2011

I -15 Mira Mesa/ Scripps Ranch Direct Access Ramp and Transit Station Cost Risk Management Report

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3/25/2011

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‘PROBABLE IMPOSSIBILITIES ARE TO BE PREFERRED TO IMPROBABLE POSSIBILITIES’

ARISTOTLE

EXECUTIVE SUMMARY

The purpose of this report is to apply the risk management concepts for assessing the project's risk profile, quantify the risks in terms of cost, and to propose mitigation strategies for managing the risks. Caltrans has developed a Project Risk Management Handbook; the guidelines of this document were followed on this study.

The preferred project site, the I-15 Mira Mesa/ Scripps Ranch Direct Access Ramp and Transit Station, is located in the eastern portion of the Mira Mesa community along I-15, at approximately 380 meters (m) north of the Carroll Canyon Road interchange. The total length of the project is approximately 1.28 km. Currently the project is in the design phase and is set for completion by 2014.

The risk management methodology was applied for quantifying the cost of risks implied in the Risk Register. A Risk Management Team (RMT) was formed and its members represent the project's different functional units. Cost risk analysis results were obtained for the Risk Register; these results were put together for obtaining the project's contingency and the total project cost with risk.

Major findings and mitigation recommendations are included at the last section of this report.

1. PROJECT BACKGROUND

The California Department of Transportation (Caltrans), in cooperation with the Federal Highway Administration (FHWA), is proposing to construct a Direct Access Ramp (DAR) and a Transit Station (TS) to connect the Interstate 15 (I-15) Managed Lanes facility with the local street system and the Mira Mesa and Scripps Ranch communities.

The Project will provide congestion relief for local and regional traffic by providing direct access for transit vehicles from the local streets and Transit Center to the I-15 Managed Lanes.

The San Diego Association of Governments' (SANDAG's) "Final 2030 Regional Transportation Plan" (RTP), updated in 2007, identifies DARs as part of the region's Managed Lane/High Occupancy Vehicle (HOV) network. The RTP specifically identifies DARs as features along the I-15 corridor within the Project area. This Project is classified as a Project Development Category 3 project, as defined in the Project Development Procedures Manual for the following reasons: it is on a previously constructed access controlled route; it will require a new or revised Freeway Agreement and new right of way will be required; it provides a new connection to the freeway; and it does not meet Category 5, 6 or 7.

This project was first identified in the I-15 Managed Lanes Project Study Report (PSR) and draft Project Report (PR). Subsequent to circulation of the I-15 Managed Lanes Draft Project Report in 2002 and in response to public comments, the Mira Mesa/ Scripps Ranch DAR was removed from consideration in the I-15 Managed Lanes project. Therefore, Caltrans determined that a separate PR and an Environmental Document were required for this project.

2. PROJECT SCOPE

The project will construct a Transit Station (TS) and Direct Access Ramp (DAR) that will connect to the Interstate 15 Express Lanes in the communities of Mira Mesa and Scripps Ranch. The Transit Station will be located south of the Hillery Drive/Westview Parkway intersection on the north edge of San Diego Miramar College and will join the DAR located at Hillery Drive, just south of Mira Mesa Boulevard. This improvement will provide a seamless connection between the street system and the Express Lanes.

The Mira Mesa/Scripps Ranch DAR will consist of five structures, including one elevated ramp extending at-grade from Hillery Drive and crossing over southbound I-15 and four on- and off-ramps that will extend to the Express Lanes. The DAR will give direct access for carpools, vanpools, buses, motorcycles, permitted clean-air vehicles and FasTrak users into the Express Lanes without having to merge through mainline traffic.

The Mira Mesa/Miramar College Transit Station will have up to 12 bus bays and associated transit furnishings. It will include one center island passenger platform with four bus bays. The remaining bus bays and passenger platforms will be constructed in a circular pattern surrounding the center island. This Transit Station will serve passenger access and transfer needs for local and express bus routes and will also accommodate planned Bus Rapid Transit (BRT) services.

3. REPORT SCOPE

The scope of the risk management report is to identify, analyze, quantify and respond to the project's risks and uncertainties as mandated by the California Department of Transportation (CALTRANS) within its Office of Statewide Project Management Improvement (OSPMI) per the Project Risk Management Handbook (Second Edition, May, 2007). The report presents the cost risk analysis results for determining the project's contingency amount.

4. SUPPORTING DOCUMENTS

The following documents were used as a basis for the risk management process:

- Project Report
- Value Analysis Report
- Environmental Document
- Project Basic Engineering Estimating System (BEES)

5. CALTRANS RISK MANAGEMENT PROCESS

The risk management methodology follows CALTRANS' guidelines and methodology described with the Project Risk Management Handbook developed by the OSPMI. The cost risk analysis process described within the risk management report uses a probabilistic simulation method based on excel and the *Crystal Ball* software. The cost risk analysis results are intended to serve a critical necessity; the establishment of reasonable contingencies (50 percent confidence level whenever is applicable) to successfully accomplish the project work. Furthermore, the scope of the report includes the identification and communication of important steps, logic, key assumptions, limitations, and decisions to help ensure that the cost risk analysis results can be appropriately interpreted.

The cost risk analysis results are also intended to provide project leadership with contingency information for scheduling, budgeting, programming and project control purposes; as well as to provide tools to support decision making and risk management as the project progresses through design and construction. To fully recognize its benefits, risk management should be considered as an ongoing process conducted concurrently with other important project processes such as scope and execution plan development, resource planning, programming, procurement planning, value analysis, cost estimating, budgeting, and scheduling.

6. METHODOLOGY

The RMT was formed from the Project Development Team (PDT); including representatives from other agencies and consultants. A complete list of the RMT is included in Appendix B. The main project functional units were represented, providing very valuable input to the whole process.

For the study, cost data from the Basic Engineering Estimating System (BEES) as February 8, 2011 was used.

The cost risk analysis process for this study is intended to determine the probability of various cost outcomes and to quantify the required contingency needed to achieve any desired level of cost confidence for the project. For that reason, a cost risk analysis model was created from the Risk Register.

In simple terms, contingency is an amount added to an estimate (cost or schedule) to represent realistic risk scenarios implied with the project. The contingency for this report is only referred to the Risk Register. However, this amount should be considered as part of the project total cost estimate. The amount of contingency included with the project cost estimate depends, at least in part, on the project leadership's willingness to accept the risk of project cost overruns. The less risk that the project leadership is willing to accept, the more contingency should be considered with the project cost estimate. The risk for overrunning the project cost is expressed under different scenarios (confidence levels) in Figure 7.

The confidence level adopted by the RMT for addressing the cost contingency was P50, which represents a 50-percent confidence level. It should be noted that using P50 as a decision criteria is a risk neutral approach, whereas the use of >P50 would be a risk adverse approach, and use of levels less than 50 percent would be risk seeking. Consequently, a P50 confidence level results in greater contingency as compared to the project's current contingency estimate for this study (see Figure 4).

The cost risk analysis process uses the *Monte Carlo* technique to determine the probabilities and contingency. The *Monte Carlo* technique was utilized by a commercially available risk analysis software package *Crystal Ball* that is an add-in to Microsoft Excel. The Risk Register was packaged into an Excel format as a cost risk analysis model and used directly for cost risk analysis purposes.

The primary steps, in functional terms of the risk management process, are described in the following subsections. Risk analysis results are provided in section 8.

Overall, the methodology implemented along the entire process followed the standard steps for implementing risk management: planning, identification, analysis, response, monitoring and control.

6.1 Risk Identification

To begin the process, a kick off meeting was held with the RMT for planning the implementation process and determining the number of meetings required for completing the cost risk analysis.

The risk identification meeting held with the RMT provided the first input data for creating the Risk Register. Identifying the risks via the RMT is considered a brainstorming process which results in establishing a Risk Register that serves as the document for further study. Risks are events and conditions that may influence or drive uncertainty in project performance. They may be inherent characteristics or conditions of the project or external influences, events, or situations such as weather or economic conditions. Risks may have either favorable or unfavorable impacts on project cost and schedule.

The RMT was composed of representatives from different functional units, an external agency and consultants. From this risk identification meeting, a draft Risk Register was produced that identified 49 potential risks, emerging from six different areas, containing the brainstorming output of the meeting attendees.

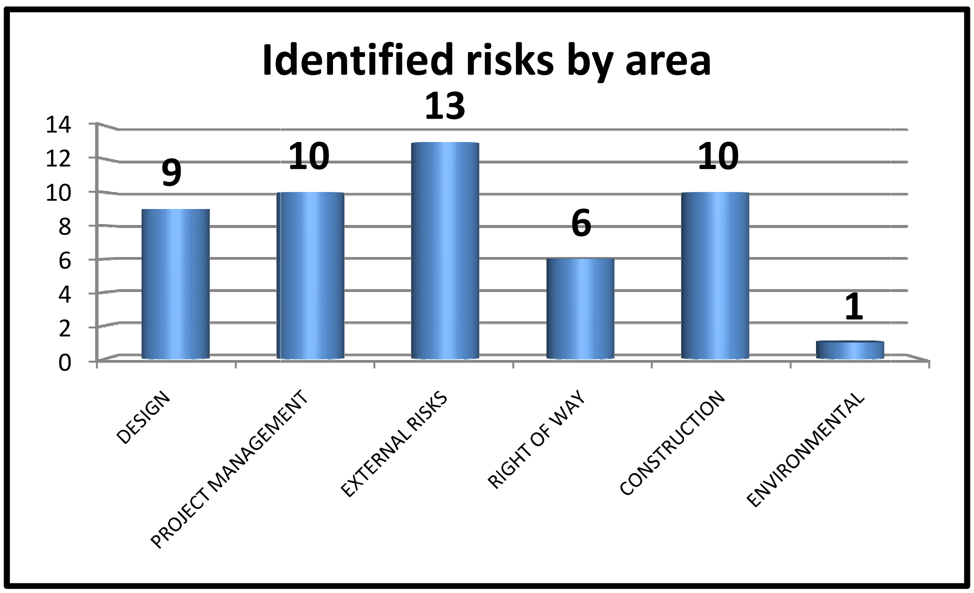


Figure 1. I-15 Mira Mesa/ Scripps Ranch Direct Access Ramp and Transit Station

As can be observed in Figure 1, the highest concentration of risks were within the External (13 risks), Project Management (10 risks) Construction (10 risks) and Design (10 risks) areas. Whereas the areas of Right of Way and Environmental have six and one risks identified respectively.

These risks were identified at the RMT's first meeting, but no risk assessment was performed. This step was part of the subsequent meeting and is described in the next section. For detailed content of the Risk Register refer to Appendix A.

A Caltrans risk checklist was used to facilitate the risk identification. Along with valuable input from the RMT, additional project data from the Project Report, the Environmental Document and the Value Analysis reports was considered.

6.2 Qualitative and Quantitative Cost Risk Analysis

The second meeting of the RMT focused on the qualitative and quantitative risk assessment.

Using the Risk Register developed from the risk identification meeting, the RMT evaluated the probability and impact for each risk. A risk matrix was used in order to combine the risk probability and impact values and for obtaining a risk score. In that way, the risks contained in the Risk Register were classified in terms of their criticality. Refer to appendix A in order to see a detailed example of the qualitative approach used. For example, a risk was considered critical for this study when it's impact was Very High (VH) even though the probability was Low (L). The risk matrix is based on Caltran's Project Risk Management Handbook.

Figure 2 shows the critical risks obtained through the qualitative assessment for the I-15 Mira Mesa/ Scripps Ranch Direct Access Ramp and Transit Station project.

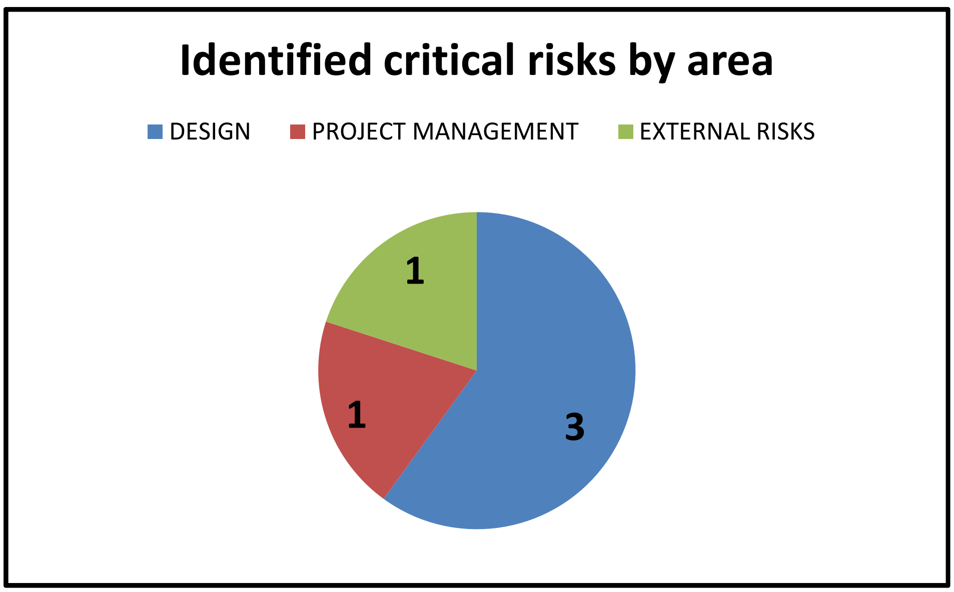


Figure 2. Qualitative Assessment for the I-15 Mira Mesa/ Scripps Ranch Direct Access Ramp and Transit Station Project

The quantitative risk assessment input data was obtained after performing the qualitative risk analysis. This was possible because within the Risk Register, a range of probable risk cost impacts was created and linked to the risk score. In other words, once a risk score was obtained through the qualitative assessment, it was possible to select a cost range representative for its impact. This cost range, represented by minimum and maximum values is used by the simulation model to calculate the probability distribution curve. The risk matrix, the cost range and the risk scores were validated with the RMT.

The quantitative risk impacts were analyzed using a combination of professional judgment and project data. It was an iterative, consensus-building approach to estimate the elements of each risk. Risk impacts were quantified using probability distributions (density functions) that were entered into the *Crystal Ball* software. Refer to appendix A in order to see a detailed example of the quantitative approach used.

As can be observed, from the five identified critical risks in Figure 2, three risks, were assigned to design, one risk to project management and one to external sources.

The risk analysis process is essential for quantifying the risk impacts. Figure 3 describes the process used per Caltrans' risk management guidelines.

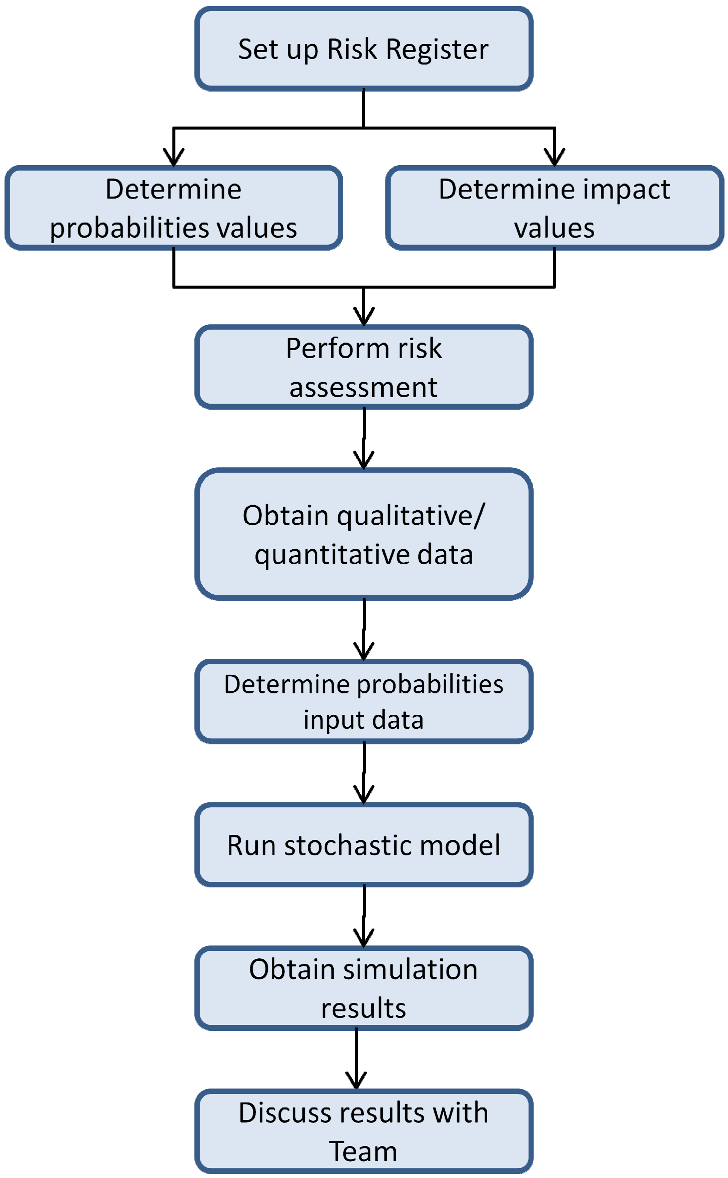


Figure 3. Risk Analysis Approach

The risk analysis results are described in Section 8. The source data for performing the qualitative/quantitative cost risk analysis was the Risk Register as illustrated in Figure 3. It was possible with this approach to determine the total project cost with risk.

6.3 Cost Risk Analysis Model for the Risk Register

The Risk Register is a tool to allow both qualitative and quantitative cost risk analysis to happen simultaneously. A qualitative matrix and scale are used for assessing the risk's probability with its impact which determines a risk score. This risk score is the primary result of the qualitative analysis. If the risk score was identified as critical (red area of risk matrix), the qualitative output was linked to a cost impact table which became the input data for the cost risk analysis model. The cost range provided minimum and maximum values, constituting the input data of the model. A *Monte Carlo* simulation was run for 1000 trials to produce the probability curve that represents the risk contingency behavior.

6.4 Contingency Analysis

Contingency was calculated using *Crystal Ball* software. The *Monte Carlo* simulation technique was performed by using the appropriated estimated cost range values (maximum and minimum) as the risk inputs for the model inserted in the Risk Register. Only the critical risks were considered for the contingency analysis as moderate and low-level risks are typically not considered, but remain within the initial Risk Register created at the identification meeting for monitoring and follow up purposes.

With the Risk Register, the cost obtained with the simulation for each risk represents the contingency. Figure 4 illustrates the contingency quantified by the *Monte Carlo* simulation for this project.

7. KEY ASSUMPTIONS

The following key assumptions are important to ensure that the project leadership and other decision makers understand the steps, logic, limitations, and decisions made in the risk analysis process, as well as any resultant restrictions on the use of findings and results.

In addition, certain risks were excluded due to their nature and triggers (for example earthquakes, Acts of God, etc.).

- The project is in the design phase
- The cost risk analysis was performed only for assessing the project's contingency
- Only the most critical risks were included for the cost risk analysis

8. RISK ANALYSIS RESULTS

This section includes the cost risk analysis results obtained from the *Monte Carlo* simulation for the project. The section is divided into Risk Register analysis results and total project cost risk analysis results.

8.1 Risk Register Contingency

Figure 4 shows the contingencies obtained from the cost risk analysis of the Risk Register. The values of the first column represent the contingency proposed from the project BEES. The simulated cost risk values (50 % confidence level) of the Risk Register items are the ones shown with the second column.

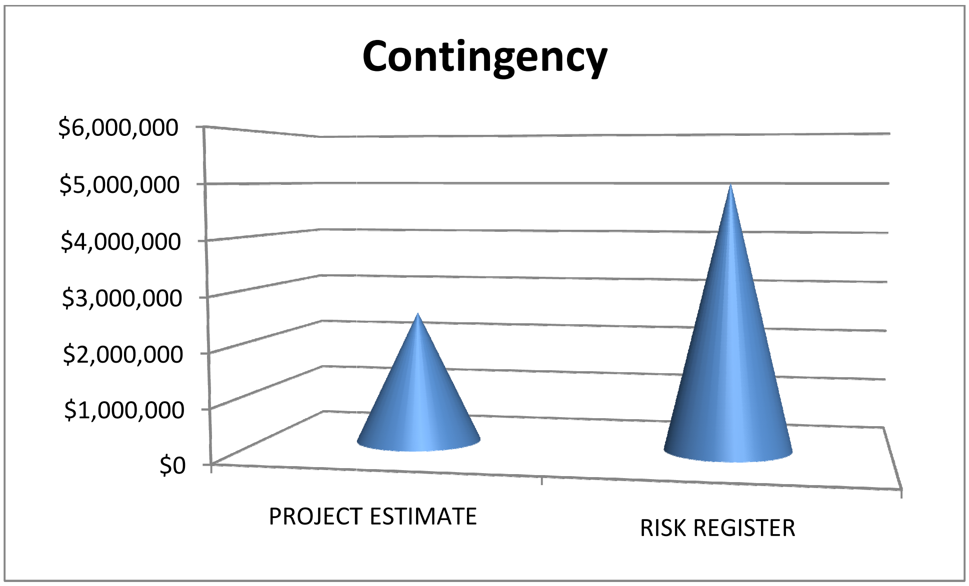


Figure 4: BEES and Risk Register Contingency

The contingency proposed within the project BEES equals $2,499,069 while $5,019,175 of contingency was calculated with the risk analysis exercise. The difference between both contingency amounts is $2,520,106. The Risk Register contingency is based upon those critical risks identified with the RMT which are related to the project's delivery process.

8.2 Total Project Cost

The risk analysis approach was applied as described in Figure 3. The total project cost with and without risks is shown in Figure 5.

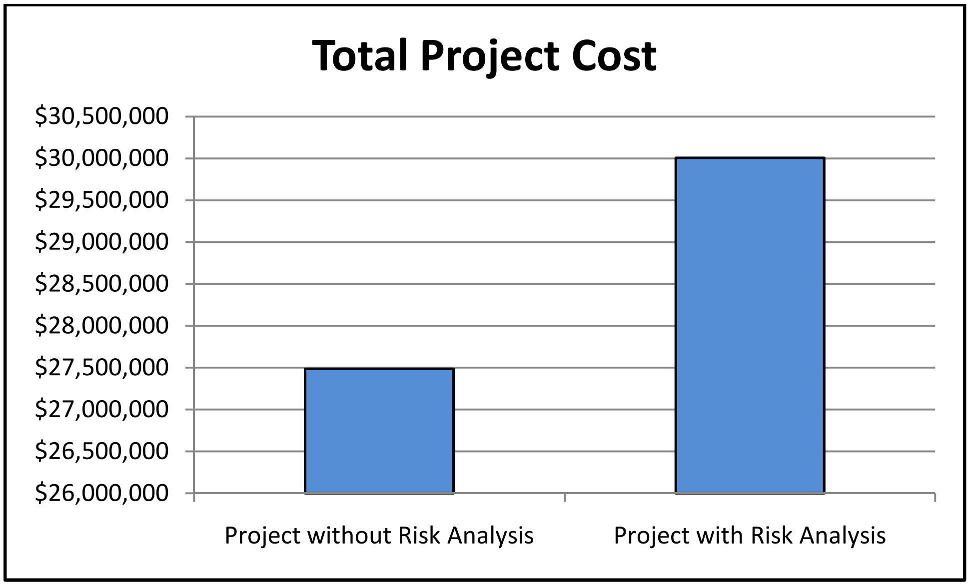


Figure 5: Total Project Cost

The total project cost without risk analysis equals $27,487,511(obtained from the project BEES) and with risk analysis is $30,007,616 (project subtotal cost plus risk contingency). Although the project cost including the risk analysis is higher, it is important to clarify that this is due to the contingency calculated with the Risk Register which at the end, provides more certainty to the project delivery because is direct related to specific risks.

9. MAJOR FINDINGS AND CONFIDENCE LEVELS

This section presents the major findings from the cost risk analysis process. Figure 6 illustrates the contingency probability histogram, together with its frequency behavior along the 1000 iterations. The main output of this histogram is the contingency mean value which equals to $5,019,175.

The cumulative probability distribution with confidence levels for the project cost risk analysis (uncertainty behavior) is presented in Figure 7. The objective is to show the risk impact into the final project cost while selecting an appropriate contingency amount depending on the level of confidence desired by project stakeholders.

The contingency proposed without taking into account the cost risk analysis results equals to 10% ($2,499,069 from the project BEES) of the project total cost. Providing this contingency value a confidence level of less than 10% (see Figure 7), meaning that there is a 90% chance of overrunning. The contingency calculated from the cost risk analysis equals to $5,019,175 (Figure 6), representing a 50% confidence level (mean value).

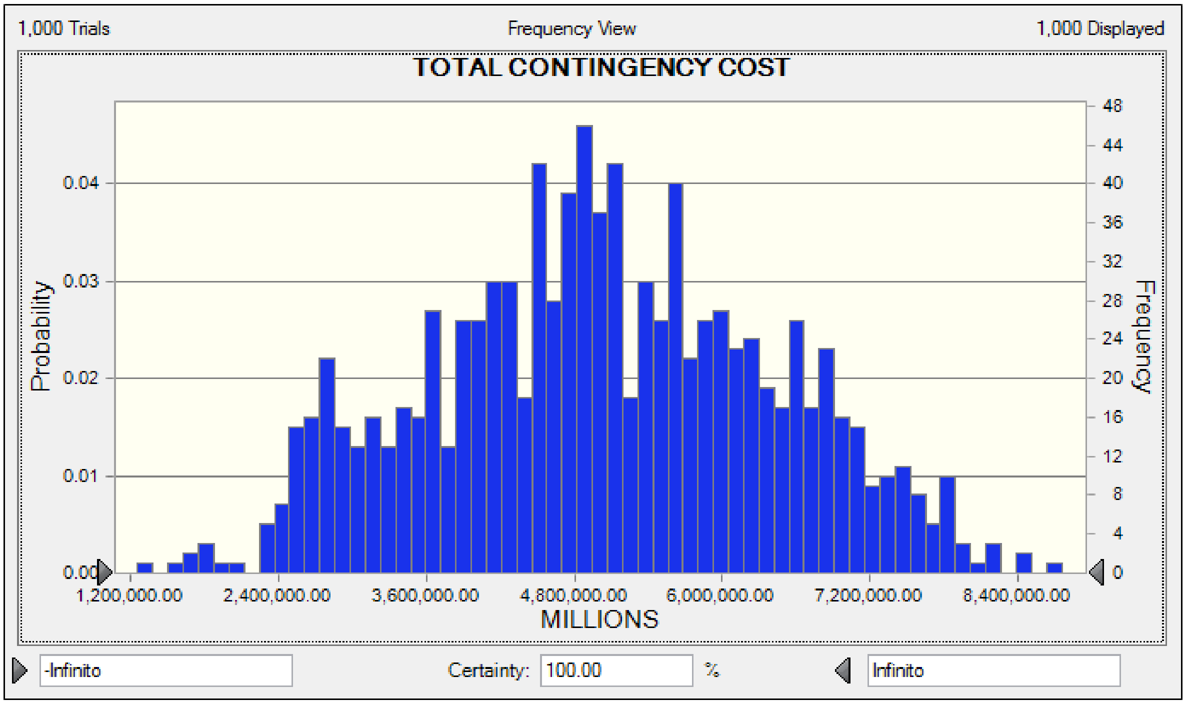


Figure 6: Contingency Probability Histogram

If the desire of the project team is to increase the contingency confidence level to a higher value, for example to 80%, then a contingency of approximately $6,257,361 will be needed. Therefore, the total project cost will be increased.

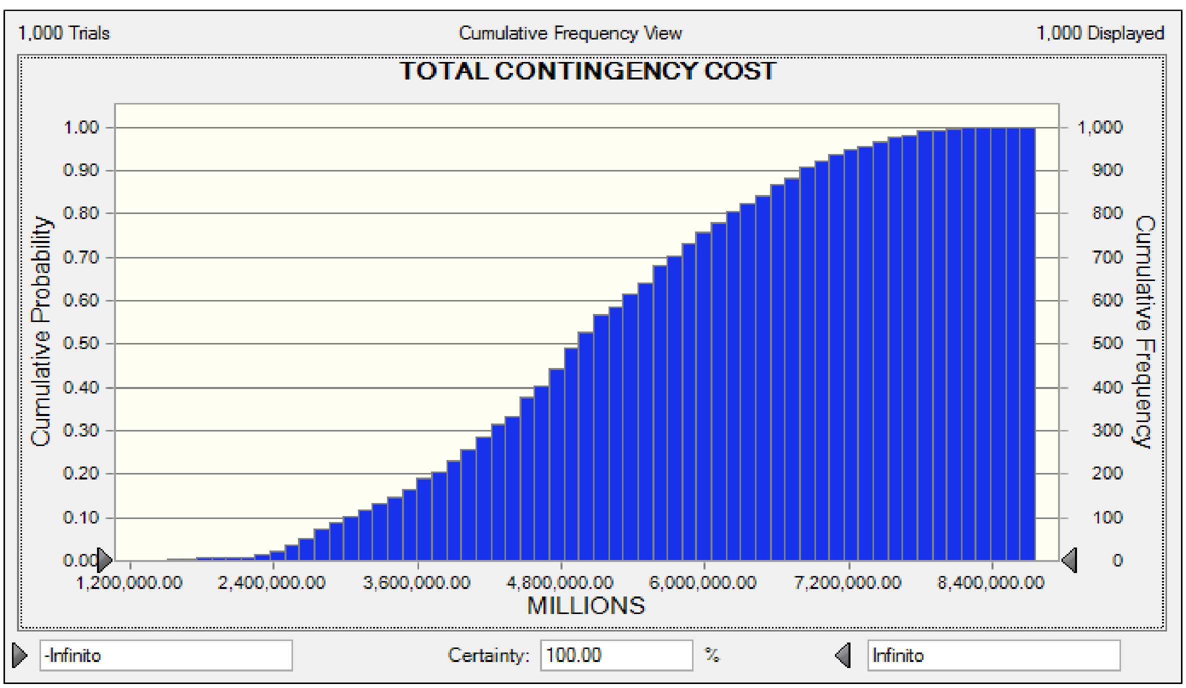


Figure 7: Cumulative Probability Distribution for the Project Contingency (confidence levels)

10. MITIGATION RECOMMENDATIONS

Each critical risk identified in the Risk Register was assigned a risk owner from the RMT. The risk owner was responsible for identifying a response strategy and explaining what actions would be needed to mitigate the risk. Table 1 below shows a summary of these recommendations.

Risk Event	Risk Owner	Strategy	Response Actions
Lack of coordination with adjacent projects (College area and Coffman in Unit 2)	Gerard Chadergian	Avoidance	-Implementation of a 55 day delayed start. Will monitor Unit 2S progress the closer we get to Beginning Construction. -Will have approved TCE in place to ensure contractors rights to accessing the work area needed.
Utility info late, incomplete, inaccurate or discovery of additional utilities,	Gerard Chadergian	Acceptance	-If needed, contractor could relocate cable or AT&T as a CCO. -Hire a subcontractor to do the utility work. -Add work around to contract. -Begin relocations before construction begins.
Loss of project capital funding during construction	Andrew Rice	Transference	Shortfall in funding would be covered with Local TransNet funds as SANDAG and the region have a vested interest in the success of the project. TransNet funds would be repaid once additional bond funds became available.
Unplanned work that must be accommodate	Gerard Chadergian	Transference	Regardless of the impact of this risk into the DAR project, the risk will be monitored and eventually would be removed from the Risk Register once SANDAG minimizes its probability and impact into the Transit Station project.

Risk Event	Risk Owner	Strategy	Response Actions
An agreement between the College and SANDAG/MTS is needed concerning parking for the transit station. There is a risk that the College will not move forward with any Right of Way contract without an approved agreement on the parking. This may require an additional MOU. SANDAG not willing to condemnate the Community College.	Frank Owsiany	Execute a Right of Entry	Right of Entry would be issued between Caltrans and the Community College to commence with construction of the DAR and transit station prior to executing a MOU or agreement.

Table 1: Risk Strategies and Responses

APPENDIX A

RISK REGISTER

Dist - EA	11-2T0951		
Co-Rte-PM	SD-15-M015.0-M015.5		
Date	2/23/2011		
Project Mngr	Andrew Rios	Telephone Number	(619) 688-3384

I-15 Mira Mesa/ Scripps Ranch Direct Access Ramp and Transit Station

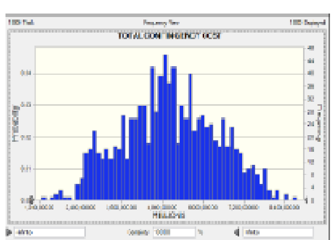
RISK REGISTER

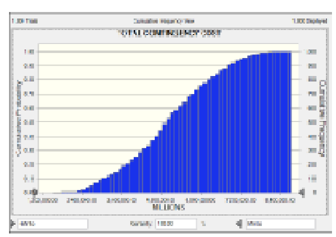
Probability	
Very low	0-5%
Low	6-35%
Moderate	36-50%
High	51-75%
Very High	76-99%

COST IMPACT($)	OPTIMISTIC	PESSIMISTIC
Very Low	10,000	250,000
Low	250,000	500,000
Moderate	500,000	1,000,000
High	1,000,000	1,500,000
Very High	1,500,000	3,000,000

RISK REGISTER

Priority (1)	Status (2)	ID # (3)	Date Identified / Project Phase (4)	Functional Assignment (5)	RISK EVENT (6)	SMART Column (7)	Risk Trigger (8)	Type (9)	Probability (10)	Impact (11)	Risk Matrix (12)	Type	Use Activity Estimate (13)	Value ($ or Days)	50% probable cost/time	Strategy (14)	Response Actions including advantages and disadvantages (15)	Affected WBS Tasks (16)	RISK OWNER (17)	Status Interval or Milestone Check (18)	Date, Status and Review Comments (19)
			Identification					Qualitative Analysis				Quantitative Analysis				Response Strategy			Monitoring and Control		
1	Active	4	12/5/2010 PS&E	Design	Lack of coordination with adjacent projects (College area and Caltrans in Unit 2)	* Could have Unit 25 delayed and not out of the work area by the time we are ready to work on freeway portion. * Potential conflict with ongoing construction at the College.	*Unit 25 work delayed. *College begins work in DAR work area.	Cost Schedule	Moderate	High	X	COST SCHEDULE	MIN Most Likely MAX MIN Most Likely MAX	0 1,000,000	500000	Avoidance	*Implementation of a 30 day delayed start. Will monitor Unit 25 progress the closer we get to Beginning Construction. *Will have approved TCE in place to ensure contractors rights to accessing the work area needed.	None	Gerard Chaussigian		
1	Active	7	12/5/2010 PS&E	Design	Utility info late, incomplete, inaccurate or discovery of additional utilities	*Many utilities need to be relocated within the specified work window. Delay could cause entire project delay. * There may be new utilities encountered or incorrect locations of existing utilities as the work to relocate utilities commences.	*Approaching end of window to relocate utility and realizing there is not enough time to complete work. *Finding new utility in the field.	Cost Schedule	Moderate	High	X	COST SCHEDULE	MIN Most Likely MAX MIN Most Likely MAX	0 500000	250000	Acceptance	*If needed, contractor could relocate cable or AT&T as a CCO. *Hire a subcontractor to do the utility work. *Add work around to contract. * Begin relocations before construction begins.	None	Gerard Chaussigian		
1	Active	26	12/5/2010 PS&E	Project Management	Loss of project capital funding during construction	Eighty percent of the construction capital funding is programmed with Prop 1B Corridor Mobility Improvement Account (CMIA) bond funds. This funding is dependent on the ability of the State Treasurers Office (STO) to sell bonds on the open market	Risk would occur if the STO could not sell enough bonds to replenish the account that pays for the ongoing construction contract.	Cost Schedule	Moderate	Very High	X	COST SCHEDULE	MIN Most Likely MAX MIN Most Likely MAX	0 3,000,000	1500000	Transference	Shortfall in funding would be covered with Local TransNet funds as SANDAG and the region have a vested interest in the success of the project. TransNet funds would be repaid once additional bond funds become available.	None	Andrew Rios		
1	Active	54	12/5/2010 PS&E	Design	Transit Station design unplanned work that must be accommodated, the work is currently been developed by SANDAG	A delay may occur for delivering on time the Transit Station design product, the one that is being done currently by a SANDAG consultant	Risk would occur if the design product gets delayed considerably. Nevertheless, the impact of this risk would not jeopardize Caltrans delivery schedule and objectives for the Direct Access Ramp (DAR) project	Cost Schedule	High	High	X	COST SCHEDULE	MIN Most Likely MAX MIN Most Likely MAX	500000 2,000,000	1250000	Transference	Regardless of the impact of this risk into the DAR project, the risk will be monitored and eventually would be removed from the Risk Register once SANDAG minimizes its probability and impact into the Transit Station project	None	Gerard Chaussigian		
1	Active	61	12/5/2010 PS&E	External data	Can not obtain Right of Way Certification	An agreement between the College and SANDAG/MTS is needed concerning parking for the transit station. There is a risk that the College will not move forward in any Right of Way contract without an approved agreement on the parking. This may require an additional MOU. SanDag not willing to condemn the Community College.	Project ready to RTL but can not move forward due to lack of Right of Way contract with Mira Mar College	Cost Schedule	High	High	X	COST SCHEDULE	MIN Most Likely MAX MIN Most Likely MAX	0 3,000,000	1500000	Acceptance	Right of Entry would be issued between Caltrans and the Community College to commence with construction of the DAR and transit station prior to executing a MOU or agreement.	None	Frank Gessay		





APPENDIX B

RISK MANAGEMENT TEAM

RISK MANAGEMENT TEAM (RMT)	
NAME	**FUNCTIONAL UNIT/AGENCY**
Gustavo Dallarda	Corridor Project Director I-15 TRANSNET Caltrans
Andrew Rice	Project Manager/ Caltrans
Gerard Chadergian	Design Manager/ Caltrans
Greg Gutierrez	Right of Way/ Caltrans
Frank Owsiany	SANDAG
Josua Reese	Project Manager Assistant/ Caltrans
Dennis Jung	Environmental/ Caltrans
Marlene Gros	Landscape Architect/ Caltrans
Fu Sun	CH2M Hill
Duy Ngoc Hoang	Design/ Caltrans
Michael.Crull	AECOM
Pedro Maria-Sanchez	Risk Manager/ Caltrans