



The Hard Realities of Earthquake Recovery: Christchurch, NZ – Two Years Later & How We Build a More Resilient Washington

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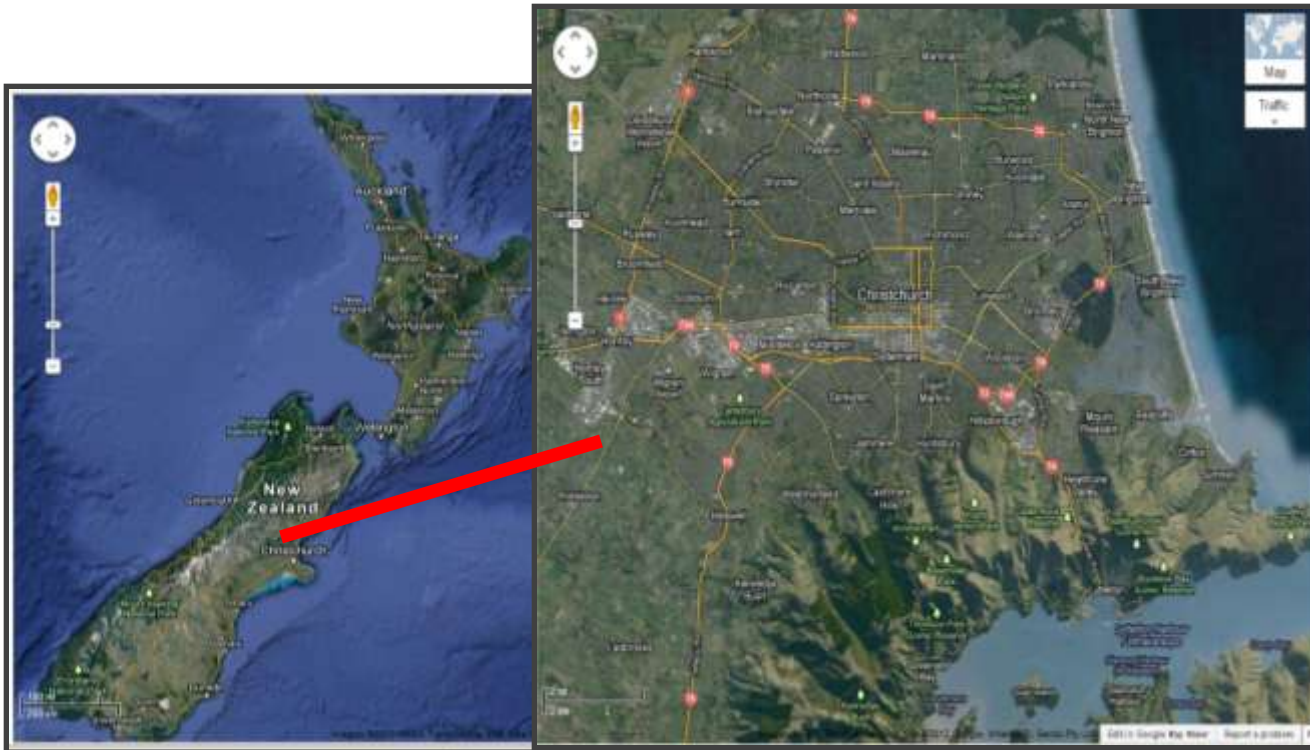
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Overview: The Canterbury Earthquakes

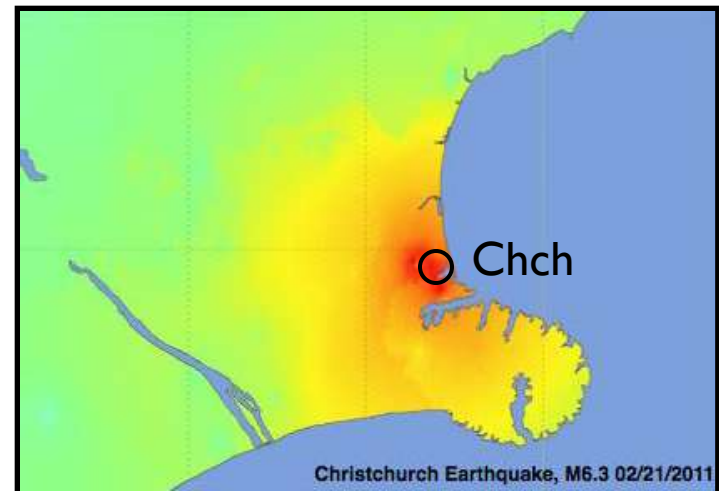
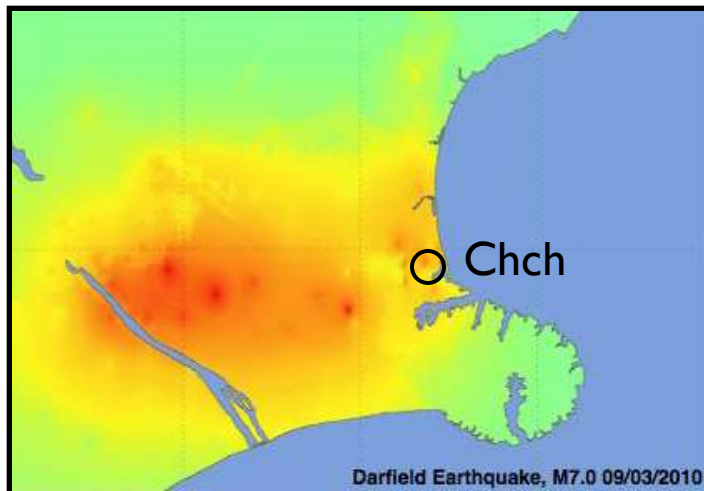
Location & Demographics



- ▶ Christchurch is the largest city on the south island of New Zealand
 - ▶ Pre-Earthquake Population: 359,900 (~68% the size of Seattle's Population)
 - ▶ 174 square miles (~the size of Mountlake Terrace to Sea-Tac Airport)
 - ▶ Founded in 1856 (Washington State admitted to Union in 1889) - Similar development histories
 - ▶ Seattle's Sister City since 1981

The Canterbury Earthquakes

- ▶ **September 4, 2010 @ 4:35 a.m.**
 - ▶ Magnitude 7.1
 - ▶ 25 miles west of Christchurch near Darfield
 - ▶ 6 miles deep
- ▶ **February 22, 2011 @ 12:51 p.m.**
 - ▶ Magnitude 6.3
 - ▶ 3 miles southwest of Christchurch
 - ▶ 3 miles deep



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC. (mg)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL. (mm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Pre-Earthquake: Christchurch Central Business District (CBD)



During Earthquake: Christchurch Central Business District

Christchurch, February 22, 2011
“Munted”



Post-Earthquake: (Recovery in Process) Christchurch Central Business District



Photo by Mark Woods

Initial EQ Impacts

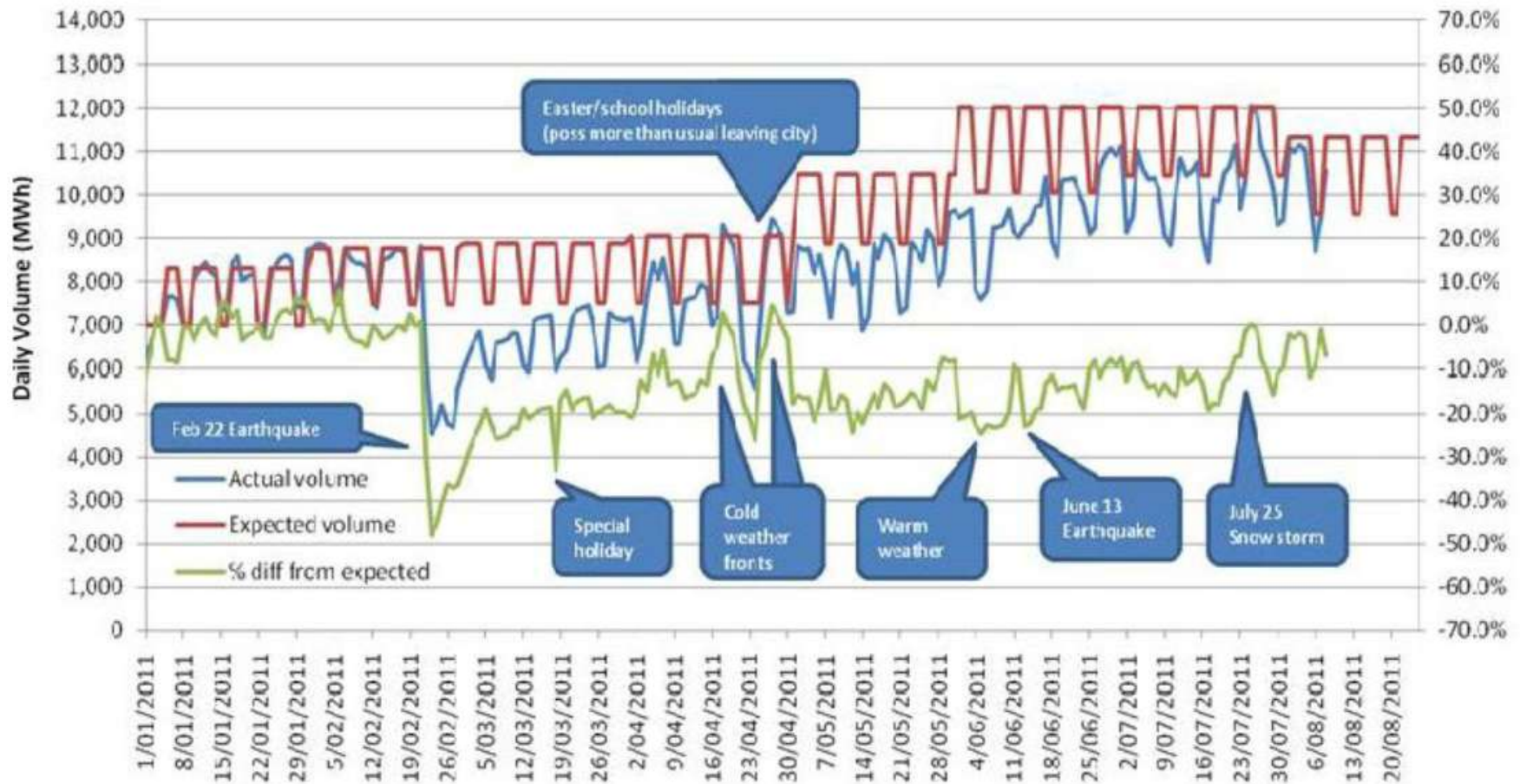
- ▶ 185 deceased
- ▶ **EXTENSIVE and WIDESPREAD** liquefaction damage
- ▶ Loss of utility power, water, and wastewater treatment utilities for weeks to years
- ▶ Significant damage to transportation network
- ▶ 600+ buildings in downtown Christchurch affected
- ▶ 43,000 seat AMI Stadium experienced pervasive damage
- ▶ **SEVERE** damage to unreinforced brick buildings



Photo: Kishor Jainwal

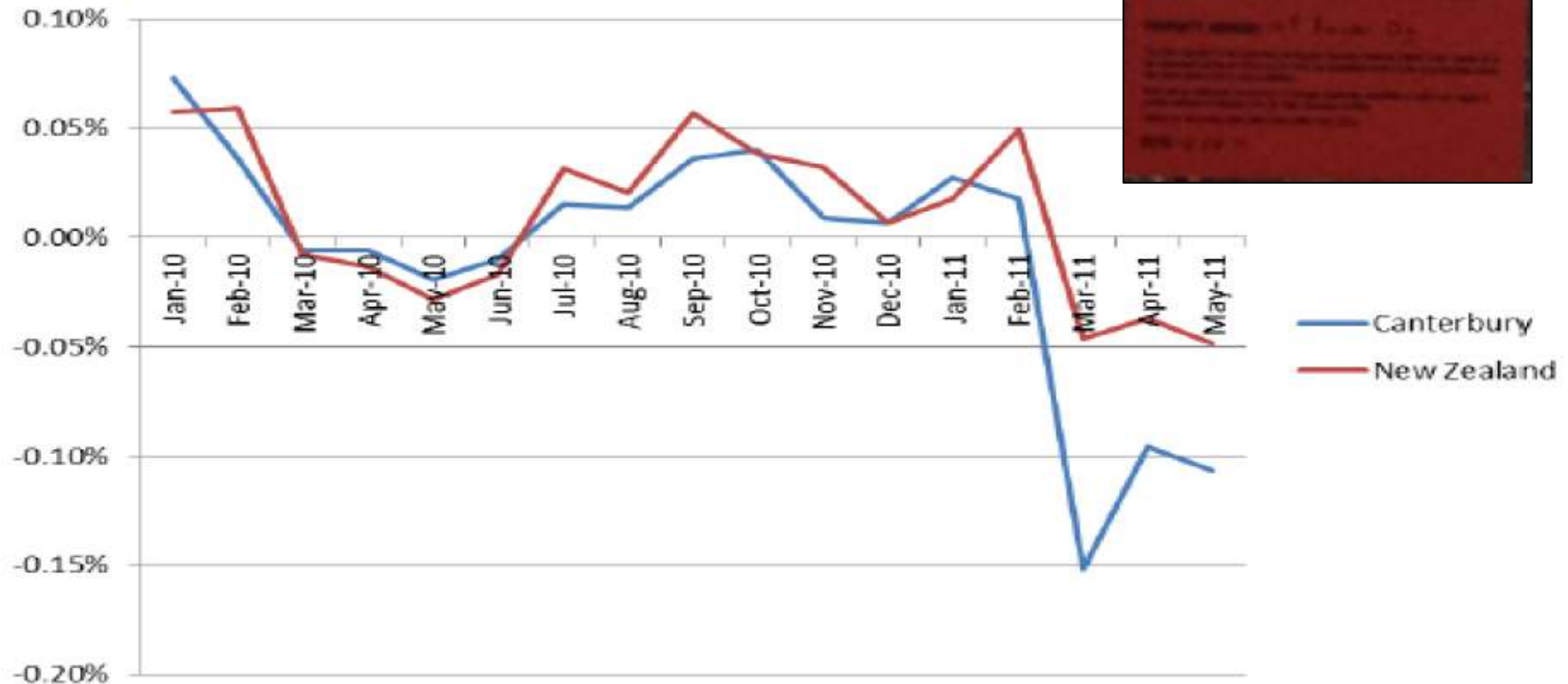
Electricity Impacts

Orion Network Total Volumes



Short-Term Population Impacts

Net Migration as % of Population

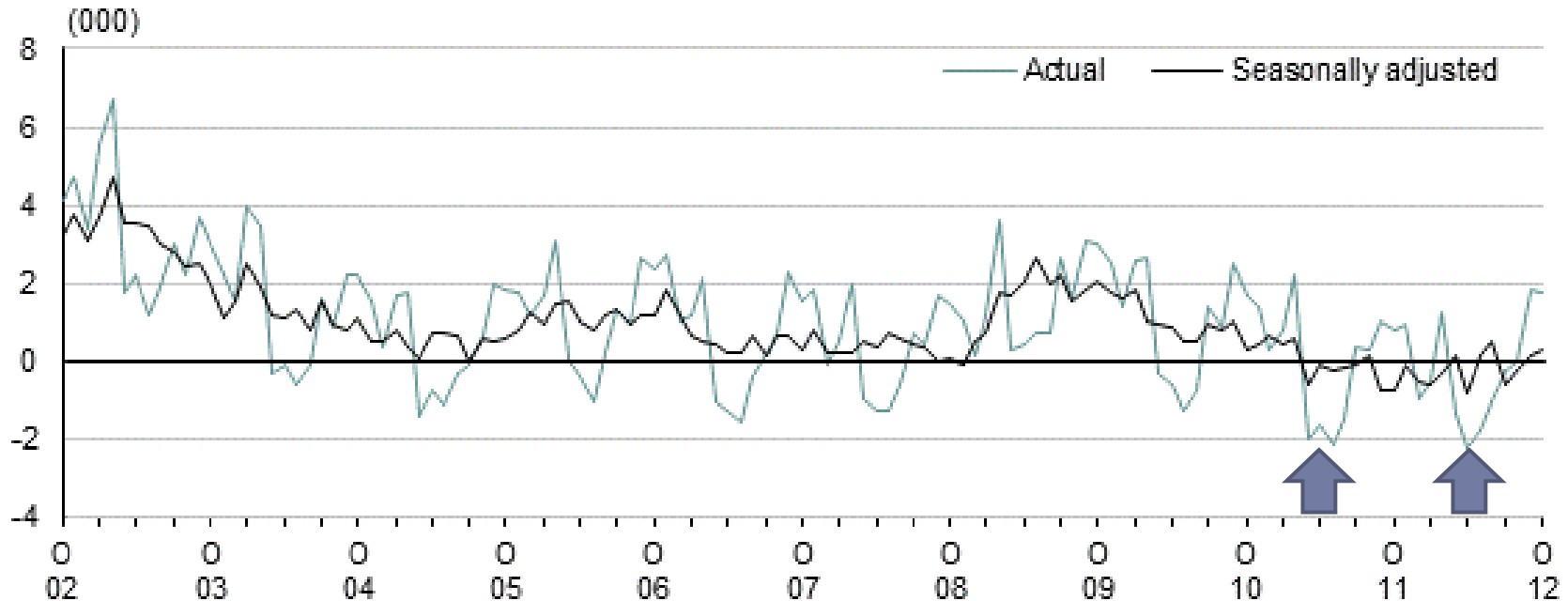


Source: Statistics New Zealand

Longer-Term Population Impacts

Monthly net permanent and long-term migration

October 2002–12

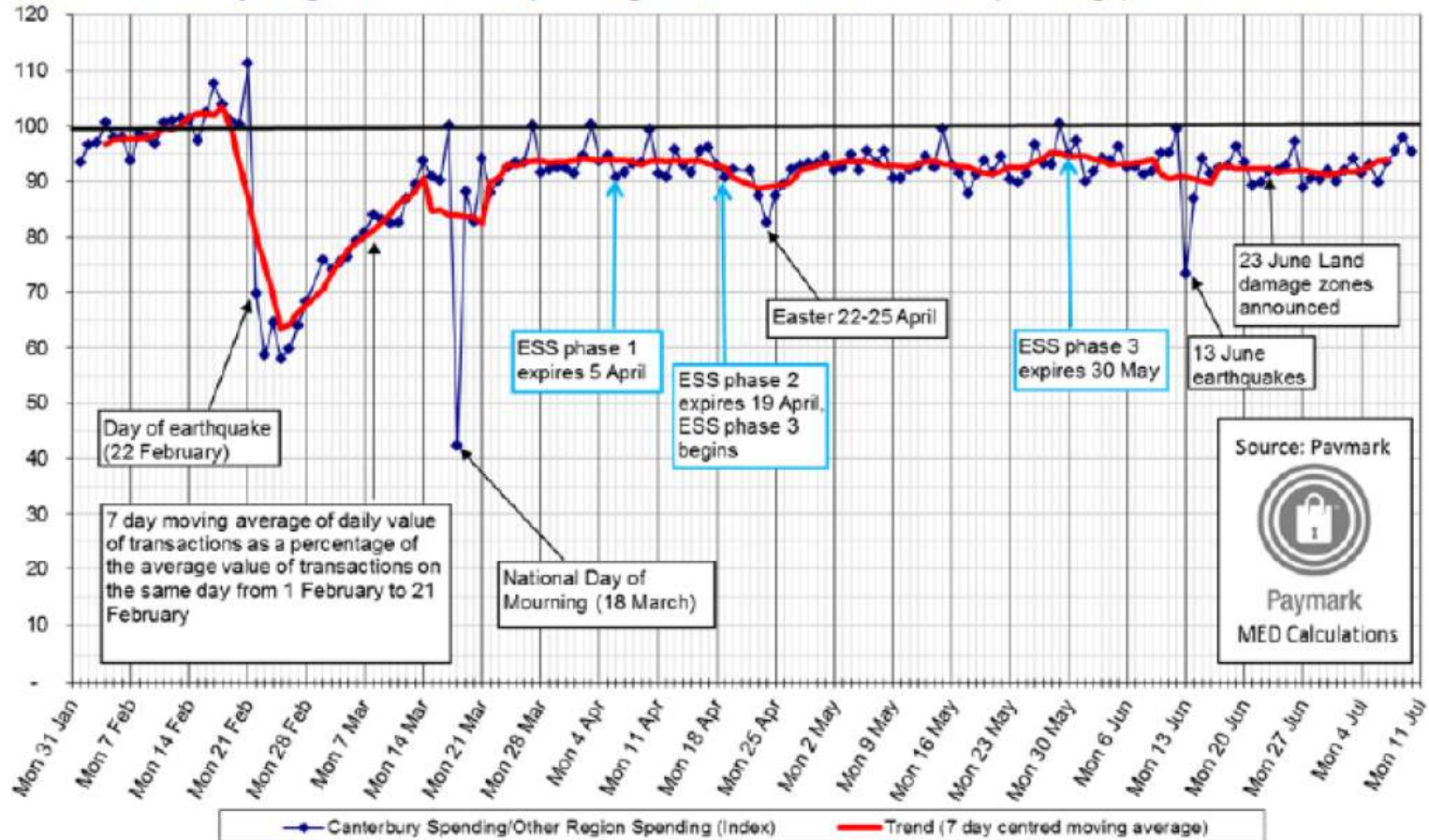


Source: Statistics New Zealand

➡ Note that while the population has been in flux over the longer term and is beginning to reach pre-earthquake levels, the two largest declines follow the most significant earthquakes.

Business Activity Impacts

Index of Canterbury Region EFTPOS Spending Relative to Rest of NZ Spending (1st 3 weeks of Feb=100)



Liquefaction is much, much more than a nuisance...it's a game changer for recovery

Earthquake happens...which leads to

Liquefaction occurring...which leads to

Sewer lines shift, break, fill with silt...which leads to

Wastewater treatment not possible...which leads to

Some beaches closed for 1+ years due to presence of fecal coliform bacteria...which leads to

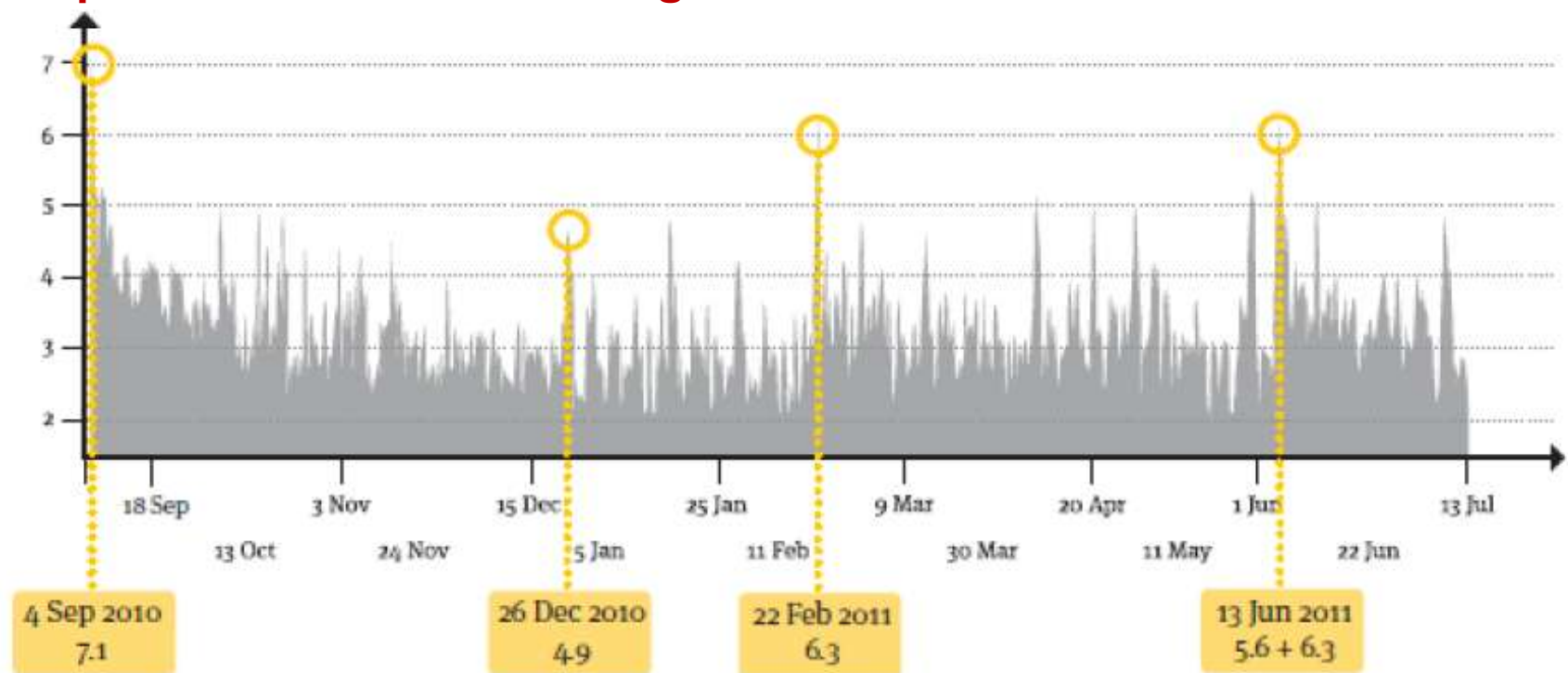
Impacts to health, safety, welfare, environment, tourism, recreation, etc.

Which leads to...which leads to...which leads to...



The Canterbury Earthquakes: September 4, 2010 - ?

More than 12,000 aftershocks since September 2010 – heard time & again that Christchurch population is suffering from ‘quake brain’ – stress from exposure to continuous shaking...



*Figure from Draft Christchurch City Council
Central City Plan, August 2011*

Recovery in Action

*“It takes a ‘munting’ to build stronger; but
What do we design for? Where do we put it?”*

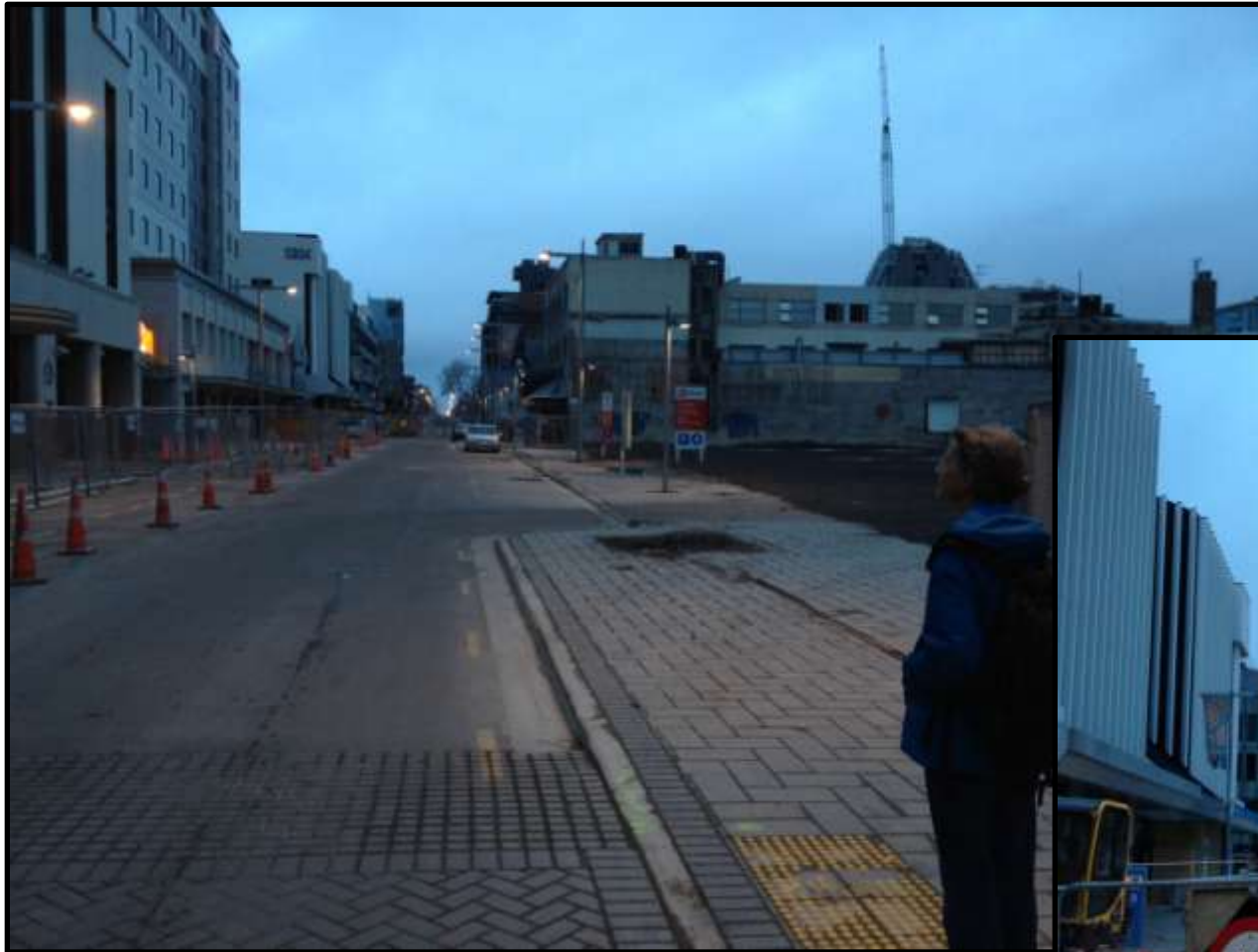
“Downtown” Christchurch 2-Years Later



“Downtown” Christchurch 2-Years Later



So, what do you do when your entire downtown is completely closed for 2+ years?



You think “out of the box”...



Post-Earthquake CBD Shopping Center: ReSTART Mall



Why cargo containers?



- ▶ Temporary, non-permanent
- ▶ Standard size for easy configuration/placement
- ▶ Easy to transport
- ▶ But perhaps most importantly:
 - ▶ As temporary structures, they do not require water, sewer, or electric utilities.
 - ▶ They also do not require building permits or inspections.



Scorpio Books...then



And now...



The Port Hole Bar and Grill... Lyttelton, NZ



Yes
We are open
But
Please go around to
the Front Entrance
area
And use the Front
Door

Cheers Very Much



The Port Hole Bar & Grill...Lyttelton, NZ



Making the most of (temporary?) new accommodations, the Port Hole has helped Lyttelton residents and visitors establish a new gathering place.



Post-EQ Nightlife in Christchurch: The Smash Palace

“Goodbye Blue Monday was a bar in Christchurch that ran from 2009-2011. A family owned and run business, Goodbye Blue Monday liked to think it provided some of the best gigs in Christchurch.

The bar was closed following the Christchurch earthquake on February 22nd 2011. While this was a sad time for us all, we counted ourselves lucky to be alive.

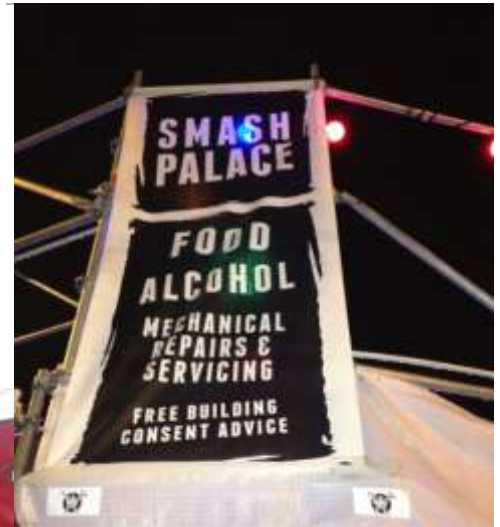
Nowadays we remember the fun times. We had so many cool bands through over the years that it felt like we were participating in helping Christchurch's up-and-comers have a stage to perform on... As well as music we had lectures, debates, life drawing classes, motorbike restoration nights, chess competitions, table tennis tournaments...

Oh, we had some fun. Now the bar is gone and all we are left with is memories.”

www.thesmashpalace.com



Post-EQ Nightlife in Christchurch: The Smash Palace



Temporary retail was fairly common...



But many, many brick and mortar locations were fully operational...and some served lamb.

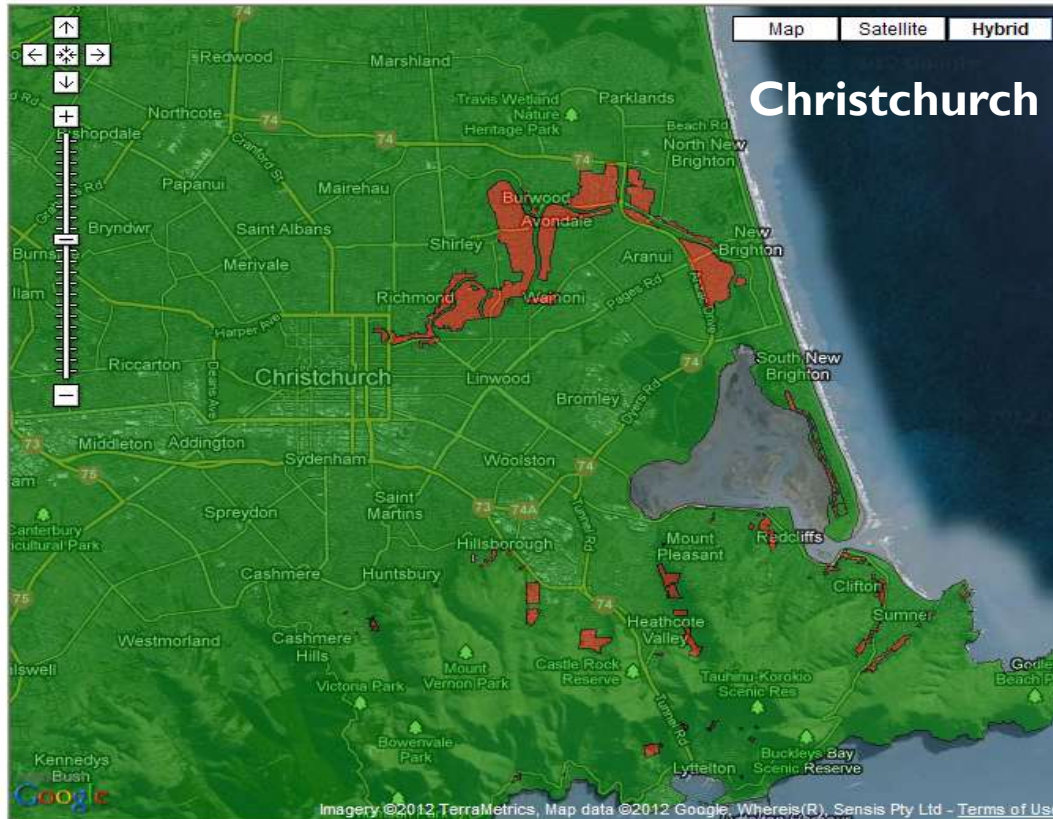


Transportation Recovery was On-Going

- ▶ Temporary solutions used in prime liquefaction zones
- ▶ Many complaints from residents about not knowing from one week to the next which roads would be open and which would be closed for to allow road and/or utility repairs.



Canterbury Earthquake Recovery Authority Land Decisions (as of Sept. 14, 2012)



Most severe liquefaction occurred near existing and historic waterways, like the Avon River in Christchurch or the Kaiapoi and Waimakariri Rivers in Kaiapoi---think Downtown and Duwamish in Seattle...



Key

- Green Zone
Repair / rebuild process can begin.
- Orange Zone
Further assessment required.
- Red Zone
Land repair would be prolonged and uneconomic.
- White Zone
CBD or hillside suburb, mapping still underway

So, how do you go to the bathroom and get water after an earthquake in a Red Zoned area?



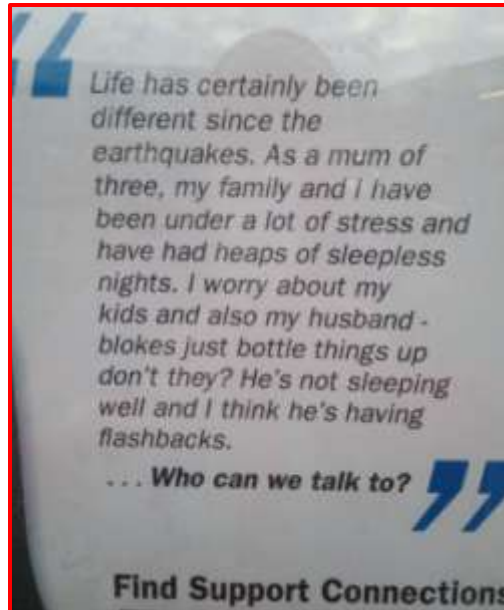
Waimakariri District & Kaiapoi



Historic Kaiapoi



An Example of Community Notification Methods: Recovery Bulletin Boards



Downtown Kaiapoi...



Specialized Teams Located in Banking/Finance Establishments



Map Showing Planned/Programmed Infrastructure Repairs (Yes, that says 2015.)

Many new opportunities for community open space & public art



Restoring a sense of place (& having fun!), even if it's just temporary... Gap Monopoly



► <http://www.gapfiller.org.nz/>

Restoring a sense of place (& having fun!), even if it's just temporary... Gap Golf



► <http://www.gapfiller.org.nz/>



Restoring a sense of place (& having fun!), even if it's just temporary... Gap Chess



► <http://www.gapfiller.org.nz/>



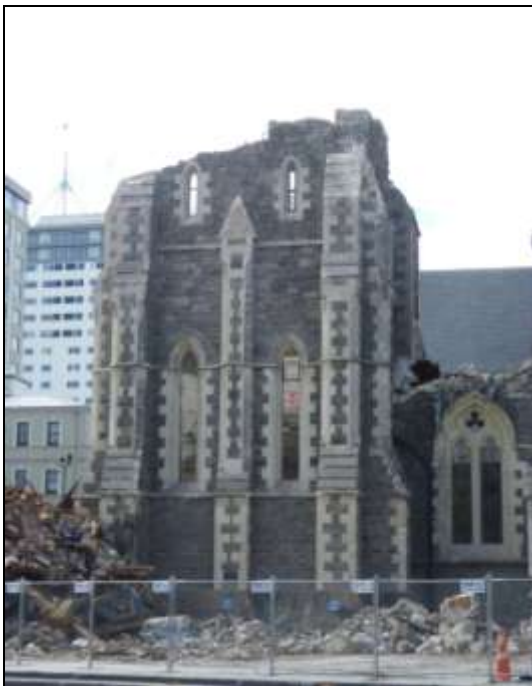
Where and how we build in earthquake country...matters.

“Orion had invested in the investigation and analysis of the weak points in the network and addressed these both before the 4 September 2010 earthquake and again before the February 2011 event.

*For example, the mitigation measures put in place after a vulnerability study (1994-97) cost \$6 million **but are estimated to have saved \$60-65 million in direct asset replacement costs as result of the earthquakes in addition to the contribution to rapid restoration of services.**”*

Long-term consequences to historic structures: Unreinforced Masonry Buildings

- ▶ We typically place increased value on historic structures and our places of worship. However, without appropriate mitigation in advance of an earthquake, we are left with few options afterwards and most must be demolished...



Long-term consequences of life-safety only codes: AMI Stadium



Welcome to the new **AMI Stadium**

The stadium suffered considerable structural damage in the 2011 quakes. Built in under 100 days, the new AMI Stadium □ has brought back the ability for the city to host large outdoor sporting and music events once again.

Think about the emotional and economic impacts to a community when they lose the ability for their local & national teams to play sport.

<http://www.vbase.co.nz/venues/ami-stadium>

Long-term consequences of life-safety only codes: Example – Downtown Businesses



Long-term consequences of construction in liquefaction areas: Example - Neighborhoods



Long-term consequences of construction in liquefaction areas: Example - Neighborhoods



Long-term consequences of construction in liquefaction areas: Example – Flood control



Temporary levee along the Avon River for flood control due to lateral spreading

Also note the:

- Gravel street with single travel lane
- Green refuse container in the distance.

This is life in a post-earthquake neighborhood that was built in a liquefaction area.

Long-term consequences of construction in landslide areas: Example - Schools



Top 10 Biggest Issues & Challenges 2 years on...

- ▶ I. Initial Establishment/Organization of a Recovery Authority
 - ▶ Canterbury Earthquake Recovery Authority established 1 month after earthquake
 - ▶ CER Act passed 2 months afterward giving CERA extensive powers
 - ▶ Responsive in establishing the an authority, but many residents are frustrated with effectiveness
 - ▶ II. Central Business District remains closed 2 years later
 - ▶ Remains closed, in part, due to collapse hazards of taller buildings
 - ▶ III. Earthquake Insurance – Pros & Cons
 - ▶ Lack of initial surge capability/staff by EQC Earthquake Commission to process insurance claims to expedite recovery
 - ▶ Lack of clarity on just which earthquakes were covered
 - ▶ Dealing with cumulative earthquake impacts to a structure
 - ▶ 80% of losses are covered under insurance, making this the most insured earthquake in modern history
-



Top 10 Biggest Issues & Challenges 2 years on...

- ▶ IV. Development of a recovery plan and accommodating long-term instability from liquefaction damage
- ▶ V. Removal of entire neighborhoods and horizontal utilities damaged by liquefaction
- ▶ VI. Population Movements and Notification/Consenting on Redevelopment Plans, Buy-Outs, & Settlement
- ▶ VII. Labor supply and accommodating influx of people to work on the “Christchurch Rebuild”
- ▶ VIII. Numerous responsibilities across multiple agencies
- ▶ IX. Displacement of children again & again as well as lack of resources for those who moved outside of Christchurch
- ▶ X. Affordability and “Financing the Rebuild”



With every disaster comes opportunity.



It doesn't
matter how
slowly you go,
as long as
you don't
stop!



Will we seize our opportunities to create a better, more resilient Washington **before** or **after** our next big earthquake(s)?

