Data-Driven Modeling Engine for Short-Term Forecasting

MetLife Stadium (MLS) Transit Ridership Forecasting Approach

presented to

Model Task Force, Fall 2023

presented by

Cambridge Systematics, Inc.

Nikhil Puri

TEAM: Moby Khan, Jason Lemp, Daniel Patterson, and Xuenan Ni

CAMBRIDGE SYSTEMATICS

Think Forward

November 8, 2023

Data-Driven Models in Response to Demand Model Pain Points

CHALLENGES

- Long model development & run times
- Constrained by model limitations
- Difficulty explaining results
- Poor reporting and visuals

APPROACH

- Data-driven models*
- Scalable and short run times
- Improved visuals and reporting
- Rooted in modeling best practices for short-term forecasts
- Ability to blend data sources and model input

* Data-driven models are data agnostic

Big Data-Driven Model Examples

CAMBRIDGE SYSTEMATICS
Think Forward

- **ORANGE COUNTY, NY –** Model development from scratch in the absence of a household travel survey
- **SAN DIEGO –** Multimodal sketch planning tool – walking, biking, transit mode shares
- **METLIFE STADIUM DATA-DRIVEN MODEL**
- **ONEIDA COUNTY, NY –** Highway corridor sketch planning model (underway)
- **SAN FRANCISCO BAY –** Mode share and transit competitiveness sketch planning tool

MetLife Project Description

Secaucus Junction – Meadowlands Complex

Secaucus Junction

10 rail lines | **Gameday rail** to MLS

Meadowlands Complex

MetLife Stadium

American Dream Mall

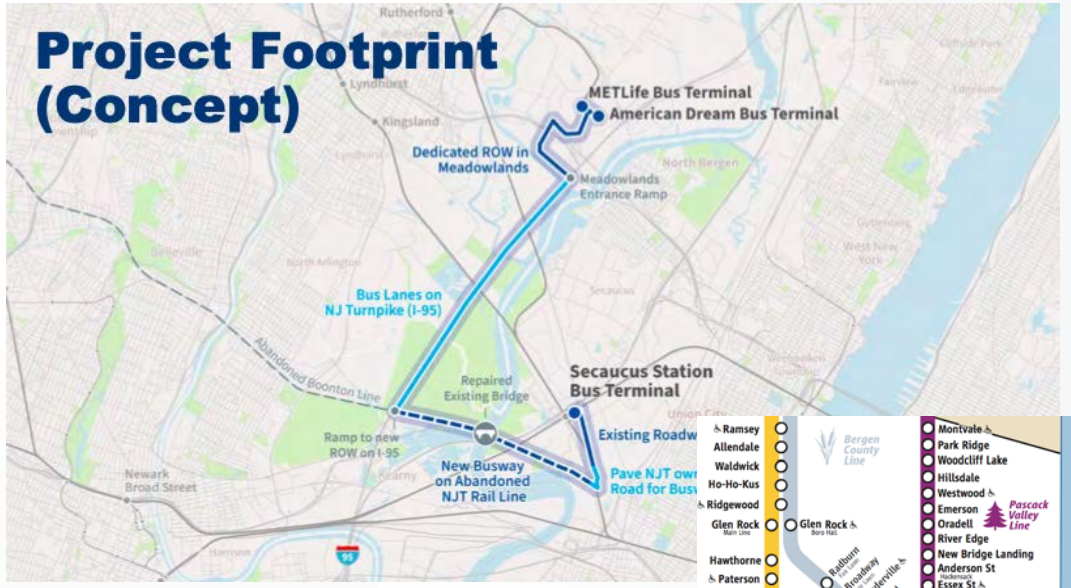
Racetrack

Key Events

Football and soccer games

Concerts

Weekends



CAMBRIDGE SYSTEMATICS

Modeling Approach Rationale

CREATIVE SOLUTION TO A NONTRADITIONAL CHALLENGE

CHALLENGE

- Predominantly weekend travel
- Flexibility to expand service market
- Ability to consider markets beyond model region
- Limited data availability
- Short deadline

APPROACH

- Leveraged LOCUS – allows scalability add tailored solutions
- Developed a sketch planning tool using best practices
- Leveraged regional models
- Short-term forecasts

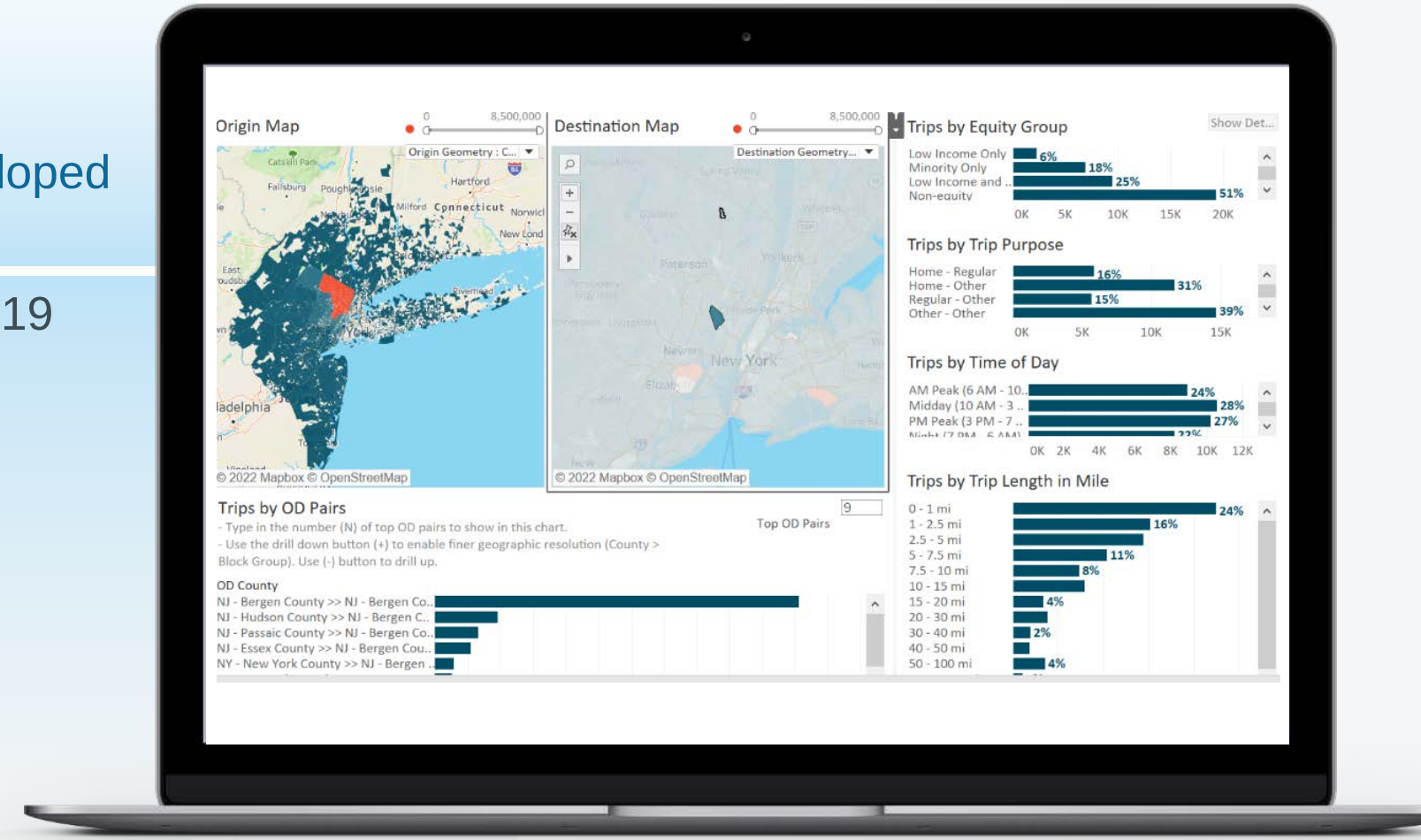
* LOCUS – Big data platform developed by Cambridge Systematics

Establishing a Baseline – LOCUS

LOCUS

BIG DATA PLATFORM developed by Cambridge Systematics

- ✔ Anonymized cell phone data – 2019
- ✔ Travel patterns
  - » origin-destination
  - » time of day
  - » equity tagging
  - » trip purpose
- ✔ Dashboarding
- ✔ Ability to analyze raw data to answer unanticipated questions



CAMBRIDGE SYSTEMATICS

Trip Generation

Trip Generation is an input into the model

For example, the user specifies the following:

- **Number of MLS attendees** for a particular event
- **Number of visitors to the mall**

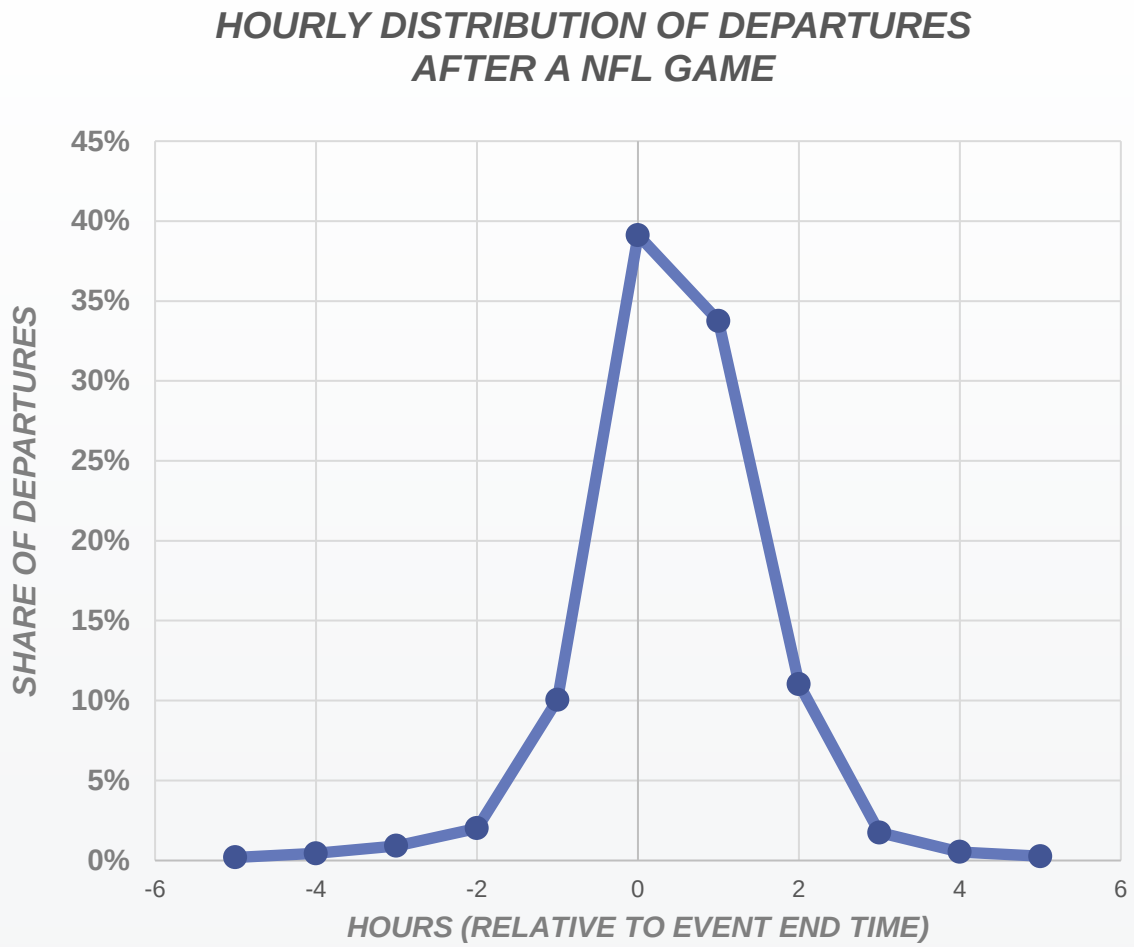
Event type is an input

- **For stadium –** sports event, concert, and other
- **For mall –** weekday, Saturday or Sunday

Trip Distribution

Relied on LOCUS data for trip distribution	*Tailored approach to account for lower than anticipated sample size*	*Ability to leverage raw data*
▪ Census block group level	▪ Used trip (origin-destination) and home location information	▪ Analyzed data to understand visits to the **stadium** and the **rail line** ▪ Identify calendar date of event ▪ Distributions by geography, time of day, etc.

Alternative Scenario Results (Typical NFL Game) – *Hourly Distribution*



73% DEPARTURES within **2 HOURS** of event ending

Hour before game end	Hour 0-1 after game	Hour 1-2 after game
10%	39%	34%

TRANSIT DEPARTURE BY HOUR

Hourly Departure Splits	Hour	Outbound
39%	Hour 0-1	4,075
34%	Hour 1-2	3,543

Baseline Results

Mode	Daily Inbound		Daily Outbound		Total
Bus	2,099	3%	2,359	3%	**4,457**
Rail	7,357	10%	8,299	11%	**15,656**
Auto	65,574	87%	64,372	86%	**129,946**
TOTAL	**75,030**	**100%**	**75,030**	**100%**	**150,060**

Assumed ~ 75K attendees

Sensitivity Testing

Types of sensitivity tests conducted

- **Doubled the fare –** decreased ridership by approximately 30 percent
- **Increased travel times –** resulted in a 12 percent reduction in ridership
- **Reduce rail headways –** increased ridership by approximately 11 percent

Validation and sensitivity test results vetted by agency staff and thought to be reasonable

Alternatives/Scenario Planning

TYPICAL NFL GAME WITH INCREASED TRANSIT SERVICE

Meadowlands Rail + New Transit Mode

Secaucus Junction – Meadowlands

- **Rail –**15 min IVT & 15 min headway (4/hour)
- **New Transit Mode** ~ 13 min IVT & ~ 90 second headways (38 per hour)

Modeled

- Combined “rail” mode
- ~ 90 sec headways
- ~ 12.8 min travel time (weighted average)

Alternative Scenario Results (+ New Transit Mode) – *Typical NFL Game*

Mode	Daily Inbound		Daily Outbound		Total
Bus	1,958	3%	2,151	3%	**4,109**
Rail	3,965	5%	4,390	6%	**8,355**
New Transit Mode	5,446	7%	6,031	8%	**11,477**
Auto	63,660	85%	62,458	83%	**126,118**
Total	**75,030**	**100%**	**75,030**	**100%**	**150,060**

- New Transit Mode modeled as rail – similar attributes
- Approx. **16 % transit share**, including buses
- **27% increase in daily Rail +** New Transit Mode **ridership** between Secaucus & MLS, compared to baseline
- **~ 46 % shift from Rail** to New Transit Mode attributable to high frequency New Transit Mode service

Large Sporting Event

(*Rail + New Transit + Additional Visitors from NYC , Hudson, Essex+ Reduced Parking*)

Mode	Daily Inbound		Daily Outbound		Total
Bus	2,500	3%	2,800	3%	**5,300**
Rail	12,500	15%	13,000	16%	**25,500**
New Transit Mode	17,400	21%	18,100	22%	**35,500**
Auto	50,100	61%	48,600	59%	**98,700**
Total	**82,500**	**100%**	**82,500**	**100%**	**165,000**

Assumption – 1.5 X baseline share of visitors from New York, Essex, Hudson, Queens, and Kings counties

- *Reduced outside counties by delta*
- *Reduced parking by 65% (28K to 9.8K)*
- Approximately **40% transit share**, including buses

In Summary

Alternate approach to travel demand models that offers:

- **Geographic flexibility and scalability**
- **Quick run times**
- **Scenario testing**
- **Data fusion**

- **A variety of applications –** transit mode choice, highway corridor studies, multimodal planning, and a framework to develop a simpler travel demand model

Ability to run models in the cloud

Caveats

- **Not a replacement for long-term forecasting models**
- **Ideal for short-term forecasting and sketch-planning**

Contact Information

Thank You for Listening !

Nikhil Puri

Cambridge Systematics

email: npuri@camsys.com

Tel: 201–926–0425