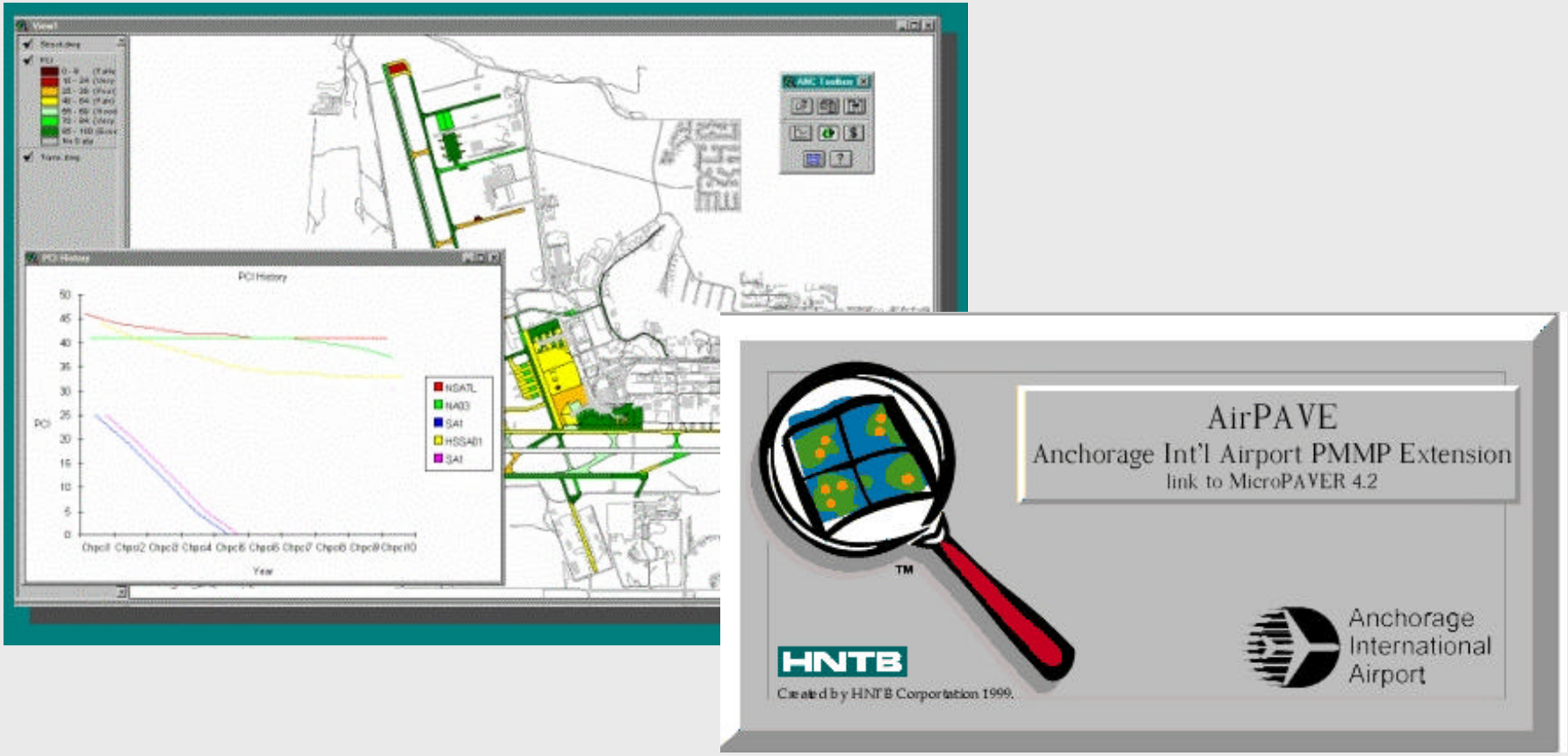
Bridging the Gap: Modeling and GIS

Jeff Siegel, AICP
James Hurley

HNTB Corporation
Architects Engineers Planners

GIS is Adding Dimension to Existing Modeling Environments



ΓΙΣ λινκ το παϖεμεντ μαναγεμεντ σψστεμ – ρελατιοναλ δαταβασε ανδ μοδελινγ ενγινεερινγ ενϖιρονμεντ χαλλεδ ΜιχροΠΑςΕΡ, δεϖελοπεδ βψ Υ.Σ. Αρμψ Χορπσ οφ Ενγινεερσ

Interface to aid in database connections and frequent use of data items

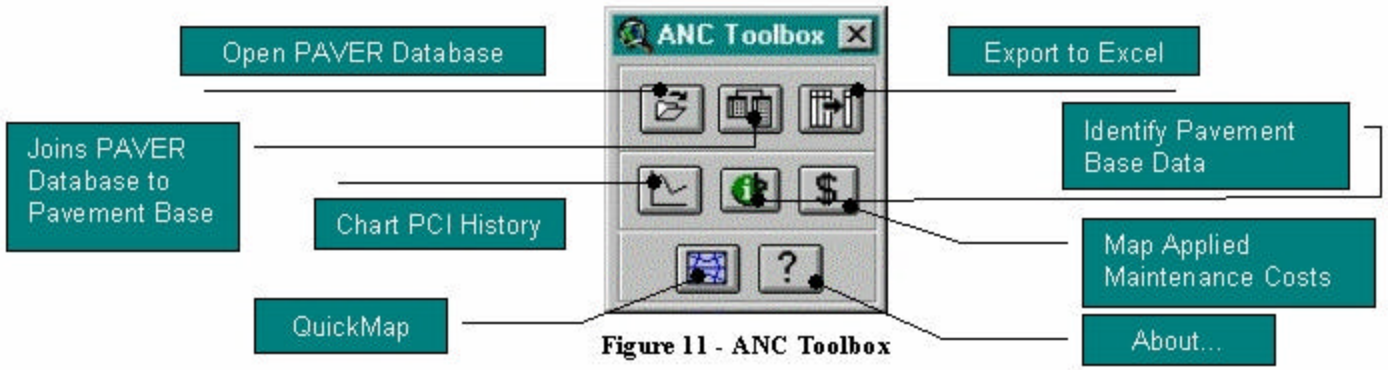
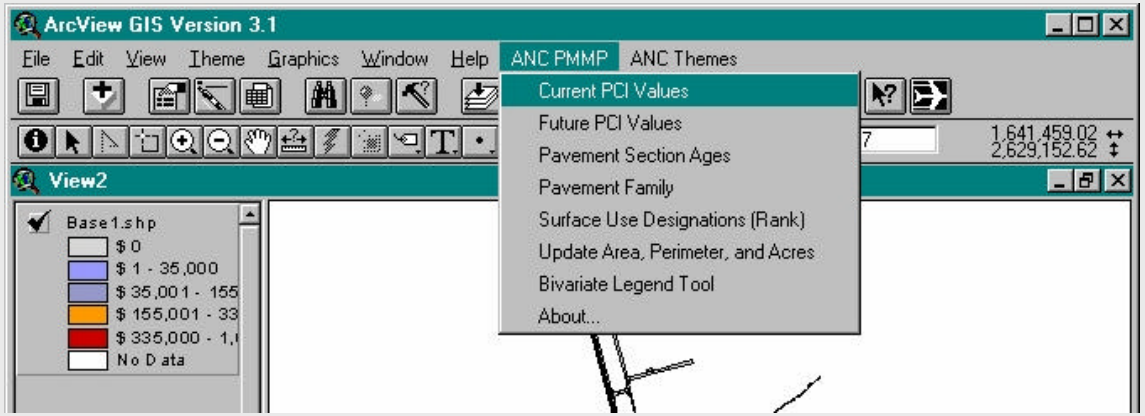


Figure 11 - ANC Toolbox



Avenue Scripts

Χονσιστεντ τηεματιχ μαπσ

Εασψ λαψουτ χονστρυχτιον

Χλεανερ ιδεντιφιχατιον τοολσ

Αδδ τηεμεσ ωιτηουτ σεαρχηινγ τηε πατη

Εασψ δεϖελοπμεντ οφ λινε γραπησ

Μετηοδολογψ φορ υπδατινγ γραπηιχσ ασ ωελλ ασ δατα ιτεμσ

MODELING WITHIN THE GIS ENVIRONMENT

ArcView/3D Analyst

Franklin Township Needs Assessment
Indianapolis Regional Bicycle and Pedestrian System Plan

CREDITS AND ACKNOLEDGMENTS

Franklin Township Development and Assessment Committee (FTDAC)
City of Indianapolis, Department of Metropolitan Development (DMD)
Indianapolis Metropolitan Planning Organization
IUPUI, School of Public and Environmental Affairs (SPEA)

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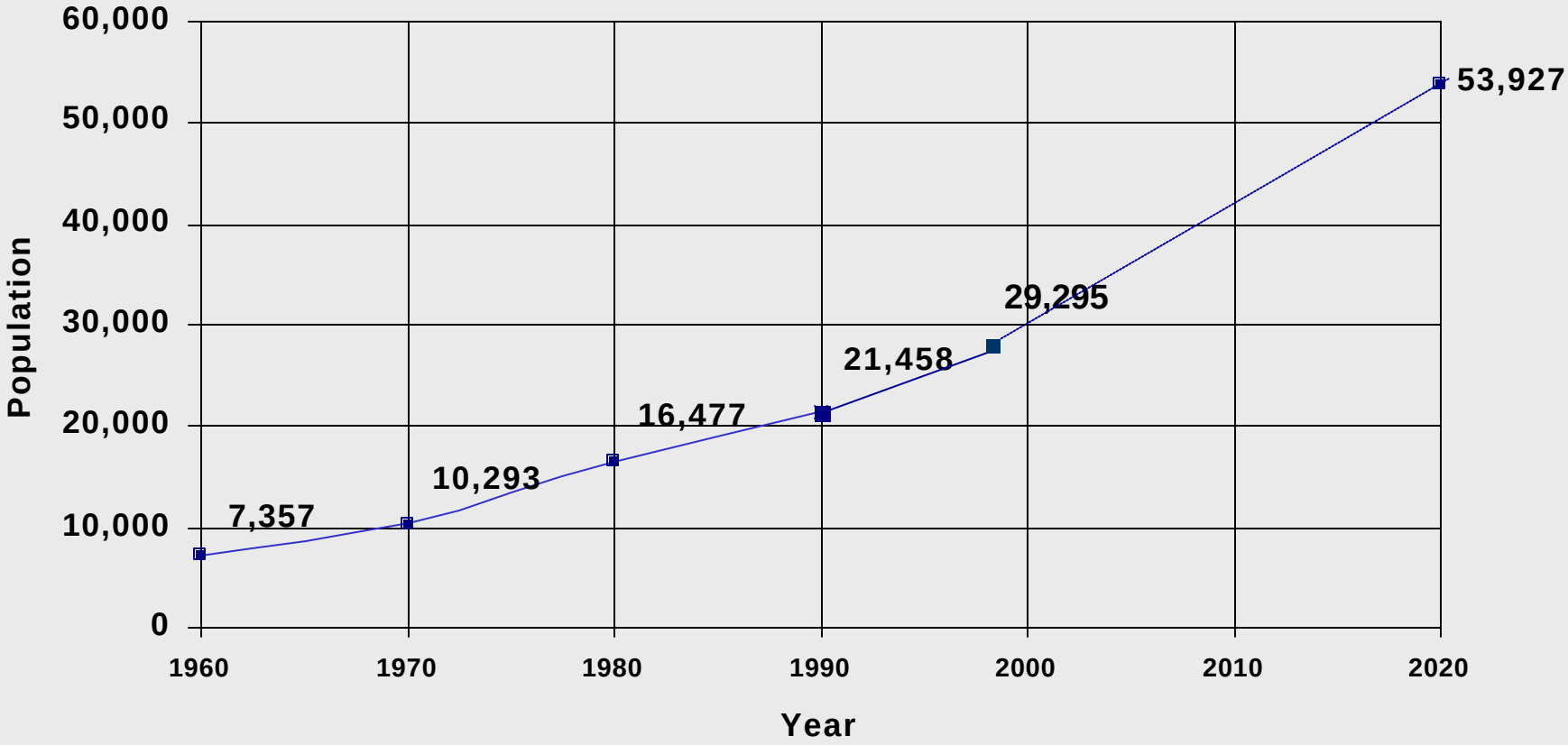
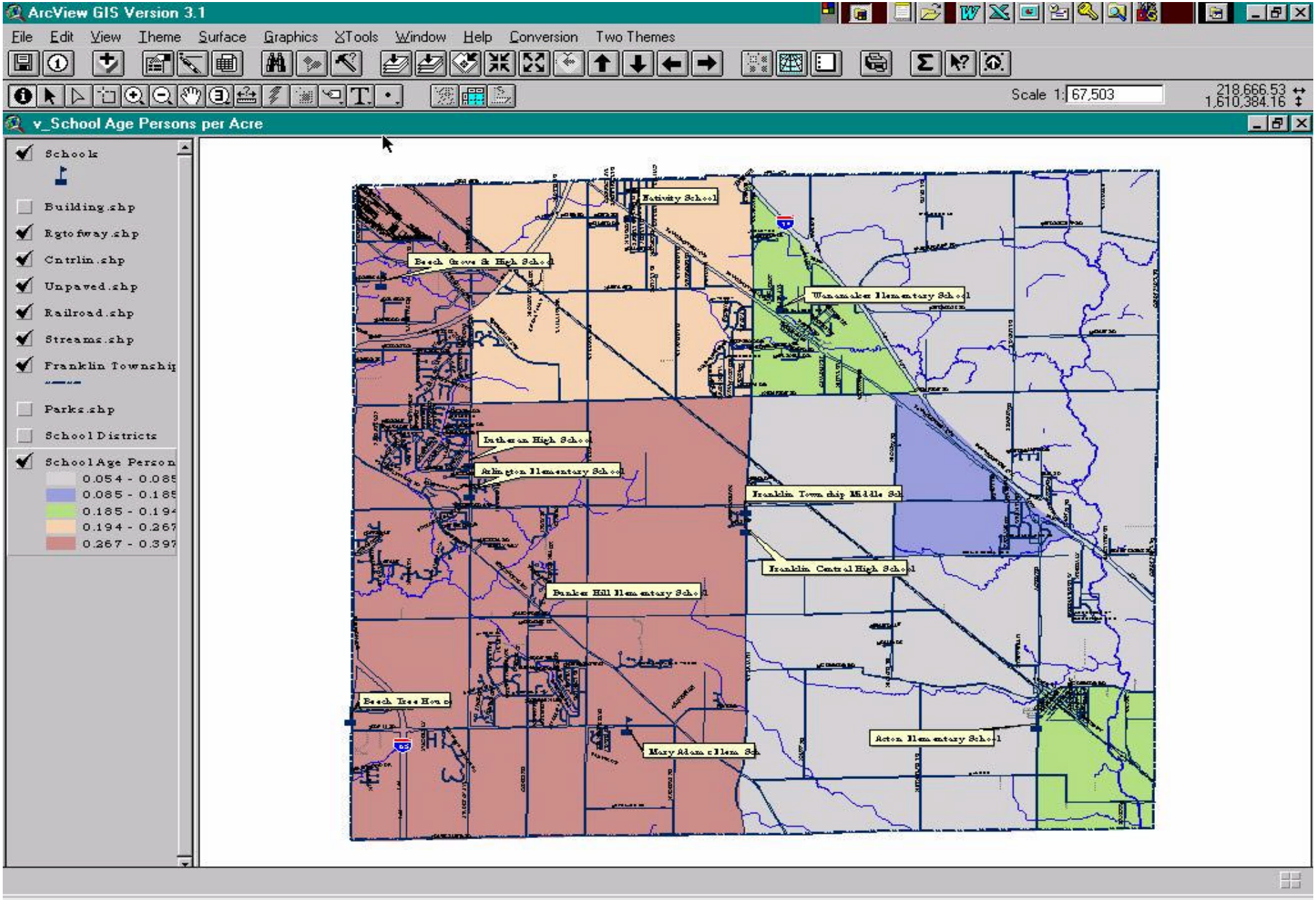
imagis

BACKGROUND INFORMATION - FRANKLIN TOWNSHIP

POPULATION GROWTH



Sources: **Historical population - U.S. Census Bureau**
Population projections (in italics) are provided by DMD, Division of Planning


ArcView GIS Version 3.1
File Edit View Theme Surface Graphics XTools Window Help Conversion Two Themes
Scale 1: 67,503
218,666.53
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v_School Age Persons per Acre
Schools
Building.shp
Rgtofway.shp
Cntrlin.shp
Unpaved.shp
Railroad.shp
Streams.shp
Franklin Township
Parks.shp
School Districts
School Age Person
0.054 - 0.085
0.085 - 0.185
0.185 - 0.194
0.194 - 0.267
0.267 - 0.397
Nativity School
Beech Grove Jr High School
Wanamaker Elementary School
Lutheran High School
Arlington Elementary School
Franklin Township Middle Sch
Franklin Central High School
Bunker Hill Elementary School
Beech Tree House
Mary Adams Elem Sch
Acton Elementary School

SCHOOLS DATABASE

Number of Full Time Teachers

Number of Students

Number of Support Staff

Facility Square Footage

Number of Classrooms

Number of Computers

Library Stock

Students per Grade

Special Services

SCHOOLS ANALYSIS
BASE YEAR - 1998

Students per Classroom

Grade	Classrooms	Students	Students per Classroom	Planning Standard	Exceedance/ Deficiency
K-5	145	2367	16.32	24	7.68
Junior High	49	1214	18.12	25	6.88
High School	93	1532	16.47	26	9.53

Student-Staff Ratio

Grade	Students	Teaching Staff*	Ratio		
K-5	2884	129	18.35	22	3.65
Junior High	1214	67	18.12	20	1.88
High School	1532	83	18.46	19	0.54

Space per Occupant

Grade	Space	Occupants**	Space per Occupant (Sq. ft)		
K-5	265,709	3117	102.20	90	12.20
Junior High	176,701	2495	135.72	120	15.72
High School	282,961	1625	174.13	150	24.13

*The term *teaching staff* is defined as only full time teaching staff.

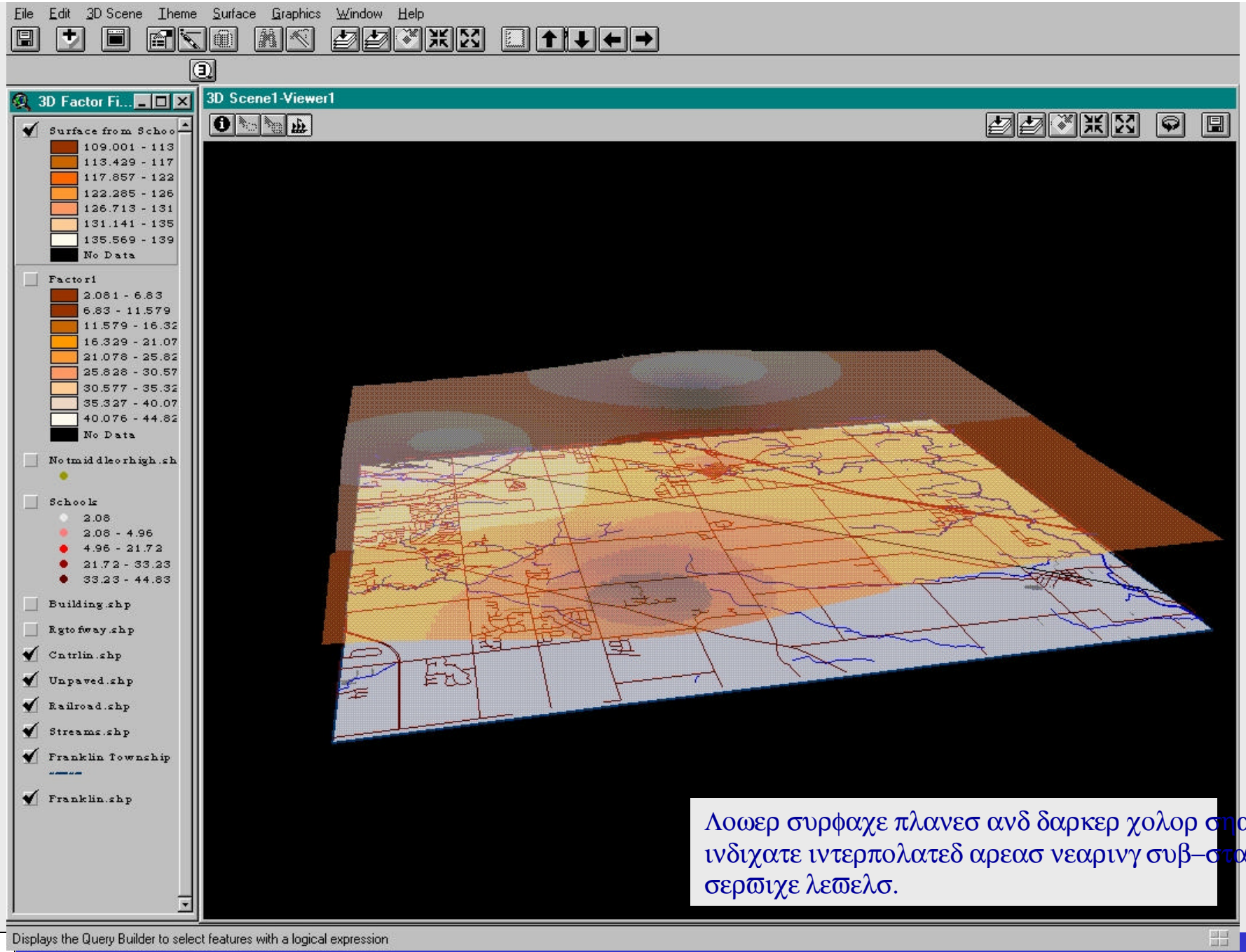
**The term *occupant* is defined as all occupants of the building, including students, teaching staff, and support staff as reported from the local schools in the data collection.

The projected needs analyses should be used as "general" guidelines for future service supply (limitations).

SCHOOLS ANALYSIS
SERVICE LEVEL FACTOR ANALYSIS

	Standards Analysis			
	Students per Classroom	Student-Staff Ratio	Space per Occupant	Service Level Factor
Acton Elementary School	1.40	1.22	1.15	1.26
Mary Adams Elementary School	1.11	1.13	1.02	1.09
Arlington Elementary School	1.57	1.33	1.21	1.37
Bunker Hill Elementary School	1.88	1.03	0.96	1.29
Wanamaker Elementary School	1.43	1.36	1.41	1.40
Franklin Township Middle School	1.34	1.10	1.13	1.19
Franklin Township High School	1.58	1.03	1.16	1.26

Factors were averaged to account for even input into the model.



Λοωερ συρφαχε πλανεσ ανδ δαρκερ χολορ σηαδεσ ινδιχατε ιντερπολατεδ αρεασ νεαρινγ συβ–στανδαρ σερϖιχε λεϖελσ.

MODELING BICYCLE AND PEDESTRIAN TRAVEL DEMAND

- "Sketch" type model for understanding and predicting trip behavior

- Provide a quantifiable method for plan decision-making

- A communication device to bridge the gap between engineering type modeling and public input

- Flexible approach to account for amount of information available

DATA SOURCES

Data Item	Source	Description
Census Block Groups	U.S. Census Bureau	STF1A, 1B files – Demographics and transportation mode choice data
Traffic Analysis Zones	Indianapolis Metropolitan Planning Organization (MPO)	Detailed demographics organized by zones defined in the 1992 Transportation Plan Update for simulation modeling.
Existing Land Use	Indianapolis Department of Metropolitan (DMD) Development, Division of Planning	Land use designations for the township.
Transit Lines	IndyGO	Transit routes
Aerial photography	Indianapolis Mapping and Geographic Infrastructure System (IMAGIS)	Digital photography, year 1997
Centerlines, buildings, edge of pavement, rights-of-ways, streams	IMAGIS	Basic planemetrics for the township.

According to the *National Bicycling and Walking Study* (1993), the average bicycle trip is about 17 minutes and the average walking trip is 15 minutes. Using 12 miles per hour as the average bicycling speed, a 17-minute bicycle trip would cover about 3.5 miles. Therefore, the 3.5-mile radius around the high school is defined as the impact area.

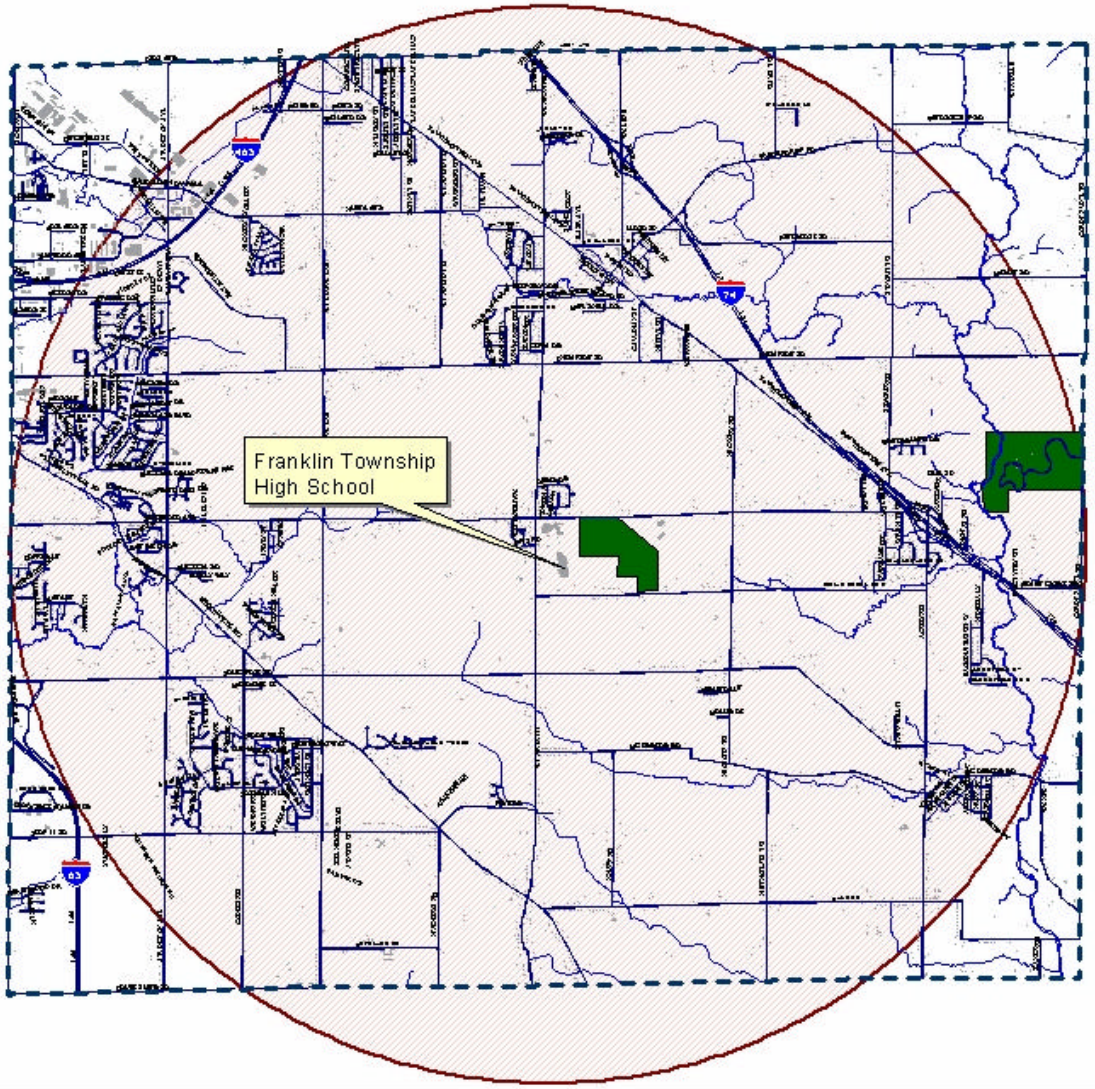


Figure 1 - Impact Area
A GIS-Based Methodology for
Modeling Bicycle and Pedestrian Travel Demand

Township Boundary
Parks
Impact Area

3000 0 3000 6000 9000 Feet

Objectives of Connections

- **Maximize Use**
  - Number of trips
  - Minimize Travel Time
  - Attract New Users
- **Continuous Network**
  - Limit number of segments
- **Encourage intermodal linkages**
- **Maximize safety**
  - Fewer conflicts with vehicles
  - Design facilities for B/C users
- **Minimize cost**
  - Utilize existing facilities
  - Consider social and environmental costs

"Great walking cities are those with destinations within a 15- to 20- minute walk of each other ... varied architecture. Diverse neighborhoods and a lively street life ... filled with open spaces and parks ... widened sidewalks, auto-restricted zones, and amenities." The Walking Magazine, August 1991

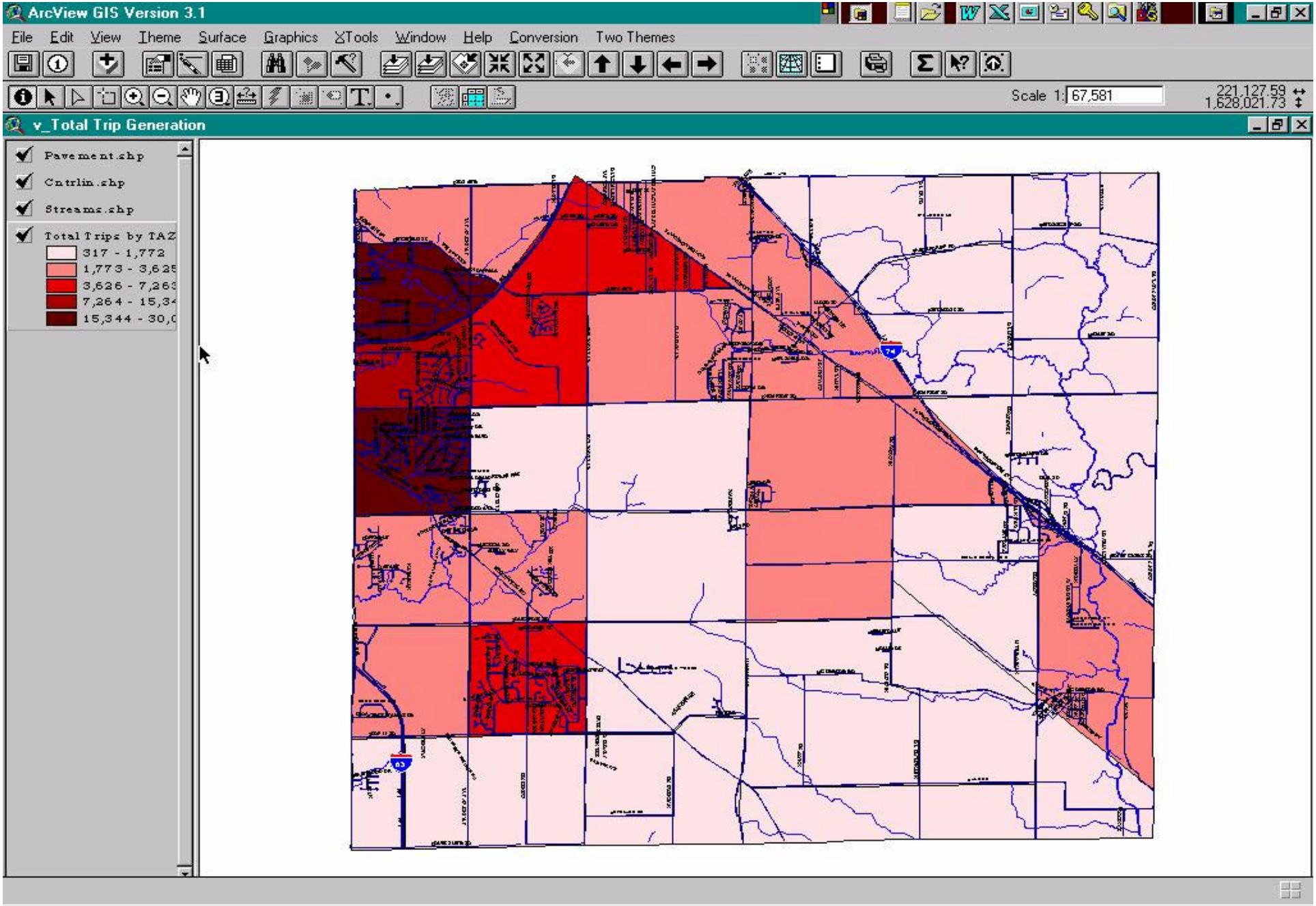
TRIP GENERATION

- ITE Trip Generation Rates

- Calculation of Residential, Non-Residential Trips

Land Use	Generation Rate
Single Family Residential	9.57 per unit
Commercial Non-Retail (Office)	3.32 per employee
Commercial Retail	22.36 per employee

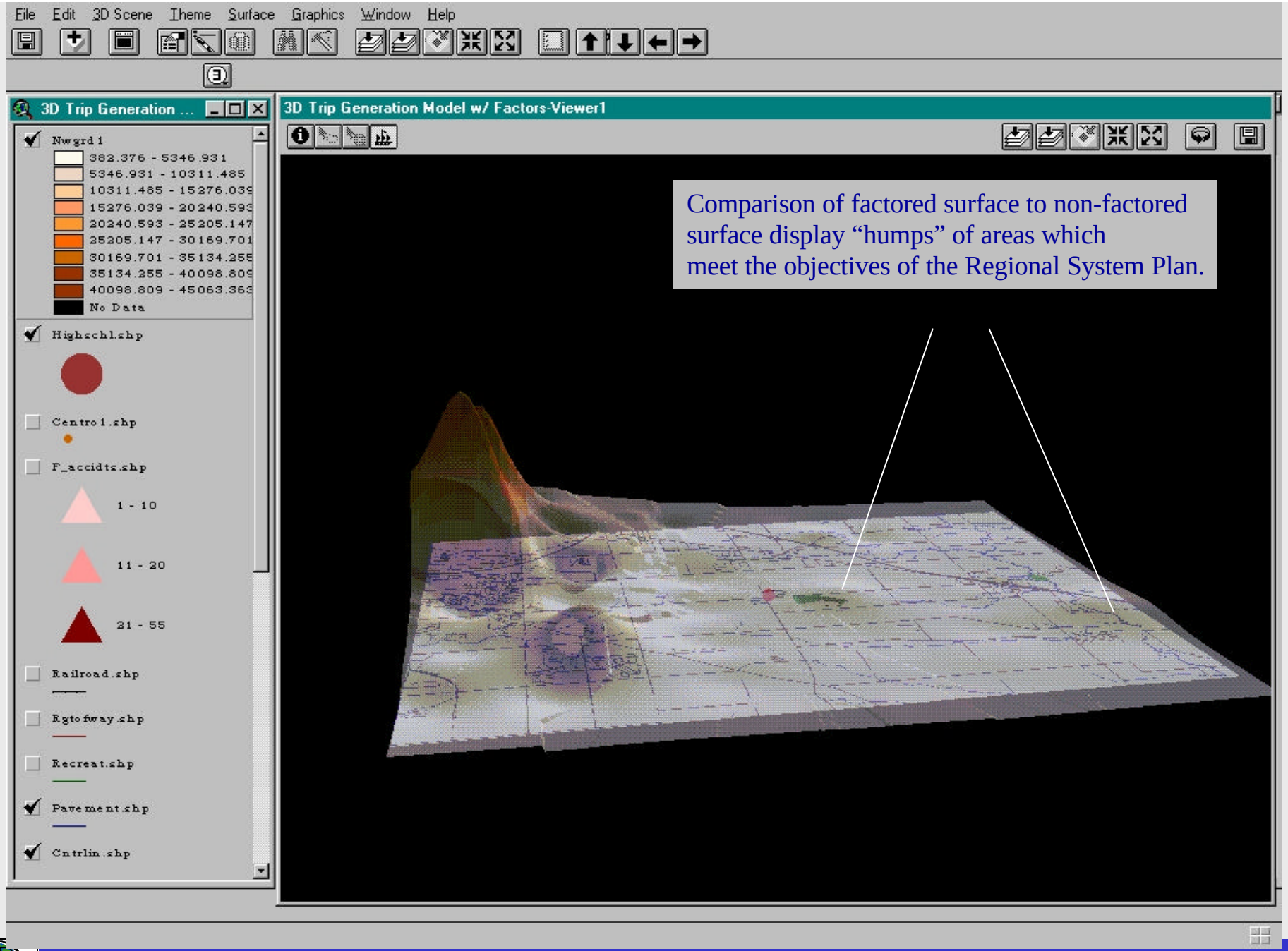
Institute of Transportation Engineers Trip Generation


ArcView GIS Version 3.1
File Edit View Theme Surface Graphics XTools Window Help Conversion Two Themes
Scale 1: 67,581
221,127.59
1,628,021.73
v_Total Trip Generation
Pavement.shp
Cntrlin.shp
Streams.shp
Total Trips by TAZ
317 - 1,772
1,773 - 3,625
3,626 - 7,263
7,264 - 15,34
15,344 - 30,0

DESIGN FACTORS

.

CATEGORY	RATING FACTOR	DESCRIPTION
1. Land Use	5	Mixed Land Uses
	3	Medium Density Residential or Commercial
	1	Low Density
2. Transit Access	5	Transit Center, Park and Ride Lot
	3	Transit Line
	1	None
3. Roadway Network	5	Grided, well-connected network
	3	Semi-conducted network
	1	Widely separated, unconnected
4. Sidewalk Configuration	5	Continuous connected network
	3	Existence of sidewalks
	1	None
5. Location of other bike/ped facilities	5	Existing greenway or bicycle lanes
	3	Existence of sidewalks and/or wide streets
	1	None


File Edit 3D Scene Theme Surface Graphics Window Help
3D Trip Generation ...
Nwgrd1
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5346.931 - 10311.485
10311.485 - 15276.039
15276.039 - 20240.593
20240.593 - 25205.147
25205.147 - 30169.701
30169.701 - 35134.255
35134.255 - 40098.809
40098.809 - 45063.363
No Data
Highschl.shp
Centro1.shp
F_accidts.shp
1 - 10
11 - 20
21 - 55
Railroad.shp
Rgtofway.shp
Recreat.shp
Pavement.shp
Cntrlin.shp
3D Trip Generation Model w/ Factors-Viewer1
Comparison of factored surface to non-factored surface display "humps" of areas which meet the objectives of the Regional System Plan.

Conclusions

- ArcView/3D Analyst provided tools for enhanced communications of public service and demand
- Flexible planning methods could be applied to many other issues
- Provided tools to back up “hunches” or examine conflicts as a technician
- Effective report graphics that go beyond the spreadsheet and typical map

"Maps break down our inhibitions, stimulate our glands, stir our imagination, loose our tongues. The map speaks across the barrier of language; it is sometimes claimed as the language of geography."

-- Carl O. Sauer, *The Education of a Geographer*, 1956

GIS at HNTB
MAPPING THE FUTURE

Jeff Siegel, AICP
jsiegel@hntb.com

James Hurley
jhurley@hntb.com