Imagine a tsunami is coming toward southern California. How do you efficiently evacuate a large city in time? The evacuation system needs to:
- balance traffic on the road network
- scale to large geographical areas
- generate routes in reasonable time

How it’s been done before? There are descriptive and prescriptive methods. CASPER is a prescriptive method.

- LP-based solutions
  [Stepanov & Smith, 2009]
- DR, max-flow / min-cut
  [Hoppe & Tardos, 1994]
- Heuristic, CCRP

First we read the road network, evacuee points and safe zones. Then we index all vertices starting from the super-sink (vertex connected to all safe zones). The generated Dijkstra tree will be used as the evacuation heuristic. We call this step CARMA: capacity-aware reverse map analyzer.

The system runs an A*-like routing algorithm on every evacuee starting with the one farthest away. After each generated route, the traffic congestions are updated according to the traffic model. The CARMA tree gets a lazy update.

The map shows Santa Monica city in California. Each route is colored based on its evacuation cost in minutes. Our experiments showed that CASPER consistently generates shorter evacuation routes independent of which traffic model is selected.

- S1: 17,500 cars
  132 evacuee points
- S2: 51,000 cars
  353 evacuee points
- S3: 130,000 cars
  859 evacuee points