

Performance-Based Technology Scanning for Intercity Rail Passenger Systems

Carl D. Martland

Lexcie Lu

Dalong Shi

Joseph M. Sussman

Massachusetts Institute of Technology

Presented to the

Transportation Research Board

Washington, DC

January 13, 2003

Objectives

- Identify technological opportunities that will improve the competitive position of the world's railways over the next 15-25 years
- Develop methodologies that will help individual railways determine the most promising technologies:

“Performance-Based Technology Scanning”

Performance-Based Technology Scanning

- General search for technologies
- Technology mapping
 - Identify points of leverage for cost, service, safety, or capacity
- Rail systems modeling
 - Model technologies in terms of performance capabilities
- Customer requirements analysis
 - Estimate Customer responses to enhanced rail performance
- Analysis of specific technologies

Approach

- Model rail and competitor performance
 - Access
 - Terminal
 - In-vehicle time
- Model customer utility as a function of time and cost
- The best technological opportunities are the ones that give railroads a competitive edge

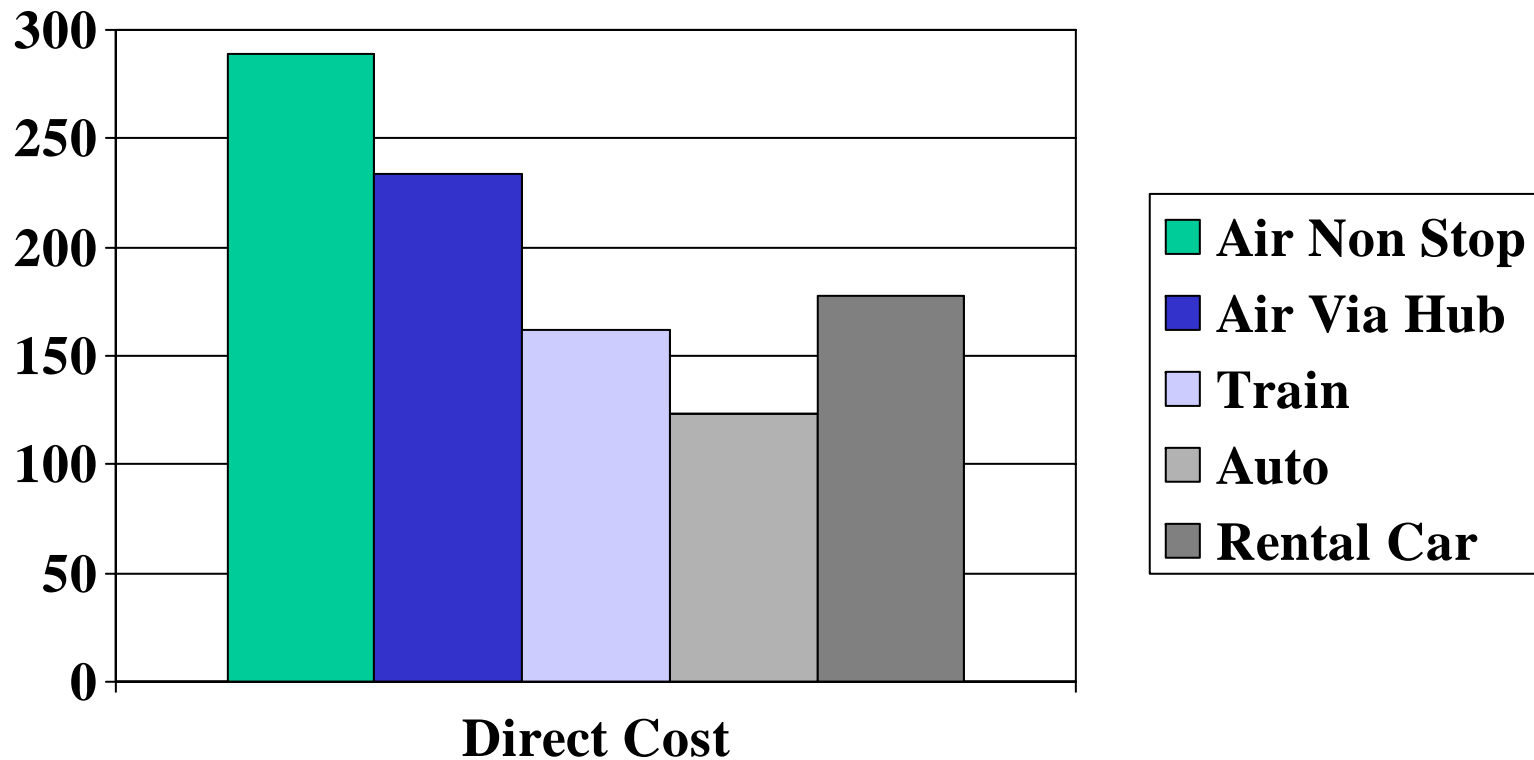
Classes of Technologies Relevant to Passenger Services

- Operational technologies
- Accommodation/entertainment technologies for passengers
- Accessibility technologies
- Consolidation/coordination technologies

Key Market Segments

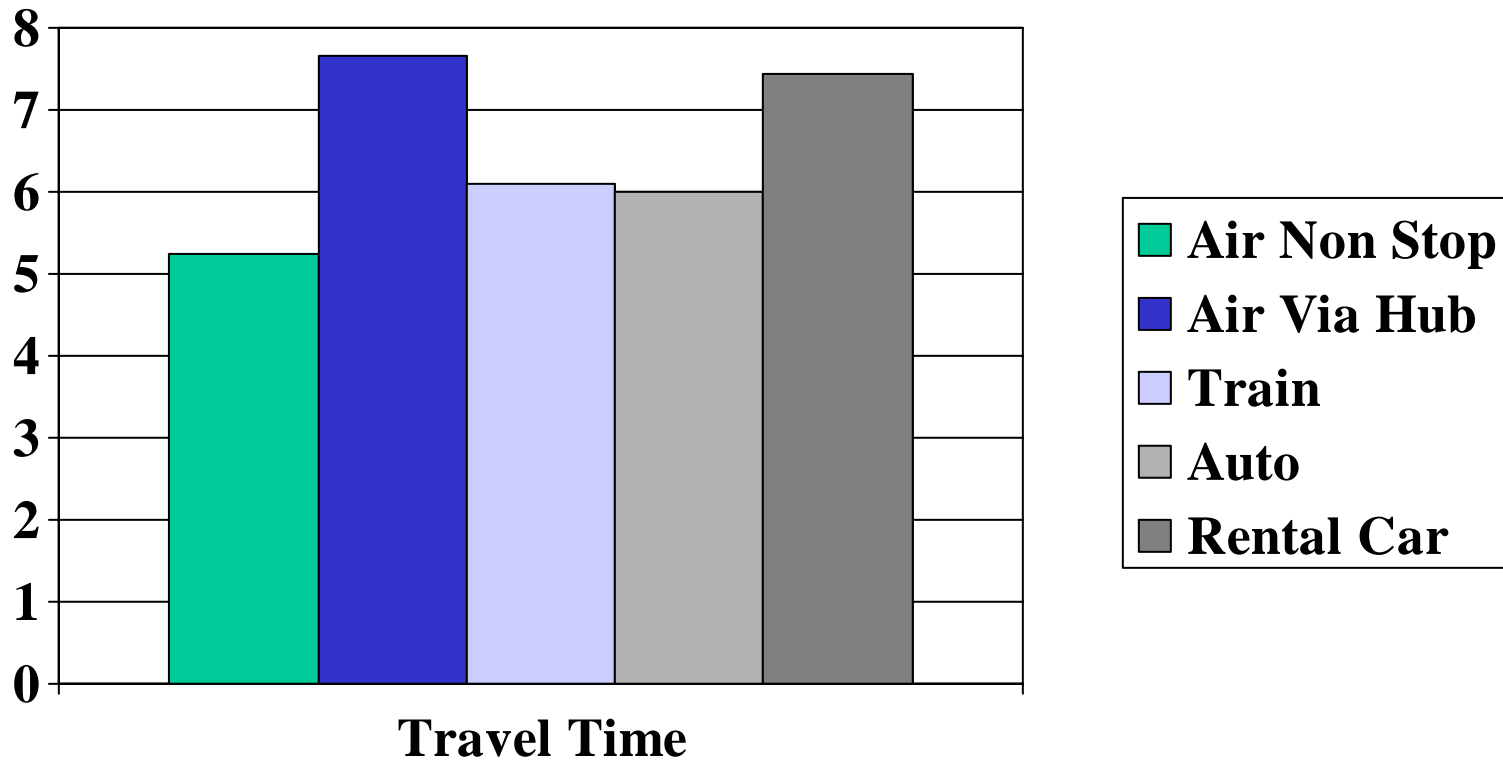
- Medium distance rail service over a dense network as a direct competitor to air, bus, or automobile transportation
- Rail as part of a long, medium-speed intermodal trip involving air or bus connections
- Long distance, medium-speed overnight rail services

Rail and Automobile have the Lowest Direct Cost (Hypothetical 250-mile Trip)

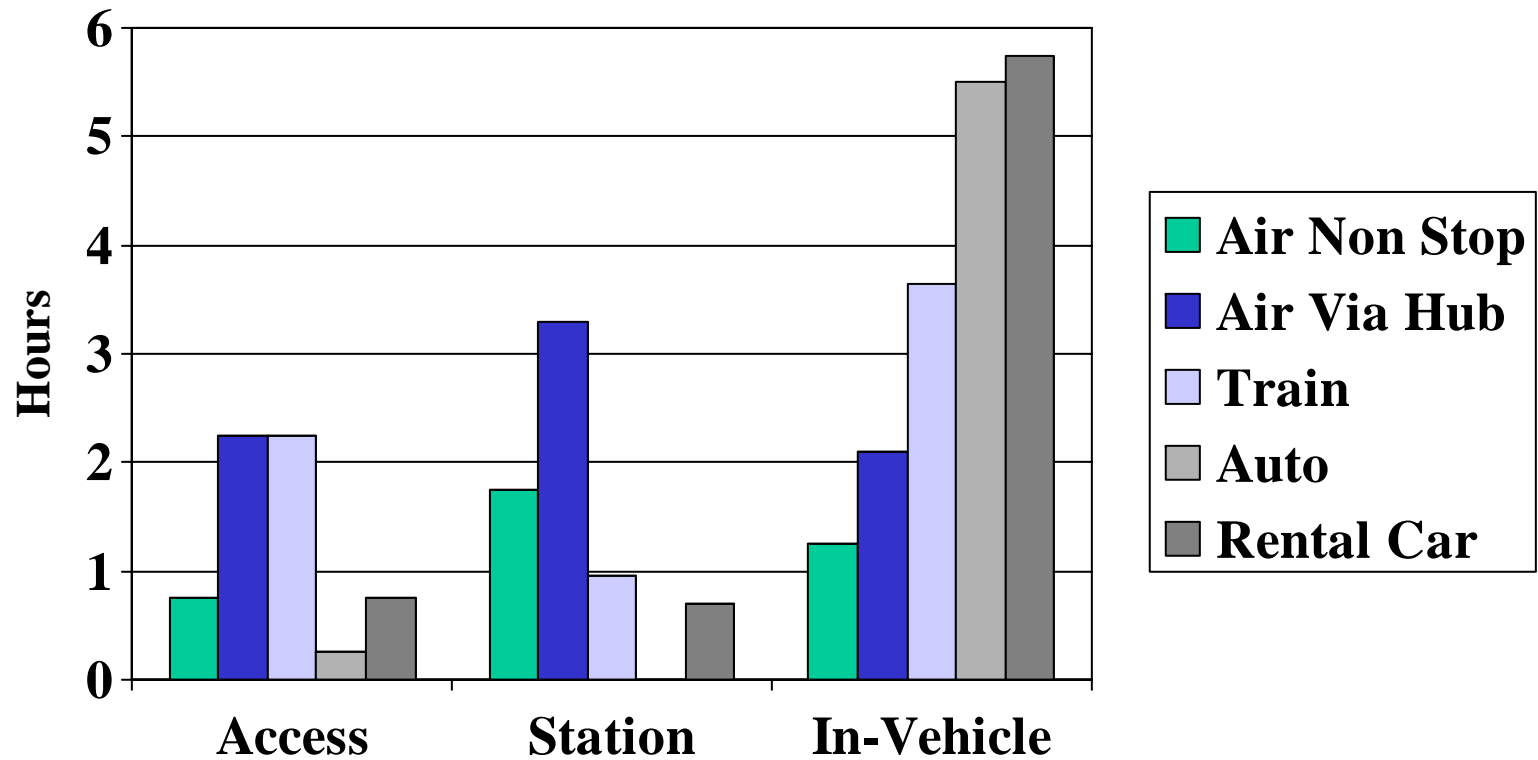


Air is Fastest – but not by Much

(Hypothetical 250-mile Trip)



How the Time is Spent is Important (Hypothetical 250-mile Trip)

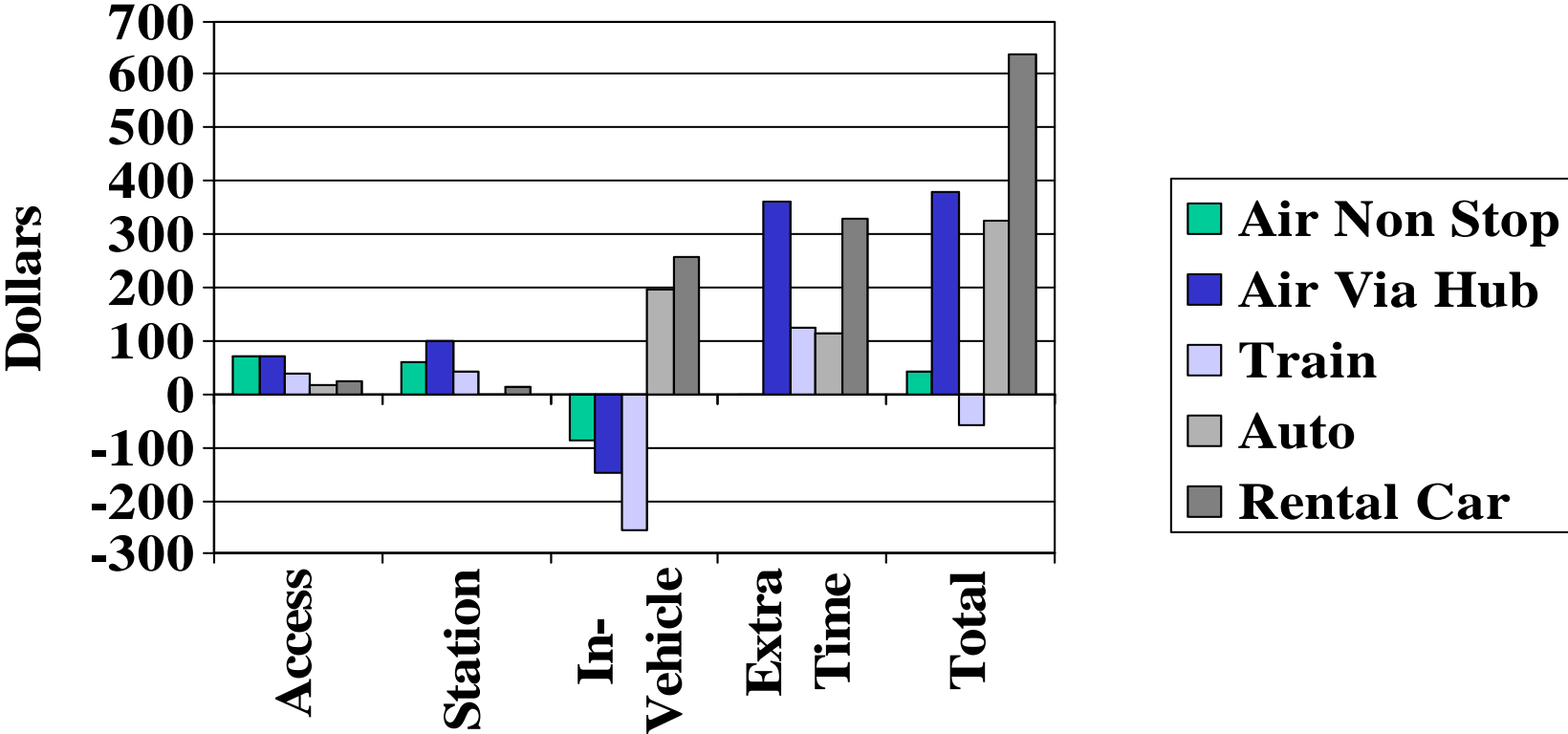


Hypothetical Values of Time For a Business Traveler

- Working: \$100/hour (a benefit)
- Entertainment: \$0
- Waiting time in terminal: (\$10/hour)
- Access & traveling: (\$20/hour)
- Processing in terminal: (\$50/hour)
- Extra time relative to fastest option: (\$150/hour)

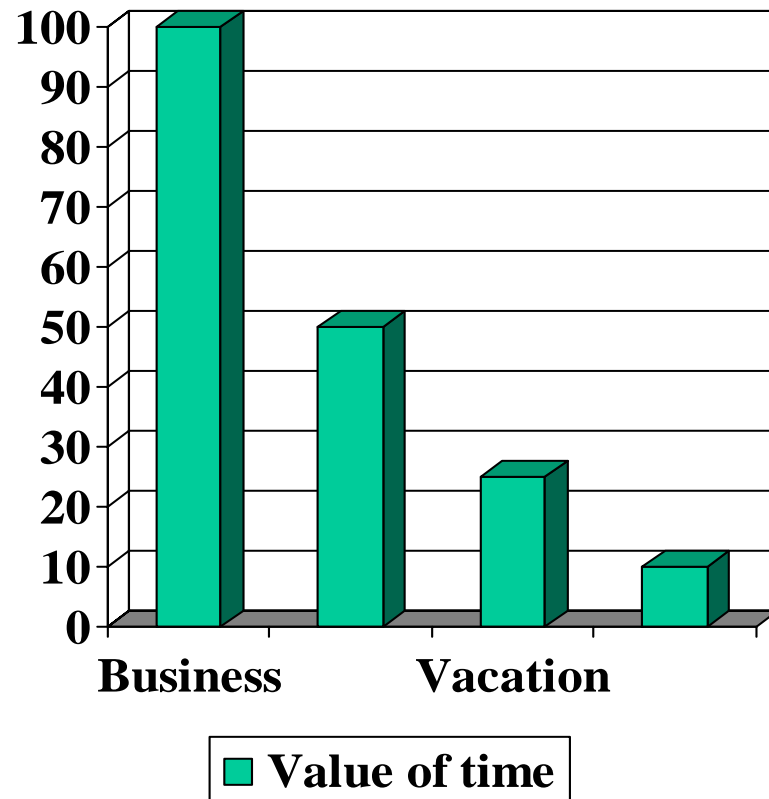
Disutility of Time for Business Travelers

(Hypothetical 250-mile Trip)



Other Types of Travelers Will View the Same Options Differently

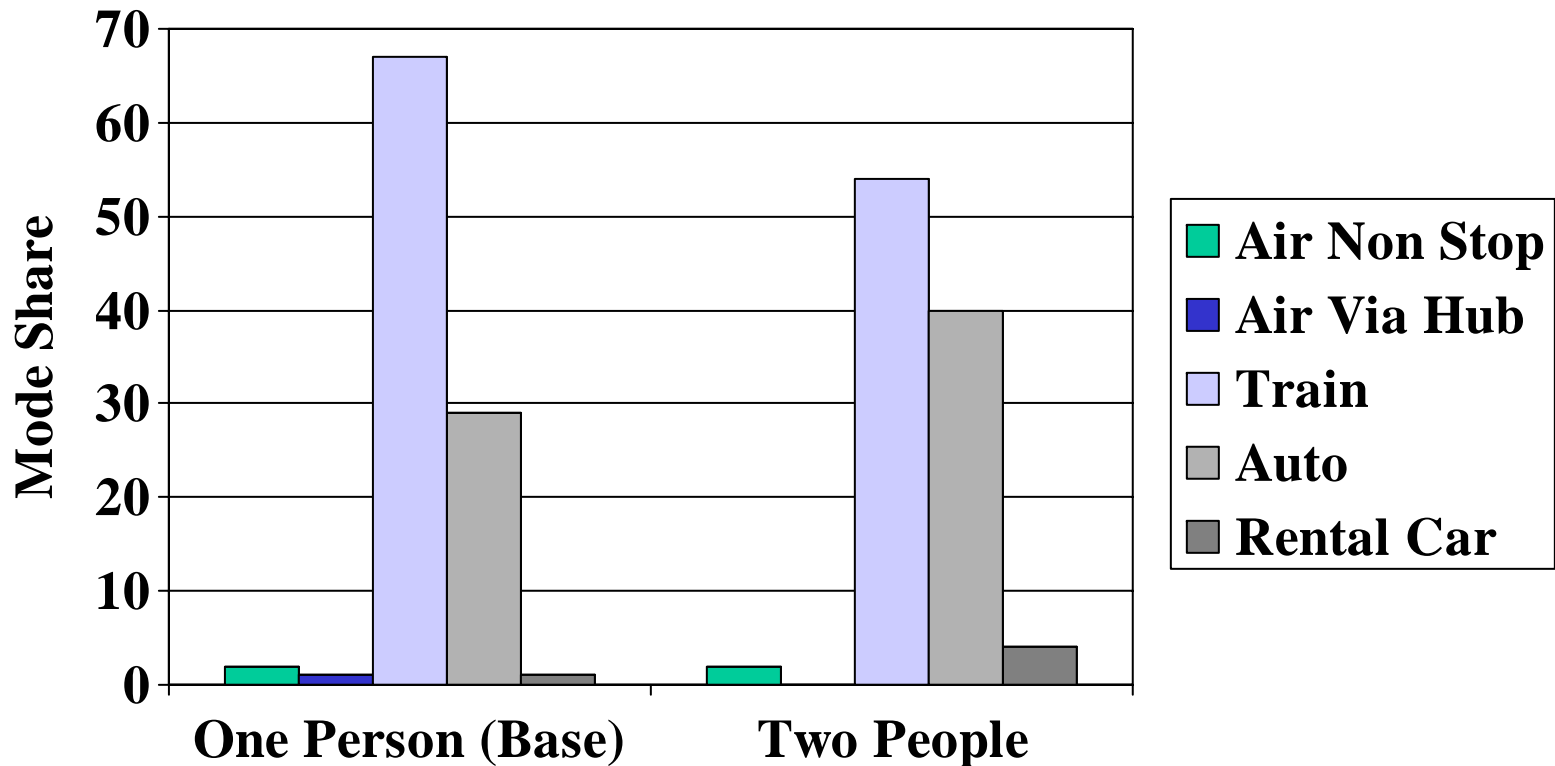
- Value of time can be much lower
- Opportunity to do work may not be relevant
- Opportunities to dine or shop may be important



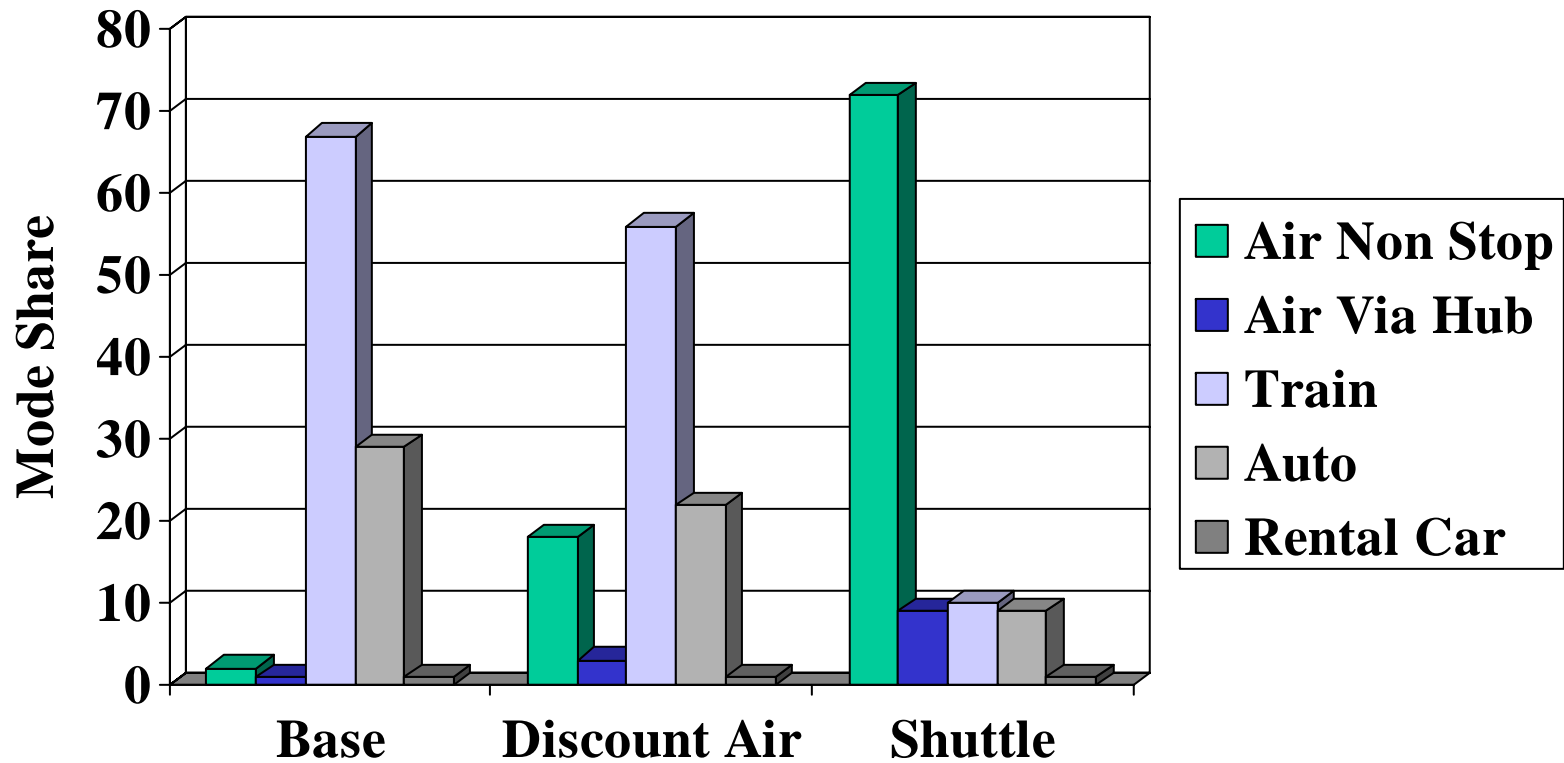
Relating Utility to Mode Split

- Assumptions
 - Mode split is dependent upon perceived utility
 - Value of time provides a meaningful measure of utility
 - Logit model relates mode share to utilities
- Goal
 - Demonstrate how various types of technologies can enhance rail competitiveness

Rail and Auto Capture the Market if Air Travel is Expensive (250 Miles)

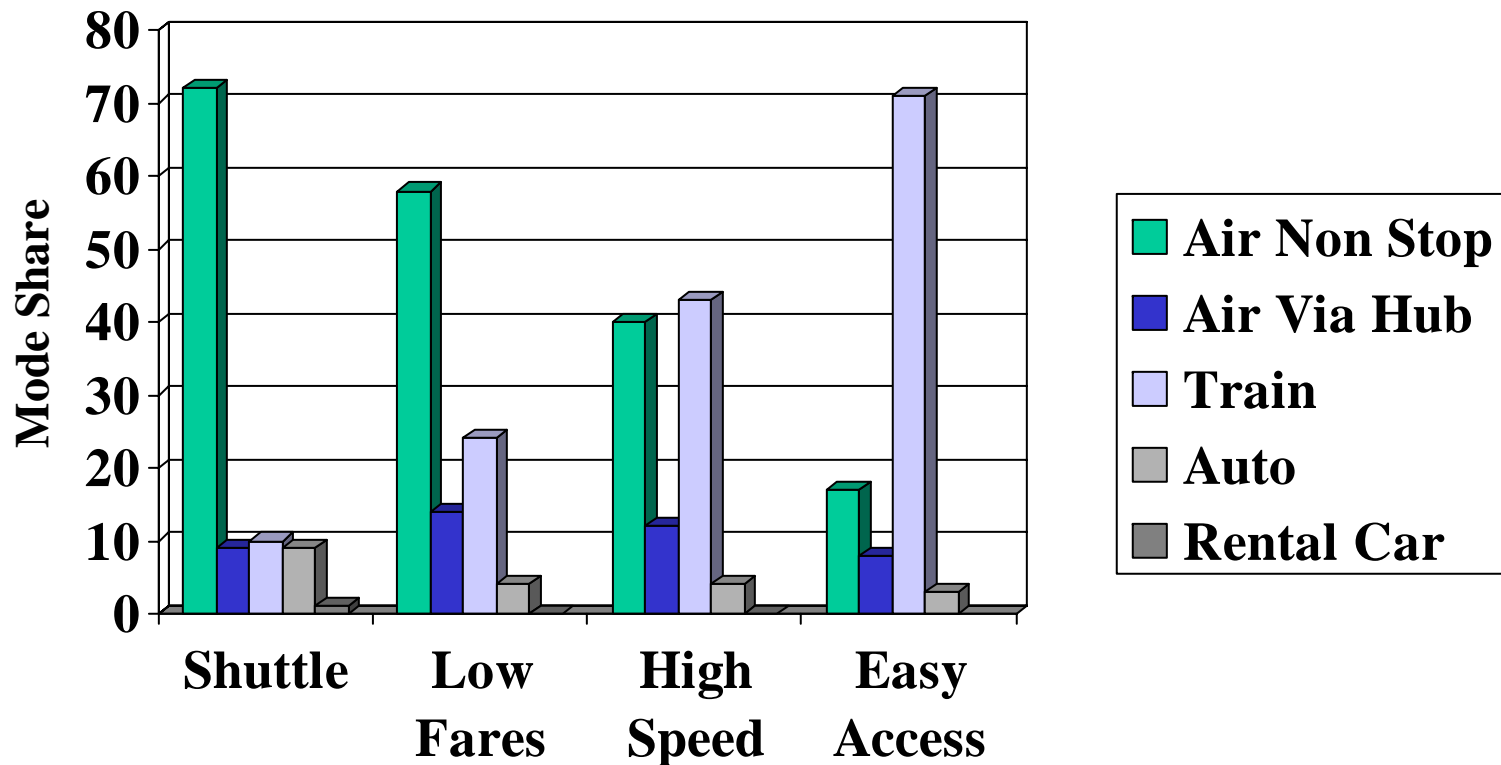


However, Discount Air Services Capture Most of the Market (250 Miles)

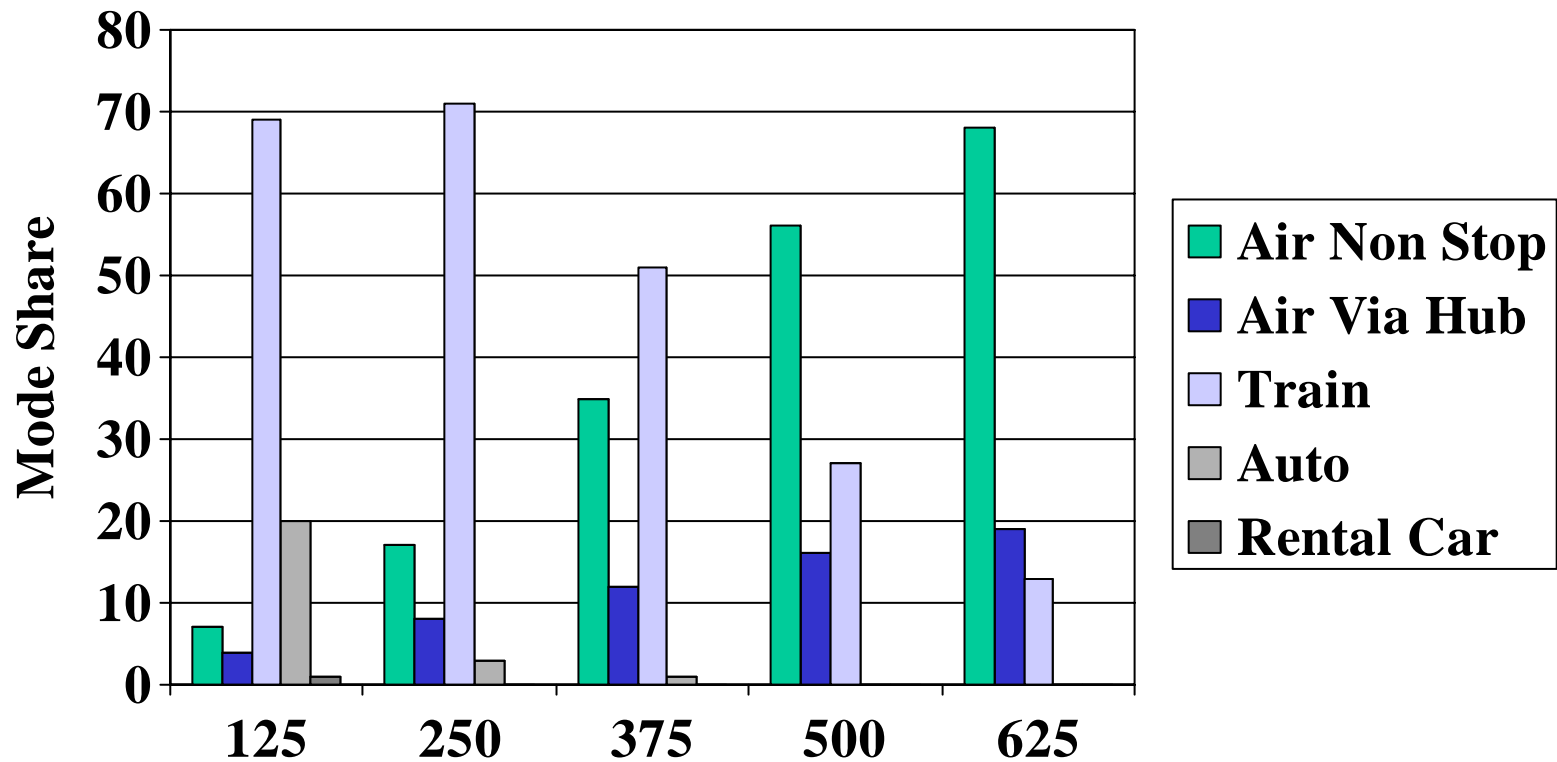


Rail Can Respond in Various Ways

(250 Miles)



Rail is Most Effective at Intermediate Distances (Easy Rail vs. Shuttle)



Other Markets

- Air-rail intermodal
 - Rail can provide connections to major air hubs, eliminating need for short flights
 - Rail can help integrate operation of nearby airports
 - Integrated terminal operations are key
- Air-bus intermodal
- Overnight rail
 - Timing and comfort may be more important than speed
 - Opportunities to link with express package services

There *IS* a Role for Rail and a Need for Technology

- Rail can be competitive in many markets
 - Price, speed, travel time, comfort, and convenience all are relevant
- Technologies that affect *ANY* of these factors can be relevant
- PBTS provides a methodology for comparing the whole range of potentially available technologies

Utility is the Key, not Speed!

- **Importance of passengers utility:**

Utility of total trip

Total trip time

In-vehicle time

Time spent travelling at high speed

Strategies for Making Rail More Competitive

- Systems issues:
 - Number, quality, location, and accessibility of stations
 - Effective services, based upon network design, frequency of service, connection times, and operations control
 - Enhanced passenger amenities on trains and in and near terminals
 - Better integration with air and bus services

Technological Research Needs to Go Beyond “High Speed Rail”

- Technological R&D should seek technologies with the most cost-effective impact on passenger’s utility
- Time spent traveling at full speed is likely the least onerous part of the trip – and the hardest to speed up!
- Ease of access, efficient terminals, and opportunities to make better use of time in trains and in stations require much more than traditional rail technologies.

Technological Opportunities

- **Communications & Information Technology**
 - Customer service, personal entertainment and productivity, coordination and control of operations
- **Dramatically better intermodal coordination**
 - Ticketing, security, baggage handling, terminal design and coordination of operations
 - Improved transit, highway, and pedestrian access
- **More effective combinations of passenger and freight services**
 - Joint use of infrastructure, of trains, and of special-purpose equipment

Concluding Observations

- Technological advances will be rapid – but they will NOT be driven by needs of railways
- Highway and air transportation will likely benefit more directly from R&D
- Accessibility, comfort, and productivity of time can be major assets for railways
- “High Speed Rail” is a limited and possibly a limiting concept. What’s needed is:
 - ***“Competitive, Integrated, Effective Rail”***
- This may seem obvious, but take a look at DOT research budgets and State DOT rail plans

Further Reading: Metropolitan Access

- How access might improve intercity rail
- Customer-focused, market-pull approach to technologies
- Urban infrastructure serves everyone

Please pick up a handout as you leave

From the Limiteds and the Zephyrs to the 21st Century MetroFlyer

(or The Vital Role of Metropolitan Access
in Intercity Passenger Transportation)

*Alex Lu and Carl Martland, Center for Transportation Studies, MIT 1-153,
77 Massachusetts Avenue, Cambridge, MA 02139-4301. lexie@mit.edu, martlan@mit.edu*

Presented at the 82nd Annual Meeting of the Transportation Research Board, Washington, D.C., January 2003.



*The Modern Day Olympian Hiawatha – a “Limited” – at Glenview, Illinois.
Wouldn't it be wonderful if this train, like the North Shore Line, also made stops on the Loop?*

Further Reading: Technology Evaluation

- Understanding technologies and passenger utilities
- Evaluating technologies
- Technology-push approach

Please ask for handout
Nº 2 as you leave

Are High Speed Rail Customers Really Speed Demons?

(or Performance-Based Technology Scanning
for Intercity Rail Passenger Systems)

Carl D. Martland, Lexie Lu, Dalong Shi, and Joseph M. Sussman.

Center for Transportation Studies, MIT 1-153,
77 Massachusetts Avenue, Cambridge, MA 02139-4301. martlan@mit.edu

Presented at the 82nd Annual Meeting of the Transportation Research Board, Washington, D.C., January 2003.



Dear Customer, Would you like the Cadillac, the Porsche, or the SUV?
(Amtrak F-40 #280 and AEM-7 #901 at Boston South Station, Mass.)

Still Like More Information?

- Compendium of MIT's recent rail research
 - Technology Scanning: Passenger & Freight
 - Metropolitan Access
 - Open Access?

Please ask for a CD-ROM or leave your business card

