

Function Driven Risk Management

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Abstract

The effect of uncertainty on value can play a major role in decision making. Threats can just as surely erode project value, as can missed opportunities. The improvement and utilization of quantitative risk analysis and management techniques in recent years has brought greater attention to the role of risk in effectively evaluating and delivering projects of all scope and scale. Risk studies are becoming commonplace; however, there exist gaps in thinking that directly link to a lack of understanding of project functions. The exploration of relational dependencies of risk on project functionality can allow for uncertainty to be evaluated and managed in a more effective and proactive fashion. In addition, a developed understanding of project functionalities that drive risk affords proper management of the impacts of uncertainties involving threats and potential opportunities throughout the project lifecycle. This paper suggests a Function Driven Risk Management (FDRM) process to fully integrate function analysis into risk management practices that will bring focus to identifying project risks, aid in prioritizing them, and focus critical thinking on the development of appropriate risk response strategies.

Introduction

The discipline of risk management has traditionally focused on the identification and quantification of risk. This focus on problems, while it has indeed proven to be effective in improving decisions that involve uncertainty, often misses the mark with respect to identifying appropriate responses in an innovative way that maximize project value. Value improvement relative to the management of risk requires that attention be given to project functions. The integration of function analysis, specifically the technique of the Function Analysis System Technique (FAST), into risk management provides a powerful means to do this.

The application of function analysis first focuses the attention of the project stakeholders toward developing a deeper understanding the project and, consequently, improves their ability to identify and discover potential risks. Just as in cost management, Pareto's Law tends to be quite applicable with respect to risk management. Most commonly 80% of the risk can be found in 20% of the project's functions. Exploring functions develops insight into which areas of a project may possess the greatest risk. As a result, stakeholders and workshop participants who are given the task of identifying risk can make better use of limited resources to focus on critical functions in order to target risks that are most in need of management in order to minimize threats and capitalize on opportunities as early as possible.

Prioritization of the critical risks is not as straight forward as simply calculating the expected impacts. This is due to the potential cascading of impacts resulting from risks that may not be fully understood when the analysis is performed. In addition, when project data and information is limited, a more qualitative risk assessment and management plan may be deployed in order to address concerns before the impacts are fully understood. As a result, sometimes risk management efforts can be misdirected

toward managing non-critical project risks. By applying function analysis the prioritization of risks is made easier. The highest priority risks most commonly fall in the most complex and critical functions of the project, making it a natural way to prioritize risks based on the importance of project function.

By digging deeper into the functions of a project and evaluating risk from this perspective, the possibility of developing more targeted and focused risk response strategies emerges. Traditional risk workshops tend to place greater emphasis on the identification of risk. While it is important to identify risks as early as possible, one of the most important aspects of risk management is having the proper response plan in place. While this still requires the identification of risk, it shifts emphasis away from the traditional method of producing studies and reports that miss the main point of how to most effectively manage a project in the face of uncertainty. By introducing the concept of function into the analysis, the most important element, or risk response strategy, can be developed in a targeted and focused manner that is centered on the management of the execution and delivery of a project from beginning to end. This is increasingly important when considering the continued globalization of markets, national and international politics, and a number of other factors such as market volatility, all of which create a much more complex environment than is often anticipated.

Function Driven Risk Management

The Function Driven Risk Management (FDRM) process is similar to the traditional risk management workflow; however, function analysis is applied at various points during the process. There are four major phases involved in performing FDRM with the related Value Methodology (VM) activities identified within each phase as outlined below.

1. Risk Identification
 - FAST Diagramming
 - Risk Brainstorming
2. Risk Analysis
 - FAST Dimensioning
3. Risk Response Planning
 - Risk Response Function Analysis
 - Risk Response Brainstorming
 - Risk Response Evaluation
 - Risk Response Development
4. Risk Monitoring and Control

Similar to most risk management workshops, FDRM utilizes a multi-discipline team composed of subject matter experts (SMEs) representing various areas of knowledge relevant to the project. In addition, FDRM requires a facilitator whom is also fluent with function analysis as well as other VM techniques. This may be the same person as the risk manager or a co-facilitator who will work in conjunction with the risk manager. It is important to note that a skilled facilitator with the necessary qualifications is important, as they will ultimately be able to best drive the process and achieve the desired outcome.

Figure 1 outlines a process flowchart for FDRM. The process essentially begins with the identification of the project's basic function(s) and ends with the implementation of specific risk response strategies. A detailed discussion is provided for each phase.

Risk Identification

The Risk Identification phase of a FDRM workshop provides workshop participants with a general understanding of the project's baseline assumptions and potential issues. Critical constraints, details, and target milestones should be reviewed to ensure that all workshop participants fully understand the project's scope, schedule, and budget. The following activities comprise the Risk Identification phase:

- a. Identification of Stakeholder Issues and Concerns – Key stakeholder issues and concerns, as well as project constraints, are presented by the project team. Issues affecting decisions and concerns of the design teams or any other stakeholders should also be presented.
- b. Base Cost and Schedule Validation – The baseline cost and schedule assumptions should be verified by the team. This includes verifying key milestone dates and costs for the project or system by all stages of delivery.
- c. Function Analysis / FAST – A FAST diagram should be developed for the project's current design concept. A more detailed discussion of this step is provided in the section that follows.
- d. Preliminary Risk Identification – Initial Risk Identification should commence with the brainstorming of potential risk events. The critical functions identified during the development of the FAST Diagram should be focused on for team brainstorming. Risk events pertaining to the critical functions should be elicited first, followed by potential risk events relating to less critical project or system functions. The preliminary risks identified should be reviewed and validated by the workshop participants once it has been determined that the majority of potential risks have been identified.

Function Analysis / FAST

The analysis of functions allows for a clearer understanding of the reasons for why the various elements within a project exist. It requires the articulation of functions using a two-word abridgment. This convention forces conciseness in thinking and ensures a dissociation from specifics which is essential in developing a deeper appreciation for why specific elements in a project exist. For example, the basic function of a hammer would be described as "transmit force." This is a very concise description of what a hammer is designed to do without associating this definition to a specific means to do so. We are free to visualize any variety of objects and/or methods to "transmit force," a hammer being just one way.

In FAST, functions represent the basic building blocks that are then arranged into a logic structure that relies on "How-Why" logic. A function located to the right of another function answers the question "How?" while a function located to the left another answers the question "Why?" Building upon the example of a hammer (Figure 2), if one asked the question "Why transmit force?" the answer might be "To drive nails." Moving in the opposite direction, if one asked "How does it transmit force?"

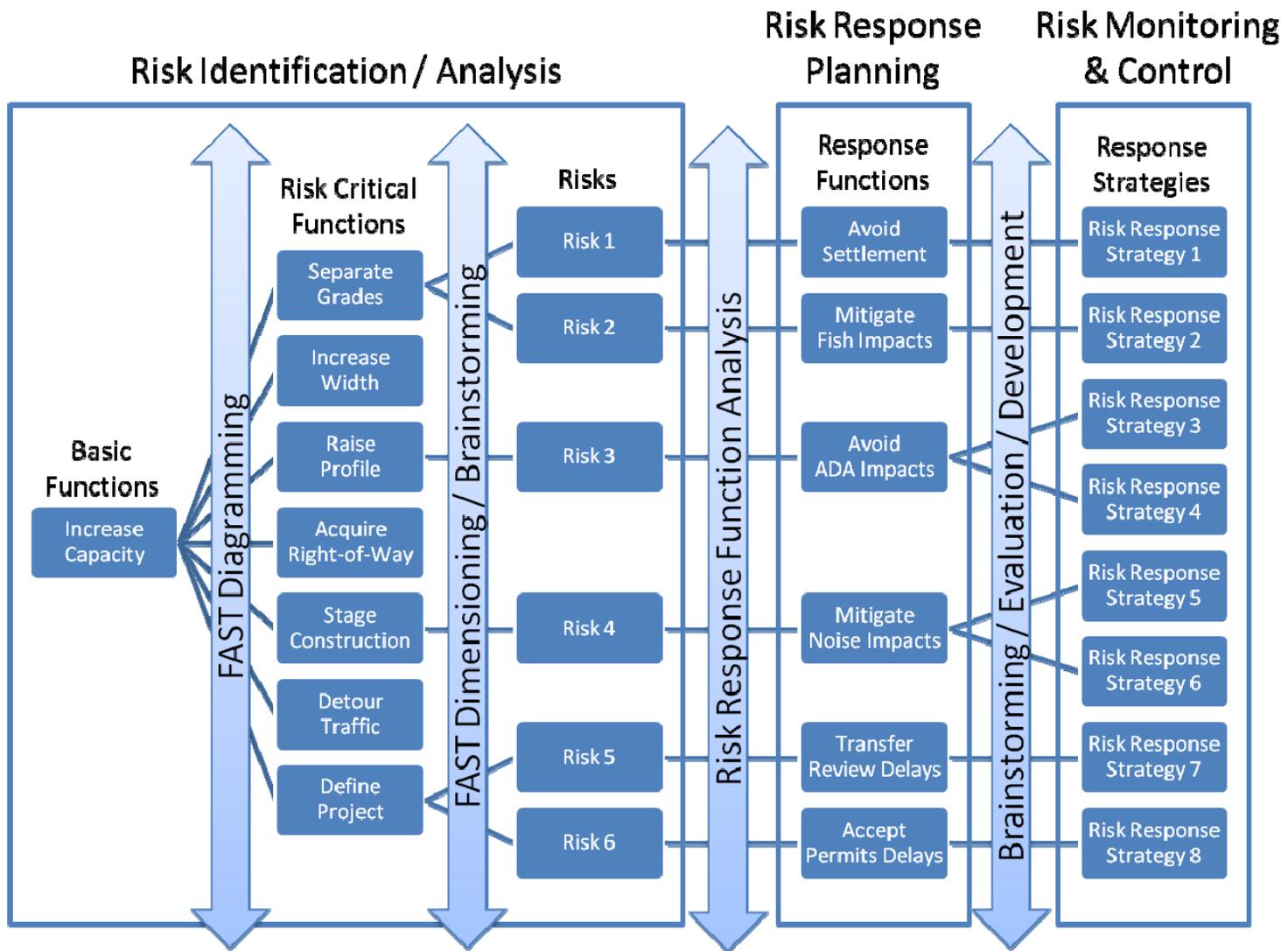


Figure 1 – Function Driven Risk management, Process Flowchart

the answer might be “By applying force.”

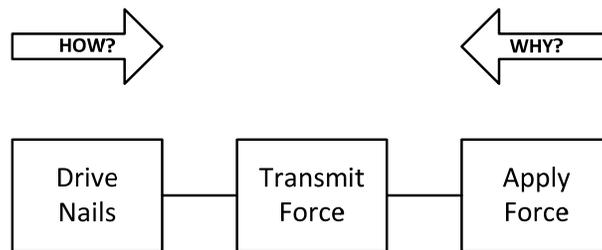


Figure 2 - How-Why Logic

A FAST diagram is essentially an elaboration of the simple linear diagram shown in Figure 1, and includes additional elements and logic paths. It is assumed that the reader has a basic understanding of function analysis and FAST diagramming, so details on the basic principles and techniques are not covered in this paper. It is recommended that those unfamiliar with these techniques refer to the bibliography at the end of this paper for further information.

So why use FAST? Perhaps the strongest reason to use it comes directly from Charles Bytheway, the originator of FAST:

“Most conflicts exist during an analysis because of poor communication between the parties involved when several people are working together on a given project. The main benefit of using Why-How Logic is the thinking and communication that take place as the participants try to reason out the logic and arrive at meaningful answers.”

Other important reasons are that it shows cause and effect relationships in an unambiguous way, reveals missing functions, and stimulates creativity. Lastly, it allows us to link information pertaining to project cost, time and performance value directly to the functions. This process is referred to as “dimensioning” a FAST diagram.

Provided in Figure 3 is an example of a FAST diagram developed for a railroad grade separation project that describes an over-crossing that is planned to be constructed over an existing rail line. The FAST diagram shows the relationship of all of the functions. Reading this diagram, one can see that the need for the project, referred to as the “higher-order function(s),” is to “Relieve Congestion” and “Improve Safety.” The purpose, referred to as the “basic function(s),” is to “Increase Capacity” and “Reduce Accidents.” The remaining functions located to right of the basic functions are referred to as “secondary functions,” and only exist due to the manner in which the basic functions are being delivered as part of the current design concept. If another way to “Increase Capacity” can be found, than it is possible that some or all of the secondary functions to the right could be changed or even eliminated.

Having completed the FAST diagram, the risk management team is now ready to begin brainstorming risks related to each function. Just like any good brainstorming session, the focus is on the quantity of risks rather than their quality – the risks themselves will be evaluated further during the next phase, Risk Analysis.

Railroad Grade Separation Project – FAST Diagram

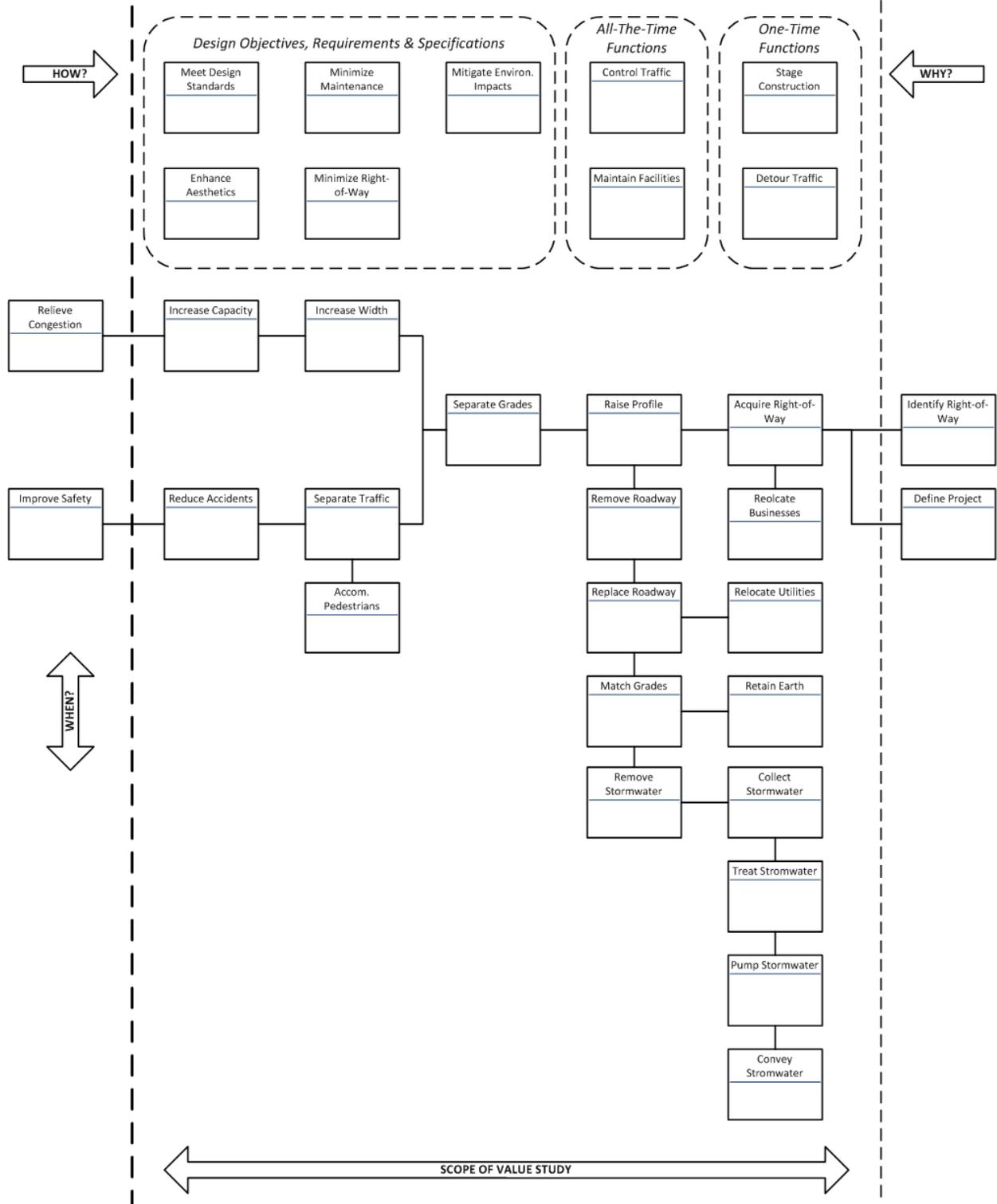


Figure 3 - FAST Diagram of a Railroad Grade Separation Project

FAST Dimensioning

Depending upon the complexity of the project and the time available to perform FDRM, the risk management team may want to take the additional step of dimensioning the FAST diagram. Dimensioning refers to the process of linking project information, specifically cost, schedule and performance data, to the functions on a FAST diagram. If possible, it is recommended that all three types of data are included in the dimensioning process using the direct method.ⁱⁱ

Cost data should be evaluated by element or system based on estimates. The costs should then be distributed in a relative manner between functions as deemed appropriate by the team. For example, in the railroad grade separation project, assume that the cost for the roadway structural section is \$3 million for the project. Assume that the existing roadway is 4 lanes, which must be replaced, and the project is going to construct an additional 2 lanes for a total of 6 lanes. This means that the costs could be approximately distributed between the following functions: \$1 million for “Increase Width,” and \$2 million for “Replace Roadway.” A cost-function matrix can be utilized to assist in this process if specific cost elements are distributed between many functions. A similar approach can be used for schedule information.

Information pertaining to project performance (i.e., scope) can also be considered. If specific project performance attributes have been identified, these can be assigned directly to the functions based on their relative influence on project performance. Methods for doing this are identified by previous work written by Robert Stewart.ⁱⁱⁱ For example, in the railroad grade separation project, the function “Increase Width” is being precipitated by the basic function “Increase Capacity.” Both of these functions are related to the dominant performance attribute, “Traffic Operations,” which is a measure of the overall level of service provided by the project. Therefore, these functions would be annotated with this information directly on the FAST diagram.

Once all of the pertinent information has been added to the FAST diagram, the risk management team can now consider how sensitive the functions are to risk. The risks for each function can be discussed and notes taken relevant to risk. Probabilities and impacts should be considered. In essence, using this approach is a form of qualitative risk analysis. The FAST diagram can then be dimensioned with this information. In Figure 4, a dimensioned FAST diagram is shown for the project. The graphic information includes a mini-bar chart for cost information; the name of the key performance attribute; and a colored flag representing the overall risk level for each function.

This approach allows the risk management team to better assess the level of risk for each function relative to its influence on performance, cost and schedule. In projects containing many functions, this can help the team focus their efforts on functions that are both high value and/or possess a high level of uncertainty in identifying risks.

Railroad Grade Separation Project – FAST Diagram

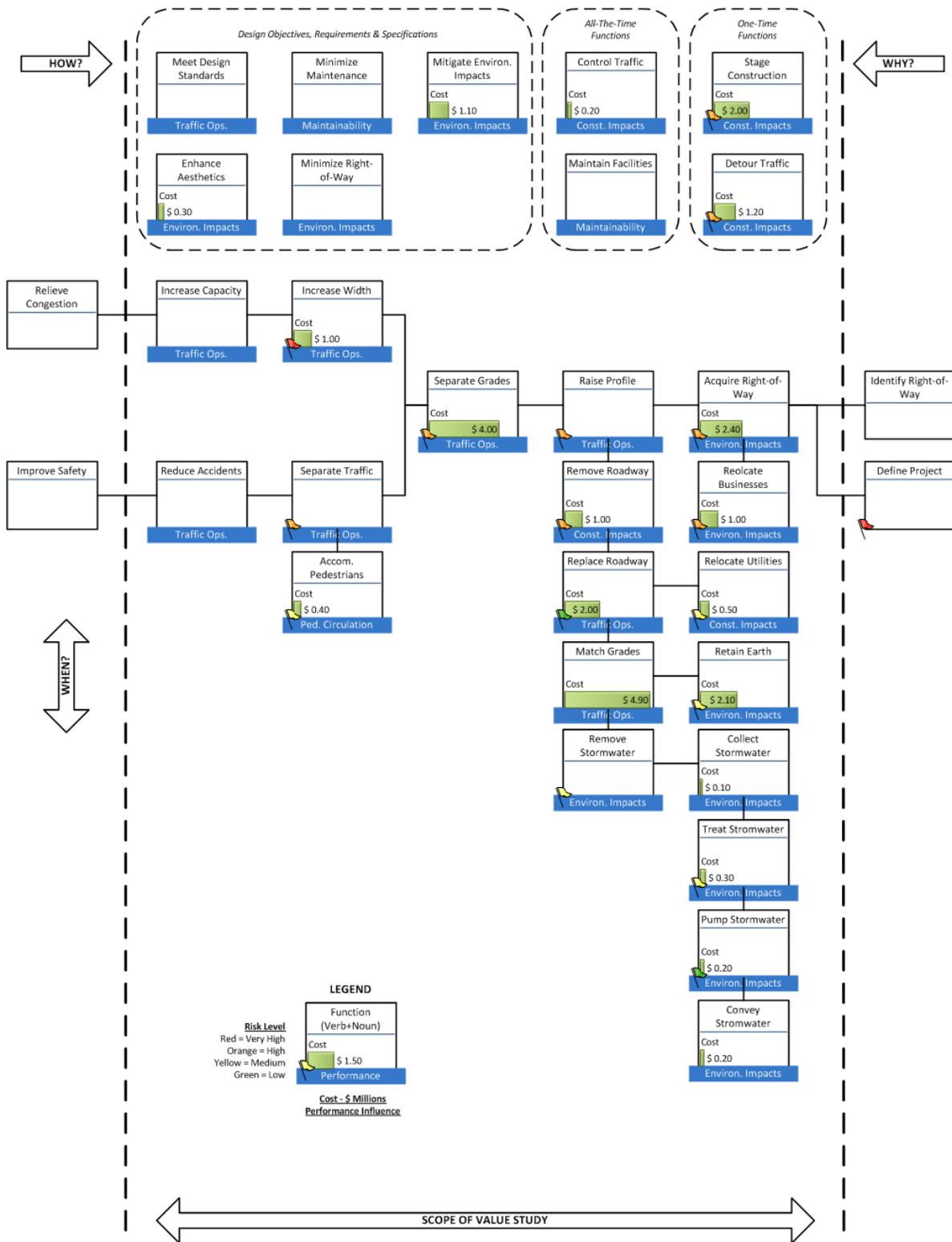


Figure 4 – Dimensioned FAST Diagram of a Railroad Grade Separation Project

Risk Analysis

The Risk Analysis phase is the stage at which the risks that were identified are subsequently elaborated upon and analyzed. In addition, the nature and range of the risk impacts are further defined in order to gauge estimates of cost, performance and schedule impacts facing the project. The following activities comprise the Risk Analysis phase:

- a. Additional Risk Identification – Further exploration of risks facing the project should be conducted. It is impossible to capture every risk, but the most relevant and highest impacting risks should be flushed out. This includes identification of new risks and expansion upon previously identified risks by the workshop team.
- b. Risk Register Refinement – The risk register should be qualitatively evaluated to determine what risks facing the project need review, modeling, response planning, and tracking. Again, priority to risks relating to critical project functions should be given. A way to qualitatively refine the risk register is to highlight the individual risk numbers in the risk register using a red, yellow, green color scheme to evaluate the risks. The following system of qualitatively coding risk priority can be used:
 - i. Red – Risks elevated to the highest priority and in need of risk management.
 - ii. Yellow – Risks elevated to a moderate level of priority and in need of risk management.
 - iii. Green – Risks determined to be at a low level of priority and not requiring direct risk management, but still requiring monitoring and tracking.
- c. Establishment of Probabilities and Impacts through Team Consensus – The probabilities and impacts for each individual risk should be developed. The team determines the range of cost and schedule impacts resulting from specific risks by establishing the low end of the range, high end of the range, and the most likely outcome. In addition, the likelihood of incurring the impact should developed by the risk assessment workshop team. References for specific data elicited in the workshop setting needs to be documented in order to provide details surrounding the origin and basis of data being utilized. Commonly, most data elicited in a workshop setting is drawn from previous experience, so it is important to know the nature of the data to be able to gauge its relative reliability when conducting a quantitative risk assessment.
- d. Modeling of Pre-Response Risk – A pre-response risk model in which the risks are assumed to be in an unmanaged state is run in this step. Often the physical modeling is not conducted during the workshop time in which participants are meeting due to the complexity required in programming the mathematical risk model, as well as the time involved. Each of the risks and potential outcomes should be simulated 10,000 times using a Monte Carlo method. The resulting statistics should then be compiled and evaluated to determine the range of project cost, duration, and total risk under the specified conditions of uncertainty. *Note: The use of a more qualitative model is possible when data is scarce or unreliable, at which point the modeling effort will be far less complex and may allow for results to be more quickly generated.*

- e. Establish Secondary Risk Priority by Expected Value Impact Severity – The primary risk priority is dictated by the most critical project functions. The secondary risk priority is driven by the relative level of potential impacts that may be incurred. The expected value impacts of each of the individual risks are calculated and can be plotted on another tool known as a Tornado Diagram in order to visually demonstrate the risk impact severities. The Tornado Diagram has the highest level risks plotted at the top of the tornado and the lowest level risks at the bottom of the tornado. This diagram helps to provide a visual presentation of the risk priority ranking based on the expected value impacts. The larger the risk impacts, the higher the priority and vice versa. The Tornado Diagram can serve as a guide of where to focus the efforts of the Risk Response and Planning phase in combination with the consideration of project function. An example of a Tornado Diagram is provided in Figure 5.

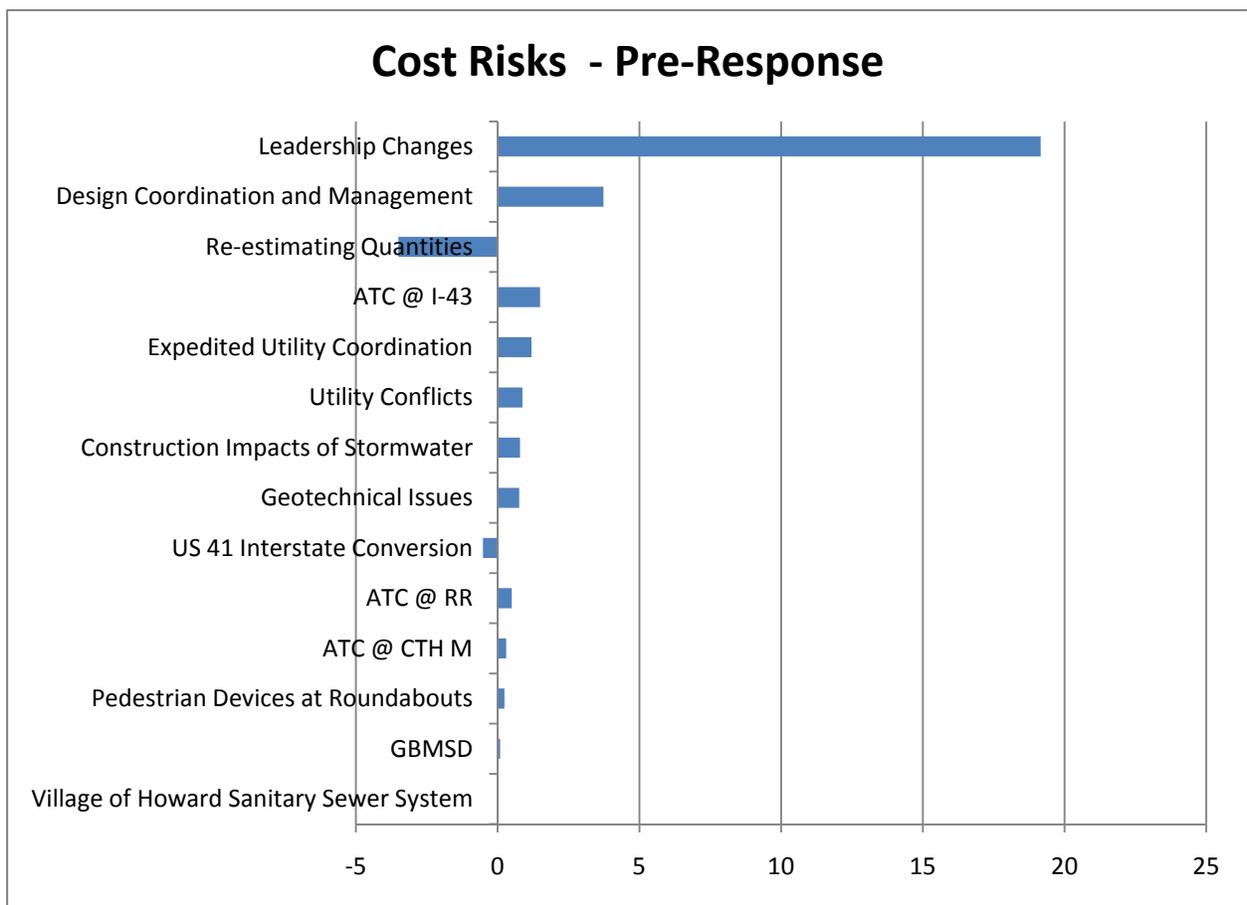


Figure 5 – Pre-Response Risk Tornado Diagram

Risk Response Planning

The Risk Response Planning phase is the most crucial phase of the entire workshop. This is the step where unique risk response strategies are developed for each of the risks, and each of the individual risk impact ranges and probabilities are updated to reflect the risk falling into a managed state. This stage focuses on laying the foundation for a solid management plan and includes full development of risk response strategies, complete with action plans. The following steps comprise the Risk Response Planning phase:

- a. Risk Object Identification – The affected area of impact is best described by the Risk Object. The Risk Object is the area affected by the risk in relation to the activity or project function being impacted. It is effectively also the elemental nature of the risk that can be managed. The object of risk for each individual risk is identified and utilized as the management target for idea development for risk response strategies. The Risk Object is typically the noun from the impacted project or system function, which is comprised of a two word abridgement of a verb-noun combination.
- b. Brainstorming of Risk Response Strategies by Function – The Brainstorming of Risk Response Strategies by Function is a three-step process. The first step is to establish the Risk Object, which becomes the target element that can effectively be managed, and it is also the element to which a risk response will provide the most direct buffering of risk impacts. Second, brainstorming of risk response strategies are developed by identifying the Risk Response Function. The Risk Response Function is a verb/noun combination that describes the risk response strategy to be employed. Third, a brief description of each idea is provided for each response strategy. Throughout the process of brainstorming, each high and moderate priority risk should receive attention. Also, the brainstorming process includes identification of specific strategies in the form of the function/verb that are possible to use, depending on whether the risk is a “Threat” or an “Opportunity.” For Threats the following function verbs are possible:
 - i. Accept – Accepting a risk involves accepting a risk as it currently exists.
 - ii. Avoid – Avoiding a risk involves avoid impacts of the risk, often by spending additional capital up front to reduce later potential impacts.
 - iii. Mitigate – Mitigating a risk involves reducing the range of impact of the threat, reducing the likelihood of occurrence, or a combination of reducing both impact range and likelihood.
 - iv. Transfer – Transferring a risk involves the passage of potential impacts to another party or stakeholder. This often comes in the form of a premium to base costs, but it can often be less than the total impact of the risk by allowing a third party to manage and buffer risk impacts.

For Opportunities the following Function verbs are possible:

- i. Enhance – Enhancing a risk involves maximizing the potential opportunity in an attempt to realize the full impact. Often the outcome is anticipated to be better than originally planned.

- ii. Exploit – Exploiting a risk involves taking advantage of an opportunity and putting strategies and actions in place to realize the impact. This often involves recognition of opportunities that were not previously identified.
 - iii. Share – Sharing a risk involves recognition of an opportunity that can be dispersed across several activities, project segments, or future planned projects.
- c. Evaluation of Risk Response Strategies – The evaluation of risk response strategies are brainstormed and evaluated to determine which responses provide the most relative value to either minimizing threats or maximizing opportunities. Each response strategy should be qualitatively evaluated in relation to this criterion. For example, each response strategy can be given a green check mark, a yellow exclamation mark, or a red “X”. The response strategies that have green checks become the risk response strategies that are developed in further detail. The yellow check marks become fall-back strategies that could be put into place as efforts to manage the risk if the preliminary strategies are not working as effectively as anticipated. The yellow check marks also have the possibility of being developed as additional risk response strategies. The red Xs are deemed to be invalid or ineffective risk response strategies to utilize in the context of the project. Keeping the evaluation simple is best in this case so that the time in the workshop can be most effectively utilized. Figure 6 provides an example worksheet of this process.
- d. Development of Action Plans for Risk Response Strategies – The final development of the risk Action Plans involves a combination of several elements. This includes the assignment of the risk to key individuals or groups that are deemed to be best equipped to manage or deal with the risk by the Risk Assessment workshop team. Development of action plans also includes providing more detail around the risk response strategy selected in the form of developing specific actionable steps that can be followed in order to best manage the risk.
- e. Secondary Risk Analysis – This step involves reassessing the probabilities and ranges of potential impact for each individual risk. Included in the reassessment should be the consideration of the risk response strategies and action plans to be put into place and how they would be anticipated to help in either minimizing or maximizing the risk impacts and potential likelihoods of occurrence. The following steps summarize the Secondary Risk Analysis phase:
 - i. Establishment of Post-Response Probabilities and Impacts – The probabilities and impacts for each individual risk are developed again. This time the team determines what the range of cost and schedule impacts resulting from specific risks would be by establishing the low end of the range, high end of the range, and the most likely outcome by taking into consideration the risk response strategies and action plans. In addition, the updated likelihood of incurring the impact is developed by the risk assessment workshop team.
 - ii. Modeling of Post-Response Risk – A post-response risk model in which the risks are assumed to be in a managed state should be run. This is typically not conducted during the workshop due to the complexity required in programming the mathematical risk model, as well as time constraints. It is possible, however, when utilizing a more qualitative model to obtain

Risk Response Strategies

Team Brainstorming



Risk ID	Risk Name	Type	Description	Object of Risk	Probability	EV Cost	EV Schedule	Function		Ideas	Rating
								Verb	Noun		
23.1	TransCanada at Main Ave/CTH G	Threat	A critical TransCanada pipeline crosses Main Ave/CTH G just west of the southbound ramp terminal, then follows the west side of the SB off-ramp and crosses US 41. This pipeline may be in conflict with the proposed storm sewer system, pond excavation, and street lights. TransCanada typically requests a 25-foot wide clear zone between their pipelines and any structures, such as manholes, inlets, and light poles. Whereas this line is primarily within the right-of-way, it's relocation will be minimally compensable and TransCanada is slow and expensive to move.	Pipeline Conflicts	75%	\$1.31	1.25	Mitigate	Pipeline Conflicts	Aggressively and clearly define all conflicts with the TransCanada pipeline	✓
								Mitigate	Pipeline Conflicts	Early coordination with TransCanada to identify pipe location	✓
								Mitigate	Pipeline Conflicts	Investigate legal coordination issues early on with TransCanada to establish who was there first and what the compensation levels were	✓
								Avoid	Pipeline Conflicts	Redesign intersection to eliminate any conflicts with the pipeline	✗
								Avoid	Pipeline Conflicts	Move to a tight diamond configuration to shift profile (assuming both Ashland Ave. structures are being replaced)	⚠
23.2	Expedited Utility Coordination	Threat	The risks associated with violating TRANS 220 timelines or the need to fairly compensate utilities may be outweighed by the need to minimize construction delays. Thus DOT would take on liability for construction delays due to unresolved utility conflicts.	Utility Liability	95%	\$1.20	2.53	Avoid	Utility Liability	Follow TRANS 220 process	⚠
								Accept	Utility Liability	Violate TRANS 220 process for the trade-off of getting projects built earlier and allocate necessary funds to budget	✓
								Mitigate	Utility Liability	Engage in extra coordination with utilities	✓
								Mitigate	Utility Liability	NCG monthly meetings with Beecher Hoppe for coordination	✓
								Transfer	Utility Liability	Shift responsibility to contractor and have him price risk in bid	⚠
24	Re-estimating Quantities	Opportunity	There is the opportunity to realize cost savings resulting from re-estimation of quantities	Cost Savings	75%	\$6.88	0.00	Exploit	Cost Savings	Get consultant under contract to provide updated estimate to validate cost savings	✓
								Exploit	Cost Savings	Review upcoming bids to "learn" what unit prices are looking to be and what the contractor bidding environment is possibly looking to be	✓

Figure 6 – Risk Response Brainstorming and Evaluation

results relatively sooner due to the reduced complexity of the model. In situations where a qualitative model is being used it may be possible to obtain the results during the workshop. When using a quantitative model, each of the risks and potential outcomes should be simulated 10,000 times using a Monte Carlo method. The resulting statistics should then be compiled and evaluated. The results of the post-response risk model can then be compared to the pre-response state in order to assess the difference that managing and responding to the risks makes.

- iii. **Reevaluate Expected Value Impact Severity** – The expected value impacts of each of the individual risks are calculated again and plotted with the pre-response state on the original Tornado Diagram in order to provide a direct comparison of the post-response state. Again, the Tornado Diagram has the highest level risks plotted at the top of the tornado and the lowest level risks at the bottom of the tornado. This diagram helps to provide a visual presentation of the expected values resulting from proactive risk management. The Tornado Diagram with the pre-response and post-response results serves as a guide of the relative effectiveness of the proactive risk management of the highest priority risks. Figure 7 depicts a sample Tornado Diagram in which the pre-response and post-response results have been plotted.

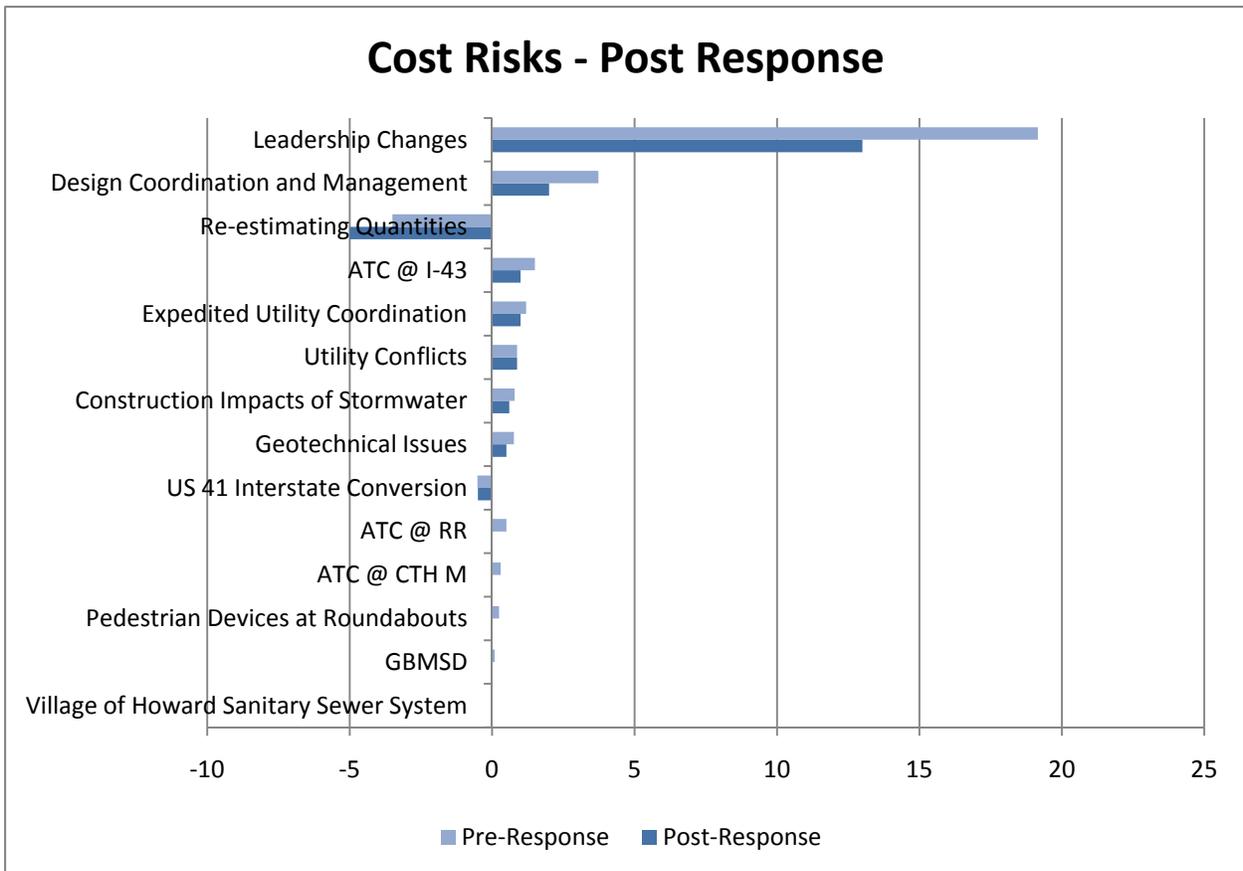


Figure 7 – Post-Response Risk Tornado Diagram

Risk Monitoring and Control

The Risk Monitoring and Control Phase is the stage of the workshop that concludes the immediate assessment of risk and compiles and presents all of the data that was generated in the Risk Assessment workshop. This does not end the risk management process, but rather serves as a transition into the ongoing process of monitoring and controlling project risks. The following steps comprise this phase:

- a. **Compile Results of Risk Analysis and Workshop** – The compiling of the risk analysis and workshop data involves compiling of all versions of the risk register as it evolved throughout the workshop and prior steps of the risk management process, compiling the outcomes of risk response strategy brainstorming, evaluation, and development, and finally compiling of all of the resulting output data from the mathematical risk model. The data and results are compiled typically for inclusion into a final communication medium. In this process we will use the term “report”.
- b. **Compile Risk Management Plan** – Compilation of the risk management plan is effectively the editing and refinement of the Risk Action Plan development forms produced during the risk assessment workshop. The individual Risk Action Plan development forms combine to create the risk management plan as it presents the management strategies, action plans, milestone review dates, and risk owners for each individual risk.
- c. **Produce Report** – The production of the report involves compiling all of the data, results, and outcomes from the entire risk process. The report serves as the summary of the risk workshop, presentation of the risk analysis results, and the established and agreed upon risk management plan.
- d. **Establish and Execute Risk Monitoring and Control Plan** – The establishment and execution of a risk monitor and control plan is the final step in engaging in a detailed and comprehensive strategic risk management process. The risk monitor and control plan establishes the frequency of additional risk review, risk identification, and evaluation. It is an iterative process that engages the project team in continuous review and feedback of how risk is evolving throughout the project. This step includes updating risks to be in an active, dormant, or retired state, as well as updating the progression of the risk throughout the project lifecycle by identifying any new risks and retiring risks that are no longer a threat or opportunity. For any newly identified risks the process of identifying adequate risk response strategies and developing the action plans should be repeated. In general, the risk monitoring and control phase is effectively the continuous follow-through step of the risk management process and ensures that risk response strategies and action plans are being followed, thus ensuring that the risks of the project remain in an actively managed state.

Conclusions

The integration of function analysis and FAST diagramming into the traditional risk management process is a means to enhance the overall process. Use of FAST diagrams helps to facilitate communication and

enable workshop team members to focus on the project or system delivery goals. In addition, function analysis resulting from the development of the FAST diagram helps to bring focus to potential areas of uncertainty. The project critical functions can also be identified as a means to focus the elicitation of project risk. Furthermore, risk priority can be assigned based on function criticality in order to provide rank and order to the project or system risk profile. Finally, adequate risk response strategies can be brainstormed and developed with the focus of project function as the risk object. Each of these benefits carries an advantage that helps to enhance the overall risk management process in Function Driven Risk Management (FDRM).

The modification to the traditional risk management process comes in the form of three main changes. The first main change is to incorporate the use of function analysis and the development of a FAST diagram into the risk management process. Typically the risk management process focuses on the general project and what risk events may impact it. By looking more globally at project function, the process is enhanced by providing direct focus on the functions of critical importance. The second main change is the added step of dimensioning the FAST diagram in a manner that helps to establish function priority. The functions with the highest priority are of importance to the project or system in that if the specific functions were eliminated the project or system would be negatively altered. By using this as a means to brainstorm risk events on critical functions, the highest priority risks of the project are naturally established. The third main change is the use of project function in the brainstorming and development of risk response strategies. The use of project function provides focus to the direct object of risk impact that requires solutions to optimize the impact of the risk event. The development of the risk response strategies and action plans is enhanced as a result of the focus on project function because of the direct linkage from top to bottom (i.e., the project function drives the risk identification, which in turn drives the risk priority establishment for risks to manage, which also establishes the object of focus for risk management strategies and action plans).

Overall, the use of function analysis as a means to augment risk management incorporates some of the tools of VM that best facilitate communication and understanding of the project or system. By enhancing the traditional process, the results generated provide for a better and more focused effort of risk management throughout a project or system's lifecycle. The process is directed toward holistic thinking while still providing for fully developed plans for dealing with risk. With better understanding and communication of function the effectiveness of the risk management strategy can be enhanced by allowing for focused decision making and efficient usage of resources in the execution of project or system delivery.

ⁱ Bytheway, Charles W., "FAST Creativity & Innovation," J. Ross Publishing, 2007, Ft. Lauderdale

ⁱⁱ Stewart, Robert B., "Value Optimization for Project & Performance Management," John Wiley & Sons, 2010, Hoboken

ⁱⁱⁱ Ibid.