Does the Passenger Train have a Future?

DAVID BURNS
RAILROAD INDUSTRIAL ENGINEERING CONSULTANT
CHICAGO, USA
The Answer!

- YES
- NO
- MAYBE

- It depends on where it is
- People want to travel for work and pleasure
- It started with the horse
- Then came the bicycle,
- Motor cycle,
- Car

Somewhere in this transition are the
- Urban, commuter, metro, and LRV trains
- Regional train
- Intercity and, perhaps, high speed trains
Travel is Proportional to Income

Comparison of US Miles per Capita and GDP per Capita

Miles per Capita

GDP per Capita

WW II

Miles per Capita per Year

GDP per Capita
As Income Increases, Mode Changes
US km per Capita, by Mode

[Graph showing the increase in annual km per capita from 1900 to 2000, with different modes (Car, Rail, Transit, Air) represented by different colors.]
Cars are inevitable

**Vehicle Penetration Follows a Pattern**

Typical saturation = 550 Cars/1000 adjusted for:
- Geography (usable land area)
- Government policy
  - Consumer constraints
  - Domestic auto production
  - Infrastructure spending
  - Oil import dependency

Income per Capita (Purchasing Power Parity - 1993)
Vehicles per 1000 population & Income

2005 data
URBAN RAILWAYS

Urbanization, a growing trend, why?

- More jobs
- Better jobs
- Better income
- Better social life
The Urban Travelers' Choice

Which mode would you choose?
Almost everybody will choose to own a car which increases congestion

Which

- Increases pollution
- Increases lost time
- Increases the need for construction
- Lowers property values
- Etc.
As Income and City Population Increase, Rail Mass Transit Becomes a Necessity

When does a city need to construct urban railways?
So the City is Forced to Build an Urban Railway

There are basically 3 types:

- **Light Rail Vehicles (LRV)** or maybe **Bus Rapid Transit**
  Stations every 500 m  Route length  12 to 15 km

- **Metro Rail**
  Stations 1.5 to 4 km  Route length  15 to 30 km

- **Commuter Rail**
  Stations 4 to 10 km  Route length  25 to 80 km

All are expensive!  Except BRT
Cost of Urban Rail – very expensive

- Beijing - $75 million per km
- Delhi - above ground, $24 million per km
- Delhi – underground, $56 million per km
- Bangkok - above ground, $55 million per km
- London - $75 to $360 million per km
- Los Angeles - $100 to $200 million per km

- However, Bus Rapid Transit (BRT) is as low as $10 million per km
Bus rapid transit costs less than light rail, so why spend the extra money?
People want to ride the trains? BUT

- Given the choice, most people want to ride in their own air conditioned cars with their own background music

Commuting by public transit (rail & bus)
- Dallas: 4.5%, New York: 20%, Paris: 24%,
- Tokyo: 57%, Osaka: 60%, Singapore: 65%
- Why the difference?
When a City’s Population is 35 million, this what is needed  - Tokyo
The System will Require a Large Subsidy if Ridership looks Like This

One North American Railway needs 180 coaches for peak hours, and no more than 18 coaches the rest of the day
What is Needed for Financial Viability

Rail-Centered Mentality

- User friendly
- Stations must be destinations
- Park and Ride or ‘Kiss and Ride’
- Must be an integrated transport system
- Rail can only be marginally more expensive than buses

Transit Orientated Development

- Must include, housing, offices, retail shopping
Example of User Friendly – Berlin Main Station

- Intercity, regional, and urban trains in one station
- Trains on 3 levels with lifts and escalators to the middle of the platforms
- Shops, restaurants, parking for 800 cars, bus connections
- Indoor connection to offices

Note:
German population density 25% that of Bangladesh
Housing Development Played a Major Role in Building Metros

Note: Information for houses can be obtained at station
Property and Urban Railways Development Must be Coordinated

An attempt at coordinated property development and urban rail
Unfortunately, rail and property are being developed separately
Japan’s Railways - successful

- Urban Transport 26%
- Real Estate 20%
- Entertainment and Communications 12%
- Travel 13%
- Hotels 9%
- Retail 16%

Hanshin-Department-Umeda-Store owned by Hanshin Electric Railway
Adjacent to an Osaka Station
A Perfect TOD – Baseball!

The railway company has a baseball team above a station. By controlling game time, it can encourage passengers during off peak hours.
Hong Kong – does it right

Typical Cash Flow Income
- Property Development 48%
- Property Management 10%
- Station Businesses 11%
- Railway 31%

Storage yard and workshop
Restrictions on cars – a must

Government restrictions on ownership
- Parking
- Restrictions on car ownership, Japan, Singapore, Hong Kong
- Annual inspection

Pricing constraint on usage
- Fuel tax
- Toll ways
- Congestion Charging
Subsidy is Required unless using the ‘Japanese’ approach

- Some urban railways cover as little as 28% of the operating costs
- Almost none cover construction cost
- Almost all dedicated urban railways require substantial subsidy – taxes?

Percentage coverage of operating costs

Bar chart showing:
- Brussels: 28%
- Atlanta: 32%
- Paris: 43%
- Boston: 44%
- Chicago: 44%
- Zurich: 66%
- London: 70%
- Sao Paulo: 70%
- Osaka: 130%
- Hong Kong: 149%
Urban Railways Conclusion

- Urban railways are a necessity for cities where size and income that road traffic causes congestion
- Urban railways MUST be actively involved in urban planning - NOT the reverse
- Governments should ‘encourage’ property developers to build urban railways
- Proactive approach is essential
- National and, especially, city governments must actively discourage automobile ownership and use

98% of commuters want rail mass transit for the other person to ride!
A quote from the ‘The Onion’
Finally

Urban Rail - You build for your grandchildren because you probably cannot justify building it today

But, if you wait for tomorrow, you will be able to afford to build it even less then today!
Regional and Inter-City Trains

- No regional and intercity trains cover their fully allocated costs
- Almost all passenger service require annual subsidies
- In high income countries, rail national market share less than 10%, except Japan
- On corridors rail seldom has more than 30% market share

- So is there a future?
Travel increases BUT NOT BY TRAIN!!!!!
National Rail Market Shares

- France 9%
- German 8%
- Britain 6%
- USA 0.2%
- Brazil 0.1%?
- Switzerland 12%
- Japan 30%

What does this tell you? Switzerland gives a clue, but Japan appears to have the answer
The Japanese Use the Train, Why?

- Must have off street parking to own a car
- Annual car inspection $1000
- Gasoline $5.66 per gallon
- High speed train every 15 minutes
- There is a ‘Railway Mentality’
- Excellent public urban transportation

- Train fare Tokyo Osaka $130
- Plane fare Tokyo Osaka $146
- Highway toll Tokyo Osaka $130

- However discount airlines are causing market share to decline
So Why Take a Regional or Intercity Train?

- Avoid the congestion
- Ticket price cheaper than plane ticket
- Convenience
- Save time
- Able to work en-route
- The service and food is better?
- Better for the environment
Intercity car travel congestion usually not a problem
Typical Range of costs/prices for about 500 km of travel

Trains are seldom the cheapest way to travel.
Buses can offer more frequent service

Capital costs are about the same!
On Price and Frequency the Bus is Strong Competition

In the USA an intercity bus ticket can be as low as $1

In Sweden the bus is 35% the price of the train

And both offer service from outside the train station!
## Convenience

<table>
<thead>
<tr>
<th>Intercity Train</th>
<th>Plane</th>
<th>Car</th>
</tr>
</thead>
<tbody>
<tr>
<td>House walk to bus</td>
<td>House walk to bus</td>
<td>House to car</td>
</tr>
<tr>
<td>Wait</td>
<td>Wait</td>
<td>Drive</td>
</tr>
<tr>
<td>Bus to train</td>
<td>Bus to train</td>
<td>Congestion delay?</td>
</tr>
<tr>
<td>Wait</td>
<td>Wait</td>
<td>Car to House</td>
</tr>
<tr>
<td>Intercity Train</td>
<td>Train to Airport</td>
<td></td>
</tr>
<tr>
<td>Wait</td>
<td>Check in</td>
<td></td>
</tr>
<tr>
<td>Train to bus</td>
<td>Wait</td>
<td></td>
</tr>
<tr>
<td>Wait</td>
<td>Fly</td>
<td></td>
</tr>
<tr>
<td>Bus</td>
<td>Wait for luggage</td>
<td></td>
</tr>
<tr>
<td>Walk to house</td>
<td>Train to bus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wait</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Walk to house</td>
<td></td>
</tr>
</tbody>
</table>

Which is more convenient?
Work on Train?  But how much more would you pay?

- Businessmen are usually prepared to pay a premium ticket price
- $60 per hour value of time saved (according to UK MoT)
- Businessmen may pay $60 per hour more
- But even if they did, typically only 30% of passengers are businessmen
Train Speed is not that Important

- Up to 200 km car requires least time
- 300 km less than 1 hour time difference between modes
- 400 km only at 300 km/hr saves 1.5 hours
- If you have to wait an hour for the train, up to 400 km car can be just as fast
Frequency Needs Passengers

- To justify frequency, you need population
- In a developed country, the average person makes about only 5 long distance trips a year
- If 10% are by rail, for hourly service, population centers of 4 to 8 million are required to fill the trains
- If a higher percent choose train, reduces population centers, but how?
- If 30% are by rail, for hourly service population centers of 1.5 to 2.5 million are required
The Regional Train

- An extension of the urban commuter railway
- Primarily for longer distance commuting
- As opposed to subsidized by city, it should be subsidized by regional government to promote development of its region

Does not need to go fast, max. speed 150 km/hr
Is High Speed Rail the Answer?

- High speed rail corridors may have 85% of train and plane passenger traffic
- But will seldom have more than 30% if cars and busses are included, except in **Japan**
- Washington to New York corridor is only about 8% of market share which, compared to the national average of 0.2%, is very good!
Passenger Trains Generate Economic Benefits

- ‘Environmentally Friendly’ with a Lower ‘carbon footprint’
- Reduces need for roads
- Safer than road
- Less pollution
- Could be operated with electricity

- Will the traveler choose the train because it is ‘Environmentally friendly’? - Maybe a few will

- But, who will pay the railway for the economic benefits? The private health insurance companies!?!
Is Concessioning or PPP the Answer?

- Privately operated railways tend to be more efficient, but they need sufficient revenue.
- Private companies are unlikely to invest heavily in an existing passenger railway.
- Manufacturers and infrastructure contractors will build a new system. Without a generous subsidy, they will seldom operate the system for more than the warranty time.
Conclusions

Regional and Intercity Trains have a Transport Role but:

- Can only be justified where the population size requires frequent service
- For success there has to be a ‘Rail Mentality’
- People prefer to ride a train and not a bus, but the bus is cheaper and usually more frequent
- Legislation against cars is almost a necessity for financial viability
- An excellent urban transport system is a necessity
Conclusions Continued

- Revenue from property management and development around stations is a necessity
- **Must** have consistent source of subsidy
- Regional railways should be subsidized by the region in which they operate
- On most routes, high speed is less important than frequency

With all this, maybe regional and intercity passenger trains make economic sense
“It does not matter how fast the intercity trains are so long as they are frequent, on time, and LOOK as though they go fast!”

Quote of a United States State Governor