High-Capacity Roundabout Intersection Analysis: Going Around in Circles

David Stanek, PE & Ronald T. Milam, AICP

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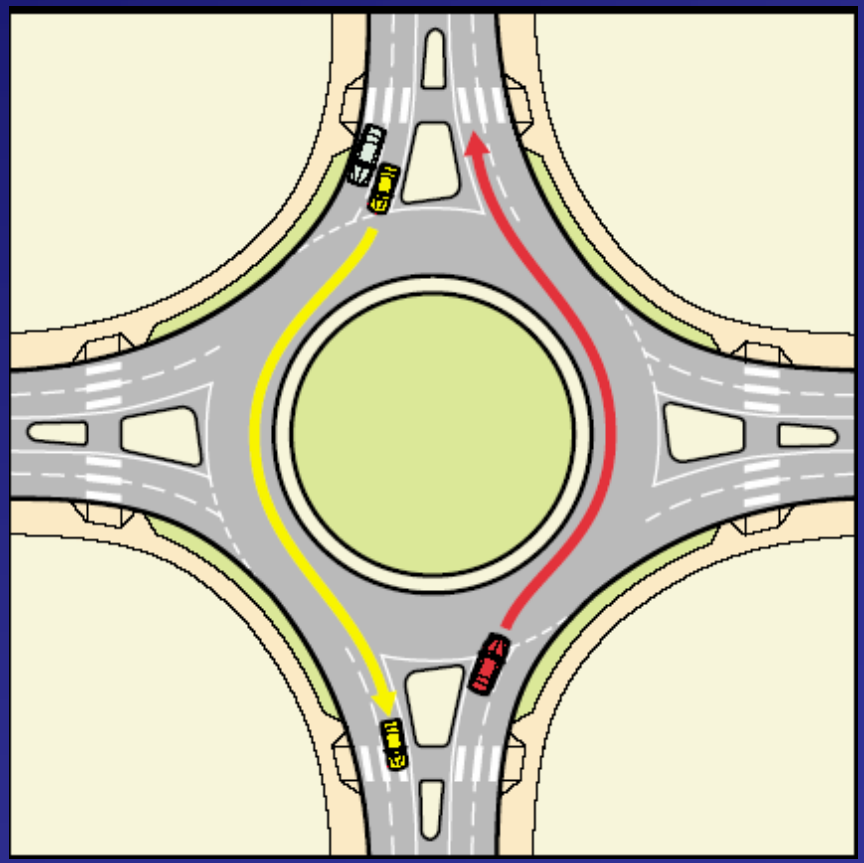
Fehr & Peers
Transportation Consultants

Presentation Overview

- What is a high-capacity roundabout?
- What methods are used to analyze traffic operations?
- How are these methods applied to real-world problems?
- What are the differences in analysis results between methods?
- Which method should be used for a given set of conditions?

High-Capacity Roundabout

- **Modern roundabout with yield entry**
- **Approaches with 2 or more lanes**
- **An alternative to traffic signals for high-volume locations**



Roundabout Analysis Methods

- **Highway Capacity Manual (TRB, 2000)**
  - **Only one-lane roundabouts**
  - **LOS thresholds are undefined**
- **Roundabouts: An Informational Guide (FHWA, 2000)**
  - **Equations for two-lane roundabouts**
  - **Design to v/c of 0.85**
  - **List of analysis software**

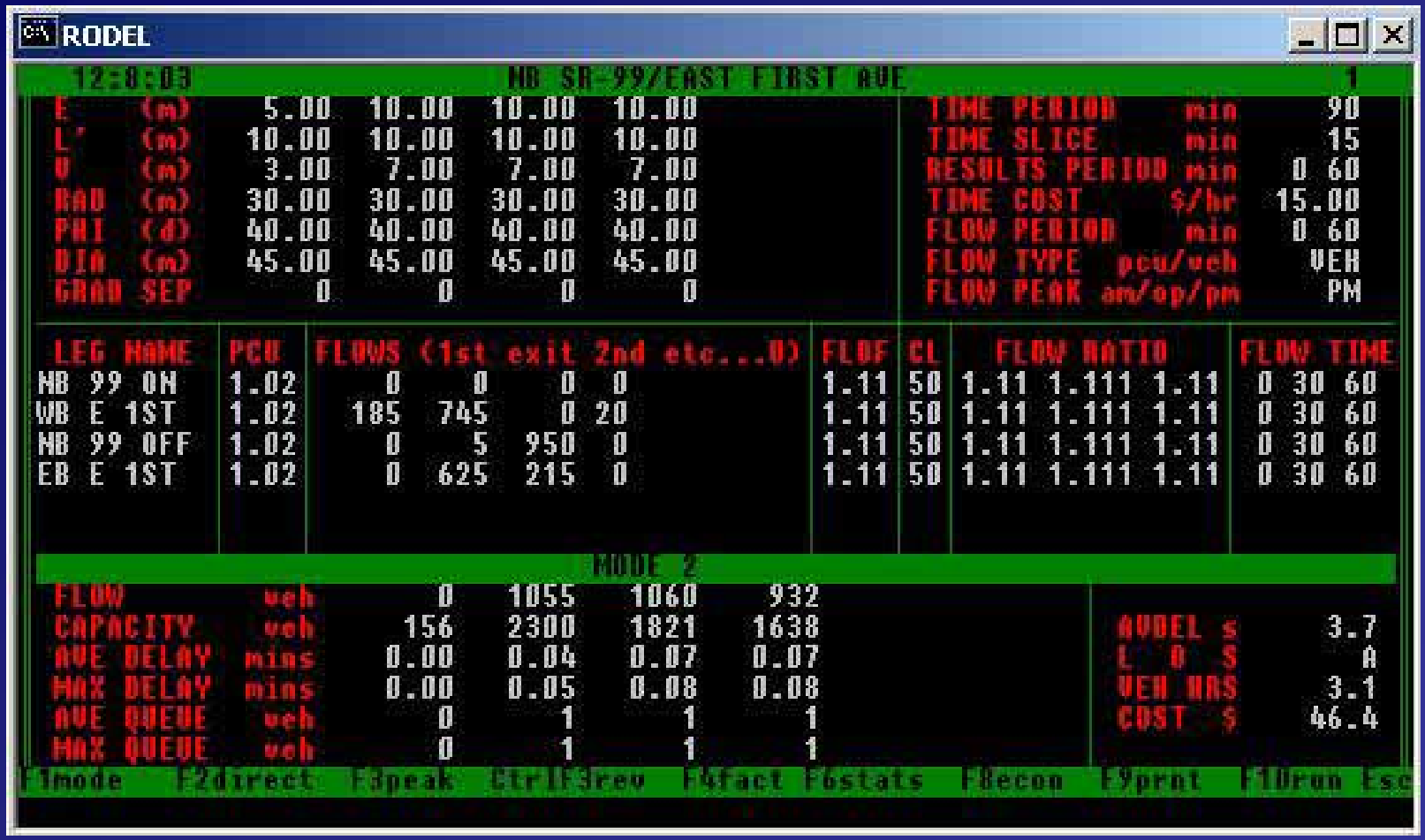
Roundabout Analysis Methods

- **Macroscopic Models (Isolated)**
  - **Analyze vehicle flows**
  - **Methods: RODEL & SIDRA**
- **Microscopic Models (System)**
  - **Analyze individual vehicles & drivers**
  - **Methods: SimTraffic, Paramics, & VISSIM**

RODEL

- **Barry Crown, UK**
- **Regression equations based on observations of UK intersections**
- **Design elements determine approach capacity (diameter, entry width, etc.)**
- **Interactive design / operations analysis**

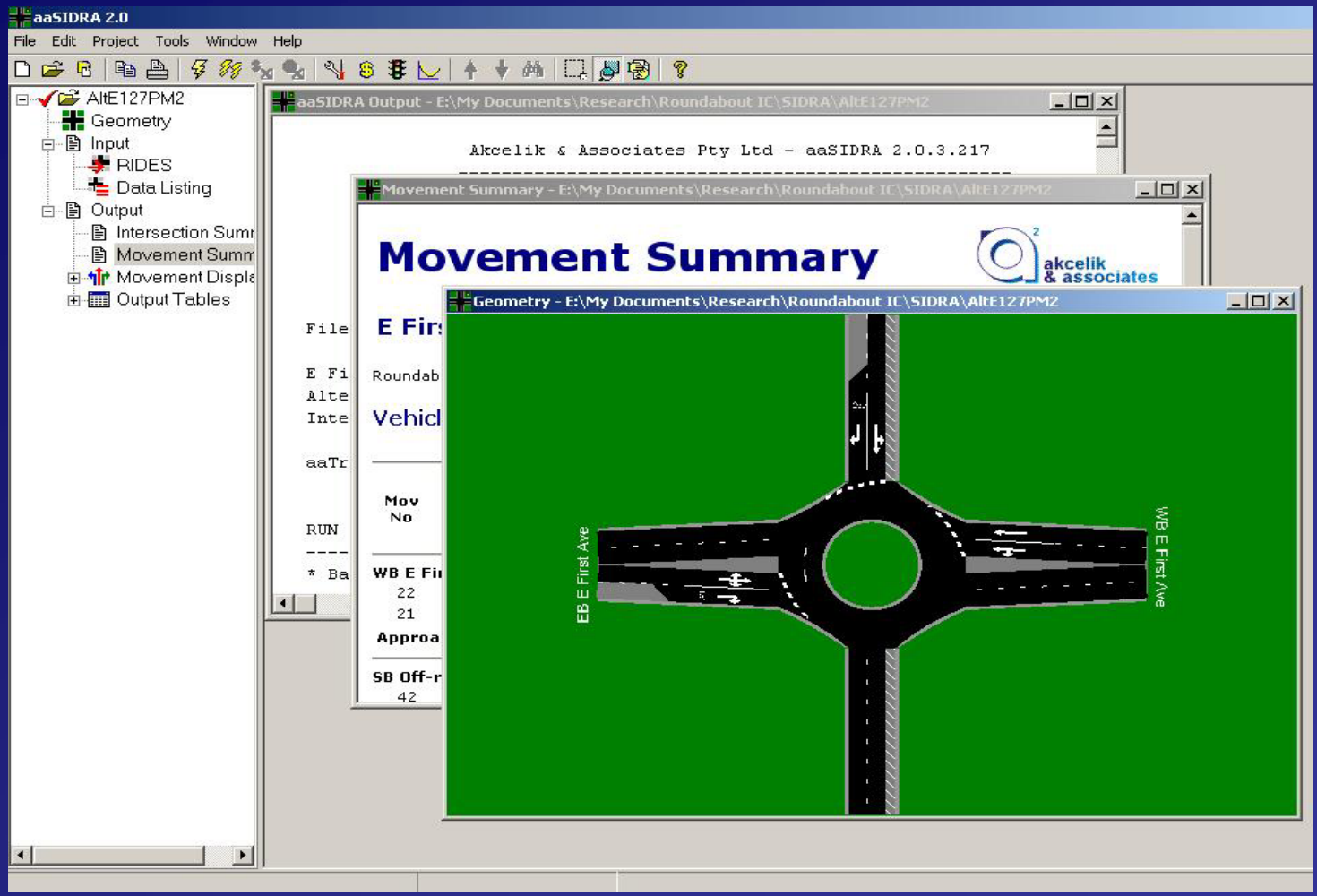
RODEL



SIDRA

- **Akcelik & Associates, Australia**
- **Intersection analysis similar to HCM**
- **Uses gap acceptance and lane utilization to determine capacity**
- **Can change headway values to calibrate to local conditions**

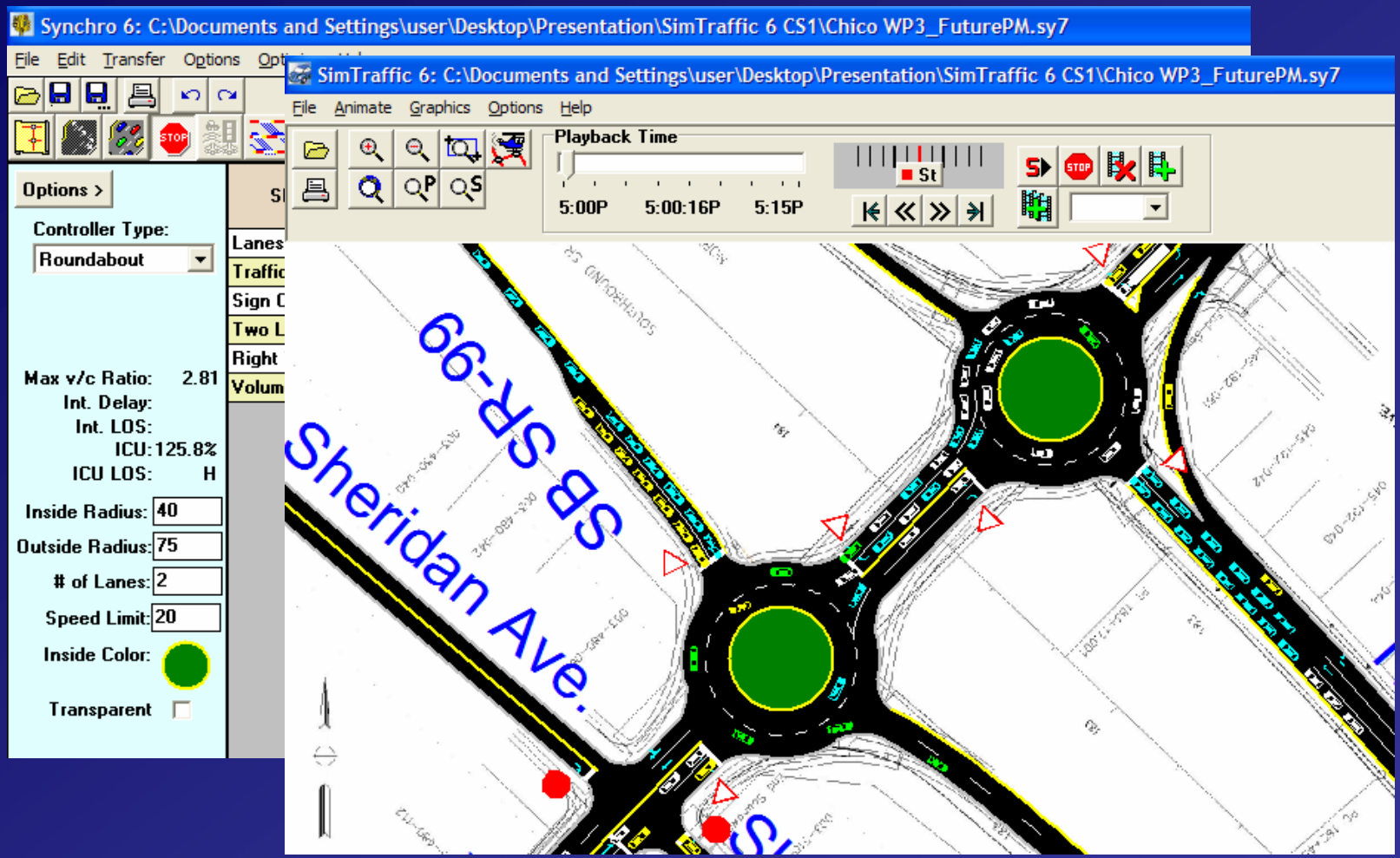
SIDRA



SimTraffic

- **Trafficware, USA**
- **Stochastic simulation model**
- **Uses Synchro for data input**
- **Driver behavior and vehicle characteristics**
- **Can change headway factors to calibrate to local conditions**

SimTraffic



Paramics

- **Quadstone, UK**
- **Stochastic simulation model**
- **Driver behavior and vehicle characteristics**
- **Link/node network structure**
- **Automatically creates roundabout**

Paramics

VISSIM

- PTV, Germany
- Stochastic simulation model
- 3D animation features
- Link/connector network structure
- Specify gap acceptance parameters by lane for each approach

VISSIM

Review of Methods

- **FHWA & RODEL**
  - **Based on British regression equations**
  - **Gap acceptance & lane configuration are not factors**
- **SIDRA & SimTraffic**
  - **Allow calibration of gap acceptance parameters to local conditions**
- **Paramics & VISSIM**
  - **Most flexible in modeling behavior**

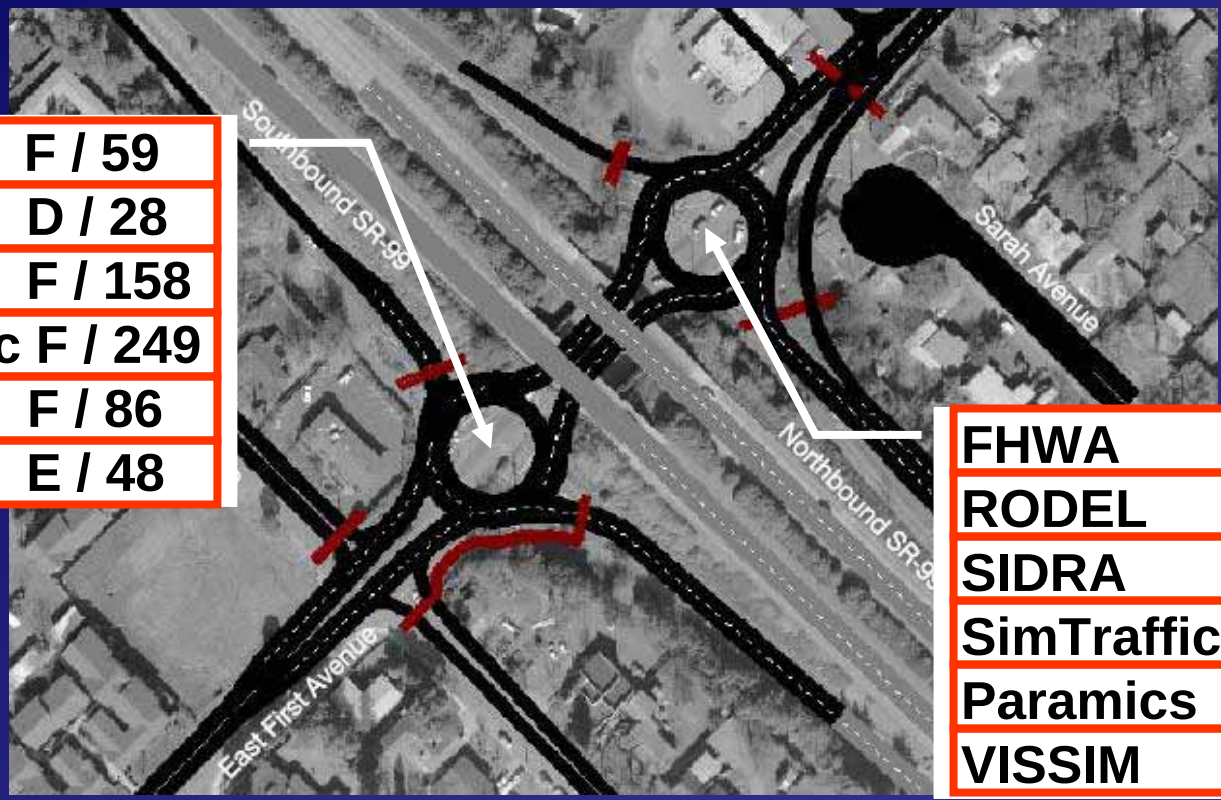
Case Study #1 - Description

- **SR-99/East First Avenue in Chico, CA**
- **Design Year (2027) PM Peak Hour**
- **Other alternatives with signals analyzed with CORSIM**
- **Diamond interchange with roundabout ramp terminal intersections**

Case Study #1 - Description

Case Study #1 - Results

FHWA	F / 59
RODEL	D / 28
SIDRA	F / 158
SimTraffic	F / 249
Paramics	F / 86
VISSIM	E / 48



FHWA	A / 5
RODEL	A / 4
SIDRA	D / 28
SimTraffic	F / 353
Paramics	C / 24
VISSIM	B / 11

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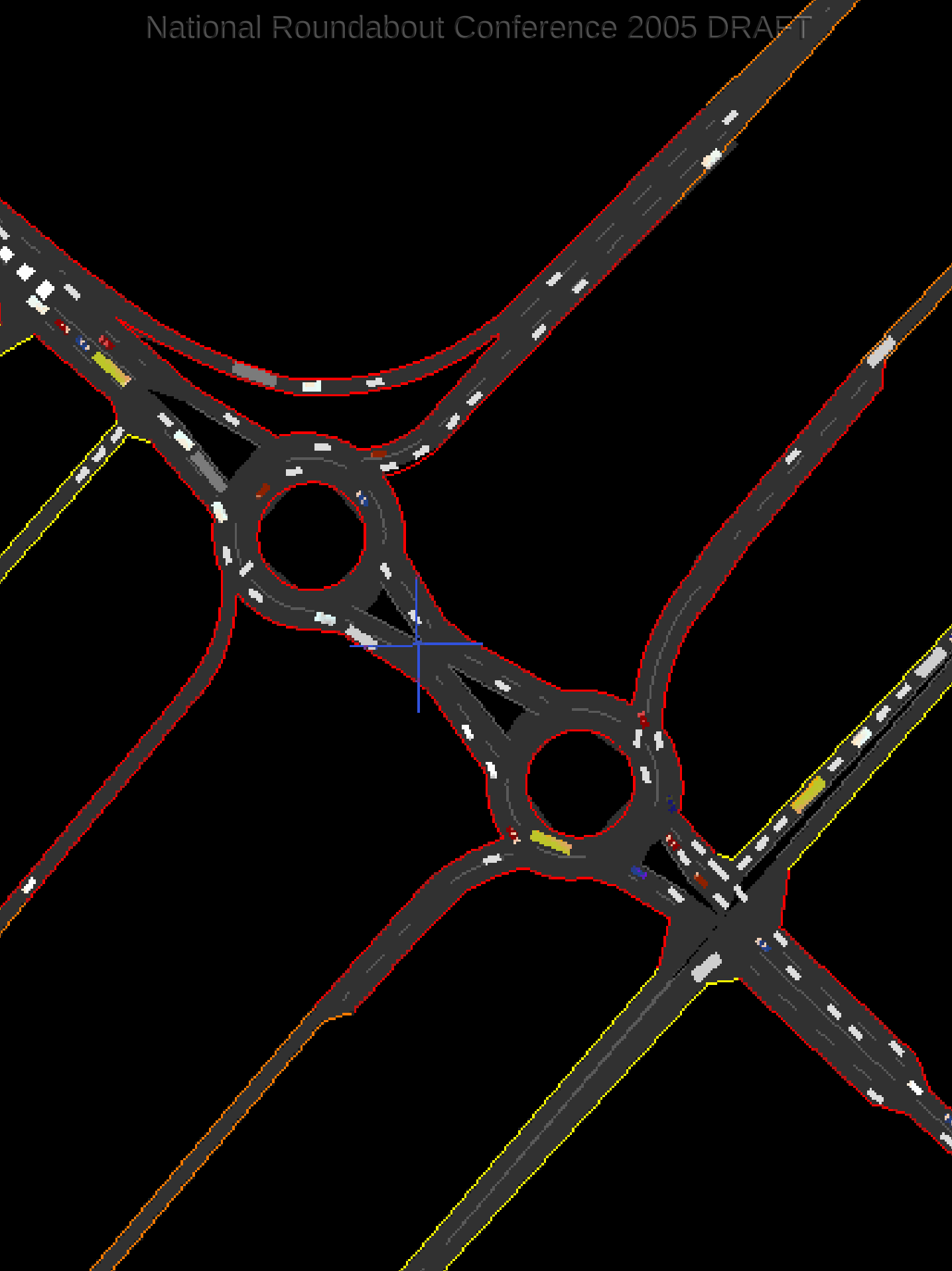
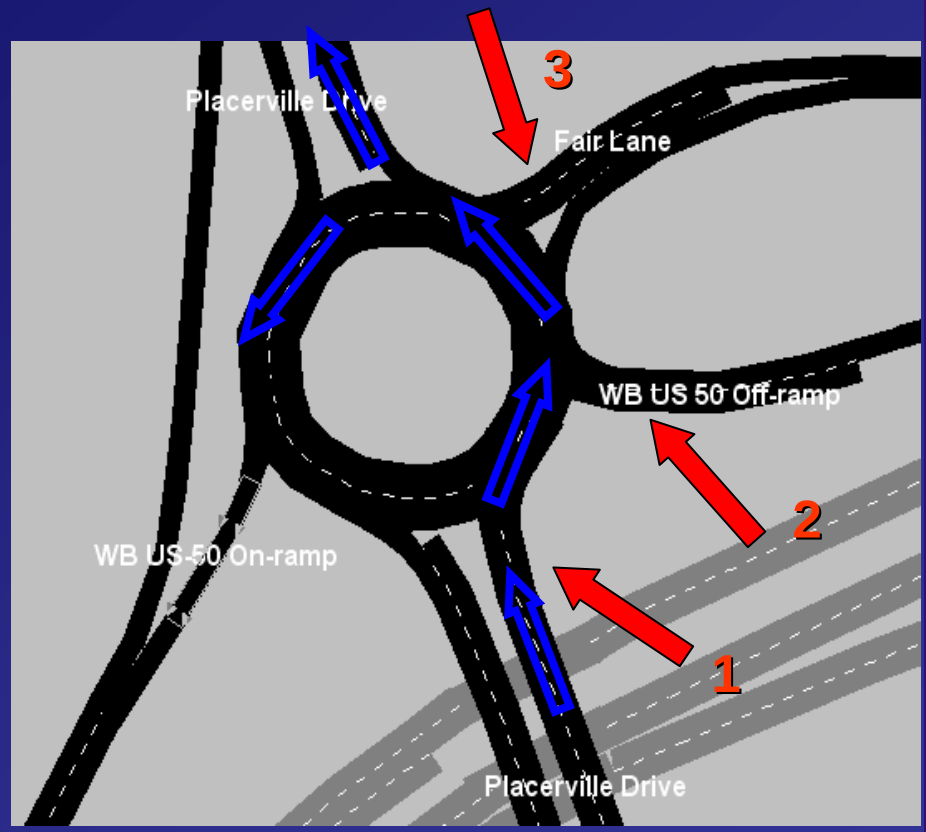


Case Study #2 - Description

- **US-50/Placerville Dr. in Placerville, CA**
- **Design Year (2030) PM Peak Hour**
- **5-leg roundabout at westbound ramp terminal intersection**

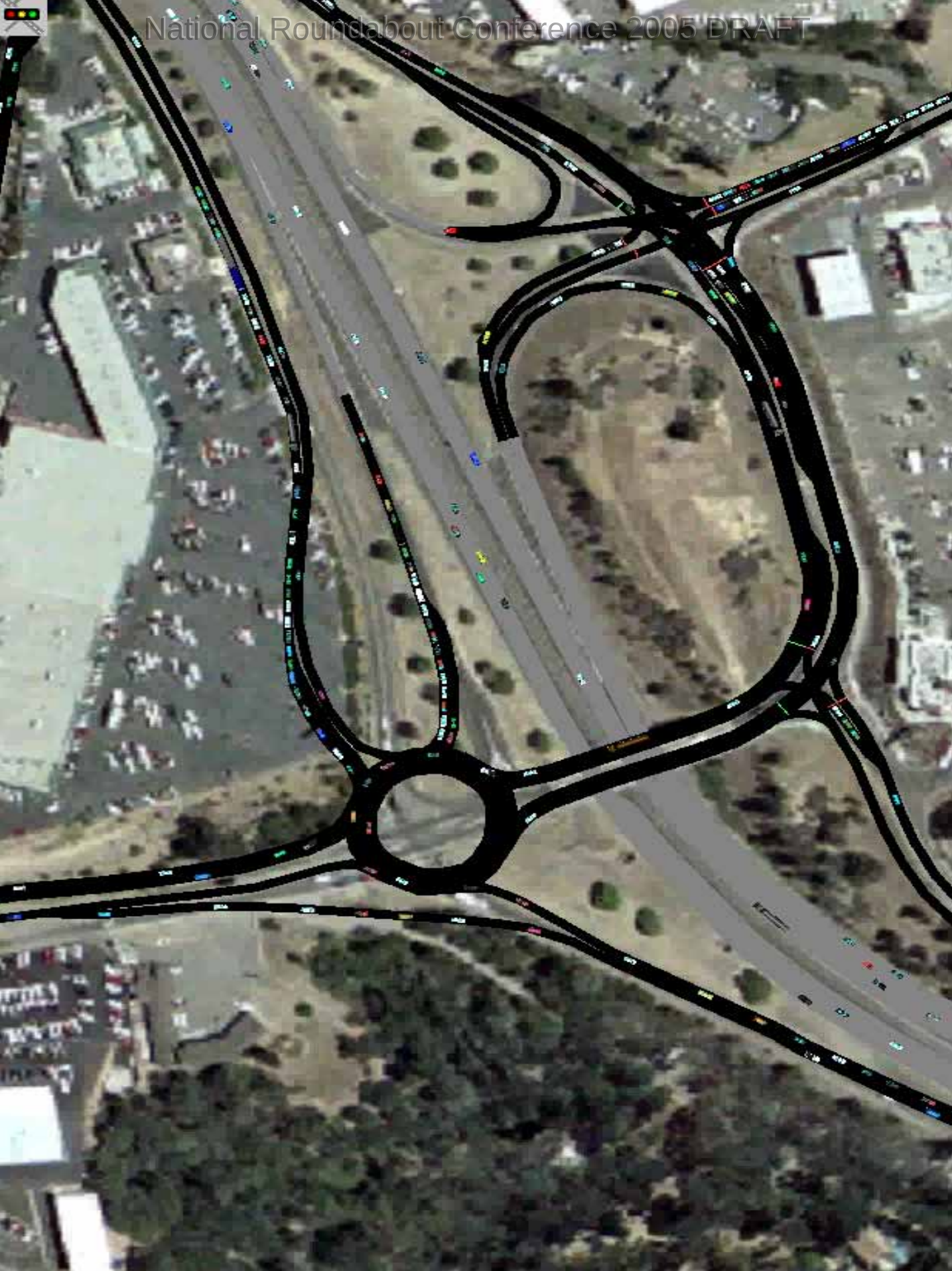


Case Study #2 - Results

- **RODEL & SIDRA report good LOS**
- **Difficult to model the geometry accurately**

Method	LOS / Delay
RODEL	B / 11
SIDRA	B / 15
VISSIM	F / 99

- **VISSIM can model one-lane exits, lane restrictions, & gap acceptance factors**
- **Shows insufficient gaps for 3rd approach**



Recommendations

- **FHWA, RODEL, & SIDRA**
  - **For uncongested conditions**
  - **For isolated locations**
- **SimTraffic**
  - **For congested conditions**
  - **For system-wide analysis**
  - **For restricted geometry (one-lane exits or forced right two-lane exits)**

Recommendations

- **Paramics & VISSIM**
  - **For congestion conditions**
  - **For system-wide analysis**
  - **For complex geometry, such as:**
    - **Weaving within the roundabout**
    - **Signalized intersections**
    - **Right-of-way constraints**
    - **Freeway ramps**
    - **Driveways**

Questions?

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