

*The National Academies of*  
SCIENCES • ENGINEERING • MEDICINE

TRANSPORTATION RESEARCH BOARD

**Transportation & COVID-19**  
**Practices from other disease outbreaks**

Monday, March 23  
2:00 - 3:30 PM Eastern

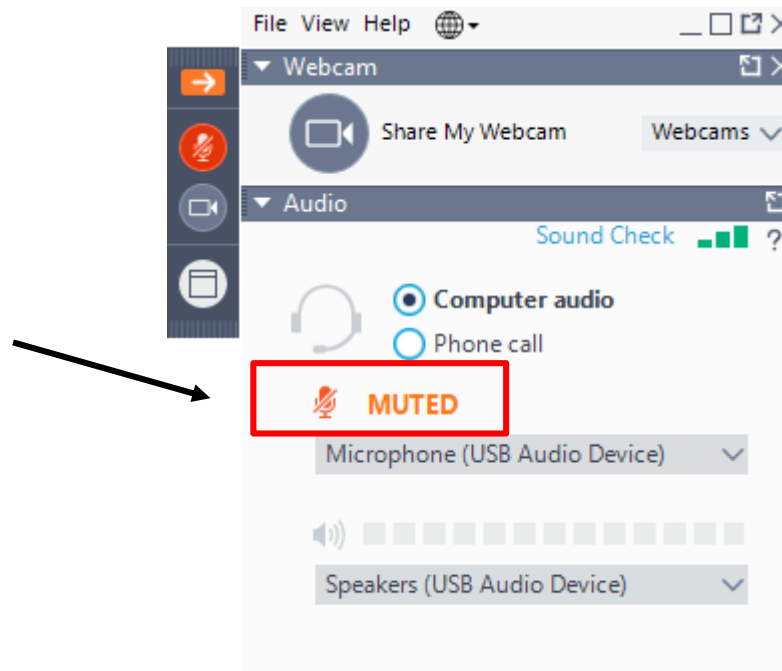
*The National Academies of*  
SCIENCES • ENGINEERING • MEDICINE



TRANSPORTATION RESEARCH BOARD

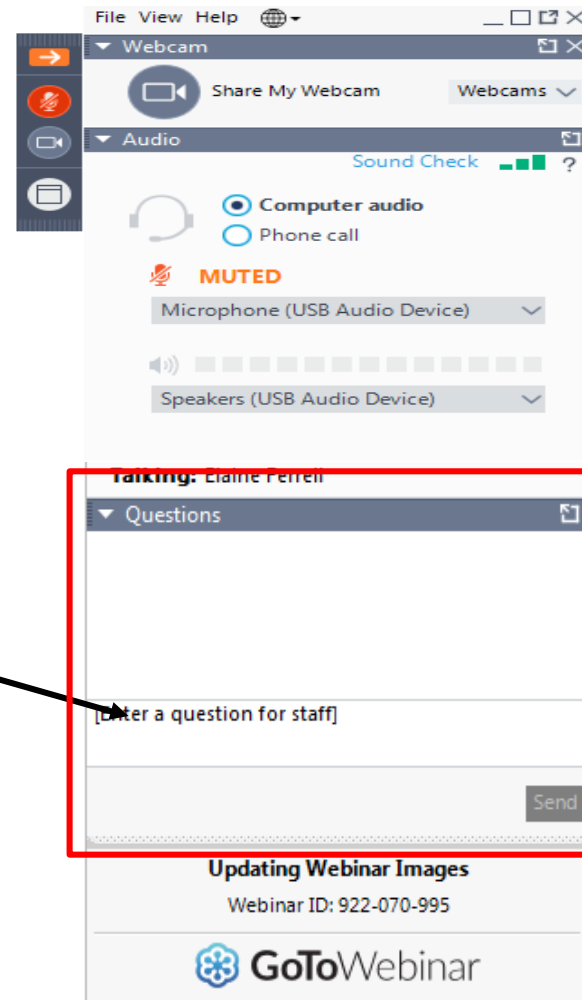
**#COVID19**

# All Attendees Are Muted

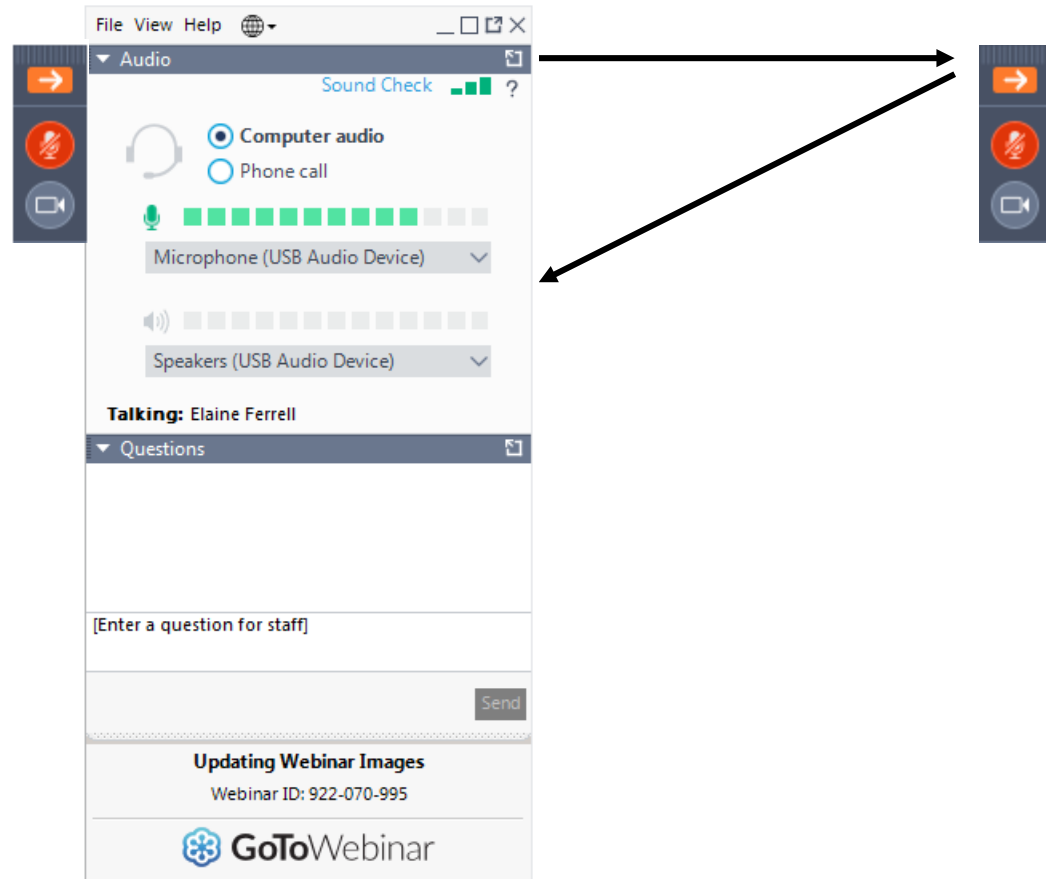


# Questions and Answers

- Please type your questions and include your name into your webinar control panel
- We will read your questions out loud, and answer as many as time allows



# Can't locate the *GoToWebinar* Control Panel?



# Panelists Presentations

<http://onlinepubs.trb.org/onlinepubs/webinars/200323.pdf>

*After the webinar, you will receive a follow-up email containing a link to the recording*



Moderator  
Neil Pedersen, TRB  
Executive Director

Photos (top to bottom) from AP, WHO, and Getty

**#COVID19**

# Issues to Be Addressed

1. Impacts of COVID-19 on the transportation system
2. What we know about how transportation agencies have responded to past communicable outbreaks
3. How should this outbreak be handled by transportation agencies and coordinated between various levels of government and the private sector?
4. What should be the next steps for transportation and public health agencies?

**#COVID19**

# Impacts of COVID-19 on the Transportation System

- Aviation
  - Bans on non-U.S. citizens from certain countries
  - Dramatic reduction in demand and flights
    - Delta scaled back more than 70% of flights and parked 600 jets
  - Shutdown of air traffic control tower at Midway Airport in Chicago
  - White House has asked for \$58 billion in loan guarantees for airlines
  - Airports have asked for \$10 billion in cash grants



# Impacts of COVID-19 on the Transportation System

- Transit
  - Major reductions in ridership
    - New York MTA reductions: 60% on subway; 49% on buses; up to 90% on commuter rail
    - San Francisco BART: 85% fewer riders
  - Operations
    - Dramatic increases in frequency of cleaning
    - Passengers boarding through rear doors
    - Detroit bus drivers refusing to drive
    - Houston increasing buses on most crowded routes
  - \$20 billion bailout in Senate bill

# Impacts of COVID-19 on the Transportation System

- Highways/Toll Roads/State DOTs
  - Major reductions in traffic volumes and revenues
    - Golden Gate Bridge peak hour traffic down 70%
  - Toll road operations
    - Suspension of cash collection of tolls
  - Closure of rest areas
    - Impact on truck parking
  - AASHTO request for \$16.7 billion for state DOTs
  - Sen. Barrasso proposing reauthorization bill as an economic stimulus

# Impacts of COVID-19 on the Transportation System

- Supply Chain
  - Major reductions in port traffic, esp. from Asia
    - Port of Los Angeles volume down 23% in February
  - Railroad volume reductions
    - Carloads down 7.3%; Intermodal down 9% in February
    - Anticipate larger decreases in the future
  - Trucking
    - Increases for medical supplies, paper products
    - Trucking company layoffs due to decreased demand
    - FMCSA and states easing hours of service and weight regulations

# Impacts of COVID-19 on the Transportation System

- Amtrak/Passenger Rail
  - Amtrak ridership down 90%
  - Amtrak emergency request for \$978 million, includes \$200 million for state-supported routes.
- Shared Mobility
  - Concerns about health issues with TNCs
    - Cleaning of vehicles
    - Drivers continuing when sick
  - Health concerns about micromobility
    - Miami has banned shared use scooters, mopeds, bicycles



# Presenters

- **Vicki Hertzberg**, Director, Center for Nursing Data Science, Emory University
- **Herby Lissade**, Principal Transportation Engineer at the California Department of Transportation, Chair of several NCHRP panels on emergency management
- **Kim Fletcher**, President, Loch Haven Partners, P.I. for *NCHRP Report 769: A Guide for Public Transportation Pandemic Planning and Response*

**#COVID19**

# Aviation

**#COVID19**

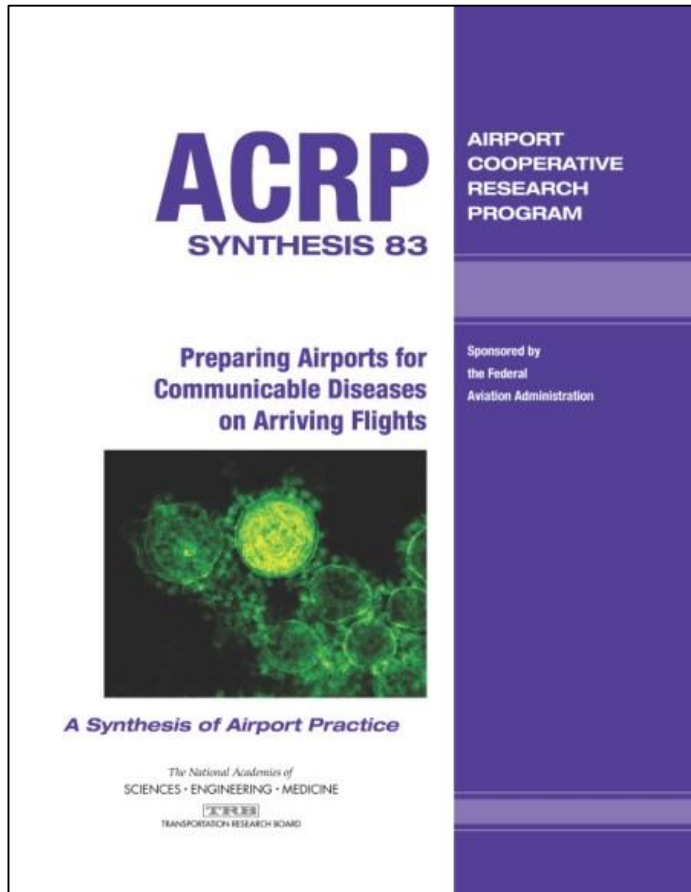
# Infectious Disease Mitigation in Airports and on Aircraft



Guidebook identifies 24 recommended actions to mitigate disease transmission at airports and aboard aircraft that are classified into three broad categories to assist managers with identifying actions for buildings, airplanes, and people.

**#COVID19**

# Preparing Airports for Communicable Diseases on Arriving Flights



Findings and best practices in

- Comprehensive planning
- Partnership and stakeholder engagement
- Legal issues
- Strategic communications
- Exercising, drilling, training, and education
- Evaluation and continuous improvement.

**#COVID19**



**Vicki Stover Hertzberg**  
*Professor, Emory University*  
and

*Director, Center for Nursing  
Data Science, Nell Hodgson  
Woodruff School of Nursing*



**#COVID19**

# COVID-19: Implications for the Transportation Industry

**Vicki Stover Hertzberg, PhD, FASA, P.Stat.®**

**Professor**

**Nell Hodgson Woodruff School of Nursing**

**Emory University**

**Atlanta, GA**

# Outline

- **Modes of transmission of upper respiratory infectious diseases in transportation**
- **Documented instances of upper respiratory infectious disease transmission in air travel**
- **FlyHealthy Study**
  - **Behaviors and movements: risk of becoming infected**
  - **Airplane cabin microbiome**

# Modes of transmission of disease

- **Large droplets**
- **Aerosols**
- **Fomites**



Photo courtesy of CDC/Brian Judd

# Modes of transmission: large droplets

- **Definitions vary, some say  $> 5 \mu\text{m}$ , others say  $> 60 \mu\text{m}$  in diameter**
- **Droplets contain**
  - **Cells (epithelial cells that line the airways; immune cells)**
  - **Physiological electrolytes such as those in mucus and saliva (e.g.,  $\text{K}^+$ ,  $\text{Na}^+$ ,  $\text{Cl}^-$ )**
  - **Infectious agents (e.g., bacteria, fungi, viruses)**

# Modes of transmission: large droplets

- **Quickly fall to the ground (within  $\sim 1\text{m}$ ) (gravity – it's more than a theory, it's a law)**
- **Expelled from mouth and nose by multiple modes**
  - **Sneezing**
  - **Coughing**
  - **Talking**
  - **Breathing**

# Modes of transmission: aerosols

- **Smaller than a large droplet**
- **Generated in the same manner as large droplets**
- **Same content as large droplets**
- **Can remain suspended in air for long periods of time, and therefore**
- **Can travel distances > 1m**

# Modes of transmission: fomites

- **Droplets and aerosols can become deposited on surfaces**
- **The microbes present can survive for hours or days, depending on the particular microbe, the environment, and the type of surface**
- **Indirect transmission from person to person**
- **Door knob example**



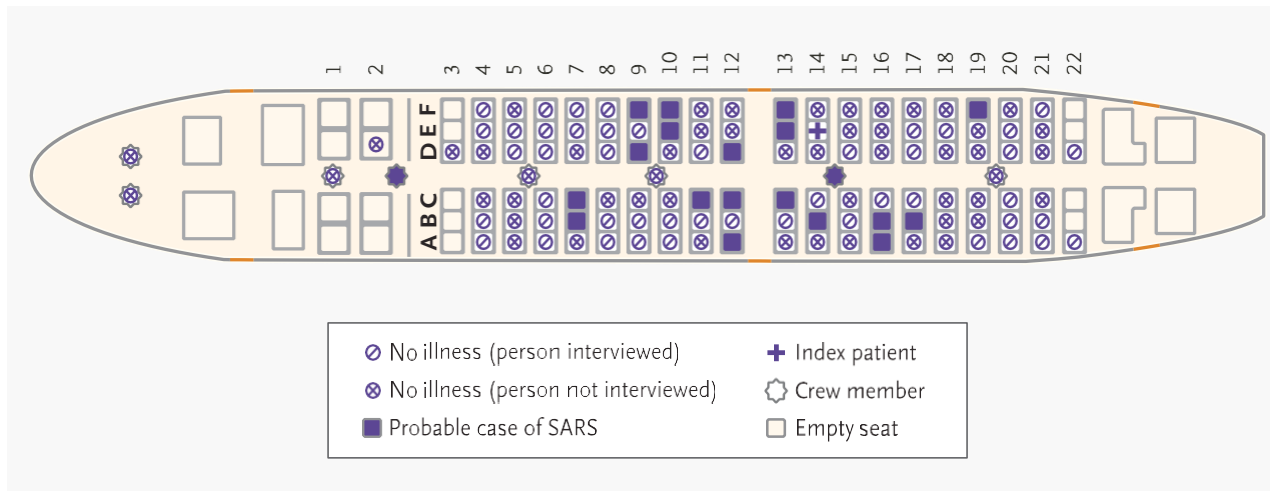
# Transmission of infectious diseases on airlines

There were an estimated 4.5e9 flights taken in 2019. Spread of disease by air travel is a significant global health concern.

**Documented cases of diseases transmitted on airplanes:**

- TB (4 reports)
- Measles (2 reports)
- Influenza (5 reports, including H1N1p)
- SARS (2 reports)
- Meningococcal infection
- Norovirus (3 reports)
- Cholera
- Shigellosis

# SARS transmission on CA 221 from HKG-PEK



Olsen, Sonja J., et al. "Transmission of the severe acute respiratory syndrome on aircraft." *New England Journal of Medicine* 349.25 (2003): 2416-2422.

# **Fly Healthy Study Goals**

- 1) Characterize the airplane cabin microbiome**
- 2) Quantify transmission opportunities**
- 3) Create seat map of risk of transmission of ID from infected individual**

# **FlyHealthy Research Study**

- **Flew a team of graduate students and postdocs between Atlanta and the West Coast**
  - 5 round trips = 10 flights
  - 4 round trips = 8 flights during “flu season”
- **Recorded behaviors and movements of passengers and flight attendants while above 10,000 feet – reconstructed all movements**
- **Took environmental samples (air, touch surfaces) before and after each flight – airplane cabin microbiome**

# FlyHealthy Research Study: Results of Environmental Sampling

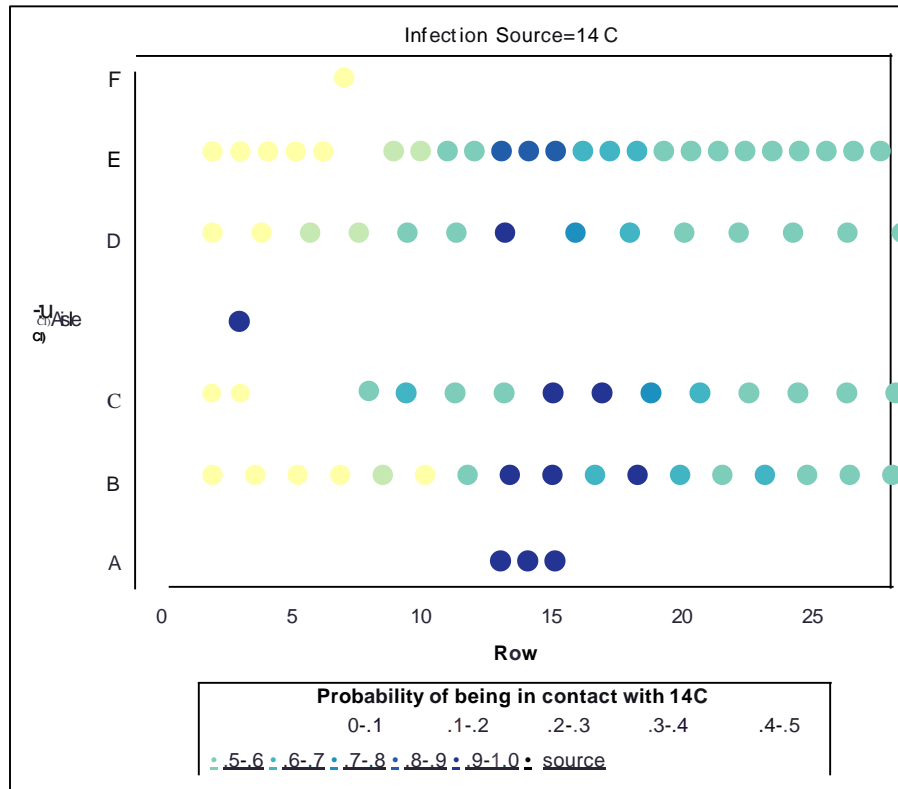
- 1. Bacterial communities were largely derived from human skin and oral commensals, as well as environmental generalists**
- 2. Identified “core” airplane cabin microbiome**
- 3. Very large flight-to-flight variations and no systematic pattern of change from pre- to post-flight**
- 4. Although different primers and sequencing techniques were used, the core microbiome from Boston subway system study has significant overlap with airplane cabins**

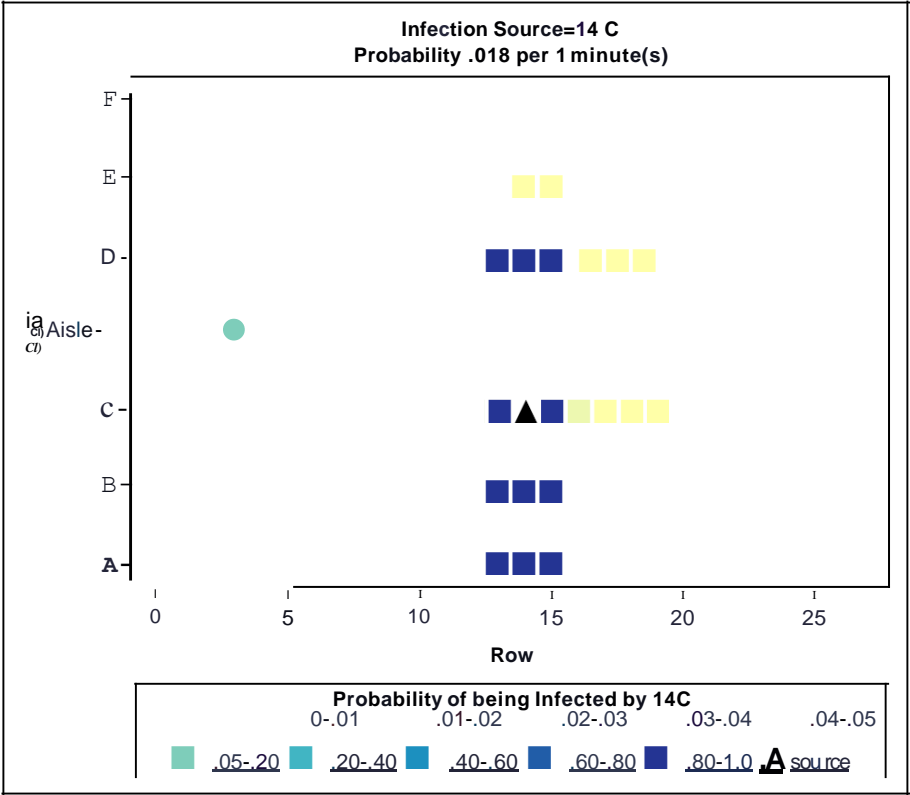
# FlyHealthy Research Study: Results of Analysis of Behaviors and Movements

**Using networks of close proximity contacts from 10 flights, generate many hundreds of thousands of 4 hour “fantasy flights”**

**Probability of transmission: 0.018 (2x0.009) for one minute of close contact**

Moser MR, *et al.* (1979) Outbreak of influenza aboard a commercial airliner. *American Journal of Epidemiology* 110(1):1-6.







# Many Thanks to

**Co-PI:**

**Howie Weiss, PhD**  
**Professor of Mathematics**  
**Georgia Tech**  
**Professor of Biology**  
**Pennsylvania State University**



**Sharon Norris, MD**  
**The Boeing Company**

**Delta Airlines**  
**CDC**  
**NIOSH**  
**TSA**

**Lead Statistician:**

**Lisa Elon, MS & MPH**  
**Senior Associate**  
**Biostatistics and Bioinformatics**  
**Rollins School of Public Health**  
**Emory University**

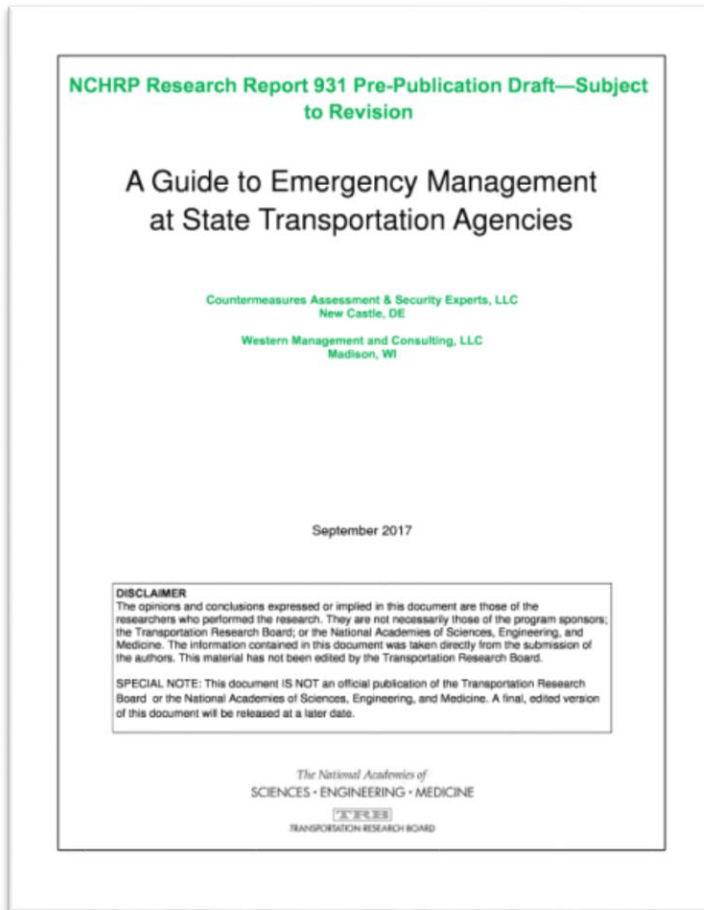


**FlyHealthy Research Team**

# State DOT Emergency Management

**#COVID19**

# A Guide to Emergency Management at State Transportation Agencies



Update to a 2010 guide that provided an approach to all-hazards emergency management and documented existing practices in emergency-response planning

## #COVID19

# Herby G. Lissade

*Assistant Division Chief,  
Offices of Maintenance  
Technical and Field  
Support, California  
Department of  
Transportation (Caltrans)*



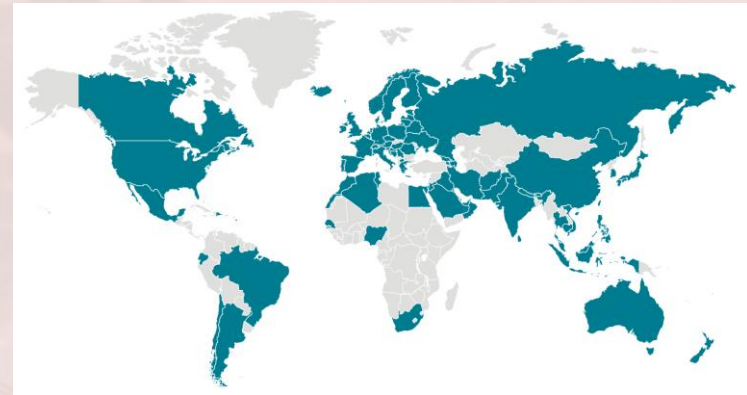
- Chair, NCHRP panel-Catastrophic Transportation Emergency Management, a Guide to Emergency Response Planning at State Transportation Agencies
- Chair, NCHRP panel-Emergency Management at State Transportation Agencies

## #COVID19

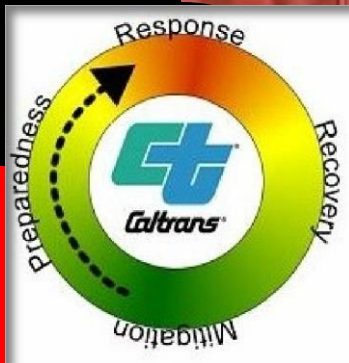
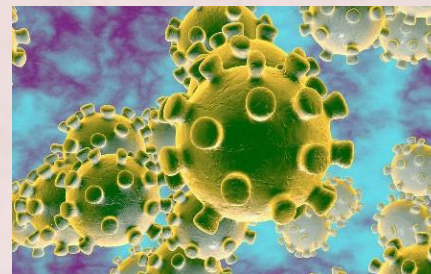
# Transportation & COVID-19

## Applying an all hazards approach

Transportation Research Board  
March 23, 2020



**Herby G. Lissade, P.E.**  
Principal Transportation Engineer  
California Department of Transportation



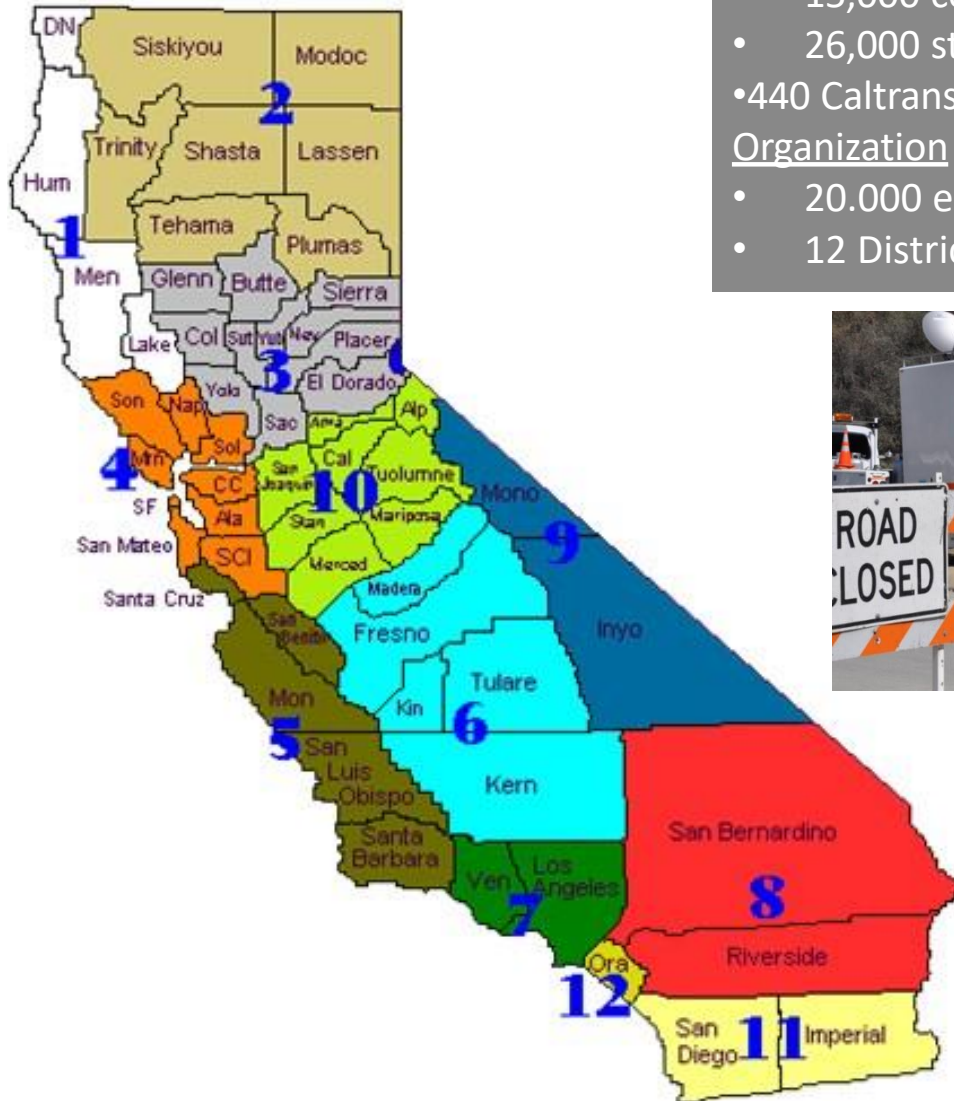
# Caltrans 12 Districts

## Infrastructure

- 15,000 centerline miles of highway
- 26,000 state and local bridges
- 440 Caltrans building facility sites

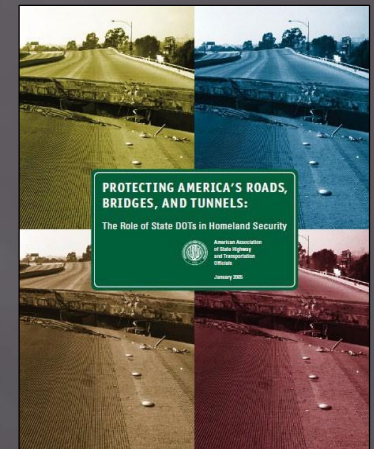
## Organization

- 20,000 employees
- 12 Districts



# State DOT's Major Responsibilities

- ▣ Highways
- ▣ Transit
- ▣ Freight and Passenger Rail
- ▣ Ports and Ferries
- ▣ General and Commercial Aviation Facilities
- ▣ Bike/Pedestrian
- ▣ Motor Carrier/Motor Vehicle Services
- ▣ State Patrol



Source: Protecting America's Roads, Bridges, & Tunnels: The Role of State DOTs in Homeland Security, AASHTO, 2006.

# State DOT's - Guardians of Nation's Transportation Network

DOT's own & operate 1.8 million lane miles & 273,200 bridges

5 billion daily vehicle miles (DVMT) traveled on DOT's roads and bridges, or 65% of total DVMT

\$92 billion/year needed just to preserve system without extra security



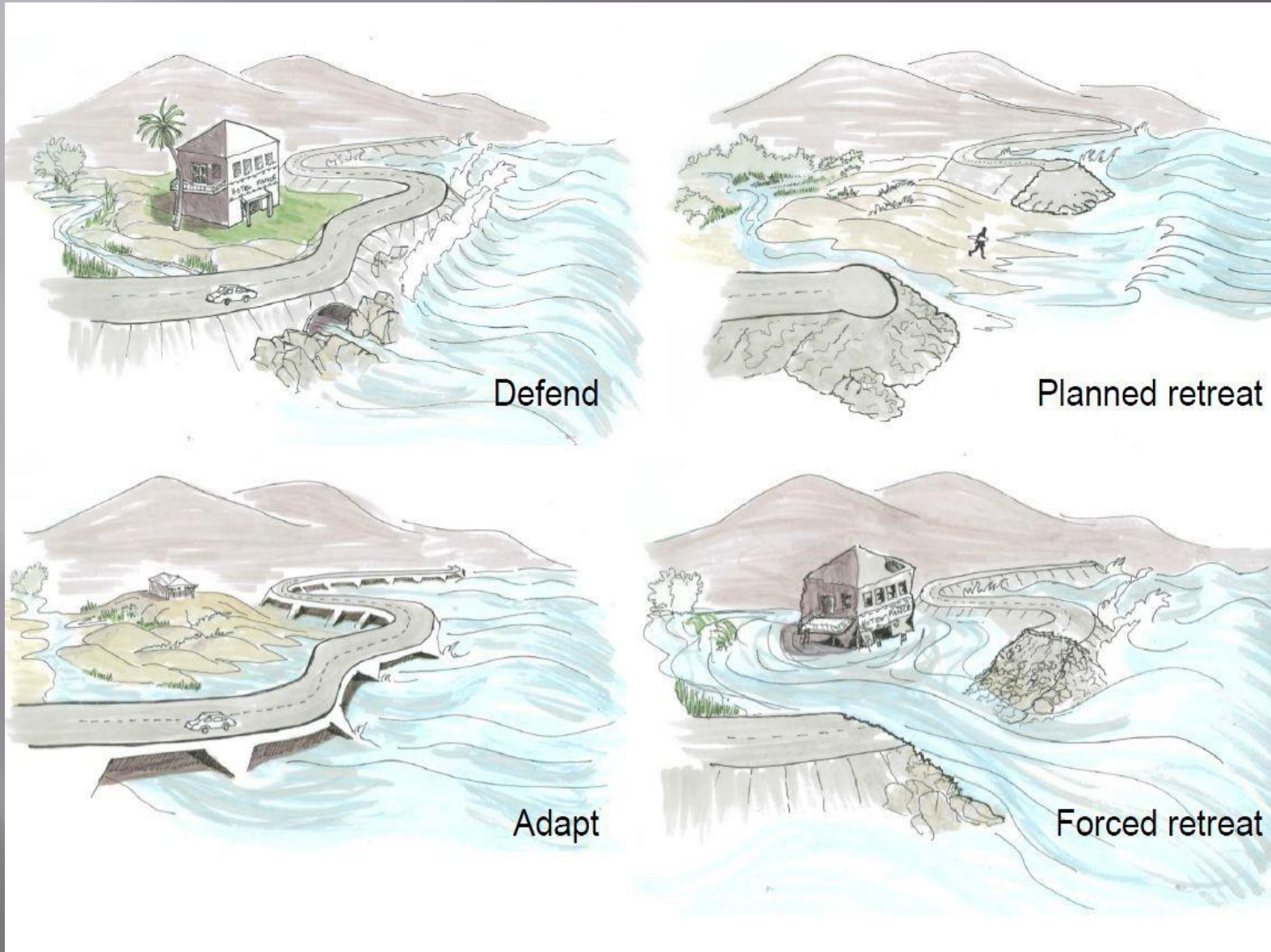


# FEMA Traditionally Recognized Types of Disasters

1. Chemical Emergencies
2. Dam Failure
3. Earthquake
4. Fire or Wildfire
5. Flood
6. Hazardous Material
7. Heat
8. Hurricane
9. Landslide
10. Nuclear Power Plant Emergency
11. Terrorism
12. Thunderstorm
13. Tornado
14. Tsunami
15. Volcano
16. Wildfire
17. Winter Storm



# Traditional Approach



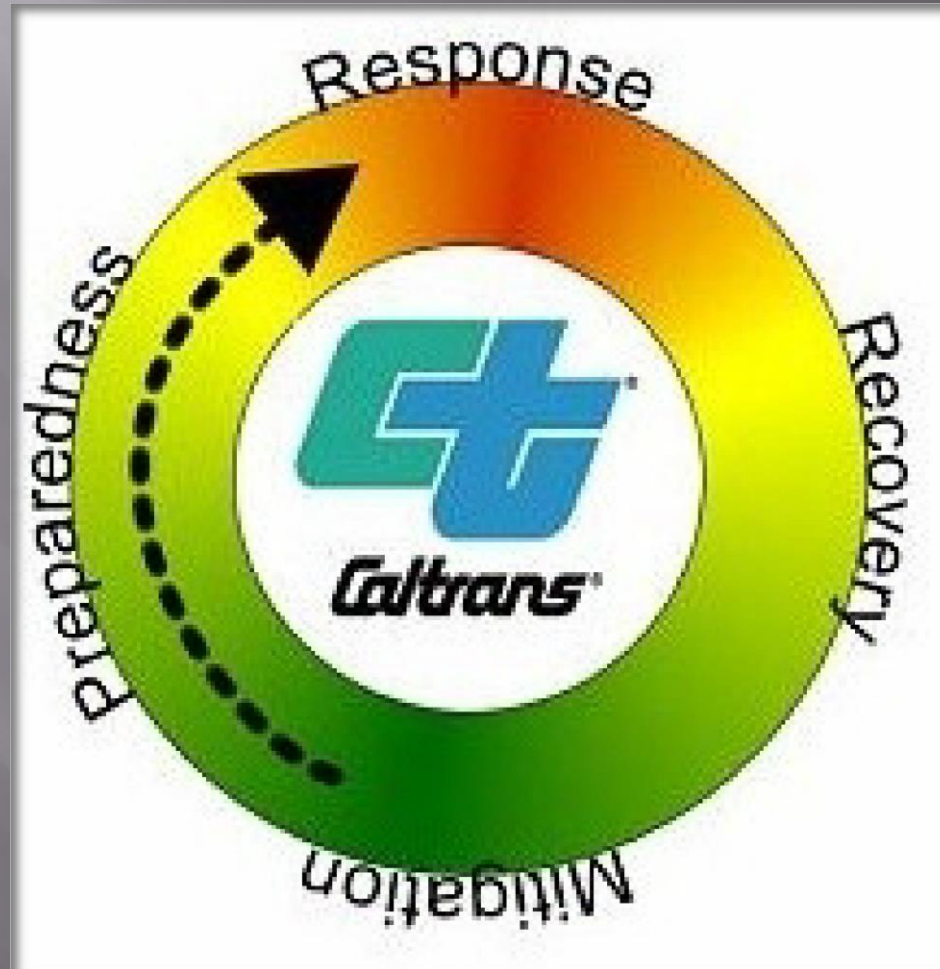
Example for Sea Level Rise Adaptation Options

# All Hazards Planning Fundamentals

- ▣ **Prevention:** Capabilities necessary to avoid, prevent, or stop a threatened or actual act of terrorism.
- ▣ **Protection:** Capabilities necessary to secure against acts of terrorism and manmade or natural disasters.
- ▣ **Mitigation:** Capabilities necessary to reduce loss of life and property by lessening the impact of disasters.
- ▣ **Response:** Capabilities necessary to save lives, protect property and the environment, and meet basic human needs after an incident has occurred.
- ▣ **Recovery:** Capabilities necessary to assist communities affected by an incident to recover effectively.

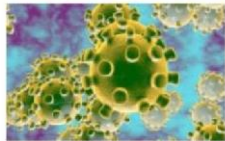


# Emergency Management State DOT Perspective



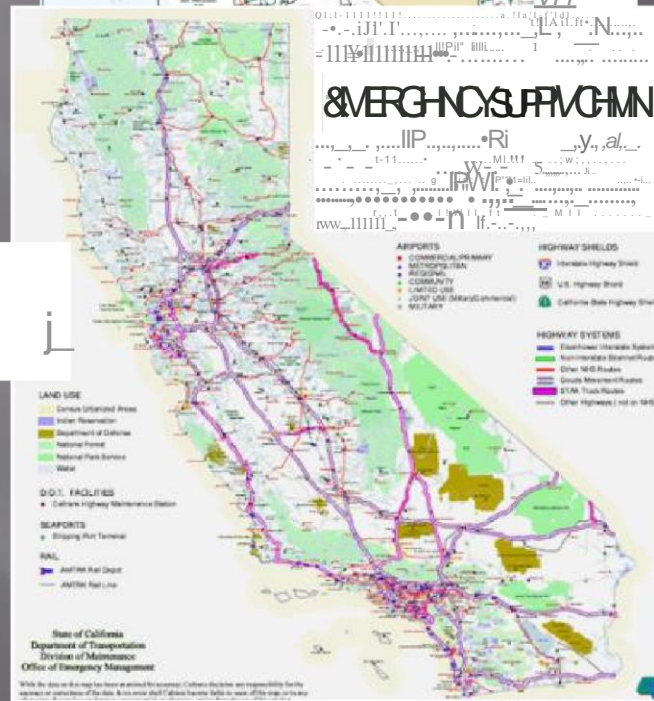
# Preparedness

CALIFORNIA DEPARTMENT OF TRANSPORTATION  
 DIVISION OF MAINTENANCE  
 Office of Emergency Management and Infrastructure Protection  
**WORKING DRAFT**  
 INTERIM PANDEMIC RESPONSE PLAN  
 2020



**Continuity  
 Succession  
 Communications  
 Risk  
 Responsibilities**

Updated March 18, 2020



# NCHRP

PORT 769

NATIONAL COOPERATIVE  
 HIGHWAY  
 RESEARCH PROGRAM

A Guide to Public  
 Infrastructure  
 Planning and  
 Construction

TRANSFORMATION RESEARCH BOARD  
 OF THE NATIONAL ACADEMIES



# Response

COVID-19 Map FAQ →

Coronavirus COVID-19 Global Cases by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)

Total Confirmed

14,631

Confirmed Cases by Country/Region /Sovereignty

- 81,250 China
- 41,035 Italy
- 18,407 Iran
- 18,077 Spain
- 16,290 Germany
- 14,230 US
- 10,891 France
- 8,652 Korea, South
- 4,164 Switzerland
- 3,297 United Kingdom
- 2,468 Netherlands
- 2,203 Austria
- 1,802 Norway



Cumulative Confirmed Cases Active Cases

Total Deaths

210

- 74 deaths Washington US
- 38 deaths New York US
- 19 deaths California US
- 11 deaths Louisiana US
- 10 deaths Georgia US
- 9 deaths Florida US
- 9 deaths New Jersey US

Total Recovered

121

121 recovered US US



Actual Logarithmic Daily Cases

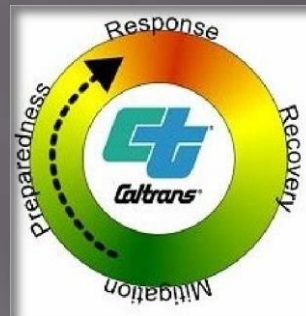
163

countries/regions

Lancet Inf Dis Article: [Here](#). Mobile Version: [Here](#). Visualization: JHU CSSE. Automation Support: [Esri Living Atlas team](#) and [JHU APL](#). Contact US: [FAQ](#).  
 Date sources: WHO, CDC, ECDC, NHC, DXY, 1point3acres, Worldometers.info, BNO, state and national government health department, and local media reports. Read more in this [blog](#).



# Recovery



# Mitigation







Thanks!

Herby G. Lissade, P.E.

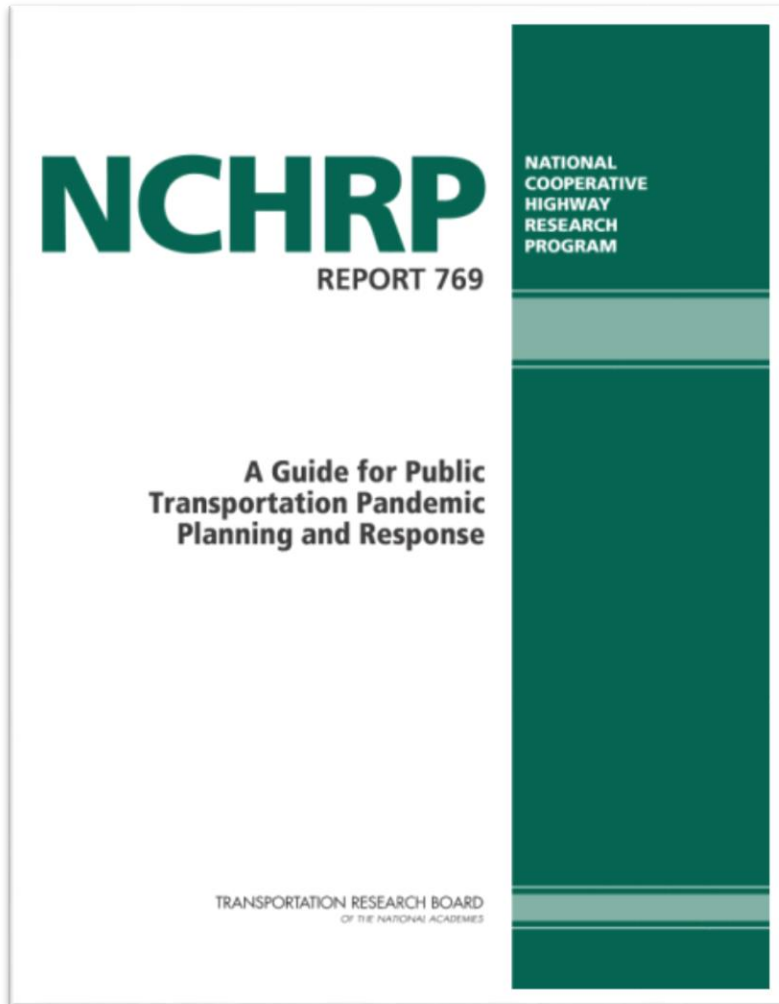
Caltrans – [Herby.Lissade@dot.ca.gov](mailto:Herby.Lissade@dot.ca.gov)



# Public Transportation

**#COVID19**

# A Guide for Public Transportation Pandemic Planning and Response



- Provides support to transportation organizations as they prepare for pandemics and other infectious diseases such as seasonal flu
- Although prepared for public transportation agencies, it can be used by all types and sizes of transportation agencies and organizations

**#COVID19**

# Public Transit Emergency Preparedness Against Ebola and Other Infectious Diseases: Legal Issues



- Legal background
- Closures of major traffic generators
- Full or partial suspension of service
- Screening and prescreening
- Quarantine and isolation
- Employee protocols and work safety
- Infection control and disinfection measures

# #COVID19

# Kim Fletcher

*President, Loch Haven  
Partners*

• lead author of *NCHRP Report  
769: A Guide for Public  
Transportation Pandemic  
Planning and Response*



## #COVID19



*NCHRP Report 769:*

**A Guide for Public  
Transportation Pandemic  
Planning and Response**

*December 2013*

*(Reflects Stakeholder and Panel Feedback)*

# Focus of the Study



Impacts of pandemic on:

- Small urban and rural transit agencies
- Human services transportation providers
- State DOTs that provide oversight for grant recipients in both categories

# Chapter 1: Introduction



- How to use the document based on an organization's experience level and size
- What is important to know about pandemics?
- Pandemic impacts to transportation organizations
- Case study: pandemic influenza versus seasonal flu
- Understanding how pandemics differ from other hazards
- When to activate your pandemic plan



# Chapter 2: How Prepared is an Organization for a Pandemic?



- Traditional components of a comprehensive emergency management program: mitigation, preparedness, response, and recovery
- How all-hazards disaster management supports pandemic response
  - 80% of pandemic response is generic to all disasters
- Identifying organizational vulnerabilities during a pandemic

# Chapter 3: Decision Making and Partnerships



- Decision making
  - Clarity in delegation of responsibility and authority is key
  - Incident command system facilitates decision making
- Working with partners
  - How to be an effective partner
  - Potential partners in pandemic response
  - Being active in the community
- Establishing an emergency operations center
- Developing strategies to ensure timely and relevant information exchange in a pandemic
- Role of policy makers

# Chapter 4: Preventing the Spread of Disease



- Measures that prevent the spread of disease
  - engineering controls, administrative controls, personal protective equipment, hand hygiene, environmental hygiene, social distancing, and ventilation
- Non-pharmaceutical interventions
  - Characteristics that determine the effectiveness of non-medicated community containment
  - Examples of containment measures with specific considerations for transportation organizations
- Cleaning and disinfection of transportation assets
- Medical Interventions

# Chapter 5: Providing Services During a Pandemic



- Identifying essential functions
- Service utilization changes
  - Normal ridership likely to decrease
  - Potential influx of people without vehicles from urban areas
- Providing services for ill passengers
  - Direct and indirect pandemic transmission
    - Examples of illnesses that spread directly or indirectly
    - Preventative actions for directly and indirectly transmitted disease

# Chapter 6: Workforce



- Causes of changes in normal staffing routines
- Preparation of human resource policies
- Family preparedness planning

# Chapter 7: Crisis and Emergency Risk Communication



- Communication during a crisis must be simple, concise, and consistent
  - Keep staff informed
  - Track and rapidly respond to rumors
  - Use diverse communication methods
- Predetermine methods for rapid and accurate public information
- Utilize traditional media (e.g. press releases, press conferences, e-mail distribution, etc.) and social media (e.g. Twitter, Facebook, etc.) for disseminating public information

# Assessment Tools and Checklists



- Sample Pandemic Activation Matrix
- Pandemic Vulnerability Assessment
- Decision Making and Partnership Planning Tool
- Preventing the Spread of Disease Checklist
- Providing Services During a Pandemic Checklist
- Workforce Checklist
- Public and Media Relations Checklist

# Implementation Plan



- Intended audiences: rural and small urban transit organizations
- Impediments to implementation:
  - Budgetary constraints, lack of resources, abstract nature of threat, cultural barriers/turf barriers, and the infrequent nature of the threat
- Potential leaders in guide implementation:
  - Transportation and public health organizations (including TRB); federal, state, and local agencies
- Online implementation support
- Criteria for measuring implementation progress and consequences
- Update regularly (every 3 years) – with new tools and lessons learned



# What Should Transit Systems Do?



- Preparing for a pandemic
- Decision making and developing partnerships
- Preventing the spread of the disease
- Providing services during a pandemic
- Workforce issues
- Crisis and emergency risk communications
- Assessment tools and checklists

# Key Learning



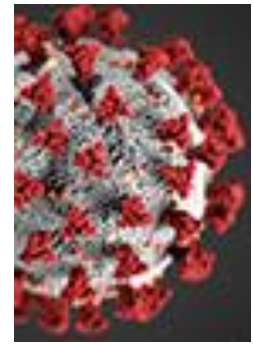
- Transportation organizations are best prepared when they have:
  - A robust overall all hazards emergency program
  - Routinely do collaborative planning, training and exercising
  - Means to communicate with riders before and during an outbreak

# Key Learning



- Developed several plausible scenarios and actions to be taken – in advance
- Developed relationships with key policy makers that are able and willing to make reasoned decisions

# Past TRB Webinars



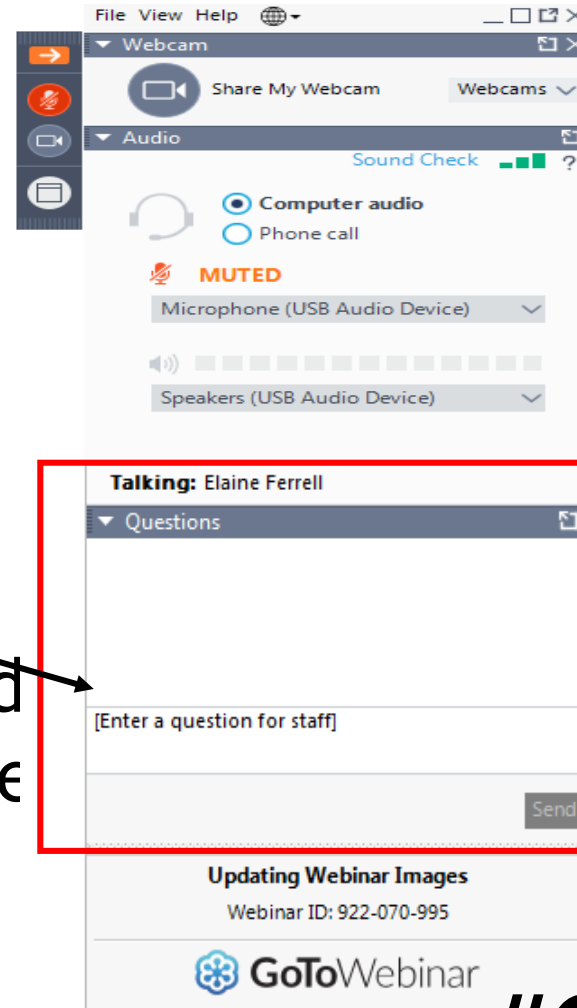
All recorded TRB webinars, including this one:  
[www.trb.org/ElectronicSessions/RecordedSessions.aspx](http://www.trb.org/ElectronicSessions/RecordedSessions.aspx)

- Emergency Preparedness Against Infectious Diseases on Public Transit, *August 14, 2018*
- Airport Response during Communicable Disease Outbreak, *December 11, 2018*
- Let's Work Together: Airport Emergency Working Groups, *February 19, 2020*

**#COVID19**

# Questions and Answers

- Please type your questions and include your name into your webinar control panel
- We will read your questions out loud, and answer as many as time allows



**#COVID19**

# TRB Resources - Communicable Disease and Pandemics



Available reports and webinars that TRB has produced.

<http://bit.ly/TRBcoronavirus>

**#COVID19**

# Get Involved with TRB

- Getting involved is free!
- Join a Standing Committee (<http://bit.ly/TRBstandingcommittee>)
- Become a Friend of a Committee (<http://bit.ly/TRBcommittees>)
  - Networking opportunities
  - May provide a path to become a Standing Committee member
- For more information: [www.mytrb.org](http://www.mytrb.org)
  - Create your account
  - Update your profile



@NASEMTRB



@NASEMTRB



Transportation  
Research  
Board

**TRB turns 100 on November 11, 2020**

**100 YEARS**  
**2020**

**TRB**

**Help TRB:**

- Promote the value of transportation research;
- Recognize, honor, and celebrate the TRB community; and
- Highlight 100 years of accomplishments.

Learn more at

[www.TRB.org/Centennial](http://www.TRB.org/Centennial)

#TRB100

**MOVING IDEAS: ADVANCING SOCIETY—100 YEARS OF TRANSPORTATION RESEARCH**