Extending Link Pivot Offset Optimization to Arterials
With Single Controller Diverging Diamond Interchange

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The trajectory view contains all the relevant information.
- Arrival times measured by a setback detector.
- Phase times measured by the local controller.

OPTIMIZATION METHODOLOGY DETAILS

Actual Vehicle Arrivals
- The trajectory view contains all the relevant information.
- Arrival times measured by a setback detector.
- Phase times measured by the local controller.

Purdue Coordination Diagram
- Originally described by Day et al. (2009). [DOI: 10.3141/2192-04]
- Shows individual vehicle arrivals in relation to the duration of green.
- Visualizes arrival characteristics for various times of day in a single graphical representation.

Purdue Coordination Diagram
- Originally described by Day et al. (2009).
- Based on “Combination Method” developed in the 1960s.
- Start from one intersection and move to the next end of the system.
- Each intersection offset is optimized to achieve best performance for two directions on the next link.
- Previously optimized link flows are preserved by adding new adjustments to all of the previously optimized intersections.

Cyclic Flow Profile
- Introduced in the 1960s as a core component of TRANSYT.
- Shows average cyclic distribution over a time period.
- Useful for optimization.

Link Pivot Algorithm for a Simple Arterial Corridor
- Based on “Combination Method” developed in the 1960s.
- Start from one intersection and move to the next end of the system.
- Each intersection offset is optimized to achieve best performance for two directions on the next link.
- Previously optimized link flows are preserved by adding new adjustments to all of the previously optimized intersections.

Application to Single-Controller Diamond

a) Existing Offsets
- Offsets are defined by relation to the cyclic reference points.
- Ring displacement (R) determines the effective offset of the sub-intersection within the single-controller diamond (Int. 3).

b) Adjustment to Diamond Controller
- This adjustment (Δ) moves the green bands for both intersections within the single-controller diamond.
- Ring displacement remains the same (R = RL), but the effective offset of Int. 3 is now different.

c) Counter-Adjustment to “Undo” the Previous Step
- To independently adjust the two intersections within the single-controller diamond, we can apply the conceptual adjustment to undo the previous step.
- This adjustment (−Δj) is applied to the ring displacement, and restores the effective offset of Int. 3 to its original state.

d) Independent Adjustment of the Offset at Int. 3
- It is now possible to apply a completely independent adjustment (Δj) to Int. 3.
- This decouples the two intersections within the single-controller diamond, enabling conventional optimization methods to be applied.
- The key formulas are:
  \[ \Delta_{(\text{Int. 3})} = (\text{Offset}) + R \mod C \]
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BEFORE/AFTER COMPARISON OF VEHICLE ARRIVALS

CHANGES IN ANNUALIZED USER COSTS

RESULTS

- Existing offset optimization methodology was applied to single controller diamond with DDI
- Significant improvements in Percent on Green within the DDI and elsewhere in the arterial corridor
- Net annualized user benefit of $563,841
  - AM Peak saw net degradation, with marginal improvements in the dominant arterial route, at the cost of worsened performance on other routes
  - Midday and PM Peak both mostly improvements across most routes
- The methodology could be rather easily extended to other single-controller interchange types

Map indicating origin and destination locations: