CPS: Synergy: Collaborative: TTP Option: Dynamic Methods of Traffic Control that Impact Quality of Life in Smart Cities

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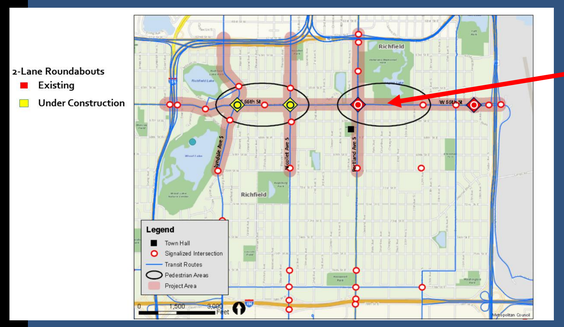
Key Problem

Traffic control management strategies have been largely focused on improving vehicular traffic flows on highways and freeways but arterials have not been used properly and pedestrians are mostly ignored. New urban arterial designs encourage modal shifts which gives further impetus to devise novel traffic sensing and control strategies to more quickly respond to changing conditions and salient events, while balancing safety and efficiency for all users. Unlike freeways, urban street and arterial traffic is affected by individual route choices, traffic signals, and interactions between other modes and pedestrians; Traditional fixed position sensors alone, such as in-pavement loop detectors, cannot characterize such traffic behaviors.

Scientific Impacts

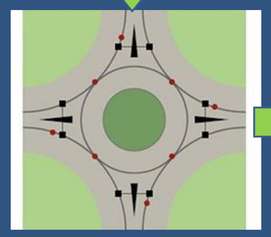
- Design and evaluate system architecture that integrates traffic actuation and non-intrusive sensing networks for high traffic urban roundabouts.
- Develop traffic simulation and modeling of large-scale urban networks for evaluating traffic sensing and control strategies.
- Provide new rich datasets quantifying urban arterial traffic behavior that can be used by traffic, scientists, and students to improve their understanding of such events.

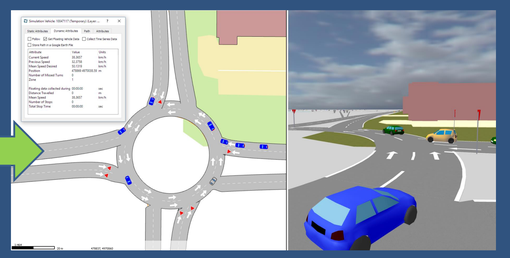


Unique urban arterial corridor is replacing several Signalized intersections with Roundabouts (City of Richfield ,population=36,125 within 7 square miles, 74 signalized intersections.

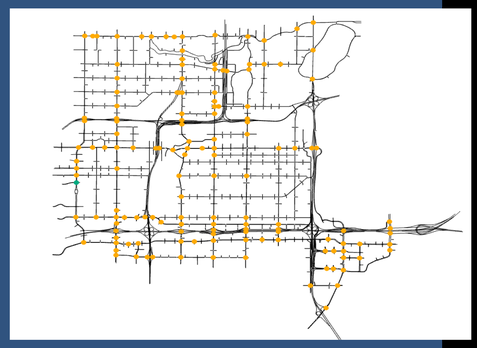
Roadside sensor system designed and deployed at first arterial roundabout built within network

- Extract real-time vehicle trajectories at Roundabouts to:
  - Quantify time variant origin-destination turnings through the roundabout
  - Quantify the gap acceptance behaviors of entering vehicles to calibrate traffic simulation network model
  - Identify salient pedestrian crossing events
  - Utilize O/D turnings, vehicle and pedestrian movements to modify signal timings at adjacent intersections





- 143 Signalized Intersections
- 21 square miles
- 124 O/D centroids (33 internal + 91 external)
- 483 Lane miles



Broader Impacts

- Improve travel times for urban commuters and other road users: enhance ‘complete street’ design goals
- Improve traffic safety for all users. Adaptation of Commercial Off-The-Shelf (COTS) components for traffic sensing and measurements
- Data and traffic simulation model framework utilized in graduate and introductory traffic engineering undergraduate transportation courses; augment hands-on programming and technology for youth day camps for local under-represented middle school kids.
- Average crossing delay estimate for ‘safe’ pedestrian crossing opportunities are 6.5 to 12.6 seconds, and increases by 12% with 2030 metropolitan forecasts, (worse during congestion), without regulating flow into intersections (Scrhoeder & Rouphail, 2010, SRF, 2014).

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