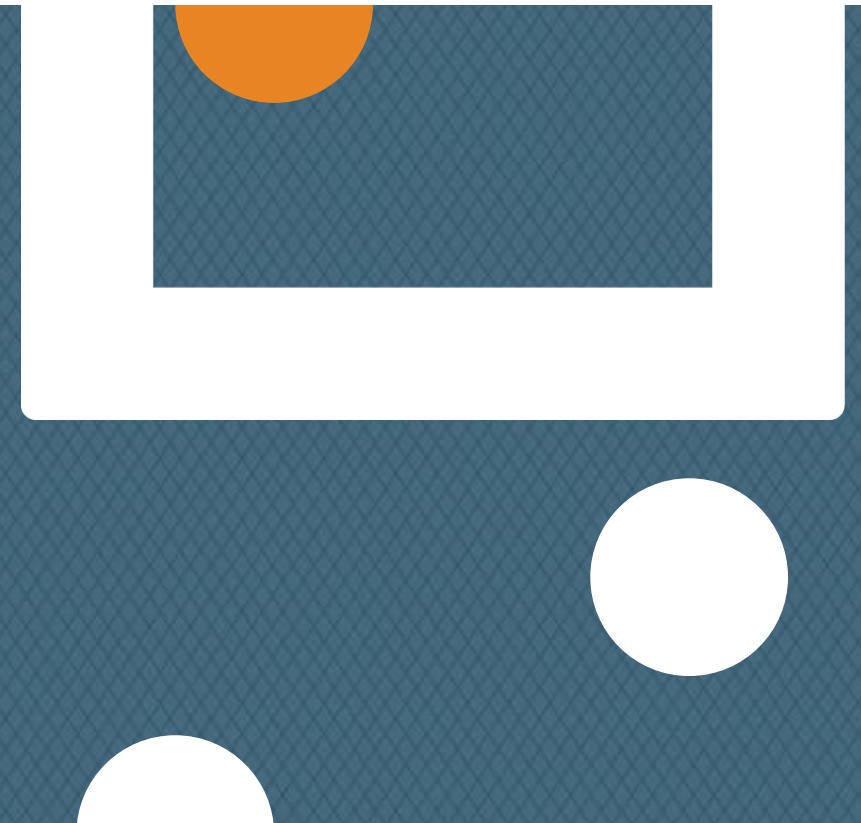


# Predictive Analytics: Making Analytics Work

Jared Ellwein  
CTO, CATCH Intelligence



# Agenda

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- Defining Predictive Analytics & Machine Learning
- The Importance of Predictive Analytics
- Practical Use Cases & Demo for Predictive Analytics

# Defining Machine Learning and Predictive Analytics



## Predictive Analytics

Condenses large volumes of data

Relies on human experts to test associations between cause & outcome. CATCH Intelligence offers Data Scientists

Data needs to be refreshed

## Machine Learning

Branch of Predictive Analytics

Relies on sophisticated algorithms to parse data, recognize patterns and learn from the data without being programmed.

Continuous learning with a lot of historical data

# Data-Driven Decisions in Businesses



**4,300%**

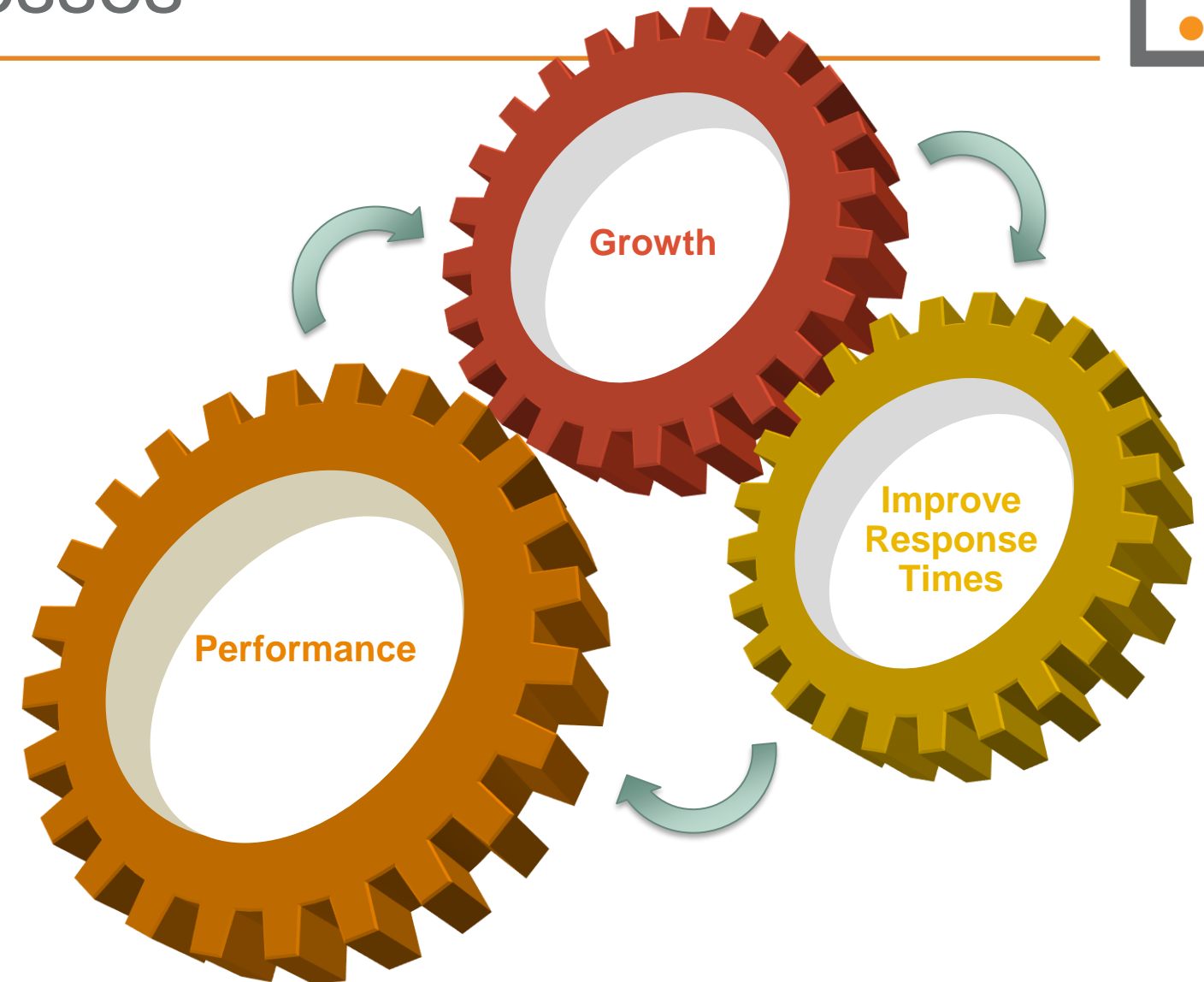
increase in annual data production by 2020<sup>1</sup>

**77%**

of organizations *lack a comprehensive information platform*<sup>2</sup>

**85%**

of people *spend extensive amounts of time trying to find the right data*<sup>3</sup>

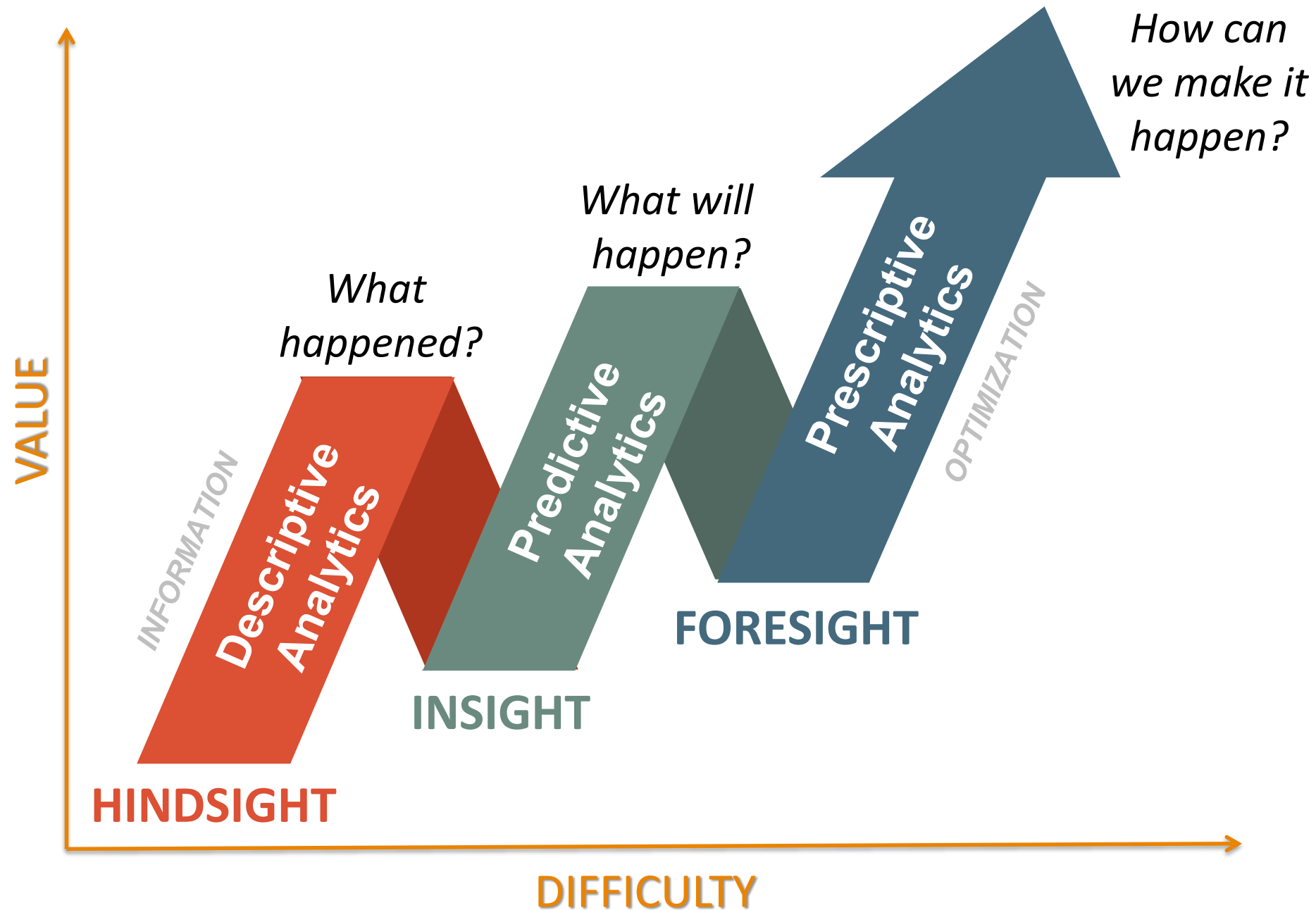


1. Forbes: “Big Data Overload: Why Most Companies Can’t Deal With The Data Explosion”, Bernard Marr, April 2016

2. IDC MaturityScape “Information, Digital Transformation”

3. AIIM “A Holistic Approach to Digital Transformation”

# Shift from Analytics to Foresight





# DOT Road Maintenance



# Predictive Analytics: DOT Use Case



## Optimize funds for bridge and road repairs

- Discover factors affecting wear
- Rely on data for improved decision making
- Allocate and use available funds vs continually requesting additional funds
- Deploy resources to make repairs and improvements proactively

Rapid Rate of  
Increased Road  
Repair

Year over year, costs have outpaced CPI Inflation.

*CPI Inflation Rate Average 2006-2017 = 1.8% Annually*



## Serviceability Index (SI)

- Comprehensive road quality index
- Prioritize and schedule maintenance
- Deterioration Rate refers to the rate of reduction for the road's SI value
- Used Structural Information in a Ridge Regression Model to Predict future SI



## Structural Information

- ✓ Pavement Material Type
- ✓ Surface Thickness
- ✓ International Roughness Index (IRI)
- ✓ Number of Lanes
- ✓ Truck Annual Daily Traffic (ADT)
- ✓ Maintenance District
- ✓ National Highway System Code



# Serviceability Index Evaluation Codes

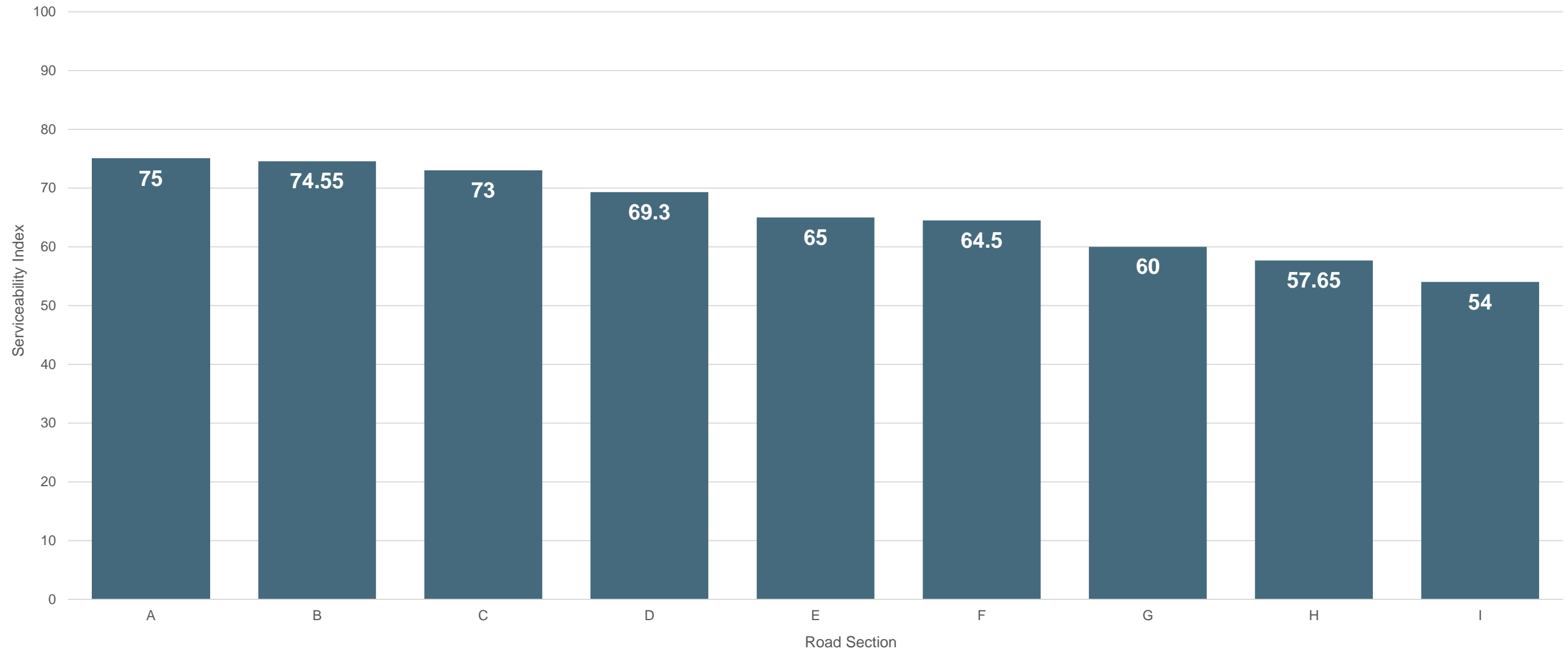


SI	Condition	Description
90-100	Excellent	Road surface is in like new condition
70-90	Good	Provides a comfortable smooth ride Exhibits few if any visible signs of deterioration
50-70	Fair	Can include rutting, map cracking, or extensive patching May not be tolerable for high speed traffic
30-50	Poor	Roadway has deteriorated affecting free-flow traffic May have large potholes and deep cracks
0-30	Very Poor	Only traversable at reduced speeds Distress occurs over 75 percent or more of the surface

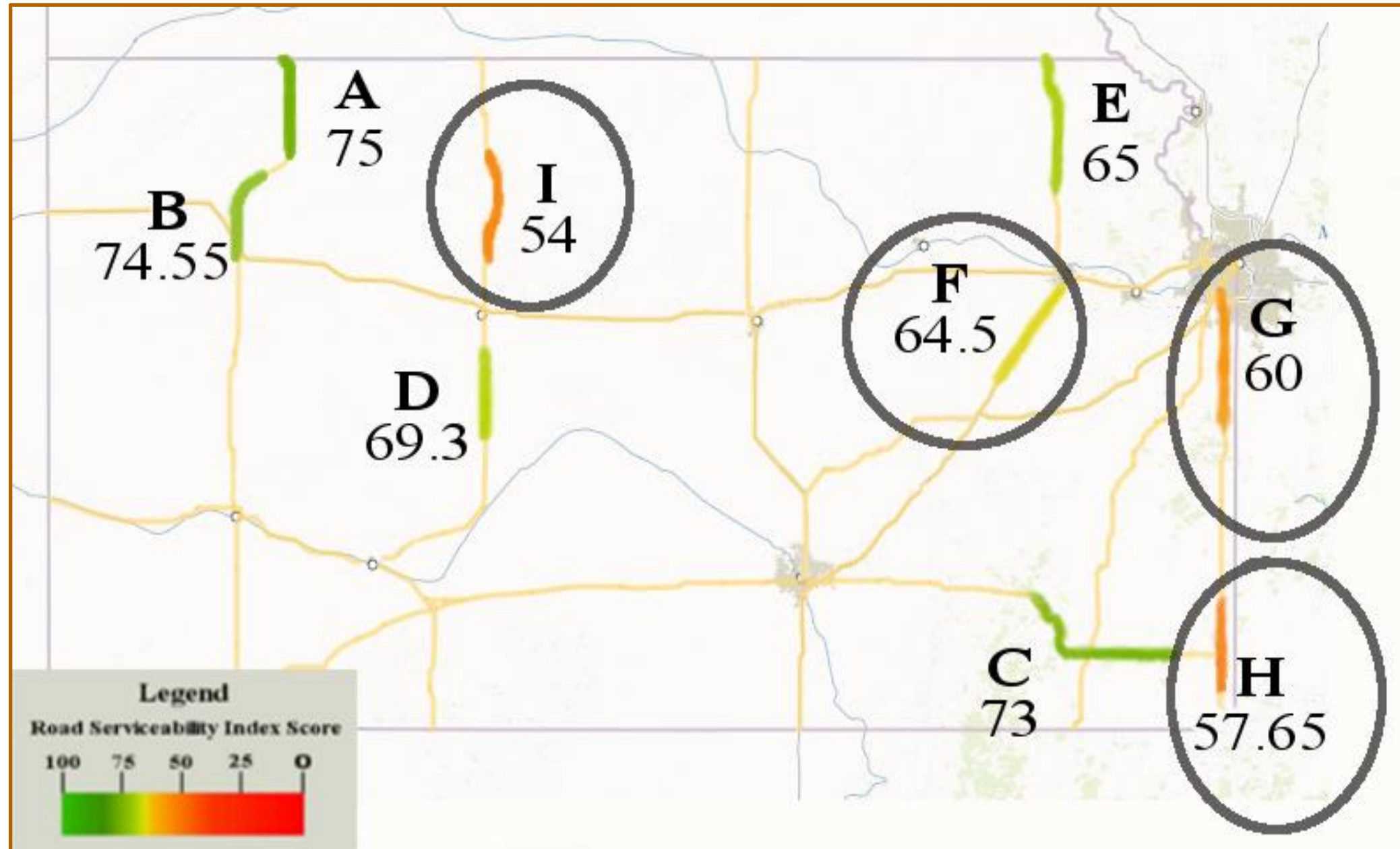
# Repair Planning – Based on SI Score



- 9 stretches of road
- All had an SI of 50-75 or a Fair SI Condition.



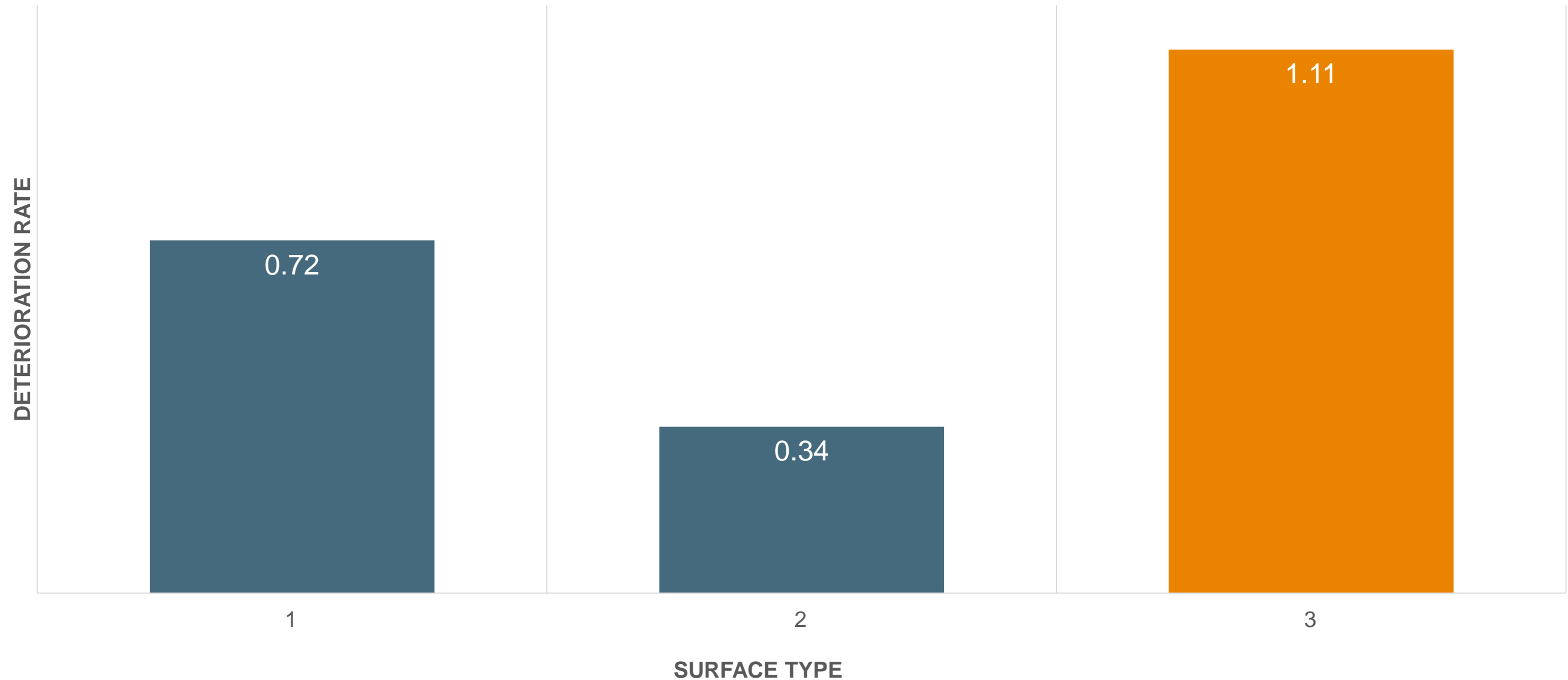
# Results by Lowest SI Scores



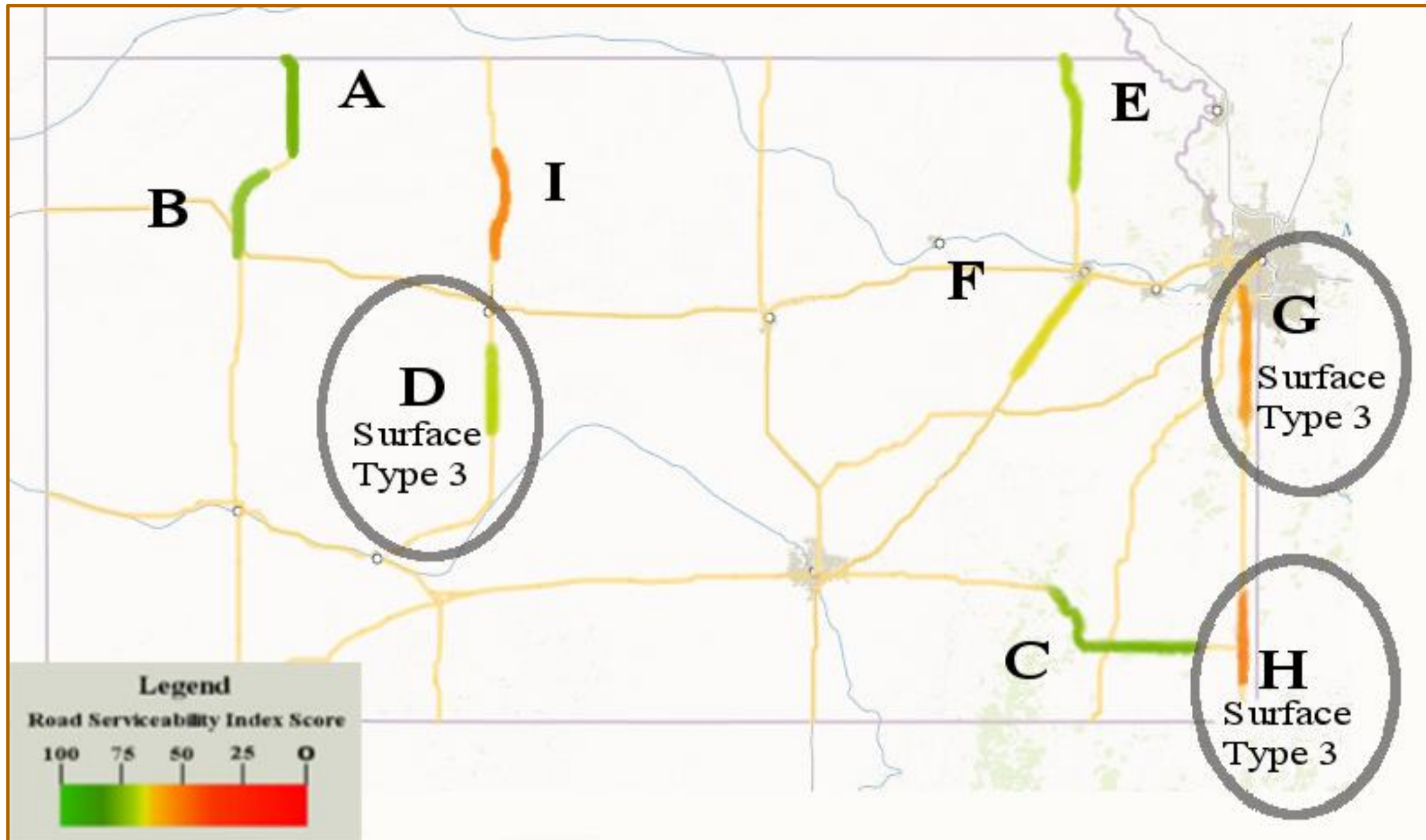
# Repair Planning – Deterioration by Surface Type



ANNUAL DETERIORATION RATE BY SURFACE TYPE



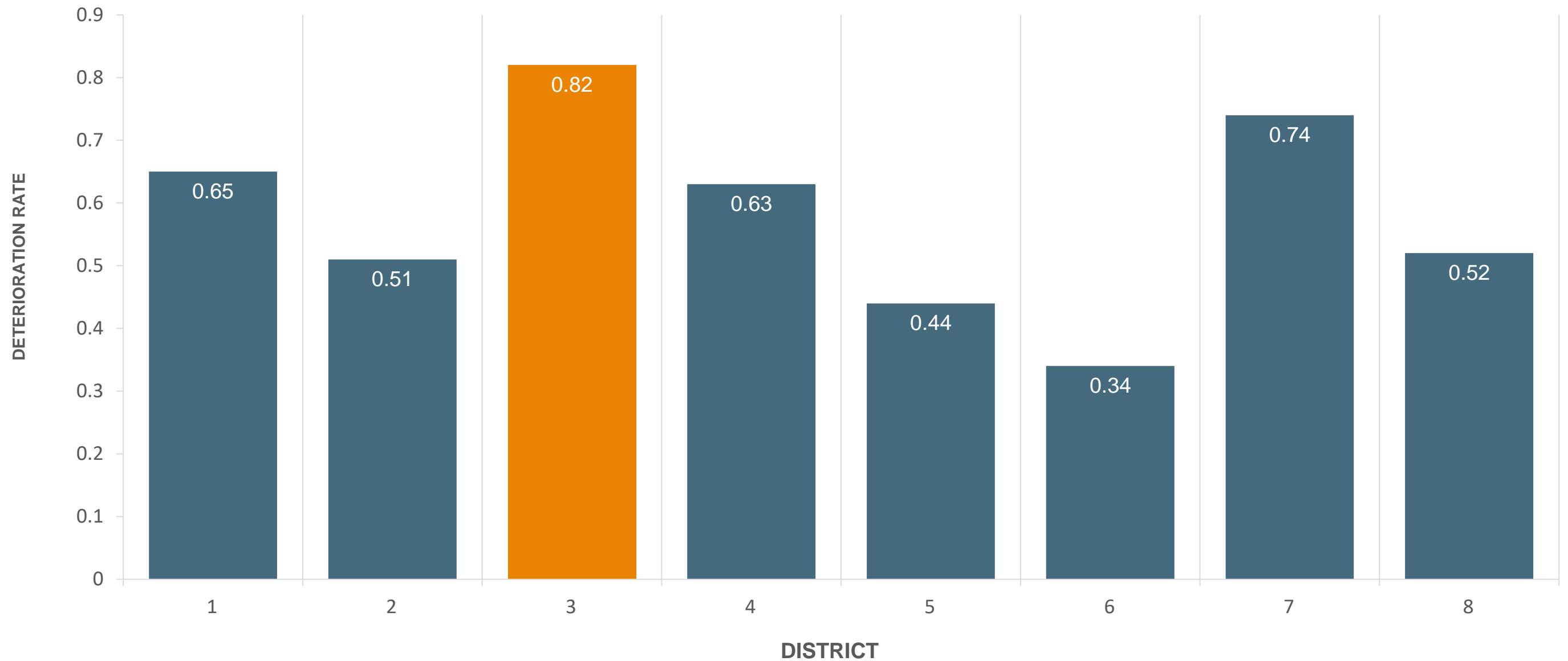
# Results by Surface Type



# Repair Planning by District

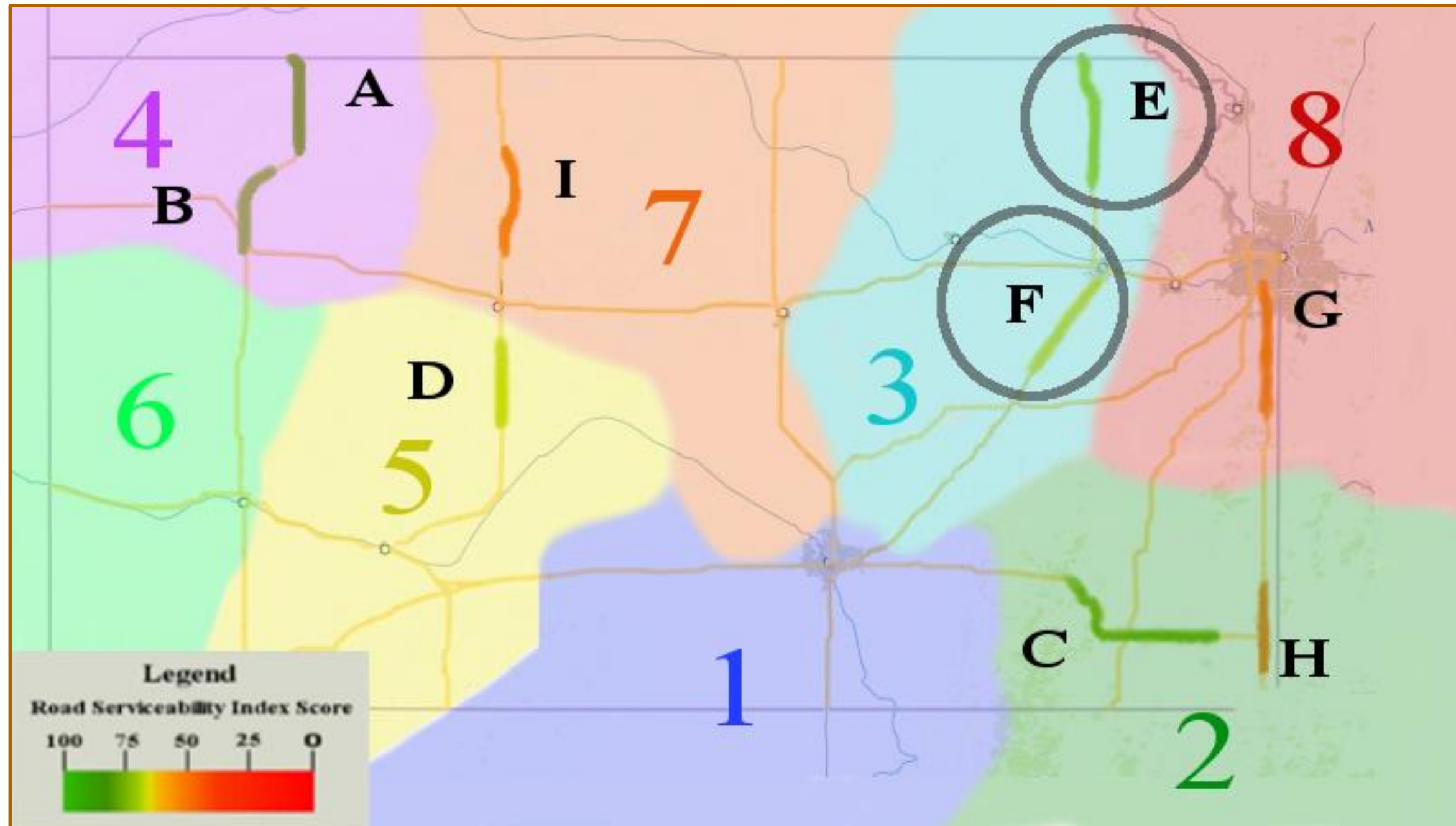


ANNUAL DETERIORATION RATE BY DISTRICT

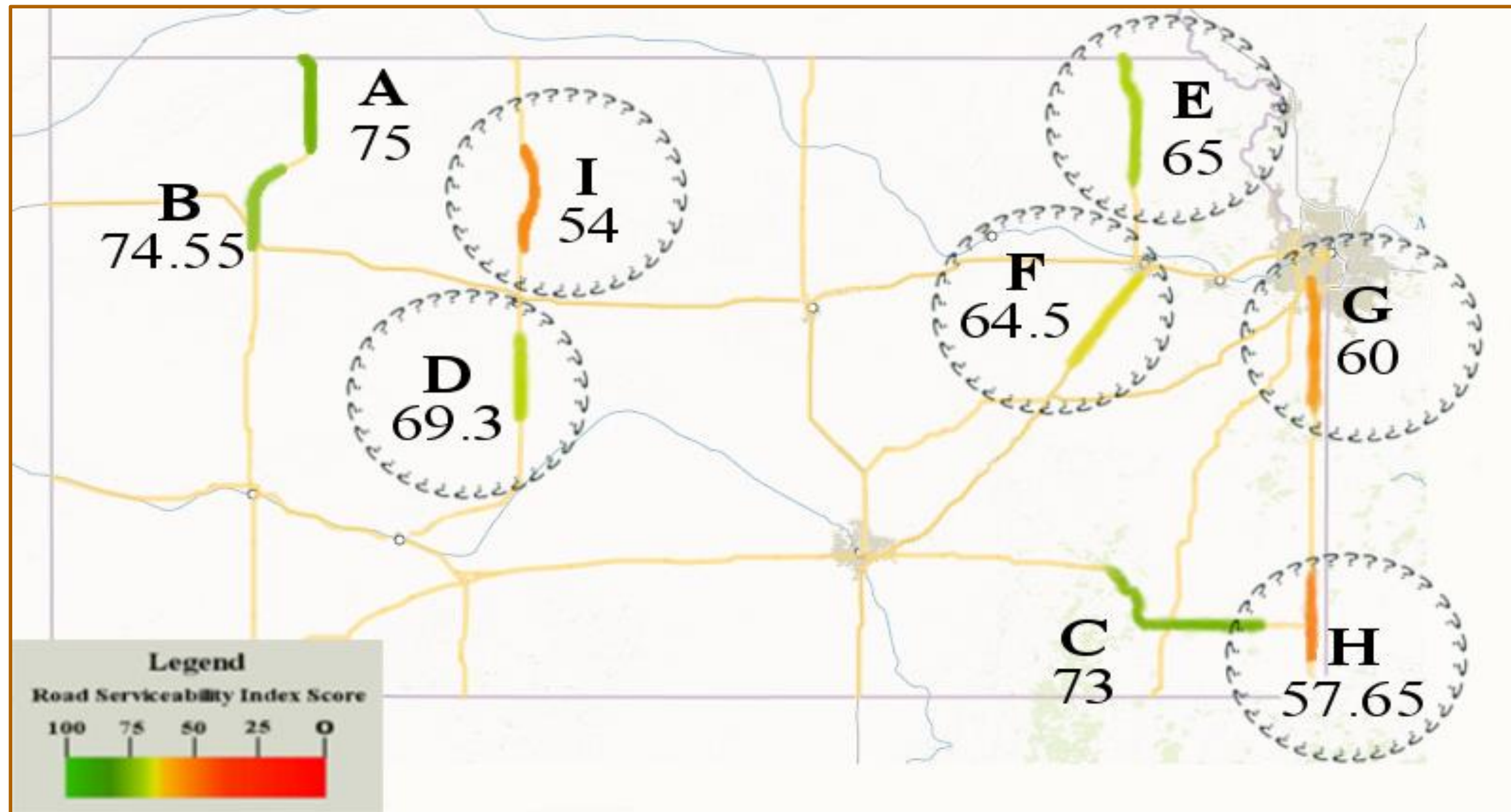




# Results by District



# Several Variables = Inconsistent Results



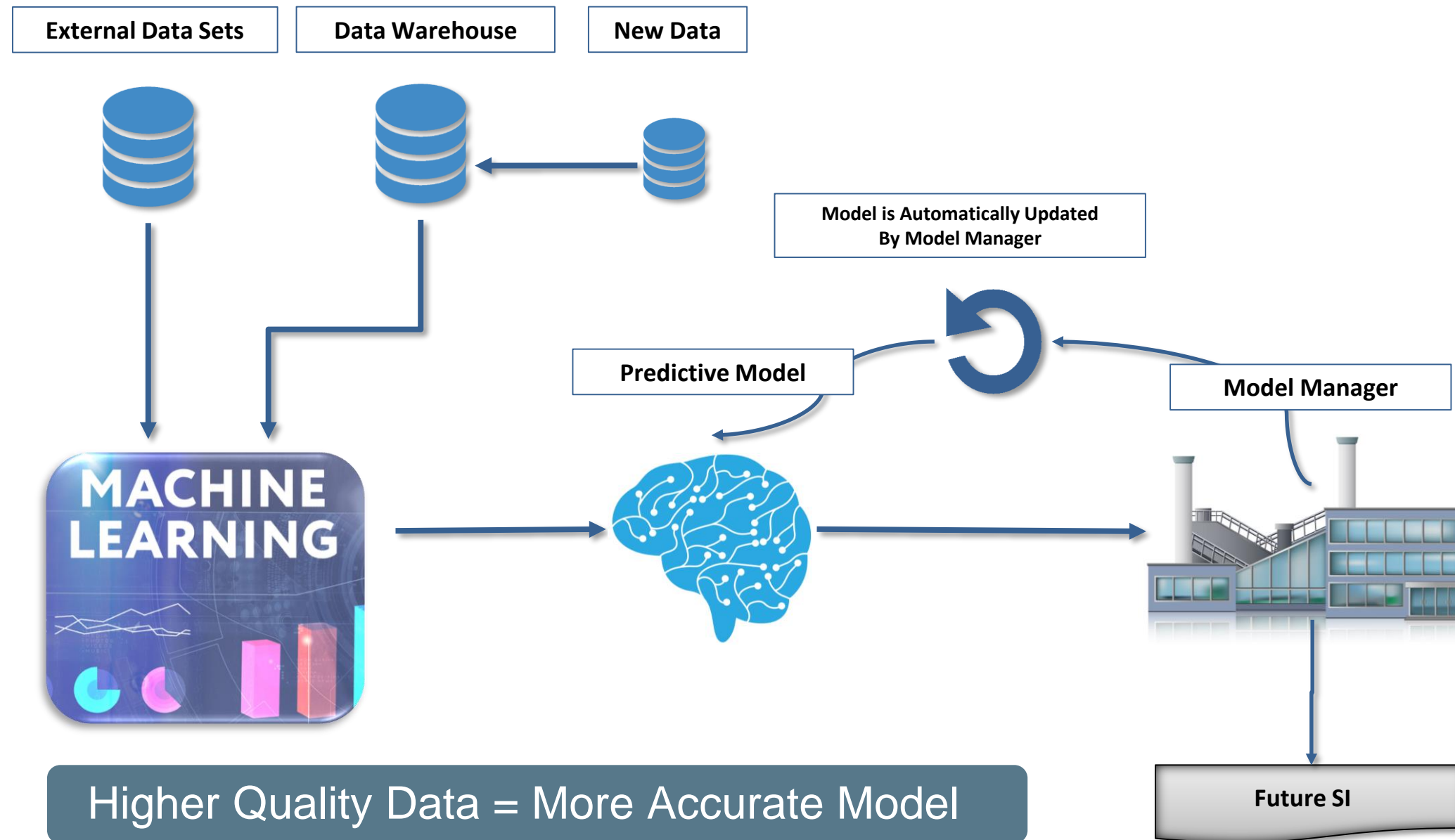
# Predictive Analytics Recommendation



- 1) Predict primary deterioration factors of roads
- 2) Predict/prioritize road repairs proactively

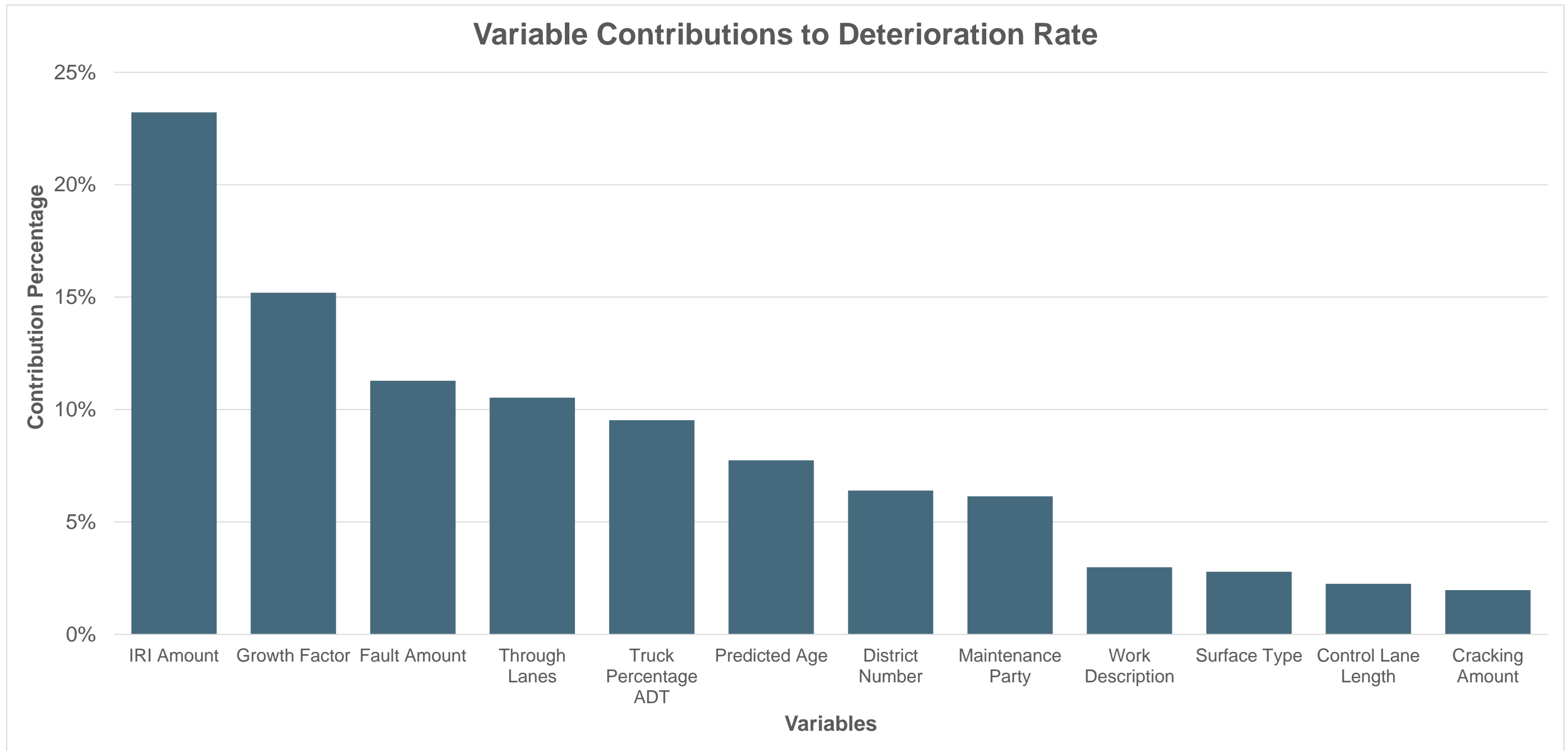


# Predicting Future SI





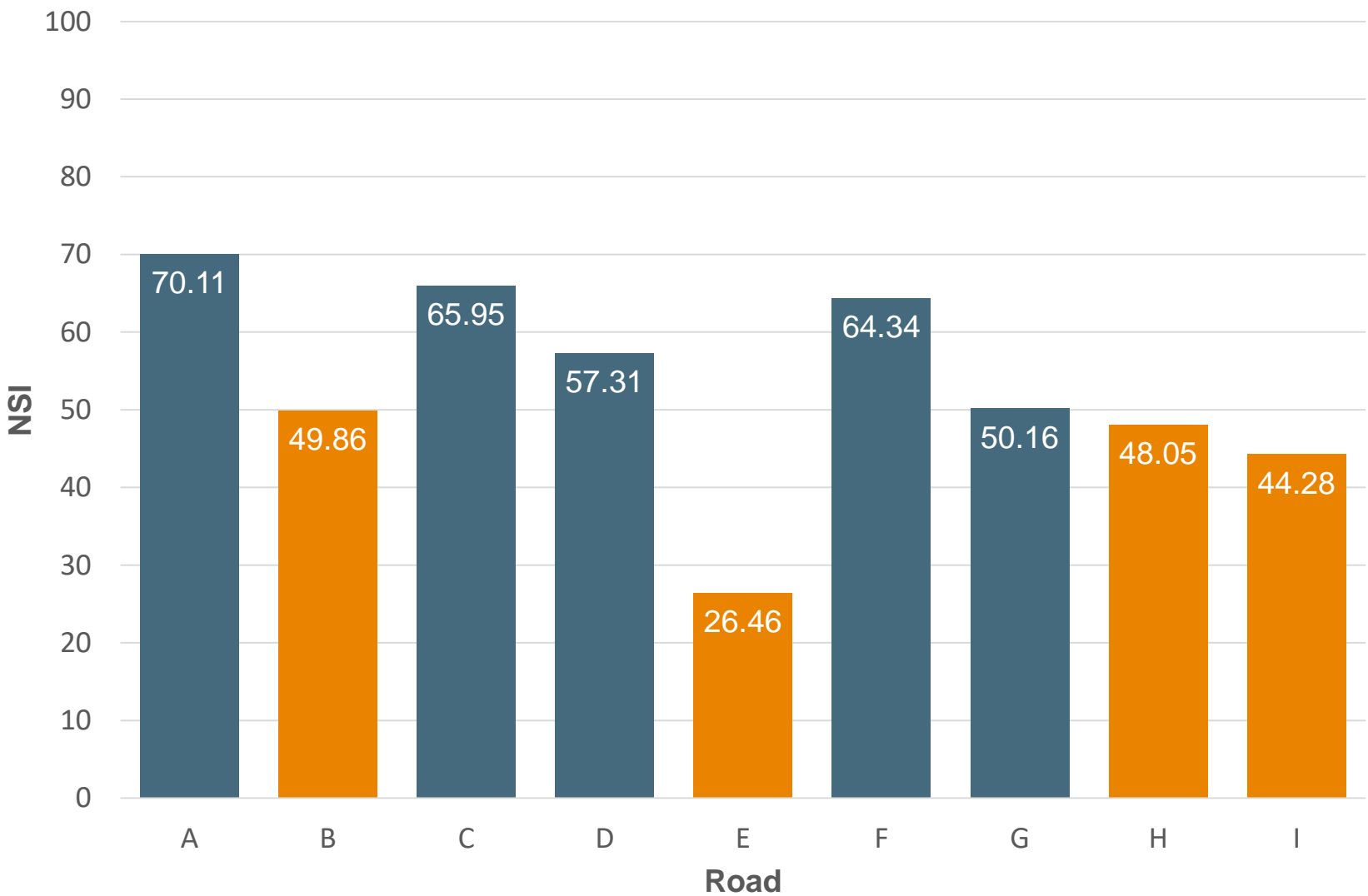
# The Difference with Predictive



# Result: 5 Year Repair Planning



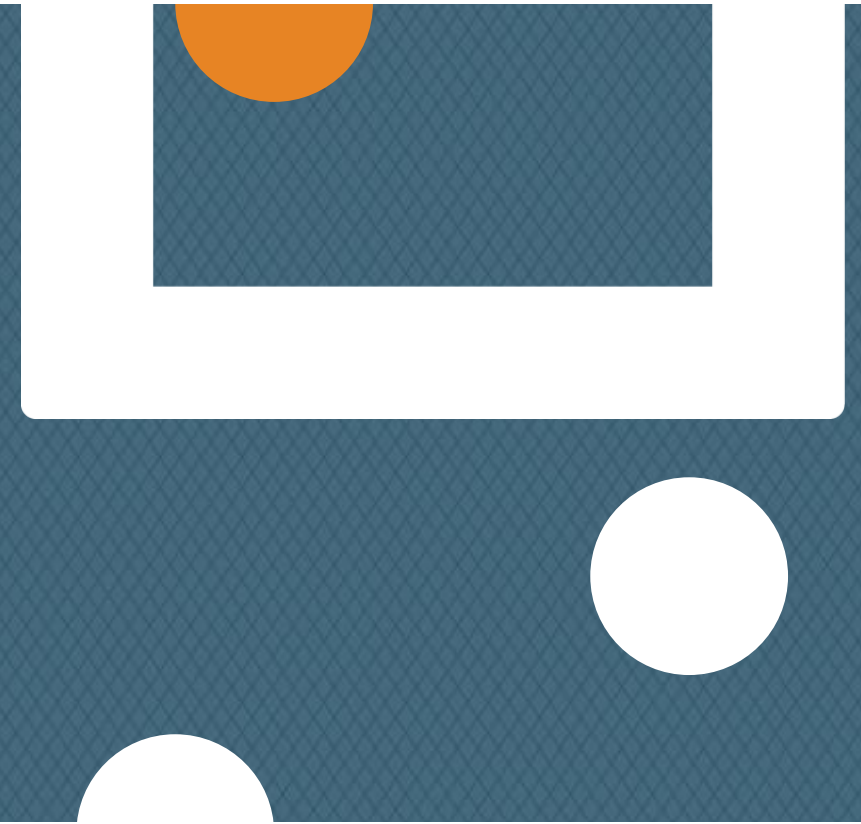
Serviceability Index by Road – 5 Year Prediction



Road	Single Variable			All Variables
	SI	Surface	District	Predictive
A				
B				Repair
C				
D		X		
E			X	Repair
F	X		X	
G	X	X		
H	X	X		Repair
I	X			Repair



# Utility Company: Optimized Bid Strategy



# Utility Company: Data-Driven Decisions



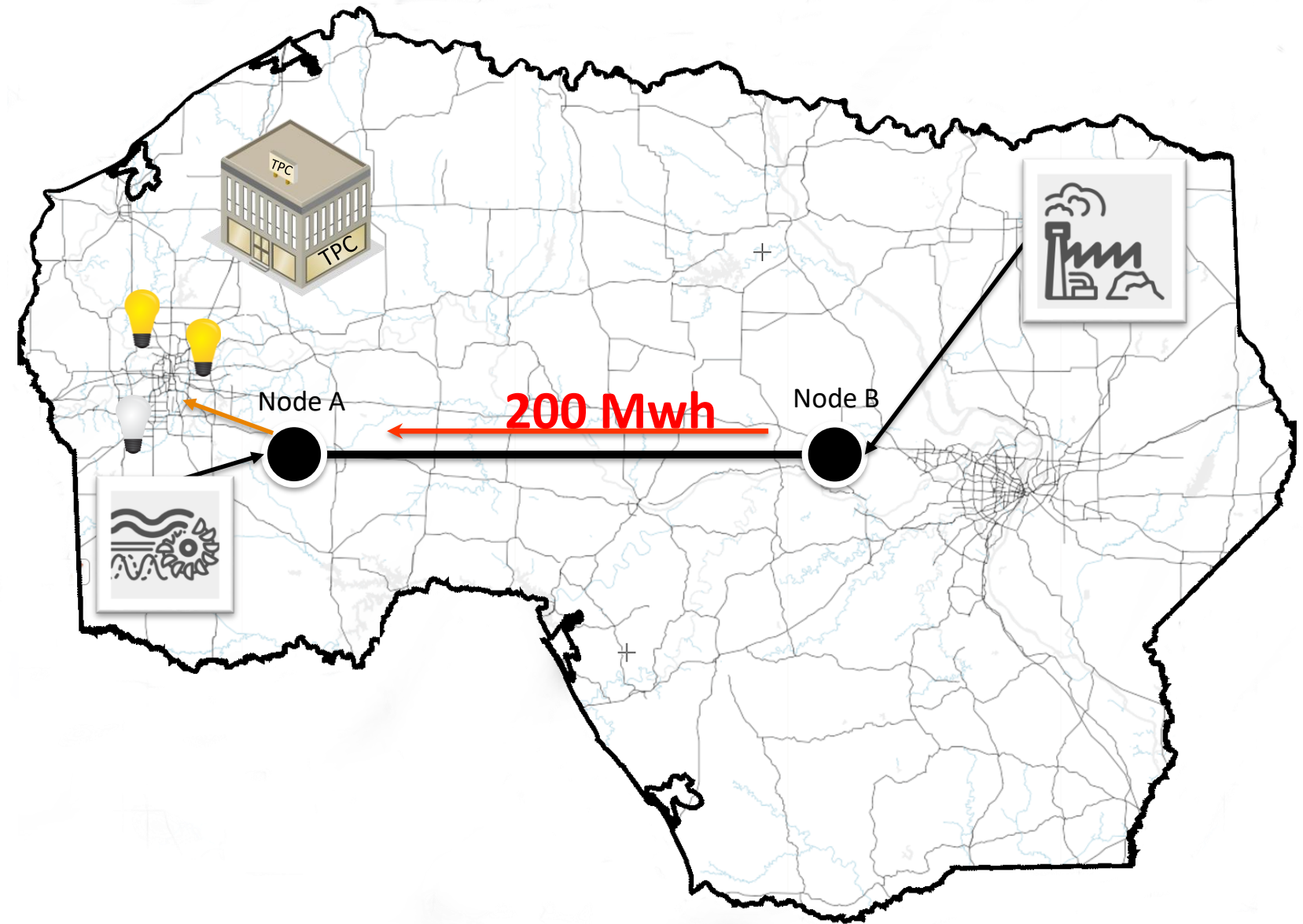
Before Predictive	With Predictive
Isolated data	Data used in proportion to its effect on the target
Unused data	Data easily analyzed for contribution to predictive models
High risk decisions	Continually assess “right time to sell” Save time Increase profits

# Energy Trading



## Bi-lateral Trade Agreement for 200 Mwh per hour

- 95% of trade occurs in day-ahead market
- Purchase options in the day-ahead market, lock in the rates, settle in real-time market
- Hours not spent in the day-ahead market can be used in real-time market the next day
- 12 Analysts



# Predictive Analytics: Challenges



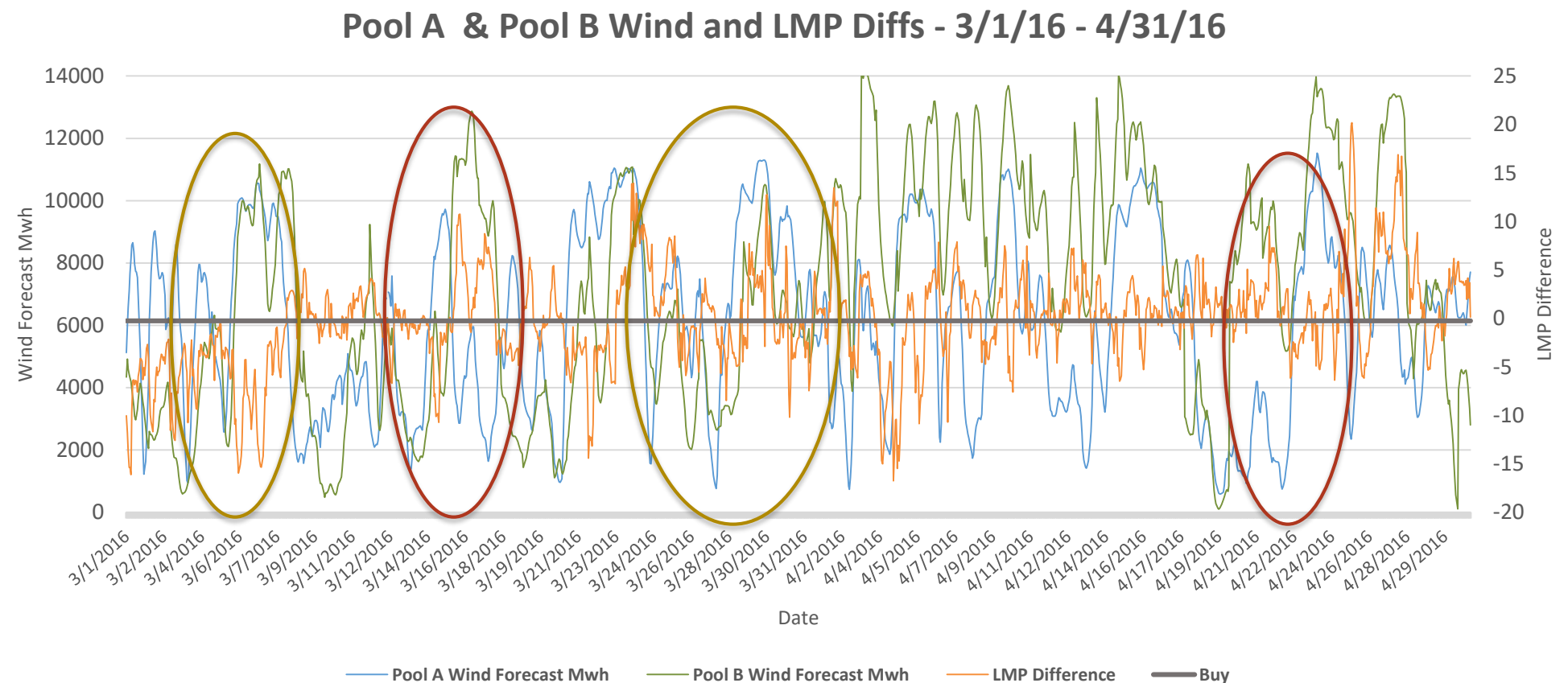
- Company wants analysts to optimize hedging strategies.
- Can they use transmission rights in a more speculative way?
- How can they be more aggressive?
- How can analysts split 200 hours between day-ahead market and real-time market?
- What is an acceptable amount of risk?
  - More speculative the company is, the more the Company is open to crew obligations
- How do we allocate human analyst resources to this challenge?



# Complex Data



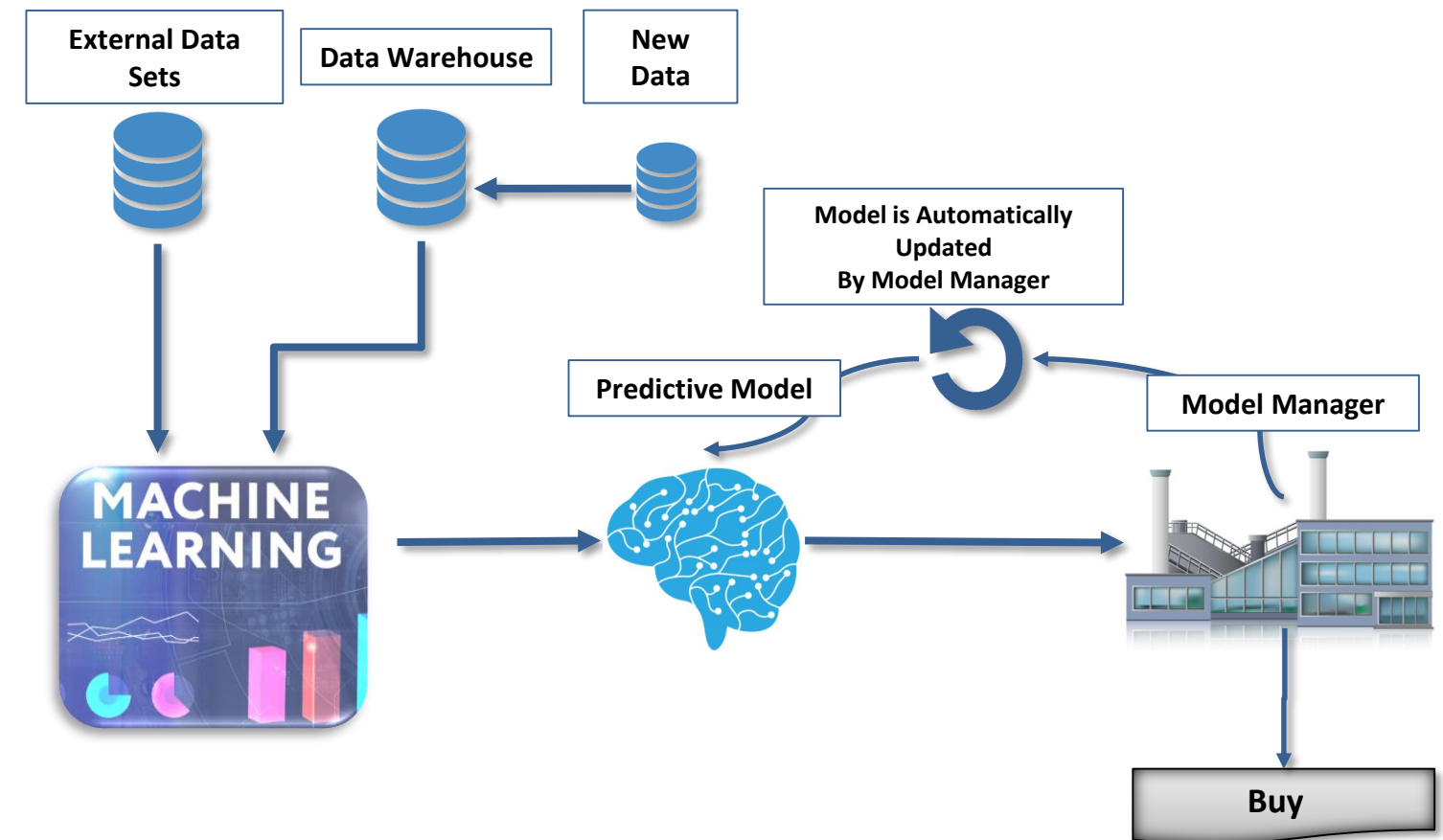
- Volume of data
  - 18 months of day-ahead hourly historical data
- Types of Data
  - Historical LMP Differences
  - Forecasted Wind Megawatt Hour Generation
  - Forecasted Midterm Load
  - Hourly Temperature
  - Natural Gas Prices



# Predicting Day-Ahead Energy Prices



- Historical data fed into predictive modeler to create Predictive Algorithm
- Algorithm predicts whether or not it is Good to Buy
- Model applied to new observations to predict whether or not it is Good to Buy for each Day-Ahead hour
- Models can be created for the specifics of Real-Time Marketing as well

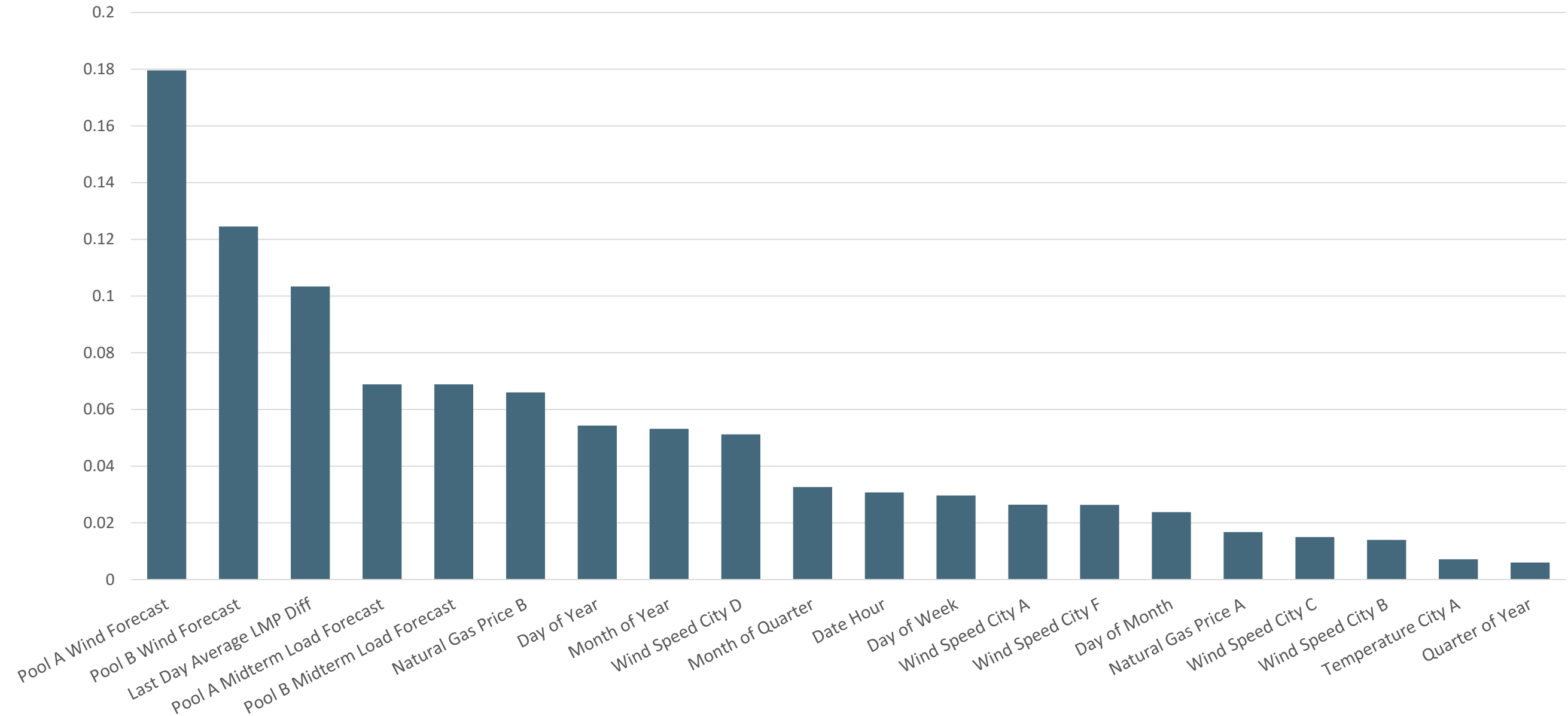




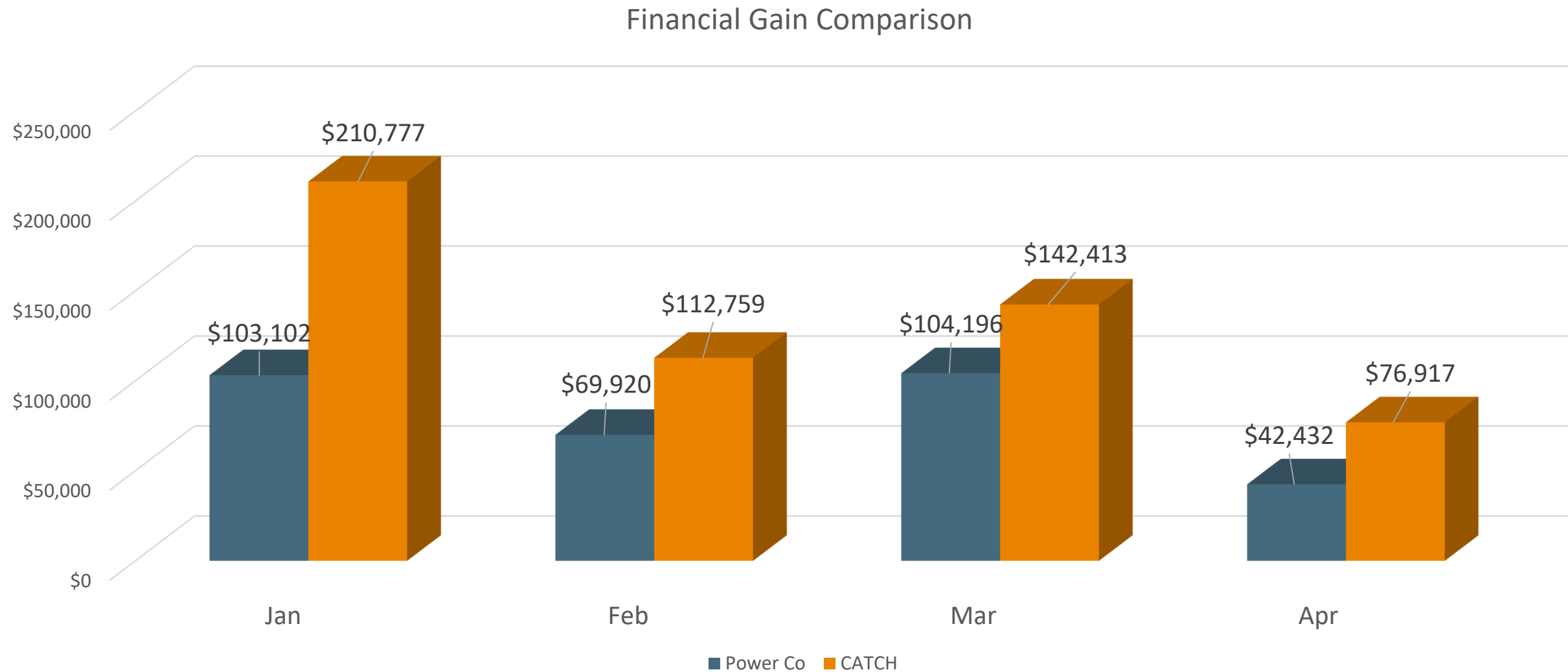
# Contributions by Variable – Day-Ahead Buy



Model Variable Contributions

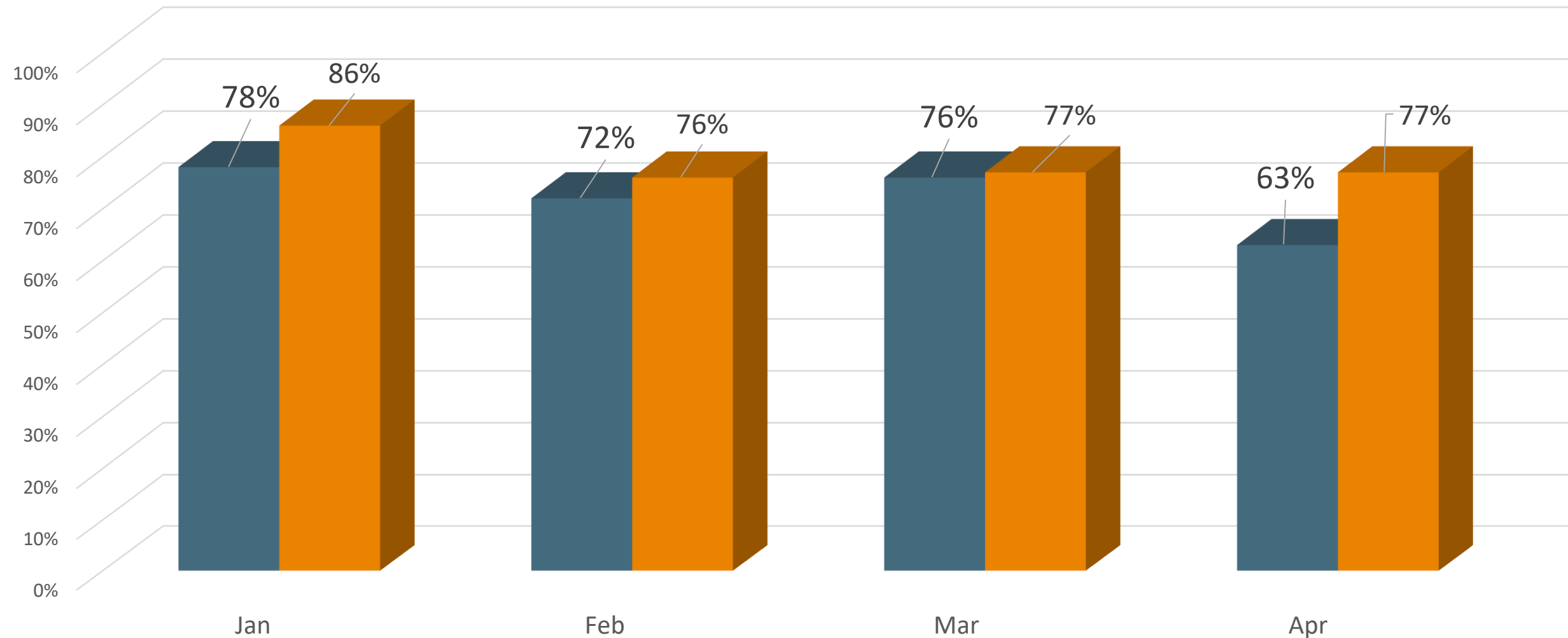


# Comparing Outcomes: Financial Gains



**\$223,216 Financial Gain with Predictive Analytics from CATCH Intelligence (4 month period)**

# Comparing Outcomes: Accurate Results



**Average Accuracy of Time to Sell:**

CATCH Intelligence 79% vs. Power Company 72%

# Comparing Outcomes: Additional Benefits

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- 84% less time involved when bid strategies are optimized by CATCH Intelligence
- Algorithms tailored to every unique bidding situation
- Manage risk exposure
- Leverage existing data infrastructure
- Remove excess costs and complexity in analytics systems



**THANK YOU**

**Jared Ellwein**  
CTO, CATCH Intelligence

**[www.CatchIntelligence.com](http://www.CatchIntelligence.com)**