D4 Traffic Forecast Accuracy

Historical Review and Looking Ahead

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Agenda

- Background
- Objectives
- Methodology
- Key Steps
  - Step 1: Forecast Database
  - Step 2: Forecast Assessment
  - Step 3: Forecast Uncertainty
- Recommendations

Background and Opportunity

- D4 develops dozens of traffic forecasts every year
  - Forecast reports are archived on a regular basis
  - Accuracy of the forecasts are accessed from time to time, using actual/realized traffic counts (previous assessments done in 2010, 2014 and 2020)

- Opportunity to utilize the archived data to enhance D4's forecasting process

Objectives of the Study

- Assess the accuracy of historical and recent forecasts
  - Identify areas of improvements

- Apply lessons learned from the rich data set of forecasts
  - Quantify uncertainty in the forecasts and assist district reviewers estimate potential error range in project forecasts

Methodology

- Adopt guidance from the NCHRP 934 report (developed with D4 contributions)

- Utilize rich archived data and professional experience of seasoned D4 staff

- More emphasis on **products that are easily reproducible and applicable**

- Opening year forecasts assessed for accuracy

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

NCHRP RESEARCH REPORT 934

Traffic Forecasting Accuracy Assessment Research

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Key Tasks

Data Gathering	Data Analysis	Uncertainty Analysis
• Gather forecast reports developed since 1999 and develop a database of D4 traffic forecast	• Analyze data and develop an automated routine to create an interactive report that can be easily updated by FDOT staff when including future projects	• Develop a process to define potential uncertainty in a forecast

Step 1: Forecast Database

Data Compilation

2010 Study	2014 Study	2020 Study
Projects from 1999-2007	Projects from 2008-2014	Projects from 2015-2019
214 Records	143 Records	240 Records

Data mostly limited to electronically stored reports and those available in GIS format.

597 Total Records!

Traffic Forecast Database

- Forecasts stored in Excel
- Includes forecasts developed after 1999

County	# Records
All D4 Counties	597
Broward	279
Palm Beach	161
Martin	49
St. Lucie	67
Indian River	41

SUMMARY OF ALL D4 TRAFFIC PROJECTIONS

143 SELECT REPORTS CONDUCTED FROM 2008 THROUGH 2014

| GENERAL ROADWAY INFORMATION				TYPE OF STUDY	DATE	EXISTING YEAR		PROJECTIONS			FORECASTED DA					
Segment/ Intersection	Roadway ID	County	Roadway Segment	Operational/Planning Study	Date of Report	Report's Existing Year	Report's Existing Year AADT	Year Open to Traffic	Year Open to Traffic AADT	Number of Forecasting Years	Future Forecasted Year (Opening Year)					
SR 5/US 1 from 11 Street to Silver Beach Road	93020000	Palm Beach	SR 5/US 1 from 11 Street to Silver Beach Road	Traffic Projection Report	04/23/08	2008	26,800	2013	29,200	5	2013					
SR A1A from Azalea Terrace to (MP 4.030)	86030000	Broward	SR A1A from Axalea Terrace (MP 2.011) to S. of Sheridan Street (MP 4.0)	Traffic Projection and 18-Kip	06/23/08	2007	23,500	2012	29,100	5	2012					
SR A1A from Azalea Terrace to (MP 4.030)	86030000	Broward	SR A1A from Axalea Terrace (MP 2.011) to S. of Sheridan Street (MP 4.0)	Traffic Projection and 18-Kip	06/23/08	2007	20,500	2011	24,100	4	2011					
SR A1A from Cordova Road to East of Eisenhower Boulevard	86180000	Broward	Cordova Road to East Eisenhower Boulevard	Traffic Projection Report and 18-Kip	09/15/08	2008	44,300	2013	47,700	5	2013					
SR 708 from Old Dixie Highway to 1100 feet east of Old Dixie Highway	93012000	Palm Beach	SR 708 Blue Blvd from Dixie to US 1	Traffic Projection and Turning Movement	03/11/08	2007	27,500	2013	30,100	6	2013					
SR 70 Okeechobee Road Virginia Avenue from East of Jenkins Road (MP 21.600) to US 1 (MP 25.255)	94030000	St. Lucie	SR 70 from Jenkins Road to Virginia Avenue	Traffic Projection and 18-Kip	11/12/08	2008	34,000	2012	39,200	4	2012					
SR 70 Okeechobee Road Virginia Avenue from East of Jenkins Road (MP 21.600) to US 1 (MP 25.255)	94030000	St. Lucie	SR 70 from Okeechobee Road to US 1	Traffic Projection and 18-Kip	11/12/08	2008	25,200	2012	30,300	4	2012					
SR 804 from East of Hagen Ranch Road (MP 2.760) to West of Jog Rod (MP 3.360)	93200000	Palm Beach	from Hagen Ranch Road (MP 2.76) to Jog (MP 3.36)	Traffic Projection, and 18-Kip	10/14/08	2007	32,500	2012	37,400	5	2012	37,400	935201	41000	-3,600	-9.63%
SR 802 East of Congress Avenue (MP 7.200) to West of Lake Osborne Drive (MP 8.010)	93180000	Palm Beach	SR 802 East of Congress Avenue (MP 7.200) to West of Lake Osborne Drive (MP 8.010)	Traffic Projection, and 18-Kip	10/14/08	2007	23,500	2012	25,500	5	2012	25,500	930025	24500	1,000	3.92%
SR 811 from Hillsboro Boulevard to SW 18 Street (Boca Raton)	86170000	Broward	SR 810 to Broward and Palm Beach County Line	Traffic Projection, and 18-Kip	08/13/08	2007	15,500	2012	23,900	5	2012	23,900	860490	15600	8,300	34.73%
SR 713 St. Lucie County from SR 614/Indrio (MP 7.5) to North of Spanish Lakes Blvd (9.5)	94003000	St. Lucie	Kings Hwg from Indrio Road (MP7.5) to North of Spanish Lakes Blvd(MP 9.5)	Traffic Projection and Turning Movement	05/14/08	2008	12,800	2013	15,600	5	2013	15,600	940269	9000	6,600	42.31%

Step 2: Forecast Assessment

Interactive Report – RMarkdown HTML

- Read and Analyzes the Excel database – develops interactive tables and maps in a HTML report
  - D4 staff can easily monitor the accuracy in house on a more frequent basis (e.g., every year)

- Provides recommendations to further improve the forecasting process
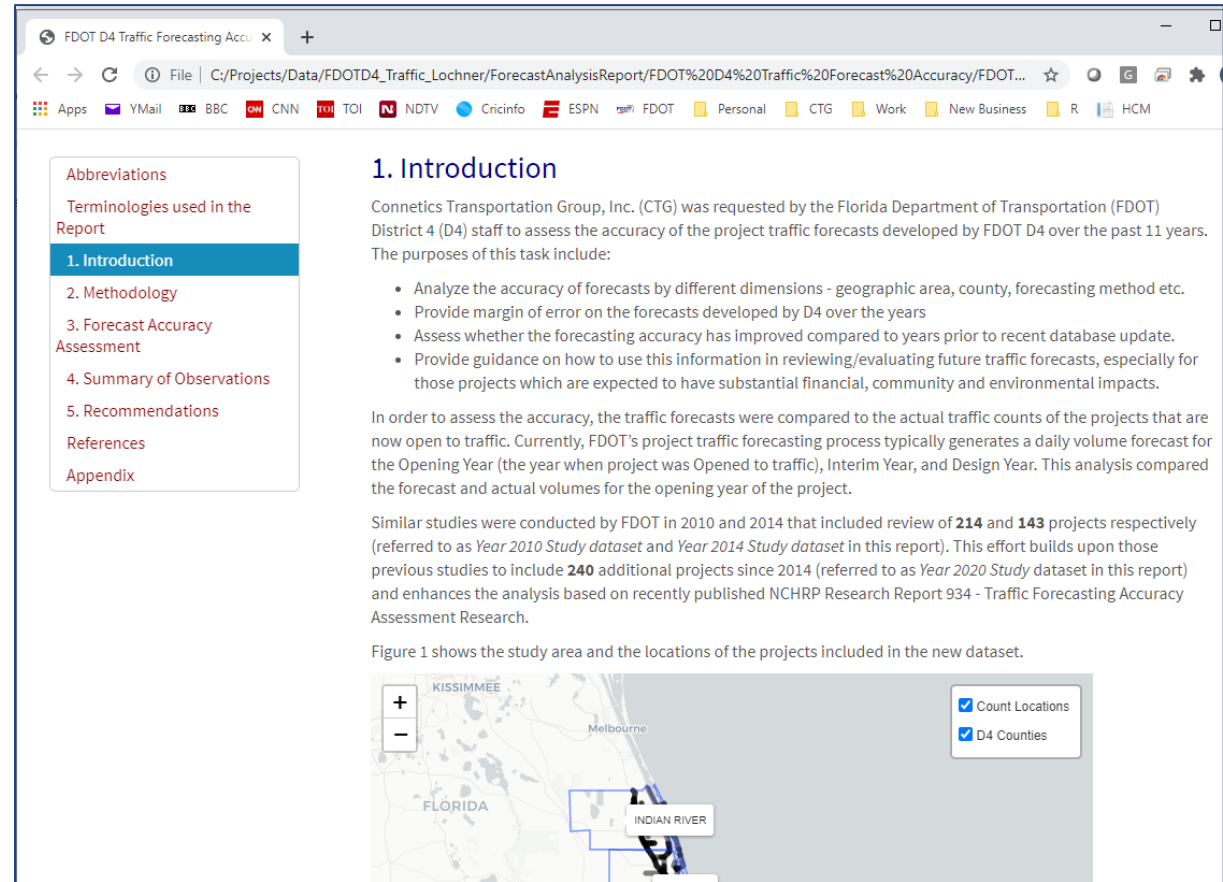
How to Measure Forecast Accuracy

$$Percent\ Difference\ from\ Forecast\ (PDFF) = \frac{Actual\ AADT - Forecasted\ AADT}{Forecasted\ AADT} * 100$$

-ve: Over-estimation
+ve: Under-estimation

$$Mean\ Percent\ Difference\ from\ Forecast\ (MPDFF) = \frac{1}{n} * \sum_{i=1}^{n} PDFF_i$$

$$Mean\ Absolute\ Percent\ Difference\ from\ Forecast\ (MAPDFF) = \frac{1}{n} * \sum_{i=1}^{n} (|PDFF_i|)$$

Source: NCHRP 934

**Opening year forecasts are used in this assessment.**

Districtwide Observations

Attributes	Value
# Records	597
Mean of PDFF (MPDFF)	-7.2%
Median of PDFF	-6.2%
MAPDFF	**15.4%**
Standard Deviation of PDFF	19.7%

- Evidence of over-estimation in opening year forecasts
- Forecasts ~15% off the actual counts

PDFF = Percent Difference From Forecast; -ve value means overestimation
MPDFF = Mean Percent Difference From Forecast
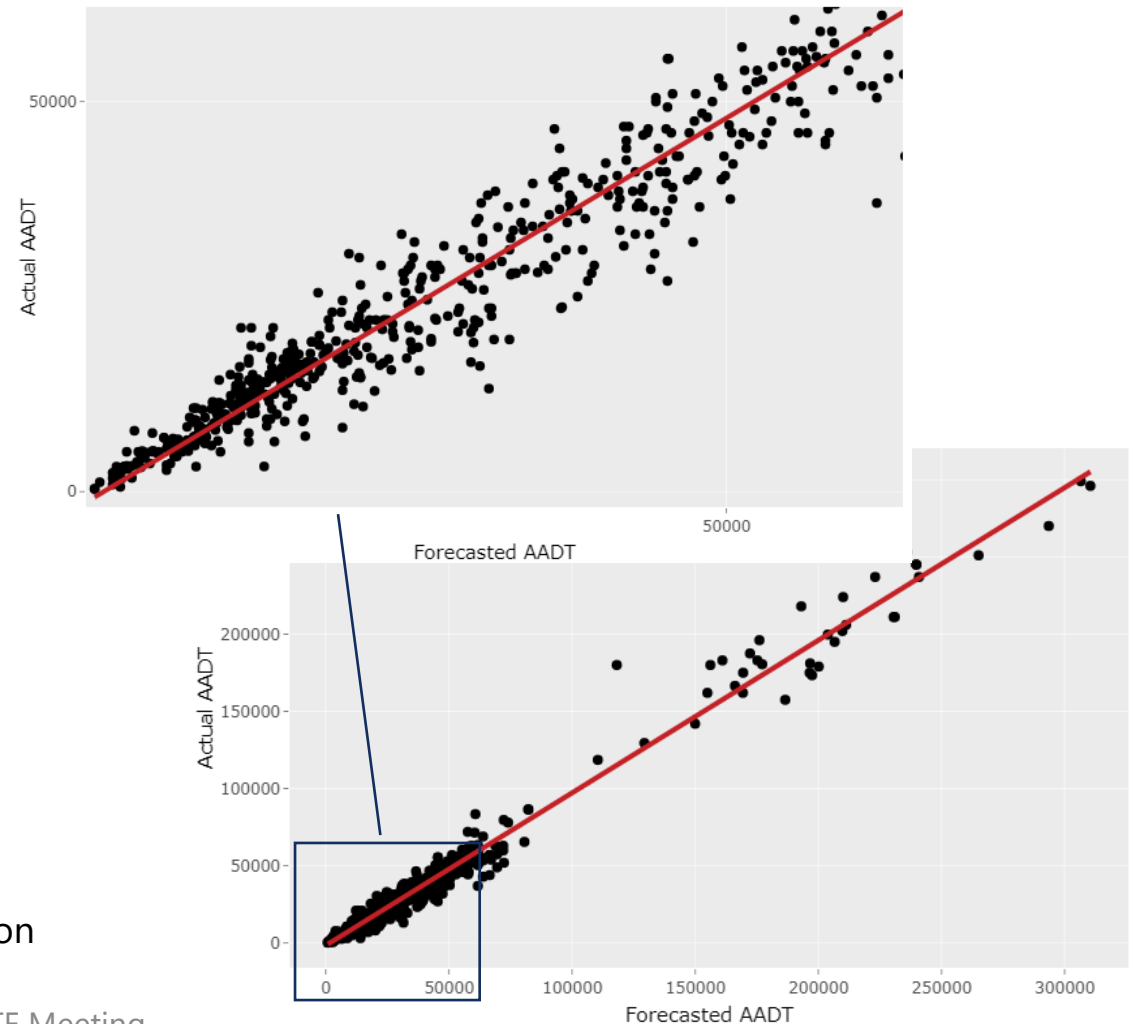
Variables Utilized for Detailed Analysis

- Location of Project (County)

- AADT Range (~LOS D Service Thresholds)

- Number of Years Forecasted
  - 0-9 years

- Urban vs. Rural Areas

- Facility Type

- D4 vs. National Database

Observations

- On an average, the D4 forecasts are within ~**15%** (MAPDFF) of the actual traffic volumes

- Slightly better accuracy of D4 forecasts compared to the database developed for NCHRP 934 report

- Greater accuracy for the urban areas, high volume and short-term forecasts

- Improved accuracy for the more recent set of forecast data

- Regional models are very relevant to the D4 forecasting decision making process

Step 3: Forecast Uncertainty Analysis

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Uncertainty Assessment: Web Application

FDOT reviewer defines characteristics of the project here

- Developed a process to **quantify uncertainty** in a forecast to assist D4 in traffic forecast reviews
    - Process based on *NCHRP 934 Traffic Forecasting Accuracy Assessment*
    - Uncertainty range desirable if a "lane call" is involved
    - Requires house-training of the methodology

Traffic Forecast Uncertainty Analysis

Uncertainty Analysis of Opening Year Forecasts for Test Project 1

⬇ Data Sample/Template

Browse... Upload [input data]

Project Forecast:
Forecasted Opening Year AADT
50000

Project Characteristics Inputs:

| Project County | Area Type | Function Class | Source of Recommended Growth Rate |
| Broward | URBAN | | |

| Diff between Opening & Existing Years | No. of Lane (Option Currently Not Available) | Type of Project (Option Currently Not Available) |

Results: Uncertainty Analysis of the Project Forecast

1. Based on **279** records, 90% of all projects had actual AADT between **38,380** and **58,369** and 60% of all projects had actual AADT between **43,094** and **52,710**, when the forecasted AADT was 50,000.
2. Based on **279** records, 79.9% of all projects had actual AADT between the 120% and 80% of the forecasted AADT.

Recommendations

Recommendations

1. Develop and maintain traffic forecast database as it provides invaluable information

2. Utilize the findings from this assessment to **review and defend project forecasts**

3. Develop a **range of forecast** for certain type of projects

4. Utilize the *Forecast Accuracy* application to **quantify the uncertainty** in a forecast

5. Continue **improvements in the modeling process** to enhance the forecast accuracy

    - E.g., a thorough review of the model network fidelity, trip rates and TAZ sizes

6. Revisit the use of **Historical + Model** method

7. Conduct a **regular update of the forecast database and (less regular update of) similar accuracy study** through the automated process developed as part of this effort

8. Develop a defined program to update the forecast database in real time

Next Steps

- Utilize the findings from this assessment to **enhance D4's forecasting / modeling process**

- **Utilize and train the uncertainty methodology** for D4 project application

- Enhance this assessment based on continued application and **inputs from other D4 departments**

- Develop process to understand potential impacts of **uncertainty on traffic operations analysis** of future studies

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FLORIDA MODEL TASK FORCE

THANK YOU

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