In this study, it was assumed that the number of traffic emergency events occurring on each segment of the network follows a Poisson distribution. Once the $N_e$ event arises at segment $i$, the probability that additional events may occur at the same segment can be calculated as follows:

$$P(N_{t+1} = n|N_t = n-1) = \frac{\lambda_i}{(n-1)!} e^{-\lambda_i}$$

for $n \geq 1$.

The proposed system consists of three main models, working collectively for estimating the probabilities of event occurrences, projecting the incident clearance time, and optimizing the location and coverage of available response units.

The system is designed to assist responsible agencies in assessing the need to relocate available incident response units in real-time operations, based on the available resources and detected traffic information.

The empirical evaluation results showed that the dynamic real-time dispatch strategy can outperform the static dispatch and state-of-the-practice patrolling strategies with respect to minimizing the network-wide delay induced by events and waiting times of vehicles involved in the events for response.

The proposed system framework consists of three main components: (i) a real-time traffic event detection module; (ii) a potential future incidents or assists request prediction module; and (iii) a location and coverage optimization module.

### Models Embedded in the System

- **Traffic Event Detection Model**: This model uses a method of Random Forests, an ensemble of unpruned classification trees, for two traffic emergency event detectors – one for incidents and the other for assists requests.
- **Potential Future Incidents or Requests for Assistance Model**: This model calculates the potential future incidents or assists requests based on the number of available response units and emergency occurrence rates at state $k$.
- **Location Allocation Model**: This model uses a method of randomized regression trees to predict the clearance time and is compared with the existing (CHART) system performance.

### Conclusion

This study has proposed a real-time dynamic dispatch strategy, based on the relocating decision support system, consisting of three technical components for consecutively estimating the probabilities for traffic emergency events, predicting the incident clearance time, and dispatching available response units – to optimally relocate the detected/reported traffic emergency events.

Since the proposed system is designed mainly for the traffic incident management teams to respond to traffic emergency events, the system aims to improve the network-wide traffic conditions with a shorter average response time according to two conflicting objectives.

The empirical study using CHART II Database has also shown that the resulting external delays with the proposed dynamic dispatch strategy are smaller than those with the static dispatch and the CHART’s patrolling strategies.

Also, the proposed strategy outperforms the static dispatch strategy and CHART’s current practice with respect to reducing the internal delays, i.e., the duration for those vehicles involved in accidents.

Furthermore, the real-time, dynamic dispatch strategy demonstrates more efficient utilization of available resources than with the static dispatch strategy, especially when many traffic emergency events may occur in a relatively short time period.