# USER MANUAL

Version 1.0

# CPED

## Crash Prediction for Expedited Detection

UCF Smart & Safe Transportation Team (UCF SST)

http://ucfsstcped.com/

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This system is called the **Crash Prediction for Expedited Detection (CPED)** application. In total, the application consists of four parts: 1) CPED page, 2) CCTV page, 3) report page, and 4) third-party page. The following sections discuss each part accordingly.

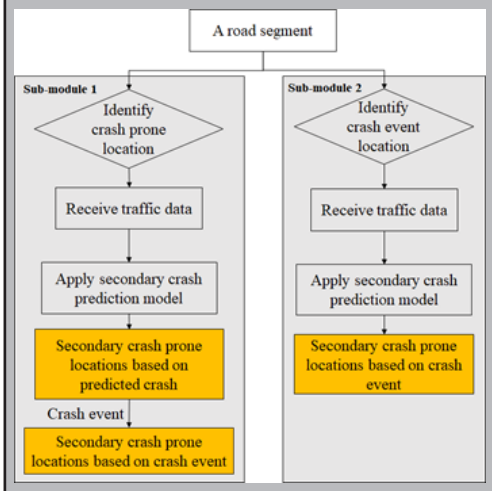
The following are the two most important modules for the CPED application:

- Secondary crash prediction: This module works by taking real-time traffic data (e.g., speed, volume, occupancy) and event data as inputs and generating the secondary crash potential. The secondary crash prone locations are visualized in the interactive map on the CPED page. To limit the number of icons on the web page, only the start- and the end-segment are displayed. The segments between these two segments are predicted to be prone to secondary crashes. The same logic is applied to the secondary crash prediction based on crash events.
- CCTV verification: The objective of the CCTV verification module is to facilitate real-time monitoring of crash-prone locations on the freeways, including secondary crashes. The process promptly identifies the set of relevant cameras based on the real-time prediction algorithms.

## Default page view:


**CPED page screenshots that indicate crash prone locations**

**The differences between "based on crash events" and "based on predicted event" for secondary crash prediction**




The left figure illustrates the secondary crash prediction module workflow. The workflow consists of two sub-modules, and they are running in parallel and need different triggers for application.

The main purpose of sub-module 1 is to generate early warnings by using the results from the predicted crashes. If a potential crash is predicted by the real-time crash prediction algorithms at a segment, traffic turbulence could happen at its upstream segments and cause crashes. The secondary crash prediction algorithm could provide warning information prior to the happen of crashes. Sub-module 2 has a similar workflow as sub-module 1. The purpose of using sub-module 2 is to avoid the false-negative results (i.e., a crash is not predicted) from the crash prediction algorithm.

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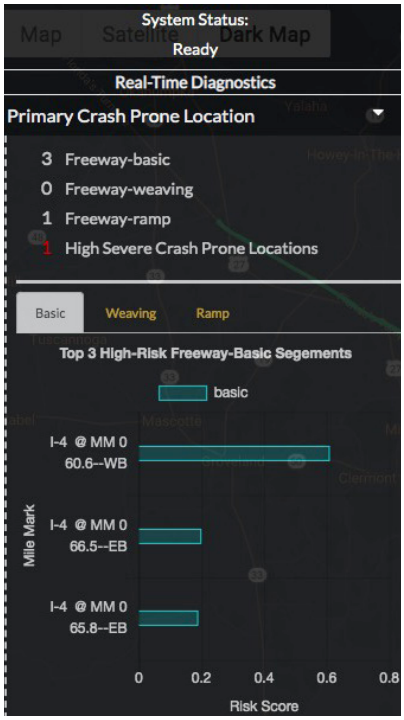
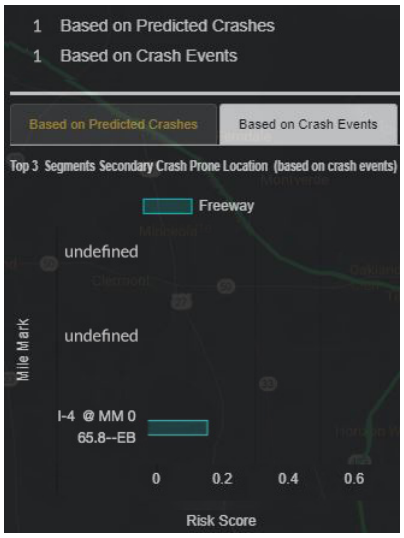
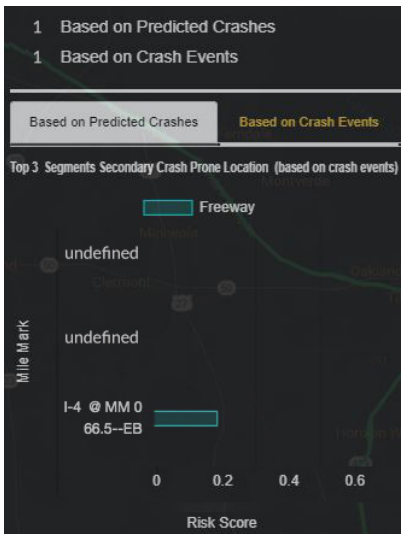
## Real-Time Diagnostics

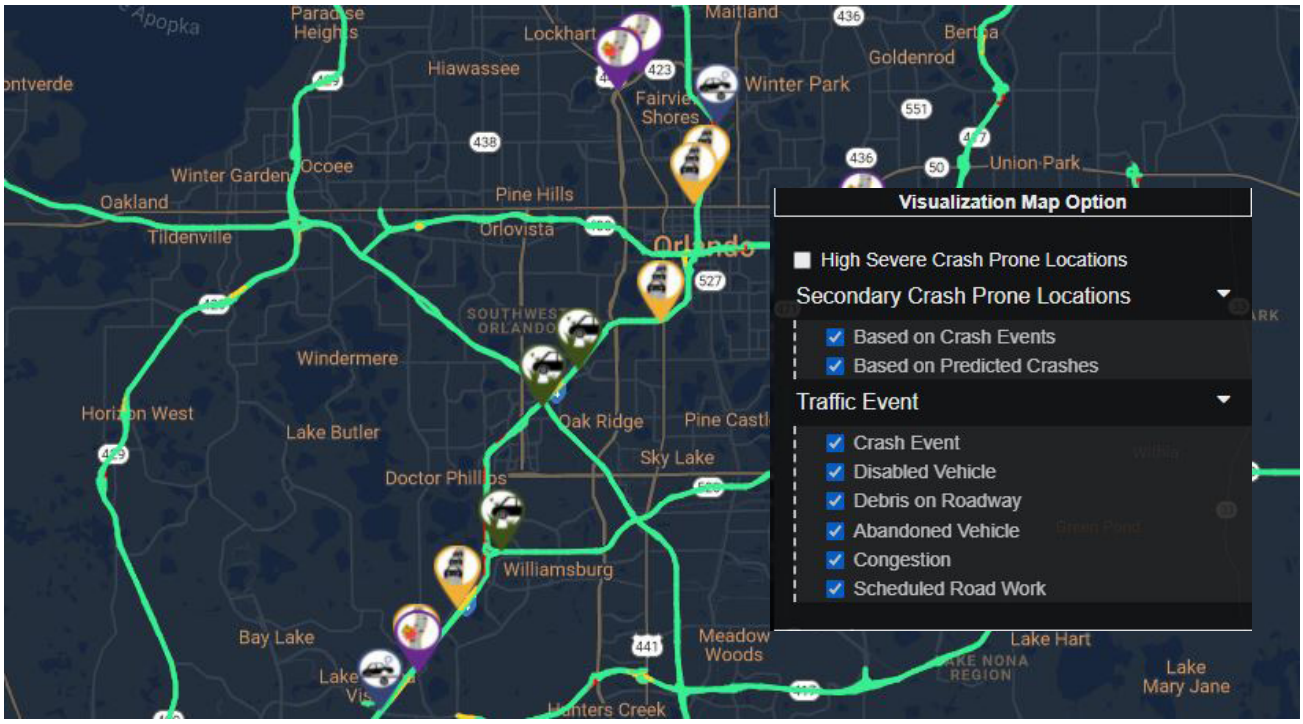
Locations with top crash/secondary crash potentials for each facility type (i.e., basic, weaving, ramp) are displayed with bar charts. If a user clicks one of the locations from the bar charts, the map will be zoomed to the selected location for the user to examine.




## Visualize secondary crash prone locations & traffic event locations

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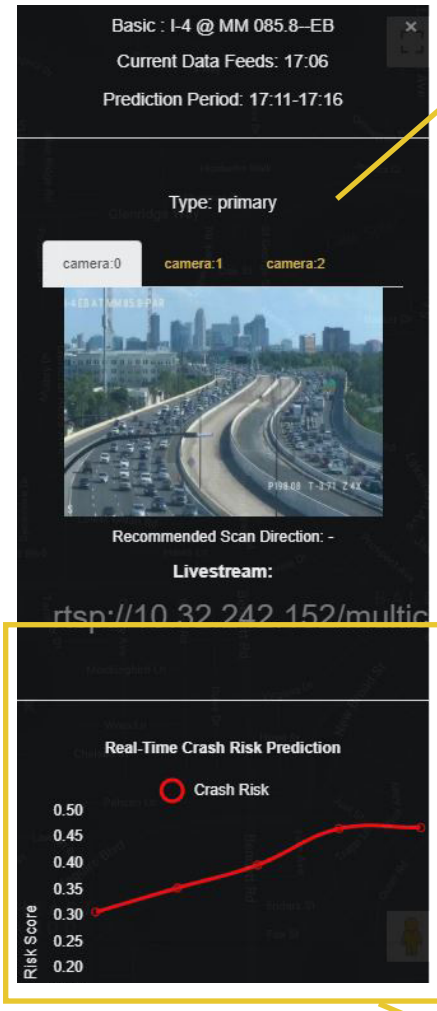
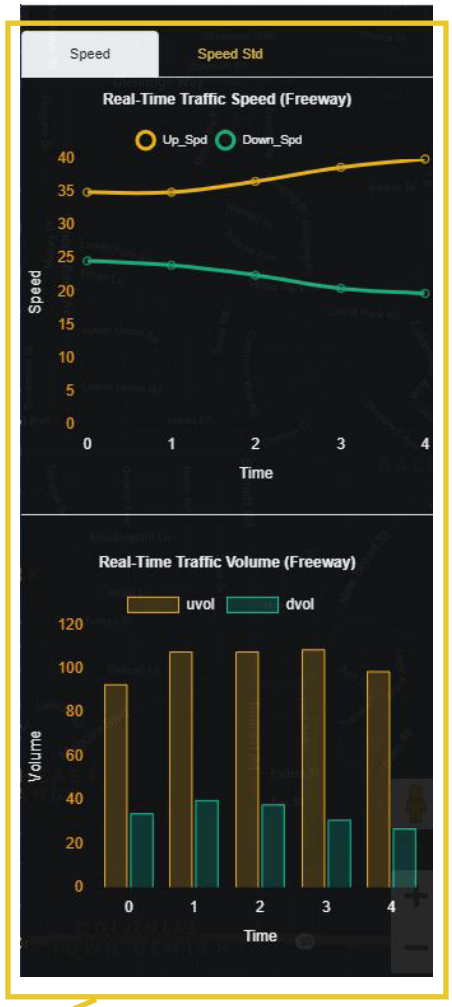
Open when there is a road segment selected.



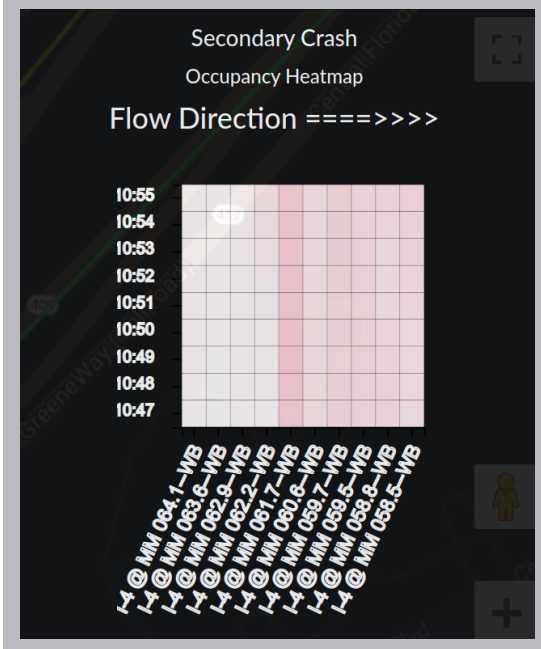

**Nearby CCTV information for the selected roadway segment (the CCTV snapshots are updated every 60 seconds)**

For every segment in the identified and recommended nearby CCTV cameras are ordered by proximity, and snapshots/livestreams from each CCTV stream are presented accordingly. The CCTV snapshots are updated every 60 seconds. The recommended scanning direction and the link to the livestream is listed under each video snapshot stream. Upon clicking on the livestream link, an XML Sharable Playlist Format (XSPF) file is downloaded. The XSPF file opens the video stream and is compatible with the VLC media player software.




**Traffic & safety profile of the selected road segment (I-4 @MM 085.8 -EB)**

The figure below is a speed heatmap (only for secondary crash prone location).



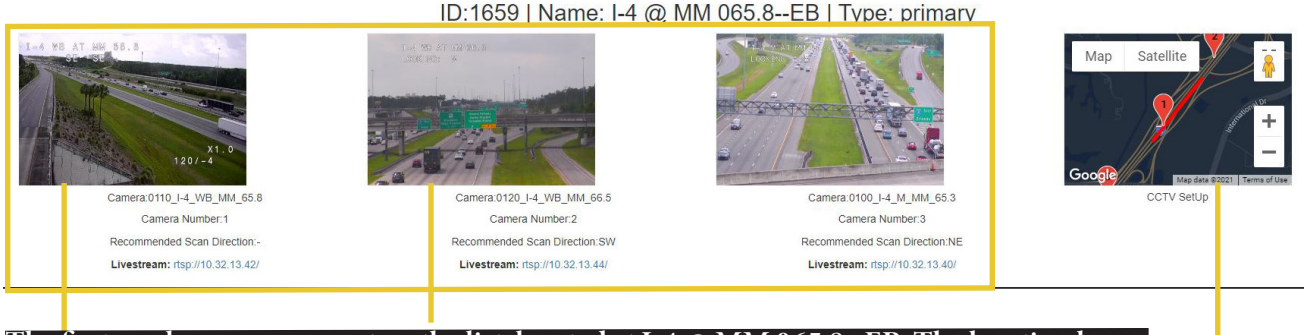

A crash is considered as a secondary crash if it occurred within the spatio-temporal impact range of a prior crash (i.e., primary crash). A heatmap is used to show the occupancy of the secondary crash-prone segment and its downstream segments for the past 10 minutes. The dark colors indicate higher occupancy than light colors.

## CCTV page overview:

The CCTV module front-end page contains two tabs: A "Crash-Prone Segments" tab and a "Secondary Crash-Prone Segments" tab. The tabs contain a list of high crash-prone segments and secondary crash prone segments based on the respective prediction algorithms. For each recommended camera, a snapshot of the livestream stream is presented. The livestream path for each recommended CCTV is also displayed.

Secondary crash-prone parts are divided into two categories: segments that are prone to secondary crashes due to 1) a downstream location with a crash event 2) a downstream crash-prone location. The system highlights the first category in red to alert the operators.

### Crash-Prone Segments




The first crash-prone segment on the list, located at I-4 @ MM 065.8--EB. The location has three nearby cameras with recommended scan direction and livestream link.

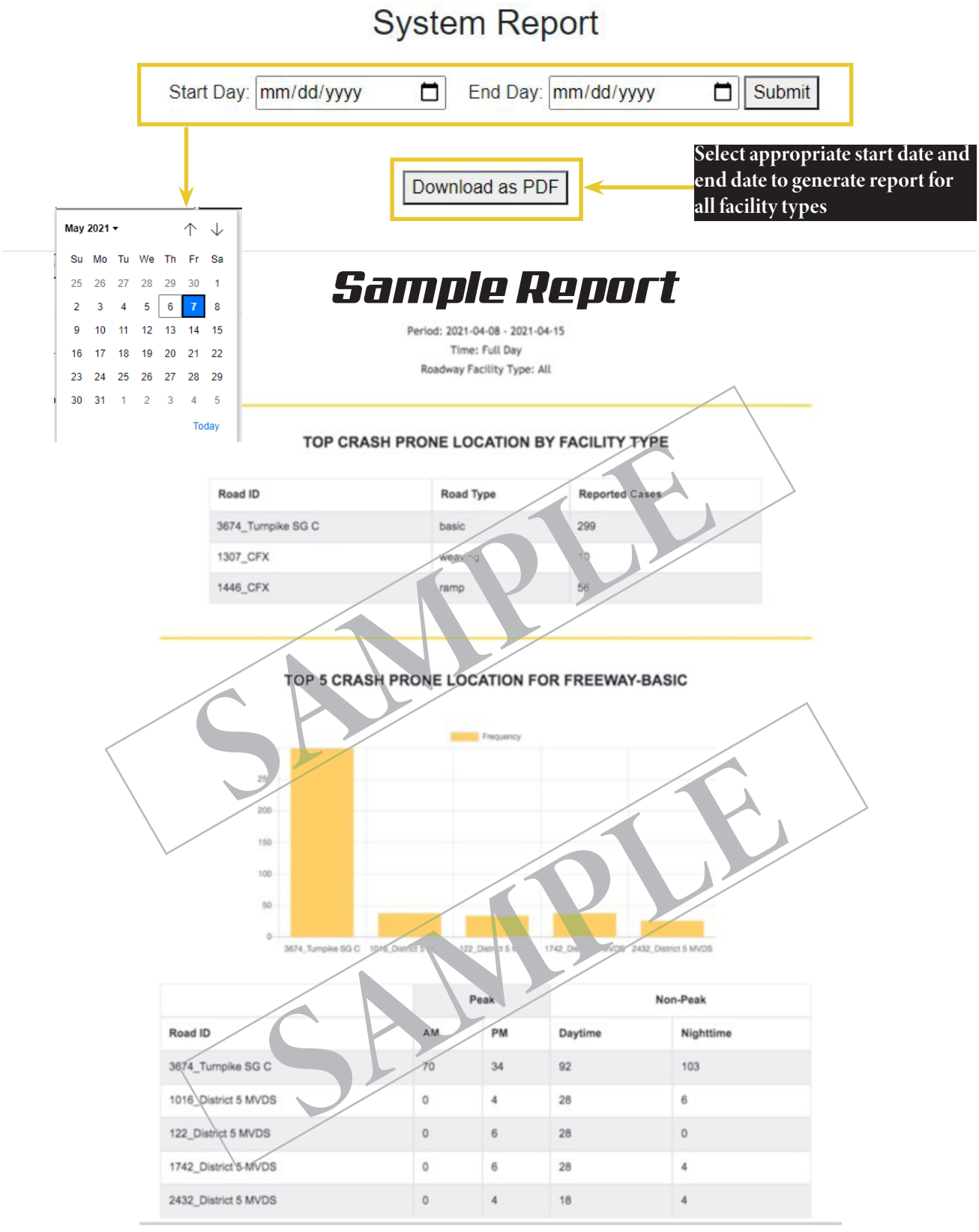
### Secondary-Crash-Prone Segments


The map on the right-hand side illustrates the position of each camera with respect to the segment.

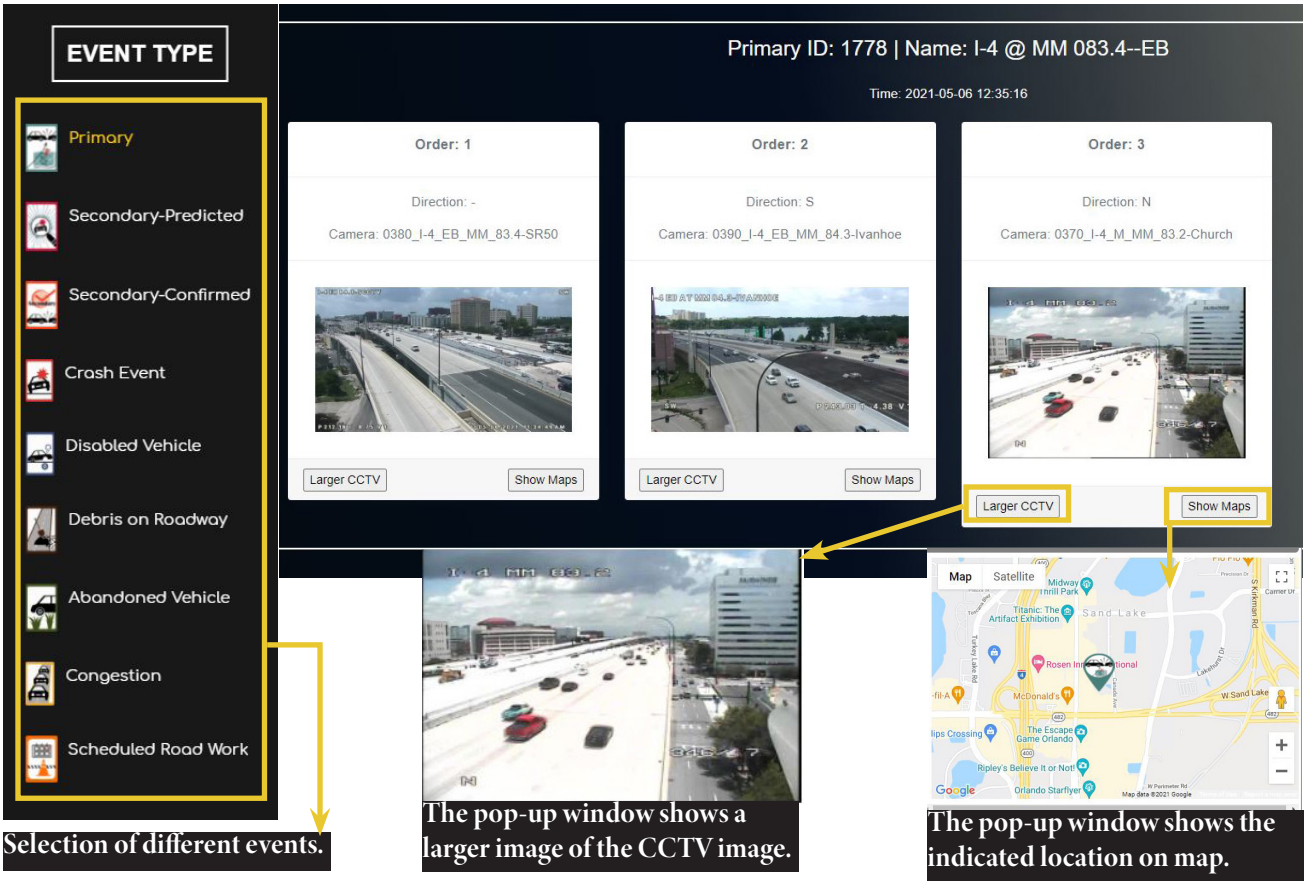
The secondary crash-prone segment on the list, located I-4 @ MM 081.5--EB. The location only has one nearby camera with recommended scan direction and livestream link.

# Report Page

Users can view/download system reports for the selected range from the report page. Top crash-prone locations for each facility type are listed in the report.



Authorized third-party users can access the page, which displays real-time information related to (secondary) crash prone locations and traffic events (e.g., crashes, disabled vehicles).




Selection of different events.

The pop-up window shows a larger image of the CCTV image.

The pop-up window shows the indicated location on map.

# Contact Information

For all inquiries, please contact Smart and Safe Transportation (SST) Team Director Dr. Mohamed Abdel-Aty, P.E., F.ASCE, F.ITE (E-mail: M.Aty@ucfedu).


Your Name

Your Email

Subject

Message

SEND MESSAGE