

# Appendix A.6

## Network Integration Strategic Service Planning (NISSP) Analysis Documentation



## 1.0 Introduction

This technical memorandum describes the process and outcomes of the Network Integration and Strategic Services Planning (NISSP) effort undertaken as part of the California State Rail Plan (Rail Plan). The network integration planning process was conceived by CalSTA in two phases:

1. **Statewide Market Assessment & Rail Infrastructure Review:** The first phase of effort was coordinated by CalSTA to undertake an evaluation of the market capture potential of an interconnected statewide passenger rail network using High Speed Rail modeling resources. This phase also included a review of statewide infrastructure constraints and network opportunities, including definition of boundary “visions” for analysis and refinement. This analysis was undertaken prior to, and outside of the scope of the Rail Plan to provide inputs for the technical tasks that are part of the Rail Plan scope. Details of this analysis is included in separate documents.
2. **California State Rail Plan – Network Service Refinement and Statewide Passenger Rail Vision:** Refinement of Phase 1 boundary scenarios was undertaken by Caltrans during development of the Rail Plan, which responds to state requirements (GC Section 14036) for Caltrans to plan for a “comprehensive and integrated statewide passenger rail system, including High-Speed Rail, conventional intercity and commuter rail, and connections to urban rail systems.” This planning process included outreach to statewide passenger rail stakeholders to review and refine vision scenarios into a single long-term vision for the passenger rail network.

The overarching goal of the network integration planning process is to plan for a statewide passenger rail system that maximizes the performance potential of intercity passenger rail as a time- and cost-competitive travel option for meeting the State’s transportation needs and goals. This methodology is responsive to the following specific concerns / requests made by Caltrans DMRT and CalSTA:

- Current ridership forecasting models utilized for intercity rail forecasts are calibrated to current modes of operation and may underestimate rail demand for a system which delivers better on-time performance (OTP), provides better connectivity, and which provides more frequent service than generally exists today
- Current nominal Operations & Maintenance (O&M) cost factors per train mile or per train hour for intercity service may overstate future year costs and/or bias measures of

effectiveness when intercity services are better integrated into the Statewide high-speed rail and urban transit networks

- Detailed analysis of infrastructure requirements developed by identification of conflict points along existing infrastructure using specific trial operating plans may be less robust than evaluating capacities, service mixes and throughputs on a corridor and corridor sub-segment level

Institutional roles and responsibilities and recommendations on governance as part of an integrated network was not included within the scope of the network integration planning process and the State Rail Plan does not explicitly prescribe governance roles. Network integration planning and the California State Rail Plan are intended to provide a framework for prioritizing state investment in the passenger rail network and to guide incremental planning and investment decisions in phases so as not to preclude future investments needed to achieve the long-range vision. Decisions about governance should be informed by and based on an understanding of the systemwide goals and services to be operated.

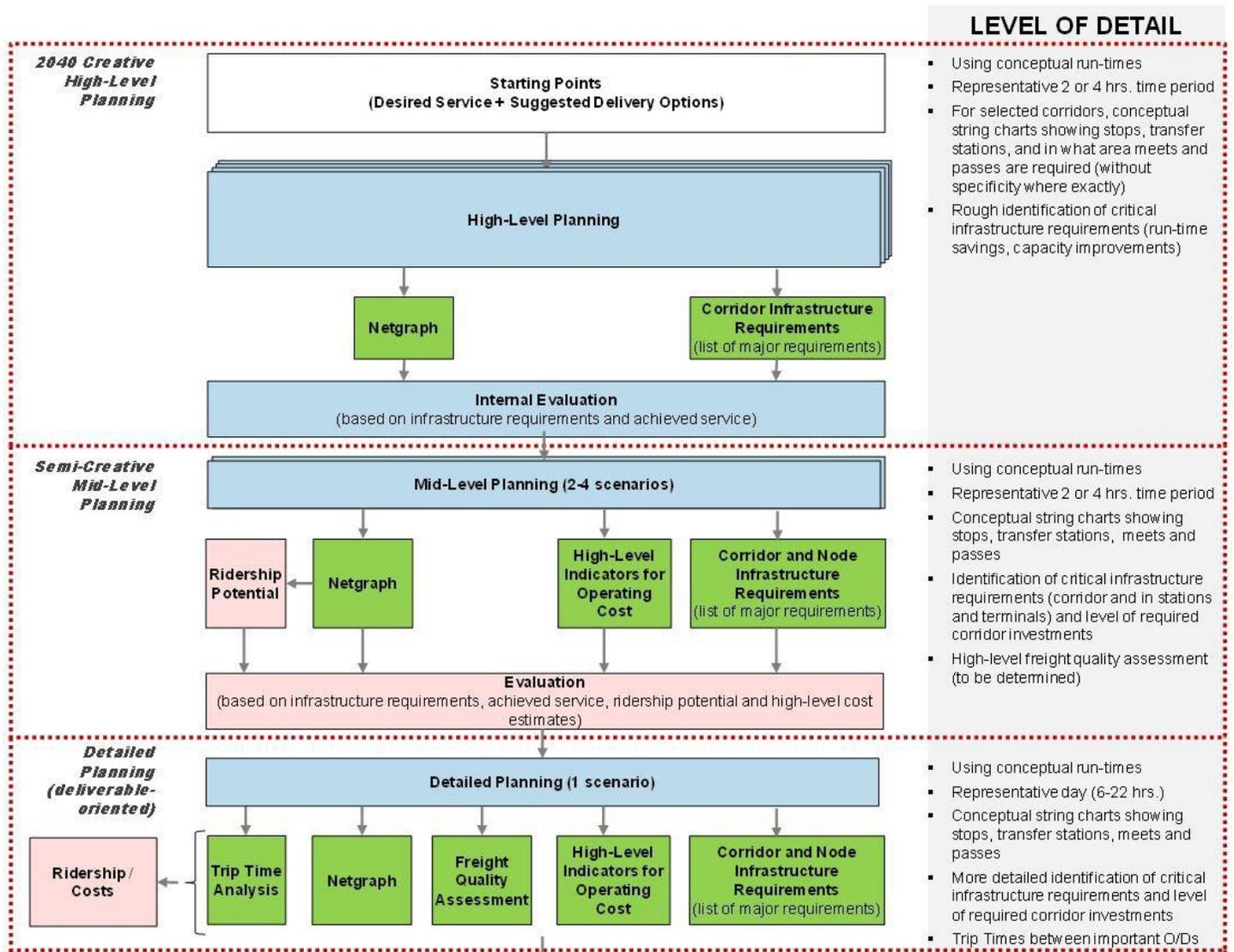
## 2.0 Process and Procedure

The network integration strategic planning process in the State Rail Plan itself was generally divided into three phases of activity:

1. Technical Collaboration
2. Service Plan Refinement
3. Final Service Plan Refinements and Vision

The following block diagram schematically identifies principal procedures accomplished in each phase. These three work periods are identified as “2040 Creative High-Level Planning”, Semi-Creative Mid-Level Planning” and “Detailed Planning (deliverable –oriented)”, respectively. These phases are described in more detail below.

**Exhibit 1: Major Phases of Activity during Network Integration and Strategic Services Planning**



## 1. Technical Collaboration

### Network Integration Phase 1 Boundary Visions

The Boundary Visions of Phase 1 are not scenarios for the State Rail Plan, the Boundary Visions only describe service goals and are used to define scenarios for the long-term State Rail Plan Vision.<sup>4</sup>

The Boundary Visions define theoretic boundary conditions. The Boundary Visions are based on California's policy objective of creating an integrated network that uses HSR Phase 1, and they describe service visions that would result from the not-yet-defined policy goal of achieving high/low coverage and quality.

The boundary visions include only services of statewide relevance. Statewide relevance has a different meaning, depending on the desired coverage and quality as shown in the diagram on the following page.

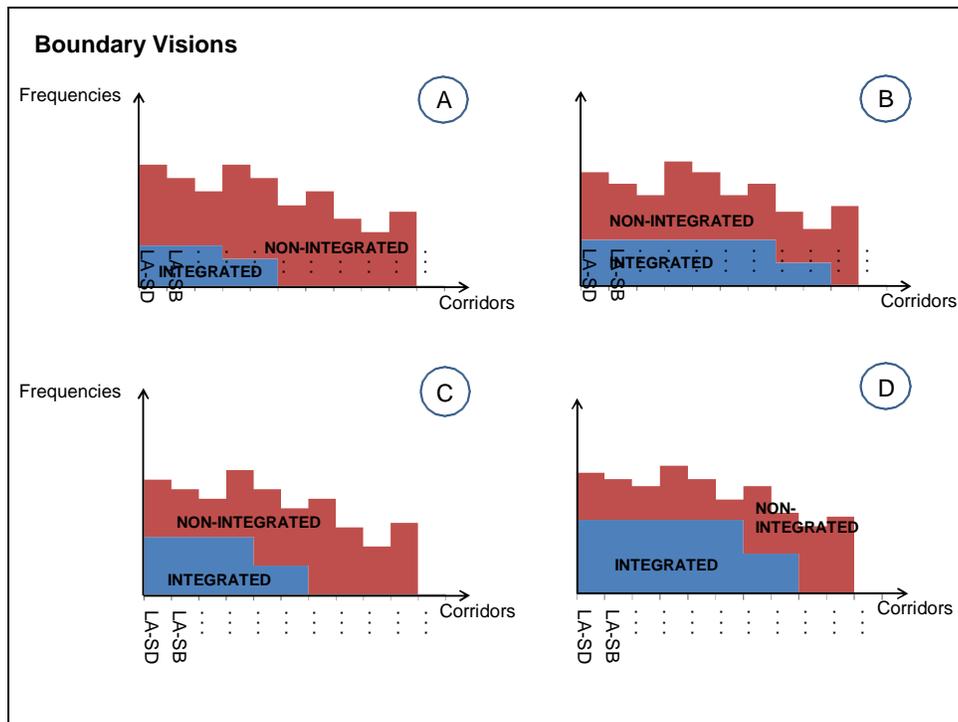
The Boundary Visions describe solely public transportation service (the "desired service" or "product") and do not define operations or infrastructure (the "delivery"). Operations and infrastructure are considered only implicitly as existing run-times and conservative service

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<sup>4</sup> A vision being a document defining desired service, a scenario being a starting point for analysis consisting of (1) desired service, (2) a specific idea how to deliver the desired service.

levels are used for Visions A and C, and therefore these should be realistic. Visions B and D, however, require market-competitive run-times and frequent service and therefore are realistic to the extent that credible future funding levels of sufficient magnitude to support the infrastructure development program are foreseeable.

**Exhibit 2: Network Integration Boundary Visions – Service Quality vs. Coverage**



Draft Vision Statement

The CSR’s draft vision statement, will be informed by the NISSP Phase 1 work and will describe the service vision and policy goals that have been used for Phase 1:

- Policy objective of creating an integrated public transportation network and solving the associated soft issues to overcome service fragmentation, including governance issues, ticketing and funding.

- Creation of a network which includes services and corridors which are so designated as serving a statewide need for public transport with to-be-determined quality and coverage parameters.<sup>5</sup>
- A network based on pulsed frequencies providing fast direct connections between major centers and by-design transfers to provide high-quality connectivity to and between smaller places throughout the state.

The Vision includes all services of statewide relevance, including high-speed rail, conventional rail and bus, which makes the State Rail Plan essentially a Statewide public transportation plan.

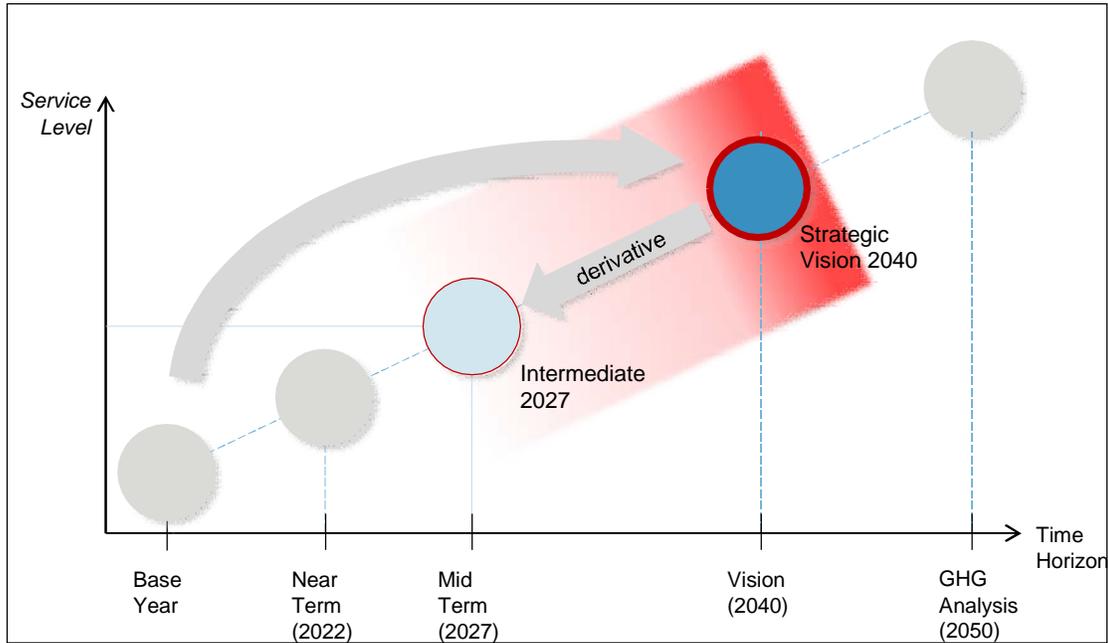
### Scope of Network Integration – Phasing of the Network Vision

Based upon early collaboration between CalSTA and Caltrans in September 2015, it was confirmed that the 5-Year (Near Term) plan will essentially provide an update to current infrastructure investment and services expansion plans in process, updated to reflect current conditions. It was also determined that the focus of Network Integration will be the 2040 Vision plan (25-Year horizon) and that the 10-Year Intermediate plan will be derived from the 2040 Vision plan. (With the 2050 horizon reserved for Greenhouse Gas analysis.)

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<sup>5</sup> “Public Transport” as used in the context of the State Rail Plan refers to all forms of transportation which are available for purchase by or provided to the general public including but not limited to rail services, intercity bus, mass transit (bus and rail), taxis and “Technology Enabled Transportation Services” for which a payment is collected (such as “Uber” or “Lyft”). Excluded from the Public Transport category are privately operated vehicles (whether driven solo or as shared-ride), goods movement conveyance, and commercial vehicle operations not open to the general public.

**Exhibit 3: Network Integration Phasing**

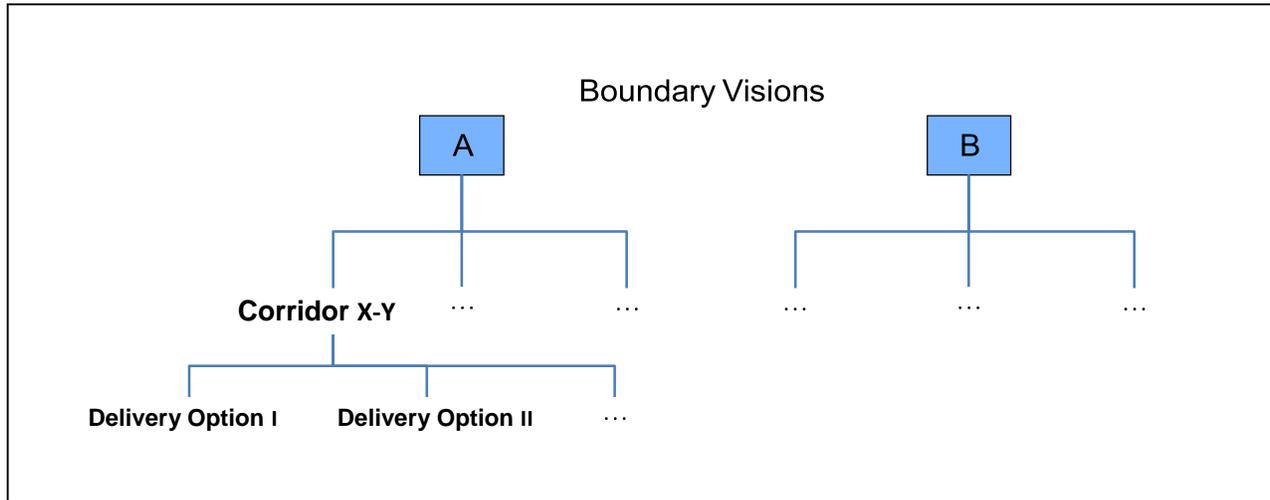


Technical Collaboration Workshops

The Boundary Service Visions from NISSP Phase 1 were used as an input to define a set of scenarios for further analysis. These scenarios have to both define desired service (e.g., become one of the service visions or an adaption of the service visions) as well as to provide guidance on how to pursue the desired service (“delivery options”).

During the Phase II Scenario Development Workshop the team discussed and defined potential options to deliver the envisioned service levels of each Boundary Vision, corridor-by-corridor, as shown in the diagram below:

**Exhibit 4: Boundary Vision Development – Corridor Service Delivery Options**



For most corridors only a few types of delivery options are available:

- Existing Highway Corridor (with Intercity Bus) with or without Managed Lanes;
- Shared Existing Freight Rail Corridor with Access Agreements (with potential revisions to access agreements and performance metrics);
- Shared Existing Passenger Rail Corridor Existing Rail Corridor primarily for passenger operation (acquired corridor or revitalized abandoned corridor);
- New Conventional Passenger Rail Corridor (new alignment);
- Enhanced Existing or New Urban Transit Corridor (bus/BRT or rail);
- New High-Speed Rail Line;

Or;

- Revisit Service Goal (if no delivery option available or reasonable).

For critical transfers/connections the team considered delivery options at the station level:

- Existing Station;
- Improved Station;
- New or Relocated Station;

Or;

- Revisit Service Goal (if no delivery option available or reasonable).



The perspective of the freight railroads was respected when describing delivery options and their needs reflected in the suggested delivery option.

Using the Boundary Visions and Delivery Options, starting points for the SRP scenarios are specified (Initial Scenario Definition). These starting points include a clear service goal and suggested delivery methods corridor-by-corridor, for instance:

- *Achieve hourly intercity service with a 60-minute run-time between Sacramento and Stockton, making connections at Sacramento to Reno, Redding and Fairfield/Vacaville and in Stockton to Livermore and Tracy. Use the existing rail corridor assuming feasibility of the required speed improvements, and a new-type access agreement with the host railroad.*

*Note: In all cases planning for expansion of passenger services on freight corridors included consideration of replacing lost capacity needed to support projected increases in freight traffic, to the extent that such capacity is available.*

Guided by the Initial Scenario Definitions the analysis engaged in a creative, high-level planning exercise, dropping clearly unattractive scenarios based on an internal evaluation process:

- Is the service outcome attractive?
- Would we need clearly unrealistic design requirements to get scenario to work?

An objective of the Technical Collaboration process was to determine a range of credible service frequencies and delivery options along principal corridors between key nodes based upon the previous Market Analysis, competing peak and off-peak highway times and potential rail journey times.

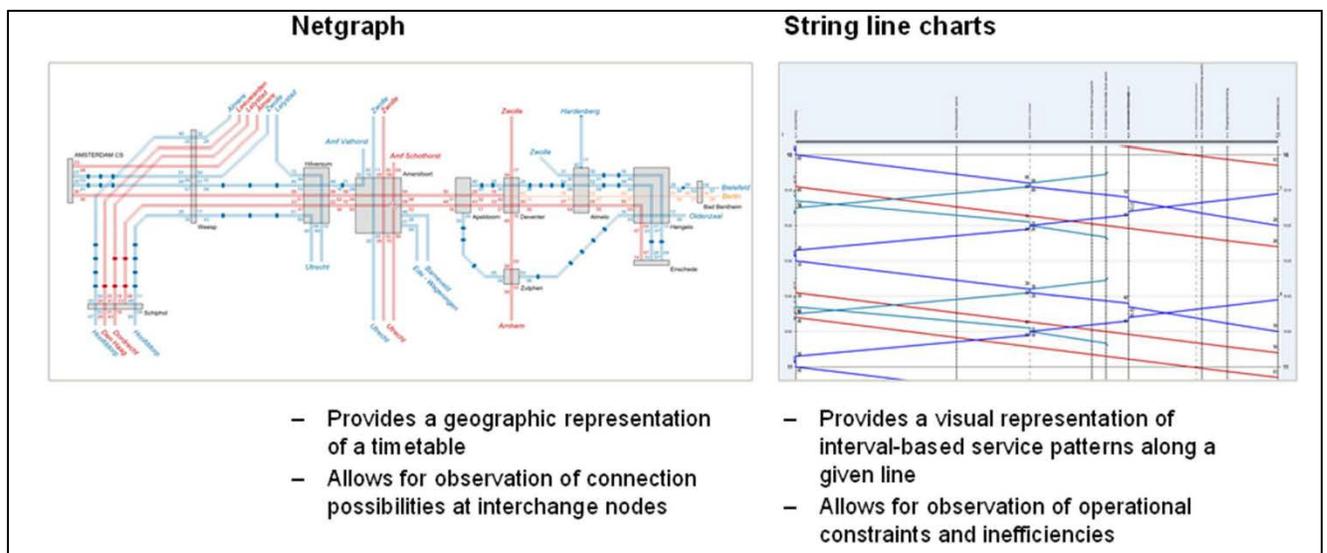
Three scenarios representing conservative, moderate, and aggressive network options informed by the Phase 1 boundary Visions were presented to state rail providers at a series of workshop sessions to solicit feedback in December.

The results of these evaluations were considered by Caltrans in the Service Plan Refinement phase to develop a single scenario recommended for inclusion as the State Rail Plan Vision.

## 2. Service Plan Refinement

Subsequent to the Technical Collaboration Workshops, Viriato software was utilized to develop “Netgraphs” depicting the service scenarios. Viriato was also used to develop “String Line” charts which can be used to identify key operational constraints and inefficiencies. This information was considered along with a mainline “Level of Service” to develop an Infrastructure Requirements Assessment.

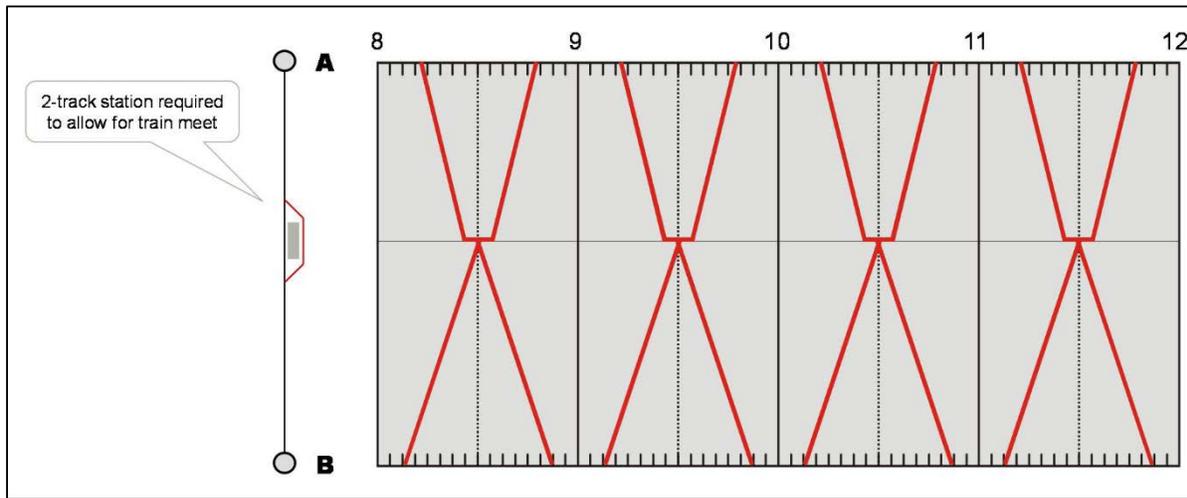
### Exhibit 5: Example Viriato Service Planning Software Outputs



<sup>6</sup> Refer to Ridership and Revenue Technical Criteria and Methodology Memorandum for specific procedures.

<sup>7</sup> Refer to Capital Improvement Analysis Technical Criteria and Methodology Memorandum for specific procedures.

**Exhibit 6: Identification of Infrastructure Requirements Using String Chart**



The Vision Scenario was refined and described based on the following considerations:

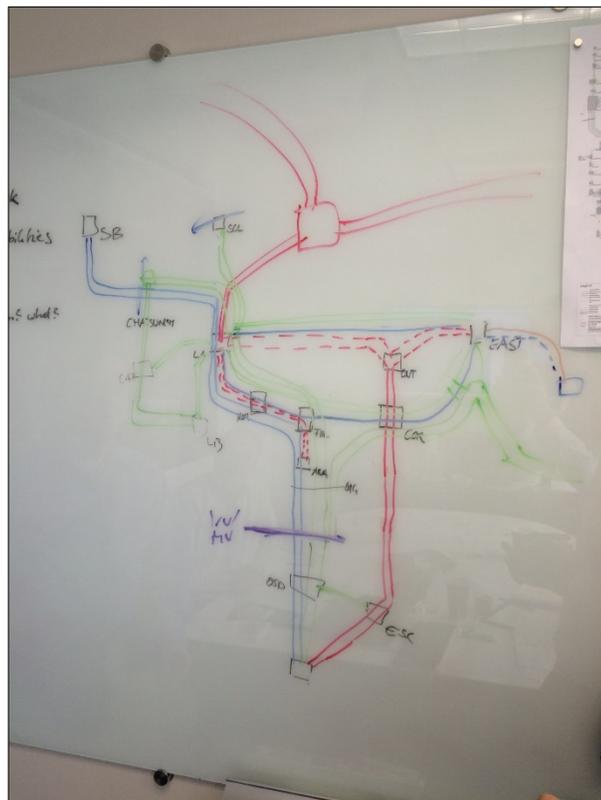
- Service level adjustments given understanding of market capture potential for each corridor;
- Critical design requirements (run-times, line capacity, station configuration) for each corridor and generic projects meeting requirements given a pulsed operation;
- Delivery options and underlying trip time assumptions/mobility benefits for each corridor, and potential alternative delivery options (rail and express bus/urban mass transit);
- Capacity analysis of the envisioned service levels/frequencies and infrastructure to evaluate trade-offs between desired service and design requirements/delivery options;
- Freight quality based on freight flows analysis and freight train forecasts for each corridor; and
- Rough order-of-magnitude estimate of capital costs.

Caltrans prepared Netgraph representations of Service Plans under consideration. The Netgraph diagrams defined the types of service(s) provided in each corridor, the travel times between principal nodes, the frequencies of service and the coordination of transfer opportunities at identified timed transfer points.

A single “Demonstration Scenario” Netgraph was developed as a network proof of concept document for review with state rail stakeholders and as the basis for ridership analysis and quantification of “program effects” described in Chapter 6 of the State Rail Plan.

### 3. Final Service Plan Refinements and Vision

The outputs of Caltrans service plan refinement were further developed for presentation as a draft State Rail Network Vision for further review and refinement. This evaluation included review by rail stakeholders, capital improvement analysis to evaluate service goals and delivery options in a corridor based on high level costs for providing services, a statewide ridership analysis to evaluate the performance of the network and confirm that proposed services were tailored to expected market demand, and an estimate of operating costs associated with the integrated network to confirm that the integrated services and investments were meeting the state’s expectation for achieving operating efficiencies reducing operating costs consistent with documented examples of integrated systems elsewhere in the world.



#### Stakeholder Outreach – Term Sheets

Caltrans and CalSTA sought detailed feedback from rail stakeholder agencies around the state on the Draft Vision for the passenger rail network as a check on the technical analysis being performed and developed Term Sheet documents describing proposed service improvements and infrastructure assumptions in individual corridor segments for discussion purposes. The Term Sheets were used to divide the state rail network into service planning regions, or “geographies” conforming to the state’s understanding of regions and travel markets. These geographies in turn were used as the basis for analyzing capital improvements and developing capital cost “budgets” for service regions in the State Rail Plan.

Caltrans scheduled meetings with 29 individual stakeholder agencies around the state to present the Draft Vision and network assumptions and collect feedback for use in finalizing the Vision. The final Term Sheet document served as the basis for the description of passenger

service goals and improvements in the Draft State Rail Plan, with subsequent updates based on the latest understanding of project development assumptions and costs.

### Capital Cost Analysis

The 2040 Vision identifies the service type, frequency (system pulse), required average line speed, departure and arrival times, and route nodes used to develop corridor specific improvements and build related capital cost estimates. This Vision was used to identify capacity requirements at the corridor level throughout the State. These capacity requirements were the primary basis for all project descriptions and assumptions in the implementation cost estimate.

The service and connectivity goals, along with corridor-level improvements required to achieve the 2040 Vision, are described in a phased plan with capital projects identified for the near-term, i.e., the next four years (2022); and mid-term needs identified for the next decade (2027); along with improvements and investments for long-term (2040) planning. The Capital Cost methodology is documented as a separate document in the State Rail Plan Appendix. Note that the phases track with the Vision phasing process outlined in Exhibit 3.

- 2022, the Near-Term, catalogs the capital plan of ongoing and committed projects as part of an enhanced existing conditions assessment of present and near-term rail services across the State. Near-term projects totaled to \$4.8 billion in Year 2018 dollars.
- 2027, the Mid-Term, captures new and established projects and planning studies intended to maximize capacity and utility of the existing passenger rail network, and begin using high-speed rail while connecting it to the statewide integrated network. Mid-term projects totaled to \$47.0 billion.
- 2040, the long-term Vision, identifies additional corridor-level investments and service goals needed to fully realize the 2040 Vision, connecting regional networks into a statewide integrated system. 2040 Vision projects totaled to \$85.0 billion.

More on specific projects and phasing of projects appears in Chapter 6.

### Ridership Analysis

Caltrans prepared a macro-level ridership analysis using a Rail Market Analysis Tool developed by Steer Davies Gleave for the Rail Plan to document ridership effects of the long-term Vision and validate the scope of investment in an integrated statewide passenger rail network. The model was developed to capture rail and transit demand from changes in modal split driven by the key improvements in the Rail Plan, including higher service quality (increased speeds, higher frequencies, timed connections and minimal transfer times, and expanded coverage into additional markets). This tool utilized High Speed Rail network and demand matrix information, impedances and weights for Highway, Air, Rail/Transit modes to feed mode choice (cost, door to door travel time including transfers, number of transfers and frequencies – including weights to reflect future perception of an integrated system and improved service quality), mode split model coefficients from similar projects, literature research and

## Appendix A.6: Network Integration Strategic Service Planning Analysis Documentation

recommendations for other model applications, and 2015/16 ridership data from NTD California operators to calibrate the model and provide post-processing adjustments. The model also accounted for additional demand not included in the model itself, including an external analysis of tourism-related trips and growth in market share using Visit California data, as well an induced demand analysis for rail trips avoided in a no-build scenario without improvements in the Rail Plan.

The model included coding for High Speed Rail, conventional long-distance, intercity and commuter rail systems, Demonstration Scenario services in the long-term Vision Netgraph, BART and LA Metro rail services, Light Rail services, Amtrak Thruway Bus routes, other major bus connections and ferry connections.

A summary of the ridership model outputs is included in Chapter 6 of the Rail Plan.

