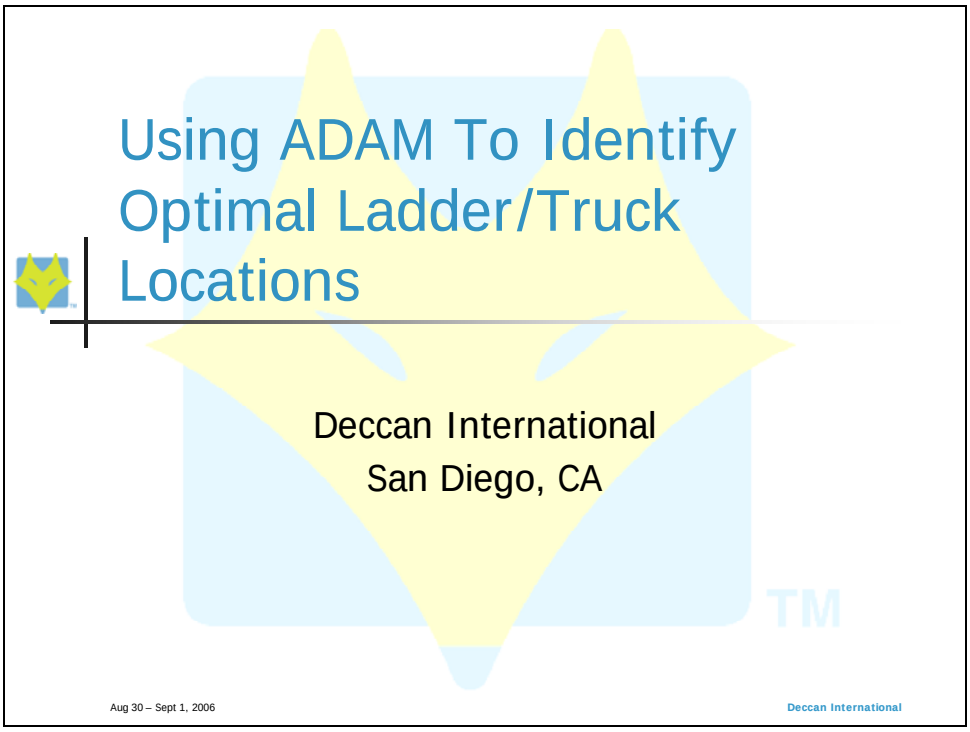
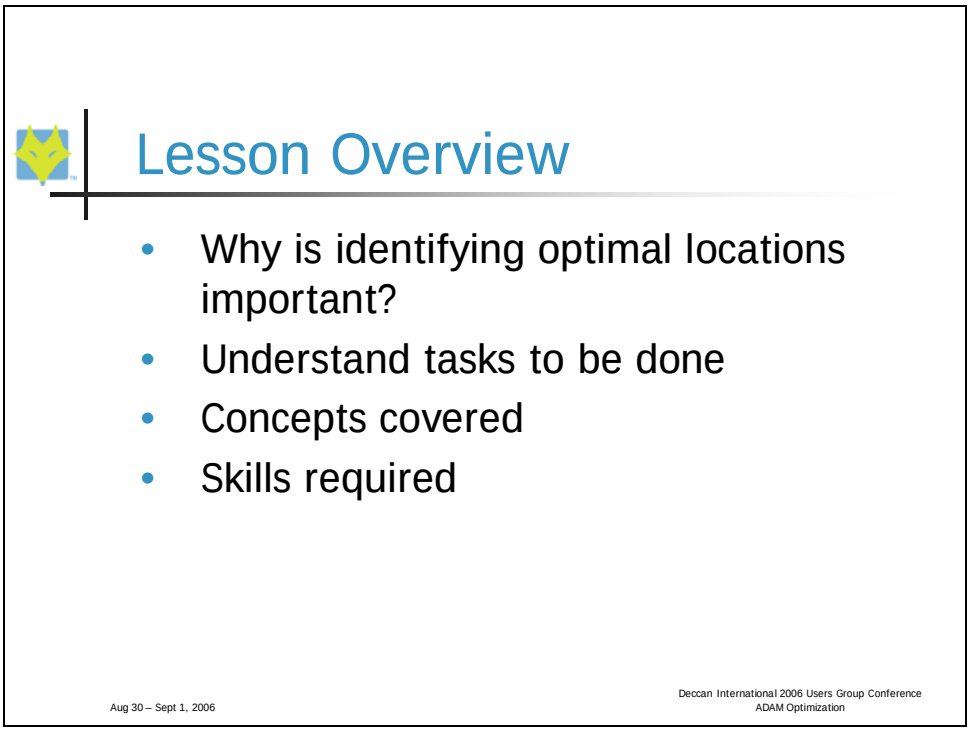
ADAM OPTIMIZATION

USING ADAM TO IDENTIFY OPTIMAL LADDER/TRUCK LOCATIONS



Using ADAM to Identify Optimal Ladder/Truck Locations:

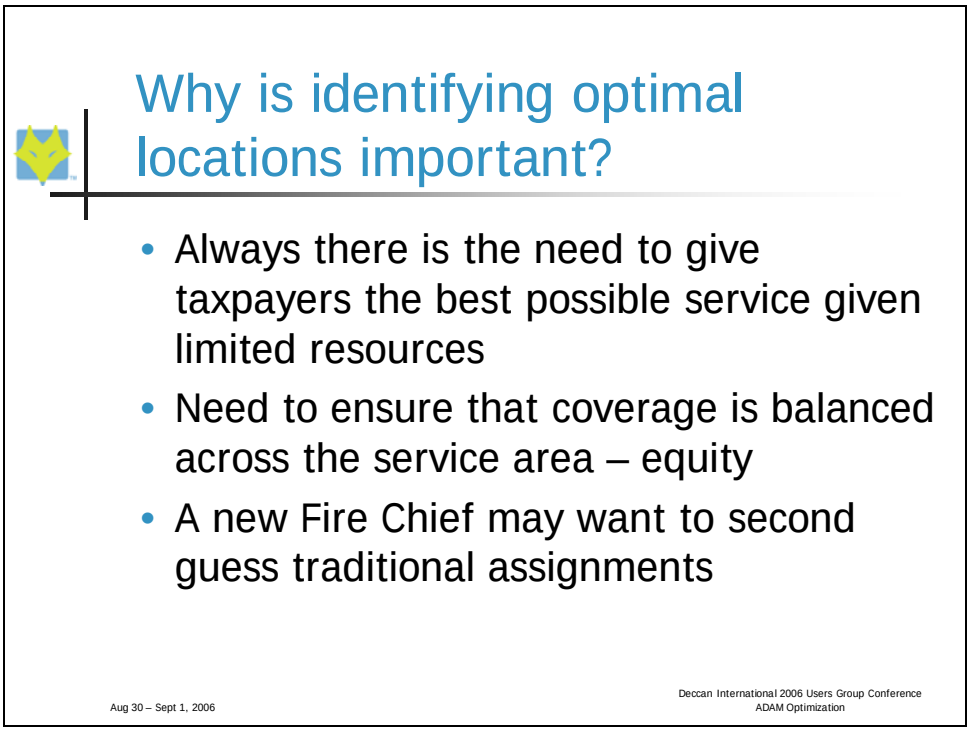
In this lesson, you will learn to how to confirm if your ladders/trucks are in the right locations. The lesson covers the key concepts, skills and procedures you will need to use ADAM in a real-world case study, involving location of apparatus.



Lesson Overview:

We will first focus on the motivation and then on the objectives of this lesson. We will then go over the concepts to be taught in this lesson and the skills related to these concepts. We will then review the concepts and the skills for this lesson.

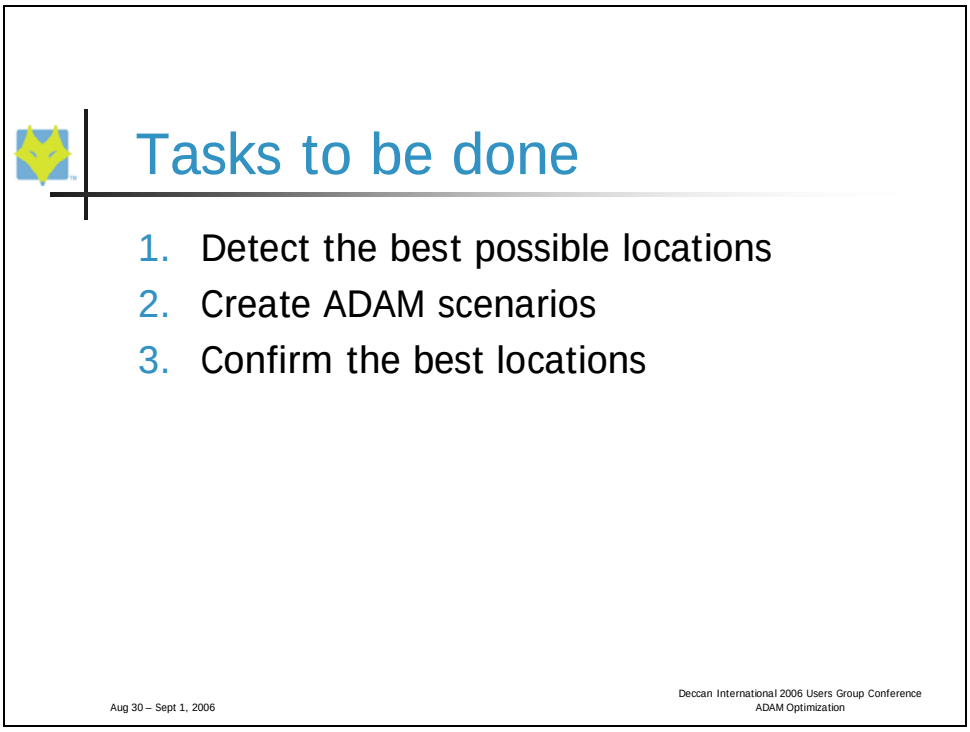
Finally, you will apply the learned concepts and skills to actually doing a project using ADAM. We will have an overview of the exercise. We have used a case study based approach for the exercises. This will be followed by the description of the problem at hand. Following this you would then switch over to actually doing the exercise, using the provided **Exercise Book** as a guide.



Why is identifying optimal locations important?

This lesson focuses on confirming whether your trucks/ladders are in the right locations. You need to make sure that the current resources for the department is being used to fullest possible capacity and that no resources are being wasted. We also need to make sure that the coverage for a particular resource (e.g. ladders) is balanced equally across the entire service area and that no area is left with inadequate coverage.

After identifying other possible optimal locations of your resources, you can be assured that you are utilizing your department resources most efficiently.



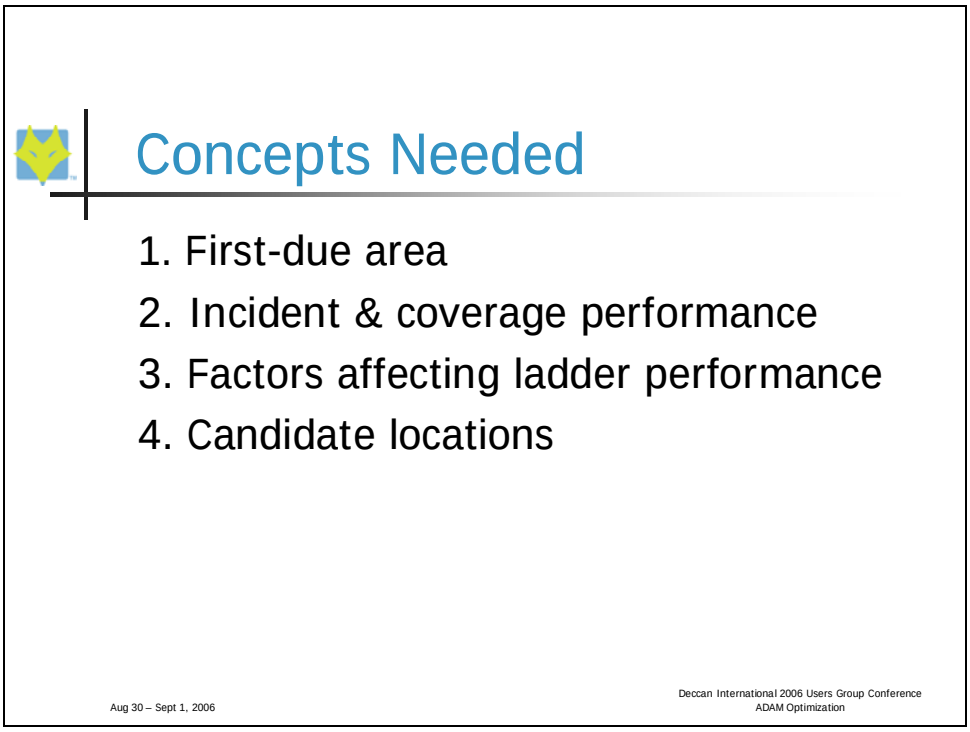
Lesson Objectives:

In order to confirm whether ladders/trucks are in the right locations, you need to:

1. Identify the best possible location of resources
2. Create ADAM scenarios with these multiple deployment choices
3. Confirm which deployment choice is best possible

You would need to create an inventory of all possible locations within your service area to position the resources, which in this case are ladders/trucks. This lesson will teach you the concepts and skills necessary to find the most appropriate locations to place your ladders.

You can then create different deployment scenarios in ADAM and view the impact of these changes. Finally, you can compare performance for the new deployment scenarios and decide which particular one is the optimal deployment.



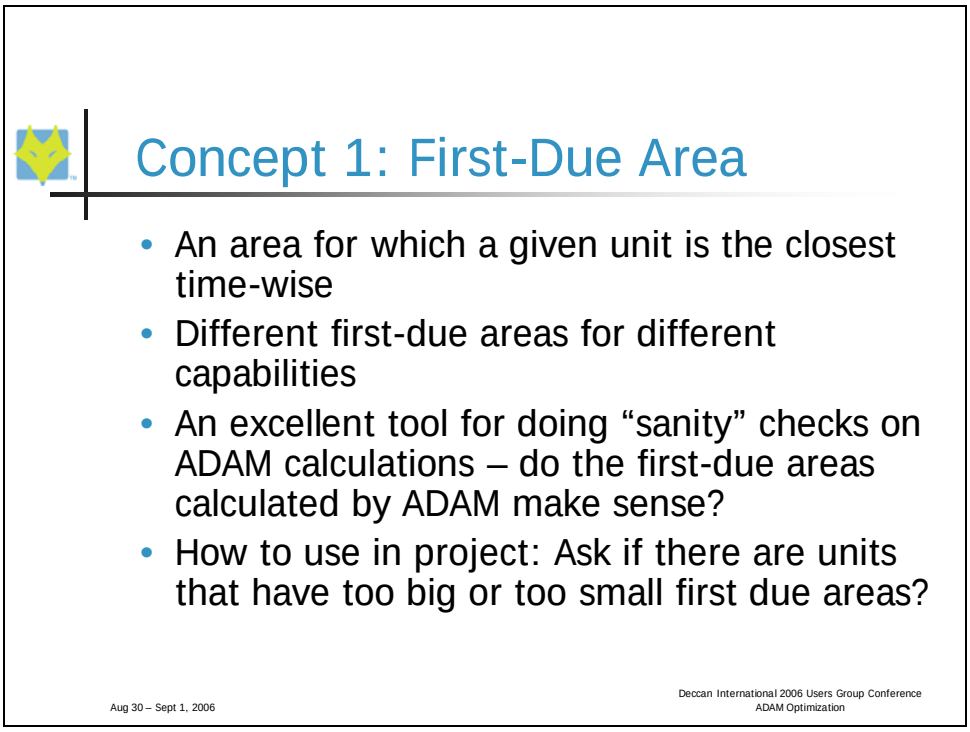
Concepts Needed:

First Due Areas: Understand areas for which a unit is closest than any other unit.

Incident and Coverage Performance: The difference between incident and coverage performance.

Factors Affecting Ladder Performance: What factors should you consider while changing deployment of ladders?

Candidate Locations: What are the possible locations to move resources to?

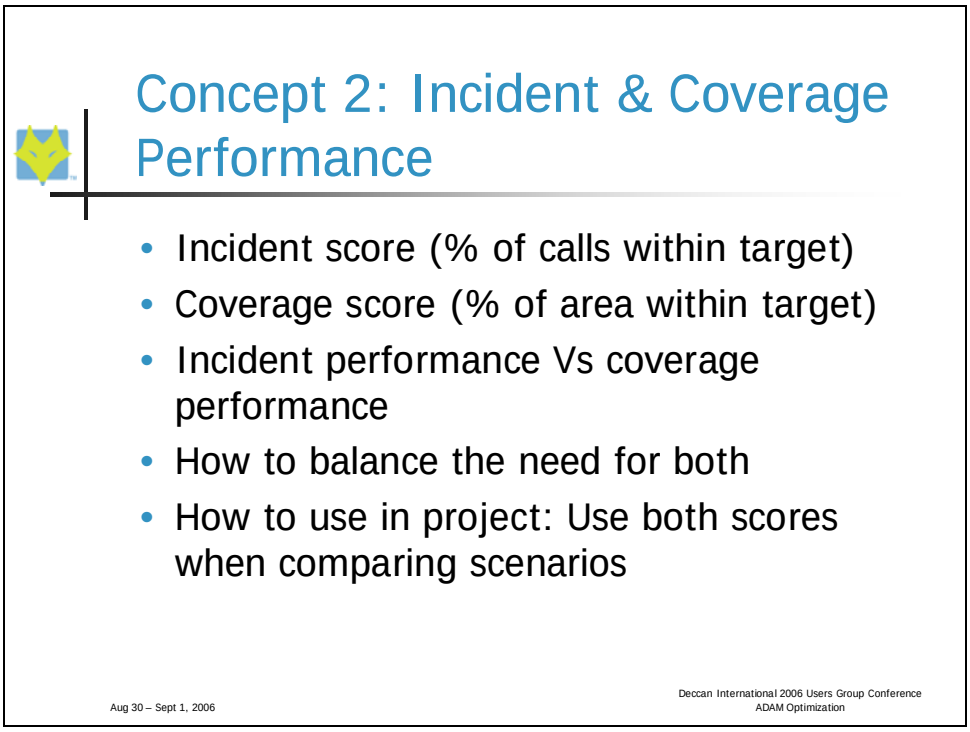


Concept 1: First Due Areas

First due area is the area where a unit is closest in terms of time than any other unit.

All units in ADAM have a certain set of capabilities assigned to them, e.g. engine, ladder, rescue, etc. ADAM provides the user with a thematic map for the first due areas for each capability available. For example, if there are 8 engines within the service area, ADAM will provide 8 first due areas, one for each of the engines.

The first due areas can be used to do sanity checks on ADAM calculations, routing information and also on deployment used. One can easily find if there are any missing or additional units deployed. Using the first dues, a user can determine what sized areas are covered by particular units with respect to other units in the service area.



Concept 2: Incident & Coverage Performance

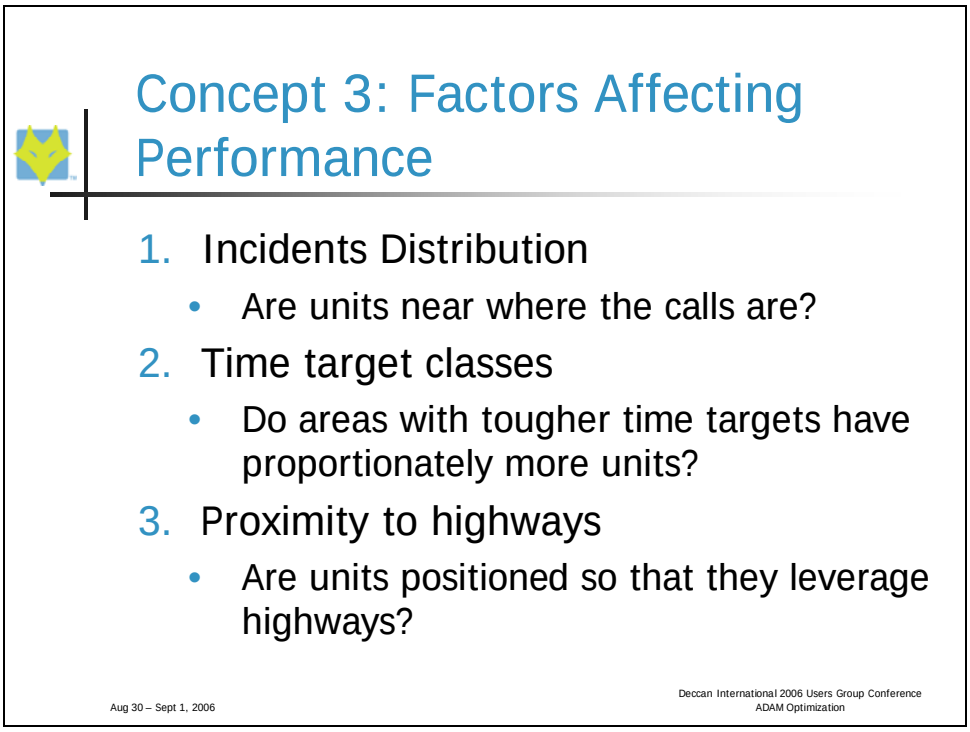
ADAM provides two different scores, Incident and Coverage scores. **Incident score** gives the percentage of calls that can be reached within the specified time target. The performance for the areas with high call volume is given more weight than the areas with lower call volume. **Coverage score** gives the percentage of area that can be reached within the specified time target. The performance for all areas within the service area is equally weighted.

How to balance both?

When a change in deployment causes both the incident and the coverage score to improve, we know that the deployment change was for the better.

In certain cases, the incident score might improve and the coverage score might worsen. In such cases you have to make a decision to identify which score is more important. Which score should be improved, depends on the problem at hand. For example, if we are looking at addressing an area which does not have many incident but needs to be covered

for other reasons, then coverage score is important. On the other hand, if we are looking at addressing areas with high call volumes, then the incident score is more important.

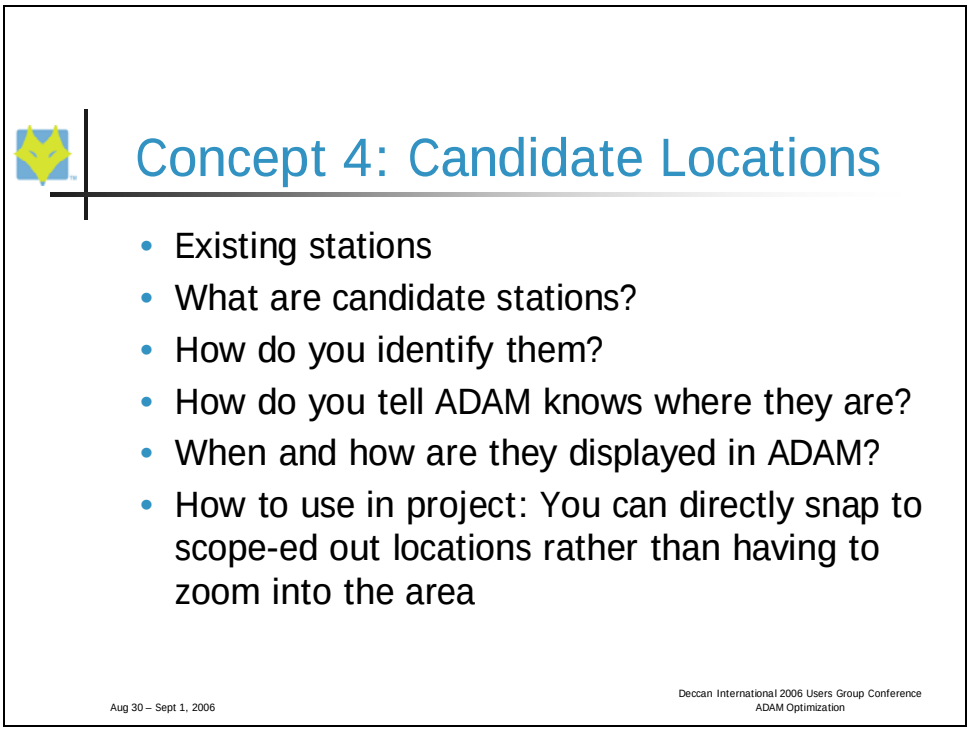


Concept 3: Factors Affecting Performance

1. **Workloads:** Workloads are the number of runs made by a unit for a fixed period of time. In ADAM, we usually use the workloads for the last one year. Ladders or Trucks need to be located in areas where there are high structure fires. This will result in better performance for those incidents thus increasing the overall incident score.

2. **Time Target Classes**: Time target classes are also important factors that influence the response performance for ladders/trucks. Time target classes denote different areas within the service area where the department has differential time targets for the same response criterion. For example the department might want to have an engine respond to a structure fire in an urban area within 6 mins, but for an incident in a rural area the engine can take up to 10 mins to reach. As a result, the ladders have to proportionately spread over the service area, so that the regions with stricter (tougher) time targets, such as urban or commercial areas, have more number of ladders than the other regions.

3. **Proximity to Highways:** Ladders would be able to respond much faster if they are provided better access to highways and freeways, thus improving overall performance. So we can try and position a ladder as close to highway and freeway accesses as possible.

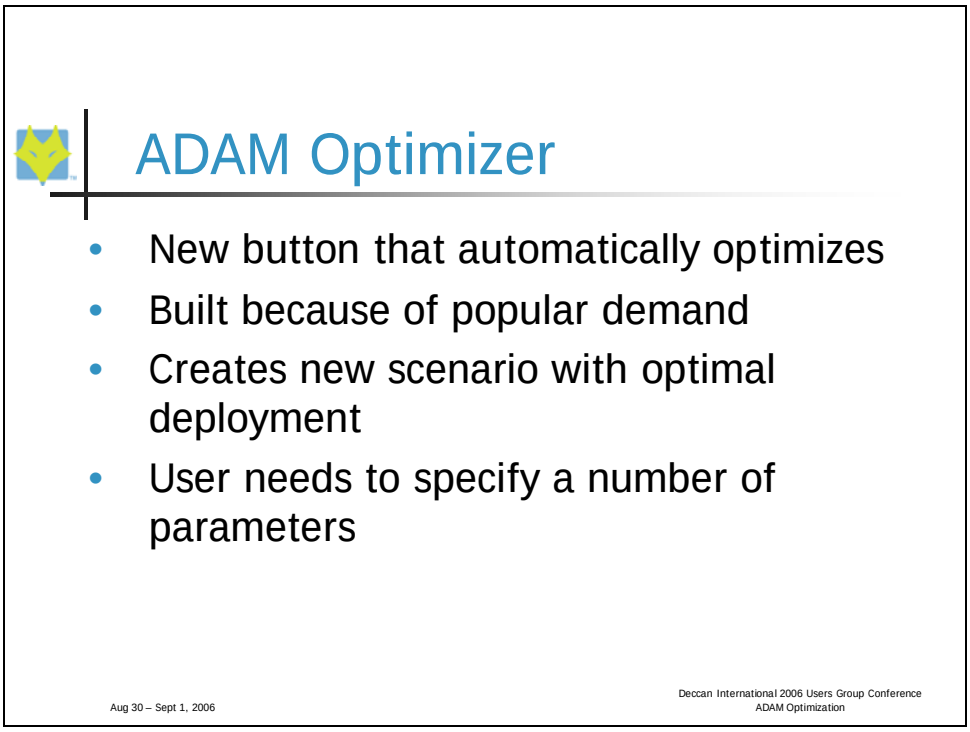


Candidate Locations:

The stations seen on the ADAM map are existing or active stations. On the other hand, a candidate station is a location where a station is planned in the future. These are locations where a fire department can possibly build new stations. These could also be locations where the department has some areas where they could prospectively build new stations. These could also be old station locations where new stations could be re-built.

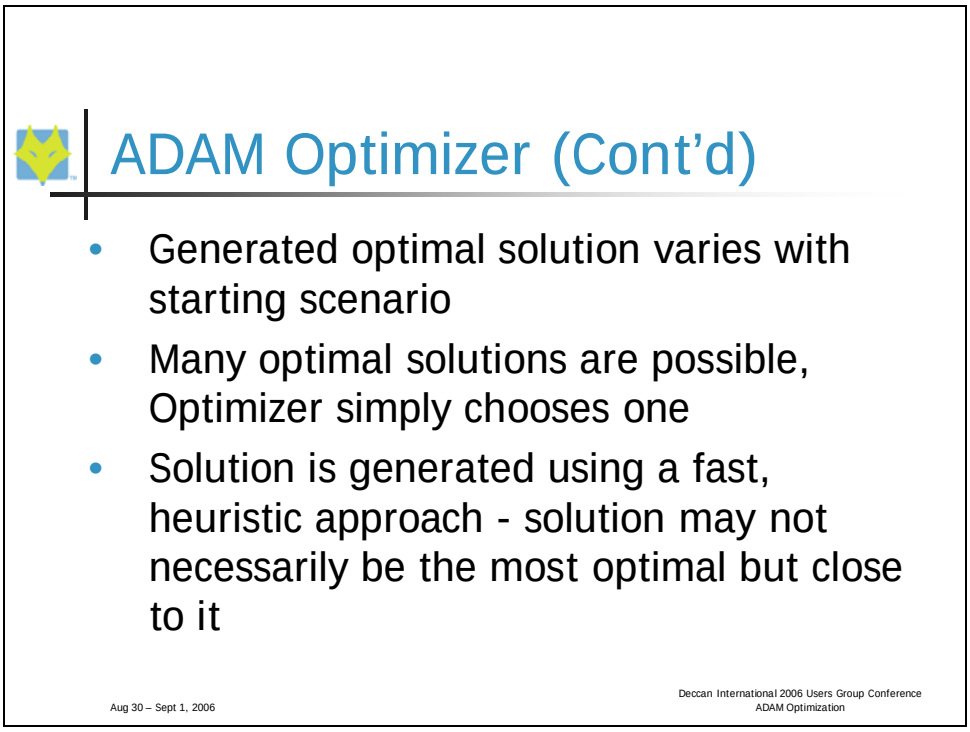
ADAM can accept a map layer showing the location of all such candidate locations. A user can then directly see the candidate locations on the map when adding or moving new units. Thus it would be easy for a user to find such locations without zooming into the map to find the exact street location. Using ADAM, you can move ladders to:

1. Existing Station (which does not have a ladder/truck)
2. Candidate Location
3. Any location on the map accessible by a street.



ADAM Optimizer:

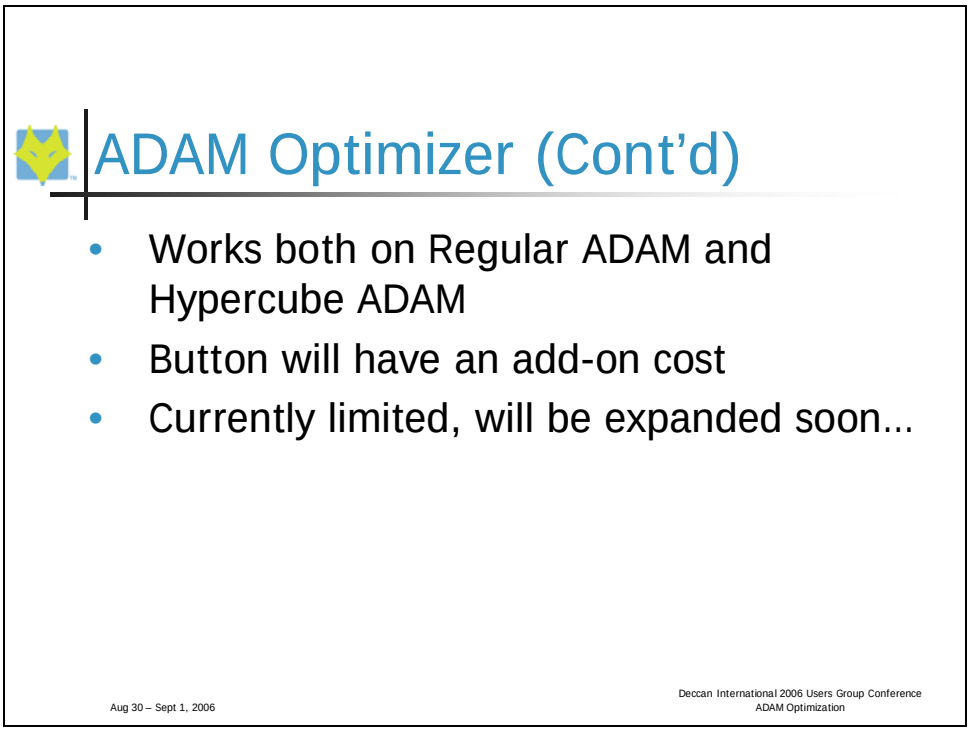
We are now introducing a new button that automatically optimizes a pre-specified ADAM response criterion given certain number of units. This was done in response to feedback we got from last year's user group conference. It automatically identifies an optimal deployment, creates a scenario and saves it for you to look at later. There are number of factors that direct the optimization and the user needs to specify them.



ADAM Optimizer (cont'd):

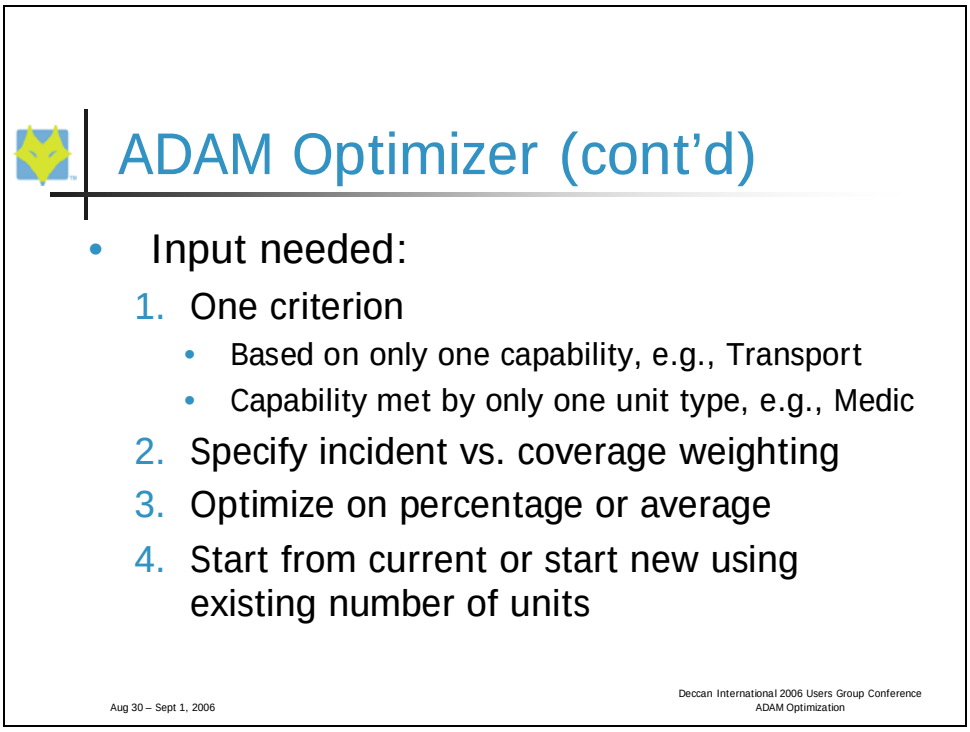
Depending on the base scenario a different optimal solution will be generated. Thus, you can create many different optimal scenarios. Even with a given base scenario there are many optimal solutions possible. The optimizer arbitrarily chooses one to offer to you.

Typically, there are two ways to do an optimization. One is to set up the project as an optimization problem and get an exact optimal solution using optimization software; the other is a "heuristic" approach. Using the optimization software can be time consuming and requires specialized additional expensive software. In contrast the heuristic approach is fast but may not necessarily yield the optimal solution though the solution will be close to it. It does not require any additional software. Given the many variables involved in optimization this seems to be a small price for using a heuristic. The ADAM Optimizer is heuristic based.



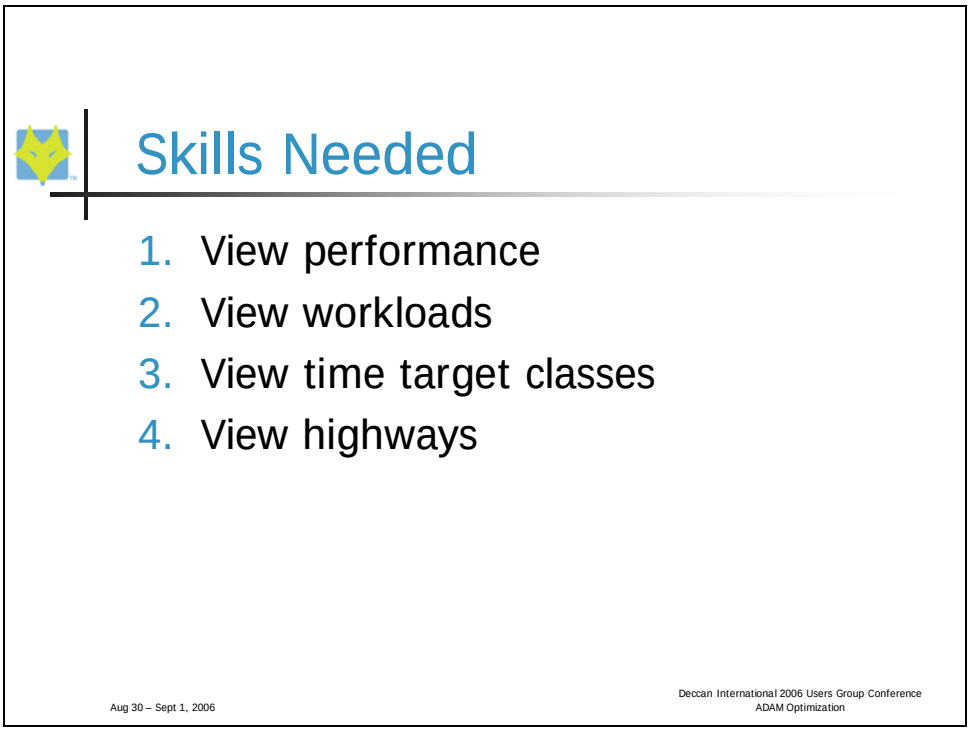
ADAM Optimizer (cont'd):

Optimizer works on both regular and hypercube ADAM. Because of the work involved in building and supporting it, this will have an additional cost. So the customer will have to purchase this feature. Currently the feature is limited to optimizing certain number of units. It is being extended to identify minimal number of units needed to meeting target response performance.



ADAM Optimizer (cont'd):

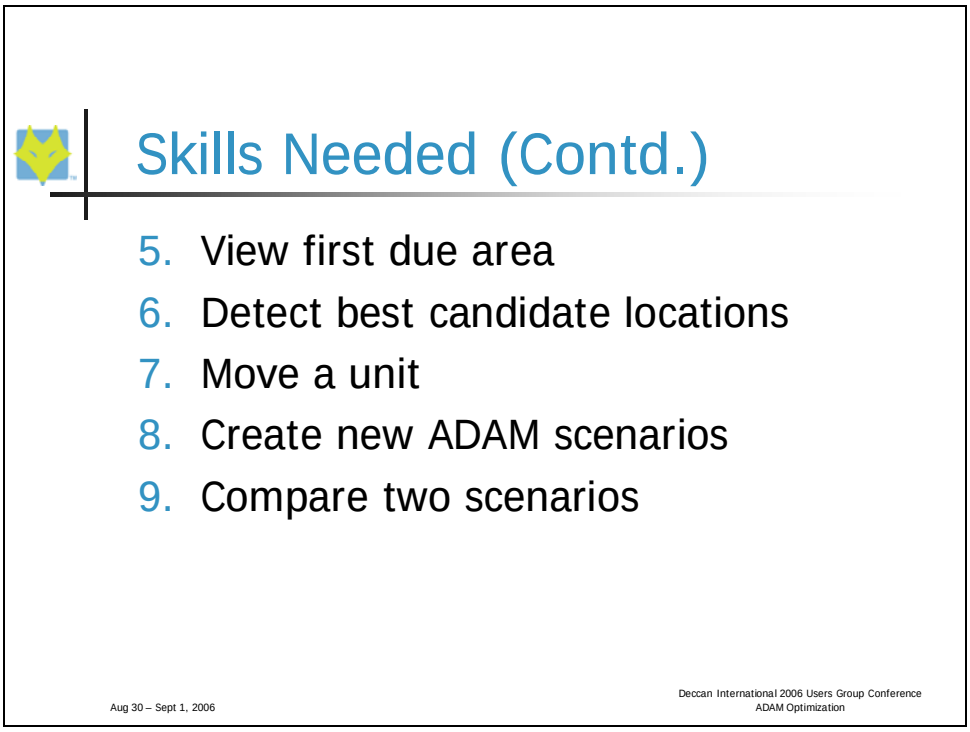
Currently the optimizer can optimize on only one criterion, with an additional constraint of being based on only one capability, for e.g. ladder. Lastly, only one unit type should be able to provide this capability, for e.g. ladder truck. Thus, currently if ladder capability is offered by both ladder trucks and quints, the optimizer will not work. This limitation will soon be removed. The user also has to specify how much of the 100% should be divvied up between incident performance and coverage performance. A 100% for incidents and 0% for coverage reflects complete focus on incident performance. In contrast 0% for incidents and 100% for coverage reflects full focus on coverage performance. Finally 50%-50% for each reflects equal importance for incidents and coverage. The user also has to choose whether to focus on percentage or the average performance. Lastly the user has to specify whether the optimizer has to improve on the current scenario or the optimizer can start with a clean slate.



Skills Needed:

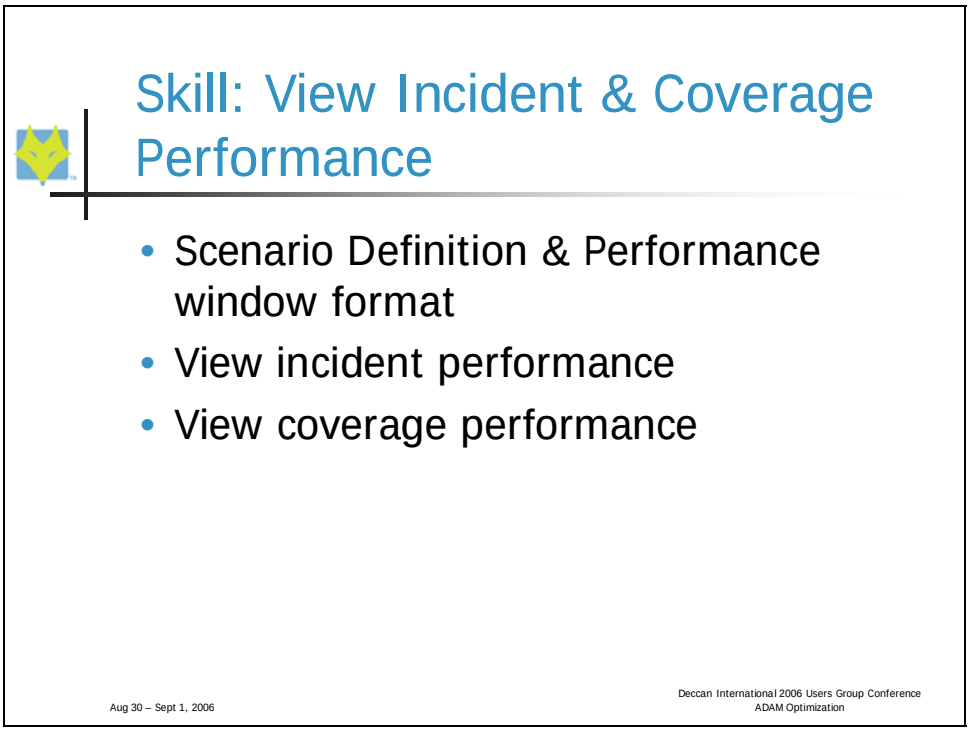
The following are the different skills in ADAM which are related to the concepts taught. You would be using these skills later on in this lesson, as a part of an exercise.

- View performance
- View workloads
- View time target classes
- View highways



Skills needed (cont'd):

- View first due area
- Detect best candidate locations
- Move a unit
- Create new ADAM scenarios
- Compare two scenarios

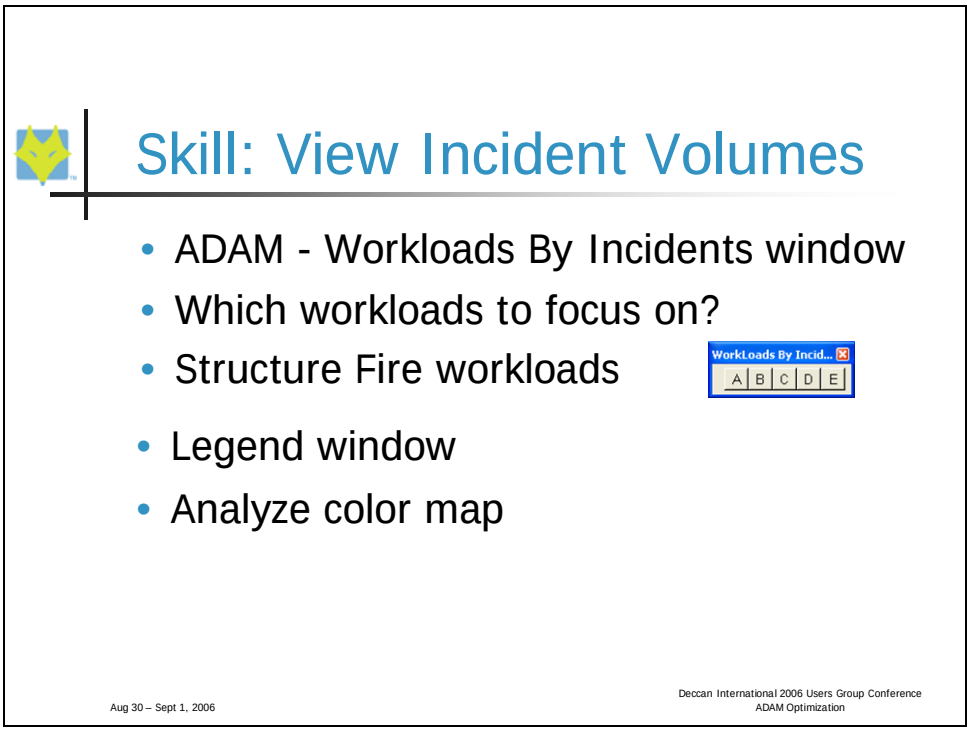


Viewing Incident and Coverage Scores:

In ADAM, the incident and coverage scores for any scenario can be obtained from the scenario and performance definition window. It is also called as the score-sheet window.

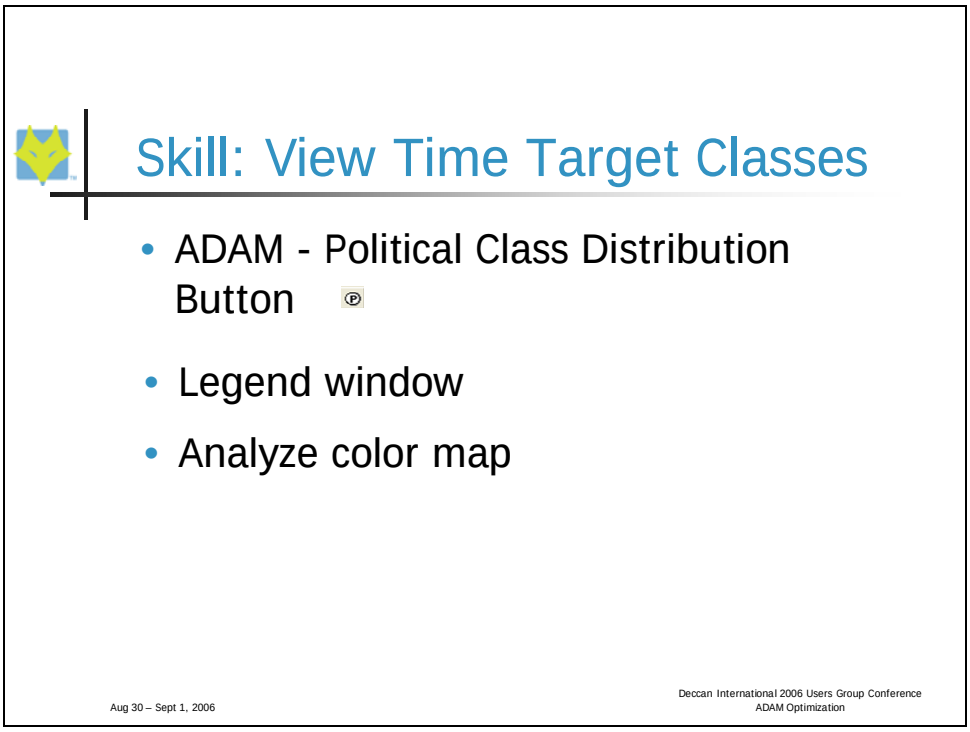
The score-sheet window has two distinct sections for the Incident and the Coverage scores. Within each section, the scores are listed for each of the response criteria configured in ADAM. For each response criteria, the average and the percentage scores are listed.

In the window, you should focus on response criterion which is related with ladder/truck performance, which is "**First Quint/Truck Response Time (Dispatch To OnScene)"**.



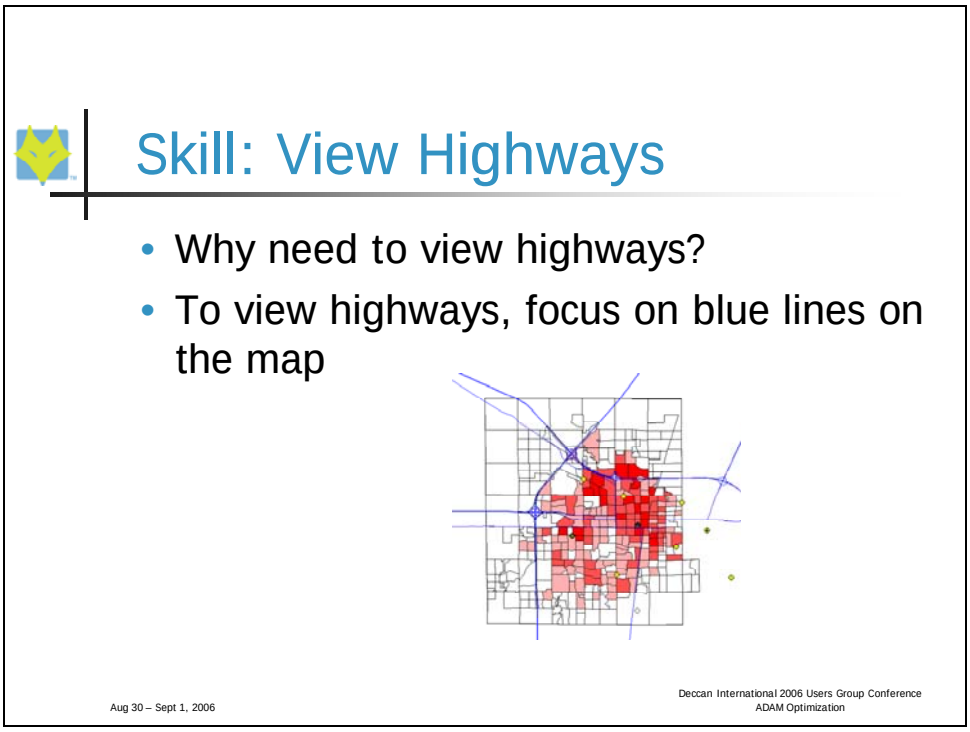
ADAM Workloads:

In ADAM, the workloads by incident buttonpad can be used to view the thematic shading of the workloads. As we are evaluating ladder performances, we should focus on structure fire workloads only and not all the workloads.



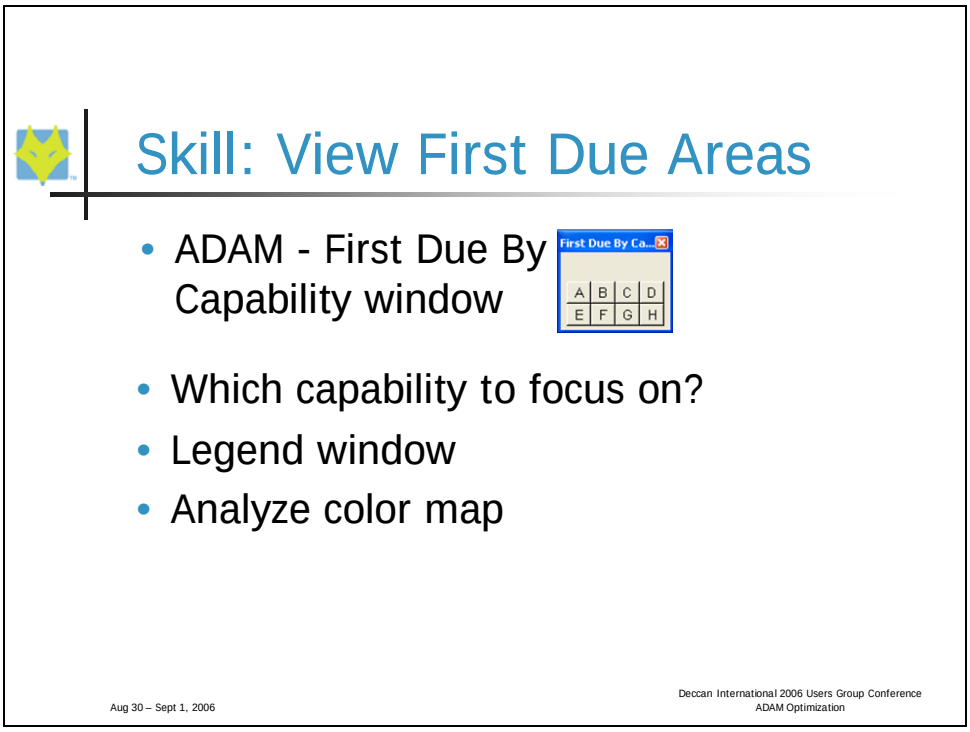
Time Target Classes:

We have already discussed what time target classes are. You can click view the thematic distribution of the time target classed by clicking on the  button



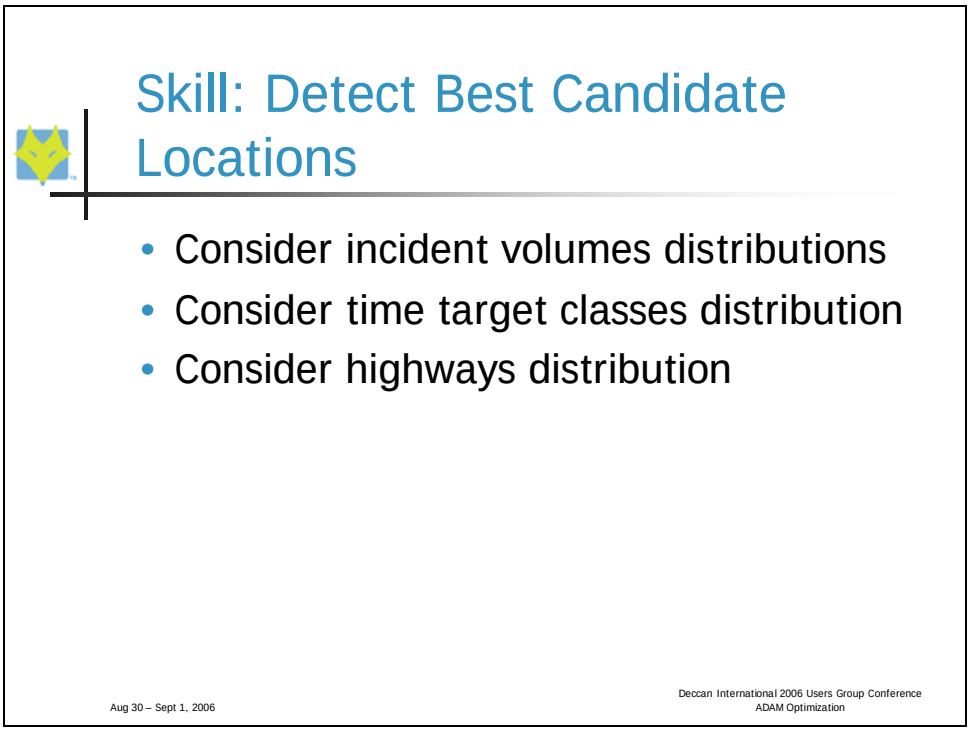
Highways:

As discussed earlier, we need to position the ladders with better access to the highways. The above map shows the highways in the service areas.



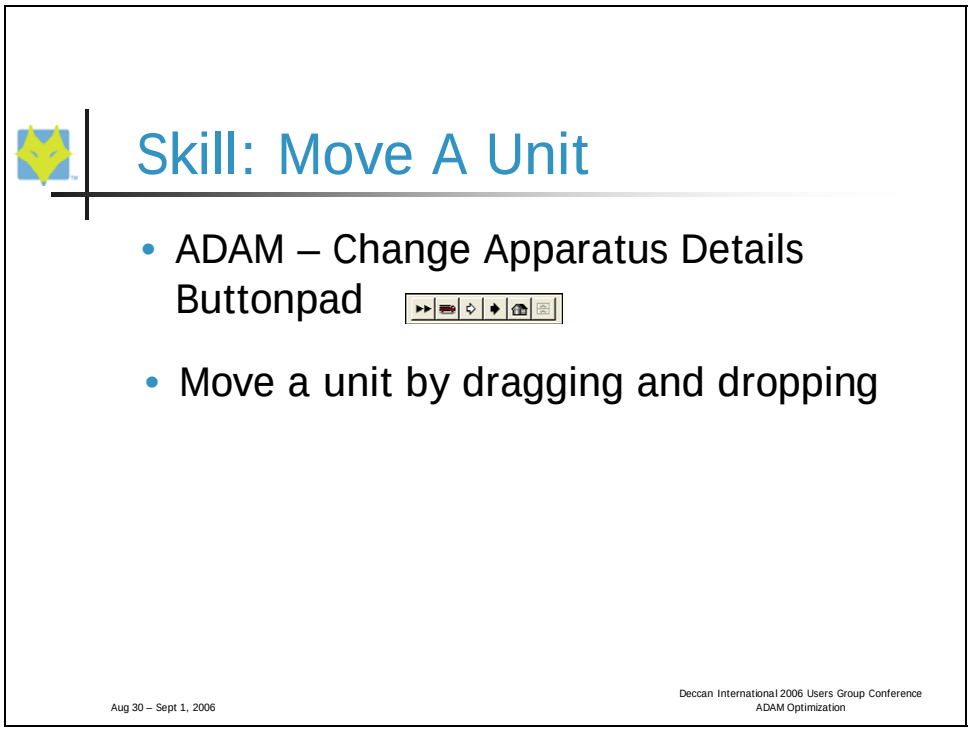
First Due Areas:

ADAM First Due by Capability buttonpad can be used to view the first due areas for the ladders. You can refer the legend window to view the color coding for each ladder's first due area. As discussed earlier, we need to review the first dues to evaluate whether they are too small or big for a particular ladder/truck. The overall response performance can be improved by balancing the size of the first due areas for the ladders/trucks.



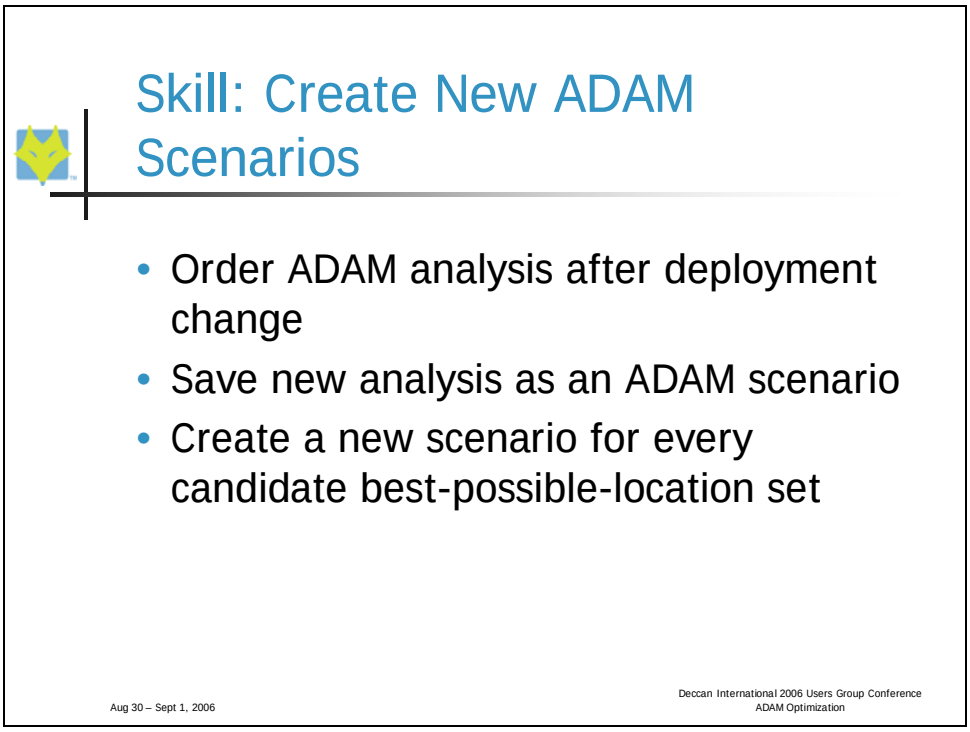
Detecting Best Ladder Locations:

You can review possible locations for ladders based on the above factors. You can look at each factor individually or in combinations. The former would be simple but would lead to many possible locations to review.



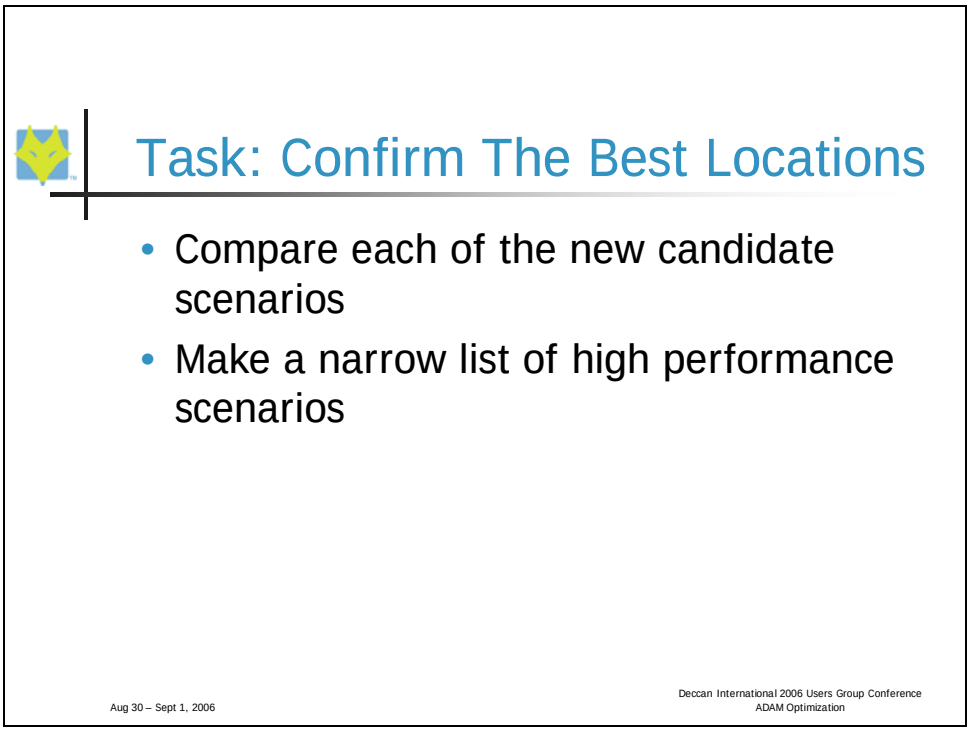
Moving A Unit:

In ADAM, a unit can be moved by clicking on the  button, and dragging the unit from current to final location on the map.



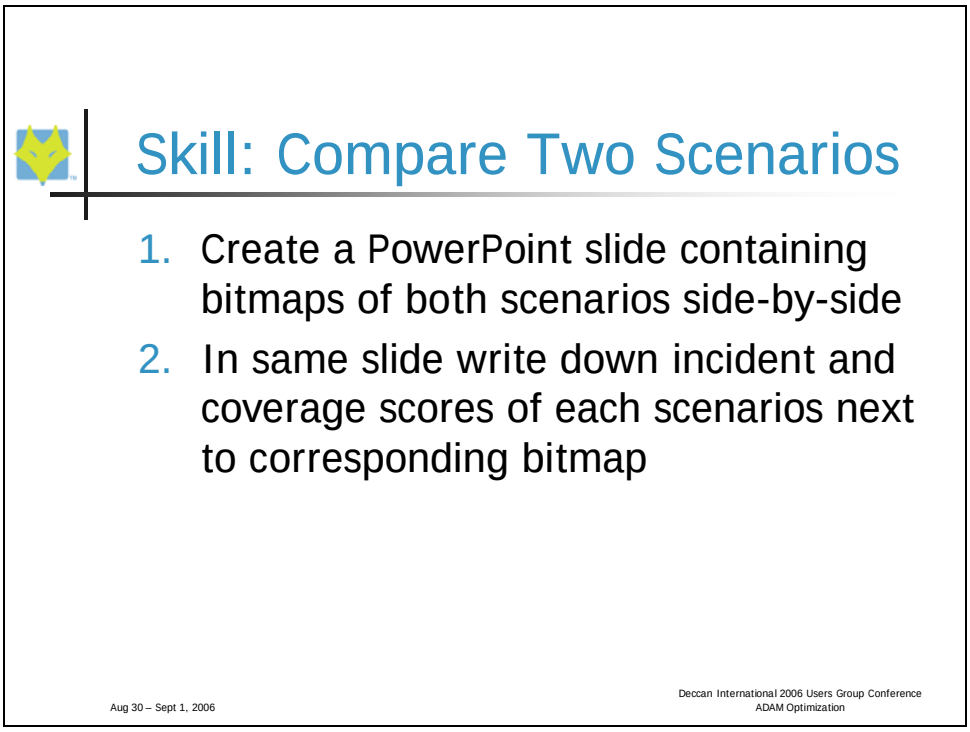
Creating ADAM Scenarios:

ADAM scenarios can be created by adding/moving/closing units, analyzing the performance for the new deployment and then saving the scenario.



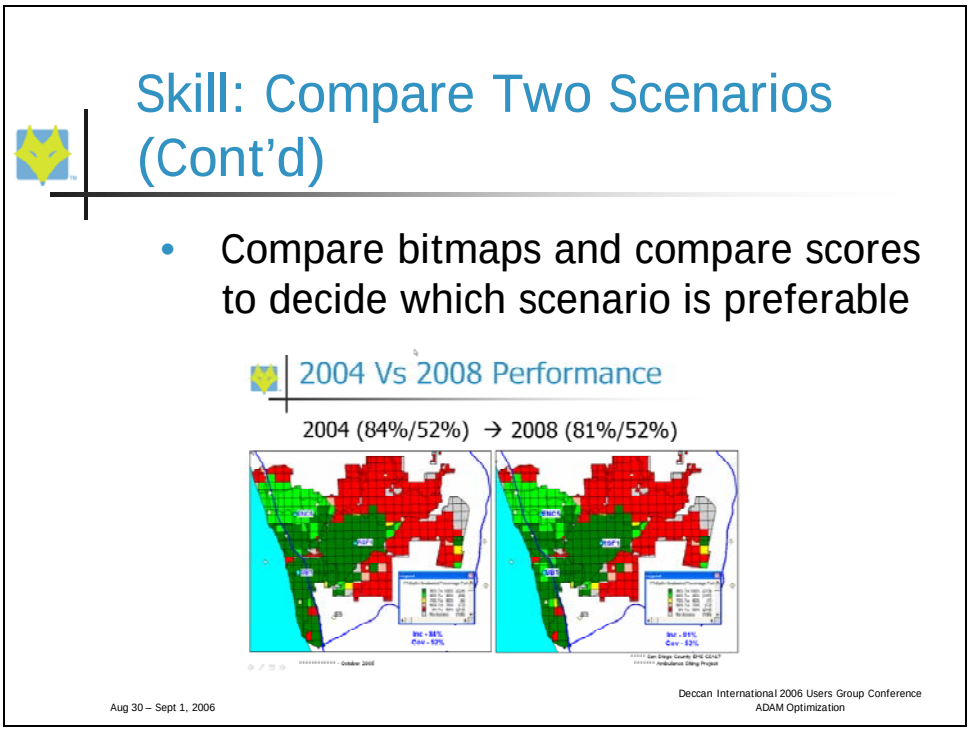
Confirming Optimal Locations:

Narrow down the list of scenarios and pre-select only those scenarios with distinctly better performance. Compare the performance for all these scenarios using the next skill.



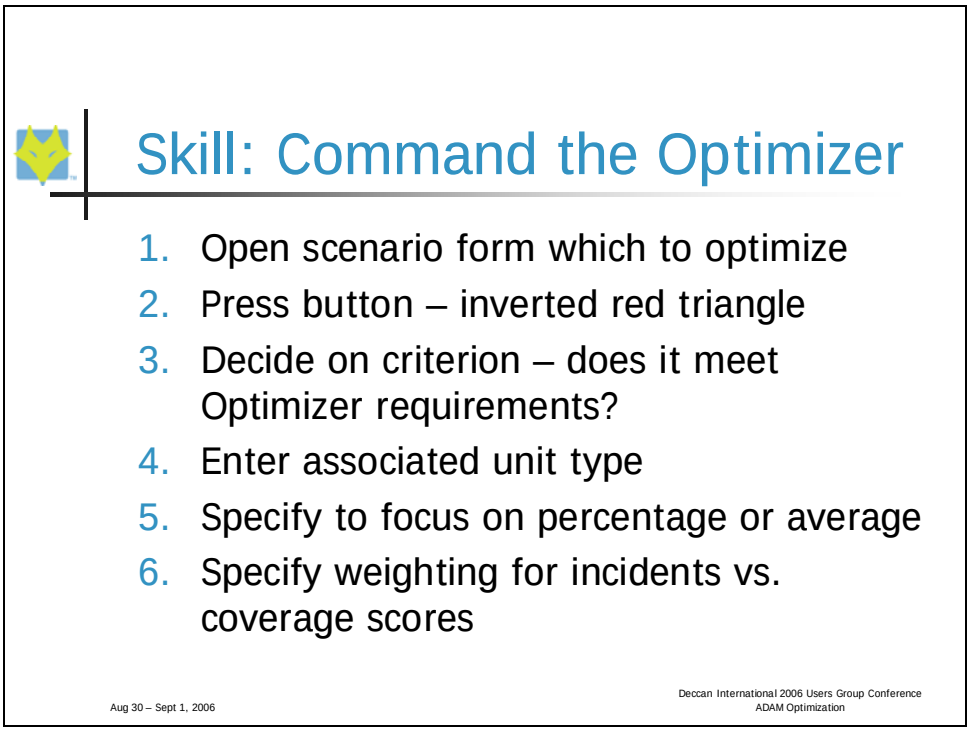
Comparing Scenarios:

You can compare the numeric scores for the two scenarios by entering the **Average** and the **Percentage** scores for any given response criterion. Comparing values from the two scenarios, an increase in the **Average** score implies a drop in performance and an increase in **Percentage** score implies an improvement in performance.



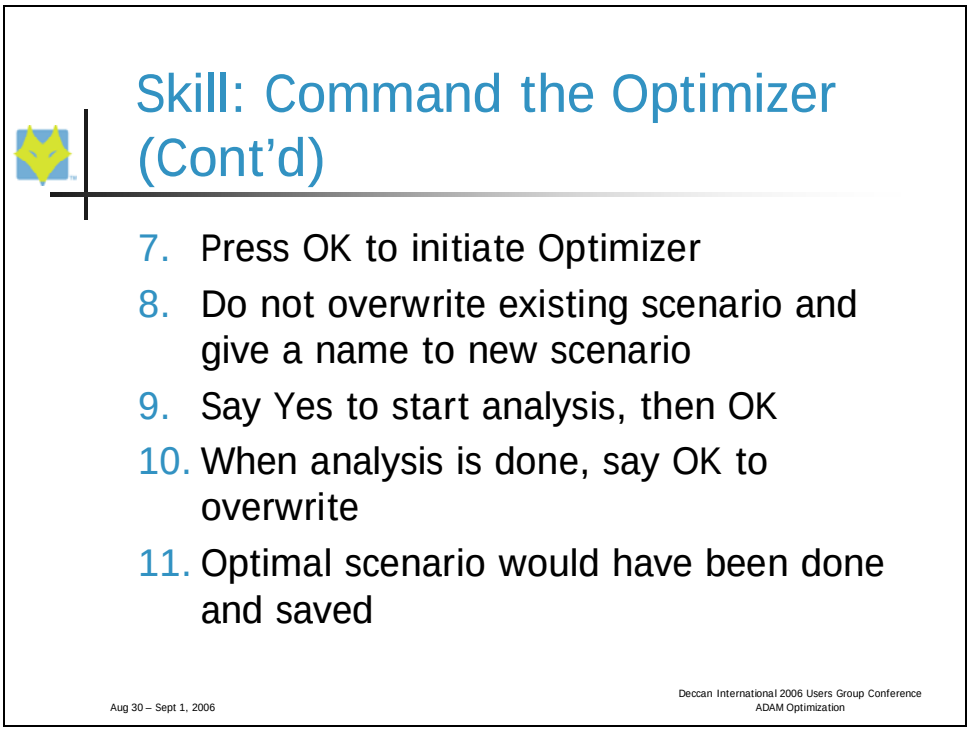
Compare Two Scenarios by Color Coding:

You can take screen shots of the maps from the two scenarios to be compared and place them side by side by pasting them into a "Word" or "WordPad" document. Color Coding can be compared on the two maps for the area of interest. "**Dark Green**" would imply very good performance and "**Dark Red**" would imply poor performance. A corresponding color change in a given area would imply whether the performance improved or worsened.



Command the Optimizer:

The user needs to decide the scenario from which the optimizer should work off of. The optimizer button is an inverted red triangle. A dialog will appear that will require the user to specify unit type associated with criterion, choose percentage or average, and assign weight for incident performance.



Command the Optimizer:

When the user presses ok on the dialog, the optimizer starts to work. It will request the user to give a new name for the optimal scenario that is going to be created. Once the user has saved the scenario he/she can view the optimal solution at their leisure.