As one of the most popular states for tourism in the United States, California is overdue for upgrades in transportation. The third largest state by area and the largest by population, California, has an overwhelming need to address future transportation needs today. Emily Alpert Reyes of the LA Times reported, “California’s population grew by roughly 332,000 people in the last fiscal year — its biggest increase in nearly a decade, according to new California Department of Finance estimates.” (Reyes, 2013).

California recognized the need for alternative transportation solutions as early as 1981. In 1981, the California legislature began discussing the feasibility of building a high speed train in the state with Japanese representatives. At that time, Japan had the world’s fastest high speed train, the “Shinkansen,” or “bullet train.” California continued to develop plans to bring a high speed train to their state, and in 1996, the California High Speed Rail Authority (CHSRA) was created to assess the feasibility of a high-speed rail system. Within a year, the CHSRA delivered a report of their findings to then California Governor, Pete Wilson, stating that a high speed rail system was indeed feasible. The Governor gave the CHSRA their next mission which was to develop an execution and cost plan that could then be introduced to the citizens of the state.

I. Background

California Infrastructure Financing

The Governor of California submitted a five-year infrastructure plan along with the annual budget bill to the California Legislature in 1999, as a requirement of the California Infrastructure Planning Act. Construction and maintenance of infrastructure is a main concern for the state because infrastructure and capital assets uphold the state’s plans for long-term economic growth. The fiscal challenges since the Great Recession, however, hamper the state’s need to invest in new and existing infrastructure.1

The state of California currently relies largely on debt financing rather than “pay-as-you-go” spending. The state has used debt financing as a large part of their infrastructure investing. In 1974 California voters authorized $38.4 billion in General Obligation (GO) bonds to support infrastructure projects.2 In 2000, voters enhanced bond-funded programs and approved an additional $95.5 billion of GO bonds.2 $83.6 billion in bonds that consist of $73.9 billion of GO bonds and $9.7 billion of lease revenue bonds are still outstanding today.3 There are also an additional $33.9 billion of GO Bonds and lease revenue bonds that will be issued when pending, future projects are approved.4

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4 ibid
The 145% increase in annual expenditure shows that payment for debt financed projects rose from $2.9 billion to $7.1 billion from 2000-2001 to 2013-2014, respectively. Moreover, there are authorized but unissued bonds totaling $33.9 billion and this will raise the payments even higher. Figure 1 shows the projected debt servicing cost to be nearly $8.6 billion (the state’s debt service ratio is a tool to measure relative borrowing capacity).

**California High-Speed Rail Capital Cost**

The California High Speed Rail Authority (CHSRA) proposed to build a high speed rail line that would theoretically allow trains to reach speeds up to 220 mph. The objective of the project is to lower the number of intrastate trips within California that were previously attributed to automobile and airplane. The project also encourages Californians to reduce private vehicle transportation in favor of public rail transportation, and moreover, establishes an accessible mode of public transportation. The high-speed rail system addresses the movement to efficiently connect people, services, and goods across the state, and serves as a way to reach sustainable development goals. The high-speed rail system is expected to reduce congestion as well as meet the state’s greenhouse gas reduction goals.

The construction of the high-speed rail will initially connect Merced to the San Fernando Valley (Initial Operating Section, or “IOS”), then connect San Francisco to the San Fernando Valley via Merced (Bay to Basin), and ultimately connect San Francisco to Los Angeles/Anaheim (Phase II). The system will include 800 miles of rail line, 26 stations; 150 miles of bridges, viaducts, and elevated structures; 35 miles of tunnels; 610 grade separations; and 510,000 square yards of retaining walls.

The capital costs for the high-speed rail system are presented below:

- **Constant Dollars**
  The calculations are provided in constant 2013 dollars as a baseline for conversion to year-of-expenditure (YOE) dollars. The cost of construction in Initial Operating System (IOS) is $27,775 millions, cost to construct Bay to Basin is $42,521, and for Phase 1 is $54,894 (see Figure 2).

- **Year-of-Expenditure Dollars (YOE)**
  The YOE dollars are the result of constant dollars conversion, later, the YOE was projected using the phased implementation approach and schedule. The cost of construction in Initial Operating System (IOS) is $31.2 millions, cost to construct Bay to Basin is $50.7, and for Phase 1 is $67.6 (see Figure 2).

- **Operation and Maintenance (O&M)**
  The high speed rail is expected to begin operation in 2022 after the completion of the Initial Operating Section. Initially, fixed cost will dominate cost in order to comply with regulatory requirements for inspections and maintenance. Figure 3 highlights High, Medium, and Low forecasts in 5 year increment O&M cost scenarios using the Monte Carlo analysis from 2024 to 2060.

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5 ibid  
7 ibid  
8 ibid  
9 ibid
II. Analysis

California has multiple sources of funding available; therefore, we highlight the sources of funding that are most beneficial to fund the high speed rail project. The top funding sources are: Property Taxes, User Fees, Cap-and-Trade Revenue, Federal Funding and Private Financing.

California passed Proposition 1A, the Safe, Reliable, High-Speed Passenger Train Bond Act for the 21st Century, in November 2008, to provide the CHRSA with the rights to issue roughly $9 billion in General Obligation bonds for the development of a high-speed train system. In addition, the federal government has awarded the CHRSA $3.3 billion, targeted mostly for the development of the Central Valley section of the rail project.

A. Property Taxes

California has a long history of utilizing property taxes to pay for infrastructure projects. Prior to 1978, California municipalities frequently financed infrastructure ventures with current year’s property tax receipts. This put huge strain on communities with expensive incoming developments. California property taxes prior to 1978 averaged around three percent of the market value, amongst the highest property taxes in the nation.

On June 6, 1978 California residents voted for a tax reform called Proposition 13. The new law capped the statewide ad valorem general tax at 1%. In order to get a good baseline of home property values, the state used property assessed values from 1975. The state instituted a 2% annual limit on increases of property value from 1975.

An additional provision of Proposition 13 included a two-third voter approval for any "special" taxes raised by municipalities for designated or specific projects. This section of Proposition 13 gave voters the power to approve the government’s borrowing of funds from the General Budget to make principal and interest payments on General Obligation bonds or other forms of debt financed for projects approved by California citizens. The two-third voter approval ensured that citizens had final decision on government borrowing decisions.

General Obligation Bonds

California uses voter approved municipal (muni) securities to finance infrastructure projects across the state; however, property taxes are appropriated to pay the principal and interest on most borrowing activities. Some of the state projects have included schools, roads, housing, public facilities and parks. The California High Speed Rail System is an infrastructure development that could provide a much needed service to California’s transportation system. The purpose of this section of is to evaluate the use of General Obligation bonds as a feasible solution to finance the High Speed Rail.

Why use GO Bonds

The management of all state bond sales falls on the California State Treasurer. According to the current State Treasurer, Bill Lockyer, “The bulk of these bonds will help finance infrastructure projects. California voters have approved the issuance of more than $65 billion of bonds to improve and build new schools, roads, housing, parks and levees. Over the next few years, the State will be selling these bonds to raise the money to build these projects. By investing in these bonds, you will help turn the projects you approved at the polls into reality – adding to our quality of life and the vibrancy of our economy.”

http://www.buycaliforniabonds.com
The most popular security used to finance infrastructure projects in California are General Obligation (GO) bonds. GO bonds are loans provided by investors to the State in order to accomplish a specified goal or project. In return for the loan, the State provides each investor a bond as proof of their commitment. Bonds are official State documents that show the details of each loan. When an investor buys a California State GO bond, California provides a promise that the state will pay the investor the principal amount of the bond plus a set amount of interest.

**Investor Benefits**

GO bonds are not the only type of investments that are available to individuals or groups who would like to lend to California, however, this particular bond has benefits that attract certain investors. One benefit is that GO bonds are secured bonds. California State and Local GO Bonds are required to be “secured by either the full faith and credit of the issuer or by a promise to levy property taxes in an unlimited amount as necessary to pay debt service, or both”. Because this is a State project, State bonds are required to be secured by full faith and credit, which means that the State pledges to use their general funds to pay the monthly payments (principal and interest) on those bonds instead of using property taxes which are available at the local level.

Another feature associated with GO bonds is that they require public approval. California requires a majority vote from their citizens to approve a GO bond. This ensures that citizens are aware of the projects that the State is conducting and have a say in the way state funds are spent. This requirement provides another layer of security for the GO bonds that makes this a more attractive funding option. Another investor benefit is the fact that interest earned on GO and other muni bonds are free from Federal Taxes. This option allows GO bonds to compete with alternative means of investments (Corporate bonds, stocks, etc.) that provide a higher rate of return but are subject to Federal taxes.

A final subject that surrounds muni bonds that benefits California’s GO bonds are the history of muni bond defaults. According to Iris J. Lav, “Municipal bond default is actually quite rare: no state has defaulted on a bond since the Depression.” Investors that may be weary of providing a government entity with funds may find comfort in knowing that municipal bonds have a low default rate which ultimately means that they will get their money back and more.

**Benefits to the State of California**

As an issuer of municipal Bonds, California spreads the true cost of the debt financed by the from a relatively short upfront period to an average of 30 years. The Public Policy Institute of California reports that over the past four decades, 86% of California’s general obligation (GO) bond authorizations have supported public transportation projects (rail, port, and highway systems) and the construction and repair of education facilities and natural resource projects.

On November 4, 2008, California voters approved the Safe, Reliable High-Speed Passenger Train Bond Act for the 21st Century. This act was also known as ballot Proposition 1A. This law gave state administrators the right to sell $9.9 billion in GO bonds to raise funds necessary for construction of a high speed rail system and any capital improvements that would improve rail travel for future passengers.

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Potential Pitfalls
On November 25, 2013, Sacramento County Superior Court Judge Michael Kenny dealt a huge blow to the state’s funding plans for the rail program. He blocked the use of state bonds by denying a request by the CHSRA to issue a blanket validation for the sale of the bonds approved by Proposition 1A. The good news is that the ruling did not stop the state from starting construction of the rail system by using a mix of federal and disposable state funds.

The problem for the state began when the CHSRA submitted their funding plan which showed an estimated $25 billion shortfall needed to complete the first section of the of the project. Judge Kenny said the state’s business plan is inadequate and used that as the basis for the denial. This plan also violated the requirements highlighted in the language of Proposition 1A (such as cost/budgetary requirements of the project and train speed requirements). The state is required to have a funding plan to fully pay for a self-supporting, initial operating segment. The judge ordered the state to come up with a new plan if they want to get the courts approval to sell the bonds. This ruling has made history as the first time a judge has blocked the sale of bonds. California Treasurer Bill Lockyer responded by announcing he would not continue with the sale of the bonds without the court’s validation.

Future of Proposition 1A GO Bonds
Governor Jerry Brown, the California High Speed Rail Authority, and Treasurer Bill Lockyer submitted a petition on January 24, 2014 requesting the California Supreme Court expedite their request to overturn the decisions that prevented the state from selling the Proposition 1A voter-approved bonds. On February 15, the request was answered by receiving a stay from the Third District Court of Appeals on Judge Kenny’s ruling. This stay ensures that the governor will get a quick ruling on his request.

On March 4, 2014, Sacramento County Superior Court Judge Michael Kenny agreed to “hear arguments from attorneys representing a group of Central Valley farmers and landowners who argue that the state's $68 billion high-speed rail plan no longer complies with promises made to voters.” If the ruling is overturned, the sale of the $9.9 billion in GO bonds would be approved. This would give the state the option to sell the bonds as part of the state’s rail system funding plan. At this time, a date has not been set for the new trial which puts a major source of financing on hold.

As a result of the ruling, CHSRA is retooling their funding plan to address the increases in cost that caused the judge to rule against the sale of the state’s bonds. The draft has been provided to the public on the CHRSA website giving them up to five different methods to provide comments to the plan. No date has been provided for a finalized plan.

B. User Fees

The CHSRA provided the Travel-Demand-Modelling practices in order to produce the ridership and revenue forecasts. The Authority developed six components which include: Service Characteristics, Mode Choice Models, Induced Travel, Ridership Forecasts, Farebox Revenue Forecasts, and Sensitivity Analysis. The reliable ridership and revenue forecasts are important to estimate the California High Speed Rail financial viability and construction improvement.

http://article.wn.com/view/2013/10/25/Kings_Country_highspeed_rail_opponents_ask_judge_to_halt_fund/
(1) Determining and Applying Service Characteristics

The data on service characteristic (such as travel time and fares) is valuable to forecasting the ridership along the High-Speed Rail trace.\textsuperscript{13} “High-speed rail service characteristics were defined based on the initial service plans and fare structure.”\textsuperscript{14} The characteristic will sometimes experience changes that can affect ridership and revenue forecasts. Figure 4 shows the modes transportation type for long trips: Los Angeles-San Francisco, Sacramento-San Diego and Los Angeles-Sacramento with three modes of transport in the form of High-Speed Rail, Airplane and Private Vehicle. It is nearly 50\% of most of the trip from Los Angeles-San Francisco and Los Angeles - Sacramento will be provided by High-Speed Rail. Since Sacramento-San Diego cover the long trips, it will be served mostly by airplane, however, the High-Speed Rail covers over 30\% of the trip.

(2) Developing Mode Choice Models

In order to develop the mode of choice models, the Authority used advanced techniques. This model illustrates how different variables such as income, travel time, and travel costs affect travel choices, including decisions about selected mode of transportation.\textsuperscript{15} The result is shown in Figure 5, representing the mode choice before and after the implementation of High-Speed Rail where 15\% of trips will be transferred from other modes to the High-Speed Rail.

(3) Estimating Induced Travel

The induced travel refers to trips after the implementation of the high-speed rail project.\textsuperscript{16} The CHSRA forecasted induced travel after the implementation of the High-Speed Rail to be at 2\% of total high-speed rail trips. This number is still acceptable according to United States High-Speed Rail 2010 which states that 10\% of of total high-speed rail trips is the maximum number.

(4) Developing Trip Tables: Ridership Forecasts

After the CHSRA determined the three factors above, they process the ridership forecasts by compiling data on current travel patterns along the proposed high-speed rail route into trip tables. Figure 6 shows the ridership forecast from 2025 to 2060, and we used the year 2025 as our baseline. The CHSRA developed three scenario forecasts: High, Medium, and Low ridership scenarios.\textsuperscript{17} Based on the results of the analysis, the Medium scenario is the expected ridership while the High and the Low scenario represent variations in more or less risk. “The Medium scenario shows an overall ridership greater than 10 million trips in 2025, rising to 35 million trips in 2040 once the market has reached maturity and is fully ramped-up, 11 years after the completion of Phase 1.”\textsuperscript{18}

\textsuperscript{13} GAO Report : California High Speed Passenger Rail, 2013. \url{http://www.gao.gov/assets/660/653401.pdf}
\textsuperscript{14} Ibid
\textsuperscript{15} Ibid
\textsuperscript{16} Ibid
\textsuperscript{18} Ibid
Estimating Expected Fare Revenue: Farebox Revenue Forecasts

The revenue forecasts shown in Figure 7 and Figure 8 are direct, farebox revenues, presented in 2013 dollars and YOE dollars. The direct farebox does not include ancillary income from stations or other commercial activities. All farebox revenues in Figure 7 were provided in 2013 dollars while the revenue projections in YOE were calculated by including the inflation for 2014 through 2060. The example of the projected revenues in 2015 is $801 million, representing the fourth year after completion of the IOS. This farebox revenue increases under $3 billion in 2035, six years after the completion of Phase 1.

Conducting Sensitivity Analysis

The CHSRA estimated sensitivity analyses on the ridership and revenue on the first 30 miles of construction. The results of the various sensitivity show that the model is appropriately sensitive, representing 3 components of sensitivity:

a. Sensitivity to mode-shift
   There is 17.17% of passengers would come from air, 80.73% would come from automobiles, and 2.1% of trips would be induced because of the existence of California High-Speed Rail.

b. Sensitivity to Avoided Automobile Trip for High-Speed Rail
   The average trip distance of 30 miles for the 80.67% of high-speed rail users shifting from automobiles drives the economic savings of avoided automobile travel.

c. Sensitivity to Average High-Speed Rail Ticket Price
   The average trip fare is at $52.75 in 2012 dollars.

Revenue Bonds

Generally, the revenue bond mechanism is most suitable to projects that: (1) are able to be operated on a user-fee basis; (2) have the ability to be self-supporting under public or private operation; and (3) can produce sufficient revenue without negatively affecting the community.

The source of revenue in support of revenue bond sales for the California High-Speed Rail Authority (CHSRA) project is generated from user fees. User fees are a suitable source to fully or partially fund revenue bonds where there is clearly an identified group of parties that benefit directly from the bond sales and expenditures.

We present two main reasons for using revenue bonds based on our literature review, they are:

1. “Revenue bonds are based on the concept that only the users of a facility financed by the sale of bonds should pay for that facility.”
2. “Revenue bonds are not ordinarily subject to statutory or constitutional debt limitations. Revenue bonds do constitute an obligation of the issuing jurisdiction. However, the obligations extend only to the payment of the bonds from a special source of revenue.”

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19 Ibid
21 http://www-personal.umich.edu/~steiss/page63.html
23 Ibid
The benefit of revenue bond includes:  

- The revenue bonds share Low Interest Rates compared to other bonds such as private equity bonds and other conventional taxable alternatives, since revenue bonds financing typically offers interest rates that are up to 35% less than conventional taxable alternatives.  
- The revenue bonds offer better terms since they are issued on a long-term basis (e.g. 20-30 year) with a fixed interest rate, compared with conventional taxable debt which is usually issued on a shorter term with a variable interest rate.  
- The revenue bonds provide a comprehensive financing option where the amount financed can be utilized for construction.  
- The revenue bonds allow borrowers to retain accumulated funds.  
- The revenue bonds are not subject to the limitations of California’s private activity bond volume cap.

We provided the forecasts on ridership scenarios and farebox scenarios as mentioned in the User Fees section. The financing for the project comes from the fare-backed revenue bonds projections which will be based on the Medium farebox scenario that is estimated at \$12.471 billion in present value (2013 dollars).

In California, revenue bonds do not require voter approval. However, since the state of California has not utilized revenue bonds for any past projects, we examine the revenue bond issuance with respect to the Ohio Turnpike, Chicago Water project, and Washington Dulles Toll Road projects. The state of Ohio issued $500 million in revenue bonds as of March, 2013 and all bonds are secured by net toll revenues of the Ohio Turnpike. By April 2014, the City of Chicago recently authorized $1 billion of water and sewer revenue bonds to finance work on the aging water and sewer infrastructure; the city also intends to sell $475 million in new money water revenue bonds. In 2009, the Washington Airports Authority issued the Dulles Toll Road Revenue Bonds totaling $963.3 million, and currently the Authority also authorized the issuance of $450 million Dulles Toll Road Revenue Refunding Bonds. Revenue bonds have been successful in financing infrastructure projects in other states. There is no reason California cannot enjoy similar success with revenue bonds.

C. Cap-and-Trade Revenue

In 2006, California launched its cap-and-trade program, which uses a market-based approach to reduce greenhouse gas emissions. In addition to driving emissions, California’s program will provide a model on how an economy-wide cap-and-trade system can function in the United States. The California Air Resources Board conducts quarterly auctions where it sells
emission allowances, as part of the cap-and-trade program.\textsuperscript{31} The Governor requested to appropriate an estimated $850 million in auction revenue to go toward numerous state projects in the 2014-2015 budget proposals. These programs are supposedly directly related to sustainable communities, clean transportation, energy efficiency, natural resources, and waste diversion. Furthermore, the Governor stated that it is essential that auction revenues be reinvested in projects that promote GHG emission reductions for a given level of spending to minimize the negative environmental impact of economic activities.\textsuperscript{32} After 6 (six) auctions, California cap-and-trade program generated $810 million for the state.

The life-cycle of inventory for High-Speed Rail shows the electricity production because of the High-Speed Rail adds to 40% to the energy, the High-Speed Rail emit roughly 490 million metric tons of greenhouse gases which is equal to 2% of California’s current annual emissions, and the High Ridership scenario are necessary to improve the environment and human health condition.

\textit{Current Policy}

In April 2014, California Senate Leader Darrell Steinberg presented a Long-term Investment Strategy for Projected Cap-and-Trade Revenues.\textsuperscript{33} It is a commitment to provide a permanent source of funding for mass transit and develop 21st Century infrastructure for California to reduce traffic and polluting emissions. This long-term investment strategy shows that the construction of the High-Speed Rail will be accounted for 20% of the total cap-and-trade amount (see Figure 9).\textsuperscript{34}

However, the implementation of cap-and-trade-revenue for High-Speed Rail has raised questions, given that during construction, the project would generate emissions rather than reduce them.\textsuperscript{35} Therefore it has not yet been approved by the State Legislature.

\section*{D. Federal Funding}

In addition to the funding sources delineated above, California can also take advantage of federal government funding available for financing long term capital projects such as the California High Speed Rail (CHSR). The federal funding sources that will be discussed in this section will be the American Recovery Reinvestment Act (ARRA), the Transportation, Housing, and Urban Development, and Related Agencies (THUD), and federally subsidized bond programs (such as the Build America Bond program and the America Fast Forward Bond program).

The California High Speed Rail Authority (CHSRA) is the state agency tasked with planning, designing, building and operating the proposed high speed rail system that will eventually connect San Francisco to Los Angeles.\textsuperscript{36} The estimated cost of undertaking such a capital

\begin{itemize}
\item \textsuperscript{32} Ibid
\item \textsuperscript{33} http://sd06.senate.ca.gov/news/2014-04-14-senate-leader-proposes-permanent-funding-sustainable-affordable-housing-mass-transit
\item \textsuperscript{34} “A Long-Term Investment Strategy for Cap-and-Trade Revenue,” April 11, 2014 http://sd06.senate.ca.gov/sites/sd06.senate.ca.gov/files/MASTER%20COPY%20Long%20Term%20Cap-and-Trade%20Investment%20Strategy.pdf
\item \textsuperscript{35} http://www.foxnews.com/politics/2014/04/27/california-eyes-plan-to-speed-bullet-train-using-cap-and-trade-program-proceeds/
\item \textsuperscript{36} Peterman, D.R., Frittelli, J., Mallett, W.J. “The Development of High Speed Rail in the United States: Issues and Recent Events.”
\end{itemize}
The CHSRA, in 2010, estimated that the costs of constructing the first phase of the high speed rail system would be roughly $36.4 billion (in 2010 dollars). In 2012, the CHSRA’s revised estimates suggested that a “full” high speed rail system would cost between $65.4 billion to $74.5 billion and a “blended” system would cost between $53.4 billion to $62.3 billion. The “full” high speed rail system would take advantage of the latest rail technologies, laying new, separate tracks that could accommodate the higher speeds of 200 mph and above, and the “blended” system would consist of laying some new track and updating current rail infrastructure to safely accommodate for higher rail speeds (however, even after updating the older rail infrastructure, top speeds of 200 mph and above may not be reached).

American Recovery Reinvestment Act and THUD
To fund highly expensive capital projects, such as the CHSRA, the federal government enacted the American Recovery Reinvestment Act (ARRA) in 2009 (an economic stimulus package to “save and create jobs,” and invest in infrastructure, education, healthcare, and renewable energy sources). Specific provisions and funding under this economic stimulus package was set aside to aid state and local governments with intercity passenger rail projects.

The ARRA, in conjunction with the Passenger Rail Investment and Improvement Act of 2008 (PRIIA), appropriated $8 billion in federal funding for high speed rail projects all over the United States. The Federal Railroad Administration (FRA) established the High Speed Intercity Passenger Rail (HSIPR) program to provide discretionary grants for high speed rail projects with the $8 billion in federal funding appropriated by the ARRA and PRIIA. The HSIPR approves and disburses grant money, and the FRA provides oversight and establishes guidelines to HSIPR recipients to ensure the proper and efficient use of federal dollars. Additionally, the Transportation, Housing, and Urban Development, and Related Agencies (THUD) appropriated an additional $2.5 billion in federal funding for high speed rail projects in an appropriations act during 2010.

As of 2010, California has been awarded the largest grant by the HSIPR, amounting to $2.25 billion to go toward construction of the CHSR. Subsequently, in a second round of funding, California received an additional $901 million. As of December 2013, California has received an estimated $3.3 billion in total federal funding toward constructing the CHSR. Federal funding has been absolutely vital to the construction efforts of the CHSR.

Build America Bonds Program
In addition to the direct federal funding programs aimed at supporting high speed rail projects, the Build America Bonds program (BAB) provided state and local governments the ability to access capital markets to finance long term projects after the financial crisis of 2007-2008. The BAB was a popular bond program in 2009 and 2010, but has since expired.

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37 Ibid.  
38 Ibid.  
39 Ibid.  
40 Ibid.  
41 Ibid.  
43 Ibid.  
Traditional municipal bonds are attractive investment vehicles to domestic investors because of their tax exempt status. The interest payments from the municipal bonds are not characterized as taxable income to the buyers of the bonds for federal tax purposes. State and local governments benefit from this tax exempt status of municipal bonds because investors will accept lower yields generated by municipal bonds versus comparable taxable securities with similar risk and maturity. In essence, the municipal bond is only an attractive investment because of the tax exempt status of the debt instrument. In the wake of the 2007-2008 financial crisis, new investors, previously untapped, were needed to bolster the capital markets to provide low cost borrowing to state and local governments undertaking long term capital projects. Previously, investors, such as pension funds and foreign investors, who were not subject to federal income tax did not invest in municipal bonds because there would be no comparable advantage in investing in a tax exempt asset if you could not reap the benefits of that tax benefit. The Build America Bond program sought to change this by offering a new debt instrument that would be attractive to this subset of investors, such as pension funds and foreign investors.

The Build America Bond program directly subsidized interest payments (at the rate of 35%) of municipal bonds issued by participating state and local governments. This structure provided a blanket benefit to a broad group of investors without regard to income tax liability or status compared to the previously discussed tax exempt structure of state and local government bond issuance. Moreover, investors were attracted to BAB’s due to the guarantee of a federal subsidy at the rate of 35% on all coupon interest payments. Investors saw this feature as making the investment safer than comparable securities. Econometric models comparing the performance of BAB’s and the traditional tax exempt bonds showed significantly lower borrowing costs at every maturity level in favor of BAB’s. Build America Bonds outperformed traditional tax exempt bonds with an interest cost savings ranging from 36-90 basis points.

The Build America Bond program, as previously mentioned, expired on December 31, 2010, however, there is strong support by state and local governments and Congress for a possible, indefinite renewal of the program. If the Build America Bond program (or a substantially similar program) were renewed, this would be an attractive, alternative financing option.

**America Fast Forward Bonds**

The America Fast Forward Bond program (AFF) is highly similar to the Build America Bond program and has been proposed by the Obama administration for fiscal year 2014. The AFF is substantially similar to the BAB in that it would provide long term borrowing for capital projects at the state and local government level without regard to investor tax liability or status. The key difference between the BAB and the AFF is the rate at which the federal government will subsidize the interest payments offered by the debt instruments. BAB offered a rate of 35% and AFF would offer a rate of 28%. If the AFF program is approved,
it would be extremely attractive as an alternative financing option due to its substantial similarity to the BAB. A broader base of investors would be attracted to the AFF program, and relying on the popularity of the BAB program, the AFF should enjoy similar success.

E. Private Financing

Historically, major long term capital infrastructure projects in the United States have been funded primarily with federal funds (some projects funded by as much as 80% in federal dollars). This model was introduced in the 1950’s during the construction of the interstate highway system. Since then, however, federal funding for major infrastructure projects has fallen by approximately 30%, forcing state and local governments to pick up the slack to bridge federal funding gaps. Additionally, private funding sources have developed to aid in funding infrastructure projects. Private investors, specifically pension funds, have been attracted to long term assets with stable cash flows (infrastructure projects such as toll roads in the U.S.) and have begun investing in long term infrastructure projects.

In the 2014 California High-Speed Rail Authority’s Draft Business Plan, the CHSRA acknowledges that each phase of construction will require varying degrees of private funding (private debt financing, equity investment, etc.). To complete the track segments that connect the San Francisco Bay Area to the Los Angeles Basin, the CHSRA estimates that roughly $10.1 billion (or 19.8% of the total construction cost) will have to come from private capital (see Figure 10).

The CHSRA also estimates that with the completion of the initial operating segment (Madera to Bakersfield line which is currently underway) the passenger service, ridership data, and revenues collected from the operation of this line will usher in the opportunities for future private investment. The CHSRA projects that $4.5 to $5.5 billion in debt financing can be secured through demonstration of future revenues. The attraction of private financing through demonstration of profitability and achievable ridership targets via the initial operating segment is believed to be a viable long term financing plan by the CHSRA (see Figure 11).

As demonstrated by the CHSRA’s financing plan, public sector funds will be employed in the initial years of construction, and private financing will be employed toward the end. Additionally, there are a variety of other instruments in private finance that could be available to the CHSR project. Vendor financing is a popular option which could reduce the amount of

57 Ibid.
58 Ibid.
59 Ibid.
61 California High-Speed Rail Authority Funding & Finance – May 2013. http://www.hsr.ca.gov/docs/newsroom/fact%20sheets/High-Speed%20Rail%20Funding%20and%20Finance.pdf
upfront borrowing required for construction and reduce overall costs of financing. Vendor financing is a form of lending where a private firm lends to the borrower, so the borrower may purchase the vendor’s products or property (generally in the form of deferred loans or interest shares subscribed by the vendor). This option would allow for substantive private sector participation early on in the construction and development of the rail network. It would also allow the CHSRA to shift a substantial amount of risk onto the private firms that are willing to participate in this private financing option.

“Design-build contracting” can also be employed to allow the CHSRA to transfer significant design, construction, and technical development and operations to private sector firms. This option would not generate large sums of upfront investment, however, could reduce costs during operation and significantly reduce or eliminate risks associated with increases in costs during construction and technical development (because the risk would be shifted onto the private firms that undertake the construction and technical development via government contracts). Design-build contracting can also include operations and maintenance contracts after construction is complete. Payment of the contracts will be ultimately tied to operating revenues, so firms have an incentive to run facilities as efficiently and as profitable as possible. To structure the payments and contracts in this way, it reduces the risks of construction, operation, and maintenance on the part of the state by shifting risk to private sector firms and incentivizing firms to perform profitably and efficiently. The long term costs to the state will ultimately be reduced by these contracts.

The CHSRA draws from large amounts of federal funding and private financing to complete construction of the costly rail system in its latest Draft Business Plan for 2014. There are certain funds that have already been obtained ($3.3 billion in federal funding via HSIPR grants), and a variety of possible financing options that are available (AFF bonds if approved by Congress, private financing if revenues and ridership can be proven, vendor financing, etc.). However, it seems there is still a huge financing gap that must be fulfilled by a mixture of federal funding that may not be available, and private financing that may also be illusory.

III. Recommendation

1. The funding mix for the first recommendation includes property taxes backed by GO (General Obligation) Bonds and Federal Funding

The amount financed by the GO Bonds currently is at $9.9 billion (additional bond sales for future phases may become necessary and appropriate due to increasing costs of the project). The total cost to taxpayers is estimated at $19.4 billion over 30 years (generally GO Bonds have a term of 30 years) with an average of 5% interest paid to investors annually. The annual cost to taxpayers over the life of the bonds is $647 million. In order to meet this higher yearly expenditure, the California government would need to increase property taxes, cut spending in other areas, or raise revenues some other way to account for this added $647 million a year for interest coupon payments to investors.

Federal funding currently provides roughly $3.3 billion from ARRA Funds. If the AFF bonds program is approved by Congress, the state of California could issue these bonds that offer a lower borrowing cost because the federal government would subsidize 28% of the

64 Ibid.
65 Ibid.
interest coupon payments to investors. This would be a cheaper, federally subsidized financing option.

A **$55 billion funding gap** remains that would be needed to complete construction. Following the CHSRA’s current draft business plan, the remaining funding mix would come from additional federal grant money (although there are currently no dedicated federal dollars for the project), AFF bond sales (assuming this program is approved by Congress), and private financing options (however, this is highly contingent upon the CHSRA’s demonstration that ridership levels and revenues will hit their projections and the project will ultimately be profitable).

2. **The funding mix for the second recommendation includes property taxes backed by GO (general obligation) Bonds, Cap and Trade Revenue, User Fees backed by Revenue Bonds, and Federal Funding**

The amount financed by the GO Bonds currently is at $9.9 billion with its additional bond sales for future phases. The total cost to the taxpayers is estimated at $19.4 billion for 30 year bonds with the average of 5% interest therefore we determine the total cost to the taxpayers per year over the life of the bond is $647 million. In order to meet this higher amount of expenditure, the California government should increase the property taxes, or raise other government revenue that fund the state’s general fund.

The amount financed by the revenue bonds is at $12.471 billion in present value (2013 dollars) according to the farebox revenue Medium scenario. Moreover, we present the revenue from the cap-trade-revenue is estimated at $250 million. The Federal funding provides the $3.5 billion from ARRA Funds. If the AFF Bonds enacted by the Congress, the state of California can issue these bonds that offer a lower borrowing cost because the federal government will subsidize 28% of the interest coupon payments to investors.

There is roughly **$32.7 billion funding gap** and we consider that it could be achieved with additional federal funds, private financing, and increase in user fees/revenue.

3. **Stop the statewide high speed rail project in favor of smaller, local infrastructure projects**

The estimated cost of the construction of the CHSR is roughly $68.4 billion (this figure is among some of the most conservative estimates). Currently, the guaranteed funding available to the project includes $3.3 billion in federal funding and $9.9 billion financed through approved general obligation bond sales (cost to taxpayers will be more than double the amount financed with respect to interest coupon payments made to investors over the life of the bonds).

The estimated $250 million in cap and trade revenue has been promised by Gov. Jerry Brown, however, the usage of cap and trade revenue for the CHSR has not been approved by the state legislature (nor is it certain that the usage of cap and trade revenue for the CHSR is entirely legal due to the uncertainty of whether or not the project will significantly reduce greenhouse gas emissions). Operational revenues also remain uncertain, and projections place future revenues over a 30 year period at $15.9 billion for “high” ridership, $12.47

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billion for “medium,” and $9.39 billion for “low.” Because operational revenues are not only uncertain, but highly variable, private financing has yet to be secured for the CHSR.

Future federal funding is also highly uncertain. The HSIPR program has not been funded with a dedicated revenue stream because the original funds appropriated by the ARRA were from the federal government’s general fund. The HSIPR program must compete in the future with other discretionary programs for funding. The HSIPR has received no further funding since 2010. With an estimated $13 billion secured (via federal funding and general obligation bond sales) and a wide range of uncertain financing options, the CHSR effectively has a $55 billion financing gap to reach the conservative estimate of $68.4 billion needed to complete construction of the rail system. Due to this uncertainty in funding, the statewide high speed rail project should be scrapped in favor of smaller, local infrastructure projects.

IV. Conclusion

Based on lack of funding, uncertainty in ridership and revenues, and ambiguous environmental impact, we recommend the CHSRA stop the statewide project in favor of reserving funds for smaller, local infrastructure projects. With respect to lack of funding, the numbers are clear. The project currently has roughly $10 billion financed through general obligation bond sales (however, this amount may not even be guaranteed because of the pending court case that may disallow the sale of bonds for the project), and $3.3 billion in grant money guaranteed from the federal government. The most conservative cost estimates for construction place the final bill at an estimated $68.4 billion. This means, with the “guaranteed funds” the state currently holds, the project would require another $55 billion to complete construction.

The state plans to utilize the revenues from the initial operating segment (Madera to Bakersfield) to aid in the construction of the Bay to Basin segment as well as demonstrate to private firms the profitability of the project to draw investors in. As discussed in the revenue and ridership sections, the projections for revenue are not only highly variable, but uncertain. There is no guarantee that the project will attract riders and ultimately turn a profit. Of the dozens of high speed rail lines that run in the world there are only two that turn a profit (the TGV in France and the Shinkansen in Japan).

It is doubtful that the CHSR can demonstrate profitable at such an early stage to attract private investment on a large enough scale to cover construction costs. Furthermore, the revenues would only provide about $238 million for construction, a mere .05% of the total cost of $68.4 billion. With respect to ambiguous environmental impact, Professor Arpad Horvath of UC Berkeley conducted a study that estimated that 10 million metric tons of carbon dioxide per year would be released during project construction. Additionally, coal fired plants that provide electricity for the operation of the train would release even more greenhouse gases into the atmosphere. The study estimates that the train's power to reduce greenhouse gas emissions from reduced driving and airline travel may never be realized due to construction emissions and operation emissions. Because of the myriad of uncertainties that surround the statewide project, we recommend that the project be scrapped for cheaper, local alternatives.
Appendixes

Figure 1
Debt Service on General Obligation and Lease Revenue Bonds ($ in million)

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>General Fund Revenues</th>
<th>Debt Service</th>
<th>Debt Service Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012-13</td>
<td>$99,915</td>
<td>$0,086</td>
<td>6.09%</td>
</tr>
<tr>
<td>2013-14</td>
<td>$100,147</td>
<td>$7,141</td>
<td>7.13%</td>
</tr>
<tr>
<td>2014-15</td>
<td>$104,503</td>
<td>$7,601</td>
<td>7.36%</td>
</tr>
<tr>
<td>2015-16</td>
<td>$112,087</td>
<td>$7,973</td>
<td>7.11%</td>
</tr>
<tr>
<td>2016-17</td>
<td>$117,671</td>
<td>$8,172</td>
<td>6.94%</td>
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<tr>
<td>2017-18</td>
<td>$123,131</td>
<td>$8,580</td>
<td>6.97%</td>
</tr>
</tbody>
</table>

The debt service ratio expresses the state's debt service costs as a percentage of its General Fund revenues.


Figure 2
Capital Cost in 2013 Dollars and Year of Expenditure Dollars


Figure 3
CHSR Operation & Maintenance (O&M) Forecast in 2013 dollars

<table>
<thead>
<tr>
<th>Year</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
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</thead>
<tbody>
<tr>
<td>2025</td>
<td>$403</td>
<td>$358</td>
<td>$317</td>
</tr>
<tr>
<td>2030</td>
<td>$920</td>
<td>$817</td>
<td>$730</td>
</tr>
<tr>
<td>2035</td>
<td>$946</td>
<td>$841</td>
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<tr>
<td>2045</td>
<td>$1,007</td>
<td>$894</td>
<td>$807</td>
</tr>
<tr>
<td>2050</td>
<td>$1,027</td>
<td>$912</td>
<td>$821</td>
</tr>
<tr>
<td>2055</td>
<td>$1,049</td>
<td>$932</td>
<td>$838</td>
</tr>
<tr>
<td>2060</td>
<td>$1,096</td>
<td>$947</td>
<td>$850</td>
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Figure 4
Service Characteristics


Figure 5
Mode Choices Models Before and After the High-Speed Rail


Figure 6
Ridership, IOS through Phase 1 (in millions)

Figure 7
Farebox Revenue Forecast in 2013 dollars (in millions)

<table>
<thead>
<tr>
<th>SCENARIO</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
<th>2040</th>
<th>2045</th>
<th>2050</th>
<th>2055</th>
<th>2060</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Ridership</td>
<td>$773</td>
<td>$1,571</td>
<td>$1,943</td>
<td>$2,110</td>
<td>$2,218</td>
<td>$2,331</td>
<td>$2,450</td>
<td>$2,575</td>
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<tr>
<td>Medium Ridership</td>
<td>$578</td>
<td>$1,235</td>
<td>$1,521</td>
<td>$1,652</td>
<td>$1,736</td>
<td>$1,825</td>
<td>$1,918</td>
<td>$2,016</td>
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<tr>
<td>Low Ridership</td>
<td>$417</td>
<td>$915</td>
<td>$1,149</td>
<td>$1,248</td>
<td>$1,312</td>
<td>$1,379</td>
<td>$1,449</td>
<td>$1,523</td>
</tr>
</tbody>
</table>


Figure 8
Farebox Revenue Forecast in YOE dollars (in millions)

<table>
<thead>
<tr>
<th>SCENARIO</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
<th>2040</th>
<th>2045</th>
<th>2050</th>
<th>2055</th>
<th>2060</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Ridership</td>
<td>$1,071</td>
<td>$2,522</td>
<td>$3,615</td>
<td>$4,552</td>
<td>$5,546</td>
<td>$6,757</td>
<td>$8,233</td>
<td>$10,031</td>
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<tr>
<td>Medium Ridership</td>
<td>$801</td>
<td>$1,966</td>
<td>$2,831</td>
<td>$3,564</td>
<td>$4,342</td>
<td>$5,291</td>
<td>$6,406</td>
<td>$7,854</td>
</tr>
<tr>
<td>Low Ridership</td>
<td>$577</td>
<td>$1,469</td>
<td>$2,139</td>
<td>$2,692</td>
<td>$3,280</td>
<td>$3,997</td>
<td>$4,870</td>
<td>$5,934</td>
</tr>
</tbody>
</table>


Figure 9
California Long Term Investment Strategy

Source: “A Long-Term Investment Strategy for Cap-and-Trade Revenue,” April 11, 2014
Figure 10
Relative Amount of Sources of Funding for Bay to Basin

Source: California High-Speed Rail Authority Funding & Finance – May 2013.
http://www.hsr.ca.gov/docs/newsroom/fact%20sheets/High-Speed%20Rail%20Funding%20and%20Finance.pdf

Figure 11
Phase One Project Sources of Funds

Source: