Transit Pre-Planning and Data Collection for Multi-Modal Corridor Studies





November 15th, 2013

Topics

- Motivations
- Overview
- Results and findings
- Reactions and refinements



MOTIVATIONS





The Problem

- Multi-modal corridor studies typically suffer from lack of corridor-level transit data that is
 - Up-to-date,
 - Sufficiently detailed, or
 - Of sufficient quality for corridor analysis

• Pre-planning for these types of studies is generally limited to the collection readily-available, system-/region-wide travel data



Objectives

- Identify issues in advance to inform project scope development
- Move data collection and model development outside of the project
 - Better control of costs/delivery of the data and models
 - Reduce study distractions from the data/model work
 - Keep focus on the study analysis and consensus efforts
- Faster delivery of projects to NEPA/design phases
- Reducing PM stress and extending life expectancy ©



OVERVIEW





The Tasks

- Data collection
 - Corridor-focused surveys
 - Auto travel time survey
 - Gathering of readily-available data sources:
 - CTPP, ACS, INRIX, BCT's 2009 COA and SERPM-related data
- Corridor analysis & refinement of technical tools
- Products
 - Expanded survey data
 - Cumulative data "package"
 - Corridor-refined SERPM and/or simplified model
 - Preliminary Case for the Project



Why Corridor-focused Surveys?

- The 2010 BCT system-wide on-board survey provided an overview of the system-wide travel patterns of the patrons
- This is helpful to understand patterns and demographics at a system-level, but not as helpful for individual corridors →
 System-wide averages are computed from the diversity of values at the route-level
- Corridor-focused surveys provide more focused understanding of travel patterns in individual corridors: travel flows, transfer movements, and demographic information
- The resulting data can be used for developing simplified transit model or refining SERPM for these corridors



Types of Corridor-focused Surveys Conducted

- Ons and offs counts survey provides
 - Number of boarding/alighting activities at each stop along the route for each bus run
- Boarding-to-Alighting survey provides
 - Boarding and alighting stop locations of the riders
 - Distance and time traveled by riders on the bus
- Origin-destination survey provides
 - Trip origin and destination locations of the riders
 - Purpose of the trip
 - Transfer information
- Platform survey provides
 - Understanding location-specific issues



Route-Specific Transit Data Collection

- Two surveys conducted simultaneously
 - Boarding-to-alighting (B2A) survey
 - Captures boarding and alighting stops for each rider
 - Card distributed to rider, and returned to surveyor when rider alights
 - 40-55% sample rate (at least 4-5x standard transit O/D survey)
 - Simplified main survey, asking questions oriented to route:
 - Origin and destination
 - Up- and down-stream transfers
 - Trip purpose
 - Others as necessary
 - ~20% sample rates (2-3x standard transit O/D survey)
- Main survey data linked to B2A data → route-specific rider database
 - Easily converted into trip table



Survey Methodology (Overview)

- Coordination with BCT staff prior to the survey
 - Dispatch, supervisors, bus drivers were informed of the survey efforts
 - Survey flyers posted on the buses two weeks prior to the full survey
 - Obtained route schedule block sheets and available GFI/APC data prior to the surveys
- Sampling plan
 - Weekday surveys only
 - 50% local bus runs and 100% of the Breeze runs
 - Survey targets after cleanup
 - 80% B2A response (i.e. 40% local riders and 80% Breeze riders)
 - 50% of the B2A respondents for OD responses (i.e. 20% local riders and 40% Breeze riders)
- Surveyor training and pilot surveys conducted prior to the full survey
- B2A and OD records linked together, and expanded to daily boardings



Survey Instrument for Collecting B2A Data

- A 4" by 5.5" heavy stock card with a scannable barcode is handed to the riders while boarding and is collected when they get off the bus.
- A surveyor uses IPhone to scan the boarding time and location just before handing the card and another surveyor scans the alighting time and location just after the rider hands over the card.





Survey Instrument for Collecting OD Data

- Personal interview
- Questions loaded on IPad with drop-down list of possible answers
- Real-time
 - Accumulation of the data
 - QA-QC of the data
 - Geocoding of the address responses

University Drive IP ad Interview Survey Questionnaire (in the order of the how they were asked)

- What type of place are you coming from? (Drop down list available home, work, doctor/hospital/medical, mall/shopping, social/entertainment/restaurant, hotel/motel, school/daycare, college/university or other)
- 2. What is the address of the place from where you started this trip? (Google Map interface available)
- Did you transfer from another route to get to Route 2 (or University Drive Breeze) for this trip? If yes,
 - i. Which route? (Drop-down list available all possible transfer routes including community buses)
 - ii. Did you transfer from another route to get to that route?
 - iii. If yes, which route? (Drop-down list available all BCT routes, community buses, MDT, Tri-Rail, Metrorail, 95 Express, Palm Tran)
- 4. What type of place are you going to? (Drop down list available home, work, doctor/hospital/medical, mall/shopping, social/entertainment/restaurant, hotel/motel, school/daycare, college/university or other)
- 5. What is the address of the place are you going to? (Google Map interface available)
- 6. Will you transfer to another route after Route 2 (or University Drive Breeze)? If yes,
 - i. Which route? (Drop-down list available all possible transfer routes including community buses)
 - ii. Will you transfer to another route after you get off that route?
 - iii. If yes, which route? (Drop-down list available all BCT routes, community buses, MDT, Tri-Rail, Metrorail, 95 Express, Palm Tran)



Page 13

Auto Travel Time Survey

- Using Bluetooth technology
- Provides segment to segment travel times
- 3 days at each location
- 2-5% capture rate (based on AADT)







AECOM

Readily-Available Data

- Population, employment, households by auto-ownership, workers and enrollment for 2010 and 2035 (source: SERPM 6.7)
- Person trip flows by purpose for 2010 and 2035 (source: SERPM 6.7)
- Work trip flows from 2000 Census and latest American Community Survey (sources: CTPP 2000, ACS)
- Daily vehicle volumes, counts, and V/C ratios for 2010 and 2035 (source: FDOT, SERPM 6.7)
- INRIX auto speeds (source: INRIX dataset)
- Transit operating speeds/travel times between time points from APC or other data
- Person trips by purpose for 2010 and 2035 (source: SERPM 6.7)
- Transit travel and rider characteristics for corridor riders (source: 2010 BCT survey)
- Operational metrics for corridor routes (e.g., on-time performance, passengers per revenue mile, etc.) (source: 2009 BCT Comprehensive Operational Analysis)
- Estimated transit boardings for 2010 and 2035 (source: SERPM 6.7)



RESULTS and FINDINGS



Corridor-focused Surveys

Corridor	Routes Surveyed	Weekday Boardings	Survey Timeframe	Types of Surveys (with Sample Rate*)	Survey Method	
Oakland Park Blvd	Route 72	~9,000	Apr-May 2012	On-off count by stop (100%) Boarding-to-Alighting (17%) Origin-destination (17%*)	Manual counting / Tablet-based interviews	
SR-7	Route 18, 441 Breeze	~16,300 ~2,700	Nov-Dec 2012	Boarding-to-Alighting (50+%)	APC for On/offs; GPS tracking device;	
University Drive	Route 2, University Breeze	~7,100 ~1,000	Jan-Feb 2013	Origin-destination (20+%)	IPhone scanner for B2A; Tablet-based interview for OD	
US-1	Route 1, US-1 Breeze	~7,150 ~1,050	Sep-Oct 2013	On-off count by stop (100%) Boarding-to-Alighting Origin-destination	Manual counting; IPhone scanner for B2A; Tablet-based interviews	

*percent of average weekday riders

Lessons learned from Oakland Park Blvd survey efforts helped revise the survey methodologies, survey plans and QA/QC efforts for the subsequent surveys.



A Comparison of Approaches: An Actual Example (Route 18)

	Traditional (Regional transit survey)	With Pre-Planning & Data Collection (Corridor-specific transit survey)	Notes
Riders making at least one transfer	49%	67%	More riders transferring than previously thought;
Top 4 transfer routes	22, 72, 34, 36	72, 36, 7, 34	different routes and magnitudes
Percentage of work trips	43%	49%	Relatively similar
Average trip length (overall)	rip length 8.33 miles 7.18 m		Previous estimates over-
Average trip length (on bus)	6.54 miles	4.93 miles	trip response bias)
Sub-route travel movements	Insufficient information	Detail information; created trip table	Now have better data to inform route planning

Result: Improved, refined understanding of corridor transit travel patterns



AECOM

Findings (Overview) 1/3

Item	Route 18	Route 2	Route 72
Daily boardings	16,300	7,100	9,000
Major activity segment	60% riders board <u>and</u> alight between Davie Blvd and Sample Rd	Fairly evenly distributed throughout the route	58% riders board <u>and</u> alight between University Drive and US-1
% of trips beginning & ending in 'study area'	os beginning & 62% 77% in 'study area'		Not Available
% work trips	49%	52%	48%
% riders making at least one transfer	67%	64%	55%
% riders making two or more transfers	20%	15%	17%
Top 4 transfer routes (in order) – number shown is the # transfers to/from the route	#72-Oakland Park (1,315) #36-Sunrise Blvd (1,088) MDT#77-NW 7 th Ave (722) #7-Pines Blvd (714)	#72-Oakland Park (612) #7-Pines Blvd (572) #22-Broward Blvd (450) #36-Sunrise Blvd (338)	#18-SR-7 (1,411) #2-University Dr (775) #31-NW 31 st Ave (534) #81-Lauderhill-BCT (507)
Average trip length on bus	4.96 miles (25 minutes)	4.97 miles (24 minutes)	3.59 miles (20 minutes)



AECOM

Findings (Overview) 2/3

	Route 18	441 Breeze
Daily boardings	16,300	2,700
Major activity segment	60% riders board <u>and</u> alight between Davie Blvd and Sample Rd	Fairly evenly distributed throughout the route
% of trips beginning & ending in 'study area'	62%	64%
Average dwell time / stop	15 seconds	36 seconds
% work trips	49%	58%
% riders making at least one transfer	67%	76%
% riders making two or more transfers	20%	28%
Top 4 transfer routes (in order) – number shown is the # transfers to/from the route	#72-Oakland Park (1,315) #36-Sunrise Blvd (1,088) MDT#77-NW 7 th Ave (722) #7-Pines Blvd (714)	#72-Oakland Park (289) #28-Miramar Pkwy (218) #34-Sample Rd (215) #7-Pines Blvd (143)
Average trip length on bus	4.96 miles (25 minutes)	9.10 miles (34 minutes)

Findings (Overview) 3/3

	Route 2	Univ Dr Breeze
Daily boardings	7,100	1,000
Major activity segment	Fairly evenly distributed throughout the route	Fairly evenly distributed throughout the route
% of trips beginning & ending in 'study area'	77%	60%
% work trips	52%	71%
% riders making at least one transfer	64%	77%
% riders making two or more transfers	15%	23%
Top 4 transfer routes (in order) – number shown is the # transfers to/from the route	#72-Oakland Park (612) #7-Pines Blvd (572) #22-Broward Blvd (450) #36-Sunrise Blvd (338)	#72-Oakland Park (116) #7-Pines Blvd (58) #55-Commercial Blvd (50) #36-Sunrise Blvd (48)
Average trip length on bus	4.97 miles (24 minutes)	9.44 miles (31 minutes)





Corridor-Focused Surveys: List of Data Items

- Boardings and alightings by stop by direction by time period
- Rider flows by stop segment
- Number of transfers
- Tabulation of routes transferred to/from
- District-to-district flows
- Survey TAZ-to-TAZ trip tables
- Dwell/delay times by stop
- Distributions of distance traveled, in-vehicle travel time, access/egress distance
- Map of trip productions and attractions
- "Desire" maps



BCT Route #2/#102 Transit Rider Desire Map



AECOM

On to Off Transit Trips (Daily)

Daily	1	2	3	4	5	6	7	8	9	Grand Total]
1 - Golden Glades - County Line Rd	424	480	466	57	164	103	37	23	5	1,760	
2 - County Line Rd - Hollywood Blvd	671	380	375	46	167	57	19	8	8	1,732	
3 - Hollywood Blvd - Griffin Rd	313	422	452	121	365	96	50	26	9	1,854	
4 - Griffin Rd - Davie Blvd	29	70	176	43	145	102	21	3	8	598	
5 - Davie Blvd - NW 12th St	146	167	329	177	658	811	245	126	26	2,684	Route 18
6 - NW 12th St - Commercial Blvd	95	122	174	73	768	1,337	671	364	78	3,682	
7 - Commercial Blvd - Atlantic Blvd	43	33	48	34	296	601	506	511	81	2,153	
8 - Atlantic Blvd - Turtle Creek/Sample Rd	14	14	19	8	135	267	380	491	130	1,458	
9 - Turtle Creek/Sample Rd - Sandlefoot Blvd	2	1	5	-	15	58	72	102	89	344	
Daily Total	1,738	1,689	2,044	559	2,712	3,434	2,000	1,655	434	16,264	
									Top 10 S	Segment Trips	

- ~60% of the activity between Davie Blvd and Sample Rd.
- ~37% activity south of Davie Blvd.
- ~27% of the trips begin and end within the same segment.

Daily	1	2	3	4	5	6	7	8	9	Grand Total	
1 - Golden Glades - County Line Rd	93	82	102	23	58	56	16	36		465	
2 - County Line Rd - Hollywood Blvd	139	35	34	14	32	37	14	38		344	
3 - Hollywood Blvd - Griffin Rd	26	47	41	18	27	74	39	34		305	
4 - Griffin Rd - Davie Blvd	11	19	17	8	24	33	14	24		151	
5 - Davie Blvd - NW 12th St	64	38	35	16	32	52	23	31		290	111 Broozo
6 - NW 12th St - Commercial Blvd	81	61	56	49	55	44	35	75		456	441 DIEEZE
7 - Commercial Blvd - Atlantic Blvd	36	43	17	25	43	59	36	57		315	
8 - Atlantic Blvd - Turtle Creek/Sample Rd	42	42	36	21	57	80	48	50		377	
9 - Turtle Creek/Sample Rd - Sandlefoot Blvd										-	
Daily Total	491	367	337	173	328	436	225	346	-	2,703	
									Top 10	Segment Trips	

- Similar amount of activity throughout the route
- ~13% of the trips begin and end within the same segment.





Route 18 and 441 Breeze CDF – Distance Traveled



Average travel distance (miles) #18 – 4.96 miles Average travel distance (miles) 441 Breeze – 9.10 miles



Simplified Model: Definition

- Straightforward calculations/representation of relatively simple and predictable project situations
- Some advantages
 - Straightforward; minimal "moving parts"
 - Reduced development costs
 - Reliable insights
 - Encouraged by FTA where appropriate
- Some disadvantages
 - Generally focused on specific corridors (not regional)
 - May not be able to evaluate wide range of alternatives and markets



Simplified Model: Broward County

- Three main ingredients
 - 1. Route-specific transit data,
 - 2. Auto skims, and
 - 3. Auto/transit networks from regional travel model
- Incremental logit mode choice model (pivot-point)
 - Suggested in TCRP Report 118: BRT Practitioner's Guide
 - Auto and all transit travel modes
 - Peak and off-peak time periods
 - HBW, HBO and NHB trip purposes
 - Zero-car households and households with car
- Development time/cost: 1 month and ~\$30,000 (for BCT's highestridership route; ~25 miles in length)
- 15% of regional model running time (6x faster)



Simplified Model: Calibration Results (1)

Route 18 and 441 B	Breeze Daily Activity Analysis	Route 18						
C	Corridor Segment	Average Weekday Activity ([Ons+Offs]/2)						
From	То	Observed	Estimated	Difference	Estimated/ Observed			
Golden Glades	County Line Rd	1,801	1,482	(319)	0.82			
County Line Rd	Hollywood Blvd	1,935	1,967	32	1.02			
Hollywood Blvd	Griffin Rd	1,690	2,028	338	1.20			
Griffin Rd	Davie Blvd	579	827	248	1.43			
Davie Blvd	NW 12th St	2,701	2,699	(2)	1.00			
NW 12th St	Commercial Blvd	3,556	3,332	(224)	0.94			
Commercial Blvd	Atlantic Blvd	2,072	2,193	121	1.06			
Atlantic Blvd	Sample Rd	1,565	1,669	104	1.07			
Sample Rd	Sandlefoot Blvd	419	590	171	1.41			
	Total	16,318	16,786	468	1.03			

*Activity is defined as (Boardings + Alightings)/2

*Observed boardings obtained from 2012 Route 18 and 441 Breeze boardings/alightings survey

Very good results, even at sub-route level...



Transit Pre-Planning - DRAFT

Simplified Model: Calibration Results (2)

Route 18 and 441 B	Breeze Transfer Analysis	Route 18					
Route No.	Description	2012 Observed Transfer Boardings	% of 2012 Observed Transfer Boardings	Estimated Transfer Boardings	% of Estimated Transfer Boardings		
92	Palmetto Park Rd Local Bus	162	2%	75	1%		
91	Glades Rd Local Bus	151	2%	153	2%		
72	Oakland Park Blvd Local Bus	1,315	13%	1,099	12%		
36	Sunrise Blvd Local Bus	1,088	11%	1,267	14%		
7	Pines Blvd Local Bus	714	7%	464	5%		
34	Sample Rd Local Bus	697	7%	446	5%		
28	Miramar Pkwy Local Bus	681	7%	932	10%		
55	Commercial Blvd Local Bus	630	6%	632	7%		
22	Broward Blvd Local Bus	539	5%	608	7%		
81	West Tamarac to BCT	505	5%	148	2%		
40	Sistrunk/17 St/A1A	411	4%	255	3%		
62	Cypress Creek/McNab Local Bus	409	4%	514	6%		
9	Young Circle to BCT	351	4%	621	7%		
42	Atlanticd Blvd Local Bus	333	3%	393	4%		
83	Copans Rd Local Bus	295	3%	359	4%		
77	NW 7th Ave MDT	722	7%	593	7%		
22	22nd Ave MDT	475	5%	325	4%		
183	Miami Gardens Dr MDT	346	4%	214	2%		
	Subtotal	9,824	100%	9,098	100%		



Transit Pre-Planning - DRAFT

REACTIONS and REFINEMENTS



A Comparison of Approaches

	Traditional	With Pre-Planning & Data Collection
Available corridor transit data	Aggregate boarding/alighting counts (by stop?), sometimes outdated	Stop-to-stop movements with travel details
Knowledge of corridor issues, ridership patterns	Anecdotal, general	Detailed understanding
Technical tools available	Regional travel model, TBEST	Enhanced regional travel model, simplified models
Applicability of technical tools	Regional model assumed to be applicable and "good to go" for corridor analysis	Developed/Enhanced with corridor in mind
Corridor analysis scope of work	Generic	Tailored to corridor needs and transportation problems
Percentage of AA/Systems Planning budget devoted to data collection	Significant	Minimal
AA/Systems Planning schedule delay risk	High	Low
Transit Pre-Planning - DRAFT Novembe	r 15, 2013 Page 31	ALCOM

Reactions / Summary

- Highly favorable reactions by FTA, BCT and FDOT
- Pre-planning & data collection efforts provide many benefits to transit planners
 - Improved understanding of corridor
 - Focused use of resources
 - Reduced schedule delay in corridor studies
- Tailoring methodology to specific corridors
 - 'Platform' surveys to better assess transfer movements
- Increasing awareness of rider patterns and traditional surveying limitations
 - Traditional surveys appear to over-estimate trip lengths
 - Breeze riders use routes to make longer trips in peak period.



• THANK YOU!

