Adjusting Temporal Demand for DTA: A Practical Method

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Subarea
Regional Network Abstraction

Subarea
• 18 TAZs
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Traversal Demand Static Assignment
Find new O-D matrix such that

\[
\min \sum_{\text{counts}} (\text{assigned flows} - \text{counts})^2
\]
Demand Adjustment

Find new O-D matrix such that

$$\min \sum_{\text{counts}} (\text{assigned flows} - \text{counts})^2 + (1-\alpha) \sum_{\text{O-Ds}} (\text{adjusted demand} - \text{seed matrix})^2$$

- links and turns
- multiclass
- time-varying
- (weighted)

weight
$0 \leq \alpha \leq 1$

traversal matrix

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Adjusted Car Matrix 7:00-7:15
Adjusted Car Matrix 7:15-7:30
Adjusted Car Matrix 7:30-7:45
Adjusted Car Matrix 8:00-8:15
Adjusted Car Matrix 8:15-8:30

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Adjusted Car Matrix 8:30-8:45
Adjusted Car Matrix 8:45-9:00

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Adjusted Demand Static Assignment

7:06-9:00
before adjustment
Multiclass Demand Adjustment

Link scatterplot

Y = 0.967496 * X + 62.4003  
N: 70  
R²: 0.807544

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Multiclass Demand Adjustment

cars
7:45-8:00
$\alpha = 0.75$

Link scatterplot

$Y = 1.0064X - 9.99726$

N: 70
R²: 0.988936

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Multiclass Demand Adjustment

cars
7:45-8:00
α = 0.75

Turn scatterplot

Y = 0.935779X + 9.15697
N: 108  R2: 0.947135
Multiclass Demand Adjustment

cars
7:45-8:00
$\alpha = 0.75$

Matrix scatterplot

$Y = 0.970768X + 0.303906$

$N: 16384$  
$R^2: 0.949665$
Find new O-D matrix such that

\[
\min \alpha \sum_{\text{counts}} (\text{assigned flows} - \text{counts})^2 \\
+ (1-\alpha) \sum_{\text{O-Ds}} (\text{adjusted demand} - \text{seed matrix})^2
\]

weight
\[\alpha = 0.75\]
Find new O-D matrix such that

$$\min \alpha \sum_{\text{counts}} (\text{assigned flows} - \text{counts})^2$$

$$+ (1-\alpha) \sum_{\text{O-Ds}} (\text{adjusted demand} - \text{seed matrix})^2$$

weight
$$\alpha = 1.00$$
Multiclass Demand Adjustment

cars
7:45-8:00
α = 1.00

Matrix scatterplot

Adjusted Demand

Y = 0.985211X + 0.267443
N: 16384
R²: 0.886344
Initial DTA Results

>600 vehicles waiting

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Initial Convergence

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Initial Calibration

Link Scatterplot
- $R^2 = 0.856954$, Slope = 0.830507, Y offset = 137.556

Count 2340
Average flow 1318
Queue Spillback 8:00-8:30

7:30 queue builds at Ebound on ramp

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Queue Spillback 8:00-8:30

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Queue Spillback 8:00-8:30

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Queue Spillback 8:00-8:30

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Calibration: another outlier

Count 1111
Average flow 1981

Link Scatterplot
R Squared=0.856954, Slope=0.830507, Y offset=137.556
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Dynamic Select-link Analysis

left turns

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Dynamic Path Analysis

departures
7:30-7:45
Dynamic Path Analysis

departures
7:45-8:00

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Dynamic Path Analysis

departures
8:00-8:15
Dynamic Path Analysis

departures
8:15-8:30

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Dynamic Path Analysis

departures
8:30-8:45

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Dynamic Path Analysis

departures
8:45-9:00
Downstream Bottleneck

V/C > 1.2

static assignment of adjusted demand 7:45-8:00
Car Counts
Dynamic Select-link Analysis

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Select-link Demand for Ebound On Ramp

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Select-link Demand for Ebound On Ramp

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Select-link Demand for Ebound On Ramp

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Select-link Demand for Ebound On Ramp

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Dynamic Demand Adjustment

Scale down the demand matrix for each demand interval in proportion to the dynamic select-link demand until the spillback is sufficiently reduced.
Calibration: more outliers?
Final Calibration
Mature Convergence
Conclusions

Static demand adjustment
- Check the network coding
- Collect consistent counts for gates, main intersections, ramps
- Do not abuse the seed demand
- Assign the adjusted demand and check V/C

Dynamic demand adjustment
- Follow poorly fitting flows downstream to identify bottlenecks
- Scale down O-D flows causing the bottleneck with dynamic select-link analysis