University of Missouri

Development of an Intelligent Truck Transportation Management Application

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Agenda

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3. Scenario Analysis/Demo
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5. Subscription Demo
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7. Next Steps

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MU Team

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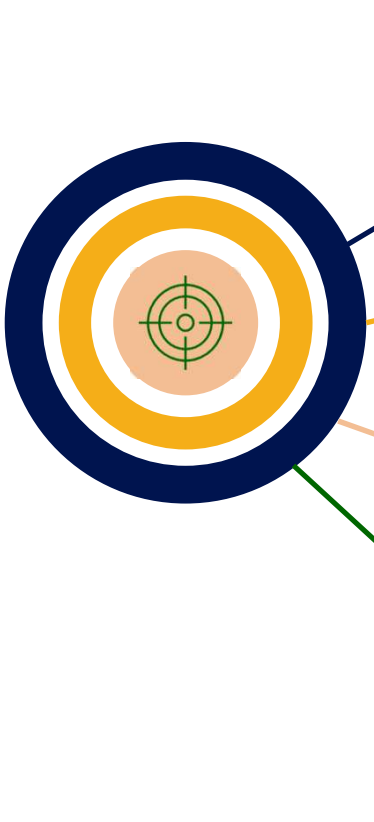
Project Goal and Objectives

Develop and evaluate an intelligent hub for the management of port operations (PortOps) to improve the efficiency of truck operations, incident management, planning and alerts notification.



01 Develop simulation models for assessing impacts of various events

02 Develop interactive analysis toolbox for short-term incident management

03 Conduct what-if analysis to understand the best route plans for managing freight truck operations

04 Establish connected platform to improve port-related communications among stakeholders

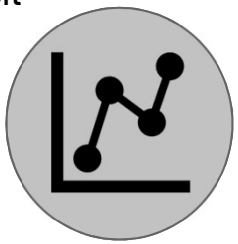
Guiding Question:
How do we best model and validate the current port operations for enabling what-if analysis and scenario planning?

Simulation Modeling of Current Port Operations

Inputs

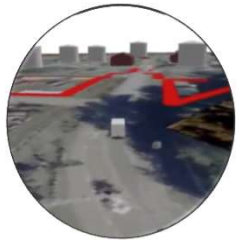
Observations from team site visit

Information collected from relevant stakeholders



AKDOT WIM Data

Models



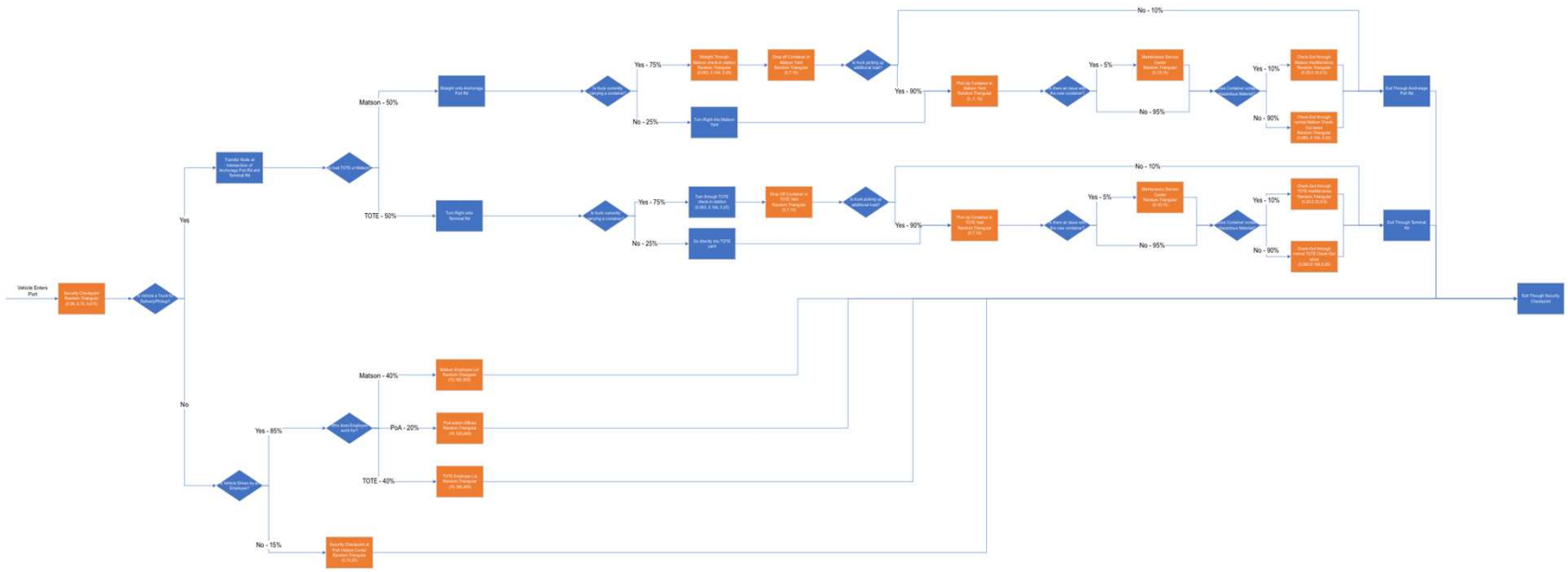
Simio Model

SimPy Model

Outputs

Relevant statistics for system performance (cycle times, waiting times, queue lengths, etc.)

Simulation Modeling of Current Port Operations



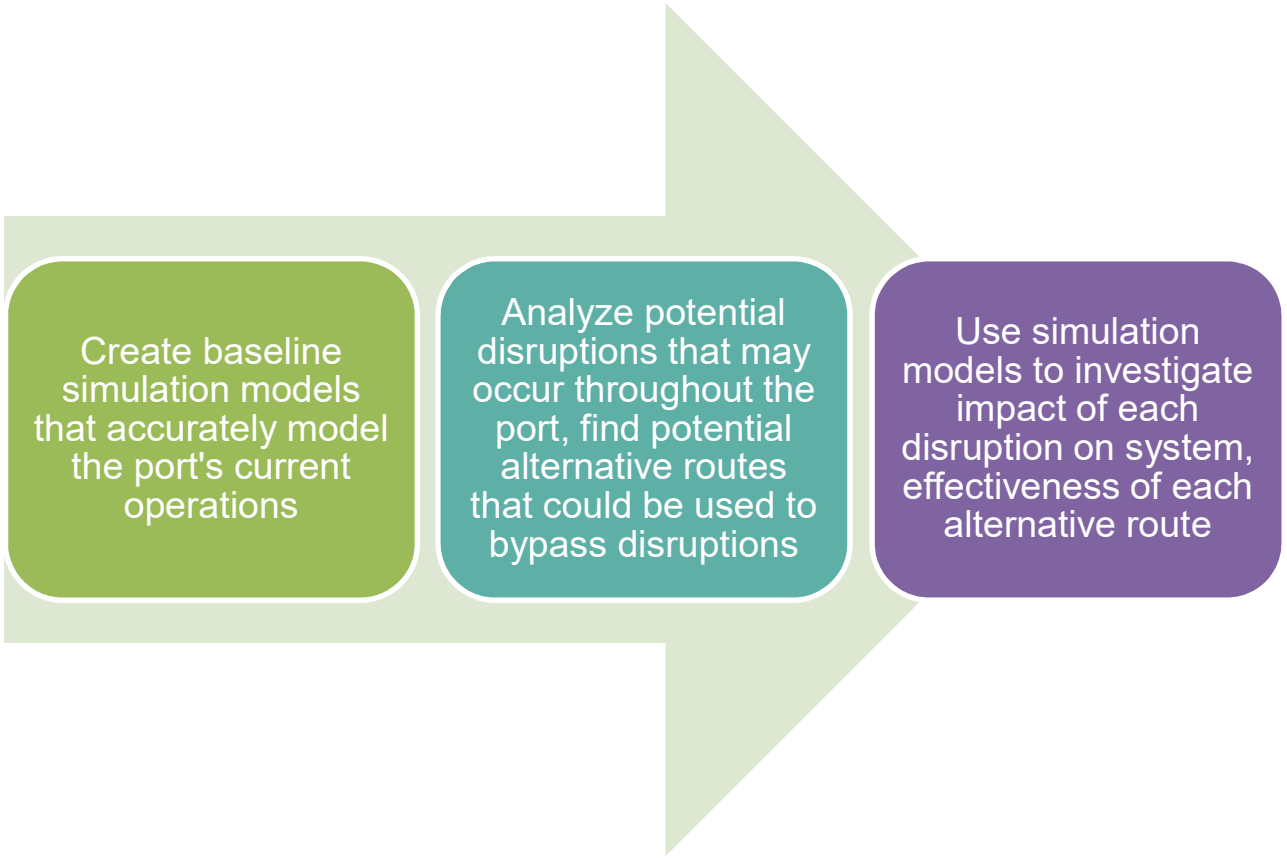
Simulation Modeling of Current Port Operations

Question	Randy	Samantha	Current Baseline Model
Average Total Cycle Time	~20 min	~20 min	~23 min
Average Waiting Time at Checkpoint	0 min	2 min	0.0787 min
Max Waiting Time at Checkpoint	5 min	15 min (with trains)	7.34 min
How frequently do trains block entries into the port?	Depends, anywhere between several times a day and once a week	Almost Daily	Every two days
On average, how long do trains block entries for?	N/A	2-5 minutes	20 minutes
Time taken to drop a trailer off in the yard	10 minutes	10-15 minutes	5-10 minutes

Guiding Question:
What approach do we take to manage scenarios that could disrupt normal truck operations?

Scenario Analysis Methodology

- Purpose: Provide a comprehensive evaluation of the port's current operations and the impact of potential disruptions along normal routes throughout the port



Scenario Analysis

Disruption Analysis

- Analysis of different potential disruption locations throughout the port
- Separated into sections along main route

Alternative Route Analysis

Analysis of different potential alternative routes that can bypass blockages along main routes within the port

Incident Management

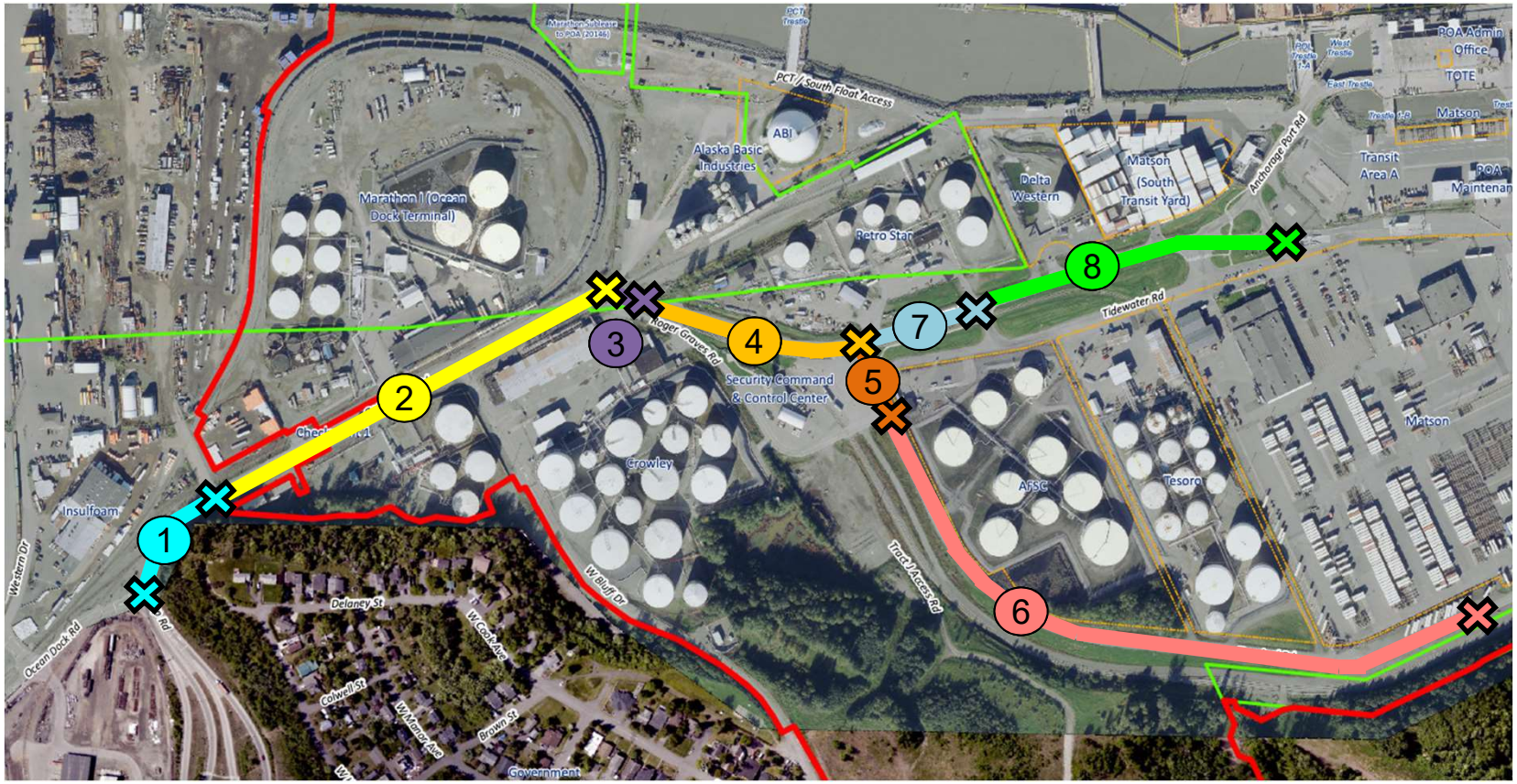
- Analysis of different alternative routes that can bypass blockages in different sections from Disruption Analysis
- Preliminary results of the risk level of disruption sections, the effectiveness of alternative routes from simulation models

Guiding Question:
How do we identify the potential disruption locations and their impact on the regular truck operation condition?

Disruption Analysis

- Potential disruptions along main routes analyzed throughout port
- “Main” Routes → Routes from port entry to Matson/TOTE yards
- Disruptions classified in sections based on availability of alternative routes to bypass blockage
- Each section consists of a portion of main routes throughout the port that has its own unique challenges, alternative routes

Disruption Analysis



Guiding Questions:

How can we propose alternative routes for different sections of the port to redirect traffic during disruptions when needed?

How can scenario analysis be integrated into a web platform so that it is accessible and customizable for port usage?

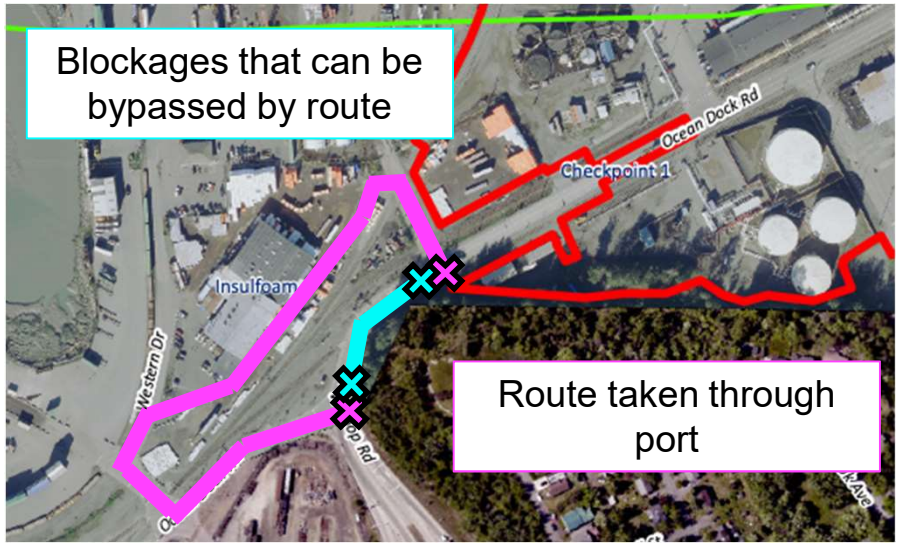
Alternative Routes

- Devised to bypass blockages in each section
- Consist of different routes throughout port, sometimes through areas rented by outside firms
- Different routes can be combined going in and out of the system, certain routes can bypass blockages in multiple sections
- Feasibility of implementation of each route not yet considered

Alternative Route 1: Insulfoam

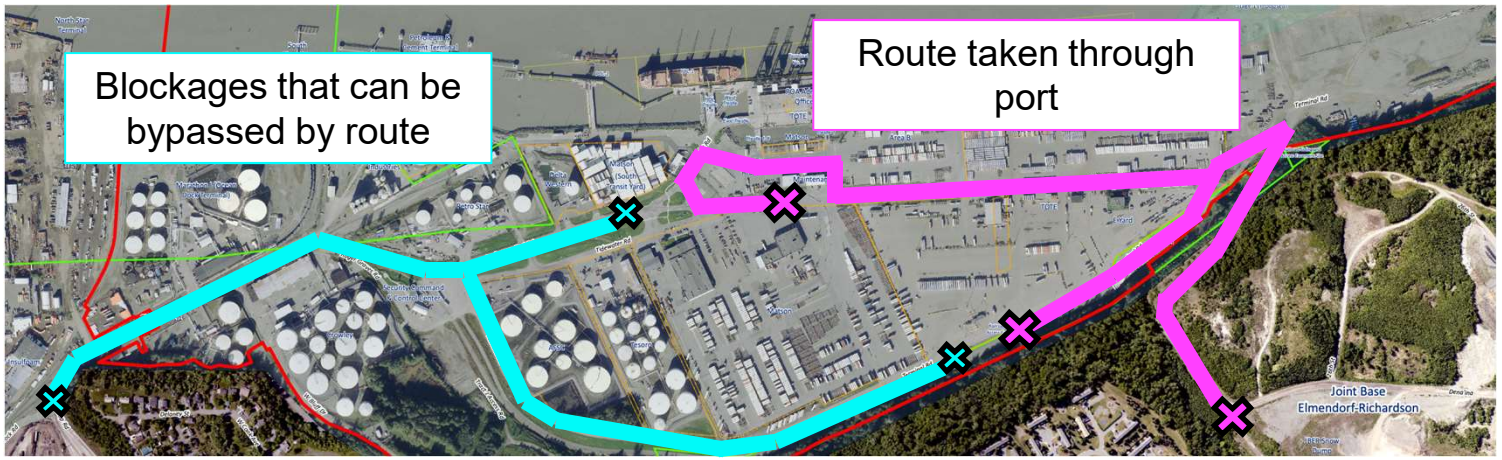
- Route through Insulfoam lot used to bypass blockages at main entry

- Only used to bypass blockages at beginning of Ocean Dock Rd



Alternative Route 2: Military Base

- Current available route through base in case of emergency
- Helps bypass most blockages along main entry route



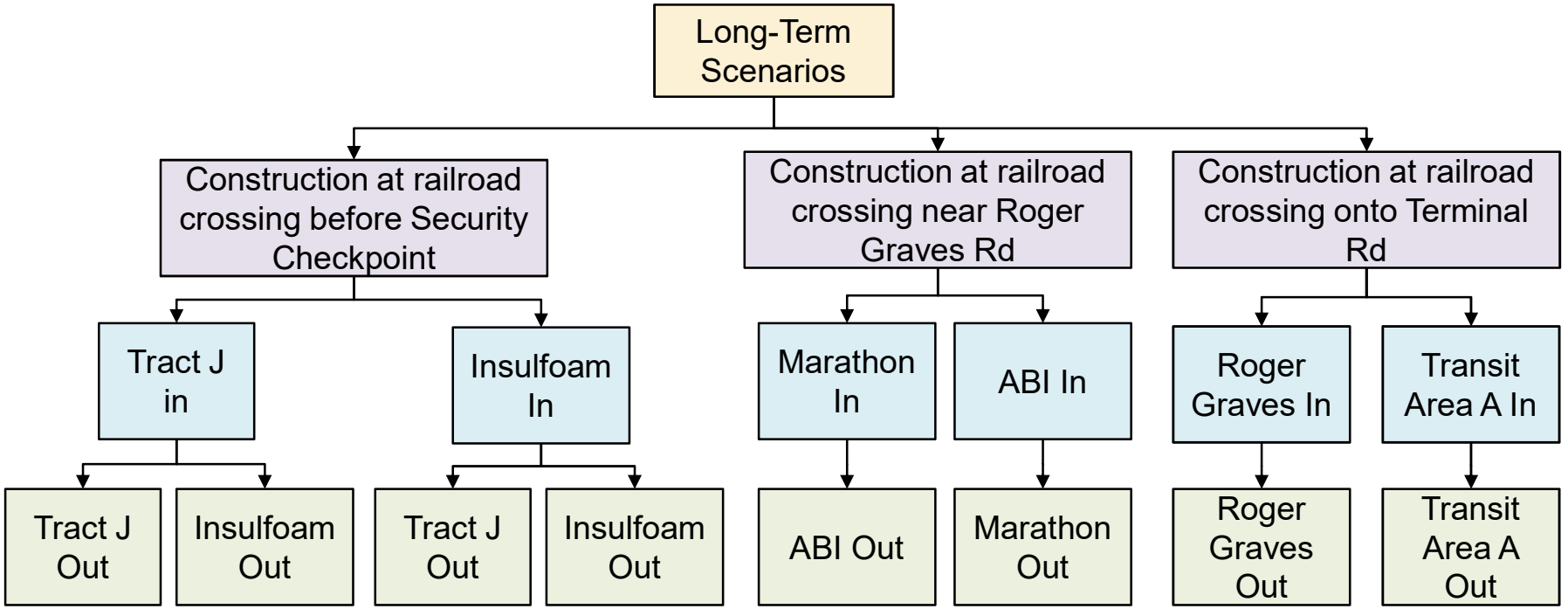
Guiding Question:

How can we effectively simulate and analyze long-term route disruptions in the port due to expansion plans, construction projects, or maintenance operations?

What about short-term route disruptions like weather-related disruptions, periodic inspections, collisions, and hazardous materials spills?

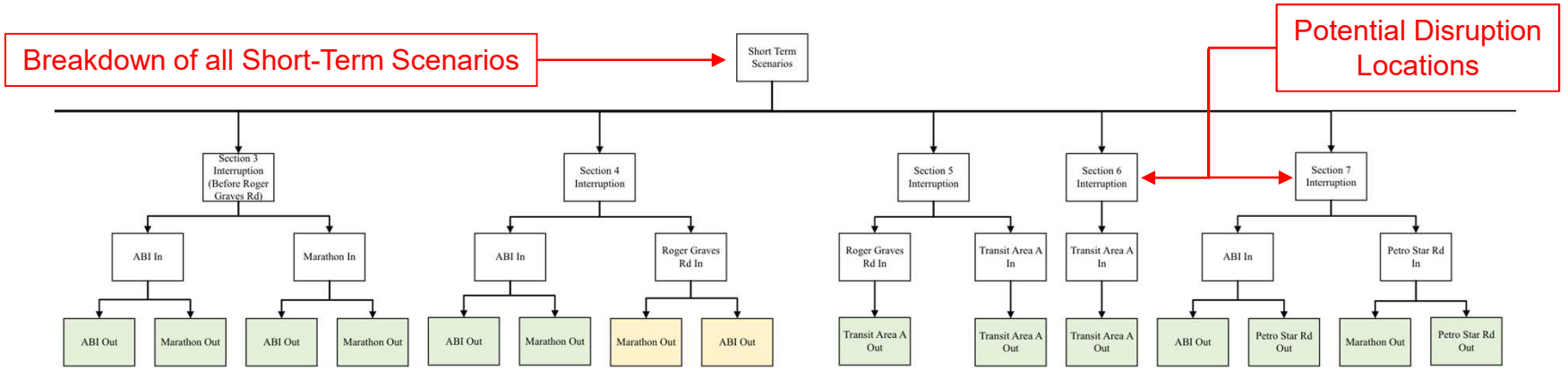
Incident Management

- For each disruption location, different alternative routes proposed to bypass blockages at given location
- Analysis separated into short-term and long-term scenarios
- Long-term scenarios → locations of potential stoppages for long-term construction (rail realignment)



Incident Management

- For each disruption location, different alternative routes proposed to bypass blockages at given location
- Analysis separated into short-term and long-term scenarios
- Short-term scenarios → locations of potential stoppages from traffic accidents or dangerous road conditions



Incident Management

- At every disruption location, multiple alternative scenarios were run in simulation models to see impact of new routes on key metrics (cycle times, waiting times, queue lengths)

- Key trends: certain routes resulted in longer cycle times from increased distance traveled, other routes led to longer waiting times/queue lengths due to increased congestion

- **Key takeaway: while certain routes performed better than others, most important trait is route availability to bypass blockages in each section**

Incident Management

- For each disruption location, matrix was created to evaluate potential risk levels
- For different categories, locations ranked on efficacy of alternative routes, number of potential alternative routes, and amount of traffic impacted
- Each category ranked from 1 (most risky) to 10 (no risk at all)

Incident Management

Disruption Location	Alternative Route Efficacy	Alternative Route Diversity	Amount of Traffic Impacted	Overall Risk Level	Rank
Section 1	3	2	1	6	1
Section 2	5	2	1	8	2
Section 3	5	4	3	12	3
Section 4	5	6	4	15	4
Section 5	9	9	7	25	7
Section 6	8	8	7	23	6
Section 7	8	7	7	22	5
Section 8	10	10	8	28	8

Key: 10 = Most Risk, 1 = Least Risk

Incident Management

- Similar preliminary analysis conducted for each alternative route

- For each route, simulations were run to find relative efficacy based on three categories: ease of implementation, relative performance, and route diversity

- In each category, routes were ranked from 1 (not effective) to 10 (extremely effective)

Incident Management

Alternative Route	Ease of Implementation	Relative Performance	Route Diversity	Overall Efficacy	Rank
Military Base	3	2	9	14	7
Tract J	1	3	7	11	8
Insulfoam	3	3	1	7	9
Marathon	7	4	7	18	4
ABI	5	7	7	19	3
Transit Area A	8	8	4	20	2
Roger Graves Rd	7	6	3	16	5
Petro Star	4	10	1	15	6
Terminal Rd	10	10	3	23	1

Key: 10 = Most Effective, 1 = Not Effective

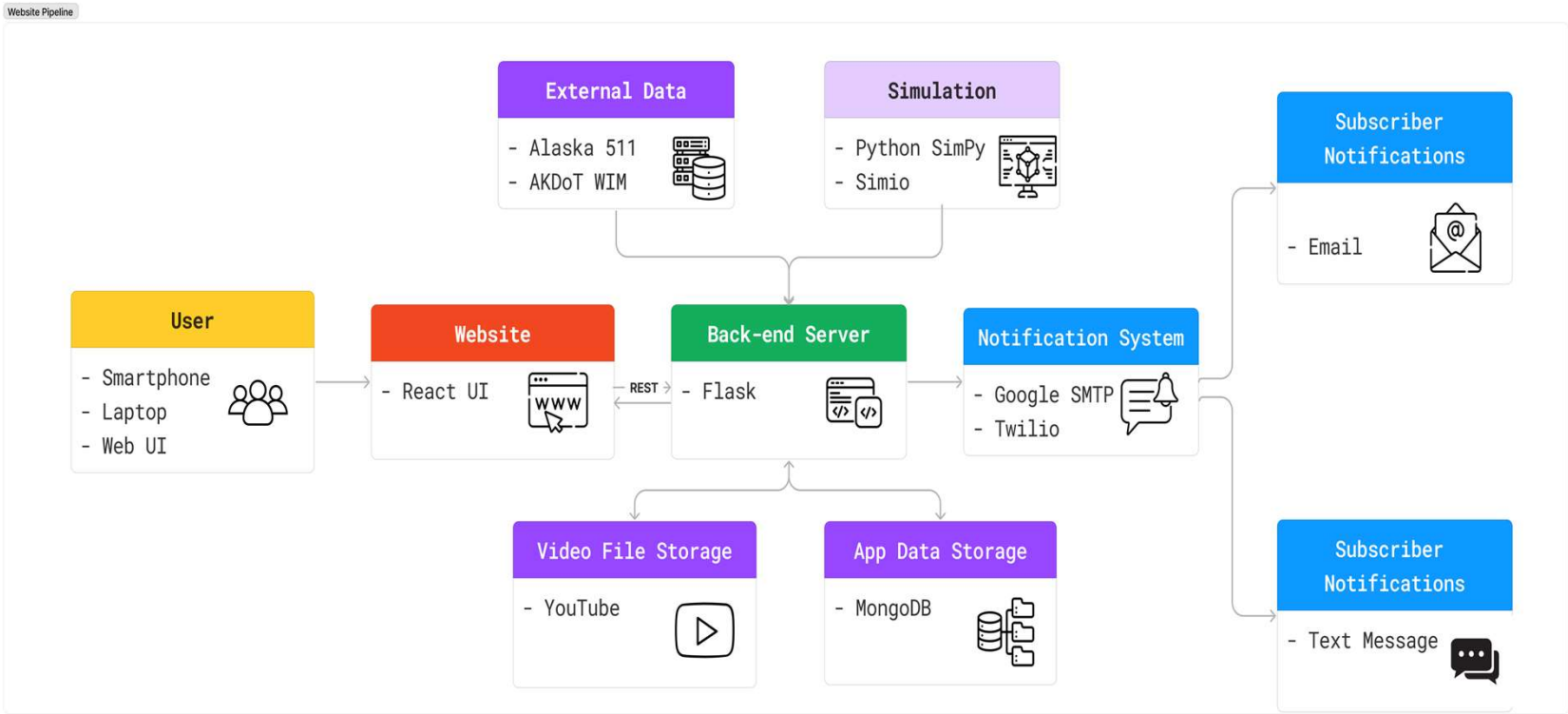
Guiding Question:

How to use the best practices to design a central hub for

- scenario planning
- incident management
- freight truck routing
- alerts notification

We call our application **PoA iFreightOps Hub** – Port of Alaska Intelligent Freight Operations Hub

iFreightOps Hub Architecture



Next Steps

Final Testing and IT Coordination

Qualitative and Quantitative Validations

Refine and Deploy iFreightOps

Preparation of a Detailed Project Report

Thank You!