Metropolitan Travel Forecasting Models:

Trends, Possibilities and Priorities.

Vladimir Livshits

Maricopa Association of Governments

May, 2010

MARICOPA ASSOCIATION of GOVERNMENTS

ON THE MOVE
PARTNERS IN PROGRESS

Trends

IBM 704 - Electronic Computer central panel used for tabulating the Survey data.

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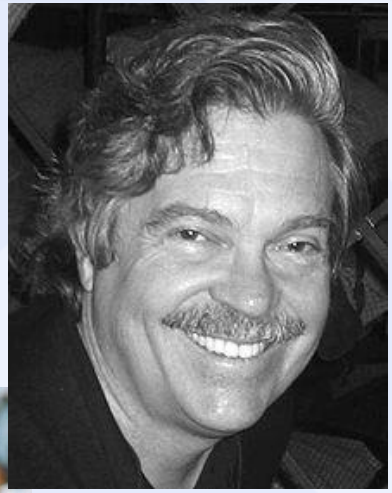
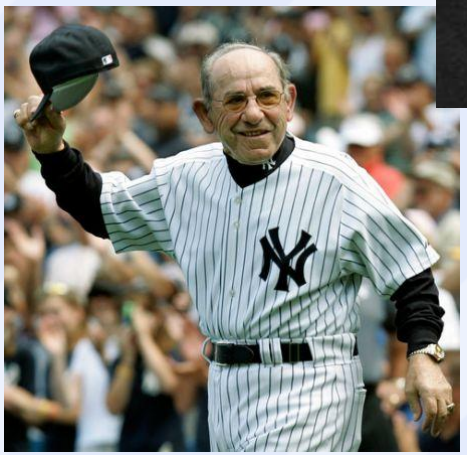
Prediction is very difficult, especially about the future.

Niels Bohr, Danish physicist



The best way to predict the future is to invent it.

Alan Kay, American Computer Scientist



The future ain't what it used to be.

Yogi Berra, New York Philosopher

?

Forecast is a negotiation

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MODELLING SOFTWARE TREND I:

Visualization

- Towards print quality images
- Integration with data bases
- Integration with other software and seamless accommodation of different formats
- 3rd dimension

Modelling Paradigms 2003 (II)

- Use of iconic, physical models in 50s
- Domination of mathematical models in 60s and 70s
- Domination of data models in 80s and 90s
- Return of iconic models utilizing modern software (GIS, microsimulation)

MODELLING SOFTWARE TREND II:

Automation

- Information hiding: pre-prepared "black" boxes of large model blocks
- Analysis, standardization and automation of most commonly used models and methods
- User-friendliness of the modelling procedures, clear interfaces, following the accepted interface practices

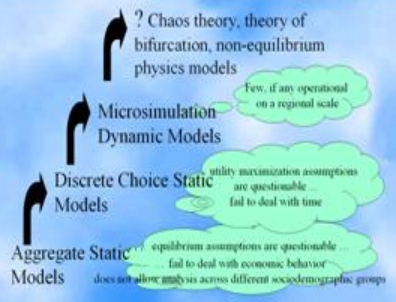
Planning Methods vs. Problems: concomitant movement?

Problems complexity	Methodology
Transportation systems, land use, urban forms, human behavior, environmental issues, sustainability issues	Dynamic simulations, activity modelling, disaggregate modelling, four steps
Transportation systems, land use, urban forms, human behavior, environmental issues	Dynamic simulations, Disaggregate modelling, four steps
Transportation systems, land use, urban forms, human behavior	Disaggregate modelling, four steps
Traffic, land use, urban form	Aggregate modelling, four steps
Traffic and land use	Aggregate modelling, four steps
Traffic	Extrapolation

Top issues in Transport Modelling as identified by an international survey (1995)

1. Activity Modelling
2. Stated preference choice
3. Location-based choice models
4. GIS as spatial database
5. Revealed stated preference modelling
6. Measures of accessibility
7. Dynamic traffic assignment
8. Travel market segmentation
9. Advanced static choice models
10. Equilibration procedures
11. Survey collection strategies
12. Vehicle ownership models

MODELLING SOFTWARE TREND III:



Modelling Paradigms 2003 (I)

- Shift towards activity based modelling from trip based modelling
- Shift towards simulation models for scenario and policy assessment from purely demand forecasting models
- Wider use of multimodal multiclass models
- Wider use of simultaneous equilibrium models

Modelling Paradigms 2003 (II)

- Use of iconic, physical models in 50s
- Domination of mathematical models in 60s and 70s
- Domination of data models in 80s and 90s
- Return of iconic models utilizing modern software (GIS, microsimulation)

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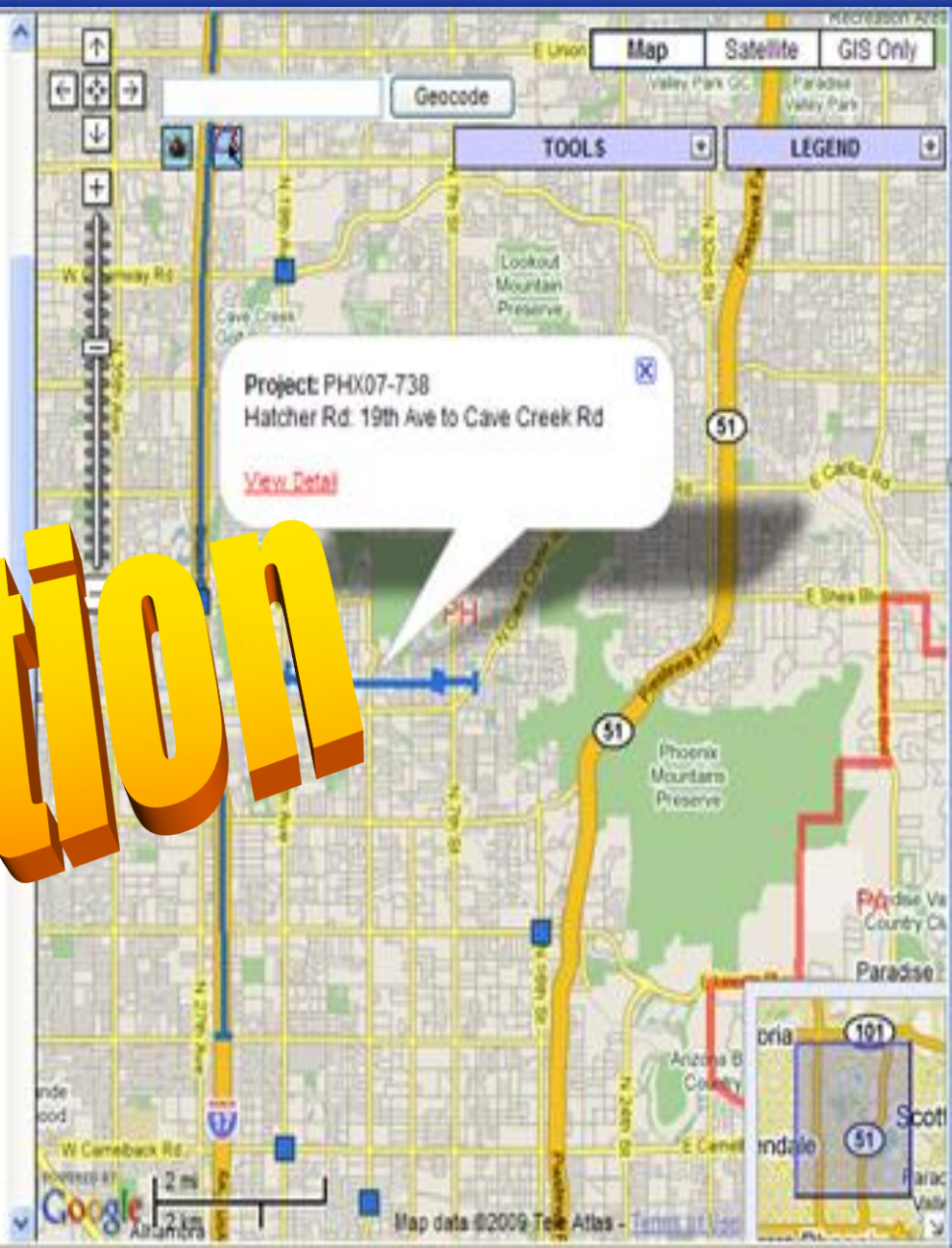
Project ID	PHX07-738	Project Type	TIP
RTP ID		RTP Phase	
Agency ID		Status	Deferred
Lead Agency	Phoenix	Road Closure	
Description	Design and construct roadway safety improvements		
Imprmt. Type	Safety		
Mode	Safety		
Facility	Collector Street		
Est. Start Dt.		Est. End Dt.	
Act. Start Dt.		Act. End Dt.	

LOCATION			
Type	LINK	Township	
County	Maricopa	Section	
Community	Phoenix		
Latitude	33.571333	Lo	
Located On	Ha		
From Road	19t		
To Road	Ca		
Direction			
Limits	Ha		

		2
SB or W		1
NB or E		1
		No
Bus	No	No
Paved Shoulder	No	No
Curbs	No	No
Sidewalk	No	No



Visualization

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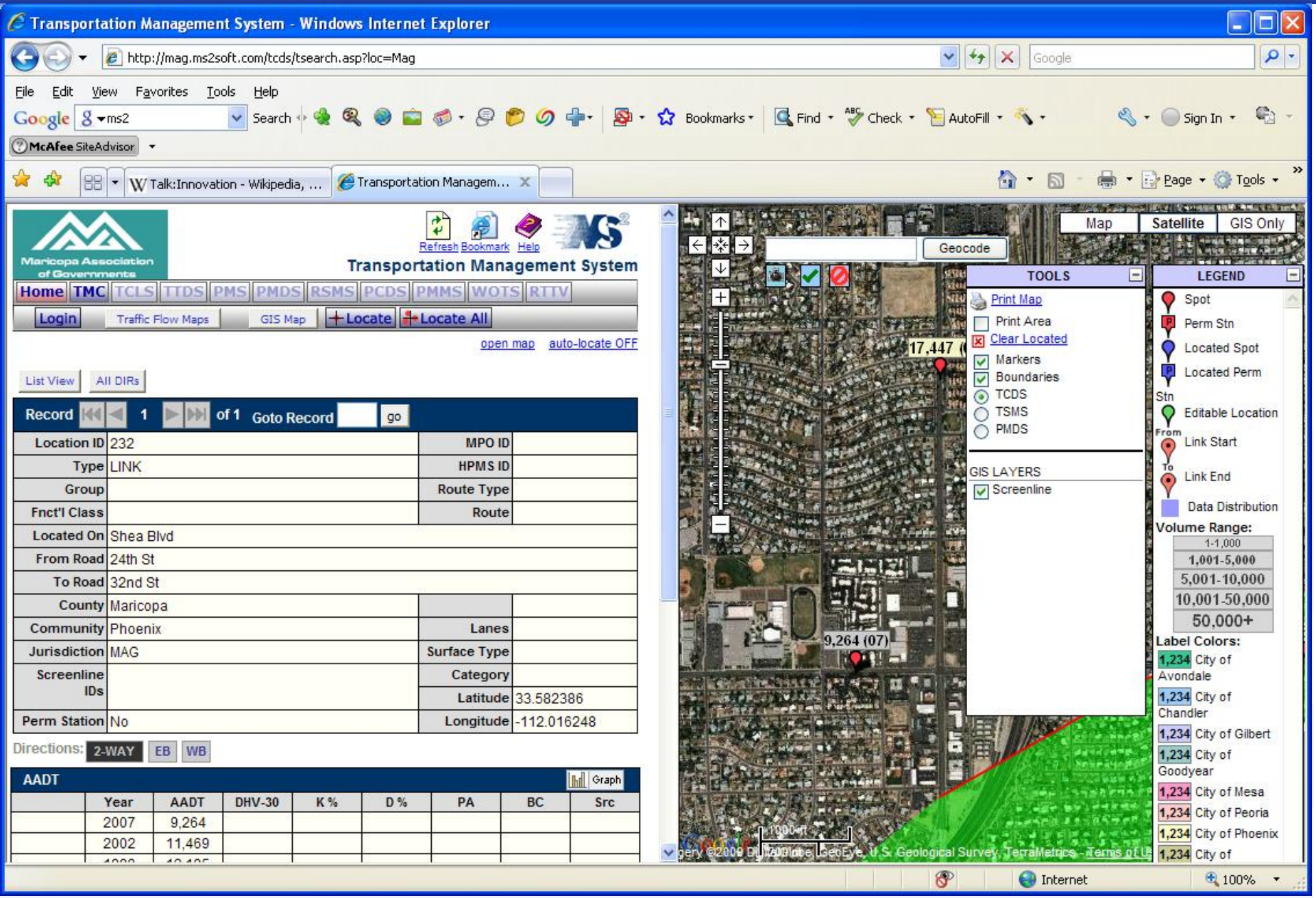
Transportation Management System - Windows Internet Explorer
http://mag.ms2soft.com/tcds/tsearch.asp?loc=Mag
Maricopa Association of Governments
Refresh Bookmark Help
Transportation Management System
Home TMC TCLS TTDS PMS PMDS RSMS PCDS PMMS WOTS RTTV
Login Traffic Flow Maps GIS Map Locate Locate All
open map auto-locate OFF
List View All DIRs
Record 1 of 1 Goto Record go
Location ID 232
Type LINK
Group
Fnct'l Class
Located On Shea Blvd
From Road 24th St
To Road 32nd St
County Maricopa
Community Phoenix
Jurisdiction MAG
Screenline IDs
Perm Station No
MPO ID
HPMS ID
Route Type
Route
Lanes
Surface Type
Category
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Directions: 2-WAY EB WB
AADT Graph
Year AADT DHV-30 K % D % PA BC Src
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2002 11,469
Map Satellite GIS Only
Geocode
TOOLS
Print Map
Print Area
Clear Located
Markers
Boundaries
TCDS
TSMS
PMDS
GIS LAYERS
Screenline
LEGEND
Spot
Perm Stn
Located Spot
Located Perm Stn
Editable Location
From Link Start
To Link End
Data Distribution
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1,001-5,000
5,001-10,000
10,001-50,000
50,000+
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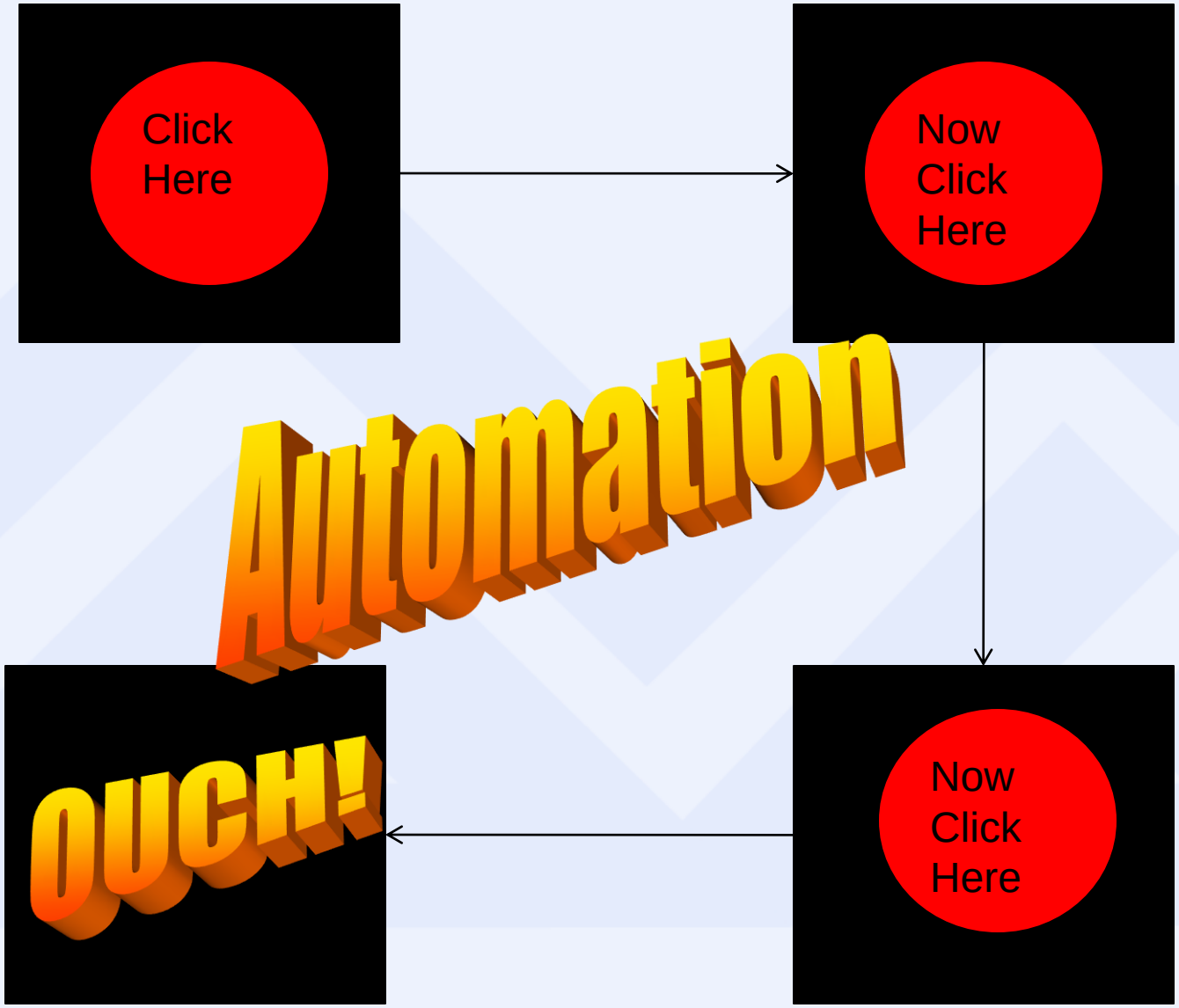
1,234 City of Chandler
1,234 City of Gilbert
1,234 City of Goodyear
1,234 City of Mesa
1,234 City of Peoria
1,234 City of Phoenix
1,234 City of
17,447
9,264 (07)
Internet
100%



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See presentations from the Tuesday morning session

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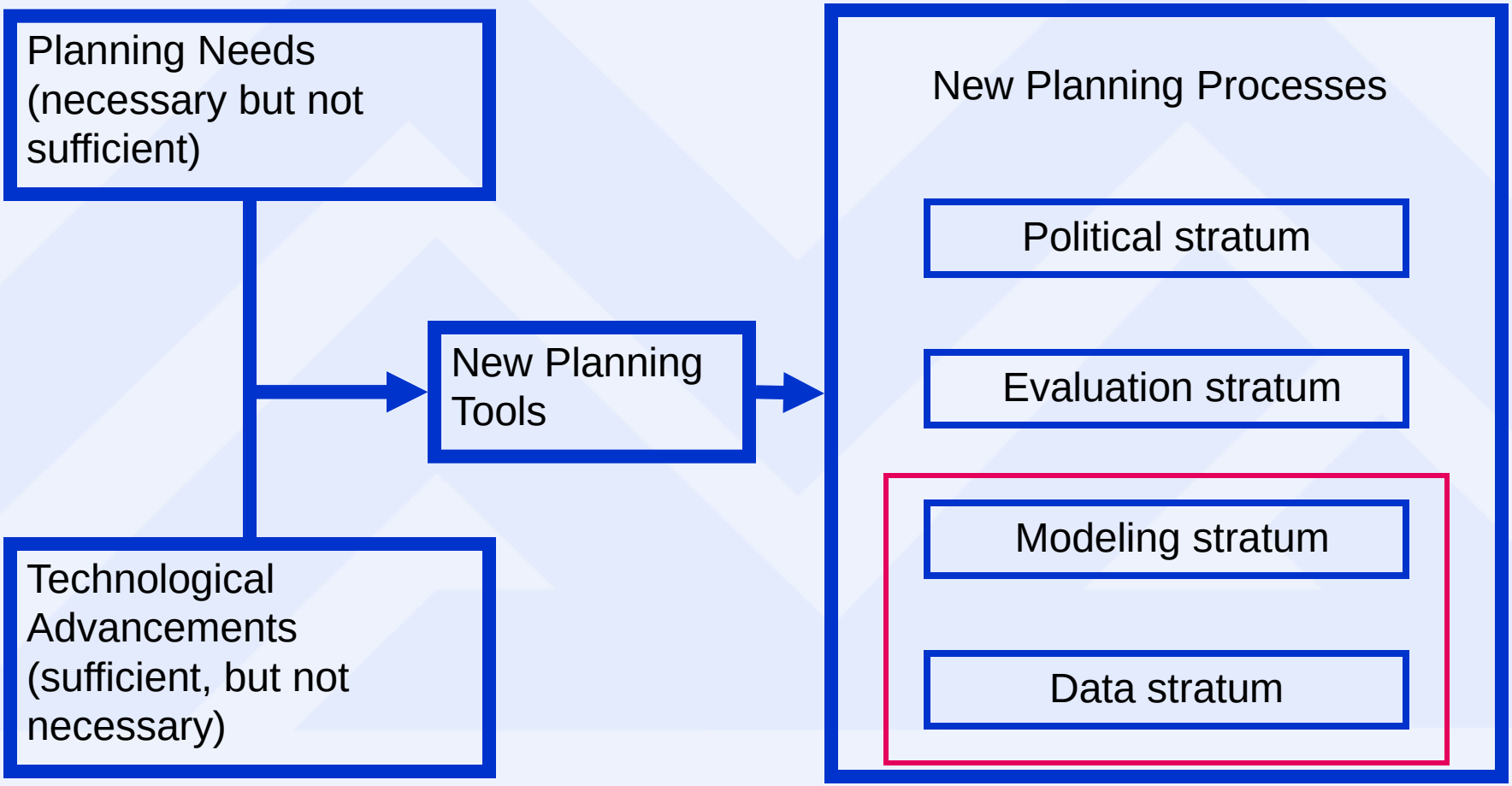
Possibilities
GPS data collection
Modeling of Dynamic Traffic Phenomena
Activity-based Travel Forecasting Models
Multiyear Master Transportation Networks
Photo visualization
Uncertainty Analysis
Mobile GIS
interactive overlay

Main Causality of Technical Innovations in *Regional* Planning and Modeling



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Current Policy Issues

- Road pricing
- Air quality & greenhouse gases
- Land use policies and TOD
- Alternative mode strategies
- System operations and reliability
- Travel reduction / peaking strategies
- Evacuation / accommodation
- Economic development
- Demographic change

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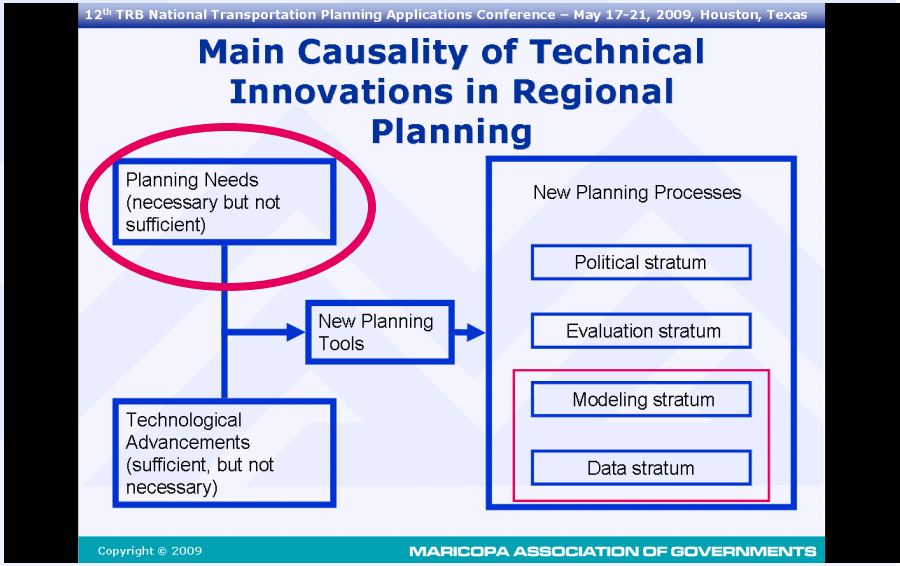
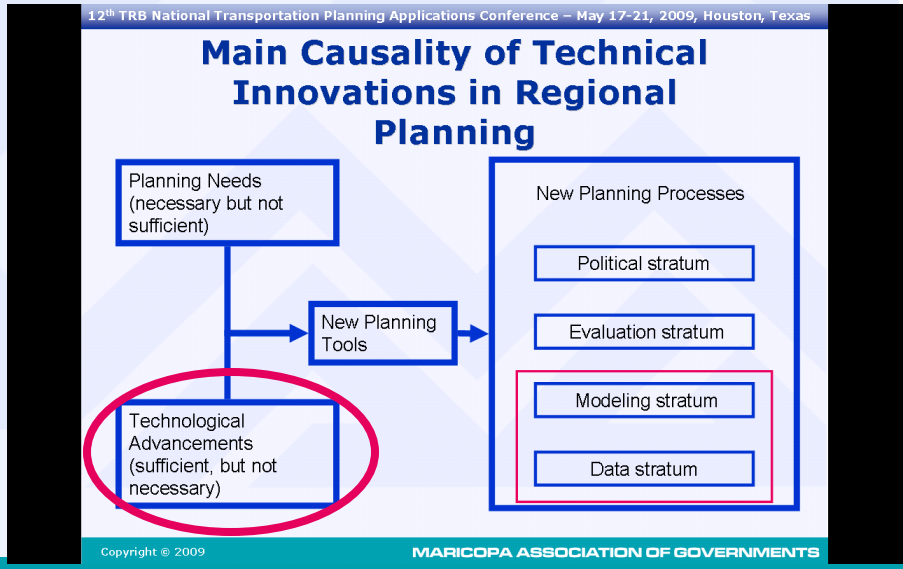
- Climate Change and Environmental Protection Needs
- Sustainability Needs
- Needs to account for Economic Volatility and for Plan Sensitivity
- Needs to Account for Uncertainty
- Needs to Evaluate New Travel Modes and Transportation Technologies
- Needs to Evaluate New Policies and Regulations
- Needs to Reflect New Travel Behavior

Are emerging planning needs threats or opportunities in achieving planning goals/regional visions?



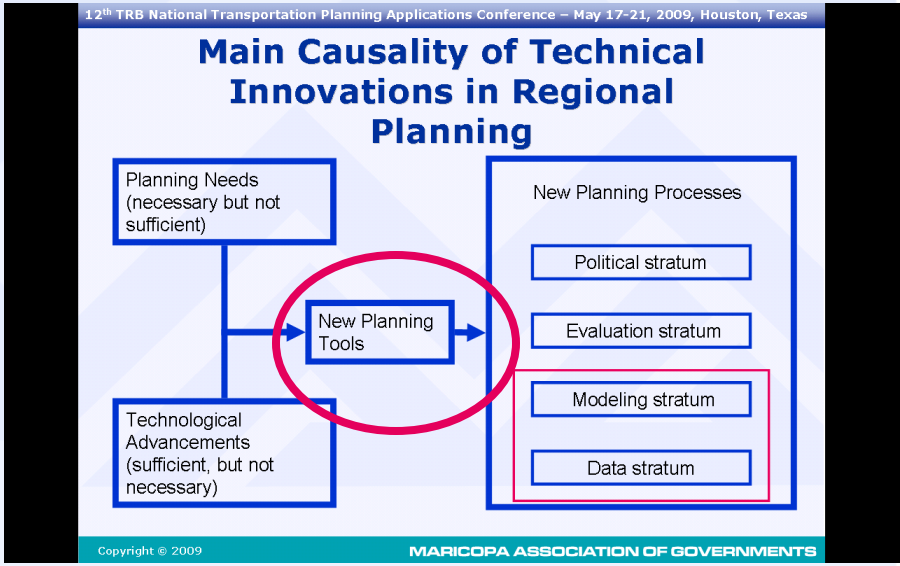
- Dramatic Increase in Computing Power: multiple processors, distributed computing, cloud computing
- Dramatic Decrease in Computational and Storage Costs
- New Web Technologies
- New GIS technologies
- New GPS technologies
- New Technological Expectations
- Lack of New Technological Expertise
- Competitiveness on the HR market

Can Technological Advances help to address new challenges /threats in achieving planning goals?

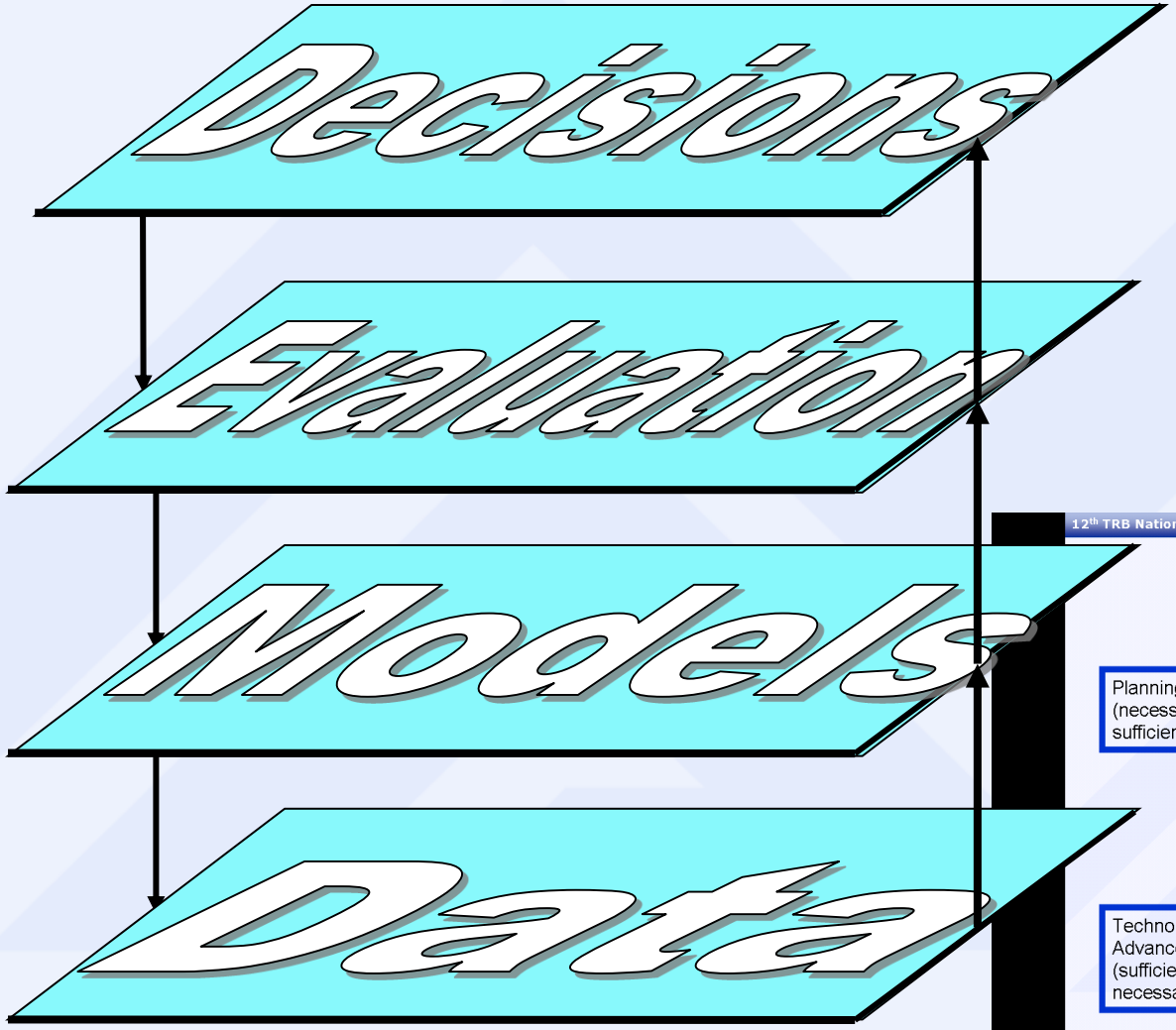


- Future Staff Requirements and Availability of Technical Expertise
- Life Cycle of existing technologies, maintenance and support cost and availability
- Stakeholders and general public expectations
- Applicability to foreseeable tasks
- Efficiency in execution of typical technical tasks

What are weaknesses and strengths of proposed innovations in terms of advancing regional planning agenda?

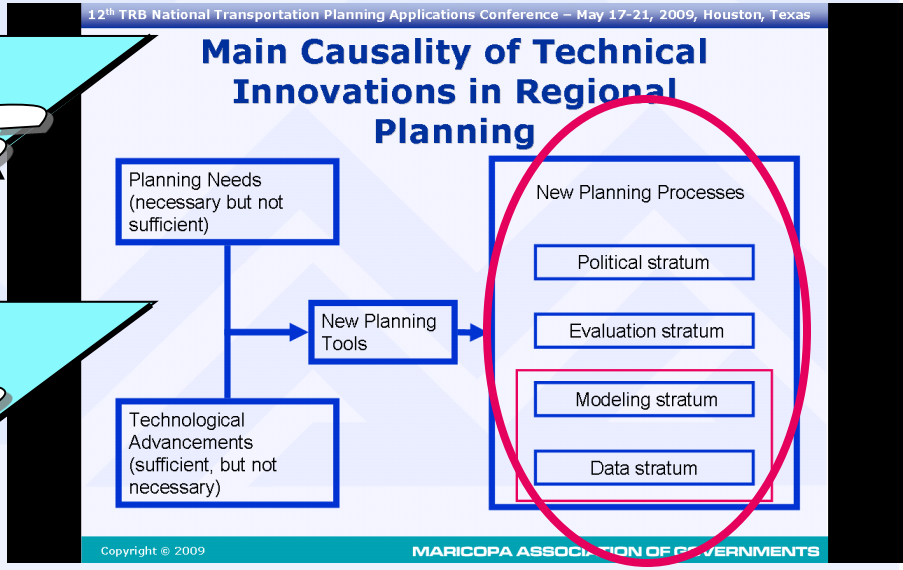


Technical Innovations Strata in the Regional Planning Process



Core technical process strata:

- Observed data for analysis and modeling
- Models for predictions, explanations and descriptions
- Project evaluations and programming/planning



Data Stratum: Innovative Planning Tools

- Web-based GUI data access
- Visualization: GIS, Google
- Data Integration (different types of data, historic data, jurisdictional data)
- Enterprise Application Integration (e.g. integration with modeling applications - automated model validation tools, with data collection applications - QA/QC, automated data upload)
- Built-in data analysis tools

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Data Collection and Management Innovation Decision Matrix

	Threats	Opportunities
Strengths	**Urgent** **Not Important** e.g. innovative capitalization on another ongoing project where the need can be addressed with traditional tools as well	**Not Urgent** **Not Important** e.g. opportunity to improve data disposal
Weaknesses	**Urgent** **Important** e.g. innovative approach to address unmet data needs from a major project or stakeholder	**Not Urgent** **Important** Best Time to introduce innovations

- data collection
- data acquisition
- data analysis
- data storage
- data security
- data retrieval
- data access and dissemination
- data archiving
- data disposal

Arrows indicate results of example project level decisions on data management innovations

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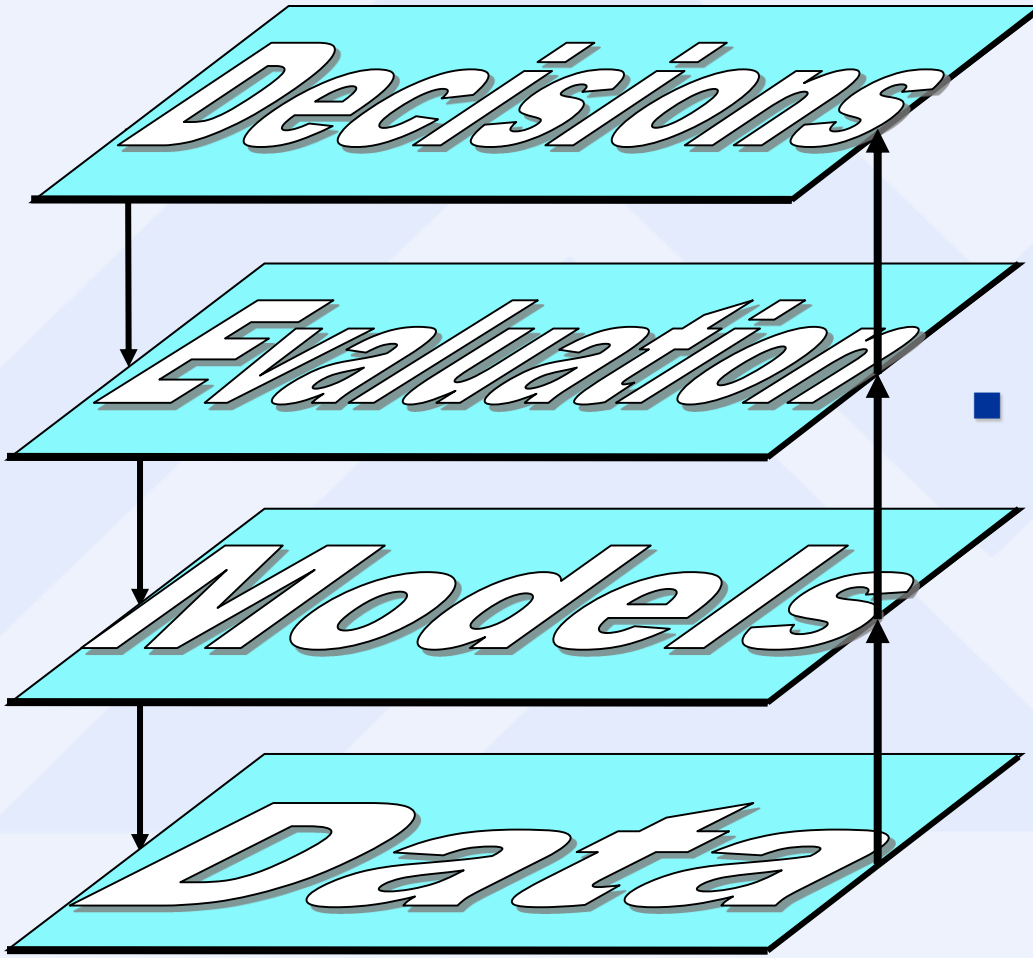
Modeling Stratum: Strengths and Weaknesses



- Modeling assumptions are inadequate for future planning needs but are in-line with existing planning processes
- Models are not integrated with each other and other parts of the planning process

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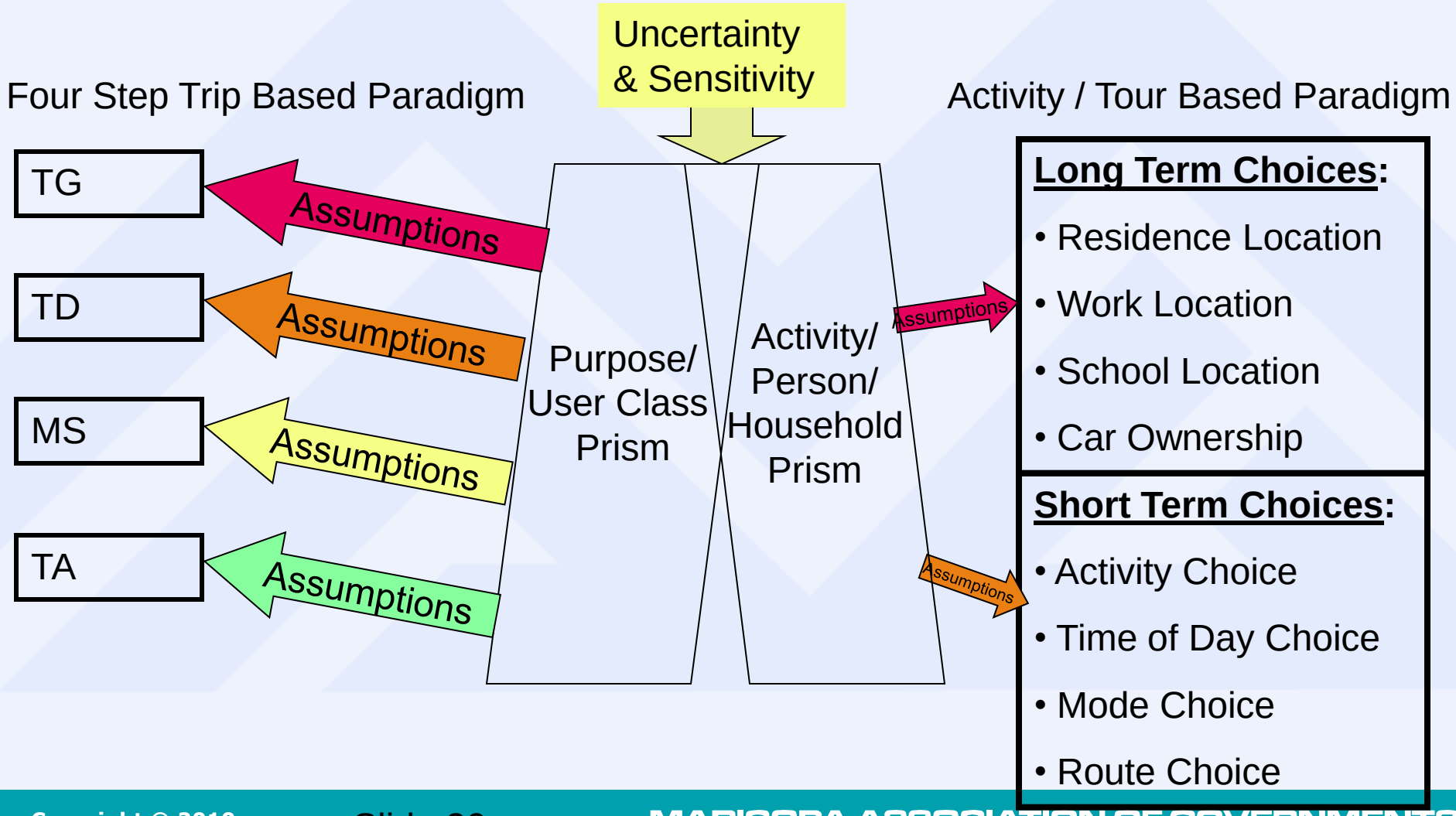
Innovations in Transportation Modeling = Relaxed Modeling Assumptions * Increased Fidelity + Capitalization on Computing Technology



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Transportation Modeling Innovation Decision Matrix

	Threats	Opportunities
Strengths	**Urgent** **Not Important** e.g. innovative capitalization on another ongoing project where the need can be addressed with traditional tools as well	**Not Urgent** **Not Important** e.g. an improvement in the traditional four step based procedure that is not crucial for model applications or future development
Weaknesses	**Urgent** **Important** e.g. innovative approach to address unmet data needs from a major project or stakeholder	**Not Urgent** **Important** Best Time to introduce innovations

- **Paradigm Shift** and disaggregation – Data Mining and Knowledge Management - Database Approach, ABM
- **Enterprise Application Integration and Automation** - PMDS, Geo Database, Master Network
- **Data Accessibility and Visualization** - Web-based GIS technologies, 3D

Arrows indicate results of example project level decisions on data management innovations

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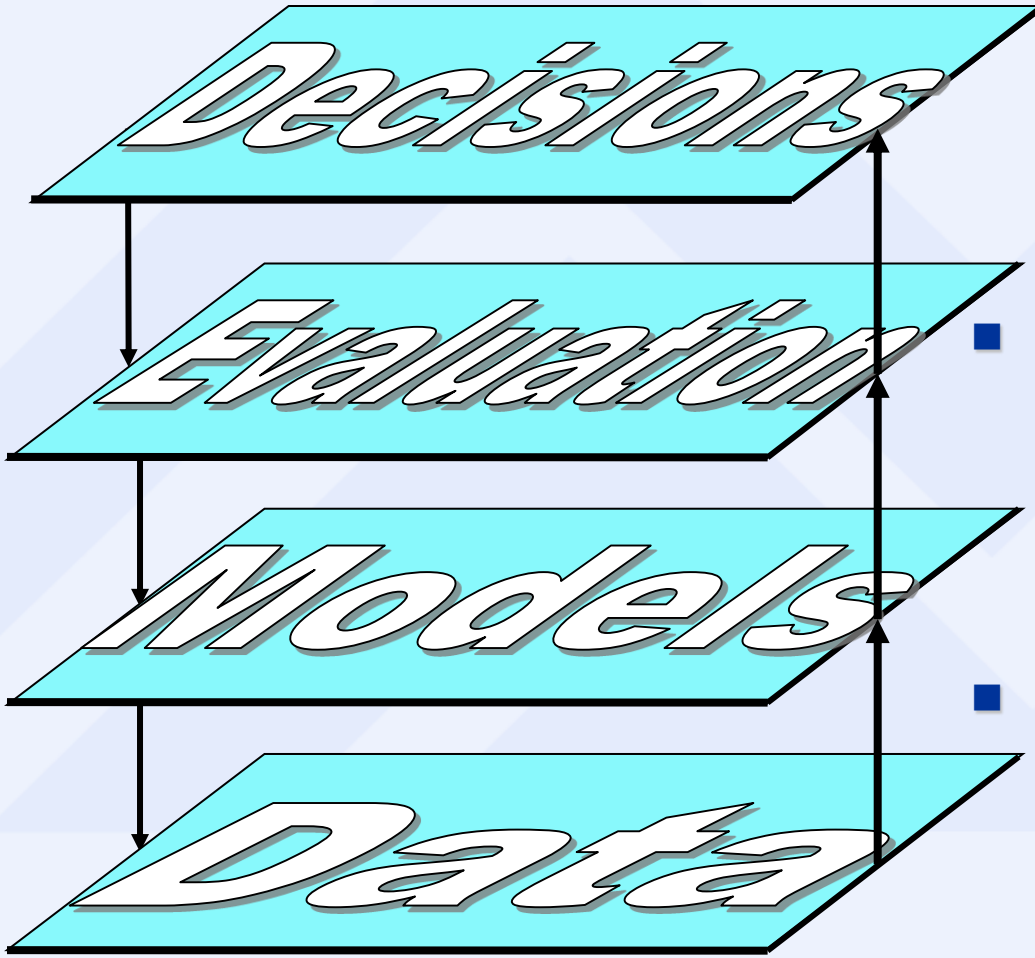
Evaluation Stratum: Strengths and Weaknesses



- Disconnect between evaluation, data analysis and modeling, necessity for complex manual effort
- Insufficient accessibility of project data, ability to easily visualize and query project information
- Robust manual procedures and established guidelines

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Evaluation Stratum and Process Integration Innovations

- New dimensions introduced by both political and technical nature of the process
- Process Integration Issues with other strata
- Visualization and Accessibility- web based
- Outsourcing and Cooperation – vendors

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Different questions – different answers

We can ask	Or we can ask
What are the possibilities	What are the priorities
Where the modeling trends will take us	Where we will take the modeling trends
How much it cost to implement an innovation	What is the effectiveness of implementing an innovation
What are the development costs	What are the development and maintenance costs
What percentage of planning costs is in modeling	What percentage of planning, design and building costs is in modeling
What are the benefits of modeling advancements	What are the costs of planning mistakes
If a model delivers a better forecast	When we need a better forecast and if we need a better model

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A few questions for conclusion:

- **Can we hope for dissemination of innovative modeling tools without propagation of innovative planning processes?**
- **Can we foresee innovative planning processes without drastically different and pressing planning needs?**
- **Can we foresee big changes in planning needs by predicting changes in transportation systems and their environments?**
- **Can we predict changes in transportation systems and their environments by utilizing innovative modeling tools? (go to first question)**

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Thank You

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