GWU- School of Business
DNSC 6254

MOTORCYCLE AND BICYLING HAZARDS

Final –DNSC 6254 – Risk Management- Fall 2017

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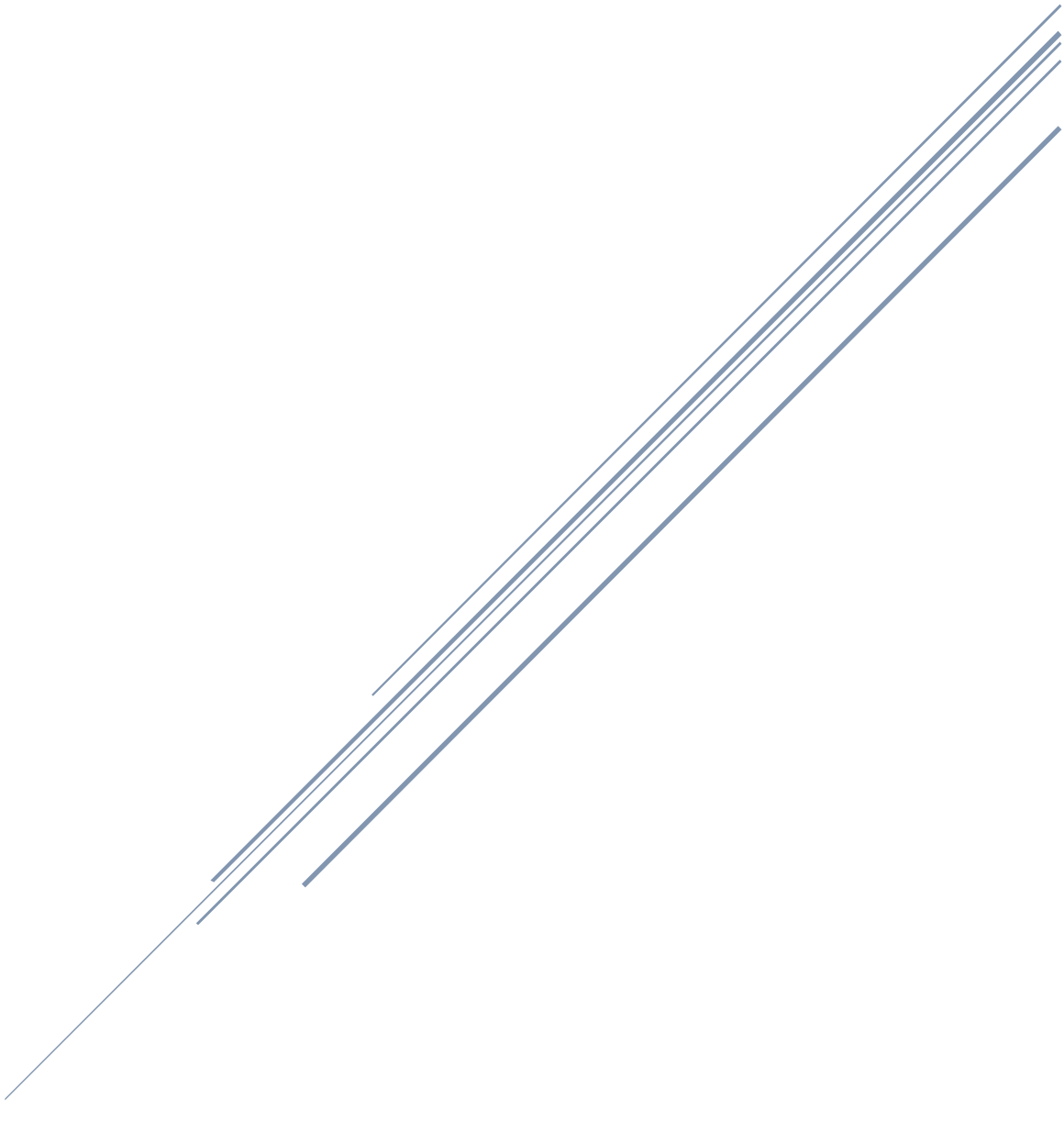
October 22, 2017



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1. Background

For our project we chose to assess the risk associated with riding a motorcycle and bicycle. Sure people can do a quick “pros and cons” and make a decision, but not many perform a true risk analysis to determine the risks associated and possible ways to mitigate them. Here in the DC area there are many perks to riding a motorcycle, like HOV lane access and toll free roads, but with it comes greater risks. The bike share program here in DC is also going strong, but all they provide is the bicycle, so this will help to understand the risks of riding without safety gear. It is very hard to compare the two as these two different modes of transportation are used differently.

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2. Structure of the Risk Model

The risk model used was Expert Choice Riskion. We will go through the basic set up of the model and move on to the measurement methods.

2.1. Events

The first step in any risk assessment is to brainstorm all the bad things that could happen. Riskion has a built in whiteboard for “Visual Brainstorming”, or if the team is collocated do it the old fashion way and write down. Remember everything is accepted and we will determine later if it makes the cut, gets combined with other things or cut. Figure 1 below is an example of the brainstorming session.

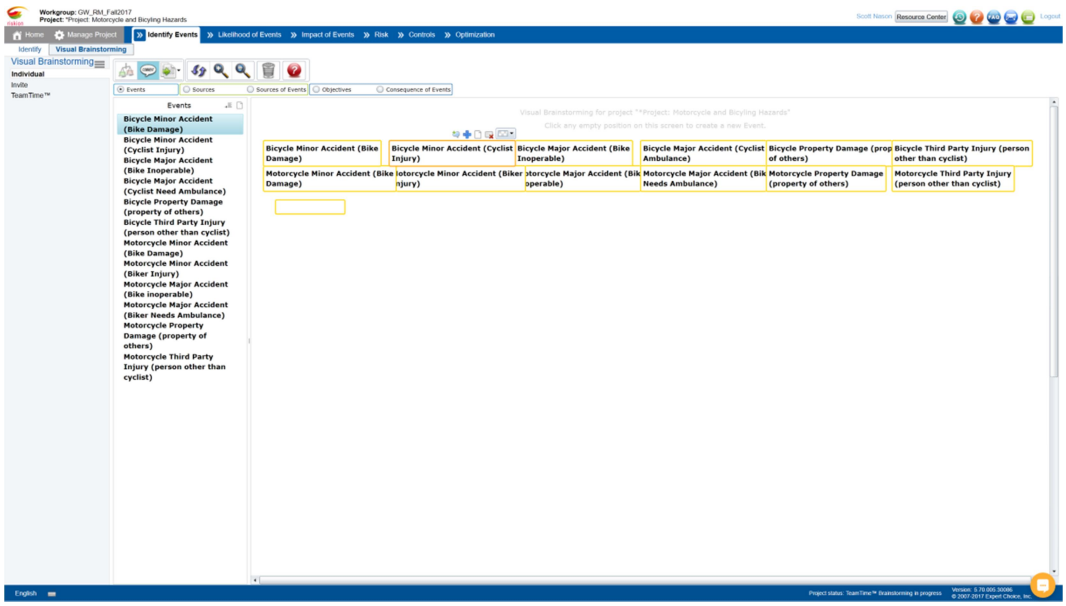

Figure 1 - Brainstorming

The end state we want a list of events. A key thing to keep in mind is that an event results in a loss. Depending on the scope of the analysis it can be vague or very detailed. Depending on time constraints I would keep the events vague, and inform management that they can be elaborated upon for a deeper look. If the threats are the same then this would not be needed and could be explained in the information document for each event. Figure 2 shows the events in a list form, we also choose to group the events by “Type of Vehicle”, and this allows us to send the Likelihood of Events survey to those that are versed in the topic. Refer to the appendix for additional discussion regarding the brainstorming session and development of the final list of events.

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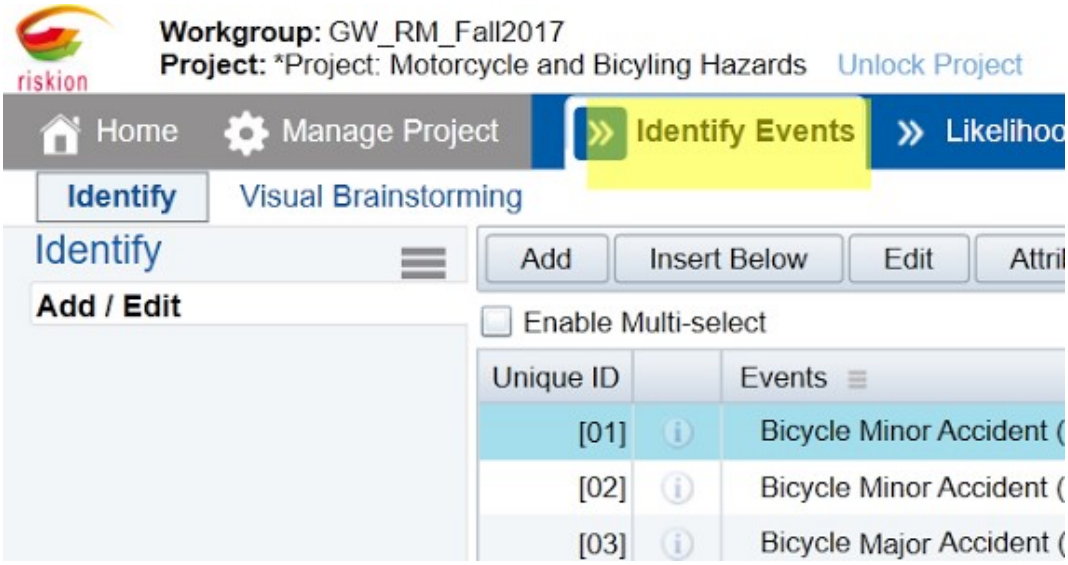

Figure 2 - Event List

2.2. Likelihood of Events

Now that we have some events that will result in a loss we need to brainstorm sources that would trigger these events. You can use the "Visual Brainstorming" for this or manually input these sources as well. In our example below we broke the sources into 4 main areas, Rider, Others on the Road, Environment, and Road Conditions then expanded on those areas. Refer to the appendix for additional discussion regarding how the team developed the list of triggers and then created the hierarchical structure that formed the final list of sources for which likelihood and impact would be assessed for each risk event.

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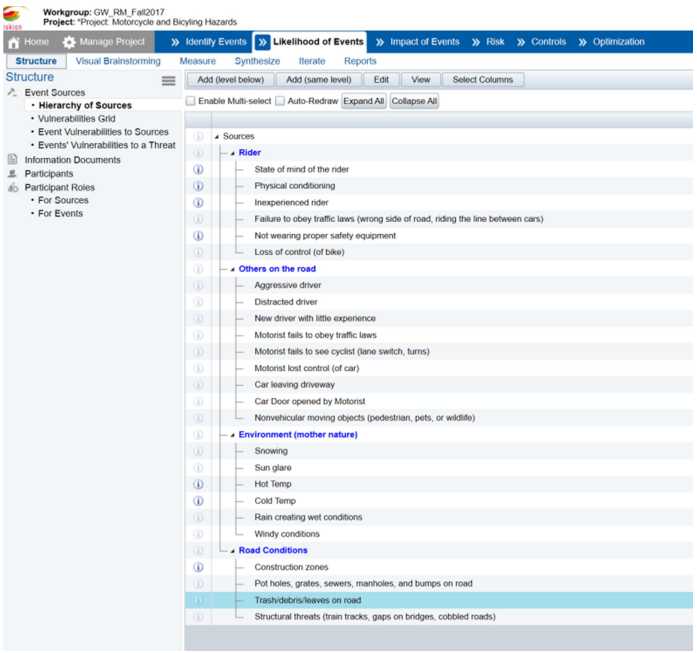

Figure 3 - Vulnerability Sources

Keep in mind that the vulnerabilities trigger the events, so if you have an event listed with no vulnerability or vice versa, you will need to take another look at the input and reassess. This was a pitfall in our analysis and made things a little confusing at first. After we made it to the "Vulnerabilities Grid", shown below, things started to clear up. Take notice that all events on the X-axis have at least one vulnerability on the Y-Axis. Later on when we get to mitigation the x and y axis intercepts will be areas to apply controls. Refer to the appendix for additional discussion regarding the team's process for determining event vulnerabilities.

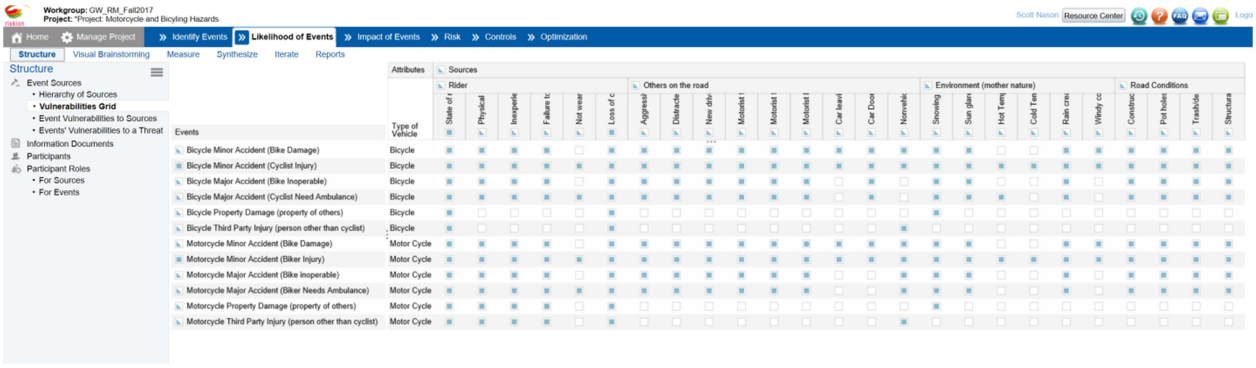

Figure 4 - Vulnerabilities Grid

2.3. Impact of events

The impacts can really become an endless list if drilled into with fine detail. Once again, Riskion has an option for visual brainstorming that may help users. To keep from going down that rabbit hole we created a hierarchical structure comprised of three (3) major areas of financial, injury and lost time. The thinking here is financial impact will affect just about anyone, injury is broken into some areas that are encompassed by motorcycle riding and bicycling, and lost time is more of a quality of life issue. As you

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will notice in Figure 5, financial has set monetary value loss for the vehicle and medical, in addition the amount of work missed. For injury we kept it to the basics as there can be so many different medical diagnoses. Lost time not only contains lost work time but loss of mobility that may affect quality of life.

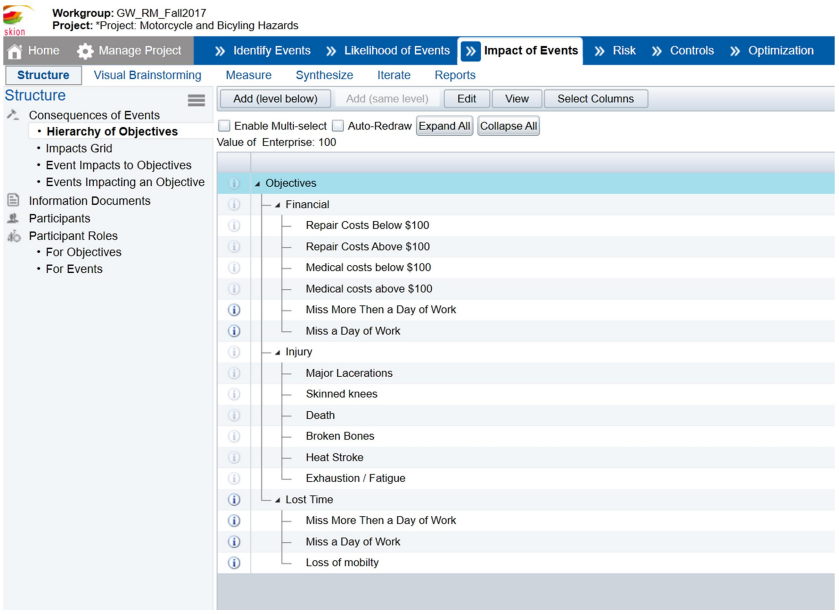

Figure 5 - Event Impacts

With the impacts entered into register it is time to map those impacts to the events in order to determine whether a specific event impacts a specific objective. This is completed like the vulnerabilities grid before. It is important to note that similar to the relationship between sources and events the relationship between events and objectives is a many-to-many relationship. Once this hierarchical structure is established and the mapping of events to objectives is completed, expert judgement can again be utilized. We can synthesize the expert judgements from all participants to derive the priorities of the objectives, evaluate the consequence of each event on the objective, and determine how much of the objective is lost should the event take place.

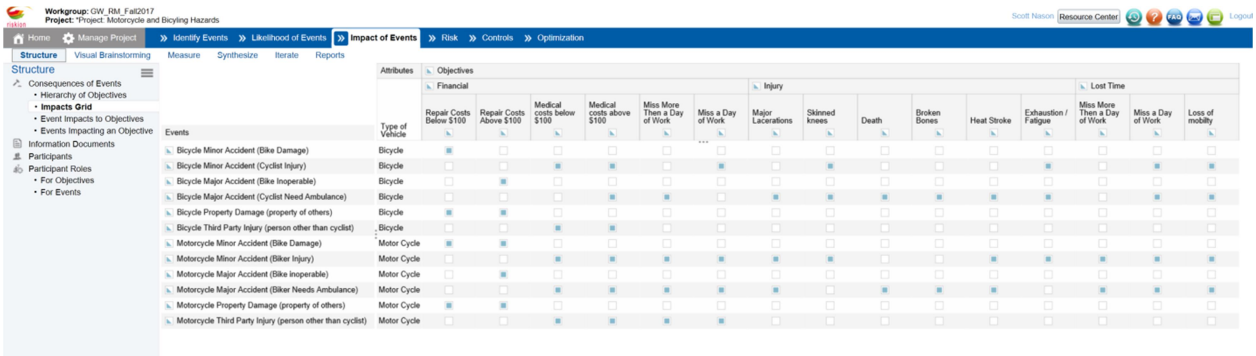

Figure 6 - Impacts Grid

In addition to the impact grid you may want to view the impact to objective. This will allow you to view each event and the impacts the event may cause; this provides a functional visual that allows you to add “new objective” with the click of a button.

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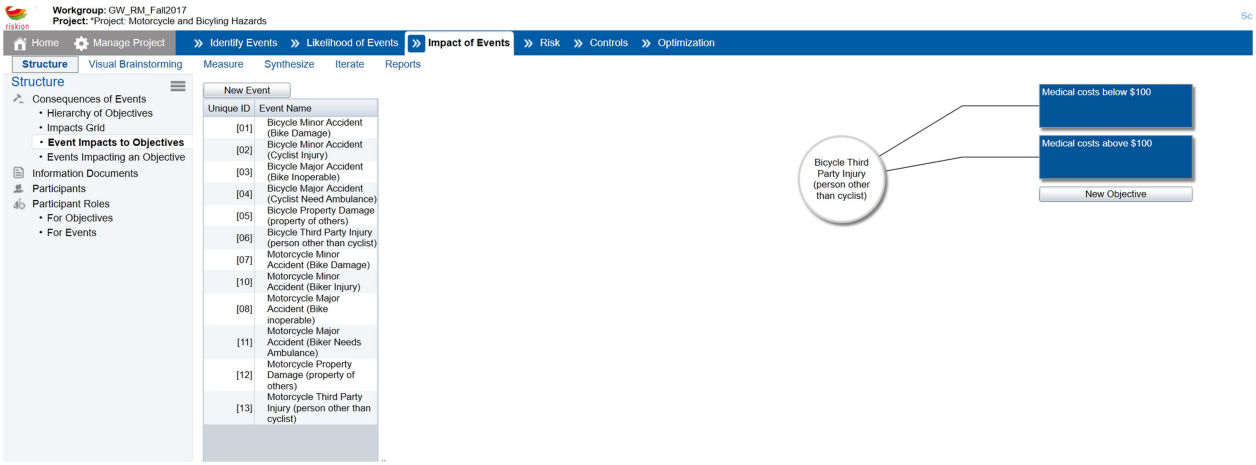

Figure 7 - Event Impacts to Objectives

Or if your mind is more objective focus you may want to view the "events impacting an objective". In Figure 8 we provide a snapshot of this view, this is sort of like a cause and effect view. In this illustration Death is the effect with bicycle major accident or motorcycle major accident as the cause. If we missed a cause "new event" will open up the window shown in the figure. This will allow us to check an existing event or create a new one.

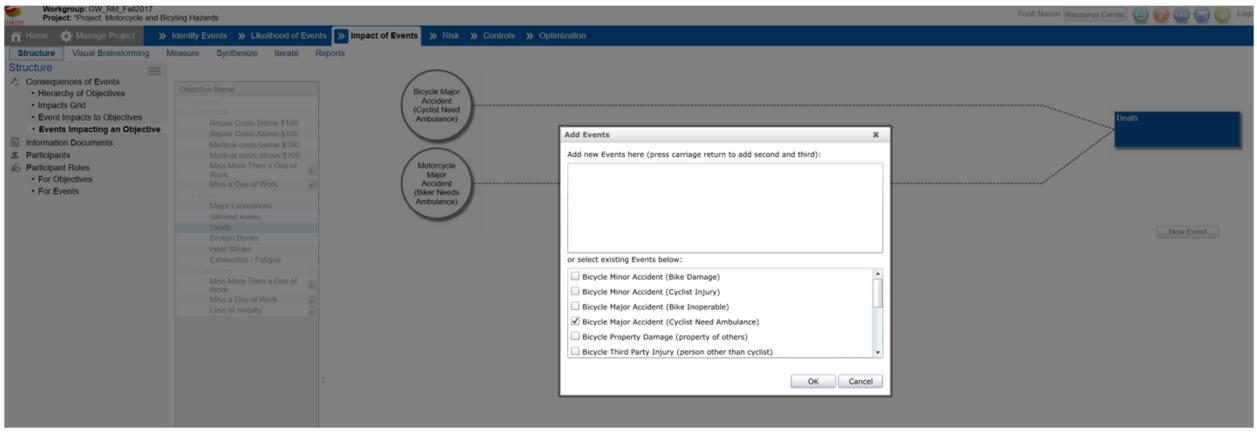

Figure 8 - Events Impacting an Objective

Now we have the events, likelihood and impact in the Riskion structure, so let's get some participants in the system to perform some evaluations.

2.4. Participants and Roles

The analysis relied solely on participants providing expert judgements to derive ratio scale values rather than using data from third party sources. Participants were asked to evaluate the likelihood of the hazards and the likelihood of the event given the hazards. Similarly, participants were asked to apply judgements to derive objective priorities and the consequence of events occurring.

This area becomes a balancing act as you want to get a good objective view the situation, but you want to be able to keep the participants engaged and not take too much of their time. We will first start with the list of participants; in a project structure this could be derived from your stakeholder registrar.

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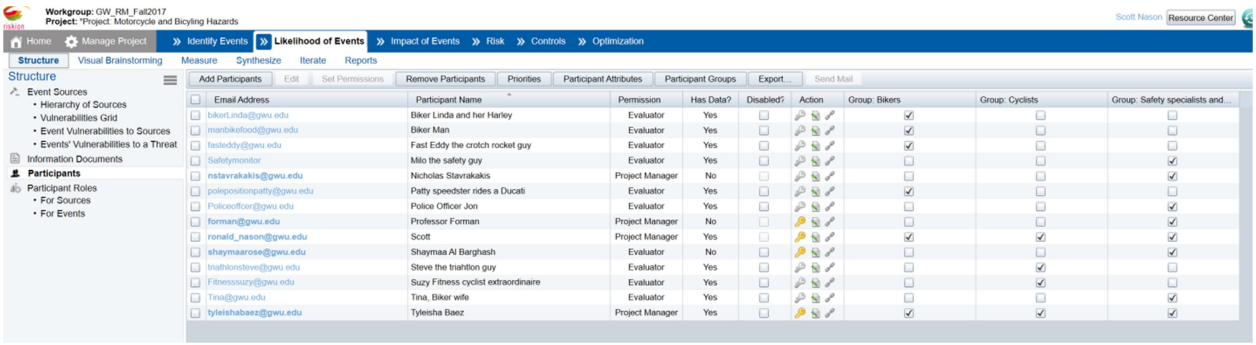

Figure 9 - Participants

We have our participants broken into different groups, so we can shape the areas they answer questions. For example, someone that is an avid bicycle rider, but doesn't ride a motorcycle would not need to answer questions in regards to motorcycle events and vice versa. Below is an example of how we used this feature for the events. The Bikers group is selected to answer any questions that pertain to motorcycle events, cyclists will only answer questions in regards to bicycle events and the Safety group will answer for all events.

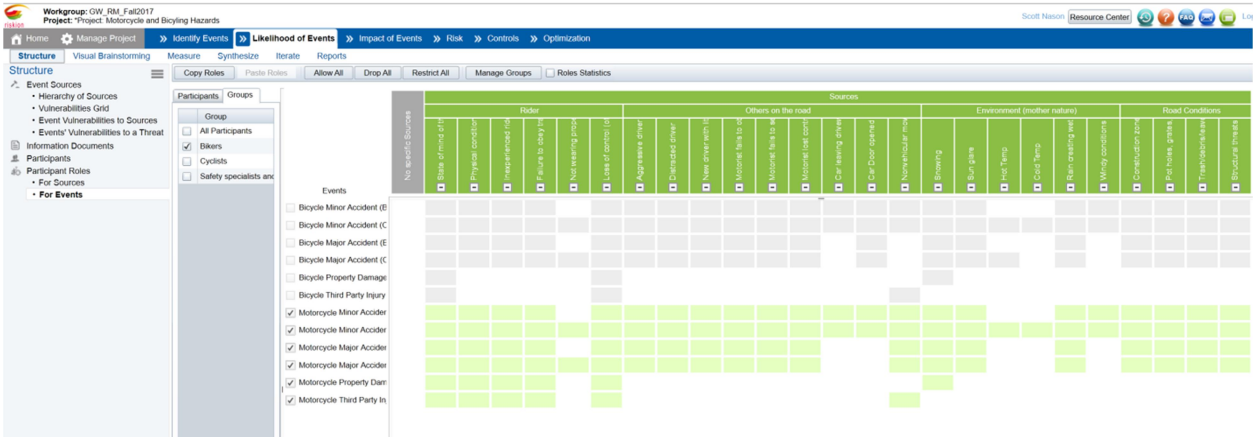

Figure 10 - Participants Events

Below we have a snapshot of participant's event likelihood. We did not shape this survey to the specific riders because we wanted a wide spectrum of perceptions. For example, most motorcycle riders believe they are awesome and totally safe, others may believe they are a deathtrap waiting to happen, so we want an equal unbiased opinion. As the administrator of the project you can allow Riskion to email the participants to take the survey or do a TeamTime Evaluation and schedule a meeting. For the purpose of this project we did a TeamTime and entered answers for our fictitious participants.

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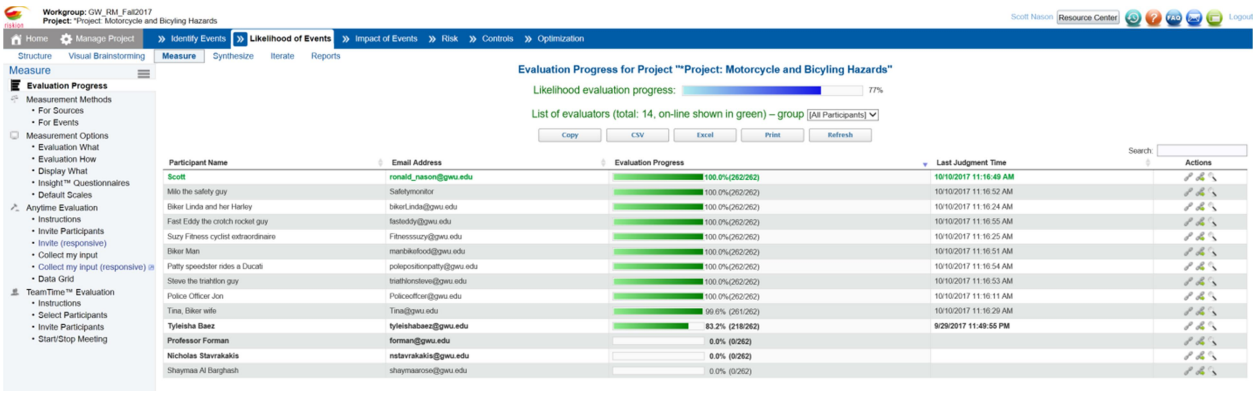

Figure 11 - Participants Likelihood of Events

Now for the impact of the events we divided the groups up as the different riders probably really can't speak to the impact if they are not performing the activity. In Figure 12 you can see the impact questions for someone in the Bikers group is 45 and Cyclist is 34. Unfortunately for the Safety group they have 89 to answer, the rational was they read reports on the topic and should have greater insight than most.

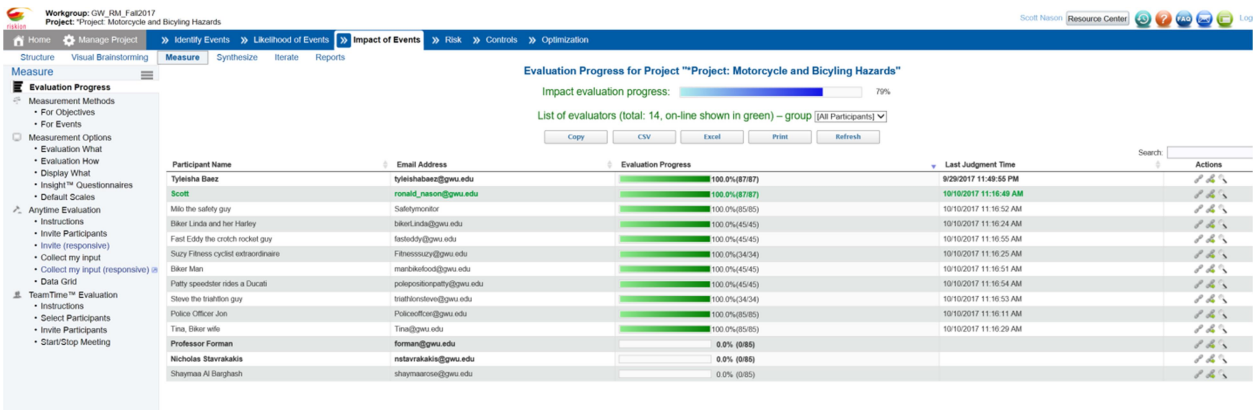

Figure 12 - Participants Measure Impact

3. Measurement

In the previous section we went over the number of judgements a participant will have to make to complete the survey, so now we will take a look at those evaluation methods to keep that balance of accuracy and time in check. To complete this risk analysis, various measurement methods were utilized to derive ratio scale measures for likelihoods using expert judgements from participants.

3.1 Measuring Methods for Likelihood of Events for Sources

Figure 13 is a snapshot of the measurement methods we choose for the likelihood of events to occur given the source. For the Rider source we chose Wide Likelihood Rating Scale, this allows direct entry of the likelihood. For others on the road we opted to go with Pairwise Comparison, for the 9 elements this would have generated 36 judgements for all pairs, so we went with Two Diagonals to keep the number

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of judgements at a reasonable level. The display all pairs allows everything to show on the screen so the user will not have to go one by one and wait for the page to load, this is a huge timesaver.

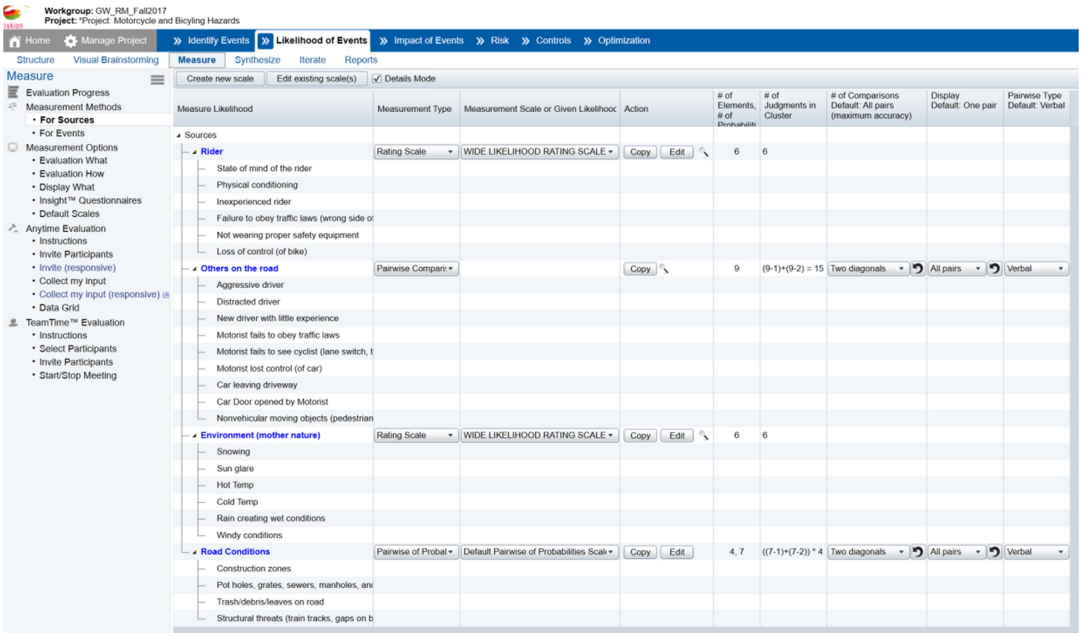

Figure 13 - Measuring Likelihood of Events for Sources

3.2 Measuring Methods for Likelihood of Events for Events

For the measuring of the event likelihood we went with Wide Likelihood Rating Scale since we had all participants complete this and wanted to see the wide range of responses. This would help to see if perception is reality when the results are presented to the stakeholders.

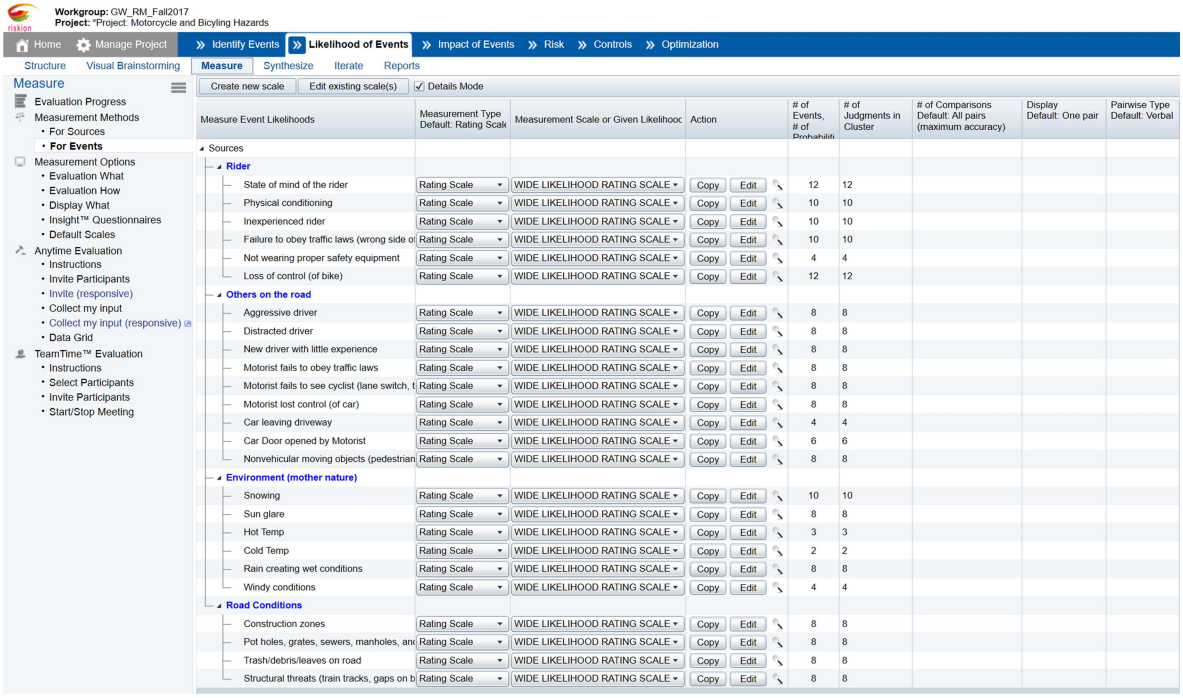

Figure 14 - Measuring Likelihood of Events for Events

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3.3 Measuring Methods for Impact of Events for Objectives

The primary measurement method utilized to derive ratio scale measures for prioritization of objectives and impacts of events on objectives using expert judgements from participants was pairwise comparison. For impact of events pairwise comparison was a clear choice as it is much easier for the participants to answer to what is more impactful and this form of analysis is most suitable for this type of assessment. Evaluators compare the relative importance of sub-objectives and event impacts to one another as opposed to arbitrarily assigning a value for each of these that would be nearly impossible to justify. (Forman & Selly, 2001) To prevent evaluator fatigue from skewing results, we reduced the number of questions presented to each evaluator by changing the default number of comparisons. Once again for the areas with over 5 diagonals it may be best to only compare two diagonals. If the measurements have the possibility to be very close you may want to keep all diagonals as this will be much more accurate. The results of evaluator responses related to impact of events on objectives can be found in the appendix.

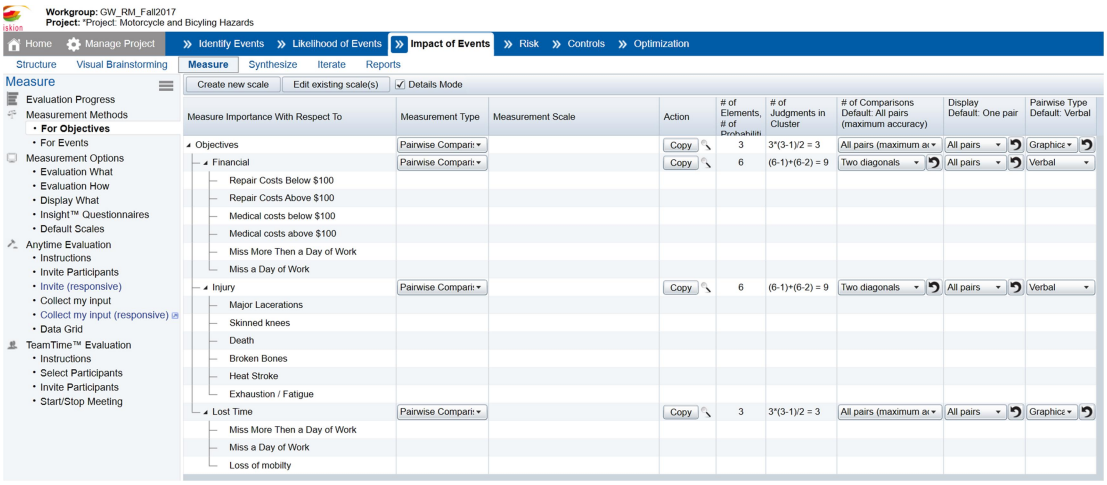

Figure 15 - Measuring Impact of Events for Objectives

3.4 Measuring Methods for Impact of Events for Events

We really wanted to stick with the pairwise comparison, but had to be courteous of our participant's time and cut some back to two diagonals again.

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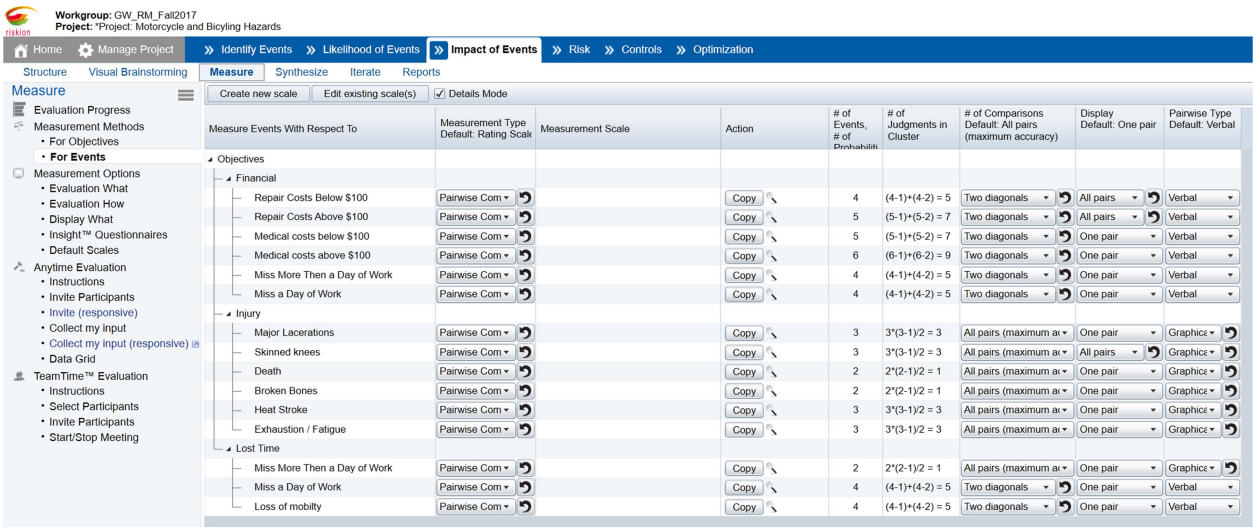

Figure 16 - Measuring Impact of Events for Events

If you may recall Figures 11 and 12 illustrated the participants, in addition it also showed the percentage of the survey they had completed. If you have a lot of participants and not expecting all of them to respond or perhaps just want to make sure you get the inputs from a few key participants this is where you can check the progress before generating reports.

4. Synthesize

This area may be one of the most important as all the evaluations are ratio scales. The "normalize" option will keep the events and impacts normalized so the percentages equal 100%. There are advanced settings that can be configured if events or impacts are mutually exclusive. For our project we kept all events independent and any one of them could happen without another event firing.

4.1 Likelihood of Events Synthesize

The event likelihoods have been normalized with all the participants' inputs in figure 17. The likelihoods all add up to 100% now. This will keep the mathematical operations possible as we progress into the project. After all you can only lose 100% of an asset to be a wash. When we look at the event likelihood you can see that Motorcycle Minor Accident (Bike Damage) is the number 1 likelihood at 17.46% with Motorcycle Minor Accident (Biker Injury) close behind at 16.62%. From my real world trials, I have had a minor accident that caused damage to my motorcycle, but not me. This data suggests I will have a minor accident in the near future, unless I do something to mitigate the threats that would cause that event.

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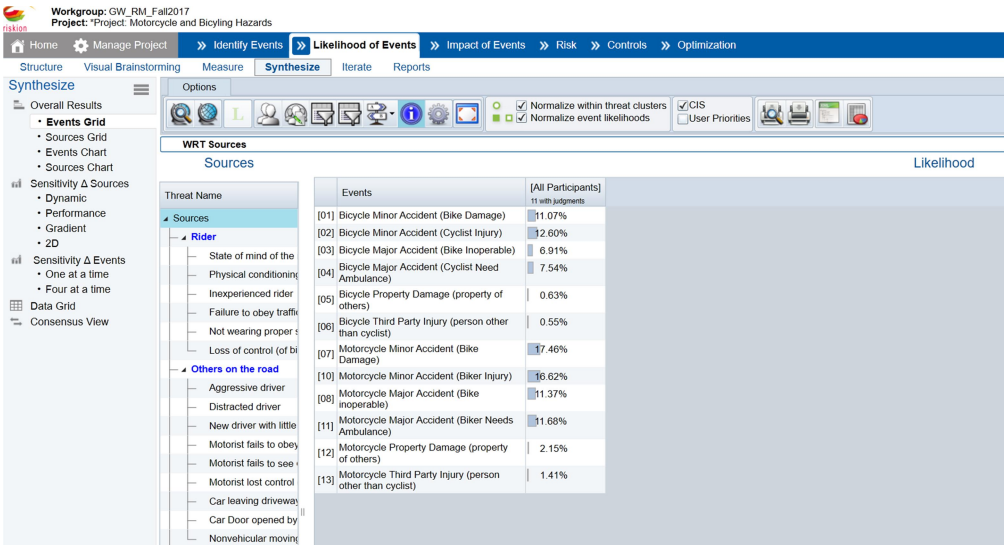

Figure 17 - Synthesize

4.2 Impact of Events Synthesized

Now that we have the likelihood of the event we need to check the calculation on the impact of the event. Here we can see the event Motorcycle Minor Accident (Bike Damage) has an impact of .88%, so though it is the highest likelihood it is one of the lowest impacts. Our highest impact item Motorcycle Major Accident (Biker Needs Ambulance), is the highest impact item. Looking at the events you can deduct this is probably the event with the highest chance of death and it makes sense that it has the highest impact. Also of note are the comparisons of Bicycle to Motorcycle events having more impact? This also makes since as a motorcycle will probably cost more and is heavier thus having more inertia in an accident.

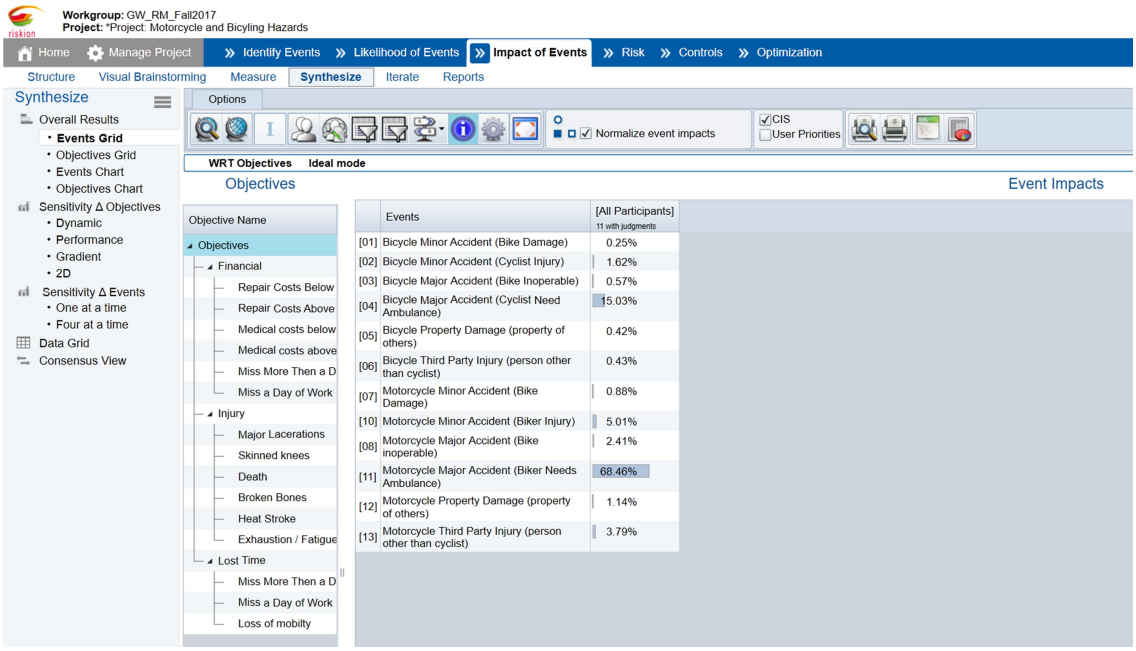

Figure 18 - Impacts of Events Synthesized

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5. Risk

Now we get in the bread and butter of the analysis. The Risk tab provides us with a plethora of data that can be used. We can stick with percentages or put in a dollar amount for an item. In our case this was not really an option as we are analyzing two different items with very different costs. A bicycle and motorcycle are completely different in costs and typically used differently as a motorcycle may be a primary mode of transportation for any distance and a bicycle is for shorter distances or just recreation use. In this sense we are comparing "apples to oranges", in the sense that both are two wheeled requiring similar safety equipment and have similar threats we can make some comparisons.

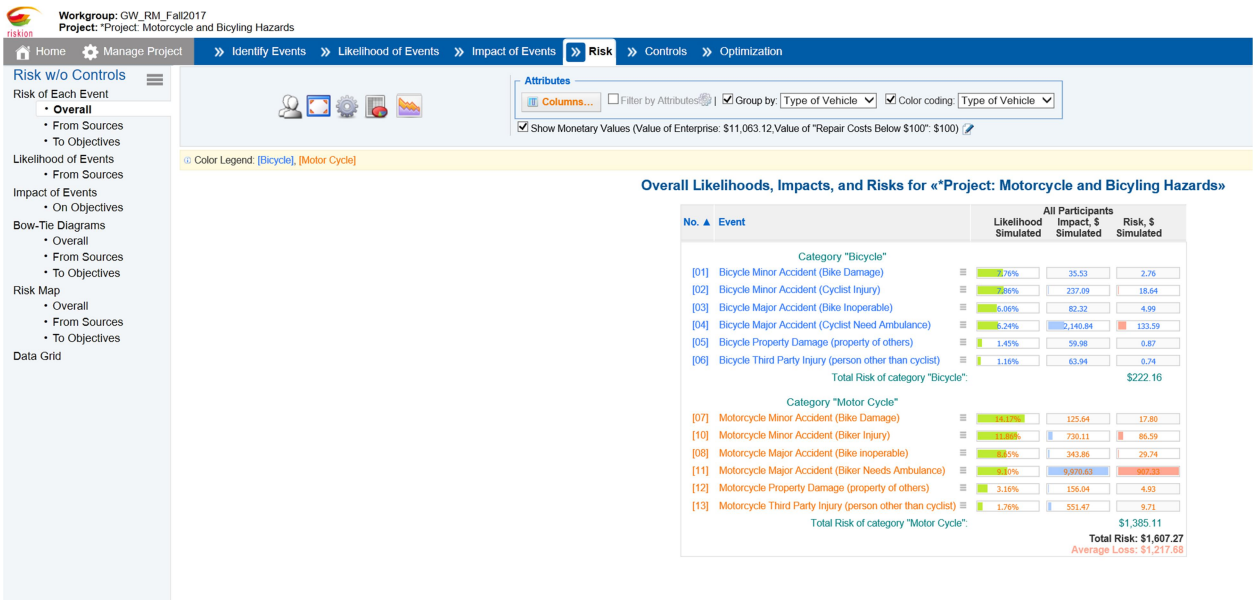

Figure 19 - Risk Overall

We are able to group the events by type of vehicle as we created when inputting the events. Figure 19 shows the monetary value, since we can only set one monetary value we chose "repair costs below $100" as the value is in the event. With this value the total risk for a bicycle is $222.16 and a motorcycle is $1,385.11. It is critical to note that the program utilizes simulations based upon the combined judgements of the participants. The number of simulations can be changed as seen in Figure 20.

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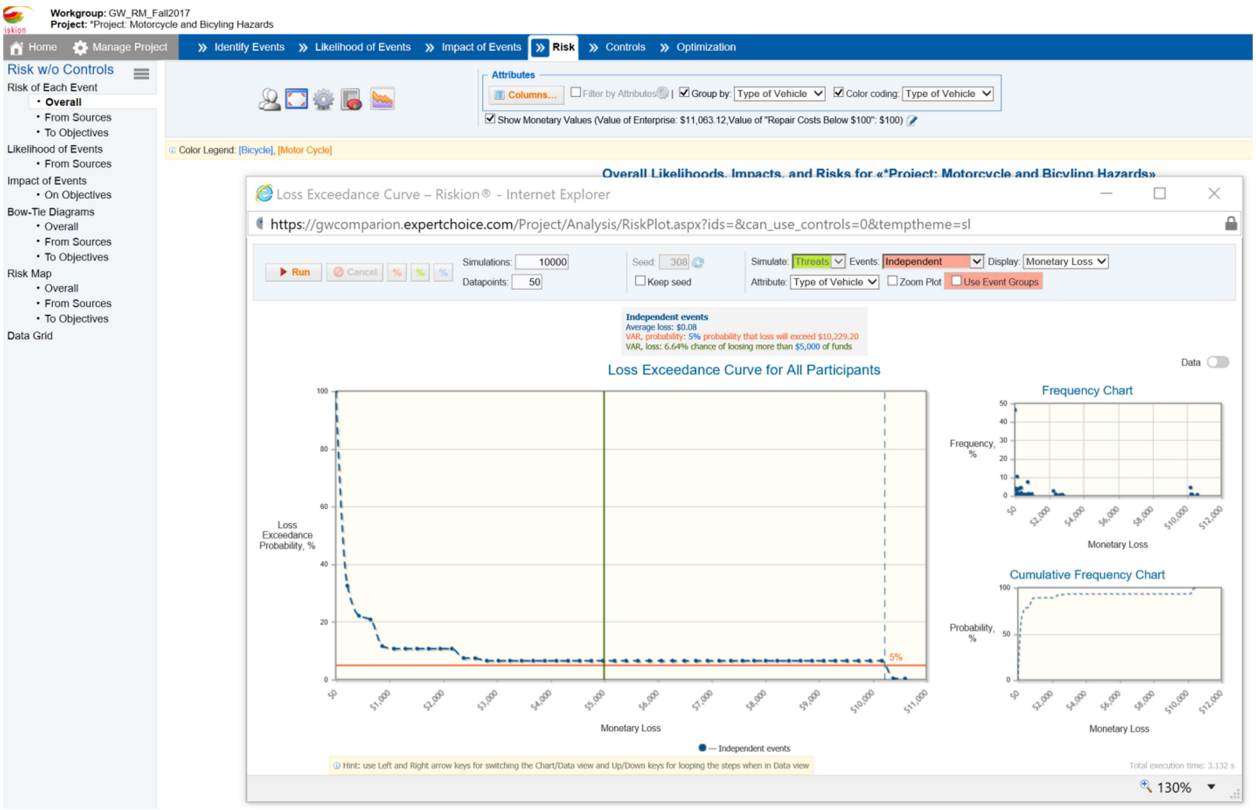

Figure 20 - Loss Exceedance Curve

The loss exceedance curve can be started by pressing the bar graph icon next to the Attributes area. This will open the second window shown in Figure 20. The loss exceedance curve provides a lot of information and allows you to modify different data points to get results based upon random simulations. Here we can the number of simulations ran, this can be increased for more granular results. We can also see the variable probability and loss. These values are shown in blue above the curve and can be adjusted to the risk appetite of the decision maker. In our example we can see there is a 5% chance the loss will exceed $10,229 and there is a 6.64% chance of losing more than $5000.

Now that we can truly understand our risk based upon the inputs from our participants we need to concentrate on getting those risks decreased. These risk controls can too be inputted into Riskion and also get weighed as to how much they mitigate the risk.

6. Controls

The controls features of the program are great in that they allow the user to create controls and apply them to risks. When creating the control the cost to implement the control is also inputted. Another very key and sometime confusing part is what the control is used for; this means the control is either for the threat, vulnerability or consequence. See figure 21 for the 27 controls we have applied to our project.

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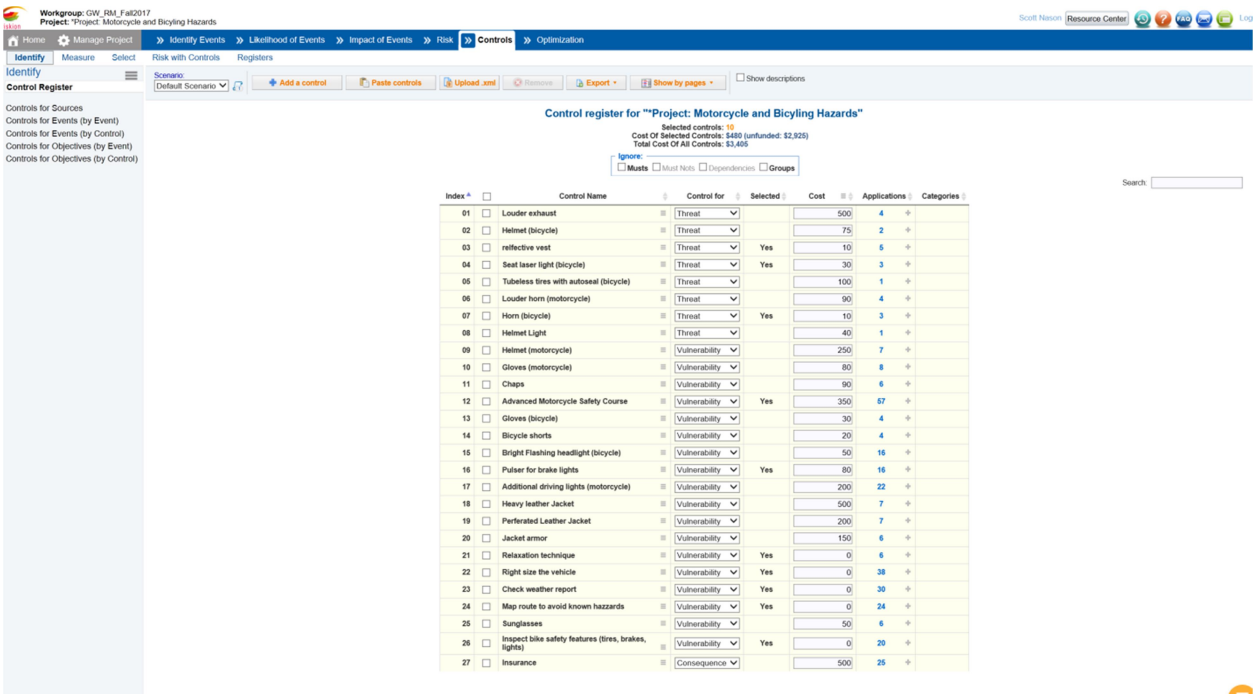

Figure 21 - Control Register

Those marked as a control for the threat are applied to the event triggers that were identified in section 2.2 likelihood of events. Below you can see the 8 controls we have for threats listed and the event triggers or sources. If the control will help mitigate the source check the box.

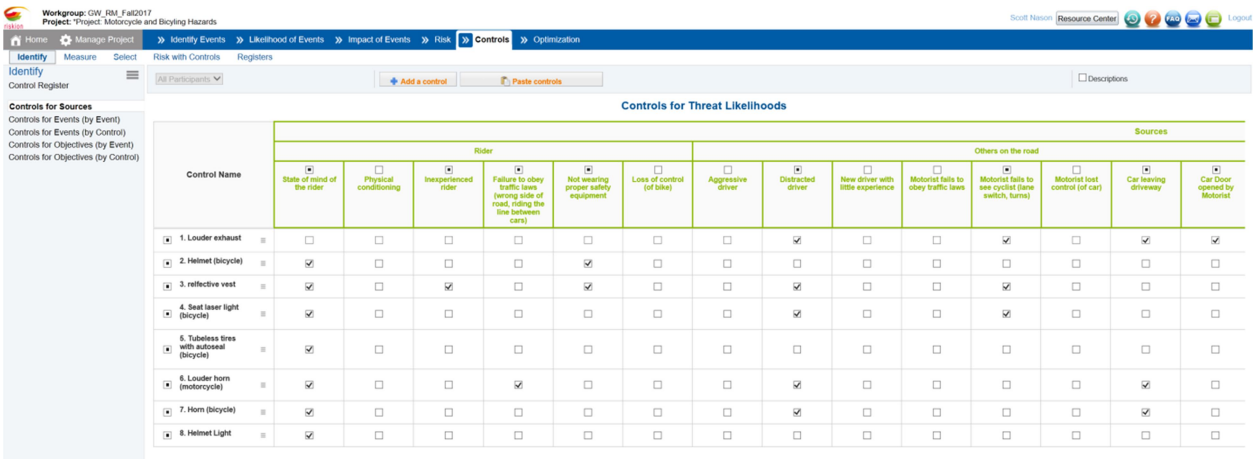

Figure 22 - Controls for Sources

The controls select for vulnerabilities are applied to the control for events. This can be confusing until you figure this out. After many updates and clicking through the different sections the correlation between “vulnerability” section and “event” happened for us. In Figure 23 we have the controls shown

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by event, you can also display by control. This is another check the box if the control when applied to the source will mitigate the risk for the event in the pulldown.

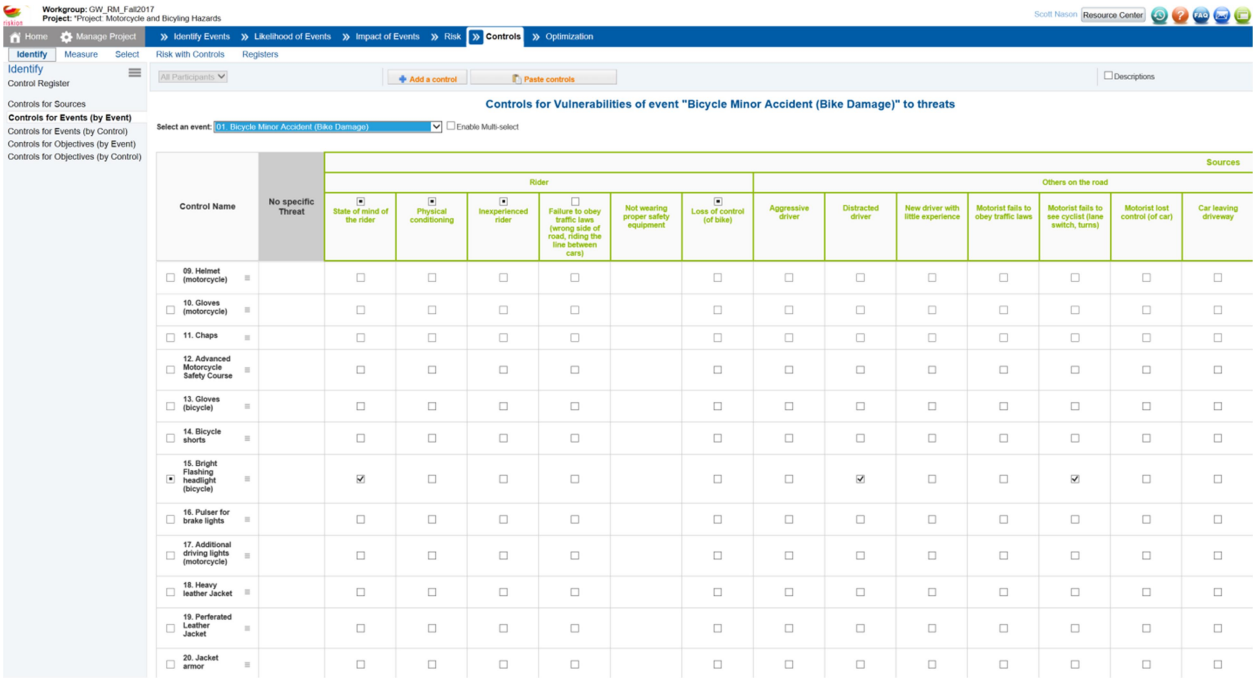

Figure 23 - Controls for Events

The final selection of consequence is used to mitigate the results of the event happening. In our project we had one, that being insurance. In PMI terms this would be purchasing insurance to transfer part of that risk to an insurance company.

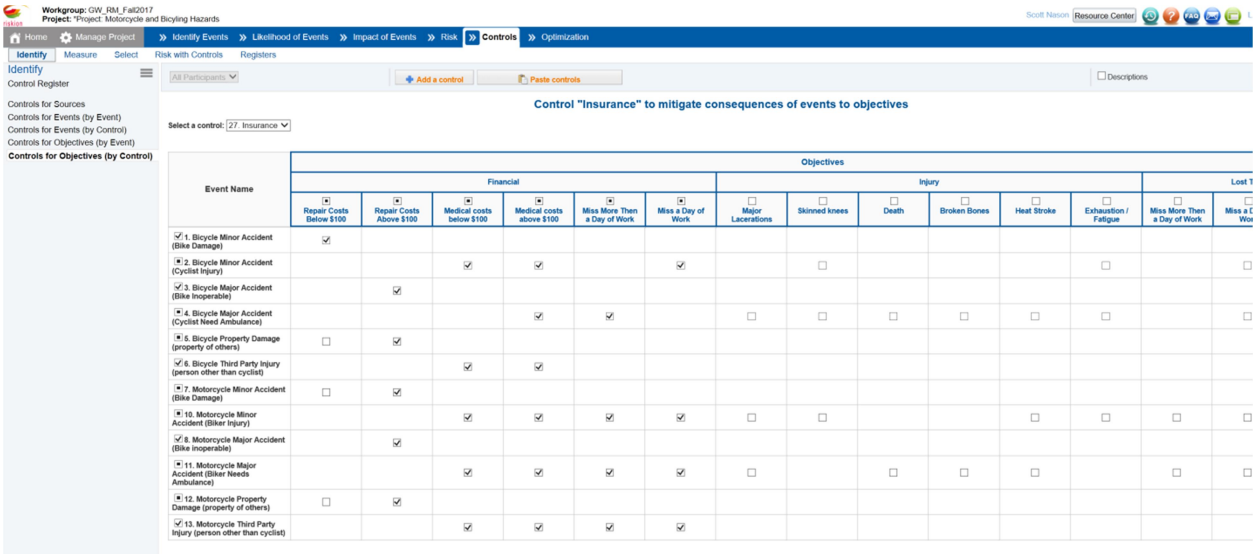

Figure 24 - Controls for Objectives

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The effectiveness of the controls can be assessed just like the likelihood and impact or it may be directly inputted between 0 and .99. Since we had 332 judgements that would need to be made we choose to go with direct input for the effectiveness of each control.

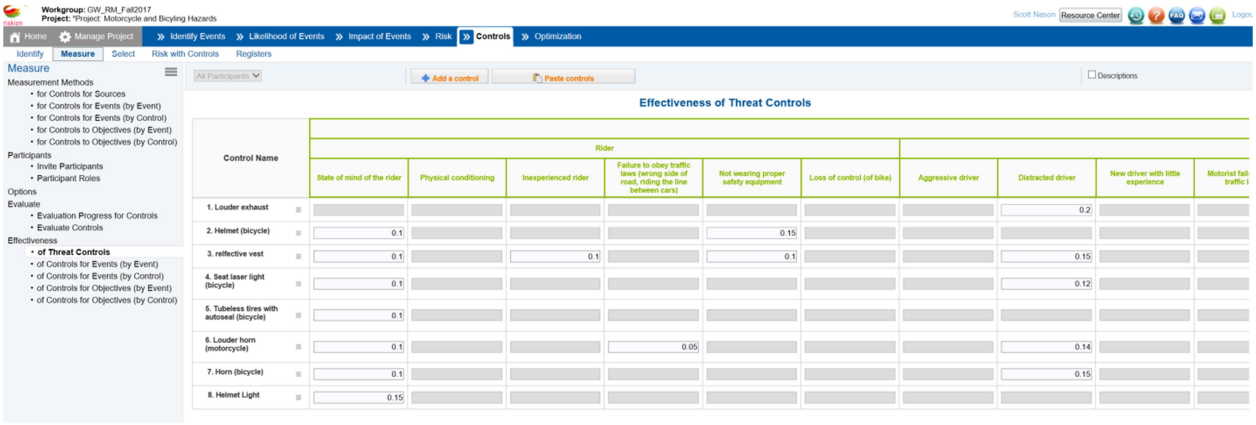

Figure 25 - Effectiveness

As you can see the input of controls and their effectiveness can be another lengthy process, but it is necessary for an accurate optimization.

7. Optimization

The optimization is the peak of the journey and provides a list of what controls are best to implemented based upon budget amount, or if you want to decrease risk to a level it will provide a budget amount that is needed. So great for requesting money for mitigation or figuring out where to apply acquired funds. In Figure 26 we have a budget limit of $1000 and based on the system outputs what controls we should implement for the best “bang for the buck”. Take note that we have some controls marked as “must”, these are required due to local laws. In our instance we could also mark some as “must not” and example here would be louder exhaust. It may mitigate the threat of a distracted driver, but it may also create enough noise to be illegal in a housing area. Another useful box to check would be S.A. Reduction; this provides the amount of reduction the control will provide.

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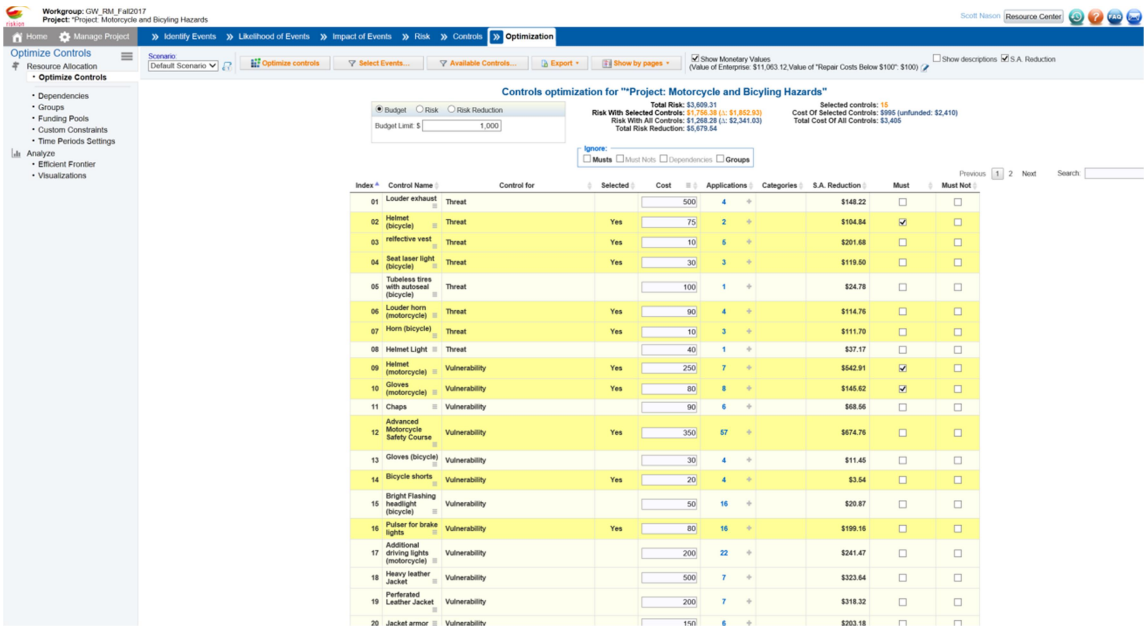

Figure 26 - Optimize Controls

Appendix

Identifying Risk Events

Identification of risk events is an important step in risk analysis and management. Often, teams begin with a brainstorming session to capture every idea and then utilize an iterative approach to ensure that events, sources or threats, and consequences are appropriately categorized to ensure that the resultant risk analysis produces meaningful results. Initially, the team developed a list of risk events associated with riding a motorcycle using a simple brainstorming technique. The initial listing produced using a listing that included events, threats and consequences. The team evaluated the results of the brainstorming session to confirm that each risk event listed resulted in a loss to our objectives. After evaluating each listed risk event against this standard, we found that some of the risks initially identified were causes of events or consequences of an event rather than a risk event. Specifically, our initial list included sources such as weather, time of day, and mechanical failure in our risk event list (Figure N). After reviewing the initial list against the standard that each event must result in a loss we revised the listing to include only events which significantly reduced the number of events in our risk analysis. We then decided to include risks associated with riding a bicycle in our analysis to ensure that we had met the threshold number of risk events required to achieve meaningful results in our analysis (Figure N). We assigned an attribute to each event so that we could distinguish between bicycle and motorcycle risks in subsequent analyses.

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Unique ID	Events
[01]	Minor Accident (walk away)
[02]	Major Accident (tow truck needed)
[03]	Death
[04]	Rider is impaired
[05]	Personnal safety equipment malfunction
[06]	Inclement weather
[07]	Day riding
[08]	Night riding
[09]	City Streets - Below 45 MPH
[10]	Highway riding - above 50 MPH
[11]	Motorcyle equipment failure occurs
[12]	Ride occurs with no event
[13]	Bicycle Minor Accident
[14]	Bicycle Major Accident (Ambulance)
[15]	Bicycle Death
[16]	Bicycle Rider Impaired
[17]	Bicycle Inclement Weather
[18]	Bicycle Day Riding
[19]	Bicycle Night Riding

Figure 27 - Original List of Risk Events

Unique ID	Events	Type of Vehicle
[01]	Bicycle Minor Accident (Bike Damage)	Bicycle
[02]	Bicycle Minor Accident (Cyclist Injury)	Bicycle
[03]	Bicycle Major Accident (Bike Inoperable)	Bicycle
[04]	Bicycle Major Accident (Cyclist Need Ambulance)	Bicycle
[05]	Bicycle Property Damage (property of others)	Bicycle
[06]	Bicycle Third Party Injury (person other than cyclist)	Bicycle
[07]	Motorcycle Minor Accident (Bike Damage)	Motor Cycle
[10]	Motorcycle Minor Accident (Biker Injury)	Motor Cycle
[08]	Motorcycle Major Accident (Bike inoperable)	Motor Cycle
[11]	Motorcycle Major Accident (Biker Needs Ambulance)	Motor Cycle
[12]	Motorcycle Property Damage (property of others)	Motor Cycle
[13]	Motorcycle Third Party Injury (person other than cyclist)	Motor Cycle

Figure 27 - Revised List of Risk Events

Risk Breakdown Structure – Hierarchy of Threats/Sources

Next the team developed a list of the potential sources for each risk event based on individual judgement and information gathered from third-party resources that collect data about the sources of motorcycle and bicycle accidents or injuries. The initial listing was surprisingly long and varied. After developing the list, we examined each threat to determine whether there were similarities among the threats that would facilitate creation of homogeneous groupings of the threats. We assembled these groupings of threats into a hierarchy of threats with no more than nine (9) threats within each category within the hierarchy. (Figure 29) Part of the reason we structured our threats into a hierarchy is to overcome a human's cognitive limitation of comparing 7 plus or minus 2 elements at a time which could result in the evaluators in our study being overwhelmed and thus unable to provide valid assessments of likelihood and impact that could skew or adversely impact our risk analysis (Forman & Selly, 2001).

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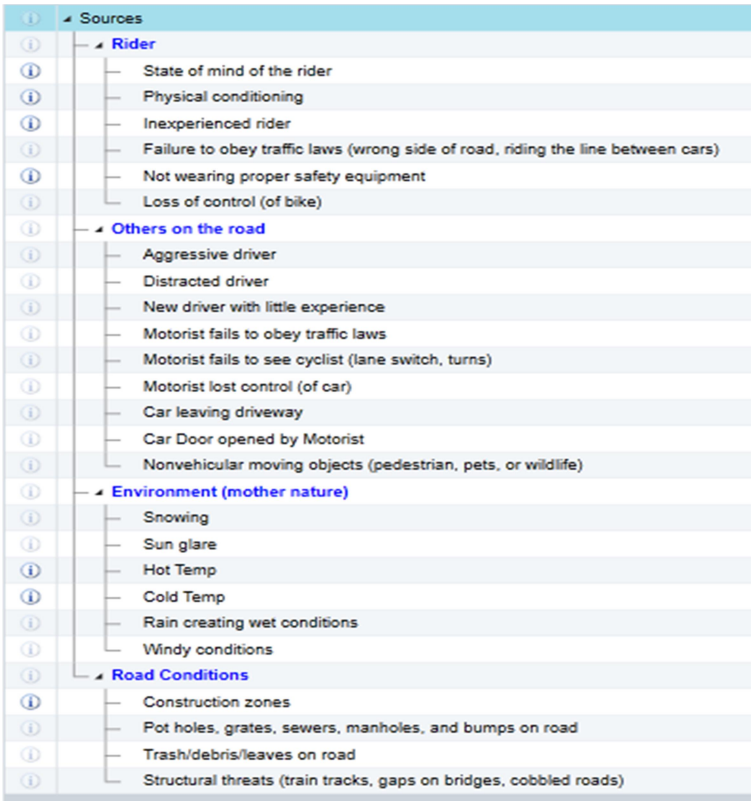

Figure 29 - Hierarchy of Threats

Mapping Sources and Events

After finalizing the list of events and hierarchy of threats the team needed to determine which threats were sources to a specific event. The team conducted a series of sessions to map sources to events using the vulnerabilities grid within Riskion. For each event the team considered which of the threats within the hierarchy could lead to that event taking place and for each threat the team discussed which event could occur as a result of that threat. Reviewing both sides of relationship between threats and events helped the team ensure that all events on the X-axis had at least one vulnerability on the Y-Axis. The team also reviewed each bowtie diagram within Riskion for both the Event Vulnerabilities to Sources (Figure 30) and Events' Vulnerabilities to Threats (Figure 31) to confirm that the mapping performed in the vulnerabilities grid was consistent with the team's assessment of the relationship between sources and events.

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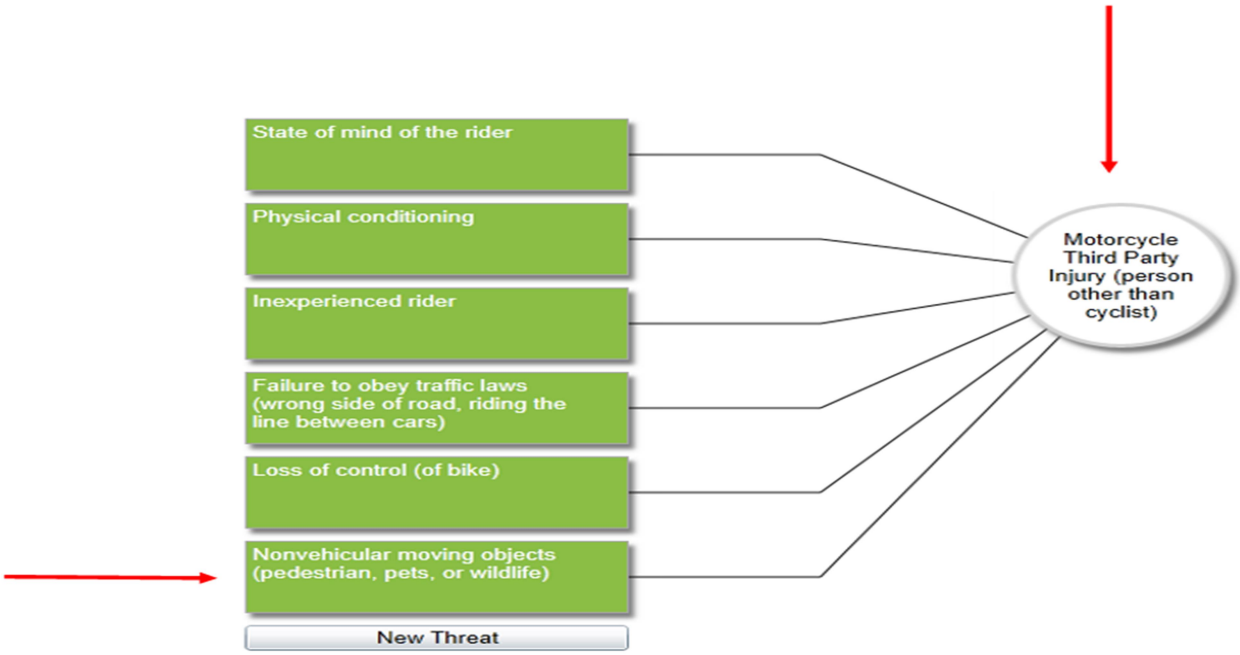

Figure 30 - Event Vulnerabilities to Sources

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Figure 28 - Events' Vulnerabilities to Threats

Prioritization of Objectives and Impacts of Events on Objectives

Figure 32 below shows that the synthesized results of evaluator responses derived that injuries were the most important objective category within the hierarchy. It also shows that the events determined to have the greatest impact on the objectives are major accidents (for both bicycle and motorcycle).

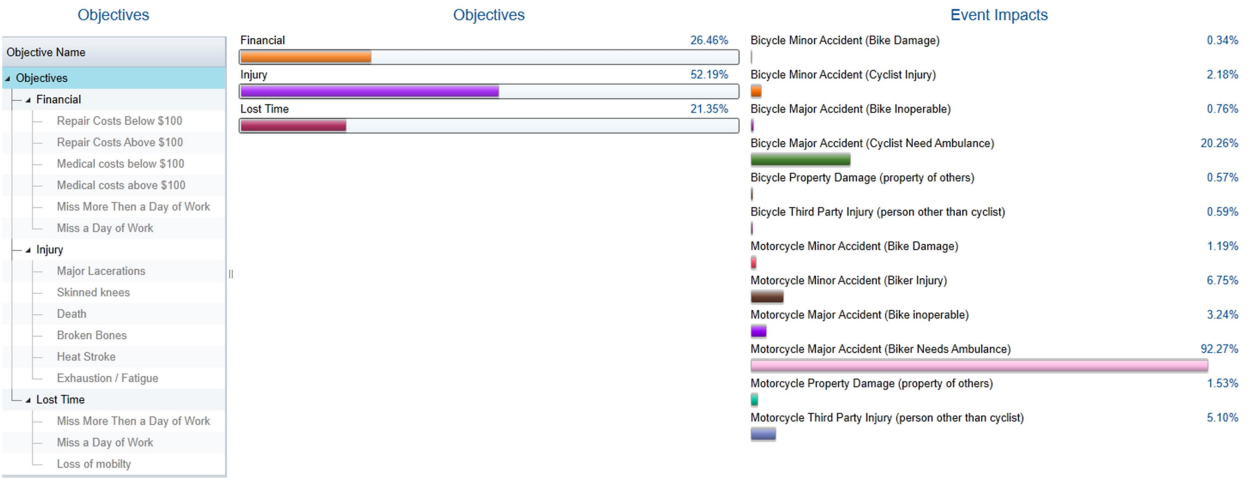

Figure 29 - Objective priorities and Impact of Events on Objectives

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Identification and Assignment of Controls

In order to identify controls, we first asked ourselves how could we reduce the risk of an event generally. We then spent time determining how each control in the list we developed impacted the risk. To accomplish this, we evaluated each control to determine how it reduced risk. Some of the key questions we asked were whether the control reduced the likelihood of a threat, did it reduce the likelihood of an event given a threat, or did the control reduce the consequence to objectives of the event occurring? We also spent time evaluating whether a single control could impact multiple events, threats, or consequences. Our analysis resulted in lists of potential controls for threats, events, and consequences to objectives. As seen in Figures 33-36)

Controls for Threats Print

1 of 1

Threat Control	Risk Threat
Helmet (bicycle)	State of mind of the rider
	Not wearing proper safety equipment
Helmet Light	State of mind of the rider
Horn (bicycle)	State of mind of the rider
	Distracted driver
	Car leaving driveway
Louder exhaust	Distracted driver
	Motorist fails to see cyclist (lane switch, turns)
	Car leaving driveway
	Car Door opened by Motorist
Louder horn (motorcycle)	Failure to obey traffic laws (wrong side of road, riding the line between cars)
	State of mind of the rider
	Distracted driver
	Car leaving driveway
relfective vest	State of mind of the rider
	Inexperienced rider
	Distracted driver
	Motorist fails to see cyclist (lane switch, turns)
	Not wearing proper safety equipment
Seat laser light (bicycle)	Distracted driver
	Motorist fails to see cyclist (lane switch, turns)
	State of mind of the rider
Tubeless tires with autoseal (bicycle)	State of mind of the rider

Figure 30 - Control for Threats/Sources

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Controls for Events

Print

1 of 2 ?

Vulnerability Control	Risk Threat	Risk Event
Additional driving lights (motorcycle)	Distracted driver	Motorcycle Minor Accident (Bike Damage)
	Motorist fails to see cyclist (lane switch, turns)	Motorcycle Minor Accident (Bike Damage)
	Car leaving driveway	Motorcycle Minor Accident (Bike Damage)
	Nonvehicular moving objects (pedestrian, pets, or wildlife)	Motorcycle Minor Accident (Bike Damage)
	Snowing	Motorcycle Minor Accident (Bike Damage)
	Rain creating wet conditions	Motorcycle Minor Accident (Bike Damage)
	Distracted driver	Motorcycle Minor Accident (Biker Injury)
	Motorist fails to see cyclist (lane switch, turns)	Motorcycle Minor Accident (Biker Injury)
	Car leaving driveway	Motorcycle Minor Accident (Biker Injury)
	Snowing	Motorcycle Minor Accident (Biker Injury)
	Rain creating wet conditions	Motorcycle Minor Accident (Biker Injury)
	Distracted driver	Motorcycle Major Accident (Biker Needs Ambulance)
	Distracted driver	Motorcycle Major Accident (Bike inoperable)
	Motorist fails to see cyclist (lane switch, turns)	Motorcycle Major Accident (Bike inoperable)
	Motorist fails to see cyclist (lane switch, turns)	Motorcycle Major Accident (Biker Needs Ambulance)
	Nonvehicular moving objects (pedestrian, pets, or wildlife)	Motorcycle Major Accident (Bike inoperable)
	Nonvehicular moving objects (pedestrian, pets, or wildlife)	Motorcycle Major Accident (Biker Needs Ambulance)
	Nonvehicular moving objects (pedestrian, pets, or wildlife)	Motorcycle Minor Accident (Biker Injury)
	Snowing	Motorcycle Major Accident (Bike inoperable)
	Snowing	Motorcycle Major Accident (Biker Needs Ambulance)
	Rain creating wet conditions	Motorcycle Major Accident (Bike inoperable)
	Rain creating wet conditions	Motorcycle Major Accident (Biker Needs Ambulance)

Figure 31 - Control for Events Given a Threat – Part 1

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Advanced Motorcycle Safety Course	State of mind of the rider	Motorcycle Minor Accident (Biker Injury)
	State of mind of the rider	Motorcycle Major Accident (Biker Needs Ambulance)
	State of mind of the rider	Motorcycle Property Damage (property of others)
	State of mind of the rider	Motorcycle Third Party Injury (person other than cyclist)
	Inexperienced rider	Motorcycle Minor Accident (Biker Injury)
	Physical conditioning	Motorcycle Minor Accident (Biker Injury)
	Inexperienced rider	Motorcycle Third Party Injury (person other than cyclist)
	Inexperienced rider	Motorcycle Property Damage (property of others)
	Inexperienced rider	Motorcycle Major Accident (Biker Needs Ambulance)
	Physical conditioning	Motorcycle Third Party Injury (person other than cyclist)
	Physical conditioning	Motorcycle Property Damage (property of others)
	Physical conditioning	Motorcycle Major Accident (Biker Needs Ambulance)
	Loss of control (of bike)	Motorcycle Property Damage (property of others)
	Loss of control (of bike)	Motorcycle Third Party Injury (person other than cyclist)
	Loss of control (of bike)	Motorcycle Major Accident (Biker Needs Ambulance)
	Loss of control (of bike)	Motorcycle Minor Accident (Biker Injury)
	Failure to obey traffic laws (wrong side of road, riding the line between cars)	Motorcycle Minor Accident (Biker Injury)
	Not wearing proper safety equipment	Motorcycle Minor Accident (Biker Injury)
	Failure to obey traffic laws (wrong side of road, riding the line between cars)	Motorcycle Major Accident (Biker Needs Ambulance)
	Not wearing proper safety equipment	Motorcycle Major Accident (Biker Needs Ambulance)
	Failure to obey traffic laws (wrong side of road, riding the line between cars)	Motorcycle Property Damage (property of others)
	Failure to obey traffic laws (wrong side of road, riding the line between cars)	Motorcycle Third Party Injury (person other than cyclist)

Figure 35 - Control for Events Given a Threat – Part 2

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Controls for Objectives

Print

1 of 1

Objective/Consequence Control	Objective	Risk Event
Insurance	Repair Costs Below $100	Bicycle Minor Accident (Bike Damage)
	Medical costs below $100	Bicycle Minor Accident (Cyclist Injury)
	Medical costs below $100	Bicycle Third Party Injury (person other than cyclist)
	Medical costs below $100	Motorcycle Minor Accident (Biker Injury)
	Medical costs below $100	Motorcycle Major Accident (Biker Needs Ambulance)
	Medical costs below $100	Motorcycle Third Party Injury (person other than cyclist)
	Medical costs above $100	Bicycle Minor Accident (Cyclist Injury)
	Medical costs above $100	Bicycle Major Accident (Cyclist Need Ambulance)
	Medical costs above $100	Bicycle Third Party Injury (person other than cyclist)
	Medical costs above $100	Motorcycle Minor Accident (Biker Injury)
	Medical costs above $100	Motorcycle Major Accident (Biker Needs Ambulance)
	Medical costs above $100	Motorcycle Third Party Injury (person other than cyclist)
	Miss a Day of Work	Bicycle Minor Accident (Cyclist Injury)
	Miss a Day of Work	Motorcycle Minor Accident (Biker Injury)
	Miss a Day of Work	Motorcycle Major Accident (Biker Needs Ambulance)
	Miss a Day of Work	Motorcycle Third Party Injury (person other than cyclist)
	Miss More Then a Day of Work	Bicycle Major Accident (Cyclist Need Ambulance)
	Miss More Then a Day of Work	Motorcycle Minor Accident (Biker Injury)
	Miss More Then a Day of Work	Motorcycle Major Accident (Biker Needs Ambulance)
	Miss More Then a Day of Work	Motorcycle Third Party Injury (person other than cyclist)
	Repair Costs Above $100	Bicycle Major Accident (Bike Inopersable)
	Repair Costs Above $100	Bicycle Property Damage (property of others)
	Repair Costs Above $100	Motorcycle Minor Accident (Bike Damage)
	Repair Costs Above $100	Motorcycle Major Accident (Bike inopersable)
	Repair Costs Above $100	Motorcycle Property Damage (property of others)

Figure 32 - Controls for Consequences to Objectives Given an Event

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References

Forman, E. H., & Selly, M. A. (2001). *Decision by objectives: How to convince others that you are right*. River Edge, NJ: World Scientific. Retrieved from http://professorforman.com/DecisionByObjectives/default.html