# Using Uneven Double Gycles <br> - To lmprove the Effectiveness <br> of Arterial Traffic Signal Operations 

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## Disclainer

- The subject project is funded by the U.S. Department of Transportation, the Texas Department of Transportation, and the participating cities.
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## Thoroughfare Assessment Program

- Client: NCTCOG
- Funding: 80\% CMAQ - 20\% Local
- Purpose: Reduce vehicular emissions through improved signal timing
- Scope
- Quantitative screening to select corridors
- Signal timing optimization
-57 "corridors" (48 linear and 9 grids)
$-1,500$ intersections
$\lrcorner 13$ operating agencies


## JAP Gorridors in Greater Dallas



## Richardson-Garland Group 1


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## Richardson-Garland Group 1



## Richarolson-Garland Group 1

- 142 total intersections
- City of Garland
- 78 Intersections
- Siemens $i^{\text {TM }}$ system with 2070 controllers
- Citiy of Richardson
- 64 intersections
- Naztec StreetWise ${ }^{\text {TM }}$ system with TS2 controllers


## Previous Timing in the Corsidor

- Cross-jurisolictional coordination since late " 80 s
- Good progression (north-south and east-west)
- Lead-lag phase sequences using
"Dallas" left-turn displays



## Challenges for the Current Project

- Cycle lengtins were no longer adequate
- AM peak - 120 seconds
- Midday - 90 seconds
- PM peak - 128 seconds
- Moderately longer AM and PM peak cycles (135 to 144 seconds) were inherently not good for two-way progression

Adjacent corridors in Dallas and Plano were using cycle lengths of 160 seconds during AM and/or PM peaks

## Advantages of the 160 -second Cycle

- Inherently accommodaties good two-way progression between the "major-major" intersections
- Typical travel times for one mile are between 85 and 90 seconds
- Substantially alleviaties congestion at the critical intersections


## Disadvantages of the 160-second Cycle

- Bay length issues at some intersections
(particularly during the PM peak)

- Long wait times on the minor streets


## Potential Mitigations for the Disadvantages

- Short bay lengths
- Lead-lag phase sequences
- Selective use of twice-per-cycle left-turn phasing
- Long minor street wait times
- Double-cycle as many of the minor intersections as possible



## Limitations of the "Even" Double Cycle



- The width of the peak-direction green band often approaches the half cycle length
」 The progression bands rarely pass through the minor intersections at exactly the same time




## Standard Phase Structures

Garland's Standard Phase Orientation for a Conventional, 8-Phase Intersection


## Standard Phase Structures

Garland's Standard Phase Orientation and Ring and Barrier Structure for Uneven Double Cycling or Twice-Per-Cycle Left Turns


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Example 1: Twice-Per-Cycle Left







## Double-Cycled Intersections During

 PM Peak 160-second Cycle

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## Timing Plan Development Process



## Thning Plan Development Process

- Use of Synchro ${ }^{\text {TM }}$
- V/C ratios can be used to determine the appropriate total split times



## Jining Plan Development Process

- Use of Synchro ${ }^{\text {TM }}$
- After those steps, however, the process becomes manual

> ...but Synchro ${ }^{\text {TM }}$ is a very effective tool for visually evaluating manual adjustiments of phasing, sequence, and offset

## Tining Plan Development Process

- Manual (and iterative) steps
- All intersections: adjust phase sequences and offisets to achieve optimum two-way progression (north-south and east west)
- Double-cycled intersections:
- Apportion the lengths of the two services of the through movements
- Select the association of the left-turn phases with the shorter or longer service of the through movements


## Tinaing Plan Implementation Status

- Began in September 2006
- All 78 Garland intersections have been running new plans since February 2007
- Over 50 of Richardson's intersections currently running the new plans



## Summary and Conclusions

- The longer AM and PM peak cycle lengtins have noticeably alleviaied congestion at the major intersections



## Summary and Conclusions , cont

- The longer AM and PM peak cycle lengiths have noticeably alleviated congestion at the major intersections



## Summary and ConcJusions, cont.

- In spite of the substantially longer background cycle lengths, the maximum wait times nave been reduced at most of the minor intersections
- Good citizen acceptance

> ...so far

