Conceptual Design--From Planning to Design

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This paper describes the transition from planning to design and implementation for a multimodal transportation facility in Santa Clara County. Numerous planning studies were completed for Santa Clara County before an UMTA alternatives analysis Draft Environmental Impact Statement (AA/DEIS) was begun. During the analysis, but about 6 months before a transportation alternative was selected for implementation, a conceptual design program was undertaken.

The three primary goals of the conceptual design program were to (a) investigate the most promising alternatives in greater engineering detail in order to ensure their successful implementation and operation; (b) provide supplementary engineering and cost information for consideration during the AA/DEIS review process; and (c) develop the engineering basis for the preliminary engineering work efforts.

The results of these efforts helped to bridge the gap between project planning and project design.

The 20-mile Santa Clara County transportation corridor has been the subject of many planning studies. A broad-scoped study, the Rapid Transit Development Project, completed in January 1975, suggested the development of a localized rail transit system in the county. The more recent Santa Clara Valley Corridor Evaluation, performed in cooperation with the Regional Transportation Planning Agency, recommended a focus on transportation needs in the Guadalupe Corridor, which includes two freeway segments—long planned, but with little possibility of ever being built.

The most recent assessment, the UMTA Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS), was completed after a year and a half of study. The governing bodies then selected for implementation a preferred transportation alternative with a broad base of political and community support.

About 6 months before this analysis was completed, an independent consultant was commissioned to conduct conceptual design analyses for the four transportation alternatives defined in the study. Such a study, it was felt, would be beneficial both in the decisionmaking process and in the early implementation of the selected transportation alternative.

Conceptual design can be described as pre-preliminary engineering undertaken to provide local staff and officials with additional detailed environmental, design, and cost information beyond the planning study level. It gives them information to use in responding to questions raised during public discussion and planning study review processes. It also helps them select, from an engineering design perspective, the best alternative for implementation.

CONCEPTUAL DESIGN FOR THE GUADALUPE CORRIDOR PROJECT

The purposes of conceptual design for the Guadalupe Corridor transportation project were to

- Investigate four of the Guadalupe Corridor transportation alternatives in more engineering detail than was practical during the AA/DEIS study process,
- Verify the requirements expected for the successful construction and operation of each alternative,
- Obtain estimates of the capital and operating costs for each alternative in order to increase the level of confidence in the relative and absolute values of the AA/DEIS cost estimates,
- Develop the engineering basis for a quick start on preliminary engineering when an alternative was chosen for implementation, and
- Initiate interagency and intraagency involvement in the planning, design, implementation, operation, and maintenance of the project facilities.

The conceptual design activities involved investigating the engineering aspects of implementing and operating each alternative. Activities included

- Reviewing geotechnical, utility, and drainage information,
- Analyzing traffic requirements at 16 key intersections,
- Drafting design criteria for busway and light rail systems,
- Defining institutional relationships and requirements,
- Preparing geometric layouts (1 inch = 50 feet) for selected key locations for each alternative,
- Simulating light rail and busway operations,
- Defining with utility suppliers the electrification system,
- Reviewing maintenance activities and maintenance facility requirements, and
- Estimating capital, operating, and maintenance costs.

These tasks were approached from the engineering rather than the planning standpoint, that is, the focus was on actual implementation of an alternative.

The major conceptual design products were as follows:

Technical Memoranda

- Utility location data
- Storm drainage data
- Geotechnical data
- Traffic control system inventory
- Institutional setting
- Operating strategies
- Platform/vehicle fare collection
- Traction power
- System controls and communications
- Street traffic controls
- Maintenance and operations policy
- Station/stop alternatives
- Southern Pacific interface
- Yard and shop sites
- Drainage
- Preliminary engineering program

Working Papers

- Design criteria
- Busway/high-occupancy vehicles (HOV) and light rail operations analysis
- Capital costs
- Operating costs

Drawings

- Typical sections
- Station/stop designs
- Track/road layouts
- Electrification and control systems

In addition to these products, problems and concerns were also identified. Initially, the automobile traffic

demands and the transit patronage projections developed for the AA/DEIS were thought to be adequate for preliminary engineering. It was soon discovered in conceptual design that these needed to be better defined and specified in more detail for design engineers to establish appropriate geometrics. For example, projected turning movement volumes for the design year were needed for proper evaluation and design of at-grade intersections.

It was also discovered that (a) at-grade intersections of major arterial streets with the Guadalupe Corridor would have to be designed for greater capacity than that envisioned in the planning process; (b) levels of congestion on a segment of existing street along which express transit services were to run would be higher than anticipated or considered tolerable in the earlier planning efforts; and (c) the use of preemption and preferential signalization for transit would not be as feasible as originally thought.

These discoveries helped make the transition from planning to design.

Several findings of the conceptual design study related specifically to transit services. In the AA/DEIS study, there were some indications that the busway/high-occupancy vehicle and expressway alternative would involve some serious operational and safety concerns, especially if the busway or expressway were adjacent to heavily congested automobile lanes. These concerns were confirmed and clarified in conceptual design, and an investigation of the busway/HOV and expressway engineering design options was undertaken. Agency staffs were able to agree on the most acceptable design option, although the solution was not as initially planned nor was it felt to be the ultimate answer. As a result of the exercise, the facilities required for the successful operation of the busway/HOV alternative were more precisely defined, and, therefore, better cost estimates could be prepared. The trade-offs between level of service (speed and reliability) and operational and implementation costs were more clearly revealed.

Another significant finding related to transit services involved the relationships among the total fleet, the number of revenue vehicles deployed, and transit service reliability. The planned transit vehicle deployment was found to be incompatible with the current bus deployment policy of the Santa Clara County Transit District. A greater percentage of the total fleet was proposed to be in revenue service than district operating experience indicated was possible if the district's 99 percent service reliability level were to be maintained. This issue has not been resolved. The conflict, however, is now widely recognized, and agency staffs are more aware of the capital cost differences between bus fleets of different sizes.

SUMMARY

Conceptual design proved effective in making the transition from AA/DEIS planning to engineering and design implementation. Many of the concerns and issues identified in conceptual design were taken into consideration during the decisionmaking process.

Conceptual design is a sensitive tool; it can enhance or destroy the balance between planning and decisionmaking. Conceptual design is best performed by individuals independent of the planning efforts. Planning and conceptual design staff or consultants, however, should report to the same person to ensure coordination between the two activities.

Conceptual design is a demanding exercise. It cannot begin until the planning process has reached a plateau in the definition of problems and the description and analysis of alternative solutions. The conceptual design staff then has a short time to assimilate what has gone on in the planning effort and to evaluate the engineering implementation aspects.

Conceptual design provides the opportunity not only to question and refine the planning efforts, but also to direct the start of the engineering design activity. Months of engineering preparatory time are saved, and the designers can become familiar with the project by the time the preferred alternative has been selected for implementation.

A Case for the Reevaluation of Subsurface Power Collection for Light Rail in Sensitive Downtown Areas

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Because of rapidly increasing costs and the disruption of the urban environment during construction, a subway is no longer the automatic choice for light rail operation in downtown areas. As a result, street surface alternatives are more frequently being considered.

In the past, streetcars powered by overhead wires were in widespread use. However, objections were raised on aesthetic grounds to the use of overhead wires in environmentally sensitive areas. To meet these objections, an alternative power collection system was developed that used conductor rails located in a ductway below the road surface. Extensive subsurface power systems functioned successfully for many years in several cities, including New York, London, and Washington, and smaller systems were operated in Brussels, Berlin, Paris, Budapest, and Dresden. Several new subsurface collection systems have since been built using modern materials and construction methods. The success of the subsurface power systems for light rail in such cities as Calgary and San Diego, where careful planning has blended the light rail operation into area traffic patterns, points the way to greater use of such systems in the future.

Construction economics and concern for the quality of urban life have made the subway a less desirable alternative as a means of meeting the growing transit demands of cities. At the same time, the lower capital costs and greater flexibility of the light rail system have increased its attractiveness. In the past, most light rail systems were powered by overhead wires. To meet objections to overhead wires in areas of special significance, an alternative, the subsurface power supply system, was developed. Several such systems functioned successfully on a large-scale in London, New York, and Washington for many years. Small installations were operated in Brussels, Berlin, Paris, Budapest, and Dresden. Several new subsurface collection systems have since been built by using modern materials and construction methods. The success