

June 7th, 2019

Team Roles



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Project Sponsors



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We'll Get You There



MOBILITY INNOVATION CENTER UNIVERSITY of WASHINGTON





Agenda

- 1. Project prompt
- 2. Problems with current systems
- 3. Overview of in-progress and current solutions
- 4. Work completed
- 5. Our solution
- 6. Recommendations



Project Proposal

How can we provide **timely congestion information** and **routing recommendations** to all road users to better inform their transportation choices when **major incidents** occur?

Project Proposal

How can **we** support roadway users (including **drivers**) who may need to **shift transportation modes** during unanticipated major congestion scenarios?

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Comparison of Current Solutions



Comparison of Current Solutions Public Survey





Public Survey



Expert Interviews

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Implementation Plan

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Implementation Plan



Marketing Plan

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Implementation Plan



Marketing Plan



Demo

Tanker turns over on I-5... What now?



What's the problem?

Public information is scattered because interagency communications are fragmented



Current Solution



Follow

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CURRENT #SeattleTanker CLOSURES:

#SeattleTanker CURRENT CLOSURES:

SB I-5 Traffic: Must exit at or before James Street.

NB I-5 Traffic: Must exit at or before the West Seattle Bridge.

SB I-5 Express Lanes: CLOSED

- All traffic can use any of the HOV off-ramps to exit.

WB I-90 Traffic: Must exit at or before Rainier Avenue South.

EB I-90 Traffic: Closed at the stadiums.

- First on-ramp to EB I-90 is Rainier Avenue South.

→ Take any exit you can to get off of I-5 or consider I-405 or SR 99 as alternate routes.





Alert from Seattle DOT, there is a major traffic disruption on SB I-5 at I-90. I-5 is closed in both directions, for details: www.twitter.c

11:07 AM - 27 Feb 2017

X5NEWS

Seattle tanker crash shuts down I-5

K 7



01 / 10 A tanker truck rolled over after being involved in a collision in Seattle, causing both directions of the freeway to be shut down, Feb, 27, 2017. (Credit: KING)



What's the problem?

Current applications provide incomplete solutions

	Incident Notification	Trip Planning	Rerouting	Mobile Tickets	Transit Schedule
TransitGo		~		~	
OneBusAway				~	
Google Maps		~	✓		~
Puget Sound Trip Planner		~			~
WSDOT App	~	\checkmark			~

What's the problem?

Do not provide timely, on-demand information or actionable recommendations for routing





Solution to Interagency Communication

Virtual Command Center





Solution to Public Communication & Routing

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Plan your route



Assumptions

- VCC will be completed and provide incident information and GTFS formatted data
- 2. Available to use on every major incident in Seattle, 1-3 times a year
- 3. Solution will be hosted on a third-party website
- 4. To be proposed to stakeholders following the launch of VCC (2021)

Prototype

SAIA Seattle Area Incident Avoidance

IVE I-90 Tanker Crash and Oil Spill

Information Map Plan your route

About the incident

A crash involving a tanker and two other vehicles happened in the southbound lanes of the I-5 collector-distributor lanes to I-90.

I-5 South/North

All lanes between James Street and West Seattle Bridge are closed. All traffic can use any of the HOV-ramps to exit.

I-90 East/West

All lanes between Rainier Avenue South and stadiums are closed.

\Lambda Avoid travel in the area if possible

Currently no estimate for reopening but expect a long-term closure.

Live updates

🔵 1:03 PM

All lanes of WB I-90 at Rainier Ave S are now closed due to this collision. Traffic must exit at Rainier Ave S.

12.58 DM

See live updates and closures of a major incident



Visually explore affected areas

Prototype

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Get guidance on parking and using public transit

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Easily identify closures

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Easily identify closures

LIVE I-90	Tanker Cras	h and Oil Spill
Information	Мар	Plan your route

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12:58 PM

All lanes of NB I-5 at the West Seattle Bridge are stopped due to this collision.

Subscribe to alerts



Easily identify closures

LIVE I-90 Tanker Crash and Oil Spill						
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Subscribe to alerts



Incident area visualization



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Free parking announcement

Due to heavy traffic, it's recommended that you leave your car or delay your departure time. The 2 hour restriction on street parking in your area will not be enforced.

Extend Parking

We recommended that you extend your parking to avoid getting stuck in gridlock. If you are using a private lot, SpotHero will help you extend your parking.

OPEN SPOTHERO

Free parking announcement

Due to heavy traffic, it's recommended that you leave your car or delay your departure time. The 2 hour restriction on street parking in your area will not be enforced.

Extend Parking

We recommended that you extend your parking to avoid getting stuck in gridlock. If you are using a private lot, SpotHero will help you extend your parking.

OPEN SPOTHERO

Exploring time/mode/route shift



Pay for parking &

mobile ticketing

12:57 PM

1:22 PM

3:00 PM

Free parking announcement

٨	Due to heavy traffic, it's recommended that you
	leave your car or delay your departure time. The 2
	hour restriction on street parking in your area will
	not be enforced.

Extend Parking

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OPEN SPOTHERO

Exploring time/mode/route shift

Recommended route Park O Use private parking on at 1465 6th 880 Ave. - US Bank Centre Garage PAY FOR PARKING \$27 for one day Leave in 3 mins Arrival 3:14 PM Pick up vehicle before 1 PM tomorrow Other routes 880 . 0 O Pine St. and 9th Ave ✓ 12 stops Leave in 1 hr 10 mins Arrival 4:57 PM 148th Ave SE and SE 22nd St. **OPEN GOOGLE MAPS** PAY FOR BUS FARE \$2.75 per person Leave in 3 mins Arrival 4:35 PM Requires TransitGo app

Free parking announcement

0	Due to heavy traffic, it's recommended that you
	leave your car or delay your departure time. The 2
	hour restriction on street parking in your area will
	not be enforced.

Extend Parking

We recommended that you extend your parking to avoid getting stuck in gridlock. If you are using a private lot, SpotHero will help you extend your parking.

OPEN SPOTHERO

Exploring time/mode/route shift

Pay for parking & mobile ticketing

Routing around an incident





Solution Architecture



- 1. Notification System
- 2. Recommendation System
- 3. Parking System
- 4. Ticketing System

Software/APIs - Tech Stack

1) Design:

• Figma

2) Design Implementation:

• Webflow

3) Map Implementation:

- Google Directions API
- Google Maps JavaScript API
- Google Places API

4) Final Demo:

- HTML5
- CSS3
- JS
- jQuery

5) Tools Used:

- Git
- GitHub
- IntelliJ





Support mode shift and rerouting with traffic analysis

Encourage Mode shift

1: Free street parking and transit ticket decision supported by data and analytics result

2: Decrease bus travel time by testing out best road closure for transit only



Provide Routing recommendation

Best route for vehicle evacuation for each directions



Traffic analytics

Use transportation planning software Emme and the Network of Downtown Seattle to develop a playbook for emergency operation that:

- Find the lowest **traffic volume cut** to clear out congestion 20 percent
- Test best road closure to use for transit only lane - 2nd and 4th ave
- Best **route** used for vehicle



Best route used for vehicle evacuation



Ave N z E Johr Denny Park Seattle Central College mpic re Park Jerk S Paramount Theatre 😳 Terra Plata Cinerar ater 😑 Pier 66 estlake Park PIKE PLACE Seattle L MARKET AVE Seattle Great Wheel 🤤 Seattle Speidel's Underground Tour E Yesl Drygoods Design S Jackson St Seattle Pinba (99) 👝 Uwajimaya CenturyLink F

Vehicle evacuation with from low V/C

Routes with low V/C

Assumptions to mock <u>incident scenario</u>

Application during real time accident

- PM peak hour
- Static data
- Close I5 to mock accident scenario

Require dynamics network
 analysis softwares with real time
 GPS location data and GTFS
 data

Day-of Marketing

Social Media Alerts



Heads up #Seattle drivers. Rollover collision is blocking all lanes of the SB I-5 c/d just south of I-90. SB I-5 mainline is still open. Heading this way? Log onto saia.wa.gov to view personalized incident recommendations for today's commute.



10:43 AM · 27 Feb 17 · Twitter Web Client

Day-of Marketing

Social Media Alerts

@wsdot traffic Heads up #Seattle drivers. Rollover collision is blocking all lanes of the SB I-5 c/d just south of I-90. SB I-5 mainline is still open. Heading this way? Log onto saia.wa.gov to view personalized incident recommendations for today's commute.

WSDOT Traffic 📀



10:43 AM · 27 Feb 17 · Twitter Web Client

50 Retweets 27 Likes 11 C ~

Text alerts



Day-of Marketing

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Text alerts



Website Banners



Year-long Marketing Timeline

Conduct pilot period with transit app users and transit bloggers to receive feedback before release.

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Months 2-3 Month 1 Publicly release the website Roll out social media ads on Facebook, Twitter, LinkedIn Release first informational blog post

Year-long Marketing Timeline

Conduct pilot period with transit app users and transit bloggers to receive feedback before release.



Pitch stories about the website to various media outlets Roll out digital ads on Yelp. ESPN, etc.





Year-long Marketing Timeline



SWOT Analysis Summary

Strengths

Weaknesses

Opportunities

Threats

- One stop shop for incident info, recommendations
- Non-platform exclusive website
- SAJOG will provide the system with detailed traffic info
- Relies on existing traffic services for infrastructure
- Needs support from content development network to prevent site from crashing
- VCC will provide accurate incident information
- Unified marketing push across transit agencies has the potential to be extremely effective
- Commuters may already be comfortable with current options or be reluctant to adopt altogether

Next Steps

- Build out accessible features (Multi-language support, call-in number, screen-reader compatibility)
- Coordinate with City of Seattle to negotiate parking incentives
- Coordinate with KCM for mobile ticketing without app download
- Continued development following the release of the VCC
 - Consult with Seattle Area Congestion Management Joint Operations Group (SAJOG)
- Plug GTFS-Realtime information into Google Maps



Try it Out!

Go to:

saia-uw.github.io/demo/

Checkout GitHub Repo:

github.com/saia-uw/demo

Thank you for listening!

Appendix for reference

General

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- <u>Terminologies</u>
- <u>Survey Highlights</u>

Google GTFS-Realtime

- <u>GTFS-Realtime Resources</u>
- Overview of GTFS Realtime feeds
- <u>GTFS Realtime feeds Data Format</u>
- <u>Transitfeed ScheduleViewer</u>

Design

- <u>Design Iterations</u>
- <u>Mobile & Web High-fidelity Design</u>

Implementation

- <u>Implementation Iterations</u>
- <u>Mobile & Web Map Implementation</u>
- <u>All Websites in one place</u>
- Evaluation of Software and APIs
- <u>Implementation Challenges</u>

Terminologies

What we defined:

• **Major Incident:** an incident that happens once or twice a year, i.e. 12-car pileup

Scale of Incident Severity The greater the severity of the incident, the greater the need for integrated traffic incident and congestion management



- **Time-shift**: changing planned departure time.
- **Route-shift**: changing planned routes.
- **Mode-shift**: changing from one mode of transportation to another during the same trip,
- **Mobile Ticketing**: pay for transit tickets via mobile phones.



Survey Highlights

Based on 95 survey responses from commuters in Puget Sound

- Diverse age range: 18 ~ 65
- Mostly public transit users and those who drive alone
- Biased towards white ethnicity and people with over \$150k household income



100%

50%

25%

0%

Scenario 1

Scenario 2



[Scenario 1] Reasons for choosing route shift and time shift



GTFS-Realtime Implementation Resources

- GTFS Realtime Overview
 - <u>https://developers.google.com/transit/gtfs-realtime/</u>
- Live updates format
 - <u>http://maps.google.com/help/maps/mapcontent/transit/live-updates.html</u>
- Transit partner dashboard
 - <u>https://support.google.com/transitpartners/answer/6375243?hl=en</u>
- <u>Transitfeed ScheduleViewer</u>
 - <u>https://github.com/google/transitfeed</u>
- GTFS official web
 - <u>https://gtfs.org/</u>
- Google GTFS samples
 - <u>https://developers.google.com/transit/gtfs-realtime/examples/python-sample</u>



Overview of GTFS Realtime feeds

What is GTFS:

• General Transit Feed Specification

What types of information it supports:

- Trip updates delays, cancellations, changed routes
- Service alerts stop moved, unforeseen events affecting a station, route or the entire network
- Vehicle positions information about the vehicles including location and congestion level



GTFS Realtime feeds - Data Format

The GTFS Realtime data exchange format is based on Protocol Buffers

• a language-neutral, platform-neutral extensible mechanism for serializing structured data.

Data Structure

The hierarchy of elements and their type definitions are specified in the <u>gtfs-realtime.proto</u> file.

```
message Person {
   required string name = 1;
   required int32 id = 2;
   optional string email = 3;
}
```

Person john = Person.newBuilder() .setId(1234) .setName("John Doe") .setEmail("jdoe@example.com") .build(); output = new FileOutputStream(args[0]); john.writeTo(output);



Transitfeed ScheduleViewer

Transitfeed Repository

🖵 google	/ transitfeed		œ	Used by -	37 💿 Wate	:h ▼ 80	\star Star	471	¥ Fork	178
<> Code	Issues 168	ຳ Pull requests 13	Projects 0	💷 Wiki	Security	🔟 Insigh	ts			
A Python library for reading, validating, and writing transit schedule information in the GTFS format.										

https://github.com/google/transitfeed...

T 409 commits	្រ 1 branch	S 31 releases	🚨 18 contribu	tors	∲ Apache-2.0	
Branch: master - New p	oull request	Create ne	w file Upload files	Find File	Clone or download -	
🌠 aababilov Use /usr/bin/	python2 as interpreter for upg	rade_translations.py and v		Latest comm	nit a766224 18 days ago	
examples	Merge branch 'm	aster' into print			this year	
extensions	More Python3/2	compatability changes			this year	
gtfsscheduleviewer	change print stat	change print statements to functions for Python compatibility last year				
i misc	More Python3/2	More Python3/2 compatability changes this year				
in tests	ts Add upgrade_translations.py and visualize_pathways.py (#471) this yea					
transitfeed	transitfeed More Python3/2 compatability changes this yet					
.gitignore	.gitignore Add new entries for build artifacts. 4 years a					
.travis.yml	Specify that tests execute using nosetests. 4 years age					
	Initial post of the GoogleTransitDataFeed Python code. 12 years ag				12 years ago	
INSTALL	STALL rollback to using pypi 5 years a					
D. MANIEEET in Mouse all unit tests from test/directory to tests/directory. E usars a					E vooro ogo	

An Example

Kingcounty Marine Divison, City of Seattle, Intercity Transit, Community Transit, Sound Transit, Metro Transit, Seattle Children's Hospital, Pierce Transit, Washington State Ferries, Everett Transit, SeattleCenterMonorail



routes.txt: route_iong_name=S to Seaway TC - N to Everett Station route_type=3 route_text_color=FFFFFF route_color=000000 agency_id=97 route_id=97-2 route_url= route_desc= route_short_name=3



Design Iterations

What we have designed:







2.Medium-fidelity





Mobile & Web High-fidelity Design



12:36 PM

The crash involving a tanker and two other vehicles happened in the southbound lanes of the I-5 collector-distributor lanes to I-90

12:58 PN

All lanes of NB I-5 at the West Seattle Bridge are stopped due to this collision.

Latest update 1:03 PM

All lanes of WB I-90 at Rainier Ave S are now closed due to this collision. Traffic must exit at Rainier Ave S.

Latest update 1:03 PM

All lanes of WB I-90 at Rainier Ave S are now closed due to this collision. Traffic must exit at Rainier Ave S.

Sign up for text alerts of this incident











Sign up for text alerts of this incident

Mobile phone number



Washington State Department of Transportation © 2019

MAY 24, 2019 A crash involving a tanker and two other vehicles has blocked the southbound lanes of the I-5 collector-distributor lanes to I-90

12:36PM

The crash involving a tanker and two other vehicles happened in the southbound lanes of the I-5 collector-distributor lanes to I-90

6PM

The crash involving a tanker and two other vehicles happened in the southbound lanes of the I-5 collector-distributor lanes to I-90

:36PM

The crash involving a tanker and two other vehicles happened in the southbound lanes of the I-5 collector-distributor lanes to I-90

an Your Route



Implementation Iterations

What we have developed:

- <u>1st Iteration</u>
- <u>2nd Iteration Code (no server)</u>
- <u>2nd iteration Code (with server)</u>
- <u>3rd iteration (Web Design Implement)</u>
- Final Demo (Combined Design and functionalities)





Design Implement





Merge



Final Demo

+











Map Implement

Mobile & Web Map Implementation







Implementation Challenges

• Redirections

- Redirect to a website w/ a specific action
- Launch a personalized app store

• Merge

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- Webflow's non-intuitive long JS file
- Webflow events (click, hide, show, hover)
- CSS Style conflicts
- HTML Elements overflow

- Live-Map
 - Auto-center the incident area
 - Default markers
 - Mockup traffic visualizations

• Plan-your-route

- Point b problem
- Display with correct zoom level
- \circ Mockup a path through 520



All Websites in one place

Web Demo:

- <u>DemoWebpage</u> (annykong.github.io/uwcapstone-modeshift/)
- <u>Demo GitHub Repo</u> (Source Code)
- <u>Demo Wikipage</u> (More details about Demo)

Team Web:

• <u>Team Webpage</u> | <u>Team GitHub Repo</u>

Map Test:

• <u>Map-Test Webpage</u> | <u>Map-Test Repo</u>

Development Iterations:

- <u>1st Iteration Webpage</u>
- <u>2nd Iteration Commits (no server)</u>
- <u>2nd Iteration Commits (with server)</u>
- <u>3rd Iteration Webpage (Web Design)</u>
- Final Demo (Web Design & functionalities)



Evaluation of Software & APIs

Software & APIs	Pros	Cons		
Wix	Easy-to-use template	Do not allow source code download		
Early web design and development	Allows responsive design	Restrictions in design		
Webflow	It is great for design	Steep learning curve		
Web design & development	Allows source code download	Impossible complex code level customizations		
	Allows responsive design	Unintuitive js event handles and variable names		
Proto.io and Figma	Allows for real-time collaboration	Does not allow high-fidelity interactive		
Prototyping and wireframing	Could be incorporated in the website	prototypes		
Google Maps API (Maps JavaScript API, Directions API Places API)	Provides public transit, driving, walking, and biking directions	Does not allow routing algorithm customizations		
Map and rerouting	Provides familiar and easy-to-use user interface	Relatively expensive plan		
Mapbox API	Provides driving, walking, and biking directions	Does not provide public transit information itself		
Map and rerouting	Free in general	Does not allow routing algorithm customizations		
		More Limitations in map uses		

Marketing Plan Overview

- Goal: How we can find ways to
 - Effectively introduce users to our service
 - Illustrate how our solution would be useful in an incident
 - Inspire confidence in drivers to use the solution in a moment's notice



Social Media/Blog Posting

- Sponsored advertisements
- Mobile and desktop designs
- Informational, testimonial blog posts





Digital Advertising

- Target heavy traffic sites and services
- Emphasized tailored incident avoidance planning
- Spotify sponsored sessions
- Reddit, Yelp, ESPN, Accuweather banner ads at the top and down the sides of the page
- Yahoo sponsored posts every five articles



All icons (except for Accuweather) created by Freepik on flaticon.com; Accuweather image credit: Amazon.com

Earned Media

- TV, Radio, Print stories
- Educational Messaging
- Emphasize the VCC



King County

We'll Get You There

Credit: King County Metro



Credit: Sound Transit

Out-of-Home Advertising

- Billboards
- Bus ads
- Gas Stations
- Grocery Stores





