Performance Measures

Edward J. Smaglik

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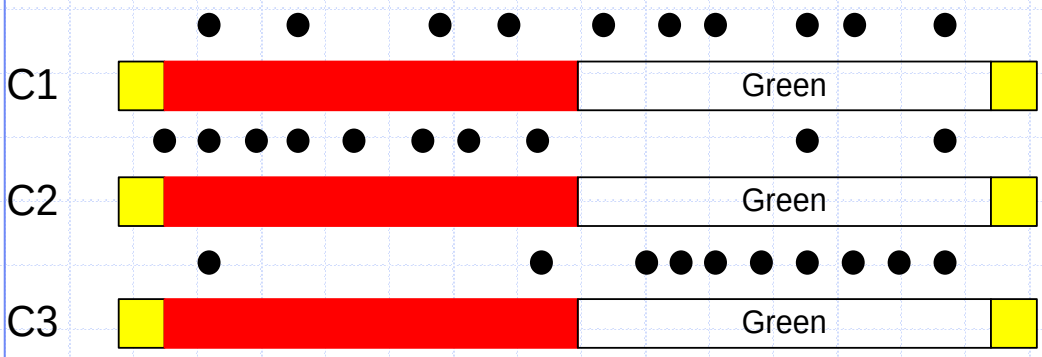
Green Occupancy Ratio (GOR) and Arrival Type (AT)

- Data requirements
- Theory
- Performance data
  - Signal Performance
  - Progression Performance

Data Requirement

- Event based data (0.1 second resolution)
  - Controller or other data collection device
- Phase and detector status
  - GOR: Phase, stopbar presence
  - AT: Phase, advance count (presence can be used)

Why event based data?



Percent Arrival on Green

60%

20%

80%

Average = 53.333%

- Aggregation removes fidelity
- Aggregation typically based upon minutes
  - Does not align with cycles

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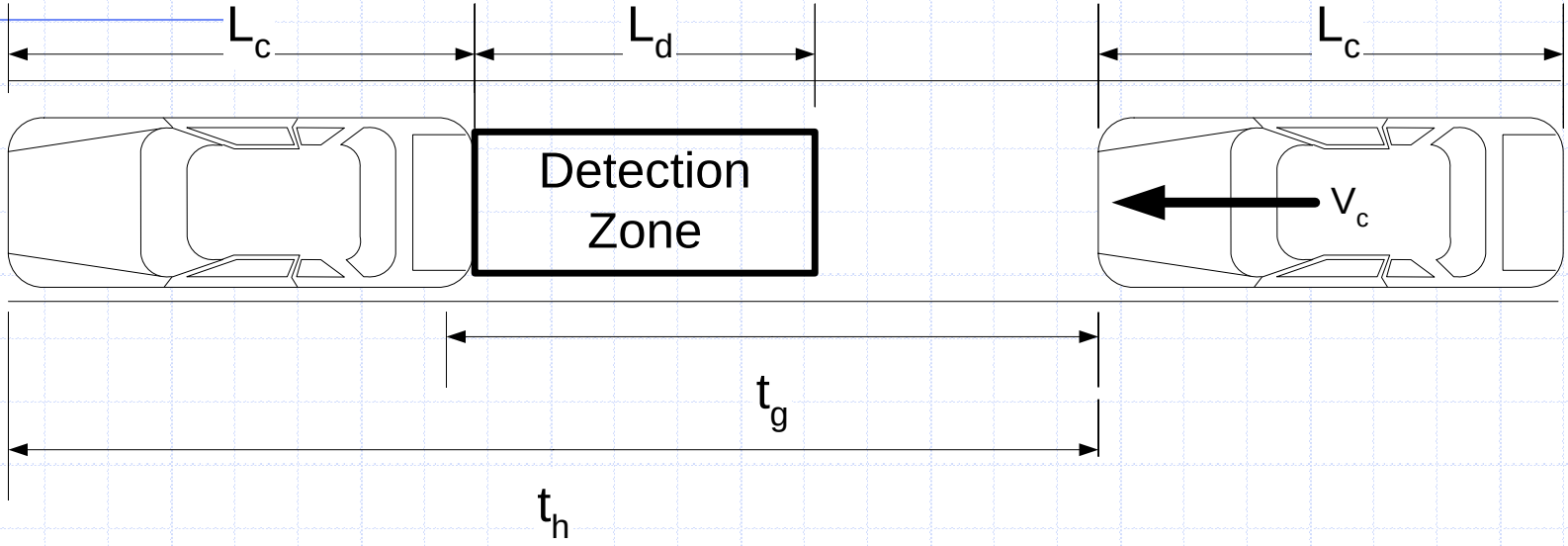
Green Occupancy Ratio



$$O_g = \sum_{i=1}^{n} \frac{(L_{ci} + L_d)}{V_{ci}}$$

$$GOR = \frac{O_g}{g_i}$$

where

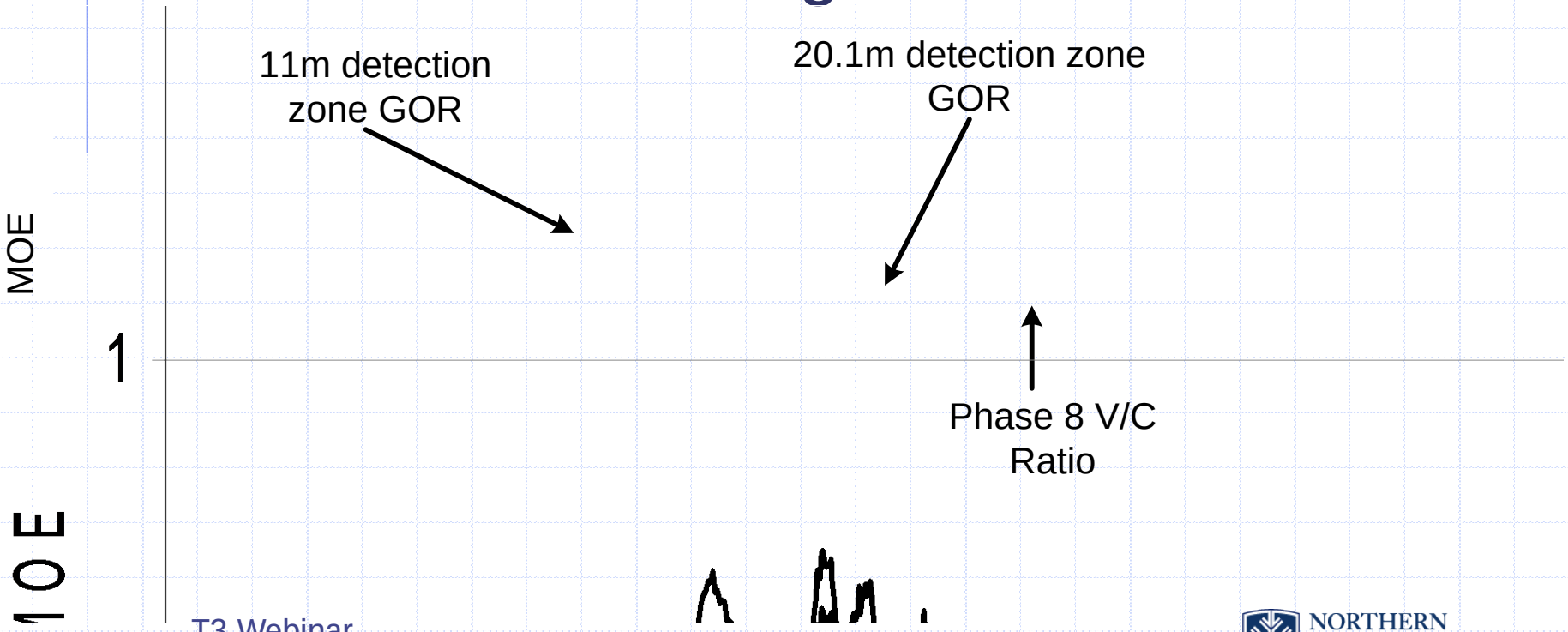
- O_g = Occupancy of a green interval i
- L_d = Length of detection zone
- L_c = Length of vehicle
- V_c = Velocity of vehicle
- t_g = time gap between vehicles
- t_h = time headway between vehicles

Green Occupancy Ratio

- Measure of signal performance
  - Higher volume, less detector off time, higher metric value
  - Metric value dependent on vehicle speed and detection zone length
    - Lower speeds => Higher metric value
    - Shorter detection zone => Lower metric value

Green Occupancy Ratio

- Comparison to V/C, with different detection zone lengths



Arrival Type

- Measure of progression performance
- Well known Highway Capacity Manual concept
  - Value has impact on delay calculation
  - Value can be developed
    - Qualitatively
    - Quantitatively

Arrival Type - Qualitative

EXHIBIT 10-18. PROGRESSION QUALITY AND ARRIVAL TYPE

Progression Quality	Arrival Type	Conditions Under Which Arrival Type Is Likely To Occur
Very poor	1	Occurs for coordinated operation on two-way street where one direction of travel does not receive good progression. Signals are spaced less than 1,600 ft apart.
Unfavorable	2	A less extreme version of Arrival Type 1. Signals spaced at or more than 1,600 ft but less than 3,200 ft apart.
Random arrivals	3	Isolated signals spaced at or more than 3,200 ft apart (whether or not coordinated).
Favorable	4	Occurs for coordinated operation, often only in one direction on a two-way street. Signals are typically between 1,600 ft and 3,200 ft apart.
Highly favorable	5	Occurs for coordinated operation. More likely to occur with signals less than 1,600 ft apart.
Exceptional	6	Typical of one-way streets in dense networks and central business districts. Signal spacing is typically under 800 ft.

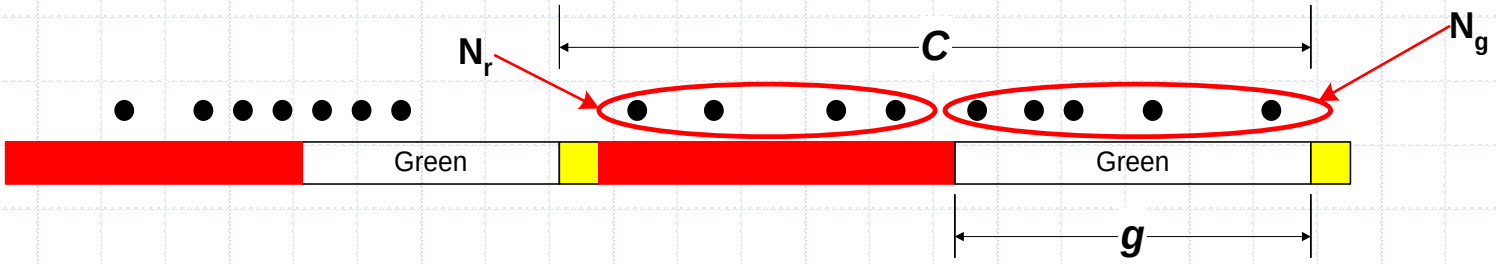
Exhibit 10-18, HCM 2000

Arrival Type - Quantitative

Arrival Type	Range of Platoon Ratio (R_p)	Default Value (R_p)	Progression Quality
1	≤ 0.50	0.333	Very poor
2	> 0.50 – 0.85	0.667	Unfavorable
3	> 0.85 – 1.15	1.000	Random arrivals
4	> 1.15 – 1.50	1.333	Favorable
5	> 1.50 – 2.00	1.667	Highly favorable
6	> 2.00	2.000	Exceptional

$$R_p = P\left(\frac{C}{g}\right)$$

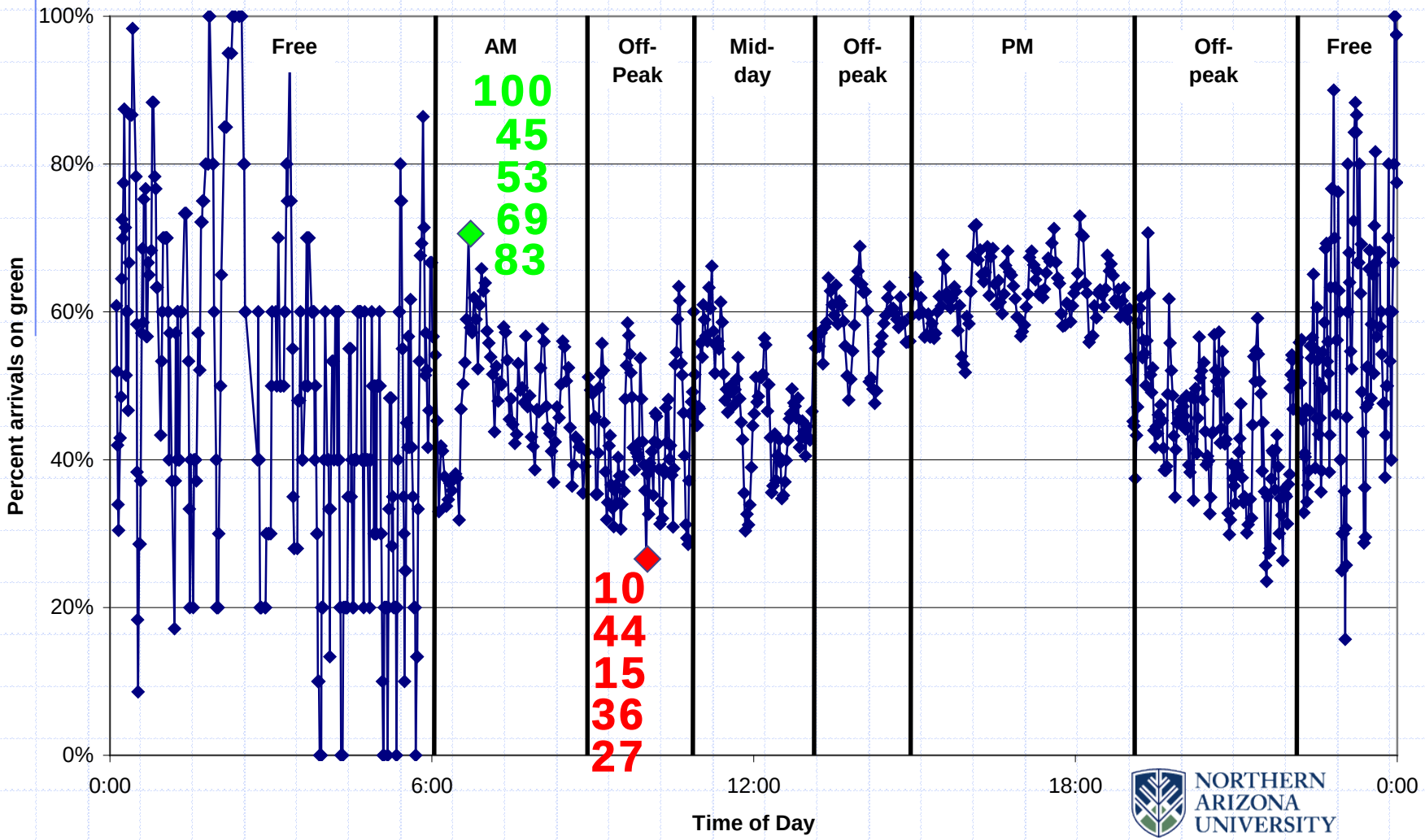
R_p = Platoon Ratio
P = Percent of Vehicle Arriving on Green
C = Cycle Length
G = Length of green interval



Arrival Type Sample Data

$$R_p = P\left(\frac{C}{g}\right)$$

Percent arrivals on green (5 cycle moving average), Northbound approach Phase 2, Noblesville, 08/09/2005



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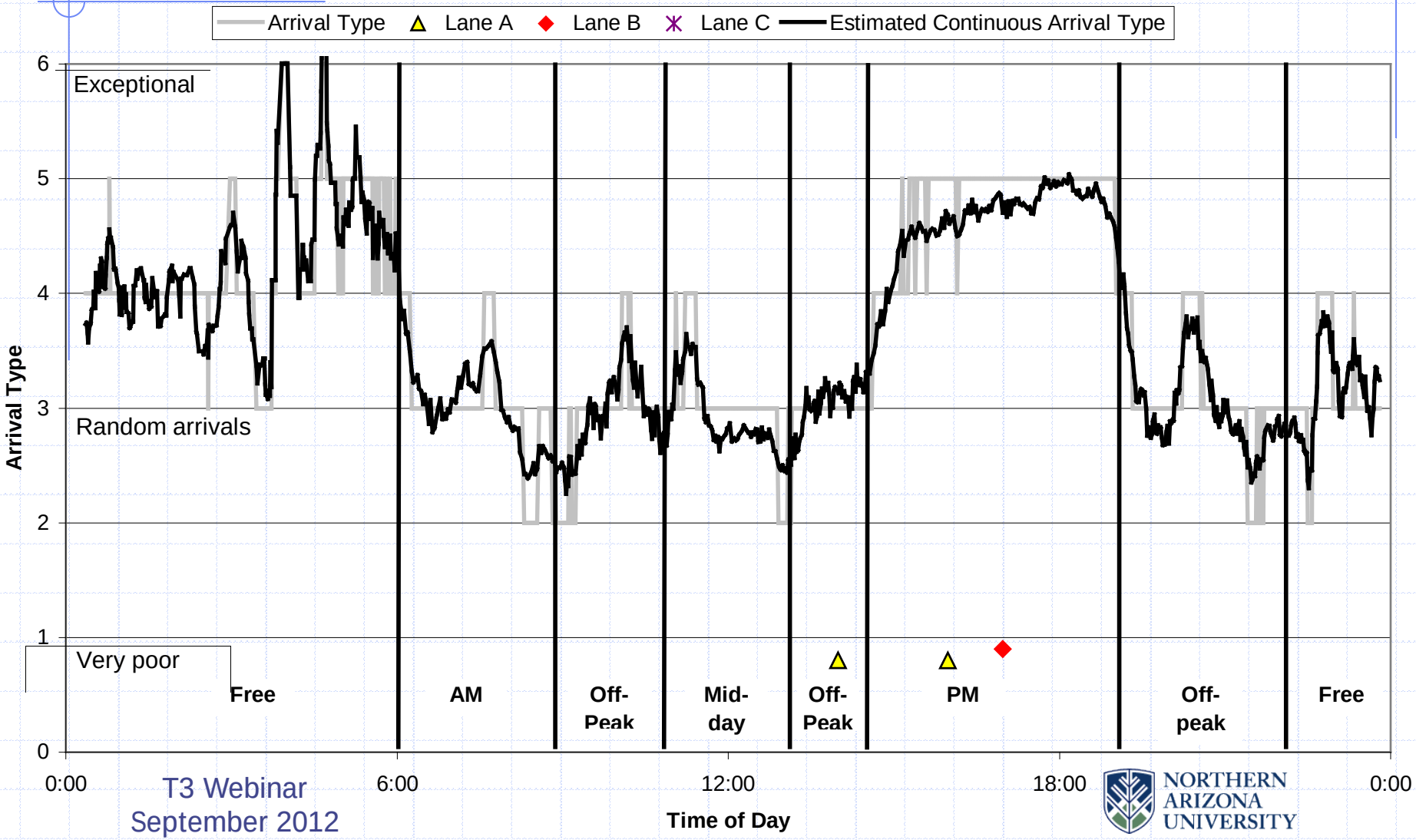
Arrival Type Sample Data

$$R_p = P\left(\frac{C}{g}\right)$$



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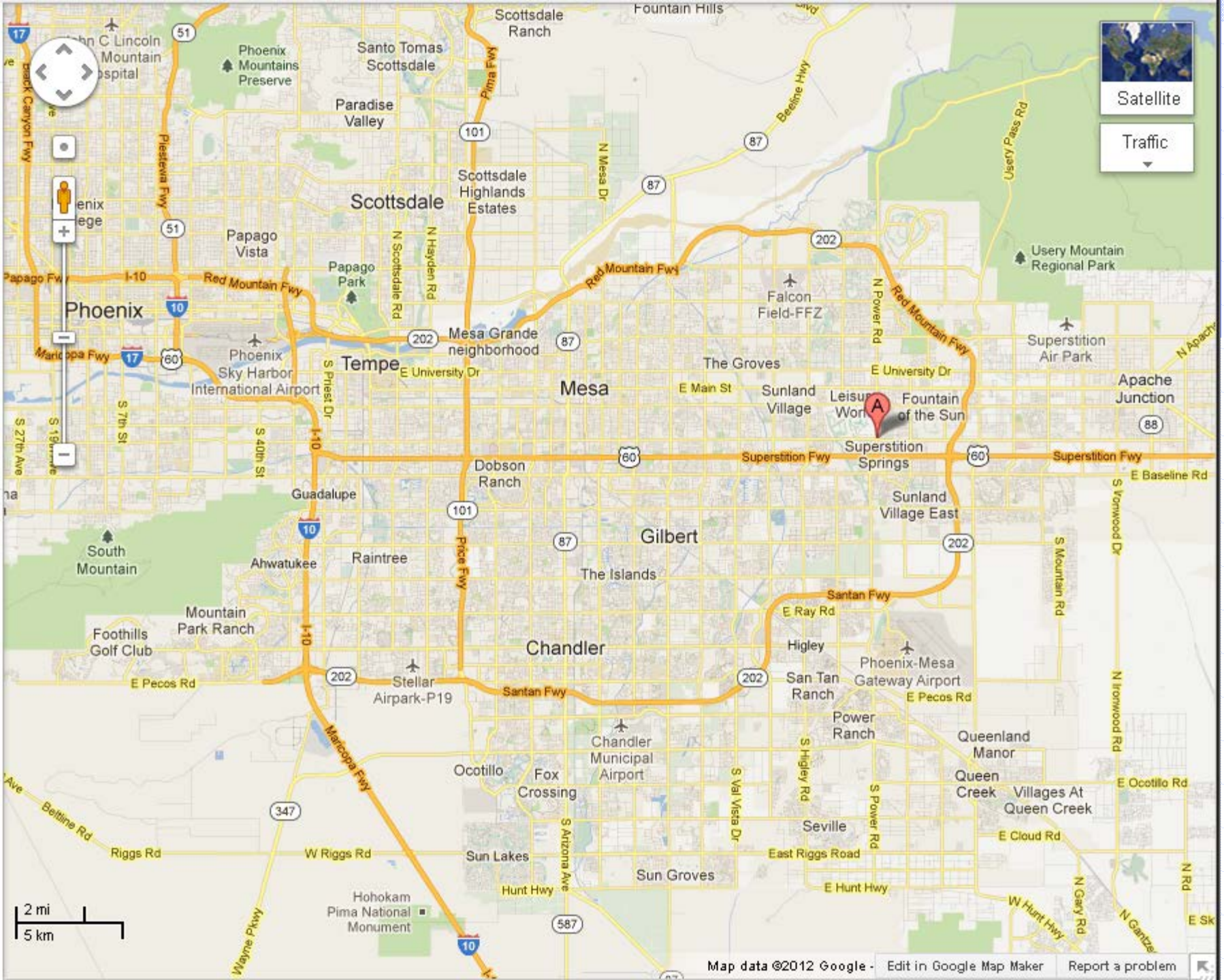
City of Mesa test intersection

- E. Southern Rd & S. Power Ave located on the east side of Mesa
- Geography
  - Adjacent to Shopping Mall and Retirement Community
  - ½ mi north of US 60
  - Wide Streets
- Adaptive control system location


Satellite
Traffic
Scottsdale
Phoenix
Tempe
Mesa
Gilbert
Chandler
Fountain Hills
Scottsdale Ranch
Santo Tomas Scottsdale
Phoenix Mountains Preserve
Paradise Valley
Scottsdale Highlands Estates
Papago Vista
Papago Park
Mesa Grande neighborhood
Phoenix Sky Harbor International Airport
Falcon Field-FFZ
Usery Mountain Regional Park
Superstition Air Park
Apache Junction
The Groves
Sunland Village
Fountain of the Sun
Superstition Springs
Sunland Village East
Dobson Ranch
Guadalupe
South Mountain
Ahwatukee
Raintree
The Islands
Mountain Park Ranch
Foothills Golf Club
Stellar Airpark-P19
Chandler Municipal Airport
Phoenix-Mesa Gateway Airport
San Tan Ranch
Higley
Power Ranch
Queenland Manor
Queen Creek
Villages At Queen Creek
Seville
Ocotillo
Fox Crossing
Sun Lakes
Sun Groves
East Riggs Road
Hohokam Pima National Monument
Usery Pass Rd
Beeline Hwy
Red Mountain Fwy
Superstition Fwy
Santan Fwy
Maricopa Fwy
Pima Fwy
Price Fwy
Piestewa Fwy
Papago Fwy
Black Canyon Fwy
Beltline Rd
Riggs Rd
W Riggs Rd
Hunt Hwy
E Hunt Hwy
E Pecos Rd
E Ray Rd
E University Dr
E Main St
E Baseline Rd
E Ocotillo Rd
E Cloud Rd
N Mesa Dr
N Scottsdale Rd
N Hayden Rd
N Power Rd
S Priest Dr
S 40th St
S 7th St
S 27th Ave
S Mountain Rd
S Ironwood Dr
N Ironwood Rd
S Higley Rd
S Val Vista Dr
S Arizona Ave
N Gary Rd
N Ganzel
2 mi
5 km
Map data ©2012 Google -
Edit in Google Map Maker
Report a problem

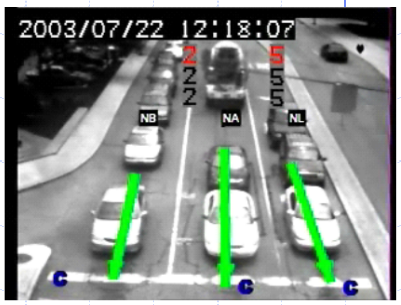
Generic Data Collection Diagram

Phase Status → SDLC Bus →

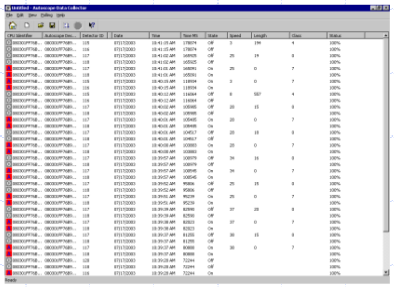
Detection Device Status (Loop or other) → TS1 Contact Closure Inputs (16) →

Data Collection Device

Coax Cable from camera →



Overlay



Data file

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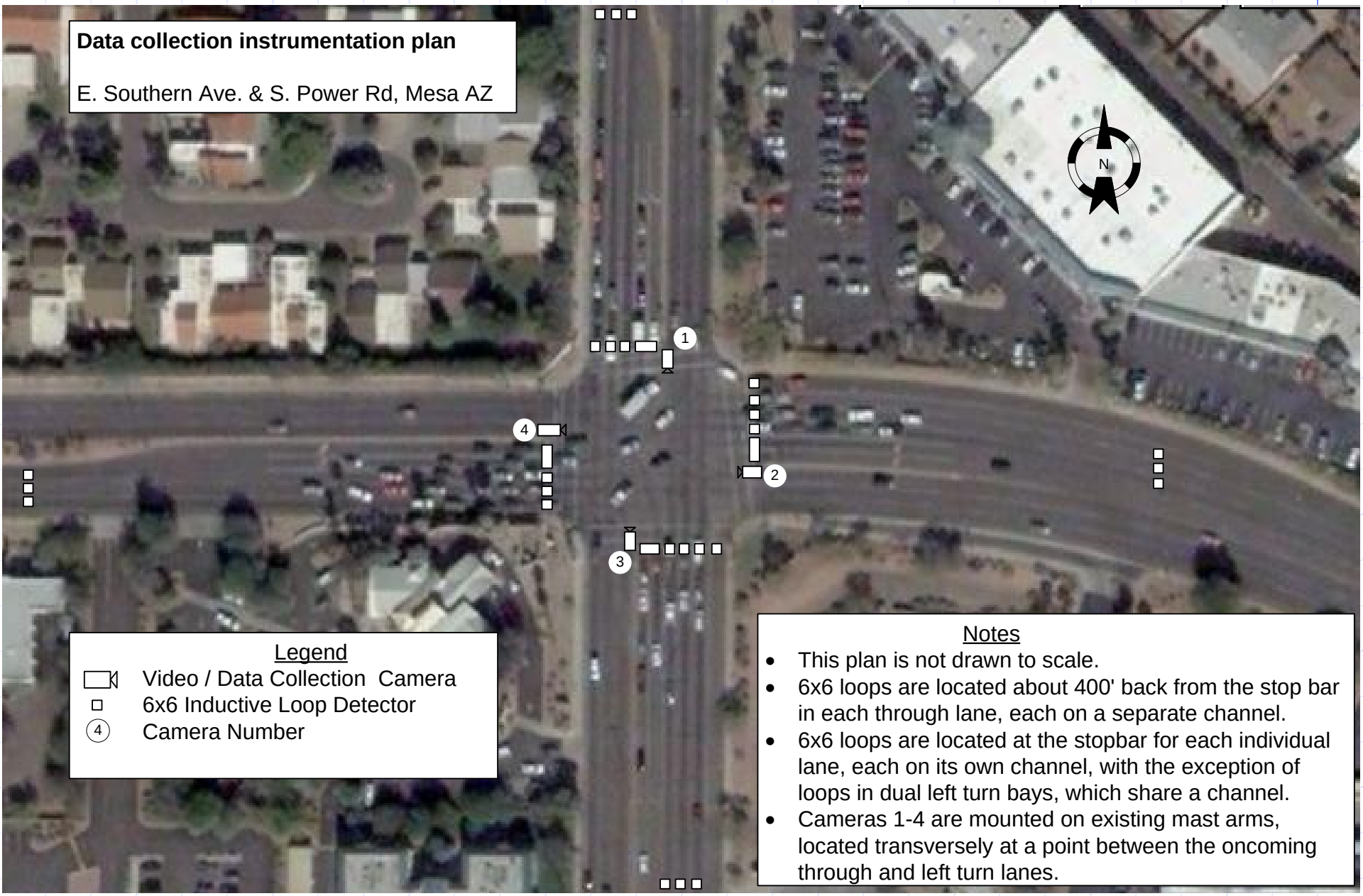
Data collection instrumentation plan
E. Southern Ave. & S. Power Rd, Mesa AZ
N
1
2
3
4
Legend
Video / Data Collection Camera
6x6 Inductive Loop Detector
4 Camera Number
Notes
This plan is not drawn to scale.
6x6 loops are located about 400' back from the stop bar in each through lane, each on a separate channel.
6x6 loops are located at the stopbar for each individual lane, each on its own channel, with the exception of loops in dual left turn bays, which share a channel.
Cameras 1-4 are mounted on existing mast arms, located transversely at a point between the oncoming through and left turn lanes.

What do I need?

- Event based data logger
  - Adaptive system
  - Available on certain:
    - Traffic controllers
    - Video detection devices
  - Standalone device
- Access to detector and phase state changes on 0.1s resolution