Cost Escalation Forecast 2014–2023
August 2014

Prepared for:
The San Diego Association of Governments (SANDAG)
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Abbreviations

The following acronyms, initialisms, and short forms are used in this report.

AIC          Akaike Information Criteria
BCI          Building Cost Index
BEA          U.S. Bureau of Economic Analysis
BLS          U.S. Bureau of Labor Statistics
BOF          basic oxygen furnace
Caltrans     California Department of Transportation
CAGR         Compound Annual Growth Rate
CBO          Congressional Budget Office
CCI          Construction Cost Index
CICI         Construction Industry Confidence Index
CPI          Consumer Price Index
EAF          electric arc furnace
EIA          U.S. Energy Information Administration
ENR          Engineering News Record
FY           Fiscal Year
GDP          gross domestic product
GRP          Gross Regional Product
HMI          Housing Market Index
IMF          International Monetary Fund
MLA          Master Labor Agreements
MSA          Metropolitan Statistical Area
OEM          Original Equipment Manufacturer
OMB          Office of Management and Budget
PBHCCI       Parsons Brinckerhoff, Inc.’s Highway Construction Cost Index
PBTCI        Parsons Brinckerhoff, Inc.’s Transit Cost Index
PPI          Producer Price Index
Q            quarter
ROW          Right-of-Way
SANDAG       San Diego Association of Governments
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>SCC</td>
<td>Standard Cost Categories</td>
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<td>SIC</td>
<td>Schwarz Information Criteria</td>
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<td>UCSD</td>
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<td>U.S.</td>
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<td>VA</td>
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FORECAST LIMITATIONS

Parsons Brinckerhoff, Inc. has conducted research and employed analytical/statistical methodologies in developing commodity, professional services, and real estate price forecasts presented in this report. This report contains certain forecasts concerning anticipated future events and such projections reflect various assumptions that are based on the best information available at the time of writing. Estimates of future conditions are subject to change as economic and world conditions change. Many of these issues are beyond the ability to control or predict and the realization of any of them could have a material effect on forecasts; however, it is believed that the forward-looking statements contained in this report are reasonable given the information available.
S.0 EXECUTIVE SUMMARY

This report provides a customized, component-specific cost escalation forecast for the Mid-Coast Corridor Transit Project. Forecasted components in this report include: steel, concrete, labor, construction equipment, and other materials, which constitute a composite construction cost escalation forecast. In addition, separate forecasts were developed for right-of-way, vehicles (rolling stock), and professional services escalation. This report is an update to the forecasts developed in October, 2010.

S.1 Forecast Summary

Composite Construction Cost Escalation

The composite construction cost escalation forecast, as shown in this report, is expected to be a modest 2.8-percent in 2014, picking up to 4.2-percent in 2015 and 2016, then falling to 3.6-percent in 2017, before settling into a long term rate of around 3.0-percent by 2019. The 2015 and 2016 spike will be driven by several factors; firstly, the economic growth in both California and San Diego, which is expected to be stronger than what will be seen in the U.S. as a whole (in terms of GDP and unemployment rates). Secondly, the increased demand for construction materials as a result of local, statewide, national, and global construction demand will also drive up prices. This yields a 10-year Compound Annual Growth Rate (CAGR) of 3.3-percent in the likely case. In the high and low scenarios, the 10-year CAGRs are 4.1-percent and 2.5-percent, respectively.

- **Steel**: Steel prices are expected to have a 10-year CAGR of 3.25-percent. The forecasted growth (most probable) is influenced by transportation costs (which are a significant contributor to overall costs) and growing global demand for scrap steel. The high and low scenarios have 10-year CAGRs of 5.5-percent, and 1.25-percent, respectively.

- **Concrete**: Concrete prices are expected to have, in the most probable scenario, a 10-year CAGR of 2.9-percent. This is lower than the 4.1-percent CAGR from 2003-2012; however, this period covered the housing bubble. Behind this forecast is an expected recovery in the construction market by 2016. The high and low scenarios have 10-year CAGRs of 4.16-percent and 1.6-percent, respectively.

- **Labor**: Wages are expected to have, in the most probable scenario, a 10-year CAGR of 3.2-percent; the expectation is that labor costs will follow local prevailing wage rates. The high and low scenarios have CAGRs of 3.7-percent and 2.7-percent, respectively.

- **Construction Equipment**: Construction equipment is expected to have, in the most probable scenario, a 10-year CAGR of 2.9-percent (2013-2022), which is in line with the historic CAGR (2003-2012) of 3.1-percent. The high and low scenarios have 10-year CAGRs of 4.1-percent and 1.7-percent, respectively.

- **Other Materials**: Other Material is expected to have, in the most probable scenario, a 10-year CAGR of 3.9-percent (2013-2022). The high and low scenarios have 10-year CAGRs of 4.9-percent and 2.9-percent respectively.
Right-of-Way
In the most probable scenario, real estate prices are expected to have a 10-year CAGR of 5.3-percent. The high and low scenarios have CAGRs of 5.5-percent and 5.0-percent, respectively.

Vehicles (Rolling Stock)
Rolling Stock is expected to have, in the most probable scenario, a 10-year CAGR of 2.8-percent. The high and low scenarios have CAGRs of 3.4-percent and 2.3-percent respectively.

Professional Services
Professional Services is expected to have, in the most probable scenario, a 10-year CAGR of 2.5-percent. The high and low scenarios have CAGRs of 3.0-percent and 2.0-percent, respectively.

The most-probable overall forecast is shown below.

### Summary Forecasts (Most Probable)

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Notes: SCC = Standard Cost Categories
1.0 INTRODUCTION

This report provides a customized, component-specific cost escalation forecast for the Mid-Coast Corridor Transit Project. The forecasting methodology places special emphasis in identifying key drivers for the key forecast components, which include—international/national construction economic market drivers, local market dynamics, and supply chain/transportation issues.

The report includes:

- Ten-year overall cost escalation forecasts on a fiscal year basis (2014-2023) for the following Standard Cost Categories: 10 through 50 (composite forecast); 60 (right-of-way); 70 (rail vehicles); and 80 (professional services). These four categories were chosen because combined they constituted approximately 85-percent of the total project costs (as per latest project cost estimates).
- Ten-year individual cost escalation forecasts for Steel, Concrete, Labor, Construction Equipment, and Other Materials on a fiscal year basis (2014-2023). These individual forecasts constitute the composite forecasts, which encompass SCC 10 through 50.

1.1 Organization

This report contains the following chapters:

- Introduction
- U.S. Construction Market Conditions
- Economic Outlook
- California Market Conditions and Economic Outlook
- Forecasting Methodology
- Forecast Assumptions
- Individual Cost Component Forecasts
- Overall Forecast
Two sources were used as proxies for general market dynamics both nationally and locally. The sources, Engineering News Record’s (ENR) Construction Cost Index (CCI) and the U.S. Bureau of Labor Statistics (BLS) Consumer Price Index (CPI) are both defined below.

- **ENR CCI**: ENR’s published CCI\(^1\) is widely used within the construction industry. The ENR CCI has four components (inputs): cement, lumber, structural steel, and labor. It does not capture all the factors that influence project costs, but it does offer a snapshot of general cost trends.

- **CPI**: The CPI is a measure of general inflation published monthly by the U.S. BLS\(^2\). The index consists of a representative basket of goods purchased by the average urban U.S. household. The term “CPI” typically refers to the most common consumer price index measure, the “CPI-U”, which measures the change in all prices for all types of urban consumers in a U.S. city.

Until approximately 2004, the BLS CPI was a good proxy for construction cost escalation. Since 2004, the variance between general inflation (BLS CPI) and construction inflation, as measured by ENR CCI, has widened, as shown in Figure 2-1, with the ENR CCI growing at a faster rate than the BLS CPI during much of the past nine years. This is largely due to the supply constraints in the commodity markets and demand spikes for construction materials.

In the fall of 2008 the two indices pulled further apart. Between August and November of 2008 the ENR CCI grew by 2.9-percent, while BLS CPI fell by 2.6-percent.

The variance between the two indices increased again in the spring of 2010; between February and May BLS CPI retreated by 0.1-percent while ENR CCI grew by 1.0-percent. The variance between the two indices reached a new high in November of 2010 with BLS CPI 13.6 points lower than ENR CCI. After this the spread retreated slightly and then experienced a period of stability averaging 12.4 points through February 2012. Recently, it appears that the difference between indices is widening again, a new high of 15.0 points was reached in June of 2013.

Table 2-1 shows the annual percentage change for ENR CCI and BLS CPI. This table further highlights the difference between construction escalation and general economic inflation. For example, in 2004 construction escalation was more than two times general inflation, and in 2009 the indices moved in opposite directions. In 2011 ENR CCI and BLS CPI experienced similar growth rates as a result of significant increases in energy prices, which have a material impact on both indices. In 2012, the ENR CCI grew at a slightly faster rate than the BLS CPI.

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\(^1\) [http://www/enr.com](http://www/enr.com)

\(^2\) [http://bls.gov/cpi/](http://bls.gov/cpi/)
The ENR CCI has also historically paralleled the ENR Builder’s Cost Index (BCI)\(^3\). The California Department of Transportation (Caltrans)\(^4\) produces its own index of the cost of highway construction. While Caltrans’ index was lower than the ENR CCI and the BLS BCI in the 1990s, it has exceeded both indices in the 2000’s and has exhibited much more volatility. Caltrans’ index has recently returned to the level of ENR’s CCI and BCI.

---

3 ENR’s CCI and BCI can be accessed at http://enr.construction.com/economics/default.asp. The difference between the indices is in their labor component. The CCI uses 200 hours of common labor, multiplied by the 20-city average rate for wages and fringe benefits. The BCI uses 68.38 hours of skilled labor, multiplied by the 20-city wage-fringe average for three trades—bricklayers, carpenters, and structural ironworkers. The materials component of both indices use 25 centum weight (100 U.S. pounds) of fabricated standard structural steel at the 20-city average price, 1.128 tons of bulk Portland cement priced locally, and 1,088 board feet of 2 by 4 lumber priced locally.

4 Caltrans’ index can be accessed at http://www.dot.ca.gov/hq/esc/oe/contract_progress/. Caltrans’ Index is composed of aggregate, concrete pavement, earthwork, asphalt, reinforcement steel, structural steel, and structural concrete. The cost of labor is factored into each component.
The fall in the Caltrans index has largely been driven by decreases in the cost of concrete. The other index components, such as asphalt, have either remained relatively level or have increased only slightly. Parsons Brinckerhoff, Inc.’s Highway Construction Cost Index (PBHCCI)\(^5\) has followed a similar trend to the Caltrans index prior to 2004. However, PBHCCI’s spike in prices during the ‘boom’ periods was not as severe as that of the Caltrans index, and has continued to grow in recent years whereas Caltrans index has fallen. Parsons Brinckerhoff, Inc.’s Transit Cost Index (PBTCI)\(^6\) has tracked closely with ENR’s CCI and BCI since its creation in 1999. CCI, BCI, Caltrans, PBHCCI, and PBTCI indexes are shown in Figure 2-2 for illustrative purposes only and are not representative of the material, labor, and equipment composition for the Mid-Coast Corridor Transit Project. For example, PBHCCI is a highway index; with asphalt is a significant cost driver, which is closely correlated to global oil prices.

**Figure 2-2. Caltrans Index for Selected Highway Items, ENR Construction Cost Index, ENR Builder’s Cost Index, and Parsons Brinckerhoff Highway Construction Cost Index (1990-2012)**

![Graph showing Caltrans Index for Selected Highway Items, ENR Construction Cost Index, ENR Builder’s Cost Index, and Parsons Brinckerhoff Highway Construction Cost Index (1990-2012)](image)

Source: California Department of Transportation; Engineering News Record; Roads & Bridges

Note: Parsons Brinckerhoff HCCI and TCI Available beginning in 1999.

In summary, over the recent years it has become clear that cost trends for construction-related goods are not tracking with general inflation. Thus, it is important that they be analyzed individually to provide the most accurate forecast possible.

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5 PBHCCI was developed by Dr. Kumudu Gunasekera and Brad Ship in 2009 and is published monthly in the magazine *Roads and Bridges*. PBHCCI is composed of the following six cost components: construction labor, construction equipment, steel, asphalt and asphalt binder, aggregate, and concrete. The resulting index represents average highway construction costs for the U.S. as a whole.

It is important to consider a wide set of economic dynamics when forecasting, as general inflation (CPI) is no longer a good indicator of construction cost escalation. This requires an understanding of the major drivers of both the national and local construction economies.

This includes the contractor bidding environment. To keep their crews busy and remain in business, contractors and subcontractors reduced their margins through the recession. This resulted in aggressive bidding (i.e., low bids) and contractors have pursued projects that they would not traditionally bid on, which led to higher levels of contractor competition. More recently this has slowly been stabilizing, due both to contractor consolidation and the return of some demand for contractor services.

Contractors are still generally more concerned about ensuring a healthy backlog rather than high profit margins. As the construction market rebounds, contractor margins will also increase, and contribute to overall construction cost inflation.

At the start of the downturn public works grew replacing some of the demand for residential work—that has since changed. On the positive side, the single family home market began to pick up in 2012, along with several commercial segments, notably hotels and warehousing. However, tight fiscal conditions, at both the state and federal level, have considerably weakened the industrial sector.

On a positive note, residential construction, a key trigger of the recession, seems to have finally started to recover. Real private residential investment has now grown for eleven straight quarters (Q), growing from $368 billion in Q3 2010 to over $486 billion in Q2 2013, a 32-percent real increase as measured in 2009 dollars. There has also been a recovery in home prices as measured by the Case Shiller Index, which had fallen to record lows in Q1 and Q2 of 2012. Since those lows, the Index has gained 16 percent as of Q2 2013, and has returned to levels last seen in late 2008 (Figure 2-3).

**Figure 2-3. Real Private Residential Investment and Home Prices (Quarterly)**

Source: U.S. Bureau of Economic Analysis, Standard and Poor's
ENR’s Construction Industry Confidence Index (CICI\(^7\)) increased by 14 points in 2013 Q1, climbing to 64 points on a scale of 0 to 100 (where 50 indicates “market stability” and 100 indicates “market improvement”). The vast majority of executives surveyed for ENR’s CICI responded that they see the market as having stabilized, with only 13 percent of executives believing that the market is still in decline. This contrasts markedly with the 2012 Q4 ENR CICI, where 30-percent of those surveyed reported the construction market was in decline.

When the index is broken down by different types of firms, designers are the most optimistic, followed by general contractors and then sub-contractors (see Figure 2-4). This pattern is consistent with the workflow we would expect to see at the beginning of a construction market recovery.

Figure 2-4. How Different Firm Types View the Next 3-6 Months

![Figure 2-4](source: Engineering News Record)

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\(^7\) ENR’s CICI is an index created by surveying 376 executives of large construction and design firms. Scores between 0 and 50 indicate a market decline, a score of 50 represents market stability and scores between 50 and 100 are used to designate market improvement.
3.0 ECONOMIC OUTLOOK

3.1 Global Economy

The world economy has come through the recession, though not as quickly or as strongly as originally forecasted (see Figure 3-1). Global growth in real gross domestic product (GDP) in 2013 is expected to be around 3.3-percent which, while not as strong as what was observed in 2010 and 2011, is stronger than 2012 and appears to be sufficiently robust to stave off another global recession. In 2014 world growth in real GDP is forecast to be 4.0-percent, rising to 4.4-percent in 2015 and then leveling off at around 4.5-percent thereafter.

![Figure 3-1. Annual Percent Change Real GDP: World, U.S., Europe, and Emerging Markets](chart)

Sections 3.2 through 3.4 present the historical and future trends in more detail for the U.S., Europe, and Emerging Economies.

3.2 U.S. Economy

In quarter (Q) 2 2013, U.S. real GDP grew at an annualized rate of 1.7-percent compared with 1.1-percent in Q1 2013. Growth was also stronger than the same time...
last year, which was 1.2-percent annualized for Q2 2012. This was largely due to Gross Private Investment and Consumer Spending, which grew 9.0 and 1.8 annualized rates, respectively. This was in addition to what was a relatively small decline in government spending of 0.4-percent (annualized). While GDP growth continues to struggle to maintain consistent growth rates, 2013 Q2 marked the first time since 2007 Q4 that the economy has seen nine straight quarters of growth, averaging 2.2-percent annualized growth each quarter. In comparison over the past ten years, 2003 Q3 – 2013 Q2, the average annualized quarterly growth has been 1.7-percent. Over the past 20 years, the average annualized growth rate has been 2.5-percent. Historically, GDP has grown by about 2.7-percent, between 2002 through 2007 in the time leading up to the recession of 2008. According to Moody’s Analytics, the U.S. economy is expected to recover to that level of growth in the second half of 2013 and will then see growth peak at around an annual rate of 4.5-percent in 2015 Q1 before returning to a long-term level of around 2-percent by the end of 2017 (Figure 3-2).

**Figure 3-2. U.S. Quarterly Real GDP Growth**

Source: U.S. Bureau of Economic Analysis; Moody’s forecasts begin 2013 Q3

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8 Bureau of Economic Analysis Moody’s Analytics
9 Moody’s Analytics has often been recognized as one of the most consistently accurate economic forecasting firms in the world. See http://www.economy.com/default.asp for more information on Moody’s.
Using an average of forecasts prepared by the International Monetary Fund (IMF), the Congressional Budget Office (CBO), the Office of Management and Budget (OMB), and Moody’s Analytics, the average real GDP annual growth rate forecast is about 2.1-percent for 2013. GDP growth is then forecast to increase in 2014 to 3.1-percent, peaking in 2015 at 3.9-percent, and then dropping slightly in 2016 to 3.7-percent. After 2016 it is expected to settle into a long term real growth rate of about 2.4-percent. In 2013 the CBO predicts a lower annual GDP growth rate than other forecasting agencies; 1.4-percent compared to Moody’s and IMF at 1.9-percent. The CBO is aware of this difference and attributes it to the fact that it used different assumptions regarding federal fiscal policy. On the flip side, the OMB is by far the most optimistic with a forecast of 3.2-percent growth for the year; this is also due to differences in their underlying fiscal assumptions. Figure 3-3 shows all four of the GDP grow forecasts and an average of all of them.

Figure 3-3. U.S. Real GDP Forecasts

Source: Bureau of Economic Analysis; Office of Management and Budget; International Monetary Fund (note: IMF forecasts end in 2015); Congressional Budget Office; Moody’s Analytics

While GDP growth in recent years has been more sluggish than originally anticipated, a number of consumer, housing, and unemployment indicators are reaching levels that have not been attained since the pre-recession economic climate.

- The Reuters/University of Michigan's Index of Consumer Sentiment reached 85.1; its highest level in six years was attained in July 2013. This represents year over year growth of 17.7-percent. July was the third consecutive month that consumer confidence reached levels that had not been seen since July 2007.

- The Bloomberg Consumer Comfort Index rose 3.5 points to -23.5 in the week ended August 8, 2013. This is up 16.2 points from where it was last year and is the strongest reading since January 2008. Views on the state of the economy climbed to -45.1, also the highest since January 2008, while opinions on personal finances rose from 4.2 to 6.6. This is the 17th consecutive positive reading for this index and is the highest level reached since April 2008. Attitudes about the buying climate also rose from -35.4 to -32.

- The NAHB/Wells Fargo Housing Market Index (HMI) rose 6 points in July, to 57. This is the index's third consecutive monthly gain and the highest reading since January of 2006. All three of the NAHB/Wells Fargo HMI components posted gains in July. The current sales component rose five points to 60, its highest level since early 2006. The component measuring sales expectations in the next six months gained seven points to 67, and the component gauging traffic of prospective buyers rose five points to 45, marking the strongest readings for both since late 2005.

- Initial claims for unemployment insurance for the week ending August 3, 2013 came in at 333,000, seasonally adjusted, up 1.5-percent from the previous week's revised level. The four week moving average, however, fell to 335,500 compared to 341,750 the week before. Also, the weekly figure is down 9.5-percent from where it was a year ago and the four week moving average is down 9.2-percent year-over-year.

The housing market is showing signs of recovery. Housing markets have been a key factor in the most recent recession. As of July 2013 the number of foreclosure filings, which includes default notices, scheduled auctions and repossessions, had fallen, year over year, for 33 consecutive months. Filings have now fallen to levels last seen in February 2007, a six and a half year low (See Figure 3-4).

### 3.3 European Economy

While the European sovereign debt crisis is no longer front page news, sluggish growth in the Eurozone continues to weigh the world economy down. In 2012 the Eurozone economy saw the feared double-dip recession, when it contracted by almost 0.6-percent. While the spread between U.S. government bonds and Spanish bonds has come down from peak levels (5.3 percentage points in July 2012), Spain is still paying a premium of approximately 2.5 percentage points compared to the U.S. (see Figure 3-5). In summary, the Eurozone economy as a whole remains fragile; with forecasters predicting a second year of contraction followed by real growth below 1.75-percent, in the foreseeable future (see Figure 3-1). A slow European recovery translated to lower global demand for construction goods.
Figure 3-4. U.S. Foreclosure Filings (Monthly)

Source: Realtytrac

Figure 3-5. Interest Rates on Government Securities: Spain and the U.S.

Source: Federal Reserve FRED database
3.4 Emerging Economies

While Brazil, China, and India felt the impact of the global recession, only Brazil’s economy dipped into negative territory. Although all three economies have recovered markedly since 2009 (Figure 3-6), they all grew at a slower rate in 2012 than anticipated in the IMF’s 2012 forecast: China at 7.8 percent compared to 8.2, India 4.0-percent compared to 6.9, and Brazil at 0.9-percent compared to 3.0.

Figure 3-6. Real GDP: Brazil, China, and India (Annual Percent Change)

The IMF forecasts that between 2012 and 2018 Brazil, Russia, China, and India will grow on average at nominal annual rates of 6.0, 7.9, 10.5, and 8.5-percent respectively. By comparison over that same period, IMF is projecting 5.1 percent nominal annual growth in GDP for the United States. This rapid expansion is predicted to have an impact on the ranks of the world’s 10 largest economies. According to the IMF, if this expansion is realized, Brazil will have move to 5th from 7th, Russia will jump to 6th from 8th, and India will overtake Italy moving into 9th place (see Figure 3-7).

The accelerated growth of these national economies has the potential to have significant impacts on the construction economy. These emerging nations have significantly lower levels of infrastructure relative to their populations compared to the other 10 largest economies. For example, the number of passenger vehicles per capita in Brazil, Russia, India, and China is significantly lower than the other seven largest economies (Figure 3-8). Passenger vehicles per-capita was used as a proxy for the measure of existing infrastructure in a country. The levels observed in the advance economies are not as important as the significant gap between them and the other countries. This gap
Figure 3-7. Ten Largest Economies by GDP 2011 and 2016

![Chart showing GDP rankings for 2012 and 2018.]

Source: International Monetary Fund

Figure 3-8. Passenger Vehicles per 1,000 People in the Ten Largest Economies (2009)

![Bar chart showing vehicles per 1,000 people for 2009.]

Source: World Bank
highlights the striking difference in the level of infrastructure across these nations. As these emerging country economies expand, their infrastructure development will need to keep pace. This development will create strong demand for global commodities such as oil, steel, and cement, which in turn will be reflected in an increased global demand for construction inputs.\textsuperscript{11} As demand increases suppliers will look to increase output and to increase efficiency by streamlining the production process. This increase in efficiency may help to offset the upward pressure increased demand will place on construction prices.
4.0 CALIFORNIA MARKET CONDITIONS AND ECONOMIC OUTLOOK

4.1 Local Economic Overview and Outlook

Prior to the recession, the economies of California and San Diego’s economy had generally followed the trends seen in the U.S. economy as a whole. While the U.S. saw a sharper recovery in 2010, since then San Diego exhibited a faster growth rate. California as a whole has been slower to recover, but in 2012 growth in Gross State Product outpaced U.S. gross domestic product (GDP) by 1.8 percentage points. The forecast is for slightly weaker growth for California and San Diego in 2013, as compared to 2012, but still expects to see growth of 3.1 and 2.4-percent, respectively. Growth in both economies is expected to peak in 2015 at around 4-percent before settling into a long-term average of around 2.25-percent for California and 2.1-percent for the San Diego Metropolitan Statistical Area (MSA). The growth in the U.S. economy is also expected to peak in 2015, but at a lower rate of 3.4-percent before settling into a long-term rate around 2.4-percent (See Figure 4-1).

![Figure 4-1. U.S. Real GDP Growth Forecasts](image)

The local San Diego economy is largely driven by the Real Estate and Rental, Government, and Professional Scientific and Technical Services sectors, which account for almost half of Gross Regional Product (GRP) (see Figure 4-2). Leading up to the recession, the Real Estate and Rental sector made up 21-percent of the local economy. The current level of 18-percent is more in line with historic levels. This is significantly higher than its share of the U.S. economy as a whole (12-percent). The region is clearly...
highly reliant on this sector and is thus vulnerable to the fluctuations of housing prices and residential construction activity. The construction industry accounted for only 3-percent of total GRP. In the San Diego MSA prior to the recession this figure was around 5.5-percent. The construction industry's total GRP has declined from its peak of $8.0 billion in 2005 to approximately $4.8 billion in 2010 for an overall decline of about 40-percent. The decline appears to have leveled off as 2010 and 2011 were flat at $4.8 billion each.

Two sectors that have gained ground over the past ten years are Profession, Scientific, and Technical Services and Manufacturing, which were 9.4 and 7.1-percent of the economy, respectively, in 2001. In 2011 the sectors had grown to 11.9 and 10.2-percent, respectively.

4.2 Local Labor Market

Similar to national trends, the unemployment rates in California and San Diego continues to recover slowly from the recession. The seasonally adjusted unemployment rate as of July 2013 was 8.7 percent for the State of California, down from 12.4-percent at the height of the recession, but higher than the pre-recession minimum rates of 5.0-
percent\(^\text{12}\). For the San Diego MSA the non-seasonally adjusted unemployment rate for June 2013 is 7.3-percent, this is down from previous June levels that peaked in 2010 at 10.6-percent. Unemployment rates are forecasted to continue to decline in both California and San Diego; San Diego is forecast to fall below 6-percent by quarter (Q) 2 2015, California’s recovery is expected to be a little slower, not falling below 6-percent until Q1 2017 (See Figure 4-3).

Figure 4-3. Unemployment Rate (Seasonally Adjusted)

Construction employment has also begun to recover. As Figure 4-4 shows, construction employment dropped off significantly from its peak employment levels in 2006 for both California and the U.S. As of 2013 Q1, construction employment for the U.S. was up 6.0-percent from its lowest point (Q4 2010). At the same time in California it was 13.7-percent above its bottom (Q2 2010). Moody’s Analytics forecasts that construction employment will continue to show positive growth in the coming quarters between 1 and 1.5-percent quarterly.

Figure 4-5 shows both the U.S. and California single family housing starts are expected to take off starting in the third quarter of 2013 and to exhibit double digit quarterly growth rates through the end of 2014. This rapid growth is forecast in response to pent up demand created by an extended period of stagnation. After peaking in the first half of 2016 levels are expected to decrease to a more sustainable long-term pattern in 2019 and onward.

Additionally, both the amount of private construction investment and home prices in the region has begun to rise. Figure 4-6 illustrates the fact that U.S. home prices began to rise modestly towards the end of 2011 and beginning of 2012. The same trend was true for the San Diego MSA. In recent months this growth has started to accelerate both in San Diego and across the rest of the U.S. The price stabilization mirrors an overall trend of real total private construction, which has grown modestly but steadily since the end of 2010 and beginning of 2011.
Figure 4-5. Single Family Housing Starts Quarterly Percent Change

Source: Moody’s Analytics

Figure 4-6. Real Private Construction Spending and Home Prices

Source: Bureau of Economic Analysis; Standard & Poor’s Case Shiller Index
4.3 Construction Spending

Overall construction spending declined through 2011 Q1 despite modest increases in public construction spending. The downward trend was driven by sharp reductions in private sector construction spending and the modest nature of increases in public spending, as seen in Figure 4-7. The private-sector has since been showing signs of recovery. In fact as of 2013 Q2 private construction spending was up 30-percent from its low in 2011 Q1, and has shown eight consecutive quarters of year-over-year growth.

Figure 4-7. U.S. Public and Private Construction Spending

Source: U.S. Census

4.3.1 Local Demand

In the mid-2000s both San Diego and Los Angeles have passed measures to increase local funding for transportation projects. In 2004, San Diego voters approved an extension ordinance and expenditure plan (Proposition A) that extends the TransNet program to 2048. The TransNet Program is a one-half cent sales tax to fund a variety of transportation projects throughout San Diego County. This extension is expected to generate approximately $21 billion for transportation projects in San Diego County between 2011 and 2048 (including the Mid-Coast Corridor Transit Project). San Diego Association of Governments has proposed an early action plan that includes 22 projects that will be completed within the next 20 years.

In November 2008, Los Angeles voters approved the Measure R program, which is a one half-cent local sales tax for transportation projects in the county. Measure R is
expected to contribute $36 billion for transportation projects throughout the county over the next 30 years\textsuperscript{13}.

The Southern California region anticipates significantly investment in transportation projects in the coming years. Figure 4-8 shows between Fiscal Year (FY) 2011 and FY 2015 the Southern California Area Governments plan to spend almost $60 billion and an additional $75 billion by FY 2020.

**Figure 4-8. Southern California Transportation Area Governments Regional Transportation Plan/Sustainable Communities Spending**

![Graph showing transportation spending](image)

Source: Southern California Association of Governments

Within the next decade there will be transportation investment in California and along the Pacific coast (see Table 4-1). Many of these projects have similar timeframes to the Mid-Coast Corridor Transit Project and thus would likely increase competition as there are few contractors who can complete projects of this magnitude. Other considerations include the possibility of California High Speed Rail Project, which would include $45 billion in expenditures for the entire 800-mile corridor. Finally, Los Angeles’ “30/10 Initiative” was awarded $546 million via the TIGER grant program. This initiative, which includes some of the projects, is listed in Table 4-1.

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\textsuperscript{13} Los Angeles Metro, Countywide Financial Forecasting Model, FY 2010-FY 2040, 30/10 Initiative, revised August 10, 2010.
Table 4-1. Selected Major West Coast Transportation Projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Estimated Cost</th>
<th>Construction Start</th>
<th>Estimated Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>San Francisco Presidio Parkway Phase 2</td>
<td>$1.05 billion</td>
<td>Underway</td>
<td>2015</td>
</tr>
<tr>
<td>Los Angeles Expo Line Phase 2&lt;sup&gt;14&lt;/sup&gt;</td>
<td>$44 million</td>
<td>Underway</td>
<td>2015</td>
</tr>
<tr>
<td>Seattle Region Sound Transit University Link</td>
<td>$1.9 billion</td>
<td>Underway</td>
<td>2016</td>
</tr>
<tr>
<td>Honolulu Light Rail Phase 1 and 2</td>
<td>$7.0 billion</td>
<td>Underway</td>
<td>2019</td>
</tr>
<tr>
<td>Los Angeles Crenshaw Line Extension&lt;sup&gt;15&lt;/sup&gt;</td>
<td>$2.0 billion</td>
<td>Underway</td>
<td>2019</td>
</tr>
<tr>
<td>San Diego Interstate 805 Expansion&lt;sup&gt;16&lt;/sup&gt;</td>
<td>$1.4 billion</td>
<td>Underway</td>
<td>2020</td>
</tr>
<tr>
<td>California High Speed Rail</td>
<td>$68.4 billion</td>
<td>2013</td>
<td>2028</td>
</tr>
<tr>
<td>San Diego Interstate 5 North Coast Corridor Expansion</td>
<td>$6.5 billion</td>
<td>2013</td>
<td>2040</td>
</tr>
<tr>
<td>State Route 91 Orange to Riverside Expansion</td>
<td>$1.3 billion</td>
<td>2014</td>
<td>2017</td>
</tr>
<tr>
<td>Los Angeles Metro Westside Subway Extension</td>
<td>$6.3 billion</td>
<td>2014</td>
<td>2035</td>
</tr>
</tbody>
</table>

In addition to demand from the transportation sector there is construction work in the energy sector taking place in southern California. Southern California Edison has announced that it was permanently shuttering the San Onofre nuclear plant near San Clemente, California. The reactor went down in January 2012 and since then the state has added 2,502 megawatts of capacity to help make up the difference. Most of the additional capacity has been natural gas with some solar (Figure 4-9).

4.3.2 State and Local Revenues

Declines in personal income tax and sales tax collections, as well as in overall state tax collections, were steeper during and after the Great Recession beginning in December 2007, than around the previous two recessions. Overall state tax collections, as well as personal income and sales tax revenues, showed continued and strong growth in the first quarter of 2013 (see Figure 4-10). The growth in total tax collections was much stronger than in the previous six quarters, mostly due to strong growth in personal income tax collections. Personal income tax collections increased by 18.4-percent, while sales tax collections rose by 5.5-percent.

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<sup>14</sup> http://www.honolulutransit.org/
<sup>15</sup> http://www.metro.net/projects/crenshaw_corridor/
Figure 4-9. Increases in Energy Capacity

Source: U.S. Energy Information Administration

Figure 4-10. U.S. State Revenue Growth

Source: Rockefeller Institute
The feasibility of all of these projects will be heavily influenced by the fiscal conditions faced by state and local governments. In FY 2012-FY 2013 California was able to run a budget surplus of around $870 million. However, they faced deficits of $4.8, $1.2, and $3.6 billion in FY 2009-2010, FY 2010-2011, and FY 2011-2012 respectively. So while California’s fiscal position is improving, they are still coming out of a period of severe fiscal tightening. The budget adopted by San Diego for FY 2013 boasts that they have been able to close a long standing structural deficit. While closing the deficit is a positive step it was done so in part through cost cutting reducing potential demand for construction goods and services. Los Angeles on the other hand is still struggling with deficits, this is common for local governments as much of their revenue relies on property taxes and real estate values have only recently begun to recover.
5.0 FORECASTING METHODOLOGY

5.1 Commodity, Professional Services, and Rolling Stock Forecast Methodology

The following describes preparation of component-level escalation forecasts for the Mid-Coast Corridor Transit Project. The approach is different from other cost escalation forecasts, many of which have methodologies that rely on historical cost trend analyses (i.e., trend based statistical extrapolations) as the basis for forecasting cost escalation. The forecasting methodology, in addition to historical cost trend analysis, places a focused emphasis on identifying key drivers for each of the following components and postulating how those drivers may affect costs over the forecast horizon.

Key forecast components include:

International and National Market Dynamics

International and national market trends are derived from an analysis of a number of third-party resources (both publicly available and subscription services). These sources contain both quantitative and qualitative analyses of the construction and general economy. These sources include, but are not limited to:

- Dodge 2013 Construction Outlook
- Moody’s Analytics commodity forecasts
- Parsons Brinckerhoff, Inc.’s Economic Forecasting Review, Volume 7, Issue 1
- Historical commodity and labor data from the U.S. Bureau of Labor Statistics
- Energy forecast information from the U.S. Energy Information Administration
- Published construction economy analysis and information from the Associated General Contractors
- International Monetary Fund’s “World Economic Outlook” database

Local Market Dynamics

In order to validate past research on local market dynamics (such as bidding environment, contractor competition, labor market, local supply chain, etc.), a number of interviews with local industry members, including regional economists and material suppliers, provided input on local market dynamics. These interviews, together with other local industry research, provided information on the local construction market. A list of interviews can be found in Appendix A.

Supply Chain / Transportation

Each of the forecasted cost components has different supply chains. In addition to varying transportation costs from origin to destination (which are a significant component of overall costs), the supply chain analysis helps understand:

- Source country market dynamics; and
- Potential bottlenecks in the supply chain, which may affect costs.
One-time Events that Temporarily Change the Market Structure

Events such as the 2005 Hurricanes (i.e., Katrina, Rita, and Wilma), the 2008 crude oil price spikes, and the 2008 Beijing summer Olympics (which affected global steel prices), have short-term effects on construction costs, which are aberrations to usual business cycles. While forecasting such events is nearly impossible, the approach incorporates the potential for such events (among others) in the optimistic (low) and pessimistic (high) scenario forecasts.

Based on these categorizations, the escalation rate reflects major underlying factor inputs or construction components. Projected rates of growth for each of five major cost inputs or components are weighted based on each of the input's estimated contribution to overall project costs. The weighted sum of all of the growth rates thus yields the component-weighted average escalation rate. In addition to the economic drivers that are inherent in each component, the forecasts are factored for transportation costs of each component and variations in contractor margins (which are a result of the level of contractor availability and competition).

The individual weights are derived from a detailed local market analysis and an extensive research database, which has been maintained and updated by Parsons Brinckerhoff over the past five years. The database includes research on highway, transit, and tunneling projects in New York, New Jersey, Florida, Hawaii, Louisiana, Ohio, Washington, and California.

Detailed forecasts for five components: steel, concrete, labor, construction equipment, other materials were projected for the ten-year period from 2014 to 2023. As is further outlined in Chapter 1.0, these individual component forecasts are combined into overall forecasts for major project cost categories. Professional services and rolling stock were forecast in a similar method but were left as standalone series and not rolled up into the composite forecast.

5.2 Right-of-Way Forecast Methodology

5.2.1 Methodology

Property values within the Corridor were forecast using a multivariate regression analysis.

5.2.2 Forecast Segmentation

The prices of different types of properties are driven by a variety of different factors. To address this, two regression models were created—one for residential real estate prices and one for commercial real estate prices. Forecasting real estate prices in segments allows for a better overall forecast because the models can each be tailored to each property type.

17 The component weights were obtained from the project cost estimators.
The percentage of residential and commercial land area was based on the property types found in the project right of way. Table 5-1 shows property types that comprise each category.

### Table 5-1. Property Types by Category

<table>
<thead>
<tr>
<th>Category</th>
<th>ROW (acres)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>2.32</td>
<td>6%</td>
</tr>
<tr>
<td>Commercial</td>
<td>35.09</td>
<td>87%</td>
</tr>
<tr>
<td>Church</td>
<td>0.18</td>
<td>0%</td>
</tr>
<tr>
<td>Commercial</td>
<td>15.24</td>
<td>38%</td>
</tr>
<tr>
<td>Hospital – Private (Scripps Hospital)</td>
<td>0.72</td>
<td>2%</td>
</tr>
<tr>
<td>Hospital – Public (VA Hospital)</td>
<td>2.23</td>
<td>6%</td>
</tr>
<tr>
<td>UCSD</td>
<td>8.22</td>
<td>20%</td>
</tr>
<tr>
<td>Public – Other</td>
<td>8.34</td>
<td>21%</td>
</tr>
<tr>
<td>Rail</td>
<td>0.02</td>
<td>0%</td>
</tr>
<tr>
<td>School – Private</td>
<td>0.14</td>
<td>0%</td>
</tr>
<tr>
<td>Other</td>
<td>2.93</td>
<td>7%</td>
</tr>
</tbody>
</table>

Notes:  ROW = Right-of-Way; UCSD = University of California, San Diego; VA = Veterans Administration

As shown in Table 5-1, the majority of land in the project right of way is commercial, 87-percent of the total. Residential represents 6-percent of the total land area. Given the lack of historic data for undeveloped land and the relative insignificance in the overall forecast, the “Other” category was excluded from the forecasts.

### 5.2.3 Model Approach

The first step in the regional analysis was to select the dependent and independent variables to be considered. Next, several different regressions were run using the chosen variables. After this was completed, the various regressions were evaluated and a single model was chosen for each property type.

### 5.2.4 Variable Selection

#### 5.2.4.1 Independent Variable Selection

Potential independent, explanatory variables for residential and commercial segments were selected based on a variety of factors. Independent, or explanatory, variables were identified and chosen based on industry knowledge, as well as the availability and quality, of historic and forecast data. The following potential independent variables were identified:
5.2.4.2 Dependent Variable Selection

Residential Property Value

Dependent variable data selection was conducted in much the same way as independent variable selection. Two historical data sources were identified for residential price data: Zillow and the Lincoln Institute for Land Policy. The two data sources were then compared. Figure 5-1 shows the annual percent change observed in each series as well as a comparison between the two. As shown the two sources track closely—the average of difference for the 14-year period is zero (0.006-percent) and the largest difference between the two datasets is 5.8-percent in 2010. Ultimately, the Lincoln Institute home price data was used as the dependent variable for the residential because it provides a larger data set (13 more years) than Zillow.

The data from the Lincoln Institute were available at a quarterly frequency and begins in 1984 quarter 4 and the most recent value is 2012 quarter 3. To be consistent with other data sources in the analysis, the one quarter of 1984 data was not used because it represented the latter 25-percent of the year. For the 2012 data, however, the three quarters of 2012 data were averaged and used as the 2012 annual value. Thus, the resulting quarterly dataset was annualized and the resulting dataset was annual values from 1985-2012. As the data series was in year of expenditure dollars, it was transformed so that all the prices were in 2005 dollars; this was done using the U.S. Bureau of Labor Statistics Consumer Price Index for San Diego. This removed any price

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18 Bureau of Labor Analysis and Moody’s Analytics
19 Bureau of Labor Analysis and Moody’s Analytics
20 Bureau of Economic Analysis and Moody’s Analytics
21 Moody’s Analytics
22 Moody’s Analytics
23 U.S. Census and Moody’s Analytics
24 U.S. Census and Moody’s Analytics
25 Bureau of Labor Analysis and Moody’s Analytics
growth that was attributable to inflation so that only real price changes were being analyzed.

Commercial Property Value

Neither the Lincoln Institute nor Zillow provided commercial real estate price data. REIS, Inc.\textsuperscript{26}—a provider of commercial real estate performance data and analysis—provided a dataset that consisted of the average price per square foot for commercial real estate in San Diego. The data set consists of all commercial transactions over $250,000 in the San Diego Metropolitan Statistical Area by year.

The REIS data set was segmented into the following categories: retail, industrial, office. From these series an average price per square foot was calculated and used as the dependent variable. As with the residential data, the commercial data was transformed such that all prices were in 2005 dollars. Commercial real estate prices were then analyzed for changes in the real price.

\textsuperscript{26} Reis, Inc. is a provider of commercial real estate performance data and analysis. https://www.reis.com/
5.2.5 Statistical Analysis

Once the variables had been selected, regressions were then run using E-Views, a statistical software package. Forecasts were created on the presumption that the historical relationships between dependent and independent variables will hold true in the future.

In regression analysis choosing the functional form is an important step. A double-log model specification was used because the study team was interested in the percent change in real estate prices year-over-year rather than the absolute real estate price. To create a double log specification the natural log is taken of each variable then the regression is run using the transformed variables. In this type of model, the coefficient of the independent variable reflects the percentage change expected in dependent variable if there were to be a one percentage point increase of the independent variable. In other words were the independent variable to increase by one percent then the dependent variable would be expected to increase by the percent equal to the independent variable’s coefficient.

Identifying and treating common econometric issues was another part of the regression analysis. It is common for time series data to have a serial correlation. Serial correlation, sometimes called autocorrelation, is a problem in which there exists a correlation between the error term of a time period and the error term in a previous period.

Addressing serial correlation appropriately is important to create the best forecasting model. If the serial correlation is not remedied it can cause the standard error to be biased. A biased standard error affects other statistical tests that could make it appear as if independent variables are relevant to the model when in fact they are not, resulting in a false correlation and poor model.

One way to address serial correlation is to use an autoregressive model. An autoregressive model adjusts for the correlation between error terms in the model. An autoregressive term of the first order takes the following form:

Equation 1: Original Equation

\[ \ln(Y_t) = \beta_1 \ln(X_t) + u_t \]

Where,
\[ Y_t \] = Land value at time \( t \)
\[ \beta_1 \] = constant
\[ X_t \] = Independent variable at time \( t \)
\[ u_t \] = first order autoregressive term at time \( t \)
\[ t \] = time point
Equation 2: Autoregressive Term

\[ u_t = \rho u_{t-1} + \varepsilon_t \]

Where,
- \( u_t \) = first order autoregressive term at time \( t \)
- \( \rho \) = autoregressive coefficient
- \( \varepsilon_t \) = error term at time \( t \)

The autoregressive term is defined in Equation 2 is then used in Equation 3.

Equation 3: AR(1) Model

\[ \ln \bar{y}_t = \beta_1 \ln(\bar{x}_t) + (\bar{\mu}_t) \]

Where,
- \( \bar{y}_t \) = \( Y_t (1 - \rho)^{1/2} \)
- \( \beta_1 \) = coefficient
- \( \bar{x}_t \) = \( X_t (1 - \rho)^{1/2} \)
- \( \bar{\mu}_t \) = adjusted error term in time \( t \)

Another way to treat the serial correlation is with a moving average term. Similar to the autoregressive term, it accounts for the relationship between errors in different time periods. See below for the general formula (Equation 4).

Equation 4: MA(q) Model

\[ X_t = \mu + \varepsilon_t + \sum_{i=1}^{q} \theta_i \varepsilon_{t-i} \]

Where,
- \( \theta_i \) = model parameters
- \( \mu \) = the expected value of \( X_t \) (its mean)
- \( \varepsilon_t \) = error terms
- \( q \) = order of the model, number of backwards observations used (a MA model of the order 1 looks only at the most recent error term, while a model of the order 2 will include the two most recent error terms.

5.2.6 Model Selection

Each of the selected variables was tested to determine the nature and strength of their relationship to real estate prices. All models for a given dependent variable were then compared to determine which explanatory variable or set of explanatory variables had the best ability to predict real estate prices.

Using a linear model to test variables, various combinations and permutations of the independent variables were evaluated. Several criteria were used to select or exclude each given variable combination. Potential model equations were first analyzed for statistically significant relationships between the dependent variables and real estate values.
When comparing different models, some explanatory variables were better able to explain the variation observed in real estate prices. The competing models were evaluated using both absolute and relative measures of goodness of fit. The R-squared value was one measure used to compare the explanatory power of a model. Additionally, the Akaike (AIC) and Schwarz (SIC) Information Criteria values were also used to choose the best model for each dependent variable. The R-squared value measures the absolute goodness of fit while the AIC and SIC are measure relative goodness of fit. All of these statistics were used in determining which models were best.

A specification that was tested but not ultimately used was the inclusion of dummy variables. A dummy variable is an independent variable that can only take on one of two values: 1 or 0; a condition is present or it is not. Two dummy variables were tested to capture the effects of the housing boom on real estate prices. The boom dummy variable had a value of 1 for the years 2004 through 2006 and all other years it was zero. The post-boom dummy had a value of 1 for the years 2007 through 2010 and all other years it was zero. The results of the test indicated that the dummy variables did not add any explanatory power to the model. This was most likely the case for two reasons. First, the dummy variables were highly correlated with other independent variables such as employment and income. Second, as the dummy variables represented roughly 20-percent of all the data points there was not a sufficient variety in the data set for the analysis to identify the pre- or post-boom impacts and attribute them to the dummy variables.

5.2.7 Model Specifications

Based on this analysis, the best price forecasting models for residential values and commercial values are shown in Equations 5 and 6, respectively.

The final model chosen for residential real estate price is shown in Equation 5. Real household income was the only independent variable that was used in the final equation. Conceptually this makes sense because the price of the house that can be afforded is largely determined by a given family’s household income.

Equation 5: Residential Equation

\[
\ln(RHP_t) = 1.19 \ln(HOI_t) + u_t \text{ ar(1)} \text{ ma(1)}
\]

Where,

- \( RHP_t \) = Real home price at time \( t \)
- \( HOI_t \) = Household income at time \( t \)
- \( u_t \) = first order autoregressive term at time \( t \)
- \( t \) = time point
- \( \text{ar(1)} \) = autoregressive term of the first order
- \( \text{ma(1)} \) = moving average term of the first order

The final model chosen for commercial real estate price is shown in Equation 6.
Equation 6: Commercial Equation
\[ \ln(PSF_t) = 1.03 \ln(GRP_t) + u_t \cdot ar(1) \]

Where,
- \( PSF_t \) = Price per square foot at time \( t \)
- \( GRP_t \) = Gross regional product at time \( t \)
- \( u_t \) = first order autoregressive term at time \( t \)
- \( t \) = time point
- \( ar(1) \) = autoregressive term of the first order

Further statistical details of these equations are in Appendix C.

5.2.8 High and Low Forecasts

To create high and low forecasts for property values the regressions for residential and commercial real estate prices were run at the ‘plus and minus 2 standard error’ levels. Assuming a normal distribution, one that is symmetrical around its mean, a range of +/- 2 standard errors will provide a band into which the actual values will fall 95-percent of the time. The +/- 2 standard error band for 2013 had a range of 0.5-percent for annual percent growth rates. This was used to create a band around the probable scenario of plus and minus 0.25-percent.
6.0 FORECAST ASSUMPTIONS

6.1 General Economic Outlook

The history and outlook for the U.S economy and labor market was analyzed in Chapter 4.0. Based on the aforementioned analysis, the following assumptions for the respective scenarios were used (applicable to all individual components):

**Most Probable**

Forecast Assumes:

- Moderate real U.S. gross domestic product (GDP) growth for the rest of 2013 and through 2014.
- Stronger growth both in California as a whole and Southern California when compared to the U.S. as a whole in the short term.
- Real U.S. GDP growth will pick up in 2015 and 2016, rising to moderate levels (around 3.2-percent annual growth) and remaining there throughout the forecast period.
- Domestic construction growth will peak between 2014 and 2015 and thereafter stabilize to a sustainable long-term growth level.
- Increased construction activity in California as a result of Measure R (projected $40 billion to traffic relief and transportation upgrades throughout Los Angeles County over the next 30 years), California High Speed Rail, and work in the energy sector.
- Global construction demand will put moderate upward pressure on prices in the short term from 2015 to 2017 and remain a factor throughout the forecast horizon.
- An average of U.S. Energy Information Administration’s (EIAs) base and high forecasts for the price of diesel was used.
- The price of electricity comes from the EIAs’ “base case” forecast for industrial electricity, and was adjusted to ensure a floor of 1-percent annual growth.

**High Scenario**

More pessimistic forecast assumptions (relative to most probable):

- Stronger real U.S. and local GDP growth in the second half of 2013 through 2014, and higher long-term growth.
- Domestic construction picks up sooner than anticipated (2013/2014).
- Higher than anticipated oil costs, which directly influence transportation costs.

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27 U.S. Energy Information Administration
Low Scenario

More optimistic forecast assumptions (relative to most probable):

- U.S. and local real GDP growth remains flat through 2014 and thereafter experiences slow to moderate growth.
- Domestic construction demand remains anemic through 2014 and thereafter experiences slow to moderate growth.
- Lower than anticipated oil costs, which directly influence transportation costs.

6.2 Transportation Costs

Construction materials in San Diego are generally regionally available, but this sometimes means importing materials from Los Angeles or elsewhere in Southern California. An increased reliance on transportation may place some upward pressure on the cost of those materials.

Oil prices are driven first and foremost by overall world demand. Limited supply is the second major driver, both due to Organization of the Petroleum Exporting Countries controls, as well as limitations in refining capacity.

Because of high fixed costs, U.S. refining capacity does not provide sufficient excess margin when demand spikes, or when refineries are put out of commission, such as after the Gulf of Mexico oil spill, and Hurricanes Katrina and Rita. As a result, refined petroleum product prices can fall independently of oil prices on spot markets. Additional observations:

- Crude oil prices are by far the most sensitive of global commodities to international political relations and conflicts. Political disruptions are always possible, and can result in shortages and price increases at any time.
- Because crude oil is commoditized—that is, it is sold primarily on spot markets, rather than directly from country to country—and also priced in U.S. dollars, individual exchange rates are less important than the overall strength of the U.S. dollar.

Based on the discussion above, the following assumptions for the respective scenarios were used:

Most Probable: Forecast assumes the average of the Energy Information Agency’s Base and High forecasts as a proxy for transportation costs

High Scenario: Forecast assumes the Energy Information Agency’s High forecast as a proxy for transportation costs

Low Scenario: Forecast assumes the Energy Information Agency’s Base forecast as a proxy for transportation costs
Chapter 7.0 – Individual Cost Component Forecasts

7.1 Steel

7.1.1 Market Conditions

Historically, steel has been a volatile commodity (in terms of price) and its volatility is due to the globalized nature of its factor inputs. As illustrated in Figure 7-1, the supply chain for steel is divided into three primary groups—raw material/inputs, production, and fabrication/delivery.

**Figure 7-1. Steel Supply Chain**

- **Raw Materials / Inputs:** Steel scrap and iron ore are vital raw materials for the production of new steel and cast-iron products. Most mills in the U.S. use scrap to produce steel. Price volatility in the price of scrap steel is the most significant contributor to the high degree of unpredictability in the price for finished steel products. Steel scrap is made from cans, automobiles, appliances, construction materials, and other steel products. Re-melting of scrap requires much less energy than the production of iron and steel products from iron ore. The global demand for steel scrap and the growth of the local automobile industry has had a significant effect on domestic scrap prices; thereby increasing overall steel prices. The high price volatility is illustrated in Figure 7-2, where over the past decade scrap prices have had very high spikes (approximately 80-percent annual growth) and declines (approximately -40-percent annual decline). In 2012 the price of scrap steel declined 12.5-percent and year-to-date for 2013 prices have fallen an additional 7.1-percent.

- **Production:** To produce steel, facilities use one of two processes: the basic oxygen furnace (BOF) or the electric arc furnace (EAF). The BOF process uses 25-percent to 35-percent scrap steel to make new steel. BOFs make up approximately 40-percent of today’s steelmaking in the U.S. The EAF process uses virtually 100-percent scrap steel to make new steel. EAFs make up about 60-percent of today’s steelmaking in the U.S. For mills that use basic oxygen furnaces, metallurgical coal (or coking coal) is a vital ingredient. For mills that use EAFs, electricity is a significant cost component.
Steel has been a volatile commodity. Prices peaked in the third quarter of 2008 then fell by 32-percent through the second quarter of 2009. After their steep drop off prices recovered, but at a much more modest pace and remained relatively stable through 2011. However, 2012 and 2013 (year-to-date) saw consistent declines, falling approximately 9.4-percent between Q2 2012 and Q2 2013 (Figure 7-3). When there is price volatility, often the Service Centers are the ones whose margins are most affected.

At this time, there is no concern about capacity constraints, since nationally steel mills are operating at below 80-percent capacity and have generally been operating between 70 and 80-percent since January of 2011 (see Figure 7-4). When talking with those in the industry, they expressed no concerns over current capacity or the near term outlook. While the construction market is recovering it is doing so at a moderate rate allowing steel mill capacity to keep pace.

7.1.2 Forecast Assumptions

Most Probable

Forecast assumes:

- 2013 forecast: steel prices have declined 0.5-percent in quarter (Q) 1 2013 and declined 1.8-percent in Q2. No price change is forecast over the remaining three quarters.
Figure 7-3. Steel Prices (PPI) Index Value Percent Change (Quarterly)

Source: U.S. Bureau of Labor Statistics

Figure 7-4. National Steel Mill Capacity Utilization (Monthly January 2008 – June 2013)

Source: American Iron and Steel Institute
The forecast anticipates that steel prices will return to 2012 levels in 2014.

- All steel is sourced from U.S. (due to Buy America provisions).

- Scrap steel prices are a significant cost driver of finished products, and we anticipate moderate long-term growth (3.1-percent, which is the long term compound annual growth rate (CAGR) for scrap prices 1983-2003). Beyond 2003 the steel prices were heavily influenced by the global construction boom, with periods of both rapid expansion and contraction. This period was treated as an outlier and was not used to calculate the long term CAGR.

- Transportation costs are a significant share of total costs.

- Energy used in the production of steel is moderate share of total costs.

- No capacity constraints.

- The anticipated recovery of the global and domestic economies in conjunction with the sustained recovery of construction activity is expected to place upward pressure on scrap steel prices in 2014, 2015, and 2016.

**High Scenario**

More pessimistic forecast assumptions (in comparison to most probable):

- In the second half of 2013 we anticipate steel prices to show 1-percent quarterly growth.

- 5.9-percent CAGR for scrap prices, which is the historical CAGR from 1983-2013. Unlike the most probable scenario, this scenario incorporates the entire historical time period (including the boom period).

- Capacity constraints due to higher than anticipated demand increases price escalation in the medium term.

- Higher overall demand for steel (including scrap steel) is driven by higher economic growth both domestically and in emerging markets.

**Low Scenario**

More optimistic forecast assumptions (in comparison to most probable):

- Steel prices in 2013 continue to decline at current rates (0.5-percent per quarter).

- Lower than anticipated energy prices for both transportation and production.

- No capacity issues lead to lower price escalation in the medium term. Lower overall demand for steel (including scrap steel).

**Forecast Summary**

Steel prices are expected to have a compound annual growth rate (CAGR) of 3.6-percent (2013-2022) in the most probable case, compared to the 2003-2012 CAGR, which was 7.4-percent. The forecasted growth (most probable) is influenced by
transportation costs (which are a significant contributor to overall costs), growing global demand for scrap steel.

The high and low scenarios have 10-year CAGRs of 6.3-percent and 1.7-percent respectively. The forecasts, and historical comparisons, are shown in Table 7-1 and Figure 7-5.

### Table 7-1. Steel Cost Escalation Forecast Summary Table (Most Probable, High, and Low Scenarios)

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### Figure 7-5. Steel Cost Escalation Forecast Graph (Historic, Most Probable, High, and Low Scenarios)

Source: U.S. Bureau of Labor Statistics, Moody’s Analytics, and Parsons Brinckerhoff Analysis
7.2 Concrete

7.2.1 Market Conditions

Concrete is primarily a combination of aggregates (sand and stone) and cement. When blended together, the resulting product is known as ready-mix concrete. Because the concrete cures naturally in a short period of time, it must be sourced from a batching facility that is close to the construction site.

There are three primary cost drivers for ready-mix concrete, namely transportation costs (localized), cement costs (sourced from elsewhere in the U.S. or Mexico), and aggregates (sourced locally).

The concrete supply chain can be categorized into sourcing of raw materials, production, and delivery (see Figure 7-6).

![Concrete Supply Chain diagram](image)

- **Raw Materials / Inputs**: Portland cement is a key ingredient in the production of concrete. As such the demand (both global and local) is a key cost driver for concrete. Historically, Portland cement prices have been relatively stable. As a global commodity, however, its price may be affected as countries such as China, Russia, India and Brazil increase infrastructure construction (see Figure 7-7).

  Aggregates make up approximately 60 to 75-percent of ready-mix concrete’s volume. Given the high transportation costs, aggregates are generally sourced from local quarries. As such, local quarry capacity is a key driver in concrete costs (see Figure 7-8).

- **Production**: The raw materials are mixed at batching plants. These plants have to be located close to the construction site.

- **Delivery**: Concrete transportation costs are high and generally vary with distance and time. As such, the capacity of local batching plants is a key cost driver for concrete.
Figure 7-7. Cement Prices (PPI) Index Value Percent Change (Quarterly)

Source: U.S. Bureau of Labor Statistics

Figure 7-8. PPI for Ready-mix Concrete

Source: U.S. Bureau of Labor Statistics
7.2.2 Forecast Assumptions

Most Probable

Forecast assumes:

- Year to date ready-mix concrete has experienced growth of 1.2-percent. This, as well as the fact that over the past eight quarters it has exhibited a low but stable growth rate (averaging 0.5-percent), informed the probable forecast.
- Aggregate is the primary driver of concrete costs, growth in aggregate prices is anticipated to peak between 2014 and 2016 as a result of local construction demand.
- Secondary cost drivers include cement, production energy, and transportation. Cement is a global commodity and, as such, is expected to see peak growth in 2015 and 2016 as a result of the expanding global economy.

High Scenario

More pessimistic forecast assumptions (in comparison to most probable):

- Local aggregate capacity constraints result in aggregate being imported from outside the region, increasing transportation costs.
- Cement prices increasing at higher than anticipated rates due to increased global demand.

Low Scenario

More optimistic forecast assumptions (in comparison to most probable):

- No aggregate capacity issues.
- Cement prices increasing at a lower than anticipated rate due to weaker global demand.

Forecast Summary

Concrete prices are expected to have a 10-year CAGR of 3.1-percent. This is lower than the 4.1-percent CAGR from 2003-2012, however this period covered the housing bubble. Behind this forecast is an expected recovery in the construction market by 2016.

The high and low scenarios have 10-year CAGRs of 4.6-percent and 2.0-percent, respectively. The forecasts, and historical comparisons, are shown in Table 7-2 and Figure 7-9.

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7.3 Labor

7.3.1 Market Conditions

From February of 2009 through October 2012, the unemployment rate in California was 10 percent or greater. In recent months the unemployment in California has begun to fall. However, through the first half of 2013 it was still on average 1.5 percent higher than national rates (see Figure 7-10).

Given the high levels of unemployment, there is little risk of labor shortages impacting construction costs or delivery. Despite the fact that the construction industry is currently facing high unemployment, union contracts tend to hold labor costs at stable, long-term growth rates.
7.3.2 Forecast Assumptions

Most Probable

Forecast assumes:

- Prevailing wage rates must be used on all San Diego Association of Governments (SANDAG) construction projects.
- Using San Diego or Southern California specific Master Labor Agreements (MLAs) for the following categories, average increases in compensation were calculated through 2014 (when the majority of the MLAs will be renegotiated):
  - Laborer, Building Construction
  - Laborer, Engineering Construction
  - Carpenter, Heavy and Highway Work
  - Cement Masons, Engineering Construction
  - Cement Masons, Building Construction
  - Operating Engineers
  - Teamsters

Source: Bureau of Labor Statistics
- Iron Workers
- General Laborers

- Wage rate increases start to rise, due to improved economic conditions, starting in Fiscal Year (FY) 2015.

High Scenario

More pessimistic forecast assumptions (in comparison to most probable):

- Wage increases anticipated to remain at the low end of historical increases in FY 2015.
- Wage rate increases, rising to slightly below historical averages by FY 2015.
- Long term rate increases from FY 2015 on at moderately above historical growth averages.

Low Scenario

More optimistic forecast assumptions (in comparison to most probable):

- Wage increases anticipated to remain below the low end of historical increases in FY 2014 and FY 2015.
- Wage rate increases stabilizing at the low end of the historical range from FY 2015 on.

Forecast Summary

Wages are expected to have a 10-year CAGR of 2.8-percent; behind this forecast is an expected recovery in the construction market by 2016.

The high and low scenarios have CAGRs of 3.5-percent and 2.4-percent, respectively. The forecasts, and historical comparisons, are shown in Table 7-3 and Figure 7-11.

Table 7-3. Labor Cost Escalation Forecast Summary Table

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7.4 **Construction Equipment**

7.4.1 **Market Conditions**

Construction equipment is typically distributed to contractors through a network of local dealers (or local branches of national rental firms) through both rental/lease arrangements and outright purchases. This is supplemented by rental arrangements between contractors. Equipment at the Original Equipment Manufacturer level comes primarily from four large firms: Case, Deere, Caterpillar, and Komatsu. See Figure 7-12 for an illustration of the supply chain for construction equipment.

At all levels of the supply chain construction equipment dealers, manufacturers, and renters were severely impacted by the economic downturn.

The downturn in construction demand which led to excess equipment in the market originally caused used equipment prices to fall considerably. Over the past nine months the excess supply has dried up, much of it having gone overseas, and now the price of used equipment relative to new equipment is back to historical norms.
New U.S. Environmental Protection Agency emission regulations for construction equipment, called Tier IV, have largely been implemented. Interim Tier IV standards have been in effect since 2011. These standards apply to all new equipment. The new emissions standards, which are met by burning fuel at hotter temperatures, have increased the cost of equipment by approximately 8-percent (from Q4 2008 to Q2 2012). Implementation of Tier IV interim standards were first implemented in 2008, with a second wave in 2011/2012, and final Tier IV standards have started to be phased in as of 2012 and will be completed by 2015 (see Figure 7-13). While Tier IV standards have yet to fully come into effect, data and interviews suggest that it has already been fully factored into equipment prices.

From January 2006 to January 2009 construction equipment prices rose 10.5-percent. Prices then stagnated for a period growing only 0.3-percent over the next 22 months (January 2009 to November 2010). In 2011 quarterly growth averaged 1.2-percent with approximately 5.0-percent growth between Q4 2010 and Q4 2011. Over 2012, construction equipment prices trended moderately upwards with a 1.6-percent growth Q2 2013 over Q2 2012 and (Figure 7-14).

The downturn in construction demand led to excess equipment in the market. This has driven used equipment prices to fall drastically, but the price of new equipment remains steady. Increased international demand for used equipment has allowed dealers to lower their inventories, which is a key component of surviving a down construction market. Costs of new machinery and equipment rose steadily from 2004 through 2008, but tapered off in 2009 with the economic downturn. Unlike the market for used equipment and machinery, new equipment was only been minimally impacted by the recession, though it has seen a decline in prices in 2013 Q2.

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28 This figure comes from discussions with individuals in the construction equipment sector.
Figure 7-13. EPA Emissions Schedule


Figure 7-14. Machinery and Equipment PPI, Index, and Percent Change (Quarterly)

Source: Bureau of Labor Statistics
7.4.2 Forecast Assumptions

Most Probable

Forecast assumes:

- Though final Tier IV regulations will not be fully implemented until 2015, the impact on price has already been materially incorporated.
- Other factors that affect the forecast include:
  - Chinese, Brazilian, Russian and Indian demand for construction equipment.
  - Moderate growth of the residential construction market.

High Scenario

More pessimistic forecast assumptions (in comparison to most probable):

- Higher than anticipated price growth in 2014-2015 due to Tier IV requirements coming into full effect.
- Stronger than anticipated growth of the residential construction market, which would increase demand for construction equipment.
- Higher than anticipated fuel prices.

Low Scenario

More optimistic forecast assumptions (in comparison to most probable):

- Slower than anticipated growth in the residential construction market.
- Lower than anticipated fuel prices.

Forecast Summary

Construction equipment is expected to have, in the most probable scenario, a 10-year CAGR of 3.0-percent (2013-2022), which is in line with the historic CAGR (2003-2012) of 3.1-percent.

The high and low scenarios have 10-year CAGRs of 4.6-percent and 2.0-percent, respectively. The forecasts, and historical comparisons, are shown in Table 7-4 and Figure 7-15.

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7.5 Other Materials

7.5.1 Forecast Assumptions

Most Probable

Other Materials and Service is a large basket of various types of equipment, manufactured goods, construction works, and services, for which the mix will likely vary year to year. Thus, developing a comprehensive forecast was not feasible.

As a benchmark, Caltrans overall construction cost index was compared with San Diego MSA Consumer Price Index (CPI). On average, Caltrans construction index was 1 percentage point higher than San Diego MSA CPI. Based on this correlation analysis, the forecasts for Other Materials and Services were developed by adding 1 percentage point to the Moody’s Analytics CPI forecasts for the San Diego MSA.

High Scenario

More pessimistic forecast assumptions (in comparison to most probable):

- An additional 1-percent was added to the Moody’s Analytics forecast for San Diego MSA CPI for a total adjustment of plus 2.0-percent.
Low Scenario

More optimistic forecast assumptions:

- 1-percent was removed from the most probable case forecast for an adjustment of 0-percent when compared to Moody’s Analytics forecast for San Diego MSA CPI.

Forecast Summary

Other Material is expected to have, in the most probable scenario, a 10-year CAGR of 3.75-percent (2013-2022). The high and low scenarios have 10-year CAGRs of 4.75-percent and 2.75-percent, respectively. The forecasts, and historical comparisons, are shown in Table 7-5 and Figure 7-16.

Table 7-5. Other Materials and Services Cost Escalation Forecast Summary Table

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Figure 7-16. Other Materials and Services Cost Escalation Forecast Graph
7.6 Right-of-Way

7.6.1 Market Conditions

As was the case across the country home prices in San Diego saw a marked climb in the early to mid-2000s with the mean home price rising 54-percent in real terms between 2002 and 2005. This sharp rise was followed by steep decline. After peaking in 2005 mean home prices in San Diego have fallen 45-percent in real terms through 2012. Overall between 2002 and 2012 the mean real home price in San Diego has fallen by 17-percent (see Figure 7-17).

Figure 7-17. Mean Home Prices San Diego (2005 $)

![Home Price Graph](image)

Source: Moody’s Analytics

Commercial real estate prices in San Diego followed a similar trend, though with a less steep rise and fall. Commercial prices peaked in 2007 at $239 per square foot (2005 $) a 20-percent increase over 2004 then fell 27-percent through 2009 since which time prices have remained fairly stable. Since 2002 the real price per square foot for commercial property in San Diego has risen 3.4-percent (see Figure 7-18).
7.6.2 Forecast Assumptions

Most Probable
Forecast assumes the following components:

- Historic price trends are good predictors of future trends.
- A Commercial/Residential split of 93.5-percent to 6.5-percent.

High Scenario
Forecast assumes (in comparison to most probable):

- Annual growth 0.25-percent faster than in the probable case

Low Scenario
Forecast assumes (in comparison to most probable):

- Annual growth 0.25-percent lower than in the probable case.
Forecast Summary

Forecasts for overall increases in Right-of-Way (ROW) were created by taking a weighted average of the residential and commercial forecasts (weights as determined by the ROW breakdown discussed in the methodology section). Then to create a nominal growth rate the annual growth rates in San Diego CPI, as forecast by Moody’s Analytics was, added to the series. The forecasts, and historical comparisons, are shown in Table 7-6 and Figure 7-20.

Table 7-6. Right of Way Cost Escalation Summary Table (Most Probable, High, and Low Scenarios)

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<tr>
<td>High</td>
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<td>7.3%</td>
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<td>5.1%</td>
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<tr>
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</table>

Figure 7-19. Right of Way Cost Escalation Forecast Graph
7.7  Professional Services

7.7.1  Market Conditions

For the Mid-Coast Corridor Transit Project, professional services are categorized as design and construction-related activities such as, architects, construction oversight, legal, and financial. There is some concern among the industry that supplies of professional services in San Diego are insufficient for a project of Mid-Coast's size. While additional resources are located throughout the region (in Los Angeles and elsewhere in Southern California), these resources may be taxed by other impending major infrastructure projects in the region. For forecasting purposes it has been assumed that some of the professional services will need to be sourced from outside of the region.

As shown in Figure 7-20, the wage escalation for professional services in California has tracked relatively well with the national average. Wages in California tend to be higher than the national average, but the relative rate of changes tend to be similar.

Figure 7-20. Average Annual Wage for Professional and Business Services: California and U.S.

![Graph showing average annual wages for professional and business services in California and the U.S.](image)

Source: Moody's Analytics
Note: California Average Annual Wages indexed to U.S. average for visual representation

Figure 7-21 compares California’s labor market to that of the U.S. as a whole. While not specific to professional services or Southern California, the condition of the general labor market provides useful insight which is relevant to professional services. The horizontal axis measures the current unemployment rate (proxy for current labor market conditions), and the vertical axis measures the proportion of jobs lost over the recession (proxy for the recessions’ effect on job supply). In Figure 7-21 the upper-right quadrant signifies a disproportionate loss of jobs relative to that of the total U.S. and
unemployment rates higher than national unemployment rates. Conversely, the lower left quadrant signifies unemployment rates lower than the national averages and smaller job losses during the recession. California’s labor market was significantly affected during the recession, with current job losses totaling 3.5-percent since the start of the recession (the U.S. in comparison was 1.5-percent) and the California unemployment rate of 8.7-percent (July 2013) is higher than the U.S. unemployment rate of 7.4-percent.

7.7.2 Forecast Assumptions

Most Probable

Forecast assumes the following components:

- Permanent residents
  - Escalated at the average wage rate for professional and business services in California with forecast from Moody’s Analytics

- Temporary San Diego residents relocated from rest of the U.S.
  - Average wage rate for professional and business services in the U.S. with forecast from Moody’s Analytics
  - Fringe (expenses such as relocation, per-diem, travel insurance, travel, etc.) escalated using Moody’s Analytics CPI forecast
U.S. labor (Outside of California)
- Escalated at the average wage rate for professional and business services in the U.S. with forecast from Moody’s Analytics

Overhead on professional and services labor included in all of the above categories
- Escalation rates based on Parsons Brinckerhoff’s analysis of historical overhead rates (including U.S. Bureau of Labor Statistics (BLS) data)

High Scenario
Forecast assumes (in comparison to most probable):

- Higher annual growth of overhead costs
- Faster recovery of demand for professional services in the U.S. and locally leading to higher near-term cost growth
- Higher than anticipated long-term economic growth in both U.S. and California that results in higher escalation for professional services from FY 2015

Low Scenario
Forecast assumes (in comparison to most probable):

- Lower annual growth of overhead costs
- Slower recovery of demand for professional services in the U.S. and locally leading to lower near-term cost growth
- Lower than anticipated long-term economic growth in the U.S. and California that results in lower escalation for professional services from FY 2015

Forecast Summary
Professional Services is expected to have a 10-year CAGR of 2.5 percent. The high and low scenarios have CAGRs of 3.0 percent and 2.0 percent, respectively. The forecasts, and historical comparisons, are shown in Table 7-7 and Figure 7-22.

Table 7-7. Professional Services Cost Escalation Forecast Summary Table

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7.8 Vehicles (Rolling Stock)

7.8.1 Market Conditions

Unlike commodities (such as steel, concrete, etc.) whose prices depend on global supply and demand market factors, the price of rolling stock is highly dependent on project specifications, procurement guidelines, and individual bid firm characteristics.

SANDAG has an existing contract with Siemens for the procurement of 57 rail vehicles for the Trolley Blue and Orange lines. This contract includes an option for future procurement of rail vehicles required for the Mid-Coast Corridor Transit Project. However, this escalation rate forecast assumes that the vehicles will be acquired in a competitive procurement. In terms of procurement guidelines, the Mid-Coast Corridor Transit Project will abide by Title 49 Code of Federal Regulations Section 661.11 (the “Buy America” regulations), which requires the following:
The cost of components produced in the U.S. is more than 60-percent of the cost of all components.

- For a component to be of domestic origin, more than 60-percent of the subcomponents of that component, by cost, must be of domestic origin, and the manufacturing of the component must take place in the U.S.

- Final assembly of trains purchased with the support of Federal funds must occur in the U.S.

The global rail vehicle industry is dominated by six non-U.S. firms: Bombardier (Canada); Alstom (France); China CNR and China South Locomotive and Rolling Stock Industry Group (China); Siemens (Germany); and Transmashholding (Russia). As a result of the lack of large domestic rail car firms, a large number of foreign-owned rail car manufacturers participate in the U.S. market (see Figure 7-23). Many of these non-U.S. firms predominantly keep their higher value activities, such as design and engineering, in their home countries, or at least in locations near much larger rail car markets.

The probability of the Mid-Coast Corridor Transit Project procuring rolling stock from a non-U.S. firm is high. As such, the forecast assumes that this non-U.S. firm will only abide by the minimum requirements of the “Buy America” requirements (i.e., 40-percent of components and materials, including car shells, will be sourced abroad).

As shown in Figure 7-24, the Producer Price Index (PPI) for Rail Equipment (as measured by quarterly percent change) has over the recent years grown at a modest rate of around 0.5 percent. There is no reason to expect this trend to change in the near future. Although Rail Equipment PPI is the closest historical guide for rolling stock prices, it is not a perfect proxy because some of the major cost drivers for rolling stock manufacture (such as internationally-sourced components, which may constitute as much as 40 percent of total costs under “Buy America” provisions) are not included in the U.S. PPI data.

The U.S. value chain for rolling stock can be divided into three categories: 1) Original Equipment Manufacturers (OEM) that build the railcar and locomotive shells and perform final assembly; 2) Tier 1, which consists of firms that provide main systems that go into rail vehicles (such as propulsion, electronics, and body and interior); and 3) Tier 2, which includes materials (steel, iron, etc.) and other input parts (such as switch gear, sensors, etc.).

The forecast assumes that the rolling stock will be procured from a non-U.S. firm that will only abide by the minimum requirements of the “Buy America” provisions. Accordingly, on the value chain a non-U.S. OEM firm may manufacture shells abroad and transport them to the U.S. for final assembly. Professional services, such as design, engineering, and OEM functions other than shell manufacturing, will also likely be done abroad. More than 60-percent of the cost components that are in Tier 1 and Tier 2 will be sourced from the U.S.

### Figure 7-23. Rail Car Manufactures Serving the U.S Market, with International Footprint

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<th>Intercity Passenger Rail</th>
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- Firm serves U.S. railcar market
- Firm serves U.S. locomotive market
- Firm serves non-U.S. market

**Notes:**
- Between 1976 and 1981, EMD supplied locomotives to Amtrak that are still part of the active fleet.
- Kasgro Rail Corporation, predominantly a freight rail company, supplied vintage streetcars for Galveston, TX.
- Skoda Transportation is leasing its streetcar technology to United Streetcar, which is manufacturing streetcars in the United States. Skoda does not have a U.S. manufacturing/assembly location.
- Worldwide, Talgo is solely focused on intercity passenger rail with speeds of 79 - 235 mph. Talgo does not yet have a U.S. manufacturing location; however, the company since 1998 has operated a maintenance facility in Seattle, WA, where it maintains trains it built for Amtrak. In 2010 Talgo will open a plant in Milwaukee, WI to build high-speed trainsets (see page 49).

**Source:** Center for Globalization, Governance, and Competiveness, “U.S. Manufacture of Rail Vehicles for Intercity Passenger Rail and Urban Transit,” June 2010
Figure 7-24. Rail Equipment PPI

Source: U.S. Bureau of Labor Statistics

7.8.2 Forecast Assumptions

Most Probable

Forecast assumes the following:

- “Buy America” provisions, which require at least 60-percent of all materials be procured from the U.S., will be followed and all rail cars will be assembled in the U.S. (this is assumed under all scenarios).
- The supplier will fulfill only the minimum sourcing requirements of the “Buy America” provisions since rail car manufacturing is a predominately international industry.
- Steel car shells will be imported from outside the U.S. (forecast data are derived from Moody’s Analytics forecast of Steel Mill Products PPI).
- Remaining materials (propulsion, electronics, body, and interior) will be sourced from both within the U.S. and internationally (forecast data are derived from Moody’s Analytics U.S. CPI forecast and International Monetary Fund’s (IMF) forecast of CPI for emerging economies).
- Assembly, which entails manufacturing labor, will be conducted in the U.S. (forecast data are derived from Moody’s Analytics U.S. Average Manufacturing Wage forecast).
• Engineering, project management, and other professional services will be conducted internationally (forecast data are derived from the IMF’s Advanced Economy CPI forecast).

• Transportation costs will be minimal in comparison to the overall rail car cost (forecast data are derived from the Energy Information Administration forecast of diesel fuel prices).

**High Scenario**
Forecast assumes (in comparison to most probable):

• Higher than anticipated steel price growth
• Higher than anticipated CPI growth (U.S. and international)
• Higher than anticipated manufacturing wage growth
• Higher than anticipated transportation costs

**Low Scenario**
Forecast assumes (in comparison to most probable):

• Lower than anticipated steel price growth
• Lower than anticipated CPI growth (U.S. and international)
• Lower than anticipated manufacturing wage growth
• Lower than anticipated transportation costs

**Forecast Summary**
Rolling Stock is expected to have a 10-year CAGR of 2.9-percent. The high and low scenarios have CAGRs of 3.4-percent and 2.4-percent, respectively. The forecasts, and historical comparisons, are shown in Table 7-8 and Figure 7-25.

**Table 7-8. Vehicles (Rolling Stock) Cost Escalation Forecast Summary Table**

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<tr>
<td>Most probable</td>
<td>3.3%</td>
<td>3.6%</td>
<td>3.3%</td>
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<td>2.8%</td>
<td>2.4%</td>
<td>2.4%</td>
<td>2.5%</td>
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<td>2.5%</td>
</tr>
<tr>
<td>High</td>
<td>3.6%</td>
<td>3.9%</td>
<td>3.9%</td>
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<td>3.1%</td>
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<tr>
<td>Low</td>
<td>2.8%</td>
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</tbody>
</table>
Figure 7-25. Vehicles (Rolling Stock) Cost Escalation Forecast Graph

- Rolling Stock (History)
- Probable
- High
- Low

2009 = 100
8.0 OVERALL FORECAST

The component-level forecasts were used to derive three bottom-line forecasts to be applied to the cost estimate (see Table 8-1, Table 8-2, and Table 8-3). These three bottom-line forecasts were derived as follows:

Composite Forecast (SCC 10 through 50)

The component-level forecasts for steel, concrete, labor, construction equipment, and other materials and services were combined using approximate weights from the construction cost estimate for each component. The resulting weighted-average average rate was then adjusted to account for the competitiveness of the market, the degree to which contractors could pass costs onto customers, and the degree to which contractors are cutting margin to win highly competitive bids. The scenarios for each of these forecasts are detailed in individual component sections of this report.

Right-of-Way (SCC 60)

The property value escalation forecast as detailed in this report were used.

Vehicle (Rolling Stock) (SCC 70)

The vehicle escalation forecast as detailed in this report were used.

Professional Services (SCC 80)

The professional services escalation forecast as detailed in this report were used.

Table 8-1. Component Level Forecasts, Weightings, and Bottom Line Forecasts (Most Probable)

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Notes: SCC = Standard Cost Categories
### Table 8-2. Component Level Forecasts, Weightings, and Bottom Line Forecasts (High)

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Notes: SCC = Standard Cost Categories

### Table 8-3. Component Level Forecasts, Weightings, and Bottom Line Forecasts (Low)

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Notes: SCC = Standard Cost Categories
Appendix A
Interview Profiles
APPENDIX A  INTERVIEW PROFILES

- Senior Economist (San Diego Association of Governments)
- Principal Construction Engineer (San Diego Association of Governments)
- Senior Construction Engineer (San Diego Association of Governments)
- Senior Engineering Manager (Balfour Beatty)
- A leading steel fabricator whose primary market is the West Coast.
- A major building materials and construction firm that serves the Western U.S. and Canada.
- Supplier of Light Rail Vehicles
Appendix B
Independent Variables Considered but Not Used in the Final Regression Model for Right-of-Way Cost Forecasting
APPENDIX B  INDEPENDENT VARIABLES CONSIDERED BUT NOT USED IN THE FINAL REGRESSION MODEL FOR RIGHT-OF-WAY FORECASTING

- Employment
- Government employment
- Gross regional product
- Income
- Lagged housing starts
- Population
- Post-housing boom dummy variable
- Pre-housing boom dummy variable
- Unemployment
Appendix C
Detailed Regression Output
APPENDIX C  DETAILED REGRESSION OUTPUT

Residential Real Estate Price Model E-Views Output:
Mean Home Prices

![E-Views Output](image)

- Dependent Variable: LOG(HOME_PRICE_REAL)
- Method: Least Squares
- Date: 08/23/13  Time: 17:32
- Sample (adjusted): 1986-2012
- Included observations: 27 after adjustments
- Convergence achieved after 12 iterations
- MA Backcast: 1985

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R-squared: 0.929202
Adjusted R-squared: 0.923303
S.E. of regression: 0.074446
Sum squared resid: 0.133012
Log likelihood: 33.41625
Hannan-Quinn criterion: -2.210242

Inverted AR Roots: .83
Inverted MA Roots: -.90
Commercial Real Estate Price Model E-Views Output:
Commercial Price per Square Foot

![Image showing the regression output table]