Chapter 7
RESULTS

This chapter synthesizes, by topic, the results of the projections.[1] It covers not only system requirements and performance but also benefits and costs, and treats all the illustrative corridors except for the Empire and Southeast examples, which the analysis regarded as Northeast Corridor extensions and which receive special treatment in Chapter 8.

SYSTEM REQUIREMENTS AND PERFORMANCE

Investment Requirements

Initial investment costs for HSGT vary widely among corridors, and particularly among technological options. The more ambitious options show the widest variations among corridors in absolute terms, as Table 7–1 shows.[3]

The variations within each technology reflect several important factors:

Table 7–1
Initial Investment Cost Ranges for Illustrative Corridors

Technology	Typical Range of Total[2] Initial Investment per Route-Mile (Millions of Dollars)
Accelerail 90	$1 to $3.5
Accelerail 110	$2 to $5
Accelerail 125F	$3 to $5.5
Accelerail 125E	$5 to $7.5
Accelerail 150F	$4.5 to $7
Accelerail 150E	$6.5 to $9
New HSR	$10 to $45
Maglev	$20 to $50

Corridor length. Because each individual corridor was estimated as a separate project, shorter corridors must absorb a greater share per route-mile of fixed support facilities (e.g., equipment shops) than longer corridors. San Diego—Los Angeles has relatively high costs for this among other reasons.

Traffic densities. As traffic densities increase (including ambient freight and commuter volumes in Accelerail options), the need arises for more double track and passing sidings.

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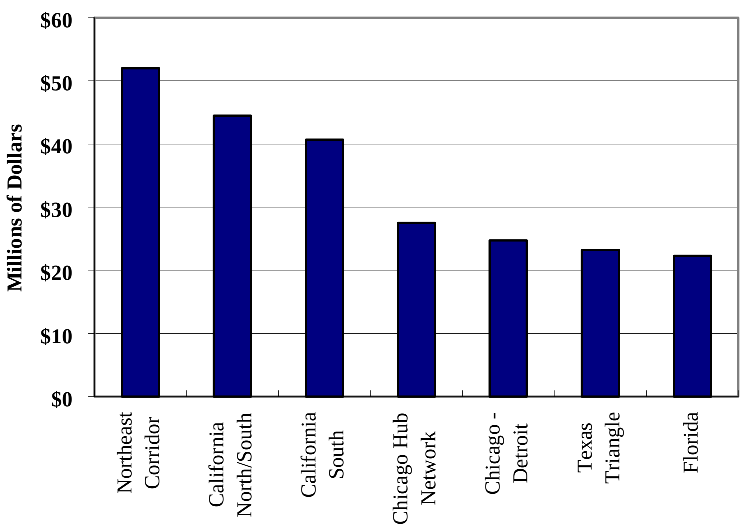
[1] By their very nature, projections depend on the reasonableness of their underlying assumptions (described in Chapter 4) and are subject to divergences between the assumptions and actual conditions. For these and other reasons, the results of the systems described in this report may vary materially from the projections. This further underscores the need for detailed studies prior to initiation of corridor development.
[2] I.e., including infrastructure and vehicles.
[3] See Table 7–4, page 7-21, for the projected initial investment by case.

Size of vehicle purchase. The initial vehicle purchase varies with route mileage, HSGT ridership, and concomitant frequency. While amounting to between 20 and 40 percent of the initial cost of Accelerail 90 and 110 cases, vehicles comprise a small portion of total costs for more intensive options. The importance of vehicles in the initial costs of Accelerail 90 and 110 may enhance the commercial feasibility of those options, since vehicles are a more fungible investment than fixed facilities and have traditionally attracted lease financing.

Figure 7-1
Initial Investment per Route-Mile: Maglev Examples



Setting. Corridors that entail difficult mountain crossings, require major tunneling, or traverse continuously urbanized landscapes naturally incur relatively high initial costs.

Figure 7-1 summarizes the effects of these factors on the Northeast Corridor and California, as compared with some other potential HSGT sites.[4]

Whatever the cost, the different investment levels share a single purpose: to reduce line-haul travel times, and—by extension—total travel times.[5] Yet the various technology options do not produce even gradations in their trip-time effects. In fact, the typical pattern, shown in Figure 7-2 for Chicago—St. Louis, involves—

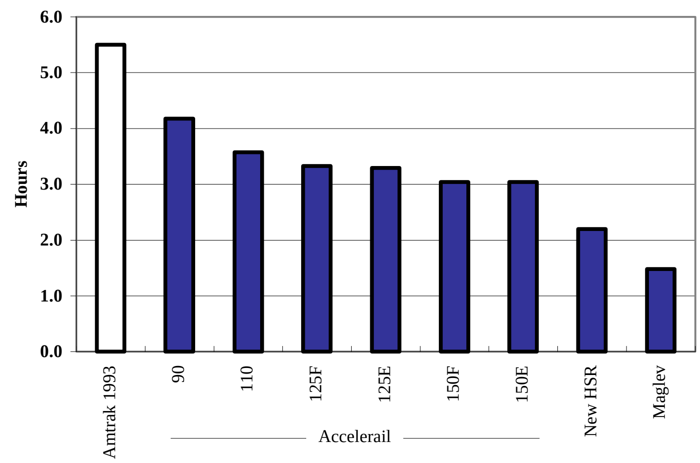
- A sharp decrease in existing Amtrak running times with the institution of tilt-train Accelerail 90 service;

[4] California's initial investment costs call for a brief explanation in light of the complex alignment situation caused by the topography and demographics of that State. In order to provide a broad range of initial costs in the Los Angeles—Bay Area segment of the corridor, this study assumed the lowest possible cost solutions at the Accelerail 90 and 110 level: via the existing Coast Line. Employing the somewhat more heavily populated Valley route via Fresno and Stockton to Oakland, the Accelerail 125 and 150 options assumed a new right-of-way only between Los Angeles and Bakersfield across the Tehachapi Mountains. Finally, the New HSR and Maglev cases were likewise assumed to cross the Tehachapis but to follow a new, more westerly alignment from the Fresno vicinity to San Jose and downtown San Francisco. Due to the massive civil works assumed in Accelerail 125 and above, the non-coastal California cases have a much higher cost per route-mile than the ranges shown in Table 7–1.

[5] See below under "demand and revenues" for a discussion of total travel times.

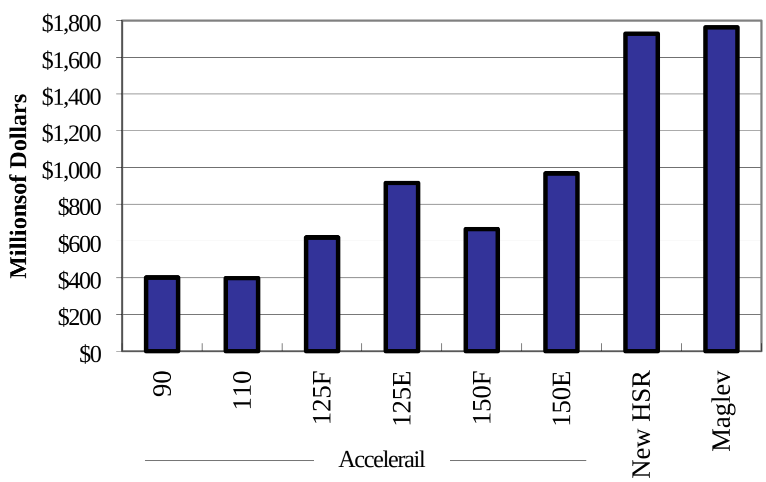
- A still marked trip time improvement in Accelerail 110;
- Slight improvements in the 125 and 150 Accelerail range; and
- Dramatic trip time benefits from New HSR and, especially, Maglev.

Figure 7-2
Line-Haul Running Times, Chicago—St. Louis



Investment requirements grow, sometimes disproportionately to trip time savings, as the options become more ambitious. These trends lead to the pattern typified by Figure 7-3, showing the dollars of initial investment per timetable-hour saved over Amtrak's 1993 performance in the Chicago—Detroit corridor. The cost per hour saved grows noticeably, although not steadily, beyond the Accelerail 110 case. This escalating cost of travel time savings raises the question whether demand and revenues grow commensurately across the options.

Figure 7-3
Initial Investment Per Hour Saved Over Amtrak 1993 Base
Example: Chicago—Detroit



Demand and Revenues

In response to an ever-improving product across the range of options, the cases generate significant demand and revenues, in several cases surpassing the 1.3 billion passenger-miles generated by Amtrak in the Northeast Corridor in 1993.

The Product

The HSGT product has three salient characteristics, which work together to influence ridership in the models for this study: travel times, fares, and frequencies.[6]

Travel Times

The ability to divert patrons from existing modes depends not on line-haul times but on comparative total travel times, which also include access to, egress from, and time spent in stations. The composition of those total travel times varies dramatically among modes, as shown in Figure 7-4 for the Chicago—Detroit market. In any comparison of total timings, auto has an inherent advantage in its door-to-door convenience (avoiding access and terminal time), and air benefits from its superior cruising speeds.

Figure 7-4
Composition of Each Mode's Total Travel Time
Example: Chicago—Detroit City Pair

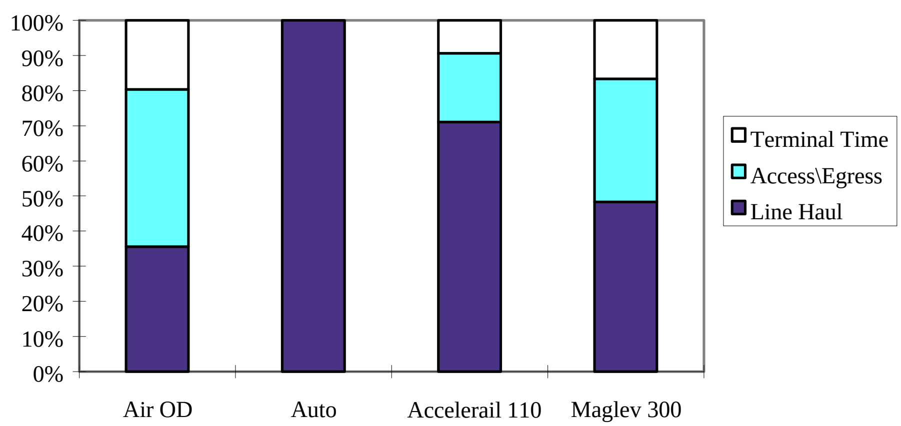


Figure 7-5 compares the total travel times by mode in three sample city-pairs: San Diego—Los Angeles (128 miles), Chicago—Detroit (280 miles), and Los Angeles—Bay Area (425 miles). The examples indicate that an Accelerail trip, in total, can take longer than the often cheaper auto in shorter city pair markets, but that Accelerail timings can better those of auto in medium- and longer-distance corridors. Maglev can outperform air on total travel times even in markets in the 400-mile range, whereas New HSR approaches but does not achieve time comparability with air in such longer markets. The competitive situation will, of course, differ from market to market depending on specific route length and

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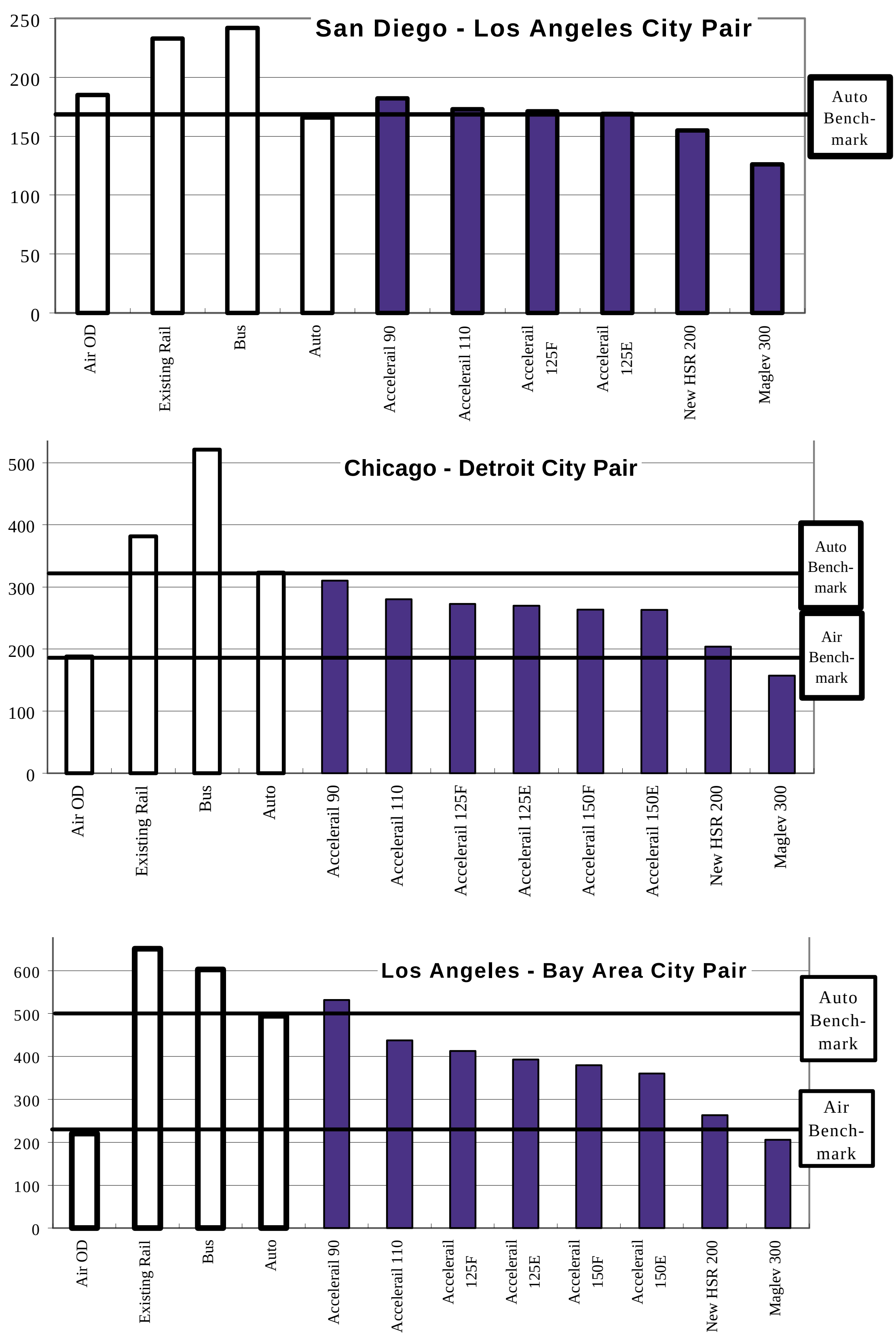
[6] Service quality factors are theoretically represented in the coefficients of the demand models. Obviously, a transport entity that finds new ways to serve the public better can defy the limitations of mathematical models and do better than the predictions, just as a failure to provide quality control after the project is built will undermine operating and revenue performance.

Figure 7-5: Competitive Position of HSGT in Three Sample City Pairs—Total Travel Time in Minutes

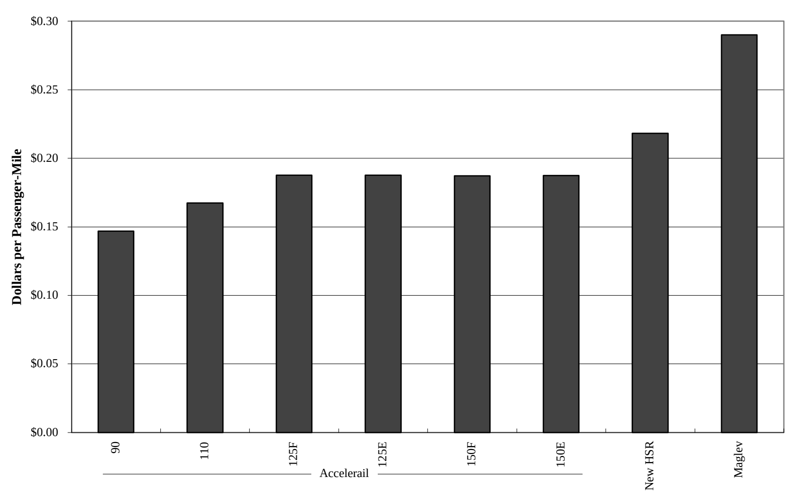


alignment considerations and traffic congestion levels in major cities. The demand projections for this study clearly reflect these competitive facts of life: the diversion rates to HSGT from auto and air mirror very closely the decreases in HSGT trip times across options.

Fares

Average fares, as measured by yield,[7] vary dramatically from one corridor and option to another, in response to the competitive situation and to the quality of the HSGT product. Generally, fares increase gradually as travel times improve across the options, since the traffic will bear a higher price for an improved service. In keeping with the trip time trends described above, the increases are particularly marked in the range of Accelerail 90 and 110, and again for New HSR and Maglev. The Chicago Hub Network's fares, depicted in Figure 7-6, typify the trends in the illustrative corridors.

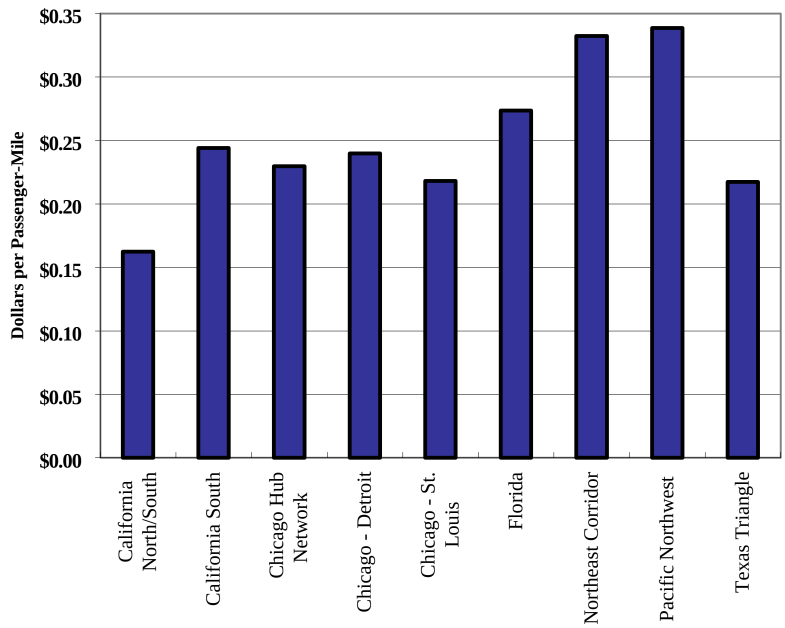
Figure 7-6
Fare Yields in the Chicago Hub Network (Year 2020)



Across all options, each corridor has a distinct niche on the array of fare levels, as shown in Figure 7-7. What the traffic will bear in one corridor, in the presence of low-fare air competition, will differ markedly from yields in corridors where airline operating costs and prices are high. The California corridor illustrates this point: low-fare airline competition over the prime Los Angeles—Bay Area market precludes the HSGT operator from charging high fares. The only significant increase in fares over 16 cents per mile—in Maglev, which betters total air travel time between Los Angeles and the Bay Area—remains

[7]The models for this study posit specific business and nonbusiness fares for each HSGT city-pair. The average fare yield per passenger-mile in each corridor (passenger transportation revenues divided by passenger-miles) indicates the relative prices charged to HSGT passengers and provides the basis for this section.

Figure 7-7
Fare Yield by Corridor, Year 2020
Example: New HSR



at 20 percent, because Maglev's travel-time edge is not pronounced. By contrast, the Northeast Corridor—with its high air fares and ideally-configured HSGT markets (particularly New York to Washington, and New York to Boston)—allows for very high New HSR and Maglev yields, more than half again as high as the current Amtrak estimated average fares.

Frequencies

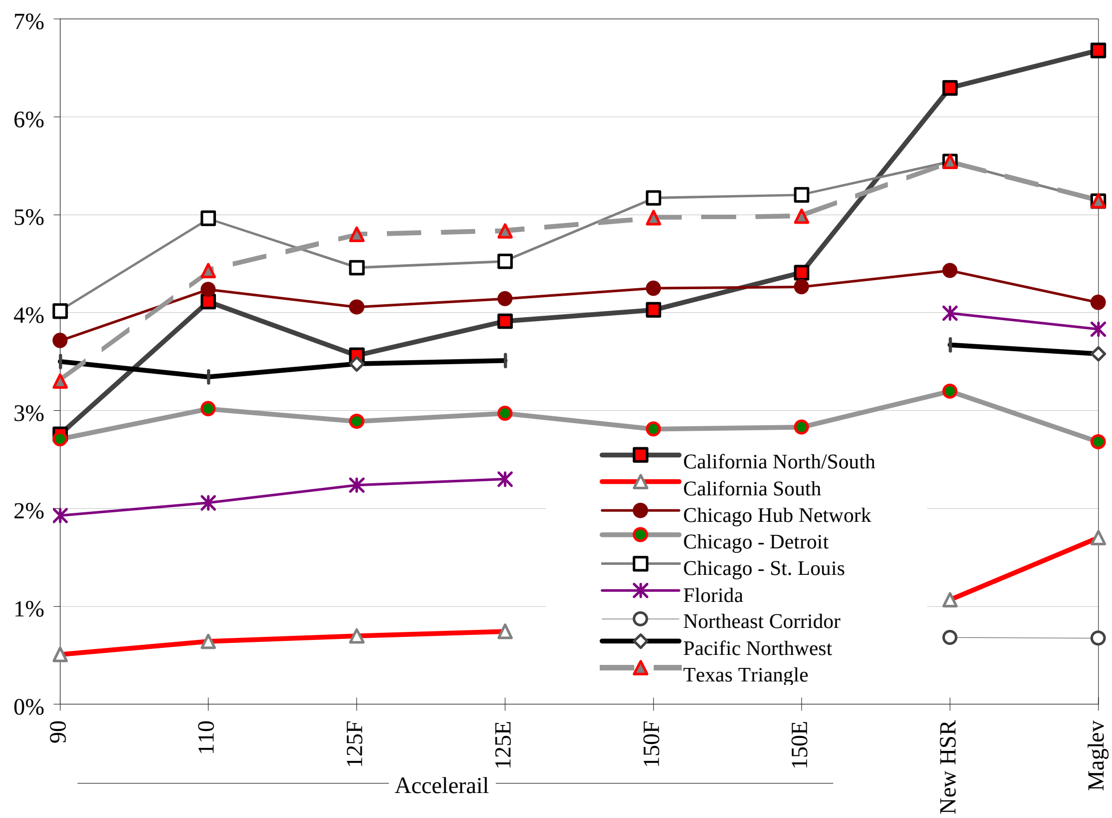
Frequencies—arrived at iteratively—vary significantly among corridors and cases in response to, and as a contributing factor toward, demand. For the Accelerail options, most corridors support between 10 and 20 round trip trains per day. The California corridors, with their heavier traffic densities, justify more frequent service. New HSR and Maglev both entail much higher train frequencies, as exemplified by the 100 daily round trips projected in the Northeast Corridor between New York and Washington. These high frequencies allow New HSR and Maglev to attract ridership despite their generally higher fare levels.

The Outcome

This analysis suggests some limitations on the ability of HSGT to divert auto traffic under current travel and land use patterns, conditions of energy availability and price, nearly universal auto ownership, and the ready availability of the Interstate System. **Should these**

underpinnings of America's transportation structure shift in a fundamental way—beyond the mere inconvenience of growing congestion, which affects all modes—diversion levels from auto to HSGT would be higher. As projected in this study, however, most cases divert between three and six percent of auto trips (Figure 7-8). The travel time improvements in New HSR generally attract noticeably higher auto diversions, despite fare increases of 20 to 40 percent over Accelerail levels. In California, where air competition obviates such fare increases, the auto diversion rate grows by 50 percent from Accelerail to New HSR.[8]

Figure 7-8
Percent of Intercity Auto Traffic Diverted to HSGT by Corridor, Year 2020



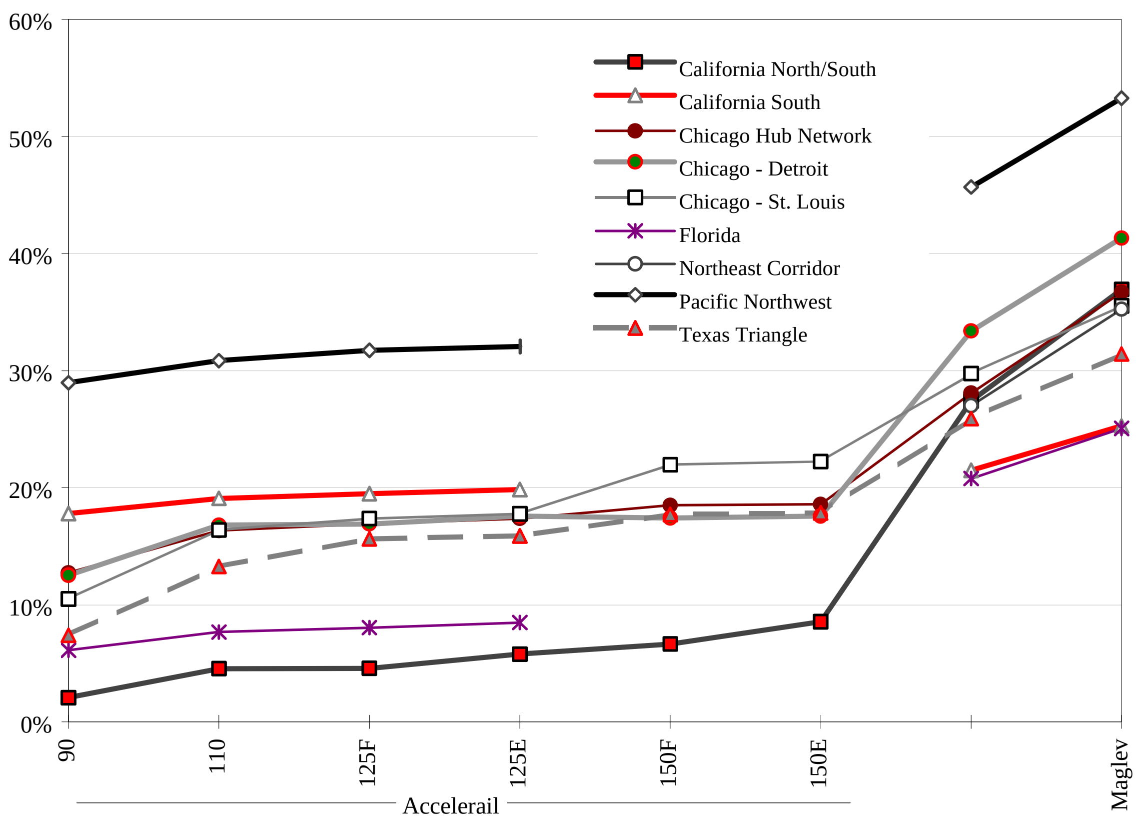
Corridors with short average trip lengths (under 150 miles) show the lowest diversion rates, for price and time reasons described above. Auto diversion percentages for New HSR and Maglev in the Northeast Corridor are relatively low because they are incremental to those accomplished by Accelerail 150E, assumed to be in place by 2000, and by its precursor Accelerail 125E, currently extant.

[8] Of course, the trip time improvement from Accelerail to New HSR is particularly strong in California due to the routing changes explained in footnote 4.

The auto diversion rates to Maglev show in stark relief the balancing act inherent in HSGT pricing. With total trip times often better than for any other mode, Maglev can support very high fares in airline-competitive markets. This policy will often maximize net revenues to the HSGT entity, but discourage auto diversions. An actual Maglev operator would have the flexibility to use yield management and variable pricing to maximize revenue and still attract greater automobile-based traffic levels than those posited here.[9]

While varying widely due to local market conditions, air diversion percentages

Figure 7-9
Percent of Intercity Air Traffic Diverted to HSGT by Corridor, Year 2020



respond generally to the degree of improvement in the HSGT product and, with New HSR and Maglev, from one fifth to half the air traffic base diverts to HSGT. (See Figure 7-9.) Whatever the starting point, the diversions climb markedly to Accelerail 110, grow by degrees through the other Accelerail options, and soar with New HSR and Maglev as HSGT enters the range of time parity with air in major endpoint markets. The curve is steepest where the improvements are proportionately greatest—in the long California corridor, with

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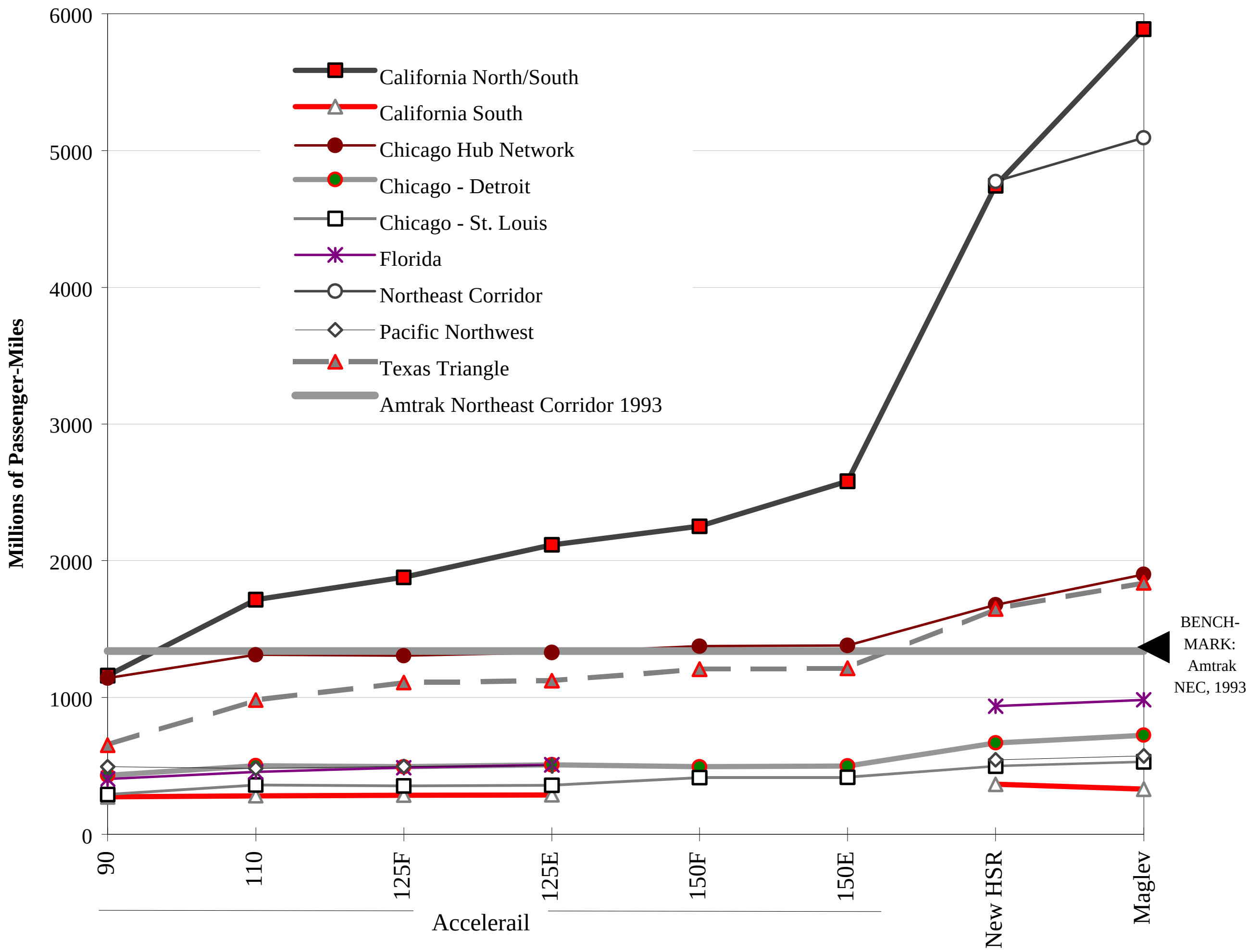
[9] The greatest challenge HSGT faces in attracting automobile traffic is overcoming the inherent economic advantage enjoyed by the automobile for two or more persons traveling together. Since the auto can carry several people for the same cost as carrying one, its price advantage compared to public transportation increases with group size.

the introduction of a new alignment between Los Angeles, the Central Valley, San Jose, and downtown San Francisco in the New HSR and Maglev options. The Northeast Corridor air diversion rates in Figure 7-9 are all the more noteworthy because they are incremental to such diversions as have already taken place or are ascribed to Accelerail 150E.

These air and auto diversions, plus diversions from rail and bus where applicable, combine to produce large quantities of transportation in many of the illustrative corridors. Figure 7-10 summarizes the passenger-miles by case in the year 2020 and provides a useful benchmark for size: Amtrak's 1993 operation in the Northeast Corridor, the largest rail passenger market in North America. The chart indicates that—

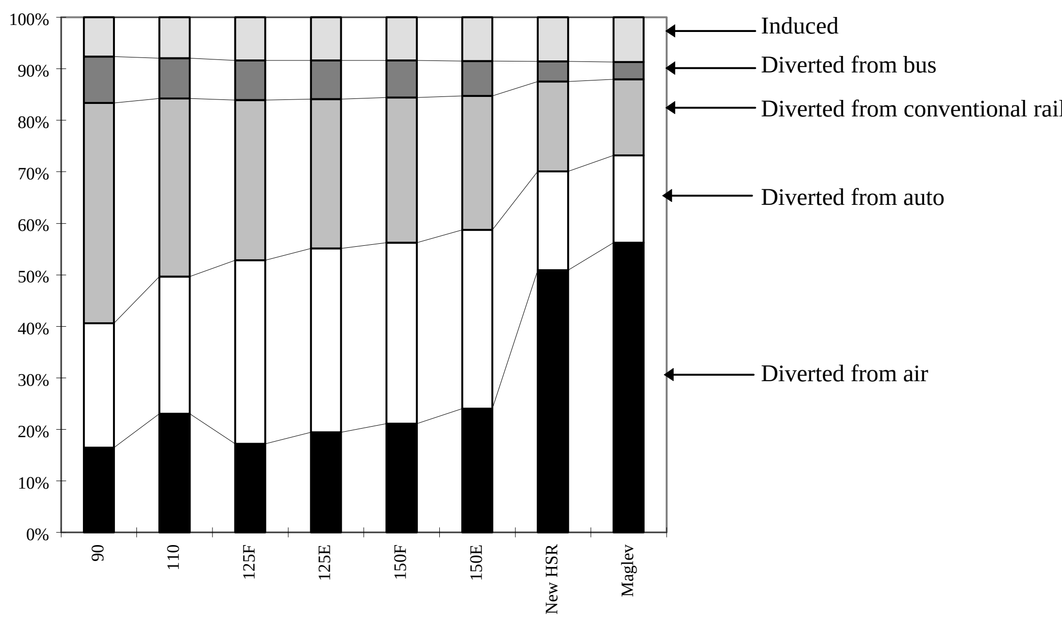
Figure 7-10
Passenger-Miles, Year 2020, by Corridor



- Three corridors may exceed Amtrak's existing Northeast Corridor volumes by the year 2020: the California North/South corridor, the Chicago Hub Network, and the Texas Triangle. California could generate volumes four times as large as the Northeast Corridor did in 1993.
- The Northeast Corridor traffic could quadruple by the year 2020 with the introduction of New HSR or Maglev.
- Commensurate with their size, several other corridors would also generate sizable traffic levels, approaching half the benchmark Northeast Corridor volumes.

These are significant volumes, and noteworthy findings. **Despite profit-maximizing fare levels and very modest diversions, particularly from auto, HSGT would generate transportation production on a meaningful scale outside the Northeast Corridor, although at a significant financial cost.** While sheer size cannot assure partnership potential, it underlines the importance that HSGT can achieve in intercity transport on a nationwide scale.

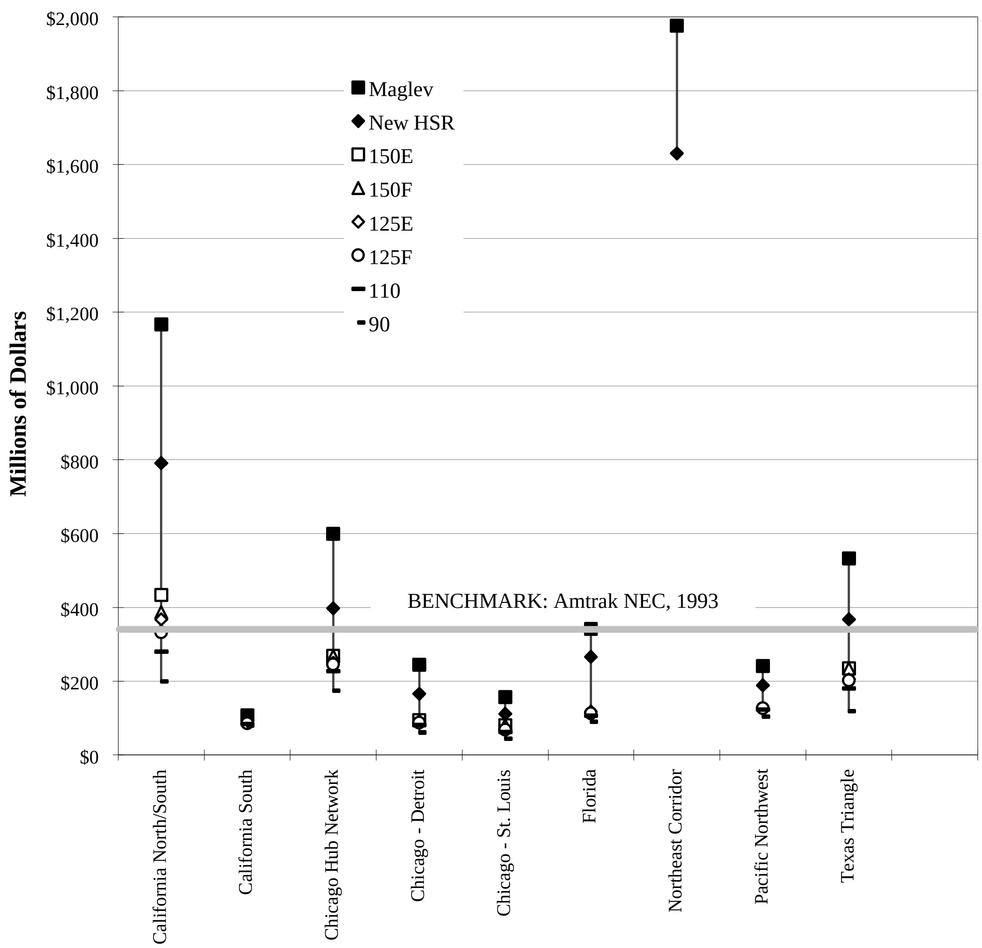
Figure 7-11
California North/South Corridor—
Composition of Traffic Base by Option, Year 2020



The composition of the HSGT traffic base would reflect diversions from the source modes. Figure 7-11 depicts the shifts, by option, in the sources of the traffic base in the California North/South corridor. In particular, the chart shows how diversions from air assume a predominant role in the New HSR and Maglev options, in keeping with their trip time capabilities.

The combined effects of the pricing policies and passenger volumes appear in the total system revenues, summarized in Figure 7-12. Here too, the California North/South, Chicago Hub Network, and Texas corridors could exceed the Northeast Corridor 1993 benchmark. The huge volumes and higher fares in the Northeast Corridor for New HSR and Maglev would, of course, produce revenue levels much higher than for other corridors.

Figure 7-12
System Revenues by Corridor and Technology Option, Year 2020

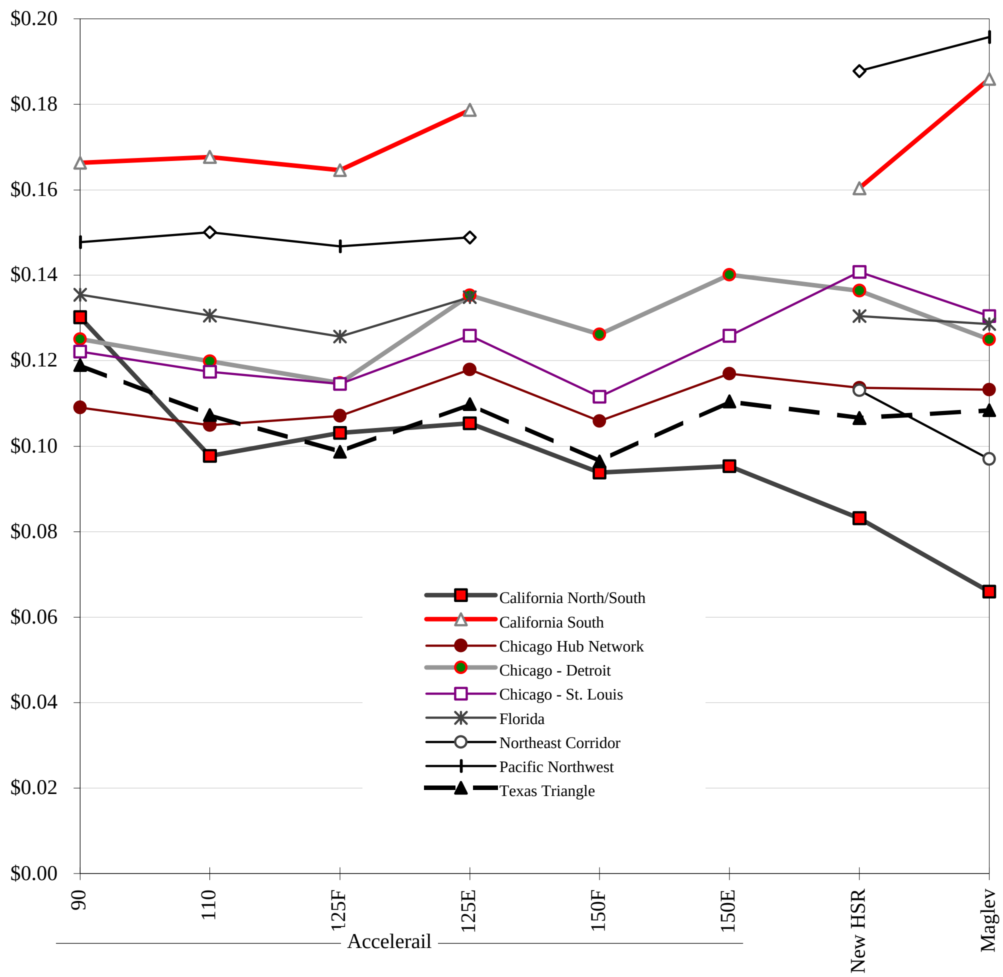


Operating and Maintenance Expenses

For most illustrative corridors, this analysis projects HSGT to cost approximately 10 to 14 cents per passenger-mile to operate and maintain. (Figure 7-13.)

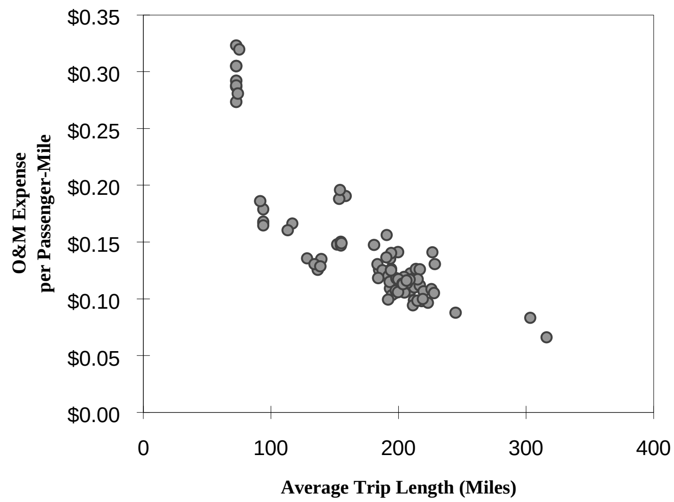
For all cases taken together, the operating and maintenance expense model produces unit expense results that respond predictably to system design and operating efficiencies. Such factors as traffic volume, route length, passenger-miles per train-mile, load factor, passenger-miles per gross ton-mile, passenger-miles per train-hour, and average trip length strongly influence the cases' expense levels. Figure 7-14, for example, shows a discernible relationship between average trip lengths and operating and maintenance unit expenses.

Figure 7-13
Operating and Maintenance Expenses Per Passenger-Mile, Year 2020



Differences in unit expense levels **among corridors** reflect in large measure the above factors as predestined by each region's geography and demographics. Exemplifying this phenomenon are the Maglev cases in California and the Northeast Corridor; the former,

Figure 7-14
Operating and Maintenance Unit Expenses Versus Average Trip Lengths (Year 2020—All Cases)

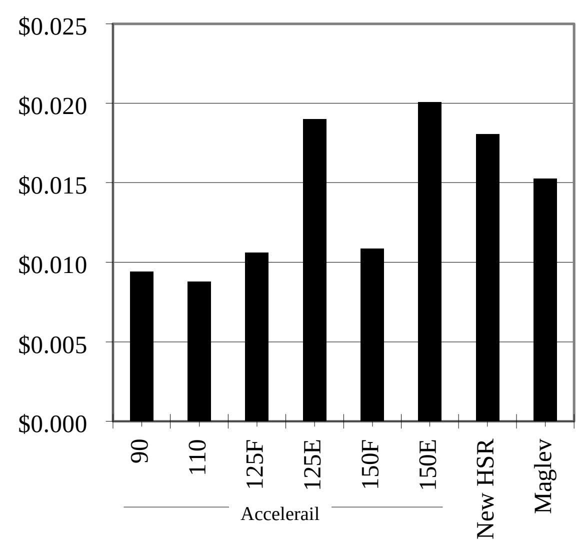


with its major city pair 400 miles in length and average trip lengths of 316 miles, can reach load factors of 56 percent, or 14 percent higher than those of the latter, with its major point of attraction in the center (New York), much shorter major markets on either side, and a 192-mile average trip. For these reasons among others, Maglev in California would enjoy unit operating expenses one-third less than those of the Northeast.

Among options in each corridor, expense levels respond to the different technologies and institutional assumptions. The unit expense curves in Figure 7-13 summarize underlying (and sometimes countervailing) trends in the major functional expense categories, as portrayed below.

Among the Accelerail options, **maintenance-of-way expenses** (Figure 7-15) reflect, first and foremost, the presence or absence of electrification. The Maglev and New HSR options must invariably absorb the full expense of fixed plant maintenance, but their higher passenger volumes and (in the case of Maglev) technology-based economies help to moderate, and in some cases lower, the unit expenses from Accelerail levels.

Figure 7-15
Maintenance-of-Way Expense Per Passenger-Mile (Chicago Hub Network Example)



Maintenance-of-equipment expenses (Figure 7-16) include fixed expenses for service, inspection, and repair facilities, and thus benefit from volume increases across options. The electrified Accelerail options, omitting on-board power generation, further reduce these expenses. New High-Speed Rail, with its two locomotives per trainset and lower-capacity cars, occasions relatively high unit expenses; Maglev, with its revolutionary design, eliminates much of the mechanical wear and tear of the steel-wheel systems, and is projected to have the lowest equipment maintenance unit expense.

Figure 7-16
Maintenance-of-Equipment Expense
Per Passenger-Mile
(Texas Triangle Example)

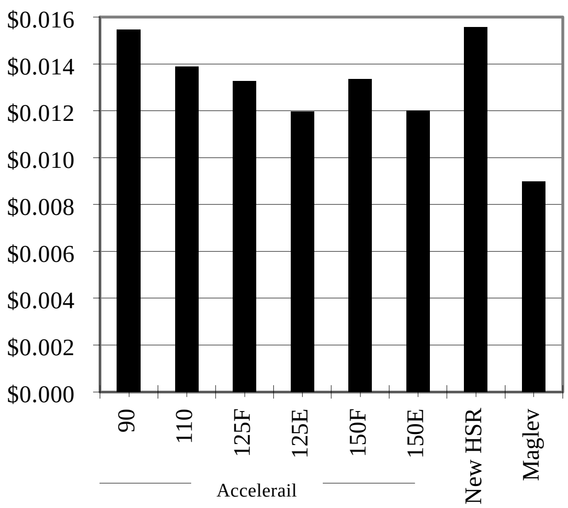
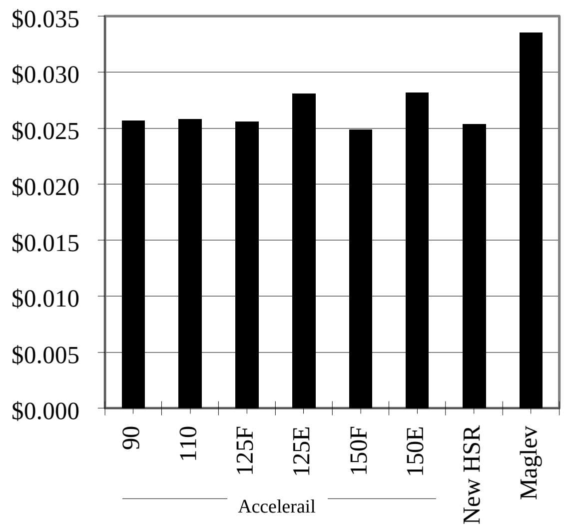


Figure 7-17
Transportation Expense per Passenger-Mile
(Chicago—Detroit Example)



Transportation expenses (Figure 7-17) embody the relative operating efficiencies and passenger volumes of the options. Electrified Accelerail cases incur higher unit fuel costs (based on the assumption of constant petroleum prices), which New HSR can counteract with crew cost savings based on higher patronage and train speeds. In corridors outside the heavily traveled California and Northeast corridors, Maglev was assumed to use two-car trains and therefore has higher crew and energy expense levels than other options.[10]

Passenger Traffic and Services and **General and Administrative** expenses (Figure 7-18 and Figure 7-19) are rightfully independent of technology and generally decline as passenger volumes increase. Marked declines for New High-Speed Rail and Maglev in California and the Northeast Corridor show the beneficial effects of huge traffic increases on these accounts.

[10] Higher fares, justified in part by greater frequencies, yield revenues that more than offset these costs. With regard to energy, Maglev has somewhat higher unit energy costs in all corridors. Yet despite its very high speeds and use of energy for suspension as well as propulsion, Maglev's energy costs are by no means orders of magnitude higher than those for steel wheel options. Light in weight and unburdened by the structural

Figure 7-18
Passenger Traffic and Services Expense Per Passenger-Mile (Chicago—St. Louis Example)

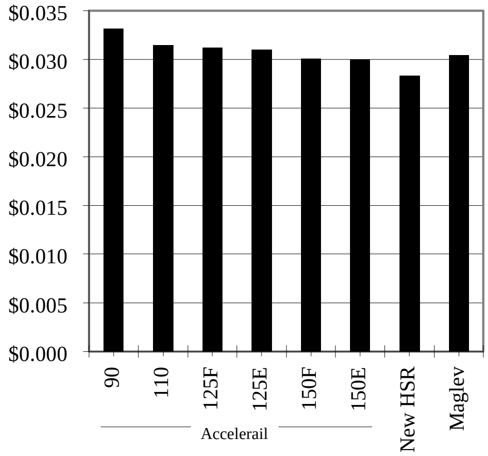
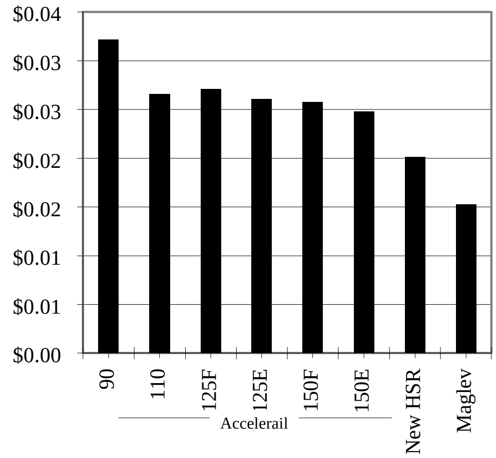


Figure 7-19
General and Administrative Expense Per Passenger-Mile (California North/South Example)



Synthesis: Investments and Operating Results

In the most elemental terms, HSGT's ability to perpetuate itself (by providing a contribution over and above its continuing investment needs) depends on two things:

- The **volume** of traffic that it generates, measured in passenger-miles; and
- The difference, or **unit margin**, between the fare yield and operating expense per passenger-mile.

In regard to margins, the comparative performance of the illustrative corridors (Figure 7-20) depends on two largely independent factors: the competitive situation versus other modes, which limits allowable prices; and the inherent efficiencies of the cases, which reflect many variables treated above. **A very efficient operation can have low unit margins,** as exemplified in the California North/South corridor's performance among the New HSR cases.

The reasons for California North/South's relatively poor unit margins become clear in a comparison with the Northeast Corridor (Figure 7-21) for New HSR. California's comparatively low per-passenger-mile yield—caused by such differences in market conditions as the importance of low-fare air carriers, the distance between the two largest

standards mandated in mixed freight/passenger railroad operations, Maglev generates very high passenger-to-weight ratios, overcoming much of its energy disadvantage.

Figure 7-20
Unit Margin for New HSR in Nine Illustrative Corridors
(Year 2020)

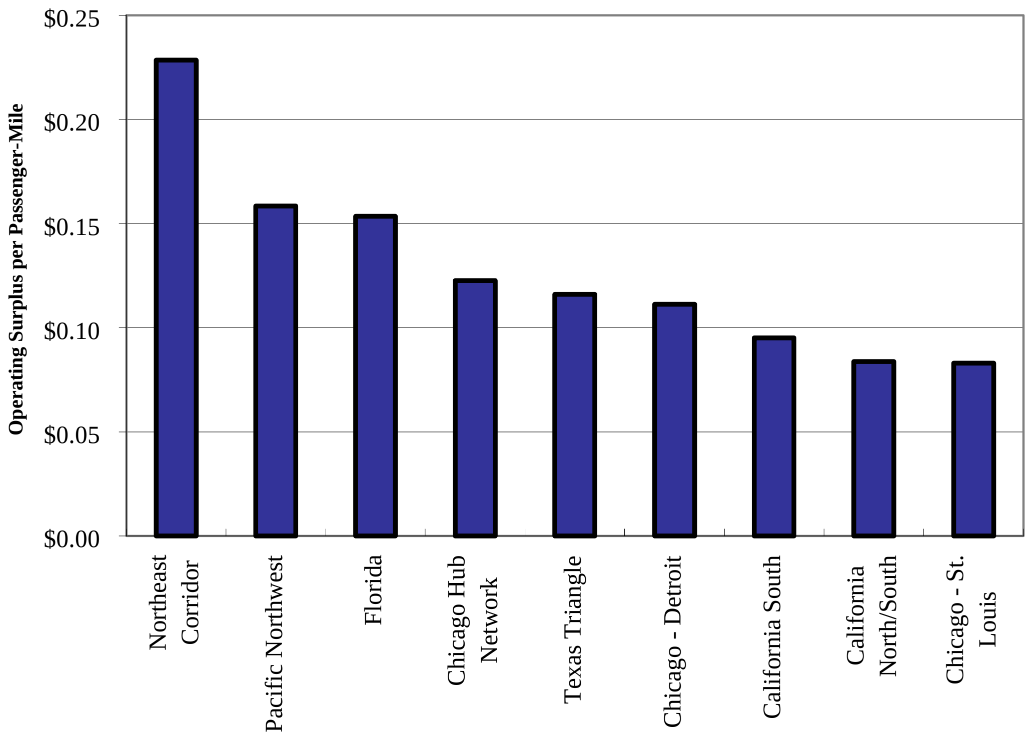
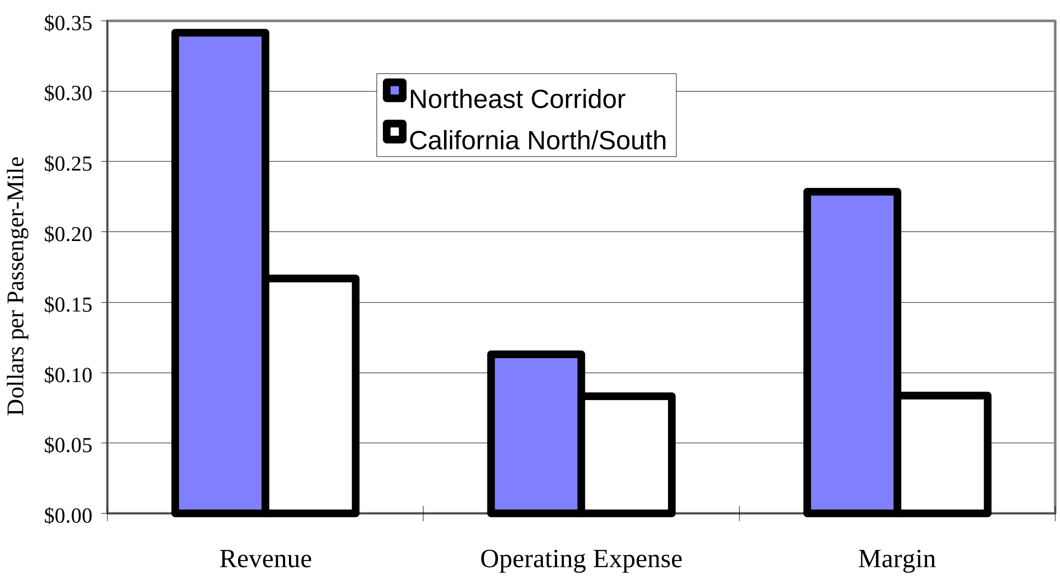


Figure 7-21
Comparison of Unit Margin Components:
New HSR in the Northeast and California North/South Corridors

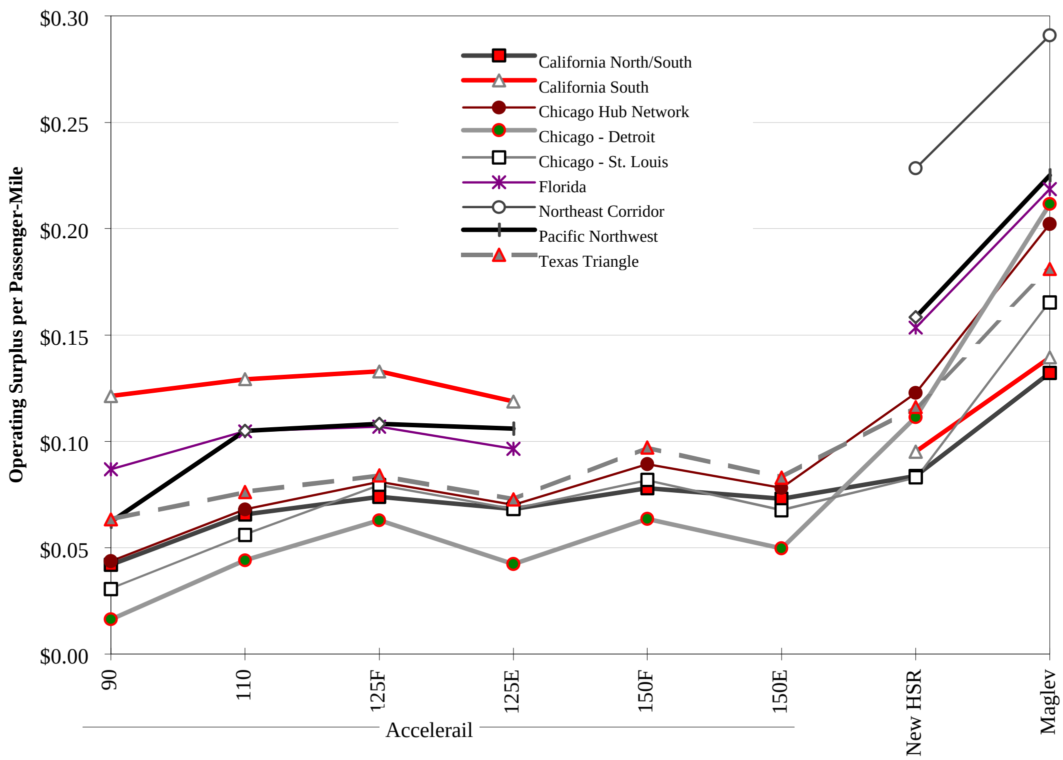


metropolitan areas, and New HSR's resulting inability to compete head-to-head with air on total trip times—far overshadows the effect of better operating efficiencies and lower unit expenses on the Bay Area—Los Angeles—San Diego route.

Figure 7-22 indicates that the illustrative corridors, taken together, change similarly from one option to another. The basic trends include:

- Improved margins in the **lower-speed Accelerail ranges** (90 to 110 to 125F) reflect unit cost reductions in virtually all corridors, and fare yield improvements in some.
- Within the **125E to 150E** range of Accelerail options, fare yields are relatively constant and the changes in unit margin reflect operating expense fluctuations.
- Fare yields generally rise, and O&M expenses decrease in most corridors, between **150E and New HSR,** thus causing a rise in unit margins.

Figure 7-22
Unit Margins by Corridor, Year 2020



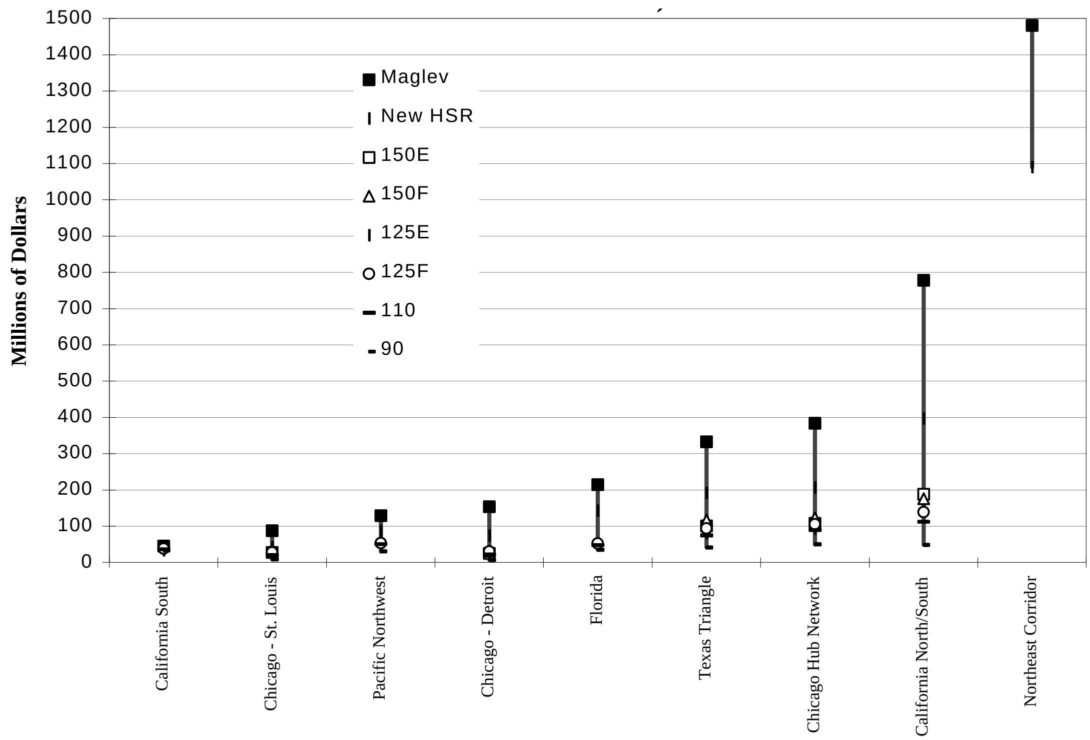
- **Maglev** shows markedly improved unit margins over New HSR, but the reasons differ among corridors, as shown in Table 7–2. **In the highest-volume Northeast Corridor and California North/South corridors, Maglev's heavy passenger volumes and assumed technological efficiencies combine to produce dramatically reduced unit expenses over New HSR.** These economies do not appear, however, in lower volume operations. In all corridors, Maglev—with its higher frequencies and unmatched trip-time performance—commands much higher fares, accounting for most of the margin improvement in lower-volume cases.

Table 7–2
Analysis of Difference in Unit Margins between New HSR and Maglev in Selected Corridors

	Difference in unit margin	Percent of difference from revenue changes	Percent of difference from O&M changes
California North/South	$0.048	65%	35%
Chicago - Detroit	$0.100	89%	11%
Chicago - St. Louis	$0.082	87%	13%
Chicago Hub Network	$0.079	99%	1%
Florida	$0.065	97%	3%
Northeast Corridor	$0.040	74%	26%
Texas	$0.065	100%	0%

The annual operating surplus for each case can be regarded (for some analytical purposes) as the product of the unit margin and the passenger-miles. Figure 7-23—arraying the corridors in order of travel volumes—demonstrates not only the considerable variance in operating surpluses within each corridor, but also the degree to which unit margins can predominate over traffic levels in determining the outcome. The Northeast Corridor, generating traffic volumes similar to (or less than) those of California, outshines the latter—and all other corridors—in annual operating surplus for reasons analyzed above. Most other corridors show surpluses in the $0 to $100 million range for Accelerail, and from $50 to $200 million for New HSR and Maglev. California's performance, of course, covers a wide range because of the divergent products offered by the various options, a natural consequence of the challenging routing and sheer size of that State.

Figure 7-23
Range of Annual Operating Surpluses by Corridor
(Year 2020: Corridors Are Arrayed in Order of Ascending Passenger-Miles for New HSR.)



The definition of partnership potential in Chapter 3 requires a case to do more than simply cover its annual expenses out of annual revenues. The present value of the future operating surpluses must cover at least the present value of the continuing investments.[11] How do the illustrative corridors fare on this measure?

As shown in Table 7–3, all the illustrative cases—with one exception, Chicago–Detroit at 90 mph—meet the "surplus less continuing investments" standard for partnership potential. Virtually all the cases are projected to cover their operating and maintenance expenses and continuing investment needs given the fare levels, unit costs, and partnerships described herein.

[11] The continuing investments range from approximately 5 to 18 percent of the initial investment for Accelerail 90 and 110, down to 2 to 8 percent of the higher-performance Accelerails, New HSR, and Maglev. These amounts are present values of investments that occur throughout the 40-year planning period.

Table 7–3
Surplus (Deficit) After Continuing Investments by Case
(Millions of Dollars, 40-Year Present Values) (Shaded Cases Were Not Analyzed)

	Accelerail						New HSR	Maglev
	90	110	125F	125E	150F	150E		
California North/South	$276	$714	$870	$864	$1,151	$1,232	$2,489	$5,584
California South	$206	$241	$252	$214			$176	$284
Chicago Hub Network	$257	$560	$708	$584	$835	$690	$1,371	$2,974
Chicago - Detroit	($16)	$114	$189	$82	$184	$115	$457	$1,160
Chicago - St. Louis	$33	$111	$169	$131	$215	$154	$218	$618
Florida	$152	$244	$270	$239			$915	$1,552
Northeast Corridor							$8,277	$11,607
Pacific Northwest	$181	$333	$359	$324			$521	$859
Texas	$195	$456	$586	$486	$797	$646	$1,168	$2,453

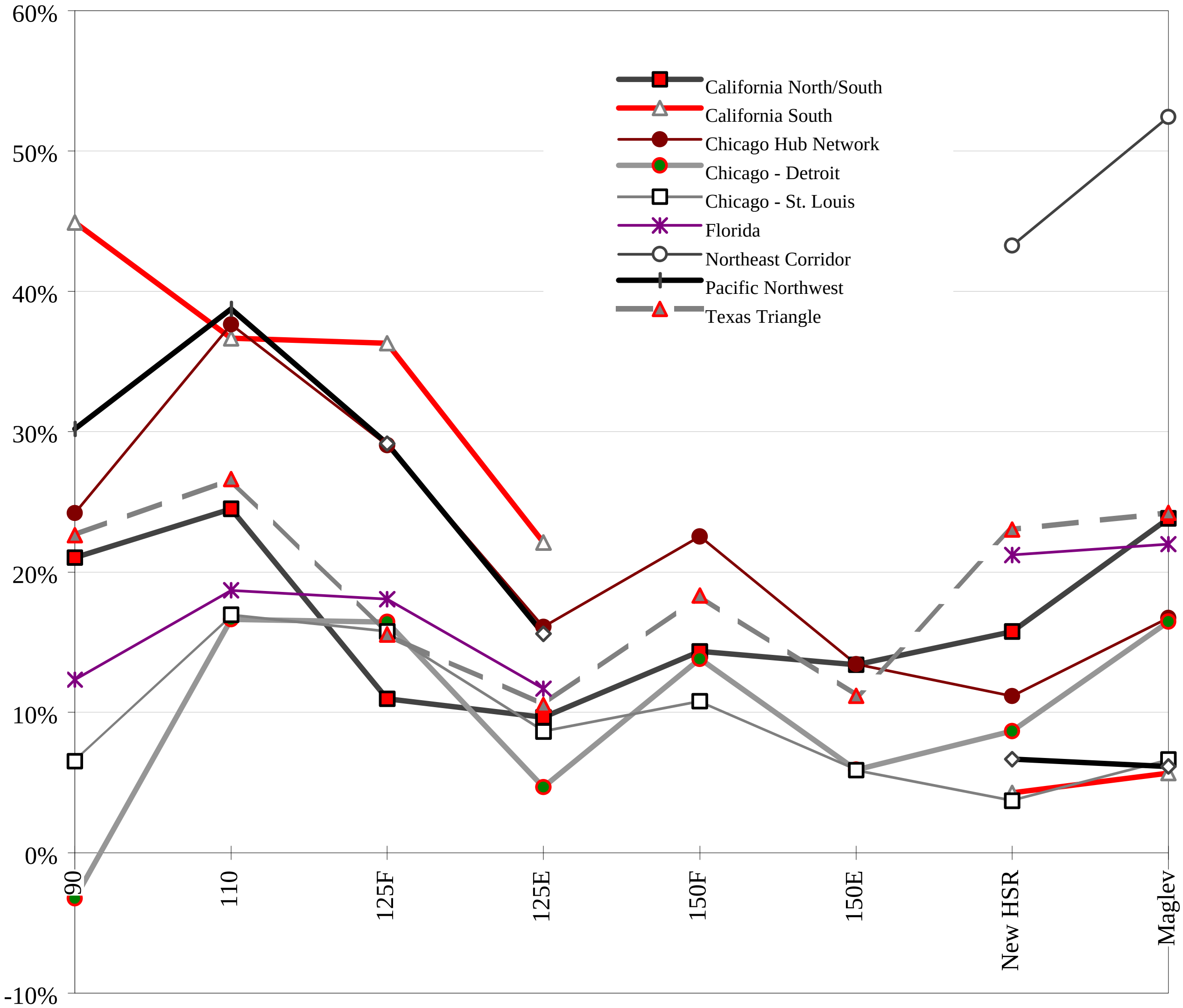
These surplus amounts must come into comparison with the initial investments required for each case (Table 7–4).

Table 7–4
Initial Investment by Case
(Millions of Dollars)

	Accelerail						New HSR	Maglev
	90	110	125F	125E	150F	150E		
California North/South	$1,314	$2,914	$7,931	$8,948	$8,024	$9,203	$15,792	$23,430
California South	$459	$657	$694	$969			$4,112	$5,006
Chicago Hub Network	$1,062	$1,487	$2,438	$3,628	$3,708	$5,137	$12,285	$17,787
Chicago - Detroit	$484	$688	$1,151	$1,748	$1,329	$1,945	$5,284	$7,044
Chicago - St. Louis	$500	$657	$1,074	$1,516	$1,991	$2,617	$5,900	$9,291
Florida	$1,235	$1,305	$1,494	$2,041			$4,316	$7,054
Northeast Corridor							$19,127	$22,137
Pacific Northwest	$598	$859	$1,233	$2,076			$7,819	$13,980
Texas	$863	$1,714	$3,767	$4,613	$4,349	$5,780	$5,071	$10,127

As shown in Figure 7-24, surpluses could cover about half of the initial investment in the Northeast Corridor; over one third of the initial investment in certain California South, Chicago Hub Network, and Pacific Northwest cases; and up to one quarter of the initial investment in California North/South and the Texas Triangle.

Figure 7-24
Percent of Initial Investment Covered by Surplus After Continuing Investments



Despite local differences, certain general trends emerge from Figure 7-24. Almost universally, Accelerail 110 provides better coverage than Accelerail 90 because the former's revenue-producing potential outweighs its incremental investment. As investment needs increase and performance improvements moderate in higher-level Accelerail cases, surpluses cover a declining percentage of the investment (with some adjustments due to electrification). This trend typically reverses itself with New HSR and particularly with Maglev, due to their ability to generate higher unit and total margins.

Figure 7-24 epitomizes the purely commercial projections in that it gauges the maximum proportion of each corridor's initial investment that might be financed on the basis of future operating surpluses, under all the assumptions governing this study. Many cases—mainly lower-speed Accelerail technologies and new Northeast Corridor systems—show promise of financing significant portions (one-fifth to one-half) of their initial capital costs. While potentially encouraging the formation of private/public partnerships, the projections displayed in Figure 7-24 do not meet the traditional private-sector criterion for "commercial feasibility."

Wherever possible, the study assumptions were intended to maximize the percentages displayed in Figure 7-24. In particular, the fare-setting protocols[12] tended to maximize operating surpluses. This practice allowed the simulated cases to show optimal—although not necessarily successful—results from a commercial perspective, in keeping with the literal intent of Congress to explore HSGT's "commercial feasibility." However, this fiscally cautious approach did not necessarily maximize all ratios of benefits to costs.

BENEFIT/COST COMPARISONS

As Chapter 3 explains, commercial feasibility is only one basis for calculating the worth of HSGT. Other important comparisons are total benefits with total costs; benefits to HSGT users with costs borne by users; and benefits to the public at large with publicly-borne costs.

Total Benefits Versus Total Costs

Table 7–5 shows the amount by which total benefits are projected to exceed (or fall short of) total costs. In most of the illustrative cases, HSGT's total benefits exceed total costs; the projected value of the excess is generally higher in the Accelerail than in the New HSR and Maglev options.

As shown in Figure 7-25, each HSGT technology would provide a favorable ratio of total benefits to total costs in at least one corridor: New HSR, for example, is projected to have ratios equal to or greater than 1.0 in four of the nine illustrative corridors covered in this chapter, and Maglev in two of the nine. Likewise, each illustrative corridor would provide favorable ratios of total benefits to total costs in one or more HSGT technologies.

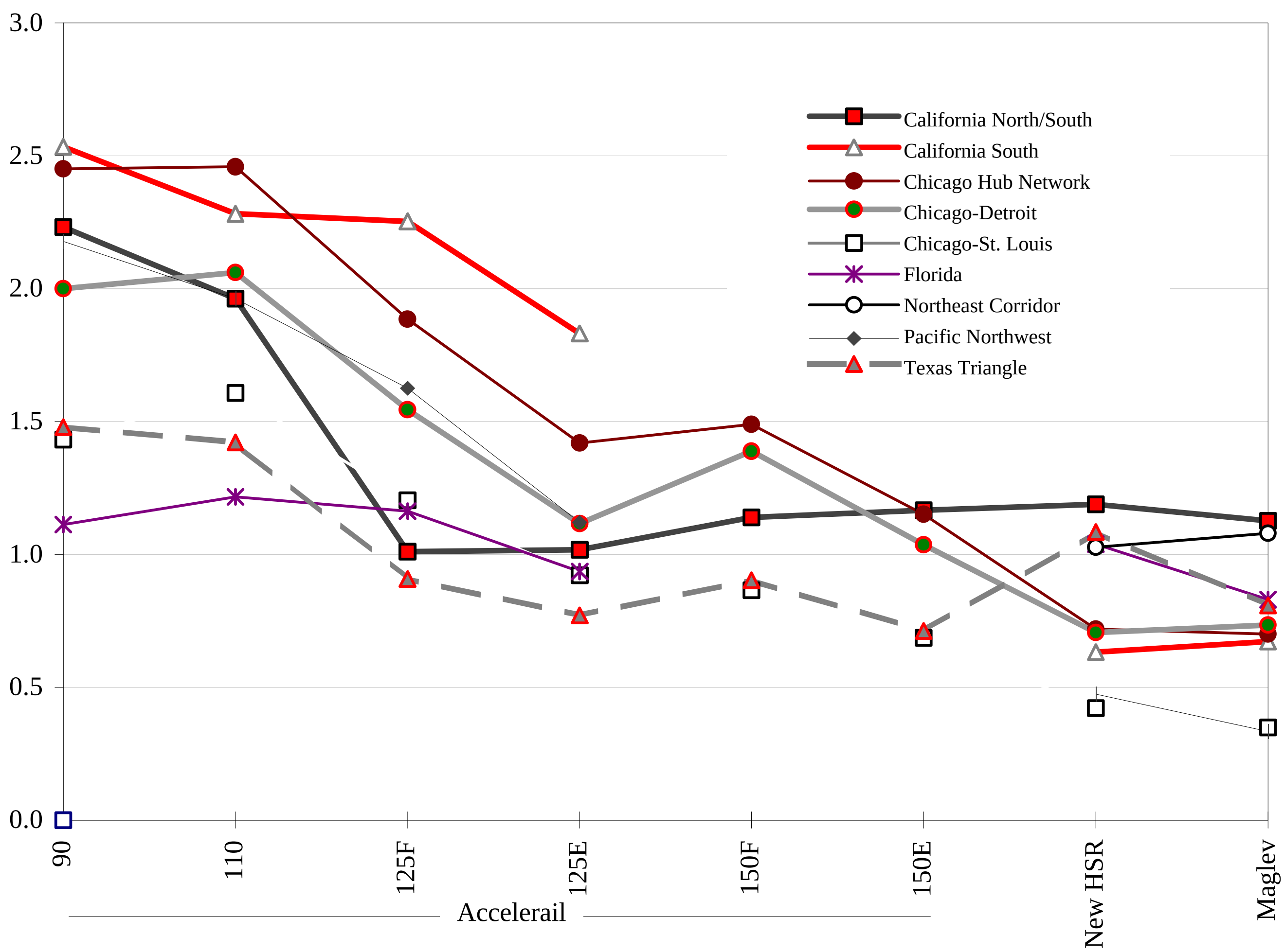
The projections suggest that—subject to the assumptions and scope of this study—the less expensive technologies, relying on upgraded existing rail lines and freight railroad cooperation, could typically provide higher ratios of benefits to costs than the very high-speed options, which may offer higher benefits but would ordinarily cost much more.

[12] See Chapter 4.

Table 7–5: Total Benefits Less Total Costs (Millions of Dollars)

	Accelerail							
	90	**110**	**125F**	**125E**	**150F**	**150E**	**New HSR**	**Maglev**
California North/South	$3,228	$4,247	$93	$191	$1,383	$1,889	$3,670	$3,422
California South	$1,329	$1,370	$1,384	$1,184			($1,715)	($1,827)
Chicago Hub Network	$3,194	$4,023	$3,280	$2,118	$2,466	$997	($3,984)	($5,951)
Chicago-Detroit	$979	$1,300	$902	$277	$735	$92	($1,805)	($2,098)
Chicago-St. Louis	$350	$632	$294	($151)	($324)	($974)	($3,810)	($6,485)
Florida	$195	$402	$335	($173)			$210	($1,402)
Northeast Corridor							$648	$2,128
Pacific Northwest	$1,447	$1,434	$1,168	$333			($4,622)	($10,028)
Texas Triangle	$749	$1,122	($441)	($1,318)	($520)	($2,015)	$570	($2,302)

Figure 7-25
Ratios of Total Benefits to Total Costs



With the exception of Accelerail 90 in Chicago—Detroit, which generates an operating deficit rather than a surplus, all the cases in Figure 7-25 with ratios of 1.0 or greater fulfill this study's threshold requirements for partnership potential.[13]

Benefits to HSGT Users Versus Costs Borne by Users

As displayed in Table 7–6 and Figure 7-26, HSGT users invariably enjoy an excess of benefits over costs (i.e., the users' consumer surplus described in Chapter 6). This excess may be regarded as a subsidy enjoyed by HSGT users, to the extent that the publicly-borne costs exceed the benefits to the public at large in a given case.

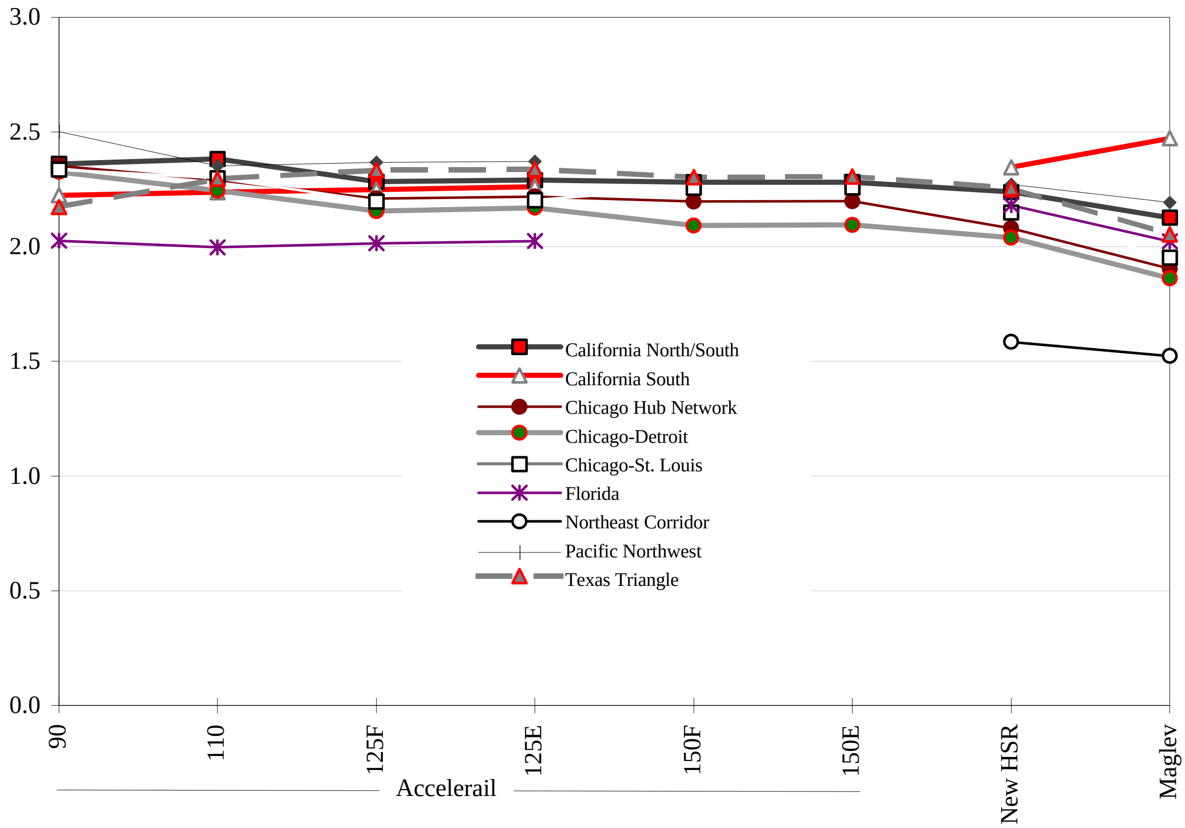
Table 7–6
Benefits to HSGT Users Less Costs Borne by Users
(Millions of Dollars)

	Accelerail							
	90	**110**	**125F**	**125E**	**150F**	**150E**	**New HSR**	**Maglev**
California North/South	$2,153	$3,055	$3,374	$3,745	$3,913	$4,396	$7,688	$10,324
California South	$752	$807	$827	$843			$976	$1,249
Chicago Hub Network	$1,888	$2,363	$2,392	$2,454	$2,594	$2,606	$3,478	$4,491
Chicago-Detroit	$635	$811	$804	$837	$813	$820	$1,380	$1,721
Chicago-St. Louis	$459	$642	$649	$662	$799	$805	$1,027	$1,225
Florida	$681	$787	$847	$886			$2,435	$2,781
Northeast Corridor							$7,861	$8,538
Pacific Northwest	$1,216	$1,304	$1,363	$1,379			$1,899	$2,310
Texas Triangle	$1,050	$1,814	$2,116	$2,146	$2,395	$2,412	$3,654	$4,543

[13] As defined in this report, "partnership potential" is the apparent capacity of an HSGT corridor to draw the private and public sectors together in planning, negotiations, and, conceivably, project implementation. To exhibit partnership potential, the projections for an HSGT technology in a particular corridor must satisfy at least the following two conditions: First, private enterprise must be able to run the corridor—once built and paid for—as a completely self-sustaining entity; in other words, the case must generate a projected surplus after continuing investments. Second, the total benefits of an HSGT corridor must equal or exceed its total costs. This report uses "partnership potential" as an indicator of the aggregate financial and economic impacts of HSGT alternatives in a set of illustrative corridors. Detailed State studies of individual corridors would benefit from additional evaluation measures as well as site-specific investigations and data. Thus, while "partnership potential" may offer useful insights in assessing the likelihood of HSGT development by State and local governments and their private partners, it does not constitute an express or implied criterion for Federal approval or funding. For further particulars on "partnership potential," the reader is referred to Chapters 3 and 6.

The ratios in Figure 7-26 (minus one) equate to the ratio of consumer surplus to system revenues. [14]

Figure 7-26
Ratios of Benefits to HSGT Users, to Costs Borne by Users



Benefits to the Public at Large Versus Publicly-Borne Costs

For each illustrative case, Table 7–7 shows the excess (or shortfall) of benefits to the public at large in comparison with publicly-borne costs, and Figure 7-27 depicts the corresponding ratios.

As portrayed in Figure 7-27, benefits to the public at large exceed the publicly-borne costs in only about one-quarter of the illustrative HSGT cases. These all occur in the

[14] Cf. Chapter 6, which provides the equation for this ratio as:

(System Revenues plus Users' Consumer Surplus)/ System Revenues

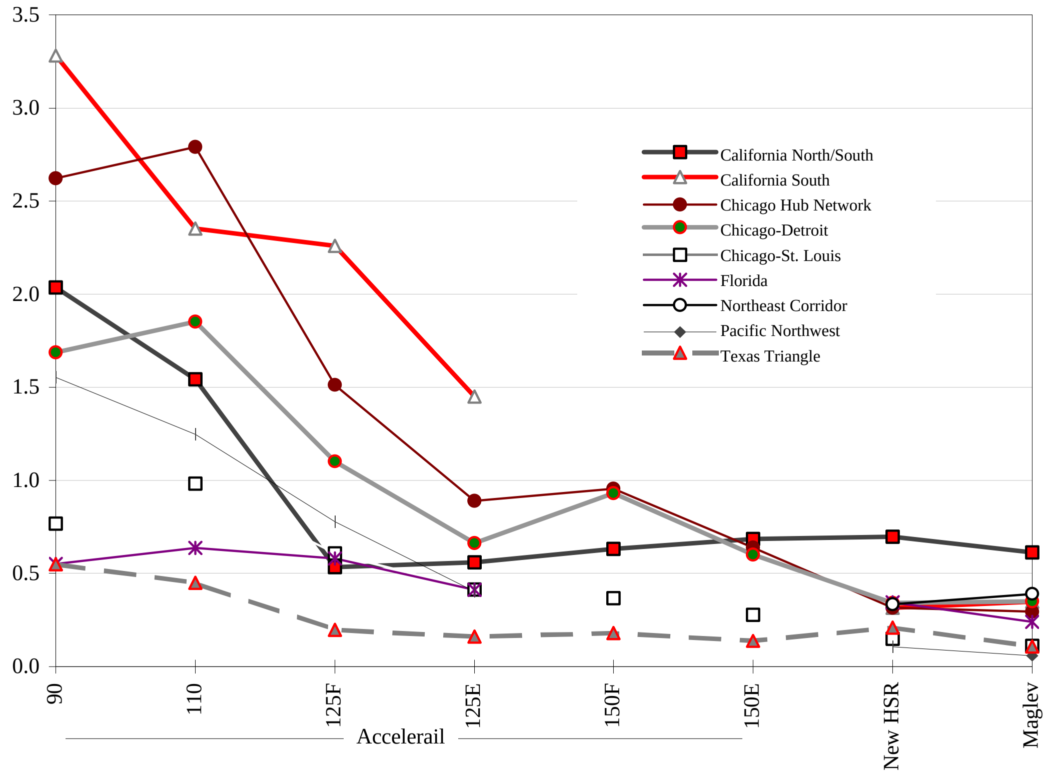
This is algebraically equivalent to:

(System Revenues/System Revenues), or one, plus (Users' Consumer Surplus/System Revenues).

Table 7–7
Benefits to the Public at Large Less Publicly-Borne Costs
(Millions of Dollars)

	Accelerail							
	90	**110**	**125F**	**125E**	**150F**	**150E**	**New HSR**	**Maglev**
California North/South	$1,075	$1,192	($3,280)	($3,554)	($2,530)	($2,507)	($4,018)	($6,902)
California South	$578	$563	$557	$341			($2,691)	($3,076)
Chicago Hub Network	$1,306	$1,660	$888	($336)	($128)	($1,609)	($7,461)	($10,442)
Chicago-Detroit	$344	$488	$98	($560)	($79)	($729)	($3,184)	($3,819)
Chicago-St. Louis	($109)	($10)	($354)	($812)	($1,123)	($1,779)	($4,837)	($7,710)
Florida	($486)	($385)	($512)	($1,059)			($2,225)	($4,183)
Northeast Corridor							($7,213)	($6,410)
Pacific Northwest	$231	$130	($194)	($1,046)			($6,521)	($12,338)
Texas Triangle	($301)	($692)	($2,557)	($3,464)	($2,916)	($4,427)	($3,084)	($6,845)

Figure 7-27
Ratio of Benefits to the Public at Large to Publicly-Borne Costs



Accelerail options. Benefits to the public at large do not exceed publicly-borne costs for any Maglev, New HSR, or Accelerail 150 options. Such effects on users versus the public at large merit further attention in State analyses of HSGT and in reaching decisions on public funding of high-speed rail and Maglev.

When benefit-cost analysis of HSGT is approached in accordance with Figure 7-27, lower-cost HSGT options appear to generate higher ratios of benefits to costs—a trend analogous to that of Figure 7-25 for total benefits and costs. Along with this finding, public benefit-cost analysis may yield valuable information necessary for fully apprising decision makers and the public of the value of HSGT options.

However, cases where public benefits do not exceed public costs need not be ruled out for consideration by States or private concerns. In such cases, prospective transfer effects, mobility concerns, and environmental factors may justify further consideration, even though such impacts did not enter into the benefit/cost calculation for this analysis.[15] The state-specific localized benefits from HSGT corridors further illustrate why it is appropriate to focus on State, local, or private financing rather than Federal financing for these projects.

Indeed, in contrast with a nationwide study such as this one, individual State studies can more closely examine specific corridors, with greater sensitivity to the State's underlying reasons for considering HSGT. Such detailed examination may favor a non-HSGT solution, Accelerail, New HSR, or Maglev. A State, for example, may wish to provide a high-reliability, high-frequency HSGT option and may believe that only New HSR or Maglev can offer a sufficient quality of service. Likewise, a State may place an extraordinarily high value on environmental benefits, and would seek the HSGT option that maximizes those benefits. A State may regard the cooperation of its freight railroads as impossible to achieve, thereby precluding Accelerail; or a State may perceive Accelerail as the ideal compromise between its fiscal constraints and its desire for improved intercity transport. Financing issues, moreover, would call for detailed scrutiny, since the absolute size of the required initial investment (in conjunction with the available resources of the private and public participants) will heavily influence the feasibility of HSGT proposals. Finally, the States and localities, through their intermodal planning processes, are uniquely qualified to judge the synergy between HSGT corridor development and the enhancement of regional public transit services, highways, and airports. Taken together, these examples underscore the importance of site-specific, State-sponsored studies to the definitive characterization of HSGT and other intercity transport options.

[15] See Chapter 6.