GEOSPATIAL HAZARD AND CRITICALITY ASSESSMENT FOR INFRASTRUCTURE NETWORKS

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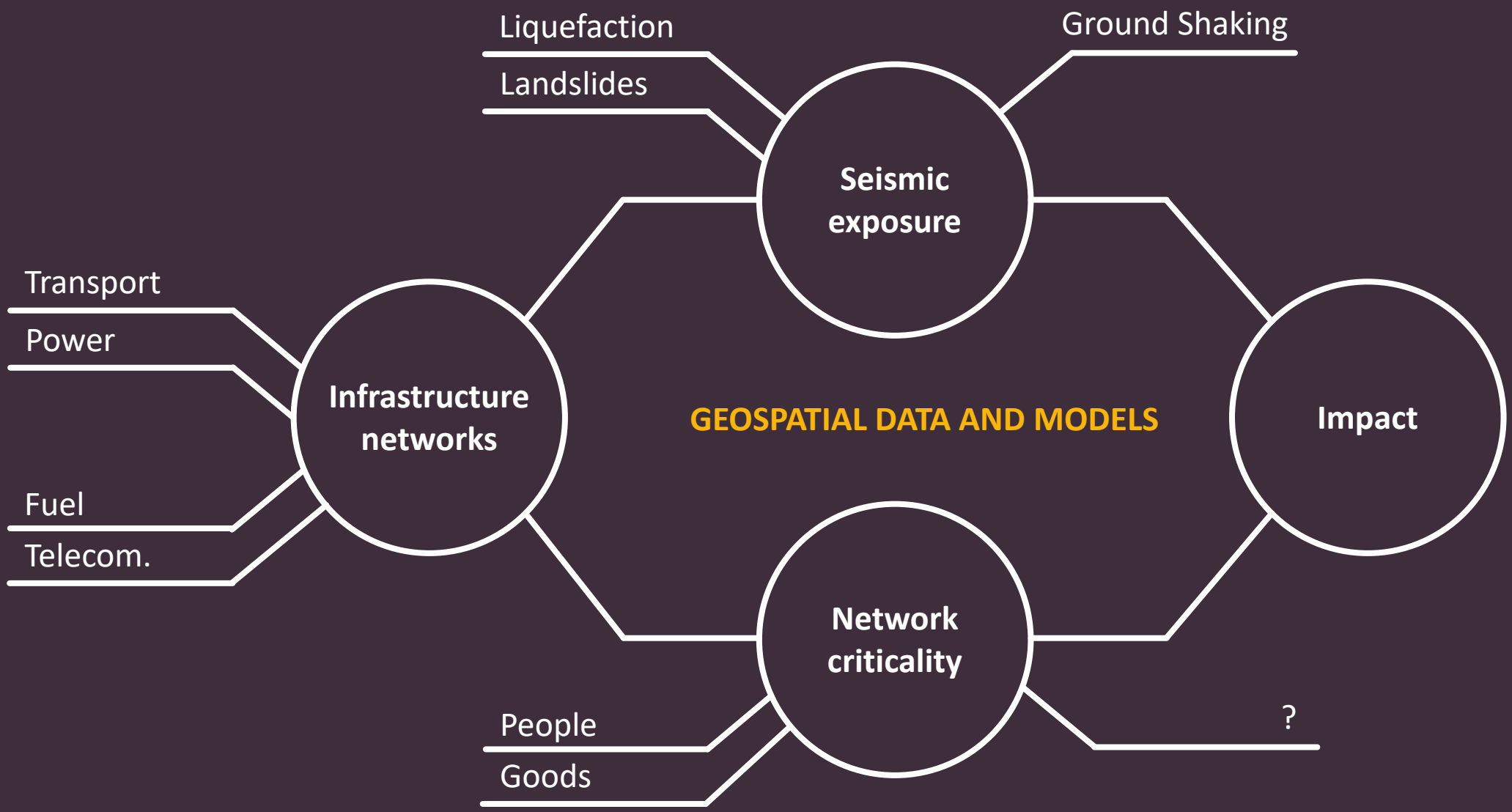
INTRODUCTION



SEISMIC EXPOSURE

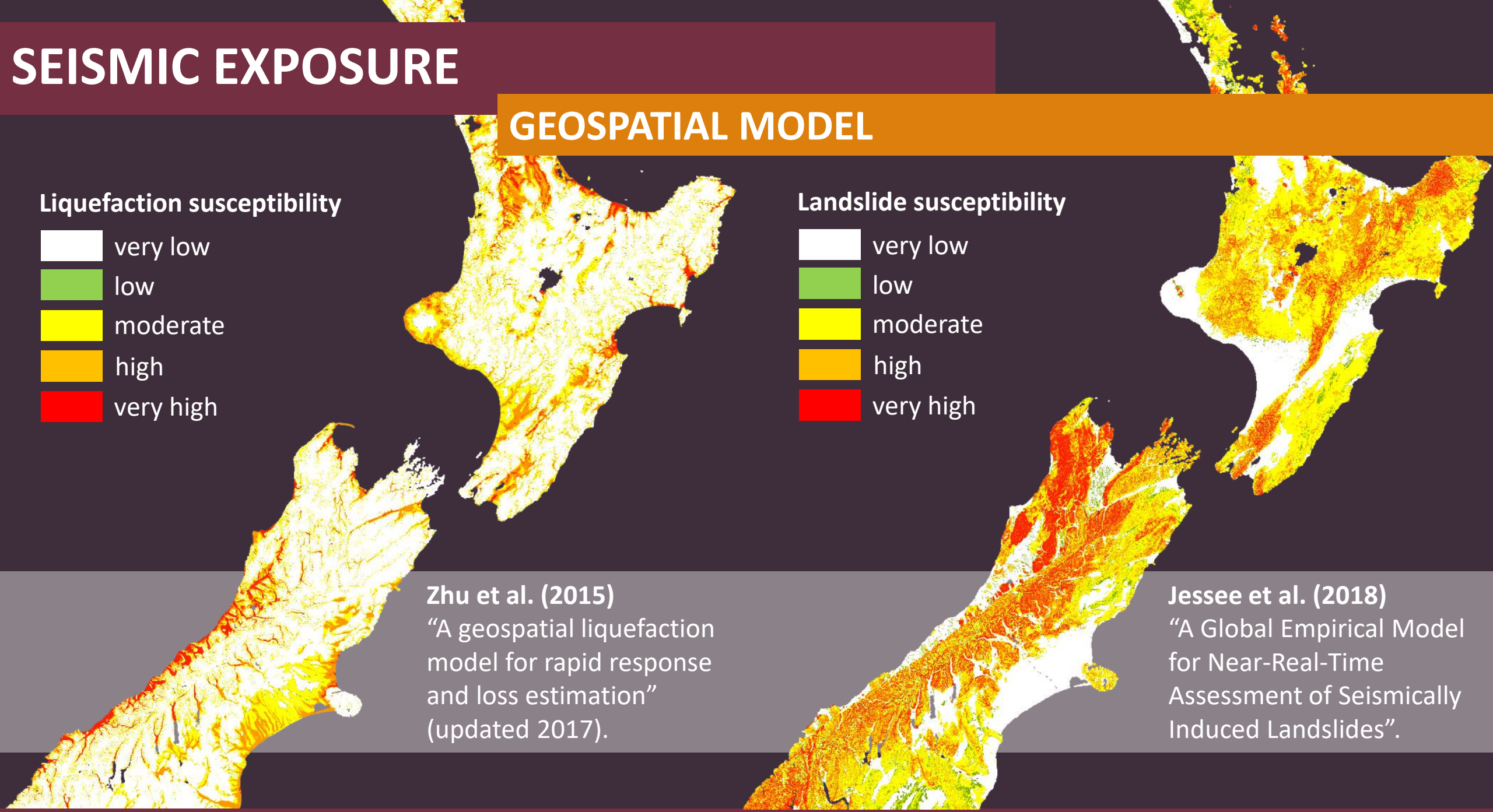
GEOSPATIAL MODEL

Liquefaction susceptibility

- very low
- low
- moderate
- high
- very high

Landslide susceptibility

- very low
- low
- moderate
- high
- very high



Zhu et al. (2015)
"A geospatial liquefaction model for rapid response and loss estimation" (updated 2017).

Jessee et al. (2018)
"A Global Empirical Model for Near-Real-Time Assessment of Seismically Induced Landslides".

SEISMIC EXPOSURE

NETWORK MODELLING

Split polylines

Spatial join

SEISMIC EXPOSURE

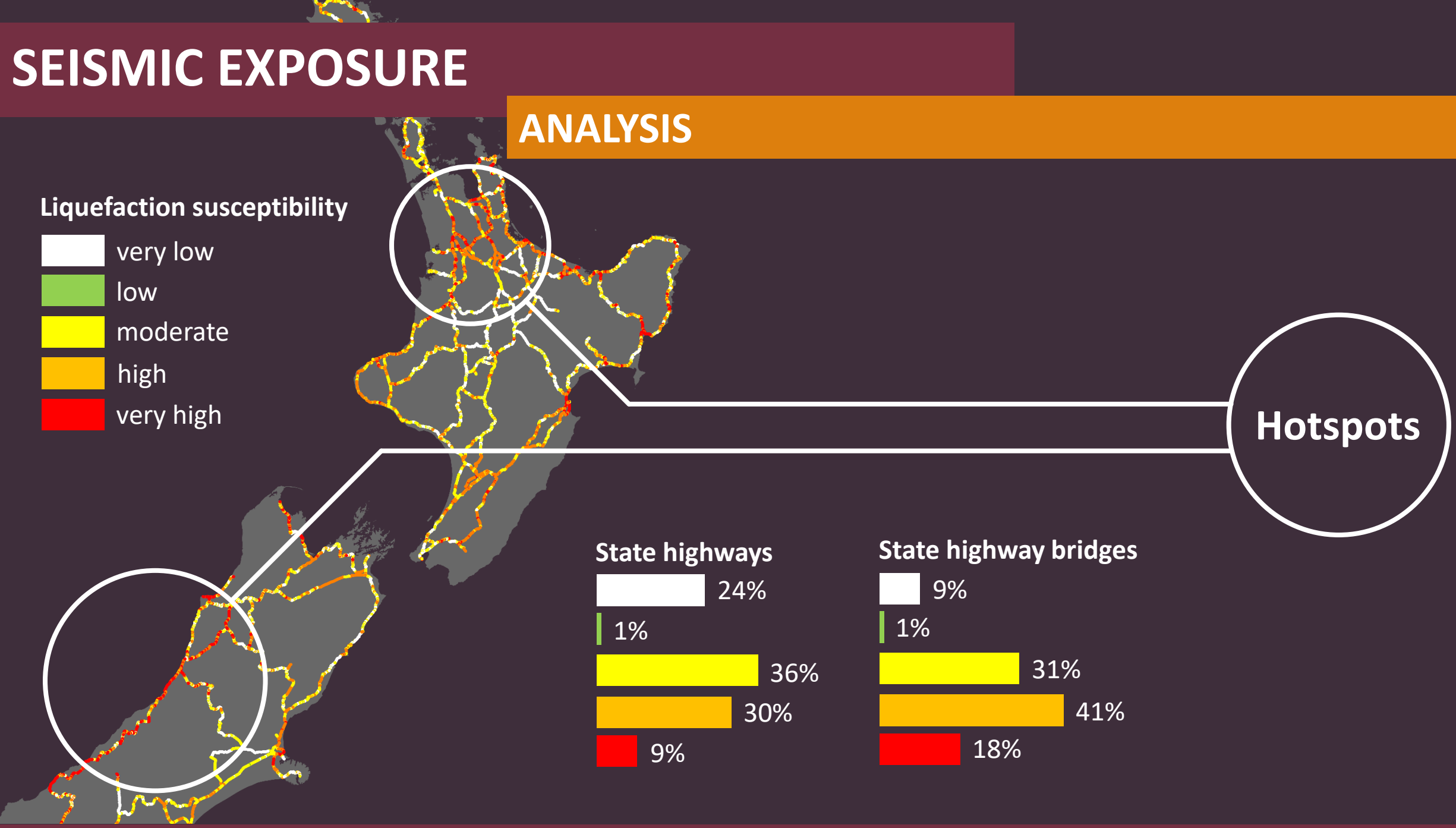
ANALYSIS

INFRASTRUCTURE NETWORK	LIQUEFACTION			LANDSLIDES		
	SUSCEPTIBILITY	GROUND SHAKING	PROBABILITY	SUSCEPTIBILITY	GROUND SHAKING	PROBABILITY
STATE HIGHWAYS	✓	✓	✓	✓	✓	✕
RAIL	✓	✕	✕	✓	✕	✕
POWER TRANSMISSION	✓	✓	✕	✓	✓	✕

Alpine Fault earthquake

SEISMIC EXPOSURE

ANALYSIS



State highways

very low	24%
low	1%
moderate	36%
high	30%
very high	9%

State highway bridges

very low	9%
low	1%
moderate	31%
high	41%
very high	18%

SEISMIC EXPOSURE

ANALYSIS

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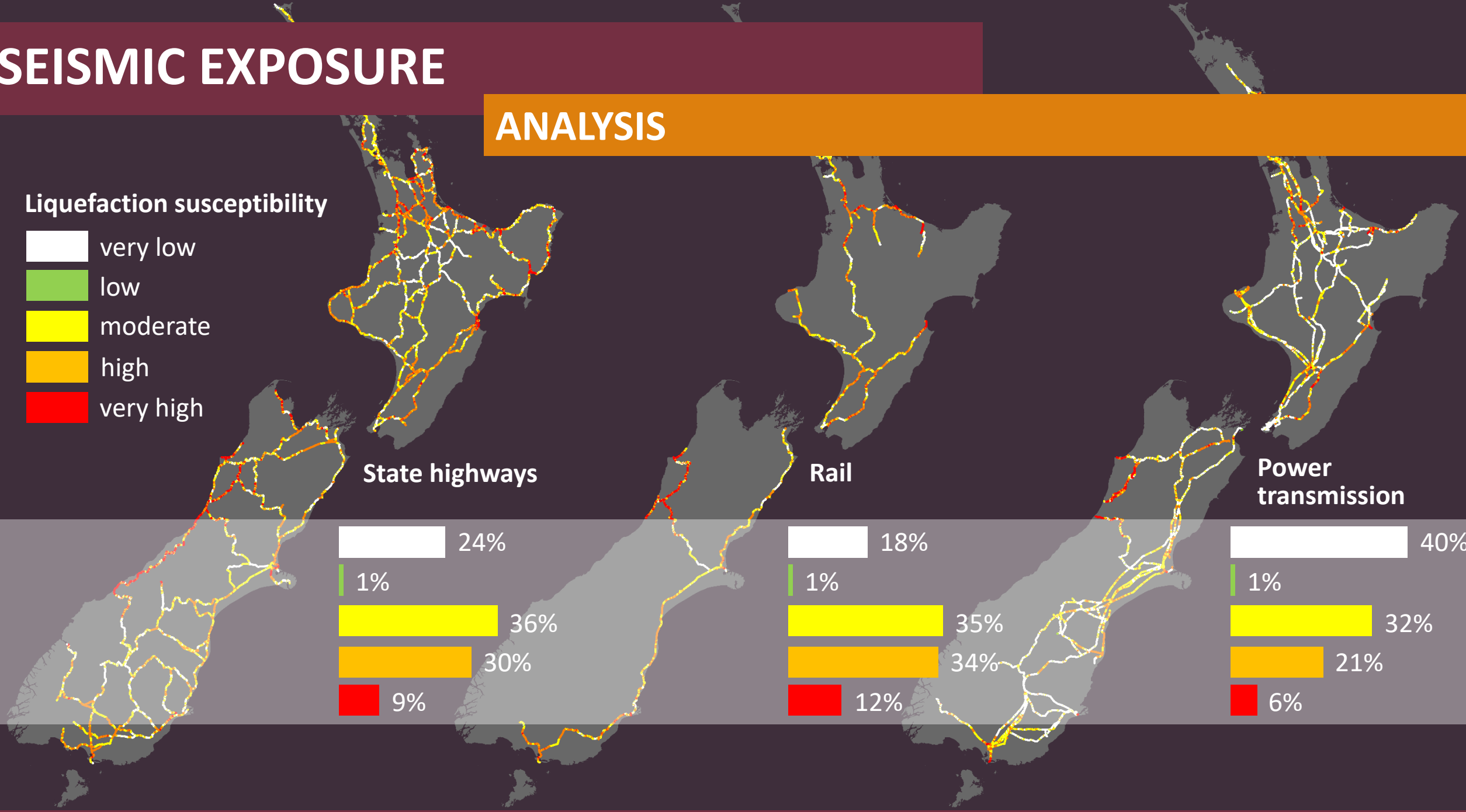
RAIL	✓	✕	✕	✓	✕	✕
POWER TRANSMISSION	✓	✓	✕	✓	✕	✕

SEISMIC EXPOSURE

ANALYSIS



SEISMIC EXPOSURE

ANALYSIS

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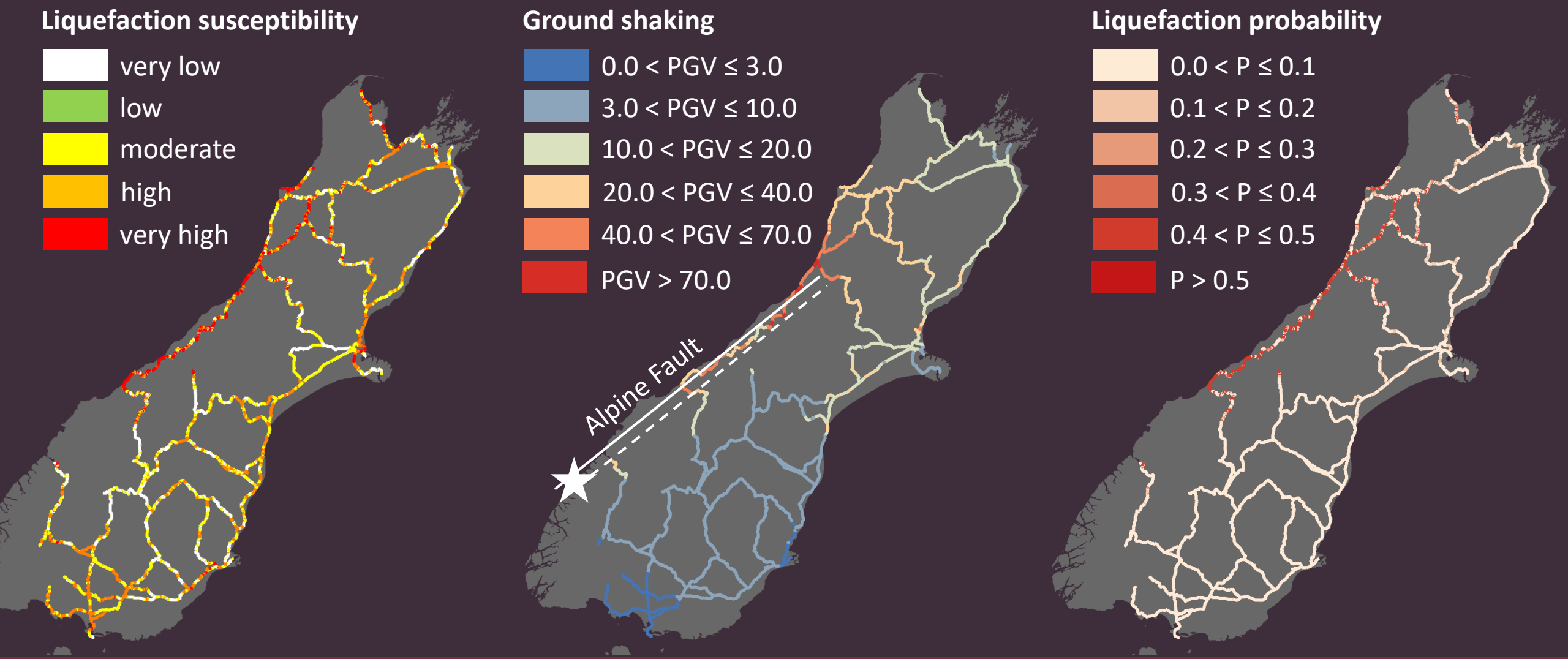
SEISMIC EXPOSURE

ANALYSIS



SEISMIC EXPOSURE

ANALYSIS

+ more data

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STATE HIGHWAYS	✓	✓	✓	✓	✕	✕
RAIL	✓	✕	✕	✓	✕	✕
POWER TRANSMISSION	✓	✓	✕	✓	✕	✕

Interdependencies

+ more data

NETWORK CRITICALITY

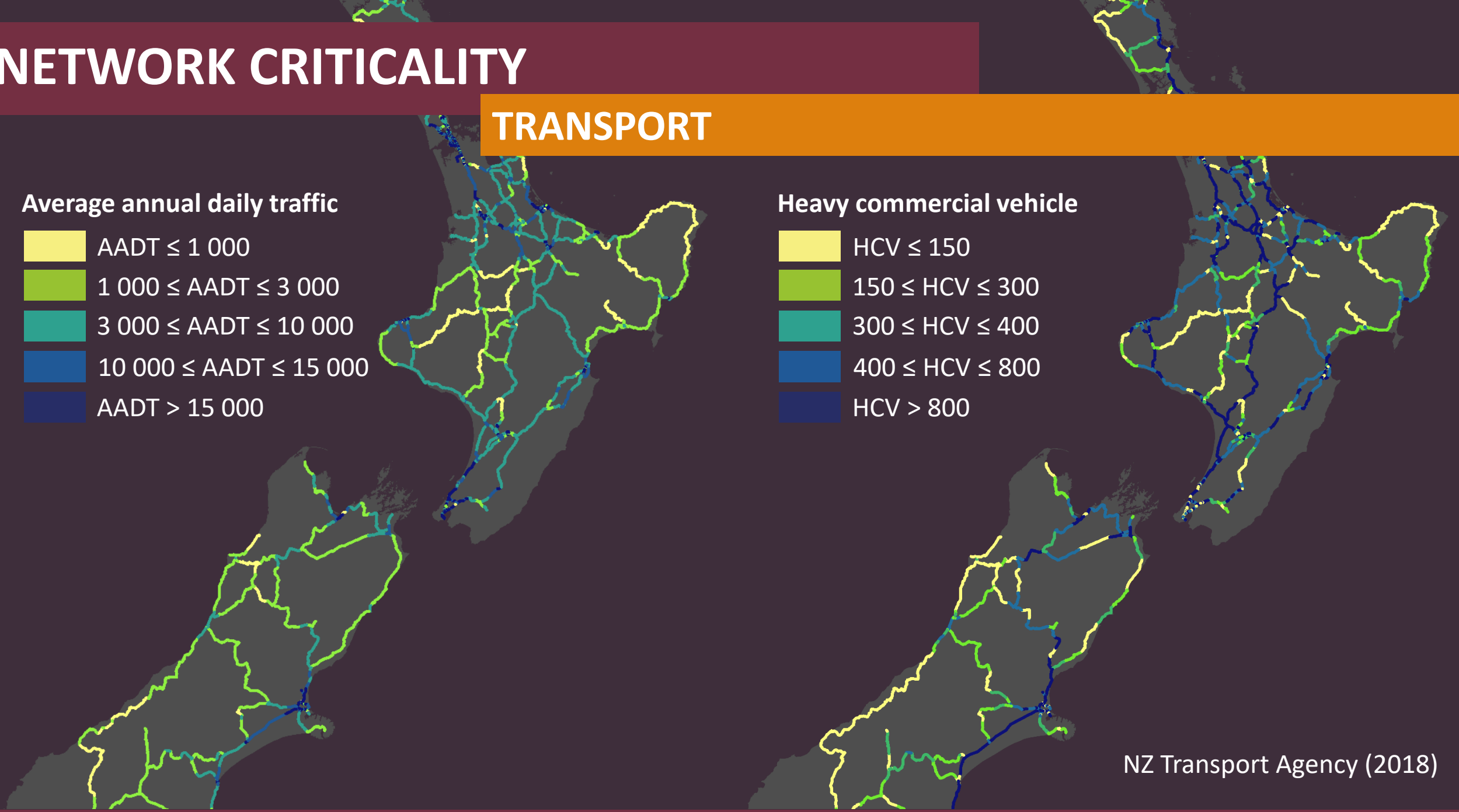
What is network criticality?

Critical assets are sites, facilities or routes that “are especially significant to societal wellbeing and that therefore merit priority attention by utilities in emergency response and recovery”. (NZ Lifelines Council)

How to determine network criticality?

NETWORK CRITICALITY

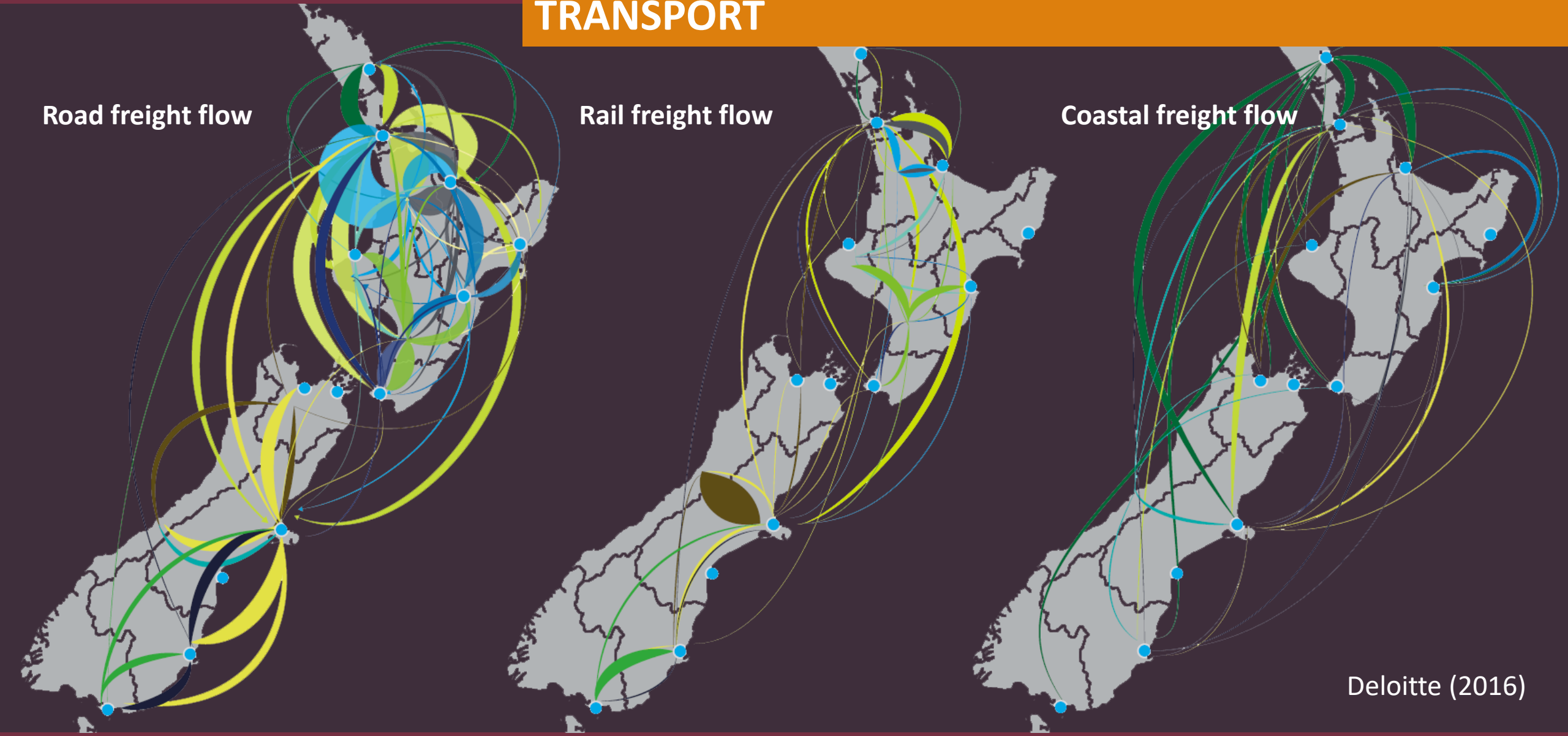
TRANSPORT



NZ Transport Agency (2018)

NETWORK CRITICALITY

TRANSPORT



Deloitte (2016)

SUMMARY

What's done?

1. Partial assessment of national infrastructure to seismic exposure.
   - Transport & power network.
   - Alpine Fault earthquake.
2. General analysis of indicators for network criticality.

What's next?

1. Complete seismic exposure assessment of national infrastructure.
   - Include more networks.
   - Add more earthquake scenarios.
   - Consider interdependencies.
2. Develop a systematic approach to determine network criticality.
3. Link seismic exposure and network criticality for broader impact assessment of national infrastructure.