Mathematical Approaches To Traffic Flow Management

III. Traffic Control
Special Topics

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Dynamic Speed Advisory
(source: BMW)

V2I Example:
SPaT message
Variable Speed Limits (1)

- **Examples**
  - Lodge Freeway, MI
  - M25, UK
  - Netherlands
Variable Speed Limits (2): Impacts
Dynamic Lane Use (1)
Control of an Oversaturated Intersection

Gazis & Potts,
“The Oversaturated Intersection”, 2nd ISTTT, 1963

\[ \frac{q_1}{s_1} + \frac{q_2}{s_2} > 1 - \left( \frac{L}{C} \right) \]
System Oversaturation: Control Strategies

- Forced and hold green
- Gating and metering
- Maximum capacity flow
- Negative offset- reverse green waves
- Green waves with cross streets
- Flared green with cross street
- Diversion away from congestion
- Shorter cycle length
- Longer cycle length

**Spillback:**

- Spillback is caused when the queue from downstream intersection uses up all the space on the link and prevents vehicles from entering the upstream intersection on green

**Strategies:**

- Negative offsets (reverse progression)
- Dynamic adjustment of offsets
- Metering, “Flare” the green
Transit Priority Strategies

- **Design**
  - Bus (HOV) lanes
  - Queue Jump lanes

- **Control (Traffic Signals)**
  - Passive
  - Active

- **Combination**

- **Benefits to Transit**
  - Travel time (delay) reduction
  - Improved schedule reliability
  - Customer satisfaction/ridership increase
Passive Priority Strategies (1)

Source: L Head, TCRP A-16
Active Priority: Early Green (Red Truncation)
Active Priority: Green Extension

- Reduced Cross Street Green
- Extended Main Street Green
- Transit Vehicle Detected
Active Priority Strategies: Issues (1)

Spare Green time in the Signal Cycle

Critical intersections
High pedestrian volumes
Insufficient queue storage

\[ G_e = \sum_{i=1}^{N} G_i (1 - X_i) \]

N : number of phases
G_i : green time for phase i
X_i : degree of saturation for the critical link --phase i

Bus Route Progression
Schedule Adherence

Empty/Out of Service Late Runners?
Active Priority Strategies: Issues (2)
ITS Technology & Impacts

Expanding ITS technology envelope

- Capacity
- Air quality
- AHS
- Driver assistance
- ATMIS
- Safety

Current technologies