MEMO

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FROM: Greg Saur, WSP

CC: Will Tolbert, Ericka Miller, and Matt Duffy; WSP

SUBJECT: IndyGo Blue Line BRT: Mode-Shift Factor

DATE: September 17, 2018

INTRODUCTION

The proposed IndyGo Blue Line BRT (Bus Rapid Transit) will provide high capacity transit along Washington Street/US 40 through Indianapolis, Indiana. Along the route, some general-purpose travel lanes will be converted into dedicated, transit only lanes or business access and transit (BAT) lanes. Implementation of these runningways will result in a decrease in roadway capacity and potentially worsen level of service (LOS) at intersections along the route.

At the same time, the fast, frequent, and reliable BRT service will attract and serve four distinct types of riders:

1. Transit Dependent - those who reside in a household without access to a vehicle and must use transit service to travel beyond reasonable walking or biking distances and are:
    a. Not currently using transit OR
    b. Currently using transit – most likely the existing Route 8 service
2. Non-Transit Dependent - those who reside in a household with access to one or more vehicles and can elect to use a vehicle or transit service to travel distances beyond reasonable walking or biking distances and are:
    a. Not currently using transit OR
    b. Currently using transit – most likely the existing Route 8 service

An increase in type 2b riders, or non-transit dependent riders who are not currently using transit, will result in a travel mode-shift from personal vehicle to BRT usage. This will result in a decrease in the number of vehicles along the corridor.

PURPOSE

The purpose of this memorandum is to explain how existing vehicle volumes, existing local service transit ridership information, and forecasted BRT ridership information was used to develop “mode-shift factors”. The mode-shift factors quantify the number of travelers who currently travel by vehicle but would be attracted to the new BRT service and would elect to instead travel by transit. These factors were applied to existing vehicle volumes along the corridor to account for the reduction in vehicle travel at intersections along the route. The process described below was used to determine appropriate mode-shift factors along the

Blue Line route. It presents the approach that was used for estimating the nexus between an increase in BRT ridership and decrease in vehicle travel.

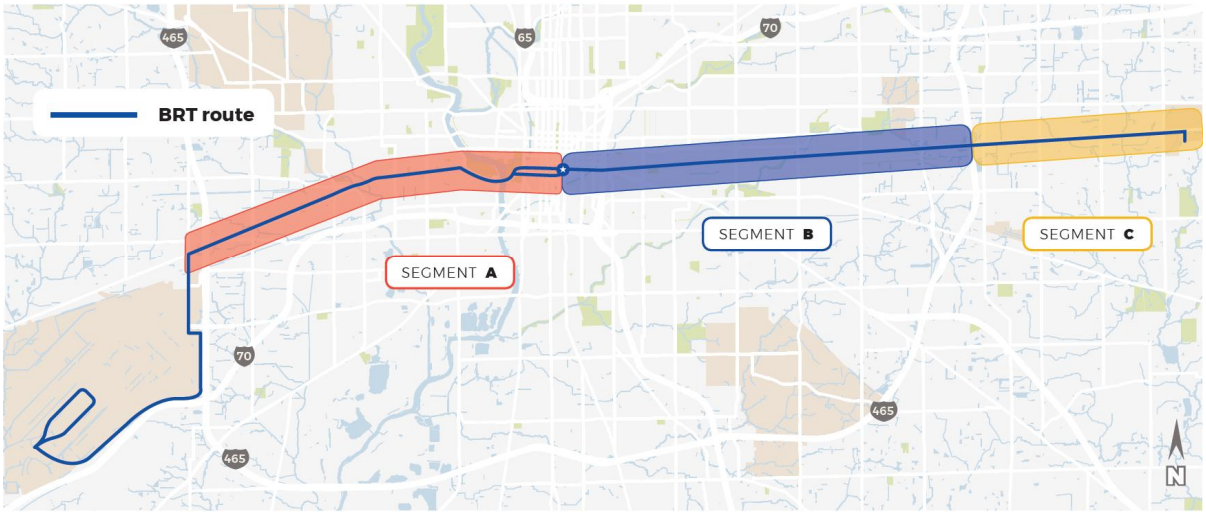
APPROACH

The approach used to determine the mode-shift factors along the Blue Line corridor was separated into the following sections: geography, assumptions, inputs, calculations, and results. Key information on these sections is summarized below; for additional details, refer to the attached spreadsheet.

GEOGRAPHY

The following three segments were identified for separate mode-shift factors based on their distinct land uses, distance to I-465, travel patterns, and traffic volumes:

1. Segment A: The route east of S. High School Rd. and west of the downtown transit center
2. Segment B: The route east of the downtown transit center and west of I-465
3. Segment C: The route east of I-465



ASSUMPTIONS

The following assumptions were made when calculating the mode-shift factors on each of the four segments on the Blue Line Route:

1. Existing traffic data along the corridor is reasonable and representative of a typical weekday
2. Existing transit data along the corridor is reasonable and representative of a typical weekday
3. Forecasted transit data along the corridor is reasonable and representative of a typical weekday
4. A 2-hour vehicle peak period and a 3-hour transit peak period are comparable because the length of transit trip travel times include starting and/or ending a trip outside of the 2-hour vehicle peak period, in addition to the travel time during the vehicle peak period
5. Forecasted transit ridership in the AM peak period is directed to the downtown transit center
6. Forecasted transit ridership in the PM peak period is directed from the downtown transit center
7. Forecasted transit ridership in Segment A represents boardings at all stations within that segment and west of Segment A (Indianapolis International Airport, FedEx, and Infosys)

8 Forecasted transit ridership in Segment B represents boardings at all stations within that segment and Segment C
9 Forecasted transit ridership in Segment C represents boardings at all stations within that segment
10 Forecasted transit ridership is based on preliminary FTA Simplified Trips-on-Project Software (STOPS) results that assume a BRT operating in dedicated lanes for a majority of the route
11 Mode-shift factors must only account for type 2b riders, or non-transit dependent riders who are not currently using transit, but will elect to shift from personal vehicle to BRT usage
12 Separete mode-shift factors must be applied to AM and PM peak hour traffic volumes

INPUTS

Data and Sources

1 Existing Route 8 ridership (provided by IndyGo)
   a Daily ridership
   b AM peak period ridership (6:00 AM – 9:00 AM)
   c PM peak period ridership (3:00 PM – 6:00 PM)

Peak Period	Percent of Daily Ridership
AM	16%
PM	23%

2 Existing intersection traffic counts (collected by WSP)
   a AM peak hour traffic counts (7:15 AM – 8:15 AM)
   b AM peak period traffic counts (7:00 AM – 9:00 AM)
   c PM peak hour traffic counts (4:30 PM – 5:30 PM)
   d PM peak period ridership (4:30 PM – 6:30 PM)

Segment	AM Peak Hour Percent of Peak Period Vehicle Traffic	PM Peak Hour Percent of Peak Period Vehicle Traffic
A	54%	53%
B	55%	53%
C	52%	52%

3. Existing roadway segment traffic counts (obtained from the Indiana Department of Transportation traffic count database)
    a. Annual average daily traffic (AADT) counts
    b. K factor (max hour of traffic density)

Segment	Average AADT	K Factor
A	22,283	10%
B	20,842	10%
C	23,823	10%

4. Preliminary transit ridership forecasts from STOPS (calculated by WSP)
    a. Net new daily transit ridership on the BRT – both transit and non-transit dependent
    b. Net new daily transit dependent ridership on the BRT – only transit dependent

Segment	Net New Daily Transit Ridership on the BRT	Net New Daily Transit Dependent Ridership on the BRT
A	4,162	1,562
B	4,340	2,009
C	1,997	753

5. Existing vehicle occupancy factor (obtained from the Indianapolis Metropolitan Planning Organization)
    a. Vehicle occupancy factor = 1.1 persons per vehicle

CALCULATIONS

Traffic Volumes

Input/Calculation	Variable	Formula	Unit
Annual Average Daily Traffic (Total volume of vehicle traffic on a road for a year divided by 365 days)	AADT	N/A	Vehicles per Day
K Factor (Proportion of AADT occurring in the Max hour of traffic density)	K	N/A	Percent of AADT
Peak Hour Traffic (Total volume of vehicle traffic on a road for the Max hour of traffic density)	PHT	AADT * (K / 100)	Vehicles per Hour
Peak Hour vs. Peak 2-Hour Traffic (AM)	P2KAM	(Vehicles Counted Max hour) / (Vehicles Counted Peak 2-Hours)	Percent of Peak 2-Hours
Peak 2-Hour Traffic (AM)	P2HTAM	PHT / P2KAM	Vehicles per 2-Hours
Peak Hour vs. Peak 2-Hour Traffic (PM)	P2KPM	(Vehicles Counted Max hour) / (Vehicles Counted Peak 2-Hours)	Percent of Peak 2-Hours
Peak 2-Hour Traffic (PM)	P2HTPM	PHT / P2KPM	Vehicles per 2-Hours
Vehicle Occupancy Factor (Average number of persons per vehicle)	VOC	N/A	Persons per Vehicle
Annual Average Daily Person Trips (Total number of daily persons on a road)	AADPT	AADT * VOC	Person Trips per Day
Peak Hour Person Trips (Total number of peak hour persons on a road)	PHPT	PHT * VOC	Person Trips per Hour
Peak 2-Hour Person Trips AM (Total number of peak 2-hour persons on a road)	P2HPTAM	P2HTAM * VOC	Person Trips per 2-Hours
Peak 2-Hour Person Trips PM (Total number of peak 2-hour persons on a road)	P2HPTPM	P2HTPM * VOC	Person Trips per 2-Hours

Transit Ridership

Input/Calculation	Variable	Formula	Unit
Net New Daily Ridership (Total number of daily new riders on the BRT - previously did not use transit)	NNDR	N/A	Riders per Day
Net New Daily Ridership from 0 Car Households (Total number of daily new riders on the BRT from Transit Dependent households)	NNDR0	N/A	Riders per Day
Net New Daily Non-Transit Dependent Ridership	NNDRTD	NNDR - NND0R	Riders per Day
Peak Factor AM (Proportion of daily ridership occurring in the peak period of service)	PAM	N/A	Percent of NNDR
Net New AM Peak Non-Transit Dependent Ridership (Total number of daily new riders on the BRT during the peak period)	NNTDPRA	NNDRTD * PAM	Riders per 3-Hours
Peak Factor PM (Proportion of daily ridership occurring in the peak period of service)	PPM	N/A	Percent of NNDR
Net New PM Peak Non-Transit Dependent Ridership (Total number of daily new riders on the BRT during the peak period)	NNTDPRP	NNDRTD * PPM	Riders per 3-Hours
AM Peak Mode-Shift Factor (Total percentage of existing vehicles that will be removed)	MSAM	(Existing Vehicle Trips – Vehicle Trips Remaining) / Existing Vehicle Trips)	Percent of Existing Vehicle Trips Removed
PM Peak Mode-Shift Factor (Total percentage of existing vehicles that will be removed)	MSPM	(Existing Vehicle Trips – Vehicle Trips Remaining) / Existing Vehicle Trips)	Percent of Existing Vehicle Trips Removed

RESULTS

Daily

		Segment A	Segment B	Segment C
Person Trips	Existing	24,511	22,926	26,205
	Net New Non-Transit Dependent	2,958	3,575	1,244
	Remaining	21,553	19,351	24,961
Vehicle Occupancy Factor		1.1	1.1	1.1
Vehicle Trips	Existing	22,283	20,842	23,823
	Net New Non-Transit Dependent	2,689	3,250	1,131
	Remaining	19,594	17,592	22,692
Mode-Shift Factor		12%	16%	5%

AM Peak Hour

		Segment A	Segment B	Segment C
Person Trips	Existing	4,539	4,168	5,039
	Net New Non-Transit Dependent	473	572	199
	Remaining	4,066	3,596	4,840
Vehicle Occupancy Factor		1.1	1.1	1.1
Vehicle Trips	Existing	4,126	3,789	4,581
	Net New Non-Transit Dependent	430	520	181
	Remaining	3,696	3,269	4,400
Mode-Shift Factor		10%	14%	4%

PM Peak Hour

		Segment A	Segment B	Segment C
Person Trips	Existing	4,624	4,325	5,039
	Net New Non-Transit Dependent	680	822	286
	Remaining	3,944	3,503	4,753
Vehicle Occupancy Factor		1.1	1.1	1.1
Vehicle Trips	Existing	4,204	3,932	4,581
	Net New Non-Transit Dependent	618	747	260
	Remaining	3,586	3,185	4,321
Mode-Shift Factor		15%	19%	6%

CONCLUSION

The process described above is theoretically sound and represents a reasonable approach for estimating the nexus between an increase in BRT ridership and decrease in vehicle travel. The resulting mode-shift factors will be applied to existing vehicular volumes along the corridor to account for the reduction in vehicle travel at intersections along the route; mode-shift factors will be applied to all movements along Washington Street except cross-street through volumes.