75 th Street Corridor Improvement Project

COST AND SCHEDULE RISK ASSESSMENT

March 2023

Final Report

U.S. Department of Transportation
Federal Highway Administration

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EXECUTIVE SUMMARY

The Cost and Schedule Risk Assessment team (Team) included representatives of the Federal Highway Administration (FHWA), the Illinois Department of Transportation (IDOT), the Cook County Department of Transportation and Highways (DoTH), the Chicago Department of Transportation (CDOT), the Association of American Railroads (AAR), Burlington Northern and Santa Fe (BNSF), CSX, Norfolk Southern (NS), Union Pacific (UP), Belt Railway Company (BRC), Metra, and project consultants. The Team conducted a Cost and Schedule Risk Assessment (CSRA) to evaluate the cost and schedule estimates for the 75th Street Corridor Improvement Project (75th Street CIP). The 75th Street CIP is part of the Chicago Region Environmental and Transportation Efficiency (CREATE) Program and is comprised of the CREATE segments that are designated as P3, GS19, P2, and EW2.

The CSRA was held March 7, 2023, with the final report out on April 11, 2023. The objectives of the review were to:

- Verify the accuracy and reasonableness of the current project estimate (including all engineering, ROW, construction, and other costs) and schedule.
- Develop a probabilistic range for the cost estimate that represents the project's current stage of development (i.e., Phase II final design).
- Determine potential schedule impacts on the cost.

Range of Project Cost

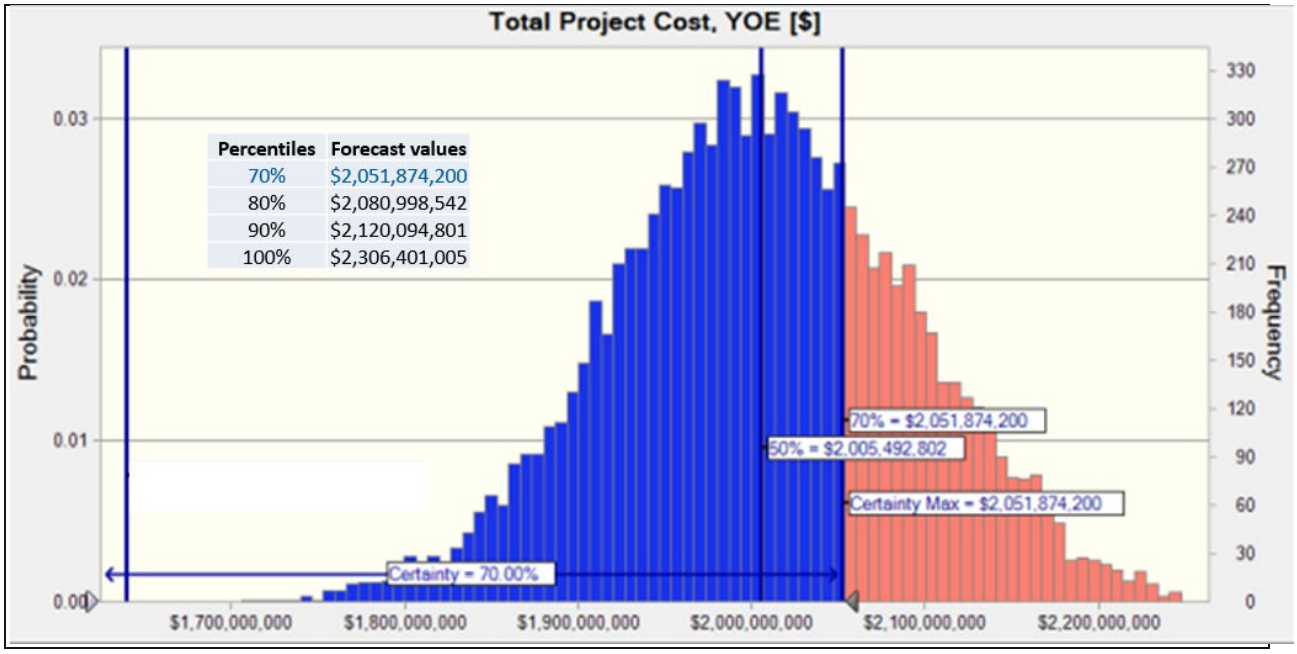


Figure 1 - Year of Expenditure Cost Probability Curve

The CSRA cost probability curve in Figure 1 represent the potential range of project cost in Year of Expenditure (YOE) dollars. The policy of FHWA is for financial plans to demonstrate reasonable funding strategy through construction with at least 70% confidence for the probable costs. At a 70% confidence level the CSRA YOE total project cost is $2,052 million. Table 1 shows the entire forecast range in 10 percentile increments.

Percentiles:	Forecast values
0%	$1,711,130,011
10%	$1,897,158,253
20%	$1,934,231,336
30%	$1,961,157,286
40%	$1,984,128,558
50%	$2,005,492,802
60%	$2,027,402,544
70%	$2,051,874,200
80%	$2,080,998,542
90%	$2,120,094,801
100%	$2,306,401,005

Table 1 - CSRA Monte Carlo Forecast YOE Results

The CSRA results are based on the Team's input related to base estimate variability, market conditions, inflation, and risk factors for the project. During the workshop, Team consensus was obtained on these items and specific adjustments to the base cost were not identified.

While it is FHWA policy for financial plans to demonstrate reasonable funding strategy through construction with at least 70% confidence for the probable costs, demonstrating a higher level of funding is appropriate sometimes.

Risk Threats and Opportunities

The CSRA process began with removing contingencies from the pre-CSRA estimate, and then adding the impact of base variability, market conditions, inflation and identified risks to arrive at the CSRA results noted. The major **cost threats** identified and modeled that could potentially increase project costs were:

- Bridge repair versus replacement scope
    - Both EW2 and P2 component projects
- Signal cost increases due to new control point
- Increases to railroad labor rates and overhead

The major **Schedule threats** that could potentially delay the project's originally estimated schedule and increase inflation costs are the following:

- Permitting – Office of Underground Coordination (OUC) and Chicago Department of Water Management (CDWM)
- Utility Coordination within Railroad ROW
- Acquisitions and Relocations

The review Team did not identify any quantifiable **costs opportunities** or **schedule opportunities** based on the information available at this time.

The results of modeling the above schedule risks (threats and opportunities) are:

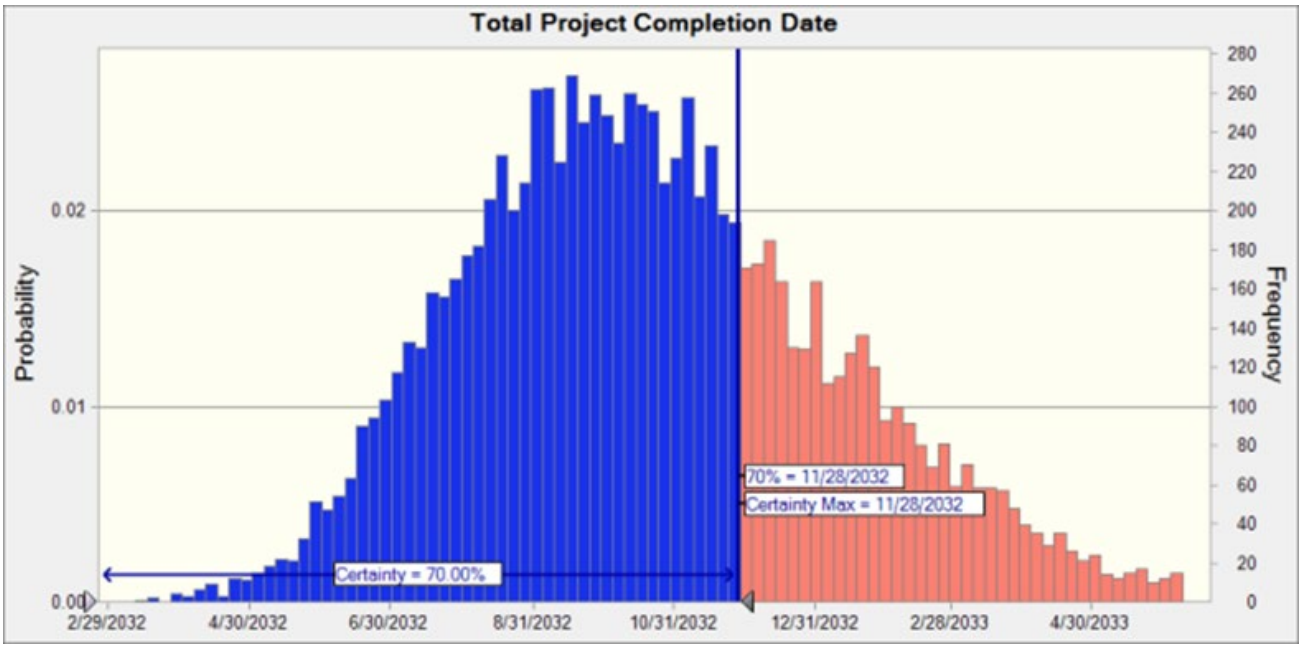


Figure 2 - Probability Based Project Completion Date

Figure 2 demonstrates that the current schedule has some risk of delay. The model shows the range of predicted project completion dates with a 70% confidence level at late-November 2032. This potential delay is the result of the impact of the previously mentioned schedule threats.

Findings and Recommendations

The **findings** during the CSRA included the following:

- The project CSRA cost estimate is believed to be appropriate for the level of design for the Phases presented.
- The Project Team risk register was comprehensive and detailed.
- The Project Team and SMEs were highly engaged and provided thoughtful and constructive input to the cost and schedule estimate review and risk discussions.
- The CSRA consisted of a detailed analysis of the project cost and schedule and helped to develop mitigation strategies for remaining risks.
- The current program management structure for CREATE appears to be functioning effectively.

The **recommendations** resulting from the review were the following:

- Establish a project budget corresponding to, at minimum, the 70th percentile CSRA cost result of $2.052 billion (YOE). This represents a project contingency of about 14.5% ($212 million) relative to the base project cost of $1.457 billion (YOE) (including prior and fixed costs). This level of contingency is consistent with the risks identified.

- Document any cost and schedule changes going forward. The CSRA results should be used to inform the next major project Financial Plan Annual Update (CY2023).

- Continue to develop a clear, shared understanding of the roles, obligations, and expectations associated with the CREATE Partners among the Project management team to ensure continuity of project delivery.

- Update and utilize the risk register resulting from this CSRA as a tool to continue managing the project's cost and schedule risks. It is recommended that the project sponsor continue to develop mitigation strategies for each identified risk, including assignment of responsibility and regular status reviews. The risk register can also be used to help inform contractual risk allocation decisions.

CHAPTER 1 – REVIEW PROCESS

The Cost and Schedule Risk Assessment team (Team) included representatives of the Federal Highway Administration (FHWA), the Illinois Department of Transportation (IDOT), the Cook County Department of Transportation and Highways (DoTH), the Chicago Department of Transportation (CDOT), the Association of American Railroads (AAR), Burlington Northern and Santa Fe (BNSF), CSX, Norfolk Southern (NS), Union Pacific (UP), Belt Railway Company (BRC), Metra, and project consultants. The Team conducted a Cost and Schedule Risk Assessment (CSRA) to evaluate the cost and schedule estimates for the 75th Street Corridor Improvement Project (75th Street CIP). The 75th Street CIP is part of the Chicago Region Environmental and Transportation Efficiency (CREATE) Program and is comprised of the CREATE segments that are designated as P3, GS19, P2, and EW2.

This document summarizes and reports the results of this review. Appendix A of this report includes the Team's April 11, 2023, close-out presentation.

The purpose of this chapter is to provide a general overview of the CSRA process, including a discussion of the review objectives, team members, documentation provided, and methodology.

REVIEW OBJECTIVE

The objective of the CSRA was to conduct an unbiased risk-based review to:

- Verify the accuracy and reasonableness of the current total cost estimate to complete the project
- Develop a probabilistic range for the cost estimate that represents the current stage of project design.
- Determine potential schedule impacts to the project cost.

This review is a snapshot in time, and it is recognized that the estimate will change as additional information becomes available.

BASIS OF REVIEW

Title 23 US Code Section 106(h) requires the financial plan for all Federal-aid projects with an estimated total cost of $500M or more to be approved by the Secretary of Transportation (i.e. FHWA). The $500M threshold includes all project costs (i.e. Engineering, Construction, Right-of-Way (ROW), Utilities, Construction Engineering, Inflation, etc.). The FHWA policy has established reasonable cost variability assumptions to be utilize as a risk-based analysis. A CSRA is required to provide the risk-based analysis of the estimate for a project over $500M and is used in the development of the financial plan.

REVIEW TEAM

The Team brought together individuals with a strong knowledge of the project, including expertise in specific disciplines represented in the project design. Throughout the CSRA individuals with specific project expertise briefed the Team on technical issues and the estimate development process, including the development of quantities, unit prices, assumptions, opportunities, and threats.

Figure 3 shows the entities that participated in the CSRA.

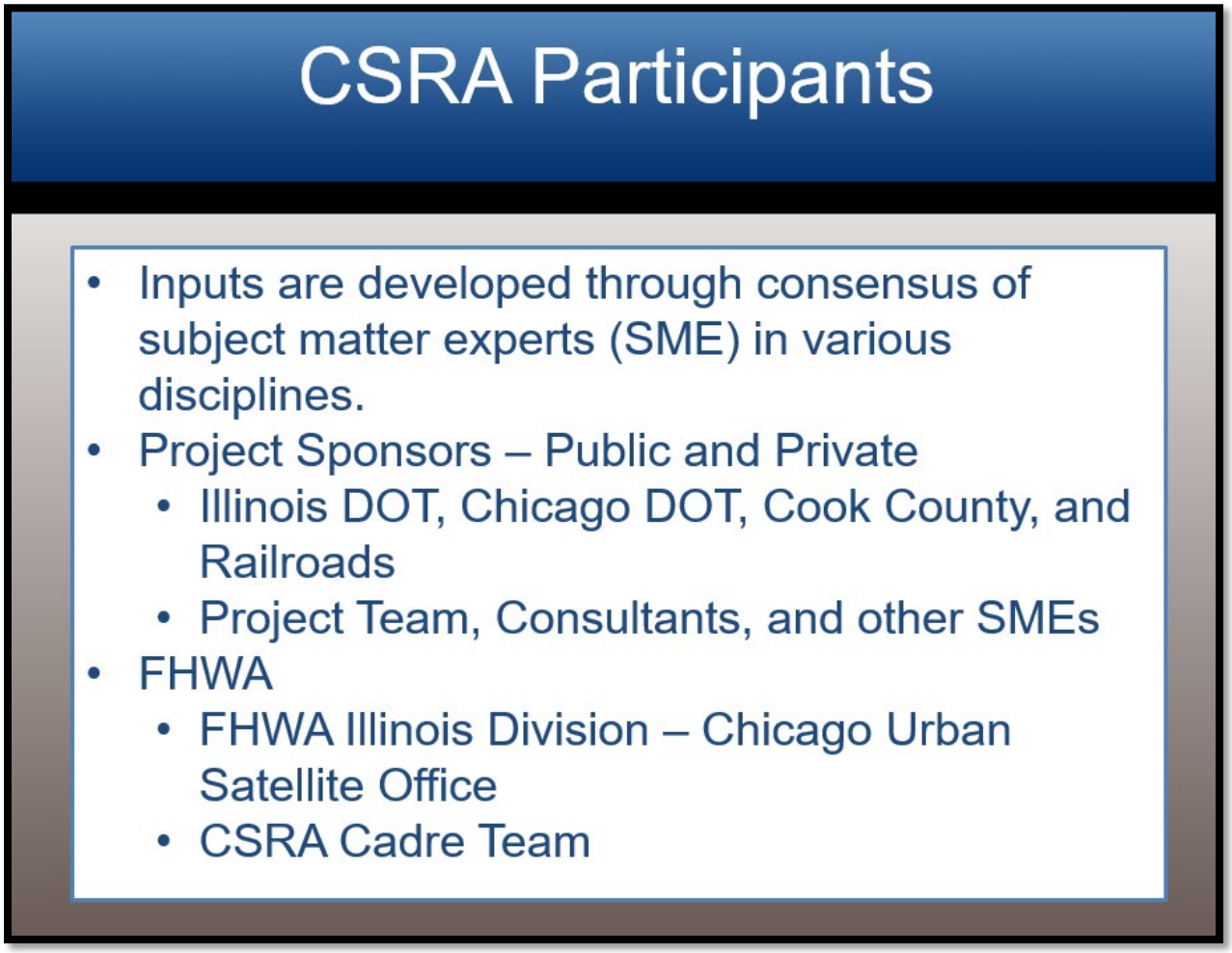


Figure 2 – CSRA Participants

DOCUMENTS REVIEWED

Documents provided to the Review Team prior to and during the workshop included:

- Project Overview Presentation
- Project Cost Estimate - Description of Capital Cost Estimate
- Project Schedule
- Draft 2022 Financial Plan Annual Update
- 2020 Cost Estimate Review
- Log of Significant Potential Risks

REVIEW METHODOLOGY

The methodology for this Cost and Schedule Risk Assessment is outlined as follows:

- Verify Accuracy of Estimate
    - Review major cost elements, descriptions, cost components, and assumptions
    - Review allowances and contingencies
    - Adjust estimate as necessary
- Discuss / Model
    - Base Variability
    - Market Conditions & Inflation
    - Key Schedule & Cost Risks
    - Perform Monte Carlo simulation to generate a forecast range of estimated project costs
    - Communicate Results to the Project Team

VERIFY ACCURACY OF COST ESTIMATE

The Team was provided a project overview, including the scope of the project, stage of design, and the cost estimating process utilized. A review of project documents including the physical layout (e.g., maps, drawings) was also provided. The Team also interviewed the subject matter experts (SMEs) and developed an understanding of the estimate for both quantity and unit cost development for the major cost categories through the review process.

MODEL PROJECT UNCERTAINTIES AND PERFORM MONTE CARLO SIMULATION

In general, uncertainties in the project estimate can be described as those relating to base variability, market risks, inflation, cost and schedule risk events. Each of these were discussed and modeled to reflect the total uncertainties associated with the estimate.

Base variability is a measure of uncertainties applied to the base estimate that represents the inherent randomness associated with the estimating process. For example, if a different estimator were to develop the estimate using the same data source and following the same general guidance his/her estimate would be different from that of the first estimator. Base variability is also a function of the project's current level of design and the process used to develop the estimate. Additionally, the lack of details about the project and assumptions that should be used to develop the estimate would cause more variability in the estimate. This base variation is a function of the system (i.e., assumptions and data sources used to define the estimate). Base variability has been applied to the base estimate exclusive of risks. Contingencies that include risks are removed from the estimate to avoid double counting risks identified in the risk register. Allowances, such as items included as percentages of other items in early estimates, and change orders typically remain in the base estimate.

Base variability is defined using a symmetrical distribution and often stated as a percentage variation from the underlying base estimate. The team considered the variability to be +/- 10% as shown in Table 2. This assumes the project is relatively well defined and has advanced engineering and identification of issues, such that reasonable estimators would fall within +/- 10% of the current estimate at this point in the project. This base variability was developed with the input that the non-railroad (civil infrastructure) elements of the project were defined to a point where a base variability of 10% was deemed appropriate. The railroad portion of the project is very well defined (when compared with the civil infrastructure improvements) and the unit prices are likely to be more stable into the near future because of long term labor and other contracts, thus minimizing the potential for variance within a range of 10%.

Portion	Final Design	Right of Way Acquisition	Utility Relocation	Construction
Base Variability	+/- 10%	+/- 10%	+/- 10%	+/- 10%

Table 2 - Base Variability

Market Conditions - The Team discussed the uncertainties associated with Market Conditions at the time of the construction procurement when contractors or suppliers are pricing the project. There is typically a strong relationship between the number of bidders and the construction cost of a project at the time of pricing. Market conditions are a measure of uncertainties that reflects the overall competitive environment at the time of pricing. The market conditions are

applied to the base estimate using a probability for "better than planned", "as planned", or "worse than planned" bidding environments (totaling 100%).

The Team had a discussion regarding the projects competing for local resources during the 75th Street CIP construction and the Team settled on the following probability distributions to use in the model:

Project Element	Market Conditions Probability of experiencing cost increase/decrease		
	Better Than Planned	As-Planned	Worse Than Planned
Construction - GS19	10%	80%	10%
Construction - P2 and EW2	10%	60%	30%

Table 3 - Market Condition - Probability of experiencing cost increase/decrease

When the market condition variations shown in Table 3 occur, the Team expected the variance from the current estimate (As-Planned) as shown in Table 4.

Project Element	Market Condition Cost Impact (Variance from As-Planned)	
	Better Than Planned	Worse Than Planned
Construction (projects P3 and GS19)	10%	10%
Construction (project P2 & EW2)	10%	10%

Table 4 - Market Conditions Variance from "As-Planned"

Following the market conditions review, the CSRA Team discussed the project cost estimate and addressed the pre-CSRA team supplied risk register for both the cost and the schedule threat/opportunity risks. The project team provided a Pre-CSRA risk register that was utilized to initially populate the CSRA model's risk register.

The risk register includes the event risk name, a description of the event, a probability measure of the likelihood the event will occur, and a probability distribution of costs if the event were to occur. The register also identifies if the risk event is a threat or opportunity for cost/schedule. Risk threats increase costs/schedule length and opportunities decrease cost/schedule length. A very important feature of the risk register is to establish the relationship of risk events. For

example, some risks are mutually inclusive/exclusive. Mutually inclusive means the risk event can only occur if the prior risk event occurs. Conversely, for a risk event to be mutually exclusive means that it can only occur if the prior risk event does not occur. Risk events can also be independent in which case the probability of occurrence is not dependent on any other risk event. Correlation determines how one risk event will sample relative to another risk event. Correlation was established when there was reason to suspect that a relationship exists and should be accounted for in the simulation.

After model inputs were developed for market conditions, base variability, and risk events, the Team utilized the Monte Carlo simulation to generate a probability-based estimate in Year of Expenditure Total Project Costs. The simulation provides "what-if" sensitivity analysis using randomly selected values from the Team's models. The simulation performs random sampling to model thousands of project cost/schedule scenarios built from the Team's input. The simulation is run until the number of iterations creates a relatively smooth distribution curve. It is important that the simulation outcomes be reviewed to ensure accuracy. The simulation results from distribution curves covering all possible outcomes as shown in Figures 1 and 2 in the Executive Summary. The key benefit of this process is that estimated cost and schedule outcomes are associated with their probability of occurrence.

Inflation usually has a significant impact on Year of Expenditure (YOE) Total Project Costs, and its affects were modeled in this review. Costs were inflated using the current project schedule and inflating to the midpoint of the planned expenditure for each project element (P2, EW2, GS19), including any delays where appropriate. The inflation applied to the base estimate utilized annual inflation rates per year (See Table 5).

Phase	2023 CSRA Inflation Rates					
	2023	2024	2025	2026	2027	2028
PE	5.0%	5.4%	4.7%	4.3%	3.8%	3.5%
ROW	5.0%	5.4%	4.7%	4.3%	3.8%	3.5%
Construction	5.0%	5.4%	4.7%	4.3%	3.8%	3.5%
Utilities	5.0%	5.4%	4.7%	4.3%	3.8%	3.5%

Table 5 - Project Inflation Rates

COMMUNICATE RESULTS

The last part of the review is to communicate the results. This is accomplished by providing the closeout presentation and final report to the Project Team and agency leaders. At the end of the review, the CSRA Team provided a closeout presentation that summarized the review findings. The presentation identified the review objectives and agenda, discussed the methodology, available resources, estimate adjustments and highlighted the results of the review. The closeout presentation also identified any significant cost and schedule risks and provided a brief overview of recommendations by the Review Team.

It is important to understand that the estimate review is a snapshot in time of the estimate. As additional information becomes available it is expected that the estimate will change and be updated.

This final report communicates all findings of the review to the Team and serves as the official document for the CSRA. CSRA reports are maintained by the FHWA Major Projects Team in the Office of Stewardship, Oversight and Management.

CHAPTER 2 – REVIEW SUMMARY

PROJECT BACKGROUND, PURPOSE AND NEED

The Chicago Region Environmental and Transportation Efficiency (CREATE) Program was initiated in 2003 as a public-private partnership to improve the rail and roadway transportation network within the Chicago area. The CREATE 75th Street Corridor Improvement Project (75th Street CIP) consists of four (4) supporting projects of independent utility, linked by the NEPA environmental clearance process. See Figure 4, which shows a map of the project.

A substantial portion of freight and passenger rail traffic in the Chicago region suffers from congestion, low operating speeds, and service delays due to traffic demands that exceed the capacity of the regional rail system. The CREATE Program Final Feasibility Plan established overall Program Level Goals and Strategies and the CREATE Program Final Preliminary Screening (both published in August 2005) presented the purpose or objective of each component project within the program. These documents have since been amended and modified. Based on the needs to improve the regional rail system, the goals of the CREATE Program are as follows:

- Reduce rail and motorist congestion;
- Improve the efficiency and reliability of freight and passenger rail service;
- Enhance public safety through the reduction of rail-highway conflict points;
- Promote economic development and job creation;
- Improve air quality; and
- Reduce noise from idling or slow-moving trains throughout the Chicago metropolitan area.

As part of meeting the CREATE goals, the purpose of the 75th Street CIP is to improve mobility for rail passengers, freight, and motorists. The specific needs of this project include:

- Reducing conflicts that affect rail;
- Reducing highway-rail crossing problems;
- Reducing local mobility problems; and
- Improving rail transit passenger service.

In coordination with CREATE partners and consultant staff, independent capital costs estimates were developed for each railroad operators' rail infrastructure improvements as well as signal systems required for efficient operations. CREATE RR partners participating in the 75th Street CIP include:

Amtrak
Belt Railway Company (BRC)
Burlington Northern and Santa Fe (BNSF)
B&OCT- Baltimore & Ohio Chicago Terminal Railroad (CSX) also known as CSX Transportation
Canadian Pacific (CP)
Canadian National (CN)
Indiana Harbor Belt Railroad (IHB)
Metra
Norfolk Southern (NS)
Union Pacific (UP)

The 75th Street CIP capital cost estimate was prepared to allow for the independent quantification and calculation of construction and professional service costs of the four (4) CREATE Program component projects (P2, P3, EW2, and GS19) that make up the 75th Street CIP. Not all the railroads or all the partners are necessarily involved in every project component of the CREATE Program. A description of the major construction components associated with each project components of the 75th Street CIP is shown below:

Component Project P2 – Metra SouthWest Service (SWS) Connection to Rock Island District (RID) Line

- New rail flyover structure for a passenger rail connector through residential area
- Metra flyover bridge on 40 MPH reverse curve, connecting to the RID Line at 74th St
- ROW acquisition from the neighborhood south of Hamilton Park = 1.39 acres (No ROW may be required from Hamilton Park)

Component Project P3 – CSX Yard Flyover of 75th Street Junction also known as Forest Hill Junction

- Raise the north/south CSX tracks over the east/west tracks at 75th Street Junction and over 71st Street (GS19)
- Two (2) temporary tracks constructed west of existing B&OCT tracks (CSX yard) during construction

Component Project EW2 – 80th Street Junction Two (2) additional track through 80th Street Junction

- Relocates Amtrak, B&OCT and UP operations from the west side of corridor to east side of corridor
- New bridge constructed for the UP over 88th Street

- New NS track constructed from I-94 (Dan Ryan) north and west to Landers Yard ROW acquisition of vacant land between two sets of RR tracks north of Vincennes Ave and south of 80th Street Junction
- Add second mainline track southeast of existing Metra track along Columbus Avenue, through existing NS Landers Yard
- Reconfigure tracks in Landers Yard

Component Project GS19 – 71st Street Grade Separation

- Depress 71st Street profile by approximately 3 feet to provide vertical clearance of 16'-6" beneath the new rail structure. Total length of reconstruction ≈ 660 feet.

The CREATE railroad partners generally staff their own, independent teams for construction of track work, signals, and associated facilities (known as force account work). Under Certain circumstance, railroads may use the services of outside contractors specifically for grading activities, environmental mitigation, structures, roadway improvements, and track construction.

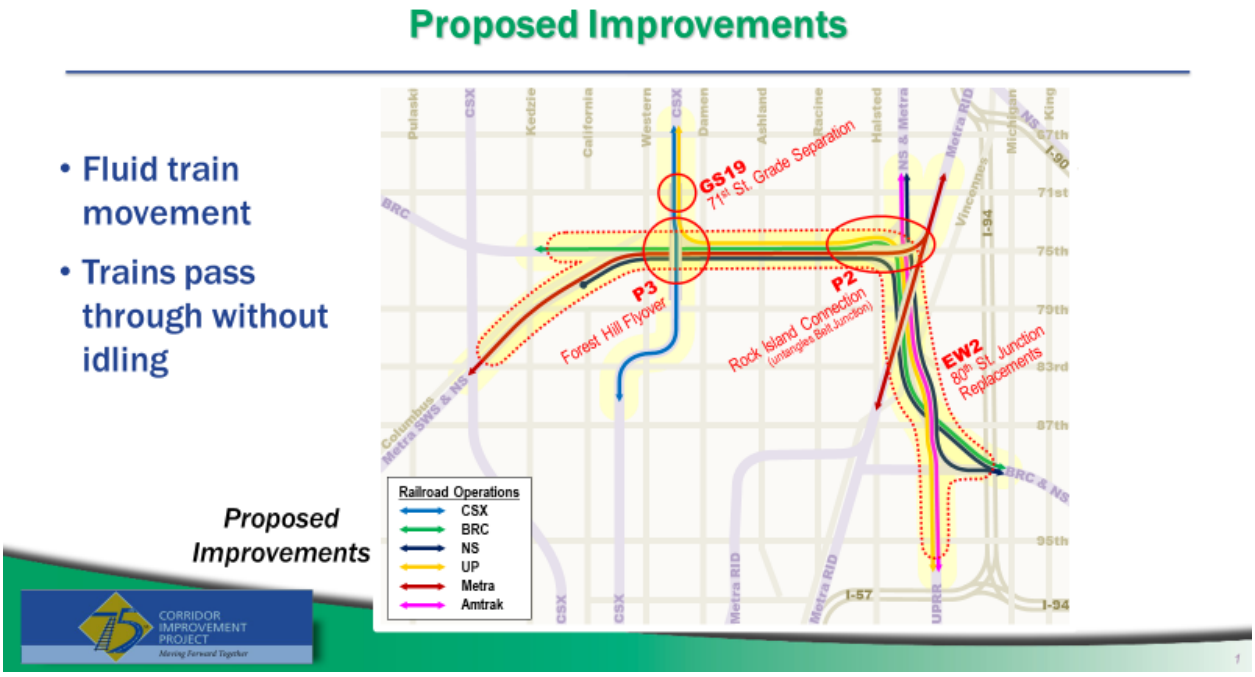


Figure 3- 75th Street CIP Project Study Area

BASE ESTIMATE

The project team provided a cost estimate prior to the workshop. This pre-review estimate of project cost was $1,712 million in current year (CY) costs, and $2,004 million escalated to year of expenditure (YOE) costs. These amounts included $243 million (CY) costs attributable to contingencies, which were excluded from the base estimate in the Monte Carlo model.

BASE ESTIMATE ADJUSTMENTS

During the review of the project, the Team discussed estimate details. Certain items were considered for adjustments to the base estimate, as opposed to being risks for potential cost changes. Ultimately, no adjustments were made to the base estimate, which is a testament to the quality and thoroughness the Team brought to the CSRA in the Team's base estimate.

Individual Pre-CSRA Estimate Items	Change to Base Estimate ($ in millions)
EW2 increase for construction, ROW, and professional services	$19
Total Estimate Adjustments	$19

Table 6 - Base Estimate Adjustments

SCHEDULE

Table 7 outlines some of the project milestone schedule dates from CREATE Project Team.

CSRA Schedule Summary

Phase	Base Case		
	Start	End	Predecessor
CN – P3	10/15/2021	9/15/2025	
CN & UT-GS19	3/15/2025	8/15/2025	
CN Prof Svcs-GS19	3/15/2025	8/15/2025	
ROW-P2	1/15/2021	5/15/2025	
CN & UT-P2	11/15/2028	6/15/2031	
CN Prof Svcs-P2	11/15/2028	6/15/2031	
ROW-EW2	1/15/2021	2/15/2026	
CN & UT-EW2	8/15/2026	12/15/2031	
CN Prof Svcs-EW2	8/15/2026	12/15/2031	
CREATE-CREATE			

Table 7 - Project Summary Schedule Dates

REVIEW FINDINGS

Several findings were noted during the CSRA, including the following:

- The project CSRA cost estimate is believed to be appropriate for the level of design for the Phases presented.
- The Project Team risk register was comprehensive and detailed.
- The Project Team and SMEs were highly engaged and provided thoughtful and constructive input to the cost and schedule estimate review and risk discussions.
- The CSRA consisted of a detailed analysis of the project cost and schedule and helped to develop mitigation strategies for remaining risks.
- The current program management structure for CREATE appears to be functioning effectively.

REVIEW RECOMMENDATIONS

The following recommendations resulted from this review:

- Establish a project budget corresponding to, at minimum, the 70th percentile CSRA cost result of $2.052 billion (YOE). This represents a project contingency of about 14.5% ($212 million) relative to the base project cost of $1.457 billion (YOE) (including prior and fixed costs). This level of contingency is consistent with the risks identified.

- Document any cost and schedule changes going forward. The CSRA results should be used to inform the next major project Financial Plan Annual Update (CY2023).

- Continue to develop a clear, shared understanding of the roles, obligations, and expectations associated with the CREATE Partners among the Project management team to ensure continuity of project delivery.

- Update and utilize the risk register resulting from this CSRA as a tool to continue managing the project's cost and schedule risks. It is recommended that the project sponsor continue to develop mitigation strategies for each identified risk, including assignment of responsibility and regular status reviews. The risk register can also be used to help inform contractual risk allocation decisions.

CHAPTER 3 – RISK ANALYSIS

Cost estimates, especially those for Major Projects, usually contain a degree of uncertainties due to unknowns and risks associated with the level of detailed design completion. For this reason, it is logical to use a probabilistic approach and express the estimate as a range rather than a single discrete value. During the Cost and Schedule Risk Assessment, uncertainties in the Project estimate were modeled by the Team to reflect the opinions of the Subject Matter Experts (SMEs) interviewed. The Team used the Monte-Carlo simulation to incorporate the uncertainties into forecast curves representing the expected range of cost and schedule for the Project.

These probability-based estimates provide essential components to the decision-making process. Probability accounts for the uncertainties and reflects the collective "best guess" of SMEs. A probability distribution can be used to represent the estimate's Total YOE Project Costs. Since the dollars represent YOE, the curve is often referred to as a forecast curve. The forecast curve of YOE Total Project Cost for this Project is discussed below.

COST FORECAST

The forecast distribution curve for the project (shown in Figure 4 below and also as Figure 1 in the Executive Summary) reflects all the underlying variation and risks associated with the project. The variation and risks include base variability, market conditions at time of letting (i.e. competition, supply and demand), inflation and project risks.

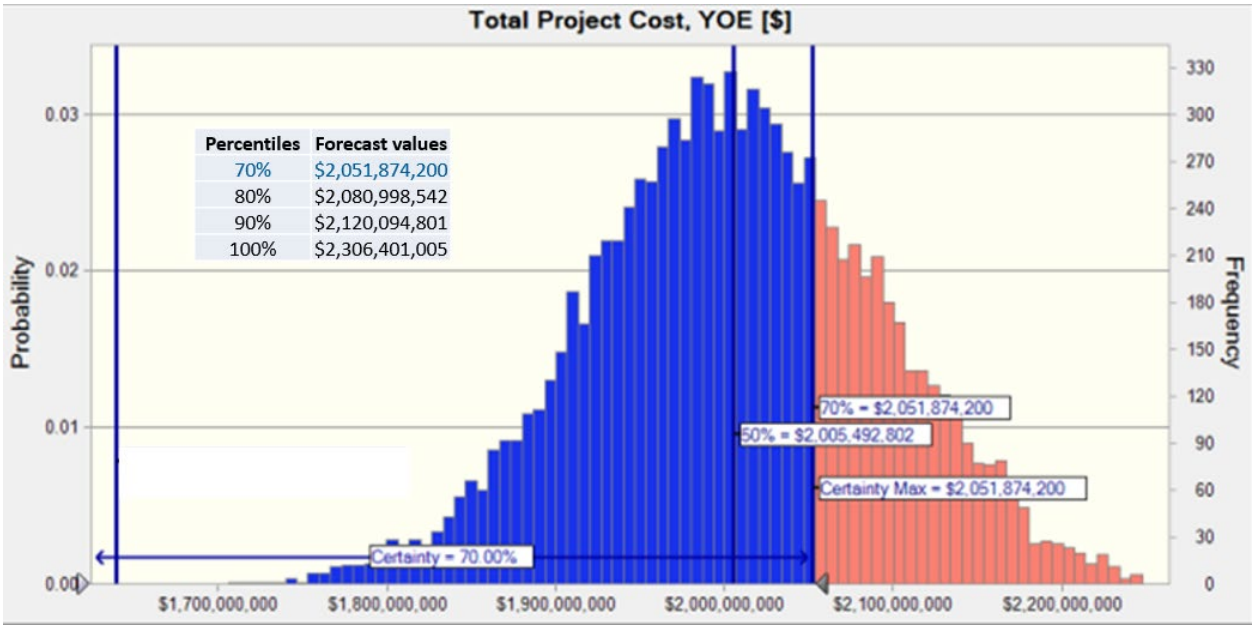


Figure 4 - Distribution of Total Project Costs in YOE Dollars

The CSRA cost probability curve in Figure 4 represent the potential range of project cost in Year of Expenditure (YOE) dollars. The policy of FHWA is for financial plans to demonstrate reasonable funding strategy through construction with at least 70% confidence for the probable costs. At a 70% confidence level the CSRA YOE total project cost is $2,052 million. Table 8 shows the entire forecast range in 10 percentile increments.

Percentiles:	Forecast values
0%	$1,711,130,011
10%	$1,897,158,253
20%	$1,934,231,336
30%	$1,961,157,286
40%	$1,984,128,558
50%	$2,005,492,802
60%	$2,027,402,544
70%	$2,051,874,200
80%	$2,080,998,542
90%	$2,120,094,801
100%	$2,306,401,005

Table 8 - Percentile Rankings of Total Project Costs in YOE Dollars

Table 8 demonstrates that the range for the cost estimate is approximately $1,711 to $2,306 million. The total range from 0% to 100% is wide and demonstrates the cost uncertainty for this project should extreme opportunities and/or risks be realized.

The following Figures 5 – 7 show the Monte Carlo forecast results in YOE dollars for the construction and utility costs of Segments GS19, P2, and EW2.

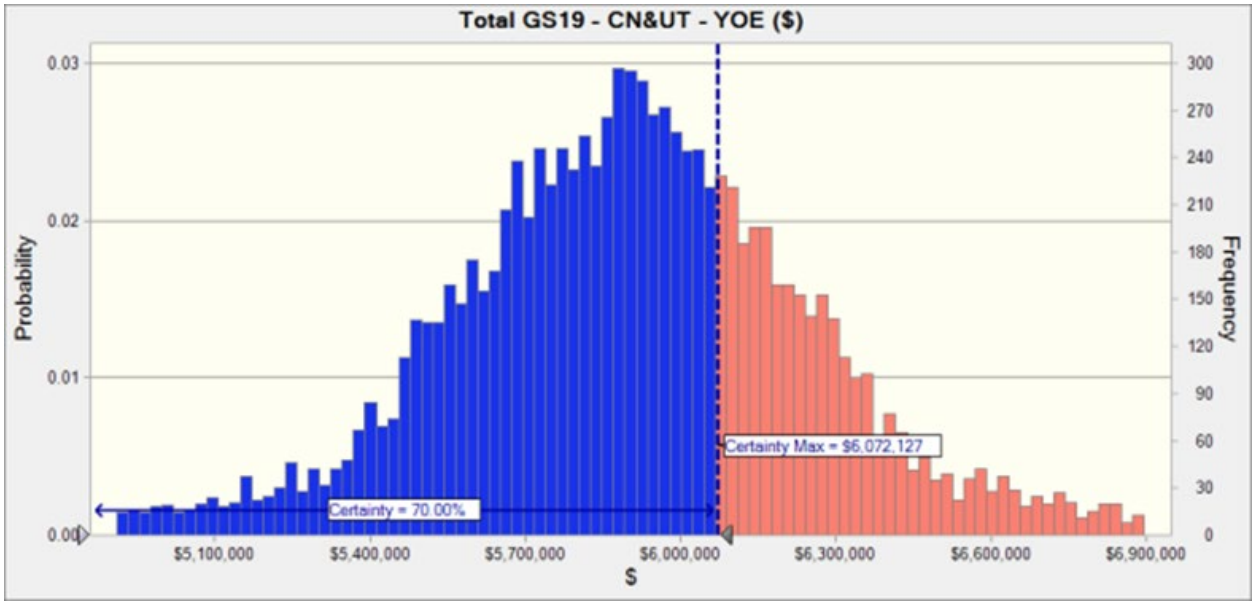


Figure 5 – Segment GS19 - Distribution of Costs in YOE Dollars

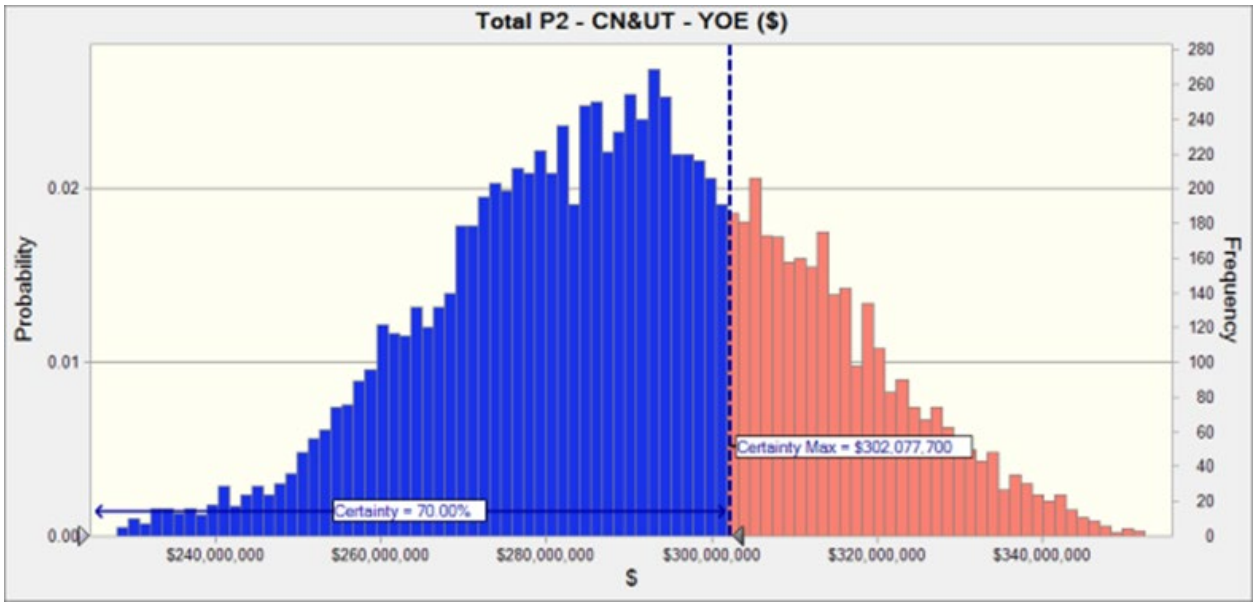


Figure 6 – Segment P2 - Distribution of Costs in YOE Dollars

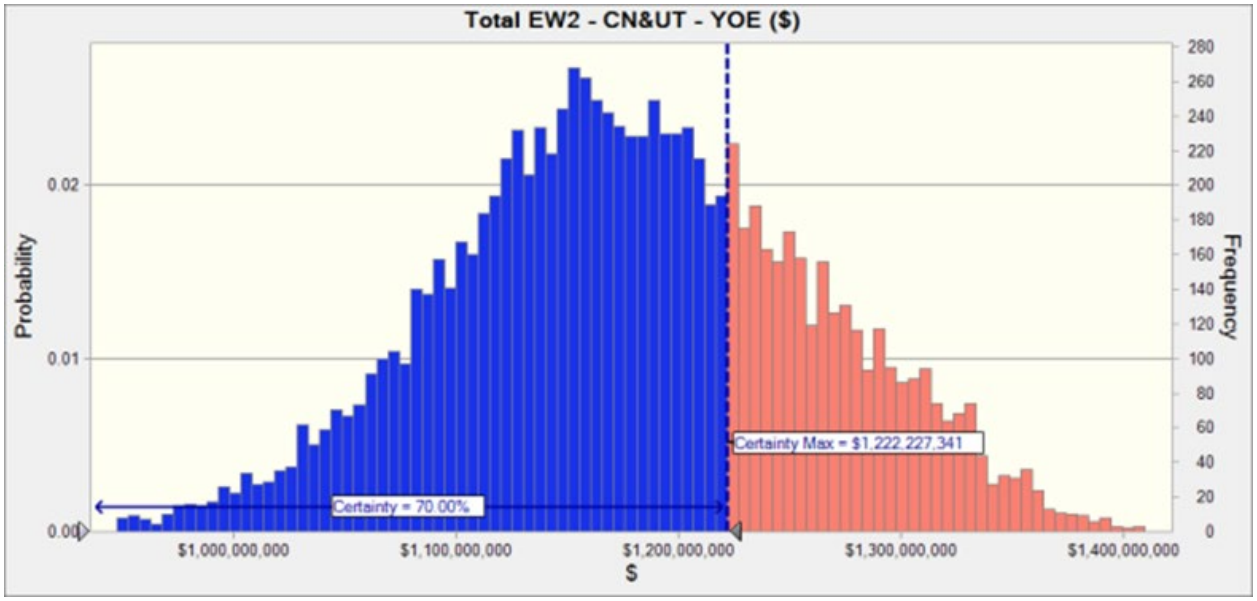


Figure 7 – Segment EW2 - Distribution of Costs in YOE Dollars

The purpose of the Risk Register is to identify significant cost and schedule risks for the project so they can be modeled instead of assuming general contingency values. In the traditional cost estimate, risks are often accounted for using estimates of contingency. During this review, the pre-CSRA estimate contingency was removed, and the team developed the potential threats and/or opportunities in lieu of contingency items. The Review Team worked together with the SMEs to develop the Risk Register in Appendix B to this report, which was included in the Monte Carlo simulation.

The most significant of these cost risks that could impact the project included the following:

- Bridge repair versus replacement scope
    - Both EW2 and P2 component projects
- Signal cost increases due to new control point
- Increases to railroad labor rates and overhead

Figure 8 shows the forecast for just the risk register cost threats on the total project cost in YOE dollars.

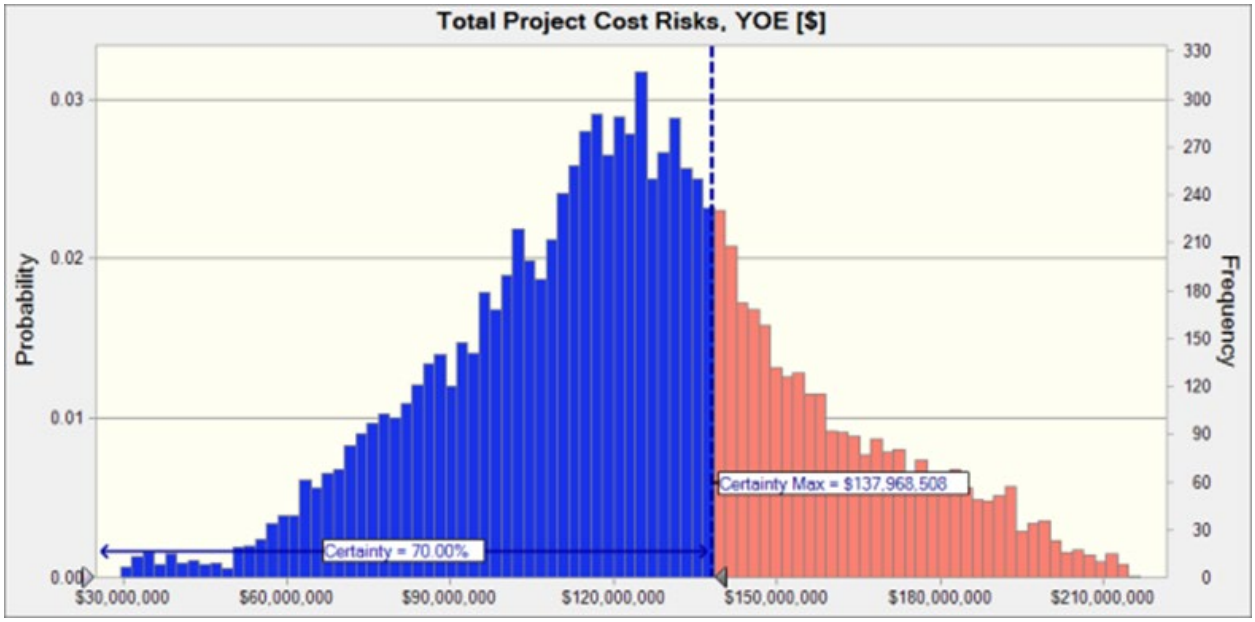


Figure 7 – Risk Register Impact on Total Project Costs - Distribution in YOE Dollars

SCHEDULE FORECAST

Figure 8 (same as Figure 2 from the Executive Summary) displays results showing a low probability for the project to end at the current scheduled completion date. The 70% probability level results in a date of November 28, 2032, approximately 60 months after the current 2021 FPAU planned date of November 15, 2027. This variance can be attributed to the significant schedule risks that have been identified and need to be managed. These threats are described in the following section.

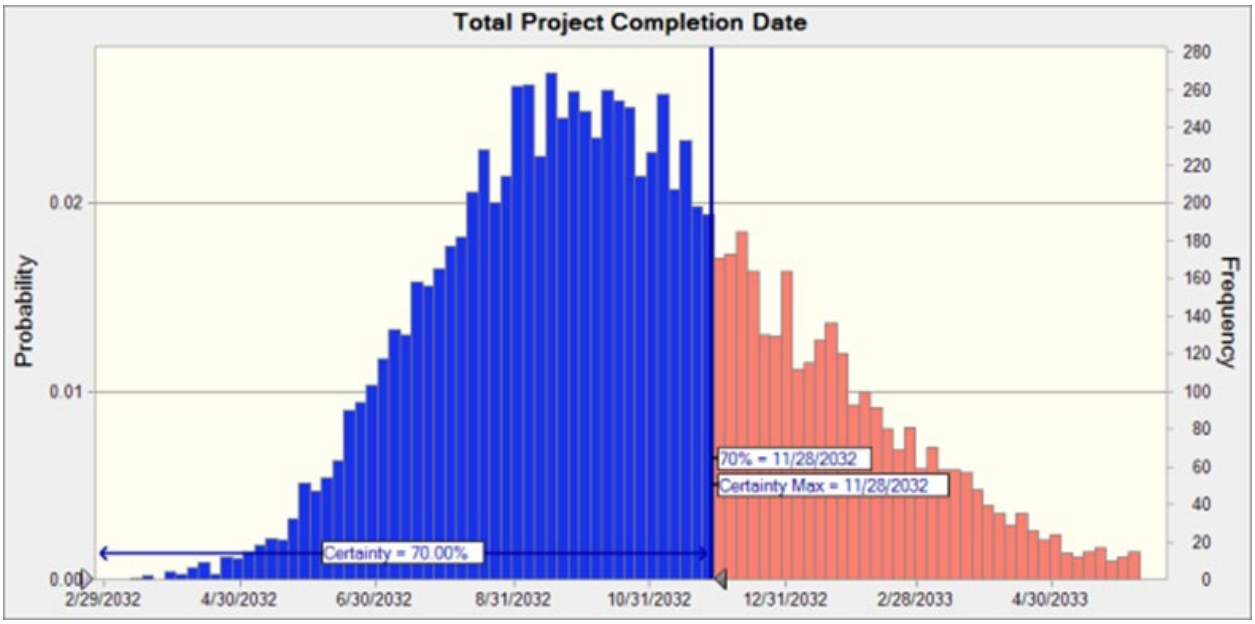


Figure 8 – Monte Carlo Forecast – Total Project Completion Date

THREATS TO DELAY PROJECT SCHEDULE

The major **Schedule threats** that could potentially delay the project's originally estimated schedule and increase inflation costs are the following:

- Permitting – Office of Underground Coordination (OUC) and Chicago Department of Water Management (CDWM)
- Utility Coordination within Railroad ROW
- Acquisitions and Relocations

REVIEW CONCLUSION

Based on the assumptions and risks discussed during this CSRA, the range of total cost for the 75th Street CIP varies between approximately $1,711 million and $2,306 million in year of expenditure (YOE) costs. The estimate at the 70% confidence level is $2,052 million (YOE).

This estimate is a snapshot in time, and it is expected that through further project development, the estimate will change.

Appendix A

CSRA Closeout Presentation

Cost and Schedule Risk Assessment

CREATE 75th Street Corridor Improvement Project
https://www.createprogram.org/

Cost and Schedule Risk Assessment (CSRA)
Closeout Presentation - Chicago, IL
April 11, 2023

U.S. Department of Transportation
Federal Highway Administration

Agenda

- FHWA Cost and Schedule Risk Assessment (CSRA) Process
- Summary of CSRA Inputs
- Summary of CSRA Model Results
- Review Observations
- Recommendations and Next Steps

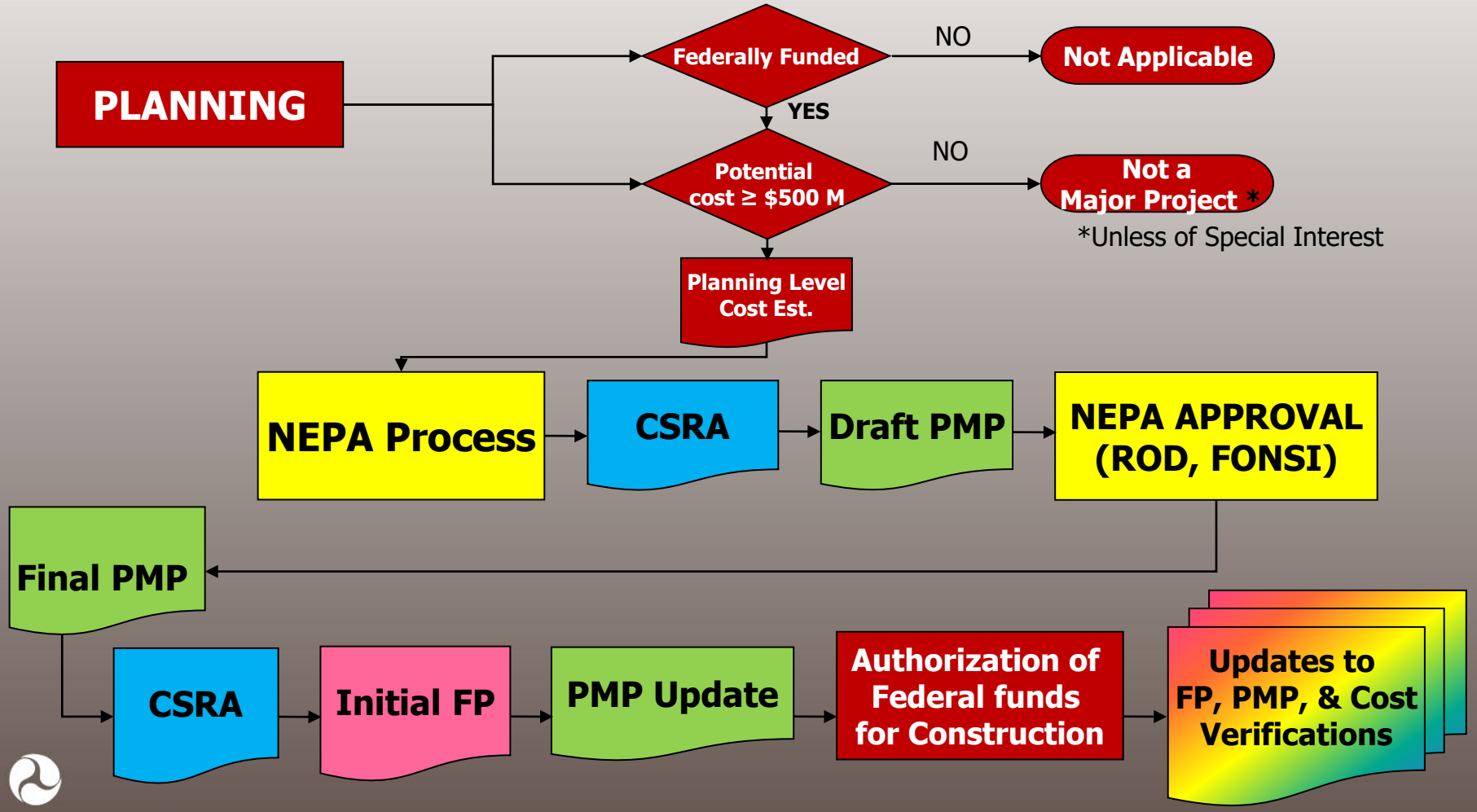
CSRA Process Objective

- Conduct an unbiased risk-based review to verify the accuracy and reasonableness of the current total cost estimate and project schedule to complete:
  - **CREATE - 75th Street Corridor Improvement Project**
- Develop a probability range for the cost estimate and schedule that represents the project's current stage of design.

Major Project Policy Directives

- First enacted by TEA-21
- Title 23 U.S.C §106(h)(3)(B)
  - …based on reasonable assumptions, as determined by the Secretary, of future increases in the cost to complete the project…"
    - Secretary = FHWA
    - Reasonable assumptions = Risk based probabilistic approach

Major Project Process



FHWA Major Project Resources

FHWA Office of Infrastructure

Website: https://www.fhwa.dot.gov/majorprojects/

Major Project Financial Plan Guidance, December 2014

- *FHWA Major Project Guidance*, January 2007
- *Major Project Program Cost Estimating Guidance*, January 2007
- *Project Management Plan Guidance*, Updated in 2017
- Active Major Project Monthly Status (FOIS Output)

CSRA Participants

- Inputs are developed through consensus of subject matter experts (SME) in various disciplines.
- Project Sponsors – Public and Private
  - Illinois DOT, Chicago DOT, Cook County, and Railroads
  - Project Team, Consultants, and other SMEs
- FHWA
  - FHWA Illinois Division – Chicago Urban Satellite Office
  - CSRA Cadre Team

Basis of CSRA

- Review based on estimates provided by the Team in advance with revisions made during the review
- Review to determine the reasonableness of assumptions used in the estimate
- **Not an independent FHWA estimate**
  - Did not verify quantities and unit prices
  - We did have Subject Matter Experts review the estimate
  - Goal is to verify accuracy and reasonableness of estimate

Risk-based Probabilistic Approach

CSRA Methodology

Verify

- Major cost elements
- Allowances/contingencies
- Adjust estimate as necessary

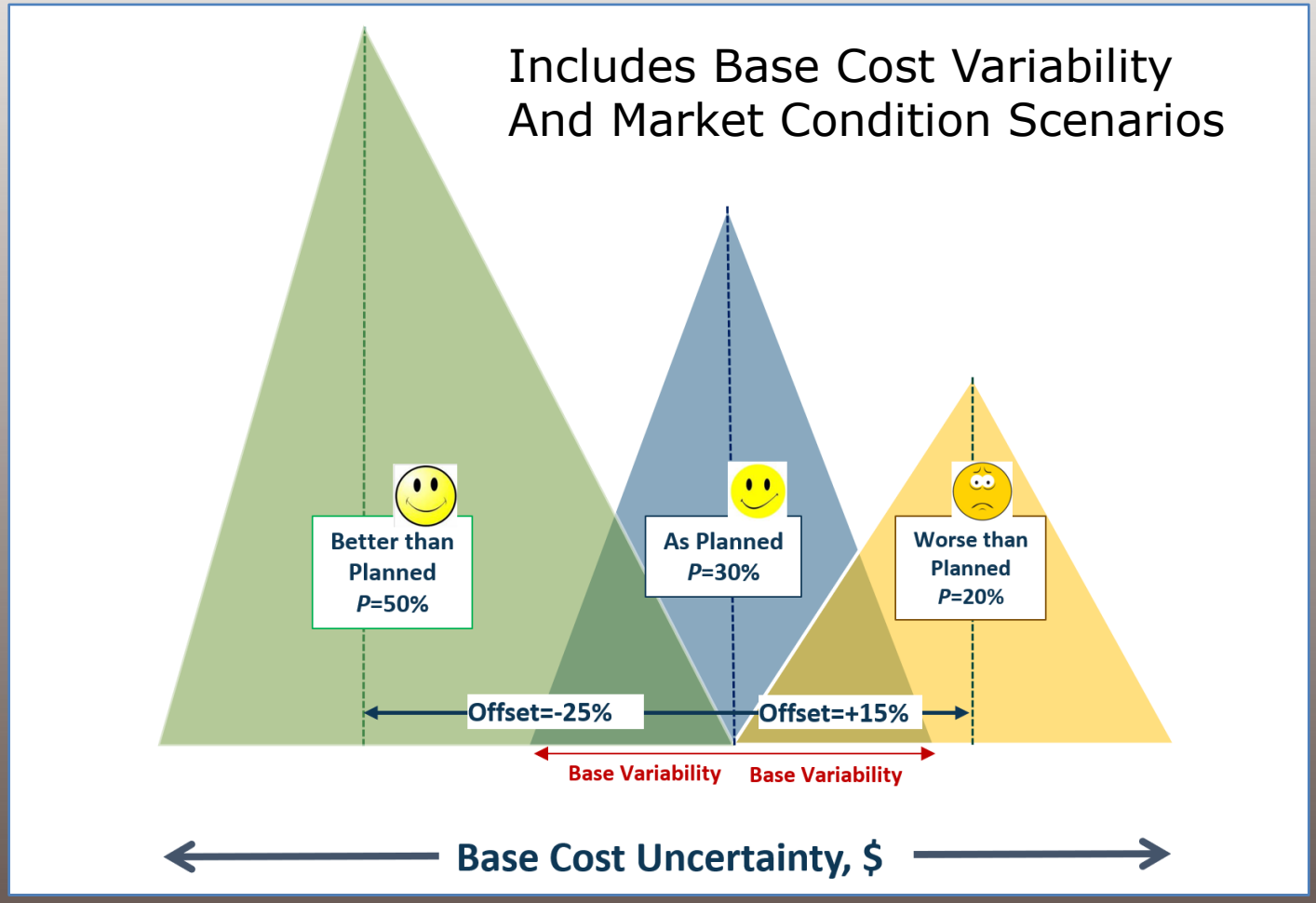
Model

- Base variability
- Market conditions and inflation
- Risk events (cost, schedule, probability, impact, relationships)
- Monte Carlo simulation

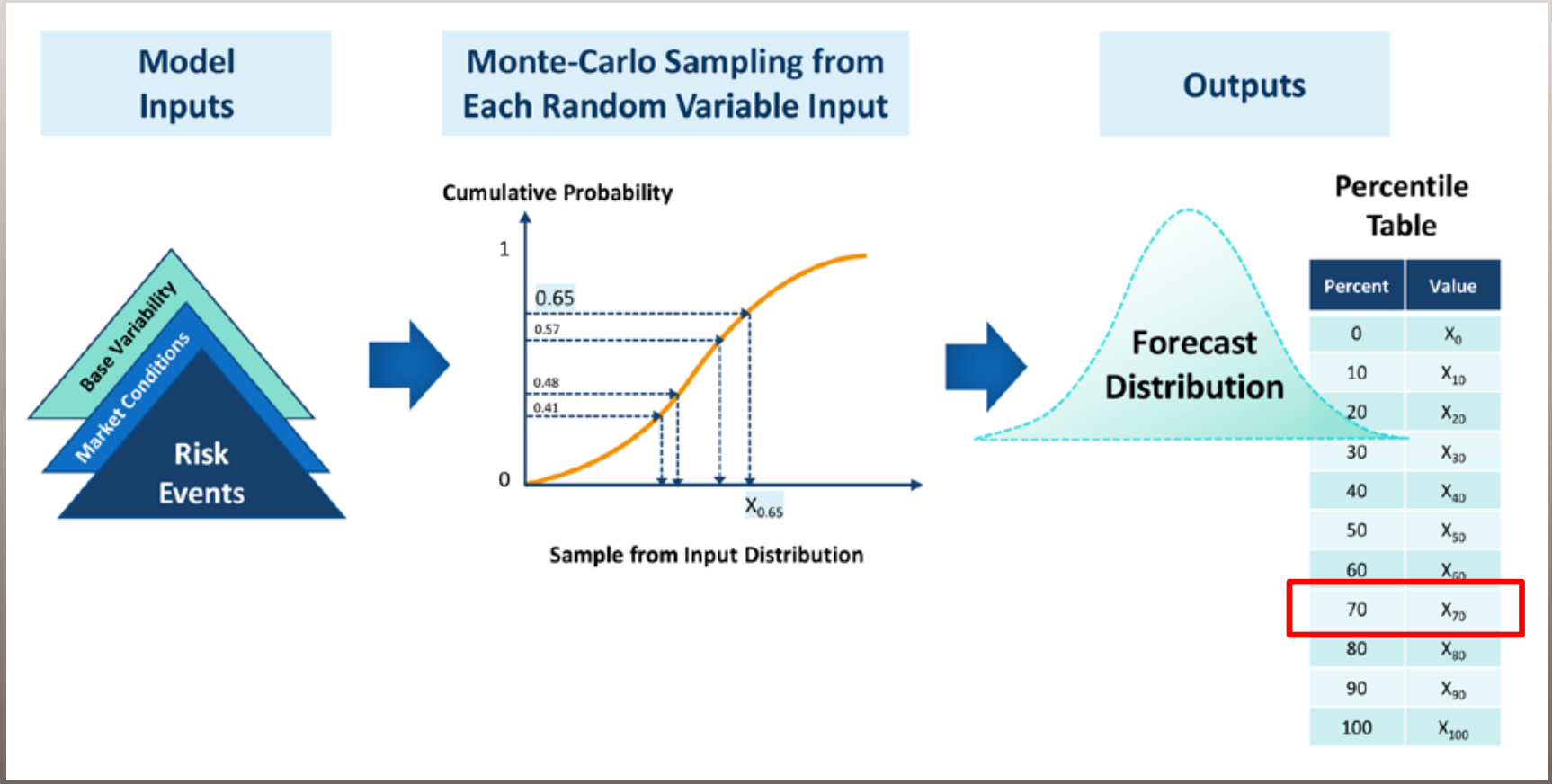
Communicate

- Closeout Presentation
- Final Report
- Issuance of NEPA Decision Document
- Approval of finance plan

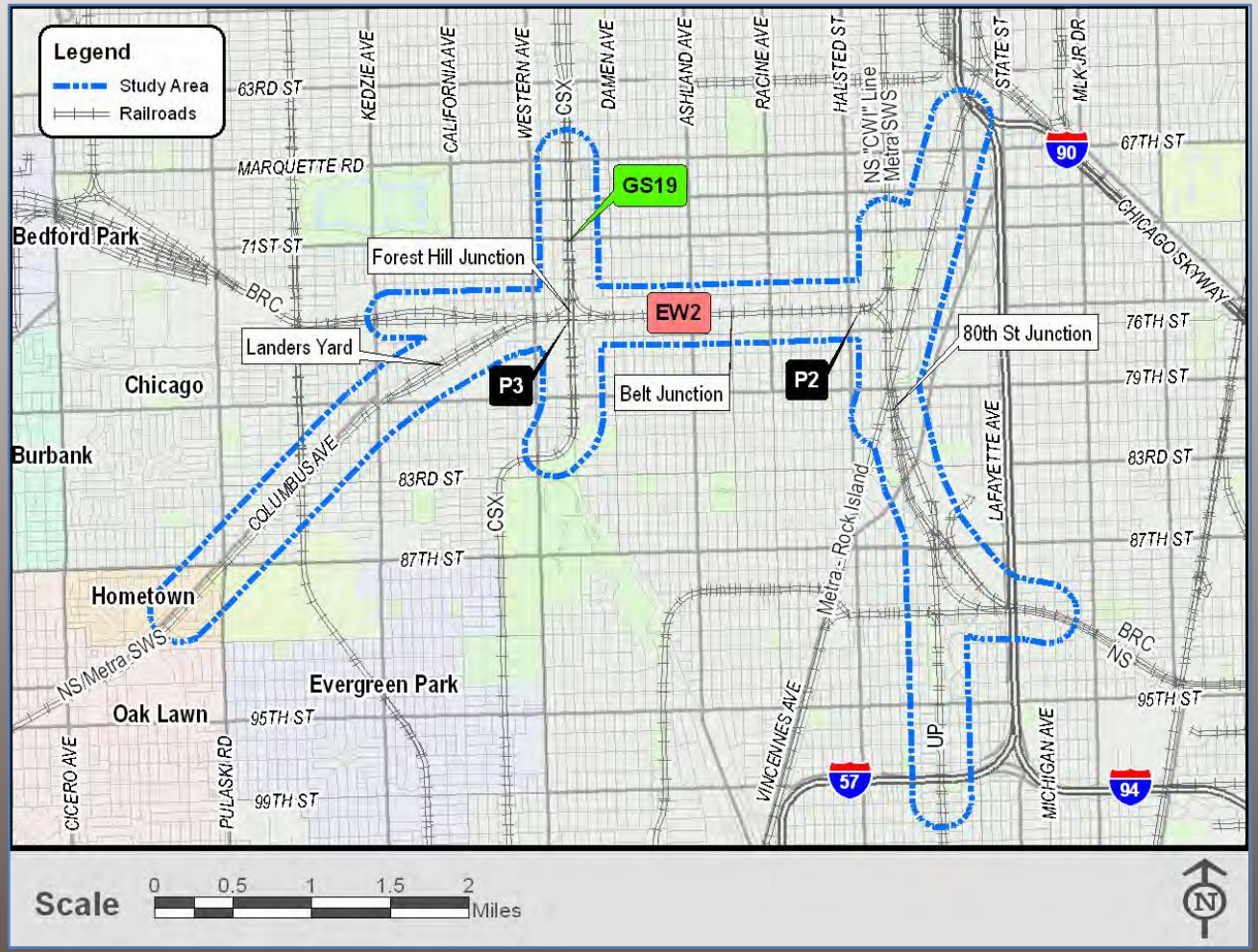
CSRA Inputs: Base Uncertainty



Monte Carlo Simulation



75th Street CIP Scope and Phasing



CSRA Inputs

- **Sponsor Cost Estimate**
  - Total project cost including NEPA, Engineering, ROW, and Construction (including contractor and owner costs e.g., CE&I)
  - Allowances (for known but not quantified items) are retained
  - Contingencies (for unknowns) are removed
  - CSRA adjustments are made as needed per workshop consensus
- **Sponsor Project Schedule (including phasing assumptions)**
  - Used to model schedule risk and year-of-expenditure (YOE) costs
- **Annual Inflation Forecast (PE, ROW, CN; may vary by year)**
- **Base Uncertainty**
  - Base Variability (unit prices/quantities/allowances)
  - Market Conditions: potential changes in bidding environment
- **Risk Register**
  - Significant risk events (threats and opportunities), relative to the base
  - Aggregate Minor Risks

CSRA Schedule Summary

Phase	Base Case		
	Start	End	Predecessor
CN – P3	10/15/2021	9/15/2025	
CN & UT-GS19	3/15/2025	8/15/2025	
CN Prof Svcs-GS19	3/15/2025	8/15/2025	
ROW-P2	1/15/2021	5/15/2025	
CN & UT-P2	11/15/2028	6/15/2031	
CN Prof Svcs-P2	11/15/2028	6/15/2031	
ROW-EW2	1/15/2021	2/15/2026	
CN & UT-EW2	8/15/2026	12/15/2031	
CN Prof Svcs-EW2	8/15/2026	12/15/2031	
CREATE-CREATE			

Pre-CSRA Cost Estimate

Phase-Segment	Phase	Segment	Cost Estimate, CY ($)	Cost Estimate, CY ($)
CN & UT-GS19	CN & UT	GS19	$ 5,233,789	$ 5,233,789
CN Prof Svcs-GS19	CN Prof Svcs	GS19	$ 484,125	$ 484,125
ROW-P2	ROW	P2	$ 9,298,793	$ 9,298,793
CN & UT-P2	CN & UT	P2	$ 200,168,933	$ 200,168,933
CN Prof Svcs-P2	CN Prof Svcs	P2	$ 20,205,854	$ 20,205,854
ROW-EW2	ROW	EW2	$ 8,270,104	$ 8,352,968
CN & UT-EW2	CN & UT	EW2	$ 767,782,617	$ 785,069,504
CN Prof Svcs-EW2	CN Prof Svcs	EW2	$ 75,276,636	$ 76,962,107
CREATE-CREATE	CREATE	CREATE		
Total			**$ 1,086,720,851**	**$ 1,105,776,074**

February 2023 Pre-CSRA Cost Estimate

Does not include Fixed and Prior Project Costs of $ 382,581,429

- Includes PE, Environment, and final design for all phases
- Construction, ROW, and Professional Services for P3

March 2023 CSRA Cost Estimate

Increase in EW2 Base Cost approximately $19M

- Includes Construction, Utilities, and Professional Services

CSRA Inflation Assumptions

Phase	2023 Pre-CSRA Inflation Rates					
	2023	2024	2025	2026	2027	2028
PE	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
ROW	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Construction	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Utilities	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%

Phase	2023 CSRA Inflation Rates					
	2023	2024	2025	2026	2027	2028
PE	5.0%	5.4%	4.7%	4.3%	3.8%	3.5%
ROW	5.0%	5.4%	4.7%	4.3%	3.8%	3.5%
Construction	5.0%	5.4%	4.7%	4.3%	3.8%	3.5%
Utilities	5.0%	5.4%	4.7%	4.3%	3.8%	3.5%

2020 CER used Flat 3.5% Inflation Rates
2023 CSRA used Tapered Inflation Rates

CSRA Inflation Assumptions

PEInflationTal Cumulative Factor (by Month)													
Year	Annual Inf	1	2	3	4	5	6	7	8	9	10	11	12
2023	5.0%	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2024	5.4%	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
2025	4.7%	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2
2026	4.3%	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
2027	3.8%	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.3
2028	3.5%	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
2029	3.5%	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
2030	3.5%	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
2031	3.5%	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
2032	3.5%	1.4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
2033	3.5%	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
2034	3.5%	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
2035	3.5%	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.7	1.7	1.7
2036	3.5%	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
2037	3.5%	1.7	1.7	1.7	1.7	1.7	1.7	1.8	1.8	1.8	1.8	1.8	1.8
2038	3.5%	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
2039	3.5%	1.8	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
2040	3.5%	1.9	1.9	1.9	1.9	1.9	1.9	1.9	2.0	2.0	2.0	2.0	2.0

Base Variability

Phase	Cost Base Variability	Schedule Base Variability
CN – P3	NA	NA
CN & UT-GS19	5%	10%
CN Prof Svcs-GS19	10%	10%
ROW-P2	10%	10%
CN & UT-P2	10%	10%
CN Prof Svcs-P2	10%	10%
ROW-EW2	10%	10%
CN & UT-EW2	10%	10%
CN Prof Svcs-EW2	10%	10%
CREATE-CREATE	NA	NA

2020 CER used 7 % (P3 CN) - 10% (Others) Cost, 10% Schedule

Market Conditions: Probability (%)

Phase	Market Conditions Probability			MI
	WtP	Planned	BtP	
CN – P3	NA	NA	NA	
CN & UT-GS19	10	80	10	
CN Prof Svcs-GS19				
ROW-P2				
CN & UT-P2	30	60	10	
CN Prof Svcs-P2				
ROW-EW2				
CN & UT-EW2	30	60	10	
CN Prof Svcs-EW2				
CREATE-CREATE	NA	NA	NA	

Market Conditions : Offset (%)

Phase	Base Variability Impact		
	WtP	Planned	BtP
CN – P3	NA	NA	NA
CN & UT-GS19	10	80	10
CN Prof Svcs-GS19			
ROW-P2			
CN & UT-P2	10	80	10
CN Prof Svcs-P2			
ROW-EW2			
CN & UT-EW2	10	80	10
CN Prof Svcs-EW2			
CREATE-CREATE	NA	NA	NA

Post-CSRA Base Cost Summary

Cost Component	Total
CSRA Base Cost Excluding Contingency (Base Year $M)	**$1,106**
CSRA Model Base Cost Inflation (CY $M)[1]	**$382**
CSRA Base Cost (YOE $M)	**$1,488**

1. Inflation based on annual rate assumptions and base project schedule.
2. Includes prior and fixed costs expended to date ($382M)

Risk Assessment

- CREATE 75th Street CIP risk register was used as the starting point for the risk assessment.
- Risks (threats and opportunities) were reviewed and assessments of potential impact to project cost and/or schedule, and associated probabilities, were confirmed or revised based on consensus of the subject matter experts.
- A total of **39** significant risks were modeled.
- Several dependent risks were identified and modeled accordingly

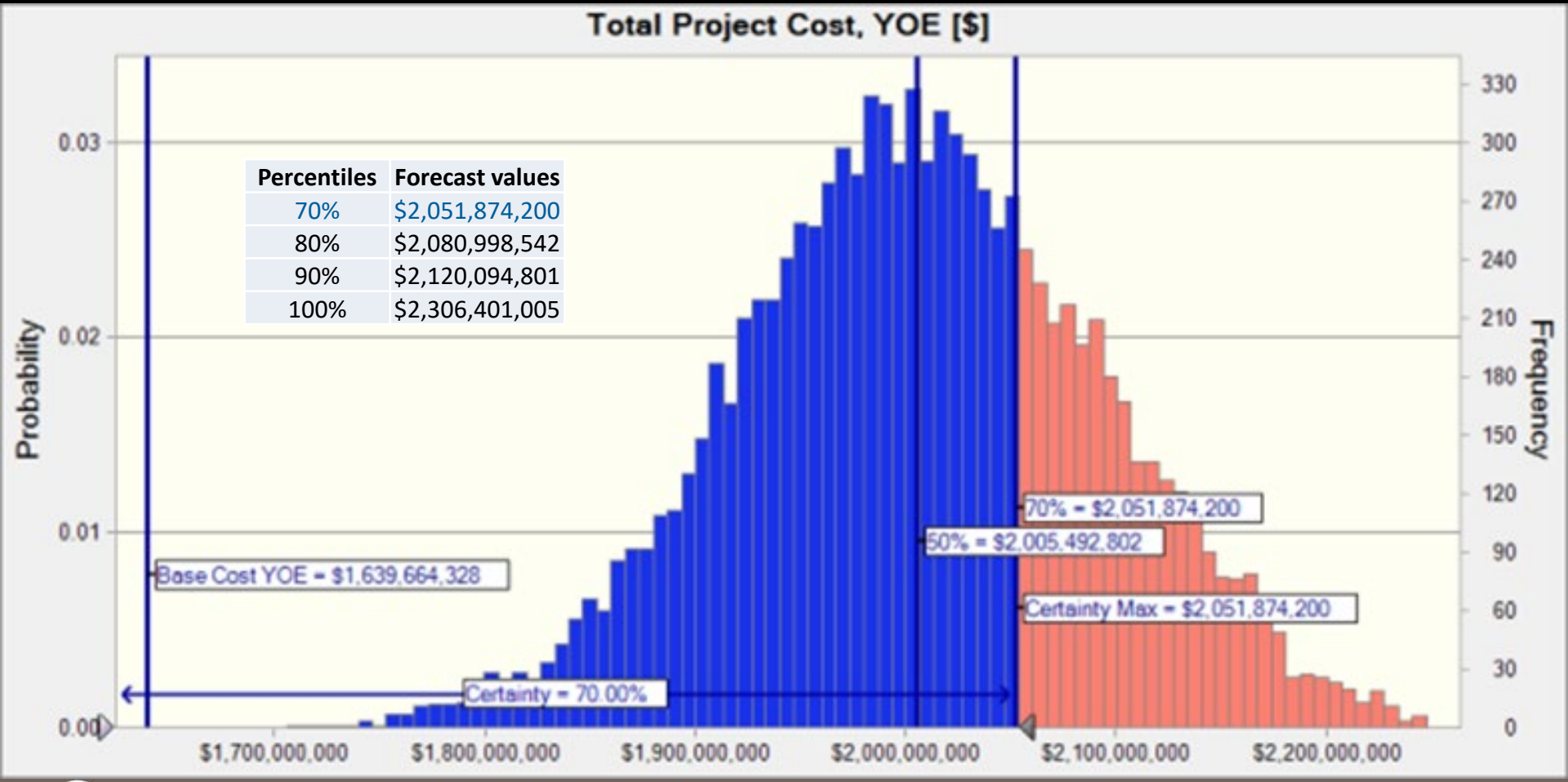
CSRA Review Outcomes

- Review findings/recommendations
- Adjustments made to estimate during review
- Project cost estimate at 70% level of confidence
- Project cost schedule at 70% level of confidence
- Risk Register – Most Significant Threats/Opportunities
- Sensitivity or scenario analyses if applicable

CSRA Model Results

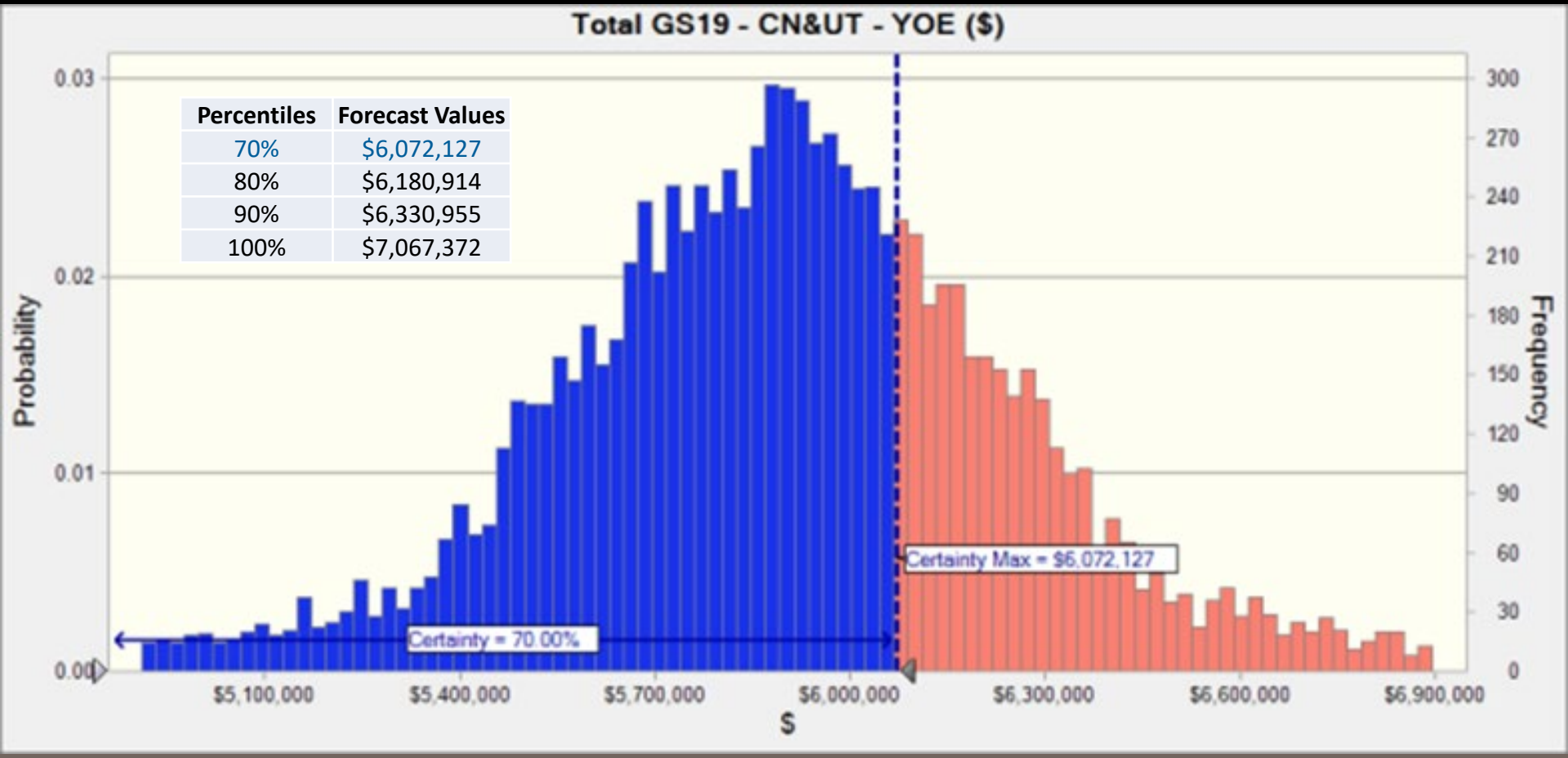
- Probability distribution of the 75th Street CIP cost and the P2, GS19, and EW2 component project costs in current year and year-of-expenditure (YOE) dollars.
- Probability distributions of Total Project Risk Costs (YOE) dollars
- Probability distributions of 75th Street CIP completion dates.
- Summary of the most significant cost and schedule risks.

75th Street CIP – Cost Results

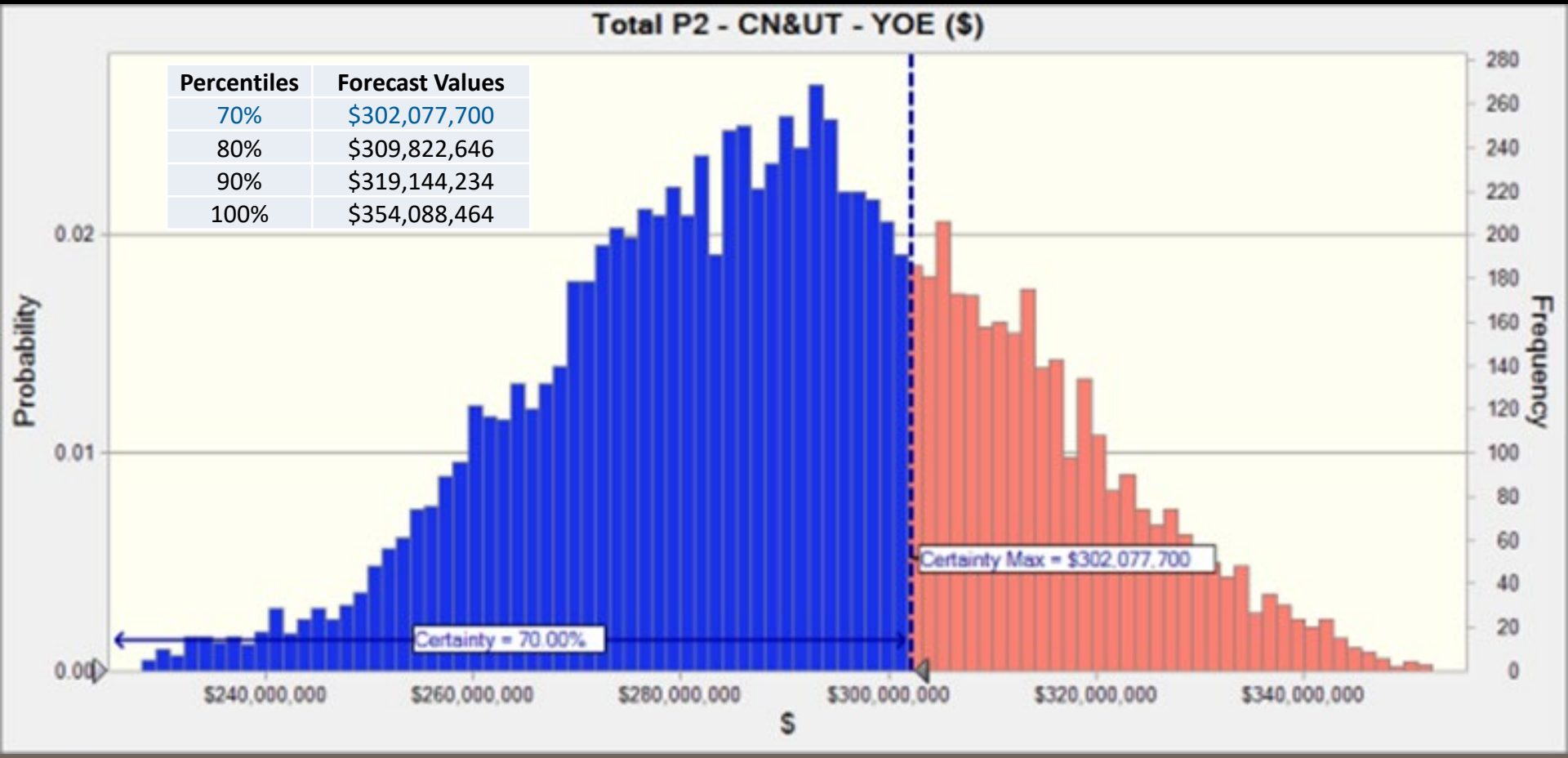


Percentiles	Forecast values
70%	$2,051,874,200
80%	$2,080,998,542
90%	$2,120,094,801
100%	$2,306,401,005

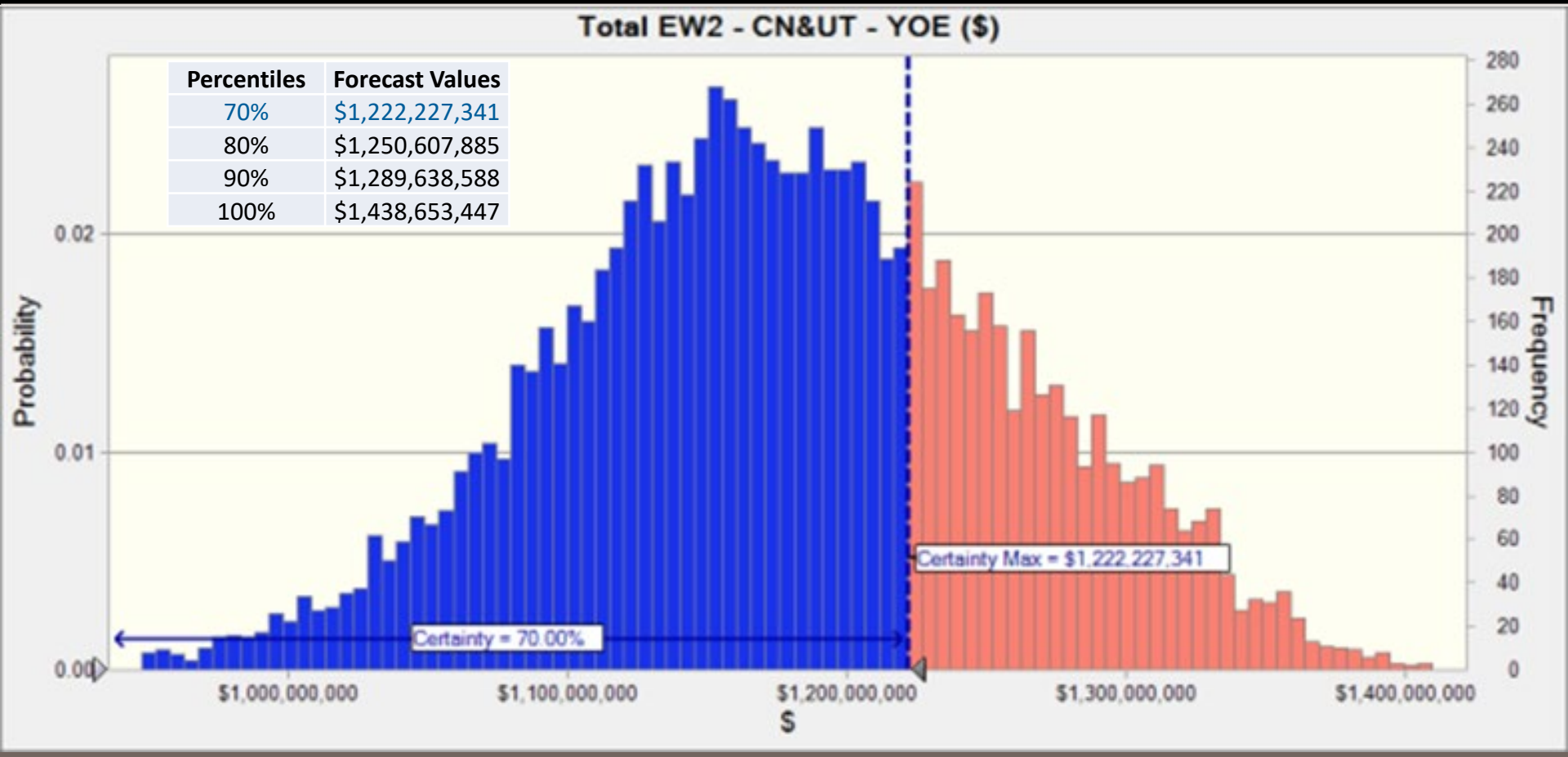
GS19 – CSRA Results



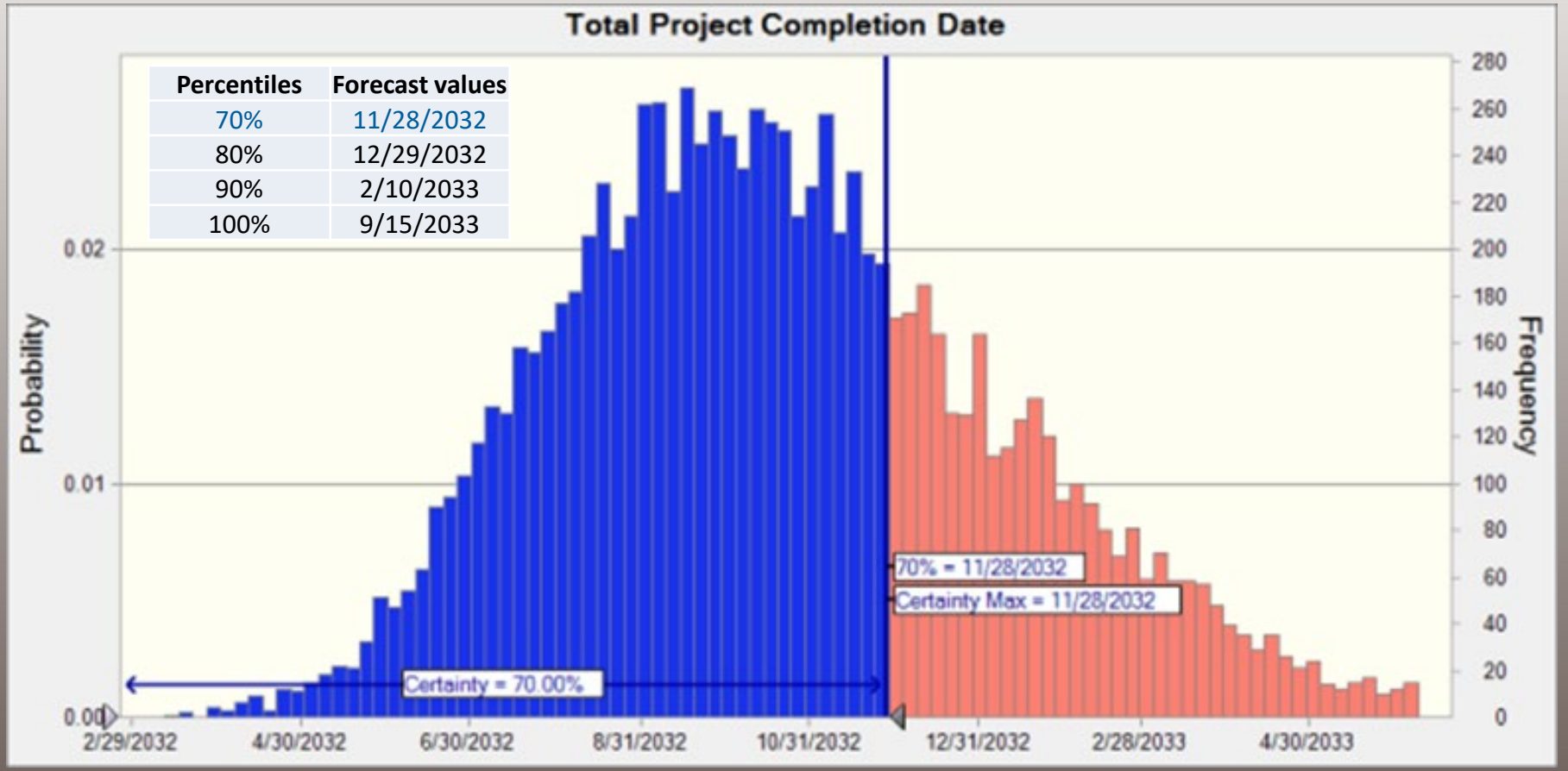
P2 – CSRA Results



EW2 – CSRA Results



75th Street CIP - Completion Date



Pre-CSRA Completion Date - December 15, 2031

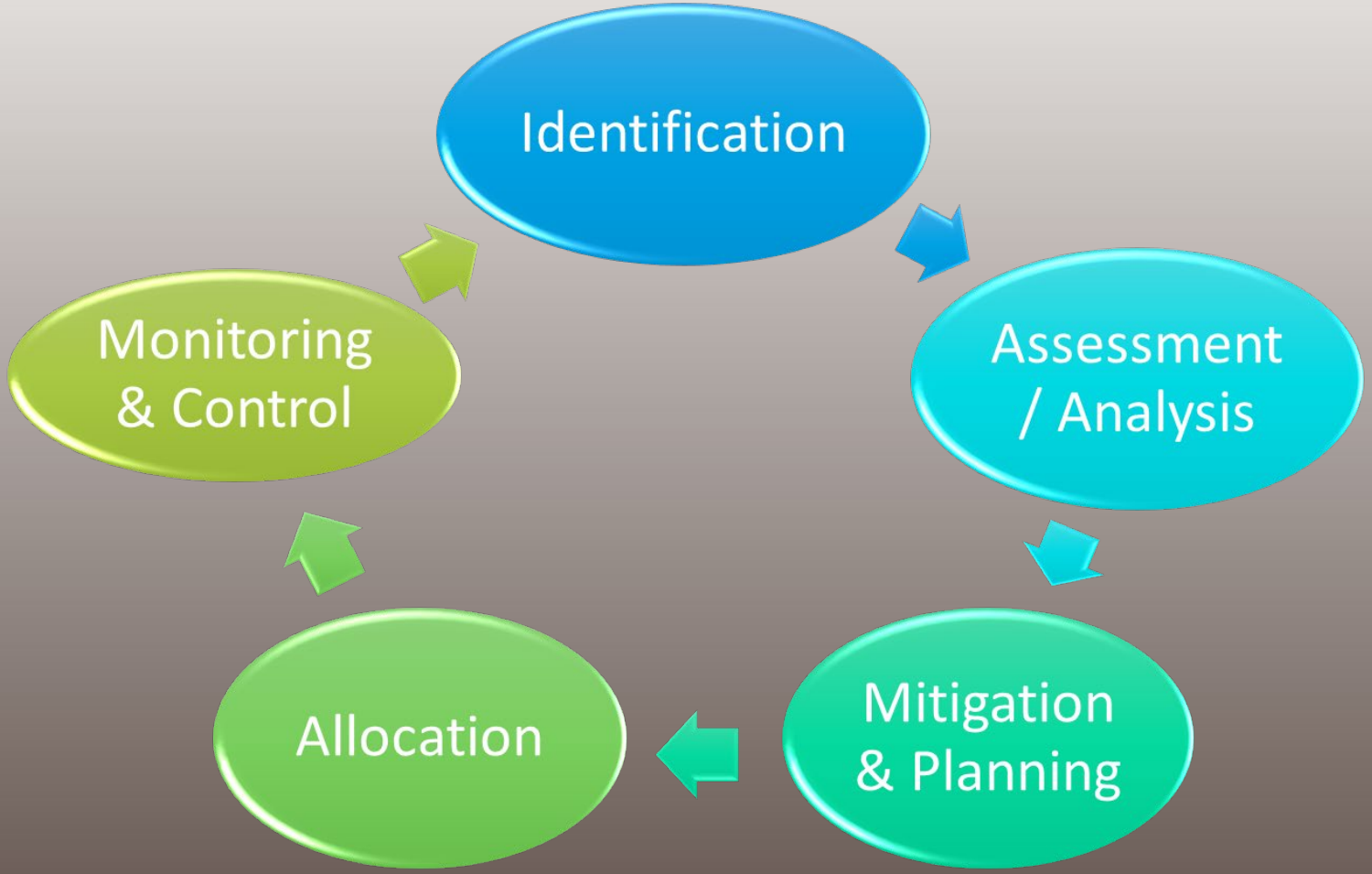
Top Cost Risks

- Bridge repair versus replacement scope
  - Both EW2 and P2 component projects
- Signal cost increases due to new control point
- Increases to railroad labor rates and overhead

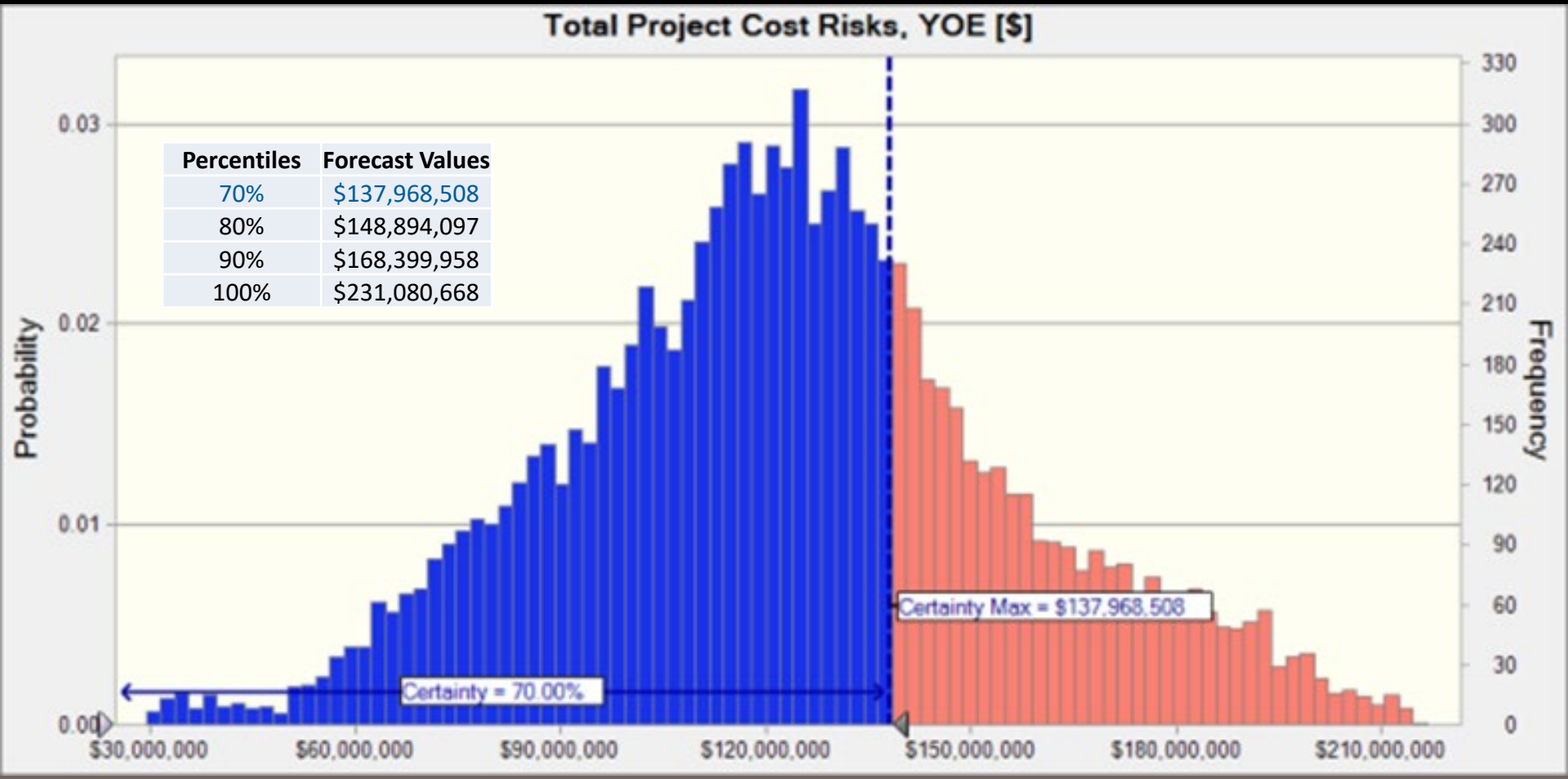
Top Schedule Risks

- Permitting – OUC and CDWM
- Utility Coordination within Railroad ROW
- Acquisitions and Relocations

Risk Management Process



Total Project Cost Risks (YOE)



2020 CER versus 2023 CSRA

- 70th percentile YOE project cost from the 2020 CER was $1.068B with a projected completion date of November 15, 2027.
- 2023 CSRA 70th percentile YOE cost is $2.052B with a projected completion date of November 28, 2032.
- Increase in YOE is $0.984B and delay in completion is 5 years.

Review Observations

- The project CSRA cost estimate is believed to be appropriate for the level of design for the Phases presented.
- The Project Team risk register was comprehensive and detailed.
- The Project Team and SMEs were highly engaged and provided thoughtful and constructive input to the cost and schedule estimate review and risk discussions.
- The CSRA consisted of a detailed analysis of the project cost and schedule and helped to develop mitigation strategies for remaining risks.
- The current program management structure for CREATE appears to be functioning effectively.

Recommendations

- Establish a project budget corresponding to, at minimum, the 70th percentile CSRA cost result of $2.052 billion (YOE). This represents a project contingency of about 14.5% ($212 million) relative to the base project cost of $1.457 billion (YOE) (including prior and fixed costs). This level of contingency is consistent with the risks identified.

- Document any cost and schedule changes going forward. The CSRA results should be used to inform the next major project Financial Plan Annual Update (CY2023).

Recommendations

- Continue to develop a clear, shared understanding of the roles, obligations, and expectations associated with the CREATE Partners among the Project management team to ensure continuity of project delivery.

- Update and utilize the risk register resulting from this CSRA as a tool to continue managing the project's cost and schedule risks. It is recommended that the project sponsor continue to develop mitigation strategies for each identified risk, including assignment of responsibility and regular status reviews. The risk register can also be used to help inform contractual risk allocation decisions.

CSRA Next Steps

- FHWA will prepare a final report documenting review findings.
  - Draft report e-mailed to Division Office for review within 30 days
  - Division Office will review the draft and forward it to the Project Team
  - Final report issued within 30 days after receipt of comments
  - Final report forwarded to the Division Office for distribution to the Project Team
- FHWA uses the results as the official cost estimate for the project (Annual Reporting)
- Estimate review is a snapshot of the current estimate

Questions?

Backup Slides

Prior and Fixed Costs

	Functional Class Costs (Less Contingency)				
Segment LOOKUP	PE/ENV	Final Design	ROW	Construction/ Utility	Construction Related Prof Svcs
P3	$3,867,046	$16,500,000	$239,153	$296,986,476	$13,769,865
GS19	$229,313	$1,125,000	$0	$5,233,789	$484,125
P2	$2,710,059	$13,725,000	$9,298,793	$200,168,933	$20,205,854
EW2	$3,616,887	$26,184,961	$8,352,968	$785,069,504	$76,962,107
Segment Total	$10,423,305	$57,534,961	$17,890,914	$1,287,458,703	$111,421,951
Check vs Detail	$10,423,305	$57,534,961	$17,890,914	$1,287,458,703	$106,495,759
CREATE Total			$1,484,729,834		

	CREATE Phase 2 Contingency (Mgmnt Res + Allocated)					
Segment LOOKUP	PE	Final Design	ROW	Construction/ Utility	Construction Related Prof Svcs	CREATE Phase II Contingency & Mgmt Res
P3	$0	$1,500,000	$0	$35,753,277	$1,200,000	$38,453,277
GS19	$0	$112,500	$0	$1,046,758	$0	$1,159,258
P2	$0	$1,000,000	$1,859,759	$40,033,787	$1,712,879	$44,606,425
EW2	$0	$1,015,169	$1,167,347	$157,013,901	$6,514,089	$165,710,506
Segment Total	$0	$3,627,669	$3,027,105	$233,847,722	$9,426,969	$249,929,465
Check vs Detail	$0	$3,627,669	$3,027,105	$233,847,722	$9,426,969	$249,929,465
CREATE Total			$249,929,465			

The yellow highlighted cells in the snips represent the Prior and Fixed Cost amount of $382.6M in the CSRA model.

Cost Changes Made During CSRA Workshop

		EW2	
		Direct Cost	Phase II Allocated Contgcy
1.0	Removals / Demolition	$10,847,322	$2,169,464
2.0	Civil - Earthwork	$33,500,320	$6,700,064
3.0	Track work	$105,614,654	$21,122,931
4.0	Signals & Systems	$132,197,335	$26,439,467
5.0	Structures	$357,903,591	$71,580,718
6.0	Viaducts	$20,169,056	$4,033,811
7.0	Environmental Mitigation	$43,489,841	$8,697,968
8.0	Miscellaneous & Temporary Facilities	$59,543,411	$11,908,682
9.0	**Utility**	$4,517,087	$903,417
10.0	**ROW**	$8,270,104	$1,167,347
11.0	**Professional Services**	$105,078,484	$7,386,642
	SUBTOTAL	$881,131,205	$162,110,511

		EW2	
		Direct Cost	Phase II Allocated Contgcy
1.0	Removals / Demolition	$10,847,322	$2,169,464
2.0	Civil - Earthwork	$33,500,320	$6,700,064
3.0	Track work	$105,614,654	$21,122,931
4.0	Signals & Systems	$132,197,335	$26,439,467
5.0	Structures	$365,043,852	$73,008,770
6.0	Viaducts	$20,169,056	$4,033,811
7.0	Environmental Mitigation	$52,922,441	$10,584,488
8.0	Miscellaneous & Temporary Facilities	$60,257,437	$12,051,487
9.0	**Utility**	$4,517,087	$903,417
10.0	**ROW**	$8,352,968	$1,167,347
11.0	**Professional Services**	$106,763,955	$7,529,258
	SUBTOTAL	$900,186,428	$165,710,506

The highlighted costs in the snips from the EW2 costs during the workshop and the changes made after the workshop amount to the $19M base cost increase.

Top Cost Threats

Phase Impacted	Risk Event Name	Detailed Description of Risk Event	Prob.	Most Likely Cost, ($)	Probable Cost Impact, ($)
CN & UT-EW2	New Control Point	Signal cost increase due to suppy and regulatory (BABA) issues	95%	$ 9,424,674	$ 8,953,441
CN & UT-EW2	Bridge Repair Locations	Potential required deep foundations where existing abutments assumed to remain	75%	$ 26,775,980	$ 20,081,985
CN & UT-EW2	Bridge Repair Locations - EW2 cost	Consecutive (or close by) bridge improvements may be delayed to minize traffic impacts due to road closures	25%	$ 35,701,307	$ 8,925,327
CN & UT-P2	Bridge Repair Locations - P2 cost	Consecutive (or close by) bridge improvements may be delayed to minize traffic impacts due to road closures	50%	$ 13,788,453	$ 6,894,227
CN & UT-EW2	Bridge Repair Locations - EW2 cost	Signal cost increase due to suppy and regulatory (BABA) issues	90%	$ 35,701,307	$ 32,131,176
CN & UT-EW2	RR Labor Rate and/or Overhead Increase	Labor force negotiation	80%	$ 7,134,360	$ 5,707,488
		Total Probable Cost Impact (CY$)			$ 85,854,757

The $85.9M Total Probable Cost Impact from these 6 cost threats represent about 93% of the $92.1M in Probable Cost Impacts for all the cost threats in the model's risk register.

Top Schedule Threats

Phase Impacted	Risk Event Name	Detailed Description of Risk Event	Prob.	Most Likely Schedule, (mos)	Probable Schedule Impact, (mos)
CN & UT-P2	Drainage (non viaduct improvements) - P2 time	Permiting and scheduling - time intensive OUC/CDWM review	81%	8.0	6.317
CN & UT-EW2	Drainage (non viaduct improvements) - EW2 time	Permiting and scheduling - time intensive OUC/CDWM review	90%	8.0	6.855
CN & UT-EW2	Relocations (RR ROW)	Siginificant unkown utility conflicts may be present within RR ROW. Permiting/utility coordination could drastically impact schedule. Additional review of relocation between utility holders.	90%	8.0	7.330
CN & UT-P2	Relocations (RR ROW)	Siginificant unkown utility conflicts may be present within RR ROW. Permiting/utility coordination could drastically impact schedule. Additional review of relocation between utility holders.	60%	8.0	5.679
CN & UT-EW2	Acquisition - EW2	Acquisition of alternative ROW parcels	75%	8.0	5.204
CN & UT-P2	Acquisition - P2	Acquisition of alternative ROW parcels	75%	8.0	5.024

These 6 schedule threats represent the most significant schedule threats in the model's risk register. While there are many other lesser schedule threats in the model's risk register, they don't have a significant impact on the model results because they are almost all in parallel with the 6 schedule threats listed here – which results in the top schedule threats controlling the model results.

Appendix B

Risk Register from Monte Carlo Model

Risk Register

RiskReg#	Phase Impacted	Risk Event Name	Detailed Description of Risk Event	Probability including Dependency	Cost Risk Threat / Opportunity	1 Low Cost, ($)	2 Most Likely Cost, ($)	3 High Cost, ($)	Schedule Threat/ Opportunity	1 Low Schedule, (mos)	2 Most Likely Schedule, (mos)	3 High Schedule, (mos)	Probable Schedule Impact, (mos)
1	ROW-EW2	ROW Demolition	Identification of contaminated items requiring development of mitigation strategy and potential procurement of services.	50%	Threat				Threat	1.0	2.0	4.0	1.242
2	CREATE-CREATE	Topsoil Excavation	Sample material to determine weather it is special waste. Additional time for hual away of special waste	50%					Threat	2.0	4.0	6.0	1.449
3	CN & UT-P2	Clear and Grub Tress for Access Roads - P2	Potential schedule threat due to workforce and environmental concerns (i.e. long eared bat migration)	75%					Threat	2.0	4.0	6.0	2.693
4	CN & UT-EW2	Clear and Grub Tress for Access Roads - EW2	Potential schedule threat due to workforce and environmental concerns (i.e. long eared bat migration)	75%					Threat	2.0	4.0	6.0	3.410
5	CN & UT-P2	Drainage (non viaduct improvements) - P2 time	Permiting and scheduling - time intensive OUC/CDWM review	81%					Threat	6.0	8.0	10.0	5.617
6	CN & UT-EW2	Drainage (non viaduct improvements) - EW2 time	Permiting and scheduling - time intensive OUC/CDWM review	90%					Threat	6.0	8.0	10.0	7.490
7	CN & UT-EW2	New Track Construction	Potential procurement and regulatory (BABA) issues	80%	Threat	$ 2,016,428	$ 4,032,856	$ 6,049,284					0.000
8	CN & UT-EW2	Turnouts - cost	Potential procurement and regulatory (BABA) issues	64%	Threat	$ 1,644,506	$ 3,289,013	$ 4,933,519					0.000
9	CN & UT-EW2	Turnouts - time	Potential procurement and regulatory (BABA) issues	80%					Threat	1.0	2.0	4.0	1.934
10	CN & UT-EW2	Track Modifications	Potential procurement and regulatory (BABA) issues	80%					Threat	1.0	2.0	4.0	1.891
11	CN & UT-P2	Track Modifications	Potential procurement and regulatory (BABA) issues	75%					Threat	1.0	2.0	4.0	1.558
12	CN & UT-EW2	Road Crossings (Permanent or Temporary)	High coordination and number of crossings; RR are generally out of control of CDOT/IDOT/ICC concurrence	90%					Threat	1.0	2.0	4.0	1.712
13	CN & UT-P2	Road Crossings (Permanent or Temporary)	High coordination with lower number of crossings; RR are generally out of control of CDOT/IDOT/ICC concurrence	75%					Threat	1.0	2.0	4.0	2.277
14	CN & UT-EW2	New Control Point	Signal cost increase due to suppy and regulatory (BABA) issues	95%	Threat	$ 4,712,337	$ 9,424,674	$ 14,137,011	Threat				0.000
15	CN & UT-EW2	Bridge Repair Locations	Potential required deep foundations where existing abutments assumed to remain	75%	Threat	$ 17,850,654	$ 26,775,980	$ 35,701,307	Threat				0.000
16	CN & UT-EW2	Bridge Repair Locations	Delay in delivery of prefabricated materials	50%	Threat				Threat	1.0	2.0	3.0	0.700
17	CN & UT-EW2	Bridge Repair Locations - EW2 cost	Consecutive (or close by) bridge improvements may be delayed to minize traffic impacts due to road closures	25%	Threat	$ 17,850,654	$ 35,701,307	$ 53,551,961	Threat	1.0	2.0	3.0	0.683
18	CN & UT-P2	Bridge Repair Locations - P2 cost	Consecutive (or close by) bridge improvements may be delayed to minize traffic impacts due to road closures	50%	Threat	$ 6,894,227	$ 13,788,453	$ 20,682,680	Threat				0.000
19	CN & UT-EW2	Bridge Repair Locations - EW2 time	Consecutive (or close by) bridge improvements may be delayed to minize traffic impacts due to road closures	50%	Threat				Threat	2.0	6.0	8.0	1.801
20	CN & UT-P2	Bridge Repair Locations - P2 time	Consecutive (or close by) bridge improvements may be delayed to minize traffic impacts due to road closures	50%	Threat				Threat	1.0	2.0	3.0	1.007
21	CN & UT-EW2	Bridge Repair Locations - EW2 time	Signal cost increase due to suppy and regulatory (BABA) issues	13%	Threat				Threat	2.0	6.0	8.0	0.769
22	CN & UT-EW2	Bridge Repair Locations - EW2 cost	Signal cost increase due to suppy and regulatory (BABA) issues	90%	Threat	$ 17,850,654	$ 35,701,307	$ 53,551,961	Threat				0.000
23	CN & UT-EW2	Noise Walls	Structure design, drainage, permitting, and adminstration of the noise wall (ownership, maintenance) with public partners (CDOT, IDOT)	75%	Threat				Threat	2.0	4.0	6.0	2.634
24	CN & UT-EW2	Hazardous Materials (risk assessment count by parcel) - EW2 cost	Unknown HazMat locations along RR or Private ROW (large project area)	36%	Threat	$ 1,924,507	$ 2,886,761	$ 3,849,015	Threat				0.000
25	CN & UT-EW2	Hazardous Materials (risk assessment count by parcel) - EW2 time	Unknown HazMat locations along RR or Private ROW (large project area)	60%	Threat				Threat	2.0	3.0	4.0	1.745
26	CN & UT-P2	Visual Impact Minimization Measures	Scope of form liners at Viaducts, Structures, Flyovers TBD	80%	Threat				Threat	1.0	3.0	6.0	1.811
27	CREATE-CREATE	Maintenance of Traffic (MOT) - cost	Extended construction duration requiring extended MOT	25%	Threat	$ 1,382,960	$ 2,765,921	$ 4,148,881	Threat				0.000
28	CREATE-CREATE	Maintenance of Traffic (MOT) time	Contractors need to develop MOT plan during non-construction months to get IDOT/CDOT approval	50%	Threat				Threat	1.0	2.0	4.0	1.040
29	CN & UT-EW2	Flagging (RR Maintenance of Way) - EW2 cost	Labor constraints and overlapping activities require increased coordination with RR's	80%	Threat	$ 894,000	$ 1,788,000	$ 2,682,000	Threat				0.000

30	CN & UT-EW2	Flagging (RR Maintenance of Way) - EW2 time	Labor constraints and overlapping activities require increased coordination with RR's	80%	Threat				Threat	1.0	2.0	4.0	2.007
31	CN & UT-P2	Flagging (RR Maintenance of Way)	Labor constraints and overlapping activities require increased coordination with RR's	80%	Threat				Threat	1.0	2.0	4.0	2.232
32	CN & UT-EW2	RR Labor Rate and/or Overhead Increase	Labor force negotiation	80%	Threat	$ 3,567,180	$ 7,134,360	$ 10,701,540	Threat				0.000
33	CN & UT-EW2	Relocations (RR ROW)	Siginificant unkown utility conflicts may be present within RR ROW. Permiting/utility coordination could drastically impact schedule. Additional review of relocation between utility holders.	90%					Threat	4.0	8.0	12.0	5.067
34	CN & UT-P2	Relocations (RR ROW)	Siginificant unkown utility conflicts may be present within RR ROW. Permiting/utility coordination could drastically impact schedule. Additional review of relocation between utility holders.	60%					Threat	4.0	8.0	12.0	3.951
35	CREATE-CREATE	Relocations (Roadway/Infrastructure) - cost	Additional mitigation meastures at known utilty conflicts	30%	Threat	$ 1,196,987	$ 2,393,975	$ 5,984,936	Threat				0.000
36	CREATE-CREATE	Relocations (Roadway/Infrastructure) - time	Additional mitigation meastures at known utilty conflicts. Permiting/utility coordination could impact schedule. Additional review of relocation between utility holders.	60%					Threat	4.0	8.0	12.0	3.047
37	CN & UT-EW2	Acquisition - EW2	Acquisition of alternative ROW parcels	75%					Threat	4.0	8.0	16.0	6.492
38	CREATE-CREATE	Acquisition	Procurement of ROW during Final Design	75%					Threat	3.0	6.0	8.0	4.831
39	CN & UT-P2	Acquisition - P2	Acquisition of alternative ROW parcels	75%					Threat	4.0	8.0	16.0	7.919
Total						**$ 77,785,093**	**$ 145,682,606**	**$215,974,094**		**62.0**	**120.0**	**191.0**	**79.0**