

# Statewide Model Update

Presented to the OTDMUG

September 20, 2007

By

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Ohio Department of Transportation

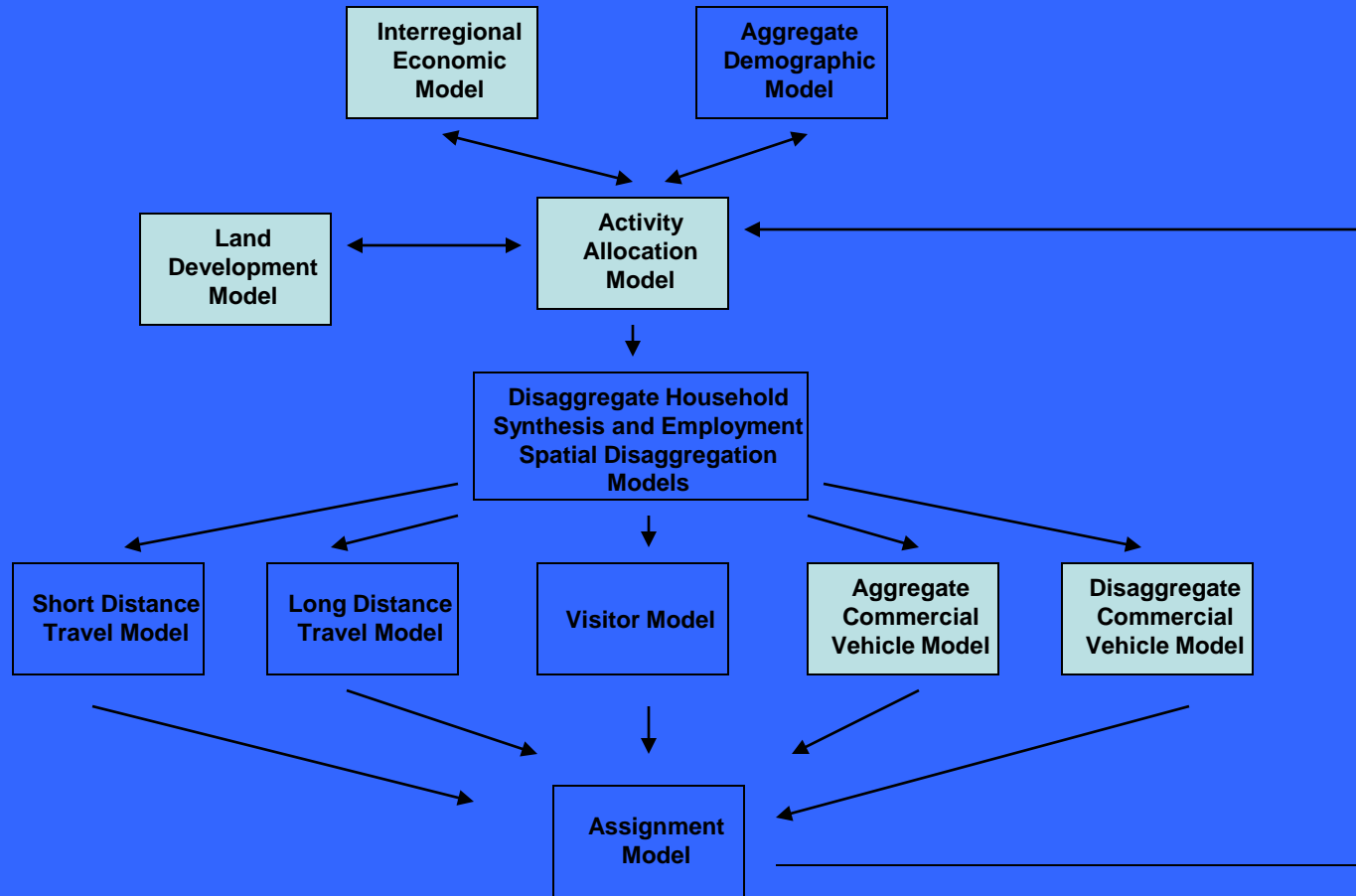
# Status

- Should have functioning soon
- Calibration/Validation will almost certainly go into next year
- Land use and activity allocation models have recently been simplified
- Interim model recently converted from 1200 zone structure to 5000 zone final network with dualized freeways and ramps

# Status

- “The” statewide model thus has/will have at least 4 main versions:
  1. 1200 zone interim “model” (static trip table)
  2. 5000 zone interim “model” (uses final model nets)
  3. Final model with full passenger demand models but some simplifications in the economic/land use/freight models
  4. Final model with additional details added

# Ohio Integrated Land Use/Economic/Transport Model



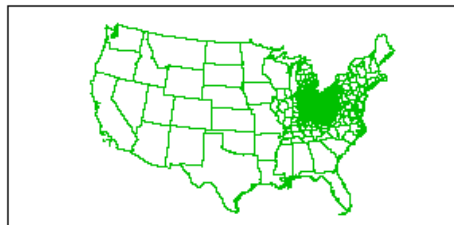
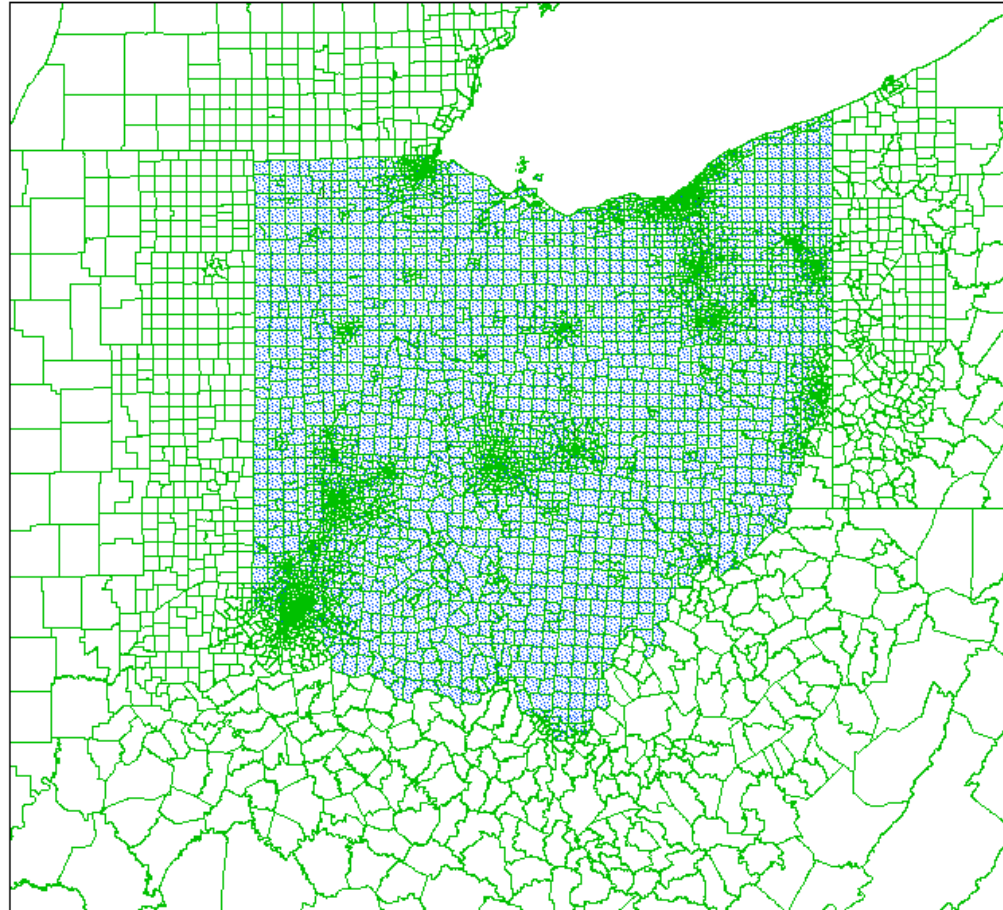
# Model Modules

- **Interregional economic model** of production & consumption by economic sector reflecting national forecasts
- **Demographic model** tied to economic activity reflecting migration and changes in population & household composition
- **Activity allocation model** to distribute model area economic and demographic forecasts to analysis zones with the related flows of goods & labor among zones from which travel demands are derived
- **Land development model** simulating developer behavior in response to demands & costs consistent with other development constraints
- **Personal & household travel model** reflecting person & household characteristics, zonal characteristics, inter-zonal economic flows & transport system supply characteristics, 2 components: short distance which looks like an activity/tour based urban area model and long distance, also tour based with purposes: business, recreation, other

# Model Modules

- **Aggregate model of goods and services** transport arising from economic and demographic activity by zone very similar to the typical DOT commodity based transport model
- **Disaggregate model of business-related person travel** related to management functions, sales & support activities, provision of services and some short distance goods delivery.
- **Model of visitor travel** within and into the model area made by non-residents
- **Transport system supply model** incorporating air, intercity bus/rail, MPO transit & roadway networks with their corresponding level-of-service characteristics

# Statewide Traffic Analysis Zones



# Highway Network

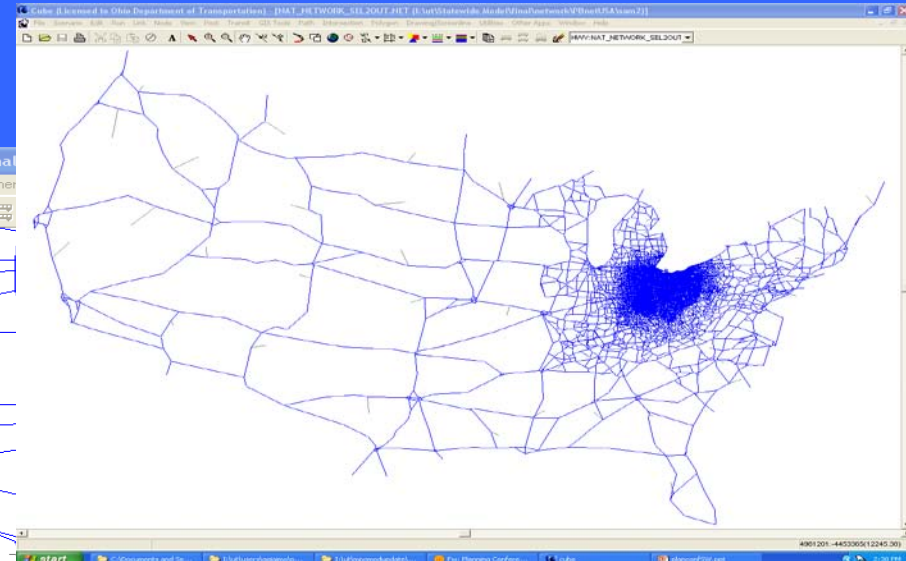
Cube (Licensed to Ohio Department of Transportation) - [NAT\_NETWORK\_SEL2OUT.NET (I:\ut\Statewide Model\final\...)]

File Scenario Edit Run Link Node View Post Transit GIS Tools Path Intersection Polygon Drawing/Screenline Utilities Other

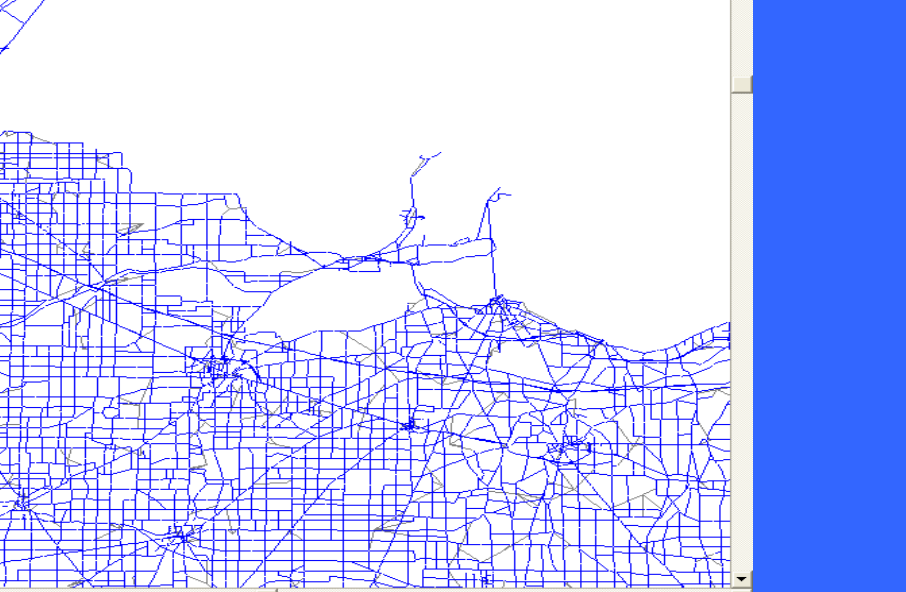


## Highway Links

AX/BX	1712543.2	1715258.5
AY/BY	1297836.8	1297758.2
A	150289	150290
B	150290	150289
DIST	0.51	0.51
POSTSPD	55	55
SPEEDMOD	0	0
FUNCLASS	40	40
AREATYPE	3	3
LANES	1	1
TWIDTH	9	9
TURNLANE	10	10
IXTYPE	0	3
MEDTURN	0	0
PARKING	0	0
TERRAIN	1	1
IXTHRU	1	1
PCTTRK	0	0
CAPADJ	0	0
CAR_TOLL	0	0
TRK_TOLL	0	0

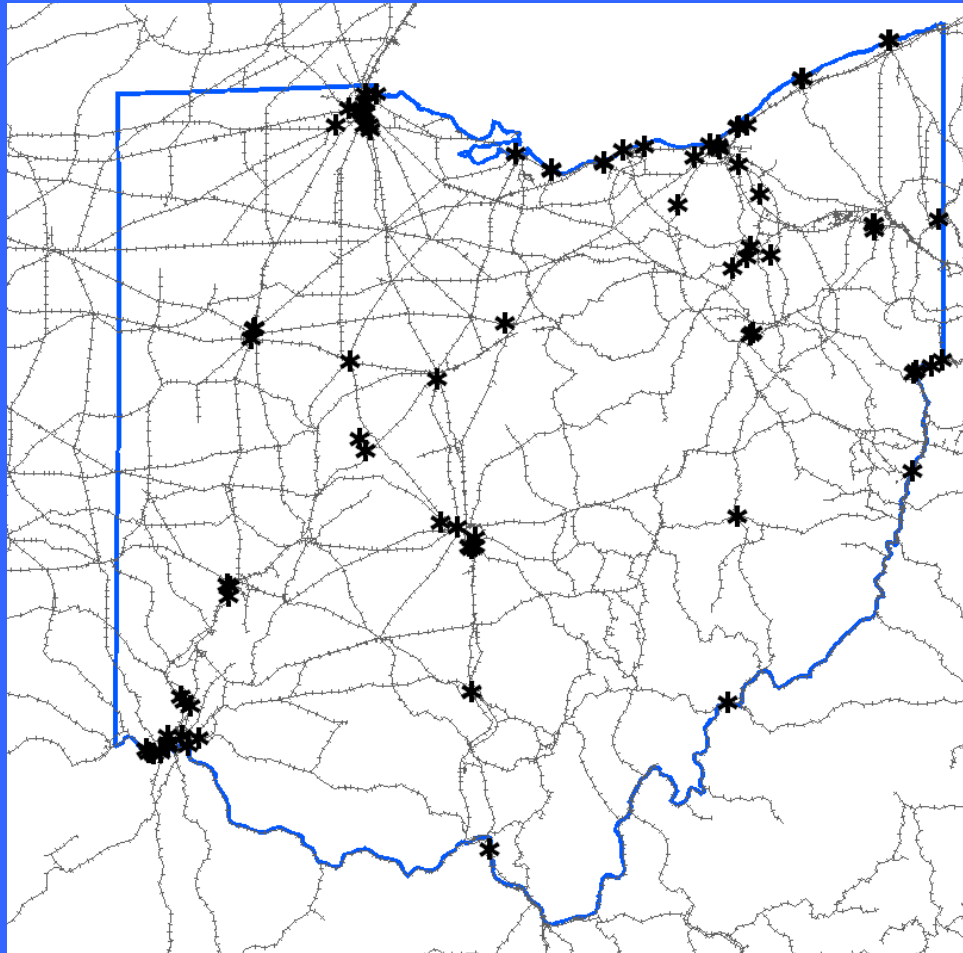


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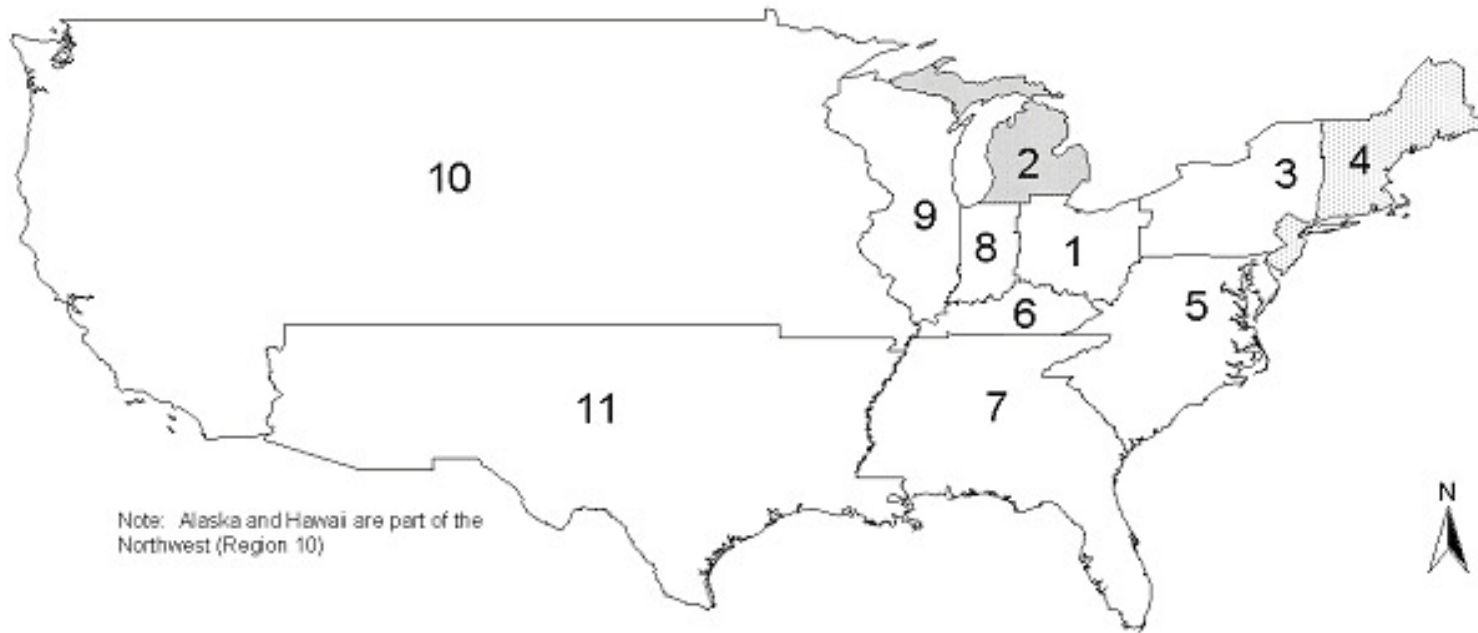
# Rail Network & Intermodals



# Interregional Economic Model

- Establishes forecast flows of goods, services and labor (in \$) between 14 regions of North America
- Uses exogenous national economic conditions and production composite utilities from the previous time step of the lower level models
- An inter-regional social accounting matrix based primarily upon IMPLAN data

## US Regions Comprising the Interregional Social Accounting Matrix



	Industry Output*	Employment	Employee Compensation*	Proprietor Income*	Indirect Income*	Total Business Tax*	Value Added*
<b>Region1</b>	\$716,166	7,966,019	\$228,234	\$21,666	\$97,448	\$27,562	\$374,910
<b>Region2</b>	\$549,640	5,250,326	\$175,241	\$11,328	\$71,412	\$19,524	\$277,505
<b>Region3</b>	\$1,631,352	16,534,837	\$580,641	\$70,729	\$272,386	\$75,873	\$999,630
<b>Region4</b>	\$1,258,568	12,878,897	\$444,828	\$47,631	\$217,457	\$61,111	\$771,027
<b>Region5</b>	\$1,315,875	15,632,564	\$464,473	\$40,713	\$211,292	\$57,678	\$774,155
<b>Region6</b>	\$159,981	1,927,710	\$48,863	\$5,282	\$21,446	\$7,229	\$82,820
<b>Region7</b>	\$1,578,235	19,633,779	\$533,452	\$55,056	\$245,220	\$72,198	\$905,927
<b>Region8</b>	\$277,576	3,077,661	\$85,579	\$8,885	\$36,968	\$9,938	\$141,370
<b>Region9</b>	\$987,168	10,362,852	\$323,315	\$32,811	\$149,933	\$41,378	\$547,438
<b>Region10</b>	\$3,841,148	43,334,759	\$1,251,396	\$172,516	\$613,615	\$173,929	\$2,211,456
<b>Region11</b>	\$1,814,957	20,563,180	\$554,248	\$84,581	\$305,219	\$80,778	\$1,024,826

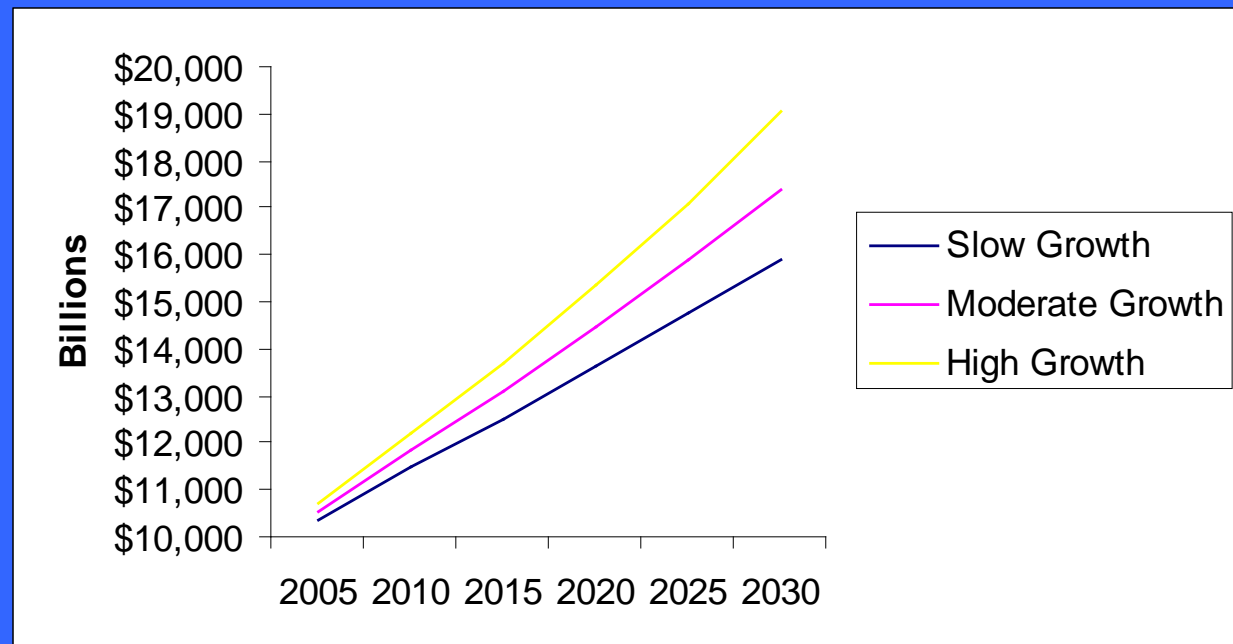
\*Millions of dollars

# Exogenous Economic Indicators

## Nation Economic Forecast Variables

<b>PCE &lt;\$5K</b>
<b>PCE \$5K - \$10K</b>
<b>PCE \$10K - \$15K</b>
<b>PCE \$15K - \$20K</b>
<b>PCE \$20K - \$30K</b>
<b>PCE \$30K - \$40K</b>
<b>PCE \$40K - \$50K</b>
<b>PCE \$50K - \$70K</b>
<b>PCE \$70K+</b>
<b>Federal gov't investment</b>
<b>Federal gov't defense</b>
<b>Federal gov't nondefense</b>
<b>Gross private domestic investment</b>
<b>S&amp;L gov't non-education</b>
<b>S&amp;L gov't education</b>
<b>S&amp;L gov't investment</b>
<b>Inventory adjustment</b>
<b>Exports</b>
<b>Imports</b>

## National Economic Growth



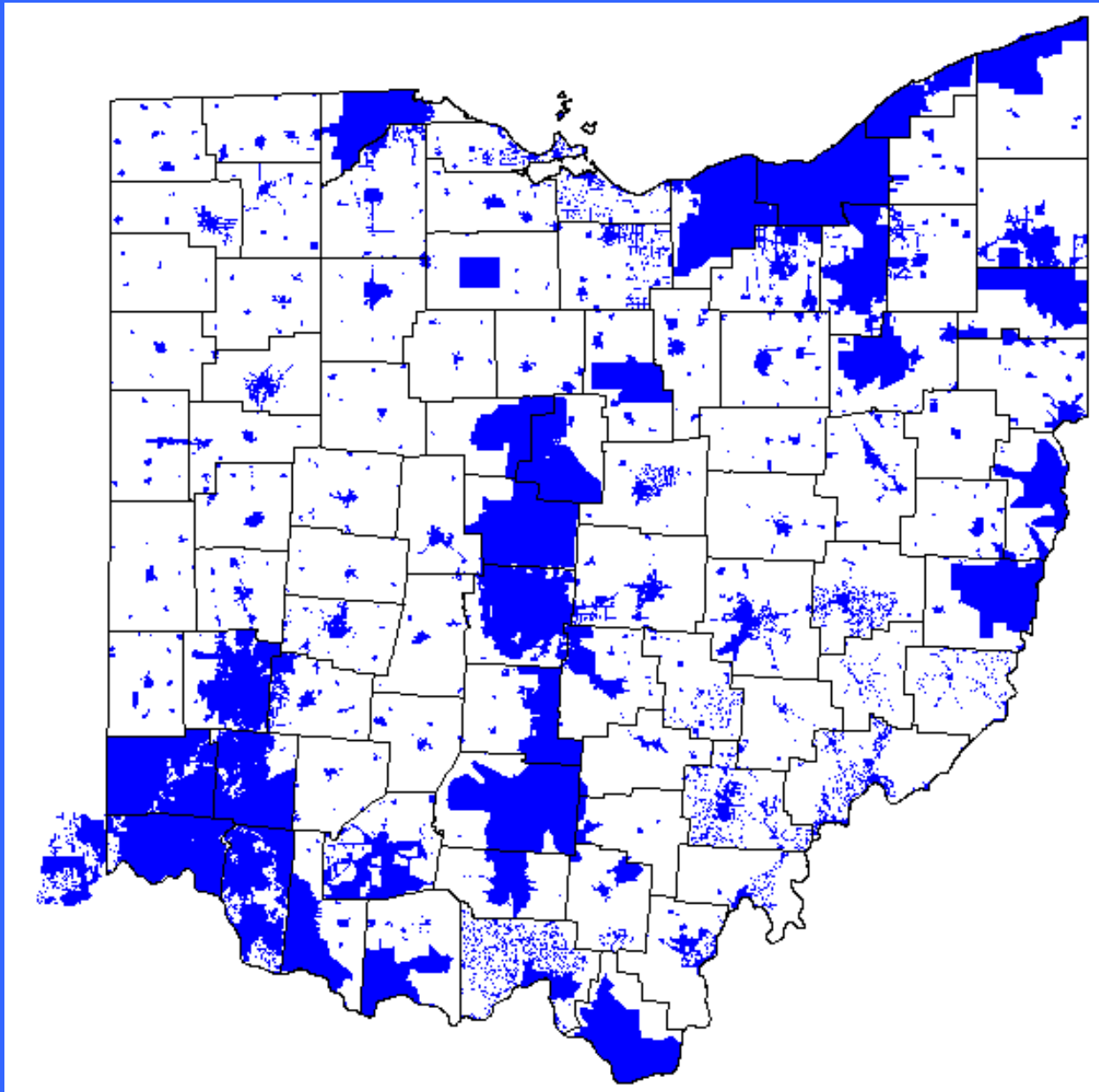
# Industry Categories

1. Agriculture, Forestry, Fisheries
2. Primary Metals (Steel)
3. Light Industry
4. Heavy Industry
5. Transportation Equipment (Auto)
6. Wholesale
7. Retail
8. Hotel
9. Construction
10. Health
11. Transportation Handling
12. Utilities
13. Other Services
14. Grade School Education
15. Post-Secondary Education
16. Government

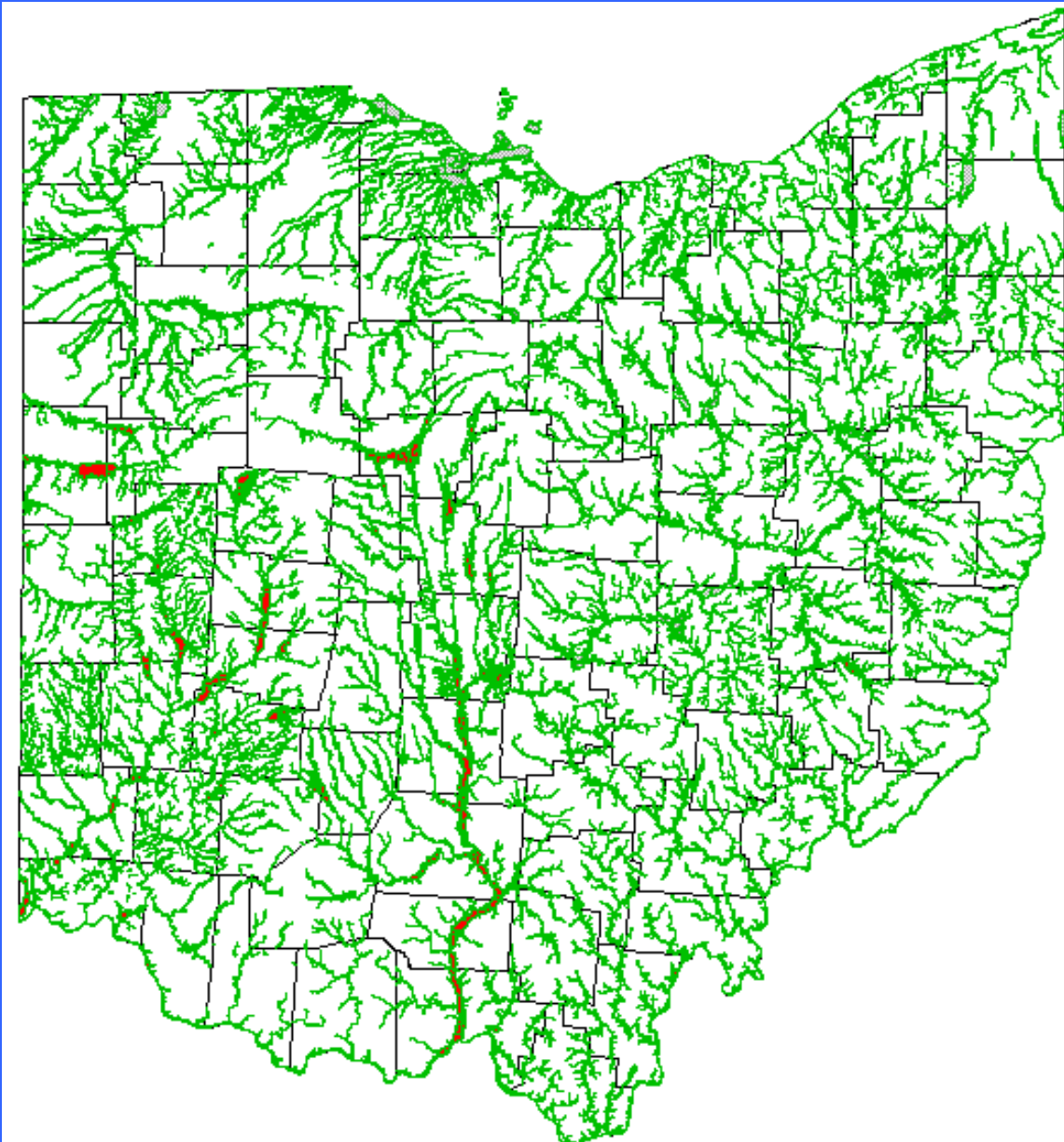
# Land Use Model

- Creates developed floor space by category by zone
- Land develops (if possible) in response to increases in households and employment in the previous analysis year (see activity allocation model) but also due to:
  - Zoning
  - Flood plains
  - Slopes
  - School district quality

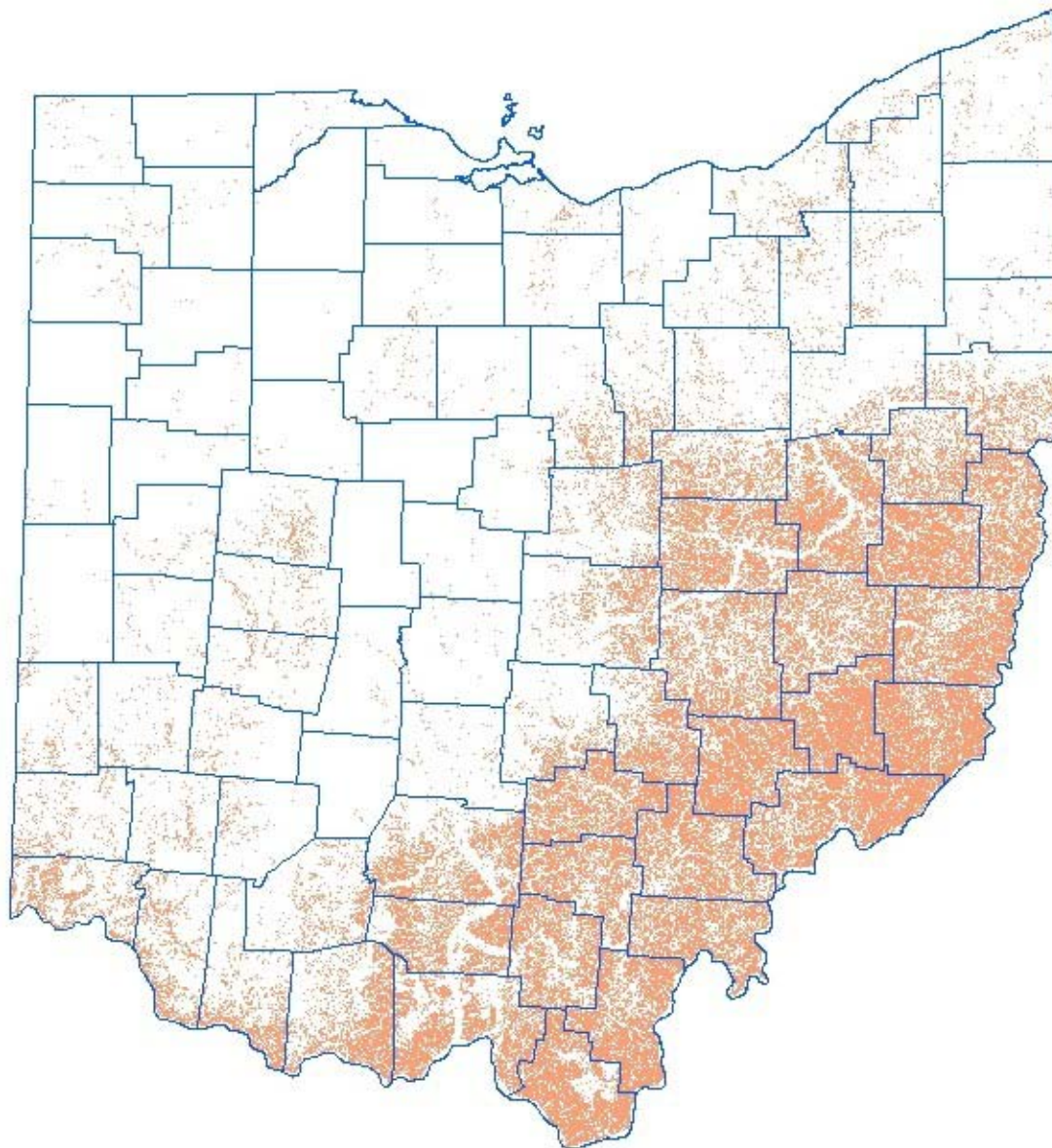
# Water Service



# Flood Plains



# Severe Slope



# Activity Allocation Model

- Subdivides activity to 5000 traffic analysis zones
  - Population
  - Employment
  - Labor Flow
  - Commodity Flow
- Uses transport utility equations relying on accessibilities and changes in developed land to redistribute activities from year to year

# Activity Allocation Model

- Inputs include:
  - Regional flows from Interregional Economic Model
  - Floor space by category by TAZ from Land Use Model
  - Households from Aggregate Demographic Model
  - Transport costs from previous iteration of Transport Models

# Passenger Transport Models

- Tour based microsimulation (i.e. a bunch of logit models) similar to MORPC model but simpler (for example intra-household interactions are not modeled explicitly)
- Separate long distance, short distance (analogous to MPO models) and visitor travel models
- Work commute tours come directly from the higher level economic model, not the passenger transport models

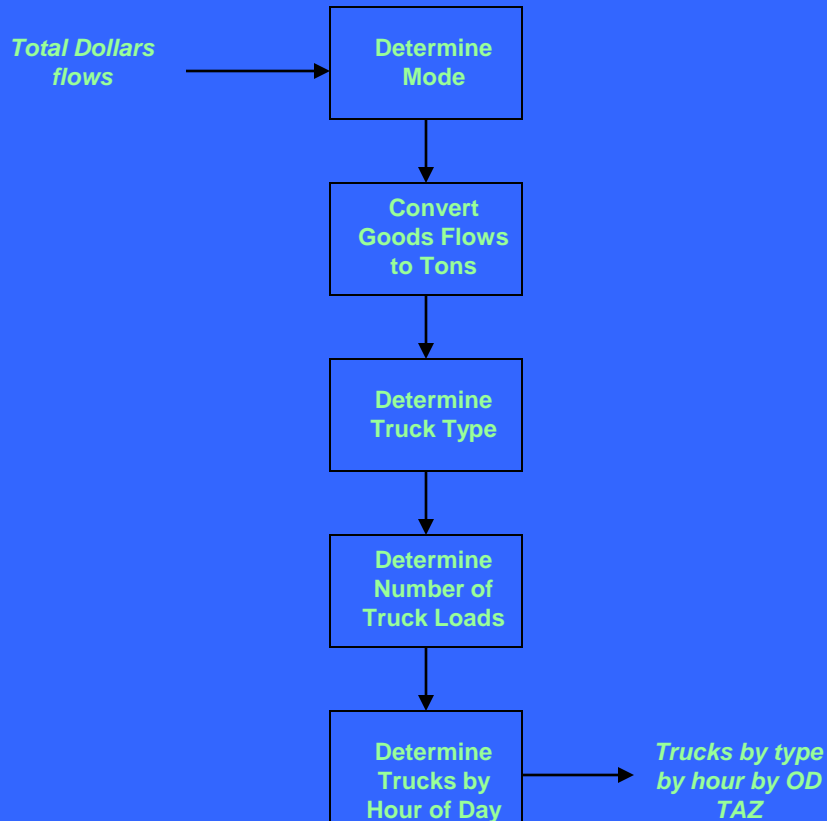
# Passenger Transport Models

- Long distance and visitor tours can result in additional short distance tour generation at their destination
- All passenger transport destination choice models can send tours outside the study area thus creating the IE trips
- All models multimodal, mode choice log sums are used as the impedance measures

# Aggregate Commercial Vehicle Model

- With the commodity flows established, the aggregate commercial vehicle model itself is very similar to the commodity representation in other statewide models
- Input is dollars of flow of goods and labor at the Traffic Analysis Zone (TAZ) level
- Output is flows of trucks between TAZ's

# Aggregate Commercial Vehicle Model Flow Chart



Fixed shares by commodity class, by distance for bulk commodities, mode choice model for inter-modal eligible commodities, based on CFS

By commodity class and distance, from CFS

By commodity class and distance, from VIUS

By commodity class and truck type, from VIUS

Based on traffic counts, conversion from annual to weekday assumes 300 equivalent week days per year. This value is obtained as follows:  $(52 * 5)$  weekdays plus  $(52 * 2 * 0.44)$  weekday equivalents for weekends minus 6 holidays.

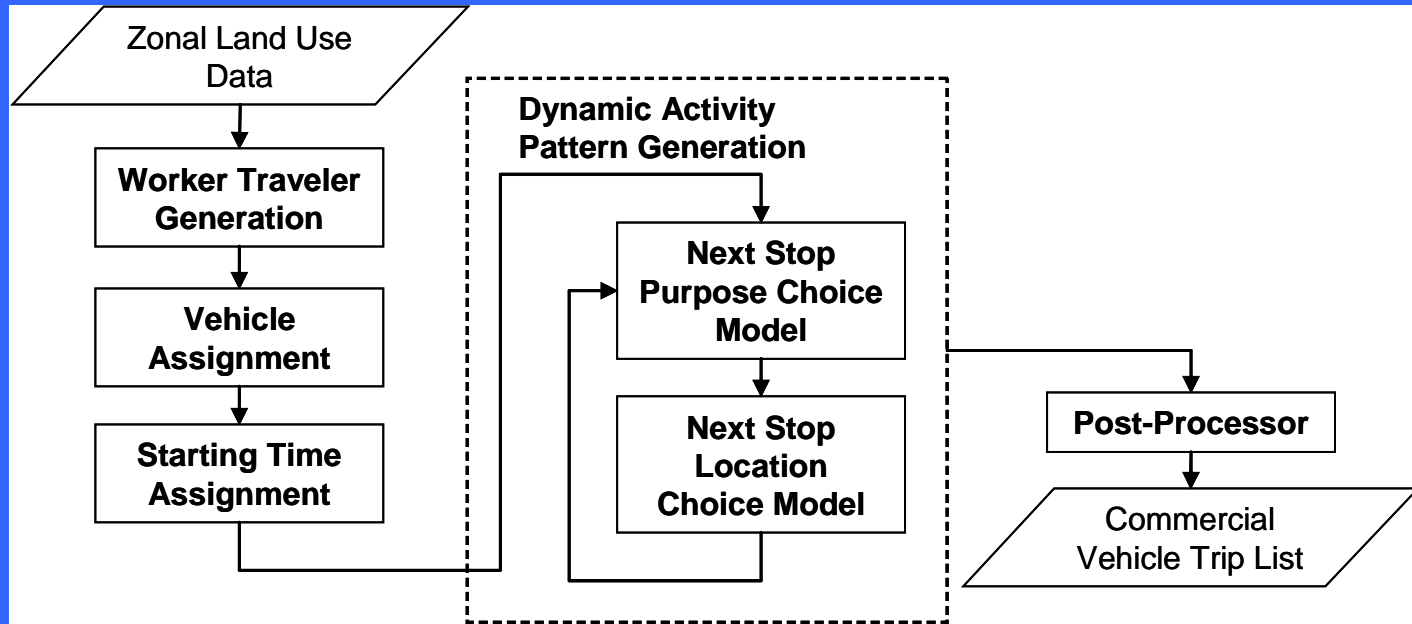
# Disaggregate Commercial Vehicle Model

- DCOM is designed to account for short distance commercial travel not related to the long distance shipping of freight (accounted for in ACOM)
- Long distance business travel is accounted for in the Long Distance Travel model of the personal transport model since these trips were obtained in the special long distance travel survey

# Disaggregate Commercial Vehicle Model

- Employs a tour based microsimulation of employees
- Based on establishment surveys
- Analogous to HH based tour based model but based at the place of work
- Does not include route delivery vehicles

# Disaggregate Commercial Vehicle Model



# Disaggregate Commercial Vehicle Model

Employment categorized as:

- Industrial
- Wholesale
- Retail
- Transportation Handling
- Service

# Disaggregate Commercial Vehicle Model

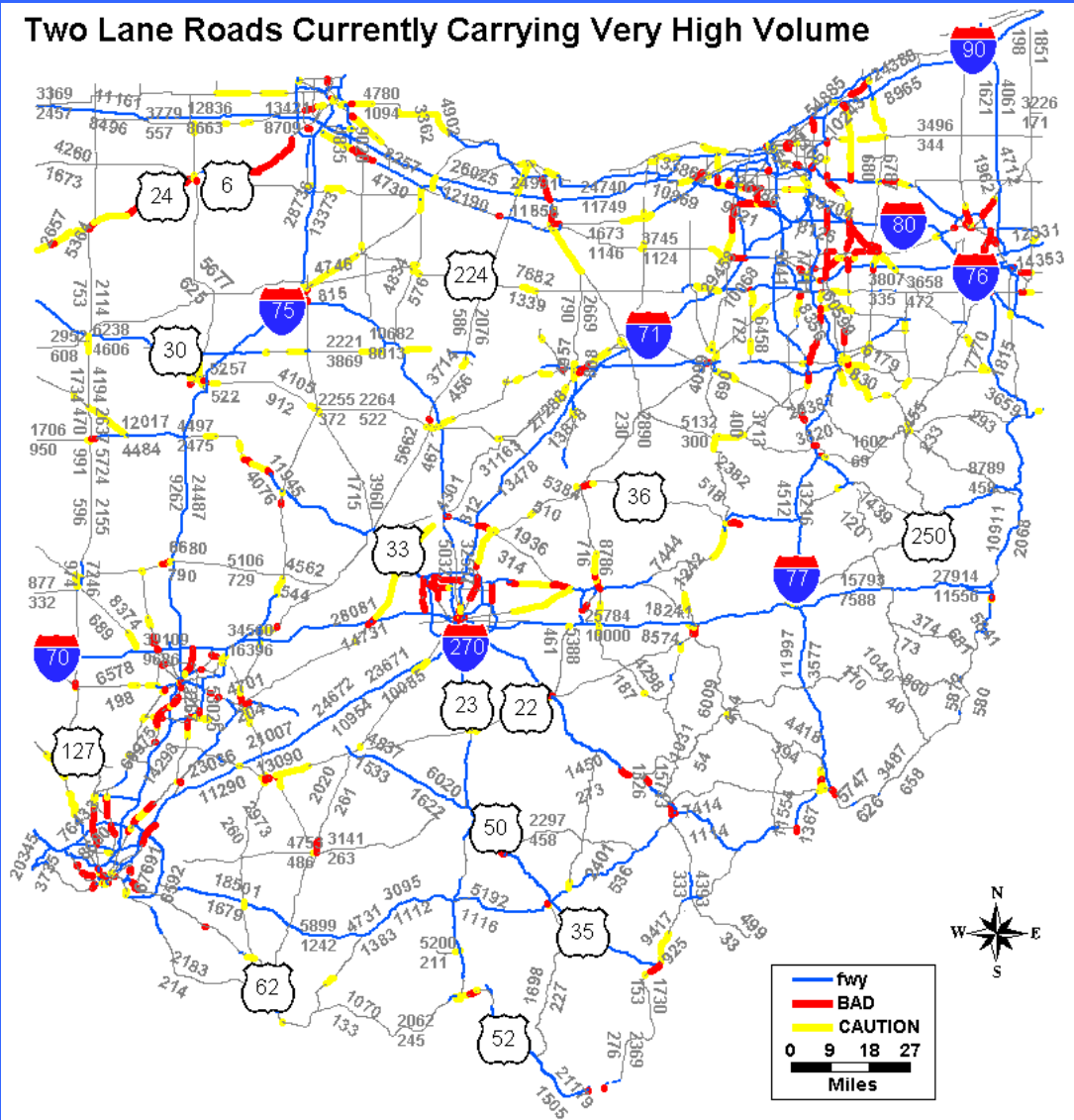
Trip purposes:

- Service
- Meeting
- Goods (delivery)
- Other (includes such things as stopping for lunch or fuel)

Outputs

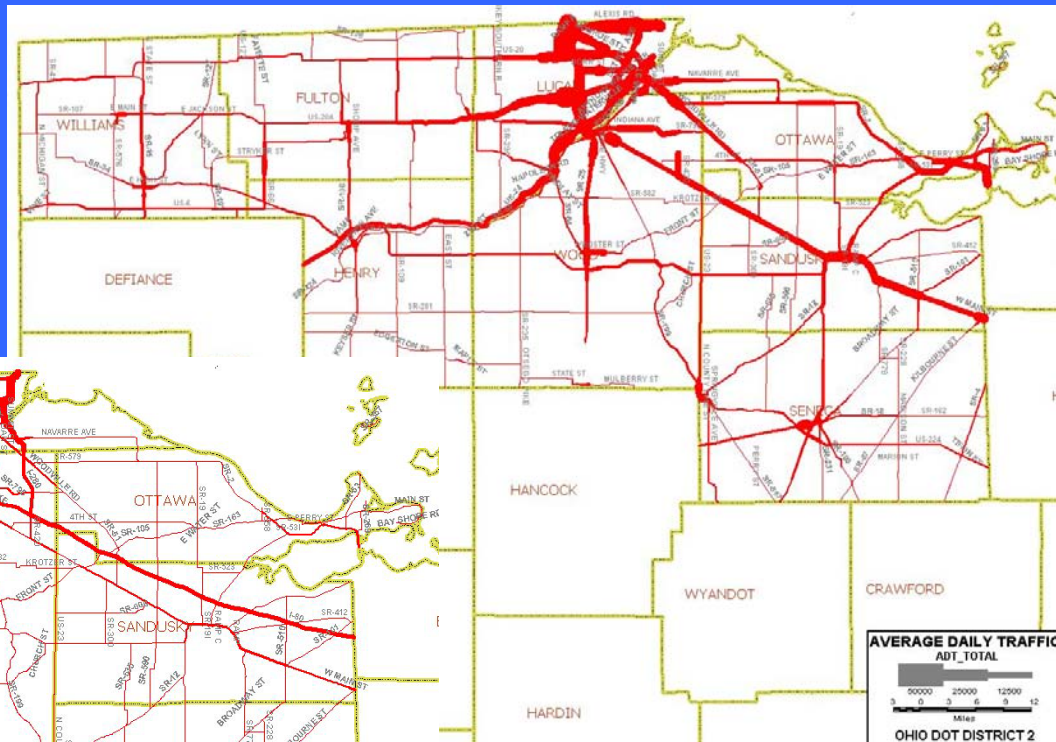
# Forecast Volumes

Two Lane Roads Currently Carrying Very High Volume

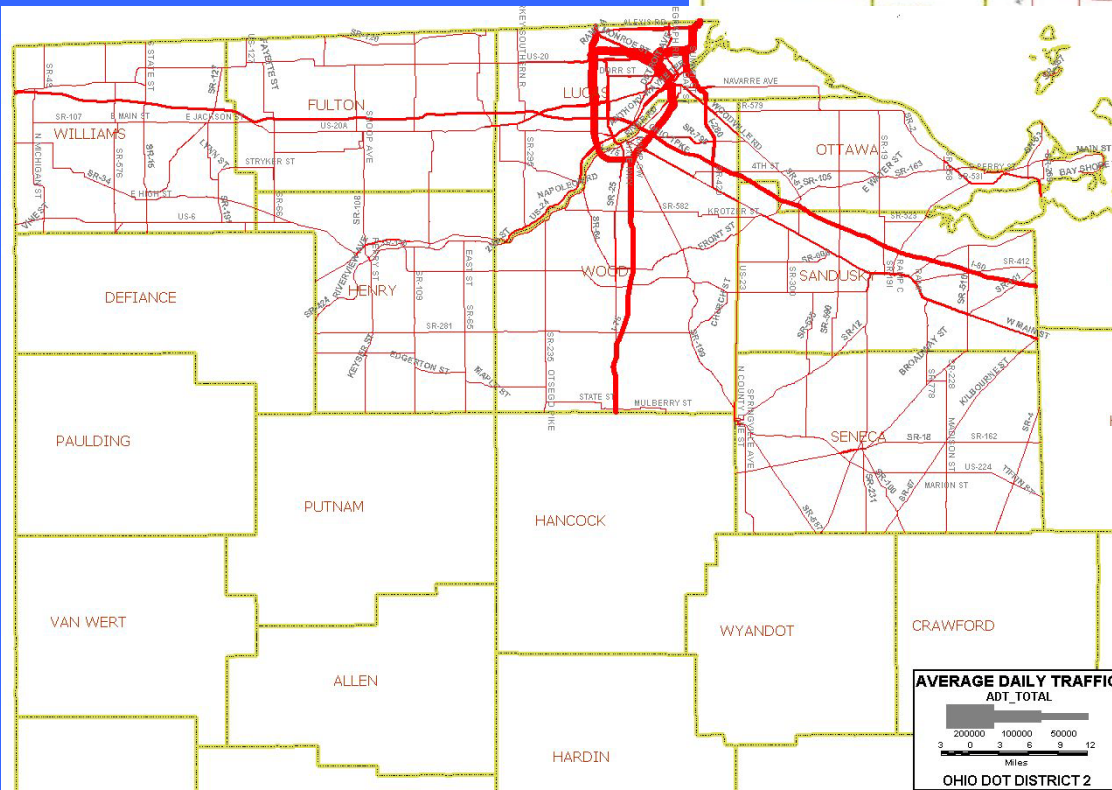


# Traffic Flow Maps

## District 2 Volumes Excluding Interstate



## District 2 Volumes Including Interstate

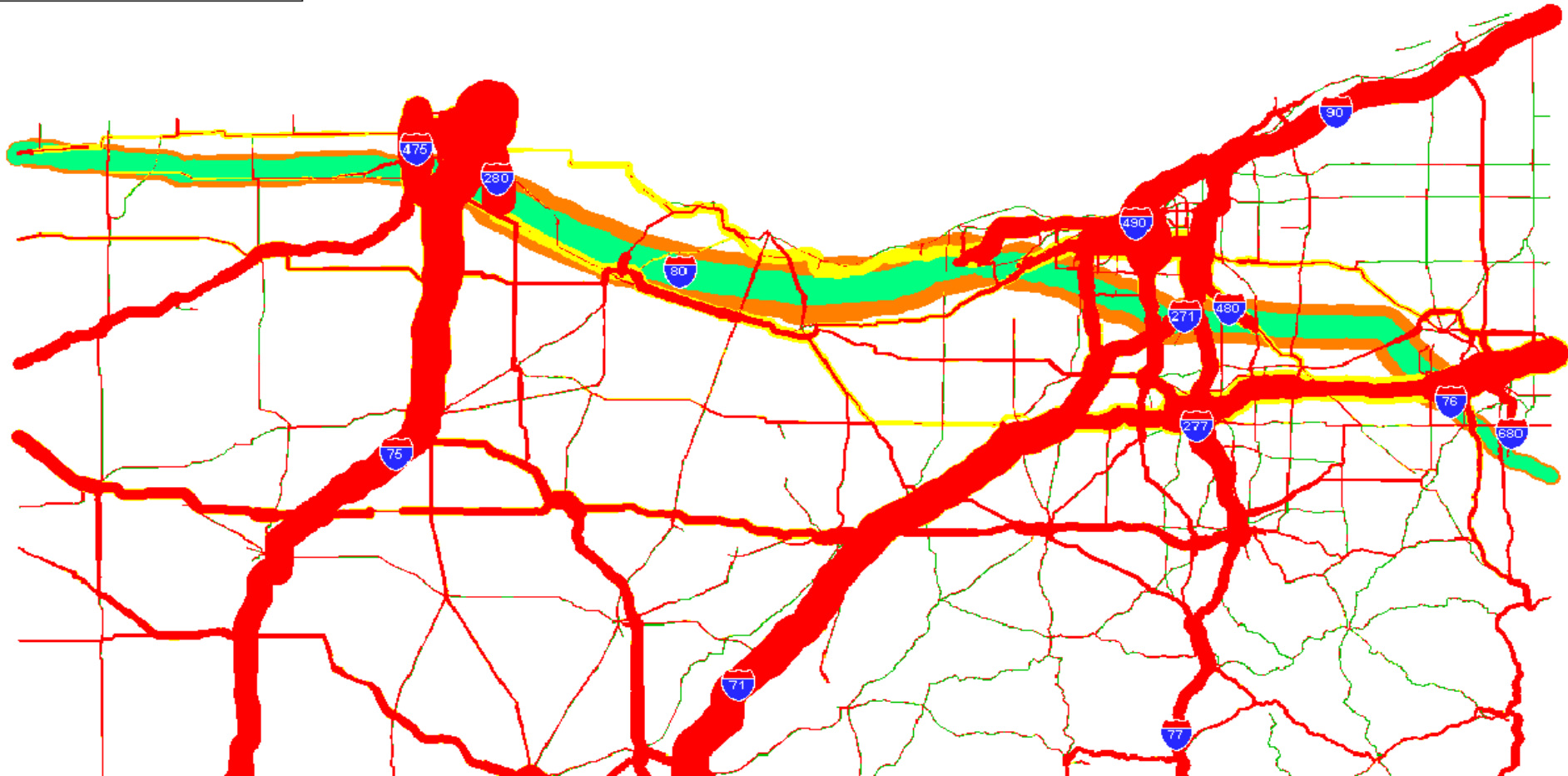
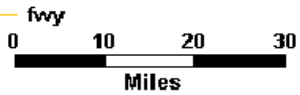


# Toll Sensitivity Analysis Showing Volumes Changes

## Truck Volume Change without Tolls

### Map Layers

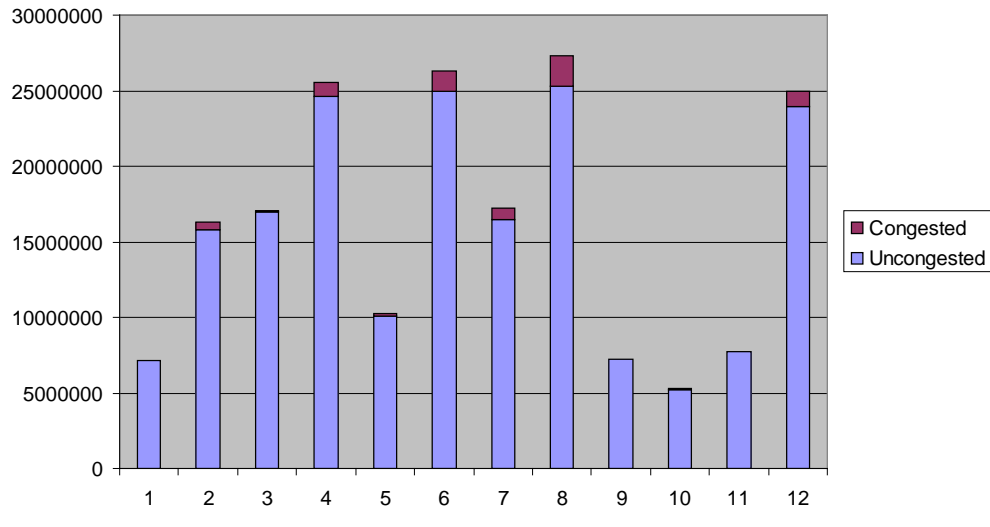
- Turnpike Trucks, No Tolls
- Turnpike Trucks, Current
- Other Roads Trucks, Current
- Other Roads Trucks, No Tolls



# Congestion Management

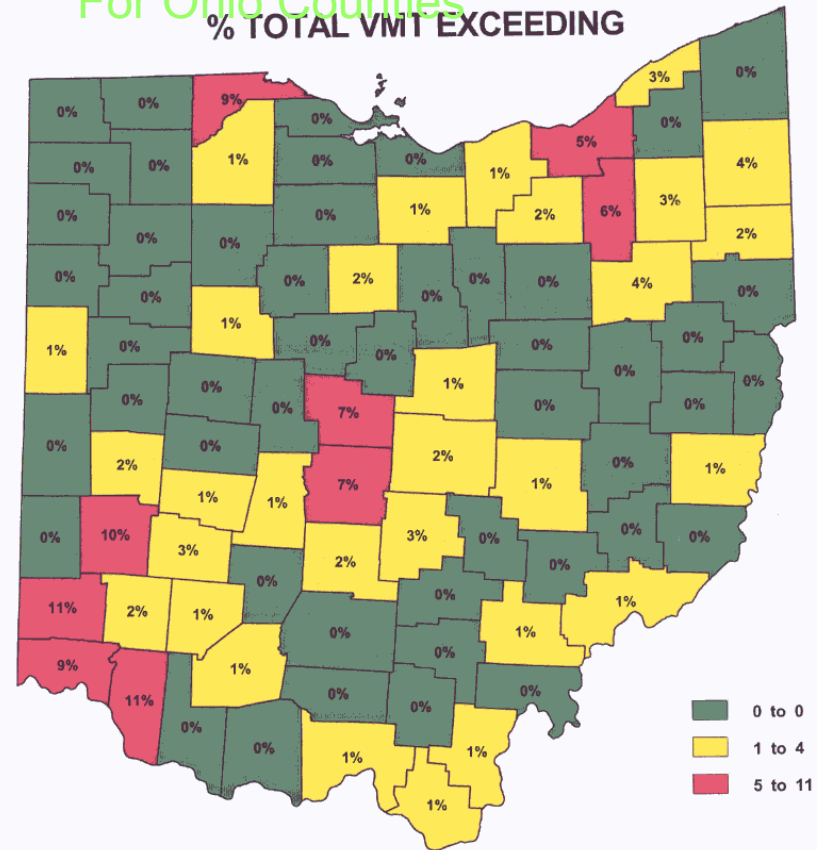
## Congestion Comparisons

By ODOT Districts Daily VMT

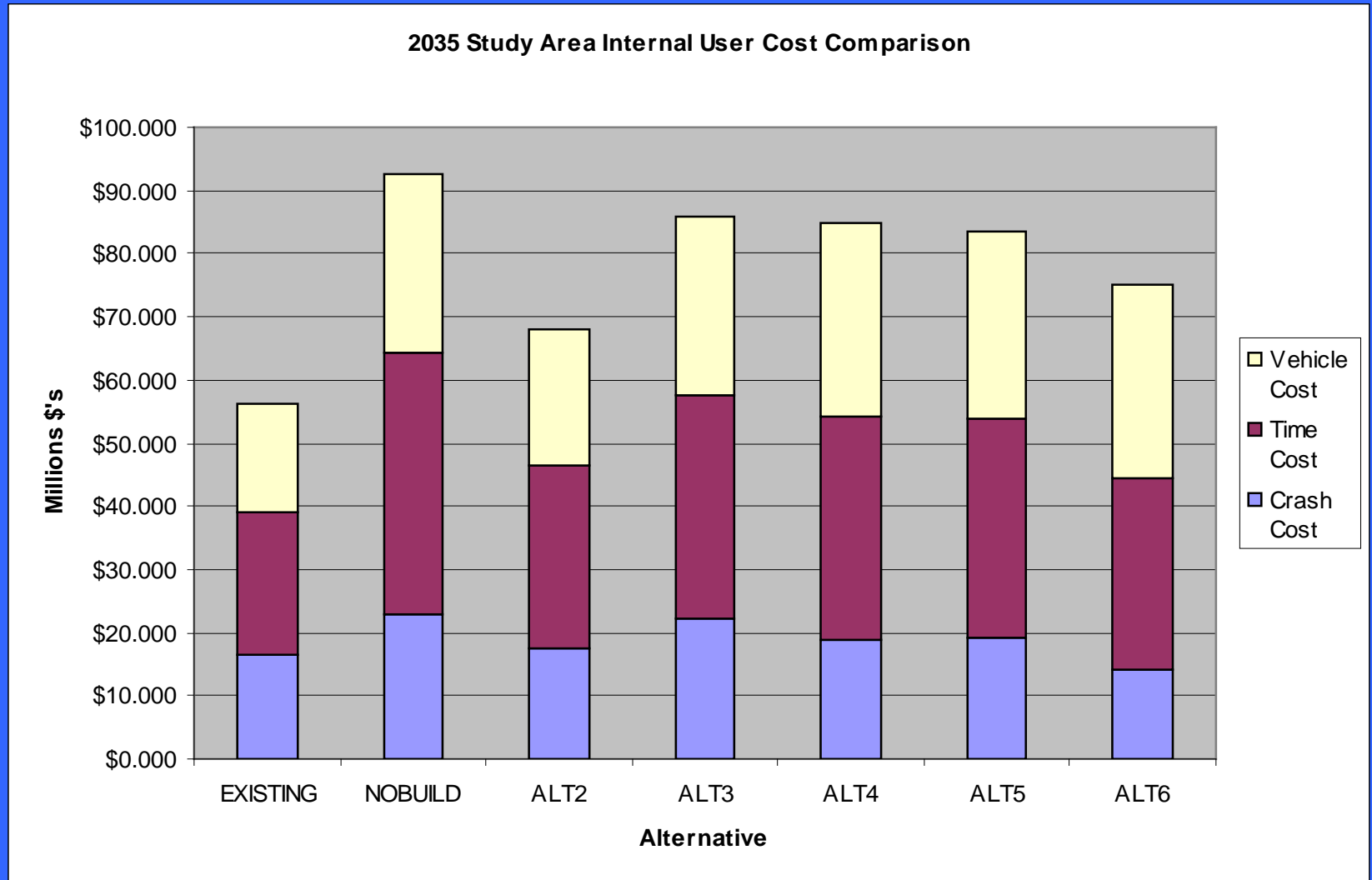


For Ohio Counties

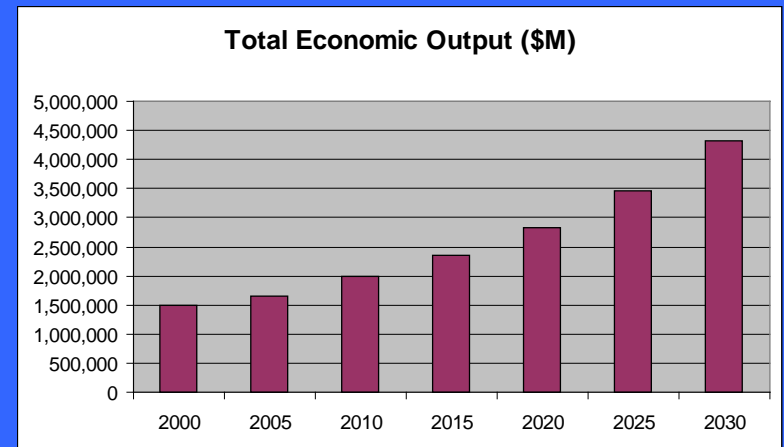
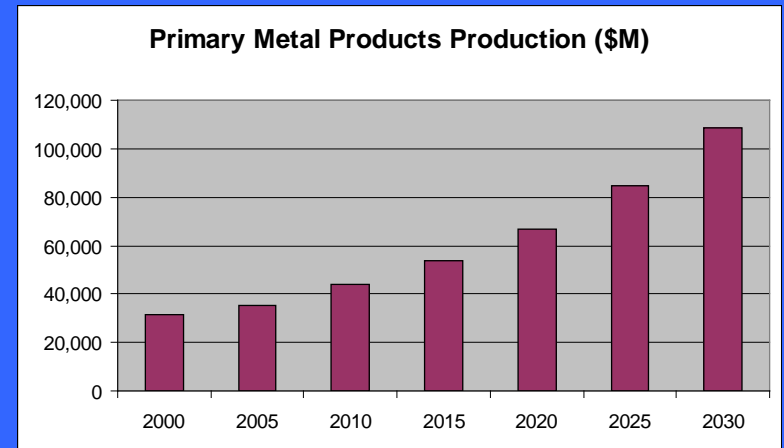
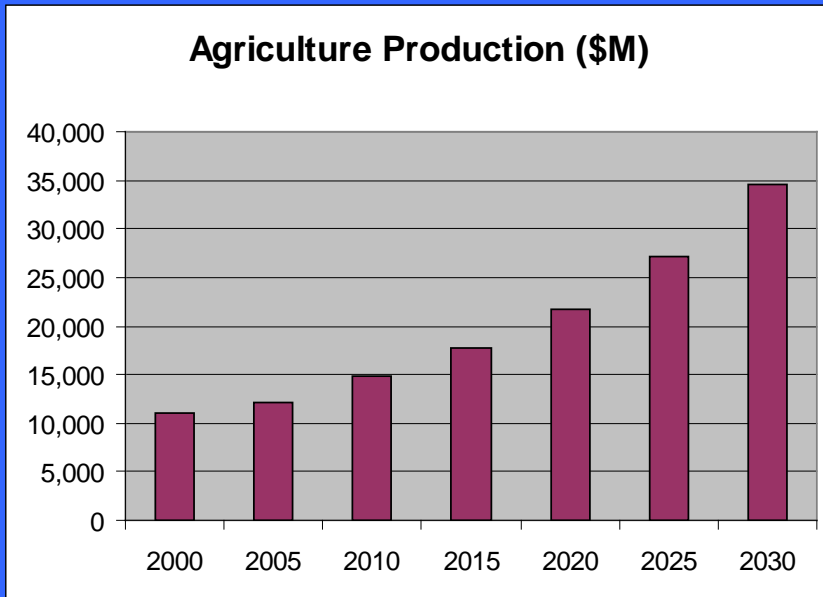
% TOTAL VMT EXCEEDING



# User Costs by Alternative



# Predicted Changes by Economic Sector

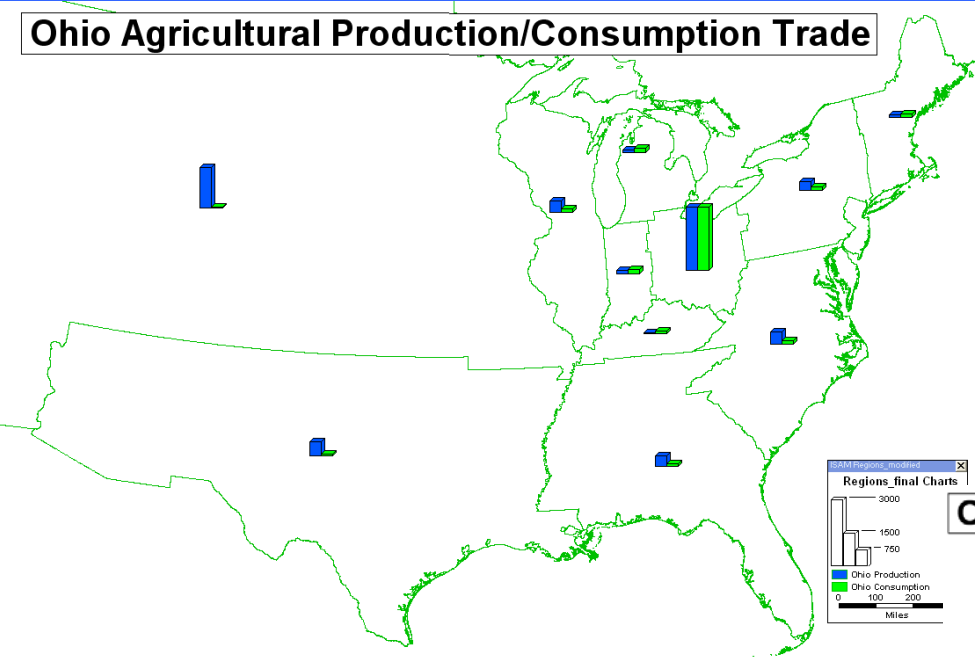


# Employment Forecasts

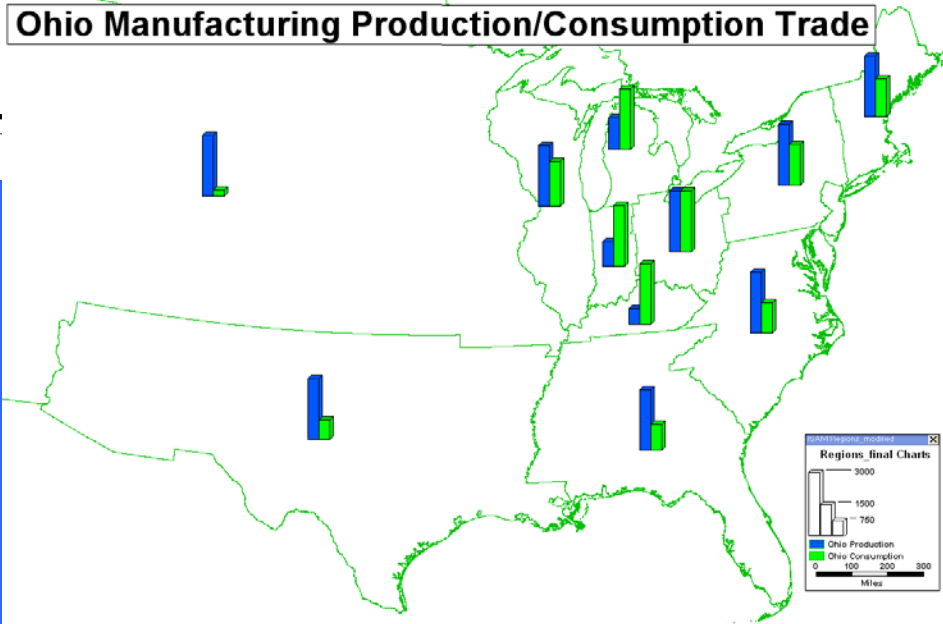
OSMP Industries	ODJFS Emp Forecast (Ohio)			ISAM Emp Forecast (Ohio+Halo)		
	2002	2012	%Change	2002	2012mid	%Change
Agriculture	92,500	85,100	-8%	184,588	174,443	-5%
Heavy Industry	493,100	473,000	-4%	749,212	705,277	-6%
Construction	235,700	269,100	14%	524,411	596,698	14%
Light Industry	180,900	177,900	-2%	310,594	303,279	-2%
Primary Metal Products	61,500	53,500	-13%	106,424	91,873	-14%
Transportation Equipment	159,900	147,900	-8%	179,874	166,250	-8%
Wholesale	239,100	261,400	9%	394,184	425,545	8%
Retail	1,020,800	1,138,000	11%	1,504,488	1,661,036	10%
Transportation Handling	160,700	184,700	15%	272,796	310,027	14%
Utilities Services	23,500	20,000	-15%	155,928	136,355	-13%
Other Services	1,321,800	1,520,100	15%	2,209,674	2,519,592	14%
Education	76,400	84,100	10%	730,246	829,958	14%
Health Care	622,800	757,300	22%	801,801	964,788	20%
Hotel and Accommodation	34,900	37,600	8%	55,383	59,553	8%
Government and Other	756,500	828,600	10%	334,501	368,899	10%
<b>Education + Government</b>	832,900	912,700	10%	1,064,747	1,198,857	13%
<b>TOTAL</b>	5,813,800	6,376,100	10%	8,514,104	9,313,573	9%

# Interaction of Ohio's Economy with the Rest of the US

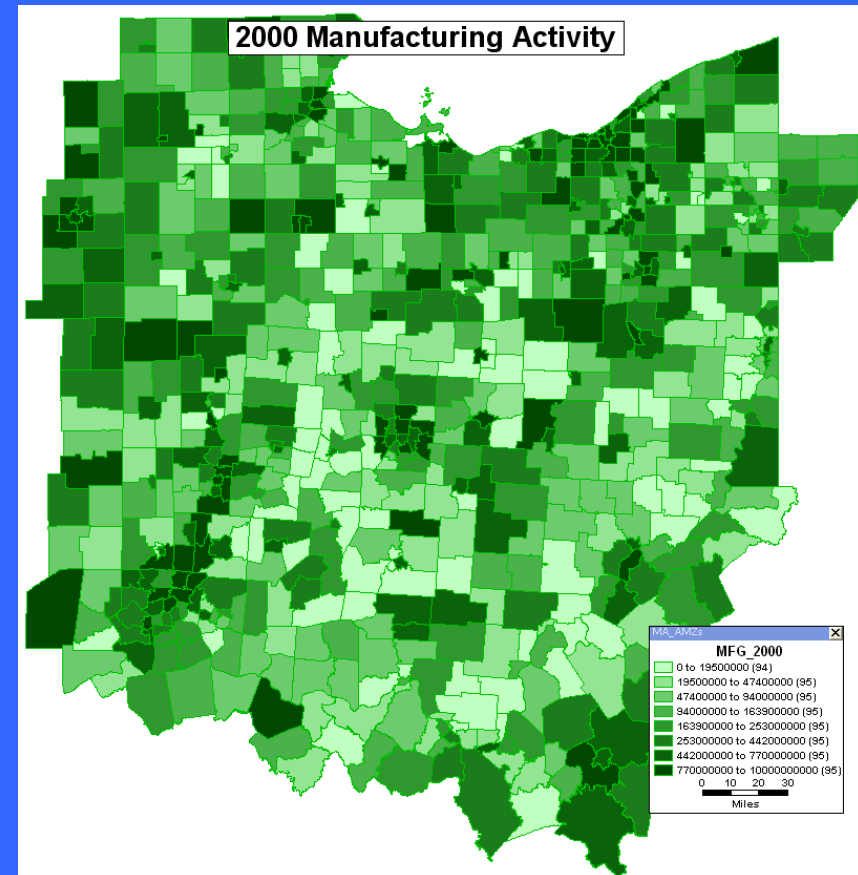
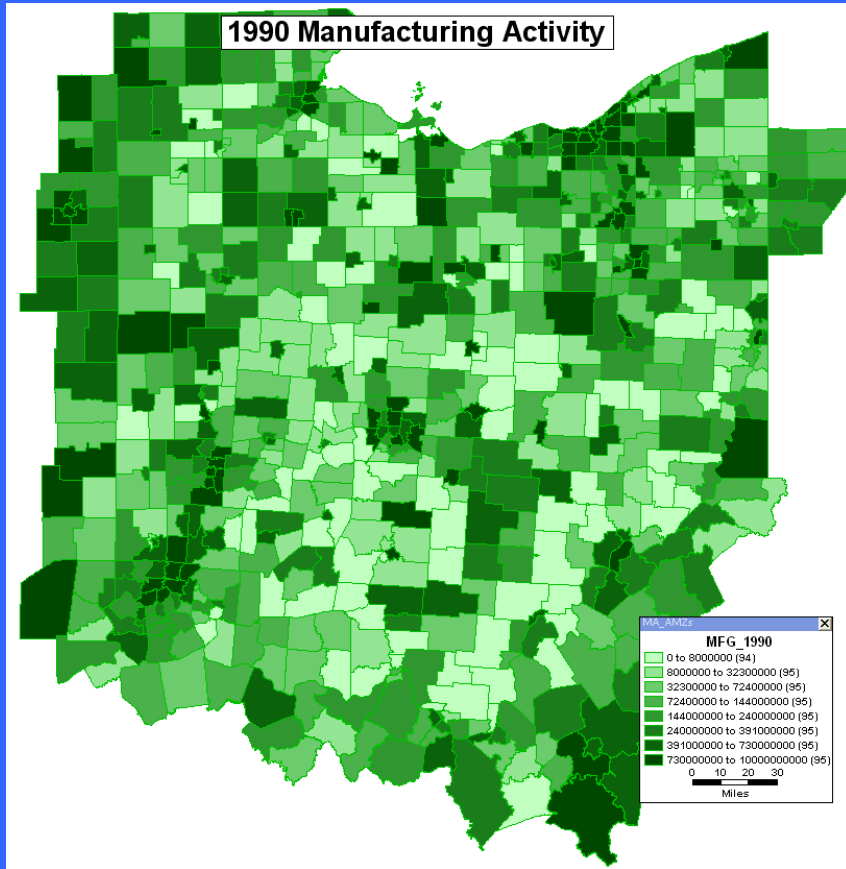
Ohio Agricultural Production/Consumption Trade



Ohio Manufacturing Production/Consumption Trade

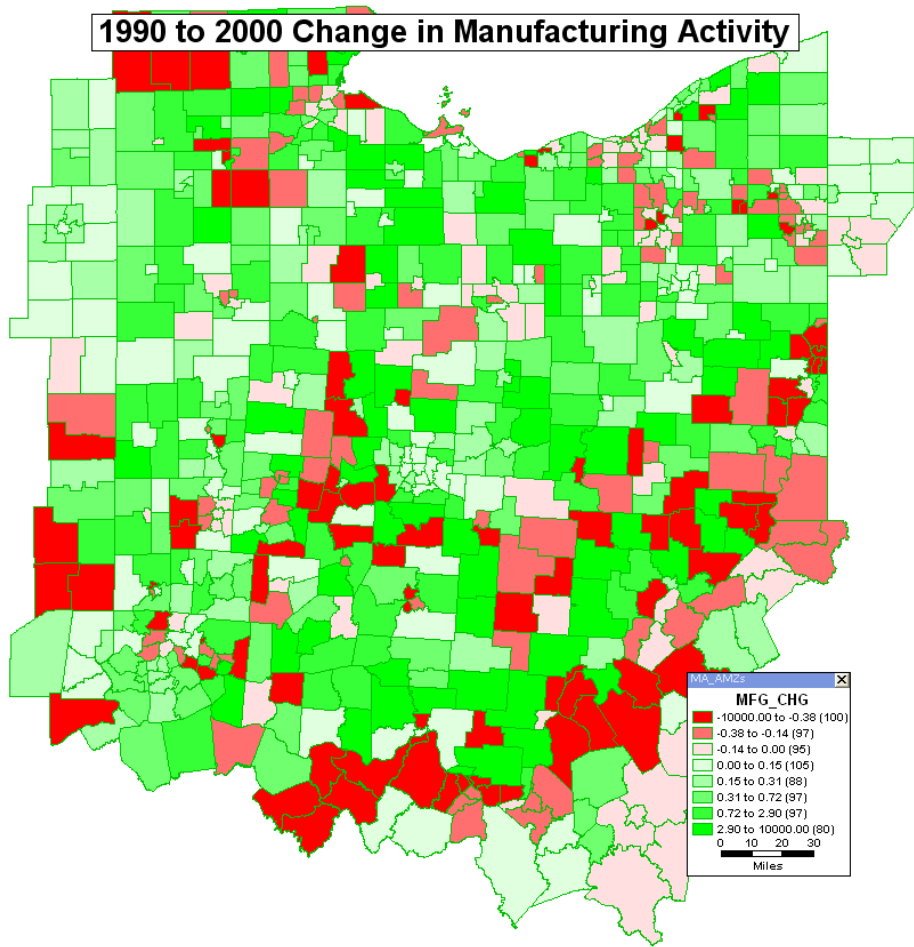


# Commodity Production

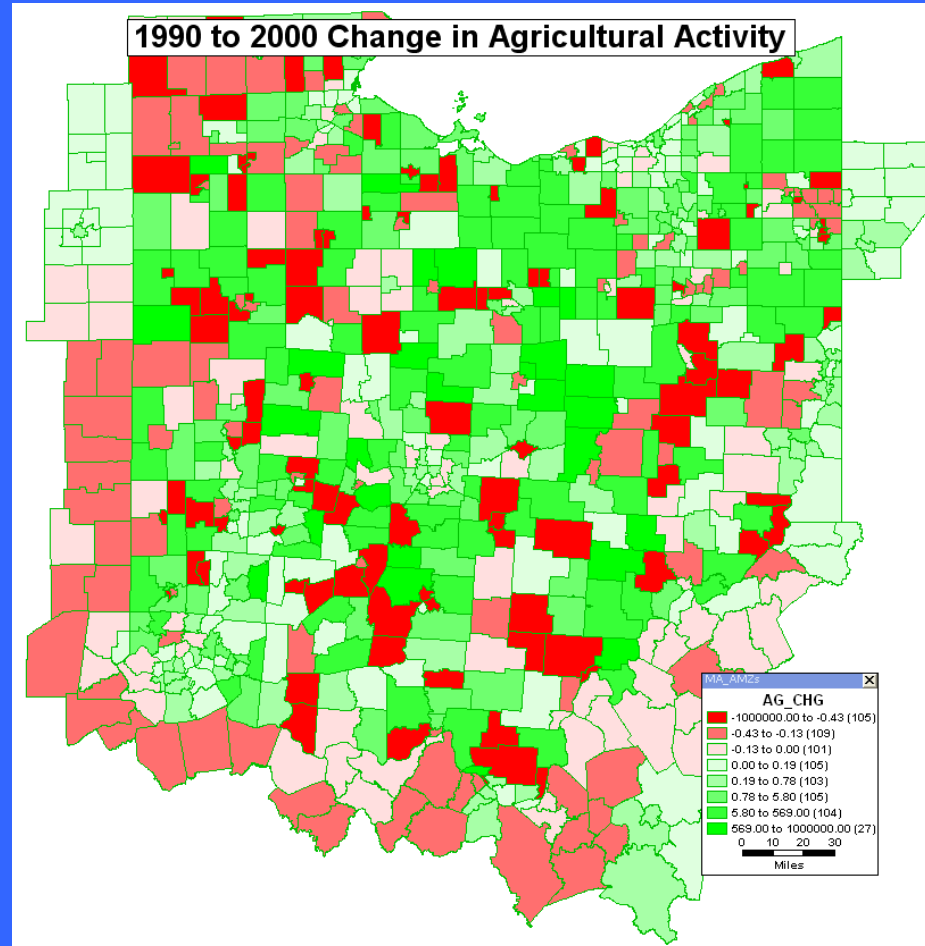


# Changes in Commodity Production

1990 to 2000 Change in Manufacturing Activity



1990 to 2000 Change in Agricultural Activity



Questions?