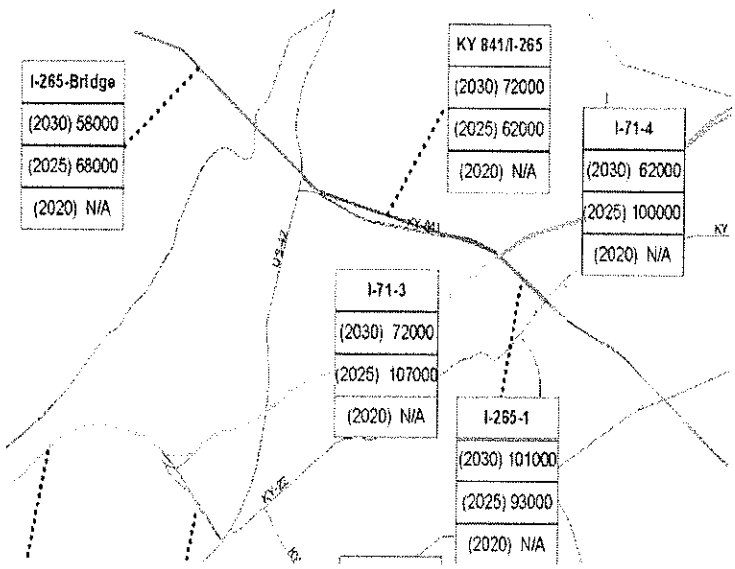
FOR DISPLAY ONLY

DO NOT REMOVE

MPO Traffic Forecasting Workshop



Division of Multimodal Programs
Kentucky Transportation Cabinet
September 14, 2004

Traffic Forecasting Workshop
Agenda

September 14, 2004; 10:00 a.m. – 12:00 p.m.
Conference Room C-410
Transportation Cabinet Office Building
Frankfort, Kentucky

Welcome

Forecasting Overview

Forecasting Process

Forecasting Documentation

Break

Forecasting Tools

Forecasting Issues

Adjourn

Forecast Overview

Traffic Forecasting Essentials

for the
MPO Traffic Forecasting Workshop
by
Rob Bostrom, P.E.
Division of Multimodal Programs

Presentation Overview

- Purpose of Traffic Forecasting
- Forecasting Process
- Forecasting Tools
- Traffic Demand Models
- Conclusion

Purpose of Traffic Forecasting

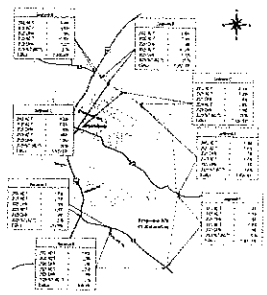
- Geometric and Structural Design Criteria
- Air Quality Analyses
- Purpose and Need Statements
- Planning
  - Corridor Studies
  - Scoping Studies
  - Needs Assessment
- Systems Planning (e.g., Urban Area Plans)
- Other (private sector requests, fast-track projects, etc.)

Forecasting Process/Who Does It?

- In-House
  - Multimodal (3 engineers, 2 techs)
- MPOs
  - KIPDA, OKI & Lexington
- Forecasting Consultants
  - Jordan, Jones & Goulding Statewide Contract
  - Parsons Brinckerhoff Statewide Contract
- Prequalification
  - Demand modeling experience and software
  - Forecasting experience
  - Ability to collect traffic data
  - Training

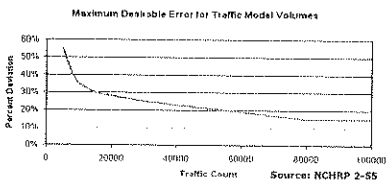
Forecasting Process/Components

- Volume
  - ADT
  - DHV
  - PHF
  - Turning Movements
- Trucks
- ESALs
- Design Year
- System parameters



Forecasting Process/Accuracy

- Historical Count Accuracy
- Variability
- Adjustment Factors
  - Seasonal
  - Hourly
  - Axle Factors
- Confidence Intervals & Ranges



Accuracy Report Summary

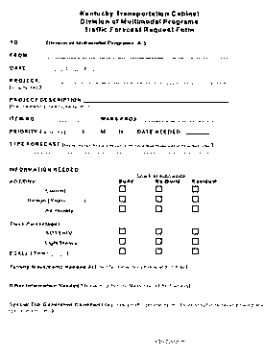
- Comparison of 10-15 year-old traffic forecasts' ADT projections with actual counts.
- Results:
  - 22 Forecasts (134 Samples)
  - Average ADT: 13,549
  - Average Deviation: 3105
  - Percent Deviation: 23%
  - Net Percent Deviation: -11%
  - Max Desirable Deviation: 33%

Accuracy Report Summary

- NEW ROUTES (5 forecasts 43 Samples)
  - Percent Deviation: 23%
  - Max Desirable Deviation: 33%
- BRIDGES (8 forecasts 27 Samples)
  - Percent Deviation: 17%
  - Max Desirable Deviation: 41%
- RECONSTRUCTION (9 forecasts 64 Samples)
  - Percent Deviation: 24%
  - Max Desirable Deviation: 29%

Forecasting Process/Start to Finish

- Request Form
  - From District or Central Office
  - Deadline, map, MARs #
- Assignment
  - In-house
  - Consultant
    - Request
    - Cost estimate
    - Letter agreement
    - Delivery order



Kentucky Transportation Cabinet
Division of Multimodal Programs
Traffic Forecast Request Form

TO
FROM
DATE
PROJECT
PROJECT DESCRIPTION
ITEM NO.
MARS ROUTE
PRIORITY
DATE NEEDED
TYPE FORECAST
INFORMATION NEEDED
ADDITIONAL

Forecasting Process/Start to Finish

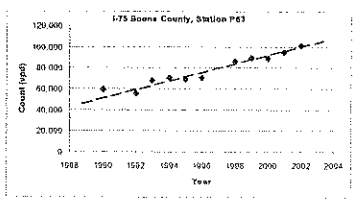
- Data Collection
  - Special traffic counts
  - Review of scope with design project man.
  - Field review
  - Consistency with previous forecasts
- Analysis
  - Depends on complexity of request
    - Point locations
    - Corridors with turning movements
    - New facilities

Forecasting Process/Start to Finish

- Reporting (see JJG example)
  - Methodology
  - Appendix
  - Business report: maps, turning movements, ESALs,
  - Exec. Summary
- Pay Estimate (Consultants)
- Database/Filing
- Feedback
  - Customers don't like #s
  - Change in project scope

Forecasting Tools/Trend Lines

- Count history
- Population projections
- Employment projections
- Comprehensive plan
- Development plans

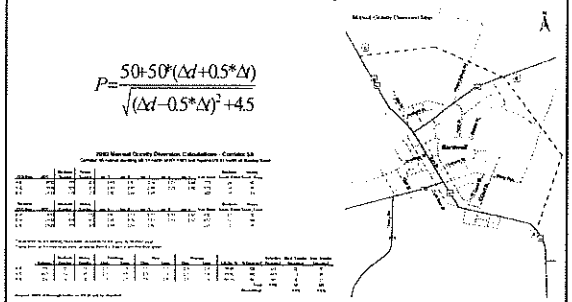


Forecasting Tools/Trip Generation

- ITE Trip Generation Report, 7th Edition
  - Used in traffic modeling
  - Used for impact studies
  - Based on national averages
- Example
  - Single family residence expected to generate 9.57 trips/day; 1.01 trips in pm peak

Forecasting Tools/Manual Gravity

$$P=\frac{50+50^{*}(\Delta d+0.5^{*}\Delta t)}{\sqrt{(\Delta d-0.5^{*}\Delta t)^{2}+4.5}}$$



Forecasting Tools

- Mapping/GIS
  - TransCAD
  - Maptitude
  - Arcview
- Data
  - Count Maps & CTS
  - Highway Information System
  - Socioeconomic data
- Defaults/Practice
  - Traffic Forecasting Report 2003
  - Web Page
    http://transportation.ky.gov/Multimodal/traffic_forecasting.asp

Forecasting Tools/Manual Gravity

$$P = \frac{50 + 50 * (\Delta d + 0.5 * \Delta t)}{\sqrt{(\Delta d - 0.5 * \Delta t)^2 + 4.5}}$$

2002 Manual Gravity Diversion Calculations - Corridor 5A

Corridor 5A leaves existing US 51 north of KY 1181 and rejoins US 51 north of Stanley Road

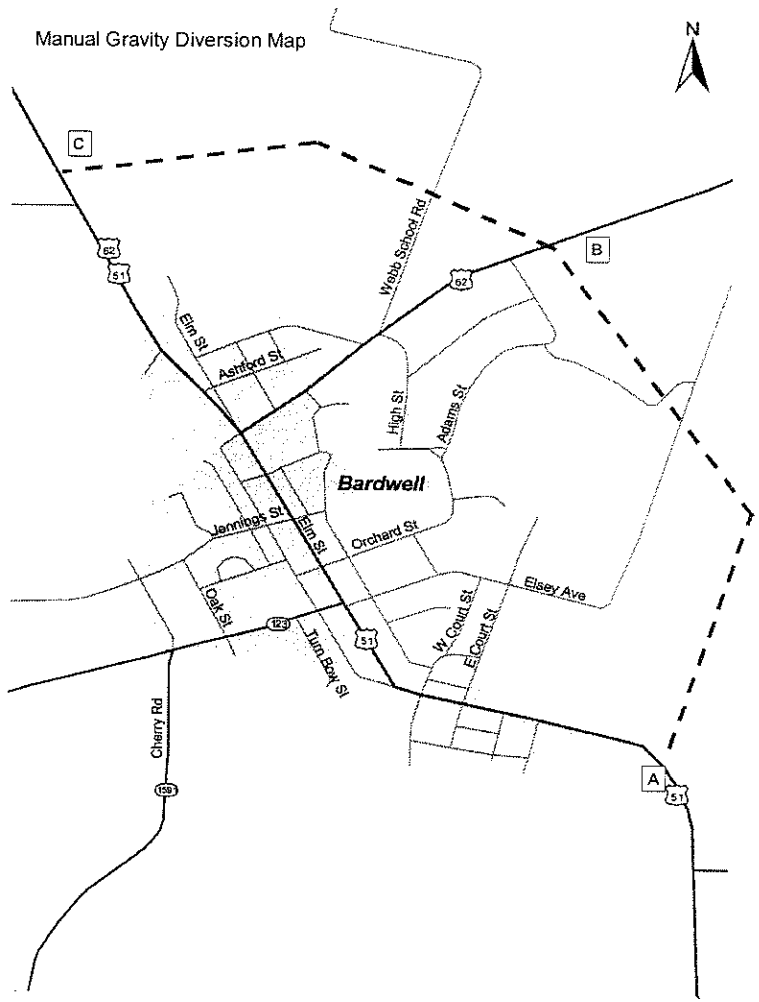
O-D Pair	ADT	Medium Trucks	Heavy Trucks	Int. 1	Int. 2	Int. 3	Int. 4	Int. 5	Vol_Exist	Medium Truck_Exist	Heavy Truck_Exist
A-B	3500	109	371	0.83	0.81	0.96	0.71	0.48	777	24	82
A-C	3500	109	371	0.83	0.81	0.96	0.29	0.80	519	16	55
B-C	2400	110	170	0.80	0.44	0.48			407	19	29

Reverse O-D Pair	ADT	Medium Trucks	Heavy Trucks	Int. 1	Int. 2	Int. 3	Int. 4	Int. 5	Vol_Exist	Medium Truck_Exist	Heavy Truck_Exist
B-A	2400	110	170	0.80	0.53	0.71	0.93	0.67	452	21	32
C-A	2600	109	369	0.48	0.74	0.71	0.93	0.67	407	17	58
C-B	2600	109	369	0.48	0.24	0.80			245	10	35

Travel times on the existing route were calculated on the capacity restraint page.
Travel times on the new route were calculated from the distance and free-flow speed.

	Volume	Medium Trucks	Heavy Trucks	Existing Dist.	Existing Time	New Dist.	New Time	Change Dist.	Change Time	CA Div %	% Diverted	Vehicles Diverted	Med. Trucks Diverted	Hvy. Trucks Diverted
A-B	615	22	57	2.1	3.5	1.2	1.1	0.9	2.4	98.88	100	615	22	57
A-C	463	13	45	2.1	3.5	2.0	1.9	0.1	1.6	69.80	100	463	13	45
B-C	326	14	32	1.7	2.2	0.9	0.8	0.9	1.4	86.16	86	281	12	27
											Total	1359	47	129
											Percentage		3.5%	9.5%

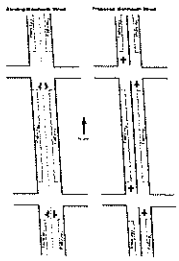
Assume 100% of through traffic on US 51 will be diverted.

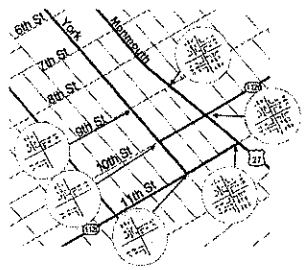


Forecasting Tools/Models

- Travel Demand Models (TDMs)
  - What is a model?
    - Set of files and programs
    - Models can simulate existing parameters such as ADT, VMT, and trip patterns.
    - Modeling started in 1960s
  - Model layers: network and TAZ
  - Software: MinUTP & TransCAD
- Traffic Simulation Models
- Other Models

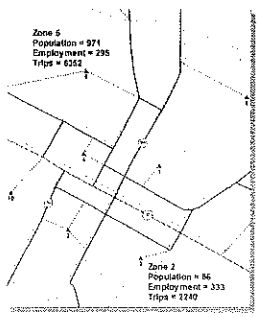
Forecasting Tools/Traffic Simulation Models



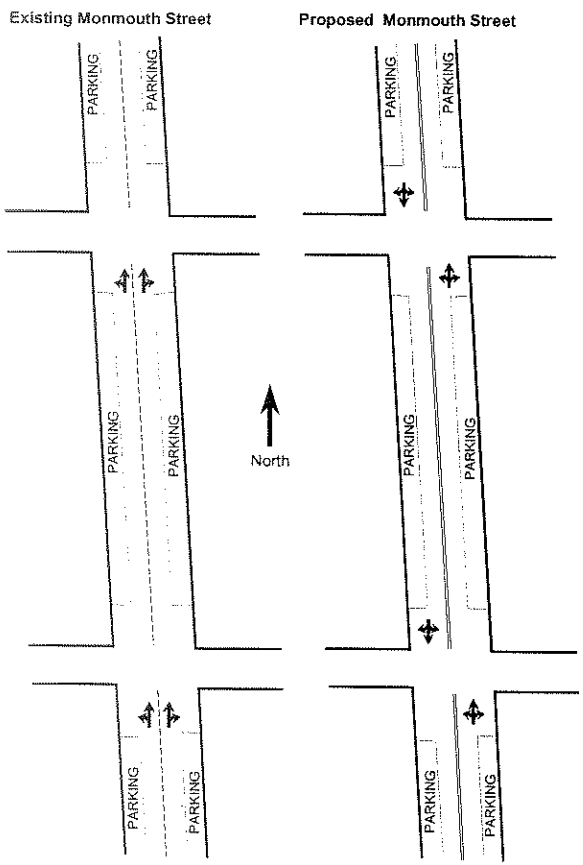


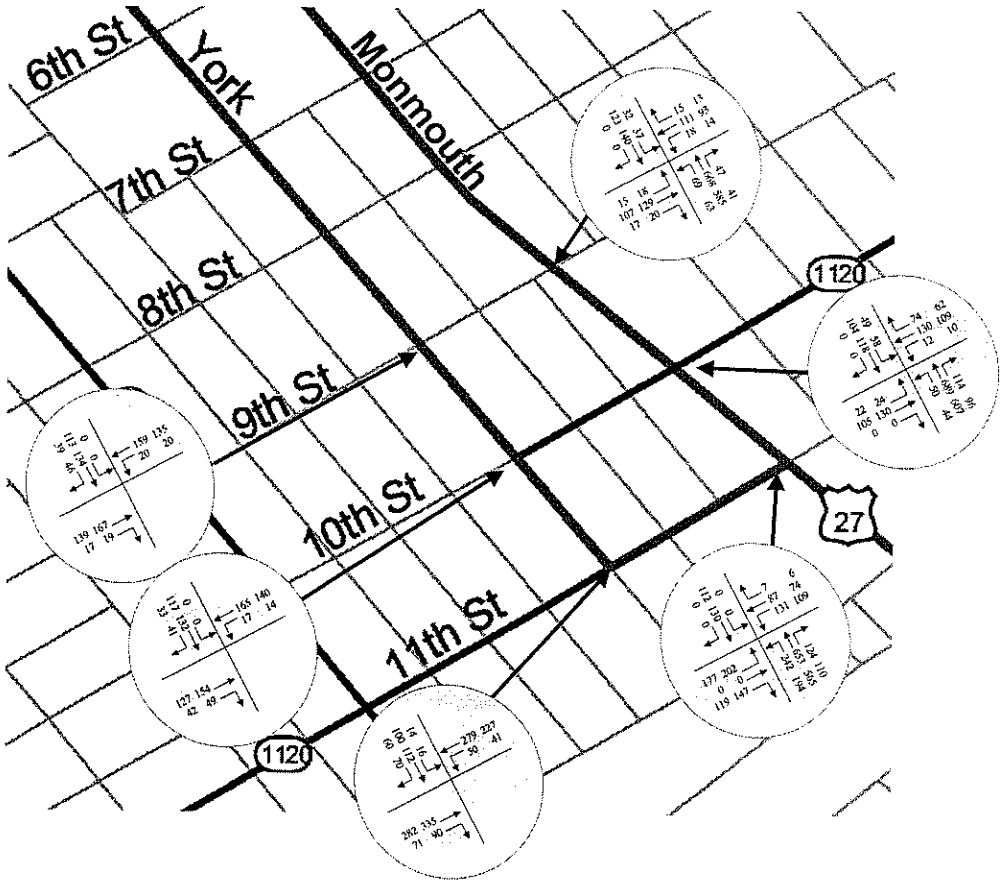
Travel Demand Models/Types

- KYSTM
- MPO
- County-level
- Small urban
- Subarea
- Sketch



Forecasting Tools/Traffic Simulation Models





Travel Demand Models/Types

- KYSTM
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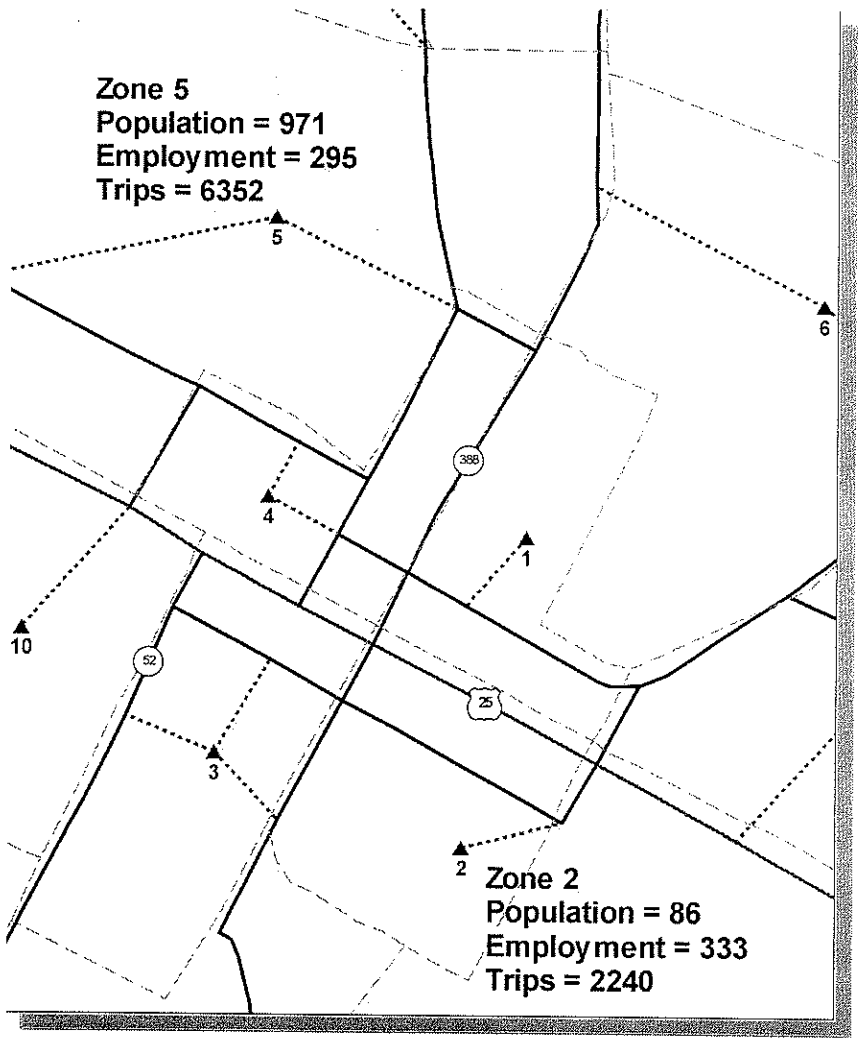
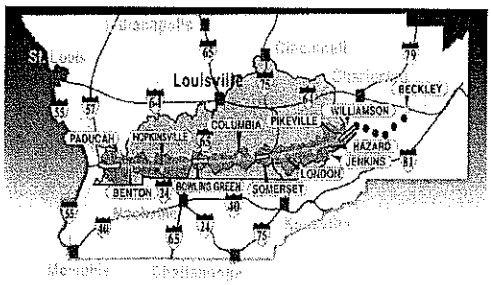
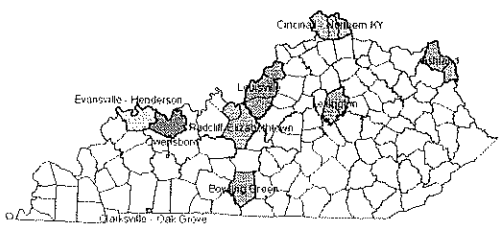


Travel Demand Models/Statewide

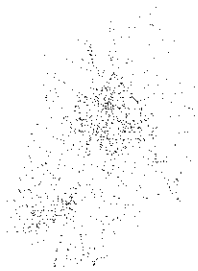
Travel Demand Models/Statewide



Travel Demand Models/MPO

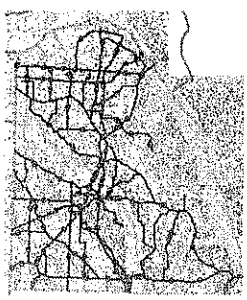


Travel Demand Models/MPO

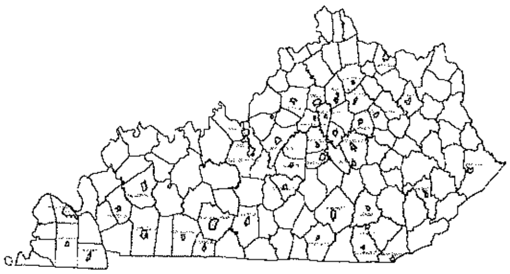


Travel Demand Models County-Level

Travel Demand Models County-Level



Travel Demand Models/Small Urban Area



Travel Demand Models/Subarea

Location	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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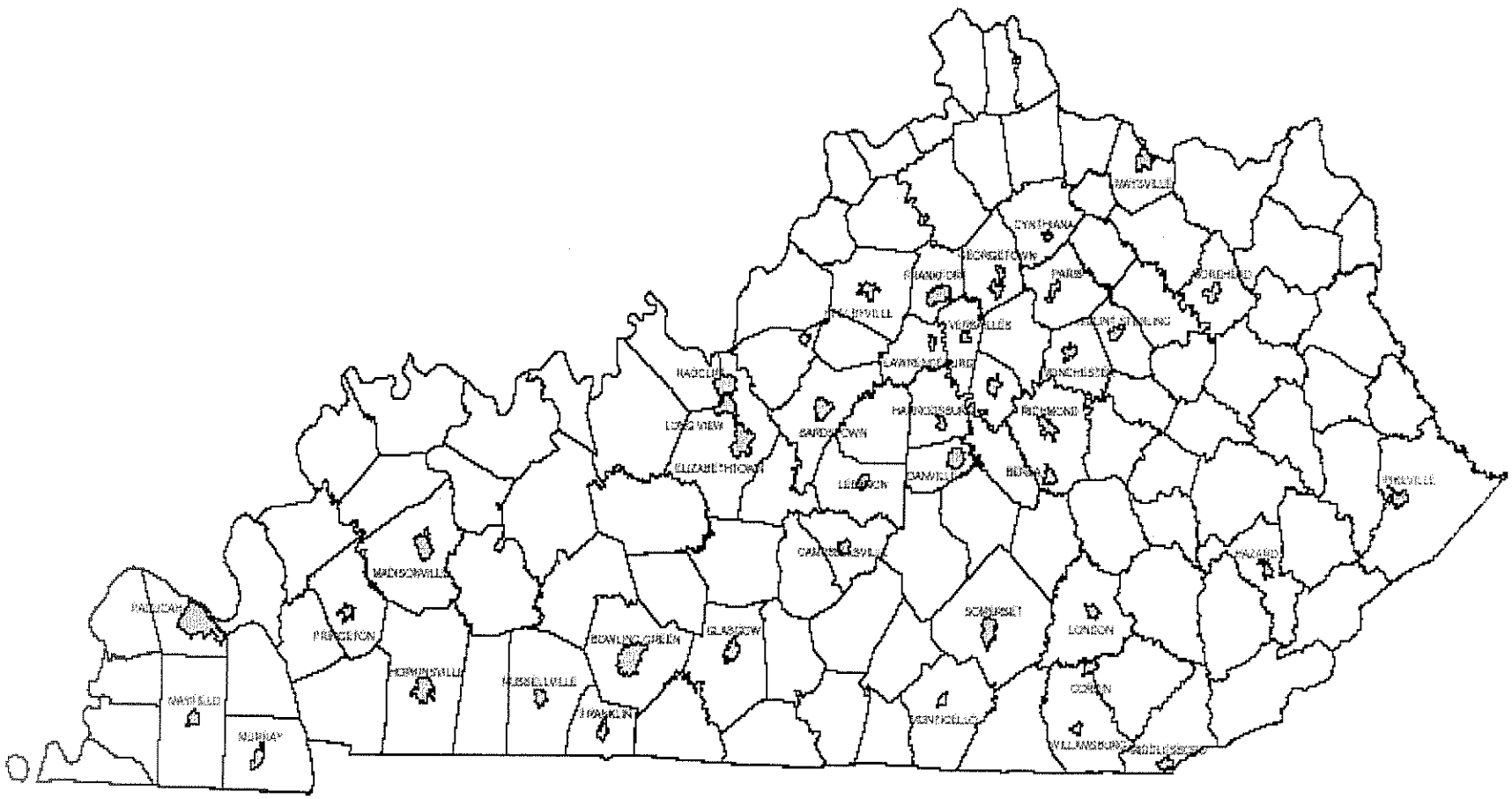
26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

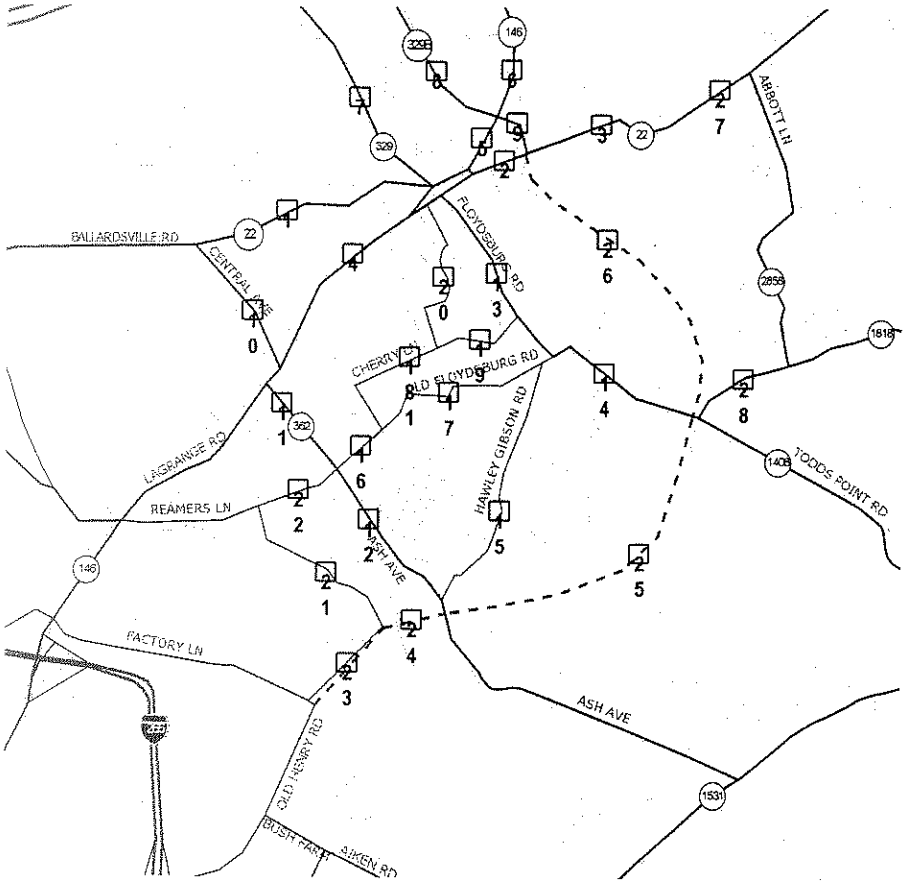
Travel Demand Models/Uses

- Forecasting - especially new facilities
- Air Quality - VMT, speed forecasting, Mobile 6.0 inputs
- Transportation Plans - used for MPO and small urban area needs analysis
- Corridor studies - I-66, I-69, I-74, and other major routes
- Special - CVM (Commercial Vehicle Monitoring) station optimization, User Cost Analysis, Detour Analysis

Travel Demand Models/Small Urban Area



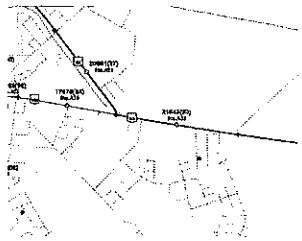
Travel Demand Models/Subarea



Location	Run 6	Run 7	Run 8	Run 9	Run 10	Run 11
1	14,700	26,400	12,600	25,900	18,200	24,900
2	8,300	15,300	14,400	16,100	10,100	14,700
3	23,700	34,800	26,300	38,800	26,500	34,000
4	14,200	14,500	13,300	12,500	14,200	14,300
5	16,300	16,700	16,300	15,400	17,100	16,700
6	26,400	26,000	27,400	26,400	26,400	26,300
7	8,500	9,800	10,500	10,500	8,700	9,700
8	19,500	13,900	23,500	19,300	18,700	15,600
9	22,700	19,100	29,900	27,000	22,100	21,000
10	6,600	3,300	5,600	4,500	5,900	3,800
11	5,800	3,700	6,600	5,100	5,400	3,900
12	7,900	5,700	10,200	8,800	7,600	6,300
13	5,700	6,200	4,600	3,500	5,900	5,700
14	4,900	4,100	4,500	1,100	5,000	3,500
15	3,800	3,800	3,800	3,800	3,800	3,800
16	1,200	1,000	800	800	1,400	1,000
17	400	100	100	100	400	100
18	800	900	700	700	900	900
19	100	200	100	100	200	200
20	200	400	100	400	200	400
21	200	100	200	200	100	100
22	4,000	2,200	1,300	800	3,900	2,300
23	45,600	42,900	66,300	60,800	45,200	43,300
24	45,500	42,900	66,100	60,700	45,300	43,400
25	35,700	34,200	52,600	48,200	35,700	34,100
26	29,100	29,600	45,100	45,100	29,400	29,500
27	23,700	34,800	26,300	38,800	26,500	34,000
28	6,500	6,500	6,500	6,500	6,500	6,500

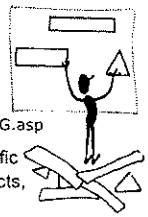
Travel Demand Models/Development

- Data collection
  - Counts
  - SE
  - Network
- External trips
- Trip generation
- Trip distribution
- Trip assignment
- Calibration



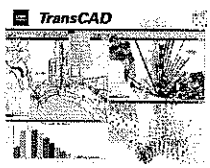
Travel Demand Models/MUG

- Eight years, meet 3 times/yr., annual workshop
- Web: http://transportation.ky.gov/Multimodal/MUG.asp
- Topics: software, freight, air quality, traffic simulation, forecasting, TRANSIMS, projects, data
- Participants: State, local, consultants, MPO, academic, FHWA



Travel Demand Models/Various

- Software
- Limitations
- Update Cycle
- Costs



Conclusion/Important Points

- There is no substitute for field review.
- Traffic volumes vary day by day.
- Errors are magnified in forecasts.
- Better safe than sorry (over-design vs. under-design)
- Traffic forecasts are the basis for many important costly decisions.

Conclusion/Customer Feedback

- Useable format?
- Appropriate level of accuracy?
- Timeliness?
- Other?

Conclusion/Contacts

- KYTC:
  - Rob Bostrom-rob.bostrom@ky.gov
  - Lynn Soporowski-lynn.soporowski@ky.gov
  - Kong Ee-kong.ee@ky.gov
  - David Hamilton-davida.hamilton@ky.gov
  - Bernie Feige-bernie.feige@ky.gov
  - Roy Rose-roy.rose@ky.gov
- Jordan, Jones & Goulding
  - Diane Zimmerman-dzimmerman@jjg.com
- Parsons Brinckerhoff
  - Rob Frazier-frazierr@pbworld.com
- Thank you for your attention!

Forecast Process

Traffic Forecasting Process

1. Preparation/Coordination

Data Collection

Traffic monitoring data

Get appropriate count/station maps and databases (volume, vehicle classification and coal haul). Review count coverage for both volume and vehicle classification. **Request new counts when necessary as soon as possible.**

Previous studies

Get copies of previous traffic forecasts, comprehensive plans, planning studies (sub area studies, urban studies, corridor studies), and other reports to use to coordinate this forecast with previous or ongoing work.

Trip data

Get trip making data from Commuting in Kentucky (CTPP Journey to Work), National Personal Transportation Study or other sources as needed.

Socioeconomic data

Get appropriate population/employment data, other TAZ information from appropriate sources (state demographer, etc.).

Land use data

Get from many sources including comprehensive plans, impact studies, economic analysis reports, district project engineer, the Internet, and field trips.

Highway data

Get appropriate highway geometrics from Highway Information System database (# lanes, lane width, speed, mileposts).

Field Trip

Make field trip on all major projects to assess area.

Coordination

Project manager

Call forecast requestor to clarify purpose and need of project. Discuss any traffic impact issues.

6YP

Check out Kentucky Six Year Plan, preconstruction status report and any other official sources of information to get background on the project.

Forecast Team Leader

Bring any questions about project to traffic forecast team leader at earliest opportunity.

Charge #s

In-house only: be sure that you have the correct MARS # and charge to project when appropriate.

Maps

Vicinity map

All jobs should have a vicinity map showing the general area of the project.

Data maps

All projects should contain data maps that have labels showing ADTs, DHVs and other key traffic information at the major sections and alternatives.. The maps must be clear with adequate identification information on it.

Quality

Always produce a quality product. A recycled station map or old topo map or some similar fuzzy product is not high quality.

2. Forecasting

Traffic Factors

Defaults

Use Traffic Forecasting Report as a source for default k-factors, growth rates, directional factors, peak hour factors, ESAL factors and vehicle types.

- The forecasts are filed in high density files and kept for approximately 10 years. The business report is copied electronically as are key supporting files.
- Key parameters will be entered in a historical database (TF_HIST) for reference.

4. Feedback

Traffic forecasting is a crucial part of the project development process at both the design, environmental analysis and planning levels. Feedback from the customers and public is expected and welcome since it only serves to improve the process. Many of the current standards and practices (such as the executive summary) are the result of higher expectations from the public.

Forecast Documentation

1. Summary
2. Example

Traffic Forecasting Documentation

Core elements:

- **Business report**: contains cover, table of contents, executive summary, vicinity map, data maps, turning movement section, ESAL section
- **Technical Memorandum** contains cover, table of contents, technical summary, count map (s) and forecast calculations which will vary from forecast to forecast.

Example forecast documentation on US 27 Lancaster Bypass, Garrard County, Item # 7-196.00 contained these forecast calculations and maps and reports:

- Proposed alignments
- Recent count map
- Zoomed in (city) count map
- CTS data and trend line projectinons and growth rates
- Recent classification data
- K factor data
- ATR data
- Directional distribution data
- Special classification count data
- Population data
- Peak hour count summary (made for forecast)
- Traffic count/model comparison summaries
- Selected link results

Traffic Forecast Report
Garrard County
US 27 Lancaster Bypass

Item No. 7-196.00

Prepared by:
Jordan, Jones & Goulding, Inc.
1050 Monarch Street, Suite 300
Lexington, Kentucky 40513

Submitted to:
Kentucky Transportation Cabinet
Division of Multimodal Programs

July 15, 2004

JORDAN
JONES &
GOULDING

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Traffic Forecast Executive Summary
Garrard County: US 27 Lancaster Bypass
Item No. 7-196.00

Forecast Summary

Traffic forecasts were developed to support the construction of the Lancaster bypass in Garrard County, Kentucky. In addition to the no build alternate, two build alternates were considered for this forecast. The Western alternate departs from US 27 just north of the Lincoln County line and continues due north, intersecting Old Danville Road and KY 52 before rejoining existing US 27 south of Boones Creek Road. The Eastern alternate departs from US 27 just north of Southway Drive and loops around Lancaster to the east, intersecting KY 39 south, KY 52 and KY 39 north before rejoining existing US 27 at KY 1355.

ADT Volumes

Base Year: The Base Year ADT volumes for this forecast were taken from historical counts at traffic count stations maintained by the KYTC in the project area. Historical counts were inflated using the established growth rate as necessary to reflect 2004 volumes.
Design Year: Design Year ADT volumes were determined for the alternates by using the model output from the Garrard County Model.

Design Hour Volumes

The K factor of 10.6 used for this forecast was determined from the statewide average for the functional class of the facility, rural principal arterial.

Growth Rates

Traffic volumes on US 27 are currently growing between 0.4 and 3.1 percent per year. The population growth rate for Garrard County is over double the statewide average, while Lancaster is slightly below the statewide average. The Garrard County model was used to project the future volumes for this forecast, which results in various growth rates being applied to the current year volumes.

Peak Hour Factor

The peak hour factor (0.89) was taken from the statewide average for rural principal arterials.

Directional Distribution Factor (D)

The directional distribution for existing US 27 was taken from a historical classification count at station A10 on US 27 in Lancaster. The direction split was 55/45, toward Lancaster in the morning and outbound in the evening. No directional split was assumed on the bypass, as it will be more of a circumferential facility servicing through traffic.

Truck Percentages

The truck percentages were taken from 2004 classification counts by KYTC at stations 772 and 516 on US 27 in Garrard County. Station 772 is located on US 27 south of KY 34 and the count showed 781 trucks. Station 516 is located on US 27 just north of the Lincoln County line and the count showed 839 trucks. Therefore, an average volume of 800 trucks in the study area was considered reasonable. The number of trucks was held constant throughout the study area. For the bypass alternates, 100 trips were assumed to use existing US 27 while the remainder used the proposed bypass alternates.

Trips Using the Bypass

The volume of vehicles traveling through the study area along US 27 is 932 in year 2003 and 1,450 in year 2030.

East Bypass – Link between KY 52 and KY 39

Origin	% Trips on the Link
US 27 North	39
KY 52	5
KY 39 South	24
US 27 South	4

West Bypass – Link between KY 52 and US 27

Origin	% Trips on the Link
US 27 North	56
KY 34	2
US 27 South	14

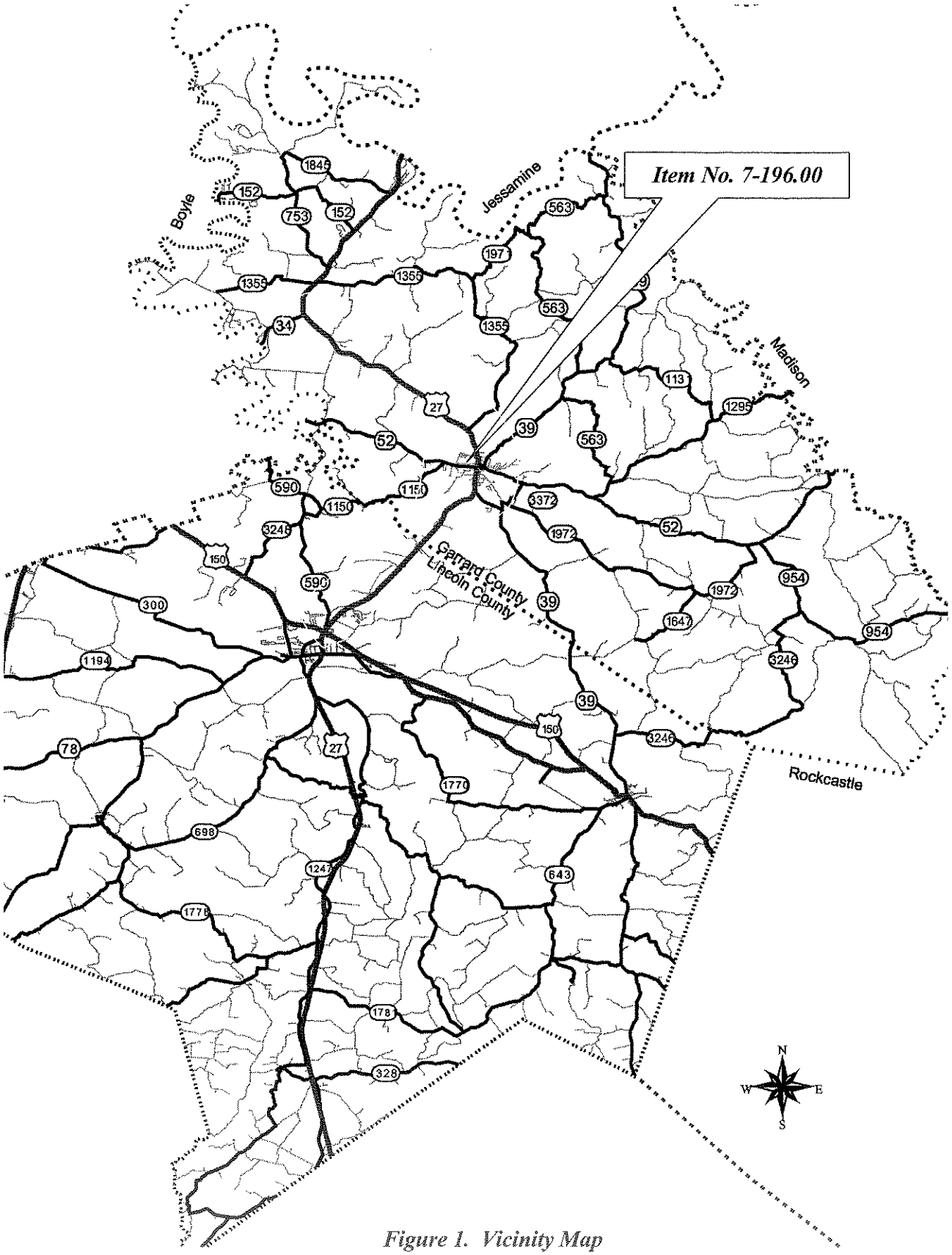


Figure 1. Vicinity Map

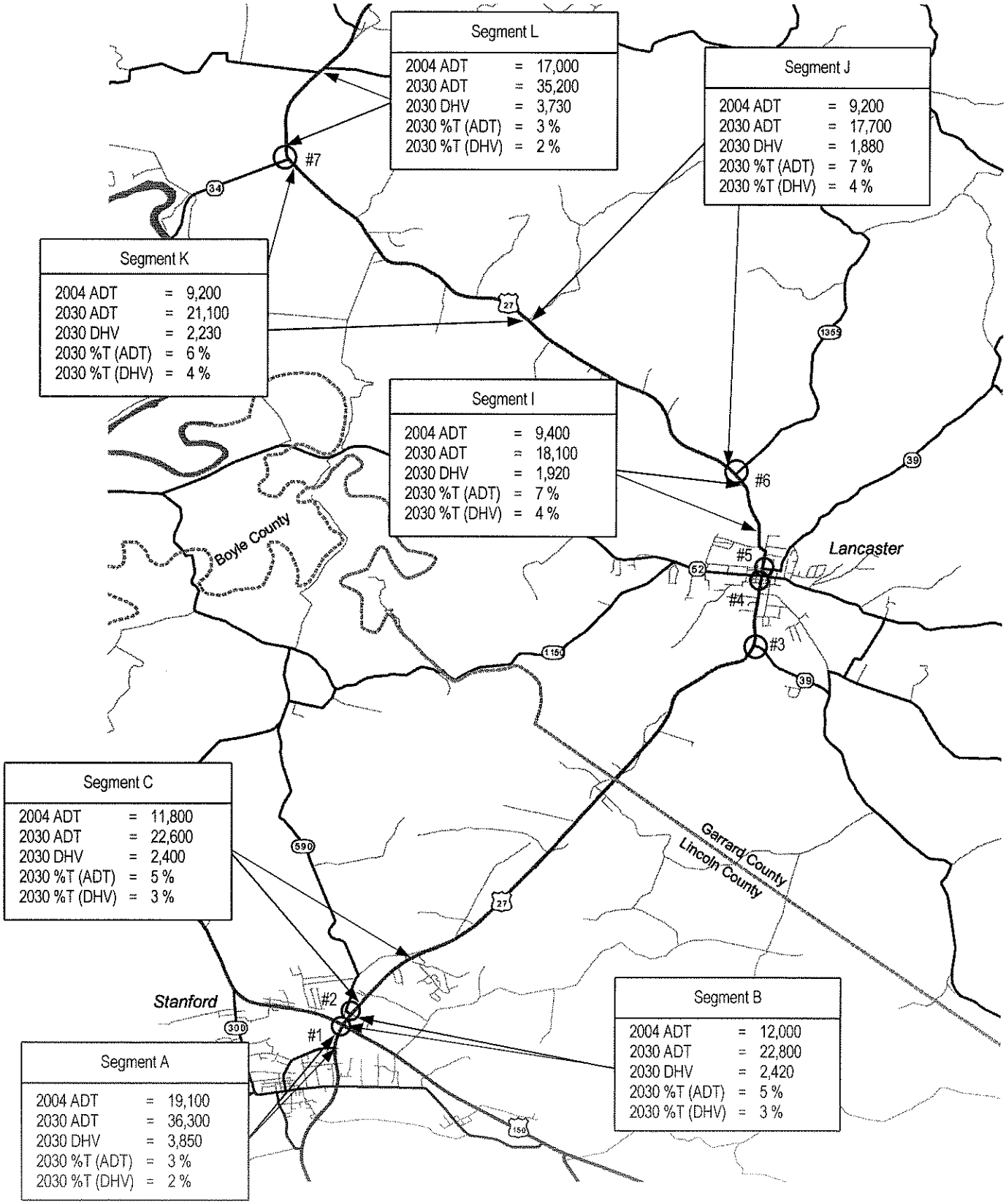


Figure 2a. Traffic Forecast Summary – No Build Alternate

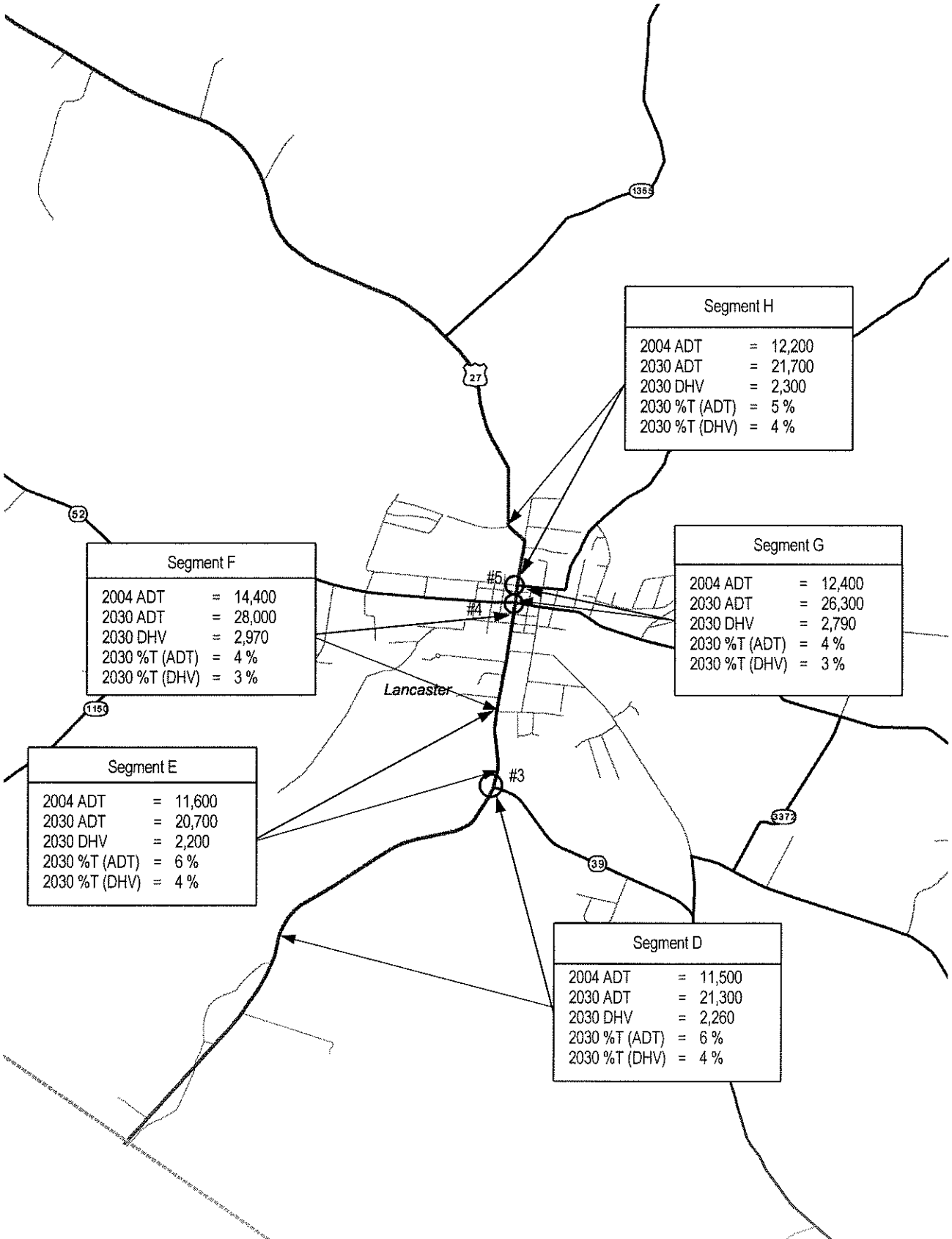


Figure 2b. Traffic Forecast Summary – No Build Alternate – Downtown Volumes

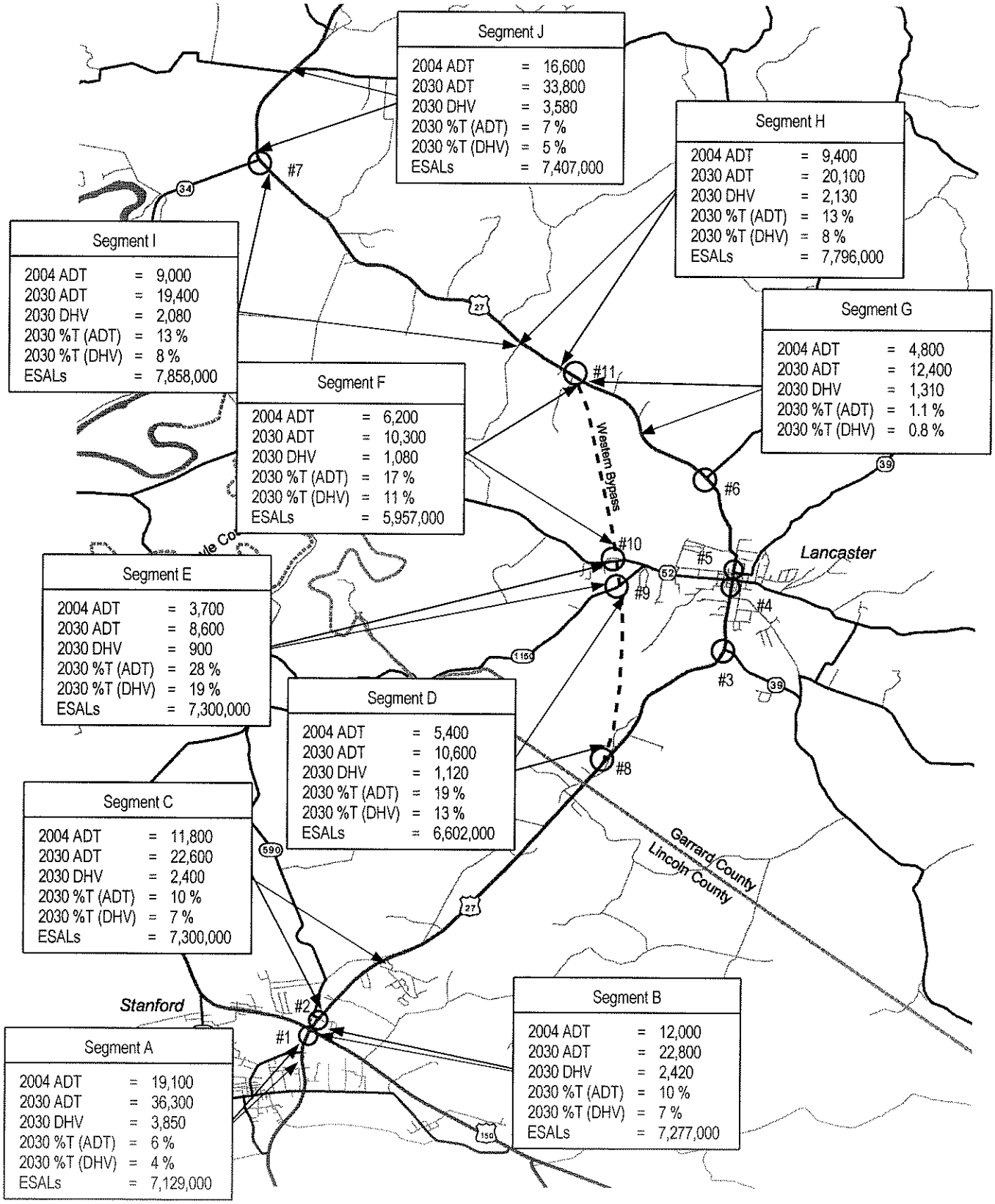


Figure 3a. Traffic Forecast Summary – Western Build Alternate

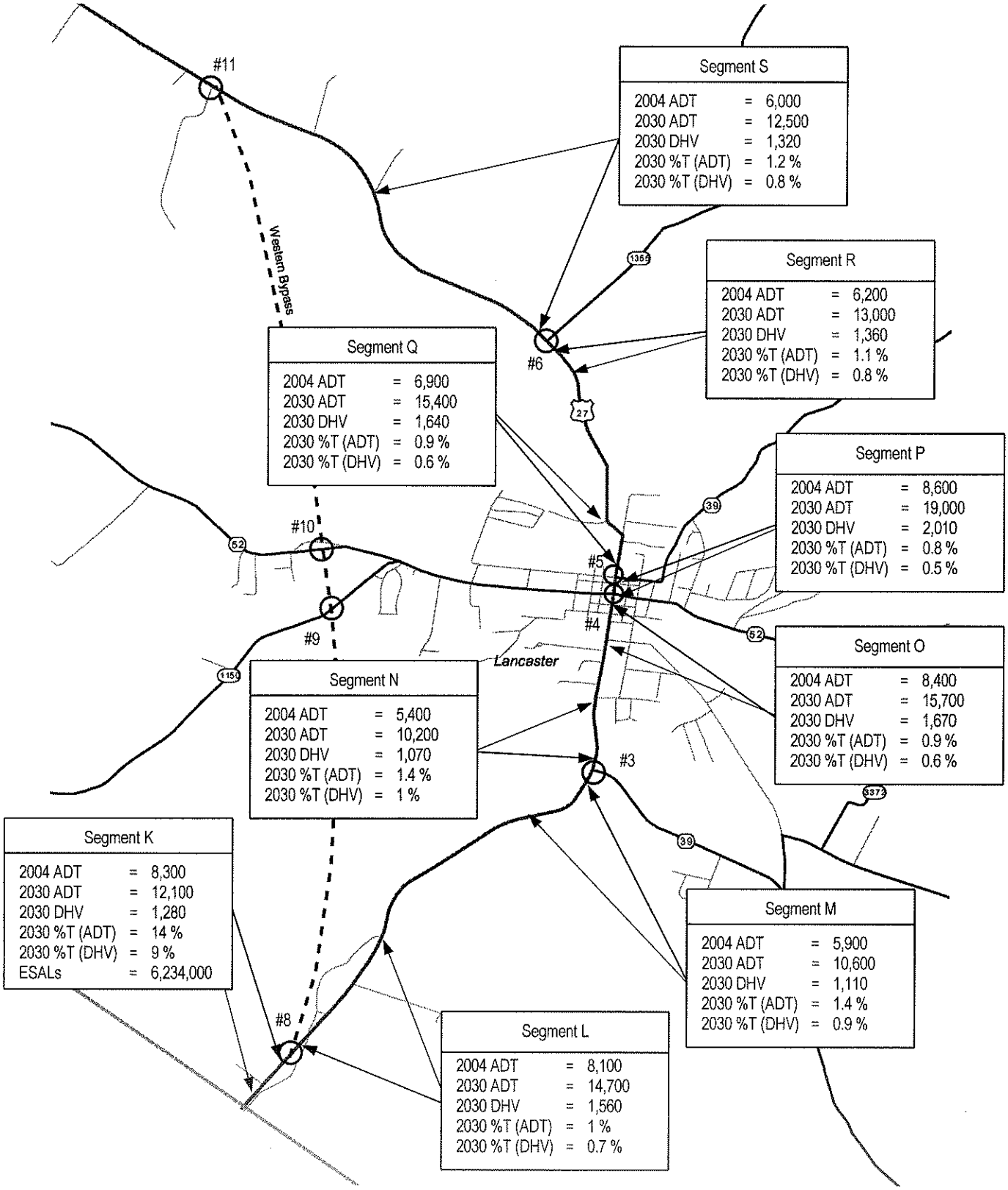


Figure 3b. Traffic Forecast Summary – Western Build Alternate – Downtown Volumes

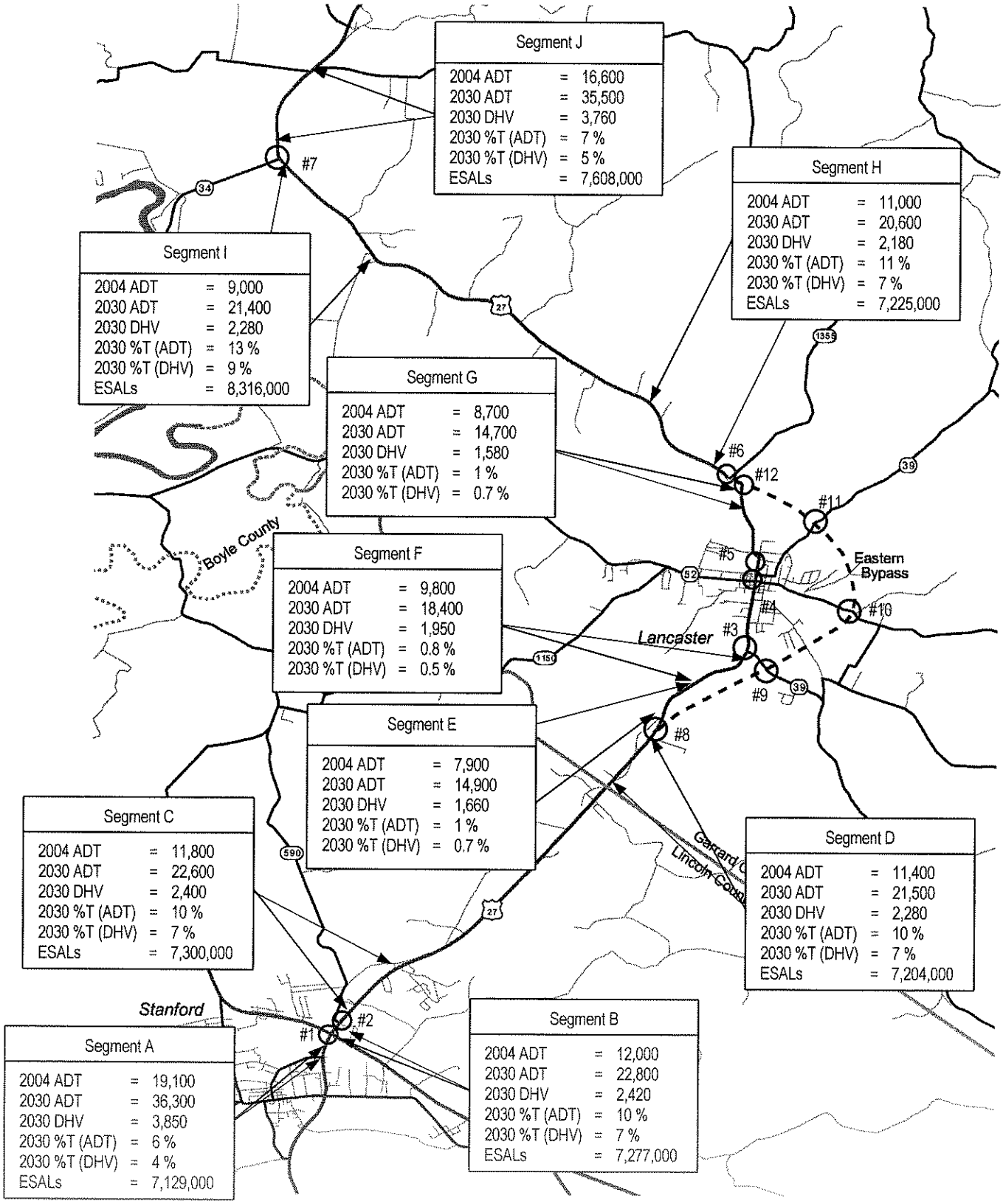


Figure 4a. Traffic Forecast Summary – Eastern Build Alternate

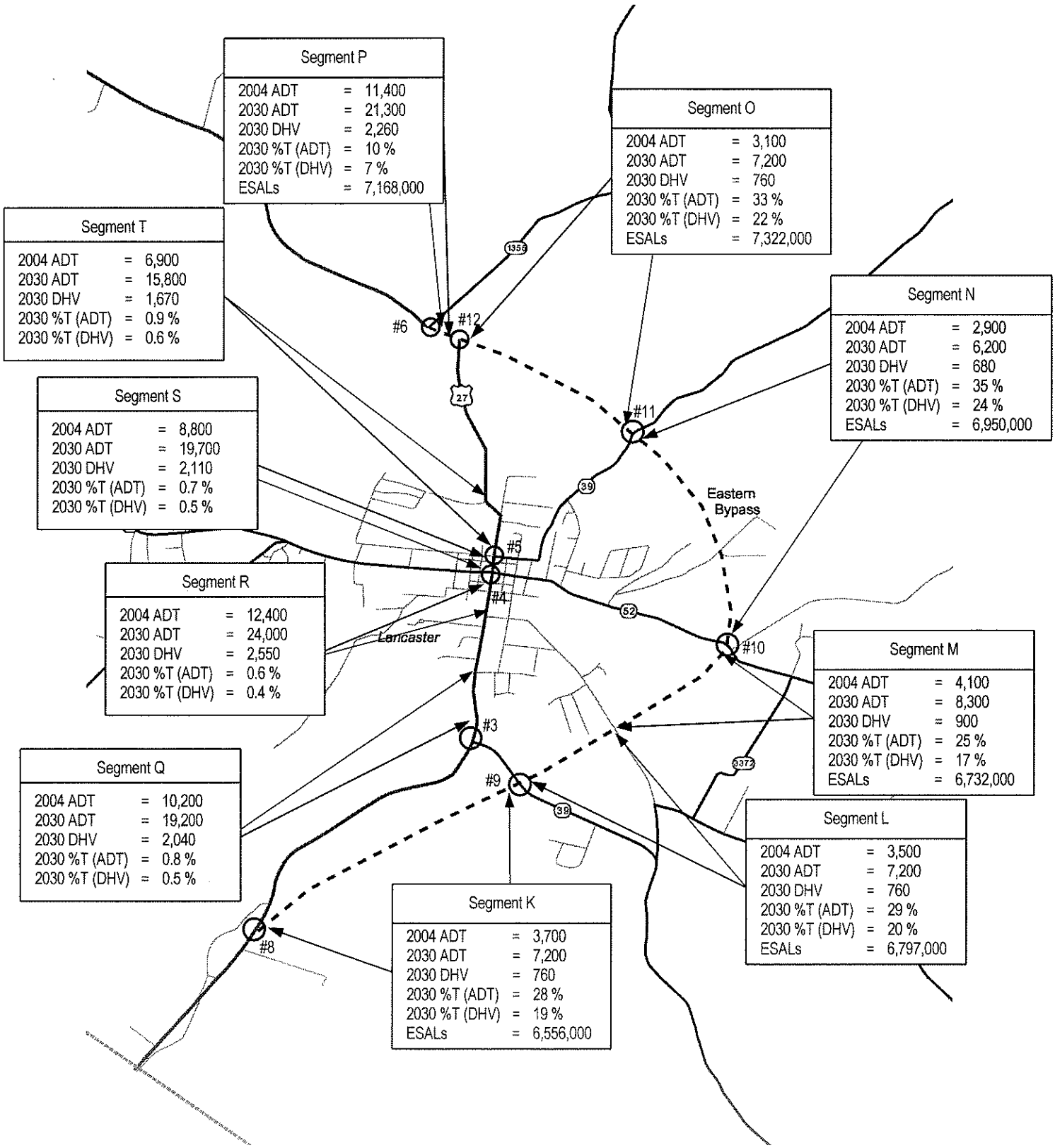
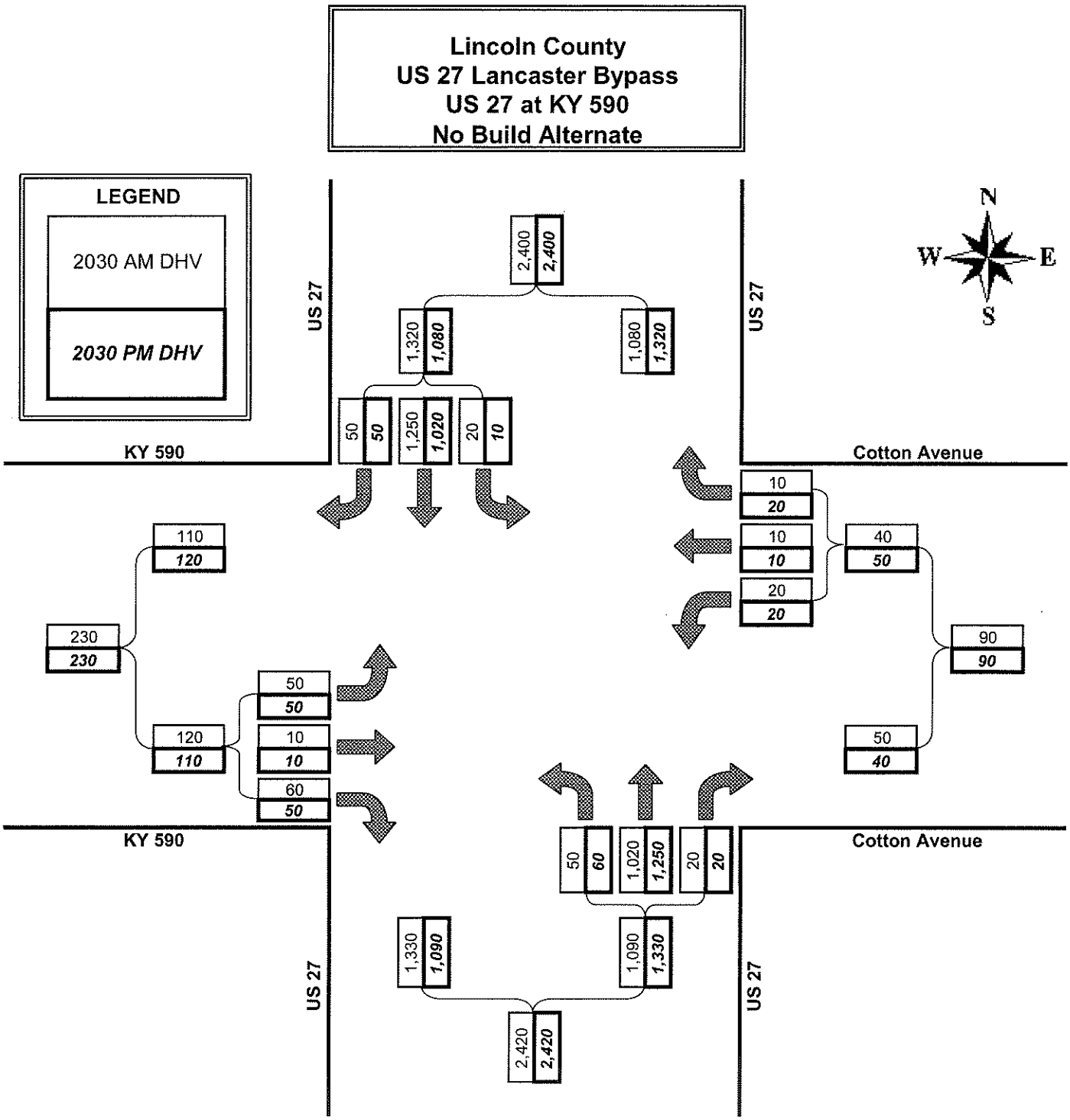


Figure 4b. Traffic Forecast Summary – Eastern Build Alternate – Downtown Volumes



PREPARED BY: G. Istre, JJG DATE PREPARED: 25-May-04	Notes: Intersection #2

TURNING MOVEMENT FORECASTS
NO BUILD ALTERNATE

TURNING MOVEMENT FORECASTS WESTERN BUILD ALTERNATE

TURNING MOVEMENT FORECASTS EASTERN BUILD ALTERNATE

ESAL FORECAST
WESTERN BUILD ALTERNATE

FORECAST OF EQUIVALENT SINGLE AXLE LOAD ACCUMULATIONS (20-year)

ROUTE ID:

County	Lincoln
Road Name	US 27
Functional Class	2 - Rural Principal Arterial
Project Description	US 27 Widening and Relocation
Scenario	Build West Bypass
Segment Description	Segment A KY 1247 to US 150 Bypass

Date	06/28/04
Forecaster	G. Istre
MARS No.	M-02299674-1
Item No.	7-196.00
Route No.	US 27
Beg. MP	17.67
End MP	17.99
T.F. No.	03.065
No. of Lanes	4
1 or 2 way	2

REFERENCES:

Previous Forecasts	none
Traffic Volume	Station A19
Truck Percent	Stations 516 and 772
ESAL Information	1998 Aggregated ESALs
Growth Rate	TLA

K- Factor Value	10.6%
K-Factor Source	Functional Class

TRAFFIC PARAMETERS:

		Present Year	Growth Rate	Construction Year	Median Year	Design Year
		2004		**2010**	**2020**	**2030**
Volume	(AADT)	19100	2.50%	22150	28360	36300
Percent Trucks	(%T)	4.200%	1.500%	4.592%	5.330%	6.185%
Number of Trucks		802		1017	1512	2245
Percent Trucks Hauling Coal	(%CT)	0.000%	0.000%	0.000%	0.000%	0.000%
Non-Coal Trucks:						
Axles/Truck	(A/T)	4.141	0.006	4.286	4.539	4.807
ESALs/Axle	(ESAL/A)	0.220	0.020	0.248	0.302	0.368
Coal Trucks:						
Axles/Truck	(A/CT)	0	0.00%	0.000	0.000	0.000
ESALs/Axle	(ESAL/CA)	0	0.00%	0.000	0.000	0.000

ESAL CALCULATIONS:

Total Median Year Daily ESALs

(AADT x (1-%T) x .005)+(AADT x %T x (A/T) x (ESAL/A))+(AADT x (%T) x (%CT) x (A/CT) x (ESAL/CA)) = 2206.213

Lane Distribution Factor = 0.44

Design ESALs in Critical Lane

Total Median Year Daily ESALs x 365 x Number of Forecast Years x Lane Distribution Factor = 7,129,000

General Comments:

Technical Memorandum

Traffic Forecast Report
Garrard County
US 27 Lancaster Bypass
Item No. 7-196.00

Prepared for:

KENTUCKY TRANSPORTATION CABINET

Kentucky Transportation Cabinet

Prepared by:
Jordan, Jones & Goulding, Inc.
1050 Monarch Street, Suite 300
Lexington, Kentucky 40513

JORDAN JONES & GOULDING

July 15, 2004

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Traffic Forecast Technical Report
Garrard County: US 27 Lancaster Bypass
Item No. 7-196.00

PROJECT DESCRIPTION

Traffic forecasts were developed to support the construction of the Lancaster bypass in Garrard County, Kentucky. In addition to the no build alternate, two build alternates were considered for this forecast. The Western alternate departs from US 27 just north of the Lincoln County line and continues due north, intersecting Old Danville Road and KY 52 before rejoining existing US 27 south of Boones Creek Road. The Eastern alternate departs from US 27 just north of Southway Drive and loops around Lancaster to the east, intersecting KY 39 south, KY 52 and KY 39 north before rejoining existing US 27 at KY 1355.

TYPES OF FORECASTS

The following types of forecasts were developed:

- Average daily traffic (ADT) and design hourly volume (DHV) forecasts were developed for US 27 and the proposed Lancaster bypass in Garrard County. These forecasts were developed for year 2003 (base year) and year 2030 (design year).
- Base year 2003 and design year 2030 ADT and DHV turning movement forecasts were developed for the following intersections:
  - US 27 and US 150 (No Build and 2 Build alternates)
  - US 27 and KY 590 (No Build and 2 Build alternates)
  - Existing US 27 and Relocated US 27 Western Bypass S. of Lancaster (Western alternate only)
  - Existing US 27 and Relocated US 27Eastern Bypass S. of Lancaster (Eastern alternate only)
  - Relocated US 27 Eastern Bypass and KY 39 South (Eastern alternate only)
  - Existing US 27 and KY 39 South (No Build and 2 Build alternates)
  - Relocated US 27 Western Bypass and Old Danville Road (Western alternate only)
  - Relocated US 27 Western Bypass and KY 52 (Western alternate only)
  - Relocated US 27 Eastern Bypass and KY 52 (Eastern alternate only)
  - Existing US 27 and KY 52 (No build and 2 Build alternates)
  - Relocated US 27 Eastern Bypass and KY 39 North (Eastern alternate only)
  - Existing US 27 and KY 39 North (No Build and 2 Build alternates)
  - Existing US 27 and Relocated US 27 Eastern Bypass N. of Lancaster (Eastern alternate only)
  - Relocated US 27 Eastern Bypass and KY 1355 (No Build and 2 Build alternates)
  - Existing US 27 and Relocated US 27 Western Bypass N. of Lancaster (Western alternate only)
  - US 27 and KY 34 (No Build and 2 Build alternates)

Design year truck forecasts (ADT and DHV) and ESAL forecasts were also provided for this project.

TRAFFIC VOLUMES

The volumes for this forecast were taken from historical counts in the project area at stations maintained by the Kentucky Transportation Cabinet. Volumes were grown to reflect 2004 volumes as necessary. All future volumes were taken from the Garrard County model, including volumes along the two bypass alignments. The relevant count data are presented as **Exhibits A** and **B**.

Exhibit A. Traffic Count Data

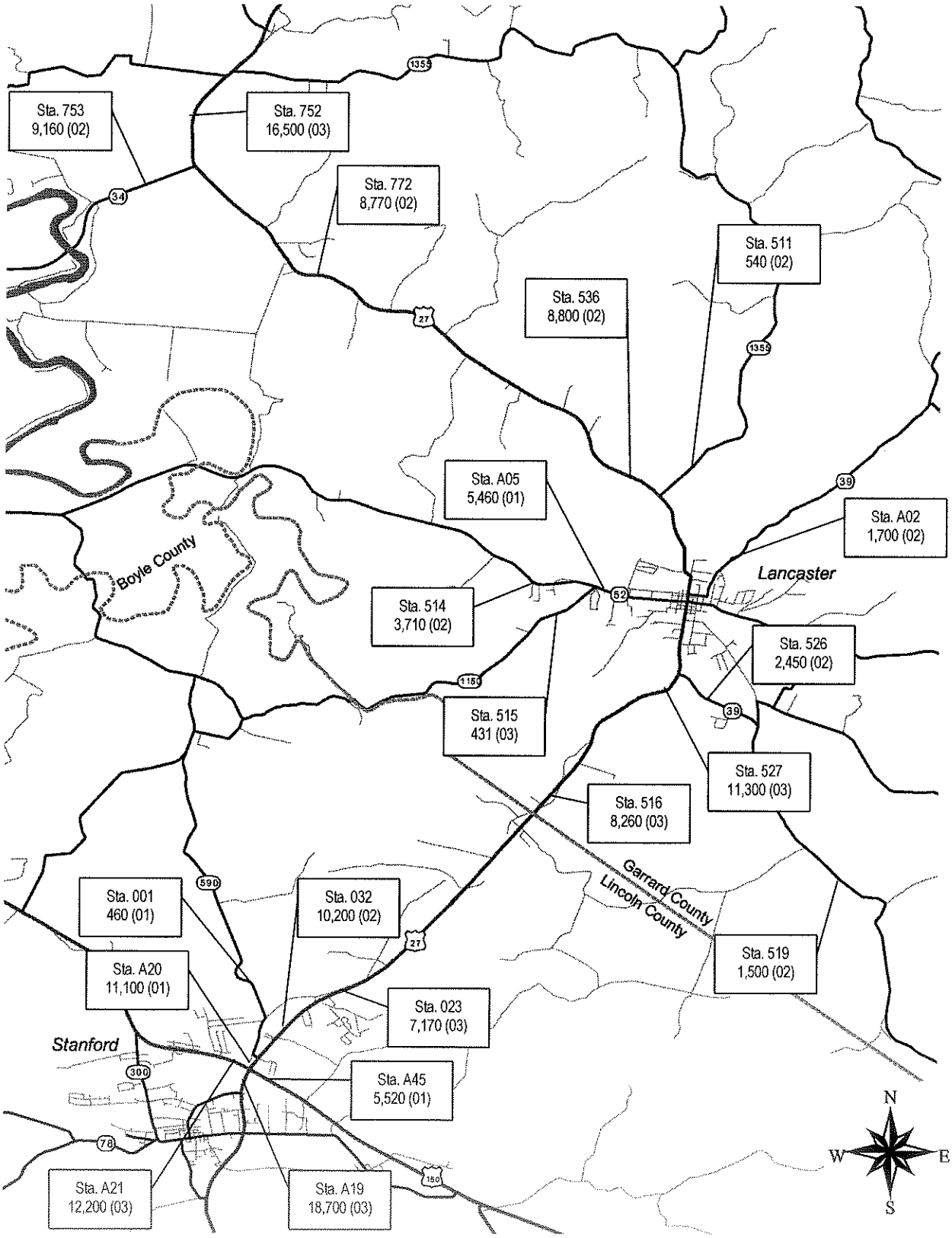
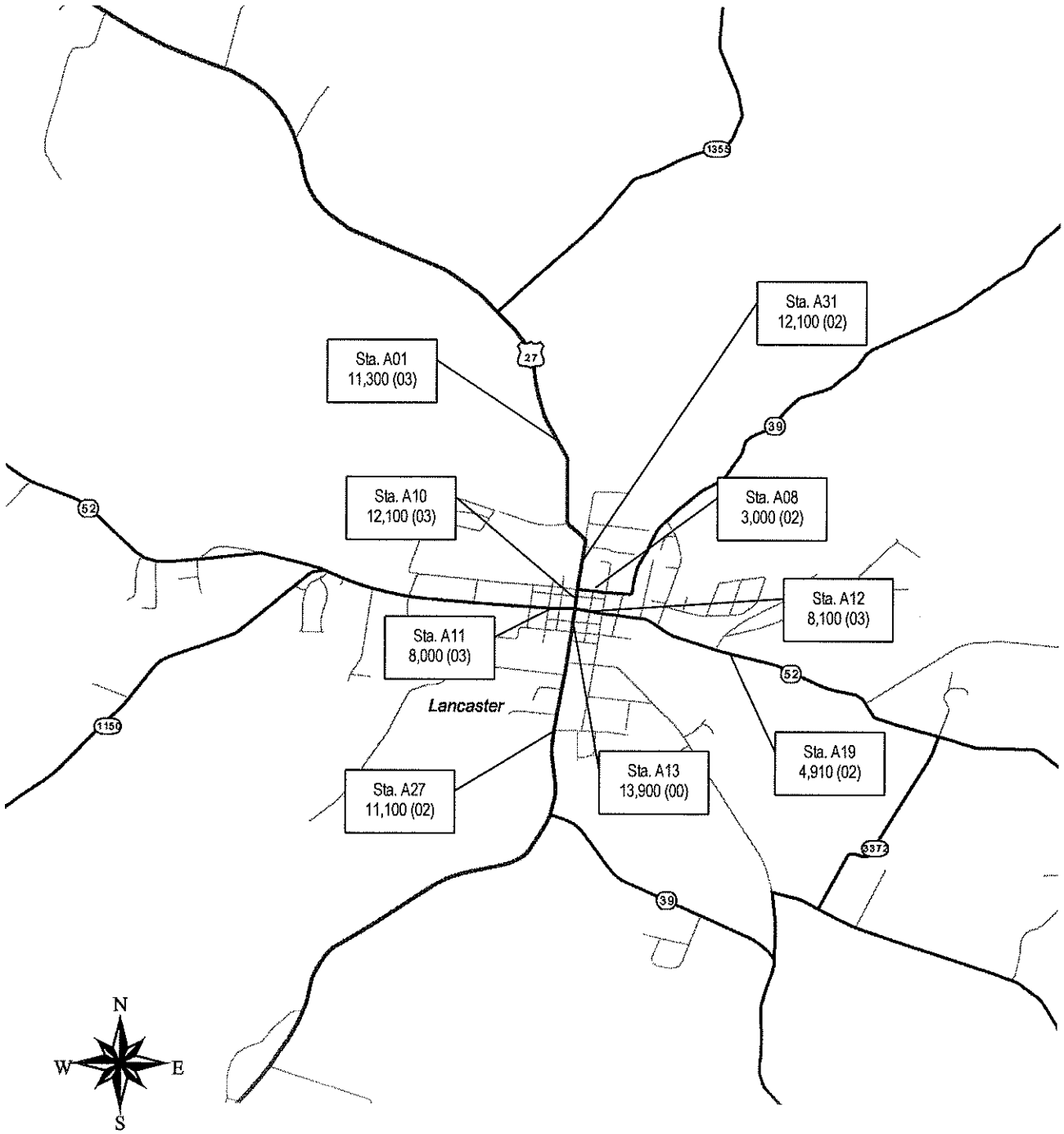


Exhibit B. Traffic Count Data in Lancaster



TRAFFIC CHARACTERISTICS

Design Hour (K) Factor

The K factor used for this forecast was determined from the statewide average for the functional class of the facility, rural principal arterial. There are no ATR stations for US 27 in Garrard County. ATR number 70 on US 119 in Pike County was similar in ADT and has a K factor of 10.0 percent and shares the same functional class. The statewide average for this functional class (rural principal arterial) is 10.6 percent. The traffic on the proposed bypass will most likely have rural properties, so the higher statewide average K factor of 10.6 percent was used for this forecast.

Peak Hour Factor (PHF)

The peak hour factor (0.89) was taken from the statewide average for rural principal arterials.

Directional Distribution Factor (D)

The directional distribution for existing US 27 was taken from a historical classification count at station A10 on US 27 in Lancaster. The direction split was 55/45, toward Lancaster in the morning and outbound in the evening. No directional split was assumed on the bypass, as it will be more of a circumferential facility servicing through traffic.

Truck Percentages

The truck percentages were taken from 2004 classification counts by KYTC at stations 772 and 516 on US 27 in Garrard County. Station 772 is located on US 27 south of KY 34 and the count showed 781 trucks. Station 516 is located on US 27 just north of the Lincoln County line and the count showed 839 trucks. Therefore, an average volume of 800 trucks in the study area was considered reasonable. The number of trucks was held constant throughout the study area. For the bypass alternates, 100 trips were assumed to use existing US 27 while the remainder used the proposed bypass alternates.

GROWTH FACTOR

Traffic volumes on US 27 are currently growing between 0.4 and 3.1 percent per year. The population growth rate for Garrard County is over double the statewide average, while Lancaster is slightly below the statewide average. The Garrard County model was used to project the future volumes for this forecast, which results in various growth rates being applied to the current year volumes.

Population

Change (Includes 2000 Census Data)

Area	2000	1990	Percent
Kentucky	4,041,769	3,685,296	9.7%
Garrard County	14,792	11,579	27.7%
Lancaster	3,734	3,421	9.1%

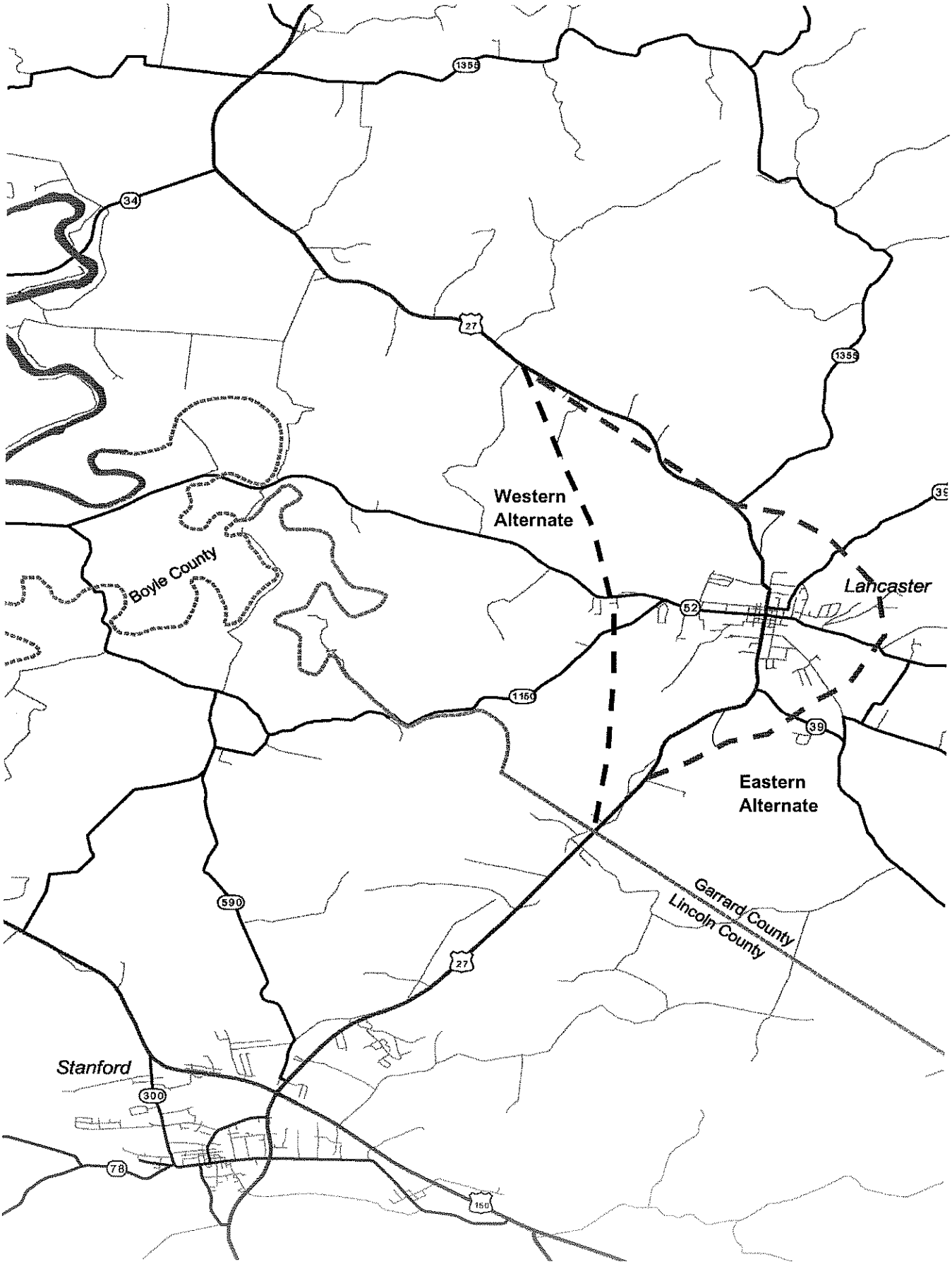
Estimated Population

County	2000	2010	2020	2030
Garrard	14,792	19,251	24,683	30,920

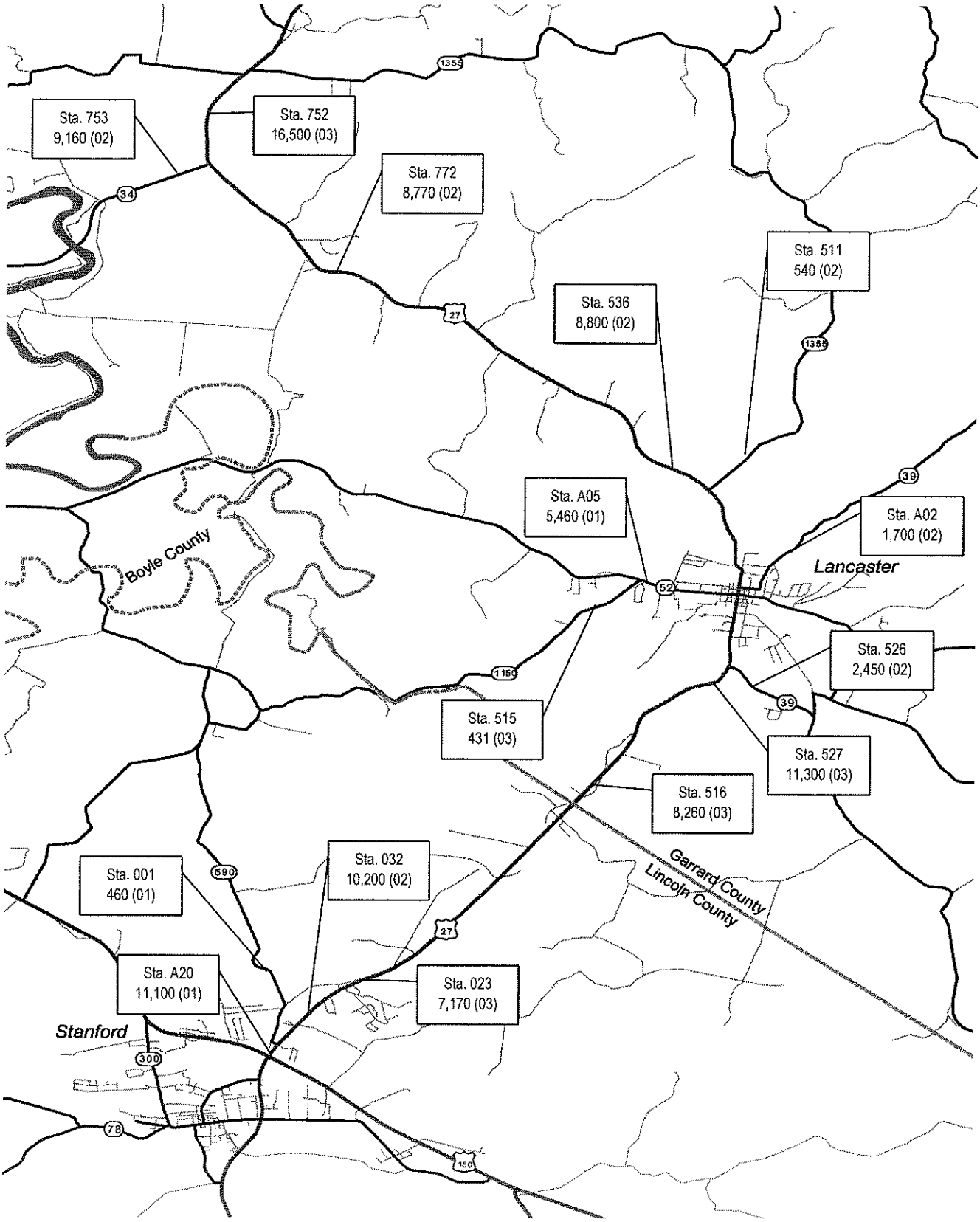
Source of population info: U.S. Bureau of the Census

APPENDIX
FORECAST CALCULATIONS

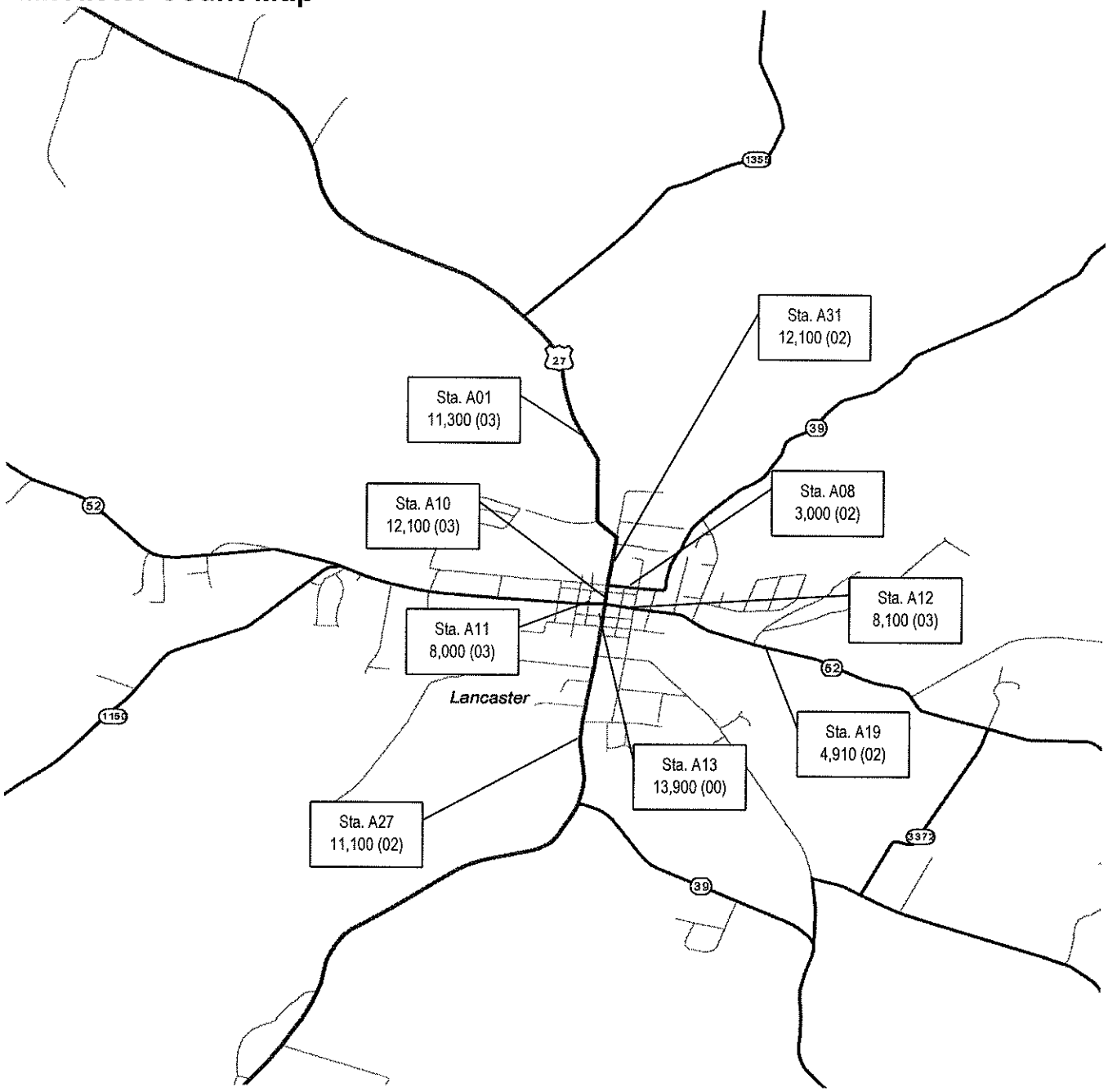
Proposed Alignments



Recent Count Map



Lancaster Count Map



CTS Data, Trend Line Projections & Growth Rates

Design Year = 2030

County	Route	Station	Location	MP	FC	Year	Count	TLA GR
Garrard	US 27	516	Lincoln County Line to Jaycees Park Rd	0.0-1.0	2	**2030**	**15000**	**2.62%**
						2003	8260	
						2000	7660	
						1997	6850	
						1994	6020	
						1992	5610	
		527	Jaycees Park Rd to KY 39 South	1.0-2.2	2	**2030**	**16500**	**1.72%**
						2003	11300	
						2000	9020	
						1994	8820	
						1992	7820	
						1991	8480	
		A27	KY 39 South to Tinder St	2.2-2.8	2	**2030**	**17200**	**1.66%**
						2002	11100	
						1997	12800	
						1991	7490	
						1985	8650	
						1978	7300	
		A25	Tinder St to Crab Orchard	2.8-2.9	2	**2030**	**15500**	**0.97%**
						2002	12800	
						1998	12400	
						1992	9840	
						1985	12800	
						1978	9360	
		A13	Crab Orchard to KY 52 in Lancaster	2.9-3.0	2	**2030**	**17600**	**0.84%**
						2000	13900	
						1993	13300	
						1991	12200	
						1985	11100	
						1978	11400	
		A10	KY 52 in Lancaster to KY 39 North	3.0-3.1	2	**2030**	**17000**	**1.30%**
						2003	12100	
						2000	12800	
						1993	10600	
						1991	11000	
						1985	9520	
		A31	KY 39 North to Gayle Dr	3.1-3.3	2	**2030**	**12300**	**0.40%**
						2002	12100	
						1997	8540	
						1991	10800	
						1985	9080	
						1978	10000	
		A32	Gayle Dr to Hagan Ct	3.3-3.4	2	**2030**	**16000**	**1.04%**
						2002	11600	
						1998	12600	
						1991	9730	
						1985	8480	
						1978	9360	
		A01	Hagan Ct to KY 1355	3.4-4.3	2	**2030**	**20200**	**2.68%**
						2003	11300	
						2000	8950	
						1995	7890	
						1992	6240	
						1991	7210	
		536	KY 1355 to Boone Creek Road	4.3-6.8	2	**2030**	**13900**	**2.14%**
						2002	8800	
						1998	8720	
						1992	5490	
						1985	6170	
						1981	4920	

CTS Data, Trend Line Projections & Growth Rates

Design Year = 2030

County	Route	Station	Location	MP	FC	Year	Count	TLA GR
						1985	1070	
		526	KY 1972 to US 27	5.3-6.3	7	**2030**	**3600**	**1.82%**
						2002	2450	
						1998	2090	
						1992	2050	
						1991	2170	
						1985	1600	
		A08	US 27 to Campbell Street	6.3-6.4	7	**2030**	**3900**	**1.19%**
						2002	3000	
						1997	2430	
						1991	2370	
						1985	1830	
						1978	2110	
		A22	Campbell Street to Hamilton Ave	6.4-6.8	7	**2030**	**2000**	**0.43%**
						2002	1860	
						1997	1390	
						1991	1970	
						1985	1390	
						1978	1600	
		A02	Hamilton Ave to Perry Rogers Rd	6.8-9.5	7	**2030**	**1900**	**0.51%**
						2002	1700	
						1997	1490	
						1991	1200	
						1985	1220	
						1978	1460	
	KY 52	507	Boyle Co to Boone Creek Rd	0.0-2.4	6	**2030**	**6000**	**1.82%**
						2002	4070	
						1998	3560	
						1992	3200	
						1991	3100	
						1981	2480	
		514	Boone Creek Rd to Old Danville Rd	2.4-4.2	6	**2030**	**6100**	**1.70%**
						2002	3710	
						1998	4490	
						1992	3560	
						1991	3450	
						1983	2760	
		A05	Old Danville Rd to Maple St	4.2-4.5	6	**2030**	**11100**	**3.63%**
						2001	5460	
						1997	4850	
						1991	4510	
						1985	2230	
		A07	Maple St to Pauling St	4.5-5.0	6	**2030**	**9500**	**1.23%**
						2002	6840	
						1997	6150	
						1991	5910	
						1985	3360	
						1978	5040	
		A11	Pauling St to US 27 in Lancaster	5.0-5.1	6	**2030**	**14100**	**2.55%**
						2003	8000	
						2000	8590	

CTS Data, Trend Line Projections & Growth Rates

Design Year = 2030

County	Route	Station	Location	MP	FC	Year	Count	TLA GR
						1993	7210	
						1991	6660	
						1985	4550	
		A12	US 27 in Lancaster to Jct of Campbell St	5.1-5.2	6	**2030**	**11200**	**1.43%**
						2003	8100	
						2000	7770	
						1993	7930	
						1991	7150	
						1985	5910	
		A21	Jct of Campbell St to Hamilton Ave	5.2-5.4	6	**2030**	**7600**	**0.36%**
						2002	7140	
						1997	5240	
						1991	9520	
						1985	5720	
						1978	6290	
		A19	Hamilton Ave to KY 3372	5.4-6.4	6	**2030**	**5500**	**0.77%**
						2002	4910	
						1997	3500	
						1991	3970	
						1985	3300	
						1978	3690	
		513	KY 3372 to Old Railroad Grade Road	6.4-10.3	6	**2030**	**2100**	**1.55%**
						2002	1360	
						1997	1530	
						1993	1360	
						1991	1220	
						1985	1050	
		001	Old Railroad Grade Road to Noe Road	10.3-15.6	6	**2030**	**1800**	**1.86%**
						2002	1200	
						1997	1060	
						1991	829	
						1985	714	
						1981	729	
	KY 1150	515	Lincoln Co Line to KY 52	0.0-2.9	9	**2030**	**500**	**0.96%**
						2003	431	
						1997	530	
						1991	722	
						1985	985	
						1978	305	
Lincoln	KY 590	001	US 27 to Carmans Lane	0.0-3.8	8	**2030**	**1800**	**2.98%**
						2001	460	
						1996	1820	
						1994	710	
						1988	450	
						1982	440	
	US 27	A19	KY 1247 to US 150 Bypass	17.6-17.9	2	**2030**	**42400**	**4.51%**
						2003	18700	
						2000	19100	
						1994	15700	
						1988	6660	
		A20	US 150 Bypass to KY 590	17.9-18.1	2	**2030**	**28700**	**4.62%**
						2001	11100	
						1997	11600	
						1994	9350	
						1988	4300	
		032	KY 590 to Ridgeway Spur	18.1-19.1	2	**2030**	**13000**	**1.39%**
						2002	10200	
						1999	7470	
						1993	8200	

CTS Data, Trend Line Projections & Growth Rates

Design Year = 2030

County	Route	Station	Location	MP	FC	Year	Count	TLA GR
						1987	6730	
						1981	6620	
		23	Ridgeway Spur to Garrard Co Line	19.1-21.9	2	**2030**	**11500**	**1.88%**
						2003	7170	
						2000	7880	
						1994	6320	
						1987	5290	
						1982	4700	
	US 150	A21	KY 300 to US 27	4.3-5.5	2	**2030**	**25600**	**3.26%**
						2003	12200	
						2001	13400	
						1998	12600	
						1997	11400	
						1994	8960	
						1988	6660	
		A45	US 27 to River Drive	5.5-6.1	6	**2030**	**4300**	**-0.60%**
						2001	5520	
						1995	2920	
						1988	5530	
		A54	River Drive to Rice Lane	6.1-7.1	6	**2030**	**500**	**-5.56%**
						2001	4270	
						1995	2920	
						1988	5530	
		A56	Rice Lane to KY 78	7.1-7.9	6	**2030**	**5000**	**1.28%**
						2000	4430	
						1994	1960	
						1988	3230	
						1981	2930	
						1979	2620	

Recent Classification Data (from 2003 Spreadsheet)

County	Station	Route	Milepoint	ADT	Truck %	CT %	Axles/Truck	Axles/CT	Axle Factor	Year
40	516	US 27	0.1	5610	4.2%	0	3.139	0	0.9770	1994
40	516	US 27	0.1	5780	7.0%	0.011	3.459	5.5	0.9590	1991
40	516	US 27	0.1	7193	9.5%	0.002	3.363	5	0.9390	1986
40	516	US 27	0.1	5520	9.5%	0.004	3.226	4	0.9440	1981
40	527	US 27	2.1	7820	3.6%	0	2.816	0	0.9860	1994
40	A10	US 27	3.1	11200	4.9%	0	3.281	0	0.9696	1997
40	A01	US 27	3.8	7008	6.9%	0.006	3.396	5.333	0.9590	1991
40	A01	US 27	3.8	7008	2.4%	0	3.034	0	0.9880	1990
40	772	US 27	8.8	6030	6.7%	0	3.466	0	0.9590	1991
40	772	US 27	8.8	4550	7.7%	0	3.295	0	0.9530	1984
40	752	US 27	10.5	8288	11.4%	0	2.94	0	0.9491	2003
40	783	KY 34	0.1	4084	5.5%	0	2.956	0	0.9740	1981
40	782	KY 39	15.4	318	10.7%	0	2.24	0	0.9870	1986
40	782	KY 39	15.4	308	6.6%	0	2	0	1.0000	1982
40	513	KY 52	9.2	1360	6.2%	0	2.389	0	0.9880	1993
40	006	KY 52	16.2	1270	34.8%	0	2.308	0	0.9491	2001
40	250	KY 954	0.1	559	1.3%	0	2.222	0	0.9990	1979
40	778	KY 1355	8.1	209	13.4%	0	2.293	0	0.9807	2003
40	540	KY 1972	0.1	605	3.2%	0	2.251	0	0.996	2003

K Factor Data

US 27
Functional Class = 2
Statewide average K = 10.6
Statewide average PHF = 0.89
Statewide average D = 57/43

ATR Data

ATR 70 - US 119 in Pike County
No ATRs with FC=6 have similar ADT
ATR 70 - FC =2
K Factor = 10.0%
PHF = 0.87

Directional Distribution Info

		NB	SB	D	
US 27, MP 3.10					
Station A10	AM Peak	470	370	0.560	Northbound
Year = 1997	PM Peak	564	663	0.540	Southbound

Use D=55/45, toward Lancaster in the morning and away in the evening.

Special Classification Counts

Station	Route	Milepoint	ADT	Truck %	CT %	xles/Truc	Axles/CT	xle Factc	Year
516	US 27	0.1	9139	9.2%	0	3.56	0	0.9300	2004
772	US 27	8.8	9370	8.3%	0	3.544	0	0.9400	2004

Station 516 = 839 trucks
Station 772 = 781 trucks

Used an average value of 800 trucks for forecast.

Population Data

Change (Includes 2000 Census Data)

Area	2000	1990	Percent
Kentucky	4,041,769	3,685,296	9.7%
Garrard County	14,792	11,579	27.7%
Lancaster	3,734	3,421	9.1%

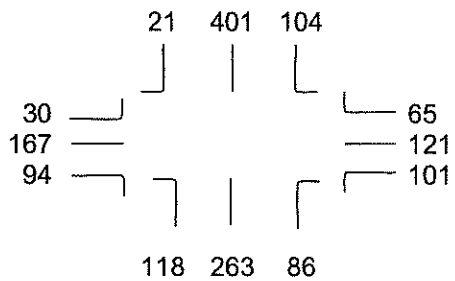
Estimated Population

County	2000	2010	2020	2030
Garrard	14,792	19,251	24,683	30,920

2001 PM Peak Hour Count
at US 27 and KY 52

	US 27 SB			KY 52 WB			US 27 NB			KY 52 EB		
Time	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**
15:55	7	31	4	6	11	8	4	23	5	2	10	11
16:00	6	26	1	3	11	6	8	28	5	5	14	9
16:05	14	33	2	5	9	7	15	28	12	1	10	8
16:10	4	31	0	7	15	4	10	19	11	4	14	9
16:15	8	37	1	2	8	4	15	21	5	2	9	4
16:20	5	35	3	15	11	6	9	24	6	1	16	6
16:25	**3**	**26**	**2**	**11**	**11**	**8**	**8**	**30**	**12**	**3**	**20**	**7**
16:30	**10**	**37**	**1**	**8**	**3**	**1**	**19**	**25**	**8**	**0**	**14**	**3**
16:35	**11**	**27**	**0**	**11**	**16**	**5**	**16**	**19**	**2**	**5**	**12**	**10**
16:40	**2**	**30**	**4**	**11**	**6**	**6**	**4**	**17**	**8**	**2**	**5**	**4**
16:45	**8**	**20**	**0**	**5**	**8**	**4**	**14**	**20**	**6**	**3**	**10**	**10**
16:50	**9**	**45**	**3**	**4**	**5**	**9**	**4**	**17**	**3**	**5**	**16**	**10**
16:55	**9**	**40**	**1**	**13**	**5**	**6**	**8**	**15**	**7**	**2**	**11**	**4**
17:00	**12**	**43**	**4**	**4**	**13**	**3**	**12**	**24**	**5**	**4**	**14**	**11**
17:05	**7**	**31**	**2**	**4**	**15**	**7**	**10**	**33**	**10**	**0**	**14**	**6**
17:10	**15**	**43**	**1**	**10**	**6**	**4**	**9**	**18**	**10**	**1**	**16**	**12**
17:15	**13**	**36**	**2**	**6**	**18**	**8**	**6**	**23**	**5**	**0**	**12**	**8**
17:20	**5**	**23**	**1**	**14**	**15**	**4**	**8**	**22**	**10**	**5**	**23**	**9**
17:25	0	0	0	5	15	4	12	29	10	0	0	0

	US 27 SB			KY 52 WB			US 27 NB			KY 52 EB		
Peak Hour	L	T	R	L	T	R	L	T	R	L	T	R
4:25 - 5:25 PM	**104**	**401**	**21**	**101**	**121**	**65**	**118**	**263**	**86**	**30**	**167**	**94**



Garrard County US 27 No Build

Ratio method selected as method to determine 2030 ADTs

Link ID	Description	2003 Model ADT	2003 Count ADT	Ratio of Count/ Model	2030 ADT E+C Model	2030 Ratio of Model to Count	2030 Difference Model to Count	Growth Rate from 2003 - 2030
7447	US 27 South of KY 39S	9,714	11,300	1.16	18,308	21,297	19,894	2.38%
12597	US 27 North of KY 39S	8,845	11,300	1.28	16,194	20,689	18,649	2.27%
13160	US 27 South of KY 52	10,854	14,300	1.32	21,258	28,007	24,704	2.52%
1577	US 27 North of KY 52	9,606	12,100	1.26	20,663	26,028	23,157	2.88%
13161	US 27 South of KY 39N	9,450	12,100	1.28	20,681	26,480	23,331	2.94%
12598	US 27 North of KY 39N	11,525	12,200	1.06	20,457	21,655	21,132	2.15%
1572	US 27 South of KY 1355	11,183	11,300	1.01	20,579	20,794	20,696	2.28%
560	US 27 North of KY 1355	10,799	9,000	0.83	21,250	17,710	19,451	2.54%
13169	US 27 South of KY 34	10,665	8,900	0.83	25,342	21,148	23,577	3.26%
565	US 27 North of KY 34	18,042	16,500	0.91	38,535	35,242	36,993	2.85%
			Average =	1.09				

Link ID	Description	2003 Model ADT	2003 Count ADT	Ratio of Count/ Model	2030 ADT E+C Model	2030 Ratio of Model to Count	2030 Difference Model to Count	Growth Rate from 2003 - 2030
13203	KY 39S East of US 27	4,866	2,500	0.51	8,580	4,408	6,214	2.12%
13159	KY 52 West of US 27	7,691	8,000	1.04	14,267	14,840	14,576	2.31%
1579	KY 52 East of US 27	5,800	8,100	1.40	11,978	16,728	14,278	2.72%
1576	KY 39N East of US 27	1,651	3,000	1.82	3,133	5,693	4,482	2.40%
13213	KY 1355 East of US 27	526	550	1.05	1,350	1,412	1,374	3.55%
566	KY 34 West of US 27	9,092	9,400	1.03	17,580	18,176	17,888	2.47%

Supporting Links for East Bypass

13203	KY 39 S - East of Bypass	4,866	2,500	0.51	8,580	4,408	6,214
13154	KY 52 - West of Bypass	4,838	4,950	1.02	9,541	9,762	9,653
13414	KY 52 - East of Bypass	4,838	4,950	1.02	9,541	9,762	9,653
1573	KY 39 N - West of Bypass	1,484	1,700	1.15	3,288	3,767	3,504
13416	KY 39 N - East of Bypass	1,484	1,700	1.15	3,288	3,767	3,504
1572	US 27 south of Bypass-N	11,183	11,300	1.01	20,579	20,794	20,696
13412	US 27 north of Bypass-S	9,714	11,300	1.16	18,308	21,297	19,894

Supporting Links for West Bypass

13201	KY 1150 - West of Bypass	331	431	1.30	1,537	2,001	1,637
13413	KY 1150 - East of Bypass	331	431	1.30	1,537	2,001	1,637
13202	KY 52 - West of Bypass	4,636	3,800	0.82	12,793	10,486	11,957
13412	KY 52 - East of Bypass	4,636	3,800	0.82	12,793	10,486	11,957
7441	US 27 south of Bypass-S	7,220	8,260	1.14	10,588	12,113	11,628
13414	US 27 north of Bypass-S	7,220	8,260	1.14	10,588	12,113	11,628
13175	US 27 east of Bypass-N	10,918	9,000	0.82	22,698	18,711	20,780
13411	US 27 west of Bypass-N	10,918	9,000	0.82	22,698	18,711	20,780

Garrard County US 27 East Bypass - 2030 Model

Link ID	Description	2030 No Build Model	2030 No Build ADT	2030 ADT East Model	2030 Ratio of No Build Model to East Model	2030 Dif. No Build Model to East Model	Growth Rate from 2003 - 2030
7447	US 27 South of Bypass-S	18,308	21,297	18,505	21,526	21,494	0.04%
12597	US 27 North of KY 39S	16,194	20,689	15,044	19,220	19,539	-0.27%
13160	US 27 South of KY 52	21,258	28,007	18,223	24,009	24,972	-0.57%
1577	US 27 North of KY 52	20,663	26,028	15,510	19,537	20,875	-1.06%
13161	US 27 South of KY 39N	20,681	26,480	15,402	19,721	21,201	-1.09%
12598	US 27 North of KY 39N	22,153	23,450	14,825	15,693	16,122	-1.48%
13419	US 27 South of KY 1355	20,579	20,794	21,110	21,331	21,325	0.09%
560	US 27 North of KY 1355	21,250	17,710	21,816	18,182	18,276	0.10%
13169	US 27 South of KY 34	25,342	21,148	25,587	21,352	21,393	0.04%
565	US 27 North of KY 34	38,535	35,242	38,828	35,509	35,535	0.03%
1572	US 27 south of Bypass-N	20,579	20,794	14,552	14,704	14,767	-0.01275
13412	US 27 north of Bypass-S and south of KY 39S	18,308	21,297	11,967	13,921	14,956	-0.01562

Link ID	Description	2030 No Build Model	2030 No Build ADT	2030 ADT East Model	2030 Ratio of No Build Model to East Model	2030 Dif. No Build Model to East Model	Growth Rate from 2003 - 2030
13421	KY 39S East of US 27	8,580	4,408	3,077	1,581	-1,095	-3.73%
13159	KY 52 West of US 27	14,267	14,840	14,032	14,596	14,605	-0.06%
1579	KY 52 East of US 27	11,978	16,728	8,938	12,482	13,688	-1.08%
1576	KY 39N East of US 27	3,133	5,693	1,532	2,784	4,092	-2.61%
13213	KY 1355 East of US 27	1,350	1,412	1,247	1,304	1,309	-0.29%
566	KY 34 West of US 27	17,580	18,176	17,655	18,253	18,251	0.02%
13413	Bypass - US 27 to KY 39 S			6,538	7,160		
13420	Bypass - KY 39 S to Crab Orchard			6,538	7,160		
13415	Bypass - Crab Orchard to KY 52			7,594	8,320		
13417	Bypass - KY 52 to KY 39 N			5,647	6,180		
13418	Bypass - KY 39 N to US 27			6,558	7,180		
13203	KY 39 S - East of Bypass	8,580	4,408	6,348	3,261	2,176	
13154	KY 52 - West of Bypass	9,541	9,762	7,057	7,220	7,278	
13414	KY 52 - East of Bypass	9,541	9,762	14,309	14,640	14,530	
1573	KY 39 N - West of Bypass	3,288	3,767	2,185	2,503	2,664	
13416	KY 39 N - East of Bypass	3,288	3,767	3,974	4,552	4,453	

Garrard County US 27 West Bypass - 2030 Model

Link ID	Description	2030 No Build Model	2030 No Build ADT	2030 ADT West Model	2030 Ratio of No Build Model to West Model	2030 Dif. No Build Model to West Model	Growth Rate from 2003 - 2030
7447	US 27 South of KY 39S	18,308	21,297	9,134	10,625	12,123	-2.54%
12597	US 27 North of KY 39S	16,194	20,689	7,961	10,171	12,456	-2.60%
13160	US 27 South of KY 52	21,258	28,007	11,943	15,735	18,692	-2.11%
1577	US 27 North of KY 52	20,663	26,028	15,052	18,960	20,417	-1.17%
13161	US 27 South of KY 39N	20,681	26,480	14,790	18,937	20,589	-1.23%
12598	US 27 North of KY 39N	22,153	23,450	14,534	15,385	15,831	-1.55%
1572	US 27 South of KY 1355	20,579	20,794	12,883	13,018	13,098	-1.72%
560	US 27 North of KY 1355	21,250	17,710	13,504	11,254	9,964	-1.67%
13169	US 27 South of KY 34	25,342	21,148	23,198	19,359	19,004	-0.33%
565	US 27 North of KY 34	38,535	35,242	36,994	33,832	33,701	-0.15%
7441	US 27 south of Bypass-S	10,588	12,113	10,588	12,113	12,113	0
13414	US 27 north of Bypass-S	10,588	12,113	12,814	14,660	14,339	0.00709
13175	US 27 east of Bypass-N	22,698	18,711	14,996	12,362	11,009	-0.01523
13411	US 27 west of Bypass-N	22,698	18,711	24,385	20,101	20,398	0.00266

Link ID	Description	2030 No Build Model	2030 No Build ADT	2030 ADT West Model	2030 Ratio of No Build Model to West Model	2030 Dif. No Build Model to West Model	Growth Rate from 2003 - 2030
13203	KY 39S East of US 27	8,580	4,408	9,333	4,795	5,161	0.31%
13159	KY 52 West of US 27	14,267	14,840	11,000	11,442	11,573	-0.96%
1579	KY 52 East of US 27	11,978	16,728	12,017	16,782	16,767	0.01%
1576	KY 39N East of US 27	3,133	5,693	3,050	5,542	5,610	-0.10%
13213	KY 1355 East of US 27	1,350	1,412	1,427	1,492	1,489	0.21%
566	KY 34 West of US 27	17,580	18,176	17,999	18,609	18,595	0.09%
13417	Bypass - US 27 to KY 1150			9,653	10,570		
13418	Bypass - KY 1150 to KY 52			7,754	8,490		
13419	Bypass - KY 52 to US 27			9,389	10,280		
13201	KY 1150 - West of Bypass	1,537	2,001	1,721	2,241	2,185	
13413	KY 1150 - East of Bypass	1,537	2,001	2,760	3,594	3,224	
13202	KY 52 - West of Bypass	12,793	10,486	12,331	10,107	10,024	
13412	KY 52 - East of Bypass	12,793	10,486	13,488	11,056	11,181	

Garrard County US 27 East Bypass - 2003 Model

Link ID	Description	2003 Model ADT	2003 Count ADT	2003 ADT East Model	2003 Ratio of Model to Count	2003 Dif. No Build Model to East Model	Growth Rate from 2003 - 2030
7447	US 27 South of Bypass-S	9,714	11,300	9,840	11,447	11,426	0.05%
12597	US 27 North of KY 39S	8,845	11,300	7,985	10,201	10,440	-0.38%
13160	US 27 South of KY 52	10,854	14,300	9,478	12,487	12,924	-0.50%
1577	US 27 North of KY 52	9,606	12,100	7,060	8,893	9,554	-1.13%
13161	US 27 South of KY 39N	9,450	12,100	6,709	8,590	9,359	-1.26%
12598	US 27 North of KY 39N	11,525	12,200	6,400	6,775	7,075	-2.16%
13419	US 27 South of KY 1355	11,183	11,300	11,277	11,395	11,394	0.03%
560	US 27 North of KY 1355	10,799	9,000	10,948	9,124	9,149	0.05%
13169	US 27 South of KY 34	10,665	8,900	10,712	8,939	8,947	0.02%
565	US 27 North of KY 34	18,042	16,500	18,104	16,557	16,562	0.01%
1572	US 27 south of Bypass-N	11,183	11,300	8,499	8,588	8,616	-0.01011
13412	US 27 north of Bypass-S and south of KY 39S	9,714	11,300	6,448	7,501	8,034	-0.01506

Link ID	Description	2003 Model ADT	2003 Count ADT	2003 ADT East Model	2003 Ratio of Model to Count	2003 Dif. No Build Model to East Model	Growth Rate from 2003 - 2030
13421	KY 39S East of US 27	4,866	2,500	1,537	790	-829	-4.18%
13159	KY 52 West of US 27	7,691	8,000	7,583	7,888	7,892	-0.05%
1579	KY 52 East of US 27	5,800	8,100	4,471	6,244	6,771	-0.96%
1576	KY 39N East of US 27	1,651	3,000	893	1,623	2,242	-2.25%
13213	KY 1355 East of US 27	526	550	464	485	488	-0.46%
566	KY 34 West of US 27	9,092	9,400	9,116	9,425	9,424	0.01%
13413	Bypass - US 27 to KY 39 S			3,392	3,710		
13420	Bypass - KY 39 S to Crab Orchard			3,149	3,450		
13415	Bypass - Crab Orchard to KY 52			3,769	4,130		
13417	Bypass - KY 52 to KY 39 N			2,634	2,880		
13418	Bypass - KY 39 N to US 27			2,778	3,040		
13203	KY 39 S - East of Bypass	4,866	2,500	3,203	1,646	837	
13154	KY 52 - West of Bypass	4,838	4,950	3,641	3,725	3,753	
13414	KY 52 - East of Bypass	4,838	4,950	7,214	7,381	7,326	
1573	KY 39 N - West of Bypass	1,484	1,700	877	1,005	1,093	
13416	KY 39 N - East of Bypass	1,484	1,700	1,671	1,914	1,887	

Garrard County US 27 West Bypass - 2003 Model

Link ID	Description	2003 Model ADT	2003 Count ADT	2003 ADT West Model	2003 Ratio of Model to Count	2003 Dif. No Build Model to West Model	Growth Rate from 2003 - 2030
7447	US 27 South of KY 39S	9,714	11,300	5,025	5,845	6,611	-2.41%
12597	US 27 North of KY 39S	8,845	11,300	4,217	5,387	6,672	-2.71%
13160	US 27 South of KY 52	10,854	14,300	6,388	8,416	9,834	-1.94%
1577	US 27 North of KY 52	9,606	12,100	6,792	8,555	9,286	-1.28%
13161	US 27 South of KY 39N	9,450	12,100	6,635	8,496	9,285	-1.30%
12598	US 27 North of KY 39N	11,525	12,200	6,476	6,855	7,151	-2.11%
1572	US 27 South of KY 1355	11,183	11,300	6,122	6,186	6,239	-2.21%
560	US 27 North of KY 1355	10,799	9,000	5,706	4,755	3,907	-2.34%
13169	US 27 South of KY 34	10,665	8,900	10,730	8,954	8,965	0.02%
565	US 27 North of KY 34	18,042	16,500	18,114	16,566	16,572	0.01%
7441	US 27 south of Bypass-S	7,220	8,260	7,220	8,260	8,260	0
13414	US 27 north of Bypass-S	7,220	8,260	7,077	8,096	8,117	-0.00074
13175	US 27 east of Bypass-N	10,918	9,000	5,823	4,800	3,905	-0.02301
13411	US 27 west of Bypass-N	10,918	9,000	11,488	9,470	9,570	0.00189

Link ID	Description	2003 Model ADT	2003 Count ADT	2003 ADT West Model	2003 Ratio of Model to Count	2003 Dif. No Build Model to West Model	Growth Rate from 2003 - 2030
13203	KY 39S East of US 27	4,866	2,500	4,846	2,490	2,480	-0.02%
13159	KY 52 West of US 27	7,691	8,000	5,556	5,779	5,865	-1.20%
1579	KY 52 East of US 27	5,800	8,100	5,566	7,773	7,866	-0.15%
1576	KY 39N East of US 27	1,651	3,000	1,625	2,953	2,974	-0.06%
13213	KY 1355 East of US 27	526	550	555	580	579	0.20%
566	KY 34 West of US 27	9,092	9,400	9,112	9,421	9,420	0.01%

13417	Bypass - US 27 to KY 1150			4,902	5,370	
13418	Bypass - KY 1150 to KY 52			3,406	3,730	
13419	Bypass - KY 52 to US 27			5,665	6,200	

13201	KY 1150 - West of Bypass	331	431	420	547	520
13413	KY 1150 - East of Bypass	331	431	1,613	2,100	1,713
13202	KY 52 - West of Bypass	4,636	3,800	4,434	3,634	3,598
13412	KY 52 - East of Bypass	4,636	3,800	6,423	5,265	5,587

Select Link Results

An assignment was made to determine which external trips are using the bypass.

For the East Bypass the Link between KY 52 and KY 39

Origin	% Trips on the Link
US 27 North	39
KY 52	5
KY 39 South	24
US 27 South	4

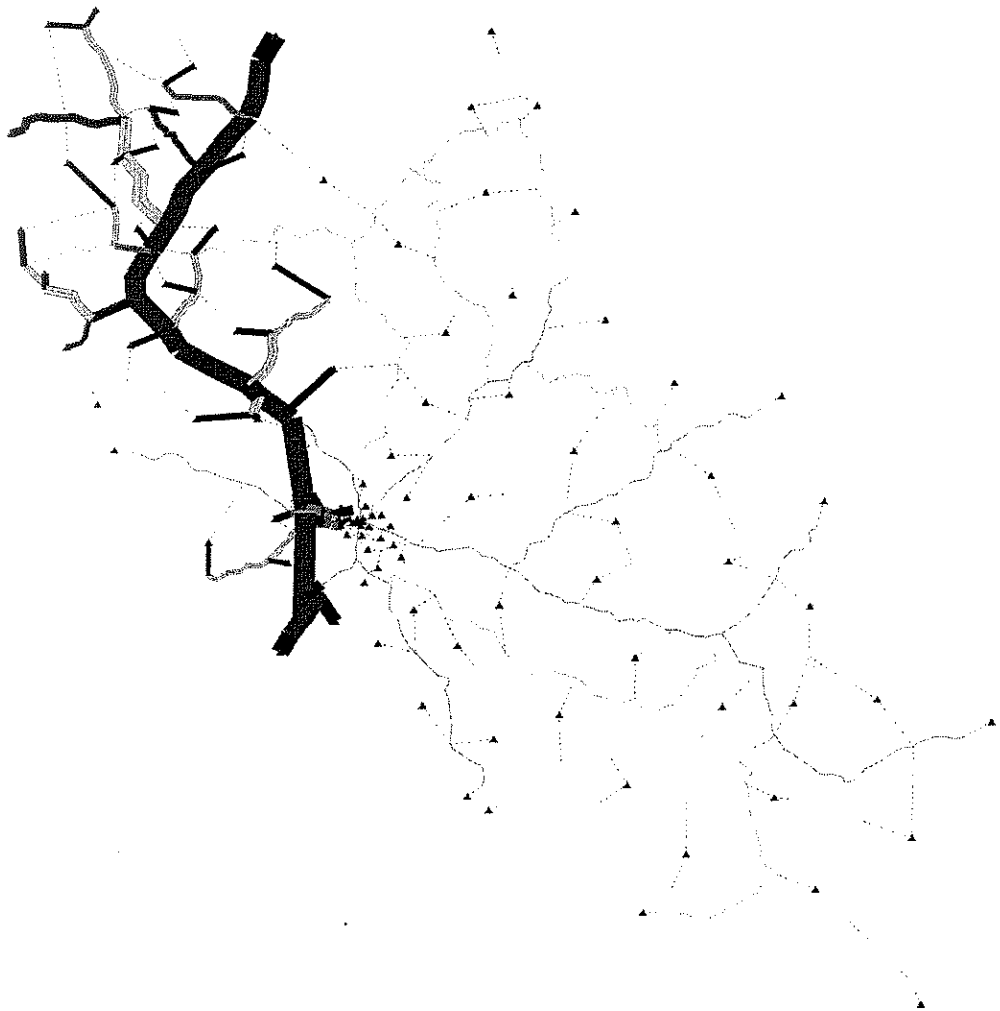
For the West Bypass the link between KY 52 and US 27

Origin	% Trips on the Link
US 27 North	56
KY 34	2
US 27 South	14

The volume of vehicles traveling through the study area on US 27 is 932 in year 2003 and 1,450 in year 2030.

West Bypass Select Link

Wider lines indicate trips using the bypass link



East Bypass Select Link

Wider lines indicate trips using the bypass link

Forecast Tools & Data

1. Summary
2. Web page
3. TFR 2003 & TFR 2004 tables
4. CTS
5. Vehicle Classification
6. Traffic count request form
7. ESAL worksheet
8. Coalseg screenshot
9. Preconstruction status report
10. Forecast FAQs

Traffic Forecasting Tools, Data, Reports and Links

Forecasting Tools and Data

Tools and data used for traffic forecasting include:

Traffic Demand Models
Traffic demand models are available upon request for use on state projects. Model categories are listed below:

- Small urban area models
- MPO urban area model
- The Kentucky Statewide Traffic Model
- County-level models
- Sub area models

More information on these models can be found in the 2003 TFR or at the Small Urban Area web page.

Computer Tools
These are available upon request for use in state projects.

- Turning movement estimation programs
- Official ESAL calculation spreadsheet
- Superpave ESAL program
- Manual gravity procedure
- Proprietary traffic demand modeling software (purchase from Caliper or Citilabs)

Data

- The Highway Information System database (request from Greg Witt of Planning)
- The traffic volume count database (CTS)
- County and city count maps
- The coal haul database
- Vehicle classification data viewer
- Proprietary databases: Reebie and Woods & Poole
- FHWA & Census database: NPTS and CTPP
- State Data Center
- KY Economic Development Information System
- State Base Map

In-house Reports

Note: Paper copies of reports available upon request from Division of Multimodal Programs.
Turning Movement Guidelines, Division of Planning, 1997.
***Traffic Characteristics Reports*, Division of Planning**, 1988-1997.
Small Urban Modeling Using MinUTP, Division of Mass Transportation, 1988.
Kentucky Statewide Traffic Model Calibration Report, Wilbur Smith Associates, 1997.
Kentucky Statewide Traffic Model Update, Wilber Smith Associates, 2001.

Links

TRAFFIC FORECASTING

Forecasting FAQs

Traffic Forecast Request Form

VCR Viewer

Guide On Statewide Travel Forecasting

Manual Gravity

Traffic Forecast Report 2003

2003 ATR Analysis Report

TRAFFIC DEMAND MODELING

Kentucky Traffic Model Users Group

Travel Demand Modeling FAQs

Kentucky Statewide Travel Modeling Overview

Kentucky Urban Transportation Models (List of available models)

Web Page

KENTUCKY TRANSPORTATION CABINET

Multimodal Programs

HOME

- Access Management
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- Ferry Operations
- Park and Ride
- Rail Systems
- Riverports
- Transportation Enhancements
- Freight

- Air Quality
- Metropolitan Transportation
- Small Urban Areas
- Traffic Forecasting
- Mobility Analysis
- Model Users Group

- Contacts

- Standard Invoice Form

Traffic Forecasting

The Division of Multimodal Programs is responsible for traffic forecasting in the state of Kentucky. This page includes team members, the scope of work, forecasting web links, in-house reports on forecasting, and research studies related to traffic forecasting. Reports are available from the publishers upon request.

Team Members

Lynn J. Soporowski, P.E. - Transportation Engineering Branch Manager
Rob Bostrom, P.E. - Transportation Engineering Specialist
Amy Thomas, P.E. - Transportation Engineering Specialist
Bernie Feige – Transportation Engineering Technologist III
Roy Rose - Transportation Engineering Technologist III
Kong Ee, P.E. - Transportation Engineer I
David Hamilton - Engineer In Training II

Forecasting Scope of Work

Traffic forecasts are made for design, planning and environmental analysis purposes. The Division of Multimodal Programs serves as the Cabinet's traffic forecasting clearinghouse and is responsible for performing the Cabinet's traffic forecasts. Forecasts in urbanized areas are done bye the Metropolitan Planning Organizations. All other forecasts are done in-house or by the Cabinet's designated statewide traffic forecasting consultant. Cabinet may request **Traffic Forecast Request Form.**

Forecasting partners include the **Traffic Model Users Group** which promotes traffic forecasting/modeling technology sharing; the **Kentucky Transportation Center** which has been instrumental in developing equivalent axle load information used for pavement design; and the **Mobility Team** which is developing new tools for the analysis of traffic congestion.

Listed below is information on forecasting tools, traffic forecasting related research studies completed by the Kentucky Transportation Center, in-house reports with traffic forecasting themes, other important forecast-related reports and links to traffic forecast related web pages.

Forecasting Tools

Related Research Studies (by KTC)

In-house Reports

Traffic Forecasting Website Links

News/Updates

- **2003 ATR Analysis Report**
- **New Mobility Analysis Web Site**
- **The 2003 Traffic Forecasting Report is available in the links**

CTS

Kentucky Traffic Counts

Route: US 25 **Street:** NEEDMORE ST

From MP: 0.470 **At:** KY 14 (MARY GRUBBS HIGHWAY)

To MP: 1.270 **At:** OLD BEAVER ROAD

Station ID: R04 **Station Cnty:** BOONE

Station Type: HPMS

Functional Class: RURAL - Major Collector

District: 6

County: BOONE

City: WALTON

Last Actual Count: 7,697 in 2002

New Road Year:

Impact Year:

Year	Count	Type
2004	8,140	Computer Estimate
2003	7,960	Computer Estimate
2002	7,700	Actual Count
2001		
2000		
1999	8,090	Actual Count
1998		
1997		
1996	7,690	Actual Count
1995		
1994		
1993	7,530	Actual Count
1992		
1991		
1990	6,540	Actual Count
1989		
1988		
1987		
1986		
1985		
1984	6,640	Actual Count
1983		
1982		
1981		
1980		
1979		
1978	4,880	Actual Count
1977		
1976		
1975		
1974		
1973		
1972		
1971		
1970		
1969		
1968		
1967		
1966		
1965	4,190	Actual Count
1964		

Vehicle Classification

Cou	Station	Prefix	Rte No	Suffix	Milepnt	ADT	[redacted]	CT %	Axles/Trk	Axles/CT	Axle Fac	Year
1	A46	KY	55		10.3	11200	[redacted]	0	3.663	0	0.9380	1994
1	A13	KY	55		10.5	10800	[redacted]	0	3.835	0	0.9610	1992
1	A07	KY	55		11	7716	[redacted]	0	2.905	0	0.9720	1986
1	A07	KY	55		11	7716	[redacted]	0	3.104	0	0.9540	1983
1	A07	KY	55		11	3925	[redacted]	0	2.667	0	0.9700	1980
1	A26	KY	55		11.1	19200	[redacted]	0	3.758	0	0.9428	1997
1	A41	KY	55		12.3	8649	[redacted]	0	2.858	0	0.9710	1979
1	008	KY	55		12.5	9150	[redacted]	0	3.257	0	0.9320	1996
1	523	KY	61		5	112	[redacted]	0	2.914	0	0.9480	2001
1	517	KY	61		10	1970	[redacted]	0	3.096	0	0.9570	1999
1	502	KY	61		12.8	1810	[redacted]	0	2.733	0	0.9610	1996
1	A39	KY	61		12.8	3864	[redacted]	0	2.873	0	0.9510	1979
1	A62	KY	61		14.6	4280	[redacted]	0	3.048	0	0.9641	1997
1	750	KY	61		16.3	3430	[redacted]	0	3.295	0	0.9392	1999
1	750	KY	61		16.3	1720	[redacted]	0	3.271	0	0.9470	1998
1	750	KY	61		16.3	1720	[redacted]	0	3.105	0	0.9560	1993
1	750	KY	61		16.3	3080	[redacted]	0	3.106	0	0.9660	1990
1	750	KY	61		16.3	3650	[redacted]	0	2.678	0	0.9750	1985
1	750	KY	61		16.3	2800	[redacted]	0	3.104	0	0.9400	1982
1	750	KY	61		17.1	2170	[redacted]	0	3.104	0	0.9507	2002
1	092	KY	76		5.2	1060	[redacted]	0	2.834	0	0.9685	2002
1	092	KY	76		5.8	640	[redacted]	0	2.268	0	0.9920	1984
1	006	KY	76		5.8	530	[redacted]	0	2.265	0	0.9870	1979
1	092	KY	76		6	164	[redacted]	0	2.53	0	0.9830	1980
1	092	KY	76		10.9	1110	[redacted]	0	2.892	0	0.9740	1996
1	P34	KY	80		2.1	1824	[redacted]	0	2.943	0	0.9510	1980
1	505	KY	80		7.7	1220	[redacted]	0	3.066	0	0.9306	2001
1	505	KY	80		8.6	700	[redacted]	0	2.232	0	0.9890	1990
1	503	KY	80		10.6	1940	[redacted]	0	2.893	0	0.9663	2001
1	A38	KY	80		11.8	10612	[redacted]	0	2.869	0	0.9396	2003
1	A59	KY	80		12	7500	[redacted]	0	3.409	0	0.9740	1993
1	010	KY	80		13	5230	[redacted]	0	3.416	0	0.9040	2001
1	010	KY	80		13.5	4730	[redacted]	0	3.624	0	0.9430	1994
1	P34	KY	80		20.1	3720	[redacted]	0	2.822	0	0.9736	2003
1	P34	KY	80		20.1	3730	[redacted]	0	3.079	0	0.9681	2002
1	P34	KY	80		20.1	3500	[redacted]	0	2.989	0	0.9507	2001
1	P34	KY	80		20.1	3410	[redacted]	0	3.243	0	0.9555	2000
1	P34	KY	80		20.1	3550	[redacted]	0	2.782	0	0.9752	1999
1	P34	KY	80		20.1	3420	[redacted]	0	3.031	0	0.9666	1997
1	P34	KY	80		20.1	3110	[redacted]	0	3.202	0	0.9490	1994
1	P34	KY	80		20.1	2970	[redacted]	0	2.917	0	0.9620	1993
1	P34	KY	80		20.1	1830	[redacted]	0	2.902	0	0.9610	1992
1	P34	KY	80		20.1	2520	[redacted]	0	3.092	0	0.9690	1991
1	P34	KY	80		20.1	2431	[redacted]	0	3.026	0	0.9540	1988

Traffic Count Request Form

DIVISION OF MULTIMODAL PROGRAMS
Traffic Forecasting

TRAFFIC COUNT REQUEST DATE: 03-Sep-04

REQUESTOR: Kong Ee T.F # 04.051

T*	6	8		US 42 at KY 536	T1			C	High
T*	6	8		KY 237 at KY 536	T2			C	High
A	6	8	KY 536		301	2002	11	B	High
V	6	8	KY 536		G73	2002	12.5	A	High

NOTES:

1. Count Types
   - Machine Volume - V
   - Manual Classification - M
   - Automatic Classification - A
   - Turning Movements - T
2. Station Numbers: Use if applicable. If no, use "N/A" and give MP.
3. Milepoints: Give milepoints when existing stations are not applicable.

[ ] See reverse side for location details
[X] See attached maps for location details

4. Reasons:
   - A. No volume count last three years.
   - B. No classification counts last three years.
   - C. Intersection turning movements needed.
   - D. Other - explain:

MARS or Project # 6977601D
County 008
Program FD52
Fund 1200

APPROVED: _____ DATE: _____
Traffic Forecasting Team Leader

ESAL Worksheet

FORECAST OF EQUIVALENT SINGLE AXLE LOAD ACCUMULATIONS

ROUTE ID:

County	Warren
Road Name	Nashville Rd.
Functional Class	16 - Urban Minor Arterial
Project Description	US 31W from Dillard Rd. to Natcher Pkwy. S. Ramp
Scenario	Build
Segment Description	US 31W from Memphis Jnct. to S. Ramps, W.H. Natcher Pkwy.

Date	09/03/04
Forecaster	B. Feige
MARS No.	7353301D
Item No.	3-317.00
Route No.	US 31W
Beg. MP	8.768
End MP	8.92
T.F. No.	03.035
No. of Lanes	4
1 or 2 way	2

REFERENCES:

Previous Forecasts	99.085, 99.027, 98.162, 97.200
Traffic Volume	Stn X08, 2003 Cnt.
Truck Percent	Stn C23, Oct. 2001 VehClsCnt
ESAL Information	1998 Aggregated ESALs
Growth Rate	TLA Stn C23

K- Factor Value	10.5%
K-Factor Source	Stn X08, 2003 Cnt.

TRAFFIC PARAMETERS:

		Present Year	Growth Rate	Construction Year	Median Year	Design Year
		2003		**2007**	**2017**	**2027**
Volume	(AADT)	19600	3.45%	22440	31500	44200
Percent Trucks	(%T)	7.800%	1.500%	8.279%	9.608%	11.150%
Number of Trucks		1529		1858	3026	4928
Percent Trucks Hauling Coal	(%CT)	0.000%	0.000%	0.000%	0.000%	0.000%
Non-Coal Trucks:						
Axles/Truck	(A/T)	3.345	0.011	3.491	3.885	4.324
ESALs/Axle	(ESAL/A)	0.152	0.015	0.161	0.187	0.217
Coal Trucks:						
Axles/Truck	(A/CT)	0	0.00%	0.000	0.000	0.000
ESALs/Axle	(ESAL/CA)	0	0.00%	0.000	0.000	0.000

ESAL CALCULATIONS:

Total Median Year Daily ESALs

(AADT x (1-%T) x .005)+(AADT x %T x (A/T) x (ESAL/A))+(AADT x (%T) x (%CT) x (A/CT) x (ESAL/CA)) = 2343.806

Lane Distribution Factor = 0.43

Design ESALs in Critical Lane

Total Median Year Daily ESALs x 365 x Number of Forecast Years x Lane Distribution Factor = 7,438,000

General Comments:

Coalseg

DT31103
10/18/02

TONS OF COAL HAULED BY HIGHWAY SEGMENT: 2001

	ROUTE	MILEPOINTS BEGIN	END	LENGTH	TONS OF COAL HAULED IN EACH DIRECTION CARDINAL	NON-CARDINAL	TOTAL	TON-MILES
5: BARREN								
I	65	52.5	54.0	1.5	0	5,250	5,250	7,875
							ROUTE TOTAL	7,875
KY	70	5.2	5.4	0.2	5,250	0	5,250	1,050
							ROUTE TOTAL	1,050
KY	90	0.0	9.9	9.9	5,250	0	5,250	51,975
		9.9	22.0	12.1	5,250	0	5,250	63,525
							ROUTE TOTAL	115,500
US	31E	14.3	14.8	0.5	0	5,250	5,250	2,625
							ROUTE TOTAL	2,625
US	31EX	1.4	1.5	0.1	5,250	0	5,250	525
							ROUTE TOTAL	525
US	68	11.7	12.6	0.9	5,250	0	5,250	4,725
		12.6	12.7	0.1	5,250	0	5,250	525
							ROUTE TOTAL	5,250
							COUNTY TOTAL	132,825
6: BATH								
I	64	121.2	129.0	7.8	6,335	0	6,335	49,413
							ROUTE TOTAL	49,413
KY	11	0.0	12.7	12.7	26,479	0	26,479	336,283
							ROUTE TOTAL	336,283
KY	36	13.0	23.8	10.8	0	6,335	6,335	68,418
							ROUTE TOTAL	68,418
							COUNTY TOTAL	454,114

Preconstruction Status Report

SYP8110 02-SEP-2004 **Preconstruction Status Report** Page: 1

Auth No. / Date | Parent No. 01 2.00 | Project No. 1-2.00

County Name MCCRACKEN
Route I-24
BMP / EMP 0 / 1.067

Desc: I-24 BRIDGE OVER THE OHIO RIVER @ PADUCAH (B100); JOINT PROJECT WITH ILLINOIS TO MITIGATE SCOUR

Typework BRIDGE INSPECTION(P) | No. Lanes | Length 1 | Measure Type
Survey Order Date | Work Order Date
Road Eng. | Bridge Eng.
Proj Mgr T. REZAEE | Bridge No. B00100 | Suff. Rating 64

Letting Status / Date * * * * * *

Environmental	Name	Date	Type	Sched. Comp.	Actual Comp.	Expire Date
Assigned:						
Requested:						

Concerns

Phase	C
Stage	ESTIMATED
Fund Code	IM
Cost	250,000
Fiscal Year	2005
Auth Amt.	
Auth Date	
Program Code	

Milestone	Status	Date	Scheduled
PRELIMINARY LINE AND GRADE	UNKNOWN	26-JUN-2000	
DRAINAGE INSPECTION	UNKNOWN	26-JUN-2000	
JOINT INSPECTION	UNKNOWN	26-JUN-2000	
GEOTEC ENGINEERING - ROADWAY	UNKNOWN	26-JUN-2000	
GEOTEC ENGINEERING - BRIDGES	ADVANCE SITUATION REPORT COMPLETED	05-MAR-2003	
BRIDGE AND STRUCTURE PLANS TO CENTRAL OFFICE	UNKNOWN	26-JUN-2000	
ADVANCE SITUATION TO CENTRAL OFFICE	UNKNOWN	26-JUN-2000	
RIGHT OF WAY PLANS TO CENTRAL OFFICE	UNKNOWN	26-JUN-2000	
ROAD PLANS TO CENTRAL OFFICE	UNKNOWN	26-JUN-2000	
TRAFFIC PLANS - SIGNING	UNKNOWN	26-JUN-2000	
TRAFFIC PLANS - LIGHTING	UNKNOWN	26-JUN-2000	
TRAFFIC PLANS - SIGNALS	UNKNOWN	26-JUN-2000	
TRAFFIC PLANS - TRAFFIC CONTROL	UNKNOWN	26-JUN-2000	

Right of Way Parcel Information

Total Parcels: 000 | Completion Date

Appraisals	of 000			
Relocated	of			
Deeds Signed				
Suits Filed				
Right of Entry				
Parcels Cleared:				

Utility Information

		Completion Date
Negotiated Starts	of	
Agreements	of	
Relocated	of	

Can you explain some of the technical terms?

- **ADT:** Average Daily Traffic is the amount of traffic volume going past a point in one day. The data comes from many sources and is factored based on monthly, weekly, and axle factors to represent the average day in a year. It should be noted that the only "true" ADT is one that comes from an automatic traffic recorder (ATR) that records data continuously.
- **DHV:** The Design Hour Volume is the volume unit that designers and planners most frequently use. It is based on the 30th highest hourly volume on a road in the year. It has been deemed by traffic theory, that the 30th highest hourly volume is a good cutoff point at which to design highways.
- **EALs:** Equivalent single axleloads are also known as EALs. This unit-less value is a measure of pavement damage and is used for pavement design. Kentucky uses its own ESAL procedures developed in a research study in 1984 and refined several times since. It is based on the concept that a semi-trailer with one axle (of the normal two tandem axles) is limited legally to a weight of 18,000 pounds. Therefore 18,000 pounds on one axle equals 1.0 ESALs/per truck axle.
- **VMT:** Vehicles Miles Traveled represents all of the vehicle trips on the highway system. This parameter is very important for air quality conformity analysis. One vehicle traveling one mile equals one VMT.

Division of Multimodal Programs

200 Mero Street

Frankfort, KY 40622

Website: http://transportation.ky.gov/Multimodal/default.asp

Traffic Forecasting Button

Rob Bostrom Email: rob.bostrom@ky.gov

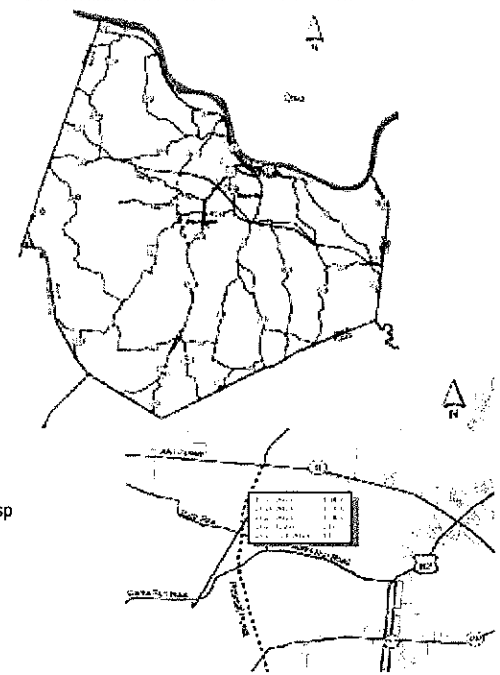
Phone: 502-564-7686 Fax: 502-564-4422

KENTUCKY TRANSPORTATION CABINET

Division of Multimodal Programs

TRAFFIC FORECASTING

FAQ BROCHURE



Traffic Forecasting *Frequently Asked Questions*

Why are traffic forecasts needed?

The main purpose of traffic forecasting is to facilitate the Cabinet's Six Year Plan. Virtually every highway project needs a traffic forecast to help define the scope, the geometry of the project and sometimes even help determine the need for a project. Examples of forecasts uses to help determine:

- the number of lanes;
- the length or number of turning lanes;
- the depth of pavement.

Highway design and planning are usually based on estimates of traffic 20 years beyond the construction date. While no one knows the future, trained traffic forecasters and modelers use special tools and experience to estimate these numbers. Typical data items provided by forecasters include:

- current and future average daily traffic;
- current and future design hour volumes;
- estimated axle loads;
- truck percentages;
- system parameters such as vehicle miles traveled.

Traffic forecasts are also used for many other purposes including corridor planning, systems planning, air quality analysis, and many special projects.

How do I request a traffic forecast?

Fill out the traffic forecast form and either mail or email to Michael Hill, Attention Rob Bostrom, Division of Multimodal Programs (Mail Code 5-3), 200 Mero Street, Frankfort, KY 40622. Please attach a map, and specify the Date needed.

How long will it take?

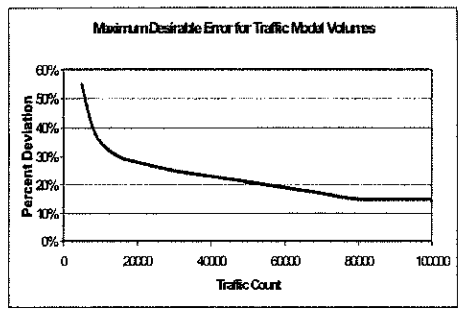
The average forecast takes about eight to ten weeks, which includes time for special counts when needed. The Division of Multimodal Programs typically does 160-180 traffic forecasts per year including those forecasts done by outside entities (Metropolitan Planning Organizations and the Statewide Traffic Forecasting consultant). Forecasts range in complexity from bridge replacement projects to statewide corridors such as I-66.

How accurate are traffic forecasts?

In general, the smaller the average daily traffic, the larger the error of the traffic forecast. The graph shown below gives a good idea of typical predicted errors from traffic models and can also be used for traffic forecasting accuracy.

Model Assignment

% Deviation = Model Assignment – Count



From: **NCHRP 255: Highway Traffic Data for Urbanized Area Project Planning and Design**

It should be pointed out that not only is there error associated with predicting traffic volumes in the future (changing traffic patterns, traffic impacts due to development, unforeseen socioeconomic conditions, changing economy, new roads and diversion, etc.) There is often error associated with making a traffic count. Data varies due to the day of the week, the month of the year, and other reasons. Therefore, it is critical that the current traffic counts be as accurate as possible since the error will only be compounded in the future. The process of quality assurance of current traffic data is one of the most important tasks of the traffic forecaster's job.

What if we don't agree with your forecasts?

The Division of Multimodal Programs welcomes feedback (depends on it actually!) at every stage of the traffic forecasting process. Traffic forecasting is a cooperative process predicting a dynamic variable in the future. With all of the uncertainty involved in the process, it is very understandable that project stakeholders will have different points of view. We attempt to gain the input of project shareholders up front. However, these forecasts are not etched in stone and we will make changes or give more detailed explanation upon request. Don't hesitate to give us your comments!

How do you do traffic forecasting?

Traffic forecasting is a complex process using many different tools. Some are listed below:

- Trend line analysis (extrapolation of current traffic patterns into the future).
- Diversion analysis (many tools other than models are used including the California Diversion curve for new roads, manual gravity and the Modlin equations to calculate traffic demand between two points.
- Trip generation: the use of standard trip rates based on land use studies.
- Turning movement calculation. Software turning movements based on incomplete data.
- Traffic models are used for diversion analysis and select link analysis.

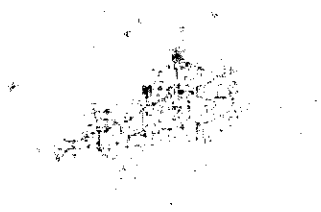
For more information on the traffic forecasting process, see **The Traffic Forecasting Report 2003** at: http://transportation.ky.gov/Multimodal/pdf/TFR%202003.pdf

What is a traffic model?

A traffic demand model is a tool used, to test alternative transportation concepts, and to evaluate transportation systems. Models are built using a specialized process based on mathematical equations and intensive data collection. See **Small Urban Area Travel Modeling Using MinUTP**. Traffic models use special software such as TransCAD or MinUTP along with sets of programs that comprise the actual traffic model. A typical model will have 10-100 input files and several output files.

The Kentucky Transportation Cabinet has many types of models that are used for traffic forecasting including:

- County Level Models for areas that have questions about air quality conformity.
- MPO models for KIPDA, OKI, Lexington and Owensboro (owned and operated by the MPOs) have many applications, including traffic forecasting.
- The Kentucky Statewide Traffic Model. See network graphic:



Statewide Model Link Node Map

- Small Urban Area models for most of the areas with population between 5,000 and 49,999. See Pikeville network graphic:

Pikeville Model Link Node Map

What data is needed for traffic forecasts?

There are several types of data needed including:

- Traffic monitoring data traffic volume counts, vehicle classification data and weigh-in-motion data.
  - Traffic volume data are obtained primarily from the Division of Planning's web site. Historic local road count maps are also available on scanned maps available from the Division of Multimodal Programs upon request.
  - Special counts: An example is a peak hour turning count made to get the individual data movements at an intersection during the peak period.
  - ESAL tables are produced by the Kentucky Transportation Center from weigh-in-motion data.
- Coal haul data is needed in view of the large impact of coal trucks on pavement.
- Socioeconomic data is primarily obtained from the UL Urban Study Center: cbpa.louisville.edu/ksdc (population data) and from the Woods and Poole database: (income and employment data).
- Trip data is obtained from special household surveys and from the Bureau of Transportation Statistics: www.bts.gov.
- Land use data is obtained from county comprehensive plans, the Area Development Districts and the Highway District offices.
- Highway Data such as lane width and other geometric data is obtained primarily from the Highway Information System database.

What is new in traffic forecasting?

Some highlights:

- The Cabinet is learning to use new modeling software (TransCAD) that has GIS incorporated into it, which should more modeling capability.
- KTC research studies are helping improve the state-of-the-art:
  - **Traffic Growth Rate Analysis:** Better forecast local road vehicle miles traveled (VMT).
  - **Development of Load Spectra**: Develop a new performance measure for pavement damage. It is expected that load spectra will replace the use of equivalent axleloads (ESALs).
  - **Highway Bypasses:** Exam patterns from existing bypasses in an effort to understand the impact of new bypasses on communities.
  - **Vehicle Classification Analysis:** Refining the way that vehicle classification data is collected and providing better ways to process the data.
  - **Evaluation of Interstate Volume Count Factoring from Adjacent Index Stations:** Develop methodology to factor interstate count locations where there is not much data variability.
- The Traffic Model Users Group is a constant source of new information and technology sharing. The web site for that group is: http://transportation.ky.gov/Multimodal/MUG.asp
- CORISM, and other microsimulation models, networks are being developed from demand models for urban highway analysis.

Forecast Issues

Traffic Forecasting Issues

Design Hour Volumes: K30 vs. K100 vs. PHV. See ATR Analysis Report.

Forecasting Variance reliability of forecast, use standard deviation or some other statistical measures

Forecasting Certification for MPOs see excerpt from The Urban Transportation Monitor.

- Forecast parameters should rely heavily on high quality data with historical information available such as automatic traffic recorder (ATR) data. Short term data must be compared to ATR data..
- All factors should be documented as to the source data and cleared with traffic forecast team leader at earliest opportunity.
- All forecast parameters must be carefully reviewed before requesting special traffic counts.

K-factors

Calculate a k-30 and a k-100 for both the current and future year.

D-factors

Base on ATR data if available or on short counts.

PHF

Base on ATR data if available and supplement with intersection count data or other portable counts.

Growth Rates

Growth rates must consider historical traffic patterns at the project location and in the nearby area; land use changes; population trends; and all other viable sources of information

Population

The state population and area population (county and/or TAZs) should always be checked .since there is a very high correlation between population growth and traffic growth. A rough rule-of-thumb might be adding 2% per year to population to get traffic growth.

Trend Line Analysis

TLAs should be done on all major count stations to gauge historical traffic growth on the subject highway and on key adjacent highways.

Model growth rates

Growth rates derived from travel demand models are also good sources of future growth rates. A comparison of current counts to the current assignments must be made in order to provide adjustment factors for the final future year volumes.

Volumes

Current ADTs

Current ADTs are normally derived from actual counts and/or recent count estimates. It is important to realize that every count is actually just a survey and it is quite permissible to factor current data to arrive at a more reasonable estimate.

Turning Movement Preparation

Use turning movement guidelines prepared by Division of Planning/Division of Multimodal Programs. Report is on the traffic forecasting web page.

- It is very important to use commonsense guidelines when preparing the turning movements and to balance movements along the entire corridor whenever possible
- Use turning movement templates that are easy to understand and read.

Variance

Use the count history to calculate a standard deviation for the current volume or use some similar reasonable method. This area is under development.

New Trips

Diversion Analysis

Manual gravity

Use manual gravity and/or Modlin equations when a traffic model is not available for new roads.

Travel demand model

Use traffic model when available for new roads, reconstruction of old roads or assessing system impacts. See traffic modeling guidelines.

- Document process carefully, especially assumptions and network changes.
- Screen shots are always useful to include.
- System parameters such as VHT and VMT also need to be explained.
- The results of select link analysis should also be included on high priority/high profile projects.

Trip Generation Report

The 7th Trip Generation Report (ITE) can be used to generate new trips at the site level. There are numerous methods for distributing the traffic which also need to be documented.

Truck Volumes/Percentages

Truck Volumes

Whenever possible, recent vehicle classification data should be used. The design hour volume truck percentage is very variable so actual data is preferred over the default assumption of T% DHV = 2/3 T% ADT. Perform TLA when data is available.

ESAL Preparation

- Use current ESAL calculation spreadsheet to calculate ESALs. See Forecast Step by Step for assistance in using this spreadsheet.
- Check results against Superpave ESAL spreadsheet. Make sure that value is being added (smoothing data, collecting new data, making important assumptions, adding in coal movements). Otherwise, let the computer do it.
- Use coal truck database as a source of data for coal trucks.

3. Final Product

Business Report

The customer receives the business report which contains the executive summary, table of contents, exhibits, turning movements, ESALs and other key information requested.

Methodology Report

The methodology report contains the finalized methodology and an appendix which contains all of the forecast work and files.

Filing/Archiving

- Traffic forecasting work must be documented for the reviewer (need maps, sources of all data, listing of assumptions, etc.).

THE URBAN TRANSPORTATION MONITOR

VOL 18, NO 11 JUNE 11, 2004

FHWA Develops Certification Checklist for Travel Forecasting Methods

Guides Reviewers in Assessing Agencies' Modeling Abilities and Vulnerability to Legal Challenges

To assist certification review teams in assessing the travel forecasting procedures of metropolitan planning organizations (MPOs), the Federal Highway Administration (FHWA) has developed a checklist against which those procedures can be measured.

The FHWA notes, "Although there are no other requirements that travel demand models must be used in the metropolitan transportation planning process, the travel forecasting methods used by an MPO should be addressed in the certification review to ensure that they adequately support the applications for which they are being used. These applications can vary considerably from one MPO to another, depending on such factors as non-attainment status, regional population and economic growth, and the types of strategies/investments being considered in the transportation plan.

"The questions included in this checklist are designed to provide the certification review team with an overview of the travel forecasting methods being used by an MPO, the suitability of those methods for intended applications, and the technical capabilities of the planning staff in applying the methods. In those cases where responses to the checklist questions raise serious concerns on the adequacy of the forecasting methods, the certification review team should request a more in-depth review by FHWA Resource Center or FHWA/Federal Transit Administration Headquarters travel model experts."

Key Indicators of Risk

Determining the adequacy of an MPO's travel forecasting methods begins with an understanding of how the forecasts will be used, according to the FHWA. The validity of forecasting procedures in conjunction with certain types of projects (e.g., to estimate motor vehicle emissions for transportation conformity determinations, to eval-

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Installation of Back-In Angle Parking Generally Successful

Results in Reduced Accidents, Benefits for Cyclists

Back-in angle parking projects in the U.S. are showing positive results when compared with front-in angle parking.

Several cities indicated they had experienced a reduction in accidents at sites where front-in angle parking had been converted to back-in angle parking, and also that the change had improved bicycle safety. The installations in some cities were too new to draw any formal conclusions.

Traffic engineers from the cities that have implemented back-in angle parking characterized streets on which back-in angle parking would be most appropriate:

- Should have low traffic speeds (less than 10 mph)
- Traffic volumes should be less than 10,000 ADT

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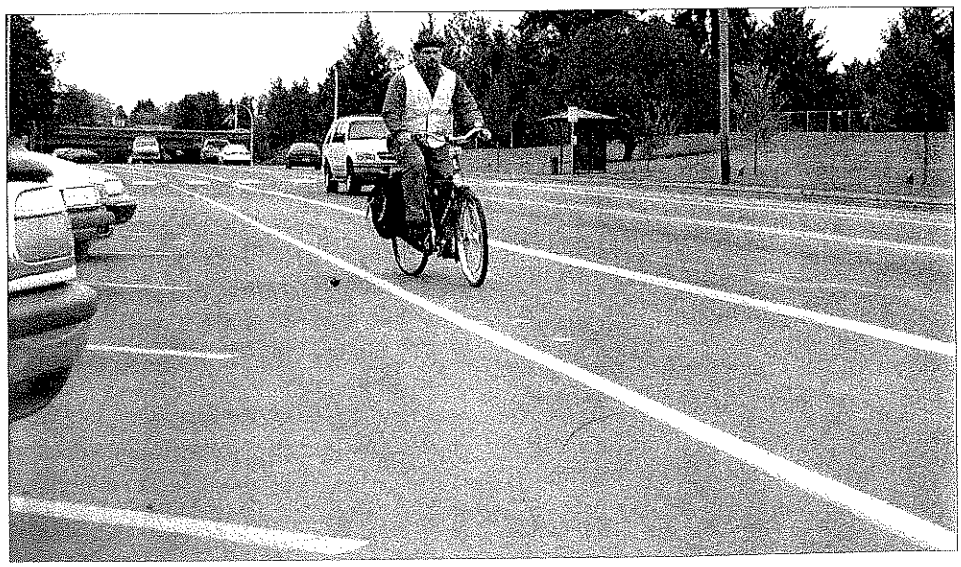

Back-in angle parking with a bicycle lane as a buffer in Vancouver, WA. (Photo: Courtesy Todd Boulanger 2004)

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Product and Industry News

modeling methodologies, project results, and data sets will be made available in the coming months.

Over the last year, based on users' feedback, several utilities have been added to TRANSIMS. These include enhanced capabilities for data import and export, transit coding, data validation, and improved visualization of output data. Users will also be able to import current networks and trip tables from their existing four-step models into TRANSIMS and rapidly leverage its powerful features.

Rapidly falling hardware prices have significantly reduced any concerns about the cost of computing power needed to run TRANSIMS. In addition to the TRANSIMS software suite, hardware, data sets and training, IBM is also offering its customers on-demand computing. Under the program, as an alternative to purchasing their own hardware, organizations can access powerful computing capabilities at a centralized IBM location and pay a fee based on usage.

For details on the TRANSIMS software and other related questions, please contact Naveen Lamba at naveen.lamba@us.ibm.com.

Citilabs Releases Version 3.2 of Cube

Citilabs announced the release of version 3.2 of Cube. According to Citilabs, Cube and its companion software products TP+, TRIPS and TRANPLAN represent the most used transportation planning system in the world today. Cube is based on ESRI's ArcGIS data formats and ArcGIS.

Cube 3.2 provides several major new functions:

- *Integrated microsimulation.* Cube Dynasim, Citilabs' multimodal microsimulation system, is now fully integrated within the Cube system. This integration allows the user to simply select a portion of their transportation model results to be simulated and trips, network, intersection control, public transit, and pathing is exported directly to the microsimulation. The integration provides enormous time savings for planners and engineers in taking model forecasts to detailed level microsimulation analysis.
- *Dynamic intersection modeling.* The traffic assignment in Cube now provides for the use of junction delay traffic assignment. This methodology allows the user to model intersection delay directly within the traffic assignment using full HCM methods. A key output is the direct calculation of intersection level of service, delay by movement, and queues. This function allows the user to make a comprehensive level of service map for their scenarios without the need to use HCS.
- *On-screen select link, select zone, path review.* One click on the screen provides a select link or select zone assignment—another important timesaver available in Cube 3.2.
- *Incorporation of Summit calculations.* Cube 3.2 provides for direct calculation, review, and export of statistics for the Federal Transit Administration's Summit process.

Cube is used in many major urban areas worldwide, including San Francisco, Los Angeles, Salt Lake City, St. Louis, Washington, Atlanta, London, Paris, Milan, Hong Kong, and Sydney. Cube provides comprehensive, fully integrated modeling of passenger and freight, microsimulation and air quality. Cube Land, Citilabs' land use forecasting system, will be released later in 2004.

For further information, please contact Michael Clarke at mclarke@citilabs.com or check the company's web page for further details at www.citilabs.com

New Version of TransCAD released by Caliper

Caliper Corporation is pleased to announce the immediate availability of TransCAD 4.7, which is a major step forward for America's most popular and most powerful transportation planning software. TransCAD 4.7 features expanded demand forecasting capabilities, numerous performance enhancements, new planning utilities, enhanced GIS capabilities, and new included transportation data.

Planning model improvements include a new nested logit application module that is very easy to use and has very high performance, and a completely revised set of modeling methods for public transit. The public transit methods enable accurate treatment of park and ride facilities, timed transfer service, fare policies, and vehicle capacities. Performance improvements have halved the running time of most transit skimming and assignment procedures. There is a completely new select link and select zone that is very flexible and convenient, and TransCAD's powerful trip table estimator is now multimodal and will simultaneously estimate trip tables for cars and various types of trucks. Support for detailed modeling of traffic at intersections and calculating intersection LOS has also been expanded. There have also been many scripting enhancements and TransCAD now includes a new customizable user interface that integrates scenario management, model scripts, and the production of informative graphics. A variety of additional modeling methods and improved importing tools make it easy to move models into TransCAD from other software without changing the results significantly. The travel demand forecasting manual has been substantially revised and expanded to reflect these new capabilities.

There is also a new version of TransCAD for the Web which is the easiest and most cost-effective way to implement transportation planning-oriented web sites. Examples of TransCAD for the Web that include transit customer information and schedule-based trip planning, planning model and Census data access, and travel diary survey administration can be found at www/web/transcad.htm.

Now completing our twentieth year of operation, Caliper is North America's leading provider of transportation planning software. For more information and free demonstration software visit www.caliper.com or call 617-527-4700.

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FHWA Develops Certification Checklist

uate major transportation investment alternatives such as new highways or transit lines) can come under increased scrutiny and possibly legal challenges. To help MPOs head off such challenges, the FHWA attempted to characterize agencies that might be more likely to face close scrutiny from other agencies or outside advocacy groups by posing the following questions:

- Is the metropolitan area a designated serious, severe, or extreme ozone or serious carbon monoxide nonattainment area? Failure to meet federal requirements may result in a delay in conformity determination, or even a conformity lapse and the restriction of federal highway and transit funds to the metropolitan area.
- Is the metropolitan area a designated nonattainment or maintenance area, and has the MPO used travel demand models previously? It must continue to use a model with similar or greater sophistication for regional emissions analysis in transportation conformity determinations or follow other prescribed minimum requirements for estimating growth in vehicle miles traveled.
- Does the metropolitan area plan to apply for an FTA transit new start grant (travel forecasting methods must then meet FTA requirements)?
- Does the transportation plan include any major projects that will significantly increase highway capacity? These projects are particularly susceptible to legal challenges in which the plaintiffs hire their own travel model experts to dissect the forecasting methods used to derive forecasts of future traffic.
- Is the metropolitan area proposing any transportation projects where there is strong and coordinated opposition by local advocacy groups? Local groups with sufficient resources, or in coordination with national organizations, may also hire their own travel model experts to challenge controversial projects on methodological grounds.
- Has the MPO been a defendant in, or threatened with, legal action in which the adequacy of their travel forecasting methods was challenged?

Affirmative answers to any of the above questions indicate that the travel forecasting methods used by the MPO are likely to be scrutinized by travel modeling specialists working on behalf of agencies or organizations other than the MPO.

Key Indicators of Agency Technical Capabilities

A few key indicators can be used to obtain a general overall assessment of the technical capabilities of the staff responsible for developing and applying the travel forecasting tools used by an MPO. These indicators are covered in the following questions.

- Who is responsible for travel forecasting at the MPO (i.e., do the technical staff have the expertise and experience in travel demand models needed to develop, maintain and interpret the output from travel forecasting methods)?

If another governmental agency provides the required modeling expertise:

- Is there a formal memorandum of agreement between the agencies to delineate technical responsibilities, lines of communication and review, authorized expenditures and reimbursement procedures?
- Who, if anyone, on the MPO staff is responsible for evaluating the technical work of the contractor? Some in-house expertise is needed to independently evaluate the reasonableness of the travel forecasts produced, to defend the methodology in public forums, and to provide institutional memory of what changes were made to the methodology or why they were made.

If in-house staff actively participate in model development and application:

- What formal training has the MPO technical staff received in travel demand forecasting?
- Do the MPO technical staff require training in specific technical areas?
- Does the MPO organizational structure include a technical committee to review planning assumptions and forecasting methods?
- Does the MPO have a strategic plan and a guaranteed minimum level of funding in its Unified Planning Work Program for maintenance and improvements to its travel forecasting methods?
- Has the MPO convened a peer review or other independent assessment of their travel forecasting methods?

Documentation

The certification review team should request and obtain written, technical documentation from the MPO covering the following subject areas:

- An inventory of the current state of transportation in the metropolitan area
- Key planning assumptions used in developing the forecasts
- Descriptions of the methods used to develop forecasts of future travel demand.

Suggested Actions by the Certification Review Team

Finally, the FHWA developed a list of suggested actions for reviewers:

- MPOs that are able to provide adequate documentation of their forecasting methods and assumptions, and that have generally positive indicators of technical capabilities and low indicators of risk, require no further action by the certification review team.
- The absence of any technical documentation, or documentation that does not adequately address key subject areas, should be discussed as a recommended area for improvement during the certification review.
- Indications of weak technical capabilities with respect to travel forecasting methods should also be discussed as a recommended area for improvement during the certification review. MPOs that have not had their travel forecasting methods recently peer reviewed should be encouraged to convene a peer review. FHWA provides financial support to MPOs for technical peer reviews through its Travel Model Improvement Program.
- MPOs engaged in high-risk applications (e.g., conformity determinations or controversial highway projects) and with indications of weak technical capabilities should have their forecasting methods reviewed by FHWA/FTA travel model experts.

The full text of the FHWA report can be accessed at http://www.fhwa.dot.gov/planning/certcheck.htm.

TRB Committee Finds "State of the Practice Standards" Lacking for Travel Forecasting in U.S.

Finding Comes After Review of Metropolitan Washington COG Procedures; Synthesis Study Requested

A Transportation Research Board (TRB) ad-hoc committee of leading experts in travel forecasting, appointed by the National Research Council following a request by the Metropolitan Washington Council of Governments (MWCOG) to review its travel forecasting program, has concluded that the field is lacking national state-of-the-practice standards for transportation modeling.

Ronald F. Kirby, Director, Department of Transportation Planning at MWCOG, has been instrumental in initiating a (synthesis) study on travel demand modeling. This study, which will be administered by the TRB with sponsorship by the U.S. DOT, is currently awaiting approval before moving forward. The scope of the study will include gathering information on and preparing a synthesis of practice on metropolitan area travel demand modeling.

The MWCOG review was requested by the agency's National Capital Region Transportation Planning Board (TPB) as part of the board's "ongoing program to upgrade its travel forecasting methods and respond to federal guidance on modeling in air quality nonattainment areas." COG has been the subject of some criticism for its travel planning process from environmental advocates.

The recommendations of the TRB committee's review were transmitted to the COG in two letters, the first issued in September 2003 (a review of current TPB travel model and emissions postprocessor model) and the second in May 2004

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Conversion To Back-In Angle Parking Generally Successful

- Enough street width should be present.
- It is an advantage to install this type of parking on one way streets to encourage compliance
- Provide a few feet of separation (buffer) between the parking spaces and the closest travel lane so drivers have adequate sight distance when exiting the parking space. This buffer can be a bicycle lane.

Angle parking is often a controversial issue among traffic engineers, with some indicating that this type of parking always results in higher accident rates and reduced street capacity. Others feel that angled parking has its place in certain locations; it particular, it is thought to help with downtown revitalization, providing a more "livable" environment where speeds and volumes are low.

Experience With Back-In Angle Parking in the U.S.

Location	Period Operated	Previous Type of Parking	Safety, Other Results	Public Response	Comments/Recommendations for Back-In Angle Parking
Arlington, VA	40 years	Front-in parking	Favorable	Unknown	Current spaces angled at 60° and 7.5 x 15 ft. are difficult for other than subcompact cars. recommend providing generous width and a few feet of separation between parking spaces and travel lane to give exiting drivers adequate sight distance.
Everett, WA	20 years	Front-in angle parking and parallel parking	Lower number of collisions	Few complaints	Used on two-way street with parking in uphill direction only (6-8% grade). One potential difficulty is lack of vertical visual clues (e.g., parking meters) for alignment behind curb.
Vancouver, WA	2 years	No formal parking	Effective at balancing bicyclist access while providing for growing parking demand	Approval gradual; public likes ability to unload bikes, equipment from back of car and not in traffic flow	Recommend enough street width, moderate traffic volumes (3,000-10m000 ADT), bike lanes as a buffer lane or very low speeds <10 mph, curbs or bollards to keep cars from parking into trees and pedestrians, and signs or educational materials. It is worth the political risk, but you must do your homework and process. Provide for alternative forms of parking stalls near by; choice is necessary.
Salt Lake City, UT	2 years	Front-in angle parking	Parking is functioning well, with improved bicycle safety	Mixed: cyclists pleased, some complaints about difficulty backing into space	Installed only on roadways with bicycle lanes. Recommend having a good reason for installing it or the public outcry against it will be significant. Our reason was for the safety of bicyclists in the adjacent bike lanes. It appears that the average person has a fear of learning a new parking maneuver and is not very confident with his/her ability to back his/her vehicle into a parking stall. (See FAQ section at www.slcgov.com/Transportation/Aboutus/FAQ.htm.)
Tucson, AZ	>5 years	Front-in angle parking	Decreased collisions	At first opposition, now acceptance	Recommend installing on street with high bicycle traffic, low speeds.
Portland, OR	2 years	Parallel parking on both sides; after widening street, angle parking on one side with parallel parking on opposite side.	Goal to increase safety for cyclists	Mixed compliance; confusion with other front-in angle parking on other streets; also drivers approach from opposite side of two-way street and park head-in. Few public complaints	City plans to change the front-in to back-in angle parking within the central business district this year. Recommend keeping it to one-way streets to encourage compliance.
Ventura, CA	>50 years	Front-in 90-degree parking	Some enforcement problems	Unknown	Install buffer between travel way on sidewalk and rear of parked cars; exhaust fumes and pollution are concerns. Public education is important.
Knoxville, TN	1 year	Parallel parking	Unknown	Slow public adaptation to new system	Slow speeds, adequate width for travel lanes; have plenty of publicity.

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TRB Reviews Washington, D.C. MPO's Travel Demand Modeling Program

(review of TPB's proposed direction of future travel demand model upgrades and on travel surveys and other data needed to accomplish future model upgrades). In its review, the committee addressed five specific elements of COG's travel demand modeling process:

- The performance of TPB's latest travel model (Version 2) in forecasting regional travel
- The proposed process for merging the latest travel model outputs to produce mobile source emissions
- TPB's proposed direction of future travel demand model upgrades
- Travel survey and other data needed to accomplish future model upgrades
- The detail (grain) of travel analysis zones that should be developed for future upgrades

Perhaps the most notable finding of the committee was that, "despite some four decades of experience with the use of travel demand models in transportation planning, there are few universally accepted guidelines or standards of practice for these models or their application. Any assessment of these models, their performance, and the current state of transportation demand modeling practice relies primarily on professional experience and judgment."

Nevertheless, the TRB committee cited improvements in demand modeling in three areas: (1) enhanced understanding of factors that influence travel demand and application of that understanding to more realistic models; (2) drastically improved power and flexibility of computers, leading to computationally more complex and data-intensive modeling methods; (3) enhanced capabilities for data collection and database management. It further noted improvements in the traditional "four-step model" and the development of revolutionary new models such as "activity-based" or "tour-based" models and microsimulation of traffic flows using less aggregated data and providing more spatial and temporal detail.

Although many agencies continue to rely on four-step modeling and seek to improve their existing modeling practices, the committee noted that MPOs must also "strike an appropriate balance between maintaining their current models and preparing for the migration to new practices." Within this context, and with specific regard to TPB's modeling process, the committee made the following points:

Among the committee's recommendations with regard to TPB's modeling process were the following:

- TPB's efforts to improve model calibration and validation statistics through improved representation of transit and highway network supply characteristics—such as refinements of volume-delay functions, free-flow speed and capacity values, linkages of transit speeds to highway speeds, and network coding—are steps in the right direction.
- TPB's proposals to develop new model components to represent truck and commercial vehicle trips are a reasonable application of methods successfully adopted by other MPOs; collection of new traffic classification counts should begin as soon as possible and model development work should be initiated without waiting for completion of these counts.
- The committee is encouraged by TPB's plan to work with the region's transit agency and others to find a method to represent bus speeds in future years.
- The practice of using K-factors and other arithmetic adjustments to improve four-step models' ability to represent base-year travel observations is not uncommon, but TPB's use of such correction factors is excessive, requiring further documentation on the logical basis and need for these adjustments.
- TPB's proposed exploration of alternatives to its rule-based heuristic approach for approximating equilibrium conditions and current representation of highway-transit composite times in distribution and mode choice is helpful; there are accepted feedback algorithms for obtaining convergence of travel times.
- Time-of-day link volumes estimated in the four-step model process should be more directly linked to TPB's postprocessing procedures. TPB should develop postprocessing procedures that maintain consistency with the agency's four-step travel demand modeling procedures.
- Although large survey sample sizes generally yield statistically more precise estimates of important modeling parameters, they can be expensive. For the purposes of model calibration, surveys that incorporate selective sampling of stratified populations can be more effective and efficient than those that entail larger random samples.
- TPB's proposal to consider a nested logit model is appropriate. However, determining the specific nesting structure requires extensive empirical analysis; TPB also consider other discrete choice model formulations that allow more flexible representation of competition among different transportation modes.

Contemporaneous with the committee's work, TPB staff surveyed the travel modeling practice at medium-sized MPOs to help define the state of the practice in regional travel forecasting models. The full report is available at http://gulliver.trb.org/publications/reports/mwcogapril04app.pdf.

For more information on TPB's modeling efforts, contact Ron Kirby, director of MWCOG's Transportation Planning Department, tel. (202) 962-3310, e-mail: rkirby@mwcog.org. The TRB committee's first letter report is available at http://trb.org/publications/reports/mwcogsept03.pdf; the second letter report is available at http://trb.org/publications/reports/mwcogapril04.pdf. MWCOG's comments to the second report are available at MWCOG's website at www.mwcog.org/uploads/committee-documents/vV5XXVg20040513164338.pdf.