Modeling the Erie (county) shore – a Play in 3 Acts: (again!)

Sam Granato, Ohio DOT

Act I – The Basics

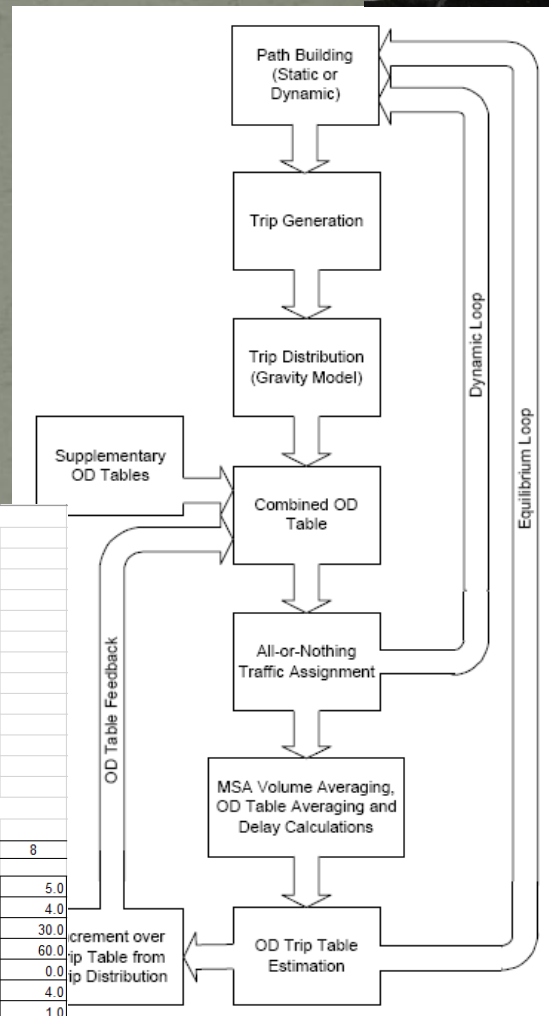Act II – Endless Summer

Act III – Big Data

Things that have changed over last 8 years:

- Travel time reliability for path building
- "Junction overrides" (timing plans) for all signals in the city of Sandusky
- Change in structure of trip generation scheme (cross-class per NCHRP 716)
- <u>Not changed</u>: DTA-based model structure & 3 seasonal scenarios (summer weekday, summer weekend, rest of year weekday)
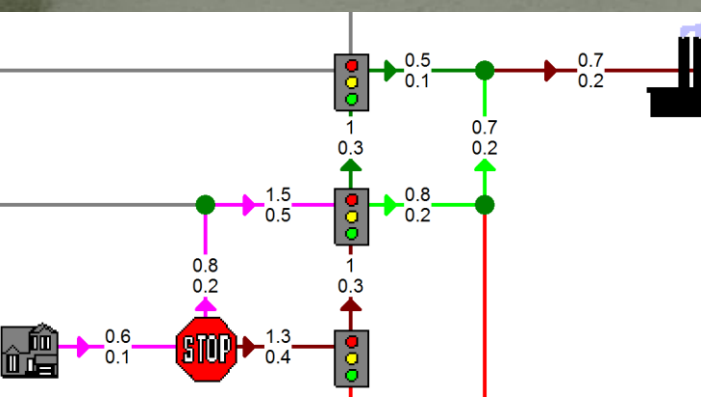
TRAFFIC CONTROLLER PROGRAMMING								
			DIRECTION					
I.D. # : 53			PHASE 1: EB LT					
LOCATION : Perkins/Hayes			PHASE 2: WB ST					
MANUFACTURE : Transyt			PHASE 3: NB LT					
MODEL : 1880 EL			PHASE 4: SB ST					
MODEL YEAR : 1990			PHASE 5: WB LT					
PHASES AVAILABLE : 8			PHASE 6: EB ST					
PHASES USED : 8			PHASE 7: SB LT					
OVERLAPS AVAILABLE : 4			PHASE 8: NB ST					
OVERLAPS USED : 0								
CYCLE TIME USED : 110								
COORDINATION- Y/N : Y								
OVERLAP JUMPERS :								
			INTERVALS/TIME IN SECONDS					
			PHASES					
	1	2	3	4	5	6	7	8
MINIMUM GREEN	8.0	20.0	5.0	5.0	5.0	20.0	5.0	5.0
PASSAGE	3.5	4.0	3.5	4.0	3.5	4.0	3.5	4.0
MAXIMUM GREEN 1	25.0	35.0	30.0	30.0	25.0	35.0	25.0	30.0
MAXIMUM GREEN 2	25.0	35.0	30.0	60.0	25.0	35.0	25.0	60.0
MAXIMUM GREEN 3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
YELLOW CLEARANCE T	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
RED CLEARANCE TIME	0.0	1.0	0.0	1.0	0.0	1.0	0.0	1.0

Path Building (Static or Dynamic)

Trip Generation

Trip Distribution (Gravity Model)

Supplementary OD Tables

Combined OD Table

All-or-Nothing Traffic Assignment

MSA Volume Averaging, OD Table Averaging and Delay Calculations

OD Trip Table Estimation

Dynamic Loop

Equilibrium Loop

OD Table Feedback

Original trip generation model for area (now uses structure of latest NCHRP QRS report, but rates still adjusted per item C)

| TRIP PURPOSE/ DIRECTION:	7-DAY AVERAGE:	WEEKDAY w/SCHOOL IN SESSION:
A)TO/FROM DWELLING UNITS		
ALL TRAVEL:	$a*\{\log(persons/du + b)\} + c*\{\log(vehicles/du + d)\}$	$e * 7\text{-day average:}$
HB WORK - PROD:	$f * workers/du$	$g * workers/du$
HB WORK - ATTR:	h	i
HB SCHOOL - PROD:	$j * enrollment/du$	$k * enrollment/du$
(4 trip purposes: Public K-8, Public 9-12, Private K-12, and College - no feedback)		
NON HB - PROD/ATTR:		
WORK CHAIN	l,p	m,q
OTHER	n,r	o,s
HB OTHER - ATTR:	t	u
HB OTHER - PROD:	REMAINDER	REMAINDER
B) TO/FROM PLACES OF EMPLOYMENT		
13 EMPLOYMENT CATEGORIES BY SIC/ AREA TYPE/ AGGLOMERATION, LINEAR REGRESSION, # EMPLOYEES * CONSTANT TERM FOR EACH PURPO		
C) CONTROLS		
TRIP TOTALS BY DU AND EMPLOYEE CONTROLLED TO FIELD STUDY/ITE RATES PRODUCTIONS = ATTRACTIONS FOR EVERY PURPOSE (NO LEAKAGE IN TRIP DISTN)		

LBRS-based network (digital e-911):

- Value is in the topology, connectivity, consistency with Census geography, and visualization (most data is overlayed from other sources)

- Stop/yield and speed limit signs on local system roads (from supplemental LBRS files) removes the need for previous "rule-based" systems (RRX delays also included)
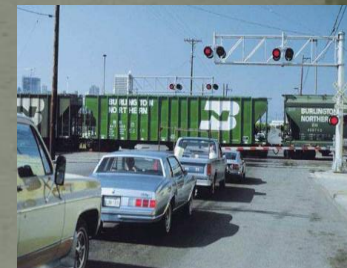
ERIE COUNTY, OH
2007 DATA UPDATE AND LBRS DATA UPGRADE STATISTICS

Mileage	2001	2007
Miles of Road (total project)	987.76	1075.07
Miles of Road (Erie County)	931.02	956.18
Miles of Road (other counties)	56.74	118.89

Road Features	2001	2007
Addresses (total project)	37,304	39,719
Addresses (ErieCounty)	34,491	36,828
Addresses (other counties)	2,813	2,891
Single Family Homes	29,276	30,088
Duplexes	2,745	1,303
Trailers	1,361	1,394
Apartments	1,116	3,832
Secondary Structures	29	45
Utility structures	137	144
Commercial Structures	2,838	2,913
Driveways	22	0
Boundaries	100	86
Bridges and Culverts	638	659
Flashing Signals	21	21
GPS Points	278,267	401,307
Milepost Signs	149	148
Railroad Crossings	117	117
Yield Signs	86	85
School Zone Indicators	87	87
Speed Limit signs	968	1,022
Stop Signs	2,431	2,508
Traffic Signals	246	248
Turn Arounds	110	115
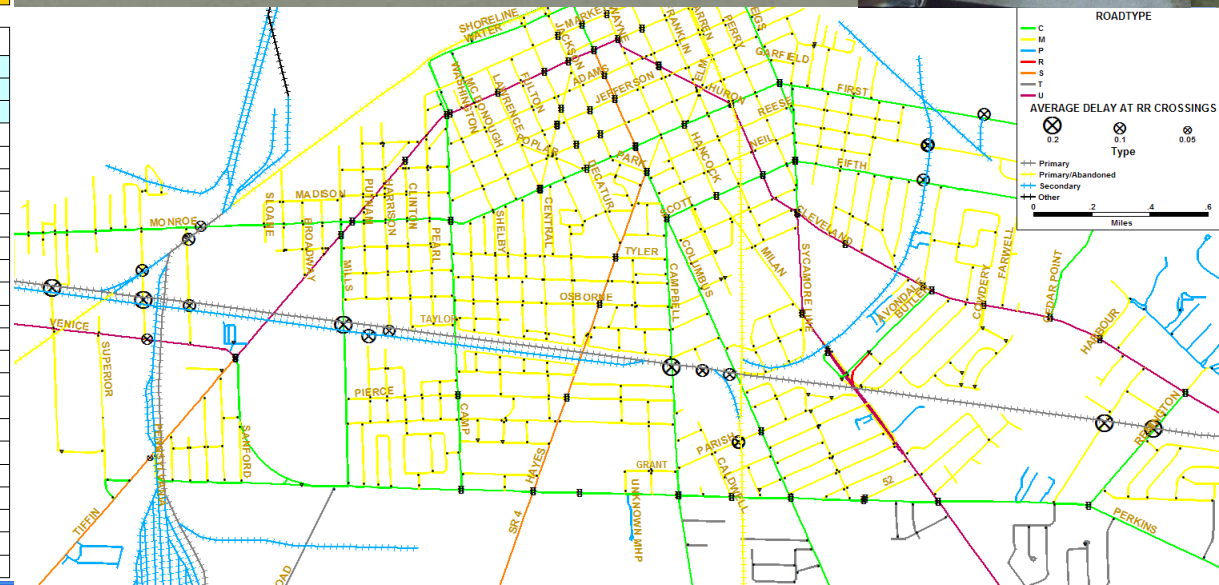
Act II – Endless Summer

The shift to modeled summertime travel leans heavily on land use (and ATR/Turnpike) data

- Added summer population based on Census count of "seasonally vacant" housing units (plus seasonal dorms at Cedar Point)

- Summer employment estimates based on QCEW employment ratios by county and season

- Trip rates by purpose (except for schools) adjusted only as necessary to maintain overall row totals and column balances

- Weekend trip gen also accounts for rates of "absenteeism"

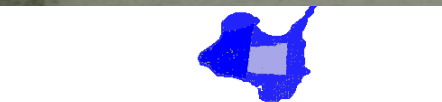**Employment and Wages by Industry Query**

Quarterly Data

* Please take a moment to visit our Customer Feedback page. We'...

[Download to Excel]

Return to NAICS Summary Level SelectionPage

Summary Profile for: Erie County (View...
NAICS Code: 71 - Arts, entertainment, and ...
NA=suppressed due to confidentiali...

Year / Quarter (definitions)	Number of Establishments	All Employees	Tot (in th
2014/2	73	3,925	$
2014/3	72	4,890	$
2014/4	73	2,007	$
2015/1	70	1,111	$

SEASONAL DWELLING UNITS
- 4 and below (1125)
- 5 to 19 (11)
- 20 to 39 (11)
- 40 to 89 (5)
- 90 to 159 (2)
- 160 to 189 (3)
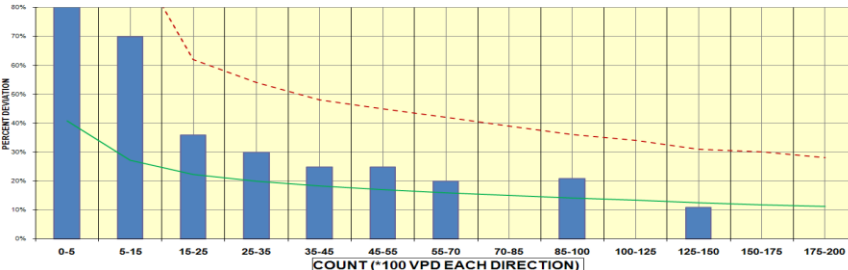- 190 to 249 (2)
- 250 and above (1)

0 2 4 6
Miles

YEAR 2000 CENSUS
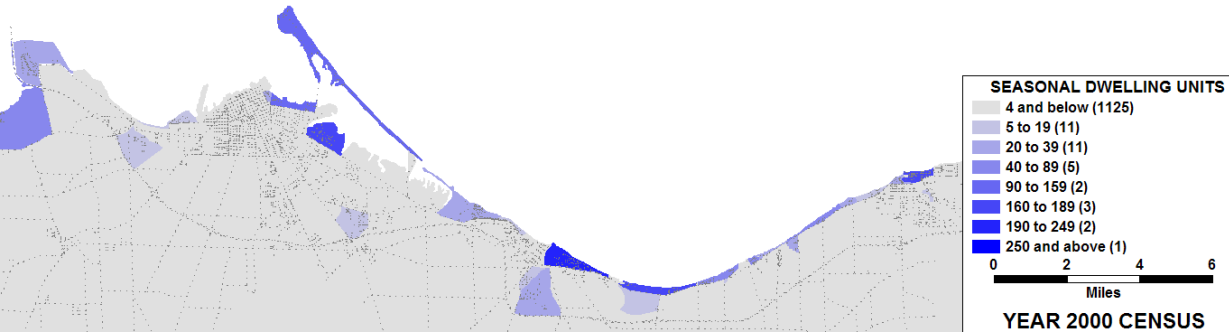
Seasonal land use pattern compared to the state of Ohio as a whole:

RATIO OF 3RD QUARTER TO					HOUSING UNITS BY STATUS:		
1ST QUARTER EMPLOYMENT:					CENSUS		
YEAR 2010	OHIO	ERIE CO			YEAR 2010	OHIO	ERIE CO
ALL	103%	122%			OCCUPIED	89.8%	84.2%
SELECTED SECTORS:					SEASONALLY		
CONSTRUCT	124%	129%			VACANT	1.1%	7.6%
MANUFACT	103%	102%			OTHER		
WHOLESALE	102%	110%			VACANT	9.1%	8.2%
RETAIL	102%	107%					
EDUCATION	95%	92%					
ARTS/ENTER.	167%	469%					
HOTEL/FOOD	107%	141%					

Base year results (volume)

ERPC 2010 BASE YEAR MODEL (summer weekdays)

MODELED AADT (BY DIRECTION)

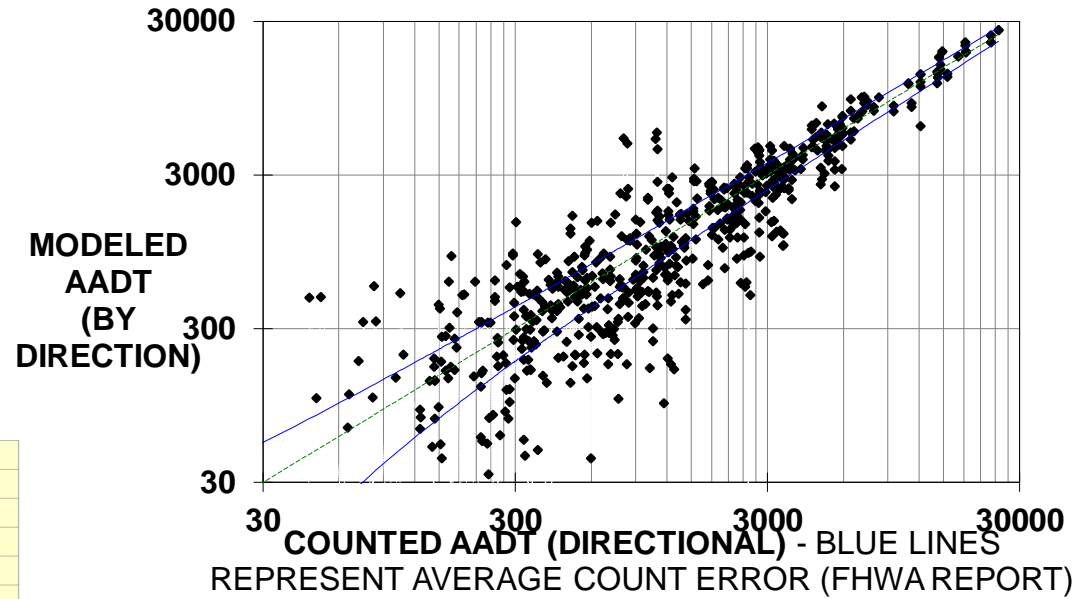COUNTED AADT (DIRECTIONAL) - BLUE LINES REPRESENT AVERAGE COUNT ERROR (FHWA REPORT)

ERIE COUNTY MPO MODEL VALIDATION
2006 SPRING WEEKDAY

ERIE COUNTY MPO MODEL VALIDATION
2006 SUMMER WEEKDAY

ERPC 2010 BASE YEAR MODEL (spring/fall weekdays)
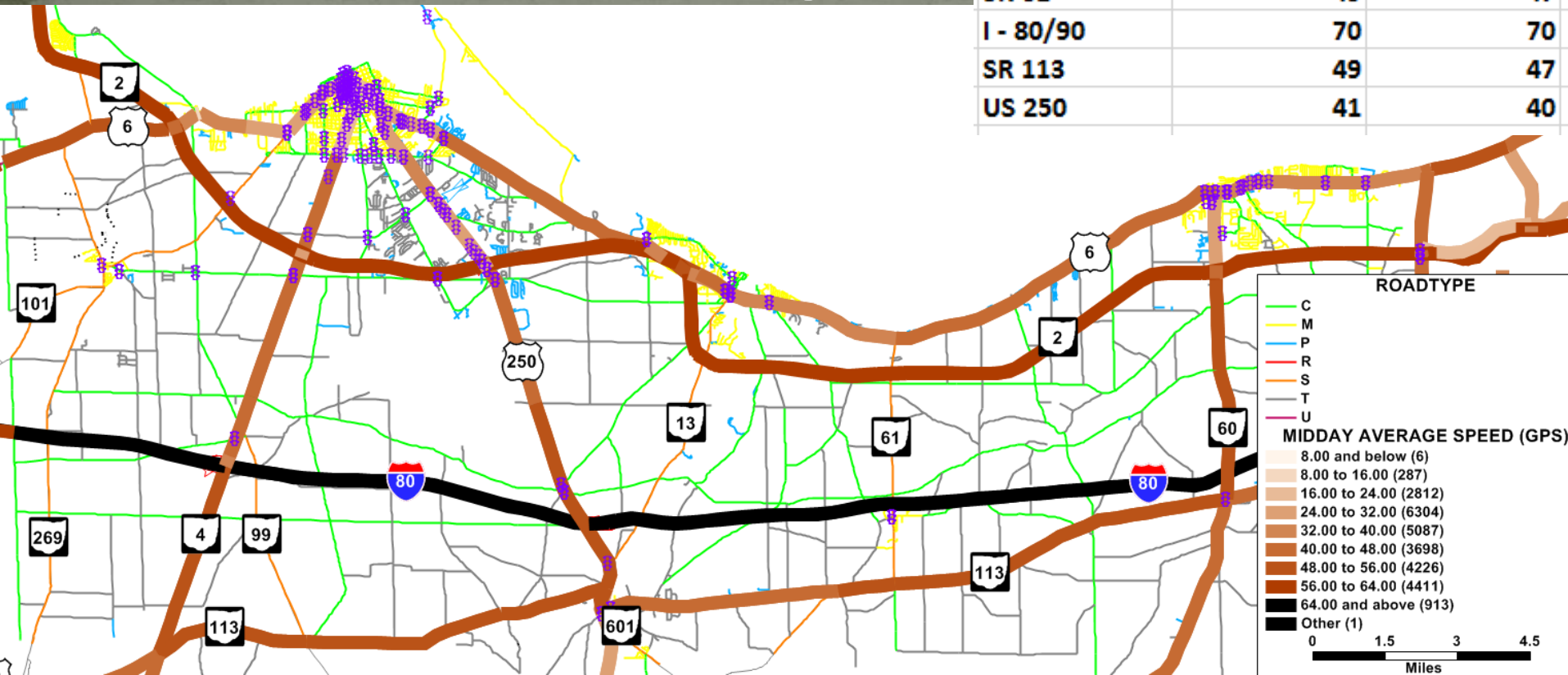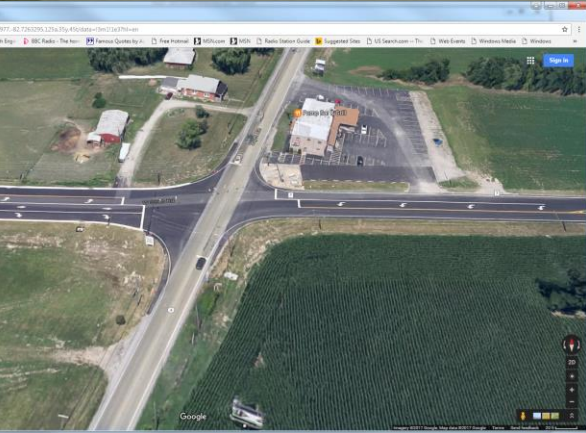
MODELED AADT (BY DIRECTION)
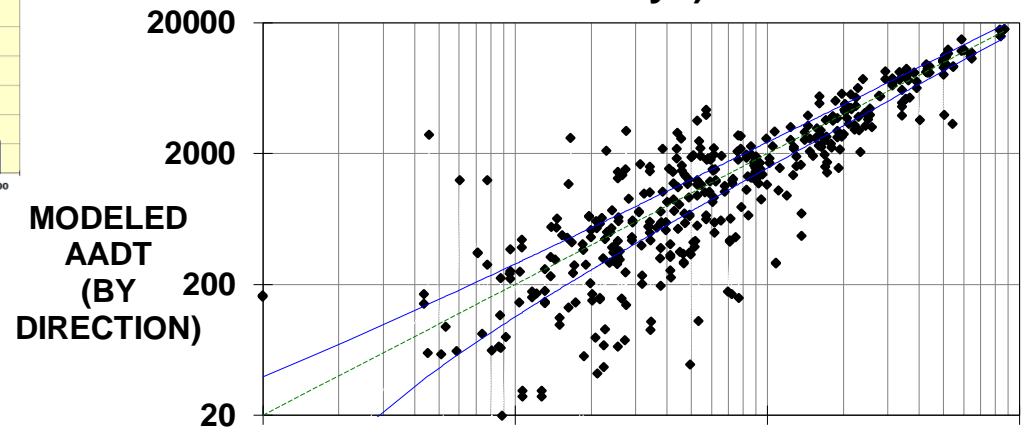
Base year results (travel times)

- Varies by level of aggregation, but TMC-level data verifies that modeled travel times are generally correct (met "borrowed" standard, spot speeds w/count data also used informally)

SUMMER WEEKDAY:	AVERAGE TRAVEL SPEED (MPH) (INCLD. INTERSECTION DELAY)	
ROUTE:	MODEL	INRIX
SR 2	65	65
SR 4	39	38
US 6	40	40
SR 60	45	39
SR 61	49	47
I - 80/90	70	70
SR 113	49	47
US 250	41	40

ROADTYPE
- C
- M
- P
- R
- S
- T
- U

MIDDAY AVERAGE SPEED (GPS)
- 8.00 and below (6)
- 8.00 to 16.00 (287)
- 16.00 to 24.00 (2812)
- 24.00 to 32.00 (6304)
- 32.00 to 40.00 (5087)
- 40.00 to 48.00 (3698)
- 48.00 to 56.00 (4226)
- 56.00 to 64.00 (4411)
- 64.00 and above (913)
- Other (1)

0   1.5   3   4.5
Miles

Test case of "sensitivity:"– SR4, LT lanes @ Strub Rd

- Project awarded on March 31, 2016, completed in November
- "Extensive monitoring" of pre & post conditions by MPO staff
- TMC segment on SR4 from WB freeway ramp to Perkins Rd
- From INRIX, average delay for March 2017 compared to same month in 2016 was 11 seconds less NB and 3 seconds less SB
- (MPO model had estimated a reduction of 10 sec both ways)

ESTIMATED REDUCTION IN NB DELAY AT SR4/STRUB RD SIGNAL

DELAY REDUCTION (SECONDS)

HOUR OF DAY

INRIX

MPO MODEL
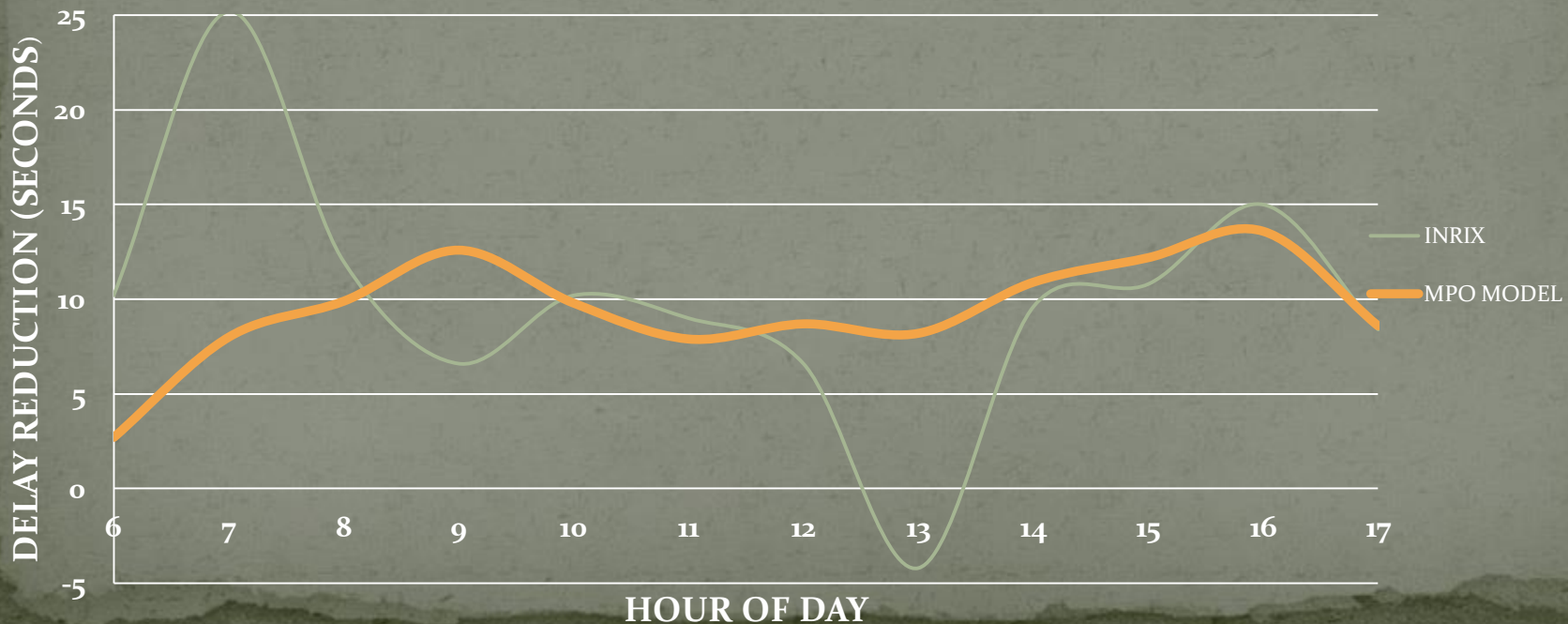
Forecasting future volumes and delays:

- Several ways to analyze/present forecasted change (and trade-offs) – impact over a full day, change over time (base year to Plan horizon), intensity vs duration of congestion/LOS, other . . .

Act III – Big Data

Local counts vs Streetlight-based data comparing summer weekday vs weekend:

AVERAGE DAILY TRAFFIC IN SUMMER MONTHS TO/FROM CEDAR POINT:

A) TRAFFIC COUNTS:

C.P. CAUSEWAY - FROM CONTINUOUS SUMMER COUNTS 2003/2005
C.P. ROAD - FROM 2013 WEEKDAY COUNT (JULY)

	WEEKDAY	WEEKEND	WEEKEND AS PERCENT OF WEEKDAY
CAUSEWAY	22,000	22,800	
ROAD	3,300	3,400 *	
TOTAL	25,300	26,200	104%

B) VIA STREETLIGHT:

B1) FROM INRIX (SUMMER 2016):

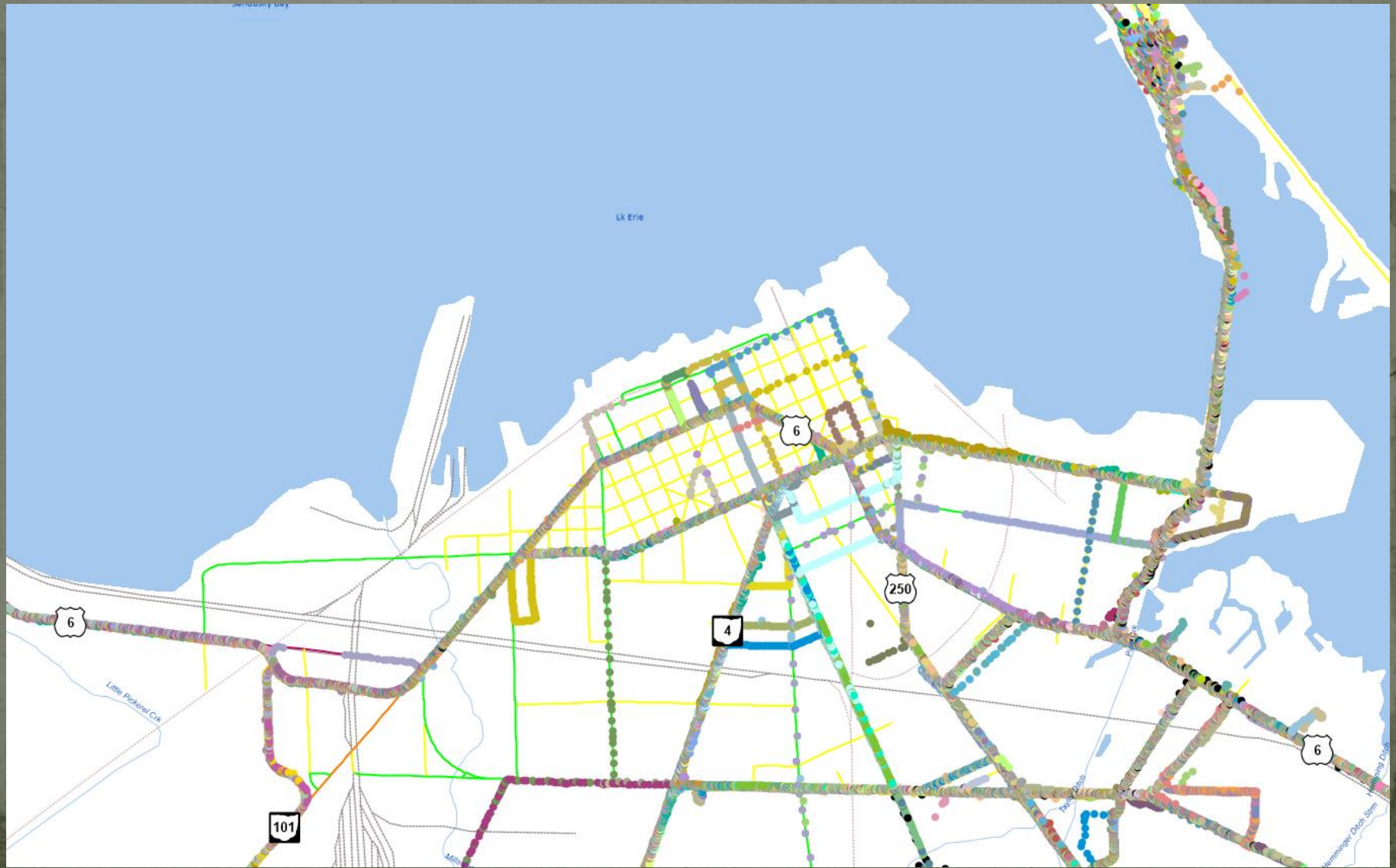|			
	32,600	42,200	129%

B2: FROM CUBIC (SUMMER 2016):

	36,400	52,500	144%
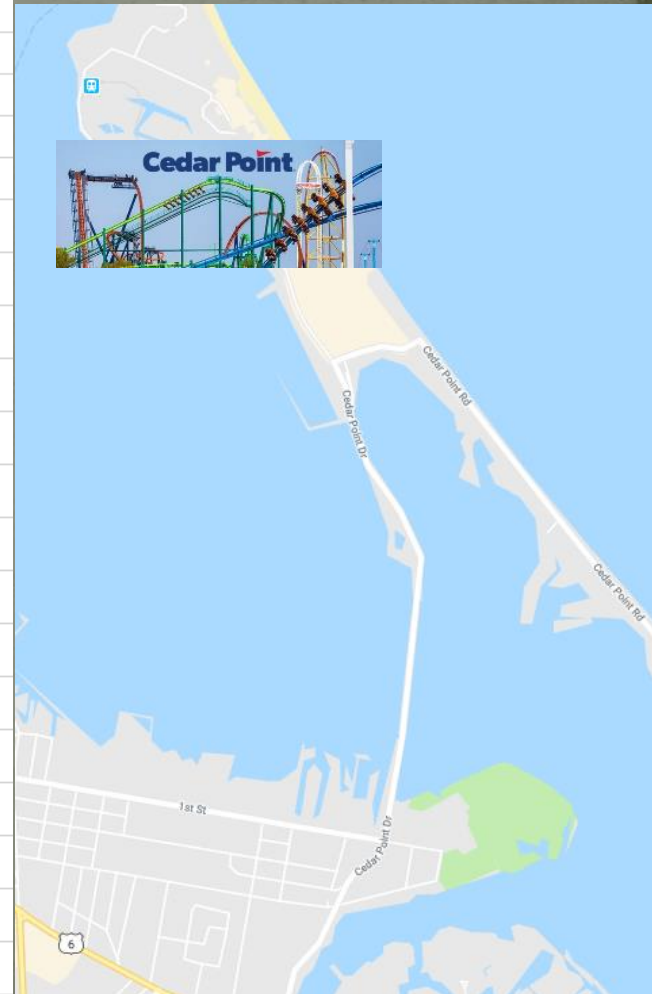
INRIX, summer 2016: Distribution of Trip origins (Census BG level) to Cedar Point.
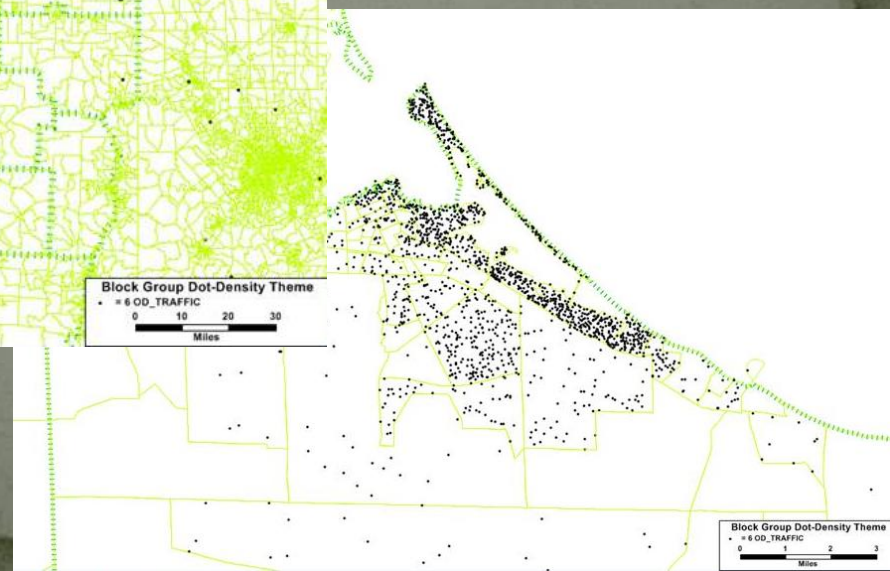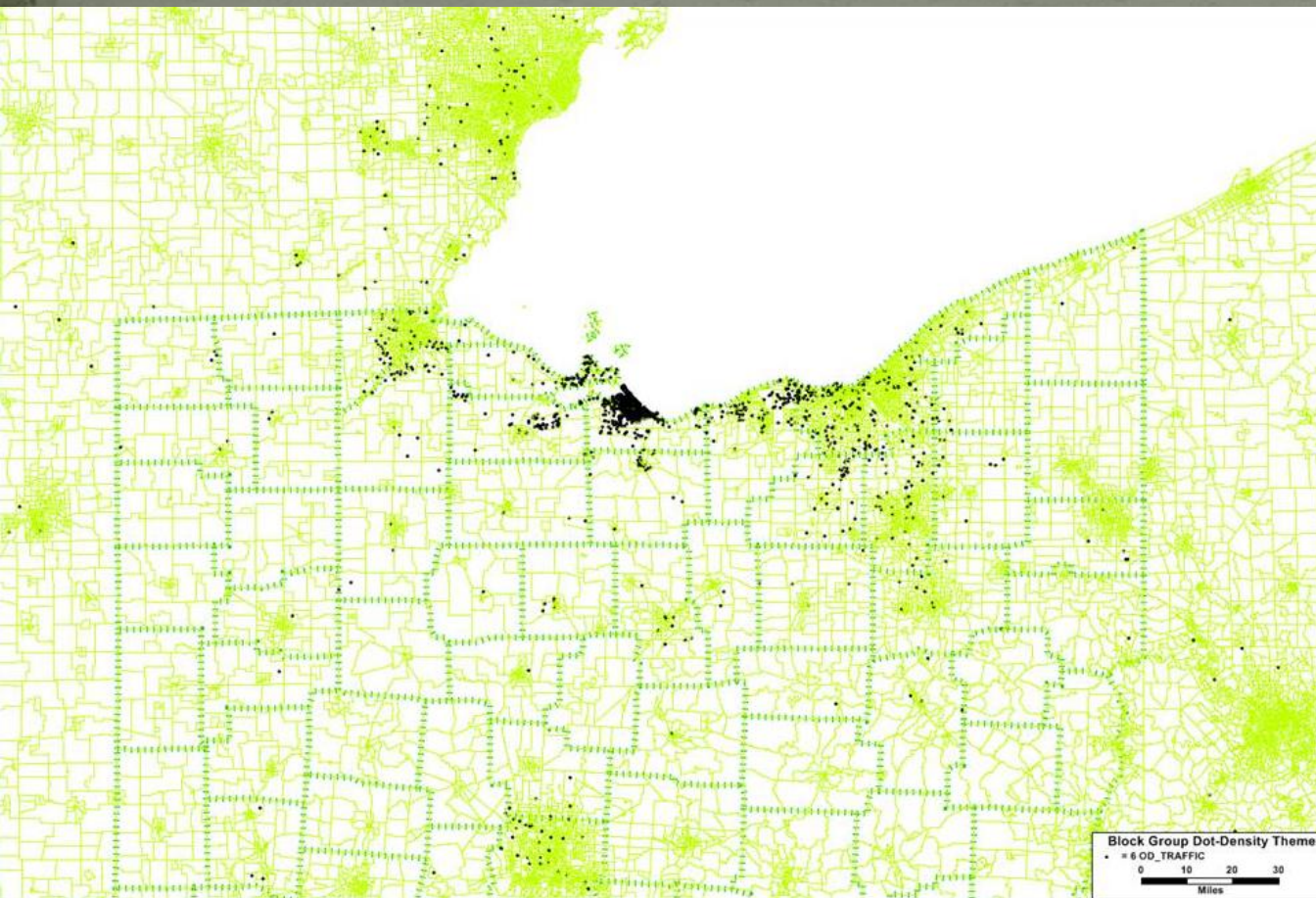
Waypoint traces for trips to Cedar Point (trips "originating" in Erie county only):

The larger picture: pattern of GPS data compared to the existing travel demand model:

- (Only 13% of Trip data detected is from embedded GPS devices, rest from phones - based on data provider info)

SEASONAL AND TIME-OF-DAY PATTERN OF GPS TRIPS IN 2016 GOING TO OR FROM THE SANDUSKY UZA: (THRU MOVEMENTS AND TRUCKS NOT INCLUDED)		OFF-SEASON WEEKDAY	SUMMER WEEKDAY	SUMMER WEEKEND	COMPARABLE FIGURES FROM THE ERIE RPC SEASONAL TRAVEL DEMAND MODELS (2010):	OFF-SEASON WEEKDAY	SUMMER WEEKDAY	SUMMER WEEKEND	DIFFERENCES: OFF-SEASON WEEKDAY	SUMMER WEEKDAY	SUMMER WEEKEND
TRIPS PER DAY:		335	485	477		414,453	486,595	483,236			
PERCENT OF OFF-SEASON TRIPS:		100.0%	144.6%	142.1%		100.0%	117.4%	116.6%	0.0%	27.2%	25.5%
PERCENTAGES BY TIME OF DAY:											
AM	6-9 AM	13.5%	10.8%	8.8%		12.7%	12.1%	7.2%	0.8%	-1.2%	1.6%
MD	9A-3 PM	38.5%	38.9%	37.8%		38.9%	39.3%	42.3%	-0.4%	-0.4%	-4.5%
PM	3-6 PM	24.3%	21.1%	19.3%		25.1%	25.2%	26.4%	-0.8%	-4.1%	-7.1%
NT	6P-6 AM	23.7%	29.2%	34.0%		23.3%	23.4%	24.1%	0.4%	5.7%	9.9%