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High Desert Corridor: Investment Grade Ridership & Revenue Forecasts

Proposal
December 2015

High Desert Corridor Joint Powers Authority

Our ref: 228766P1

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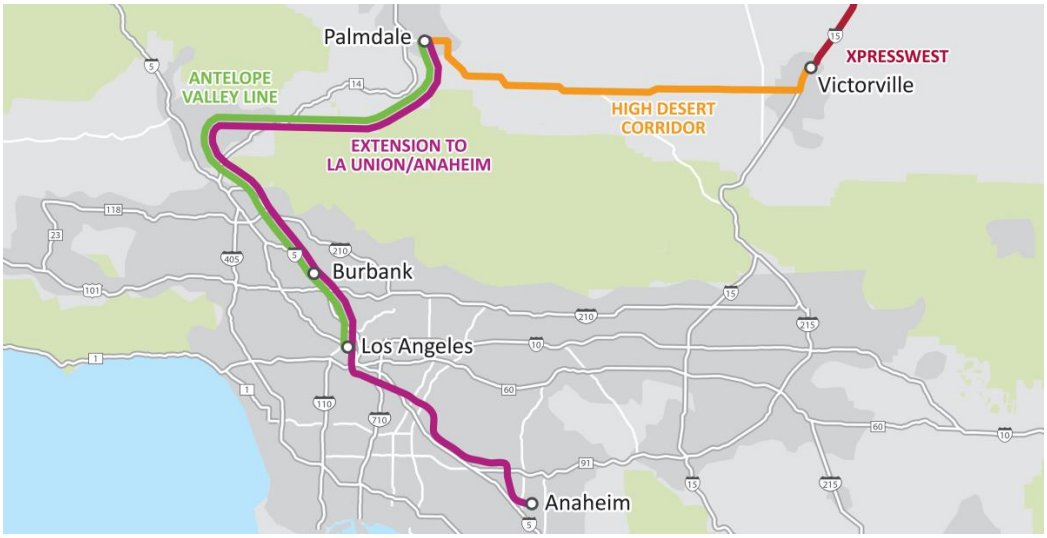
1 Introduction

Steer Davies & Gleave is delighted to provide its proposal to support the High Desert Corridor Joint Powers Authority (HDC JPA) in the development of Investment Grade ridership and revenue forecasts for the Los Angeles to Las Vegas high-speed and intercity passenger rail corridor.

The High Desert Corridor (HDC) is an approximately 60-mile link between Victorville and Palmdale which forms a critical link in creating a high-speed rail (HSR) corridor between LA and Las Vegas.



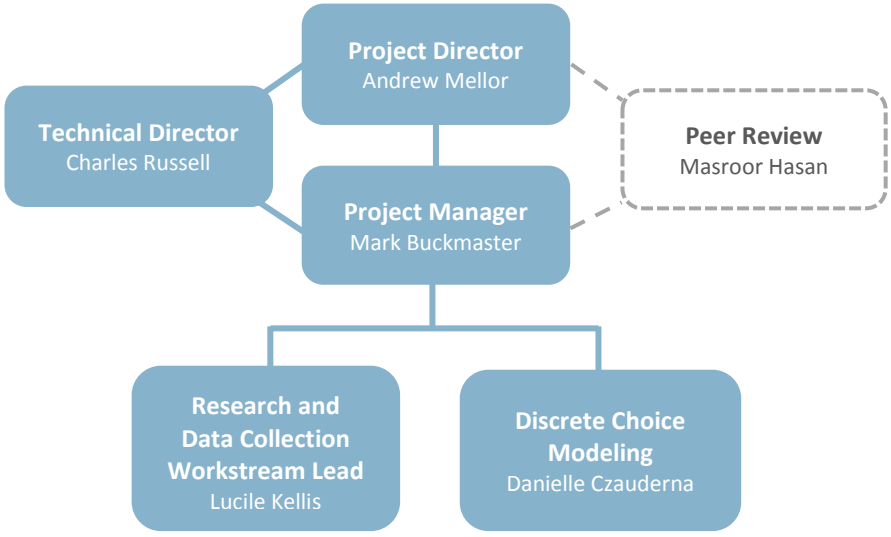
The HDC is expected to be a multi-modal link including freeway/tollway alongside the potential HSR line. The focus of this study is on the potential for HSR in the corridor, with connections to Las Vegas via XpressWest (XW) and to Burbank/Los Angeles/Anaheim using either existing Metrolink infrastructure, or California High Speed Rail (CaHSR) infrastructure in future. Ridership and revenue forecasts will be produced for all passengers using the proposed HSR line along the HDC section (but specifically excluding flows with both origins and destinations entirely south of Palmdale).

The ongoing development of the HDC will likely require financial support both from the public and the private sectors. Insofar as project stakeholders wish to approach the public sector for loans under programs such as RRIF or TIFIA, and approach the private sector investors and lenders for equity investment and loans, a robust set of Investment Grade traffic and revenue forecasts is essential.

2 Our team

Our team has been put together to provide the highest quality advice to HDC JPA. The majority of the core team has been involved throughout our work supporting the development of the XpressWest project, and has significant wider experience in producing Investment Grade ridership and revenue forecasts for HSR in the US and across the globe.

Outlined below is the organization chart for the core team proposed to undertake this work:



We propose the following key personnel as the core team for this study:

Core Team Members	
Andrew Mellor • Project Director • Office: London UK	***Experience*** Andrew brings over 30 years' consultancy providing specialist advice covering the planning, management and financial analysis of passenger rail operations. He has extensive experience in developing business strategies, market forecasts and investment cases for high speed rail projects across Europe including NTV (Italo), Eurostar, Thalys, Britain's West Coast Main Line and plans for open access HSR operation in Spain. He provided market analysis and market growth projections for the XpressWest project based on a detailed analysis of Las Vegas visitor market segments and residents, and demographic trends. He has also provided advice to Amtrak on HSR rolling stock options, maintenance and energy costs drawing on international benchmarking. ***Project Role*** Andrew will oversee the development of market growth forecasts and, as Project Director, assure the overall quality of the deliverables. Every project within Steer Davies Gleave is led by a Project Director, accountable for the delivery of high quality output which address our client's requirements. The Project Director is also accountable for the overall success of the project, including accuracy and quality of work, commercial performance, compliance with Company procedures, risk management, effective team working and ensuring staff welfare and safety.
Mark Buckmaster • Project Manager • Office: Boston MA	***Experience*** Mark is an APM-certified project manager with a track record of delivering successful outcomes in challenging project environments. He has led multi-disciplinary teams and managed complex stakeholder relations across a range of high-profile projects, including technical support for the proposed XpressWest project. He has also worked on numerous Investment Grade ridership and revenue forecasts, providing support to infrastructure owners and investors worldwide. ***Project Role*** Mark will be the Project Manager for this work. Each project within Steer Davies Gleave is led on a day-to-day basis by a Project Manager. They are responsible for the technical and financial management and planning of work, deploying resources and skills to deliver the project to time, cost and appropriate quality standards. They are also responsible for managing the client relationship at a working level and ensuring our ISO9001 certified Business Procedures are followed.
Charles Russell • Technical Director • Office: London UK	***Experience*** Charles is a Director of Steer Davies Gleave with over 30 years' experience in transportation consultancy. He has carried out assignments worldwide, and now heads Steer Davies Gleave's Infrastructure Finance group. He has provided advice both at the strategic and policy level, as well as at a more technical/commercial level. Charles was project director for the XpressWest Investment Grade ridership and revenue study. ***Project Role*** Charles will bring a combination of in-depth knowledge of the Las Vegas visitor market with international experience of ridership forecasting and risk evaluation, to ensure the quality and robustness of the analysis. The Technical Director role is used within particularly high-profile or complex projects and is fulfilled by a senior recognized expert in a particular area – in this case Investment Grade forecasting. Their role is to ensure application of a robust and valid methodology along with providing senior input into particular elements of the work (for example, engagement with FRA).

Core Team Members	
Lucile Kellis • Research Workstream Lead • Office: Boston MA	***Experience*** Lucile has managed and played key roles in Investment Grade ridership and revenue studies across North America and investigated the drivers of demand for different market segments. She has significant experience in market research, survey design and statistical analysis of data for transportation projects, with specific expertise in revealed and stated preference survey design, discrete choice modeling and behavioral analysis. ***Project Role*** As Research and Data Collection Workstream Lead, Lucile will have overall responsibility for all data collection activities, including liaising with sub-contractors to ensure the surveys are undertaken in a professional and unbiased manner.
Danielle Czauderna • Technical Specialist: Discrete Choice Modeling • Office: London UK	***Experience*** Danielle specializes in discrete choice modelling and behavioral research, encompassing research using stated preference techniques and statistical modelling underpinning the production of Investment Grade forecasts. She played a leading role in developing the ridership and revenue forecasts for proposed high speed rail projects including Texas Central and XpressWest. ***Project Role*** Danielle will provide an additional layer of assurance across all research and modelling activities.
Masroor Hasan • Peer Reviewer • Office: Boston MA	***Experience*** Masroor leads rail demand forecasting for Steer Davies Gleave in the US and has directed, managed and played key roles in several high-speed and intercity passenger rail studies including the Northeast Corridor, California, Florida, Chicago, New York and Georgia. Masroor also has a strong background in econometrics and its application to travel demand forecasting and market research. ***Project Role*** We build internal assurance into project delivery by subjecting emerging findings to challenge from outside the delivery team. Masroor will critically assess all work undertaken, using his detailed knowledge of HSR forecasting best practice.

The team will be supported by analysts as required. Resumes for each individual can be provided upon request.

3 Proposed scope of work

In this section we outline our proposed approach to producing Investment Grade ridership & revenue forecasts for the High Desert Corridor.

3.1 Investment Grade forecasts

In order to support our clients, we as consultants must prepare forecasts which are sufficiently robust to give assurance to potential investors in their investment decisions. In turn, Steer Davies Gleave must have sufficient confidence in these results to offer potential investors reliance on its work.

There are no formal rules that define the investment grade forecasts: they are characterized by their outputs rather than a specific methodology. These forecasts need to be comprehensive and based on a good understanding both of the project, access to up to date and reliable data and application of relevant forecasting techniques.

Steer Davies Gleave has extensive experience in producing “Investment Grade” forecasts for various high-speed and intercity and passenger rail studies as well as toll road projects for the investment community. The term “Investment Grade” means we derive forecasts of revenue that identify and explain risks and their potential impacts, and that we stand by these forecasts as providing a sound basis for investors to rely on to make an investment decision. These studies are not given an explicit rating by the rating agencies; rather it is the projects that are given a rating to support investment bond financing, and that rating will reflect both the forecasts, the nature and degree of associated uncertainties and the capital structure. We have been involved in projects where our forecasts have been used in support of such financing. However, we have also been in many toll road and rail projects where the private sector did not use investment bonds as a funding mechanism but relied on other funding sources including RRIF loans and equity contributions. In these projects, the rating agencies are not involved, but the investment community used and relied on our forecasts as “Investment Grade” when making their investment or loan approval decisions.

Based on our extensive experience in this field, any forecast should only be considered “Investment Grade” if it able to meet the following criteria:

- Use recently observed data for all key components;
- As far as practicable, be based on parameters specific to the project, rather than imported from other studies;

- Not rely on third-party models or data; unless such analysis has been sufficiently audited for Steer Davies Gleave itself to offer reliance on the work;
- Be subject to peer review (internally and/or externally); and
- Clearly identify and explain key risks and quantify their impact.

It is important to understand that in instances where a potential weakness or degree of uncertainty exists in the data this does not necessarily mean the forecasts are not Investment Grade. However, any such concerns should be clearly reflected in the presentation of the results, highlighted in the assumptions and reflected in a "risk envelope" around a central forecast.

At the core of Steer Davies Gleave's approach to the preparation of Investment Grade demand and revenue forecasts lies the conviction that the key requirement is a proper understanding of the situation – *supported* but not *led* by the rigorous development of modeling tools. Too often we have seen examples where the objective of the forecaster appears to be the preparation of a model – rather than the preparation of realistic, robust forecasts supported by the model.

In this context, we seek to:

- Identify **up-to-date demand, travel time and cost data**, and anchor our analysis firmly on this;
- Understand the **behavioral responses** underlying any travel choices;
- Review the **most significant assumptions** underlying our results – and explore with our clients the impacts of varying those assumptions (e.g. different operating scenarios or growth assumptions) on the forecasts; and
- **Interrogate modeled results** to clearly identify the logic behind them and sensitivity to key driving factors.

In Sections 3.3 and 3.4, we outline in greater detail our approach based upon these principles.

3.2 Options for evaluation

Primary options

The focus of this study is the High Desert Corridor and the potential ridership and revenues generated by improved accessibility of a HSR service to/from Las Vegas.

Forecasts will be developed for three options, reflecting the anticipated phased roll out of the California High Speed Rail (CaHSR) infrastructure:

1. One-seat high-speed ride linking Las Vegas-Victorville-Palmdale, with transfer to the existing Metrolink services on the Antelope Valley Line or auto access with parking facilities at Palmdale;
2. One-seat high-speed ride between Las Vegas and Burbank, using new CaHSR infrastructure from Palmdale (with intermediate stops at Victorville and Palmdale); and
3. One-seat high-speed ride between Las Vegas and Los Angeles Union Station / Anaheim Station using new CaHSR infrastructure from Palmdale (with intermediate stops at Victorville, Palmdale and Burbank).

The focus of the study will be forecasting trips using the proposed HSR service between Palmdale, Victorville and Las Vegas. Within options 2 and 3, forecasts will also be produced for trips going between Burbank/Los Angeles/Anaheim and Victorville/Las Vegas. In all cases, trips made wholly between Anaheim-Los Angeles-Burbank-Palmdale, which would not use the HDC infrastructure under any of the three options above, are not in-scope.

There are two primary reasons for this element of demand being excluded. First, trips completely confined within the Anaheim, Los Angeles, Burbank and Palmdale section will not use the HDC infrastructure, and therefore do not contribute to the business case for constructing this section. Second, the ongoing California High Speed Rail work already incorporates internal flows in the Anaheim-Los Angeles-Burbank-Palmdale section and detailed ridership and revenue forecasts have already been prepared or are currently being updated. Accordingly, a second and separate set of ridership/revenue forecasts for this section is superfluous.

Baseline assumptions

Right after project inception we will develop a set of baseline assumptions regarding the three primary options (described above). These assumptions will describe the characteristics for the existing and committed infrastructure and potential service offer (frequency, journey times etc) for the base and future years. These assumptions will be included in the modeling methodology document (described later) that will be submitted for review by the HDC JPA team and other funding partners (Metro/SANBAG/CHSRA/XpressWest). These assumptions will include the characteristics of the various transportation modes (both competing and complimentary) including potential access modes for the proposed HSR service. These will include explicit assumptions about existing and future air services, Metrolink service and auto travel over the highway network in the study corridor. In addition, assumptions related to demographic

characteristics and trends (e.g. population, employment, per capita income) in the study area will also be included.

Who is in-scope

On the basis of the primary options outlined above, we anticipate the following core markets to be in-scope for the service and to potentially respond differently to the service offer:

- Residents of Southern California going to Victorville/Las Vegas;
- Residents of Las Vegas/Victorville going to Southern California;
- Non-resident tourists going from Southern California to Las Vegas; and
- Non-resident tourists going from Las Vegas to Southern California[1].

Further, people are likely to respond differently based on a range of other characteristics (for example the number of people traveling in their immediate party). Appropriate segmentation of the market will be incorporated within the forecasts, using evidence on the key behavioral parameters from primary research undertaken.

Additional considerations

There are a large number of interactions and potential scenarios which will need to be considered as part of the work. We outline below some particularly key elements:

- Potential upgrades to the Antelope Valley Line could provide enhanced capacity which would allow a more regular service pattern and potentially faster journeys than now. The appropriate assumption will need to be agreed.
- The alignment of the proposed HSR line from Palmdale to Burbank is not yet finalized, with a number of options still under consideration. Journey times over the section are projected at between 15 and 20 minutes but these differences are not likely to be material to the results – these timings compare with the current 80-90 minute journey time on Metrolink.
- Future development of highway (and airport) infrastructure could influence mode choice by changing travel times and the predictability of journey times in peak traffic. The High Desert Corridor itself is expected to be a multi-modal link including freeway/tollway alongside the rail line. It will be necessary to define central case assumptions and to test sensitivity of the forecasts to alternative high/low investment scenarios.
- Palmdale and Burbank are expected to act as bus feeder hubs for connections into HSR. The bus links will be assumed to be available to passengers wishing to access XpressWest as well as CaHSR services.
- Some potential customers may prefer to drive to the origin station and the availability of parking near the station could be a factor influencing mode choice. We understand that the scale of parking facilities has not yet been determined, and that the results of this study could help to determine the appropriate level of parking provision. We will therefore present the option of parking at the origin station in addition to Metrolink and bus connections.
- The existing travel options involve relatively lengthy journey times, including the air option once airport access/egress, check-in times and security procedures are taken into account. A

[1] References to 'residents' and 'non-residents' throughout the remainder of this proposal relate to these 4 core markets.

HSR service offers the potential for much faster door-to-door times. We will consider the potential for developing a new day trip market as well as the impact of induced levels of demand in the overnight stay market. Both aspects involve sources of uncertainty and, as such, the forecasting framework will need to carefully articulate and isolate the impact of these factors on traffic and revenue levels.

- We will also consider the potential for enhanced demand through tourism packages, in particular when connecting through to Anaheim. It should be noted however that obtaining robust data from destinations such as Disneyland/Universal is often not possible meaning quantification of such potential demand would necessarily rely on a number of assumptions. Such demand would therefore only be considered as a potential upside scenario and not within the Central Case forecasts.
- It will also be necessary to consider some of the key risks to system revenues. The extent of competition from airlines will present a key risk to demand and revenue levels, particularly if fuel prices were to remain low. The operation and potential expansion of intercity coach services may also present a risk for less time-sensitive travelers.

Optional: Future connection with CaHSR to Central Valley, San Jose and San Francisco

We have not included consideration of a future connection in Palmdale with the California High Speed Rail service to the Central Valley, San Jose and San Francisco within our core proposal.

Should HDC JPA wish to include this as part of this work, the methodology utilized would be consistent with that which we set out for the core study below. Each element of the work would be extended to consider this additional potential connection and the opportunity for increased ridership and revenue that it may bring.

The in-scope market for this extension would be defined on the same basis as set out for the primary options above, with the focus on trips made between Northern California and Las Vegas. Trips undertaken entirely within the CaHSR infrastructure (for example between San Francisco and Los Angeles) would not be in-scope. For the avoidance of doubt, all passengers north of Palmdale would be expected to travel on CaHSR services, and no through service to/from Las Vegas is envisaged.

Should HDC JPA wish to include this as part of this work, it would be beneficial to commission this additional work alongside the core study. This would allow in particular the primary research to incorporate consideration of these connections in parallel with the core research, although the potential market base would be quite distinct. The budget set out in Section 4 for this optional work has explicitly been developed on this basis. Should this work be commissioned separately this fee would be subject to revision.

3.3 Forecasting approach

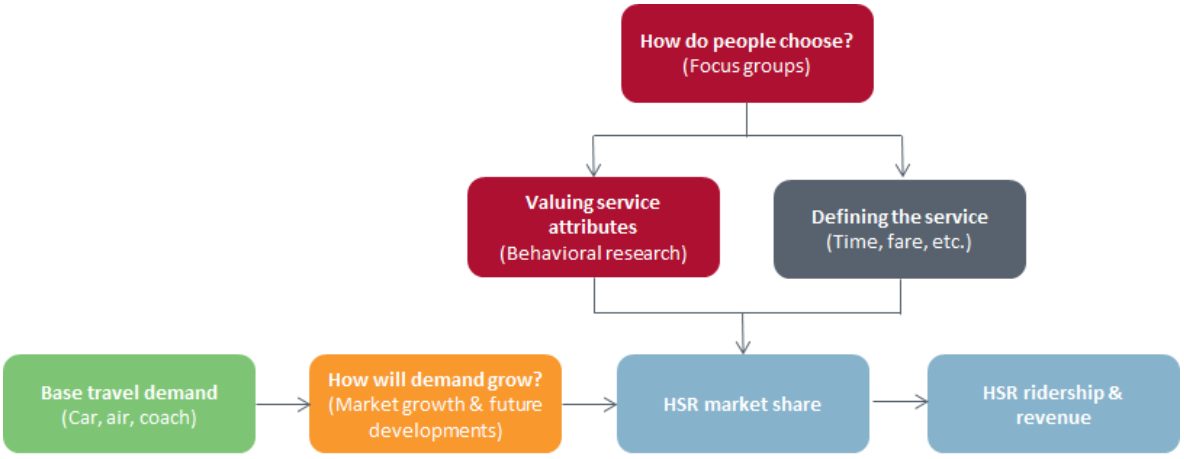
Our proposed forecasting approach will build upon the extensive body of work previously completed as part of our work forecasting ridership and revenue for XpressWest.

The latest XpressWest ridership study was completed by Steer Davies Gleave in October 2012. Since this time, the economic conditions in Southern California and the wider market have moved on with consequences for Las Vegas visitor numbers and potentially for the forecast behaviors of prospective riders. Accordingly our work will first re-establish the ‘base’ position without the HDC,

revisiting and updating all data and forecasting assumptions developed as part of our earlier work. The case for developing the HDC proposals will then be established for each of the HDC service options.

We outline below our proposed forecasting approach:

Figure 3.1: High Desert Corridor HSR forecasting approach



Passengers will make travel decisions based on a number of factors, including price, journey times, service frequencies, reliability, the convenience and accessibility of alternative modes (including factors such as through ticketing, the availability of car parking and the onward connections available by local public transport), and other factors related to the perceived quality of particular service options. A proper understanding and quantification of the base market, as well as the benefits offered by the HSR option will be required – this will enable us to estimate how effective the HSR proposals will be in capturing demand. Detailed segmentation of the base market will reflect that there will be people with distinct preferences within the overall market who are likely to respond differently to the proposed service attributes.

This forecasting approach is based upon a proven methodology which we have utilized in the development of the forecasts for XpressWest and other high-speed and intercity passenger rail studies in the US and internationally.

3.4 Scope of work

We outline below our proposed scope of work in greater detail. Note that while specific tasks are broadly presented in chronological order, many of the tasks will be progressed in parallel. A draft workplan is presented in Figure 3.2.

Where applicable within each task we outline data items which will be collected. These are split into two groups:

- **Steer Davies Gleave to obtain**: Data items which Steer Davies Gleave will source either through primary research or publically available sources; and
- **Input required**: Data items which require input from HDC JPA or a third party.

To ensure there is no delay to the workplan, we would seek to receive all requested data from HDC JPA/third parties within 10 working days of the request being made.

All the data collected (e.g. through primary research) or data obtained from public domain sources will be made available to the HDC JPA team for potential future application in planning studies undertaken by individual stakeholders. However, certain data provided by commercial organizations to inform our work may be subject to restrictions on its future dissemination in order to protect intellectual property or commercial confidentiality.

3.4.1 Project inception and approval of modeling assumptions and method

Following notice to proceed we would seek to engage with the HDC JPA team as soon as possible. A meeting would be arranged, either via conference call or in-person, with particular focus on:

- Initiating key lines of communication throughout the project (both with HDC JPA and other key stakeholders);
- Agreeing the project workplan; and
- Confirming the scope of data to be provided by HDC JPA/other stakeholders, including agreement on sources / responsibilities for providing critical modeling assumptions.

A modeling methodology document will be prepared and submitted to the HDC JPA team and other funding partners (Metro/SANBAG/CHSRA/XpressWest) for early review and comment. This document will define the modeling framework proposed for this study. The document will include a detailed description of the study corridor characteristics and key travel markets, together with SDG's proposed modeling approach for each of the principal market segments.

In addition, this document will also set out the baseline assumptions for the three options to be analyzed for this study, including level of service characteristics for each mode and the sources of those assumptions.

SDG will undertake downstream tasks following the approval of the modeling methodology document by the HDC JPA team and other funding partners (Metro/SANBAG/CHSRA/XpressWest). However, in order to ensure adherence to the agreed upon schedule, planning for fieldwork and preliminary survey design will need to be undertaken in parallel, prior to receiving formal approval of the modeling methodology. We assume a one week turnaround time to receive any feedback on the modeling methodology document.

Deliverable(s): Modeling methodology document including fieldwork and sampling strategy

3.4.2 Literature review

There are a number of studies/planning documents which have either directly considered plans for the HDC or which will likely impact upon the competitive environment in which HSR would operate. At an early stage within the work, these documents would be reviewed to ensure that the forecasts being developed are consistent with the wider transportation context.

The precise scope of documents to be reviewed will be agreed with HDC JPA at project inception, including at minimum:

- Draft High Desert Corridor EIR/EIS;
- Metro's 2009 Long Range Transportation Plan;

- SANBAG's draft 2015 Countywide Transportation Plan; and
- California High Speed Rail documentation (in particular for Palmdale-Burbank-Los Angeles-Anaheim section).

The October 2012 XpressWest ridership study undertaken by Steer Davies Gleave will be a primary source document, although we will be revisiting and updating the data and assumptions as necessary.

3.4.3 Primary research

Primary research efforts will be required to establish up-to-date local travel patterns and traveler behavior characteristics. All of these activities will be coordinated by Steer Davies Gleave. We outline below the various activities proposed to be undertaken:

Airsage origin-destination data

Airsage[2] uses anonymized cell phone records to produce matrices of trips between different geographic zones. This will be used as a core source of data for estimating trip patterns between Southern California and Las Vegas.

The Airsage data can be segmented by time of day and day of week. This facility is especially important in this corridor given the significant peaking and directional disparity in traffic patterns to and from Las Vegas (peak traffic conditions are usually observed northbound on I-15 during Friday evenings and southbound on Sunday afternoons). There can also be substantial seasonal variation in travel demand between summer and winter in the study corridor, which needs to be taken into account in the sampling.

There are some limitations to this data. In particular, phones can only be tracked when they are interacting with a cell tower, and the transportation mode used for a given trip isn't directly known (although this can be assessed based upon assumptions related to any periods of phone inactivity and where phones were last sighted (for example in the vicinity of an airport), and implied journey times between observed points).

In order to validate the data, we will use traffic count data on I-15, I-210, SR138 and other key highways, adjusting the Airsage zone pair specific trip tables (as required) to match the aggregate traffic counts. In addition, we will review the implied trip patterns against data collected from other sources (for example air passengers from DB1B) and from other studies. In particular we will compare the output matrices with those developed as part of our XpressWest work, which used the same core methodology.

The study area will be sub-divided into a number of geographic zones, with the aim of aiding the validation of the Airsage data. These zones will be developed based on aggregation or disaggregation of zone systems currently being used by various MPOs in the corridor, and in the California Statewide Travel Demand Model (CASTDM), the CaHSR ridership forecasting study and the XpressWest study. This will allow easier comparison/validation between the data collected as part of this project and demand matrices developed within earlier work.

[2] **http://www.airsage.com/**

The size of the zones will vary depending on their locations (e.g. downtown vs. suburban locations) and appropriate consideration will also be given to transportation hubs (e.g. airports, train stations) where a greater level of granularity may be required in defining zones around these facilities.

Bluetooth

The majority of autos are fitted with Bluetooth short range wireless devices. The Bluetooth identities can be used to provide information on trip patterns along highways, in particular providing insight into the split of traffic on I-15 originating from the South or from the West (i.e. via SR14 and SR18). This data will be particularly important when forecasting HSR station choice and will provide an additional layer of validation to ensure confidence in estimated traffic volumes.

The precise scope of Bluetooth data to be collected will be agreed with HDC JPA at project inception, including at minimum data on:

- I-15;
- SR14; and
- SR18.

Focus groups

We propose to undertake three sets of focus groups with a combination of residents and visitors from both Southern California and Clark County. The objective of the focus groups would be to discuss the practicalities of the HSR proposals and obtain qualitative feedback from potential users on the critical success factors of the proposed system. These groups will also provide useful insights into the choices people are likely to make in terms of accessing the HSR system under the different service options. This will enable us to develop a more detailed understanding as to how the product can be made successful and what third party actions might facilitate passengers switching to the proposed service.

Behavioral research – Stated Preference (SP) survey

The forecasts of ridership and revenue will utilize Stated Preference (SP) surveys to determine the behaviors of people travelling between Southern California and Las Vegas (and vice-versa), to determine the relative attractiveness of the HSR offer compared to the other travel modes available.

The SP survey that we propose forms an important input to the forecasting framework. The survey will be carefully designed to elicit information from travelers on the choices they might make under a range of alternative time and cost scenarios in the future. A number of different scenarios will be presented to travelers where they are offered travel alternatives by their current mode and by high speed rail under the different options. This information will then allow us to estimate travelers' different sensitivities to journey options both at a whole market level and for segments of the market who may have differing sensitivities.

Information about potential riders and their behaviors will be collected using the SP survey which look at people's preferences and priorities, and how they apply those preferences to make choices

in relation to travel. The outputs from these surveys will play a crucial role within the forecasting approach in determining how much of the 'in-scope' market HSR can capture at a given fare.

There are a number of key issues which will need to be explored, both as part of the focus groups and as part of the wider behavioral research exercise:

- Under each primary option, how likely are people to use the HSR service;
- If they do intend to use the service, which station would they use and how would they access the station; and
- How might price differentials at each station affect their choice.

For people who are responsive to the option of HSR, we would also investigate their potential increase in trip frequency, including possible day trips using HSR.

It is important that the survey methodology be developed to ensure that each distinct potential market for HSR is captured. We anticipate the following core markets to respond differently to the service offer:

- Residents of Southern California going to Las Vegas/Victorville;
- Residents of Clark County/Victorville going to Southern California;
- Non-resident tourists going from Southern California to Las Vegas; and
- Non-resident tourists going from Las Vegas to Southern California.

In order to adequately survey each of these markets we propose to use a recruitment strategy for the survey which uses a combination of online panel members (principally covering residents) and the distribution of postcard surveys in Las Vegas (principally covering non-residents). Steer Davies Gleave would host the online survey and would work with a local subcontractor for any surveys requiring on-the-ground presence.

We will seek to obtain a total of approximately 2,000 completed surveys across all recruitment methods. The target of 2,000 completes is based on similar surveys that we have undertaken on other "Investment Grade" HSR ridership studies including the XpressWest study. There are no clear requirements for minimum sample size needed for the estimation of mode choice models using SP data. However, statistical literature suggests that in these kinds of choice experiments, a minimum sample size of over 100 per market segment is advisable, and it is SDG's standard practice to use a minimum of 200 completes per market segment. The proposed size of sample is designed to provide the opportunity to address a range of potential market segments, and with this many completed surveys we are confident of obtaining satisfactory statistical results. Although it would be possible to obtain satisfactory results with lower numbers of completed surveys we have chosen to target a higher number in order to be able to exclude outliers, bad data and inconsistent responses, which are frequently encountered in these types of surveys. Moreover, this will also potentially increase the accuracy of the statistical analysis that will be undertaken using the survey data.

We will determine the precise sampling frame for the behavioral research in conjunction with the outputs from the focus groups, development of the zoning system and in discussion with HDC JPA. The modeling methodology document (described above) will also include the proposed survey plan describing the sample recruitment strategy that will be employed to achieve the target sample size of completed surveys.

Carrying out new research is important to the integrity of this study as it will allow us to collect current and relevant information to this study as it affects peoples choices and decisions now. Costs of travel in particular are constantly evolving in response to changes in the price of oil. Whilst not every change is reflected in travelers' behavior, large changes can have an impact on how people choose to spend their time and money on long distance or more discretionary trips.

Similar work was carried out in 2009 for XpressWest but we note that the world has changed quite a bit since then. In addition, the HSR service options being considered as part of this study are broader than those studied in 2009 (e.g. more access points), and potential users' responses may also be differ as a result.

Market reports

Assessment of the future growth in HSR patronage needs to consider the different drivers of demand for each of the potential ridership markets. While many intercity flows are predominantly driven by 'typical' macroeconomic effects such as population and employment, the market to/from Las Vegas is primarily affected by the success of Las Vegas in promoting itself as an attractive leisure and conventions destination.

In order to understand the latest expectations of growth in the Las Vegas market and its evolving market profile, we will commission report(s) by Applied Analysis and/or Union Gaming – both respected consultants with particular insights into the Las Vegas economy. These will be adjusted to take into account the expected relative performance of the market from Southern California.

Deliverable(s): For this task, we will prepare brief technical memorandums or working papers on-

- The Airsage/Bluetooth data; and
- The SP survey instrument and technical summary of the focus group and SP survey.

3.4.4 Base travel demand

In order to have a robust basis on which to develop forecasts, we want to find out as much as possible about existing conditions – where people are traveling to/from, who is traveling and what modes they choose to travel by.

A zoning system will be developed based on aggregation or disaggregation of zone systems currently being used within existing models in the corridor. Base demand matrices will then be developed utilizing a number of sources to most accurately reflect and validate the scale and distribution of trips made today.

Data to be used as part of the development of base matrices is outlined below:

Steer Davies Gleave to obtain

- Airsage origin-destination trip tables;
- Bluetooth data sourced at key highway locations;
- Air passenger movements from the Bureau of Transportation Statistics Airline Origin and Destination Survey (DB1B) and Air Carrier Statistics database (T-100);
- McCarran airport passenger statistics;
- Official Airline Guide (OAG) data;

- Las Vegas Convention and Visitor Authority (LVCVA) Statistics and Visitor Surveys – numbers of visitors and profiles by origin;
- Bus demand from supply side information (from the published bus schedule with appropriate assumptions for bus capacities and load factors);
- California Department of Transportation (CALTRANS) traffic counts;
- Nevada Department of Transportation (NDOT) traffic counts; and
- California County population estimates produced by DoF California.

Input required

- Zoning system and base trip matrices from the SCAG model;
- Zoning system and base trip matrices from CALTRAN's California State-wide Travel Demand Model (CASTDM);
- Zoning system and base trip matrices from the California High Speed Rail model; and
- Zoning system and base trip matrices from the XpressWest model (Steer Davies Gleave has these matrices, however permission to use these needs to be confirmed by DesertXpress Enterprises LLC).

Deliverable(s): For this task, we will prepare a technical memorandum describing the base travel demand for the various modes under consideration.

3.4.5 Defining the service

Appreciation of the costs (monetary, time-based and perceived) associated with each alternative travel mode is key to developing an understanding of the relative benefits offered by the HSR service.

Alongside typical elements such as journey time, fare and frequency, ease of access to the HSR system and the reliability of the service compared with competing modes will be particularly relevant given the congestion in and around Los Angeles.

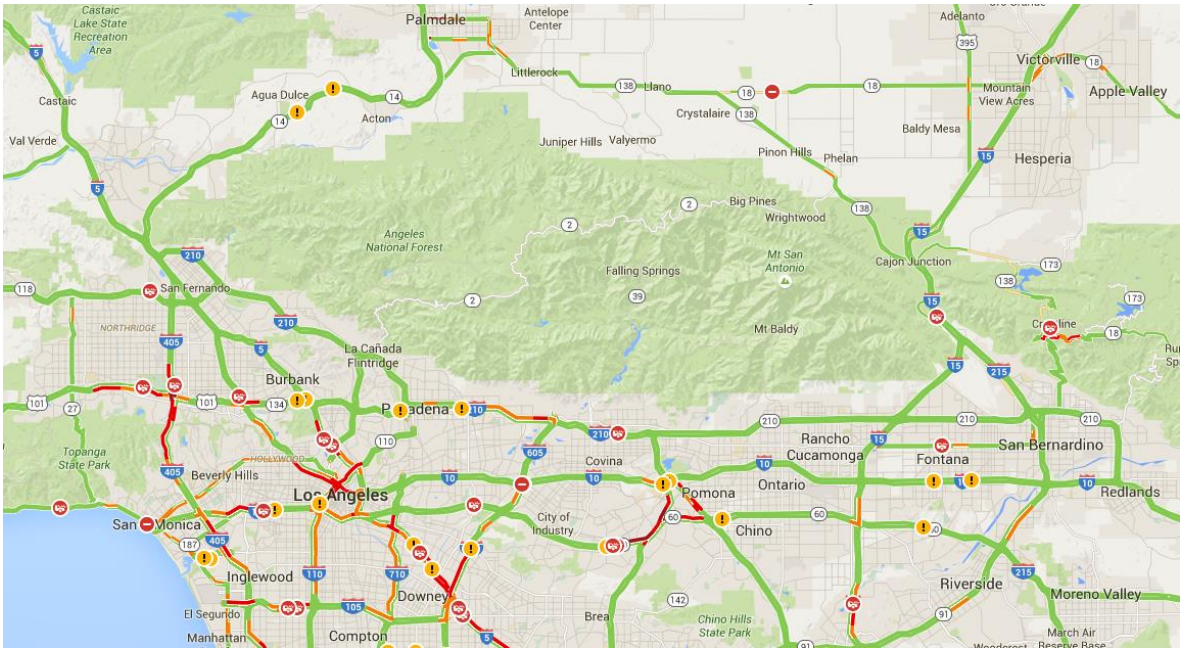
Given the nature of the potential user base, the on-board experience will also be a critical factor influencing mode choice: the vacation starts on the train, not just when they reach their destination.

Data to be used as part of defining the service is outlined below:

Steer Davies Gleave to obtain

- California/Nevada fuel prices and fuel efficiency values as published by the U.S. Energy Information Administration (EIA);
- Forecast changes in oil prices and fuel efficiency values as published by the EIA, both short and long term;
- Other driving costs from consumer websites – AAA, Kelly Blue Book;
- Las Vegas Convention and Visitor Authority (LVCVA) Statistics and Visitor Surveys –visitors profiles by origin;
- Bureau of Transportation Statistics Airline Origin and Destination Survey (DB1B) and Air Carrier Statistics database (T-100) including offered seats, service levels and fares; and
- Highway journey times from Google, validated against drive times calculated in ArcGIS Online and potentially data from INRIX.

The highway journey times, and in particular the variation in journey times given traffic congestion, is a particularly key input. Data from Google Google's trip planning tool provides average vehicles speeds on road sections in real time, and we have software which allows this data to be captured. We would therefore intend to obtain data on journey times over a period of at least one month through our automated data extraction process. Data is available for all major roads in the study area:



Source: Google Maps

Within the period of the study we will not be able to sample the full range of seasonal variations, although we have access to relevant data from our previous study for XW. We will also investigate the potential of SANBAG's new monitoring tool for the regional transportation system to provide additional journey time information to inform the assessment.

In order to ensure the robustness of the data, and in particular to mitigate against the risk of short-term highway works impacting results, we intend to validate the data against drive times within ArcGIS Online. We would also investigate the possibility of using INRIX data for specific counties around Los Angeles in order to provide historic data over an entire year.

Alongside this, data will be collected on actual delays, and perception of delays, as part of our primary research activities.

Input required

- Service assumptions for the HDC/WX high-speed rail service (split as necessary by time of day and day of week), including:
  - Journey times (including intermediate station stops);
  - Frequency of service by station;
  - Fares;
  - Parking costs (if appropriate);

  - Train capacities; and
  - On-board services/experience (key features).
- Service assumptions (both current and future scenario years) for key connecting transportation modes, including:
  - Metrolink;
  - Amtrak;
  - Bus/coach feeder services; and
  - Proposed HSR services (CaHSR).
- Future competition assumptions, including:
  - Highway improvements;
  - Road congestion (on the Interstates and in the Metro areas);
  - Airport expansions; and
  - Airline frequency/fare changes.

We note that for some elements (such as fare levels) definitive base case assumptions may not exist and the work we undertake will be used to help define these. Further in many cases Steer Davies Gleave can propose assumptions to be agreed by HDC JPA. This will be confirmed for each element with HDC JPA at project inception.

All costs will be estimated both given conditions prevalent today, and given how it is anticipated costs might change in future years.

Deliverable(s): The modeling methodology document (described earlier) will include sources and descriptions for the service characteristics of all the relevant modes. The document will be updated as the study progresses, as new data become available for any particular mode.

3.4.6 Future demand growth

Growth of the market needs to consider the different drivers for each of the markets, including the impacts of 'typical' demand drivers such as population, along with the success of key attractors, such as Las Vegas. We have successfully used this composite approach as part of our XpressWest forecasting study.

Data to be used as part of forecasting future demand growth is outlined below:

Steer Davies Gleave to obtain

- Population forecasts as county level, split by age and ethnicity, as produced by California Department of Finance;
- GDP forecasts as produced by forecasting houses (e.g. Woods &Poole);
- Air traffic forecasts from FAA's Terminal Area Forecast;
- Las Vegas market reports by Applied Analysis and/or Union Gaming;
- Wider market reports produced by gaming companies such as MGM Resorts and Caesars Entertainment, and by other analysts and rating agencies as appropriate;
- Data from the Nevada State Gaming Commission, State Gaming Control Board and UNLV Center for Gaming Research; and
- Current list of Las Vegas Strip capital improvement and development projects.

Input required

- Population and GDP forecasts as produced by COG's such as SCAG, SANDAG and SANBAG; and

- Growth forecasts, and underlying basis for these, from the SCAG model;
- Growth forecasts, and underlying basis for these, from CALTRAN's CASTDM;
- Growth forecasts, and underlying basis for these, from the California High Speed Rail model; and
- Growth forecasts, and underlying basis for these, from the XpressWest model (Steer Davies Gleave has these matrices, however permission to use these needs to be confirmed by DesertXpress Enterprises LLC).

Based on our previous experience, forecasts underlying each of the individual models outlined above will provide a potentially wide range of growth expectations. This range of potential forecasts will provide a basis for sensitivity testing around the central case forecasts we develop.

Deliverable(s): For this task, we will prepare a technical memorandum describing the future travel demand for the various modes under consideration. This will also include descriptions of the growth assumptions used to calculate the future year demand levels.

3.4.7 Forecasting ridership & revenue

Our proposed approach utilizes a spreadsheet-based model of travel and revenue, which will be able to forecast patronage levels under a range of scenarios and for different market segments, which are likely to respond differently to the service offer.

In doing so the forecasts will be able to distinguish how the demand on HSR is estimated to be composed. In particular this will provide estimates of the volumes of passengers using HSR who are currently traveling to Las Vegas via auto or air. This will enable for example estimates of the volume of car trips diverted from roads across Southern California onto HSR to be produced. From the demand forecasting exercise it will be possible to quantify reductions in Vehicle Miles Traveled (VMT) by auto as a result of the diversion to the proposed HSR service. Air quality (emissions) impacts from the proposed HSR service will also be calculated by applying established unit factors used for this purpose to the VMT savings.

It will also include a number of other elements, such as the impacts of fare sensitivity, growth, wider policy interventions, alternative fare tariffs and the effects of competition to properly take into account the impacts of a HSR service.

We have used a similar approach elsewhere, in particular to develop ridership and revenue forecasts for XpressWest. A spreadsheet based approach provides flexibility and the ability to review alternatives and options, and enables the results to be presented transparently.

The model will provide underlying detail behind the forecasts such as boarding/alighting by stop, temporal profiles, line loadings, levels of crowding and revenue by market segment. We will ensure that the model outputs will be consistent with any Financial Model input templates developed.

3.4.8 Review of forecasts

All outputs will be thoroughly interrogated and critiqued for internal consistency and their practical implications both internally and externally to the core team. There will be three levels of review employed throughout the project:

- **Ongoing review within the core team**: Each of the Project Director and Project Manager shall undertake reviews of all analysis and outputs produced;
- **Regular review by Technical Director**: Prior to completion of each core task, Charles Russell shall review the work undertaken. This will include a review of all deliverables prior to any outputs being provided to HDC JPA; and
- **Peer review**: At key project stages, including in particular development of draft and final forecasts, the work will be subject to an arms-length review undertaken by Masroor Hasan. He will critique all assumptions and outputs to ensure the robustness of the work.

Our proposed scope and budget include a peer review conducted by Masroor Hasan, Head of passenger rail consulting for SDG's US operation. In many of our "Investment Grade" demand forecasting studies, an internal peer review such as proposed here was considered sufficient by the project proponents and the investment community. Equally, we have been involved in other "Investment Grade" studies where an external peer review was sought by certain investors. We are completely open to the option of having external peer review performed by any suitably qualified outside agency, but provision for such review and necessary interaction with such third parties is not currently included within our scope, timeline and budget. Providing the extensive back and forth communication that may be required between the consultant and an external peer reviewer could extend the proposed timeline in the event the HDC JPA team decides to take this course.

3.4.9 Reporting and deliverables

Our workplan has been developed to allow for provision of both a draft and a final report. Formal intermediate deliverables in the form of modeling methodology document, technical memorandums and progress updates will also be provided at the completion of individual sub-tasks (as described before). The workplan shows these deliverables as a series of progress notes to be delivered on an approximately monthly basis, to be shared both with HDC JPA and other funding partners (Metro/SANBAG/CHSRA/XpressWest). However, dependent on the completion dates of individual tasks, the precise delivery dates for these deliverables may be shifted backward or forward within the overall timeline.

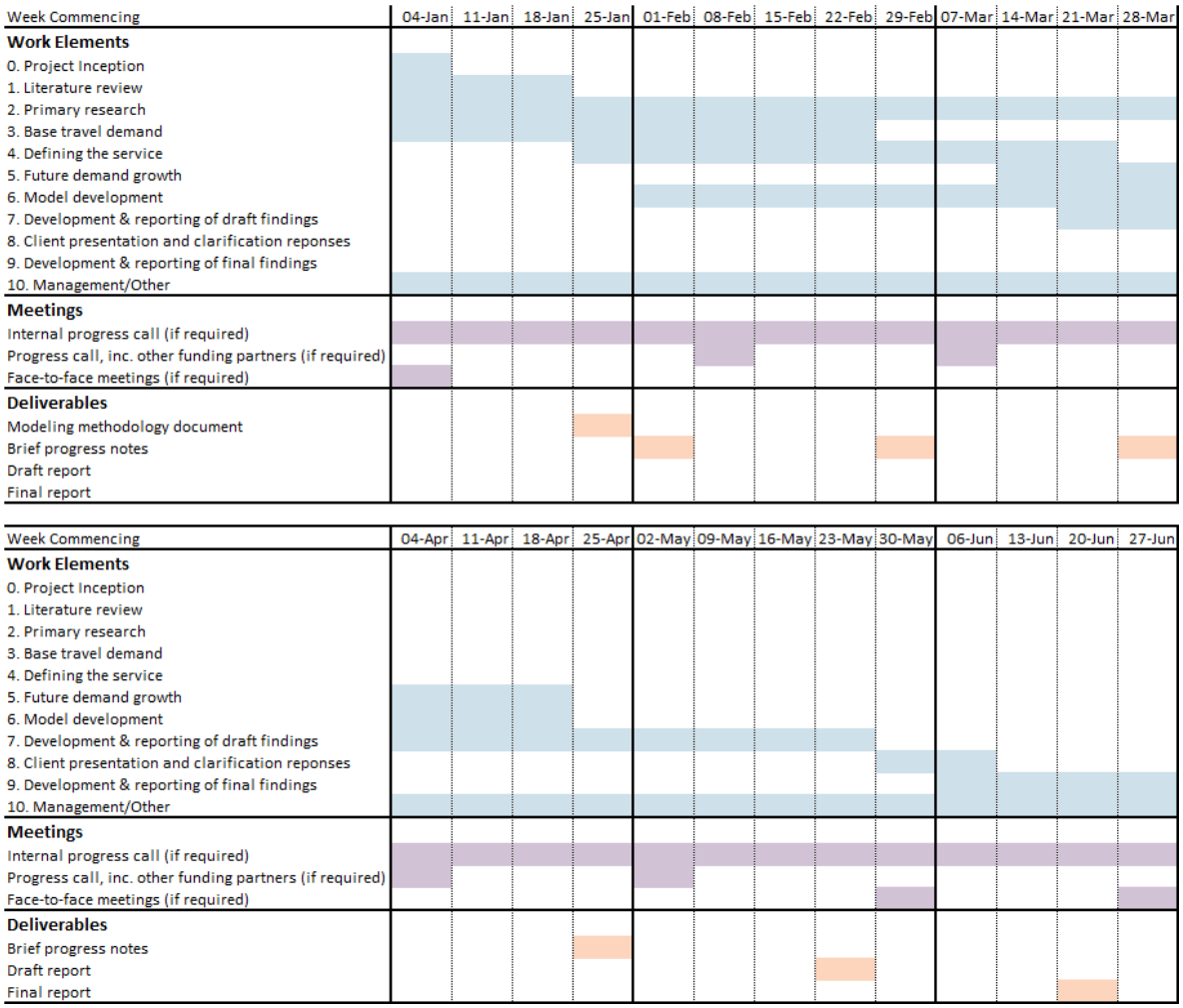
The draft report would be provided 5 months after project commencement. We intend that the draft report will provide HDC JPA with as complete a picture as possible of how the final report would look. While we would seek to provide as much detail as possible at this stage to HDC JPA, priority will be given to the delivery of draft forecasts. Accordingly it may be necessary to include placeholders for certain sections to ensure delivery of the draft forecasts (as the primary area of interest) is not delayed.

The final report would be provided 6 months after project commencement. The final report will incorporate comments from the draft report and provide more extensive sensitivity analysis. We will ensure the robustness of our forecasts by exploring the impact on ridership and revenue from changes in the underlying assumptions. All key assumptions will be subject to scrutiny, including exogenous factors, market growth, fares and other operational parameters.

3.6 Draft workplan

The following figure outlines the draft workplan for this study. In accordance with guidance provided by HDC JPA, the draft workplan envisages delivery of the final forecasts and report within 6 months of project commencement.

Figure 3.2: Draft workplan



Within this draft workplan we have assumed that work would commence the first week of January. Depending on the time required to obtain funding and notice to proceed, this may require amendment.

To ensure there is no potential delay to the workplan, we would seek to receive all requested data from HDC JPA/third parties within 10 working days of the request being made.

4 Fee proposal

In this section we set out our fee proposal for undertaking this work.

4.1.1 Total fees budget

We propose to complete the scope of work set out within Section 3 of this proposal within a capped fee of **$800,000**.

This would cover all costs associated with completing the study, including professional fees of Steer Davies Gleave staff, third party costs associated with data collection activities, and any direct costs incurred including travel and accommodation expenses.

We propose to invoice costs incurred monthly in arrears up to this cap.

Professional fees

We propose to invoice for professional fees in accordance with the rates below (and within the total capped fee outlined above):

Steer Davies Gleave Staff Grade	Daily Rate ($/day)
Director (including Charles Russell)	$2,550
Associate Director (including Andrew Mellor, Masroor Hasan)	$2,500
Associate (including Danielle Czauderna)	$2,000
Principal Consultant (including Mark Buckmaster, Lucile Kellis)	$1,600
Senior Consultant	$1,225
Consultant	$1,075
Assistant Consultant	$950

Third party costs

All costs associated with third party data collection activities would be passed on to HDC JPA with no mark-up (and within the total capped fee outlined).

Travel related direct costs

Any direct costs, such as travel or accommodation, will be charged as incurred. These costs will be included within the total capped fee outlined above subject to the following limits:

- Up to 10 return flights from Boston;

- Up to 6 return flights from London; and
- Up to 48 nights' accommodation.

The number of flights and overnight stays are for indicative purposes only. We aim to schedule any required trips well in advance based on discussion with the HDC JPA team in order to minimize the travel costs and remain within the proposed $25,000.00 direct cost budget. Should additional visits be required we would be happy to agree fee arrangements with HDC JPA as required.

Ongoing support

HDC JPA may require additional support beyond delivery of the final report. Given the uncertainty surrounding the scope of any such additional work, we would propose to contract this work on a task order basis. As each element is identified, we will agree with HDC JPA the deliverables, timescales and resources; and using an agreed table of fee rates, we will provide our estimate of the fees and costs to be expensed. For the avoidance of doubt, the fee rates set out in the professional fees table are applicable for the scope of work outlined within Section 3 of this proposal, and remain valid for a period of one-year from the date of this proposal. We reserve the right to amend these rates for any work undertaken beyond this period.

4.1.2 Optional: Future connection with CaHSR to Central Valley, San Jose and San Francisco

We have not included consideration of a future connection in Palmdale with the California High Speed Rail service to the Central Valley, San Jose and San Francisco within our core proposal.

Should HDC JPA wish to include this as part of this work, we would include analysis of these future connections for an addition to the capped fee, not exceeding **$100,000**.

This price is explicitly on the assumption that this is commissioned alongside the core study. Should this work be commissioned separately (in particular meaning that primary research for these future connections cannot be undertaken in parallel with the core research) this fee would be subject to revision.

4.1.3 Limited Notice to Proceed

It is our understanding that it is likely that a Limited Notice to Proceed will be issued for the amount of $450,000, with Full Notice to Proceed anticipated to follow in January/February 2016.

In the event that a Limited Notice to Proceed is issued for the amount of $450,000, we propose to progress the scope of work set out within Section 3 of this proposal up until this capped fee of $450,000 (including all professional fees of Steer Davies Gleave staff, third party costs associated with data collection activities, and any direct costs incurred including travel and accommodation expenses).

Within this we propose to provide the following deliverables:

- Modeling methodology document;
- Technical memorandum/working paper describing the Airsage/Bluetooth data; and
- Technical memorandum/working paper describing the base travel demand.

Any additional data items collected or deliverables which have been completed shall also be provided to HDC JPA.

For the avoidance of doubt, once the cap of $450,000 has been reached, we shall cease all activities related to the scope of work until such time as a Full Notice to Proceed is issued, except where additional work is required to complete the three deliverables outlined above.

4.1.4 Indicative Fees Breakdown

For guidance only, we provide below an estimated breakdown of how we anticipate the costs outlined above being incurred. For the avoidance of doubt, this does not constitute a cap for each individual cost area, and this estimated breakdown may change as the work progresses:

	Indicative Fee	Indicative SDG Staff Hours
1. Literature review	$20,000	100
2. Primary research	$110,000	525
3. Base travel demand	$60,000	300
4. Defining the service	$70,000	325
5. Future demand growth	$40,000	200
6. Model development	$50,000	250
7. Development & reporting of draft findings	$95,000	450
8. Client presentation and clarification responses	$20,000	100
9. Development & reporting of final findings	$50,000	250
10. Management/Other	$35,000	175
Total Professional Fees	**$550,000**	**2,675**
Travel demand data (Airsage, Bluetooth, INRIX)	$115,000	-
Behavioral data (Focus groups, SP surveys)	$85,000	-
Market report(s)	$25,000	-
Total Third Party Costs	**$225,000**	**-**
Total Direct Costs	**$25,000**	**-**
Optional Connections with CaHSR	**$100,000**	**475**

4.1.5 Terms & Conditions

We propose to undertake this commission in accordance with Steer Davies Gleave's standard terms & conditions and the terms of the professional services contract, as discussed with HDC JPA. Should HDC JPA wish to contract on a different basis, we would be willing to discuss alternative arrangements.

CONTROL INFORMATION

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1. Initial proposal	10/02/15
2. Updated proposal	10/09/15
3. Updated proposal v2	10/19/15
4. Updated proposal responding to Metro/SANBAG comments	10/28/15
5. Updated proposal following 120915 meeting	12/11/15
6. Updated proposal including expanded budget estimate	12/16/15

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