Pedestrian Timing Strategies at Large Signalized Intersections

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OVERVIEW

- Safety – Efficiency Issue
  - Impact of pedestrian timing on signal operations
- Pedestrian Timing Strategies
  - Two-stage crossing
  - Split phasing
  - Exclusive ped phase
- Summary and Conclusions
PED. CROSSING AT TRAFFIC SIGNALS

- Pedestrian crossing concurrent with parallel vehicle movement
- Sufficient time must be provided to allow pedestrian safely crossing
  - Green $\geq$ WALK + FDW
- Conflict with turning vehicles
SAFETY VS. EFFICIENCY

Safety
- Long WALK + FDW
- Ped. Protected Phase
  (Separate Ped and Vehicles)

Efficiency
- Long Green (Minor St.)
- Less Green (Main St.)
- Increased Lost Time
- Less Capacity
LARGE INTERSECTIONS
ISSUES

- Low vehicle demand but long ped time
- Two-stage crossing = longer ped delay
- Significant impact under split phasing
- Coordination issue (ped time treatments)
TWO-STAGE PEDESTRIAN CROSSING
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“Pedestrian Delay Models at Signalized Intersections Considering Signal Phasing and Pedestrian Treatment Alternatives” (09-2537) by Wang et al.

- One-stage crossing
- Current two-stage without overlaps
- Two-stage with overlaps
SPLIT PHASING

Sequentially providing green and serving the two opposite approaches
PED. TREATMENT UNDER SPLIT PHASING

- Left-turn green arrow
  (Protected LT)

- No left-turn arrow
  (Permitted LT)

- Dynamic display
  (Protected/Permitted)

Acknowledgement: Some of the following pictures were borrowed from a presentation by Scott Wainwright of FHWA
** Two Pedestrian Splits
SB Vehicles Need 30” Green per Cycle

Peds Need 5” Walk + 30” FDW

Total Vehicle Need = 45”
Total Ped Need = 70”

NB Vehicles Need 15” Green
** One Pedestrian Split

Total Vehicle Need = 45”
Total Ped Need = 35”
** One Pedestrian Split

a) With Conflicting Pedestrian Crossings on Both Sides

b) With Conflicting Pedestrian Crossings on East Side

Total Vehicle Need = 45”
Total Ped Need = 35”
**One Pedestrian Split**

c) With Conflicting Pedestrian Crossings on West Side

d) Without Conflicting Pedestrian Crossings
* Note: It may require to output φ9 and φ10 load switches to φ8 and φ4, respectively

Controller Phase and Ring Structures
LEGEND

VD = Vehicle Detector
PD = Ped Detector
HLD = Phase Hold
OMT = Phase Omit
PO = Ped Omit
CHK = Check Calls
NXT = Next Phase
ON = Phase On
NO PED ON WEST LAG CROSSWALK (NB GREEN ARROW)
WITH WEST LAG PED (NB GREEN BALL)

NB Approach
LAS VEGAS PROTECTED/PERMITTED
* Reduced Pedestrian Splits
EXCLUSIVE VS. PROTECTED LT MODEL

Model Elements:
- Ped Volume
- Cycle Length
- $\gamma = (T_a + T_b)/t_p$
- Ped Time ($t_p$)

Data for the Figure:
- Cycle = 100 sec
- $t_p = 35$ sec
COORDINATED SIGNALS

- Two timing alternatives to handle pedestrians
  - Ped timing accommodation
    - Longer cycle
  - No ped timing accommodation
    - Out of synch/Transition

SUMMARY AND CONCLUSIONS

- Efficiency ↔ Safety
- Two-stage crossing strategies
- Split phasing
- Exclusive/scramble phase
- Coordinated signals (to be continued…)

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