C2SMART
CONNECTED CITIES WITH SMART TRANSPORTATION
A USDOT University Transportation Center

New York University
Rutgers University
University of Washington
University of Texas at El Paso
The City College of New York

# A Trusted Platform for Transportation Data Sharing & Stakeholder Engagement

**March 2018**

# TECHNICAL REPORT DOCUMENTATION PAGE

| | | |
|---|---|---|
| 1. Report No. | 2. Government Accession No. | 3. Recipient's Catalog No. |
| 4. A Trusted Platform for Transportation Data Sharing & Stakeholder Engagement | | 5. Report Date<br>March 2018 |
| | | 6. Performing Organization Code: |
| 7. Author(s)<br>William G. Raisch, Carlos Restrepo, Carol Shields, Amelia Swan | | 8. Performing Organization Report No. |
| 9. Performing Organization Name and Address<br>Connected Cities for Smart Mobility towards Accessible and Resilient Transportation Center (C2SMART), 6 Metrotech Center, 4th Floor, NYU Tandon School of Engineering, Brooklyn, NY, 11201, United States | | 10. Work Unit No.<br>11. Contract or Grant No.<br>69A3551747119 |
| 12. Sponsoring Agency Name and Address<br>Office of Research, Development, and Technology<br>Federal Highway Administration<br>6300 Georgetown Pike<br>McLean, VA 22101-2296 | | 13. Type of Report and Period<br>Final report, 3/1/17-3/31/18<br>14. Sponsoring Agency Code |
| 15. Supplementary Notes | | |

16. Abstract

Information sharing to support critical transportation systems presents numerous challenges given the diversity of information sources and visual representations typically used to portray system performance and characteristics12. This research project focused on advancing transportation data sharing and stakeholder engagement by adapting an information sharing and situational awareness technology platform developed as part of the Metropolitan Resilience Network, a unique public-private partnership. Dedicated platforms were developed for Seattle, El Paso, Newark and New York, all cities where C2SMART collaborating institutions are located. This effort was used to identify key issues and considerations in further applying the platform in support of C2SMART activities as well as observations on wider information sharing and stakeholder engagement in the transportation arena.

Specifically, this project investigated the potential value of enhanced situational awareness and information sharing of live transportation data flows and other real time information about the operating environment of the four targeted cities. It also investigated the potential wider application and evolution of the platform currently utilized for this purpose in the metropolitan New York area.

| | | | |
|---|---|---|---|
| 17. Key Words | 18. Distribution Statement<br>No restrictions. This document is available to the public through the National Technical Information Service, Springfield, VA 22161.<br>http://www.ntis.gov | | |
| 19. Security Classif. (of this report)<br>Unclassified | 20. Security Classif. (of this page) Unclassified | 21. No. of Pages<br>22 | 22. Price |

**Form DOT F 1700.7 (8-72)** Reproduction of completed page author

C2SMART Center is a USDOT Tier 1 University Transportation Center taking on some of today's most pressing urban mobility challenges. Using cities as living laboratories, the center examines transportation problems and field tests novel solutions that draw on unprecedented recent advances in communication and smart technologies. Its research activities are focused on three key areas: Urban Mobility and Connected Citizens; Urban Analytics for Smart Cities; and Resilient, Secure, and Smart Transportation Infrastructure.

Some of the key areas C2SMART is focusing on include:

### Disruptive Technologies

We are developing innovative solutions that focus on emerging disruptive technologies and their impacts on transportation systems. Our aim is to accelerate technology transfer from the research phase to the real world.

### Unconventional Big Data Applications

C2SMART is working to make it possible to safely share data from field tests and non-traditional sensing technologies so that decision-makers can address a wide range of urban mobility problems with the best information available to them.

### Impactful Engagement

The center aims to overcome institutional barriers to innovation and hear and meet the needs of city and state stakeholders, including government agencies, policy makers, the private sector, non-profit organizations, and entrepreneurs.

### Forward-thinking Training and Development

As an academic institution, we are dedicated to training the workforce of tomorrow to deal with new mobility problems in ways that are not covered in existing transportation curricula.

*Led by the New York University Tandon School of Engineering, C2SMART is a consortium of five leading research universities, including Rutgers University, University of Washington, University of Texas at El Paso, and The City College of New York.*

**c2smart.engineering.nyu.edu**

# A Trusted Platform for Transportation Data Sharing & Stakeholder Engagement


William G. Raisch
*Director, INTERCEP*
*New York University*

INTERCEP Team

Carlos Restrepo
*Senior Researcher*

Carol Shields
*Program Manager*

Amelia Swan
*Project Coordinator & Research Analyst*

# Disclaimer

*The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the information presented herein. This document is disseminated in the interest of information exchange. The report is funded, partially or entirely, by a grant from the U.S. Department of Transportation's University Transportation Centers Program. However, the U.S. Government assumes no liability for the contents or use thereof.*

# Acknowledgements

The INTERCEP Team would like to acknowledge the input and cooperation of the wider C2SMART consortium members and in particular the following who provided insights into the project and its potential wider applications: Kaan Ozbay, Shri Iyer, Joseph Chow, Don MacKenzie, Xuegang (Jeff) Ban, Esmaeil Balal, and Hani Nassif.

# Executive Summary

Information sharing to support critical transportation systems presents numerous challenges given the diversity of information sources and visual representations typically used to portray system performance and characteristics[12]. This research project focused on advancing transportation data sharing and stakeholder engagement by adapting an information sharing and situational awareness technology platform developed as part of the Metropolitan Resilience Network, a unique public-private partnership.

Dedicated platforms were developed for Seattle, El Paso, Newark and New York, all cities where C2SMART collaborating institutions are located. This effort was used to identify key issues and considerations in further applying the platform in support of C2SMART activities as well as observations on wider information sharing and stakeholder engagement in the transportation arena.

Specifically, this project investigated the potential value of enhanced situational awareness and information sharing of live transportation data flows and other real time information about the operating environment of the four targeted cities. It also investigated the potential wider application and evolution of the platform currently utilized for this purpose in the metropolitan New York area.

The project built upon three years of experience with the Metro-Ops platform developed for the metropolitan New York area, which has integrated information flows from a diversity of critical infrastructure sources and is currently utilized by over 400 public and private sector organizations.

Collaborating investigators in each of the targeted cities who were provided with access to these platforms had the following observations:

- The platform could be valuable in displaying and ultimately allowing for the archiving of data for later analysis involving such areas as:
    - how people choose to travel and how they combine transportation modes, especially including both traditional mass transit and automobile transportation as well as new mobility services such as electric vehicles, car share, and bike share
    - how weather, mass transit operational status, vehicular traffic and other environmental factors impact transportation choices (including combinations of various modes) in real time
    - utilization and optimal siting for electrical vehicle charging stations
    - real time mapping of car-share company surge pricing versus environmental factors
    - mapping of bike share density in a city
    - monitoring and subsequent planning for vehicle parking capacity

    - monitoring of international border crossing status / congestion, wider transportation status, cross-border commuting patterns between border cities
- The platform could be used for information sharing among multiple stakeholders across international borders (e.g., adjacent cities such as El Paso in the United States and Juarez in Mexico), and this approach could result in additional collaboration efforts between city governments and universities in the region.
- The collaborative and multifaceted nature of the program could make data sharing by private entities more likely.
- A potential future research application of the platform could be to support the development of algorithms to detect infrastructure threats and increase security.
- The platform could be used to display data from C2SMART transportation simulations.
- Value was seen in the wider use (beyond the current Metro-New York Metropolitan Resilience Network) of the dashboard model to support efforts to gather and disseminate reliable information before, during and after a disaster to support community resilience including information on transportation, health services, communications and relief services.
- The platform could be used to create and widen linkage with municipal governments with Chief Resilience Officers funded by the Rockefeller Foundation's 100 Resilient Cities program.
- A future application of this platform for research could be to use it to collect quantifiable data from the various city dashboards and use it to compare performance across cities, especially in the area of transportation systems and other critical infrastructure systems. This could lend itself to various statistical analyses and comparisons.

INTERCEP researchers observed as well that potential applications of the platform include the following:

- The platform could facilitate information sharing and engagement
    - within the C2SMART consortium members
    - between C2SMART members and key stakeholders in both the public and private sectors in each of the cities.
- The information fusion / situational awareness dashboards could potentially be adapted to showcase / communicate / vet C2SMART research findings and insights with key stakeholders.
- The platform could potentially be used to advance the application of C2SMART research to real world challenges.

# Table of Contents

# List of Figures

# Section 1: Project Summary

## 1.1: Objectives

This project had several objectives:

- Investigate the potential value of enhanced situational awareness and information sharing of live transportation data flows and other real time information about the operating environment of four targeted cities.
- Investigate the potential wider application and evolution of a platform currently utilized for this purpose in the metropolitan New York area.
- Identify key considerations / potential for information and transportation data sharing that could support C2SMART activities including collaborations between C2SMART researchers and city, local and regional governments as well as other potential stakeholders.

## 1.2: Methodology Overview

Key activities included:

- Identifying available real time information feeds in each of four cities where C2SMART collaborating institutions are located (New York City, Newark, El Paso and Seattle).
- Developing four information sharing and situational awareness platforms, one for each of these cities.
- Providing collaborating investigators with access to these dashboards and briefing them on the platform elements and functionality.
- Soliciting observations from each of the investigators on potential applications for enhanced information sharing and situational awareness and the value of the platform in that regard.
- Distilling observations into a final report.

# Section 2: INTERCEP & the Metropolitan Resilience Network

## 2.1: About the International Center for Enterprise Preparedness (INTERCEP)

The International Center for Enterprise Preparedness (INTERCEP) at NYU is focused on organizational resilience of both private and public entities – i.e., the ability of an organization to accomplish its core mission activities despite disruptions in its operating environment. Such disruptions can include natural hazards (severe weather, earthquakes, infectious disease, etc.), technological disruptions (power / communications outages) and man-made threats (terrorism, etc.).

## 2.2: About the Metropolitan Resilience Network (MRN)

A special focus of the center is on the resilience of critical infrastructure, especially transportation infrastructure. A core multi-year initiative of the center is the Regional Resilience Program funded and championed by the Port Authority of New York & New Jersey. A central activity of this initiative is the Metropolitan Resilience Network (MRN), a unique public-private network focused on communicating and collaborating on shared risks to the operations of business, government and wider society. The MRN has over 400 public and private organizations participating in its situational awareness platform with over 1,000 credentialed users.


**Figure 1: Key Stakeholders Participating in the Metropolitan Resilience Network.**

Targeted activities of the MRN include:

- Ongoing Risk-Based Communications: Monthly Expert Briefings, Urgent Updates, Collaboration Forums, Flash Surveys, After-Action / Hot Washes post Emergencies
- Face-to-Face Risk Forums
- Joint Exercises
- Best Practice Knowledge Base / Hub
- Results-Oriented Special Projects
- Integration into the regional Emergency Operations Center of the Port Authority of NY & NJ
- Metro-Ops – A regional Situational Awareness & Collaboration Platform

INTERCEP's capabilities developed to support the MRN can be used to support C2SMART stakeholder ideation & vetting. A core focus of the C2SMART Center is to work with metropolitan area stakeholders to develop implementable solutions – the input of stakeholders is vital to assure that their needs inform the problems for which solutions are targeted and an understanding of their context assures that the solutions developed are indeed implementable. The MRN's face-to-face forums, monthly web forums and regular participant surveys can be used to identify and vet targeted solutions of the C2SMART initiative as well as inform approaches to assure that solutions once developed reflect the concerns / context of the user community in their implementation.

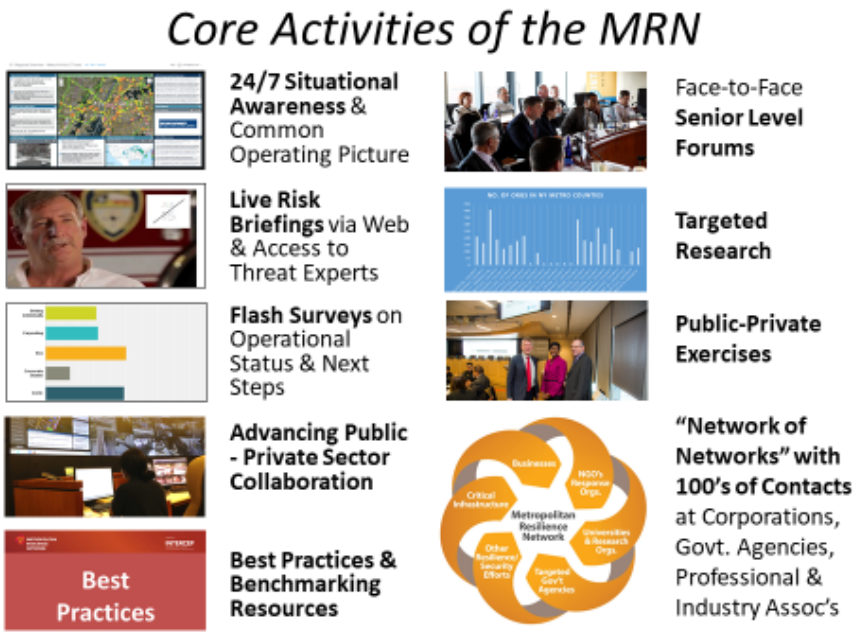


**Figure 2: Core Activities of the MRN**

# Section 3: Situational Awareness Platforms Developed for Four Cities

## 3.1: Platform Overview

Dashboards focused on the operational environment of each city with a primary emphasis on transportation data, but also including other elements of critical infrastructure. Dashboards were created for New York City, Seattle, El Paso, and Newark. All collaborators were granted credentials to access the situational awareness platform, including dedicated dashboards for the four cities. Typical real-time information flows captured and displayed on the dashboard-based platform include:

- Traffic Map
- Traffic Cameras (in some situations)
- Transportation Operational Status Links for
    - Airports
    - Mass Transit (Bus, Rail, Subway, etc.)
- Transportation Announcements
    - Airport Twitter / Email / RSS Feeds
    - Mass Transit Twitter / Email / RSS Feeds
    - 511
- Traffic Announcements – City / Regional Department of Transportation Twitter, RSS, Email
- Public Safety & Health Announcements
    - Fire Department Twitter / Email / RSS
    - Sheriff / Police / FBI Twitter / Email / RSS
    - Public Health Twitter / Email / RSS
    - Emergency Management Twitter / Email / RSS
- Utilities Announcements
    - Electric Utility Twitter / Email / RSS
    - Water Utility Twitter / Email / RSS
    - Telecom (Wireless, Telephone, Cable)
- City Government Twitter / Email / RSS
- Hourly Weather Observations via Twitter / Email / RSS (National Weather Service, etc.)
- C2SMART Information – Links to collaborating centers / universities

The situational awareness and information sharing platform developed constitutes a powerful data and information dissemination tool as well as engagement platform that can potentially help multiple stakeholders provide input into C2SMART's direction, as well as integrate data generated as part of the C2SMART research consortium into their day-to-day operational activity and to advance organizational resilience objectives. Additionally, access to these platforms provides C2SMART staff and collaborators with an opportunity to better understand commonalities and differences among targeted cities and activities and potentially generate ideas for further collaboration. Screen shots as well as a listing of information on each dashboard follows below.

## 3.2: El Paso Dashboard

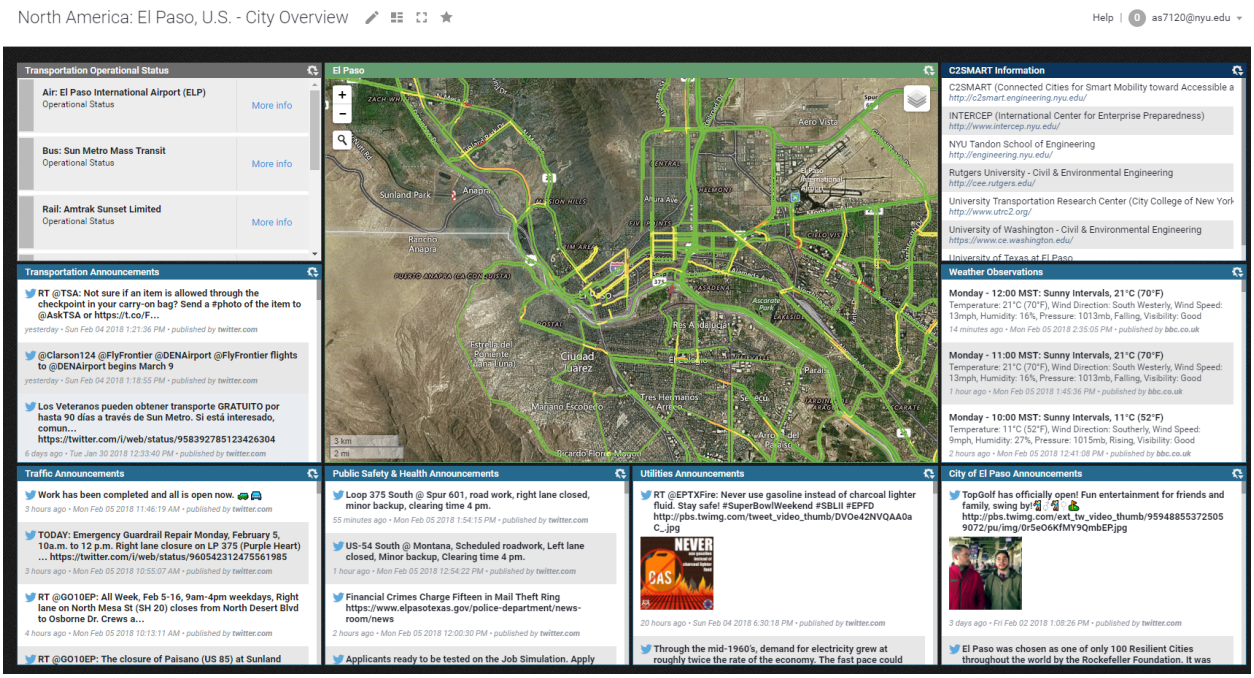


**Figure 3: Dashboard for El Paso, Texas**

El Paso, Texas City Overview includes:

- Traffic map
- Transportation Operational Status Links for
    - El Paso International Airport
    - Sun Metro Mass Transit
    - Amtrak Sunset Limited
    - Amtrak Texas Eagle
    - City of El Paso Traffic Alerts
    - Sun Metro
- Transportation Announcements
    - El Paso Airport Twitter
    - Sun Metro Mass Transit Twitter
- Traffic Announcements – Texas Department of Transportation, El Paso Twitter
- Public Safety & Health Announcements
    - El Paso Fire Department Twitter
    - El Paso Sheriff Twitter
    - El Paso Police Twitter
    - El Paso Public Health Twitter
- Utilities Announcements
    - El Paso Electric Twitter
    - El Paso Water Twitter
- City of El Paso Government Twitter
- Hourly Weather Observations (National Weather Service, etc.)
- C2SMART Information – Links to collaborating centers / universities

## 3.3: Newark Platform

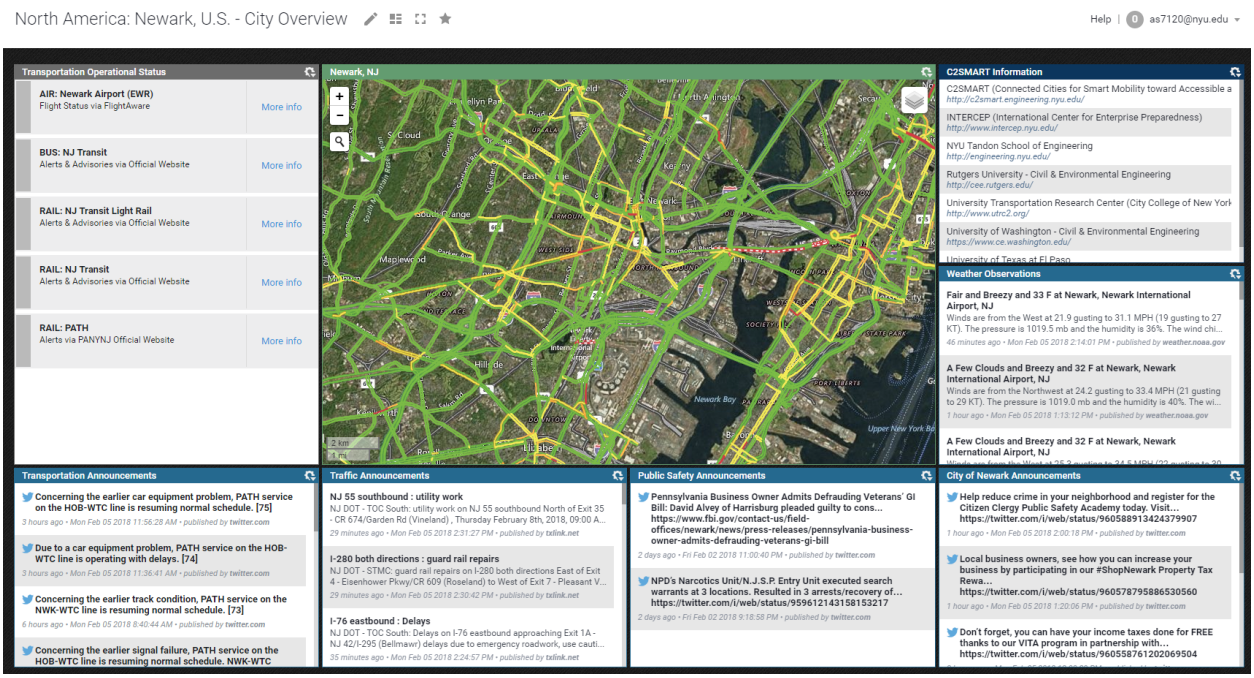


**Figure 4: Newark, New Jersey Dashboard**

Newark, New Jersey City Overview includes:

- Traffic map
- Transportation Operational Status Links
  - Newark Airport
  - NJ Transit Bus
  - NJ Transit Light Rail
  - NJ Transit Train
  - PATH Train
- Transportation Announcements
  - PATH Train twitter
  - NJ Transit Advisories Twitter
  - NJ Department of Transportation Twitter
- Traffic Announcements
  - 511 New Jersey Active Events RSS Feed
- Public Safety Announcements
  - Newark, NJ Police Department Twitter
  - FBI Newark NJ Twitter
- City of Newark Twitter
- Hourly weather observations
- C2SMART Information – Links to collaborating centers / universities

## 3.4: Metropolitan New York City

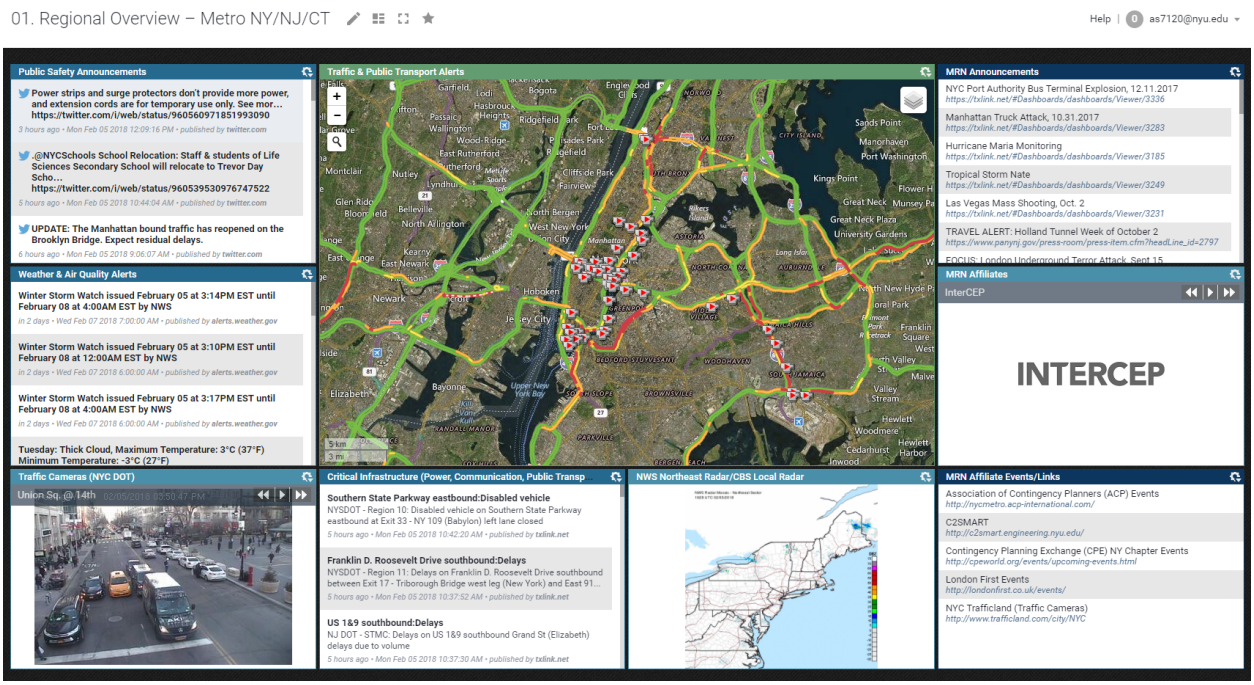


**Figure 5: New York, New York Dashboard**

**New York, New York** City Overview Contains:

- Map
  - Color-coded traffic status (green, amber, red)
  - NYC Department of Transportation Traffic Cameras
- Public Safety Announcements
  - New York Police Department News Twitter
  - NYS Counter Terrorism (DHES) twitter
  - Fire Department of New York Twitter
  - Notify NYC RSS feed
  - NYPD Detectives Twitter
- Weather observations and air quality alerts
- Critical Infrastructure Announcements
  - PATH Train Twitter
  - TransCom Traffic Alerts
  - MTA LIRR Twitter
  - MTA NYC Transit Twitter
  - Metro North Railroad Twitter
  - JFK, LGA, EWR Airport Twitter
  - ConEdison Twitter
  - PSEG Twitter
  - JCP&L Twitter
  - Time Warner Cable Twitter
- NYC Department of Transportation Traffic Cameras
- National Weather Service Regional Radar
- CBS Local Weather Radar
- MRN Announcements (links to breaking event dashboards)
- MRN Affiliate Links including C2SMART Information – Links to collaborating centers / universities

## 3.5: Seattle Platform

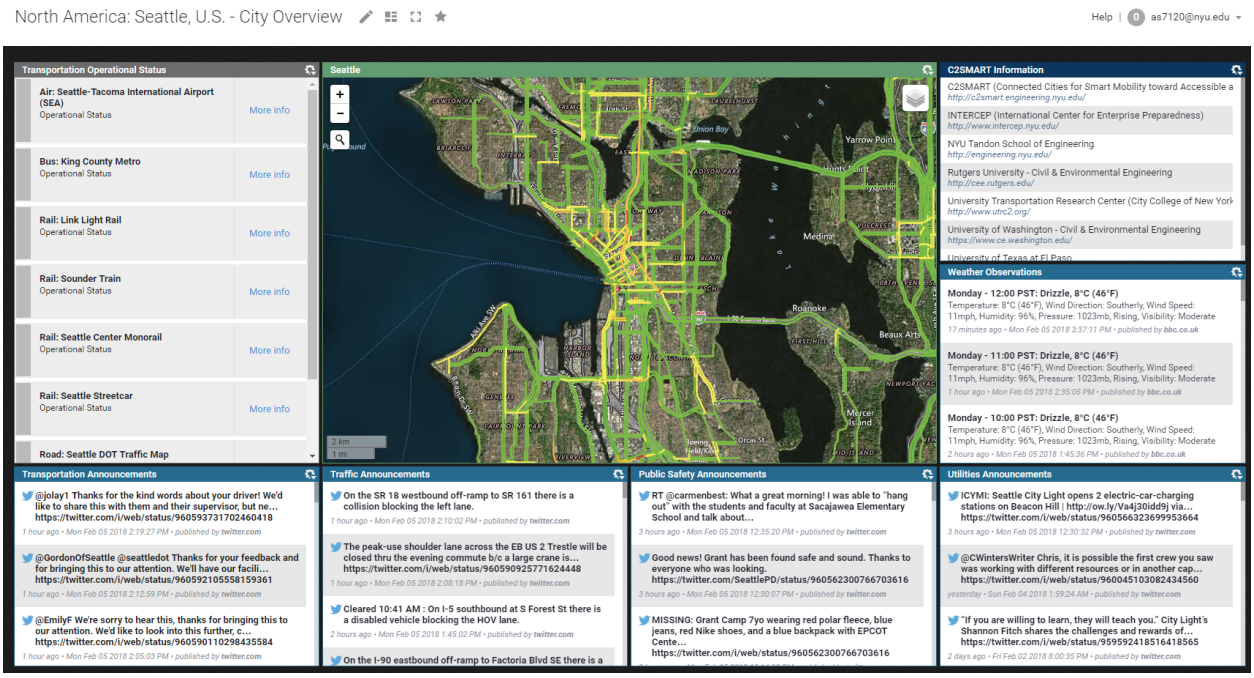


**Figure 6: Seattle, Washington Dashboard**

**Seattle, Washington** City Overview Contains:

- Traffic map
- Transportation Operational Status Links:
  - Seattle-Tacoma International Airport
  - King County Metro Bus
  - Link Light Rail
  - Sounder Train
  - Seattle Center Monorail
  - Seattle Streetcar
  - Seattle Department of Transportation Traffic Map
  - Port of Seattle
- Transportation Announcements
  - Seattle-Tacoma International Airport Twitter
  - King County Metro Bus Twitter
  - Sound Transit Twitter
  - Seattle Department of Transportation Twitter
- Traffic Announcements
  - Washington Department of Transportation Traffic Twitter
- Public Safety Announcements
  - Seattle Police Department Twitter
  - Seattle Fire Department Twitter
- Utilities Announcements
  - Seattle City Light electric power Twitter
  - Puget Sound Energy Twitter
- Hourly weather observations
- C2SMART Information – Links to collaborating centers / universities

# Section 4: Observations & Findings from C2SMART Collaborators

## 4.1: Outreach Process

The INTERCEP research team conducted a series of presentations and feedback discussions related to the information sharing platform dashboards that were created as part of this project. A general presentation was first made to the wider C2SMART community at team meetings in the fall of 2017 and then individually via web conferencing or in-person meetings to lead C2SMART researchers located in each of the targeted cities in early 2018.

## 4.2: Summary Findings

The main recommendations and feedback obtained are summarized below.

General Findings:

- For research purposes it would be helpful to archive real-time information so that it could inform scenarios or support research on potential failures or how transportation infrastructure performs during a major event, such as extreme weather.
- A future application of this platform for research related to C2SMART's mission could be to use it to collect quantifiable data from the various city dashboards and use it to compare performance across cities. This could be in the area of transportation systems and other critical infrastructure systems. This could lend itself to various statistical analyses and comparisons.
- Displaying and archiving data about how people choose to travel and how they combine transportation modes would support C2SMART research objectives.
- The dashboards could incorporate a GIS component and add that information to information captured on the dashboard for archiving and later analysis.
- The dashboard environment could be used as a tool to understand and analyze the utilization of new mobility services including the location of vehicles at different points in time under various conditions.
    - The platform could be used to display and perhaps capture for analysis real time data on electric vehicle charging stations (e.g., usage / availability). NYSERDA[3] (2018) and Plugshare[4] (2018) currently have information that could be used for this purpose. This information could potentially be used to study utilization trends individually and/or in conjunction with other environmental factors (e.g., traffic, mass transit operational status, weather, etc.).
    - The dashboards could incorporate information/maps with real time information on mobility on demand services, such as bike and car share systems. Examples of other mobility services that could be included in a map are: Via, Lyft, Uber, Chariot and the NYU Shuttle.

    - New mobility services including car share, bike share, etc. could also be captured and analyzed, including interactions between such factors potentially rendered as a map of surge pricing for Uber/Lyft and density of bike share bikes in a city.
- Since the dashboards can include information about other factors, another potential future application is to use it to better understand how weather and other factors affect transportation mode choices and combinations.
- It can be difficult to obtain access to data, especially from private sector companies, but it was felt that the concept of a multi-faceted, multi-collaborator platform focused on the wider good and more effective use of transportation options might make data sharing more likely by various entities.
- A potential future research application of this type of data collection and display via the dashboards could be the development of algorithms to detect infrastructure threats and increase security.
- C2SMART is developing simulation platforms for transportation, either for an entire city or for a few intersections. The dashboard environment created by the INTERCEP team could potentially be applied to those efforts by using the platform to display data from simulations.
- Value was seen in the wider use (beyond the current Metro-New York Metropolitan Resilience Network) of the dashboard model to support efforts to gather and disseminate reliable information before, during and after a disaster to support community resilience including information on transportation, health services, communications and relief services.
- The dashboard platform could be used for information sharing among multiple stakeholders across international borders (e.g., adjacent cities such as El Paso in the United States and Juarez in Mexico), and this approach could result in additional collaboration efforts between city governments and universities in a region. Information such as border crossing status / congestion, wider transportation status, commuting patterns, etc. could be shared and potentially analyzed.
- The platform could be used in monitoring and subsequent planning for vehicle parking capacity.
- The platform could be used to create and widen linkage with municipal governments with Chief Resilience Officers funded by the Rockefeller Foundation's 100 Resilient Cities program.
- The dashboard environment could be used to display information about goods movement, including freight carriers, terminals and consolidation centers[5] (King, Gordon and Peters 2014).
    - One application in this area would be to create a map that includes truck and rail flows through freight facilities leading into NYC. For example, currently we do not have a good idea about how much freight is coming from each container terminal to NYC and more work needs to be done in this area. There is information about how much freight is coming from the ports and rail terminals from sources such as the Commodity Flow Survey, but there is a lack of information about the terminals, distribution centers and warehouses where the freight ends up going. A first step in this area would be to create a GIS map with assignment of truck flows through the region.

- The dashboards lend themselves to support use cases and test beds, and could support future C2SMART efforts related to the Network of Living Labs.

A more detailed discussion of input from each collaborating institution follows.

## 4.3: University of Seattle Observations

A WebEx was conducted with Don MacKenzie of the University of Seattle on February 20, 2018. As part of the WebEx, the INTERCEP team discussed the Seattle dashboard, as well as other dashboards that showcase potential features that could be added to the Seattle dashboard or to other dashboards created to support C2SMART research. The following recommendations were made as part of the discussion:

- From a research perspective, displaying and archiving data about how people choose to travel and how they combine transportation modes would support C2SMART research objectives. The dashboard environment could be used as a tool to understand the location of these new mobility service vehicles at different points in time under various conditions.
- An area of interest for the University of Seattle researchers is electric vehicles. In the future it would be great to add real time data on electric vehicle charging stations to the Seattle dashboard. The data may not be available yet and some data in this area is not reliable, but this could be an area of collaboration with other stakeholders. If such data were available and could be archived, it would be useful for research as well.
- Another area where data could be added to the dashboard is new mobility services, including car share, bike share, etc. Certain data could potentially be obtained from company APIs or web scraped. Sometimes these companies don't want to make their data available and do not want it to be archived, but this could be another area of collaboration with multiple stakeholders. An example for the dashboard could be displaying a map of surge pricing for Uber/Lyft, and density of bike share bikes in the city.
- Since the dashboard includes information about other factors, another potential future application is to use it to better understand how weather and other factors affect transportation mode choices and combinations.

A WebEX to discuss the Seattle dashboard created by the INTERCEP team was also held with Xuegang (Jeff) Ban from the University of Washington on February 22, 2018. The main discussion points and recommendations for future activities were:

- A potential future research application of this type of data collection and display via the dashboard could be the development of algorithms to detect infrastructure threats and increase security.
- The University of Seattle research team is also working on community resilience, particularly on how communities can work within themselves to recover from disasters. This kind of dashboard and the model used for the Metropolitan Resilience Network (MRN) that INTERCEP has created

with the support of the Port Authority of New York and New Jersey could support these activities. Specifically, the dashboard model presented could support efforts to gather and disseminate reliable information before, during and after a disaster to support resilience.

- A potential application of a dashboard such as the one developed for Seattle would be for rural areas in Washington State, where there is a need to provide information about communications networks, medical collaborators, and other services. After a disaster these communities may have limited supplies or access to them may be curtailed or disrupted. In such cases, having a dashboard like this one where stakeholders can share information could help ensure that communications, transportation and health services are provided where needed. A tool like this dashboard can provide an information sharing platform to integrate all these components. This could be an immediate use of the platform developed by the INTERCEP team.
- C2SMART is also developing simulation platforms for transportation, either for an entire city or for a few intersections. The dashboard environment created by the INTERCEP team could potentially be applied to those efforts by using the dashboard platform to display data from simulations.

## 4.4: University of Texas Observations

The INTERCEP team developed a dashboard for the city of El Paso, Texas. A WebEx presentation was held with Esmaeil Balal from the University of Texas at El Paso (UTEP) on February 21, 2018 to discuss potential applications of this dashboard to support C2SMART research efforts in that city.

The main discussion points and recommendations were:

- El Paso is a border city. In the near future, the dashboard created for El Paso could also encompass Ciudad Juarez, which is across the U.S.-Mexico border. This characteristic makes El Paso different from the other cities included as part of this effort. Border crossings and the status of transportation and other infrastructure systems at the border could be a critical component of the dashboard.
- The dashboard could be used for information sharing among multiple stakeholders between El Paso and Ciudad Juarez across the border, and this approach could result in additional collaboration efforts between city governments and universities in the region.
- Many people cross the border from Mexico to commute to work. The dashboards may offer an opportunity to monitor and study traffic patterns.
- UTEP is working on a project on parking planning (capacity) for El Paso. They are starting this project and will work with some real traffic data to manage parking in downtown El Paso. They will explore with the city of El Paso what kind of real time data is currently available and the potential to integrate this into the dashboard platform.
- El Paso has a Chief Resilience Officer funded by the Rockefeller Foundation's 100 Resilient Cities program. UTEP researchers felt that the information sharing / situational awareness platform could be used to create greater linkage of their research activities with those of the Chief Resilience Officer of El Paso. They intend to explore the possibility of setting up a conversation with the Chief Resilience Officer. This or a subsequent conversation could include a remote presentation on the platform by INTERCEP staff.

## 4.5: Rutgers University Observations

The INTERCEP team developed a dashboard for Newark, New Jersey. This medium-sized city was selected as a way to explore potential applications and research objectives in New Jersey. A WebEx presentation and discussion was held with Hani Nassif and his research associate from Rutgers University on February 22, 2018.

The main discussion points and recommendations were:

- The dashboard developed by the INTERCEP team for Newark looks great for information sharing and involving multiple stakeholders around issues related to infrastructure and resilience.
- Since the lead researcher for C2SMART at Rutgers is based in New Brunswick, the team discussed the possibility of developing another dashboard in the future for this city. The team felt there could be a lot interest at the city level to have this kind of dashboard and this could be an area of future collaboration with the potential for additional sources of funding. There may be an opportunity to work with the city of New Brunswick around this kind of dashboard.
- A future application of this platform for research related to C2SMART's mission would be to use it to collect quantifiable data from the dashboards and use it to compare performance across cities. This could be in the area of transportation systems and other critical infrastructure systems. This could lend itself to various statistical analyses and comparisons.

## 4.6: NYU INTERCEP Observations

The INTERCEP team developed a dashboard for the New York City metropolitan region. A meeting with Joseph Chow from NYU was held on March 16, 2018. The INTERCEP team presented the dashboard and explained the main features.

The main discussion points and recommendations during the meeting included:

- The dashboards could incorporate a GIS component so that information captured on the dashboard is archived or stored for analysis.
- The dashboards could incorporate information/maps with real time information on mobility-on-demand services, such as bike and car share systems. Examples of other mobility services that could be included in a map are: Via, Lyft, Uber, Chariot and the NYU Shuttle.
- In addition, fixed transportation services like electric charging stations and their status could also be included/displayed. NYSERDA (2018) and Plugshare (2018) currently have information that could be used for this purpose.
- For research purposes it would be helpful to archive real-time information so that it could inform scenarios or support research on potential failures or how transportation infrastructure performs during a major event, such as extreme weather.

- The dashboard environment could be used to display information about goods movement, including freight carriers, terminals and consolidation centers (King, Gordon and Peters 2014).
    - One application in this area would be to create a map that includes truck and rail flows through freight facilities leading into NYC. Currently we do not have a good idea about how much freight is coming from each container terminal to NYC and more work needs to be done in this area. There is information about how much freight is coming from the ports and rail terminals from sources such as the Commodity Flow Survey, but there is a lack of information about the terminals, distribution centers and warehouses where the freight ends up going. A first step in this area would be to create a GIS map with assignment of truck flows through the region.
- The dashboards lend themselves to support use cases and test beds and could support future C2SMART efforts related to the Network of Living Labs.

Previous presentations to the NYU C2SMART consortium members resulted in the following discussion points:

- The platform could facilitate information sharing and engagement
    - within the C2SMART consortium members
    - between C2SMART members and key stakeholders in both the public and private sectors in each of the cities.
- The information fusion / situational awareness dashboards could potentially be adapted to showcase / communicate / vet C2SMART research findings and insights with key stakeholders.
- The platform could potentially be used to advance the application of C2SMART research to real world challenges.

# References

[1] Dueker, K.J. and J.A. Butler. 2000. "A geographic information system framework for transportation data sharing," *Transportation Research Part C* 8: 13-36.

[2] Chen, S., J. Tan, C. Claramunt and C. Ray. 2011. "Multi-scale and multi-modal GIS-T data model," *Journal of Transport Geography* 19: 147–161.

[3] NYSERDA. 2018. *Electric Vehicle Station Locator*. Available at: https://www.nyserda.ny.gov/All-Programs/Programs/Drive-Clean-Rebate/Charging-Options/Electric-Vehicle-Station-Locator

[4] Plugshare. 2018. Available at: https://www.plugshare.com/

[5] King, D.A., C.E. Gordon and J.R. Peters. 2014. "Does road pricing affect port freight activity: Recent evidence from the port of New York and New Jersey," *Research in Transportation Economics* 44: 2-11.