

**QUICK RESPONSE BENEFIT / COST ANALYSIS TOOL  
(QRBCAT)**

***USER GUIDE***



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## 1. Introduction

The purpose of QRBCAT is to provide agencies with a simple, user-friendly, sketch-planning level tool that will enable them to quickly assess the benefits of having an incident management program in place.

The basic approach to evaluating the benefits is to compare existing conditions (with an enhanced incident management program) with a “base” or “no-build” scenario (without the enhanced incident management program). Estimates of user delay, emissions, fuel consumption and costs are generated for the two scenarios. The incremental difference between the two scenarios are used to calculate a benefit/cost ratio.

The tool provides default values and look-up tables for various input parameters. Users can, however, override the defaults with local, site-specific data wherever available.

## 2. Getting Started

### I. USES

QRBCAT may be used for incidents which block at least one lane of a multiple lane freeway for between one and four hours. Analysis of incidents beyond the threshold parameters may not provide accurate results. In addition, the quality of the results is directly related to the quality of the input. In most cases, it is best to use regional or incident specific data as opposed to the default values.

### II. DIRECTIONS

- Open Microsoft EXCEL.
- Open QRBCATS.XLT (Be sure to enable Macros).
- Begin on first sheet- **Threshold Module**.
- Click on first gray data box. Enter requested data.
- Complete all gray boxes.
- Click **NEXT** button to continue to next sheet.
- Continue until last sheet- **Cost Module**.

### III. DATA ENTRY

The data entry boxes have been color coded to indicate the action to be taken by the user. The specifications are summarized in the following table:

Color of Box	Purpose	Action
GRAY	Initial data entry	Enter data
PURPLE	References previously entered data	None
WHITE	Calculated values	None

### 3. Modules

#### I. **THRESHOLD MODULE-**

The *Threshold Module* assesses whether an incident can be analyzed using this tool. It will compare the severity and duration of an incident against pre-established thresholds. To be evaluated using this tool, the incident duration needs to be greater than one hour and less than four hours and the incident must block at least one lane of a multi-lane freeway. For incident duration smaller than one hour and blocking less than a lane, impacts may not be accurately quantifiable on a per-incident basis. For incidents longer than four hours, significant diversion becomes an issue and a network-based model is needed to accurately estimate the diversion. Since simplicity was a pre-requisite feature, it was decided that the tool would not be network-based. To evaluate incidents longer than four hours using this tool, the users will have to quantify the amount of diversion. The amount of diversion will depend on the availability of alternate routes, the type of information dissemination tools (such as HAR, VMS, ATIS, etc.) available and several other site-specific factors.

#### → ENTER DATA

Time incident occurred- Enter the time the incident occurred in the format: hh:mm AM or PM.

Time incident cleared- Enter the time the incident was cleared in the format: hh:mm AM or PM.

Duration of incident in hours- Enter duration of incident in hours. Incident must last between one and four hours. Value is calculated- it is not necessary to enter value again.

Number of lanes on freeway- Enter the number of lanes on the affected freeway. Freeway must have more than one lane in each direction.

Number of lanes blocked by incident- Enter the number of freeway lanes blocked by the incident. At least one full lane must be blocked.

#### → CLICK NEXT BUTTON

#### II. **INCIDENT DESCRIPTION MODULE**

The incident description module describes the duration and severity of incident.

## → ENTER DATA

Describe Incident- Enter written description of incident. Include location, number and type of vehicles involved, injuries, special circumstances, etc.

Type of Incident- Select type of incident. Choose either crash or non-crash (stalled vehicles, etc).

Number of lanes blocked by incident- Enter the number of freeway lanes blocked by the incident. Value is referenced from Threshold Module- it is not necessary to enter value again.

Duration of incident in hours- Enter duration of incident in hours. Incident must last between one and four hours. Value is referenced from Threshold Module- it is not necessary to enter value again.

## → CLICK NEXT BUTTON

### **III. INCIDENT MANAGEMENT PROGRAM DESCRIPTION MODULE**

This module describes the agency's incident management program. A list of incident detection, verification, response, and clearance strategies are provided that the agencies can choose from. Only incident management strategies that have documented benefits in the literature can be evaluated using this method. Agencies can include other incident management strategies as well. However, default values for potential benefits for other strategies will not be provided. Agencies must input values based on their experience.

## → ENTER DATA

Check boxes for each incident management strategy in place- Check one circle from the first four detection items. For the next five items, check as many boxes as apply. If other strategies are in place, you may choose to include them, but you will be asked to estimate time savings due to those strategies. To include an additional strategy, check the box and enter the name of the strategy to the right. Descriptions of each strategy are given below:

None- No means of incident detection.

Loop Detectors only- Detectors or sensors which identify changes in speeds.

Closed-Circuit TV only- Closed-circuit TV monitoring corridor in which incident took place.

Loop Detectors and Closed-Circuit TV- Both strategies are in place.

Supplemental Wrecker Service- Wrecker service physically present within corridor.

Alternative Accident Investigation Site- Accident investigation may be performed at an alternate site.

Emergency Access Points- Open access points available for emergency vehicle turn-around.

Lane Control- Flexible lane control strategies available.

Other- Any other strategy in place for which the user may calculate time savings based on previous incidents. Enter name of strategy in box to right.

→ **CLICK NEXT BUTTON**

#### **IV. BASE CONDITION MODULE**

This module estimates incident duration under the “base” or “no-build” condition. It estimates the likely duration of the incident if the incident management program were not in place. A default matrix indicating the impacts of several incident management strategies on incident detection, verification, response and clearance is provided. Agencies may use these “defaults” or use data based on their own experience. The values in the table were provided in the ITS Planning Handbook (FHWA, 1998).

The values in the table correspond to the amount of time it takes to detect, verify, respond, and clear an incident from the roadway. The average total time to complete these tasks is approximately 44 minutes in the case of a crash and 41 minutes for non-crashes. It is assumed that for each strategy, the amount of time to complete one or more of these tasks will be reduced due to the implementation of the strategy. For example, if loop detectors are in place, detection should take four minutes instead of eight. The number of minutes required to perform each task may be adjusted by the user based on region-specific data. Changes will be reflected in the **Time Savings** column to the right. Only strategies which were previously checked will be included in the time savings calculation and time savings will be calculated for the type of incident checked in the Description Module. A summary of the calculated savings is located in the bottom right corner of the sheet.

- Verify that correct strategies have been checked.
- If available, enter updated times for detection, verification, response, and clearance.
- Verify results.

→ **CLICK NEXT BUTTON**

#### **V. DIVERSION MODULE**

The diversion module accounts for the reduction in traffic volumes to due the diversion of vehicles to alternate routes. The incident must meet two criteria in order to account for diversion- 1) The incident must cause delays greater than 20 minutes over the normal travel time and 2) There must exist a viable, parallel, alternate route, readily available to vehicles affected by the incident.

## → ENTER DATA

Criteria- Answer both criteria questions.

Can diversion be used- Will be answered based on response to criteria questions. If yes, continue; if no, click NEXT button.

Include Diversion- The user may choose whether or not to account for diversion.

Diversion Percentage- If user chooses to account for diversion, he must choose the percentage to be diverted from the affected route. Default is 10%.

## → CLICK NEXT BUTTON

### **VI. DELAY MODULE- EXISTING**

The delay module calculates delay for a given severity and duration of incident. The delay module uses the traffic volume, number of lanes (or capacity), and number of lanes blocked (or capacity reduced) as inputs and estimates vehicle hours of delay for a specific incident duration. Delay is calculated by comparing demand and capacity for roadway segments. Whenever, demand exceeds capacity, the excess vehicles are stored in queues to be processed during subsequent hours. This module will use the public domain spreadsheet-based model QUEUES.

## → ENTER DATA

Capacity flow rate- Enter vehicle capacity per hour for entire facility in one direction. For example, if the freeway is three lanes in each direction and the hourly capacity per lane is 2000 vehicles/hour, the facility capacity is 6000 vehicles per hour.

Initial demand flow rate- Enter the typical hourly volume at the time of the incident. The volume should be available to the user through detection or historical data.

Initial bottleneck flow rate- Enter facility capacity after incident. This number represents the reduced capacity of the facility. The value may be calculated or gathered from real-time detection data.

- All other values are calculated.
- Results are located at the bottom right of the page.

## → CLICK NEXT BUTTON

## **VII. DELAY MODULE- BASE (NO BUILD)**

The base delay module requires no additional input. This module calculates the same values as the existing delay module and the results are located in the bottom right corner of the page.

→ **CLICK NEXT BUTTON**

## **VIII. COST MODULE**

This module calculates the cost associated with incident-related delays by applying a value of time factor and the capital and operating and maintenance (O&M) costs of the incident management program. The capital and O&M costs will be reduced to a daily level for benefit-cost calculation. The benefit is the difference in the user cost between the “base” and existing scenarios.

→ **ENTER DATA**

Capital cost of incident management program- Enter the total cost of the incident management program impacting the location of the incident. For each major purchase use the eight drop down lists to choose the type of purchase and enter the cost, life cycle, and year purchase was made. Use the eight rows for purchases made during distinct years or for items with varying life cycles. For example, assume during the opening year, the building/facility and several communication and detection devices were purchased. However, the build has a different life cycle than the devices, and should be entered on a separate line. Additionally, further equipment purchases have been made during subsequent years, requiring a new line of entry. The program calculates the annualized cost based on the sum of previous acquisitions.

Annual operating and maintenance cost- Enter the annual cost of operating and maintaining the incident management program.

Average value of time (\$/hr)-

Private motorist- Choose the average value of time for a private motorist within your region. If precise data is available, choose **Enter Value** and place value in gray cell to the right of the drop down list.

Commercial vehicle- Choose the average value of time for a commercial vehicle within your region. If precise data is available, choose **Enter Value** and place value in gray cell to the right of the drop down list.

% Commercial vehicles- Choose the percentage of commercial vehicles at the time and location of incident.

## **4. Results**

The results are located at the bottom of the cost module page. The results include monetary benefits, benefit/cost ratio, queue length reduction, and delay savings.