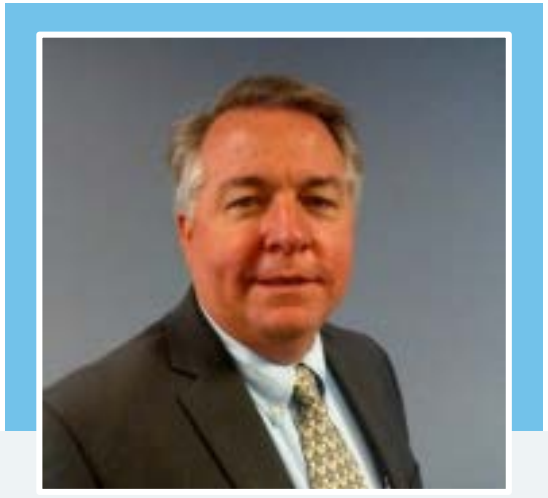
What is Predictive Construction Data and Why Should You Care?

Speakers



Tim Duggan

Director of Analytics

RSMeans data

Russ Mitchell

Enterprise Consultant

RSMeans data

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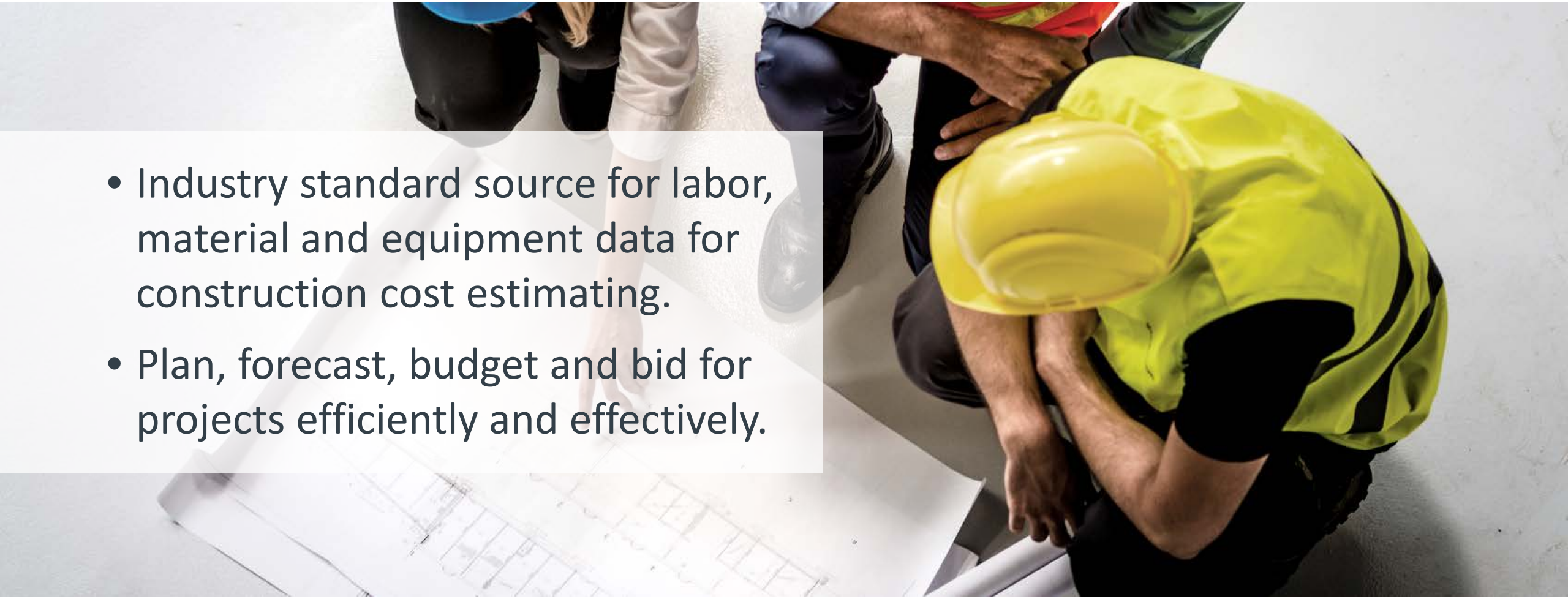
Introduction to RSMeans data

RSMeans Overview



- Industry standard source for labor, material and equipment data for construction cost estimating.
- Plan, forecast, budget and bid for projects efficiently and effectively.

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RSMeans data

- Improve cost estimating accuracy
- Minimize cost overrun risks
- Defend budgets and estimates with industry-standard data
- Prioritize and budget maintenance costs
- Customize the data for your project

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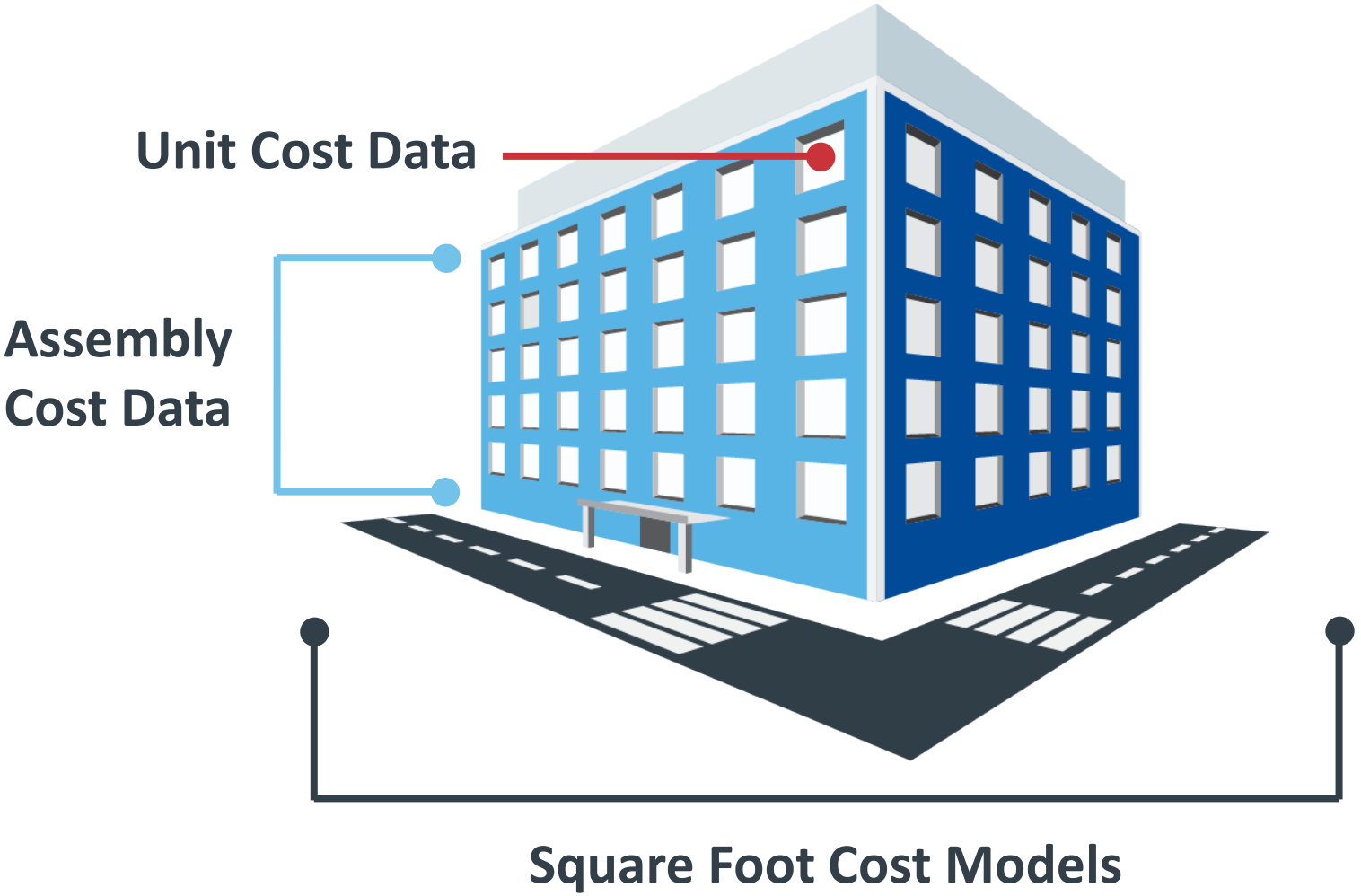
Structure of RSMeans Database

Localized to >900 North American locations



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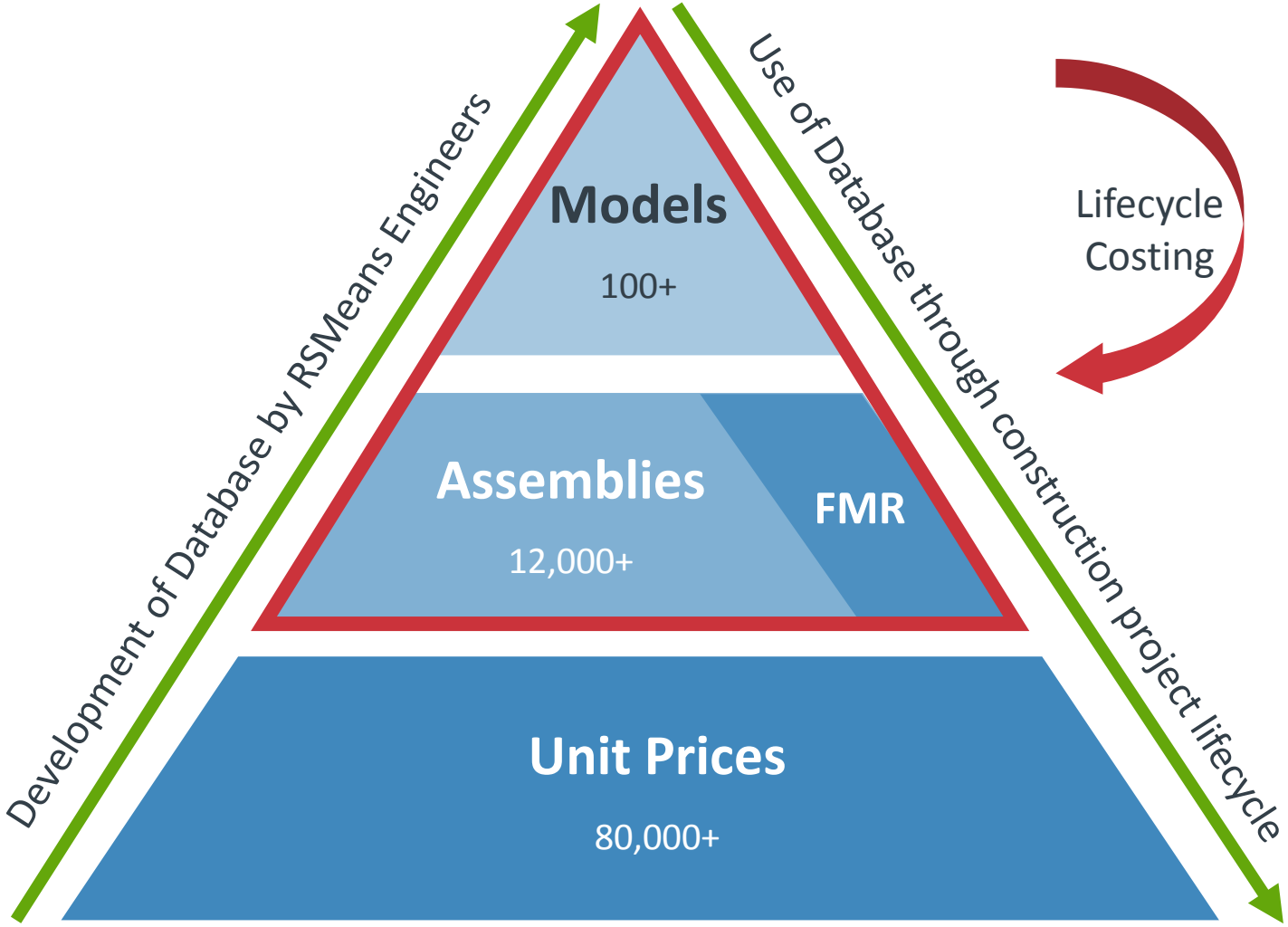
Review of RSMeans Database Structure



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The Value of RSMeans data

Improve Estimate Accuracy

- Fill gaps in preliminary estimates
- Quote benchmark prices
- Estimate labor hours

Compare & Verify Costs

- Against the national average
- Against localized pricing
- Subcontractor bid prices
- Complete estimates

Capital Planning & Forecasting

- For lifecycle maintenance and repairs
- For future construction projects

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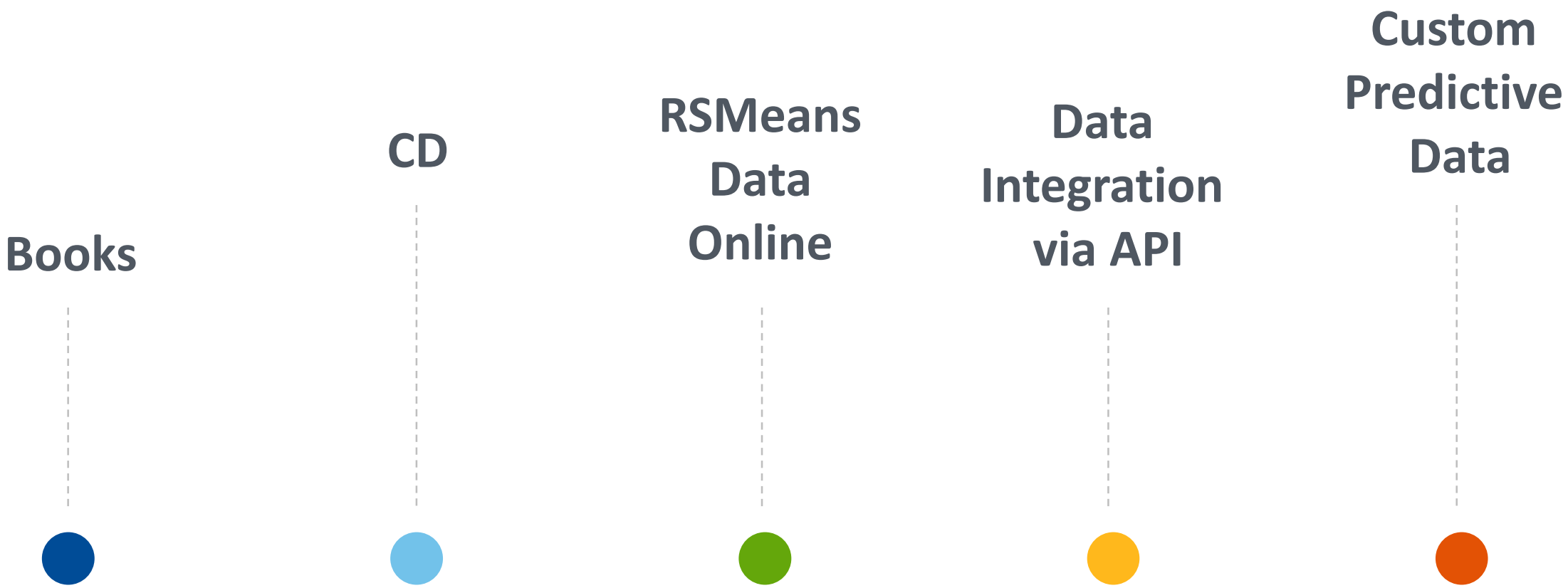
Evolution of Accessing the Data



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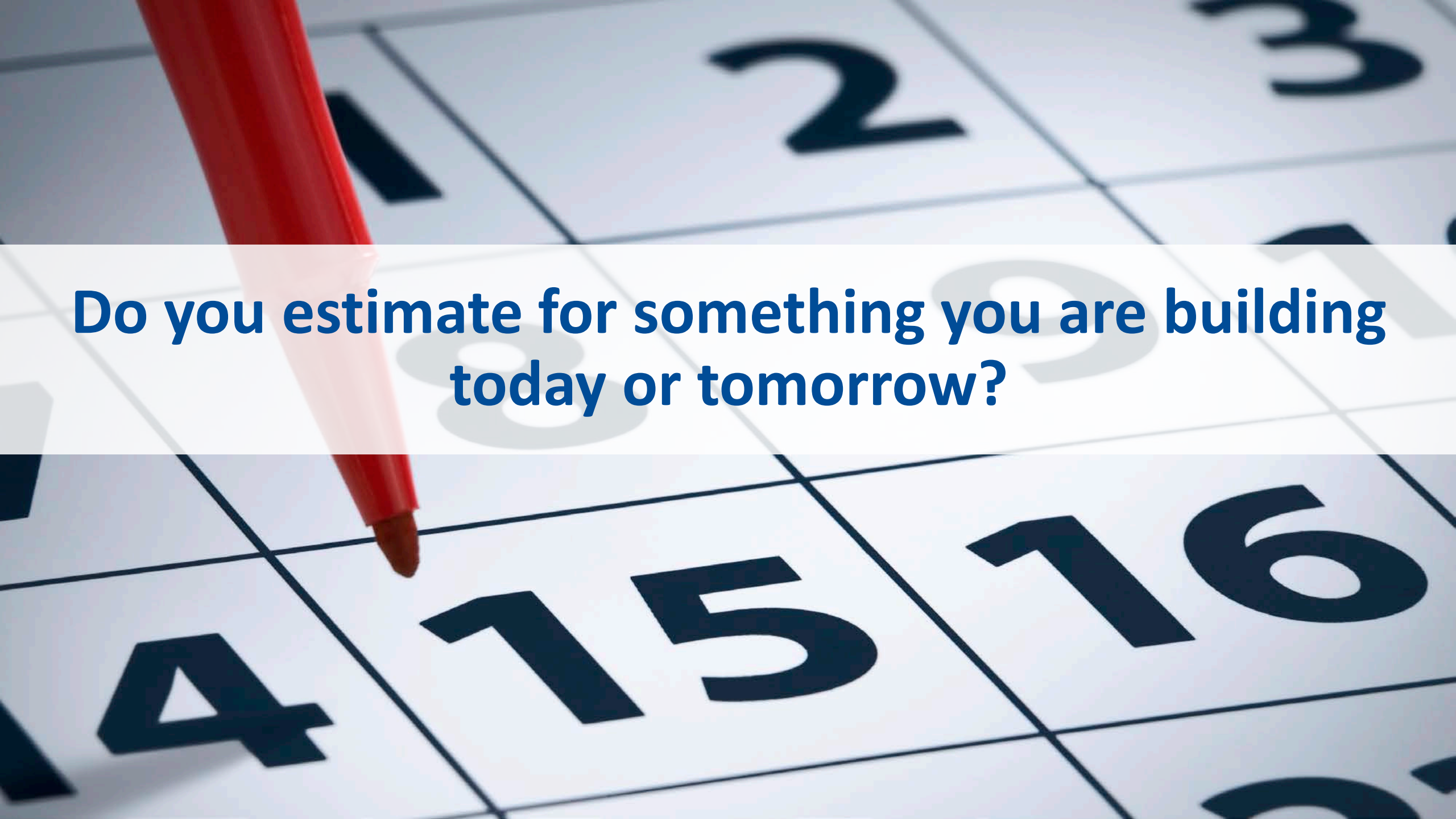

Do you estimate for something you are building today or tomorrow?

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Predictive Cost Data and Estimating for Tomorrow

Why Predictive?

Current Tools

- Macro vs. Micro Markets
- Forecast Models
- Demand Models
- Predict Market Conditions
- Predict “soft” costs

Data Needs

- RSMeans data is the Gold Standard for construction costs
- RSMeans data has over 75 years of historic costs
- RSMeans data has approximately 100+ models

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Construction Cost Data: Simple in Theory

- Material costs are based on commodities and manufacturing costs and profits
- Labor and labor cost is based on supply and demand
- Construction is a combination of material, labor and equipment costs rolled up with productivity

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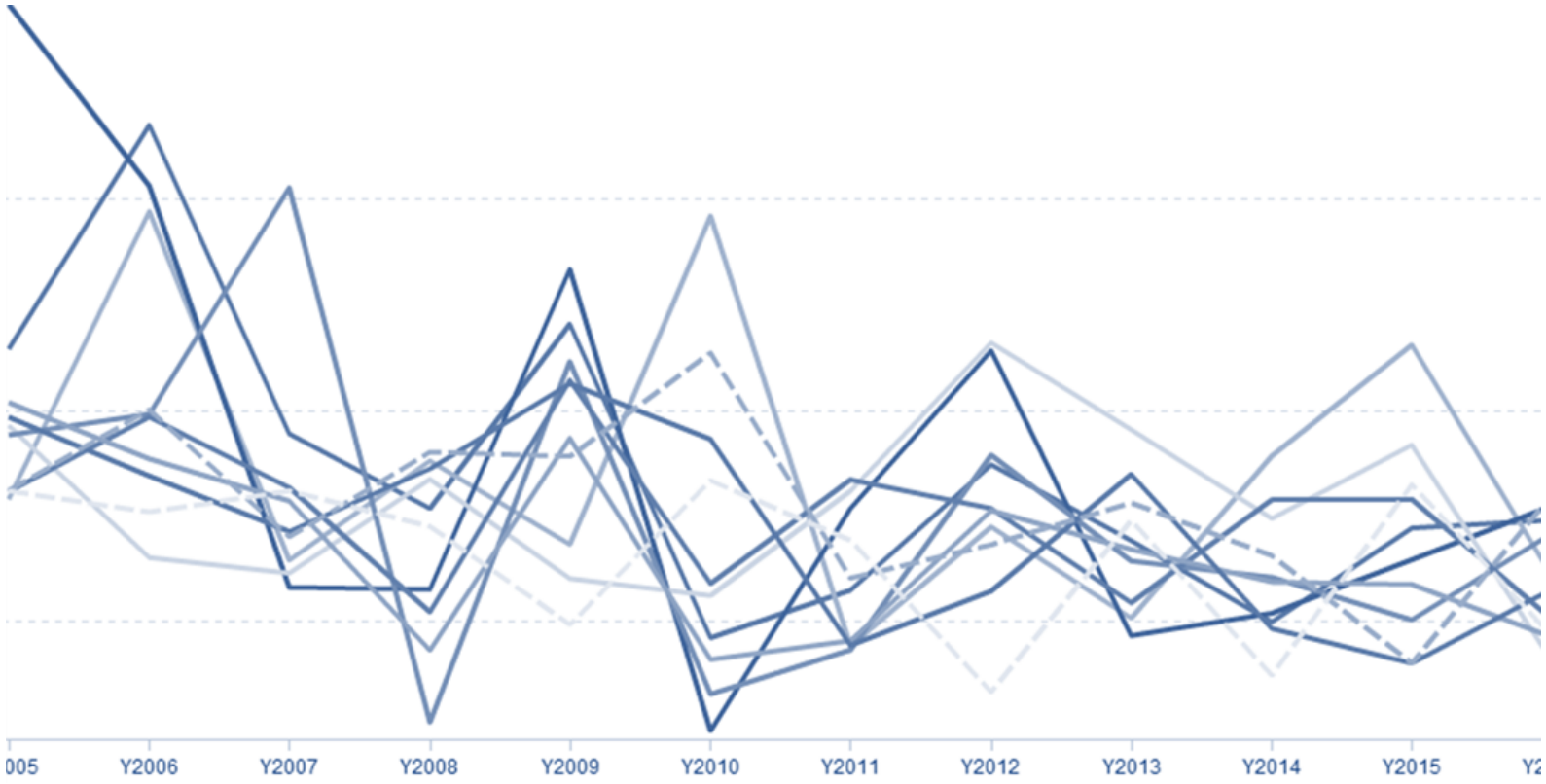
Predictive Construction Cost Data: Complex in Application

- Commodity-driven prices are volatile and do not move in tandem
- Labor costs are market-specific and slow to respond to increased demand
- Technology change and site conditions drive productivity
- Construction market is very cyclical



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What is Missing?

- Predictive data to accurately reflect near term costs
- Data that accounts for future market conditions
- Detailed data at early stages to cover “soft” costs
- Intersection of granular and parametric methodologies
- The ability to compare predictive data with actual historic costs to create new insights
- Estimating to Procurement data

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Cost Estimations

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Cost Estimations

- We can teach an estimator to convert a project to material, labor, equipment and apply productivity algorithms to estimate accurately

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Cost Estimations

- We can teach an estimator to convert a project to material, labor, equipment and apply productivity algorithms to estimate accurately
- Five factors that influence future estimating accuracy:
  1. How far in the future
  2. Location of project
  3. Local market activity
  4. Contracting method
  5. Global commodity price influence

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Cost Estimations

- We can teach an estimator to convert a project to material, labor, equipment and apply productivity algorithms to estimate accurately
- Five factors that influence future estimating accuracy:
  1. How far in the future
  2. Location of project
  3. Local market activity
  4. Contracting method
  5. Global commodity price influence
- Equals accurate estimate

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Factors that Drive Cost Changes

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A Better Solution

Multivariate Analysis (Structural Modeling)

- Multiple external datasets / variables
- Algorithms based on market conditions
  - An analysis of market drivers, true "predictors"
- Based on a combo of classical statistics and more contemporary machine learning and data mining techniques
- Overcomes "forecast" limitations for **increased error at micro markets which does not foresee market swings**

Industries Using Predictive Data

Risk
Premiums
Care
Diagnosis

Volatility
Interest
Creditworthiness

Amazon
Google
Yahoo
Everyone

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Methodology Input Metrics

Data Mining Structural Predictive Models

300+ indicators → **139 indicators** → **81 indicators** → **19 indicators**

- 300+ indicators: economic, construction industry, and material-specific indicators reviewed from Moody's Analytics
- 139 indicators: downloaded for exploratory analysis and comparison to RSM metal price data from 2002-2017
- 81 indicators: selected for more refined statistical analyses
- 19 indicators: chosen that looked most promising from advanced analysis

15 models → **4 best models** → **2 models**

- 15 models: created and compared predictive capabilities of each
- 4 best models: selected to enter validation/quality control phase
- 2 models: have withstood quality testing criteria

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Data Used

Economic Indicators

- Average Weekly Hours Manufacturing Workers
- Average Weekly Initial Claims Unemployment
- Manufacturers New Orders Consumer Goods
- Manufacturing and Trade Inventories to Sales Ratio
- Civilian Employment to Working Age Ratio
- Consumer Installment Credit to Personal Income
- M2 Money Supply
- Personal Income to M2 Money Supply M2
- Corporate Profits after Tax
- Coincident Index to Lagging Index Ratio
- ISM Commodity Prices Diffusion Index
- Interest Rate Spread 10 Year T-Bills Less Federal Funds
- Consumer Credit Total
- Consumer Credit Card Debt Outstanding to Personal Income
- ECRI Coincident Index
- ECRI Lagging Index
- ECRI Weekly Leading Index
- Employment – Total Nonfarm
- Housing Permits
- Housing Starts
- Interest Rates – Bank Prime Loan
- Trade Balance
- New Vehicle Sales
- Personal Consumption Expenditures
- Unemployment Rate - Total
- Average Weeks Unemployed
- ISM New Orders Index
- Total Population
- Retail Sales excluding Motor Vehicles
- Household Financial Obligations
- S&P Stock Price Index
- New Business Starts
- New Orders – Advanced Durable Goods
- Inventories to Shipment Ratio – Total Manufacturing
- Percent of Loans Past Due
- Commercial Real Estate Price Index

Construction Industry Indicators

Material Group Indicators

Analytical Information

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Data Used

Economic Indicators

Construction Industry Indicators

Material Group Indicators

Analytical Information

Architectural Billings Diffusion Index
Construction Price – New One-Family Homes
Commercial Property Price Index
Dow Jones REIT – Commercial Mortgages
Dow Jones REIT - Premium
Composite Housing Affordability Index
Industrial Production – Construction Supplies
Crude Oil Prices
WTI Oil Prices
Job Hires Rate - Construction
Job Openings – Construction
Construction Laborers – Number of Workers

Construction Laborers – Number of Workers Percent Change
Construction PIP to Commercial Mortgage Commitments Ratio
Construction PIP to Construction Job Openings Ratio
Commercial Mortgage Commitments
Construction PIP
Construction PIP Percent Change
Produce Price Index – Architectural Services
Insured Unemployment – Construction
Commercial Real Estate Price Index
AIA Architectural Billings – Commercial / Industrial
AIA Architectural Billings – Residential

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Data Used

Economic Indicators

Construction Industry Indicators

Material Group Indicators

Analytical Information

Total Inventories Primary Metals
New Orders Primary Metals
Shipment Primary Metals
Unfilled Orders Primary Metals
Iron and Steel Export to Imports Ratio
Capital Cost Architectural and Structural Metals Manufacturing
Unit Labor Cost – Primary Metal Manufacturing Index
New Order to Inventories – Primary Metal Ratio
Import Price – Steelmaking and Ferroalloying Materials Index
Import Price – Iron and Steel Mill Products – Index – Difference
Unfilled Orders to Production – Metal - Ratio

Iron and Steel Exports
Iron and Steel Imports
Iron and Steel World Production
Value of Construction PIP to Private NR Manufacturing Fabricated Metal – Ratio
Production – Architectural and Structural Metals – Total Dollar Value
PPI: Fabricated Structural Metal Products
Iron and Steel Scrap Index
PPI: Primary Metal Manufacturing

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Data Used

Economic Indicators

Construction Industry Indicators

Material Group Indicators

Analytical Information

- Trends of cost data tell how costs have changed in the past
- Comparison of actual costs normalized by collected cost data identifies local condition variance

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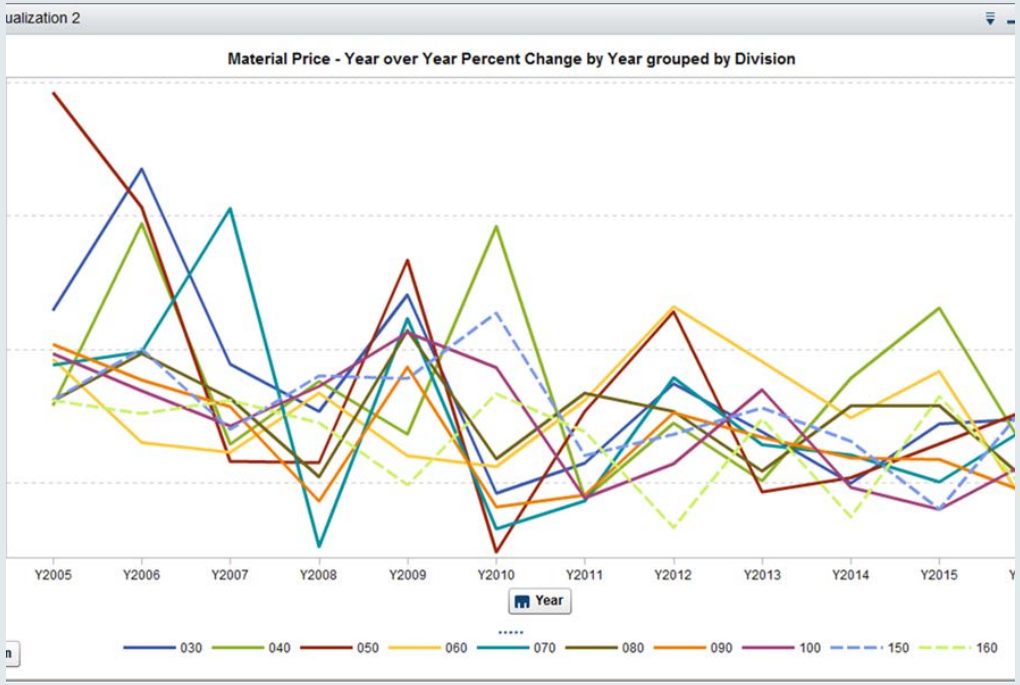
Develop Predictions Based on Historical Trends



- Conceptual cost modeling
- Predictive algorithms at unit cost level
- Predictive renovation models
- Custom factors
- Life cycle costs enhanced with predictive

What about non-industry external factors that affect our predictions/budgets?

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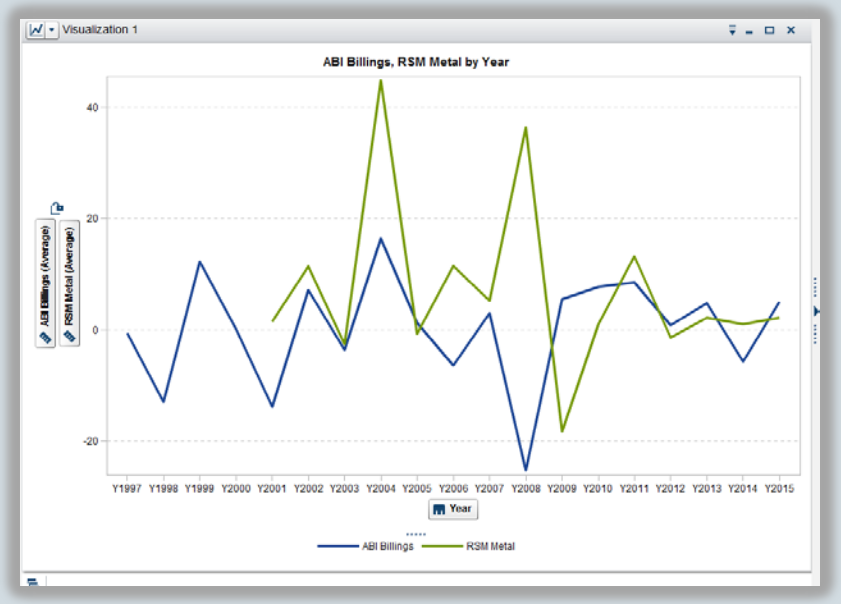
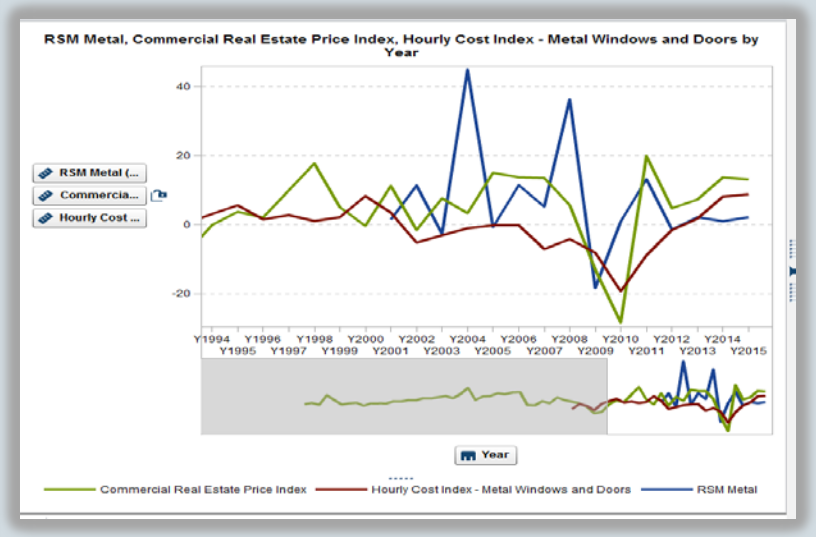
Data Understanding is the Basis for Predictive

Examples of Exploratory Analyses





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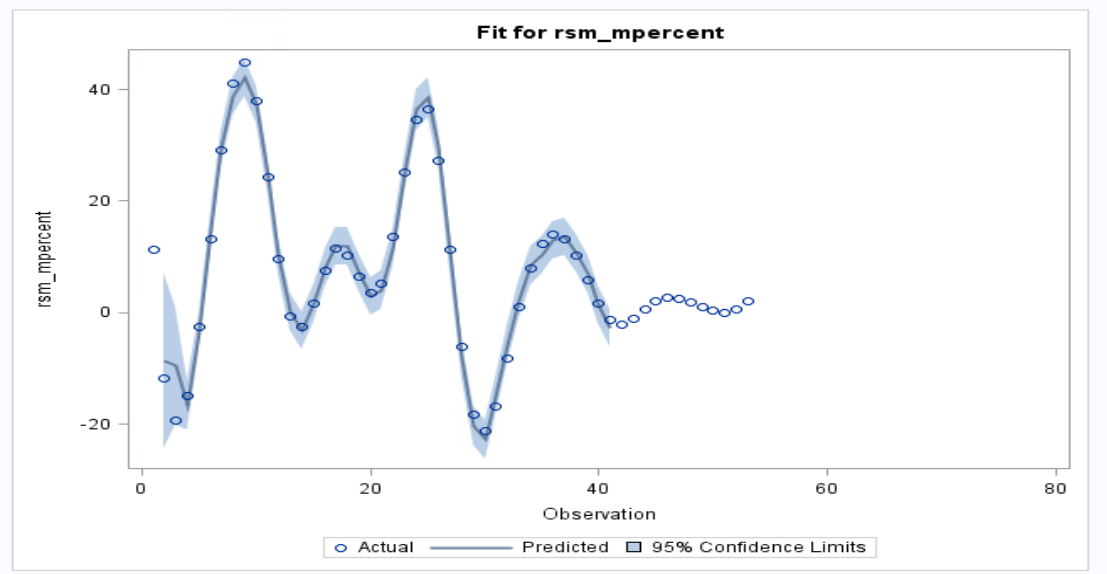
Applying Predictive Analytics to Traditional Cost Data

Predictive Model Cost of Specific Material

- Unit price level custom algorithms
- National indexes
- Global predictors



Y Axis is Year-over-Year Percent Change in Price of Material
X Axis is the Number of Quarters, Starting with 2002Q1

**Note the volatility of change*

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RSMeans Predictive Model

- Factors are applied with specific weighting and lead/lag, based on tested algorithms.
- Different predictive models are needed for each material type

Predicted market downturn within 2 percentage points 3 years in advance

Also predicted market recovery within 2 percentage points 3 years in advance

Model Results

year: quarter	rsm_mpercent actual	rsm_mpercent predicted	difference actual - predicted
2008:01:00	36.36	38.54	-2.18
2008:02:00	27.23	29.83	-2.60
2008:03:00	11.21	10.86	0.36
2008:04:00	-6.03	-8.13	2.09
2009:01:00	-18.33	-20.28	1.95
2009:02:00	-21.27	-22.78	1.50
2009:03:00	-16.88	-15.23	-1.65
2009:04:00	-8.32	-5.86	-2.46
2010:01:00	0.94	2.34	-1.40
2010:02:00	7.88	8.48	-0.60
2010:03:00	12.25	10.44	1.82
2010:04:00	14.04	13.04	1.00
2011:01:00	13.23	13.54	-0.31
2011:02:00	10.18	10.69	-0.51
2011:03:00	5.88	6.96	-1.09
2011:04:00	1.57	1.51	0.06
2012:01:00	-1.40	-2.80	1.40

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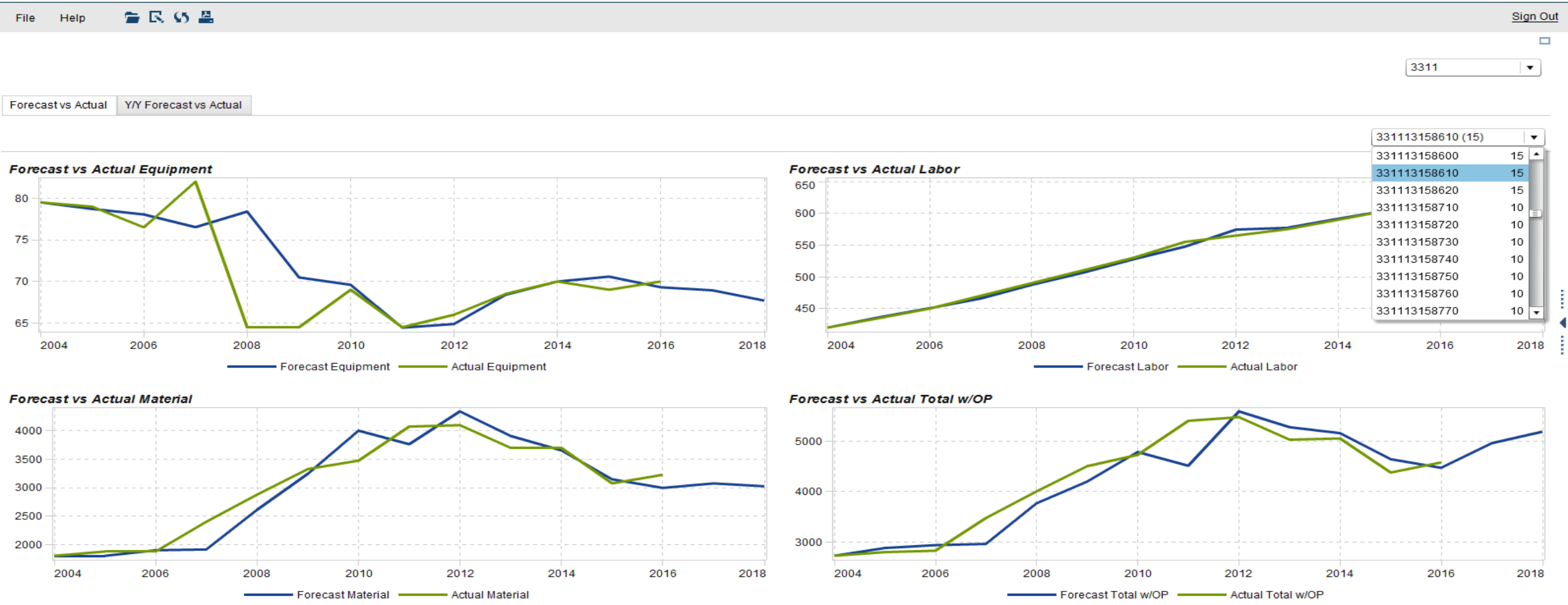
60k+ Unit Line Items



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Real World Application

Current Challenges

Need for flexible design changes

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Current Challenges

Need for flexible design changes

Need for value engineering

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Current Challenges

Need for flexible design changes

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Managing to a budget while upholding market standards

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Current Challenges

Need for flexible design changes

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Managing to a budget while upholding market standards

Material volatility

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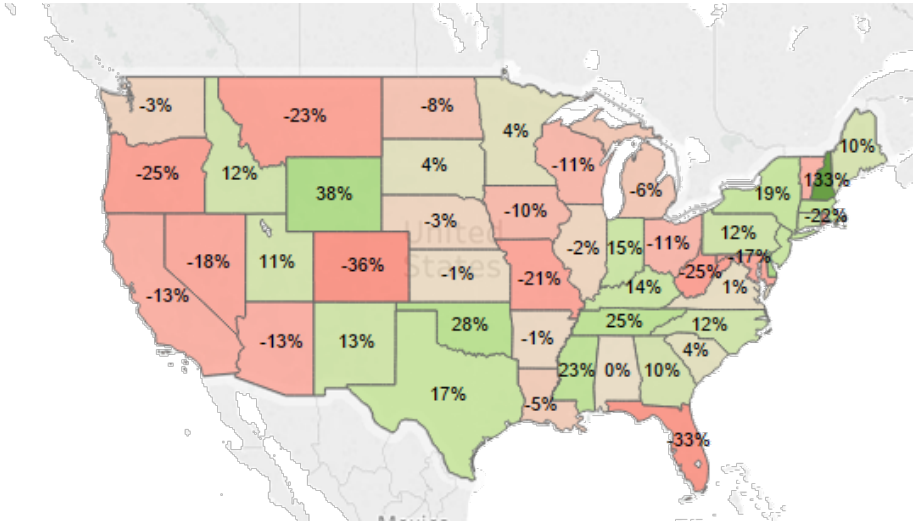
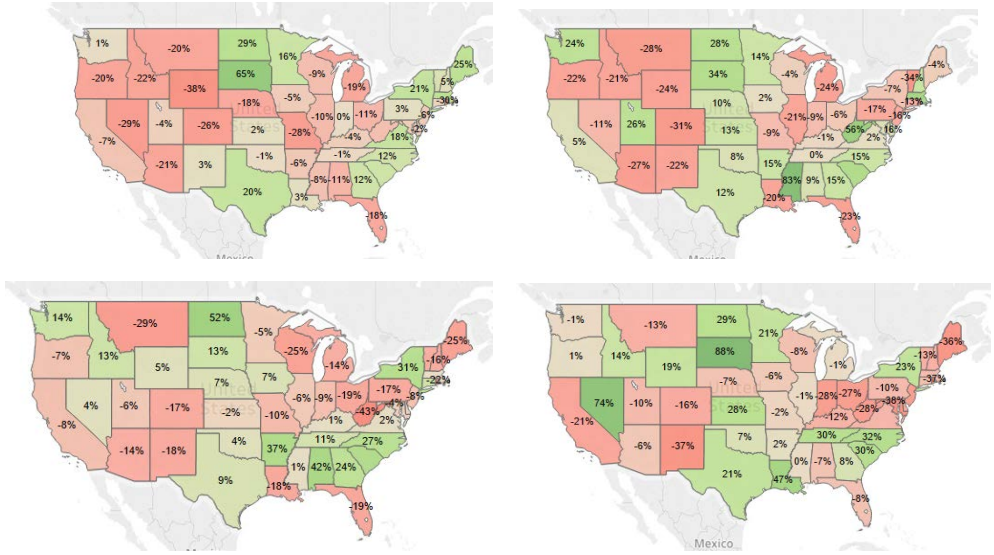
Understand Future Market Conditions

Market Intelligence Analysis of Y/Y Change In Construction Spend Per Construction Labor Pool

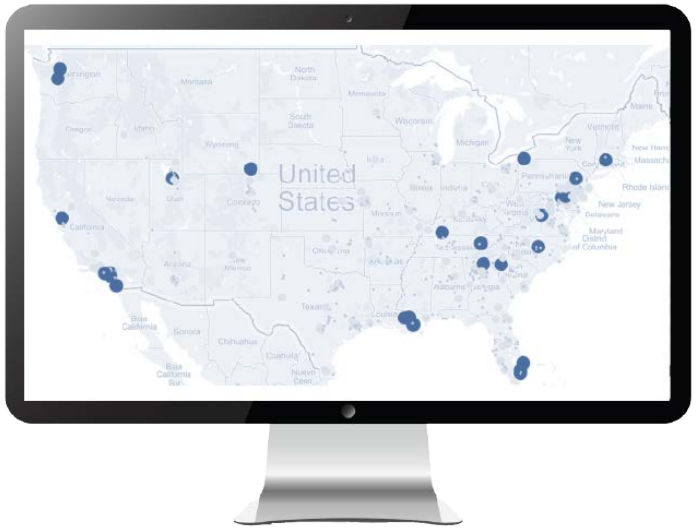


Changes in this year to year activity metric directly affect the cost to construct

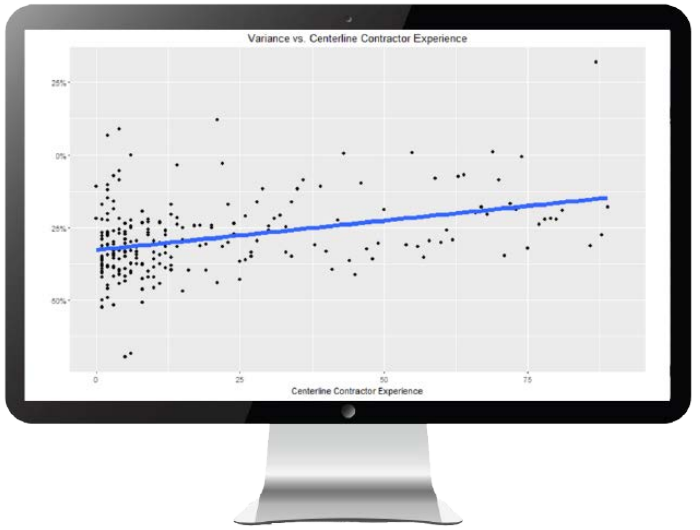


How much construction $ can each person handle without cost change?

Leverage Customized Benchmarking



Determine program cost variances



Understand construction inefficiencies

Identify improvement opportunities

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Conclusion

Improved Decision Making

Establish and communicate benchmarks to align the team to the budget

Improve visibility to future cost impacts on projects

Build defensible budgets

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To learn more about Custom Predictive RSMeans data,
visit **rsmeans.com/enterprise**

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