

# Long-term Demand Forecasting of Managed Lanes

## Challenges in Addressing Key Influential Risk Parameters

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# Managed Lane Forecasting 101

- Typically more complex than traditional forecasting
  - Competition conditions are immediately apparent
- Requires more data for operational assessment
  - Public Behavioral Characteristics
  - Geometrical Consideration/Travel Speed Deterioration Analysis
  - Time of Day Profiling
- Variability and Evolution of Eligibility and Pricing options
  - Operational Demand Management versus Revenue Generation

# Managed Lane Forecasting Challenges

- New and Innovative Demand Management Techniques
  - Dynamic Speed Limits/Dynamic Re-striping
  - Shoulder Lane Utilization
  - GPS/Dynamic Re-routing Procedures
- How does one develop a forecast?
  - Point forecasts for financial feasibility
  - Ranges for procurement assessment

# Typical Managed Lanes

- High Occupancy Vehicles (HOV)
  - Depends on number of lanes and operating policies
  - Varies heavily by time of day/direction/markets
- High Occupancy Toll Lanes (HOT)
  - HOT 2+ or HOT +3 with free usage
  - Discounting during peak periods
- Express Toll Lanes (ETL) (Managed Lanes)
  - All Modes pay with the exception of transit
  - Premium Priced Lanes
- Truck Only Toll (TOT)
  - Truck and Transit Exclusivity
  - High Truck Volume Corridor

# U.S. Examples of Variable Tolling

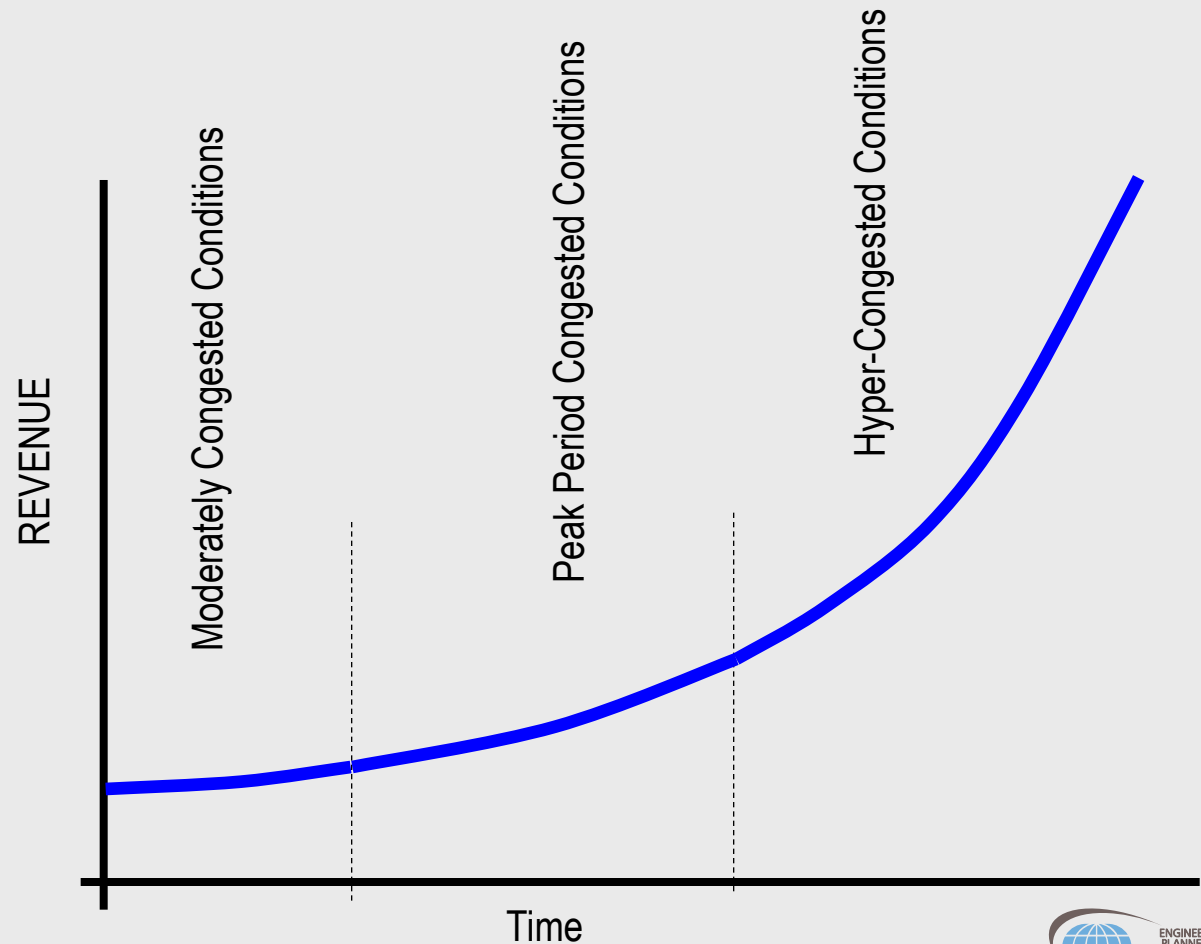
<u>Facility</u>	<u>Location</u>	<u>Facility Type</u>	<u>Pricing Type</u>	<u>Comments</u>
<b><u>Preset Variable Rates</u></b>				
SR 91	Orange County, CA	ETL's	Preset	Varies by day of week and hour of day
I-25 HOT Lanes	Denver, CO	ETL's (HOT)	Preset	HOV's free - reversible
San Joaquin Hills	Orange County, CA	Toll Road	Preset	Variable rates cash and ETC
Foothill/Eastern	Orange County, CA	Toll Road	Preset	Variable rates cash and ETC
PANYNJ	New York/New Jersey	Bridges/Tunnels	Preset	Applies to ETC only
Illinois Tollway	Illinois	Toll Road	Preset	Applies to trucks only
Leeway Bridges	Lee County, FL	Bridges	Preset	Applies to ETC Only
Highway 407	Toronto, ONT	Toll Road	Preset	Initial operation; off peak discounts eliminated
I-95 Express Lanes	Miami, FL:	ETL's	Preset*	Opens around year end
SH 121 Tollway	Dallas Texas	Toll Road	Preset	Partially open
<b><u>Dynamic Pricing</u></b>				
I-15 Managed Lanes	San Diego, CA	ETL's (HOT)	Dynamic	Must keep free flow for HOV
I-394 MNPASS	Minneapolis, MN	ETL's (HOT)	Dynamic	Must keep free flow for HOV
SR 167	Seattle, WA	ETL's (HOT)	Dynamic	Must keep free flow for HOV
IH 10 Toll Lanes	Houston, TX	ETL's (HOT)	Dynamic	Must keep free flow for HOV

# Evolution of a Managed Lane Facility

- Market Capture
  - Initially Focused on Attracting User Markets
  - Peak Period HOV Discounting
  - HOV 2+ or 3+ Market Segmentation
  - Already Relatively Mature Corridors
- Maturation of Targeted Demand
  - Captures Sufficient Targeted Daily Demand
- Management of Demand
  - New Policies and Pricing structures may be required to discourage excessive usage

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  - High Toll Rates
  - New Policies and Pricing structures may be required to discourage excessive usage



# Evolution Implications

- Hockey Stick Revenue Potentials??
  - Dependent on many factors
  - Requires detailed assessment of the all key variables (historical and new)
  - Creates a new focus on forecasting future operational performance of general purpose lanes and managed lanes
- Key Risk Associated with Forecasts
  - Competing Facilities
  - Escalation of Toll Rates
  - Maximum Demand Capture Rates
  - Off-peak/Directionality Considerations
  - Local Corridor Characteristics
  - Future geometrical and demand management considerations

# Long Term Managed Lane Considerations

*A good forecaster is not smarter than everyone else,  
they merely have their ignorance better organized  
Anonymous*

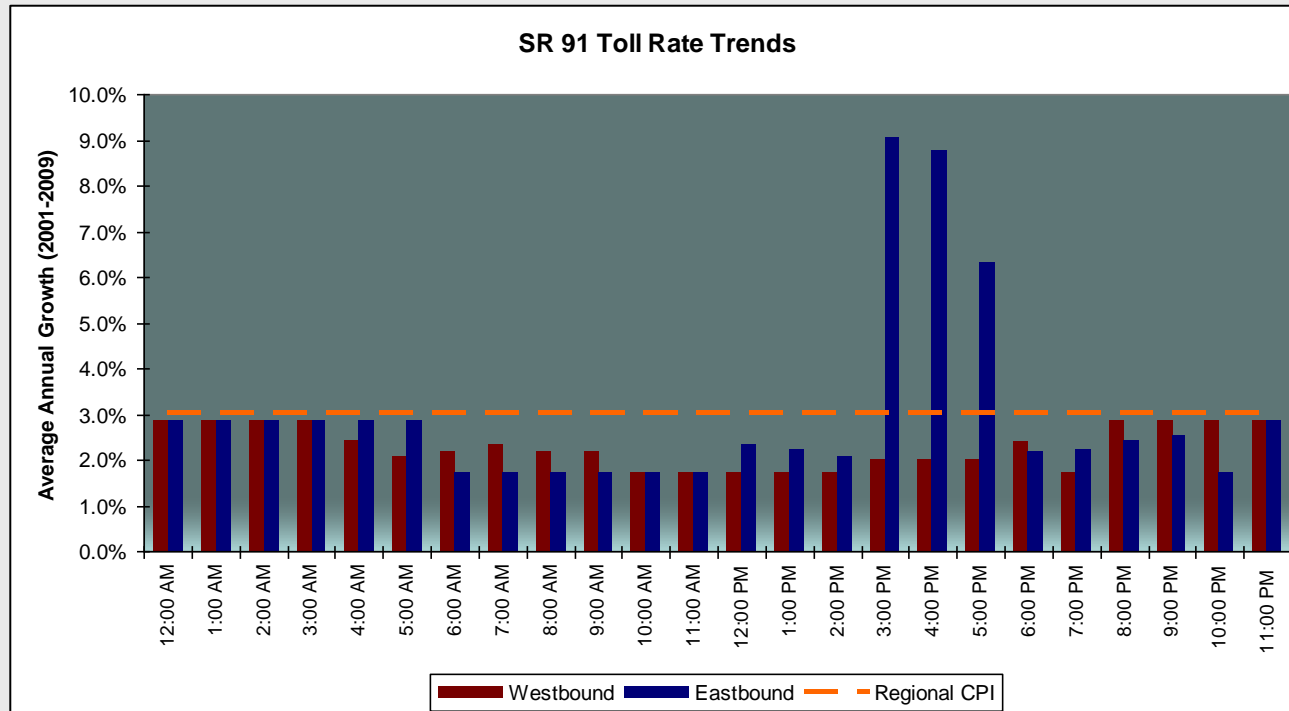
- Economic Growth
  - Long-term Cyclical Trends
  - Diversification of Growth
- Traffic Growth Profiles
  - Seasonality/Weekly/Daily/Hourly Distributions
- Values of Time
  - Income Growth and Distributions
  - Mandatory versus Discretionary

# Long Term Managed Lane Considerations

- Mode Trends/Market Shifts
  - HOV/Commercial Vehicle Market Trends
  - Aging Population/Migration Patterns
- Inflationary Trends
  - Toll Rate Escalation and Disposable Income
- Additional Influential Factors
  - Incident Rates/ Fuel Prices
  - Geometric/Operational Impedances on Speeds

# Toll Escalation

- Does it Necessarily Fall in Line with CPI?
  - Many Traditional Toll Facilities have not kept up with inflationary trends
  - What about managed lanes?



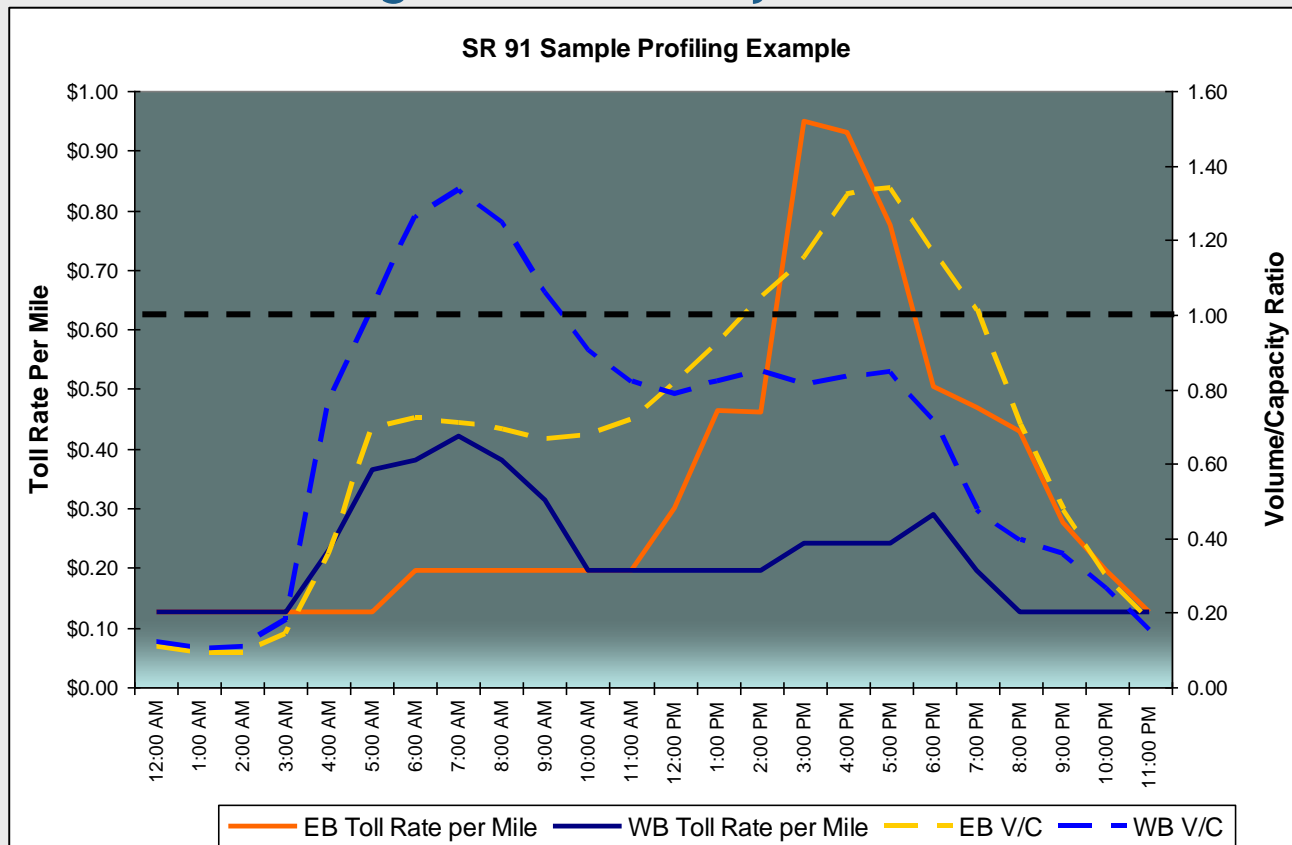
# What Determines Optimum Tolls

- Key factors:
  - Motorist value of time
    - Varies widely - and by situation
  - Anticipated time savings of Managed Lanes vs. GP lanes
    - “Error of anticipation”
- Need to recognize sensitive equilibrium on managed lanes
  - Delicate balance
  - Elasticity on SR 91 may be much higher
    - A small percent change in total traffic in the corridor can result in a significant change in revenue
    - Major revenue drop with higher gas prices



# Demand Capture Rates

- Are the Capture Rates Expected to be similar in both directions?
  - Diversion to managed lanes is very situational...

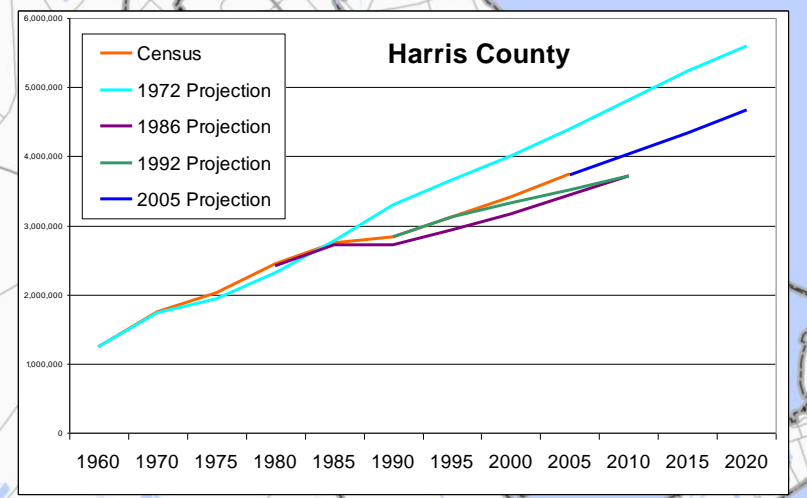
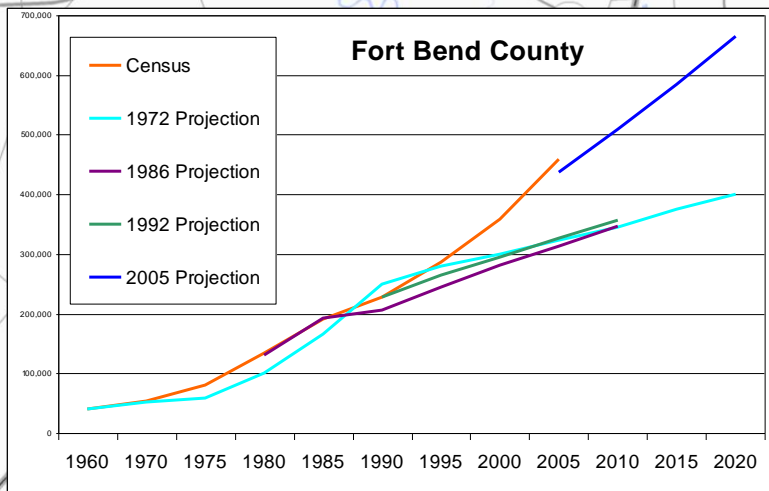
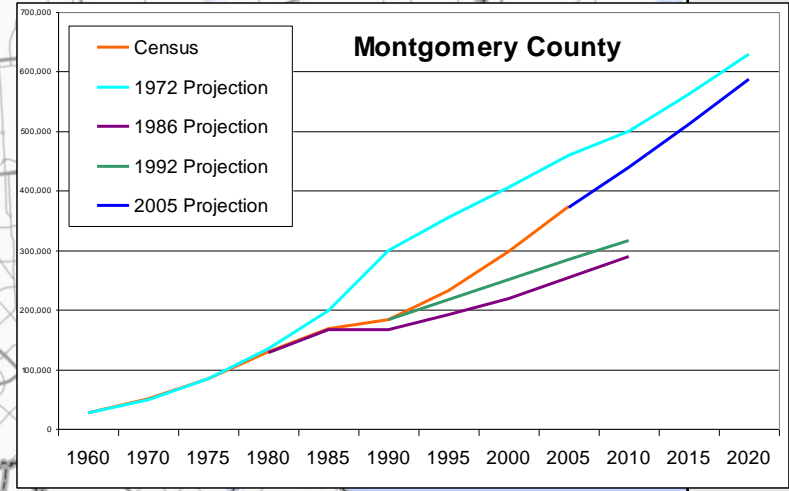
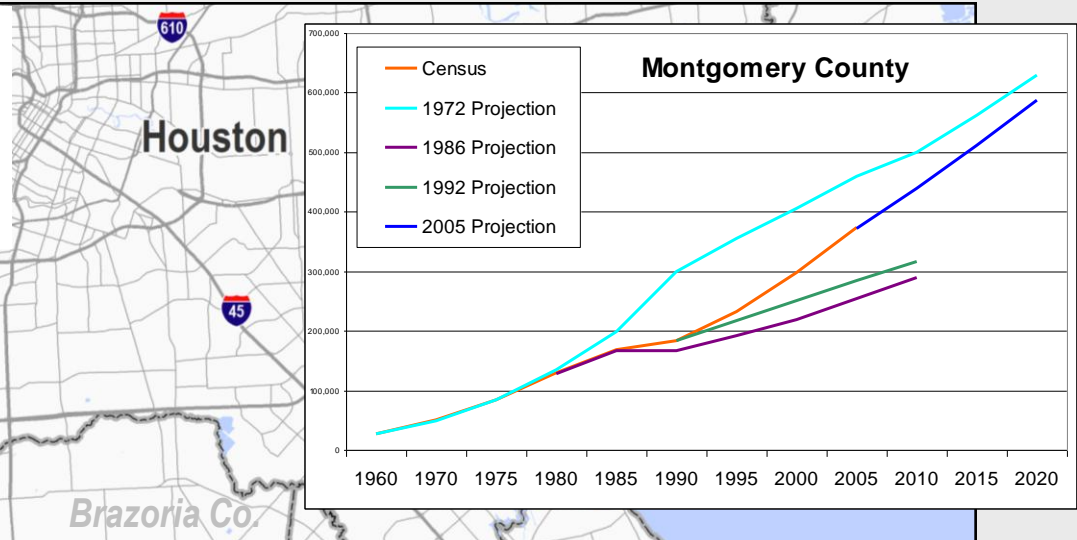


# Economic Growth

- Economic Growth
  - Location Dependent (Mature versus Undeveloped)
  - Distribution of Population/Employment
  - Metropolitan Organization Historical Forecasts
  - Regional Growth Profiling (Urban versus Suburban)
  - Economic Diversity
  - Dependency on Local Markets
- There are many ways to get to the same place
  - Concave versus Convex Growth

# Economic Growth

*“Forecasters tend to use historical data for support rather than illumination”*



# Economic Growth

- Historical Key Variables
  - Population/Employment/Households
  - GDP/Income/CPI
- New Variables??
  - Aging Composition/Gender Shifts
  - Economic and Trade Policies/Globalization of Markets
  - International Competitiveness/Dependency
  - Longer/Deeper Business Cycles

*The past does not repeat itself, but it rhymes.  
Mark Twain*

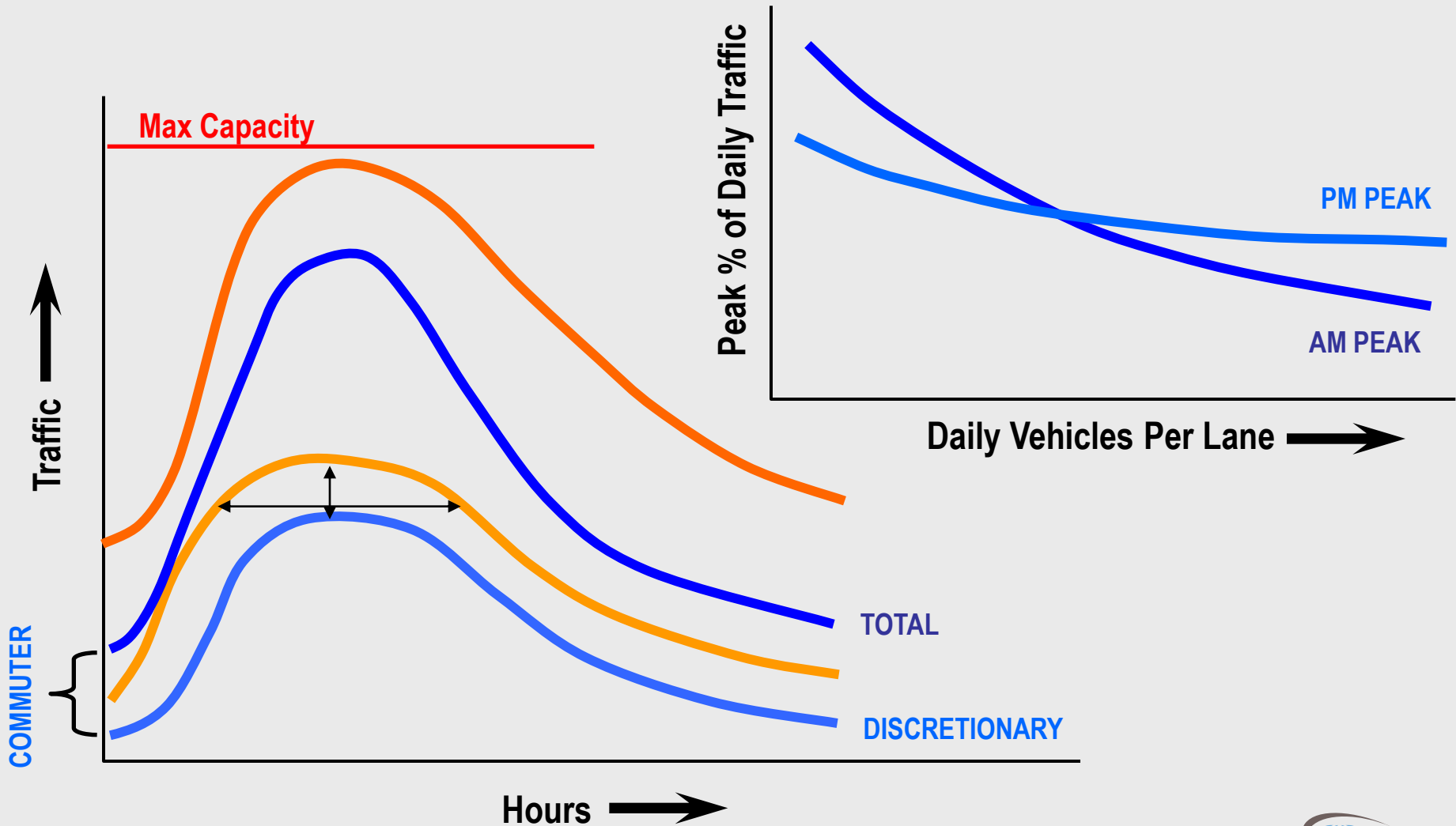
# Traffic Growth Profiles

- Radial versus Circumferential
  - Trends in Long Term Traffic
  - Shifting focus of Suburban to Suburban
  - Evolving Attraction/Production Centers
- Daily Distributions
  - Weekday versus Weekend
  - High Volume Days (Typically Thursday/Friday)
- Hourly Distributions
  - Levels of Demand
  - Directionality Peaking
  - Peak Spreading Trends

# Traffic Growth Profiles

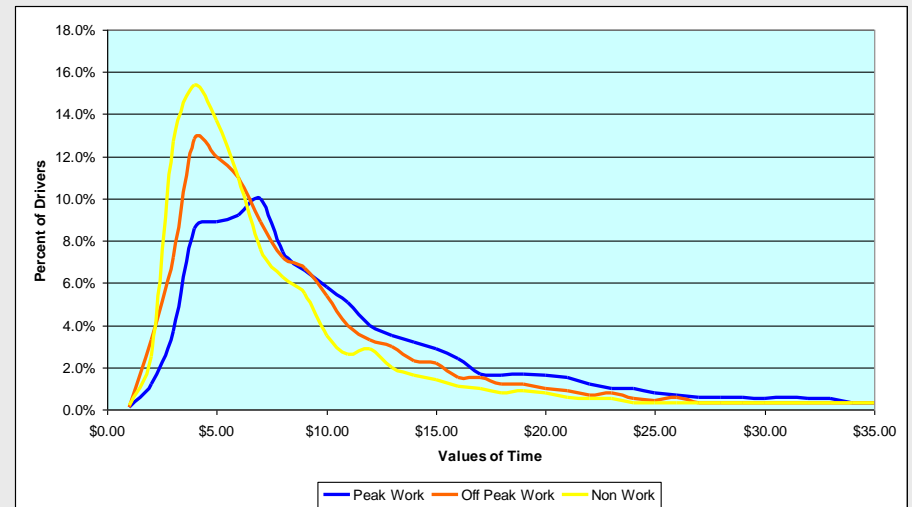
- Revenue Days
  - Difference between 275 and 365 can yield significant revenue changes
- Ramp-up Assumptions
  - Brownfield versus Greenfield
  - Duration
- Peak Spreading Characteristics
  - Composition of Demand (Work versus Non Work)
  - Radial versus Circumferential
  - Corridor Volume Capacity

# Peak Spreading Trends



# Income Growth Profiles

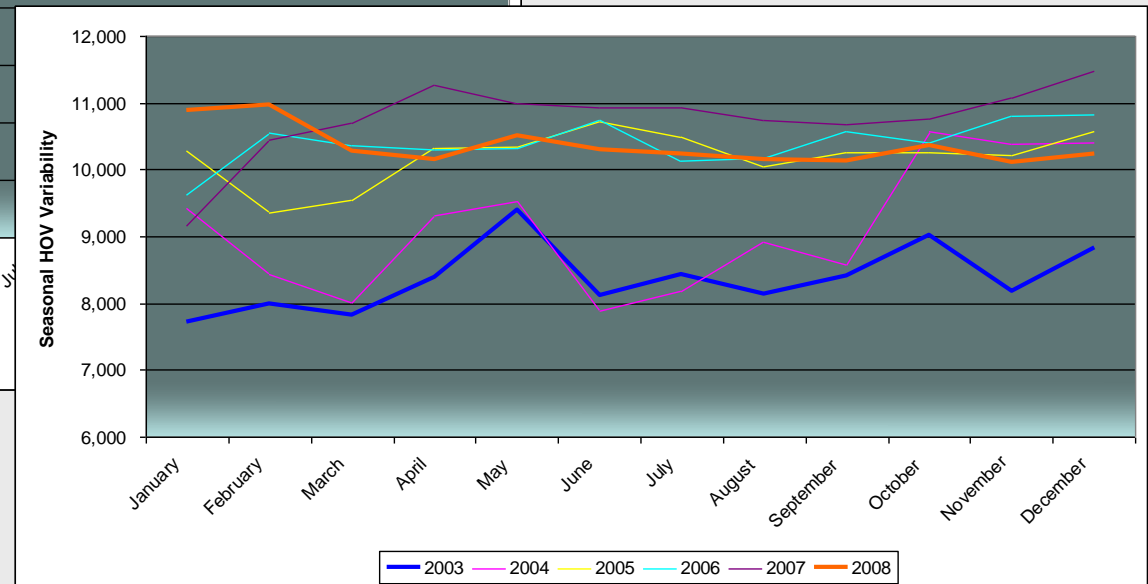
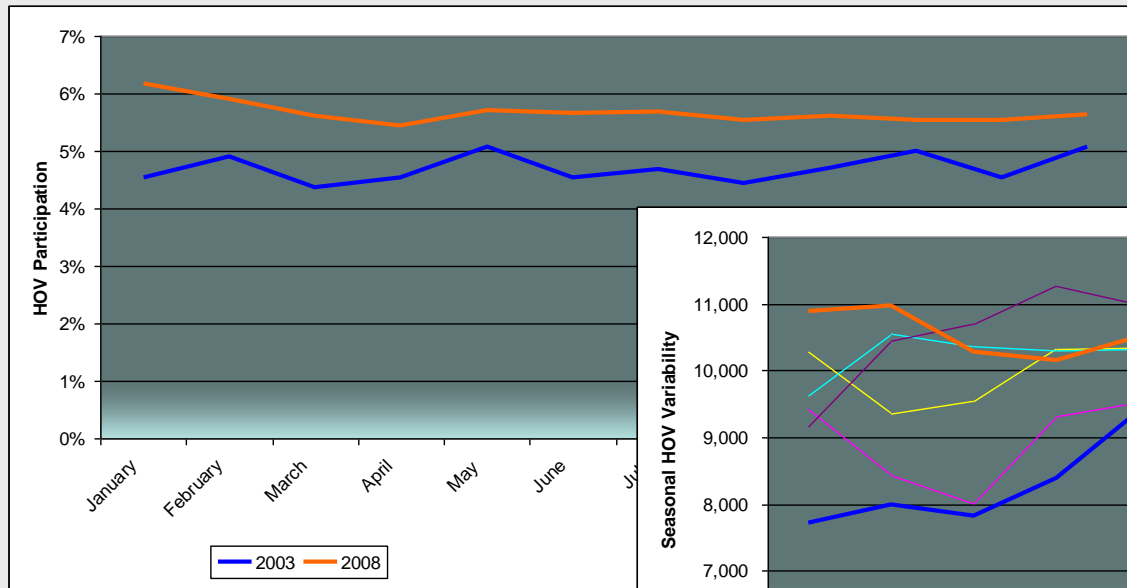
- Income Trends
  - Household Income Trends
  - Average versus Median Trends
  - Distribution of Income Earners
  - Cross-Section of Typical Usage Type
  - Growth of VOT (GDP per Capita/CPI)



# Mode Shift Profiling

- HOV Trends (example)

- Has historically consisted of 15-20 percent of peak period market (5-10 percent of overall daily market)

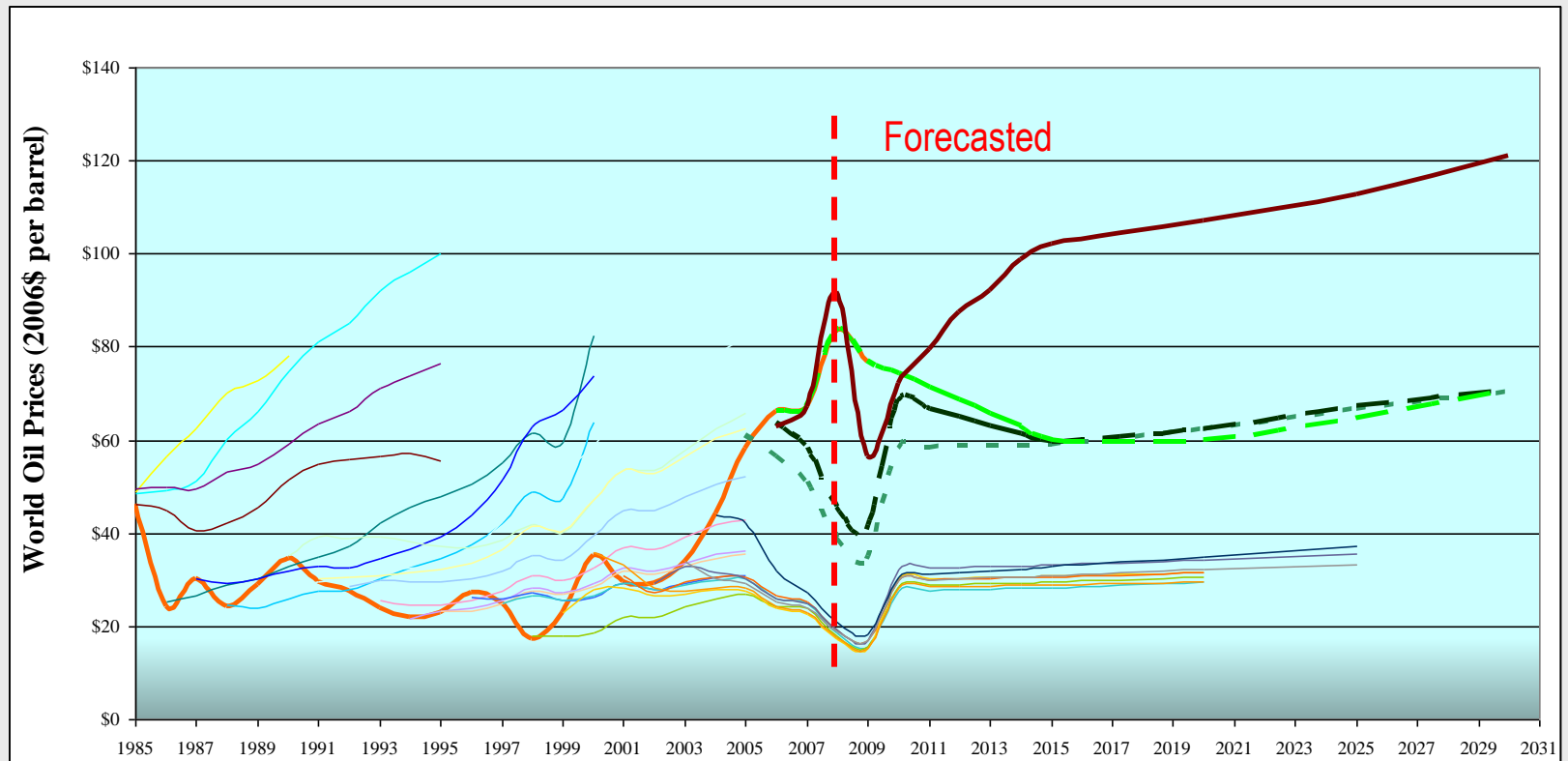


# Mode Shift Profiling

- Long Term Commercial Vehicle Trends
  - Global/Local Effects of Trade Policies
  - Just-in-Time Delivery
  - Supply Chain Strategies
  - Evolution in Truck Sizes
- Aviation and Intercity Rail Trends
  - Competing versus Complementary Modes
  - New Transportation Policies (fuel efficiency etc.)

# Additional Factors

- Fuel Prices (EIA - Annual Energy Outlooks)

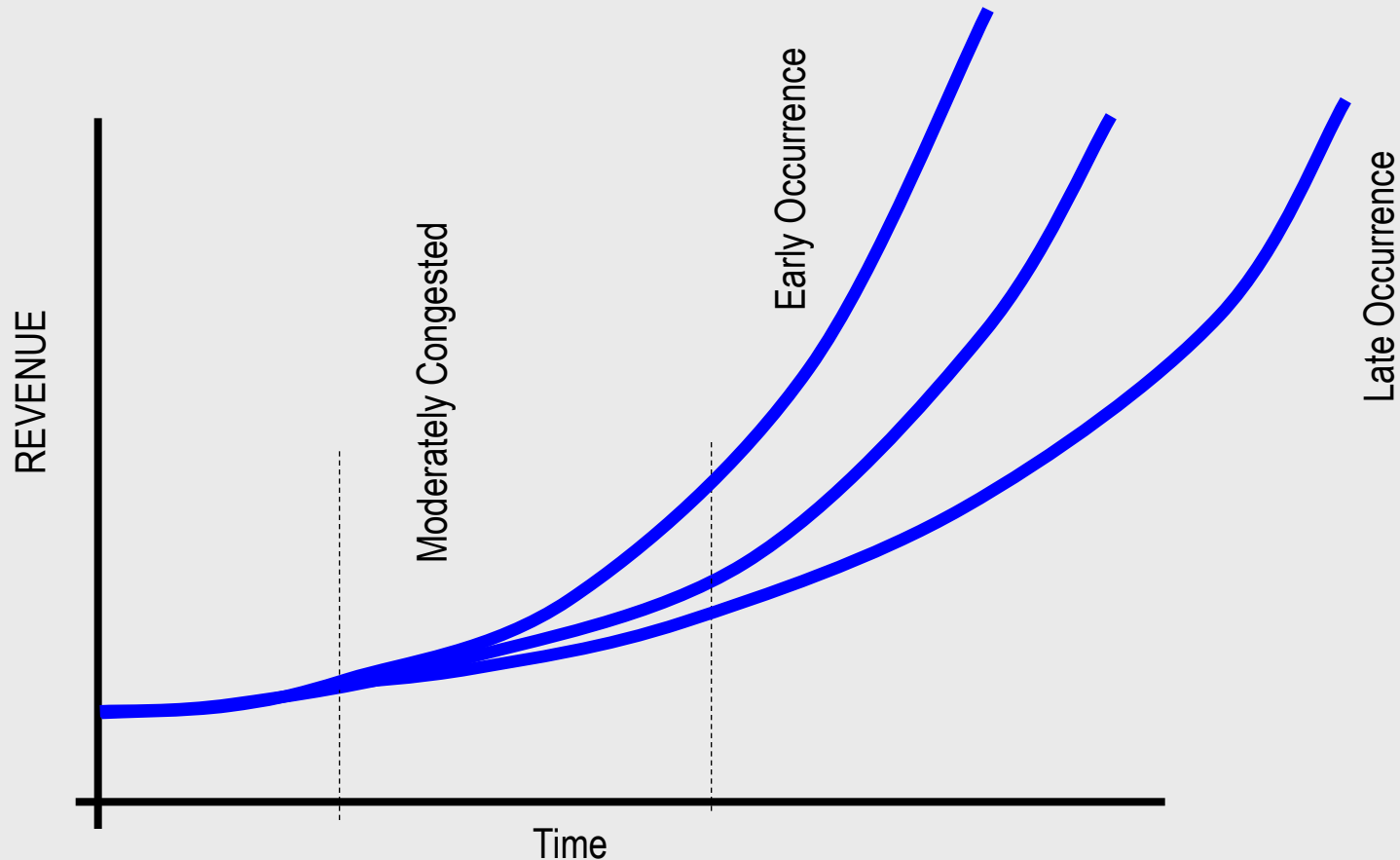


- Incidents/Accidents

# Risk Profiling

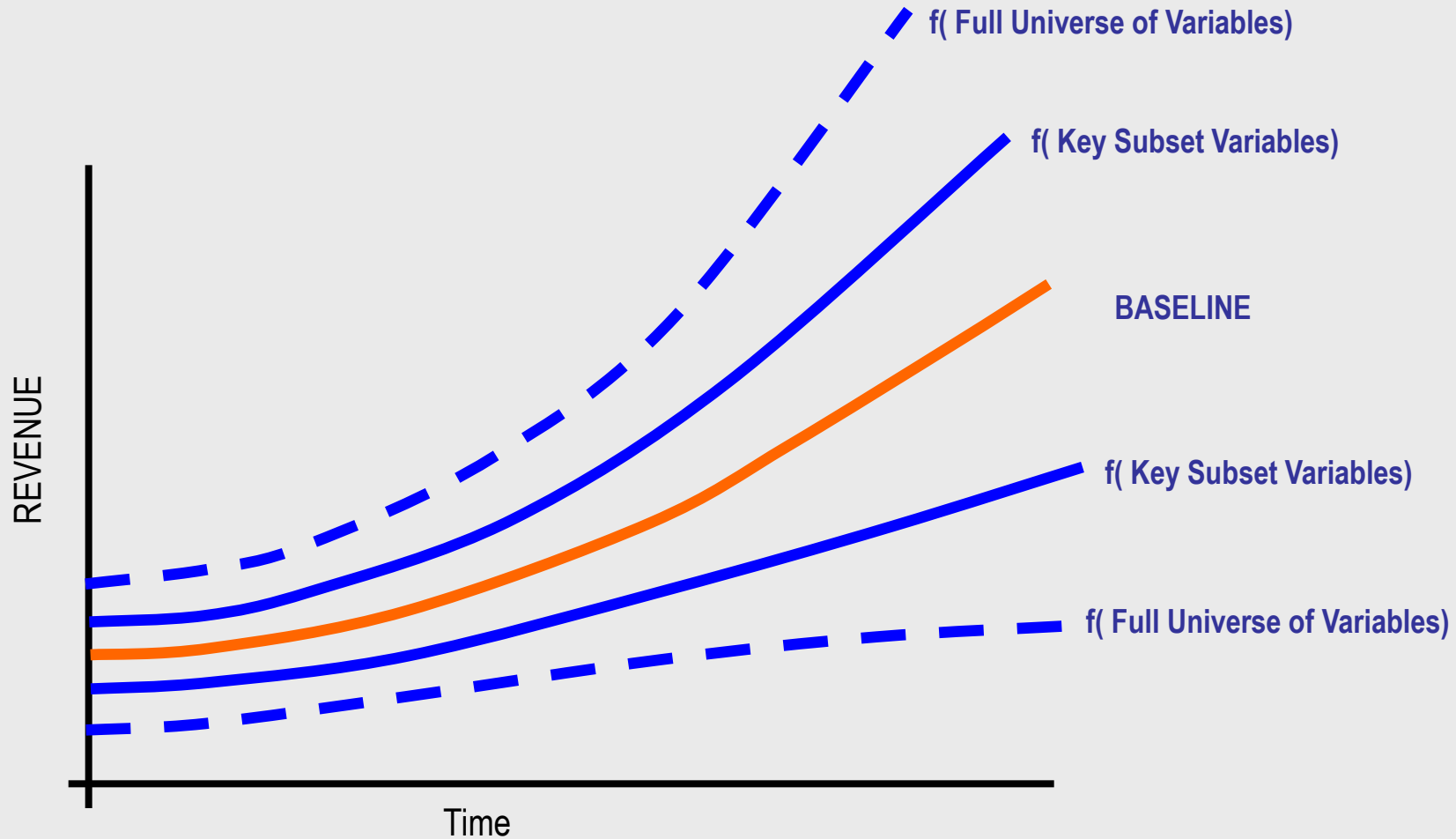
- Defining Risk
  - Where is the Risk
  - How to Quantify
  - How Significant is the Risk
  - Discrete versus Ranges
- Dependent on Data Availability
  - Historical Profiling
  - Accuracy/Variability of Forecast Sources
  - Data Filtering
  - New Modeling Approaches
  - Value of Reliability
- Incorporate all the Key variables to create realistic ranges
  - Correlation Dependency
  - Unknown/Unforeseen Variability
  - Prioritization of Key Factors

# Uncertainty Propagation



*To expect the unexpected shows a thoroughly modern intellect  
Oscar Wilde*

# Uncertainty Propagation



# Interpretation and Conclusions

- Quantification may unintentionally create an aura of precision and confidence
- How will the ranges be utilized
  - Project Feasibility
  - Bonding/Capital Improvement Plans
  - Subsidy Requirements
- How to narrow the likely ranges
  - Detailed data on current ranges
  - Assessment of Key Variables
  - Explore Alternative/New Influential variables

# THANK YOU

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