DRISI
Caltrans Division of Research, Innovation and System Information

Research Results

Experimental Studies for Traffic Incident Management

Driver Responses to Changeable Message Signs (CMS) after a Traffic Incident

Transportation Safety and Mobility

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Project Title:
Experimental Studies for Traffic Incident Management

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WHAT IS THE NEED?

Traffic incidents and other unexpected disruptions on roadways lead to extensive delays that diminish the quality of life for those that live and/or work in major cities nationwide. The effective management of these incidents is hindered by an incomplete understanding about how drivers respond to information provided by network operators.

WHAT WAS OUR GOAL?

Use modern experimental methods to identify messaging and pricing schemes best suited towards mitigating delays from unexpected disruptions.

WHAT DID WE DO?

In summary, an average of 39 subjects each controlled a simulated vehicle through a simple road network: one freeway, one alternate route with two traffic lights. All subjects traveled simultaneously (share the road) and in the same direction to their destination. Each participants started with $14.00 endowment that decreases at $0.15 per second until they reached their destination. Each subject began on the freeway, and were given one opportunity each round to switch to the alternate route. The simulation has a Changeable Message Sign (CMS) within 8 seconds before alternate route off-ramp is reached. The CMS varied based on the each scenario being tested. (See image section below for diagram of CMS content.)

The sessions presented the subjects with information that used publicly or privately visible vehicle identifiers to target the diversion recommendation at specific individuals. Another session presented standard Caltrans CMS information, and one of the sessions presented a dynamically updated desired diversion rate. Detailed statistical analyses of all treatments were completed, including the estimation of models describing the learning processes and behavioral changes of subjects in response to CMS content and the outcomes of previous route choices.

WHAT WAS THE OUTCOME?

The resulted outcome was following:

- Providing only qualitative incident information resulted in unpredictable early results. Subjects rapidly learned equilibria, however; predictability and performance in later rounds was quite good.
- Providing information even when there is no incident significantly reduces over-diversion in such scenarios.
- Providing subjects with an unchanging desired diversion rate resulted in worse outcomes than providing qualitative incident descriptions. This approach is not recommended.
- Providing subjects with dynamic desired diversion rates (that changed in response to subject behavior) was able to improve initial diversion rate predictability. This is a promising treatment, but was not implemented optimally in the experiments. A repeated session would be valuable.
- Treatments that provided numeric ID-based VMS diversion recommendations significantly reduced mis-diversion and improved predictability in early rounds. There were minimal benefits in later rounds, however. Usually, compliance with ID-based recommendations is not high enough to yield overall benefits. Factors that increase compliance are
  - o Including qualitative incident descriptions
  - o Identifying subjects using private (rather than public) information
  - o Instructing subjects not told to divert to use the main route, so that all drivers receive instructions
  - o Providing instructions on rounds with no incident
- Pricing treatments were not successful overall due to subject confusion with tolls vs. subsidies. Our treatments only priced the main route, so both tolls and subsidies were used depending on whether more or less diversions were desired. Prices were successful in isolated cases, and dynamic prices were more effective than static prices.
- Demographics and risk preferences did not have significant effects on subject behavior.
- Giving people different values of time had no appreciable impact on results.

WHAT IS THE BENEFIT?

Traffic managers will be able to modify message signs, road pricing, and other communications to improve system response to traffic incidents and other unexpected delays.

IMAGES