

A STUDY OF EVALUATION CRITERIA FOR  
HIGH SPEED RAIL CORRIDORS

by

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## INTRODUCTION

"A nation's transportation network is an integral component of its economic, social and physical structure. The transportation system serves to speed the movement of people, goods and ideas across the country. The development and maintenance of a balanced, modern and efficient transportation system is necessary if a society is to grow and prosper."<sup>1</sup>

The critical relationship between transportation systems and national development has been evident throughout America's history. The development of the railroads in the 19th century was a driving force in America's westward expansion and in our Industrial Revolution. The 20th century brought with it an emphasis on personal convenience, speed and ease of transportation via the automobile and airplane. These transportation related developments brought about the demise of passenger rail service traceable to the years immediately following the end of World War II.

"In the 1950s the freight railroads saw their once dominant position weaken as they began to lose business to competing truck and air freight service. In response to their declining share of the

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<sup>1</sup>U. S., Congress, Joint Economic Committee, Case Studies in Private/Public Cooperation To Revitalize America: I. Passenger Rail, Joint Committee Print (Washington: Government Printing Office, 1981), p. 3.

market, the freight railroads changed their operations by switching to longer, heavier and slower freight trains."<sup>2</sup> This change had a dramatic effect on the passenger rail system because it forced passenger service to become slower, less dependable and uncomfortable due to poor track conditions. Additionally, the development of an excellent interstate highway system and availability of inexpensive, in effect, subsidized fuel, and the lack of a national energy policy contributed to the increased use of automobiles. As a result, the demand for passenger rail services declined.

Outside of the United States, no developed country has ever deserted passenger rail service. Responding to Americans' demands for convenient automobile travel, Congress enacted key legislation that resulted in the nation's transportation future being centered on highways. In 1956 the United States began full construction of the 42,000-mile interstate highway system, the biggest public works project in U. S. history.

As the nation concurrently moved into the jet age and federal funds were poured into airport development, the railroads in terms of passenger service were virtually forgotten. By 1978 airlines had 84 percent of the intercity passenger travel business, and railroads had less than 5 percent. Until the mid-1940s, railroads accounted for more than two-thirds of all passenger travel.

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<sup>2</sup>U. S. Congress, Case Studies In Private/Public Cooperation To Revitalize America: I. Passenger Rail, p.11.

After World War II, Japan, France, West Germany and Britain rebuilt their economies around rail service and mass transit. These countries have proven dramatically that the development of high speed rail transportation can provide reliable, economical intercity travel.

Finally, recognizing the need for passenger rail service, Congress voted in 1970 to establish the National Railroad Passenger Corporation, better known as Amtrak, a private corporation supported by federal subsidies. Although Amtrak was not successful in its early years, marked increases in rail passenger ridership over the past several years indicates that the shift to rail travel is already underway. The present combination of higher fuel costs, smaller and more expensive cars and congested, deteriorating highways is causing Americans to reevaluate their attitudes toward personal transportation. As demand for rail travel continues to increase, market economics should result in the upgrading of outmoded facilities, purchase of new equipment, increased schedule frequency and implementation of entirely new high speed rail systems. Continued federal support of Amtrak would be beneficial, if only because Amtrak's revival is presently spurring private investment in passenger railroads. With Amtrak as a consultant, a new company, the American High Speed Rail Corporation (AHSRC) has proposed to construct, operate and maintain a privately funded high speed passenger train system using electrically powered, computerized Japanese "Bullet Trains." The 3.1 billion dollar project will be built on an entirely new track structure and will travel primarily along existing railroad and interstate highway right of ways between Los Angeles and San Diego, California.

Experience in the United States has clearly demonstrated that passenger railroad systems can be successful if certain conditions are provided. "In general terms the passenger system must provide frequent, reliable, safe and comfortable service that connects major cities in highly populated corridors."<sup>3</sup> The northeastern United States has proven that people will leave their cars and take the train on trips between 100 and 300 miles if these conditions are provided.

In addition to the northeast corridor, 20 other corridors have been identified by the Federal Railroad Administration as potential markets for a high speed rail transport system.<sup>4</sup> These include:

1. Atlanta, GA, to Nashville, TN.
2. Atlanta, GA, to Savannah, GA.
3. Boston, MA, to New York, NY, to Washington, D.C.
4. Boston, MA, to Springfield, MA, to New Haven, CT.
5. Cleveland, OH, to Columbus, OH, to Cincinnati, OH.
6. Chicago, IL, to Indianapolis, IN, to Cincinnati, OH.
7. Chicago, IL, to Cleveland, OH.
8. Chicago, IL, to Detroit, MI.
9. Chicago, IL, to St. Louis, MO.
10. Chicago, IL, to Milwaukee, WI.
11. Los Angeles, CA, to Las Vegas, NV.
12. Los Angeles, CA, to San Diego, CA.
13. San Jose, CA, to Sacramento, CA, to Reno, NV.
14. Miami, FL, to Jacksonville, FL.
15. New York, NY, to Albany, NY, to Buffalo, NY.
16. Philadelphia, PA, to Atlantic City, NJ.
17. Philadelphia, PA, to Harrisburg, PA.

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<sup>3</sup>U. S. Congress, Case Studies In Private/Public Cooperation To Revitalize America: I. Passenger Rail, p. 16.

<sup>4</sup>Amtrack, Department of Transportation, and the Federal Rail Administration, Rail Passenger Corridors -- Final Evaluation (Washington: Government Printing Office, 1982), pp. 42-173.

18. Seattle, WA, to Portland, OR.
19. Houston, TX, to Dallas-Ft. Worth, TX, to San Antonio, TX.
20. Washington, D. C., to Richmond, VA.

"The AHSRC's objective for the proposed project is to provide high speed train service to travellers in the Los Angeles to San Diego corridor, which would ultimately result in a profitable business venture for the AHSRC and offer a major new component to the existing transportation system to meet present and future travel demands in southern California."<sup>5</sup> The high speed train will offer a means of travel that is time saving in comparison to the automobile, is safe, reliable and comfortable, and is tied directly to other public transportation systems.

The AHSRC plans to operate trains at half-hour intervals in each direction, with service every 20 minutes at rush hour. This means that there will be 40 to 50 round trips per day. A ridership forecast was made by Arthur D. Little, Inc., a nationally known consulting firm, by analyzing existing regional data on travel in southern California and by interviewing transportation professionals in state, county and local governments. The estimates were verified by conducting a public opinion market survey in the counties along the corridor to determine the potential use of the service and the range of fares that would be acceptable.<sup>6</sup>

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<sup>5</sup>American High Speed Rail Corporation, "Preliminary description of Proposed Los Angeles to San Diego High Speed Rail Project," (Los Angeles: 1983), p. 7.

<sup>6</sup>"Company Hits Use of Bullet Trains Report," Los Angeles Times, 25 March 1983, Sec. B. p. 26.

By 1988 over 875,000 trips are projected to be taken each day from within a five to ten mile radius of the proposed station locations along the route. Over 90 percent of the total 875,000 trips projected in the study corridor would be made on Interstate 5 alone.<sup>7</sup> An automobile trip from downtown Los Angeles to downtown San Diego currently takes 2-1/2 to 3 hours under typical daytime conditions. The AHSRC estimates that the same trip in ten years will likely take 3-1/2 hours because of the increased congestion. A non-stop high speed train traveling the 112-mile distance connecting downtown Los Angeles with downtown San Diego will take about 59 minutes. Approximately 6 minutes will be added to the running time for each intermediate stop.<sup>8</sup>

The current Los Angeles to San Diego passenger rail operations run at top speeds of 90 mph and achieve approximately 40 mph average speed. Service is provided every several hours and the overall trip times are not generally competitive with the automobile. By contrast, raising average speeds to 110 mph (and top speeds to 160 mph) and increasing frequency to half hourly will provide increased speed and convenience to be highly competitive with the automobile.<sup>9</sup>

"The proposed system is projected to divert 36 million trips per year from the automobile, thus providing alternative transportation for travellers who would otherwise contribute to the increasing traffic

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<sup>7</sup>AHSRC, "Preliminary Description of Proposed Los Angeles to San Diego High Speed Rail Project," p. 8.

<sup>8</sup>AHSRC, "Summary Report: Engineering and Construction," (Washington: 1982).

<sup>9</sup>AHSRC, "Preliminary Description of Proposed Los Angeles to San Diego High Speed Rail Project," p. 61.

problems."<sup>10</sup> The increase in travellers diverted from the automobile by higher rail speeds and more frequent service will reduce the consumption of petroleum products and improve the regional air quality.

#### JUSTIFICATION FOR STUDY

Obviously, design criteria of high speed rail differs significantly from highway and conventional rail design. Until recent times, Landscape Architects have had little significant involvement in the planning of most transportation modes. The exclusion is unfortunate because experience has shown that Landscape Architects have made a positive contribution in the selection and design of utility and interstate highway corridors. As the profession of Landscape Architecture encompasses planning upon and managing the land in terms of optimizing land use development, with particular concern for resource conservation, involvement of Landscape Architects will have a positive impact on high speed rail corridor selection and design. Without question, any high speed rail system will have a significant environmental and social impact upon the regions through which it passes. Disruption of natural and cultural regional patterns; negative impacts on adjacent land uses and existing circulation routes; and consideration of corridor visual quality are but several aspects which could be effectively addressed by the Landscape Architect working in close association with other members of the design team -- namely engineers, planners and management.

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<sup>10</sup>AHSRC, "Preliminary Description of Proposed Los Angeles to San Diego High Speed Rail Project," p. 8.

## PURPOSE OF STUDY

The purpose of this study will be first, to identify broad environmental impacts of a high speed rail system on adjacent land uses; second, to determine the specific impacts that can best be addressed by Landscape Architects; third, to develop evaluation criteria for identifying major land use conflicts bordering a high speed rail corridor; fourth, to investigate possible alternative design measures to mitigate identified conflicts; fifth, in a case study, test the criteria; and sixth, summarize observations in the form of conclusions. When completed, it is anticipated that the criteria could be used to evaluate future high speed rail corridors in terms of environmental impact, while mitigating negative impacts as is possible on the region through which the system passes.

## METHODOLOGY

The methodology for evaluating the environmental impacts of a high speed rail system upon the surrounding areas through which it passes, specifically noise, accessibility and visual quality, includes the following sequential procedures: 1) A review of existing and proposed high speed rail systems as well as the evaluation criteria developed for assessment of linear corridor impacts in general; such as, highway, utility and conventional rail; 2) inventory and analysis of existing corridor conditions; 3) generation of evaluation process or methodology of the high speed rail impact on the adjacent land uses within the scope of this study; 4) and finally, synthesis of the evaluation methodology in the evolvment of possible measures to mitigate the negative impacts on adjoining land uses where necessary.

## REVIEW OF TECHNOLOGY

As noted in the introduction, high speed rail transportation is a budding technology in the United States today and, to a lesser degree, in the developed world. Foreign countries have had the foresight to develop this technology over the past two decades while the United States has only recently begun to examine this type of transport system.

Because this field is at such an early stage of development, few publications are available related to high speed rail service in this

country in particular. However, many parallels can be drawn from the study of foreign systems developed to date and, therefore, a wealth of unpublished reference material is available in the form of reports, studies and personal interviews with foreign railway and public/private agency experts. Results of these investigations have been incorporated in the development of the subsequent evaluation methodology.

Early on, it was apparent that two distinct variables existed with regard to application of the evaluation methodology: 1) The evaluation and possible mitigation of negative impacts within preselected corridors, and 2) the evaluation of several alternative corridors to determine the optimum corridor routing. Because the case study application of the evaluation criteria represents the critical test of the evaluation methodology, and because the case study selected represents a preselected corridor, it was decided that the thrust of this study would be directed to the evaluation of preselected corridors: specifically the AHSRC's corridor connecting Los Angeles and San Diego. The reasoning for selecting the AHSRC's Los Angeles to San Diego corridor will be addressed in Chapter 3 "Case Study" of this report.

#### INVENTORY AND ANALYSIS PHASE

The purpose of the inventory and analysis phase is to collect information regarding the physical environment and existing land uses adjacent to any proposed high speed rail corridor and analyze the inventoried data in terms of negative impact such a high speed rail corridor might have on the surrounding land uses.

Establishing accurate base information is essential to the validity of any land use analysis. Recommendations will be no better than the information upon which they are based. For purposes of this study, two levels of applicable base information were available: 1) Aerial Photographs and 2) United States Geological Survey maps (USGS). Into the evaluation methodology, it became apparent that a third level of base information was necessary: 3) on-site photographs and field verification of air photos and USGS maps.

1) Aerial Photographs

An extremely accurate and detailed interpretation of the corridor's physical condition can be obtained as a result of the aerial photographs, provided the photos are of recent vintage (one year maximum) and are taken at low altitudes during the winter when vegetative cover is minimal.

Because the dissimilarity between different types of physical environments and land uses can be so clearly perceived from an aerial view, black and white aerial photographs are the most accurate and available means of acquiring corridor base information.

2) USGS Maps

USGS topographic maps can be acquired for most sections of the United States at a scale of 1:250,000 and at a scale of 1:24,000. As the relative scale of these maps decreases, the level of detail attained becomes greater. USGS maps reveal land use and land form patterns that when combined with information taken from the aerial photographs, provide an accurate means of identifying adjacent land uses paralleling the corridor.

3) On-Site Photographic Record/Field Verification

To fully appreciate the land use character and understand the corridor's impacts, as well as communicating these findings to others, a field investigation proved to be necessary in developing and validating aerial photo/map information. The field investigation has three (3) primary purposes.

- A) Develop visual perceptions and impressions of the proposed corridor's physical character.
- B) Develop a complete photolog of the corridor for on-going reference. The photolog will be achieved by taking photos at points that best illustrate the physical character adjacent to and within the proposed corridor. To accomplish this objective, photos should be taken from within the corridor at or near the rail alignment, as well as taken from outside the corridor to the proposed alignment. Care should be taken to accurately record photograph locations on a master photolog map. The on-site photolog provides a comprehensive overview of the proposed corridor and is extremely helpful in communicating those overviews to others.
- C) Confirm the location of land uses and vehicular routes adjacent to and within corridor area.

John Simonds writes, in Landscape Architecture, we must thoroughly investigate and analyze the site if our solutions are to be valid. Not only the specific site contained within predetermined boundaries but the total site, which includes the site environs to the horizon beyond.<sup>1</sup> An understanding of the physical properties of the total site environs is of vital importance in any analysis process because the surrounding environment represents a major influence on any proposed site

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<sup>1</sup>John O. Simonds, Landscape Architecture (New York: McGraw-Hill Book Company, Inc., 1961), p. 45.

development and, conversely, the surrounding environment may be greatly affected by the proposed development.<sup>2</sup>

For purposes of this study the analysis will be limited to the impacts that the high speed rail system has on adjacent land use activities, and will not include an analysis of the impacts of the surrounding land uses on the corridor, the high speed train or its passengers.

### ANALYSIS PROCEDURE

In addition to gathering base information, the field investigation also served as the initial step in the analysis process in the sense of developing impressions of the corridor area prior to the actual diagrammed analysis. These impressions, along with the verified data gathered from aerial photographs and USGS maps are delineated and analyzed graphically and by written text, in plan -- via 1) the "Land Use and Impacts Plan" and, in section -- via 2) the "Land Use and Impacts Cross Section."

These analyses have two (2) fundamental purposes: 1) to identify the existing land uses, vehicular routes, major land forms, proposed vertical and horizontal route alignment within the corridor area, and 2) to identify the impacts the proposed rail system might have on surrounding land uses.

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<sup>2</sup>Kevin Lynch, Site Planning, 2nd ed. (Cambridge: The MIT Press, 1971), p. 9.

### The Land Use and Impacts Plan

A symbolic representation of each land use will be superimposed onto the aerial photographs to provide ease of identification and classification of adjacent corridor land uses. The symbolic aerial view analysis was devised to achieve an optimum comprehension of the development patterns along the corridor and to attain the most complete and accurate base data to analyze the impact of a linear rail corridor passing through a varied geography.

The symbol legend (figure 2.1) 1) identifies the seven major land use categories that are characteristic of general land use classifications found in the United States including housing, commercial, industrial, agricultural, institutional, recreation and mixed uses; 2) identifies the four possible vertical route alignments -- at grade, recessed, elevated and tunnel -- used in high speed rail systems; and 3) identifies the major impacts in terms of noise disturbance, accessibility and visual disturbances. A circle symbol was used to identify the land use classifications and route alignments, and a rectangular symbol was utilized to identify the impacts so as to clearly differentiate the function of one symbol to another.

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## LEGEND OF SYMBOLS

### LAND USE CLASSIFICATION



HOUSING



COMMERCIAL



INDUSTRIAL



AGRICULTURE



INSTITUTIONAL



RECREATION



MIXED USE

### ROUTE ALIGNMENT



AT GRADE



RECESSED



ELEVATED



TUNNEL

### MAJOR IMPACTS



NOISE



ACCESSIBILITY



VISUAL

FIGURE 2.1

### The Land Use and Impacts Cross Section

To compare and contrast how a high speed rail system effects the surrounding physical environment in detail, evaluation of land uses and rail impacts by Cross Section Analysis was deemed necessary. The Cross Section Analysis involved three interrelated diagrams:

1) Cross Section of Existing Conditions

Delineates and analyzes existing conditions along the proposed corridor alignment prior to high speed rail construction, identifying the positive and negative impacts the high speed rail system might have on surrounding land uses within the preselected corridor.

2) Cross Section of Proposed Route Alignment

Superimposes the probable high speed rail vertical alignment and associated improvements on the Cross Section of existing conditions and analyzes the positive and negative impacts the proposed route alignment has on the physical environment and surrounding land uses.

3) Cross Section of Design Recommendations

Delineates possible proposed design alternatives by the author to mitigate the negative impacts created by the probable high speed rail alignment and associated ramifications within the preselected corridor.

The criteria for selecting the location of the cross section areas is best determined by identifying the major points of conflict between land uses and the adjoining rail corridor. For purposes of this study it became apparent that a detailed examination of each major land use category, including those that are not significantly impacted by a high speed rail system, was necessary to achieve a valid study. Secondly,

but also important, was to realize that a broad and varied representation of the possible vertical route alignments, land forms and corridor widths was also necessary. By coordinating the three sequential analyses on one cross section diagram, the ramifications associated with the high speed rail alignment and its impact on surrounding land uses can be perceived and evaluated in a comprehensive manner. By analyzing the major areas of conflict along the corridor in cross section, the vertical route alignment, adjacent land use development, regional topography and impact zone can be clearly defined and conceptual design solutions developed.

It should be noted that the four (4) vertical alignment types have significant impact on adjacent land use activities as well as overall cost feasibility of any high speed rail system. Following are characteristics specific to each vertical alignment type to be considered in the selection of any high speed rail corridor.

1) At Grade

- A) The railbed will be vertically aligned at or very close to existing grade.
- B) No grade crossings are present, thereby negating conflicts between vehicular traffic and the rail service.
- C) The most cost effective alignment due to lower initial construction costs.

2) Recessed

- A) The railbed will be depressed below existing grade, and in some cases the depth of the excavation may exceed the height of the train.
- B) To eliminate conflicts between vehicular traffic and the rail service, a vehicular overpass will be constructed where the two systems intersect.

- C) Costs will be higher than the at grade alignment due to the added expense of retaining walls, vehicular overpasses and related earthwork operations.

3) Elevated

- A) An elevated rail alignment is used where grade crossings and high density land uses exist regularly, thereby eliminating the conflicts between vehicular/pedestrian traffic and rail service.
- B) The high speed railbed will be elevated 25' above the ground elevation, and will allow for oversize vehicles to pass underneath.
- C) Initial costs will be significantly increased compared to at grade and recessed alignments due to the construction cost of the elevated rail structure.

4) Tunnel

- A) Two types of tunnels are possible in the construction of a high speed rail system.
  - 1) A cut and cover tunnel is employed where surface disturbance will not be a problem and where the depth of the tunnel will be relatively shallow. The process will resemble the construction of a large concrete box culvert.
  - 2) A direct bore tunnel is employed where surface disturbance will be a significant problem or where natural conditions require.
- B) Tunnel alignment is the least cost effective in comparison to other vertical alignment types because of the high initial costs of the tunnel construction and the magnitude of the related earthwork operations.

## GENERATION OF EVALUATION METHODOLOGY CRITERIA

A review of the Japanese Shinkansen "Bullet Train" indicated four major impacts result from high speed rail systems.<sup>3</sup> These impacts include: 1) noise disturbance, 2) accessibility, 3) visual disturbance, and 4) vibration disturbance. As a landscape architect, this author's capabilities and background limit input to the first three impacts in terms of environmental analysis and suggested solutions. The fourth impact, vibration, is a technical engineering impact and would be best addressed by others.

## EVALUATION CRITERIA

As noted heretofore in this study, noise disturbance, accessibility and visual disturbance will become the basis for evaluating the preselected high speed rail corridor. A matrix (figure 2.2) has been devised to graphically illustrate a direct comparison between the impact evaluation of: 1) the existing corridor conditions, 2) the proposed high speed rail alignment, and 3) any recommendations to mitigate, as much as possible, those impacts having a negative effect.

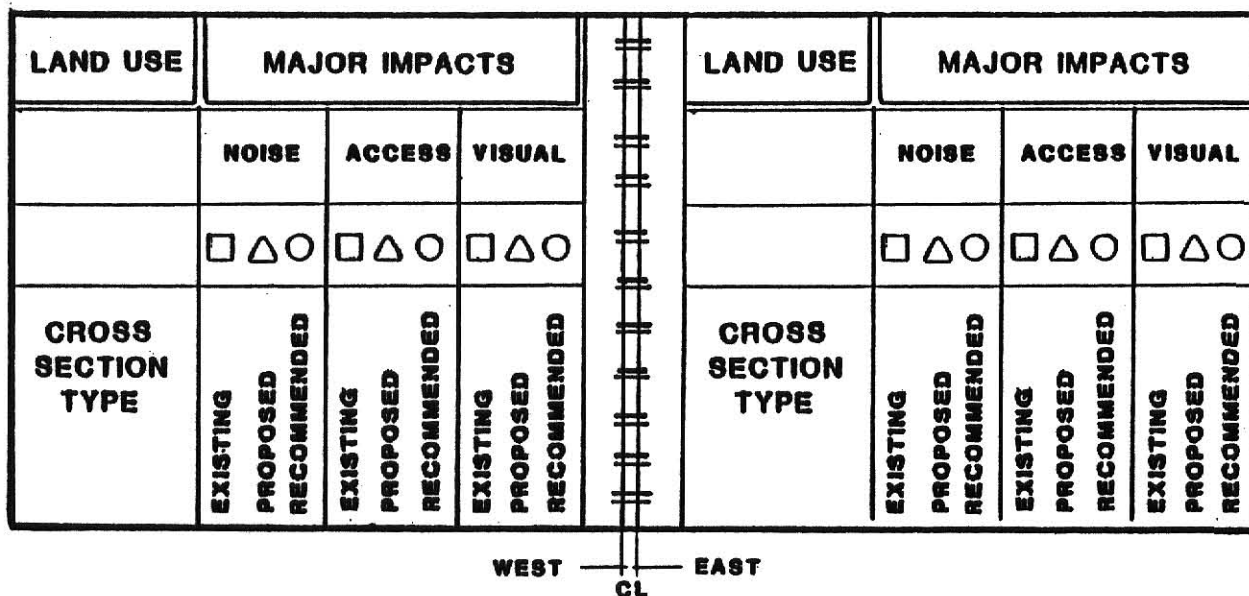
Different symbols were used to graphically identify the three interrelated cross section analyses. A square (□) represents the analysis of existing conditions, a triangle (△) represents the analysis

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<sup>3</sup>Hisashi Yoshimura, "Shinkansen and Environmental Problems," Proceedings of the Third Tokyo Transport Environmental Conference (Tokyo: The Japanese Research Center for Transport Policy, 1978), Passim.

of the proposed route alignment, and a circle (○) represents the author's recommendations and conclusions. Each symbol will be shaded fully, partially or not at all, representing an assessment determination as taken from the evaluation criteria. In general terms, the fully shaded symbol will represent severe negative impacts, a partially shaded symbol will represent moderate negative impacts, and an unshaded symbol will represent little or no negative impacts.

The matrix will identify the major land use categories and land use classifications of each cross section analysis and graphically represent the evaluation criteria determination of a high speed rail system's impact.



**MATRIX ANALYSIS DIAGRAM**  
**FIGURE 2.2**

After considerable comparative study between plan format and cross section format, it became obvious the corridor impacts were best determined and evaluated in cross section and, therefore, the matrix has been applied to the cross sections only.

## NOISE IMPACT

"Noise is a sound that is loud, unpleasant, undesirable or unexpected."<sup>4</sup> According to Charles Kammerman, an accoustical engineering technician for Wyle Laboratories, noise levels generated within the typical home setting are normally taken at 20 decibels (dbs), thereby allowing an additional 40-45 dbs from outside sources prior to the noise impacts reaching annoying levels. Physical barriers, namely concrete walls and earth berms located in close proximity to the railbed, will reduce the noise impact approximately 12 to 15 dbs. It should be noted that the effects of plant material with regard to reduction of noise levels are negligible.<sup>5</sup> In Japan the noise level 25 meters from the Shinkansen's track centerline is 80 dbs. The sound level comparison diagram (figure 2.3) indicates 80 dbs to be nearing an annoying noise level, thus residents along high speed rail corridors in Japan have asked that the db level be limited to 55 db from 9:00 p.m. to 7:00 a.m. and 65 db from 7:00 a.m. to 9:00 p.m.<sup>6</sup> The sound level diagram delineates direct comparisons between high speed rail transportation and other modes of travel. While figure 2.3 has been generated by high speed rail proponents, the decibel ratings depicted were found to be within reason. The noise of a high speed train has a 60 db reading which approaches the "quiet" noise level, while all other modes of

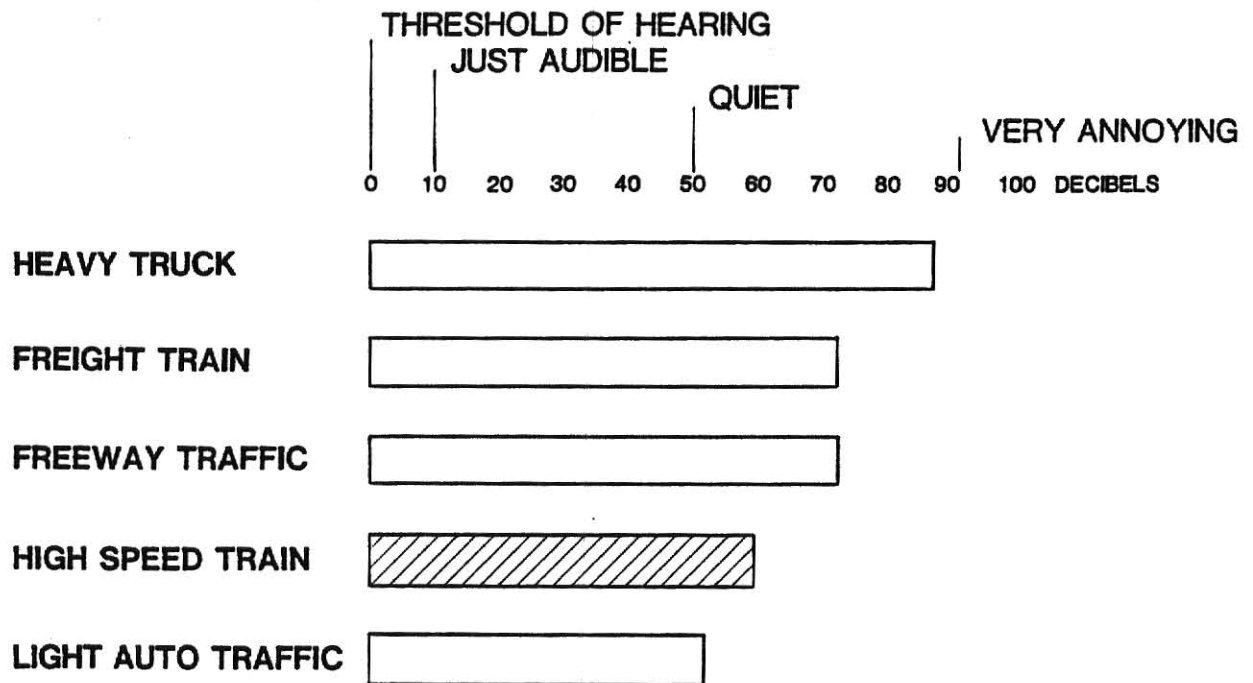
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<sup>4</sup>The American Heritage Dictionary, 2nd ed. (1982), s.v. "Noise".

<sup>5</sup>Interview with Charles Kammerman, Wyle Laboratories, El Segundo, California, 10 May 1983.

<sup>6</sup>Yoshimura, Proceedings of the Third Tokyo Transport Environmental Conference, p. 7.

travel shown, with the exception of light auto traffic, have greater noise db levels, which indicates that high speed trains are less noisy than most other types of travel modes.



## SOUND LEVEL COMPARISON



FIGURE 2.3

It is assumed by most that the human element associated with the land uses that border high speed rail corridors will be negatively impacted by the sound of the passing train. The fact is, negative noise impact of the high speed train is lessened by: 1) the noise factors generated within adjacent land uses and 2) activity involvement of various populations and individuals along the railroad right of way. For example, a home or school user might be significantly impacted by the noise of a passing train because the activities are sensitive to disruptions, whereas a factory or playfield user might not consider the

very same noise to be disruptive due to his/her non-conflicting activity. Because noise affects each person differently depending upon his/her activity and individual threshold, the evaluation of the noise impact will inevitably be subjective.

Several factors contribute to the noise discomfort as follows:

1) proximity to the railroad corridor, 2) juxtaposition of the vertical rail alignment, 3) topography adjacent to the corridor, and 4) elements existing within and paralleling the corridor, i.e., walls.

1) Proximity to the Railroad Corridor

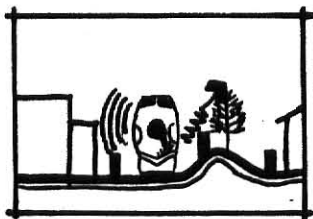
Adjacent land use activities normally butt directly against the rail corridor. As the corridor narrows, the noise factor becomes a progressively negative impact on adjacent land use due to the proximity of the noise source. Further, as the distance to the affected activities increases, the negative impacts lessens. According to Charles Kammerman of Wyle Laboratories, if the level of noise 25 meters from the Shinkansen's track centerline is 80 dbs, then the noise level 50 meters from the track centerline would be 70 dbs, and likewise, 100 meters from the track centerline the noise level would be 60 dbs.<sup>7</sup>

2) Vertical Rail Alignment

The four possible vertical route alignments within a high speed rail corridor will result in significantly different levels of noise impact.

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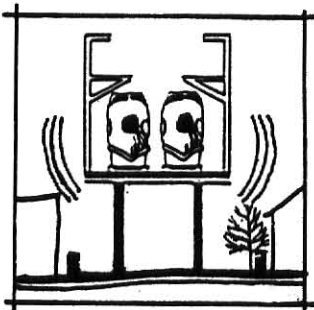
<sup>7</sup>Interview with Charles Kammerman, Wyle Laboratories, El Segundo, California, 10 May 1983.



- A) At-Grade Alignment results in moderate noise impact as considerable noise generated from the high speed rail system will be absorbed at ground level by land form and near-by structures. In addition, measures can be implemented to further absorb the noise impact of the high speed train, or at least deflect the noise impact away from sensitive land uses and into open air space utilizing earth berms and sound walls.



- B) Recessed Alignment will result in the least impact of the open (air) alignments, primarily because the noise will be deflected off the depression slopes/walls into the above open air space, with much of the generated noise absorbed in the earth. As in the at grade alignment, measures such as earth berms and sound walls can be implemented to absorb the noise impact of the high speed train or deflect the noise impact into open air space.

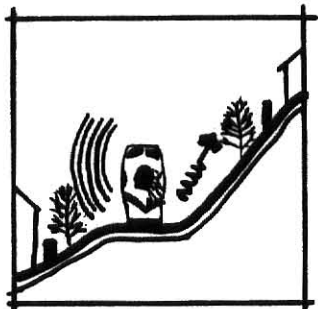


- C) Elevated Alignment will result in the greatest impact, primarily because of the position of the rail above the adjoining land uses and the ineffectiveness of known methods to deflect or absorb much of the train noise above the ground surface. The height of the rail structure will project some noise toward surrounding effected land uses.

- D) Tunnel Alignment results in the least noise impact of all alignment types as the noise of the train system is self-contained within the tunnel structure.

### 3) Topography

The negative noise impact will be greater for land uses at elevations lower than the trackbed because there is less ground surface to absorb the noise of the passing train and



measures to mitigate this noise, such as sound walls, are not as effective from below the trackbed. Conversely, the noise impact will be less for land uses at elevations higher than the trackbed because more noise will be deflected into open air space and absorbed by the earth's surface. Also, measures to mitigate the noise impact, such as sound walls, will significantly lessen the noise impact.

### 4) Existing Corridor Elements/Features

Existing walls and structures can mitigate the noise impact of the passing train. The effectiveness of these features will largely depend upon the proposed vertical alignment, regional topography and the relative proximity of the existing corridor elements to the trackbed.

## NOISE EVALUATION CRITERIA



#### Low Noise Impact

The activities of the adjacent land uses will be slightly impacted by the frequency and loudness levels of the rail system or the activities of the adjacent land uses will be insignificantly impacted by any loudness levels due to their insensitivity to sound disruptions.



#### Moderate Noise Impact

The activities of the adjacent land uses will be moderately impacted by the frequency and loudness levels of the rail system.

### High Noise Impact

The activities of the adjacent land uses will be severely impacted by the frequency and loudness levels of the rail system.

### ACCESSIBILITY IMPACT

Human nature is to investigate the unknown. This curiosity often attracts people to railroad corridors. Normally, danger exists along railroad corridors because of the speed of the passing train and the lack of safety precautions taken to restrict access. Safety associated with this study relates to the relative accessibility from outside sources to a proposed railroad corridor and not safety considerations concerning the rail alignment, rail passengers, vehicular/train conflicts, etc.

The potential for access into the high speed rail corridor is contingent upon the following factors: 1) adjacent land use type and population density, 2) proximity of land use activities to corridor and 3) existing man-made or natural barriers, paralleling or within the corridor.

#### 1) Adjacent Land Use Type and Population Density

As the population density of land uses increases adjacent to the corridor right of way (i.e., housing, commercial, industrial), the probability of people venturing into the rail corridor increases. Conversely, as the population density of land uses decreases (i.e., agriculture, vacant, roadways, utility corridors), fewer people are likely to venture into the rail corridor.

2) Proximity of Land Use Activities to Corridor

Adjacent land use activities normally butt directly against the rail corridor. Because the land use activity is in such close proximity to the rail corridor, undesired access will likely occur. Conversely, if land use activities are located a significant distance (at least 300') from the rail corridor, undesired access will likely diminish.

3) Existing Man-Made or Natural Features

Existing natural features such as steep terrain, streams and vegetation patterns and man-made elements such as highways, drainage channels, fences and structures can hinder access into the railroad corridor.

A high speed train passing by will be of greater danger than conventional trains because of the increased speed. Therefore, accessibility to the rail corridor must be limited completely for the public's safety and welfare.

The most effective method of restricting access to the railbed is via an elevated or tunnel alignment where accessibility is essentially impossible. However, of the four possible vertical alignments, elevated and tunnel alignment are most costly, so for a high speed rail system to be economically feasible, at grade and recessed vertical alignments will have to be utilized where ever possible. In an at grade or recessed alignment, measures can be implemented to discourage or restrict access into the rail corridor as follows:

- 1) Large earth berms can be constructed that provide a sense of physical barrier and limit the adjacent view to the corridor, lessening the probability of entering the railroad right of way to investigate the surroundings.

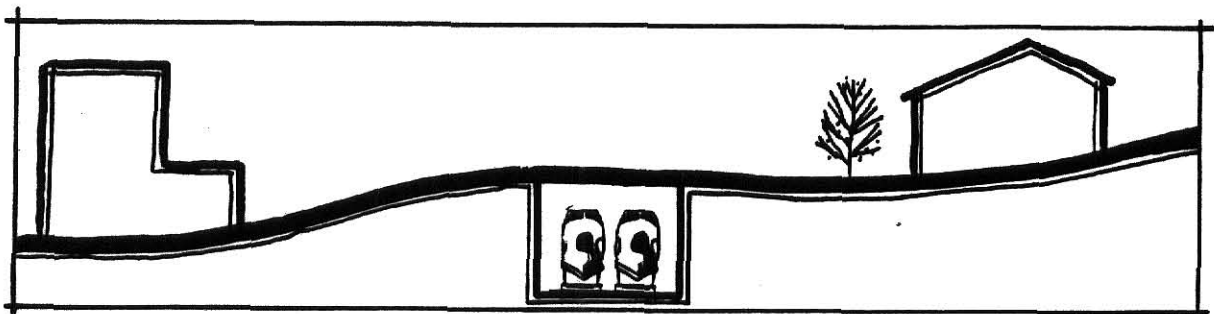
- 2) Evergreen vegetation placed strategically at corridor "edges" will serve as a physical barrier and subsequently diminish the observer's view of the railroad corridor, thereby discouraging access.
- 3) Walls or fences at least 6' in height will restrict the accessibility and view of the railroad corridor, thereby discouraging access.
- 4) Realigning the rail system horizontally can create a greater distance between the railroad corridor and any conflicting high density land use, thus allowing for effective measures such as earthberming, evergreen vegetation and walls to be utilized in further discouraging access.

#### ACCESSIBILITY EVALUATION CRITERIA



##### Inaccessible

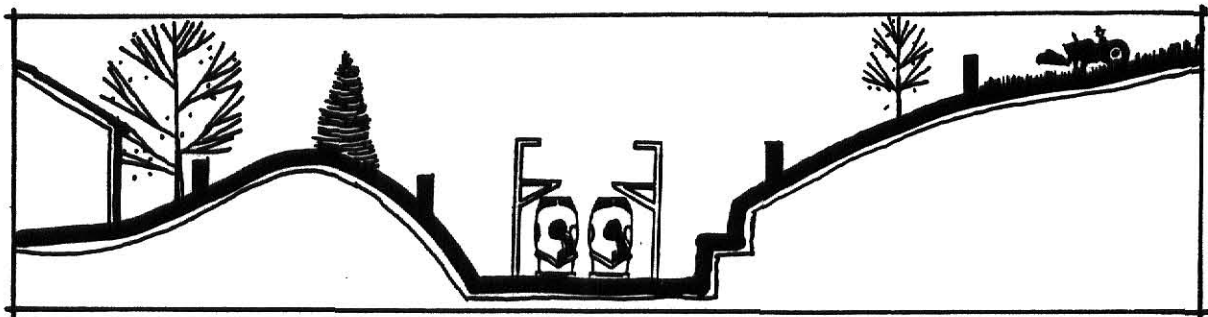
An elevated or tunnel alignment will severely restrict access into the rail corridor because it is essentially impossible to penetrate these two alignment types. Also, some adjacent land uses effectively monitor ingress and egress within their property boundaries, thereby significantly limiting access into the rail corridor.





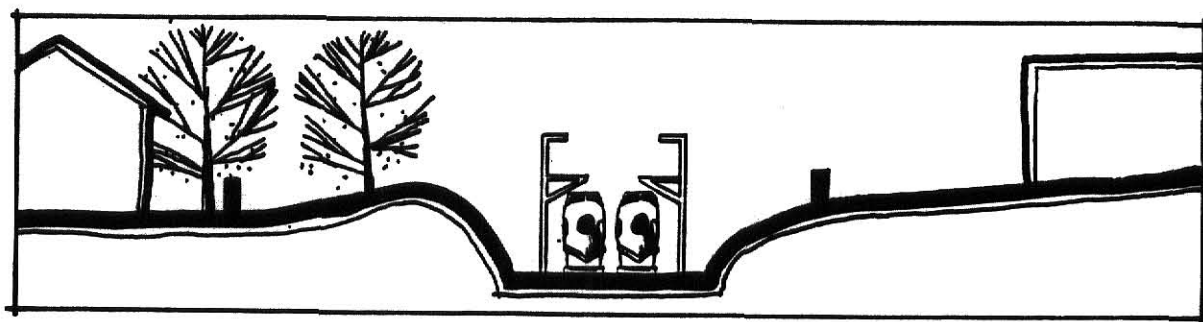
### Moderately Accessible

A 6' to 10' fence or wall barrier reinforced by large earth berms and/or plant masses will be used to further physically and visually restrict access from adjacent land uses in an at grade or recessed vertical alignment.



### Accessible

A 6' to 10' fence or wall barrier, or no physical barrier, restricts access from adjacent land uses to the railroad corridor in an at grade or recessed vertical alignment.



## VISUAL IMPACT

Several federal land managing agencies look to the regional landscape for specific resource indicators of visual quality, and, thus, high quality ratings are assigned to those landscape units which most clearly exhibit the natural characteristic of the geographic region.<sup>8</sup> However, the visual quality of any environment is perceived differently by each individual observer. While one person may view a specific feature in the landscape as a positive influence, another person may view the same feature as a negative element. Therefore, subjectivity in the evaluation of the landscape's visual quality is inevitable.<sup>9</sup>

The visual impact is similar in many ways to the noise impact along the railroad corridor. The visual impact is influenced by the surrounding environment, physical development, natural patterns and associated activity taking place on the adjacent impacted land use. In certain instances the view through the railroad corridor to surrounding land uses has little significance to the observer due to their on-going activity. As an example, a homeowner may be sensitive of the views from his backyard, while a worker within an enclosed work space is totally unaware of outside views.

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<sup>8</sup>U.S. Department of Transportation, Visual Impact Assessment for Highway Projects (Washington: Federal Highway Administration, 1981), p. 12.

<sup>9</sup>E. Zube, R. Bush, and J. Fabos, Landscape Assessment and Values, Perceptions, and Resources (Stroudsburg: Dowden, Hutchinson, and Ross, Inc., 1975).

The observer's view along a high speed rail corridor might be restricted by one or a combination of the following: 1) topography, 2) rail system design, 3) height of adjacent land use structures, and 4) proximity to corridor.

1) Topography

The terrain surrounding the corridor could vary from flat to rolling hills to steep mountains. The view to the high speed rail right of way varies considerably with topographic patterns and the juxtaposition of the observer within that topography. Atop a ridge, a view may go on for miles relatively unaffected by the rail alignment, while the view from the valleys may be obstructed or limited by elements of the high speed rail system.

2) Rail System Design

The visual impact of the high speed rail system improvements may; 1) obstruct or close off views through the rail corridor or 2) attract the observer's eye to corridor improvements. The visual impact will depend largely on the observer's juxtaposition and proximity to the rail corridor -- as well as whether the impact is perceived as positive or negative. Some of the physical improvements that might impact visual perception are:

- A) 25' high catenary poles located 195' on center along the railroad's alignment.
- B) The relative vertical alignment of the railbed in relation to the observer, in particular, an elevated alignment structure.
- C) The color and/or texture of the rail system's permanent equipment in terms of attracting the observer's eye to that feature, depending on visual contrasts rather than the views beyond.

3) Height of Adjacent Land Use Structures

The height of the structures along the railroad right of way may impede views or in some instances enhance the views.

4) Proximity of Corridor

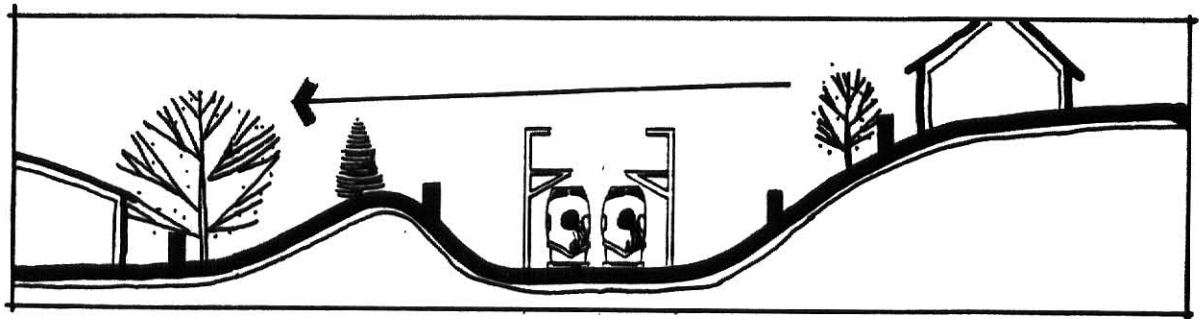
The level of detail and, for that matter, the level of impact will vary depending upon the observer's distance from the railroad corridor. As the observer's distance increases from the rail corridor, the visual impact lessens because the observer is able to perceive less detail.

### VISUAL EVALUATION CRITERIA



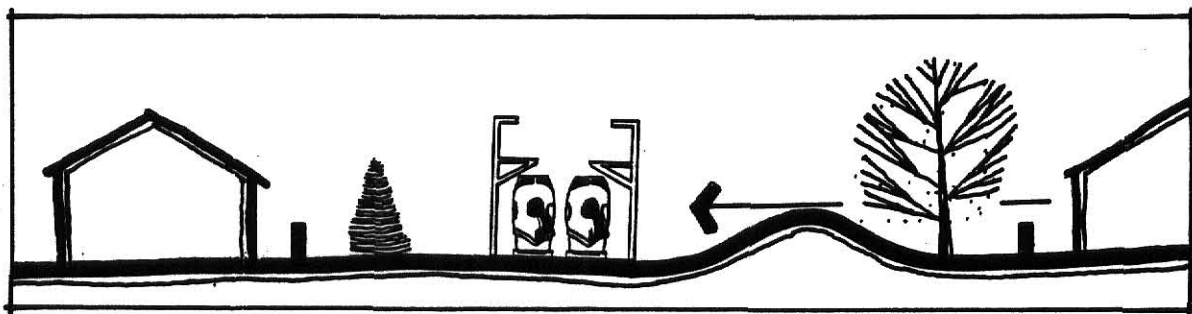
Low Visual Impact

The corridor alignment will slightly impact the observer's view in part because measures to mitigate the negative impacts, such as earth berms, vegetation and sound walls, can be notably effective, or the alignment type (i.e., tunnel) does not create negative visual impacts. And in addition, the adjacent views through the rail corridor range from good to fair to poor visual quality. (Note: a view of poor visual quality will be impacted little by rail alignment.)



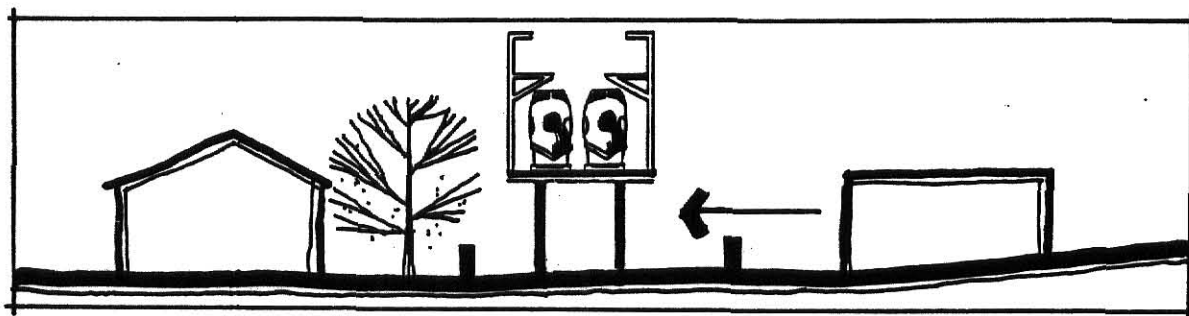
### Moderate Visual Impact

The corridor alignment will moderately impact the observer's view because measures to mitigate the negative impacts such as earth berms, vegetation and sound walls can be moderately successful, or the proposed alignment type (i.e., at grade or recessed) has moderate visual impacts. And in addition, the adjacent views through the rail corridor range from fair to poor visual quality.



### High Visual Impact

The corridor alignment (i.e., elevated) will severely impact the observer's view in part because measures to mitigate this visual impact such as earth berms and vegetation are not significantly effective, and the adjacent views through the rail corridor range from good to fair visual quality.



## SYNTHESIS OF METHODOLOGY

Following the identification of the major impacts that the high speed rail system has on surrounding land uses, conceptual design alternatives will be developed to possibly mitigate those negative impacts. Alternative solutions shall be developed in the third phase of the cross section diagrams to propose physical design proposals to lessen the negative impacts of the high speed rail improvements on adjacent land uses.

The methodology generated herein will provide the basic systematic approach of evaluating -- and where possible, offer design alternatives to lessen -- high speed rail corridor impacts on surrounding land uses. The methodology developed heretofore shall be tested in a case study corridor between Los Angeles and San Diego, California as proposed by the American High Speed Rail Corporation; Chapter 3 of this study.

## CASE STUDY

The case study is an application of the methodology for evaluating impacts of noise, accessibility and visual quality on adjacent land uses as a result of a proposed -- and in this case -- preselected high speed rail corridor as developed in the preceeding chapter. The case study focuses on the high speed rail system connecting Los Angeles and San Diego, California, presently in the final design phase by the American High Speed Rail Corporation (AHSRC). The AHSRC rail system was selected as the case study as it is the first and only high speed rail system being proposed for construction in the United States in the immediate future, representing the optimum choice in terms of current information as well as input from system designers, management and affected populations prior to construction. Secondary, but also important, the urban, suburban and rural land use development patterns adjacent to this preselected corridor are typical of corridor conditions existing in other high speed rail markets noted previously. It is the intent that conclusions drawn from this case study will be applicable to corridor evaluations in other parts of the country -- at least to some degree.

# PROPOSED ROUTE ALIGNMENT

The proposed 130-mile route extends from the Los Angeles International Airport through downtown Los Angeles to downtown San Diego. The segment from the Los Angeles Airport to downtown Los Angeles will follow the general alignment of the existing Santa Fe railroad right of way, while the segment from downtown Los Angeles to downtown San Diego will follow both the general alignment of Interstate 5 and the Santa Fe railroad right of way as delineated on the route alignment map, figure 3.1.

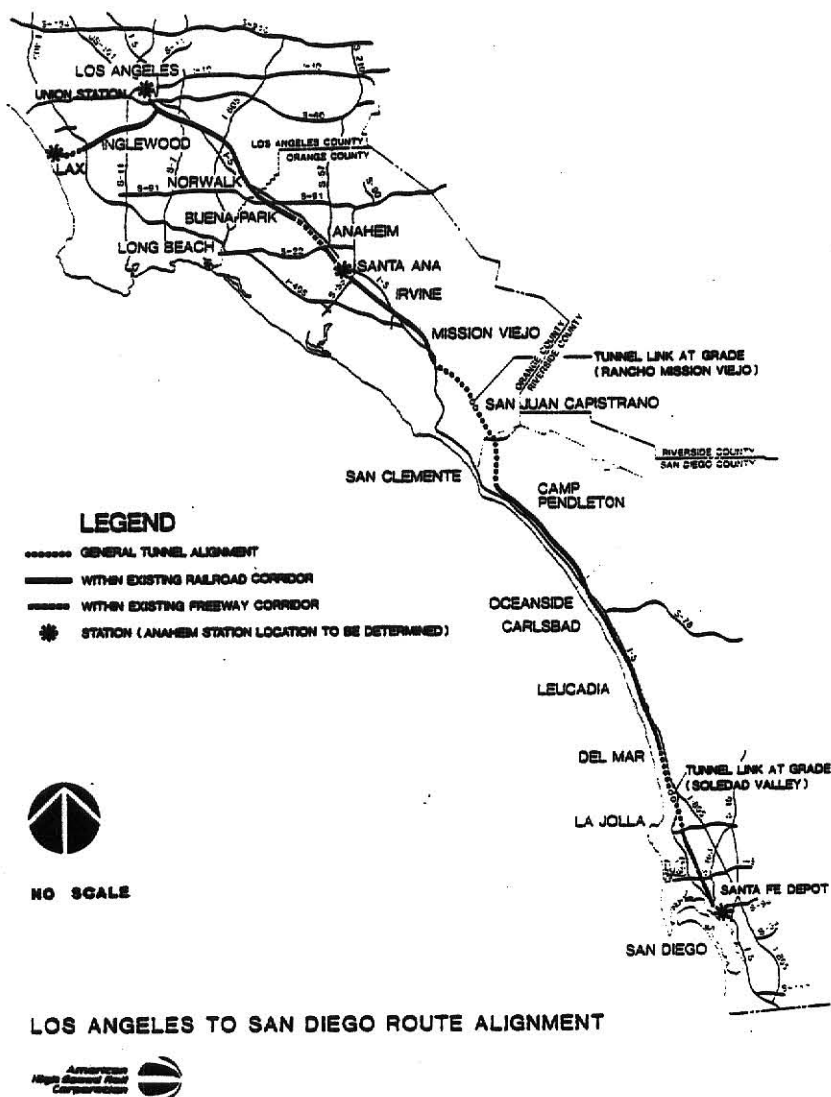
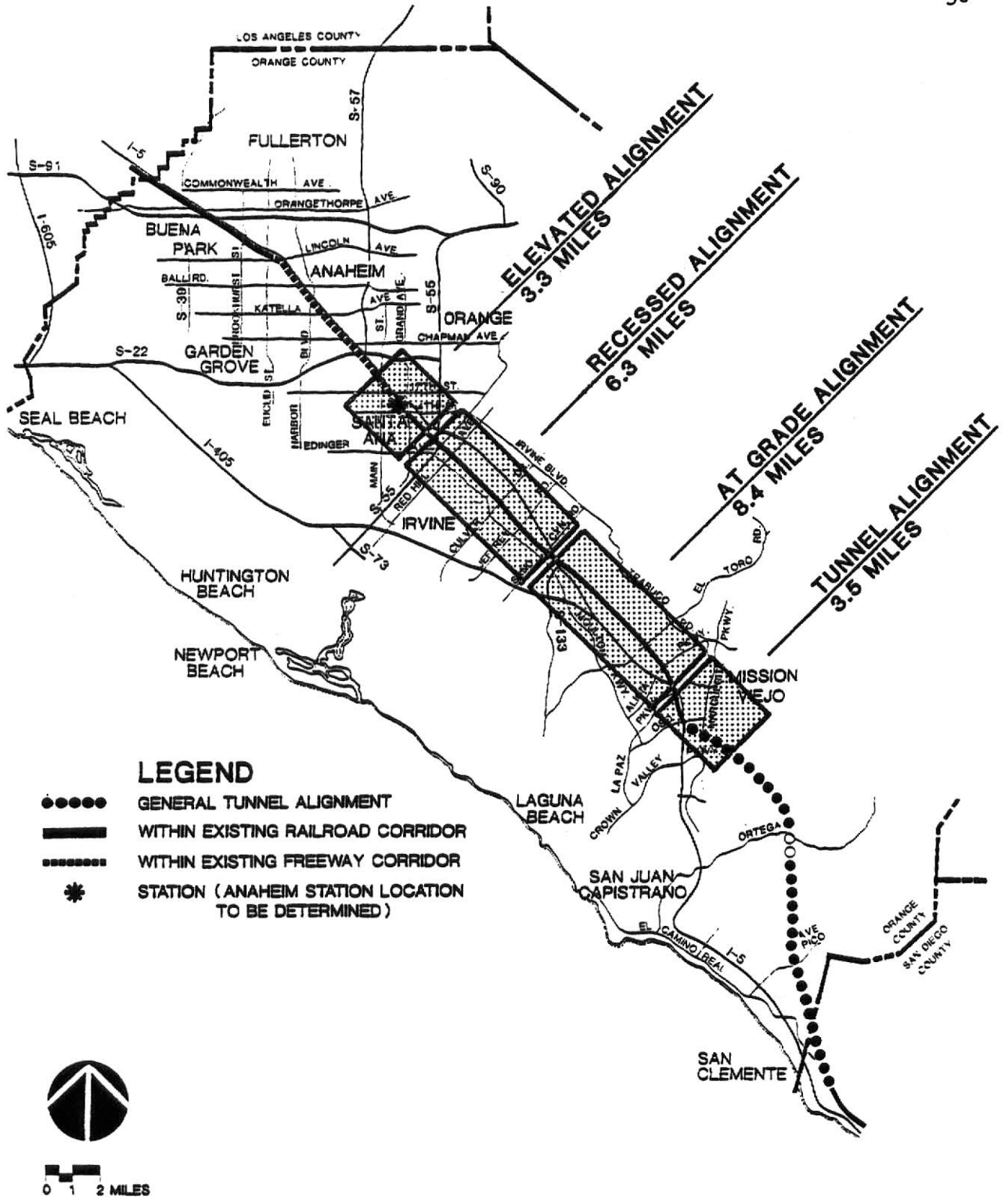


FIGURE 3.1

## SPECIFIC CASE STUDY ROUTE SELECTION

In order to provide a manageable case study area within the resources of the author and time limitations of this study, a 21.5-mile section of the actual 130-mile corridor was selected as the case study corridor. Varying vertical route alignment types and diversity of land use development patterns within the selected corridor were the primary factors in selecting the case study area. A preliminary review of the AHSRC's proposed design along the specific case study corridor indicates that all four of the vertical alignment types -- at grade, recessed, elevated and tunnel -- were employed.

Of the four possible vertical alignments within the 21.5-mile case study, at-grade alignment accounts for 39.1% of the trackage; recessed alignment accounts for 29.3% of the trackage; elevated alignment accounts for 15.3% of the trackage and tunnel alignment accounts for 16.3% of the trackage as proposed by the AHSRC. While not every land use occurring along the 130-mile corridor is included within the specific case study corridor length, the land uses that do border the case study corridor represent a broad range, and depict those land uses that will be prominent not only along this corridor, but along most corridors (see figure 3.2) proposed within the United States.



SANTA ANA TO SAN JUAN CAPISTRANO ROUTE ALIGNMENT



FIGURE 3.2

## DESCRIPTION OF CASE STUDY ROUTE ALIGNMENT

The specific case study area begins in Santa Ana approximately 40 miles south of Los Angeles extending 21.5 miles to San Juan Capistrano. The route passes by the communities of Tustin, East Irvine, El Toro and Mission Viejo following primarily along the Atchison Topeka and Santa Fe (AT&SF) railroad right of way the entire corridor distance. It should be noted that the AT&SF rail freight service line must be maintained and operated within the high speed rail corridor presenting a unique -- and in most cases -- difficult situation specific to this case study. The major problem in maintaining freight operations within the high speed rail corridor focuses on the necessity of serving industry on either side of the corridor, requiring over or under passages of the high speed trackage. Although Amtrak is presently maintaining passenger rail service on AT&SF tracks, the Amtrak service will be discontinued with the advent of high speed passenger rail service.

The AHSRC's preliminary route alignment indicates the high speed rail system will enter Santa Ana in an elevated alignment and will continue in this alignment to the southern edge of Santa Ana, where upon passing over Ritchey Road the rail system will drop into a recessed alignment. The system will travel in a recessed alignment, with the exception of several road crossings, to East Irvine, at which point the system will begin an at-grade alignment continuing to Oso Parkway in North Mission Viejo. At Oso Parkway, the rail system leaves the AT&SF railroad right of way into a bore tunnel alignment that continues through San Juan Capistrano; the termination of the case study.

## METHODOLOGY APPLICATION

As discussed within the methodology, the evaluation process will encompass three (3) distinct phases: 1) the inventory/analysis phase, 2) the evaluation phase and 3) design recommendations phase.

Inventory/Analysis

Base information was compiled for the preselected corridor from two primary sources: 1) black and white aerial photographs and 2) United States Geological Survey (USGS) topographic maps. A series of five reproducible aerial photographs were obtained from the AHSRC consultants at 1:10,000 in sequential order, progressing from north to south covering the entire length of the 21.5-mile case study corridor.<sup>1</sup> An accurate interpretation of the corridor's physical character was obtained as a result of the aerial photographs having been taken as recently as November, 1982. The high level of detail evident in the aerial photographs proved extremely useful in identifying and classifying land use types and activities. USGS topographic maps were acquired for the entire 130-mile corridor at a scale of 1:250,000 and for the selected case study area at a scale of 1:24,000.<sup>2</sup> These USGS maps revealed land form patterns, drainage patterns and to some extent, the overall development patterns not readily interpreted from the aerial

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<sup>1</sup>Ertec, Aerial Photographic Maps, Los Angeles to San Diego Plan (Cypress: American High Speed Rail Corporation, 1982), pp. 13-17.

<sup>2</sup>U.S., Department of Interior, Quadrangle Topographic Maps. Scale 1:250,000, Los Angeles 1975, Long Beach 1978, San Diego 1978, Santa Ana 1979. Scale 1:24,000, Anaheim, Orange, Tustin, El Toro, San Juan Capistrano (Denver: United States Geological Survey, 1981).

photographs. Once into the case study corridor evaluation, it became obvious the combination of aerial photographs and USGS maps were essential to provide the accurate base information necessary from which an analysis of the preselected corridor could commence.

It was determined early on in the case study that verification of existing land uses and visualization of the high speed rail impacts on surrounding land uses would require actual on-site field observation and inventory. In order to view existing corridor conditions and gain a sense of landscape character adjacent to the corridor, the author traveled to southern California to become acquainted with existing corridor conditions. Prior to the corridor visitation it was decided that the rail corridor conditions could be systematically photographed from the track centerline at regular intervals. However, it became apparent that if photos were taken at regular intervals, key landscape elements and major land uses could be overlooked. Therefore, it became necessary to identify and relate photograph vantage points in relation to major land use changes and/or major landscape features including topography, vegetation etc., not necessarily occurring on a regular interval. Further, it was determined photographs from surrounding land uses to the rail corridor would prove valuable in providing an indication of the high speed rail impact on those land uses. Subsequently, the entire 21.5-mile proposed high speed rail corridor was walked and photographed, both from within the corridor, and outside looking into the corridor. Each photograph location and view, including over 450 35-mm slides, was recorded on a copy of the aerial photographs and catalogued for future reference during the course of this study.

In addition to observing the existing corridor conditions, the author met with the AHSRC design team, the Fluor Corporation (engineering/construction management consultants), and AHSRC management, specifically Mr. Nicholas Brand, vice president in charge of rail development and planning, to obtain critical insight and base information in the planning of the proposed high speed rail corridor.

From aerial photographs, on-site field observation and on-site photographic records, each specific land use and major natural feature was identified and recorded on the base maps under the seven (7) major land use categories generated in the methodology, as follows:

- 1) Housing
  - a. Single Family Residential
  - b. Multi-family Apartments
  - c. Modular Homes
- 2) Commercial
  - a. Retail Sales
  - b. Office Facilities
  - c. Vehicular Sales
  - d. Entertainment
- 3) Industrial
  - a. Research and Development
  - b. Manufacturing Production
  - c. Wholesale and Retail Trade
  - d. Overhead Utility
- 4) Agriculture
  - a. Cropland
  - b. Orchard
- 5) Institutional
  - a. Federal Military Installation
  - b. Primary School
  - c. Secondary School
- 6) Recreation
  - a. Community Park
  - b. Open Space

7) Mixed Use

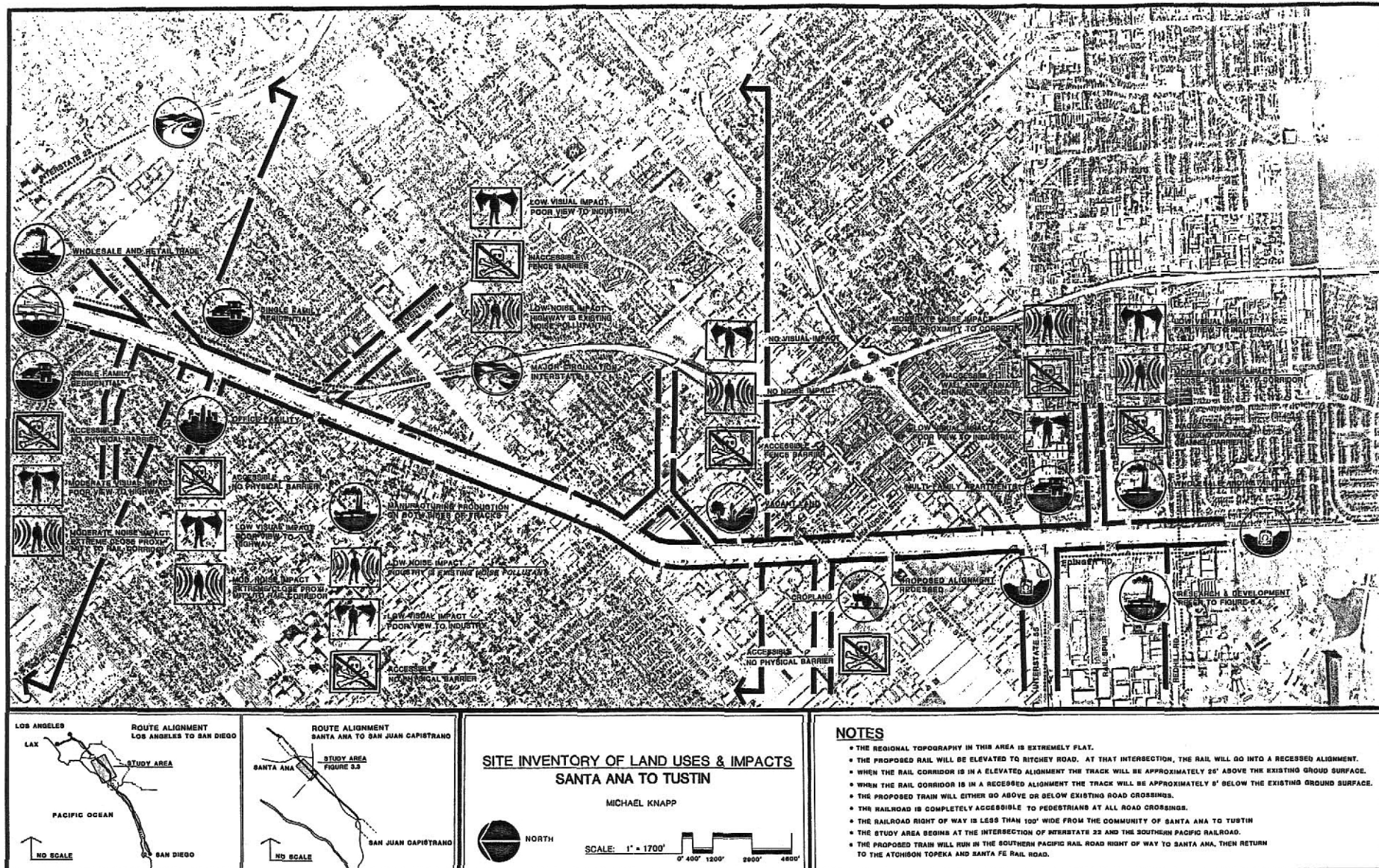
- a. Vacant
- b. Water Channels
- c. Transportation Routes

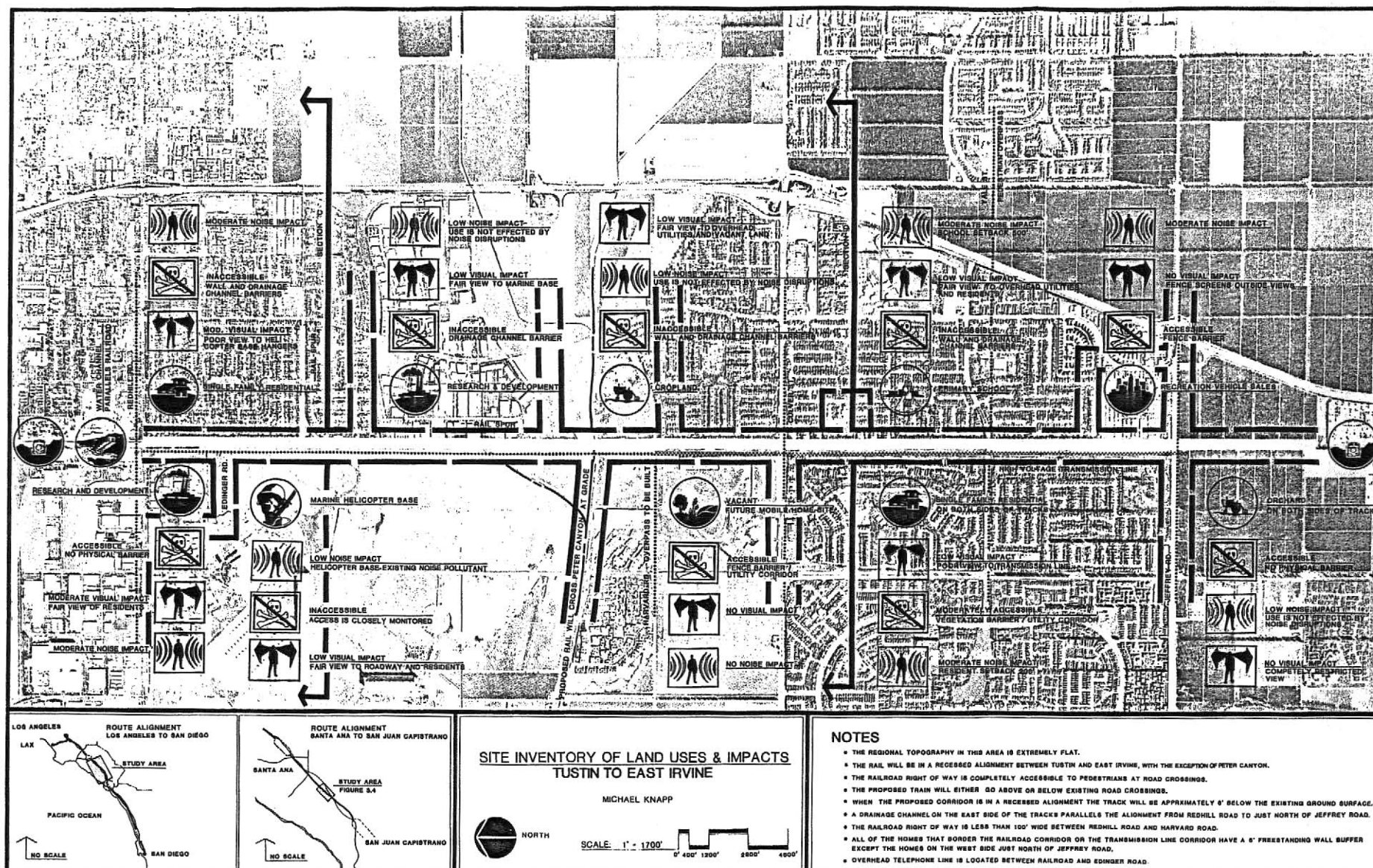
A symbolic representation of each landuse and impact evaluation was superimposed on the five aerial base maps per the symbol system developed in the methodology (see figures 3.3, 3.4, 3.5, 3.6 and 3.7). When completed this analysis provided a detailed understanding of the case study land uses and probable areas of conflict to be studied in greater detail in a Cross Section Analysis.

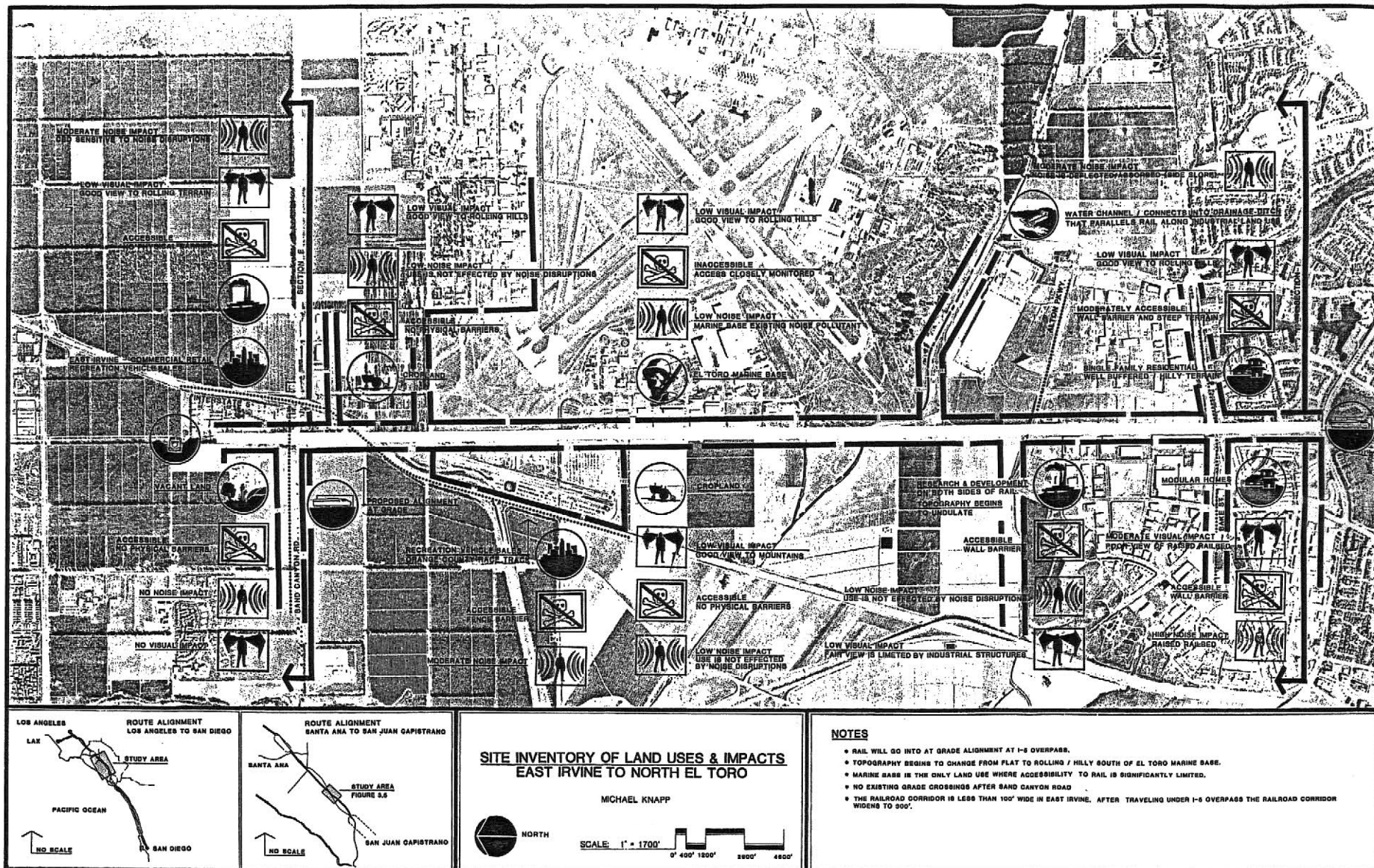
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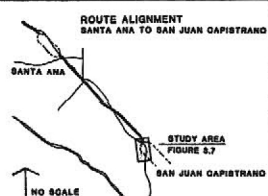
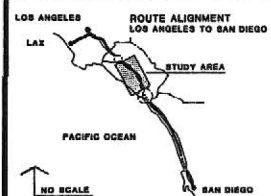
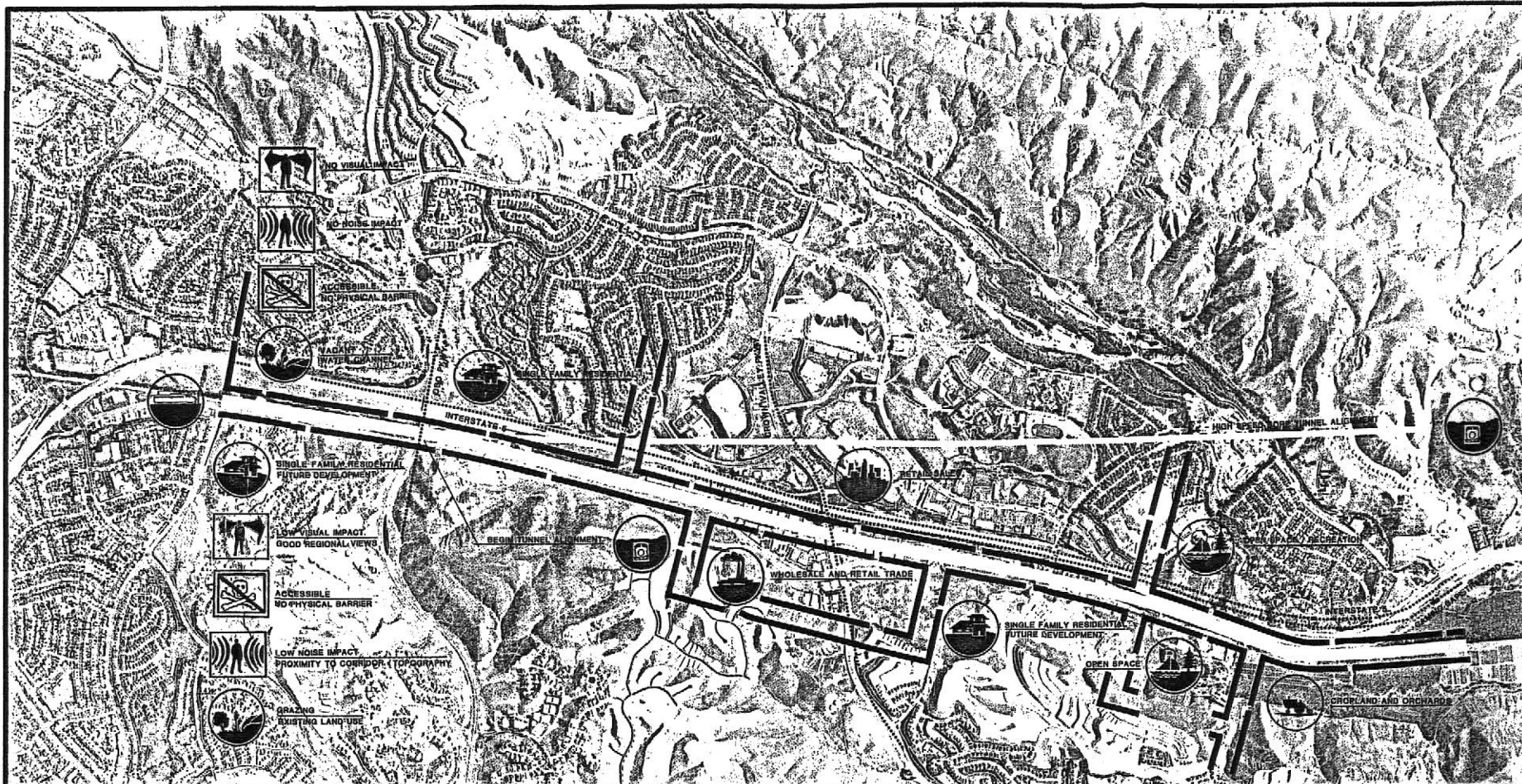
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### SITE INVENTORY OF LAND USES & IMPACTS MISSION VIEJO TO SAN JUAN CAPISTRANO

MICHAEL KNAPP

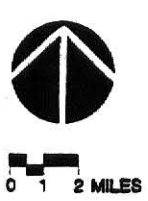


SCALE: 1" = 1700'

### NOTES

- THE REGIONAL TOPOGRAPHY IN THIS AREA IS EXTREMELY STEEP.
- THE PROPOSED HIGH SPEED RAIL SYSTEM WILL CONTINUE IN AN AT GRADE ALIGNMENT TO OSO PARKWAY. AT WHICH POINT THE SYSTEM WILL LEAVE THE RAILROAD RIGHT OF WAY IN A BORE TUNNEL ALIGNMENT, THAT WILL CONTINUE THROUGH SAN JUAN CAPISTRANO.
- THE AERIAL PHOTOGRAPH DELINEATES HOUSING PATTERNS TO THE WEST OF THE RAILROAD. BECAUSE THE TOPOGRAPHY IN THIS AREA IS EXTREMELY STEEP FEW HOMES CAN BE SEEN FROM THE EAST SIDE OF THE RAILROAD.
- THE LAND USES IDENTIFIED ON THE EAST SIDE OF THE RAILROAD CORRIDOR ARE LOCATED WEST OF INTERSTATE 5.
- THE STUDY AREA ENDS AT JUNIPERO BERRA ROAD IN SAN JUAN CAPISTRANO.
- A DRAINAGE CHANNEL MEANDERS ALONG THE RAILROAD CORRIDOR FROM MISSION VIEJO TO SAN JUAN CAPISTRANO. THE RAILROAD RIGHT OF WAY VARIES BETWEEN 100' AND 300' WIDE IN THIS AREA.

The criteria for selecting the location of the cross section areas was determined by identifying the varying range of land use and alignment types generating significant conflicts adjoining the rail corridor. The evaluation criteria and subsequent matrix developed in the methodology will graphically illustrate a direct comparison between the existing corridor conditions, AHSRC alignment proposals (representative of the current stage of project design) and the suggested study recommendations to mitigate negative impacts where possible. Ultimately, seven areas were selected to examine, in cross section detail, the impacts of a high speed rail system on surrounding land use patterns. Following are the graphic illustrations and description of the cross section areas: see cross sections A, B, C, D, E, F and G; figures 3.31, 3.32, 3.41, 3.42, 3.51, 3.52 and 3.61.



**American  
High Speed Rail  
Corporation**

**FIGURE 3.21**

# CROSS SECTION A INVENTORY AND ANALYSIS

MILE MARKER -----  $\pm$  .65 miles south of case study point of beginning

LOCATION ----- .1 mile north of Main Street/City of Santa Ana

CORRIDOR WIDTH ----- 48 ft.

ADJACENT LAND USE --- a) West of ROW (right of way) -- Office facility

b) East of ROW (right of way) -- Interstate highway

TOPOGRAPHY ----- Flat

ALIGNMENT TYPE ----- a) Existing ----- At Grade

b) Proposed ----- Elevated

c) Recommended ----- Elevated

## Matrix Analysis

LAND USE	MAJOR IMPACTS				LAND USE	MAJOR IMPACTS		
	NOISE	ACCESS	VISUAL			NOISE	ACCESS	VISUAL
COMMERCIAL Office Facility	■ ▲ ●	■ ▲ ○	□ ▲ ●		MIXED USE Interstate Highway	□ ▲ ○	□ ▲ ○	□ ▲ ●
CROSS SECTION TYPE	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED		CROSS SECTION TYPE	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED
				WEST — CL — EAST				

### Analysis of Existing Conditions

- 1) The office facility is moderately impacted by noise, due to close proximity and at grade elevation in relation to the railbed/corridor.
- 2) The interstate highway is not significantly impacted by noise, due to insensitivity to rail noise disturbances.
- 3) The office facility landuse has complete accessibility to the rail corridor.
- 4) The probability of access across the interstate highway into the rail corridor is negligible.
- 5) The observer's view from the office facility and interstate highway landuses are slightly impacted by the railroad, due to the observer's close proximity, at grade eye level position in relation to the railbed/corridor and the resultant unobstructed sight line across the ROW.

### Analysis of the AHSRC's Proposed Alignment

- 1) The office facility will be severely impacted by noise, due to the elevated alignment, and close proximity to the rail corridor.
- 2) The interstate highway is not significantly impacted by noise, due to insensitivity to rail noise disturbances.
- 3) The elevated alignment limits access to the high speed railbed for both landuses.
- 4) The observer's view from the office facility and interstate highway are severely impacted by the elevated alignment, due to the permanent physical obstruction, the observer's close proximity and lower viewing position in relation to the railbed.

Study Recommendations

- 1) Same as proposed by the AHSRC.
- 2) An elevated alignment was selected in this urban community, due to the numerous grade crossing conflicts, the adjacent interstate highway's insensitivity to rail disturbances and economic feasibility considerations, and permanent disruption of high density urbanized patterns. While the elevated alignment will have a negative impact on the office facility landuse, the elevated alignment alternative is the reasonable choice, given the existing restrictions of the corridor and surrounding landuses.

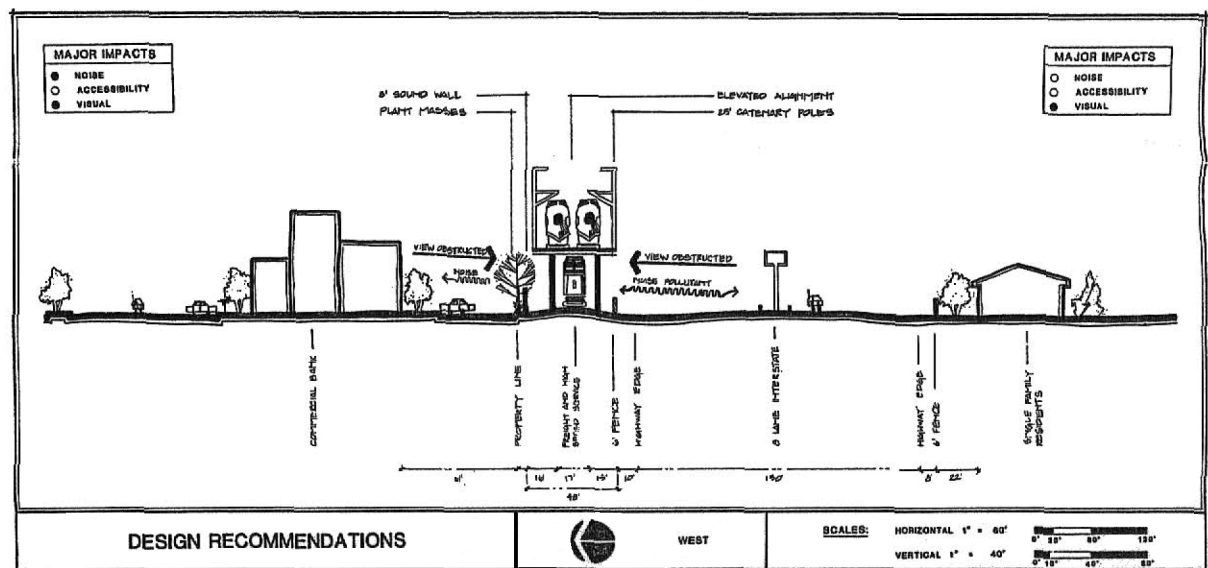
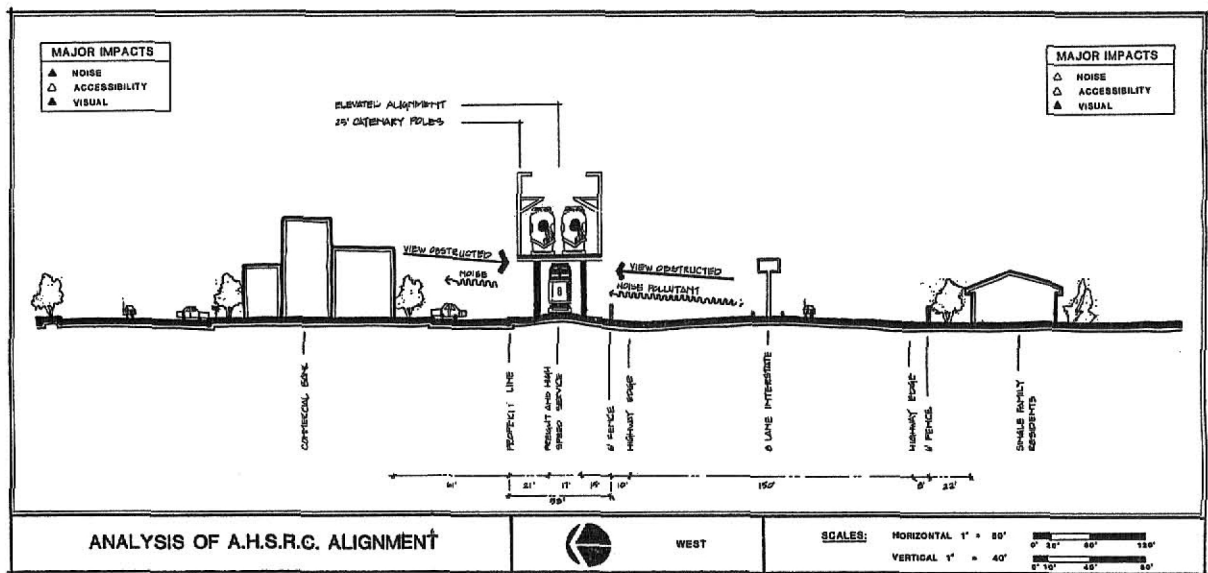
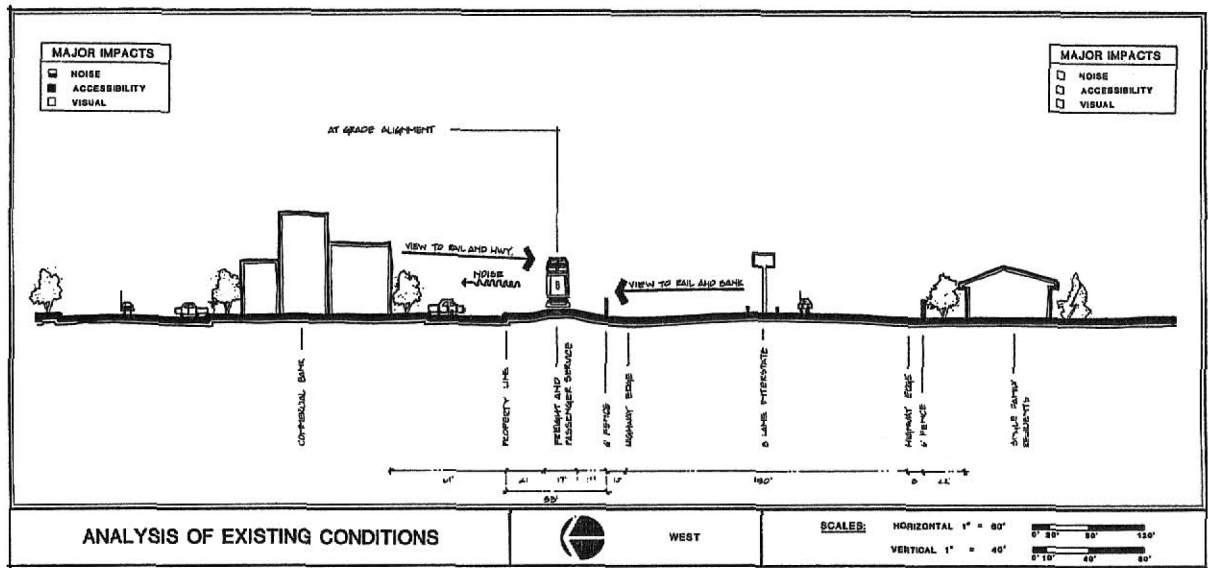


FIGURE 3.31

CROSS SECTION B  
INVENTORY AND ANALYSIS

MILE MARKER -----  $\pm$  2.8 miles south of case study point of beginning

LOCATION ----- .2 miles south of Grand Avenue/City of Santa Ana

CORRIDOR WIDTH ----- 112 ft.

ADJACENT LAND USE --- a) West of ROW -- Manufacturing production

b) East of ROW -- Multi-family apartments

TOPOGRAPHY ----- Extremely flat

ALIGNMENT TYPE ----- a) Existing ----- At Grade

b) Proposed ----- Elevated

c) Recommended ----- Tunnel

Matrix Analysis

LAND USE	MAJOR IMPACTS				LAND USE	MAJOR IMPACTS		
	NOISE	ACCESS	VISUAL			NOISE	ACCESS	VISUAL
INDUSTRIAL Manufacturing Prod	<input type="checkbox"/> <input type="triangle"/> <input type="circle"/>	<input checked="" type="checkbox"/> <input type="triangle"/> <input type="circle"/>	<input type="checkbox"/> <input checked="" type="triangle"/> <input type="circle"/>		HOUSING Multi-family apts.	<input checked="" type="checkbox"/> <input checked="" type="triangle"/> <input type="circle"/>	<input type="checkbox"/> <input type="triangle"/> <input type="circle"/>	<input type="checkbox"/> <input checked="" type="triangle"/> <input type="circle"/>
CROSS SECTION TYPE	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED		CROSS SECTION TYPE	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED
				WEST — CL — EAST				

#### Analysis of Existing Conditions

- 1) The manufacturing plant is not significantly impacted by noise, due to insensitivity to rail noise disturbances.
- 2) Multi-family apartments are moderately impacted by noise, due to close proximity and at grade elevation in relation to the railbed/corridor.
- 3) The manufacturing plant landuse has complete accessibility to the rail corridor.
- 4) Extremely limited access from the multi-family apartments will result, due to the combination of a drainage channel paralleling the corridor ROW, a 6' wall and a 6' fence restricting access into the rail corridor.
- 5) The observer's view from the manufacturing plant and multi-family apartments will be slightly impacted by the railroad, due to the observer's at grade eye level position to the railbed and the resultant unobstructed sight line across the ROW.

#### Analysis of the AHSRC's Proposed Alignment

- 1) The manufacturing landuse is not significantly impacted by noise, due to insensitivity to rail noise disturbances.
- 2) Multi-family apartments are severely impacted by noise, due to the elevated alignment, close proximity and lower position in relation to the railbed.
- 3) The elevated alignment severely limits access to the high speed railbed from both landuses.
- 4) The observer's view from the multi-family apartments are severely impacted by the elevated alignment, due to the permanent physical

obstruction, close proximity, and the observer's lower position in relation to the trackbed. The view from the manufacturing landuse is not a major consideration, due to the inward orientation of the manufacturing plant's activities.

#### Study Recommendations

- 1) The manufacturing plant and multi-family apartment landuses are not impacted by noise, due to the tunnel alignment.
- 2) The tunnel alignment eliminates accessibility to the high speed railbed from both landuses.
- 3) The observer's view from the multi-family apartments are not negatively impacted, due to the tunnel alignment.
- 4) An examination of the horizontal alignment in this urban community reveals a  $\pm 1$  mile stretch beginning at Grand Avenue (refer to diagram 3.3) where housing development exists in close proximity to the AHSRC's proposed elevated alignment. A tunnel alignment has been recommended along this section due to the multi-family apartments extreme sensitivity to rail disturbances. Although the tunnel alignment is considerably more expensive than an elevated alignment, in all probability buffer land would have to be acquired if the AHSRC's proposal was selected, due to the severe negative impacts on residential landuse created by an elevated alignment along this narrow corridor.

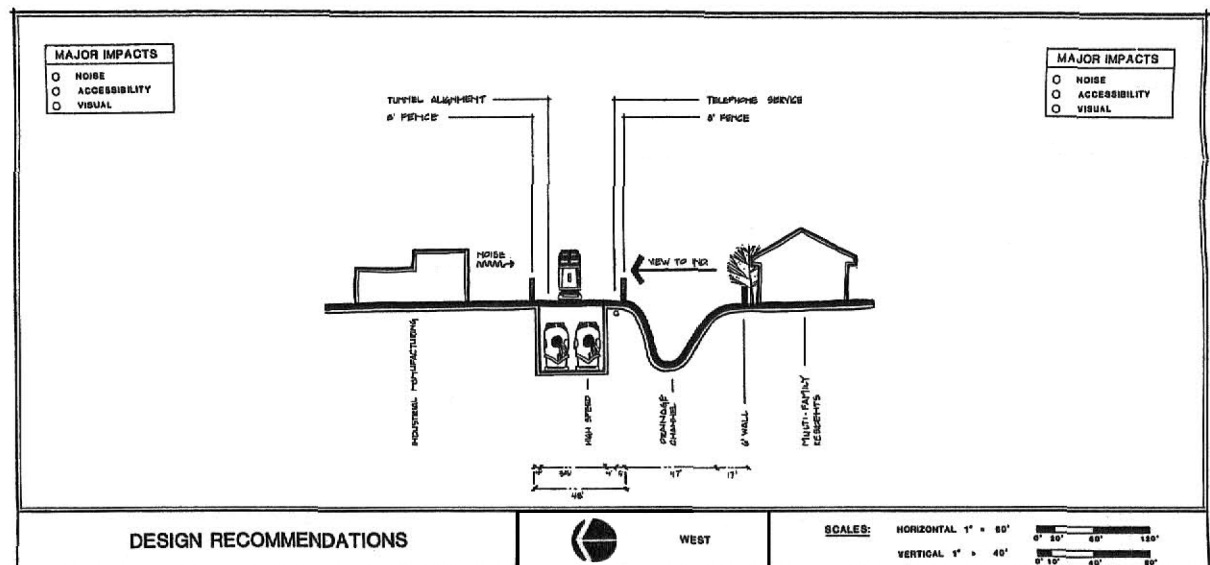
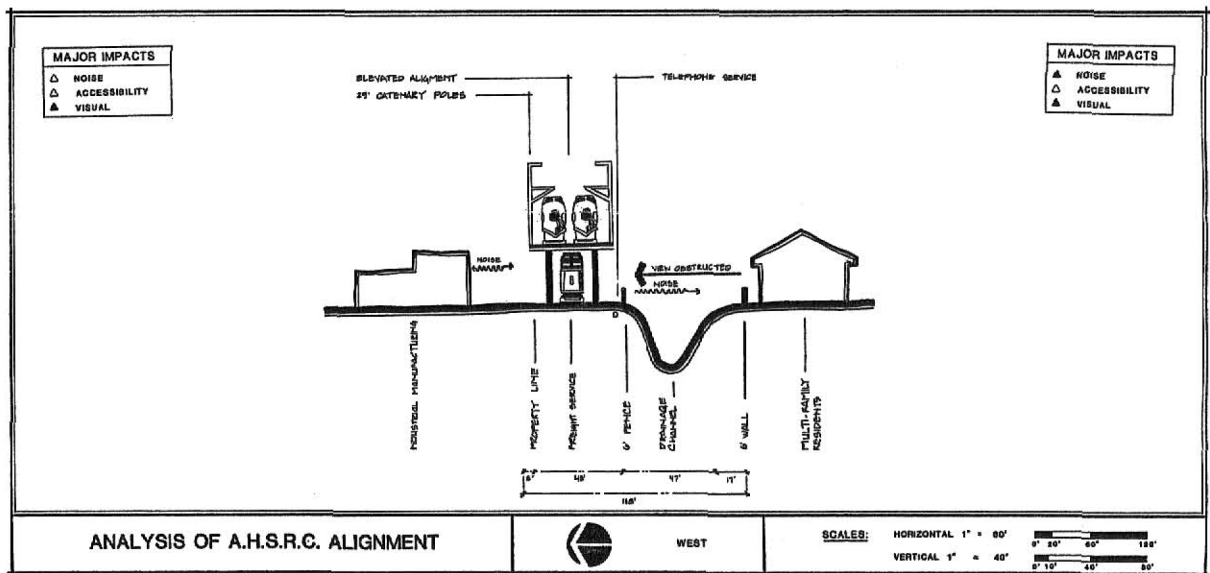
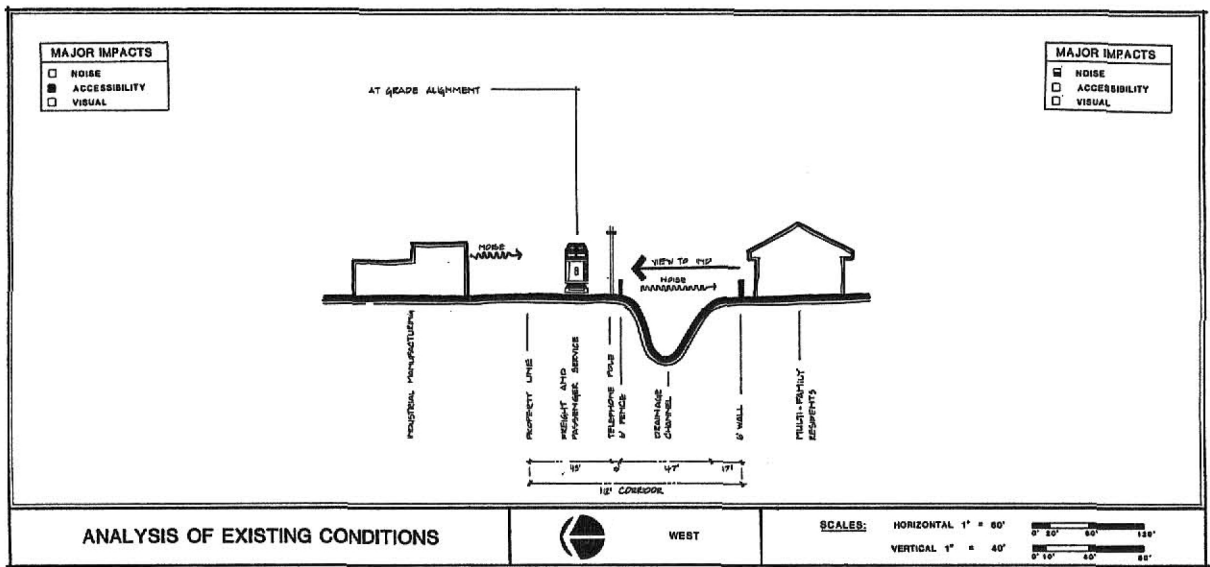


FIGURE 3.32

# CROSS SECTION C INVENTORY AND ANALYSIS

MILE MARKER -----  $\pm$  5.1 miles south of case study point of beginning

LOCATION ----- 3/4 mile south of Redhill Road/City of Tustin.

CORRIDOR WIDTH ----- a) Existing ----- 172 ft.

b) Proposed ----- 172 ft.

c) Recommended ----- 236 ft.

ADJACENT LAND USE --- a) West of ROW -- Helicopter base and Highway

b) East of ROW -- Single family residences

TOPOGRAPHY ----- Extremely flat

ALIGNMENT TYPE ----- a) Existing ----- At Grade

b) Proposed ----- Recessed

c) Recommended ----- Recessed

## Matrix Analysis

LAND USE	MAJOR IMPACTS				LAND USE	MAJOR IMPACTS		
	NOISE	ACCESS	VISUAL			NOISE	ACCESS	VISUAL
INSTITUTIONAL Federal Mtl. Inst MIXED USE Roadway	<input type="checkbox"/> <input type="triangle"/> <input type="circle"/>	<input checked="" type="checkbox"/> <input checked="" type="triangle"/> <input checked="" type="circle"/>	<input type="checkbox"/> <input checked="" type="triangle"/> <input type="circle"/>		HOUSING Single Family Res	<input checked="" type="checkbox"/> <input checked="" type="triangle"/> <input type="circle"/>	<input type="checkbox"/> <input type="triangle"/> <input type="circle"/>	<input type="checkbox"/> <input checked="" type="triangle"/> <input type="circle"/>
CROSS SECTION TYPE	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED		CROSS SECTION TYPE	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED
				WEST — CL — EAST				

#### Analysis of Existing Conditions

- 1) The helicopter base and roadway are not significantly impacted by noise, due to insensitivity to rail noise disturbances.
- 2) Single family residences are moderately impacted by noise due to close proximity and at grade elevation in relation to the railbed/corridor.
- 3) Close monitoring of egress from the helicopter base limits access to the railbed/corridor. However, pedestrians walking along Edinger Road have complete accessibility to the rail corridor.
- 4) Extremely limited access from the single family residential landuse will result, due to the combination of a drainage channel paralleling the corridor ROW, 6' wall and a 6' fence restricting access into the rail corridor.
- 5) The observer's view from the helicopter base and roadway are slightly impacted by the railroad due to the observer's close proximity and eye level position in relation to the railbed/corridor.
- 6) The observer's view from the single family residences is slightly impacted by the railroad due to the observer's eye level position in relation to the rail corridor and the resultant unobstructed sight line across the ROW.

#### Analysis of the AHSRC's Proposed Alignment

- 1) The helicopter base and roadway are not significantly impacted by noise, due to insensitivity to rail noise disturbances.
- 2) Single family residences are moderately impacted by noise due to the recessed alignment, close proximity and above grade elevation

in relation to the railbed. Proposed sound walls absorb and deflect the negative noise impact.

- 3) Close monitoring of egress from the helicopter base significantly limits access to the rail corridor. A 6' fence limits access to the rail corridor from pedestrians walking along Edinger Road, however the rail corridor is still highly accessible.
- 4) Extremely limited access from the single family residents will result, due to the combination of a drainage channel paralleling the corridor ROW, a 6' wall and a 6' fence restricting access into the rail corridor.
- 5) The observer's view from the helicopter base and roadway will be moderately impacted by the 25' catenary poles visually screened by the recessed alignment, the observer's proximity in terms of distance and eye level position in relation to the railbed. Proposed plant masses and earth berms further reduce the rail impacts.
- 6) The observer's view from the single family residences will be moderately impacted by the 25' catenary poles visually screened by the recessed alignment and the observer's position above the railbed. Plant masses and earth berms will further reduce the rail impacts.

#### Study Recommendations

- 1) The helicopter base and roadway are not significantly impacted by noise, due to insensitivity to rail noise disturbances.
- 2) Single family residences are slightly impacted by noise, due to the recessed alignment, increased proximity from the railbed and above

grade elevation in relation to the railbed. Proposed earth berms and sound walls absorb and deflect the negative noise impact.

- 3) Close monitoring of egress from the helicopter base limits access to the rail corridor. Two 6' fences, plant masses, increased distance to the rail corridor and a recessed alignment moderately restrict physical and visual access into the rail corridor, from pedestrians walking along Edinger Road.
- 4) Extremely limited access from the single family residences will result, due to the combination of a drainage channel paralleling the corridor ROW, recessed alignment, earth berms, two 6' walls and a 6' fence restricting access into the rail corridor.
- 5) The observer's view from the helicopter base and roadway will be slightly impacted by the 25' catenary poles visually screened by the recessed alignment, the observer's proximity in terms of distance and above grade position in relation to the railbed. Proposed evergreen plant masses and earth berming further reduce the rail impacts.
- 6) The observer's view from the single family residences will be slightly impacted by the 25' catenary poles visually screened by the recessed alignment, and the observer's above grade position in relation to the railbed. Proposed plant massing and substantially increased earth berming further reduce the rail impacts.
- 7) The horizontal realignment of the trackbed  $\pm 75'$  to the west and subsequent land acquisition from the helicopter base would allow for an increased setback distance between Edinger Road to the west and single family residences to the east. The increased setback would allow greater safety for vehicles and pedestrians along Edinger

Road and would allow for mitigating measures to be implemented, thus reducing the negative rail impacts on the adjacent single family residential landuse.

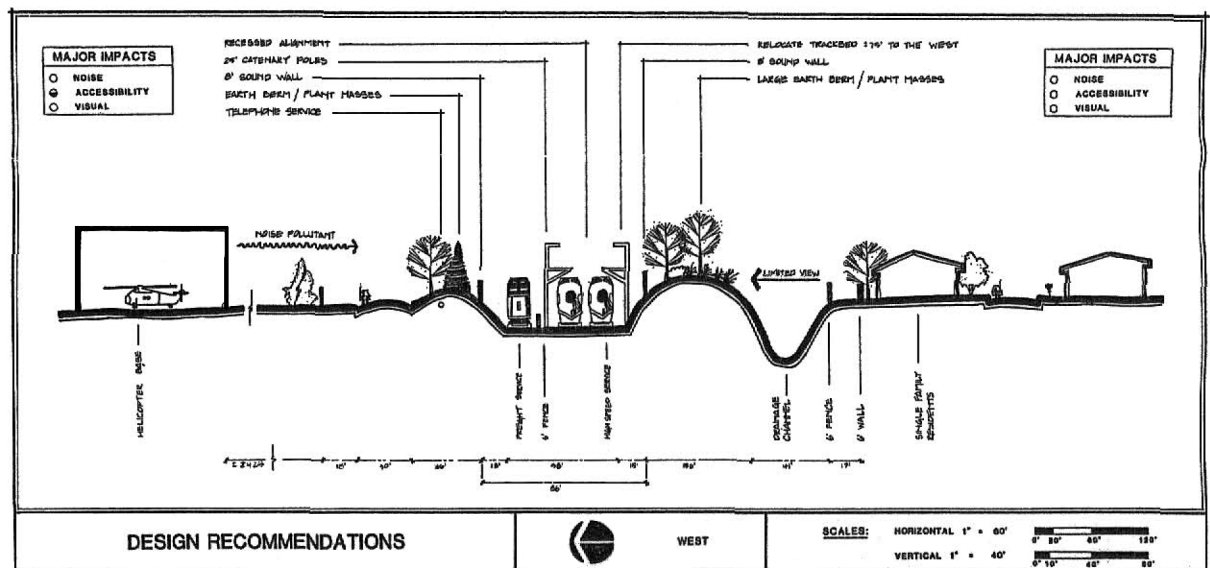
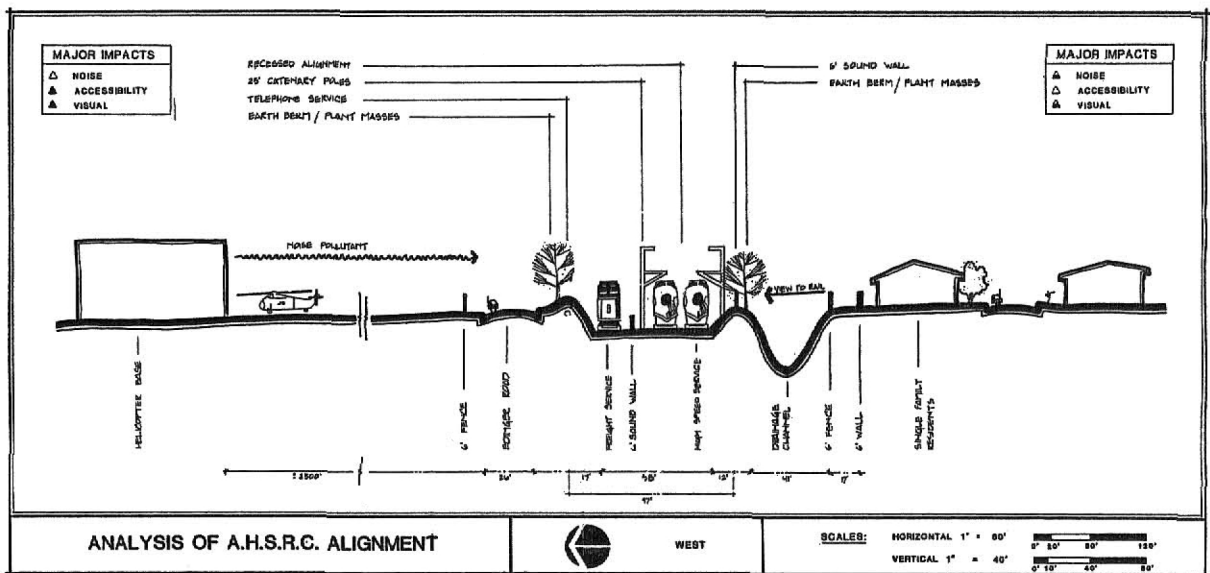
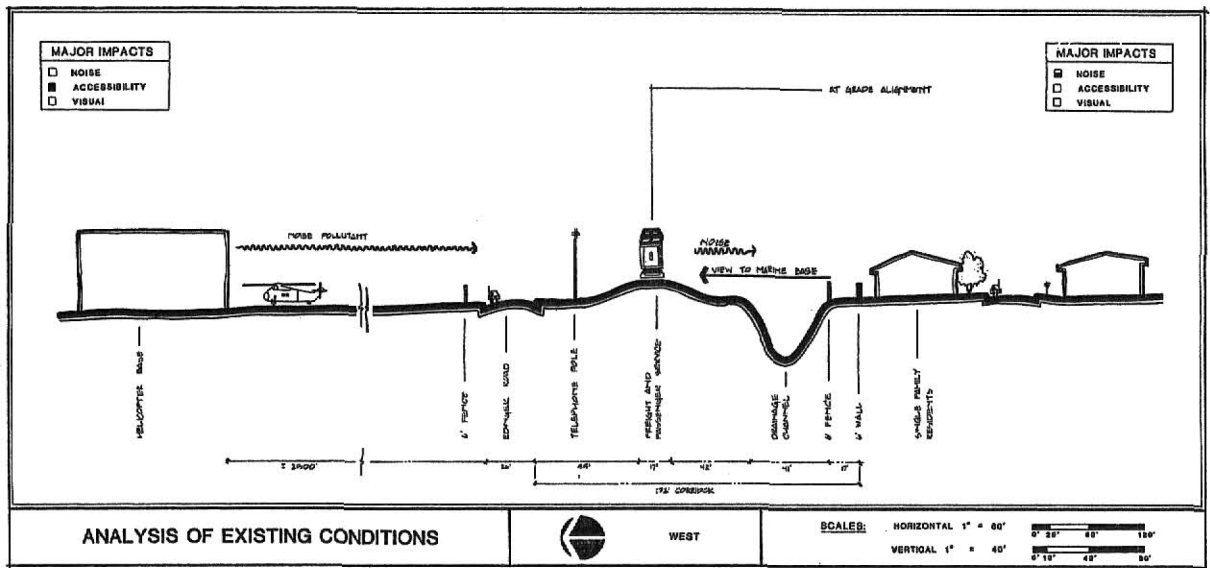


FIGURE 3.41

# CROSS SECTION D INVENTORY AND ANALYSIS

MILE MARKER -----  $\pm 7.4$  miles south of case study point of beginning

LOCATION ----- 1/4 mile south of Culver Street/City of Tustin.

CORRIDOR WIDTH ----- 350 ft.

ADJACENT LAND USE --- a) West of ROW -- Single family residences

b) East of ROW -- Primary school

TOPOGRAPHY ----- Flat

ALIGNMENT TYPE ----- a) Existing ----- At Grade

b) Proposed ----- Recessed

c) Recommended ----- Recessed

## Matrix Analysis

LAND USE	MAJOR IMPACTS				LAND USE	MAJOR IMPACTS		
	NOISE	ACCESS	VISUAL			NOISE	ACCESS	VISUAL
HOUSING Single Family Res	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		INSTITUTIONAL Primary School	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
CROSS SECTION TYPE	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED		CROSS SECTION TYPE	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED
				WEST — CL — EAST				

#### Analysis of Existing Conditions

- 1) The single family residences and primary school are moderately impacted by noise, due to proximity in terms of distance and at grade elevation in relation to the railbed/corridor.
- 2) The single family residences access to the rail corridor is moderately restricted, due to a 6' wall, a 6' fence and distance from the rail corridor.
- 3) Extremely limited access from the primary school will result, due to the combination of a drainage channel paralleling the corridor ROW, a 6' fence and distance from the rail corridor.
- 4) The observer's view from the single family residences and primary school are slightly impacted by the railroad, due to the observer's distance and eye level position in relation to the railbed/corridor.

#### Analysis of the AHSRC's Proposed Alignment

- 1) The single family residences are moderately impacted by noise, due to the recessed alignment, proximity in terms of distance and below grade elevation in relation to the railbed. Proposed earth berming will absorb and deflect the negative noise impact.
- 2) The primary school is slightly impacted by noise, due to the recessed alignment, proximity in terms of distance and below grade elevation in relation to the railbed. Proposed earth berming and sound walls absorb and deflect the negative noise impact.

- 3) The single family residences access to the rail corridor is moderately restricted, due to a 6' wall, two 6' fences and distance from the rail corridor.
- 4) Extremely limited access from the primary school will result, due to the combination of a drainage channel paralleling the corridor ROW, a 6' fence, a 6' wall and distance from the rail corridor.
- 5) The observer's view from the single family residences is slightly impacted by the 25' catenary poles visually screened by the recessed alignment, the observer's proximity in terms of distance, and below grade elevation of the railbed in relation to the observer. Plant massing further reduces the rail impacts.
- 6) The observer's view from the primary school is slightly impacted by the 25' catenary poles visually screened by the recessed alignment, the observer's proximity in terms of distance, and below grade elevation of the railbed in relation to the observer.

#### Study Recommendations

- 1) The single family residences are slightly impacted by noise, due to the recessed alignment, proximity in terms of distance, and below grade elevation of the railbed in relation to the landuse. Proposed earth berming and sound walls absorb and deflect the negative noise impact.
- 2) The primary school is slightly impacted by noise due to the recessed alignment, proximity in terms of distance, and below grade elevation of the railbed in relation to the landuse. Proposed earth berms and sound walls absorb and deflect the negative noise impact.

- 3) Moderate access from the single family residences will result, due to the combination of proximity in terms of distance to the rail corridor, a 6' fence and two 6' walls restricting access into the rail corridor.
- 4) Extremely limited access from the primary school will result, due to the combination of a drainage channel paralleling the corridor ROW, a 6' fence, two 6' walls, proximity in terms of distance and below grade elevation of the railbed in relation to the observer. Evergreen plant masses and earth berms further restrict physical and visual access into the rail corridor.
- 5) The observer's view from the single family residences is slightly impacted by the 25' catenary poles visually screened by the recessed alignment, the observer's proximity in terms of distance and below grade elevation of the railbed in relation to the observer. Plant massing further reduces the rail impacts.
- 6) The observer's view from the primary school is slightly impacted by the 25' catenary poles, due to the recessed alignment, the observer's proximity in terms of distance and below grade elevation of the railbed in relation to the observer. Increased earth berming and plant masses effectively reduce the rail impacts.
- 7) The horizontal realignment of the trackbed  $\pm 50'$  to the west would allow for a large earth berm to be constructed east of the trackbed. Although the drainage channel presently limits access to the rail corridor, the earth berm in combination with plant masses may reduce the temptation of inquisitive children from venturing to the rail corridor, on the basis of "out of sight, out of mind".

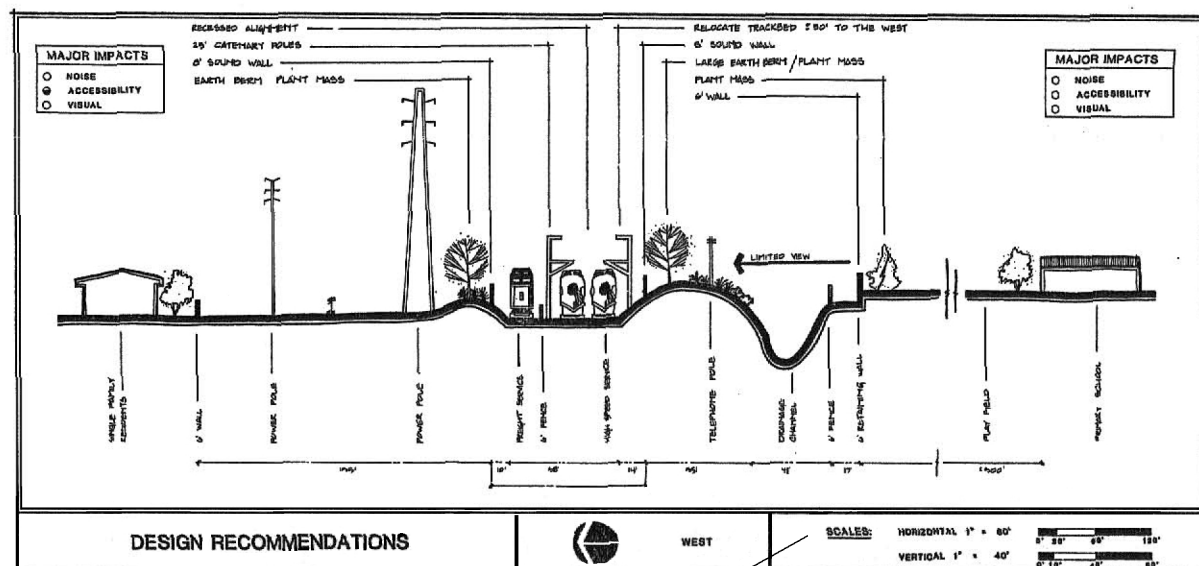
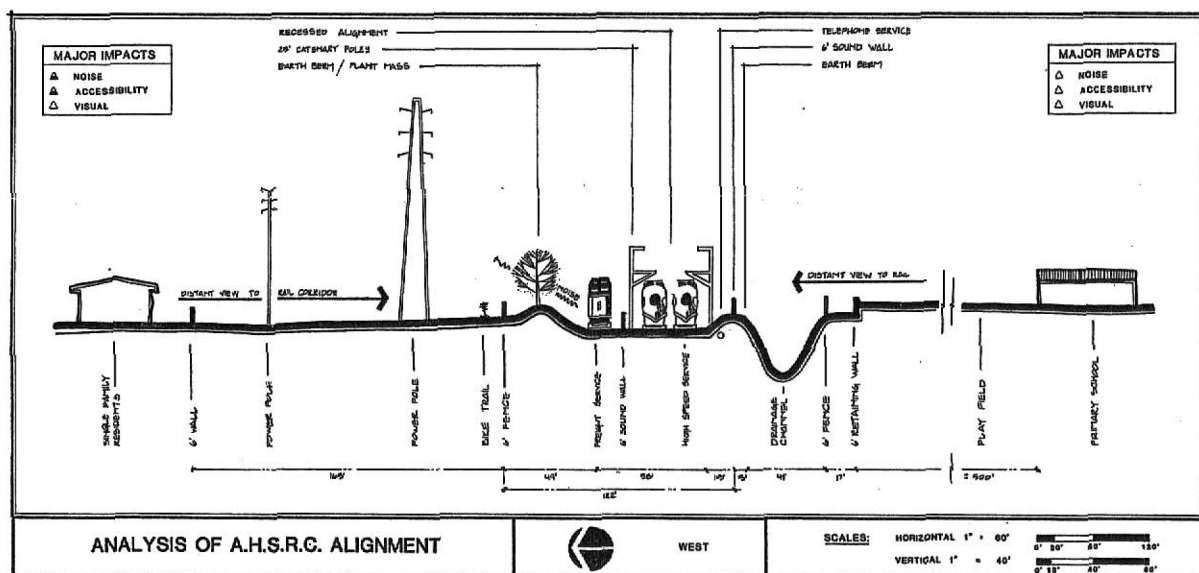
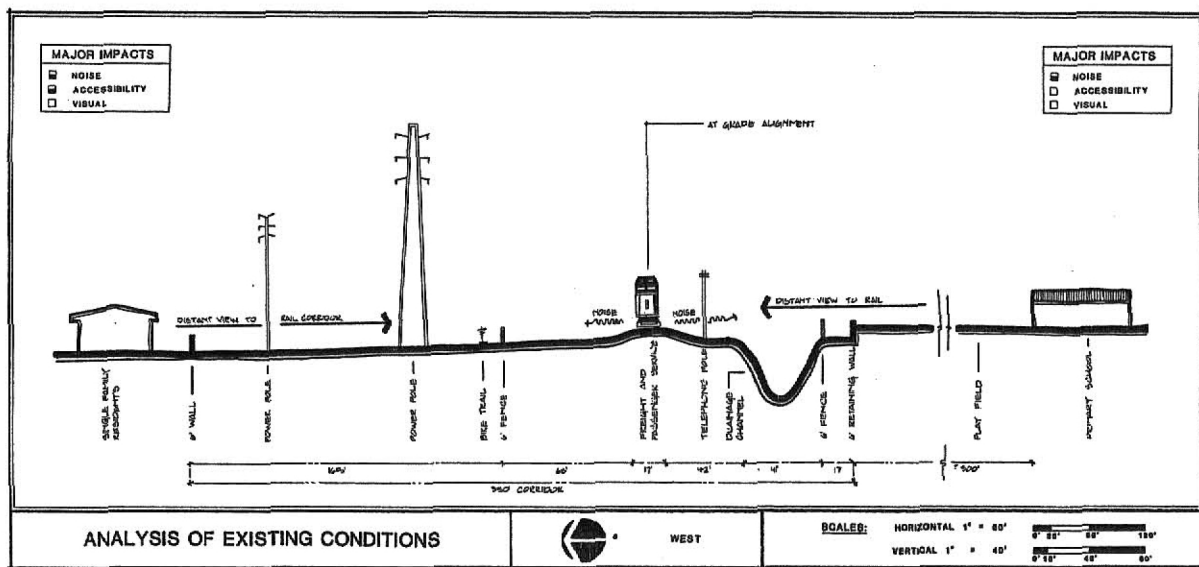


FIGURE 3.42

# CROSS SECTION E INVENTORY AND ANALYSIS

MILE MARKER -----  $\pm$  9.6 miles south of case study point of beginning

LOCATION ----- Sand Canyon Road/City of East Irvine

CORRIDOR WIDTH ----- a) Existing ----- 55'

b) Proposed ----- 89'

c) Recommended ----- 55'

ADJACENT LAND USE --- a) West of ROW -- Cropland

b) East of ROW -- Central Business District "CBD,"  
Manufacturing production and Retail trade.

TOPOGRAPHY ----- Rolling terrain either side of corridor

ALIGNMENT TYPE ----- a) Existing ----- At Grade

b) Proposed ----- Recessed

c) Recommended ----- Tunnel

## Matrix Analysis

LAND USE	MAJOR IMPACTS				LAND USE	MAJOR IMPACTS		
	NOISE	ACCESS	VISUAL			NOISE	ACCESS	VISUAL
AGRICULTURE Cropland	<input type="checkbox"/> <input type="triangle"/> <input type="circle"/>	<input checked="" type="checkbox"/> <input checked="" type="triangle"/> <input type="circle"/>	<input type="checkbox"/> <input checked="" type="triangle"/> <input type="circle"/>		INDUSTRIAL Manufacturing Prod COMMERCIAL Retail Sales	<input checked="" type="checkbox"/> <input checked="" type="triangle"/> <input type="circle"/>	<input checked="" type="checkbox"/> <input checked="" type="triangle"/> <input type="circle"/>	<input type="checkbox"/> <input checked="" type="triangle"/> <input type="circle"/>
CROSS SECTION TYPE	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED		CROSS SECTION TYPE	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED

WEST — CL — EAST

### Analysis of Existing Conditions

- 1) Cropland is not significantly impacted by noise, due to insensitivity to rail noise disturbances.
- 2) The CBD is moderately impacted by noise, due to close proximity of buildings and at grade elevation in relation to the railbed/corridor.
- 3) Cropland and CBD landuses have unrestricted accessibility to the rail corridor.
- 4) The observer's view from the cropland landuse is slightly impacted by the railroad, due to the observer's proximity in terms of distance, at grade eye level position in relation to the railbed/corridor, and the resultant unobstructed sight line across the ROW.
- 5) The observer's view from the CBD landuse is slightly impacted, due to the observer's at grade eye level position in relation to the railbed/corridor, and the resultant unobstructed sight line across the ROW.

### Analysis of the AHSRC's Proposed Alignment

- 1) Cropland is not significantly impacted by noise, due to insensitivity to rail noise disturbances.
- 2) The CBD landuse is moderately impacted by noise, due to the recessed alignment, CBD's close proximity and above-grade elevation in relation to the railbed/corridor.
- 3) A 6' fence either side of the ROW limits access to the rail corridor, however the railbed is still highly accessible.

- 4) The observer's view from the cropland and CBD are severely impacted by the 25' catenary poles and vehicular overpass necessary for automobile crossing. The observer's close proximity and lower viewing position in relation to the vehicular overpass structure, obstructs the observer's view.

#### Study Recommendations

- 1) Cropland is not impacted by noise, due to the tunnel alignment.
- 2) The CBD is not impacted by noise, due to the tunnel alignment.
- 3) The tunnel alignment eliminates accessibility to the high speed corridor from both landuses.
- 4) The observer's view from the Cropland and CBD are not negatively impacted, due to the tunnel alignment.
- 5) A tunnel alignment would eliminate the severe visual impact created by the recessed alignment and associated vehicular overpass in this sensitive and unique CBD. A tunnel alignment, although expensive, may prove cost effective in this instance because it would eliminate the need for a vehicular overpass at Sand Canyon Road, as well as an overpass or underpass necessary to accommodate rail freight operations on either side of the rail corridor (refer to figure 3.4).

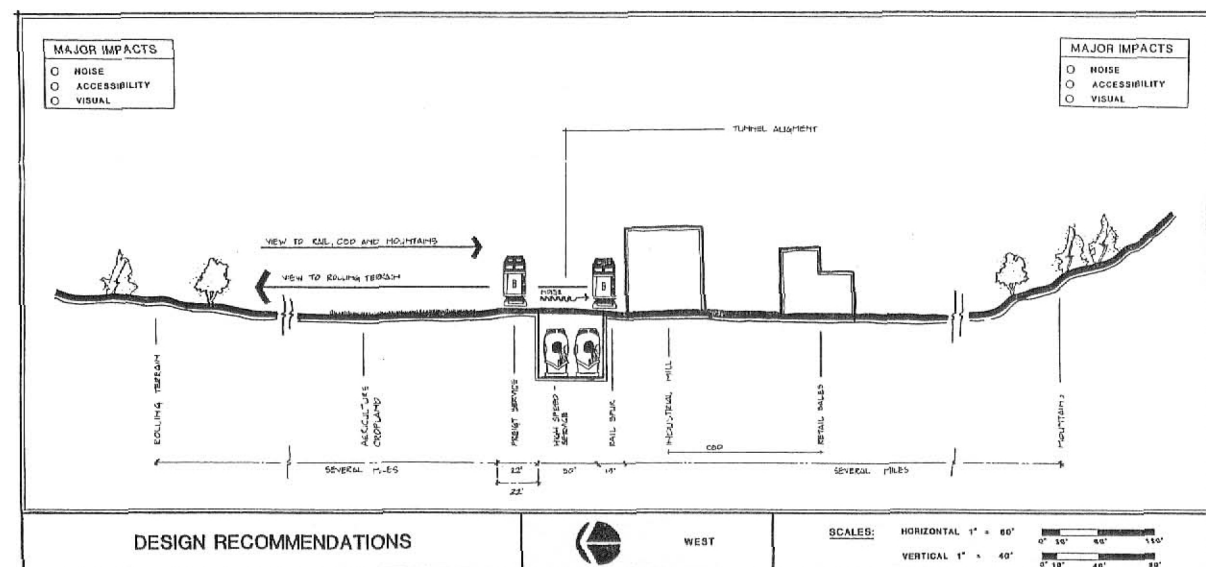
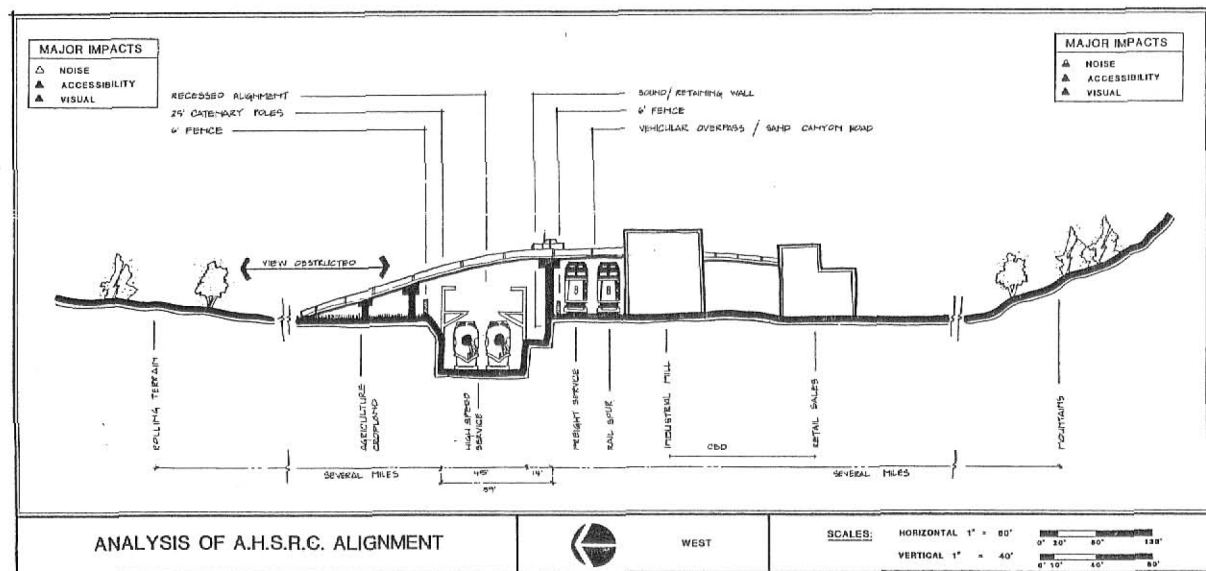
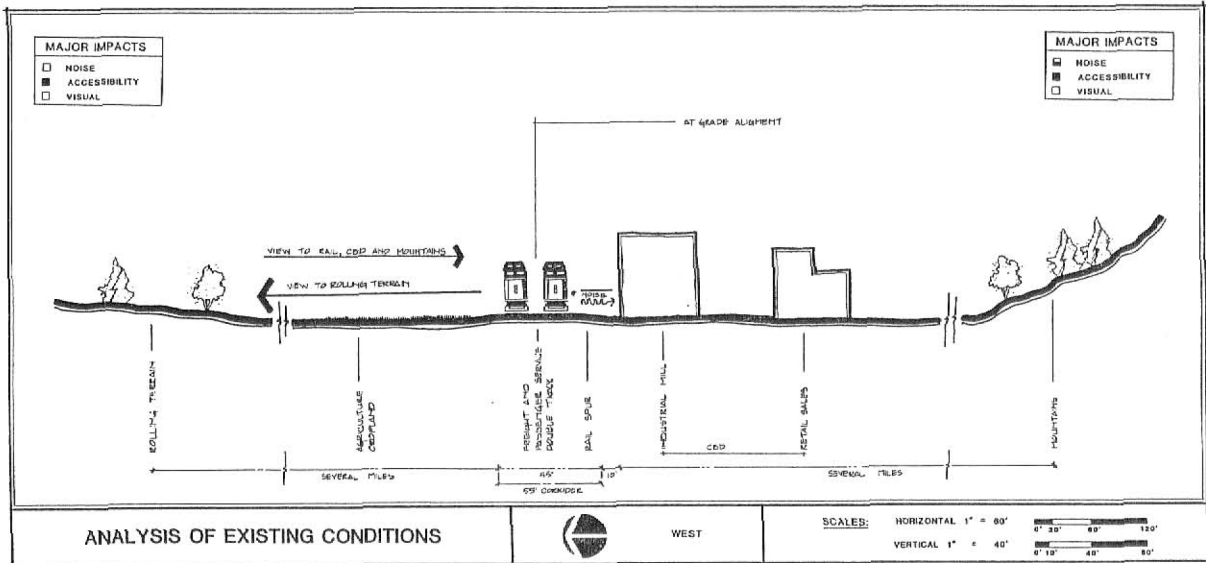


FIGURE 3.51

# CROSS SECTION F INVENTORY AND ANALYSIS

MILE MARKER -----  $\pm$  15 miles south of case study point of beginning

LOCATION ----- 1/3 mile south of Bake Street/City of El Toro

CORRIDOR WIDTH ----- 150 ft.

ADJACENT LAND USE --- a) West of ROW -- Modular homes

b) East of ROW -- Single family residences

TOPOGRAPHY ----- Steep terrain sloping from east to west

ALIGNMENT TYPE ----- a) Existing ----- At Grade

b) Proposed ----- At Grade

c) Recommended ----- Recessed

## Matrix Analysis

LAND USE	MAJOR IMPACTS				LAND USE	MAJOR IMPACTS		
	NOISE	ACCESS	VISUAL			NOISE	ACCESS	VISUAL
HOUSING Modular Homes	■ ▲ ○	■ ▲ ○	■ ▲ ○		HOUSING Single Family Res	■ ▲ ○	■ ▲ ○	■ ▲ ○
CROSS SECTION TYPE	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED		CROSS SECTION TYPE	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED

WEST ——— CL ——— EAST

#### Analysis of Existing Conditions

- 1) Modular homes are severely impacted by noise, due to position below the trackbed and close proximity to the rail corridor.
- 2) Single family residences are moderately impacted by noise, due to position above the trackbed and close proximity to the rail corridor.
- 3) Steep side slopes and a 6' wall either side of the ROW limits access to the rail corridor, however the railbed is still highly accessible.
- 4) The observer's view from the modular homes is moderately impacted by the railroad, due to the obstruction created by the raised trackbed.
- 5) The observer's view from the single family residences is slightly impacted by the railroad, due to the observer's position above the railbed, and the resultant unobstructed sight line across the ROW.

#### Analysis of the AHSRC's Proposed Alignment

- 1) Modular homes are severely impacted by noise due to position below the trackbed and closer proximity to the rail corridor improvements. Because the homes are located below the trackbed, sound walls are less effective.
- 2) Single family residences are moderately impacted by noise, due to position above the trackbed and closer proximity to the rail corridor improvements.
- 3) Steep side slopes, plant massing, a 6' wall and a 6' fence moderately restrict access into the rail corridor from the modular home landuse.

- 4) Steep side slopes, a 6' wall and a 6' fence limits access to the rail corridor, however the railbed is still highly accessible from the single family residential landuse.
- 5) The observer's view from the modular homes will be moderately impacted by the 25' catenary poles, due to the plant masses effectively screening the raised railbed thereby reducing the rail impacts.
- 6) The observer's view from the single family residential landuse will be moderately impacted due to the 25' catenary poles, wider railbed, and the observer's position above the trackbed.

#### Study Recommendations

- 1) Modular homes are slightly impacted by noise, due to the recessed alignment. Proposed earth berms and sound walls absorb and deflect the negative noise impact.
- 2) Single family residences are slightly impacted by noise, due to the recessed alignment. Proposed retaining walls absorb and deflect the negative noise impact.
- 3) Moderate access from the modular homes will result, due to the combination of earth berms, plant masses and fence barriers restricting physical and visual access into the rail corridor.
- 4) Extremely limited access from the single family residences will result, due to the combination of steep terrain, retaining walls and fence barriers restricting access into the rail corridor.
- 5) The observer's view from the modular homes will be slightly impacted by the 25' catenary poles visually screened by the recessed alignment. Proposed earth berms and plant masses effectively reduce rail impacts.

- 6) The observer's view from the single family residences will be slightly impacted by the 25' catenary poles, due to the catenary's position above the recessed alignment. Plant massing will effectively lessen negative visual rail impacts allowing for an essentially unobstructed sight line across the ROW to the modular homes and rolling hills beyond.

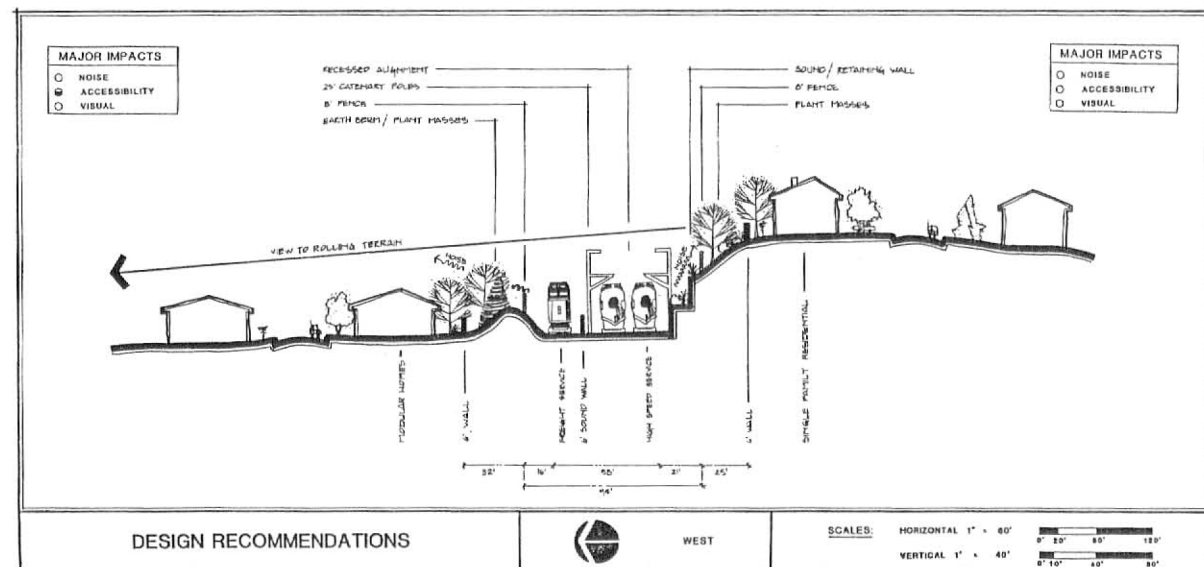
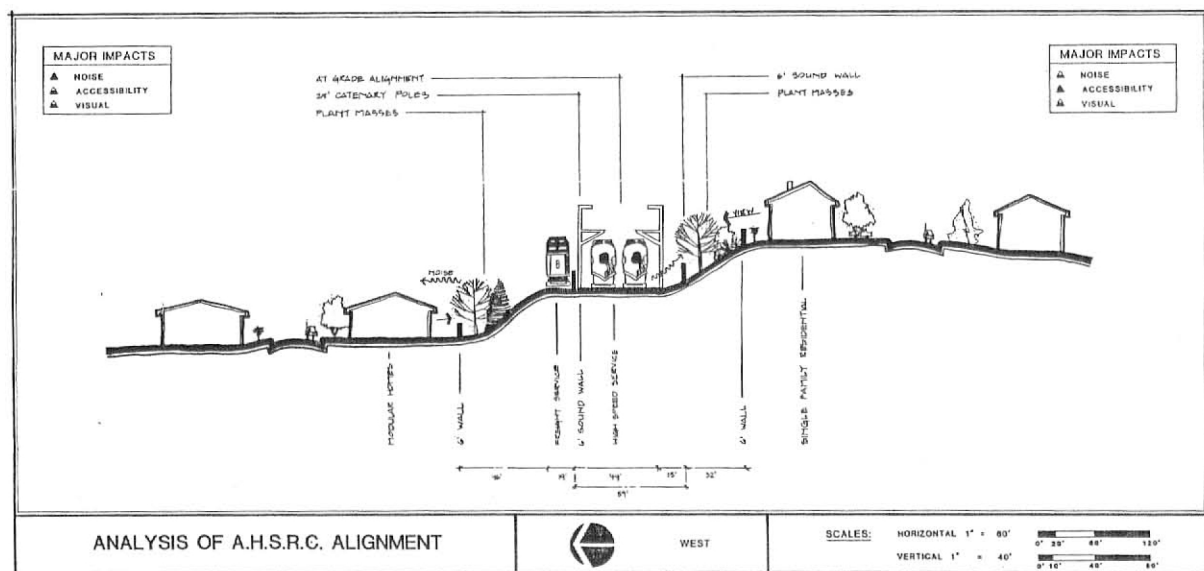
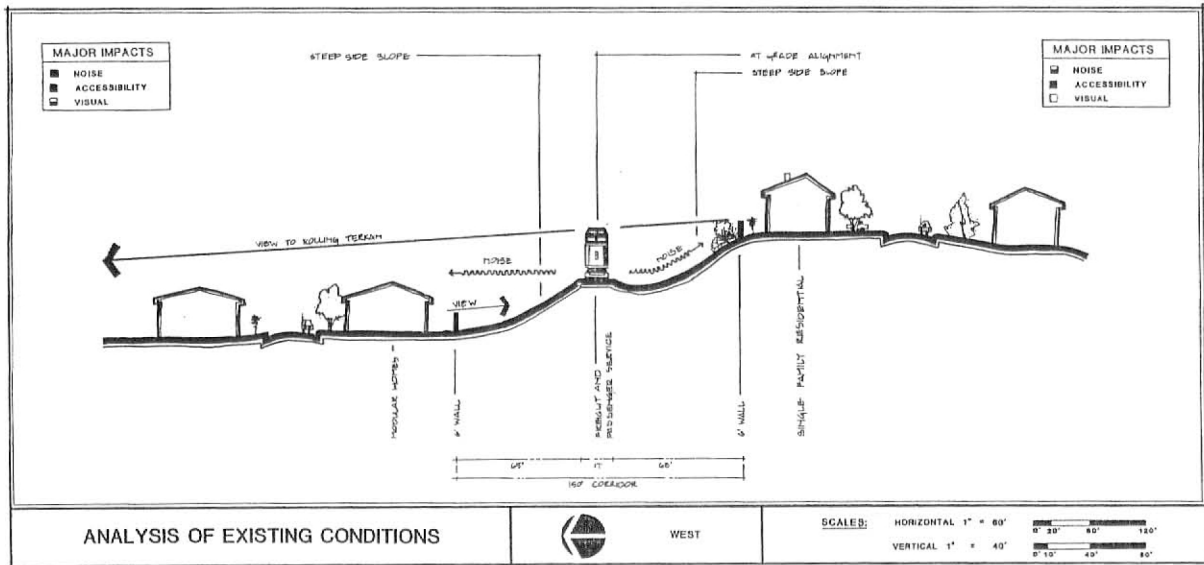


FIGURE 3.52

# CROSS SECTION G INVENTORY AND ANALYSIS

MILE MARKER -----  $\pm$  17.4 miles south of case study point of beginning

LOCATION ----- North of Alicia Parkway/City of Mission Viejo

CORRIDOR WIDTH ----- 15 ft.

ADJACENT LAND USE --- a) West of ROW -- Orchards

b) East of ROW -- Community park

TOPOGRAPHY ----- Gently rolling

ALIGNMENT TYPE ----- a) Existing ----- At Grade

b) Proposed ----- At Grade

c) Recommended ----- Recessed

## Matrix Analysis

LAND USE	MAJOR IMPACTS				LAND USE	MAJOR IMPACTS		
	NOISE	ACCESS	VISUAL			NOISE	ACCESS	VISUAL
AGRICULTURE Orchard	<input type="checkbox"/> <input type="triangle"/> <input type="circle"/>	<input checked="" type="checkbox"/> <input checked="" type="triangle"/> <input checked="" type="circle"/>	<input type="checkbox"/> <input type="triangle"/> <input type="circle"/>		RECREATION Community Park	<input type="checkbox"/> <input type="triangle"/> <input type="circle"/>	<input checked="" type="checkbox"/> <input checked="" type="triangle"/> <input checked="" type="circle"/>	<input type="checkbox"/> <input type="triangle"/> <input type="circle"/>
CROSS SECTION TYPE	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED		CROSS SECTION TYPE	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED	EXISTING PROPOSED RECOMMENDED

WEST — CL — EAST

#### Analysis of Existing Conditions

- 1) Orchards are not significantly impacted by noise due to insensitivity to rail noise disturbances.
- 2) The community park landuse is slightly impacted by noise, due to proximity in terms of distance to the rail corridor.
- 3) Orchard landuse has complete accessibility to the rail corridor.
- 4) A 6' wall restricts access to the rail corridor from the community park landuse, however the rail corridor is still highly accessible.
- 5) The observer's view from the orchard and the community park landuses are moderately impacted by the railroad, due to the obstruction created by the raised trackbed above the observer's eye level.

#### Analysis of the AHSRC's Proposed Alignment

- 1) Orchards are not significantly impacted by noise, due to insensitivity to rail noise disturbances.
- 2) The community park is slightly impacted by noise, due to proximity in terms of distance to the rail corridor.
- 3) 6' fences restrict access to the rail corridor from the orchard and community park landuses, however the rail corridor is still highly accessible.
- 4) The observer's view from the orchard and community park landuses are moderately impacted by the 25' catenary poles and raised trackbed, due to the observer's eye level position below the railbed. Plant massing will reduce the visual impacts of the high speed rail system.

Study Recommendations

- 1) Orchards are not significantly impacted by noise, due to insensitivity to rail noise disturbances.
- 2) The community park is slightly impacted by noise, due to the lowering of the trackbed elevation, and proximity in terms of distance to the rail corridor. Proposed earth berms and sound walls absorb and deflect the negative noise impact.
- 3) Two 6' fences restrict access to the rail corridor from the orchard landuse, however the rail corridor is still highly accessible.
- 4) Two fences, the lowering of the trackbed elevation and earth berms restrict access to the rail corridor from the community park landuse, however the rail corridor is still highly accessible.
- 5) The observer's view from the orchard landuse is moderately impacted by the 25' catenary poles and raised trackbed, due to the observer's eye level position below the trackbed elevation.
- 6) The observer's view from the community park landuse is slightly impacted by the 25' catenary poles and by the raised trackbed, due to the observer's eye level position below the trackbed elevation. Proposed plant massing and earth berming will reduce the negative visual rail impacts.
- 7) Lowering of the trackbed elevation was recommended in this area to lessen the high speed rails impact on the community park landuse. The lower trackbed alignment in combination with earth berms and plant masses will screen visual contact with the rail corridor improvements. These measures may at least reduce the temptation of inquisitive children from venturing to the rail corridor, on the basis of "out of sight, out of mind".

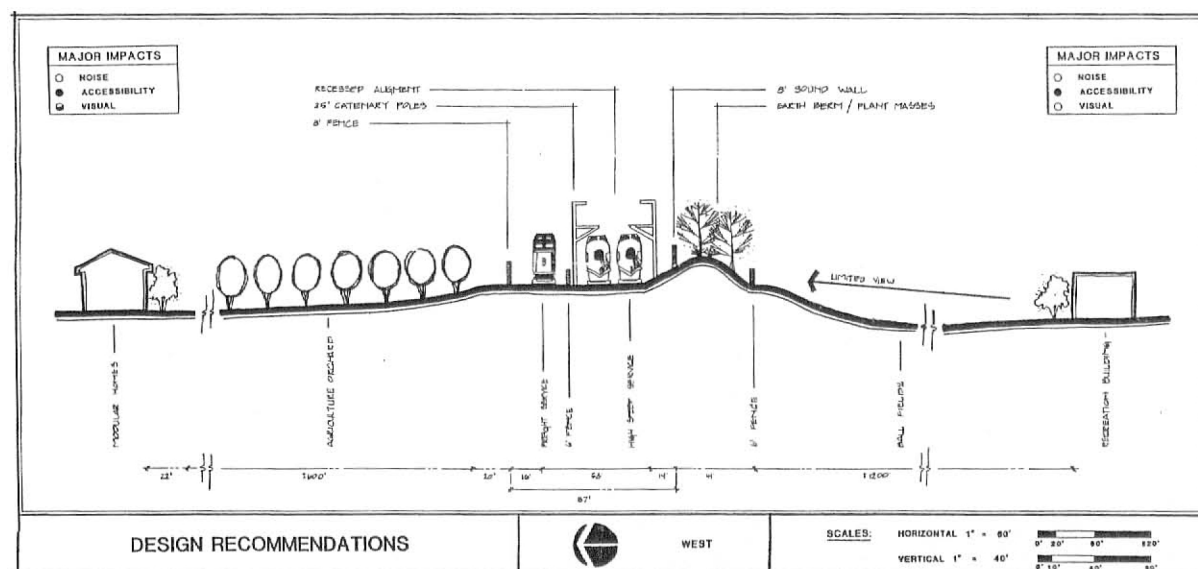
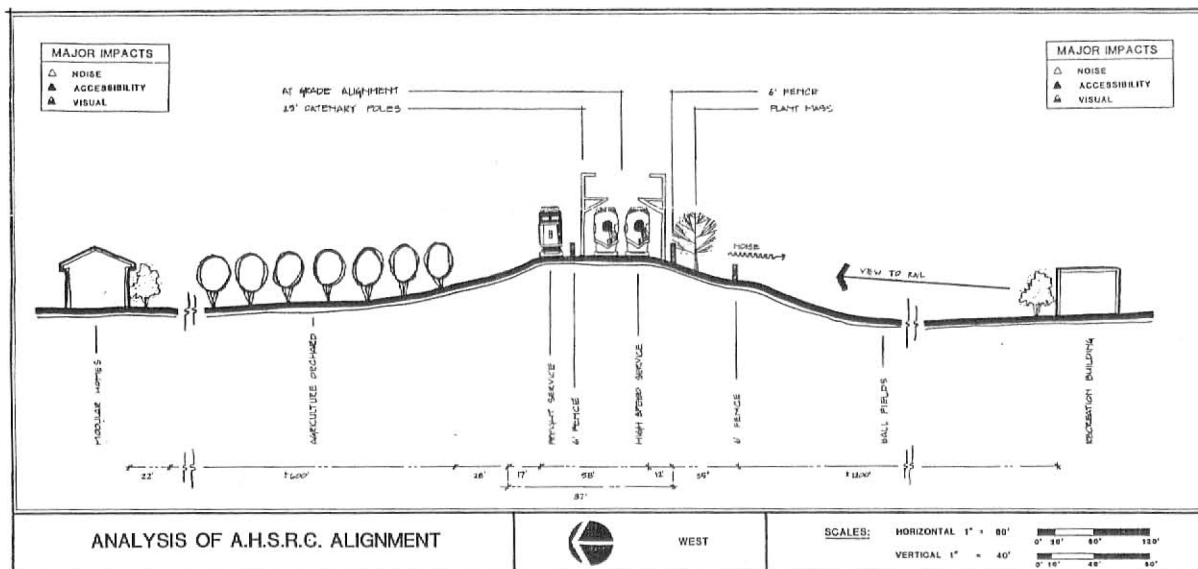
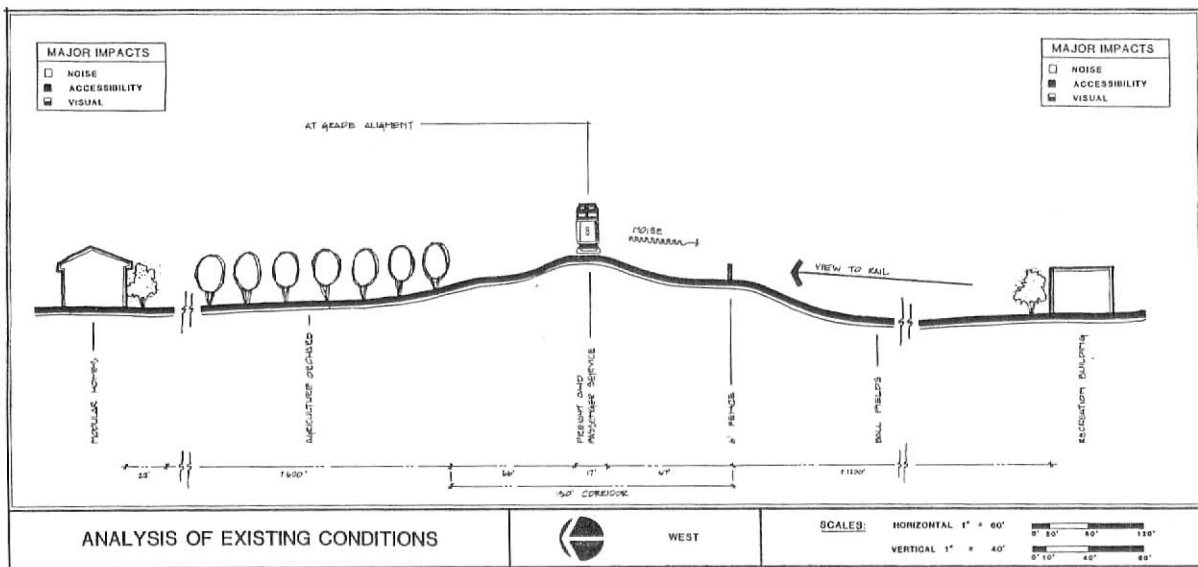


FIGURE 9.61

## CONCLUSIONS

Given the known shortage of fossil fuels in the world today and the United States' dependency on such fuel sources for industry and transportation, it can be stated that the cost of energy has and will continue to rise over the foreseeable future, which will drastically affect the life styles to which we have become accustomed. Among the activities that will certainly be affected will be our wasteful and costly personal travel habits. It has been documented that the automobile is an inefficient means of transporting people from one point to another<sup>1</sup> -- and that, given the ever increasing cost of energy, the convenience of automobile ownership will eventually take a secondary position to the cost of automobile operation.

Many foreign countries have recognized that fact and have taken steps to implement a cost effective transportation system tailored to its population needs. In many cases, a high speed passenger rail system has been adopted as an integral part of that transportation system. While there will be no rush to construct a national high speed rail system in the United States in the immediate future, evidence that the need for some individual high speed rail corridors connecting major population centers is nearing reality<sup>2</sup> -- witness the impending

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<sup>1</sup>U. S., Congress, House, "Committee on Science and Technology," Advanced Rail Technology. Hearings Before a Subcommittee of the House Committee (Washington: No. 88, 97th Congress, 2nd session, 1982).

<sup>2</sup>U. S. Congress, Case Studies in Private/Public Cooperation to Revitalize America: I. Passenger Rail, p. 5.

construction of the high speed rail system connecting Los Angeles and San Diego, California.

Two basic assumptions were made at the outset of this study; 1) eventually, high speed rail systems would become a cost effective transportation link connecting major population centers in the United States, leading to their acceptance and implementation over the long run and; 2) the Landscape Architect, as a professional planner managing land for its optimum use allocation, could predict major land use - rail conflicts in advance and offer viable alternative solutions to avoid, or at least minimize, such conflicts where they occur. Study conclusions follow:

#### Land Use Impact Conclusions

The impact zone of a high speed rail system is linear in nature confined to the generally narrow parcel of land paralleling the railroad corridor. As a result, land uses that border the rail corridor will sustain the brunt of the negative impacts from a high speed rail system and, therefore, require concessions from adjoining land owners/users in terms of environmental quality.

The impacts of a high speed rail system passing through an area vary considerably and are directly related to adjacent land use development patterns. As the intensity of land uses and their associated population density increases, the impact of a high speed rail system on adjacent land use activities likewise becomes greater. Generally, urban developments will present the most conflicts due to their high intensity of activities and high population density. Rural land uses will present fewer conflicts because of their lower intensity of activities and lessor population density.

The seven major land use categories generally accepted by the planning profession for classification of land use types were employed for purposes of this study. These include housing, commercial, industrial, agriculture, institutional, recreation and mixed use. The study concludes that housing land uses along narrowly defined corridors are most highly and negatively impacted by a high speed rail system in terms of noise disturbances, accessibility and degradation of visual quality. Specialized institutional uses, mainly schools, and office facilities, were also negatively impacted, but to a lesser extent than were housing uses. Land use types moderately affected by the negative impacts included commercial and retail facilities, recreation and light industrial facilities. Land use types that are not significantly impacted in a negative sense included intensive industrial facilities, military installations, airports, utility corridors, highways and agriculture land.

Conclusion diagram Figure 4.1 relates the degree of impact on the various land use types, indicates the preferred vertical alignment given the adjacent land use type and recommends measures for possible mitigation of negative impacts, given each vertical alignment.

The AHSRC and the author have distinct differences of opinion as to the compatibility of specific vertical route alignment types in relation to adjacent land uses, as cited in the specific recommendations of cross sections B, E and F (Figures 3.32, 3.51 and 3.52) per the case study. In these instances the AHSRC's proposed alignment was not as environmentally sensitive to the needs of the adjacent land uses and activities as could have been the case. In some instances, the acquisition of land immediately adjacent to the rail corridor can assist

CONCLUSION DIAGRAM									
LEGEND ● HIGH IMPACT ◐ MODERATE IMPACT ○ LOW IMPACT	ROUTE ALIGNMENT					MITIGATING MEASURES	Earth Berms/ Walls	Vegetation	Physical Barriers
	At Grade	Recessed	Elevated	Tunnel					
LAND USE									
HOUSING ● Narrow Corridor ◐ Wide Corridor			x		x		x	x	x
COMMERCIAL ● Office Facilities ● Community Development			x		x		x	x	x
INDUSTRIAL ○ Intensive ◐ Non Intensive		x		x			x	x	x
AGRICULTURE ○ Crop Land		x							x
INSTITUTIONAL ○ Military Installation ● Schools - Narrow Cor. ◐ Schools - Wide Cor.		x		x					x
			x		x		x	x	x
RECREATION ◐ Community Park			x				x	x	x
MIXED USE ○ Roadway, Vacant, etc.		x	x				x	x	x

FIGURE 4.1

in significantly mitigating impacts, allowing further separation of land uses from the rail corridor, and thus lessening the negative impacts. Cross sections C and D (Figures 3.41 and 3.42) within the case study are specific examples of this circumstance. While a tunnel alignment would eliminate the impacts, underground drainage channels bisect the rail corridor in these areas, making a tunnel alignment impractical. Also, the cost of acquiring additional land must be compared to the cost of a tunnel alignment prior to reaching a final alignment decision.

#### Physical Design Conclusions

The position of the railbed in relation to adjacent land uses -- at-grade, recessed, elevated or enclosed -- will result in varied impacts. In addition, the extent of negative impact is related to the nature of on-going activity within each land use parcel, the sensitivity of that activity to audio and visual disturbances, and the relative distance from the railbed to the impacted activity. The study has concluded that negative impacts can be partially mitigated in some instances (see cross sections C, D, F and G, Figures 3.41, 3.42, 3.52 and 3.61), specifically in the at-grade or recessed alignments. On the other hand, measures to mitigate the negative audio and visual impacts are severely restricted when the railbed is above grade or elevated on piers.

It is estimated that sound walls and earth berms will decrease noise disturbances as much as 15 decibels,<sup>3</sup> and, at the same time, limit

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<sup>3</sup>Interview with Charles Kammerman, Wyle Laboratories, El Segundo, California, 10 May 1983.

accessibility to the rail corridor. Further, as the distance from the railbed to the impacted land use or activity increases, the negative noise and visual impacts are lessened as documented in the study. Certainly, in terms of noise and visual impacts, study findings suggest a wider corridor separating the more sensitive land uses from the railbed would be appropriate where at all possible.

Although plant masses have little effect on noise disturbances, their placement in relation to the observer's view between adjacent land uses and the rail corridor tends to lessen the negative visual impacts. The position of plant massing in relation to the observer's eye level becomes a critical factor in terms of lessening the negative visual impact. In the case of an elevated alignment, the plant masses should be placed in near proximity to the super structure and should be of sufficient height to form a canopy directing the observer's eye downward. From afar, the at-grade alignment, recessed alignment and the super structure of the elevated alignment are effectively lessened or completely screened by the plant massings of varying heights and placement, depending on the distance from the observer to the railbed.

Screen fencing, sound walls and to a greater degree, earth berming also provide an effective visual buffer, particularly in an at-grade or recessed alignment. Obviously, the tunnel alignment, being completely enclosed, presents no visual or noise impact.

The position of the railbed -- that is, at-grade, recessed, elevated or enclosed in tunnel alignment -- also plays a major role in terms of accessibility of the rail corridor from the adjacent land uses. Accessibility is extremely limited in the elevated and tunnel alignments. Accessibility of the corridor in an at-grade or recessed

alignment varies with adjacent land use types and density of populations residing in near proximity to the corridor. The probability of trespass increases as the proximity of population density increases, suggesting additional precautions be taken to limit access, including a totally enclosed tunnel alignment in critical situations.

Some land use types restrict corridor access in themselves requiring less extreme measures. Such is the case of the rail corridor bordering a major highway right of way, a major natural feature such as an extreme slope or waterway, or an already restrictive land use type such as a military base. At minimum, 6-foot fences with barbed wire should parallel the rail corridor on either side. In addition, earth berming, sound walls and retaining walls offer some physical limitation in terms of access to the railbed proper. Plant material massing has little value in physically restraining access, but a case might be made for using plant materials to screen visual access in the sense "out of sight, out of mind." Regardless, monitoring the rail corridor -- probably from the air -- will be required on a continual basis to secure the rail corridor from unauthorized trespass.

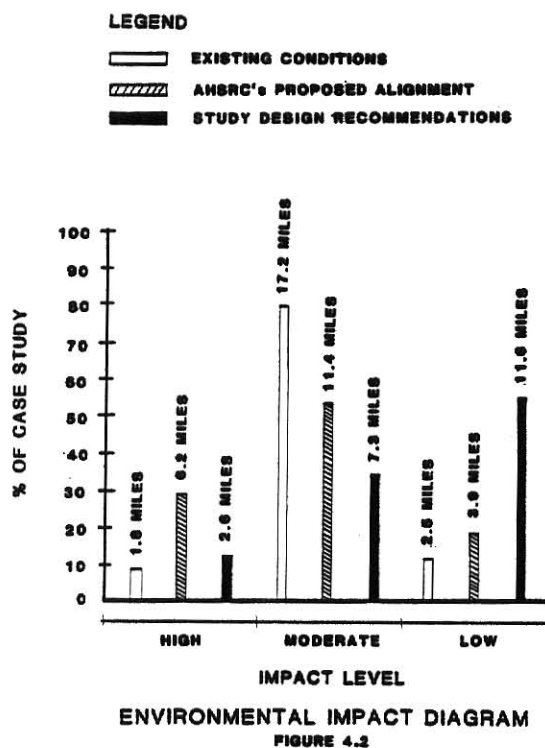
#### General Study Conclusions

Because this study dealt strictly with the evaluation of the AHSRC's preselected corridor connecting Los Angeles and San Diego, a comparative analysis of alternate corridors was not considered. It is conceivable however, that a more environmentally compatible and perhaps less expensive corridor could have been defined. Even though this study dealt only with the evaluation of a preselected corridor, it is obvious many of the evaluation criteria generated in this study could have

application in the comparative analysis of several possible alternative high speed rail corridors -- and selection of the optimum corridor.

Because no high speed rail prototype exists in the United States today no direct comparative analysis can be made to substantiate the results of this study. Upon completion of the Los Angeles to San Diego corridor however, a post-evaluation should be made to validate the findings of this study.

As evidenced in the case study cross section design recommendations within this document, a Landscape Architect can make a positive contribution toward mitigating the negative impacts of a high speed rail system at the microscale. To illustrate the Landscape Architect's positive environmental input in the planning process, diagram 4.2 provides a graphic analysis of the entire 21.5-mile case study corridor, comparing existing conditions, the AHSRC's proposed alignment, and the case study recommended alignment, in terms of high impacts, moderate impacts and low impacts on land uses bordering the corridor.



The analysis reveals distinct differences in the impact of the AHSRC's proposed alignment and the author's recommendations. Although each level of impact varies significantly, the most notable dissimilarity is the 3.6-mile (17%) difference in the high impact category. In most instances, high impact levels were directly related to residential land uses. In the majority of these cases the author's design solutions involved significant revision in terms of alignment, land purchase, etc., compared to the AHSRC's proposed alignment, the direct result of which will be an increased project cost. At the same time, a cost must also be placed on the environmental and social disruption that will be lessened due to the study recommendations.

In addition to making a contribution at the microscale in developing detailed design solutions, the Landscape Architect would also make a valuable contribution at the regional scale in terms of identifying an optimum corridor route selection. It is critical that any involvement by the Landscape Architect in the planning effort be during the early stages of the design process, if environmental compatibility is to be a consideration of high speed rail implementation.

#### STUDY RECOMMENDATION

To evaluate the findings of this high speed rail study, a post-construction evaluation several years after the system is in existence would prove useful to private enterprise or public authorities considering the implementation of a high speed rail system, particularly in terms of corridor selection and development, as follows:

- 1) An evaluation of the property values surrounding the rail corridor and station locations prior to and several years after completion of the high speed rail system.
- 2) An evaluation of the land use development patterns and trends paralleling the rail corridor prior to and several years after completion of the high speed rail system.
- 3) An opinion survey of the land owners/users bordering the high speed rail corridor to gather impressions on: 1) the overall system and 2) the success or failure of the measures employed to mitigate the negative impacts where they occur.

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A STUDY OF EVALUATION CRITERIA FOR  
HIGH SPEED RAIL CORRIDORS

by

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B.S., Agriculture, Oklahoma State University, 1979

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AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the  
requirements for the degree

MASTER OF LANDSCAPE ARCHITECTURE

Department of Landscape Architecture

KANSAS STATE UNIVERSITY  
Manhattan, Kansas

1983

## **ABSTRACT**

A balanced transportation system that capitalizes on the benefits of the many available modes of transportation is necessary in meeting this country's transportation needs. Today the combination of higher fuel costs, smaller and more expensive automobiles and increasingly congested highways is causing Americans to reevaluate their attitudes toward personal transportation.

The National Railroad Passenger Corporation, better known as Amtrak, a private corporation supported by federal subsidies, is presently serving as this country's national passenger rail system. Amtrak's reliability, speed, convenience and frequency does not readily compete with intercity automobile or airplane travel. In spite of these shortcomings, ridership has increased significantly during the past few years.

With Amtrak as a consultant, a new company, The American High Speed Rail Corporation (AHSRC), has proposed to construct, operate and maintain a privately funded, high speed passenger rail system utilizing Japanese "Bullet Train" technology. The proposed system will connect Los Angeles and San Diego, California, traveling primarily along existing interstate highway and railroad right of ways the entire 130-mile distance. A 21.5 mile stretch of the proposed high speed rail corridor became a research study area to evaluate the major negative effects on surrounding land uses in terms of noise impacts,

accessibility and visual quality impacts. An organized design methodology was developed encompassing corridor inventory and analysis, generation of evaluation criteria and physical design recommendations. Once refined, the methodology process was applied to the case study corridor to test its validity.

The inventory and analysis process revealed that noise disturbances, accessibility and visual disturbances negatively impacted adjacent land use activities in specific cases and had little, if any, discernible effect in other instances. Without question, the high speed rail system has the greatest negative impact on residential land uses. Generally speaking, the study determined that noise, accessibility and visual impacts were a valid basis for evaluating environmental effects of high speed rail corridors on surrounding land use activities.

This conclusion led to the observation that the evaluation criteria generated in this study, at best, could be used to select alternative routes of minimum conflict -- and at least reduce or mitigate land use -- corridor conflicts where they are unavoidable.