

Title: Getting Up to Speed: SOCAL High Speed Rail Corridor Analysis

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Abstract: A program level Environmental Impact Report was prepared for the proposed High Speed Rail corridor from Los Angeles to San Diego (LOSSAN). This presentation will introduce the purpose and need for the project, the objectives for conducting the analysis, as well as the ways GIS was extensively used to calculate impacts for the 13 subject reports that were created. The discussion will include how GIS was used to overcome the challenges of the project, as well as the custom scripts written to streamline the repetitive GIS tasks that were necessary. Additionally, the presenter will discuss some of the unique features of the LOSSAN corridor and how GIS was used to provide a quantitative understanding of potential impacts to those features. The presentation will include lessons learned, as well as an update on the future of the LOSSAN corridor.

Paper Body

Introduction

HDR Engineering, Inc. is providing environmental and technical support for a proposed high-speed rail (HSR) system within southern California that will be a part of a statewide HSR network stretching between the northern and southern portions of the State. HDR is preparing a state program Environmental Impact Report (EIR) and a federal Tier I Environmental Impact Statement (EIS) for the California High-Speed Rail Authority (CHSRA) on the LOSSAN Corridor. The study corridor extends from Los Angeles International Airport to Union Station in downtown Los Angeles, through the coastal area of Orange County, south to downtown San Diego. The study has formally engaged resource agencies and the public in the consideration of alternatives and potential benefits and impacts of the proposed rail system. The environmental process has enabled the evaluation of multiple alternatives at a conceptual level, thereby narrowing the range of alternatives before detailed project-specific analysis. Key elements of the program EIR/EIS process are the strategic program framework definition; early definition of purpose and need and alternatives; a screening evaluation of the HSR alignment and station locations; active participation and/or involvement of the resource agencies and the public; and development of the draft and final documents for the program EIR/EIS.

HDR's main goal is to help implement the program EIR/EIS study and to develop an independent and objective analysis that discloses the potential environmental impacts of a proposed HSR system within southern California. HDR has developed NEPA/CEQA documentation; made recommendations regarding corridor and station alignments, corridor and right-of-way preservation, and agency and public outreach activities; and responded with sensitivity to local, state, and federal environmental concerns.

In Phase I of the study, HDR identified broad corridors for the potential rail system and conducted an initial screening-level assessment to narrow the corridor options for the second phase of study. Subsequently, HDR participated in the conceptual engineering of design options within alternative corridors, compiled a comprehensive Geographic Information System (GIS) database, and prepared thirteen (13) technical reports evaluating environmental resources and potential impacts. These technical reports were

used by the California High-Speed Rail Authority (Authority) and Federal Railroad Administration (FRA) in preparing a statewide Tier I Program Environmental Impact Report (PEIR)/Program Environmental Impact Statement (PEIS). All technical reports included program-level mitigation strategies and an outline of additional studies that would be needed at the Tier II, project-specific level of analysis. HDR also produced a PEIR/PEIS for the conventional rail improvements proposed in the Los Angeles-San Diego (LOSSAN) conventional rail corridor. The state lead agency for that PEIR is the California Department of Transportation. HDR also participated in the development of a Strategic Plan for the LOSSAN corridor, to evaluate multiple alternatives at a conceptual level, and narrow the range of alternatives based on agency, municipal and public input.



The environmental study process included regular meetings with resource agencies and the public in the consideration of alternatives and potential benefits and impacts of the proposed rail system, and recommendations regarding corridor alignments and station locations. The statewide program involved the analysis of steel-wheel-on-steel-rail electrified and non-electrified (conventional) high-speed rail and magnetic levitation systems.

Purpose and Need

The High Speed Rail project was conceived based on the need to move people throughout the State of California more quickly and efficiently. The need is also defined by:

- Future growth in travel demand;
- Rail capacity constraints resulting in congestion and travel delays;
- Unreliability of travel stemming from congestion, delays, etc.;
- Increasing accidents on highways; and
- Continuing air-quality and natural resources issues.

These issues apply both statewide and to the LOSSAN region. As population in Southern California continues to grow, the challenges listed above will continue to increase. Figure 2 details the predicted population growth in Los Angeles, Orange, and San Diego Counties by calendar year (CY) 2020. In Tables 1 and 2, the necessity for additional forms of travel between Los Angeles and San Diego is demonstrated through the presentation of the current and predicted average daily traffic volumes between L.A. and San Diego, and the present and predicted travel times between L.A. and San Diego.

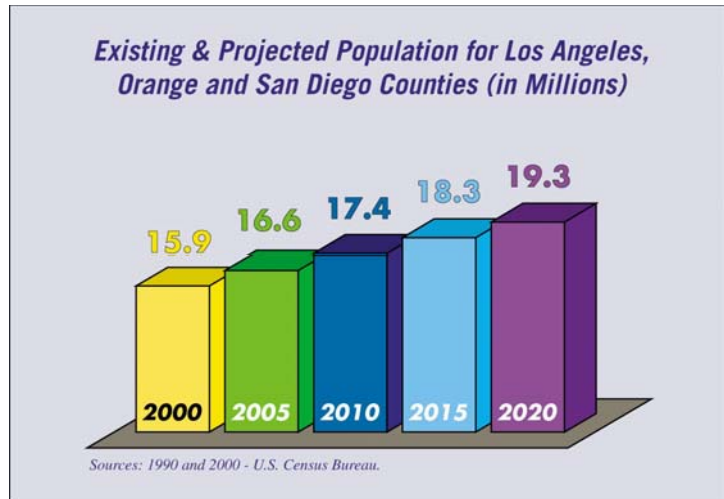


Table 1 - Average Daily Traffic Volumes between Los Angeles and San Diego

Major Highway	Average Daily Volume CY 2000	Average Daily Volume CY 2020	Percent Change CY 2000 - 2020
I-5 between Downtown Los Angeles and Downtown San Diego	171,000	280,000	64%

Table 2 - Present and Future Travel Times between Los Angeles and San Diego

Route	Auto CY 2000	Auto CY 2020	Rail CY 2000	Proposed LOSSAN Goal
Downtown Los Angeles to Downtown San Diego	2:35	3:15	2:44	< 2:00

Implementing High Speed Rail in the Southern California area would increase cost-effectiveness of State-supported intercity passenger rail systems, increase capacity of the existing route, reduce running times to attract riders and provide more efficient service, and improve the safety of State-supported intercity rail service.

GIS – Calculating Impacts

The environmental and design teams working to take the HSR project from a vision to reality are guided by the following objectives:

- Maximize Ridership/Revenue Potential
- Maximize Connectivity and Accessibility
- Minimize Operating and Capital Costs
- Maximize Compatibility with Existing and Planned Development
- Minimize Impacts to Natural Resources
- Minimize Impacts to Social and Economic Resources

- Minimize Impacts to Cultural Resources
- Maximize Avoidance of Areas with Geological and Soils Constraints
- Maximize Avoidance of Areas with Potential Hazardous Materials

GIS was extensively used to calculate impacts for the thirteen (13) subject reports that were created. The subject reports included:

- Biology
- Geology /Soils/Seismicity
- Hazardous Materials
- Land Use
- Hydrology /Water Quality
- Public Utilities
- 4(f)/6(f)
- Agriculture
- Air quality
- Energy
- Aesthetics and Visual Quality
- Paleontology
- Cultural Resources

Since the EIR/EIS is Program Level, to be used as a baseline document to create project level documents from in turn, field studies were conducted in very limited quantities. Instead, to calculate the potential impacts for the thirteen (13) reports, GIS shapefiles were used. On average, approximately seven (7) data sets of potentially impacted resources were analyzed for each report, from fifty (50) total data sets.



To conduct the GIS impacts analysis, the alternative rail alignments were buffered and then intersected with the shapefiles of potentially impacted resources. When conducting this analysis, it was important to remember that different resources are impacted in different ways, as well as at varying distances. Therefore, the buffer width for each resource was carefully chosen, based on the potentially affected environment. This resulted in eight (8) different buffer widths. To get information about the potentially impacted resources (data sets and buffers) into quantitative format (numbers), the buffers were then intersected with their respective potentially impacted resources to create impacted resources shapefiles. The shapefiles were used to create maps, and to export the databases to Excel, so that the report writers were able to interpret the data to quantify impacts.

GIS – Overcoming Project Challenges

A major challenge for the statewide HSR team was how to create a statewide document from technical reports created by six (6) different teams of writers. To create a cohesive document that could be used by regulatory agencies and the public, similar data sets and methodologies needed to be used by all the teams to evaluate impacts. GIS data sets were an excellent solution to this problem. By setting a standard for which data sets to use, as well as for the buffer widths used to calculate the impacts to those data sets, the results from each of the teams statewide would be seamless.

An additional challenge to the HSR team was how to quantify potential impacts to resources and differentiate between alignment alternatives without deploying an entire team of field researchers for data collection. By using GIS data sets, the report writers could get a program-level idea of the resources that existed in the rail corridor impact area, as well as the differences between impacts to be evaluated by alternative.

Finally, the impacts data needed to be in a format that the report writers could easily understand and utilize. The ability to easily create maps that showed where the impacts would potentially occur, as well as the ease with which the databases could be exported to Excel for the report writers to use made GIS a natural choice.

Repetitive GIS Tasks – Custom Scripting

The data needed by report writers was created by buffering the alternative corridors and intersecting the buffers with the potentially affected resources. The buffers needed to have an identifier to mark which corridor alternative each was associated with. With 35 alignment alternatives to consider, 8 buffer widths to create on each alignment alternative, and over 50 data sets to intersect, this part of the project threatened to slow the project down considerably, halting the report writers until the data analysis had been completed. A custom script was created to overcome the time consuming GIS analysis that was required. The custom script allowed the GIS user to create multiple buffer widths (specified by the user) on multiple alternatives, and would then create an additional column in the buffer width shapefile that was automatically populated with the name of the alignment alternative. This resulted in a huge time savings, and was relatively simple to create. Next, one resource layer to be intersected by the alignment alternative buffers that were applicable to the alternative. Then, using another custom script that was developed in-house, the intersected shapefile of the buffers and resource layer was “exploded” based on the field that identified which alignment alternative the resource is associated with. This resulted in a shapefile of potential impacts by resource for each of the alignment alternatives, which could then be analyzed more closely, and turned into an Excel table for the report writers to work from. The custom scripts that were created for this project resulted in great time savings, and ensured that the report writers were able to proceed in their analysis in a timely manner.

Unique Features of the LOSSAN Corridor

The estuarine lagoons of northern San Diego County are within the coastal zone. They are a unique biological resource and are the focus of many resource agencies and other entities interested in the quality of these areas. The six lagoons in the study area are described below. GIS was used to provide a quantitative understanding of potential impacts to those features.

Buena Vista Lagoon - The Buena Vista Lagoon, approximately 223 acres in size, lies within the cities of Carlsbad and Oceanside in northern San Diego County. The lagoon has unique habitat and a large number of wildlife species that use the area, including threatened and endangered species. The lagoon is also designated as Open Space per the 1995 amended City of Oceanside zoning ordinance and 1991 City of Carlsbad zoning ordinance. Habitats present in or within the vicinity of Buena Vista Lagoon include, but are not limited to, open water, seasonal sand/mud flats, brackish/freshwater marsh, some coastal salt marsh, a small riparian corridor, and Diegan coastal sage scrub.

Agua Hedionda Lagoon - The Agua Hedionda Lagoon, approximately 330 acres in size, lies within the City of Carlsbad, off Carlsbad Boulevard. In the 1950s, San Diego Gas and Electric constructed the Encina Power Plant and a tidal basin to provide its cooling water. The

tidal basin, currently owned by NRG Cabrillo Power as of the year 2001 is the Agua Hedionda Lagoon. Cabrillo Power leases a portion of their acres to the YMCA, the City of Carlsbad, and private businesses. The area is designated as open space in both the general plan and zoning ordinance for the City of Carlsbad. Habitats present in or within the vicinity of the Agua Hedionda Lagoon include, but are not limited to, open water, brackish/freshwater, mudflats, estuarine flats, patchy salt marsh areas, riparian, and Diegan coastal sage scrub.



Batiqitos Lagoon - The Batiqitos Lagoon, approximately

600 acres in size, is located at the southern edge of the City of Carlsbad. Passive recreation is the predominant use, with two trails along the north shore of the lagoon. The area is designated as Open Space in the general plan for the City of Carlsbad. Habitats present in or within the vicinity of Batiquitos Lagoon include, but are not limited to, open water, estuarine flats, coastal salt marsh, brackish emergent marsh, riparian, and Diegan coastal sage scrub.

San Elijo Lagoon - The San Elijo Lagoon, approximately 600 acres in size, is located between the cities of Encinitas and Solana Beach. The area is designated as Open Space and Reserve in the general plan for the City of Encinitas. CDFG, with the assistance of the County, manages the San Elijo Lagoon as an Ecological Reserve. The Reserve, including the wetlands acreage, encompasses approximately 900 acres and includes five miles of trails. The Reserve also accommodates passive recreation and fishing in selected areas. Habitats present in or within the vicinity of San Elijo Lagoon include, but are not limited to, open water (estuarine and fresh), sand/mudflats, coastal salt marsh, fresh/brackish marsh, riparian, and Diegan coastal sage scrub. I-5, the railroad, and Highway 101 divide the lagoon into three basins that are then connected by narrow channels confined by bridge abutments. Over the past several decades, the biological resources of the San Elijo Lagoon have deteriorated because of severely limited tidal action, hydrological and land use changes to the watershed, urbanization, sedimentation, poor water quality, introduction of exotic species, and increased visitor usage and off-road vehicle activity. The lagoon was included on the 1998 303(d) list of impaired water bodies due to exceeding standards for eutrophication, sediment and coliform bacteria.

San Dieguito Lagoon - The San Dieguito Lagoon, approximately 260 acres in size, is located at the northern edge of the City of Del Mar and at the western end of the San Dieguito River Valley. The lagoon is designated as Open Space in the City of San Diego general plan. Habitats present in or within the vicinity of San Dieguito Lagoon include, but are not limited to, open water, estuarine/palustrine flats, salt marsh, brackish/freshwater marsh, coastal salt marsh, riparian scrub, and Diegan coastal sage scrub.

Los Peñasquitos Lagoon - The Los Peñasquitos Lagoon, approximately 640 acres in size, is located in the northwestern corner of the City of San Diego, directly south of the City of Del Mar. The lagoon is designated as Open Space in the City of San Diego general plan. Recently, the status of Los Peñasquitos Lagoon was raised from "State Park" to "State Reserve" and then to "State Preserve" which has the most restricted usage. Habitats present in or within the vicinity of Los Peñasquitos Lagoon include, but are not limited to, open water (estuarine and fresh), sand/mudflats, coastal salt marsh, fresh/brackish marsh, riparian, and Diegan coastal sage scrub.

All of the lagoon features that are present in the LOSSAN study area needed to be considered in detail, without doing field surveys. GIS provided the analysis on the features and allowed the report writers to gather information such as the above for consideration in the EIR.

Lessons Learned

Throughout the creation of this Program Level EIR, GIS played an important role in determining impacts, as well as analyzing data. Some of the lessons learned include the following:

- Major time savings can be had by creating custom scripts.
- Your analysis is only as good as your data. If something looks strange in the results of the analysis, consider finding another data set to check the analysis against.
- Educating report writers about the process used to create the analyzed data sets will save time in the long run. If you can walk the report writers through the process, they will have a better understanding of how the numbers were created, and will trust that the analysis is accurate.

Looking to the Future

The statewide Draft Program EIR/EIS was published on February 13, 2004. The comment period extends to August 31, 2004. Several public meetings on the document have been held around the state, including one that was held on April 20, 2004 at the San Diego Association of Governments. The next steps in the environmental process for the proposed high-speed train system include:

- Public submits comments on Draft Program EIR/EIS at hearings or in writing
- The Authority and FRA prepare Final Program EIR/EIS that may identify preferred alignment and station options and includes responses to comments

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Appendixes:

None.

End Notes:

None.

References:

http://www.cahighspeedrail.ca.gov/eir/report/EIR_TOC.asp

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