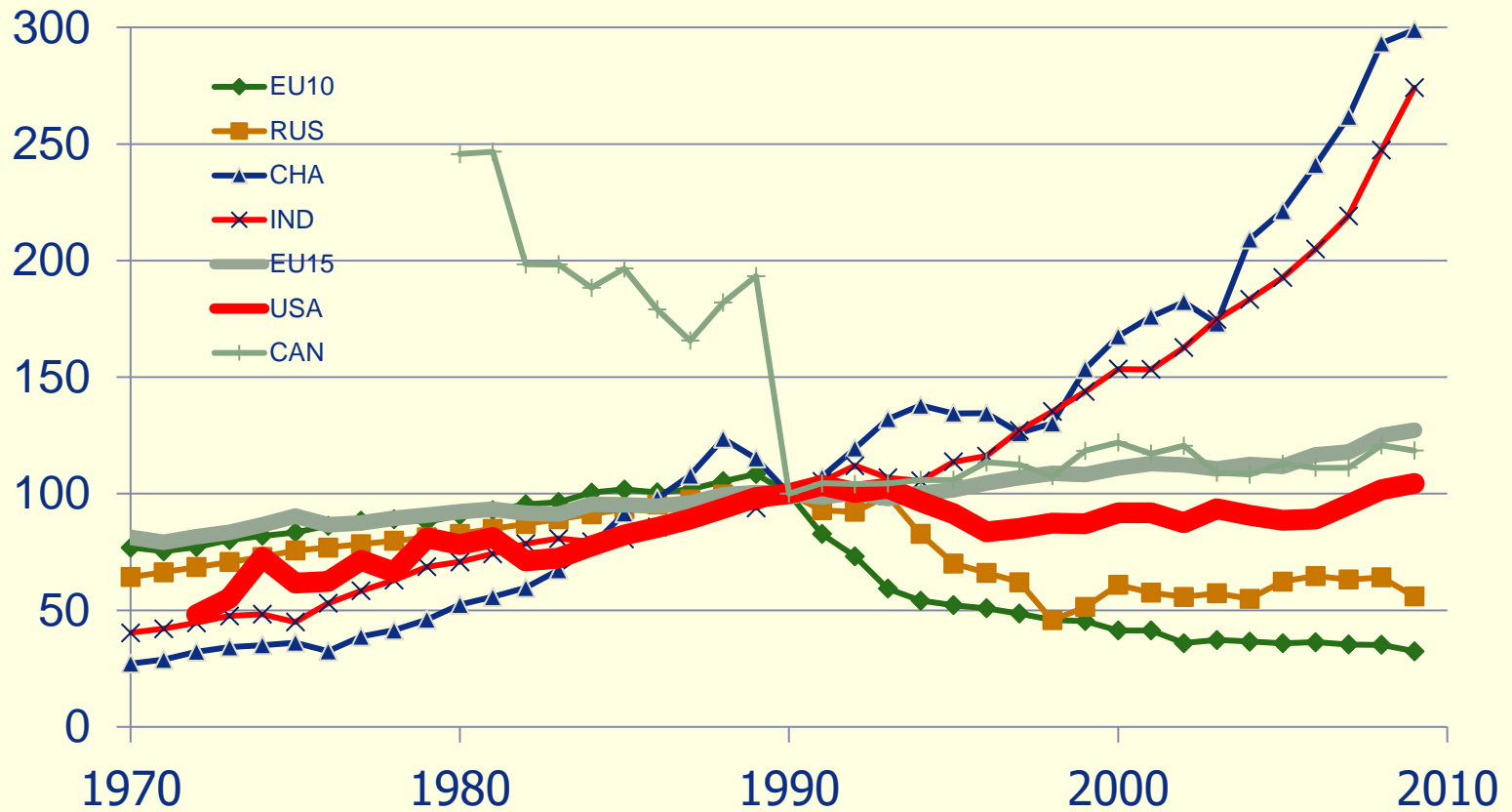
Tonne-Km Index: 1990=100



Socialist railways lost freight traffic: Russia has recovered better than others. EU 15 stagnant

Passenger Traffic Trends

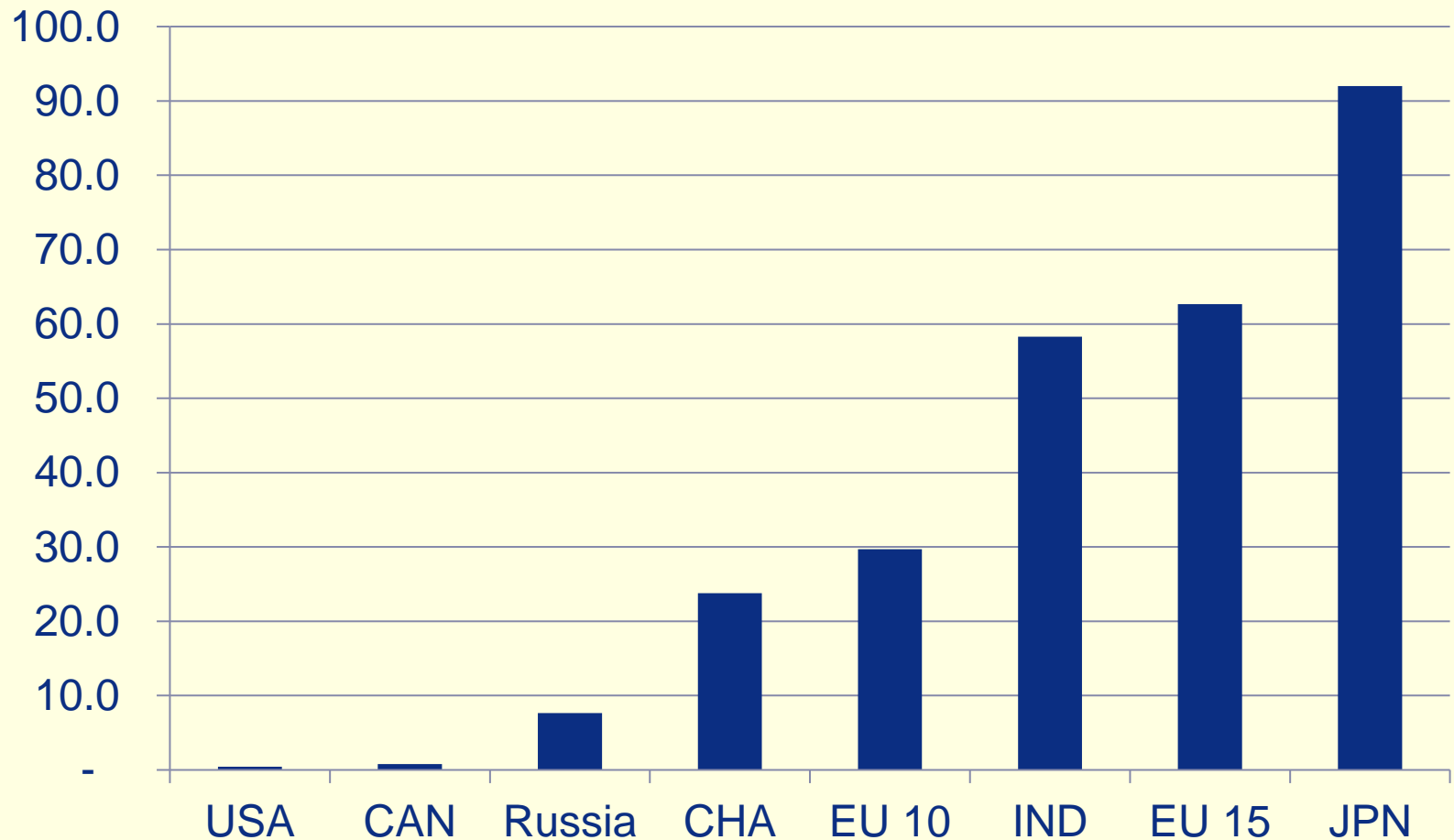
Passenger-Km Index: 1990=100



India and China grew, EU15, US Canada slow, EU10 and CIS fell.

What Kind of Railroads Are There?

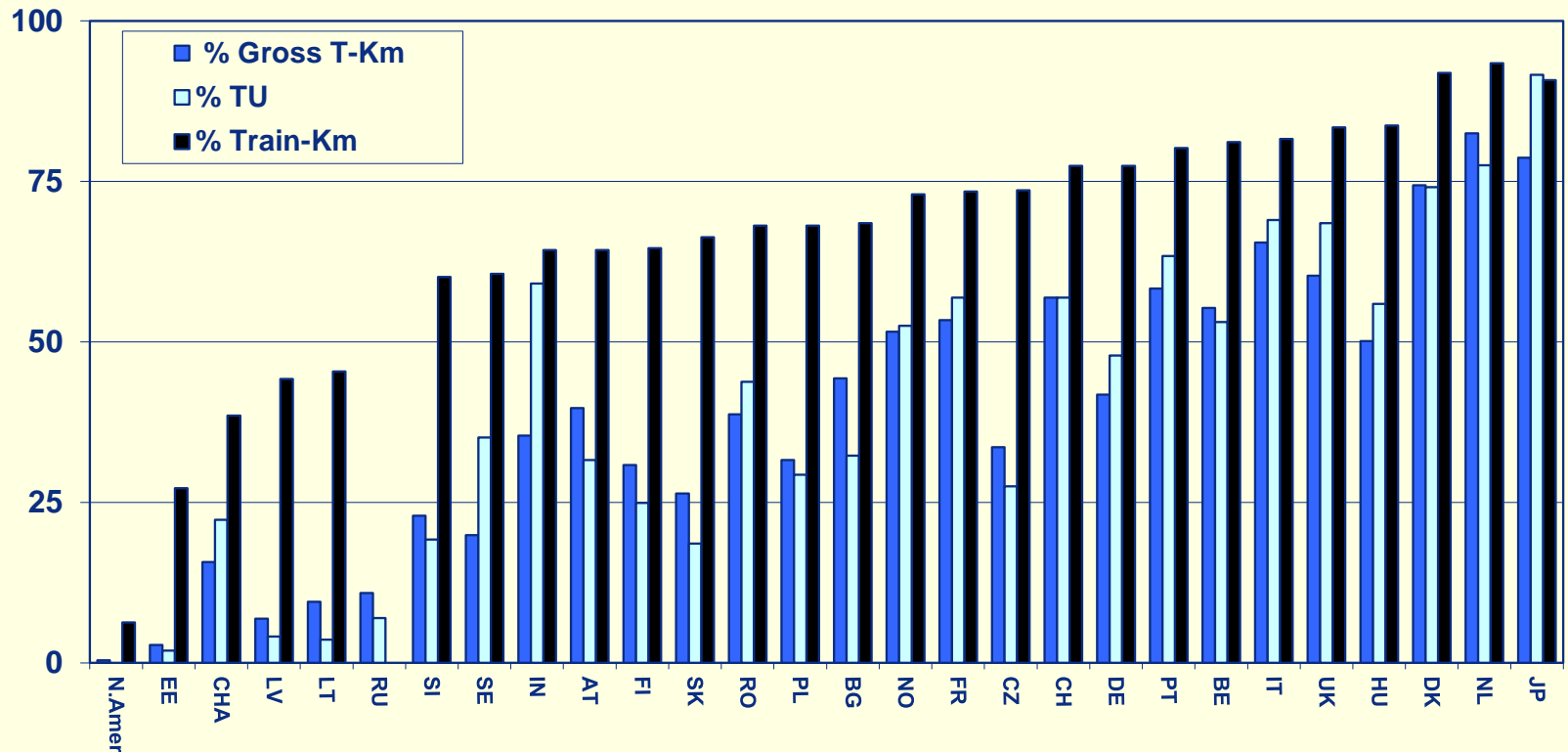
Passenger Traffic as % of total Traffic Units



% measured as $\text{pass-km}/(\text{pass-km}+\text{tonne-km})$

Various Measures of Traffic Mix

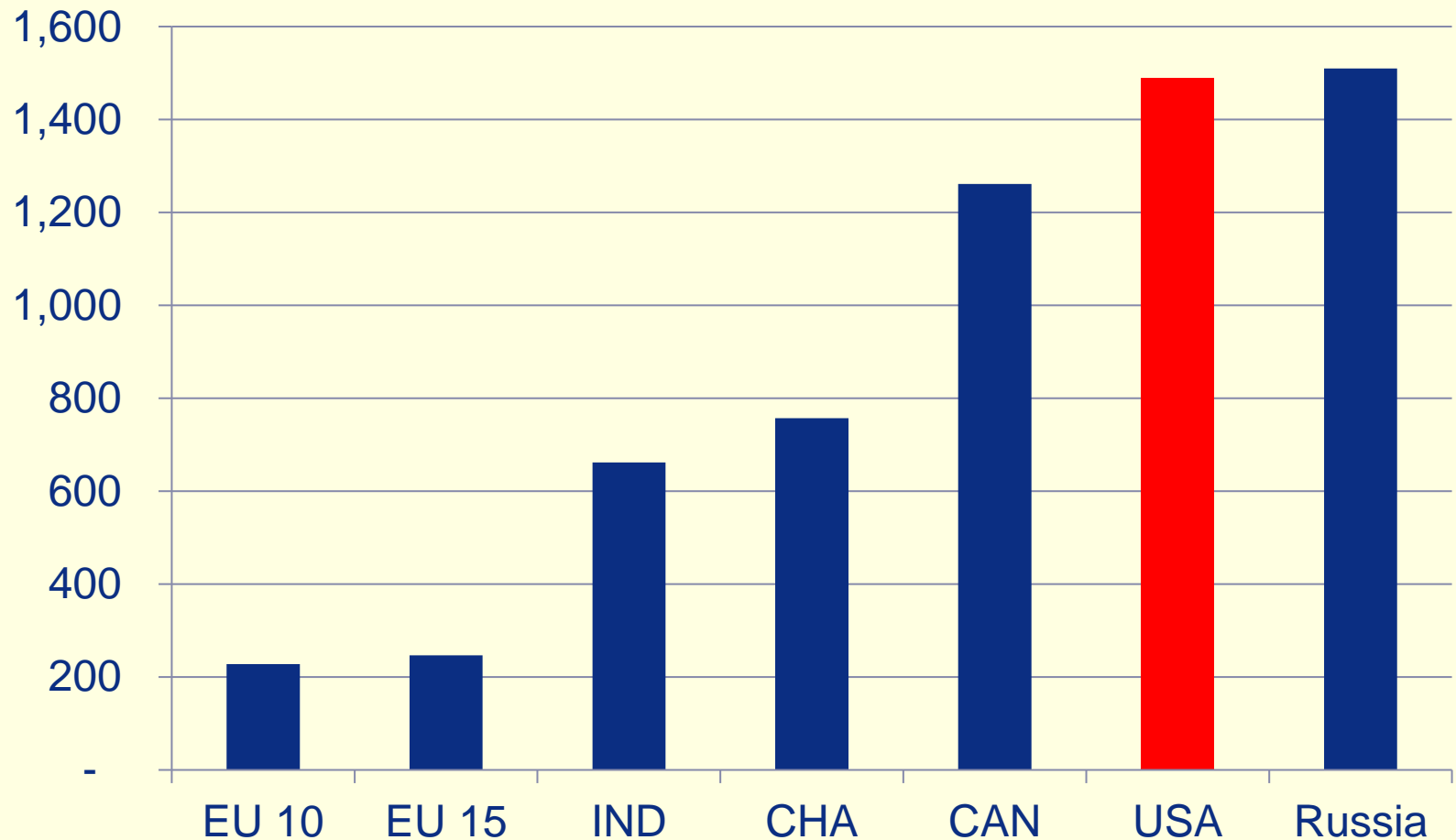
(Percent Passenger Traffic)



$$TU = P\text{-Km} + T\text{-Km}$$

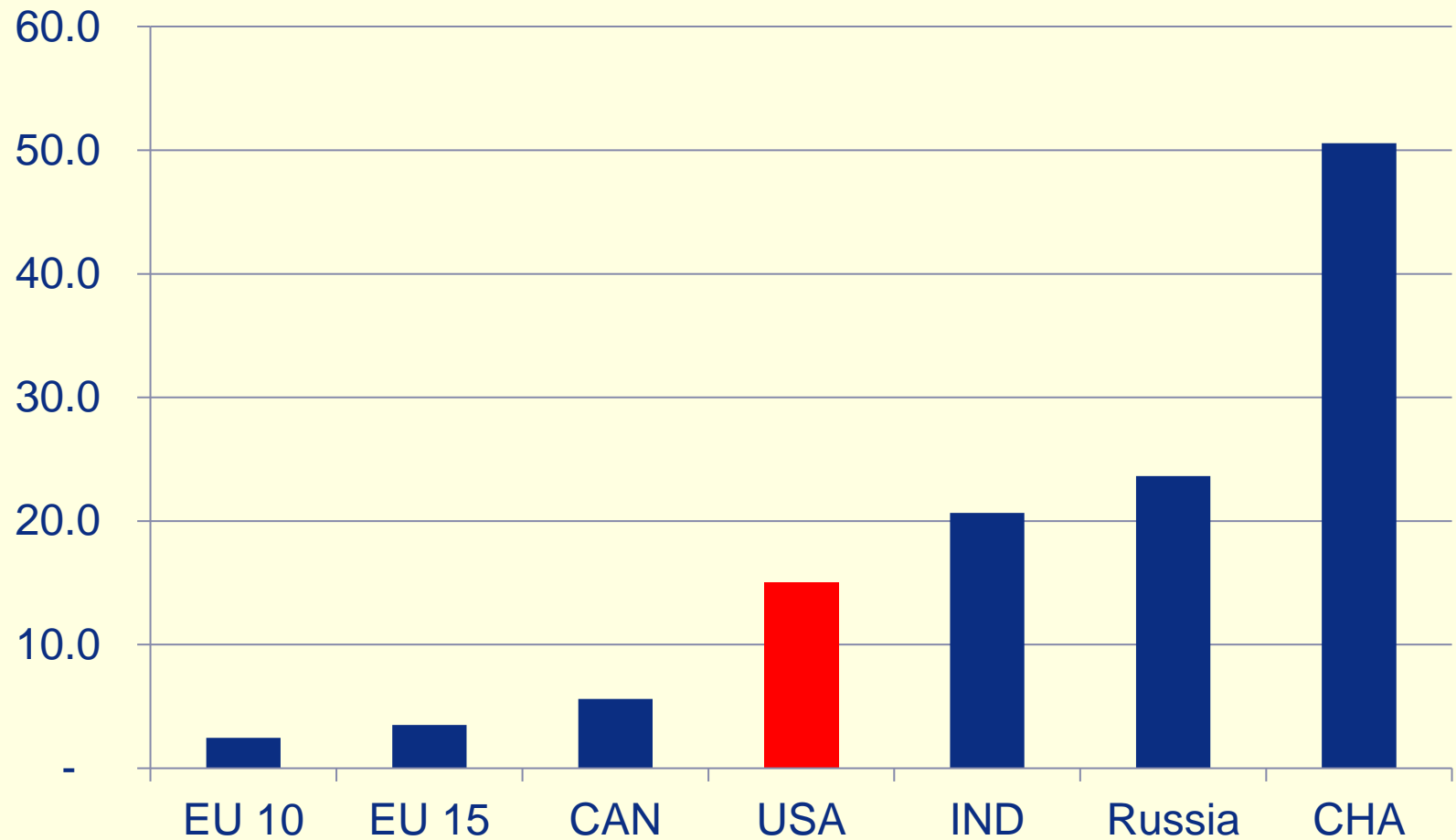
Average Freight Length of Haul

(Tonne-Km/Km of Line) Km



Total Traffic Density

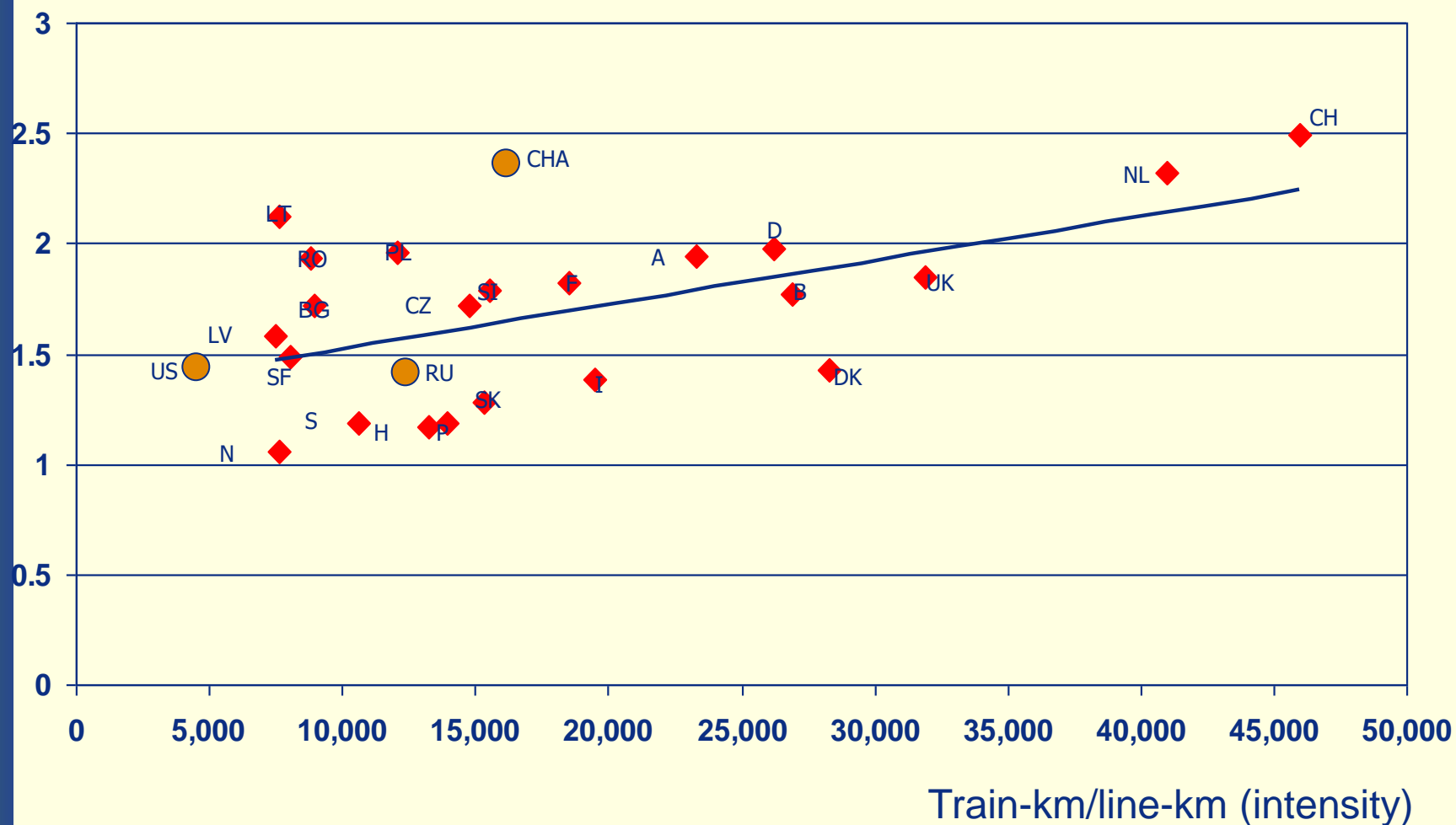
(million ton-km + P-Km/Line Km)



Network Complexity versus Intensity of Use

(train-km/km of line basis)

Ratio: track-km/line-km (complexity)



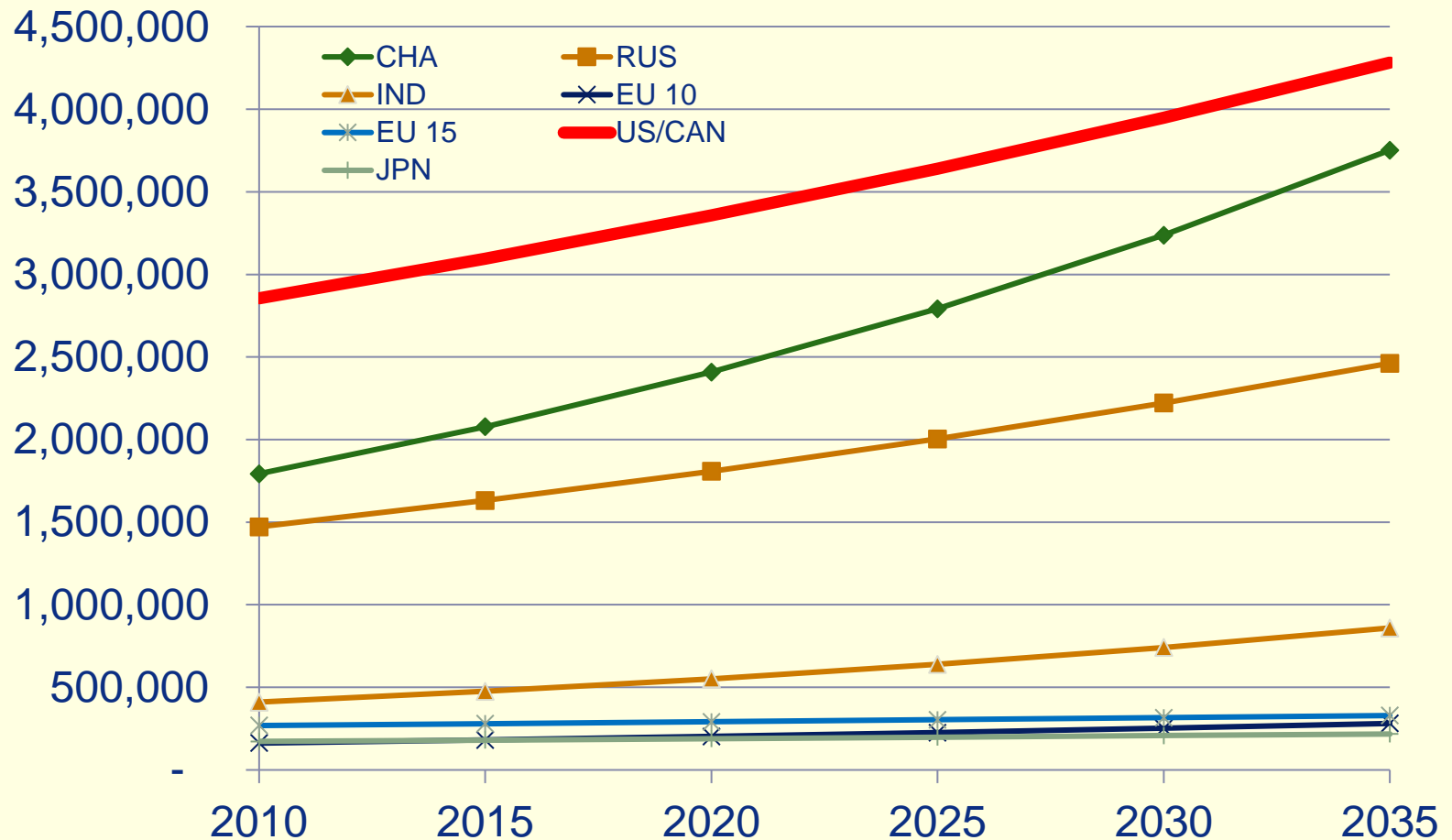
Note: Russia, US and China added manually and do not affect the regression line.

Current State of the Railroads

- N. America: freights private & dominant, **were** near capacity, profitable, recovering; intercity passenger (VIA and Amtrak) public, unprofitable; suburban systems separate and publicly supported. Transport policy (if any) is in flux. HSR a major question.
- E.U: no railway is profitable (\$60 B annual support), passenger dominant, freight minor share. Except HSR, rail in trouble. Major issues: capacity use and related access charges, inadequate support
- Russia: recovering, restructuring (freight and passenger). Major issues: recovery from neglect, pax losses and competitive structure. New Russian “Amtrak” established in December 2009, seems to be progressing.
- China: monolithic and dynamic (now more total traffic than US, soon more freight alone). Major issue: adapting to market forces. Large investment program, especially HSR.
- India: Passenger dominant, growing, improving, but still inefficient. Major issue: cross subsidies from freight to passenger.
- Japan: 3 major passenger companies private and profitable, 3 smaller passenger companies and freight company lose money.

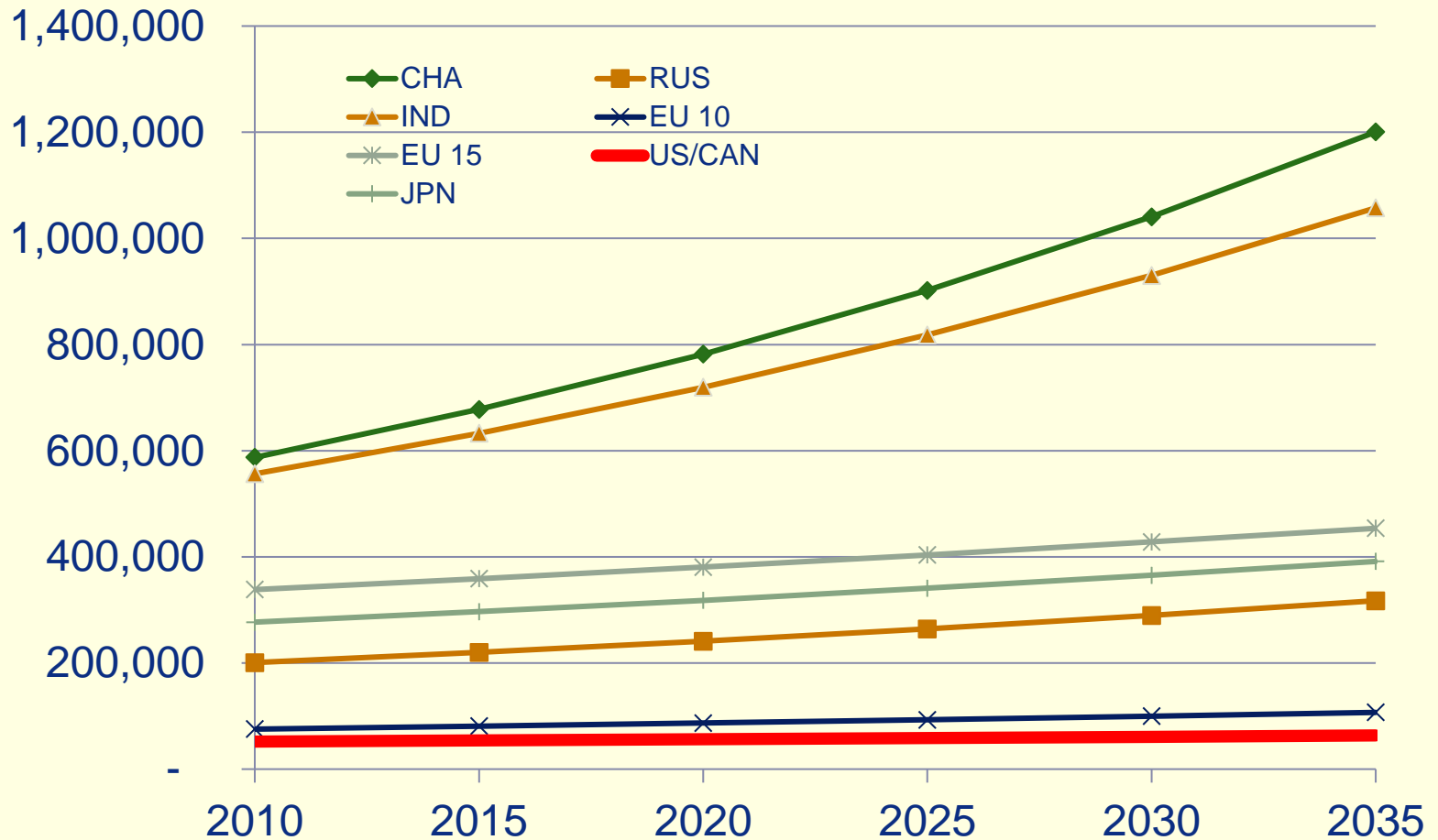
Future Freight Traffic Growth

(tonne-km)



China already > US alone; catching up to US and Canada

Future Passenger Traffic Growth (Passenger-Km)



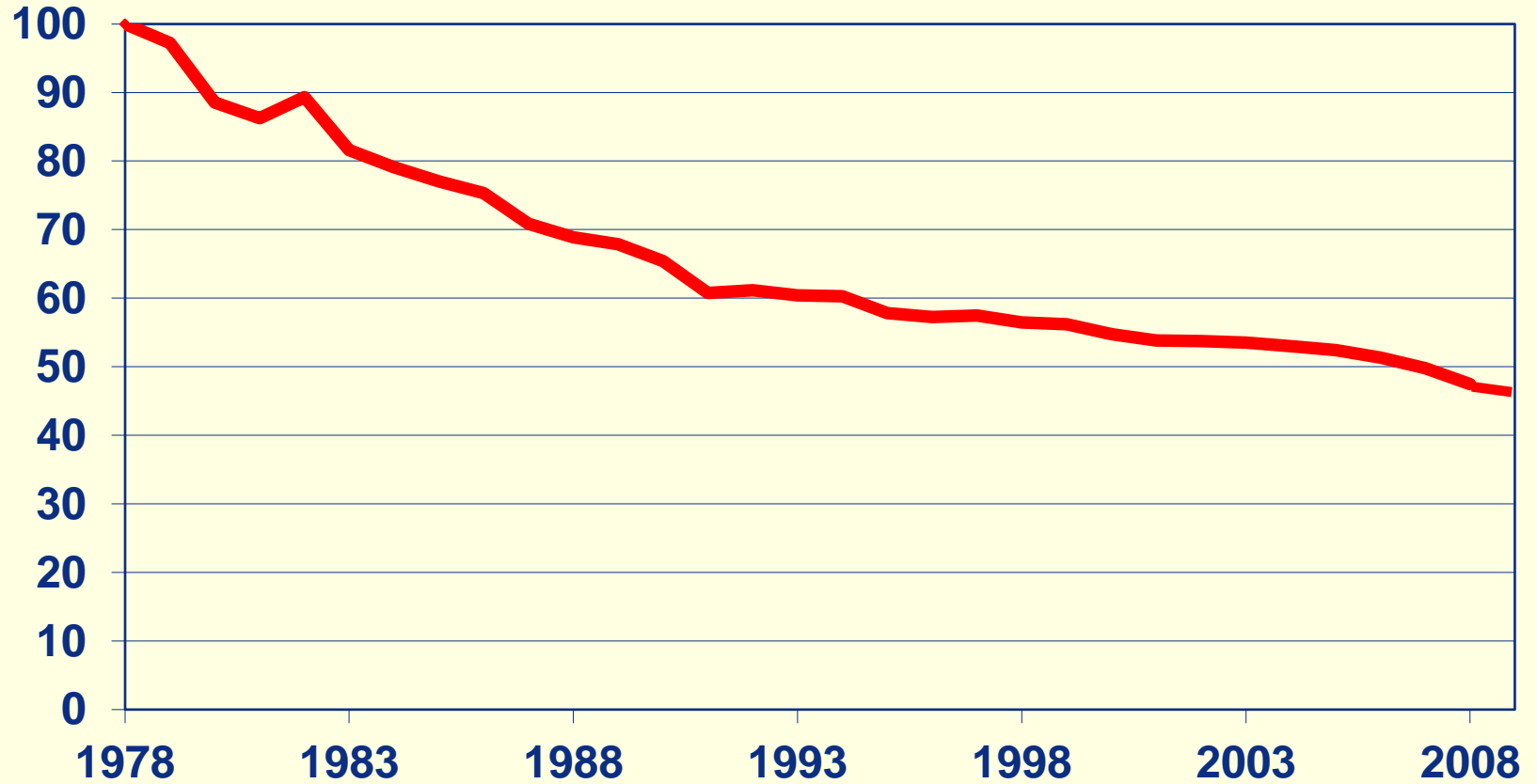
Rail Innovations: 1970 to 2011

Managing Growth & Increasing Efficiency



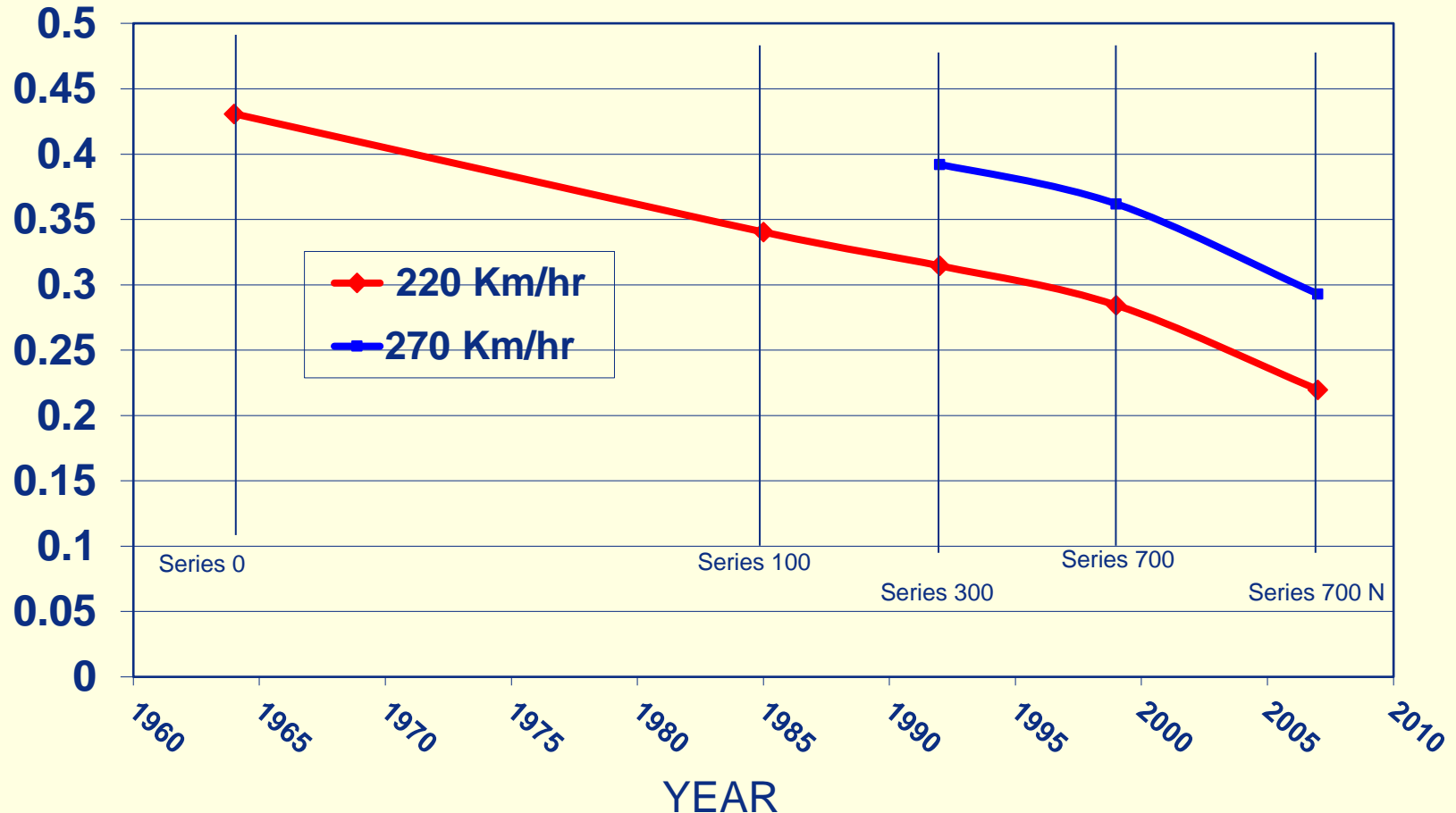
Technical Innovations	Impact	
	Freight	Passenger
High Speed Rail	Reduces freight/passenger congestion when new HSR tracks are built	Reduced weight, better aerodynamics: speed increase from 200 to 350 km/hr (?)
Information Technology	Cargo management vastly improved. Costing systems permit better pricing. Digital Communications. Automatic equipment identification (AEI) and car controls.	Efficient ticketing and reservations. Digital communications. Permits revenue maximization
Intermodal	Rails fully participate in containerization trends	Better connections to air and bus
Energy efficiency	US energy intensity reduced by over half. AC traction on diesel locomotives.	A.C. traction, solid state controls. Shinkansen energy intensity cut by half.
Heavy haul/better infrastr.	Higher axle loads, longer trains, larger locomotives, rail metallurgy. U.S. operating cost/tonne-km reduced by 62% 1978 to 2010	Continuous welded rail reduces maintenance and energy.
Signalling	Higher traffic density and improved safety: accident rates down by 2/3. PTC, GPS	Improved capacity and safety, especially with mixed freight and passenger traffic. PTC, GPS
Policy/Managerial	Freight	Passenger
Structure: monolith to owner-tenant or separation	US/Canada approach: freight dominant, passenger pays as tenant. E.U. freight operators can serve Europe-wide	EU model of infra separation permits franchising and cross-border operation. Introduces competition for markets as well as in markets
Use of Private sector	Privatization of CN, concessioning in Latin America, privatization in UK and EU	Franchising in E.U., privatization of JNR
Deregulation	Staggers Act in U.S.: tariffs fell in real terms by half. Permits contract tariffs and customer investments.	Amtrak and VIA deregulated.

U.S. Class I Railway Fuel Use per Tonne-km (Index: 1978=100)



Shinkansen Energy Use

Mega-Joules/pass-km




Data from Toyonori Noda, Japan Central Railway, presentation to Nagoya Conference entitled "The Tokaido Shinkansen and Superconducting Maglev – Contributing to a Low-Carbon Society," Charts entitled "The Energy Efficiency of Shinkansen Rolling Stock," and "The Environmental Superiority of the Tokaido Shinkansen." Assumes 60% load factor.

One Dimension of Change: New Models of Organization

- Structure and Ownership Models
- US/Canada: freight integral and private (competition **IN** the market), passenger usually tenant and public. Intermodal and intra modal (rail) competition, both parallel and vertical (trackage rights)
- EU models based on vertical separation, but ownership varies. Rail freight competition **IN** the market, rail passenger competition **FOR** the market (franchises) and intermodal.
- Australia has mixture as well
- Latin America: integral concessions (**FOR** market) with intermodal competition for both freight and passenger. Chile is only separation model.
- In all cases, regulation (if any) must be consistent with structure, ownership and competition objectives

Structure and Ownership

	Private Role 		
	Fully State-Owned	Partnerships	Privately Owned
Integral (Monolithic)	China, Belarus, South Africa,	Network Rail? Passenger and freight concessions	Smaller US freight railroads (500), East Japan, Central Japan and West Japan
Dominant Operator Integral, tenant operators separated	Amtrak and VIA, Japan Rail Freight, Russia	US Commuter railways on freight tracks, FEPASA in Chile	Most US freight railways, including trackage rights to create competition
Vertical Separation ("Open Access")	"Standard" EU model	Some UK franchises, Network Rail?	Most UK franchises, Railtrack (but not Network Rail), EWS

Unbundling



Better Use of the Private Sector

- Latin America: Argentina, Brazil, Chile, Bolivia, Mexico, Guatemala (mostly freight, some passenger)
- Africa (all services)
- Japan (outright privatization – passenger services only). Taiwan (THSRC)
- Estonia
- U.S: Conrail, now some passenger, HSR?
- Canada – CN privatization
- The famous UK experience
- Small, but growing, EU freight and passenger services

The EU Experience

- Stated objectives: reduce the fortresses, and create competition **in** and **for** the markets. Experience: **in** for freight, **for** (franchising) for (some) passengers.
- Approach:
 - separate infra from operations,
 - require “non-discriminatory” access
 - separate social from commercial
 - officially: separate I/S and B/S for infra, freight, intercity pax and various social pax and frt services.
- General result: great resistance, only partial implementation so far, but moving ahead faster. Freight mergers, HSR competition
- Key issue: access charge level and structure.

EU Access Charges

- Supposedly based on “Social Marginal Cost,” with public funding for the gap, but:
 - no consensus on calculating MC
 - differing financial goals, and thus “mark-ups”
 - different local circumstances and objectives
 - limited and conflicting data
- Widely varying access regimes both in structure (variable vs. two-part) and variables used, and as to levels
- A single “Europe” for freight does not yet exist
- Network statements are emerging and change accelerating

How are Railways Financed?

- Balance of public and private objectives
- Ownership and control
- Ability to separate activities
- Public policy for financing: capital only, competition for subsidy

How are Railways Financed?

- U.S. **Has had** no public finance for freight railroads. Amtrak (a corporation) supported by Federal budget for both operating and capital. Canada similar
- EU generally limits support for “commercial” activities (freight, intercity passenger) but permits support for infrastructure (with open access) and for “social” services. Wants to require competition FOR social markets (UK, Germany, Sweden, NL)
- UK example: support to Network Rail for infrastructure, support to franchises by competitive contract, limited support to freight under contract
- Latin America: no support for freight, competed concessions for passengers (capital and operating)
- China totally public but central/local mix
- Japan private/public mix

Future Challenges in World Railroading

- US/Canada: Financing capacity growth
 - Freight: Regulation, public finance for public purposes, fuel/carbon taxes! Keeping what we have to finance the future. Carbon sequestration.
 - Pax: Federal/State balance, definition of roles, private sector roles? Freight/passenger interaction if passenger services are expanded
 - HSR? Lack of a national policy and financing.
- EU
 - Freight: Access charges, open access for new (private operators), Shift access charge balance from pax to freight
 - Pax: HSR growth, competition **FOR** short haul services
- China: Also the problems of financing capacity growth (?)
 - Freight: Adjusting to market (pricing and service), capacity
 - Pax: Growth of autos and airlines, support policies
 - Overall: Separating railway from Government. Enormous investment in HSR and freight!
- Russia:
 - Freight: Growth of highways, competition policy
 - Pax: Forming Russian “Amtrak” and suburban spin-offs
- India: Separate Government from enterprise, rise of autos and trucks, remove cross subsidy from freight to passenger.

So, What Innovation Do US Railroads Need?

- Continuing improvements in technical areas: energy, track design
- Continuing “revolution” in management techniques: IT, GPS, control systems, “smart” everything
- Prepare for GHG control programs: best is carbon tax, second best sequestration
- Policy “evolution”: public/private roles in management and financing, congestion pricing, continuing paralysis in the Highway Fund
- Defense of Staggers so we can actually put the innovation to work for our customers
- HSR: analysis is more important than innovation

HSR Data

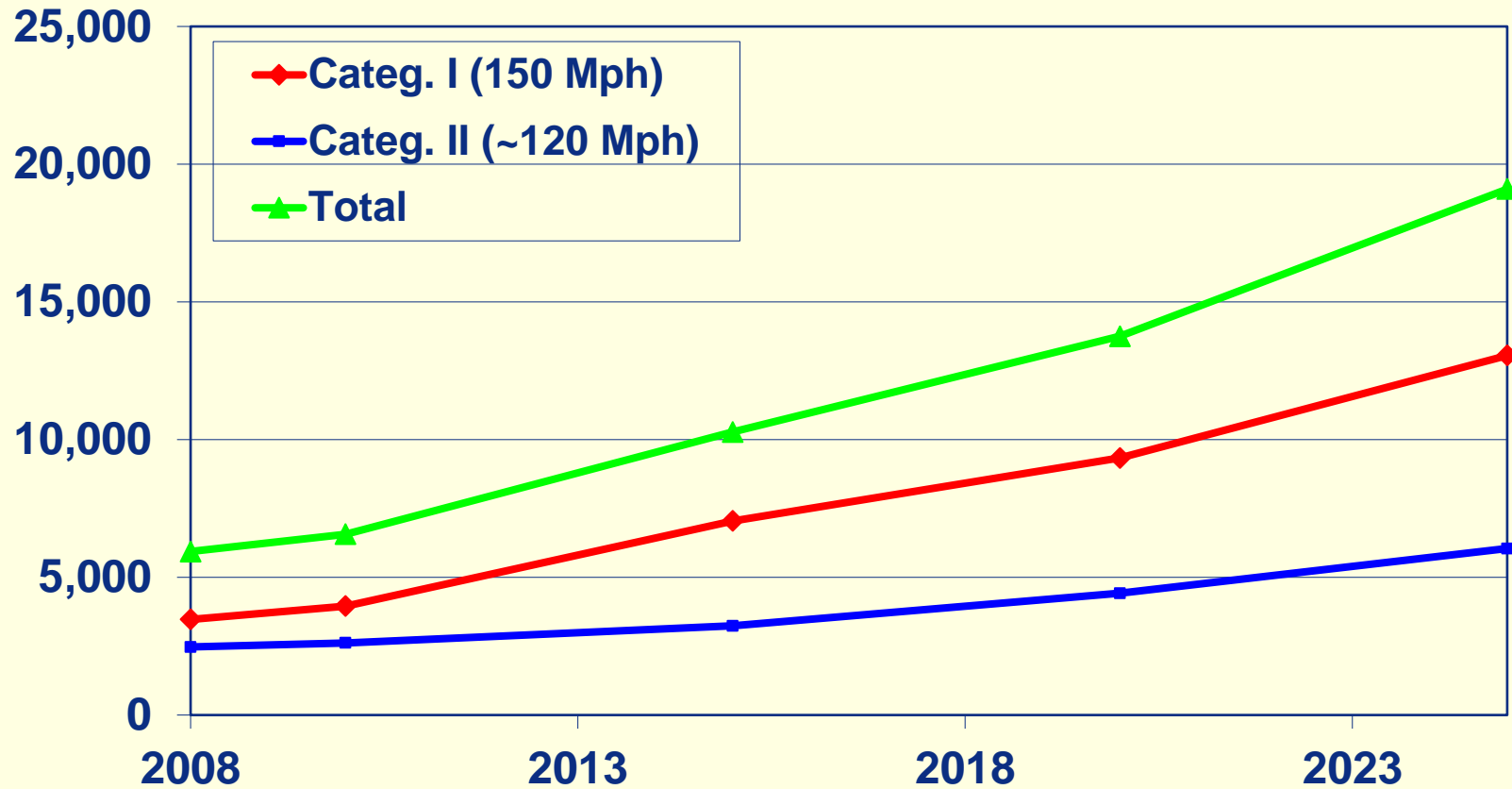
Miles of Higher Speed Line						
Country	> 150 mph "Express"	100 to 150 mph "Regional"	Total	2008 HSR Passengers	2008 HSR Passenger- Miles	Est Avg. Trip (mi)
Japan (3 JRs)	1,482		1,482	310,237	50,710	163
France (RFF/SNCF)	1,051	3,215	4,266	116,054	32,642	281
Germany (DB)	537	977	1,514	74,700	14,490	194
Korea (KTX)	149		149	38,016	6,308	166
Taiwan (THSRC)	214		214	30,581	4,077	133
Italy (FS)	330	1,718	2,049	23,882	5,513	231
Spain (ADIF/RENFE)	773	483	1,255	22,955	6,514	284
Belgium (SNCB)	108		108	9,697	670	69
UK (/Eurotunnel/Eurostar)		70	70	9,100	617	68
Sweden (Banverket/SJ)		1,600	1,600	8,764	1,858	212
U.S. (NEC Regional)		450	450	7,489	1,145	153
Netherlands		120	120	5,966	538	90
U.S. (Acela)		450	450	3,399	631	186
China	20	4,724	4,744			
World Total	4,644	9,083	13,727	660,840	125,714	190
<i>CA HSR (2025)</i>	<i>580</i>	<i>81</i>	<i>661</i>	<i>36,500</i>	<i>10,330</i>	<i>283</i>

Sources: UIC, International Railway Statistics 2008, Table 10 and Table 50

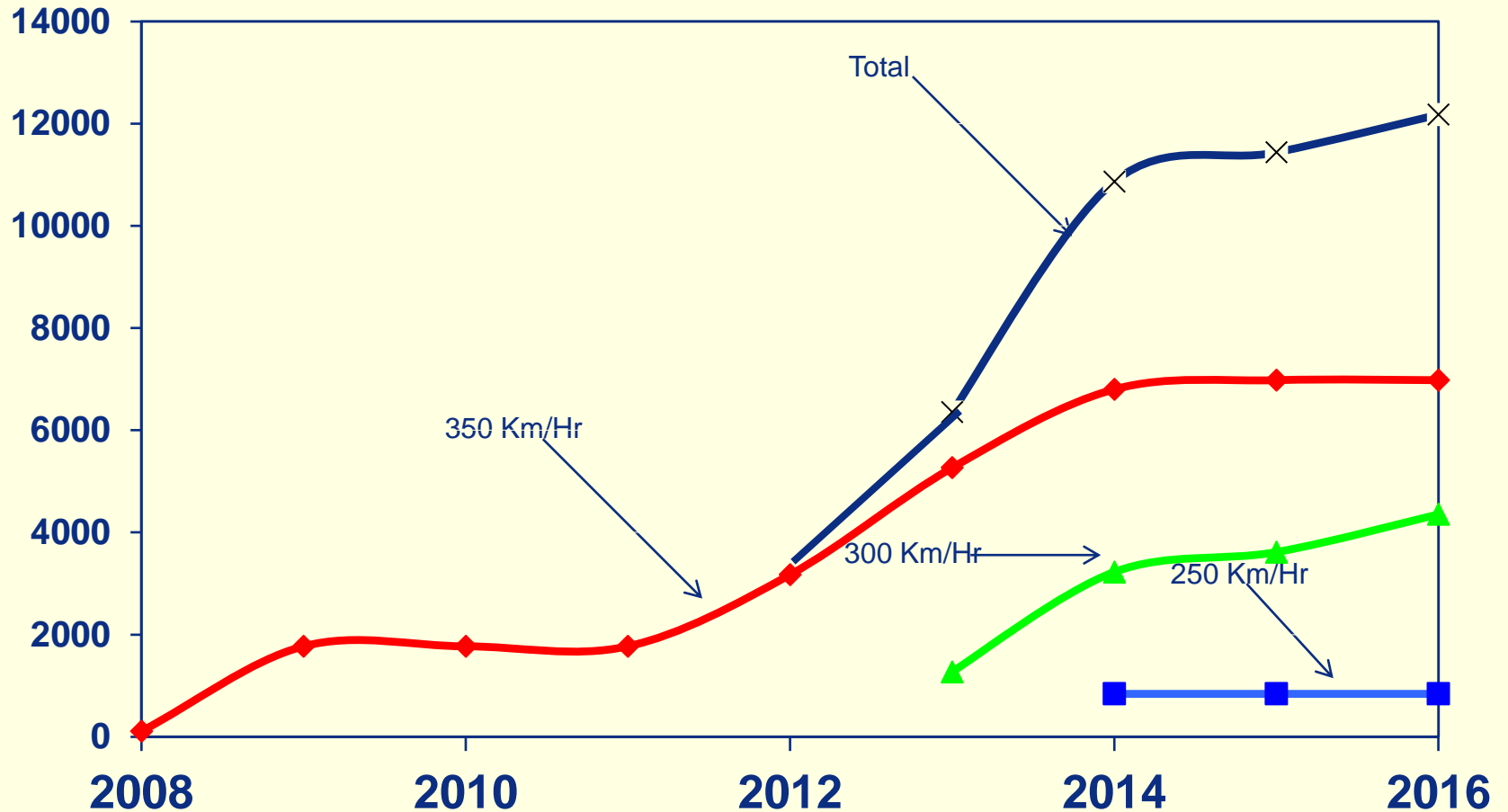
UIC, International Railway Statistics, Time Series 1970 to 2008

CA HSRA 2008 and 2009 Business Plans and PB data

E.U. HSR Line Miles by Category



Planned Km of HSR In China



HSR Future in EU and Asia

Positive Because:

- Favorable demographics (Population density, high fuel cost (taxes), social awareness, including GHGs)
- Positive government policy for rail, including HSR (EU and national levels)
- Established institutions to build and operate HSR
- Organizational experience and flexibility
- Understanding of public and (emerging) private roles
- Ability to define and pay for public benefits: economic versus financial analysis
- Ability to make and sustain public commitments

How well does the US measure up to HSR requirements?

- NOT a technical issue (we have it or can buy it)
- NOT really a financial issue: \$98 billion in CA not that much. <20 ¢/gallon fuel tax would pay fully.
- NOT an issue of private sector capability (far larger US private companies exist – Apple = \$500B)
- INSTEAD: Policy, Institutions and Politics, Federal and State levels

California Project Issues: The Peer Review Group's Concerns

- >\$350 million spent already and...
- Business model: what roles for the parties?
- Capital cost estimates: in total, uncertainties (\$43, or \$61, or \$98 billion?)
- Financial Plan: who pays what, when?
- Demand forecasts: new projections with range of error
Benefits are consumer surplus, safety, congestion, avoided investment – GHG reduction alone will not justify the project
- Project Risks: clear definition and allocation
- Impact of the Federal role, State risk if no further money
- Organization: HSRA vs Caltrans vs ?