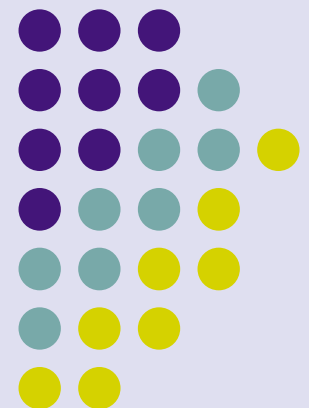# Data on Ridership Patterns – Collection Methods

Session 4

- Motivations and FTA requirements
- Thoughts on good practice
  - Data collection plan, initial planning
  - Sample size, sample expansion, ancillary data
  - Survey instruments, data items
  - Pilot tests, fielding the survey
  - Data processing
- Innovative approaches

Motivations

- Understand current role of transit
    - Model development
    - Case for project
- Understand completed projects
    - Before-and-after
    - Predicted-versus-actual

FTA Requirements

- Testing of models against current data
  - Required for entry to PE/PD (effective May 2009)
  - Data adequate to the task
  - Case-by-case determination of adequacy by FTA
- Before-and-After Studies
  - Data collection on transit ridership patterns
  - Eligible for FTA funding

- Discretionary funding in 2007 (5339 program)

Thoughts on Good Practice
Data Collection Plan

- Identify key markets
  - Major travel patterns
  - Commuters, students, shoppers, other
  - Park-ride (formal/informal) and kiss-ride
  - Special generators/events
- Fit program to the purpose and setting
  - On-board rider survey is typical approach
  - Intercept, telephone, and others may be OK too
  - Appropriate instrument for each market

Thoughts on Good Practice
Initial Planning

- Sufficient budget and schedule
  - System, corridor, other
  - Weekday travel, other
- Agency and contractor responsibilities
  - Fielding of pilot tests and main survey
  - Collection of ancillary data
  - Processing, geocoding, quality control, cleanup, expansions

Thoughts on Good Practice
Sample Size

- Practice = confidence/error levels by route
  - Applicable to just one binary variable choice
  - Low-ridership routes over-sampled
- Alternative approaches
  - Sampling based on linked-trip table
  - Consideration of transit markets (students, circulation?)
  - Stratified random sampling (park-ride?)
  - Needs for individual tasks (model estimation, transit trip tables, pathbuilder testing, access markets, etc.)

Thoughts on Good Practice
Sample Expansion

- Each transit line is its own sampling universe
  - Transfers uninvolved in expansion of <u>line boardings</u>
  - Transfers crucial in calculation of <u>linked trips</u>
- Accounting for transit riders not sampled
  - Persons under N years old
  - Problem: in the counts, not in the survey forms
  - Crucial to count separately, recognize in expansion
  - Separate survey effort for excluded riders?

Thoughts on Good Practice
Sample Expansion

- Recognition of non-response biases
  - Trip purpose
  - Income, education, language, age
  - Time of day
  - Length of time spent on surveyed vehicle
- Detection/correction of non-response biases
  - Ancillary data to control sample expansion
  - Multi-dimensional sample expansion

Thoughts on Good Practice
Sample Expansion

- Disaggregated sample expansion
  - Tradition: unique factor for each route/time-period/direction
  - Better: unique factor for each train/bus at each station/stop
  - Aggregation only where necessary to avoid very large factors
  - A contribution to controlling for non-response biases

Thoughts on Good Practice
Sample Expansion

- Multi-dimensional sample expansion
  - Primary
    - Dimensions: boarding location, alighting location
    - Fratar (iterative proportional fitting)
    - Seed matrix: survey records or on-to-off counts
  - Supplemental
    - Counts of boardings by access mode
    - Counts of alightings by egress mode
    - Socio-economic characteristic(s)
    - Others?
  - Research and software development

Thoughts on Good Practice
Ancillary Data for Expansion

- On and off passenger counts (by age, etc.?)
- Counts of access and egress modes
  - Counts of parked cars
  - Vehicle arrival counts for kiss-ride
  - Short interviews or questionnaires
- On-to-off counts
  - "Smart fare card" data
  - Short interviews or questionnaires

Thoughts on Good Practice
Survey Instrument(s)

- Rider-completed forms
- Personal interviews
  - On-board or at stations
  - Critical: random approaches of boarders
- Other
  - Phone interviews
  - Handout of forms at schools
  - Use of personal GPS devices

Thoughts on Good Practice
Data Items - Trip Characteristics

- ## Origin
  - Location, purpose, transit access mode
  - Park-ride location

- ## Transit path
  - Full set of O-to-D transit lines used
  - Boarding and alighting stop for surveyed vehicle

- ## Destination
  - Location, purpose, transit egress mode
  - Park-ride location

Thoughts on Good Practice
Data Items - Traveler Characteristics

- Person
  - Driver's license
  - Perhaps age, worker/student, gender, etc.?
- Household
  - Vehicles
  - Persons/adults/drivers/workers
  - Income?
  - Others?

Thoughts on Good Practice
Pilot Tests

- Sufficient time to conduct/analyze
- Testing of instrument only
  - In-field collection
  - Cognitive interviews
- Testing all survey mechanics
- Comparative tests
- Non-respondent interviews

Thoughts on Good Practice
Fielding the Survey

- Staffing
  - Experienced/motivated crews
    - Training and testing
    - Small number of workers over many days?
- Quality control checks
  - Adherence to in-field procedures
  - Daily checks of collected forms

Thoughts on Good Practice
Data Processing

- Geocoding
    - Note on record the method for lat/long identification
        - Address, place name, intersection, zip code
        - Note any difficulties encountered
    - Manual check of unusual paths
        - Could be geocoding or other reporting error
        - Long walk access/egress distances
            - When first boarding or last alighting location is known
        - Origin, boarding, alighting, and destination sequence
            - Reasonability of routes used

Thoughts on Good Practice
Data Processing

- Other quality control checks
  - Note: not all records can be cleaned up
    - Avoid over-imputation
    - Insights from partially-complete records
  - Pathbuilder checks may reveal data errors
    - E.g., does a no-transfer ride even exist?
  - Home purpose at both ends

Innovative Approaches

- Atlanta
  - Tests of personal interview approach
- Los Angeles
  - Phase A research and pilot tests
  - Phase B main survey
- Oklahoma State University tests
  - Distribution (male, <u>female</u>, box)
  - Length of form (<u>short</u>, moderate, long)
  - Incentives (<u>free pass drawing</u>, two free-ride tickets)

Data on Ridership Patterns – Some Examples

Session 5

- **Pilot Tests for 2008 On-Board Survey in Columbus, Ohio**
  - David Schmitt, AECOM
- **Ancillary Counts for 2008 Tri-Rail On-Board Survey in Florida**
  - David Schmitt, AECOM
- **Quality Control Checks for 2007 Dallas On-Board Survey**
  - Arash Mirzaei, NCTCOG
- **Planning for 2008 On-Board Surveys in Fort Worth and Denton**
  - Arash Mirzaei, NCTCOG
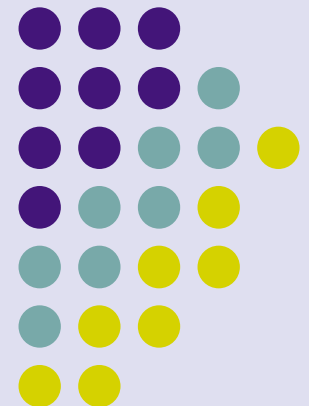
Pilot Tests for 2008 On-Board Survey in Columbus, Ohio

Dave Schmitt, AECOM

Special Thanks

- Zhuojun Jiang, MORPC
- Mike Bradley & Mike McCann, COTA
- Rebekah Anderson & Greg Giaimo, ODOT
- Jesse Casas & Fred G'sell, NuStats
- Bob Donnelly, PB
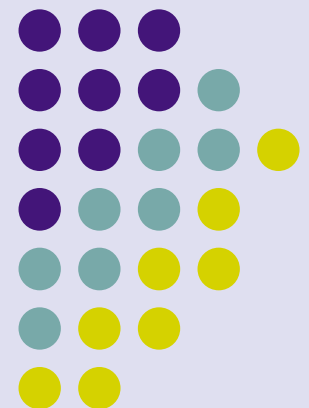
Motivations

- Detect and correct potential non-response bias
  - Public school & university students: boarding counts by <16, 16+ student, 16+ other categories
  - Short trips: systemwide APC on/off counts
  - Auto-access trips: vehicle counts at park-ride stations
- Develop multi-dimensional cross-tabulations to learn about rider patterns
- Assign survey trip table to transit network
- Verify pathbuilding parameters & assumptions
  - Access distances
  - Parking location of auto-access trips
  - Drop-off location of kiss-ride trips
  - University student vs. non-university student transit paths

Central Ohio Transit Authority

- Ohio's 3rd largest transit service provider
- ~55,000+ average weekday boardings
- 65 routes
- ~300 fleet size
- Last on-board survey conducted in 1993

Schedule

Activity	Completion
Kick-off	May 2008
Survey plan	June 2008
Pilot test fieldwork	July 2008
Pilot test analysis	August 2008
Main survey fieldwork	October 2008
Main survey analysis	April 2009
Final report	May 2009

Key Pilot Test Questions

- How can we improve the usability of partially completed surveys?

- What is a good way to reliably get the alighting stop?

- How can we collect tour travel information?

Improving the Usability of Partially Completed Surveys

Version "A"	Version "B"
Home address	Home address
Origin location	Path routes
Access mode	Access & egress modes
Path routes	Reason for the trip
Alighting stop & destination location	HH characteristics
Egress mode	Person types
Fare	Origin & destination locations and alighting stop
HH characteristics & person types	Fare
Socio-economic characteristics	Socio-economic characteristics

• Theory: short-trippers don't have time to complete survey, so front-loading key questions should improve usability of partially completed surveys

• Developed version "B" of the survey form which front-loads the critical questions

• Version "A" followed conventional path questioning

Results from Alternate Forms

Version	Completed Surveys	Useful Partial Surveys	Non-Useful Partial Surveys
A	403	136	53
B	392	175	36

- Alternate survey form did succeed in producing more usable partially completed surveys
- The definition of a "complete" survey (finalized after pilot survey fieldwork) included fields not front-loaded in "B" form, so version "B" not used in main survey
- Lesson learned: definition of a "complete" survey should be finalized <u>prior</u> to testing alternate forms

Determining the Alighting Stop

- Three options used in pilot test
  - Respondent – asked "where will you get off this bus?"
  - Surveyor – when feasible, recorded alighting stop on survey as respondents alighted
  - Post-process – alighting stop imputed using route direction and time of day, destination location, egress mode, path routes, bus stops
    - Alighting imputation will be incorrect if any piece of this information is incorrect or incomplete

Determining the Alighting Stop
Results

- All 3 results available from 237 of 699 total completed records

- Imputation matched surveyor and respondent responses 77% of the time

- Resources did not allow having 3rd surveyor on main survey, so respondent and imputation will be used for final dataset

- Imputation process can be useful QC on survey information because of the consistency required among the multiple record fields

Capturing Tour Travel Information

- Problem: MORPC's model determines mode according to characteristics of the tour, but typical on-board survey captures solely trip characteristics
  - Need to balance capturing the other travel information on the tour while minimizing burden on respondent
- Developed additional form to capture all trips made throughout the day
  - Form is distributed with on-board survey to all riders
  - Respondents expected to mail back survey
- Findings: general agreement between on-board and tour records
- Conclusion: maintain form with minor adjustments and distribution process in main survey

Pilot Test Results
Production-to-Bus Stop Distance
Bus Stop-to-Attraction Distance

• Graphing access & egress distances helped to assess initial geocoding efforts and the ability of the survey instrument to capture address information

Cumulative distribution plot of PNR and KNR Access Distances

Access distance (miles)

— PNR Access Trips — KNR Access Trips

Cumulative distribution of walk access and egress distances (Records with no transfers)

Walk distance (miles)

— Walk Access — Walk Egress
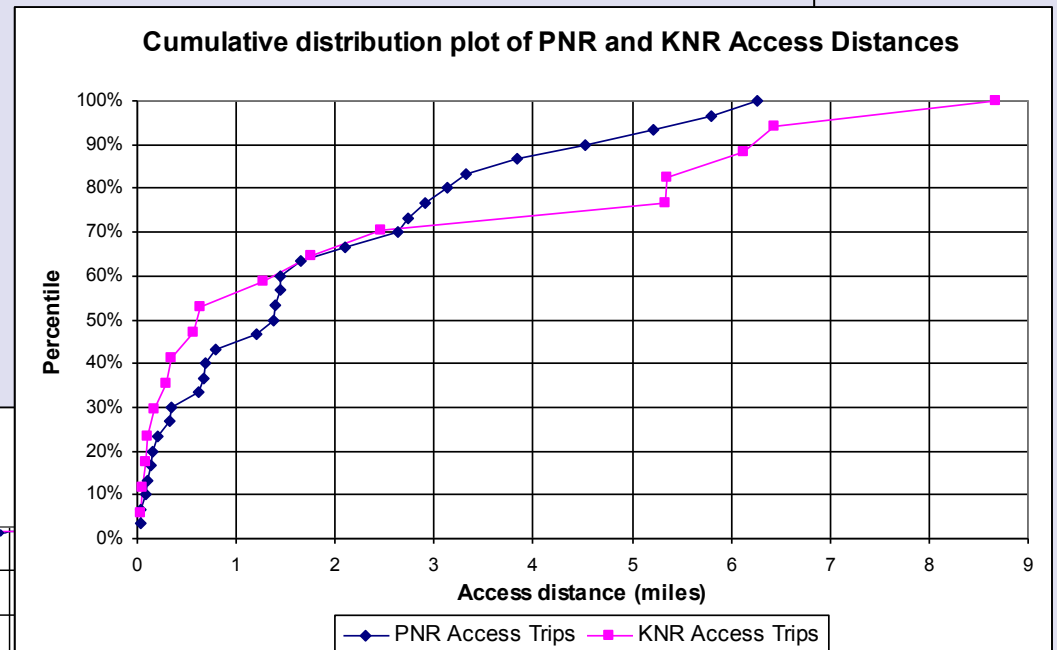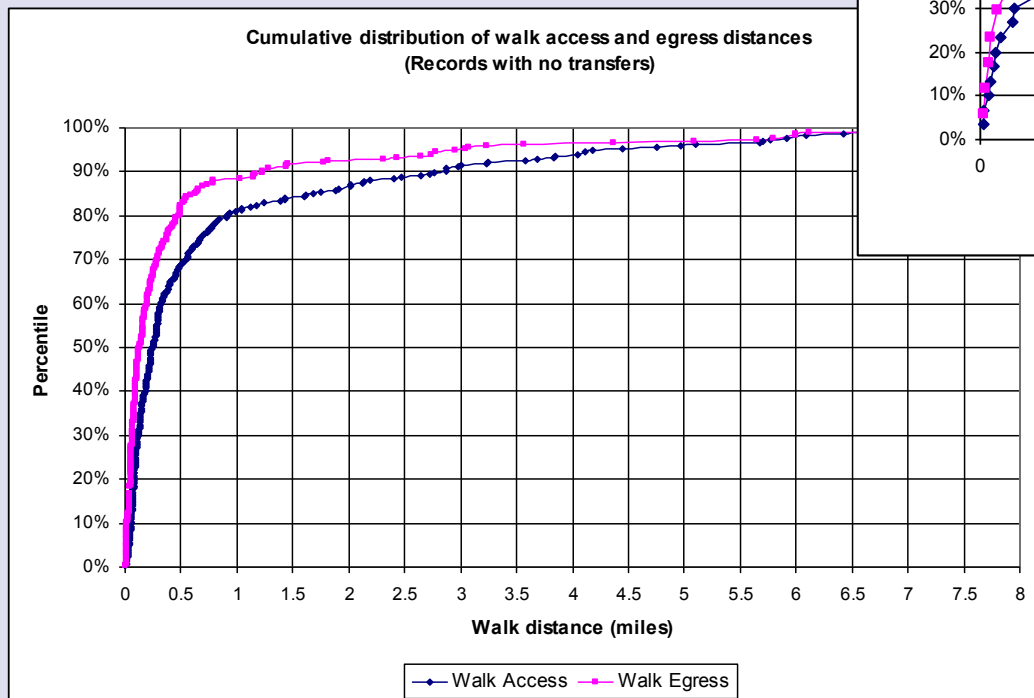
Graphs reflect records in P/ A format

Pilot Test Findings

- Front-loading key questions on the survey form does produce more useful partially completed surveys

- Automated imputation procedures for alighting locations are not foolproof, so the question should remain on the instrument

  - They can be helpful in assessing reasonableness of survey record

- An auxiliary survey form is a useful way of capturing tour information

Lessons Learned

- The pilot test was helpful for:
  - Identifying benefits and issues with capturing the alighting location
  - Testing the auxiliary survey form for capturing tour information
  - Conducting a thorough analysis of the pilot dataset
  - Revising the main survey instruments to maximize response rates and data usability
- Testing the alternate survey form was not as helpful as intended because the definition of a "complete" survey was not finalized early in the process
- Modelers and survey firms come together with different perspectives on pilot surveys, so data collection efforts have to include sufficient scope, schedule, and budget in enough detail so that the pilot can be used most effectively

Ancillary Counts for 2008 Tri-Rail On-Board Survey in Florida

Scott Seeburger, Florida DOT

Peter Haliburton, Cambridge Systematics

Yongqiang Wu, Gannett-Fleming

David Schmitt, AECOM
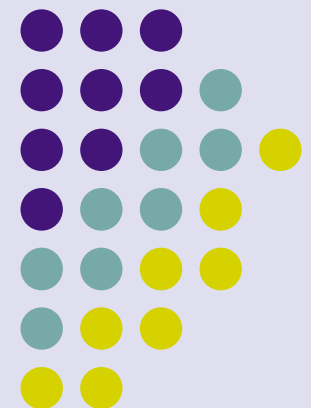
Tri-Rail

- 72-mile commuter rail system
- 18 stations across 3 counties
- 1:45 traveling time
- About 50 trains/day
- ~16,000 daily riders
- Not easily accessible to any major attraction by walking
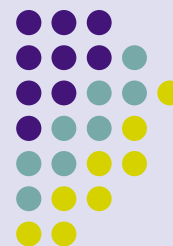
Survey Schedule

Survey plan	September 12th
Pilot test fieldwork	October 8th
Pilot test analysis	October 15th
Main survey fieldwork	October 21st – November 14th
Main survey analysis	February 19th
Final report	March 4th

Survey Objectives

- Confirm existence of non-traditional travel markets discovered in 2007 on-board survey
  - Overnight parking
    - Drive-Tri-Rail - Airport - Tri-Rail - Drive trips
    - Drive - Tri-Rail - Drive trips
    - Drive - Tri-Rail - Pickup trips
  - Walk and drop-off access
  - Auto egress
  - High school students
  - Short trips
- Detect and correct for non-response bias in traditional and non-traditional markets
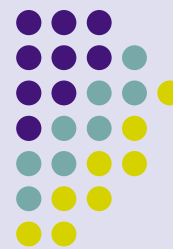
Travel Markets & Collection Strategy

Travel Market	Collection Strategy
Overnight parking	Count vehicles 30 minutes prior to 1st train; Strengthened response items to egress question
Walk & drop-off access	Count modes of access and egress at stations (including school bus)
Auto egress	
High school students	
Short trips	Conduct intercept surveys on platform ("What station are you traveling to?")
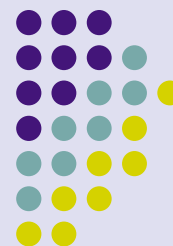
Collection Plan by Station

#	Station	Parked Vehicles	Access Mode	Station O/D	Alighting Counts	Egress Mode
1	Mangonia Park	√	√	√	√	√
2	West Palm Beach	√	√	√	√	√
3	Lake Worth			√		√
4	Boyton Beach	√	√	√	√	√
5	Delray Beach					
6	Boca Raton	√	√	√	√	√
7	Deerfield Beach	√	√	√	√	√
8	Pompano Beach			√		√
9	Cypress Creek	√	√	√	√	√
10	Ft. Lauderdale	√	√	√	√	√
11	Ft. Lauderdale Int'l Airport	√	√	√	√	√
12	Sheridian					
13	Hollywood	√	√	√	√	√
14	Golden Glades	√	√	√	√	√
15	Opa-Locka					
16	Metrorail	√	√	√	√	√
17	Hialeah Market					
18	Miami International Airport	√	√	√	√	√

Strategy & Organization

- Stations with high levels of on/off activity, school trips, and/or observed overnight parking were surveyed

- Each station surveyed one weekday

- 4-6 surveyors per station
  - 1 surveyor arrives 30 minutes before first train to count cars parked overnight
  - 2 surveyors per platform to conduct station egress intercept surveys and alighting counts
  - 2-4 surveyors deployed around station for mode of access and egress counts

Surveyor 1: NB travel distance, boarding/alighting counts, walking and biking access/egress from/to Access 1 (pedestrian/bike only).

Surveyor 2: SB travel distance, boarding/alighting counts.

Surveyor 3: NB/SB auto access/egress from/to Access 3 (north parking).

Surveyor 4: NB/SB walking and bike access/egress from/to south entrance, transit access/egress from to Access 2 (south parking).

Surveyor 5: NB/SB auto access/egress from/to Access 2.

Access 2

Access 3

Access 1

Overhead Pedestrian Bridge

Tri-Rail-Hollywood Station

Hollywood Station – Surveyor Deployment

North
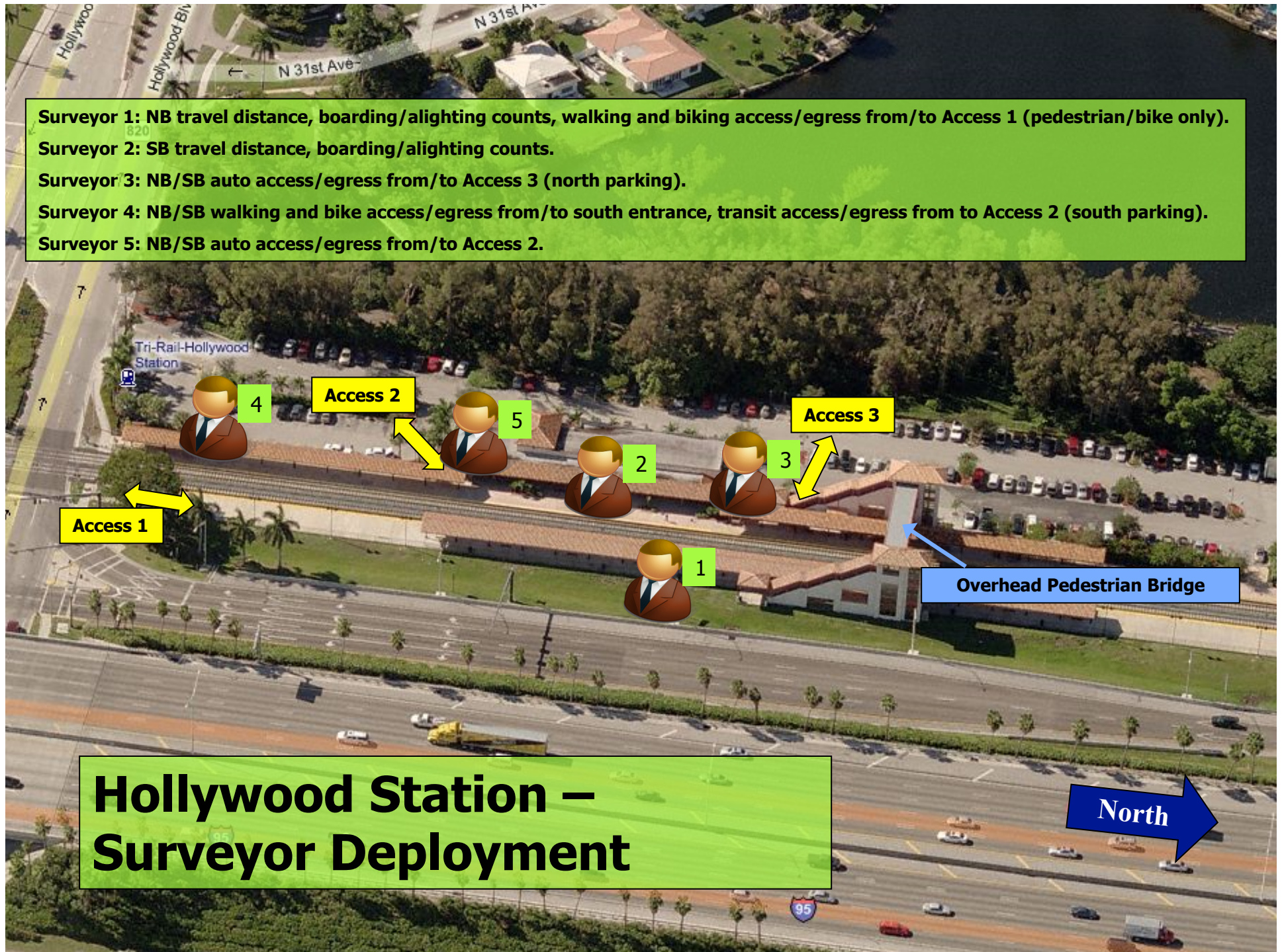
Budget & Schedule

- ~$9,000 per station
- 4-6 surveyors per station
- 10-12 hours of survey time per station
- Surveys conducted Tuesdays-Thursdays over four weeks
- Each station surveyed one day
- Schedule coordinated with on-board survey

Challenges

- Multiple access/egress points at stations
- Train arriving on different platform
- Riders staying in their cars until train arrival
- Parking car next to alighting platform rather than boarding platform
- Friends of riders roaming platform
- Dropped off by friend in AM, but depart by own car in PM

Initial Survey Expansion

- Survey dataset expanded to average weekday using factors based on:

  - Boarding station

  - Train direction

  - Time period (peak/off-peak)

- Expanded dataset compared to ancillary count information to detect non-response bias

Overnight Parking Trips

- Count: 509 cars parked overnight (12/18 stations)

- Survey: 1,800 trips who park-ride or share-ride at attraction-end

- Counts confirm significant number of trips with parked car at attraction-end

- Expanded dataset over-estimates this market, so alternate expansion is needed

Origin→Rail Station Mode

O→Board Mode	Percent	
	Counts	Survey
Park-ride	21%	31%
Drop-off	21%	18%
Transit Bus	18%	14%
Walk	18%	15%
Tri-Rail Shuttle	6%	10%
Metrorail	12%	8%
Other	0%	1%
School Bus	4%	3%

Rail Station→Destination Mode

A→Destination Mode	Percent	
	Counts	Survey
Park-ride	21%	32%
Drop-off	21%	17%
Transit Bus	18%	13%
Walk	18%	15%
Tri-Rail Shuttle	6%	10%
Metrorail	12%	9%
Other	0%	1%
School Bus	4%	2%

Alighting→Destination Mode
Mangonia Park Station
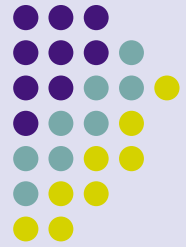
Alighting → Destination	Absolute		Percent	
	Counts	Survey	Counts	Survey
Walk	24	57	2%	5%
Bike	17	19	2%	2%
School Bus	375	221	35%	21%
Transit Bus	111	73	10%	7%
Tri-Rail Shuttle	0	0	0%	0%
Park N Ride	305	459	28%	43%
Rideshare N Park	9	3	1%	0%
Taxi	13	10	1%	1%
Drop-Off	217	212	20%	20%
Other	0	17	0%	2%
Total	1,071	1,071	100%	100%
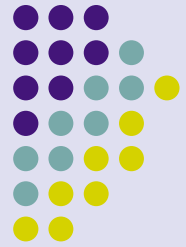
Number of Stations Traveled

Num Stations	Counts	Survey
1 Station	3%	2%
2 Stations	10%	7%
3+ Stations	87%	91%

- The survey under-reports short trips, but not significantly so
- An alternate expansion performed by doubly-constraining boardings and alightings shows some non-response bias to short trips

Doubly-Constrained Expansion Factors (Northbound)

2008 Tri-Rail Expansion Factors and Station Distances (NB)

Two data points not shown:
WPB-MP: 3.5 mi; 121 boardings; 0 surveys; EF=1200
MIA-HIA: 1.0 mi; 6 boardings; 0 surveys; EF=62

Average northbound expansion factor

Expansion Factor

Station Distance (mi)
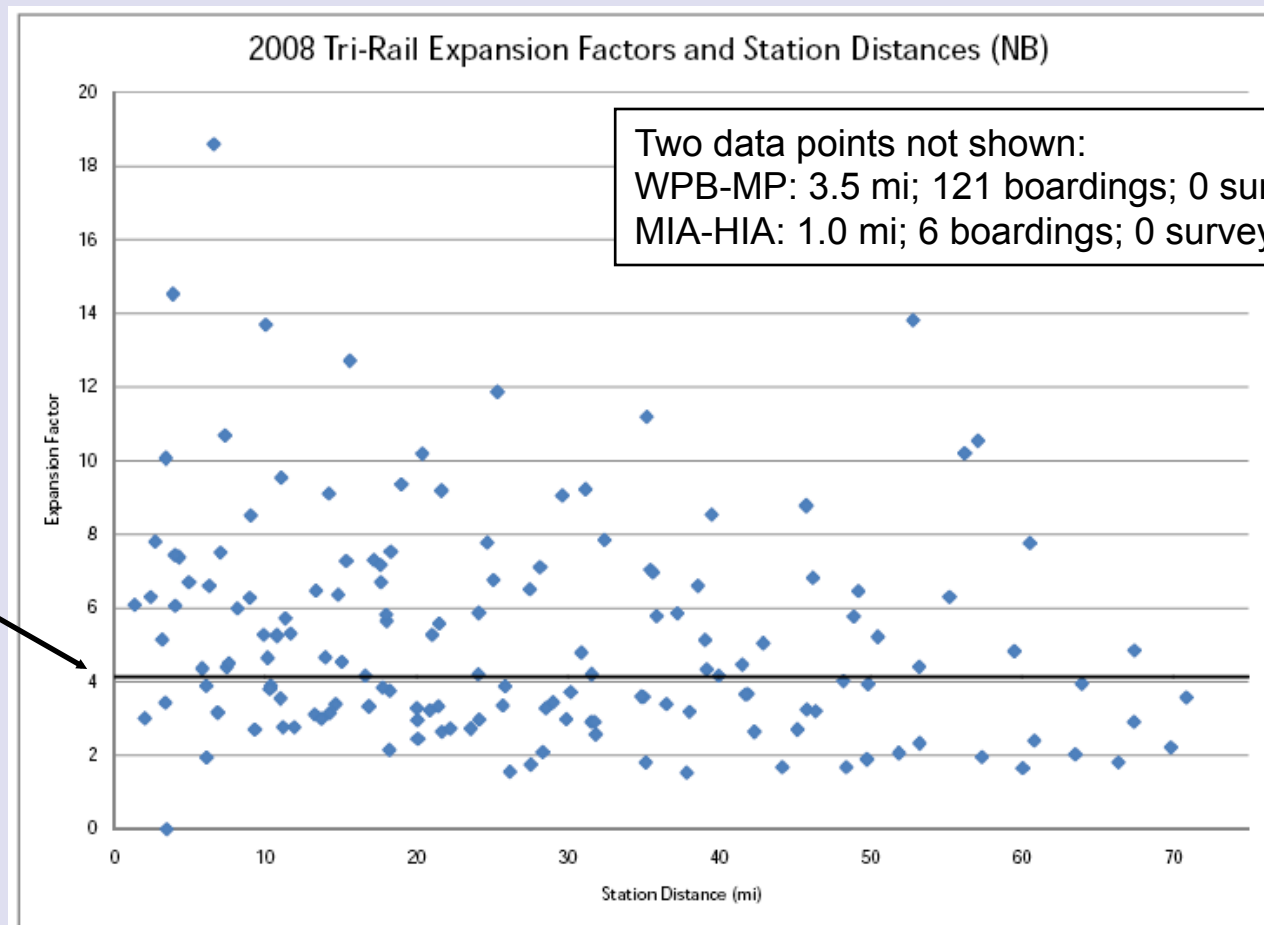
Doubly-Constrained Expansion Factors (Southbound)

2008 Tri-Rail Expansion Factors and Station Distances (SB)

Four data points not shown:
MIA-HIA: 1.0 mi; 7 boards; 0 surveys; EF=69
WPB-BB: 11.2 mi; 225 boards; 6 surveys; EF=38
MP-BB: 14.6 mi; 105 board; 4 surveys; EF=35
LW-BB: 4.3 mi; 29 boards; 1 survey; EF=29

Average southbound expansion factor
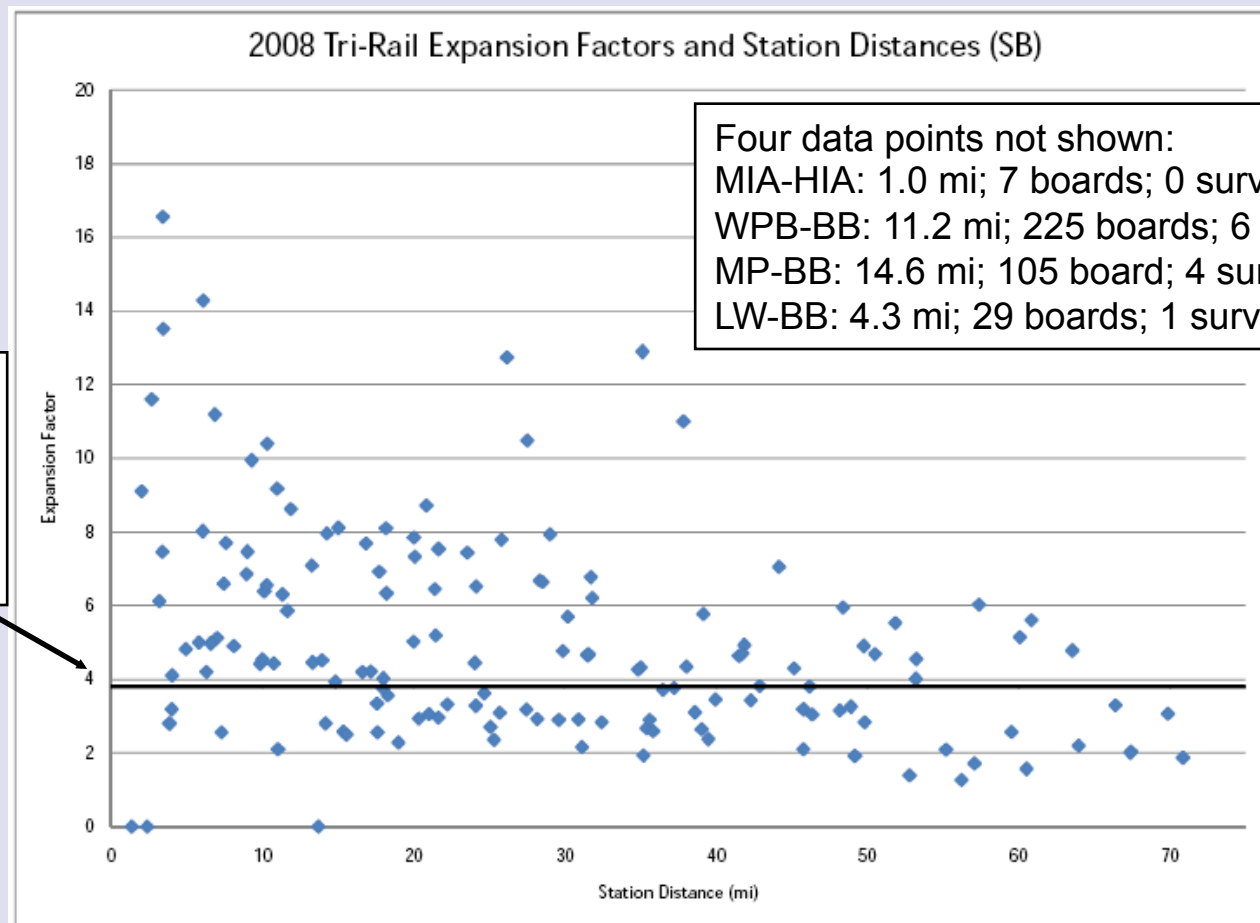
Number of Stations Traveled

Num Stations	Counts	Survey (Initial)	Survey (DC)
1 Station	3%	2%	3%
2 Stations	10%	7%	10%
3+ Stations	87%	91%	87%

- The doubly-constrained method corrects for slight underestimation of short trips

Next Steps

- Compare count data to expanded survey for other individual stations

- Develop alternate weighting strategies to minimize the non-response biases

- Assign trip table to transit network

- Verify model's representation of transit rider markets

Quality Control Checks for 2007 DART On-Board Survey

Arash Mirzaei, P.E.

North Central Texas Council of Governments (NCTCOG)
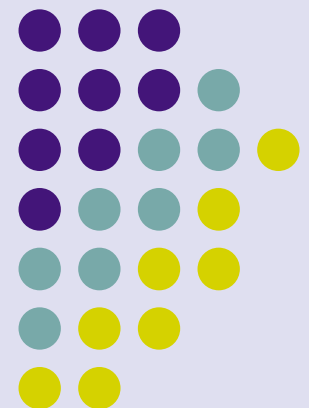
Key Topics

- Quality control checks performed on the 2007 DART transit rider survey database delivered by the contractor

- Identification and correction of errors

- Lessons learned for future data collection efforts

Transit System Information
Dallas Area Rapid Transit (DART)

On-Board Survey, Spring 2007

Transit Mode	Weekday Boardings	No. of Routes
Commuter rail	9,000	1
Light rail	62,000	2
Express bus	6,700	10
Local bus	141,000	98
Total DART System	218,700	111

DART System Map
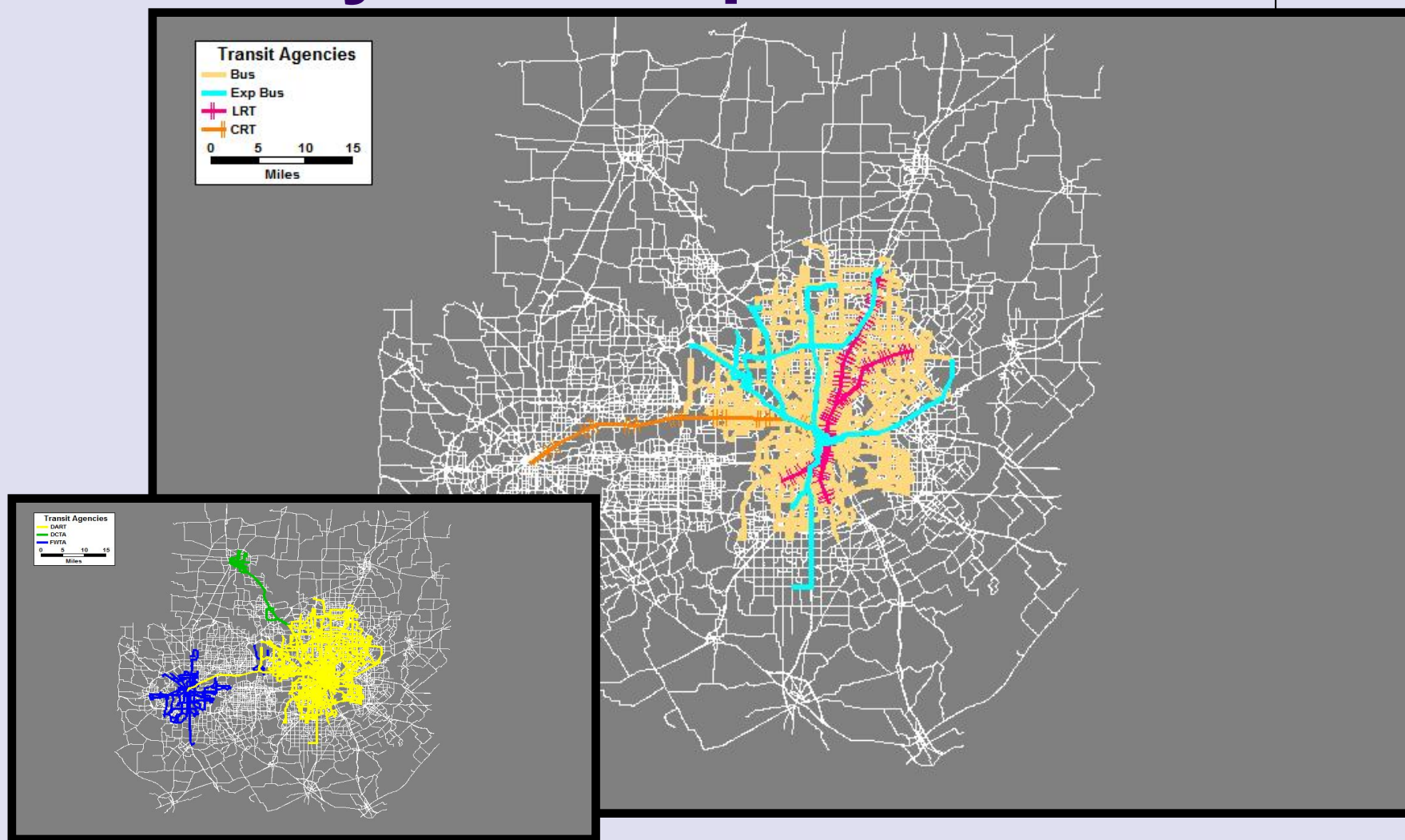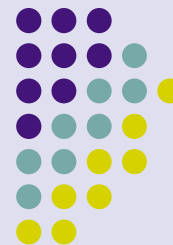
Schedule

- RFP in December 2006
- Proposals reviewed in February 2007
- Contract awarded in March 2007
- Data collection ended in May 2007
  - No time available for comparative pilot tests
  - Very limited time even for a pre-test
- Final product delivered in November 2007
- NCTCOG cleanup ended in March 2008

Weekday Sampling Plan

- Sample size based on daily route boardings
  - Desired: 95% confidence interval with +/- 5% error
  - Random sampling of vehicles by route direction in four time periods (AM, mid-day, PM, and evening)
- For each sampled vehicle:
  - Total adult (15+) boarding counts by stop
  - All adults boarding bus asked to participate

Weekday Expansion Plan[#]

1. Stop Response Factor = Total adult boardings at bus stop per vehicle trip / Usable questionnaires at bus stop per vehicle trip

2. Trip Factor = Total adult boardings per vehicle trip / Total "weighted" usable questionnaires per vehicle trip

3. Normalized Stop Response Factor = Stop Response Factor * Trip Factor

4. Vehicle Trip Expansion Factor = Total vehicle trips per route, time, and direction (RTD) / Number of sampled trips per RTD

5. RTD Factor = Normalized Stop Response Factor * Vehicle Trip Expansion Factor

6. Route Factor = Total average weekday boardings per route / Total "weighted" boardings for all RTD groups per route

7. Normalized Final Expansion Factor = RTD Factor * Route Factor

Reference: DART Onboard Survey 2007, NuStats Report
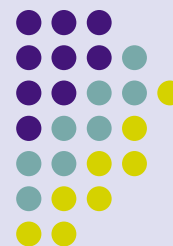
Expansion Plan Example

Sample Vehicle Trip in **R**oute = 45, **T**ime Period = a.m., **D**irection = Northbound, **D**ay = Weekday

	Bus Stop 1		Bus Stop 2		Bus Stop 3		Bus Stop 4		
# of Boardings	15	+	8	+	27	+	10	=	60
# of Completes	6		0		9		2		
Stop Response Fact.	2.5		0		3.0		5.0		
Calculated Boards	15	+	0	+	27	+	10	=	52
Trip Factor	1.15		1.15		1.15		1.15		

Route Trip Factor = 60/52 = 1.15

Vehicle Trip Expansion Factor = Total Vehicle Trips per RTD / Sampled Vehicle Trips per RTDD = 15/2 = 7.5

	Bus Stop 1		Bus Stop 2		Bus Stop 3		Bus Stop 4		
Vehicle Trip Exp.	7.5		7.5		7.5		7.5		
RTD Factor	21.6	+	0	+	25.9	+	43.1	=	90.6

Total Calculated Boardings in all RTDs = 582.4   Observed Avg. Daily Boards = 971   971/582.4=1.7

	Bus Stop 1	Bus Stop 2	Bus Stop 3	Bus Stop 4
Route Factor	1.7	1.7	1.7	1.7
Final Exp. Factor	36.7	0	44.0	73.3
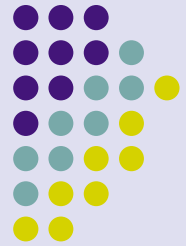
Questions

1. Home address
2. Trip origin address and type
3. Mode of access
4. Transfer from
5. Total number of transit vehicles in the trip
6. Transfer To
7. Mode of egress
8. Trip destination address and type
9. First and last rail lines and stations boarded and alighted
10. Route sequence
11. Main reason for taking the route
12. Perceived trip length in minutes
13. Frequency of use
14. Weekend and/or weekday users
15. Substitute mode of travel
16. Type of payment for the transit
17. Type of fare
18. Number of registered vehicles
19. Household size
20. Number of adults (15+) in the household
21. Male or female
22. Age group
23. Work status
24. Ethnicity
25. Household income group

Quality Control Checks

- Evaluation of geocoding
  - Origin and destination
  - Boarding location (recorded)
  - Alighting location (imputed)
- Identification of inconsistent answers
  - Route reporting
  - Mode of access and egress
- Correction of conflicting answers
  - Routes in the paths
  - Boarding and alighting locations
- Assessment of the quality of final database

Confidence in Geocoding

- How <u>accurately</u> were origin and destination locations coded in the final database?

- Random selection and review of 74 records from the database of 6,447 records

  - 96% had origin point within 0.75 miles of the user-specified location

  - 97% had destination point within 0.75 miles of the user-specified location

Identification of Inconsistent Answers

- Redundant questions about the path possibly confused people

- 2,593 of 6,447 records (40%) found to have inconsistent path information

Path Response Errors

- People described all possible routes they could take for their trip and not the ones they are specifically taking on this trip (868)

- People described their reverse trip rather than what they were taking (397)

- People described a round trip and not a one-way trip, so a route/rail was repeated in the sequence (54)

- People put down origin and destination for round trip, but described path for one–way trip - or vice versa (31)

- People put down the "From" mode in their "To" mode response - or vice-versa (3)

Correction of Paths

- Assume origin, destination, and surveyed "route" are correct
  - For walk mode of access and egress, check for distance less than 2.5 miles
- Select all routes reported in the answers to the redundant questions
  - Check for surveyed "route" in path sequence
  - If possible, identify a path that connects the origin and destination and uses the surveyed "route"
- 3,168* surveys reviewed, 3,004 corrected and returned to the database, 164 flagged for uncorrectable paths

Origin and destination tests resulted in additions to the original list of 2,593 records found to have inconsistent path information

Examination of Path Questions
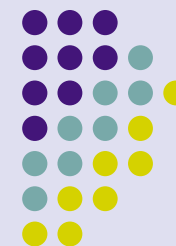
Percentage of Correct Answers to Path Questions

Path	Transfer Questions	Sequence Question
No Transfer	86%	98%
1 Transfer	73%	73%
2 Transfers	26%	59%
3 Transfers		24%
Overall	60%	72%

Path Questions
Observations

- ## We don't recommend redundancies in path questions
  - Increases survey length
  - Probably increased respondent confusion
- ## But this allowed us to perform cross-checks and identify which records to review and correct
  - Errors found with both the transfer and route sequence questions
  - The route sequence questions were more frequently correct

Confidence in Path Sequence

- Random selection of 74 records from the database of 6,283 records
  - 96% determined to have a feasible path

Potential Survey Improvements

- Rigorous sample expansion plan
  - Detect and correct for non-response biases
  - Ancillary count program
- Pilot tests conducted in a timely manner
  - Test graphic design
  - Clarify meaning of one-way trip
- Reduction in number of questions
- Elimination of redundant questions
- Alighting location asked or captured
- Transit wait time asked or captured
- Clarification of expected quality in surveyor contract

Summary

- Instead of simply accepting a transit rider survey database delivered by a contractor as correct, we conducted various quality control tests

  - Many errors in path reporting were found and corrected

  - End product was better data for model testing

- The quality control checks focused our attention on improvements needed for future surveys

- A rigorous quality control program with agency and contractor responsibilities clearly defined is essential

Planning for 2008 On-Board Surveys in Fort Worth and Denton

Arash Mirzaei, P.E.

North Central Texas Council of Governments (NCTCOG)

Key Topics

- Improvements based on review of the 2007 DART survey

- Comparative pilot tests
  - Text versus graphic designs
  - Both in-field tests and cognitive interviews

- Sample expansion plan
  - Ancillary counts
  - Non-response follow-up personal interviews
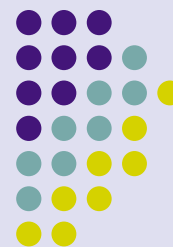
Transit System Information

On-Board Survey, Fall 2008

Transit Mode	Weekday Boardings	No. of Routes
Express bus	1,126	9
Local bus	32,882	53
Total FWTA and DCTA	34,118	62

Fort Worth Transportation Authority (FWTA)

Denton County Transportation Authority (DCTA)

FWTA and DCTA Map
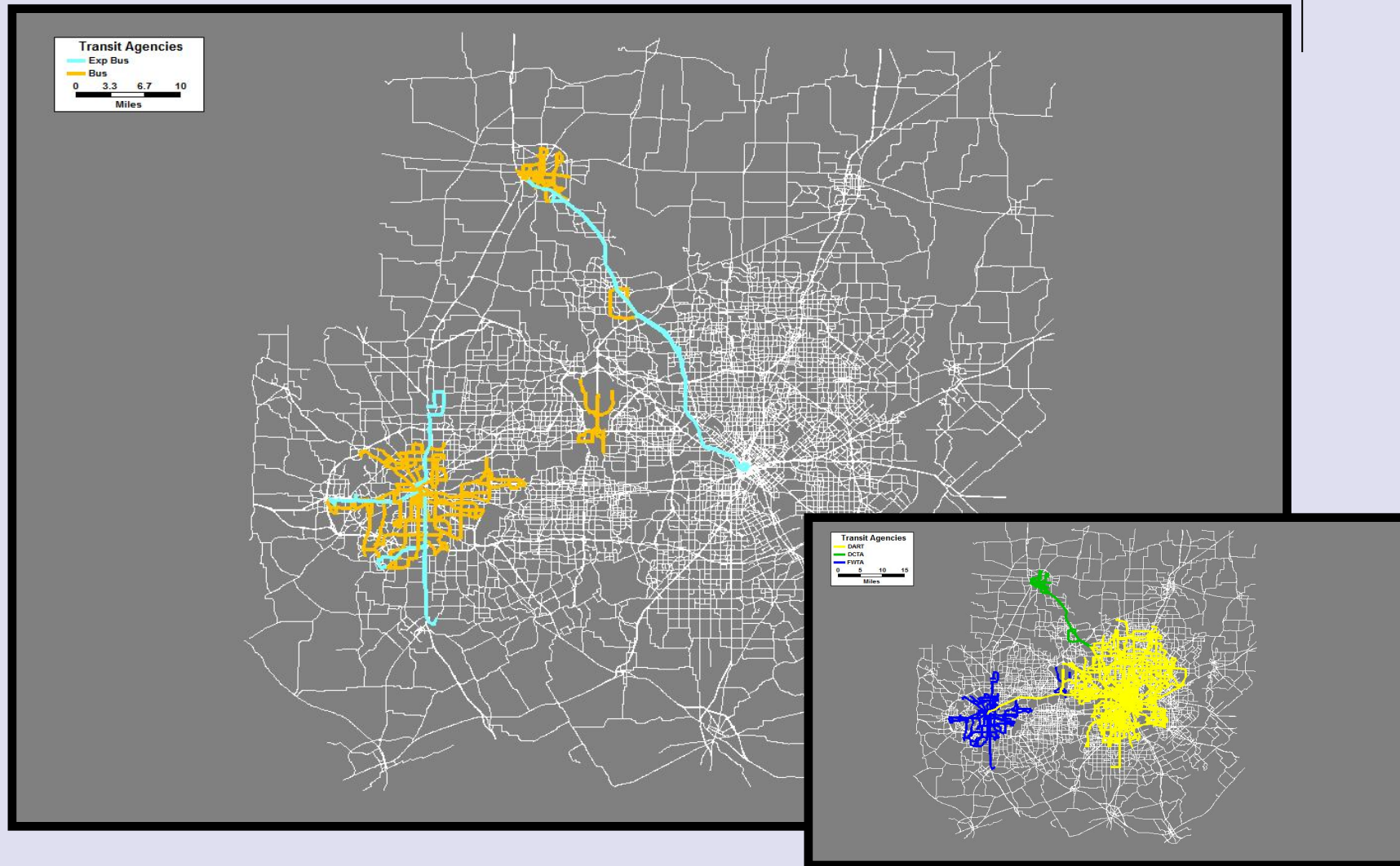
Schedule

- RFP in June 2008
- Proposals reviewed in August 2008
- Contract awarded in August 2008
- Pilot test and cognitive interviews in October 2008
- Data collection ended in November 2008
- Draft geocoded database delivered in January 2009
- Expanded database scheduled for March 2009
- Final report scheduled for May 2009

Potential Improvements (continued)

- Reduced number of questions
  - Unused questions in DART 2007 survey eliminated
  - Redundant path questions in DART survey removed
- Clarification of meaning of one-way trip
  - Advertisement campaigns
  - Consistent use of term "one-way trip"
  - Use of graphic diagrams
- Inclusion of new questions
  - Alighting location asked or captured
  - Transit wait time asked or captured

Potential Improvements (continued)
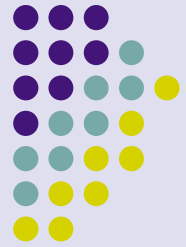
- Enhanced questionnaire design
  - Modified text design
  - Graphic design
- Pilot tests of different instruments
  - In-field
  - Cognitive interview
- Sample expansion plan
  - Sampling expansion correction by station counts
  - Non-response follow-up survey
- Clarification of expected quality in the survey contract

Unused Questions in DART 2007 Survey

1. Home address
2. Trip origin address and type
3. Mode of access
4. Transfer from
5. Total number of transit vehicles in the trip
6. Transfer To
7. Mode of egress
8. Trip destination address and type
9. First and last rail lines and stations boarded and alighted
10. Route sequence
11. Main reason for taking the route
12. Perceived trip length in minutes
13. Frequency of use

14. Weekend and/or weekday users
15. Substitute mode of travel
16. Type of payment for the transit
17. Type of fare
18. Number of registered cars
19. Household size
20. Number of adults (15+) in the household
21. Male or female
22. Age group
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25. Household income group

Redundant Questions in DART 2007 Survey
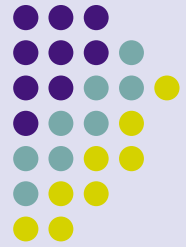
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Clarification of One-Way Trip

- Advertisement campaigns
  - Rail hangers in Fort Worth
  - Posters in Denton
- Consistent use of the term "one-way trip"
- Consistent font throughout the questionnaire
- Use of graphic diagrams

Advertisement Campaign
FWTA

Advertisement Campaign
DCTA

Consistent Use of Term "One-Way Trip"

2. What **TYPE OF PLACE** are you **COMING FROM NOW?** (START of **THIS ONE-WAY TRIP**) *(Please fill in one bubble only)*

○ Work   ○ Shopping   ○ Restaurant
○ College/University *(student only)*   ○ Social/Recreational   ○ Other (specify):_____
○ School (K-12) *(student only)*   ○ Medical appointment/Hospital visit
○ My Home ➔ | If you gave your Home address in Question 1 ➔ **Go to Question 3** |

3. How did you **GET FROM THAT PLACE (START)** to the **VERY FIRST BUS** on **THIS ONE-WAY TRIP?** *(Please fill in one bubble only)*
NO TRANSFER INFORMATION PLEASE

○ Walked 🚶   ○ Bicycled 🚲   ○ Other (specify):_____
                                                    (transferring from another bus is not a valid response)
○ Wheelchair ♿   ○ Carpooled and parked: 🚐 ➔ Parking location?_____
                                                    Parking Lot Name/Cross Streets
○ Dropped off 🚶🚗   ○ Drove alone and parked: 🚗 ➔ Parking location?_____

6a. Including this bus, how many **TOTAL BUSES AND TRAINS** will you use to make **THIS ONE-WAY TRIP?**

○ One, only this bus ➔ **Go to Question 7**   ○ Two   ○ Three   ○ Four

8. How did you **PAY** for **THIS ONE-WAY TRIP?** *(Please fill in one bubble only)*

○ One-way Ticket   ○ Monthly Pass   ○ None - I rode within the Downtown Free Zone only
○ Day Pass   ○ Annual Pass (E-pass)
○ Weekly Pass   ○ Other Pass (MITS+1, 9th grade pass, TCU Student Pass)

Use of Graphic Diagrams

The following questions are about THIS ONE-WAY TRIP you are making NOW!

Example One-Way Trip #1: Shopping to Home

SHOPPING (START) → WALK → BUS → TRANSFER → BUS → WALK → HOME (END)

Example One-Way Trip #2: Home to Work

HOME (START) → CAR → BUS → WALK → WORK (END)

Note: Your trip may be different from our examples.

Questionnaire Design

- Modified text design:

- Graphic design:

Modified Text Design

Graphic Design

Pilot Tests

- In-field: test on buses of two questionnaire designs (NCTCOG staff)

- Cognitive interview (consultant staff)
  - People recruited and interviewed for less than one hour
  - Asked to fill out both questionnaire designs
  - Discussion on how they answered each question and what they did/did not like in both questionnaires

In-Field Pilot Test Observations

- Shaky buses made writing hard
- Early morning dark conditions in the bus should be considered in design
- Font sizes should correspond to all users (some users may not use their glasses in the bus)
- Denton advertisement poster was printed on white background and posted on clear glass
- Informal interviews conducted with respondents
- NCTCOG staff got realistic feeling of what surveyors and respondents experienced

Pilot Test Results

- Comparative in-field test
  - Modified text: 69% completion rate
  - Graphic: 50% completion rate
- Cognitive interviews
  - 28 interviewees

Pilot Test Conclusions

- Modified text design was marginally more successful than graphic design
    - Tests of graphic design were not comprehensive enough to reach a solid conclusion
    - Final design incorporated a few elements of the graphic design
- In-field pilot test was more useful
- Cognitive interview method might be useful when there are many unknowns about which to decide

Final Questionnaire Design

3. How did you **GET FROM THAT PLACE (START)** to the **VERY FIRST BUS** on **THIS ONE-WAY TRIP**? *(Please fill in one bubble only)*
NO TRANSFER INFORMATION PLEASE

- ○ Walked
- ○ Bicycled
- ○ Other (specify):_____ *(transferring from another bus is not a valid response)*
- ○ Wheelchair
- ○ Carpooled and parked: → Parking location?_____ *Parking Lot Name/Cross Streets*
- ○ Dropped off
- ○ Drove alone and parked: → Parking location?_____ *Parking Lot Name/Cross Streets*

4. What **TYPE OF PLACE** are you **GOING TO NOW**? (END of THIS ONE-WAY TRIP) *(Please fill in one bubble only)*

- ○ Work
- ○ College/University (student only)
- ○ School (K-12) (student only)
- ○ Shopping
- ○ Social/Recreational
- ○ Medical appointment/Hospital visit
- ○ Restaurant
- ○ Other (specify):_____
- ○ My Home → If you gave your Home address in Question 1 → Go to Question 5

a. What is the **NAME** of the **PLACE, BUSINESS OR BUILDING** you are **GOING TO NOW**?
Example: [S][M][I][T][H] [H][O][S][P][I][T][A][L]
Name of Place

b. What is the **ADDRESS**?
(Provide the **NEAREST CROSS STREETS** if you don't know the **EXACT ADDRESS**.)
Example: [1][5][0][0] [S] [M][A][I][N] [S][T]
Address
Cross Street #1 & Cross Street #2
City   State   Zip

5. How will you **GET FROM** the **VERY LAST BUS** to the **END** of **THIS ONE-WAY TRIP**? *(Please fill in one bubble only)*
NO TRANSFER INFORMATION PLEASE

- ○ Walk
- ○ Bicycle
- ○ Other (specify):_____ *(transferring from another bus is not a valid response)*
- ○ Wheelchair
- ○ Carpool and park: → Parking location?_____ *Parking Lot Name/Cross Streets*
- ○ Get picked up
- ○ Drive alone and park: → Parking location?_____ *Parking Lot Name/Cross Streets*

6a. Including this bus, how many **TOTAL BUSES AND TRAINS** will you use to make **THIS ONE-WAY TRIP**?

- ○ One, only this bus → Go to Question 7
- ○ Two
- ○ Three
- ○ Four

6b. List the **BUS ROUTES** or **RAIL LINES** in the exact order you use them in **THIS ONE-WAY TRIP**.

| FIRST - bus route/rail line I took: | → | SECOND - bus route/rail line I took or will take: | → | THIRD - bus route/rail line I took or will take: | → | FOURTH - bus route/rail line I took or will take: |

7. Where will you get off **THIS BUS**? *(Name of the place and nearest cross streets)*

Name of Place (including Transit Center or Park & Ride Lot)
Cross Street #1 & Cross Street #2

8. How did you **PAY** for **THIS ONE-WAY TRIP**? *(Please fill in one bubble only)*

- ○ One-way Ticket
- ○ Day Pass
- ○ Weekly Pass
- ○ Monthly Pass
- ○ Annual Pass (E-pass)
- ○ Other Pass (MITS+1, 9th grade pass, TCU Student Pass)
- ○ None - I rode within the Downtown Free Zone only

9. Was your **FARE** . . .

- ○ Local (Regular fare)
- ○ Premium Fare (Express, TRE Dallas-zone, DART System and Arlington Park-n-Ride lots)
- ○ High School Student with School ID
- ○ Over 65 with ID
- ○ Disabled with ID or Medicare Card

10. **HOW MANY MINUTES** did you wait for **THIS BUS** you are on now?

- ○ Less than 5 minutes
- ○ 6 - 10 minutes
- ○ 11 - 15 minutes
- ○ 16 - 20 minutes
- ○ 21 - 25 minutes
- ○ 26 - 30 minutes
- ○ More than 30 minutes

11. How many registered **CARS, TRUCKS,** or **MOTORCYCLES** are available to your household?

- ○ None
- ○ 1
- ○ 2
- ○ 3
- ○ 4 or more

12. Including yourself, how many **TOTAL PEOPLE** live in your household?

- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6 or more

13. Do you have a **VALID DRIVER'S LICENSE**?

- ○ Yes
- ○ No

14. Are you... *(Fill in the bubble that best describes you)*

- ○ Employed (full-time or part-time)
- ○ Unemployed
- ○ Homemaker
- ○ Retired
- ○ Student

15. What is your **AGE**?

- ○ 15 - 24
- ○ 25 - 34
- ○ 35 - 44
- ○ 45 - 54
- ○ 55 - 64
- ○ 65 + years of age

16. What is your **ETHNICITY**? *(Fill in the bubble that best describes you)*

- ○ Asian
- ○ Black/African American
- ○ Hispanic
- ○ Native American
- ○ White
- ○ Other (specify):_____

17. What was your estimated **TOTAL HOUSEHOLD INCOME** in 2007 before taxes?

- ○ Less than $10,000
- ○ $10,000 - $14,999
- ○ $15,000 - $24,999
- ○ $25,000 - $34,999
- ○ $35,000 - $49,999
- ○ $50,000 - $74,999
- ○ $75,000 or more

Please continue on the back →

Sample Expansion Plan

- Boarding counts by stop
  - APC counts not available
  - Manual counts for surveyed vehicles only
- Station counts by mode of access/egress
  - Major park-and-ride and transfer stations
- Non-response follow-up survey
  - Personal interviews of people not returning the questionnaire
  - Measurement of bias in the filled surveys

Non-Response Follow-up Personal Interview Form

NCTCOG (The T) On-Board Non-Response Survey

Assignment #: _____ **Trip #:** _____ **Route #:** _____

1) Reason for not taking/completing a survey:
○ Never participate   ○ Too many questions   ○ Not interested/Don't Care   ○ Conditions on bus not suitable
○ No time to complete it on this trip / trip too short   ○ Other (specify): _____

2) How many minutes will you be traveling on THIS BUS for THIS TRIP?
○ 5 or less   ○ 6-10   ○ 11-15   ○ 16-20   ○ 21-25   ○ 26-30   ○ More than 30
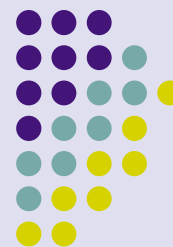
3) Age   ○ 15 - 24 ○ 25 - 34   ○ 35 - 44   ○ 44 - 54   ○ 55-64   ○ 65+

4) Ethnicity   ○ White   ○ African American   ○ Hispanic   ○ Asian   ○ Native American
○ Other (specify): _____

5) HH Income 2007 ○<10K ○10K–14.9K ○15K–24.9K ○25K–34.9K ○35K-49.9K ○50K–75.9K ○75K+

Non-Response Survey Results

Total Participation: 1,449 surveys (Early estimate of 87.8% response rate)

Response Rate to Questions

Response to	# Responded	% Response
Reason for refusal	1,424	98.27%
Minutes traveled	903	62.32%
Age	1,332	91.93%
Ethnicity	1,366	94.27%
Income	500	34.51%

Clarification of Expected Quality in Surveyor Contract

- Identify the sample frame, confidence interval, and error
  Daily boardings per route, 95%, and +/- 5%

- Identify QC specification
  The consultants should show they are 95 percent confident that 90 to 100 percent of location data and all other collected information in the survey instrument are coded correctly. This quality will be tested by random sampling of the final coded records. A record is considered incomplete if there is missing or wrong information in any of the following fields: origin, destination, purpose fields, path fields that identify the routes that the users take, mode of access and egress, time of survey, and home address.

- Identify QC implementation plan
  At the end of the data collection, the consultants should show that they are 95 percent confident that 90 to 100 percent of the collected surveys are useable. A filled questionnaire is considered useable if the respondent properly answered all of the following questions: origin, destination, purposes, path questions that identify the routes that the users take, mode of access and egress, time of survey, and home address.

Summary

- Learn as much as you can from previous surveys

- Comparative pilot tests are useful if unsure of exactly what to implement

- Keep sufficient time in the schedule for all aspects of the data collection program

- Keep FTA actively involved

Acknowledgment

- FTA staff: for providing ideas and help in analyzing the results
  - Jim Ryan
  - Ken Cervenka
- NCTCOG Model Group staff: for managing the project, analysis, and presentation
  - Kathy Yu
  - Hua Yang