



Cal OES

GOVERNOR'S OFFICE
OF EMERGENCY SERVICES

California Earthquake Early Warning Advisory Board meeting

June 29, 2022



Roll Call

- Secretary of Natural Resources Agency
- Secretary of California Health and Human Services
- Secretary of Transportation
- Secretary of Business, Consumer Services, and Housing
- Speaker of the Assembly appointee representing the interests of private businesses.
- Governor's appointee representing the utilities industry
- Senate Committee on Rules appointee representing county government.
- Chancellor of the California State University
- President of the University of California



Review of October 27, 2021 Minutes



General Program Update

Jose Lara, Chief, Seismic Hazards Branch



General Program Update

Since October 2021 advisory board meeting:

- 2022 Business Plan
- System Operations
 - CEEWS Contributing Stations: 871 (+28) contributing out of 1115 as of 5/01/2022
 - CEEWS Build Out
- Research and Development
 - HomeBase feature
- Finance
 - Budget Allocations
- Education & Outreach
 - Earthquake Preparedness Month Tour
 - Success Videos



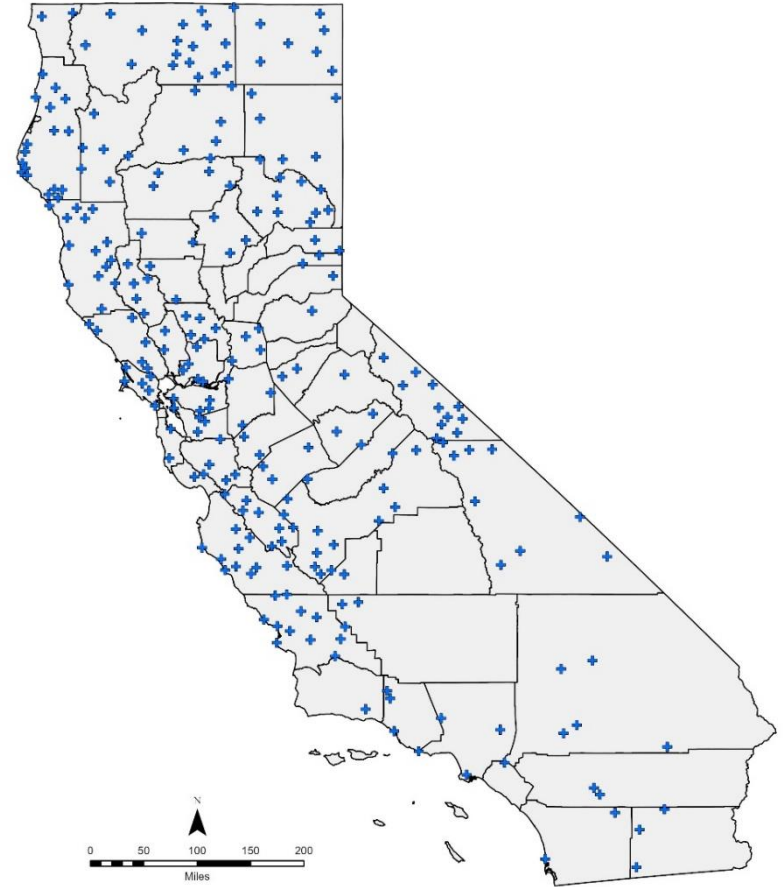
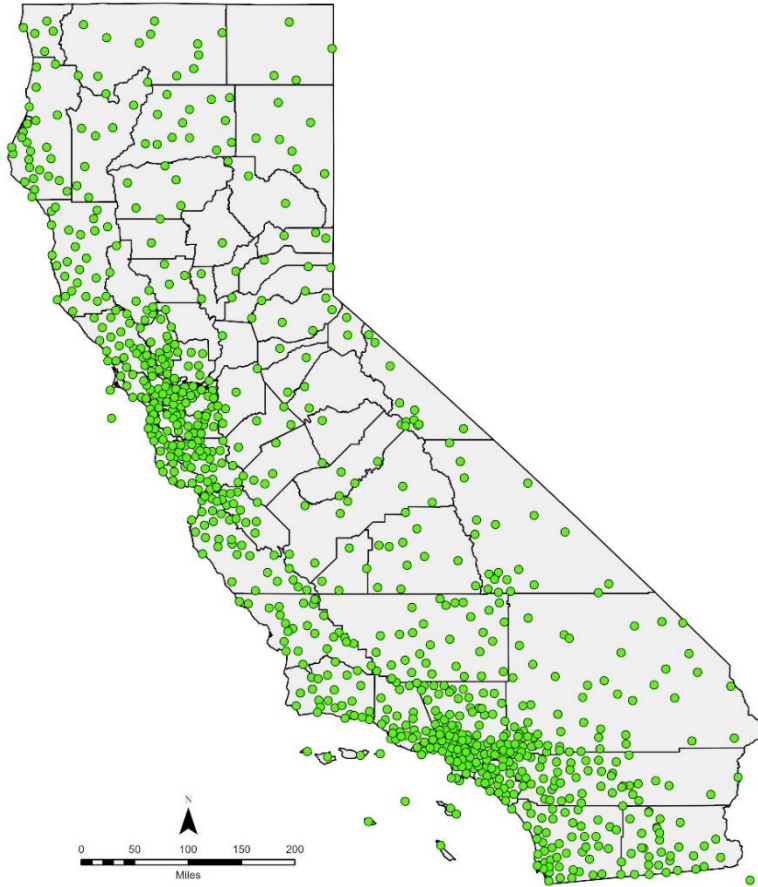
System Operations Update

Jose Lara, Chief, Seismic Hazards Branch



CEEWS Network Goal of 1115 Stations

October 2022 Status



871 stations in CA
contributing to Shake!lert™

244 stations to go!!



CEEWS System Operations Overview 2016-2022



Caltech



Accomplishments

- Completed **399** new and updated EEW/real-time stations
- Connected **63** EEW stations to State Microwave

	Funded New/Updated EEW Stations	Completed	Remaining
CA Geological Survey	232	162	70
US Geological Survey	161	101	60
UC Berkeley	152	84	68
Caltech	133	30	103
Department of Water Resources (DWR)	24	22	2
Total	702	399	303

	Funded EEW Microwave Connection	Completed	Remaining
Public Safety Communications (PSC)	330	63	267

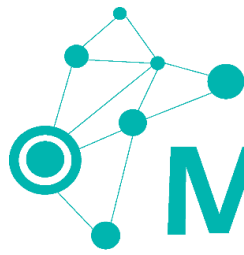


CEEWS Seismic Station Build Out Challenges

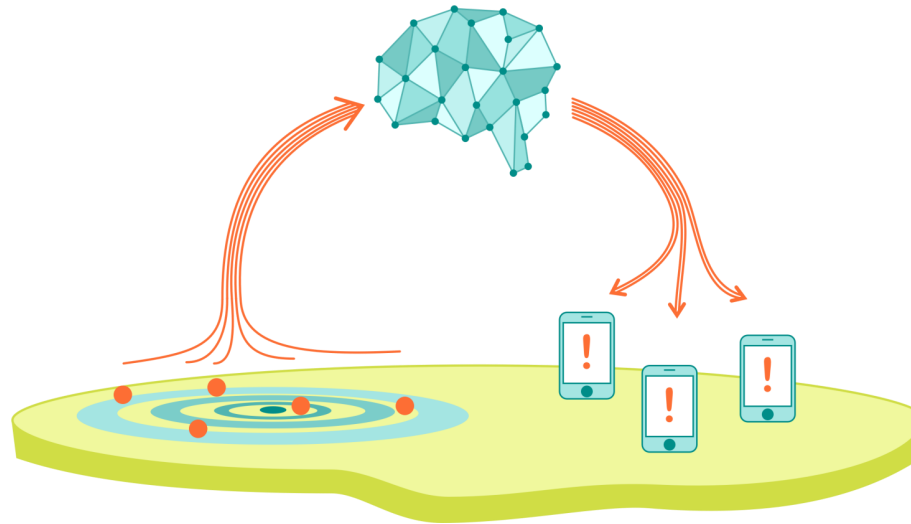
- COVID-19 restrictions
- Equipment delivery delays
- Obtaining new and renewed land-use permits / lease negotiations
- Wildfires

Next: System Operations Updates

– UC Berkeley, MyShake App



MyShake 2022 Update on Alert Delivery in CA



Jenn Strauss
Product Manager





MyShake

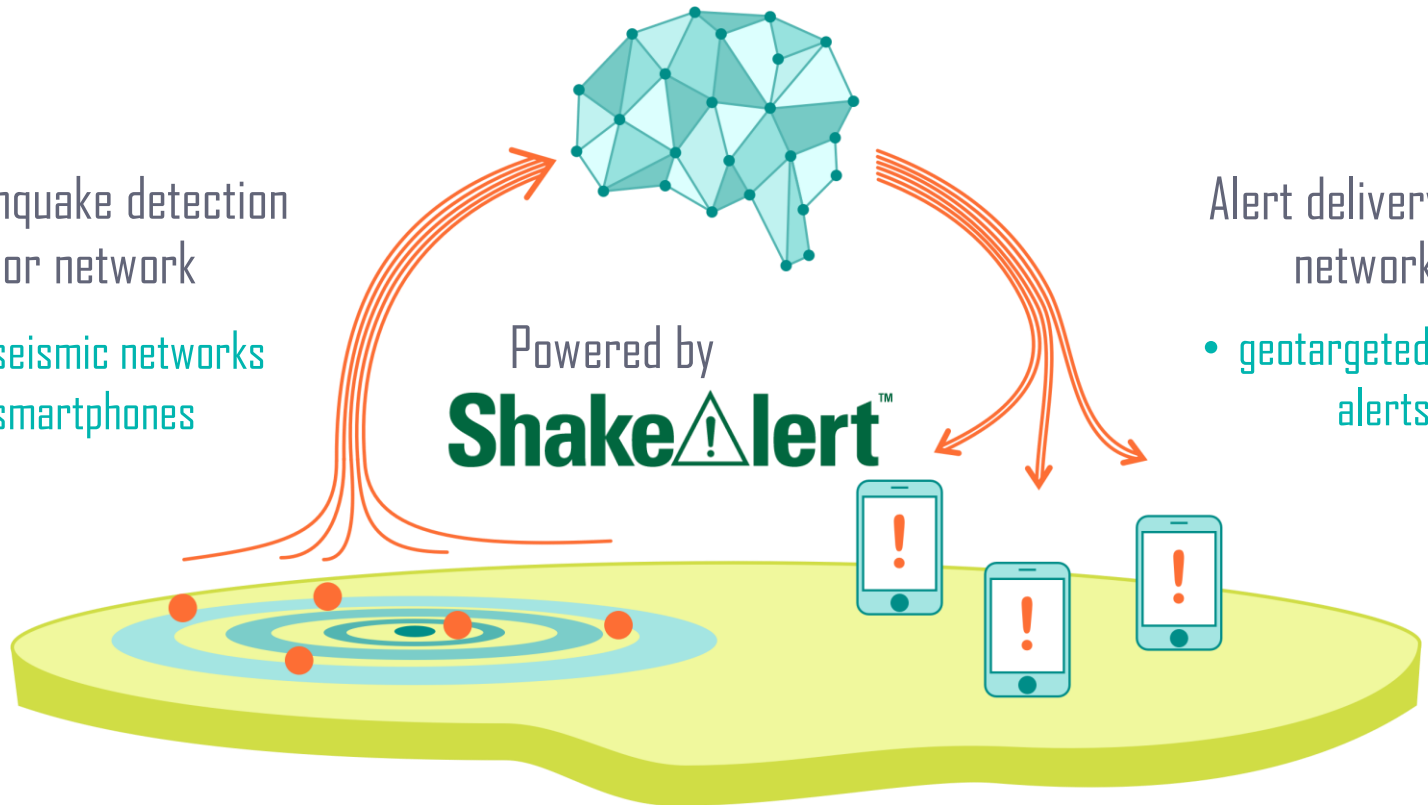
Earthquake detection
Sensor network

- seismic networks
- smartphones

Powered by
Shake!lert™

Alert delivery
network

- geotargeted
alerts





The MyShake team



Richard Allen
PI



Jenn Strauss
Product
Manager/PI



Stephen Thompson
Lead Sys Admin



Sarina Patel
PhD student



Theron Bair
Sys Admin



Steve Allen
Frontend Dev



Akie Mejia
Backend Dev



October 2019-June 2022

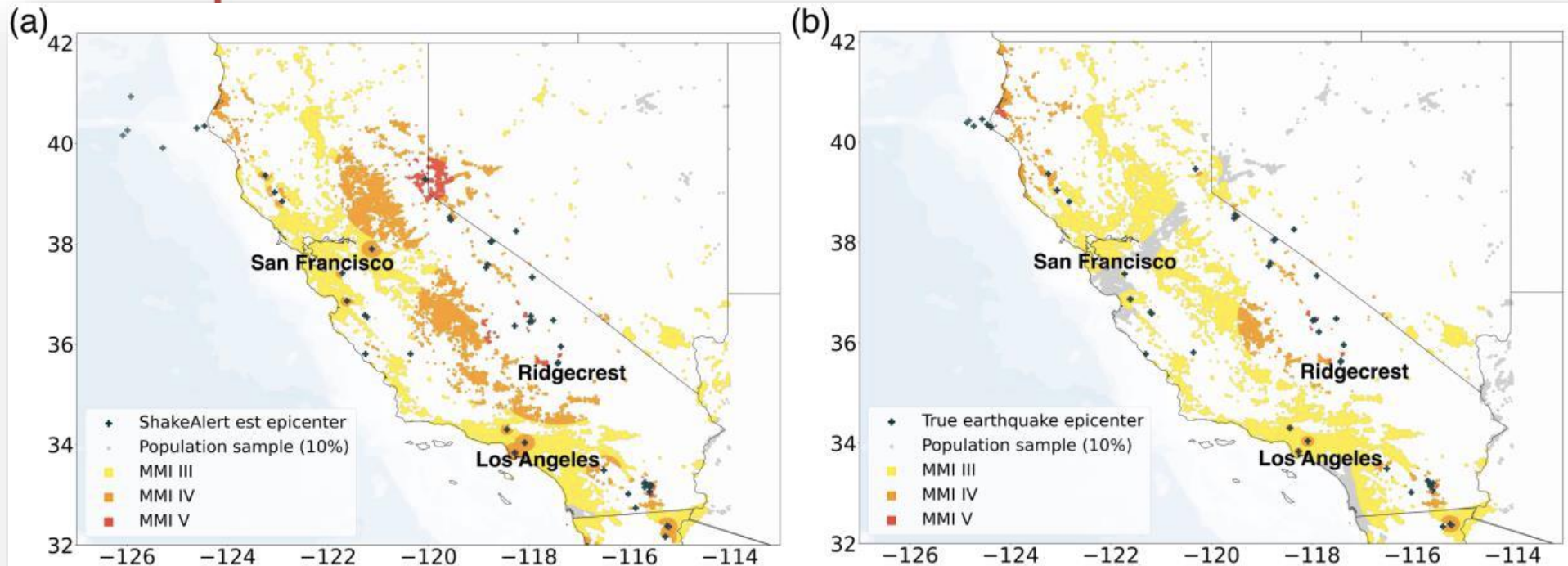
- 52 alerts through system (51)
- 185,512 users alerted overall
- Largest alert in magnitude
 - M5.9 Walker Lake (7/8/21)
 - M5.9 Fortuna (3/22/20)
- Largest alert in phones
 - M5.8 Lone Pine (6/24/20)
 - 47,747 phones alerted





California Spatially Covered by Alerts

Maps show population sampling distribution of alert deliveries through April 2022. Color coded by MMI estimates. Map (a) shows what the alert estimate outcome was, while map (b) is using the final magnitude information.





Detailed Statistics Can Be Run on Events Sent to Large Numbers of Users

Mag – Event – Date Region – Depth	Alerts Sent	Percentile	Server Processing Time (s) [t3-t0]	Alert Acknowledgement Time (s) [t7-t0]
M4.5 – El Monte – 9/19/20 Los Angeles area – 17 km depth	20,169	20%	1.39	0.74
<i>7.73 seconds between first ShakeAlert (M4.5) and largest magnitude estimate (M4.8)</i>		50%	1.84	1.88
		80%	2.59	3.50

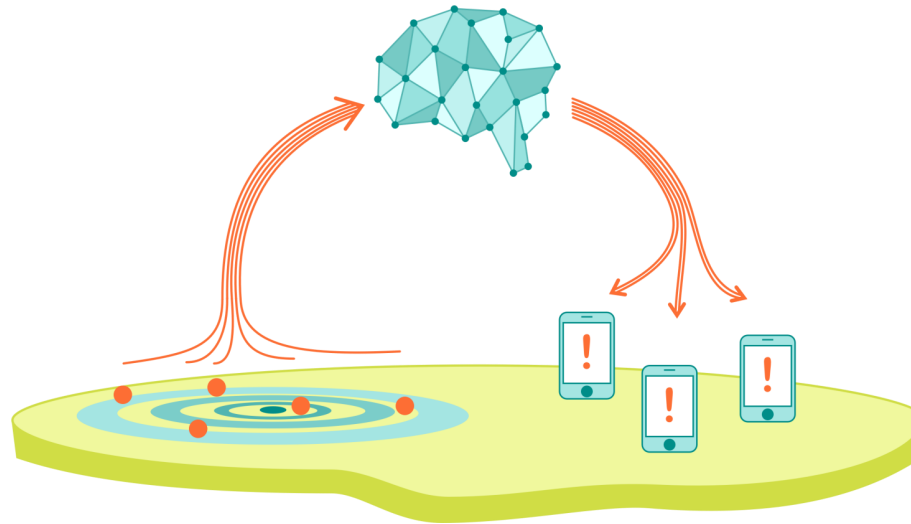


Research and Development

Jennifer Strauss, MyShake Product Manager



MyShake Continued Research & Development



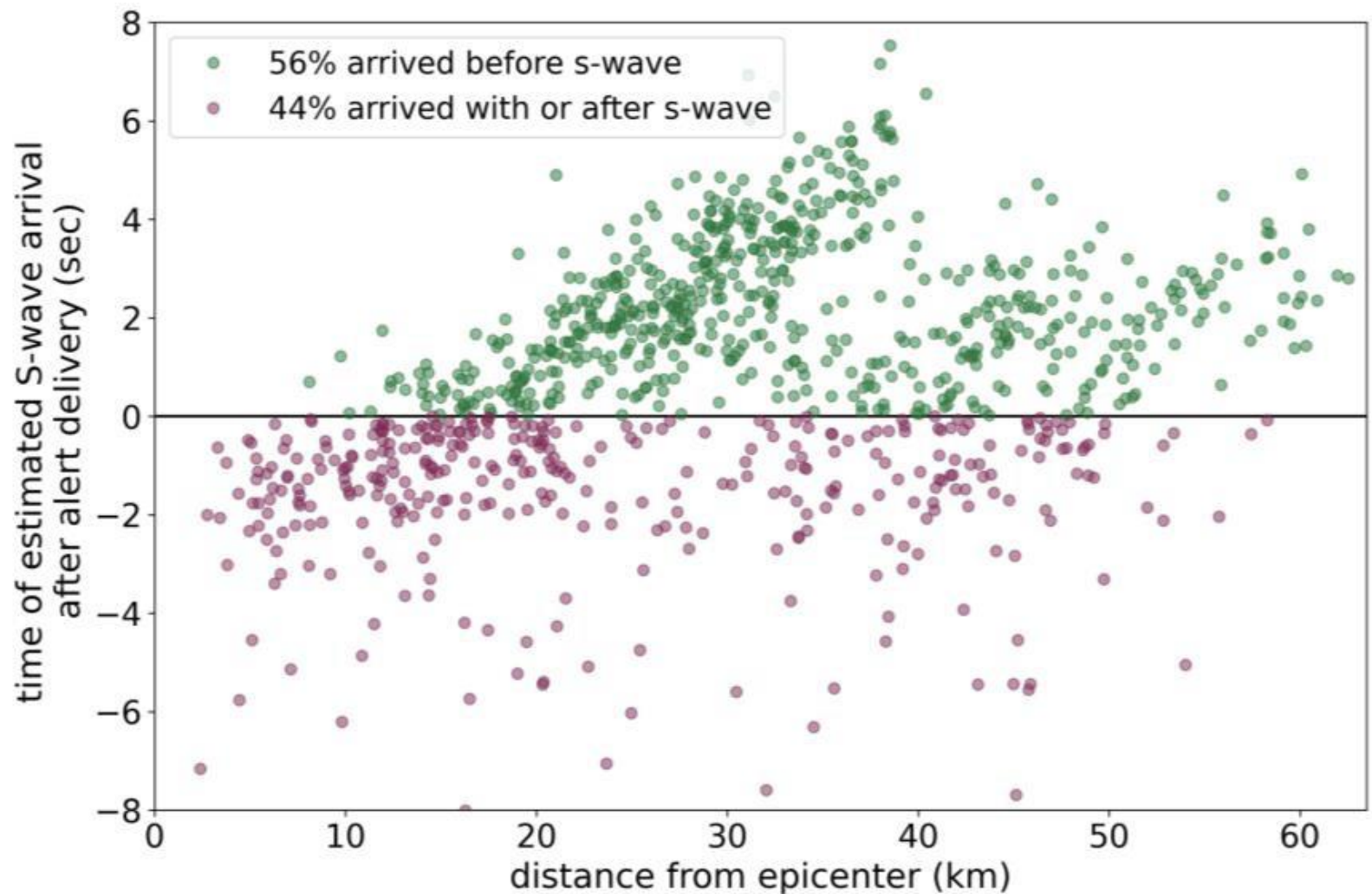
Jenn Strauss
Product Manager





Alert Arrivals

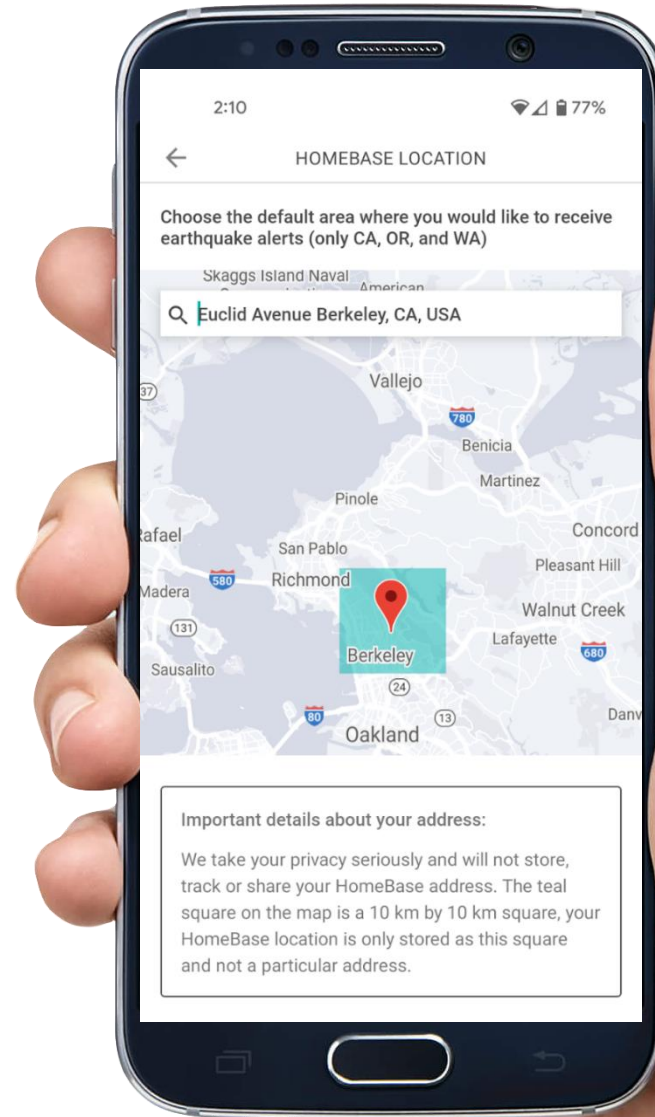
- September 2020
- M4.5 El Monte earthquake
- phones at various epicentral distances
- Green points above the central line have a positive warning time.





HomeBase

- Default backup location
- Only the square ID is stored-not the address
- M4.5 or greater
- MMI III or greater





Looking to the Future

- Publications
 - Figures from upcoming manuscript **Patel, S.C.**, Allen, R.M. (*in revision*). The MyShake App: User Experience of Early Warning Delivery and Earthquake Shaking. *Seismological Research Letters*.
 - **Kong et al.** Crowdsourcing Felt Reports using the MyShake smartphone app.
- Working with CalOES to provide additional language support
 - Chinese, Korean, Tagalog, Vietnamese
- Use waveform data to validate the alert area



Finance



Lori Nezhura, Deputy Director, Planning, Preparedness & Prevention



2021-22 Budget Allocation

- \$17.283 million one-time General Fund to finish the build-out of the California Earthquake Early Warning System
- Included:
 - New and updated seismic stations installation
 - Improving telemetry
 - Continuing statewide education and outreach campaign
 - MyShake mobile application
 - Research and development



2022-23 Proposed Budget Allocation

- \$17.1 million on-going General Fund to support education and outreach, operations, and research and development of the California Earthquake Early Warning Program
- Includes:
 - Maintenance of seismic stations
 - Continued telemetry project
 - Statewide and targeted education and outreach
 - Concentration on EEW automated actions adoption among businesses, utilities, and other services
 - Research and development in radio, television broadcasting, and other areas to enhance public alerting



Goals for EEW Education, Outreach, and Expansion

Jose Lara, Chief, Seismic Hazards Branch



2022 Overarching Goal

- *EEW for all Californians and diversifying the ways in which Californians benefit from EEW*
 - Expansion of collaboration and partnerships with state leadership, associations, businesses, and services
 - Industry Implementation



Expanding Collaboration

- Letters
- Outreach Packages
 - Packages include an [industry sector-based toolkit](#), factsheet, flier, and branded items
 - First phase will be focused on healthcare, utilities, and transit associations



Medical

TOOLKIT & RESOURCES



Utilities

TOOLKIT & RESOURCES



Transportation

TOOLKIT & RESOURCES

- Presentations



Planned Next Steps

- Deliver outreach packages to business / industry associations
- Outreach packages for non-profit organizations
- Outreach packages for legislative leaders / elected officials
- Earthquake simulator in August for Humboldt County Fair and for the October Great California ShakeOut



K-12 Education

TOOLKIT & RESOURCES



Higher Education

TOOLKIT & RESOURCES



Business

TOOLKIT & RESOURCES



Medical

TOOLKIT & RESOURCES



Transportation

TOOLKIT & RESOURCES



Utilities

TOOLKIT & RESOURCES



First Responder

TOOLKIT & RESOURCES



Telecommunication

TOOLKIT & RESOURCES



Discussion Questions

- 1) Where should we send future outreach packages?
- 2) Do you have any recommendations for other outreach strategies through partner organizations?



Industry Implementation

- Success Videos
 - [Menlo Park Fire District](#)
 - [Los Angeles Unified School District](#)
 - More on earthquake.ca.gov

Next: Highlighting Metrolink

Metrolink's EEW Implementation

Luis Carrasquero, Interim Deputy
Chief Operating Officer

Cal OES Advisory Board • June 29,
2022



METROLINK®

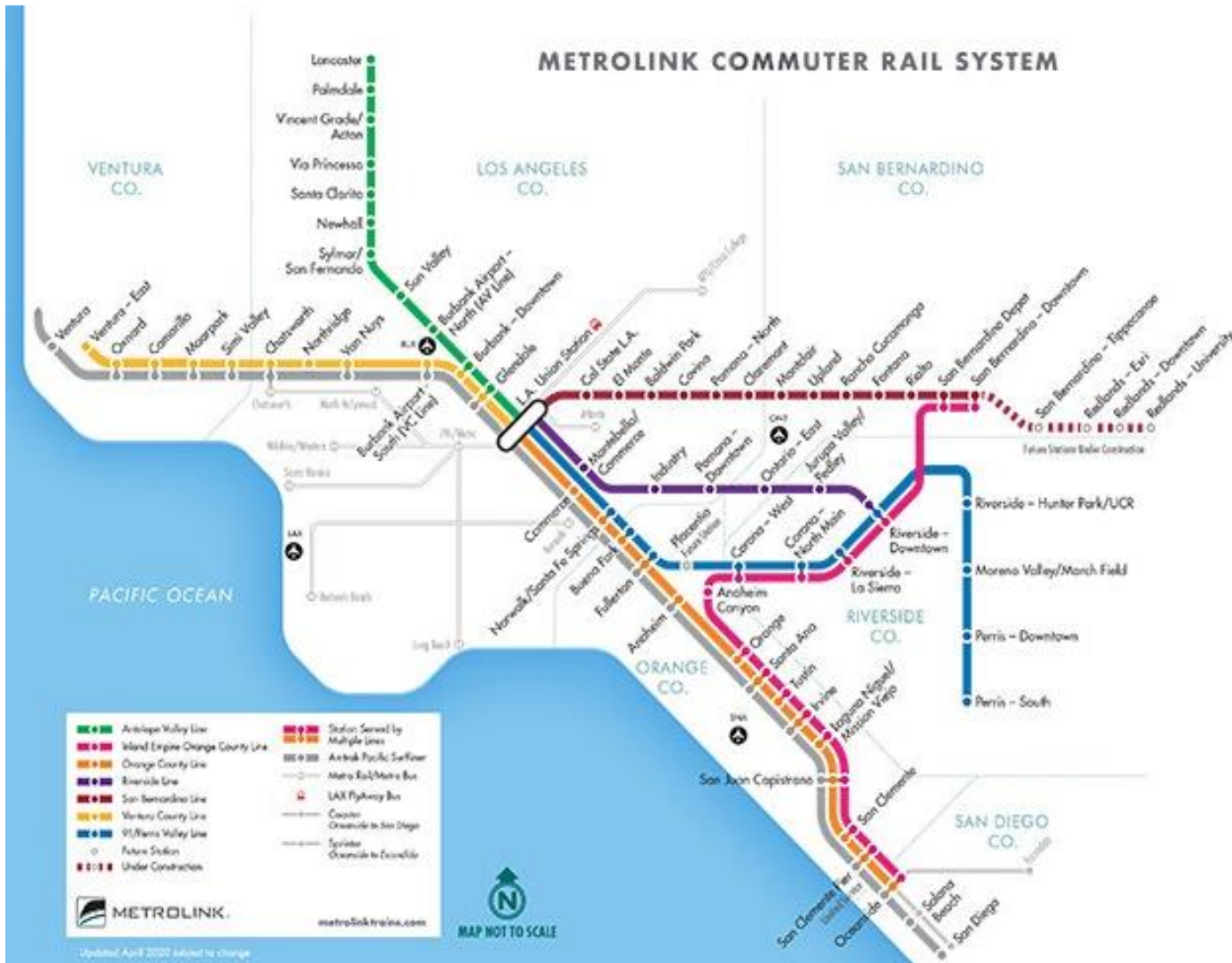
SMARTER. BETTER. ESSENTIAL.

Background Info on Metrolink

For context:

- Metrolink operates commuter rail services across the five counties in Southern California
- Operates 7 routes with 62 stations over 535 route miles
- 167 weekday trains with 40,000+ daily boardings (pre-COVID)
- Interoperable host/tenant railroads:
 - Host on: BNSF, UPRR, Amtrak, NCTD
 - Tenant on: BNSF, UPRR, NCTD
- PTC system deployed system-wide in 2015

Metrolink Overview

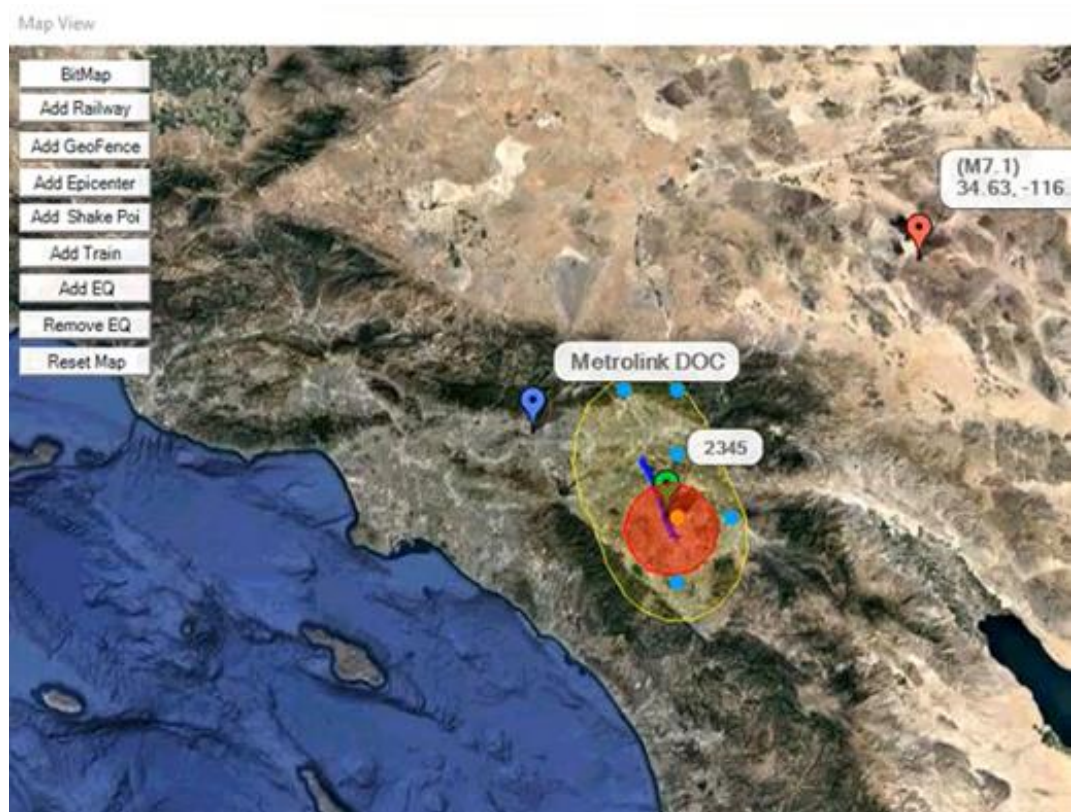


- Metrolink is the nation's 3rd largest commuter rail system.
- SCRRA is operates and is made up of five Member Agencies: SBCTA, VCTC, LACMTA, OCTA, and RCTC
- Operates 7 routes with 62 stations over 535 route miles
- Host to: BNSF, UPRR, Amtrak
- Tenant on: BNSF, UPRR, North County
- Total Daily Hosted Trains - 325
- PTC system deployed system-wide in 2015

Project Overview

Metrolink's EEW project automates the stopping or slowing of trains by developing the Commuter Railway Seismic Interface (CRSI) to integrate USGS ShakeAlert notifications with the Authority's PTC system.

- Initial pilot implementation on the Perris Valley Line
- Updating earthquake response procedures for train operations & field inspections
- Improved inspections & return to service - prioritized inspections based on shaking intensity and asset data
- Training Engineers, Conductors, Dispatch & PTC support desk
- Funded by Caltrans Division of Rail and Mass Transp. \$4.87M grant



Leverages Existing Technology

ShakeAlert Available



- Sensors throughout California
- Earthquake detection
- Calculates earthquake magnitude and determines epicenter
- Predicts peak ground acceleration radiating away from the epicenter
- Sends earthquake alerts



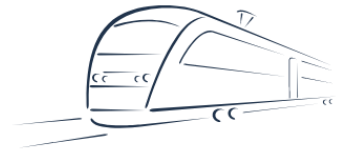
CRSI In development



- Receive earthquake alerts
- Establish rules for notifications to trains
- Send notifications to PTC
- Send notifications to Operations Center
- Phase I - IV: Send & receive alerts directly to the train
- Phase V: Automate stop or slowing of trains



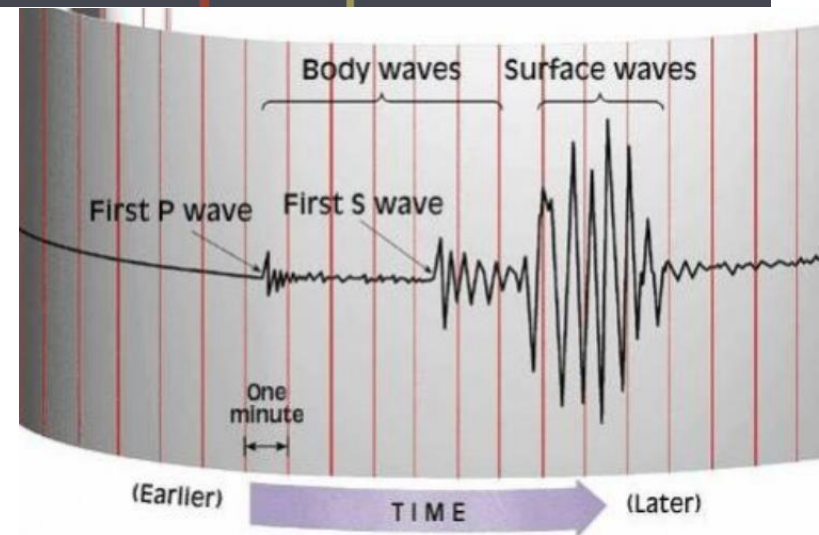
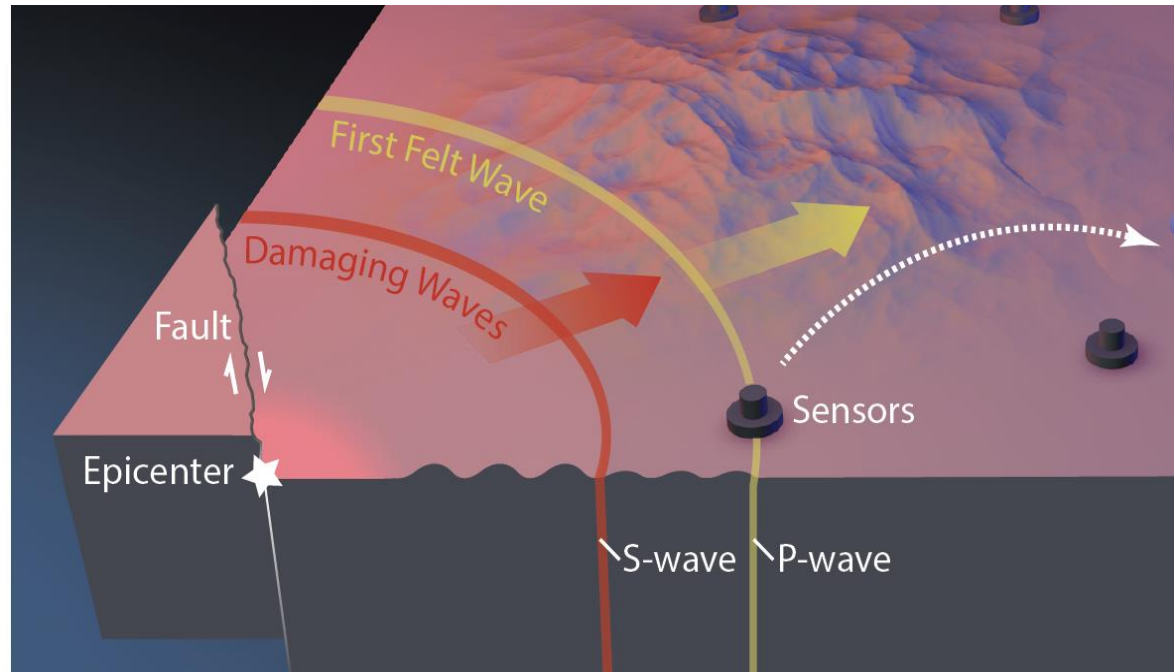
PTC Available



- Stops or slows trains
- Utilizes braking algorithms based on train characteristics

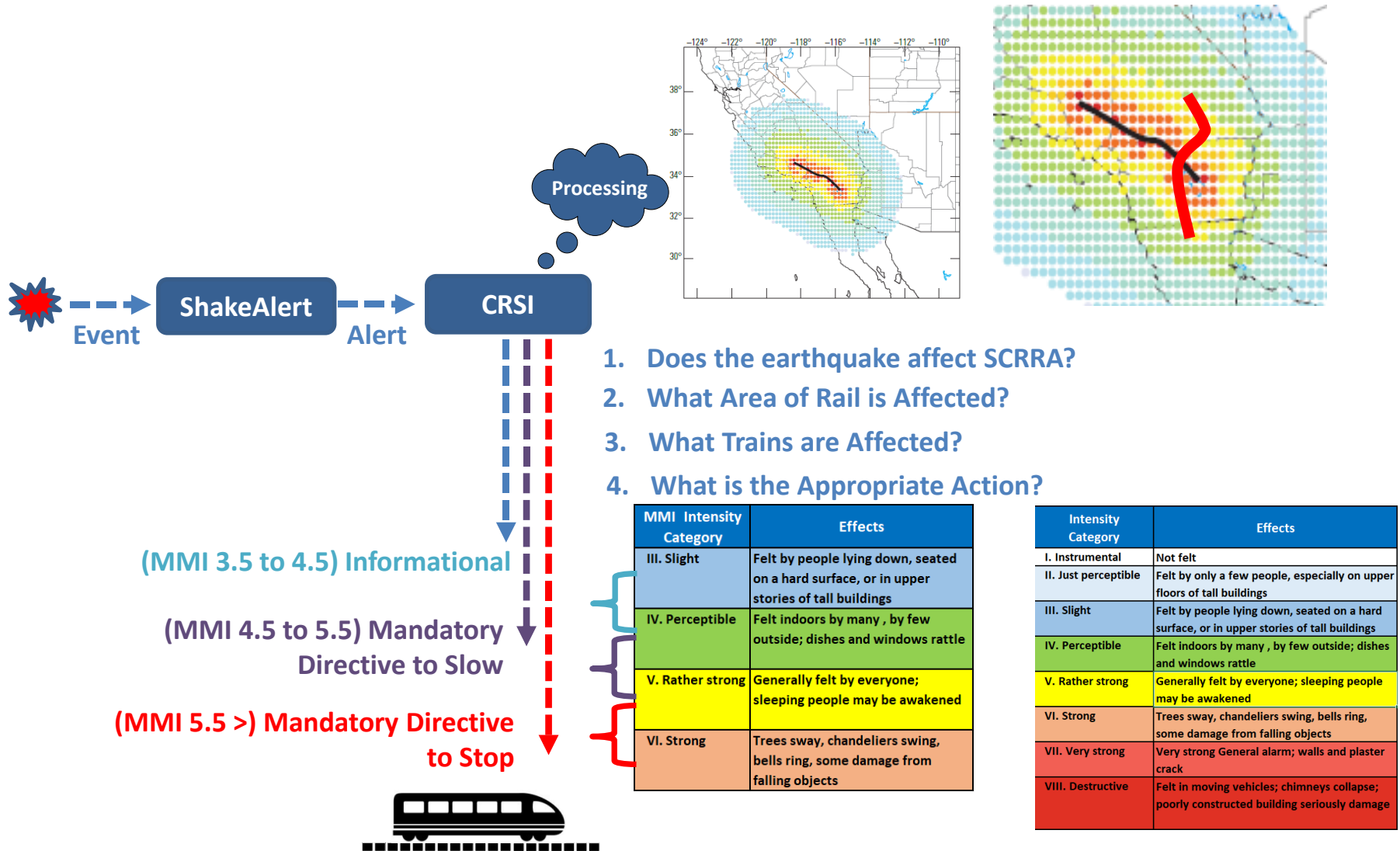
USGS ShakeAlert Integration

- USGS ShakeAlert is currently available in CA, OR, and WA.
- P-waves (compression waves) are the first waves to be detected by sensors - before S-waves (shear waves) that causes the strongest of shaking.
- ShakeAlert estimates shaking at grid points across the region and sends a notification to subscribers.
- The amount of advance warning varies based on factors including proximity to epicenter.



CRSI Application

– How does it work with PTC?



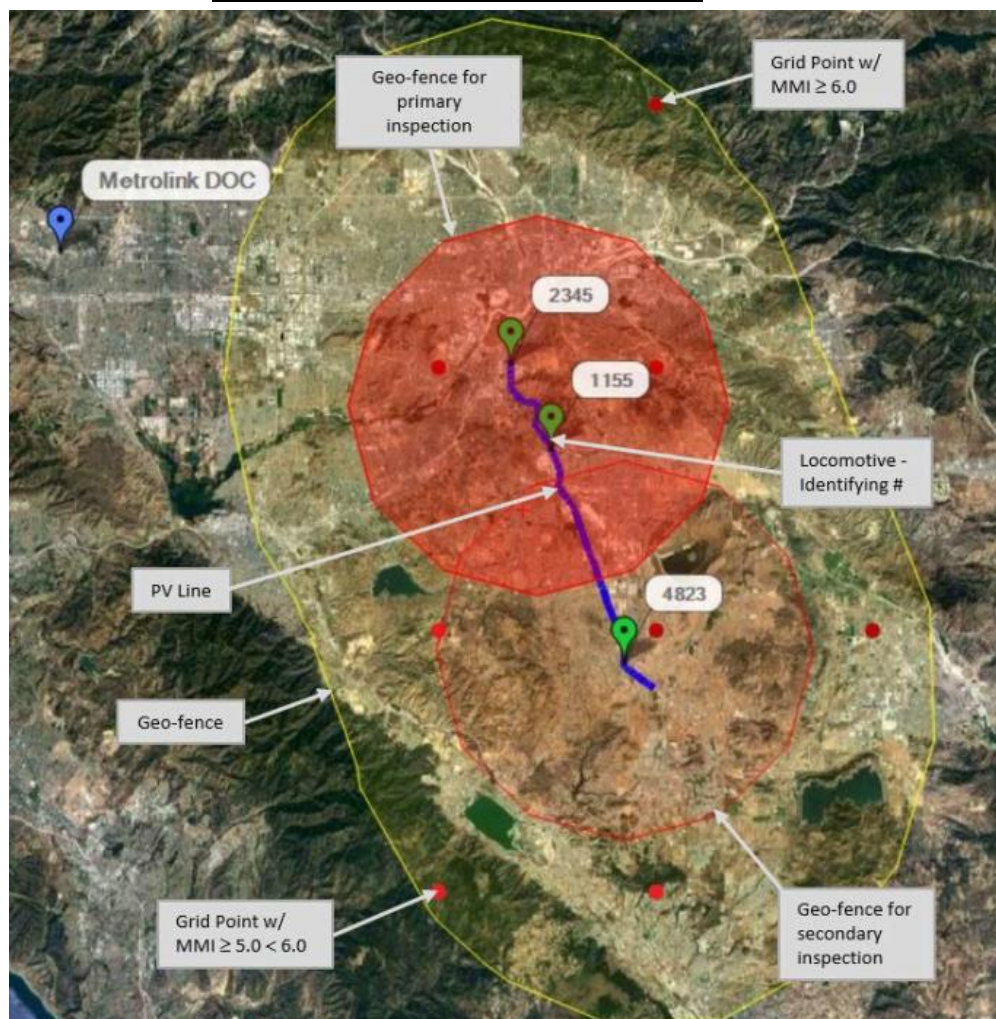
USGS ShakeAlert/California Earthquake Early Warning System

– How will it work?

Shaking Threshold	Crew Action
MMI <3.5	No advisory or alerts delivered to trains
MMI 3.5 - 4.5	Advisory to train of minor earthquake in the area. Notify operations if shaking is felt.
MMI 4.6 - 5.5	Train to immediately slow down speed to restricted speed and contact operations
MMI >5.5	Train to immediately stop train but not to stop on bridges, under overpasses, nor in tunnels and to contact operations

USGS ShakeAlert/California Earthquake Early Warning System

– How will it work?



Project Status & Next Steps

Initial Version – Notification to Trains

- ✓ System requirements, software coding and unit testing
- ✓ Lab and field testing of the system
- ✓ Deployed in Production

Final Version – Automation for Stopping & Slowing Trains

- ✓ System requirements, software coding and unit testing
- ✓ Lab and field testing of the system
- ✓ Coordinating with FRA on documentation & approvals
- ✓ Deploy in Production
- Updating SCRRRA earthquake response procedures
- System-wide expansion coordination



THANK YOU



Metrolink

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213.760.0881

metrolinktrains.com



Discussion Questions

- 1) What possibilities exist in your organizations for EEW automated actions?
- 2) What stakeholders do you work with that need to learn about EEW implementation?
- 3) How can we target the following sectors more fully:
 - a. Transportation
 - b. Healthcare
 - c. Education

Education and Outreach Overview



Yvonne Dorantes, Senior Emergency Services Coordinator

April Earthquake Preparedness Month Tour

- Focus on vulnerable populations & hard-to-reach communities
- Held outreach events in San Diego, Los Angeles, Sacramento, Berkeley, Salinas
- 468 earthquake simulator riders
- 10,000 MyShake App downloads during week, 50+ media outlets
- \$1.1 Million ad equivalence
- Shake Trailer requests statewide
- Coordinated messaging and activities with partners



EARTHQUAKE WARNING CALIFORNIA



PREVENCIÓN DE SISMOS EN RECESO PRIMAVERAL - 4-9 DE ABRIL

SAN DIEGO | LOS ANGELES | SACRAMENTO | BERKELEY | SALINAS

earthquake.ca.gov @Cal_OES @Cal_OES @CaliforniaOES



EARTHQUAKE SAFE SPRING BREAK *in Los Angeles*

TAKE A RIDE ON OUR EARTHQUAKE SIMULATOR!

TUESDAY, APRIL 5TH FROM 8 AM - 1 PM
UNION STATION AT PATSAOURAS TRANSIT PLAZA

FREE EVENT!



earthquake.ca.gov @Cal_OES @Cal_OES @CaliforniaOES

EARTHQUAKE SAFE SPRING BREAK *in Berkeley*

TAKE A RIDE ON OUR EARTHQUAKE SIMULATOR!

FRIDAY, APRIL 8TH FROM 10 AM - 2 PM
LAWRENCE HALL OF SCIENCE - 1 CENTENNIAL DR.
BERKELEY, CA 94720

FREE EVENT!



earthquake.ca.gov @Cal_OES @Cal_OES @CaliforniaOES

EARTHQUAKE SAFE SPRING BREAK *in San Diego*

TAKE A RIDE ON OUR EARTHQUAKE SIMULATOR!

MONDAY, APRIL 4TH FROM 8 AM - 1 PM
INSPIRATION POINT AT BALBOA PARK

FREE EVENT!



earthquake.ca.gov @Cal_OES @Cal_OES @CaliforniaOES

EARTHQUAKE SAFE SPRING BREAK *in Salinas*

¡SÚBASE AL SIMULADOR DE SISMOS!


SÁBADO, 9 DE ABRIL, DE 10 A.M. A 2 P.M.
SALINAS REGIONAL SOCCER COMPLEX
1440 CONSTITUTION BLVD, SALINAS, CA 93905

EVENTO GRATUITO



earthquake.ca.gov @Cal_OES @Cal_OES @CaliforniaOES





**Riding public transit when the MyShake
App sends an earthquake warning?
Remain in place, hold on, and protect your
head and neck with your arms. If at a
station or bus stop, drop, cover, and hold
on.**

Learn more at earthquake.ca.gov



**EARTHQUAKE
WARNING
CALIFORNIA**



Discussion Questions

- 1) Are there any events that your organizations hold that we can join to promote EEW?
- 2) Are you / your organization interested in participating in future Roadshows / Great California Shakeout?

The background of the slide features a large, light blue shield. Inside the shield, there is a stylized map of Florida in white. Above the map, there are several yellow rays emanating from the top center. A single pink star is positioned to the left of the map.

Advisory Board Member Closing Comment

General Public Comment





Adjournment