9th International Conference on MANAGING PAVEMENT ASSETS (ICMPA9)

DETERMINING POST-EARTHQUAKE PAVEMENT REQUIREMENTS FOR CHRISTCHURCH, NEW ZEALAND

Sean Rainsford **- Fulton Hogan**

Andrew Crofts **- SCIRT**

AASHTO THE VOICE OF TRANSPORTATION

VirginiaTech Transportation Institute

TRB

U.S. Department of Transportation Federal Highway Administration

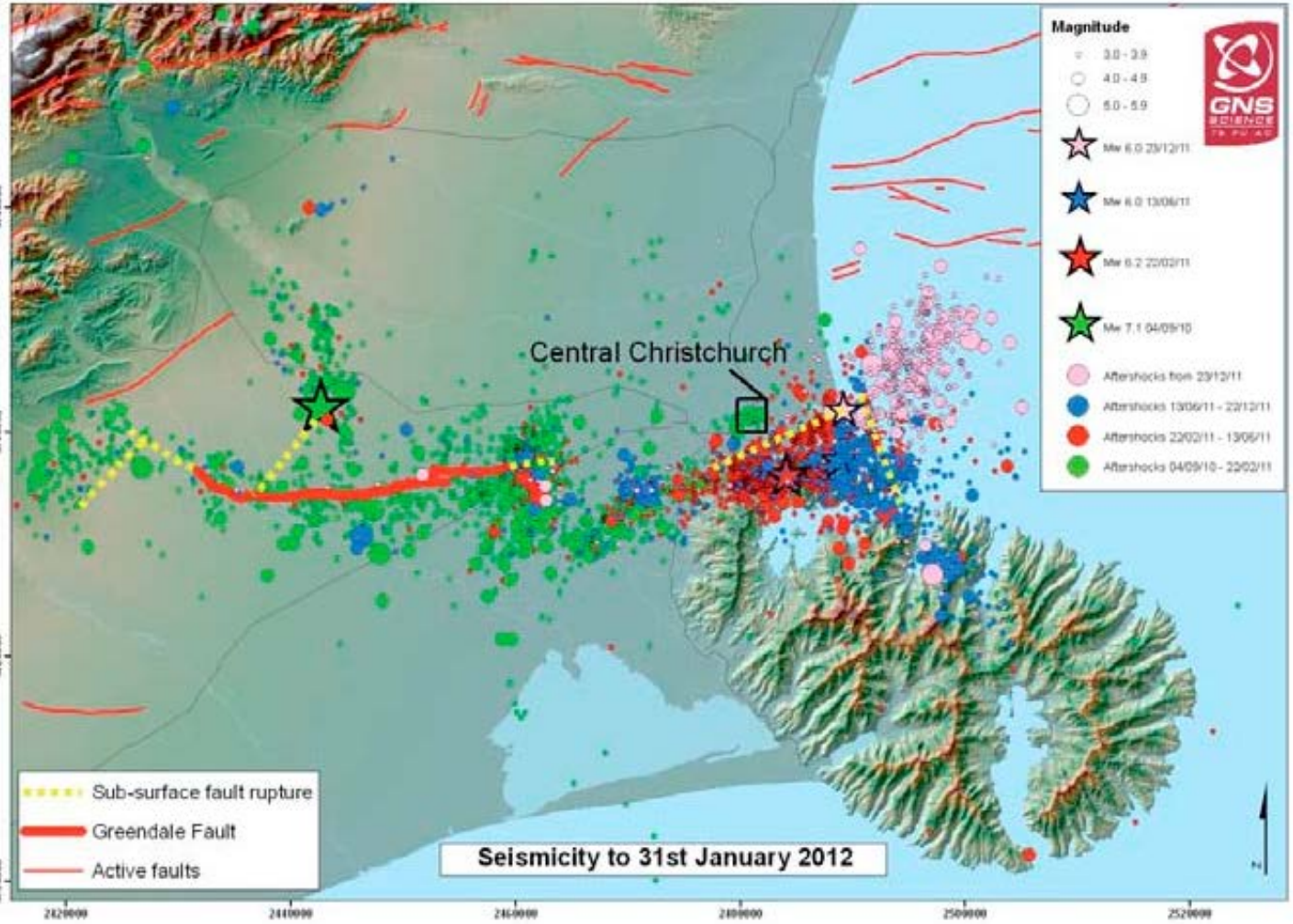
WORLD ROAD ASSOCIATION MONDIALE DE LA ROUTE 1909-2009 AIPCR PIARC

VDOT Virginia Department of Transportation

Christchurch, NZ

Sealed road length: approx. 2,000 kms (1,250 miles)
Population: approx. 400,000

The Shakes



Sept 4, 2010: Mg **7.1**

Feb 22, 2011: Mg 6.2

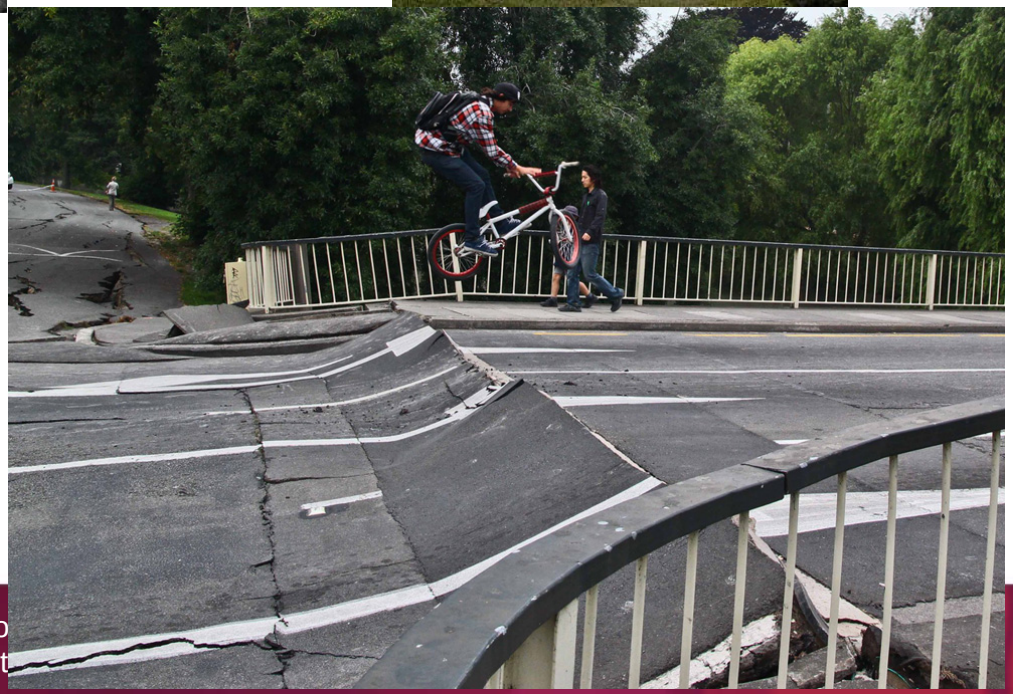
June 13, 2011: Mg **6.0**

Dec 23, 2011: Mg **5.9**

The Damage

Road Damage

Road Damage



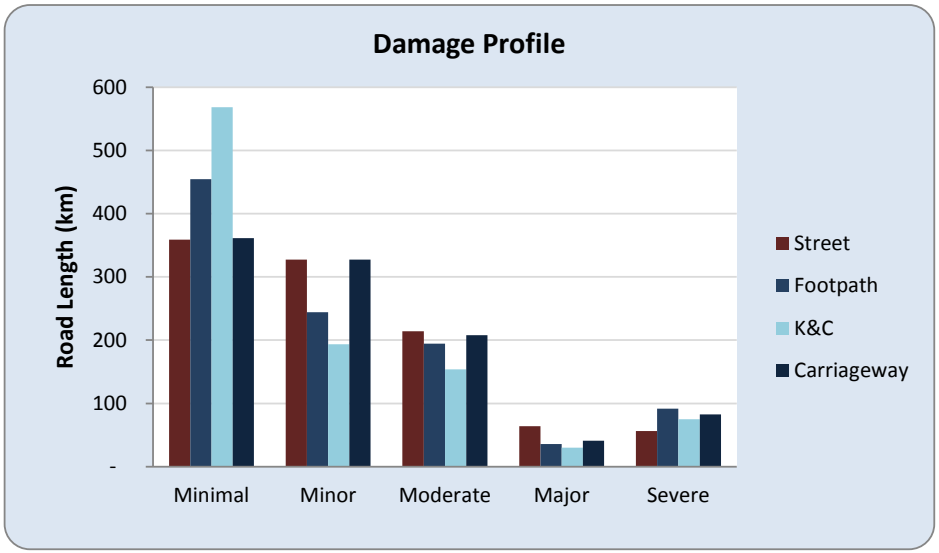
But, not everything was munted

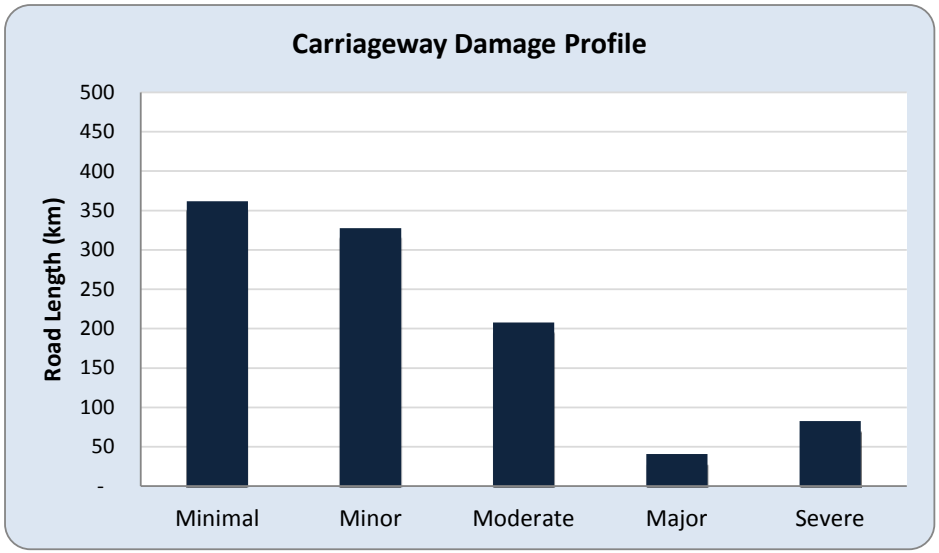
The Challenge

- Initial assessment
- Make safe repairs
- Detailed assessment
- Recovery Phase / Scoping
- Government Legislated Act
  - Canterbury Earthquake Recovery Act
- Rebuilding Phase

Detailed Assessment

- 20 Teams, trained and calibrated
- Full survey audited and reviewed
- Fault, Extent and Repair identified



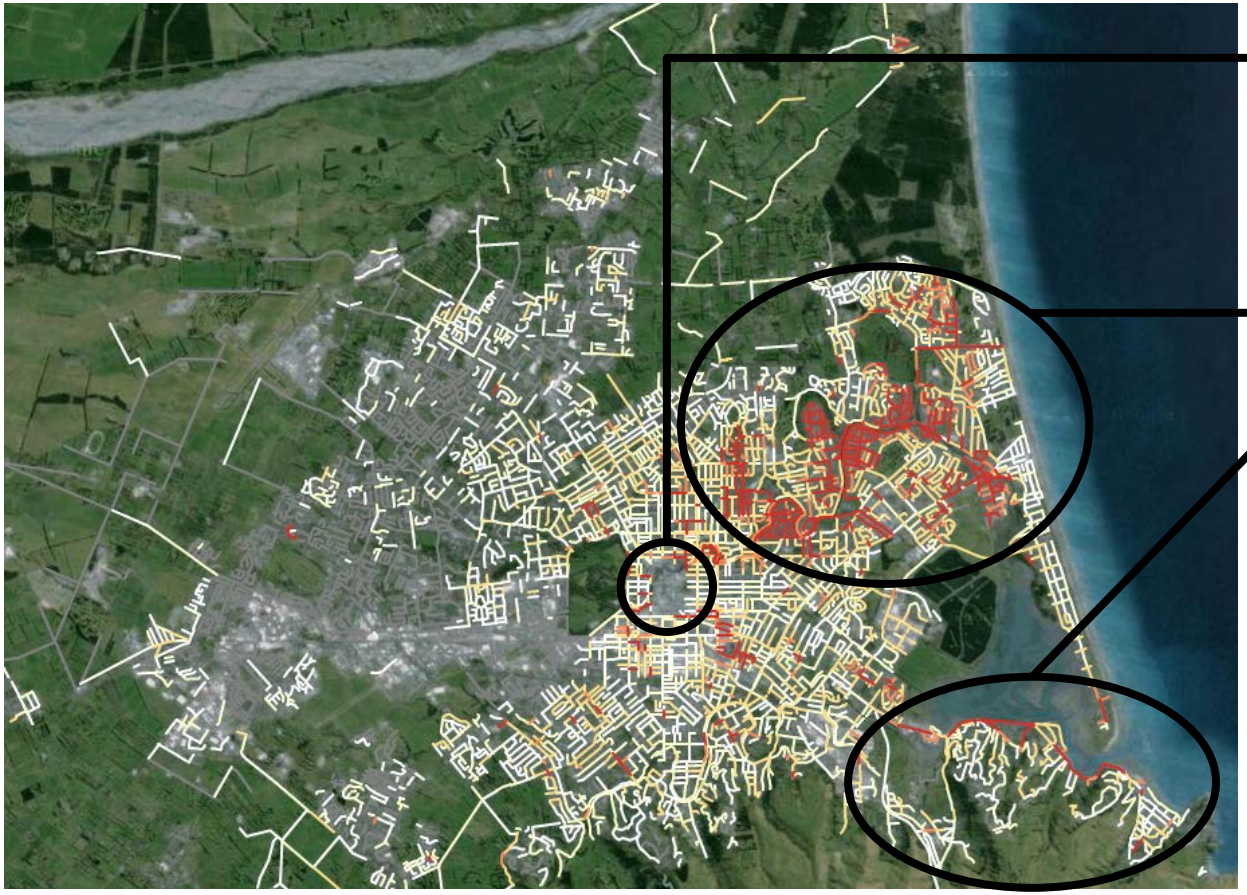


Detailed Assessment

Pavement	Crack under 20mm - Rubber
	Crk - non Displaced <5mm (Rubber)
	Crk - non Displaced 5-50mm
	Crk - non Displaced < 50mm (Rubber)
	Crk - non Displaced >50mm
	Crk vert movemt <50mm
	Crk vert movemt >50mm
	Depress - < 100mm
	Depress - > 100mm
	Pave Collapse - < 10m2
	Pave Collapse - > 10m2
	Pavement Uneven
	Pothole > 150mm
	Raised road surface - Street wide
	Raised road surface - isolated areas

The Rebuild Phase

- Assessment Defined Network to be Rebuilt



CERA
Canterbury Earthquake Recovery Authority
Te Mana Haumanu ki Waitaha

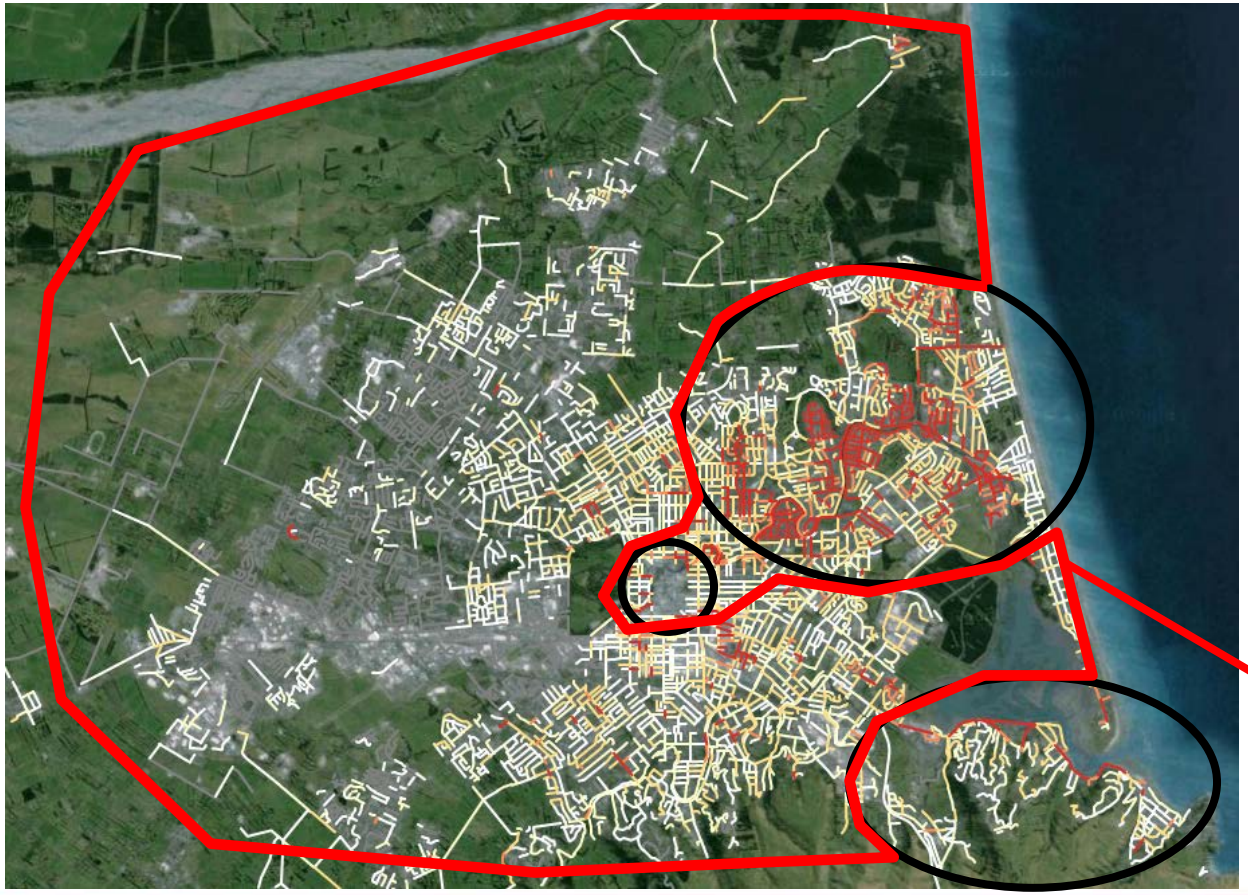
SCIRT
Rebuilding Infrastructure

NZ TRANSPORT AGENCY
WAKA KOTAHI

Christchurch City Council

The Rebuild Phase

- And what about the remainder?



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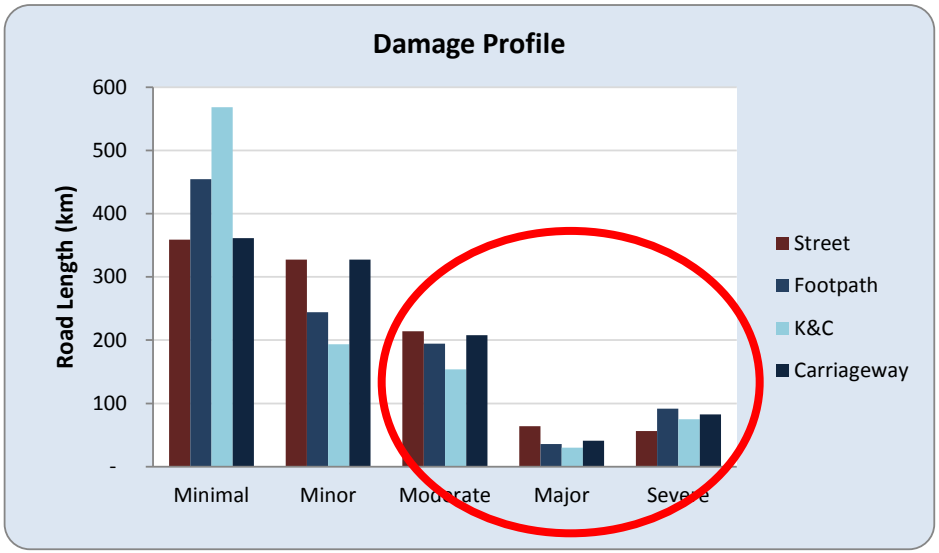
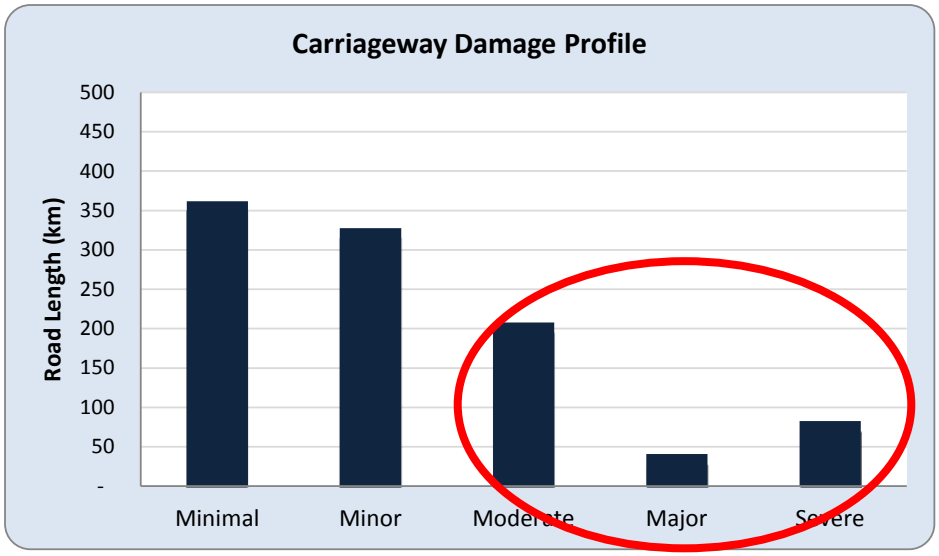
75% of Network Operational

Christchurch CC - Expectation

- The SCIRT Rebuild would fix the network
- There is no need to fund any other work over a 6 Year rebuild timeframe…





What was happening

- The traffic flow and demand had changed
- Additional loading, haulage trucks
- Impact on operating network

Interesting Facts

- Silt removal
  - 4 Sep 10 – 30,000 T removed
  - 22 Feb 11 – 430,000 T removed
  - 13 June 11 – 110,000 T removed
  - 23 Dec 11 – 26,000 T removed

Christchurch CC - Network

- We had to provide basis for funding maintenance of the operating network
- Based on previous forecasting (dTIMS)
- Incorporate Rebuild work locations and type
- Incorporate traffic dynamics
- Assume network returns to normal state after rebuild completed (2016)

Not an easy task

- We had no details on traffic changes (very dynamic)
- We had generic details on rebuild work, and expected outcomes
- Research into silt contaminants in pavement was undertaken (Pidwerbesky, Waters)
- The underground services preceded any roadwork

Assumptions

- Rebuild work would meet CCC specifications
- All Rebuild work would be completed by 2016
- Network would return to as-new state on Rebuild sites
- Traffic would return to normal routes

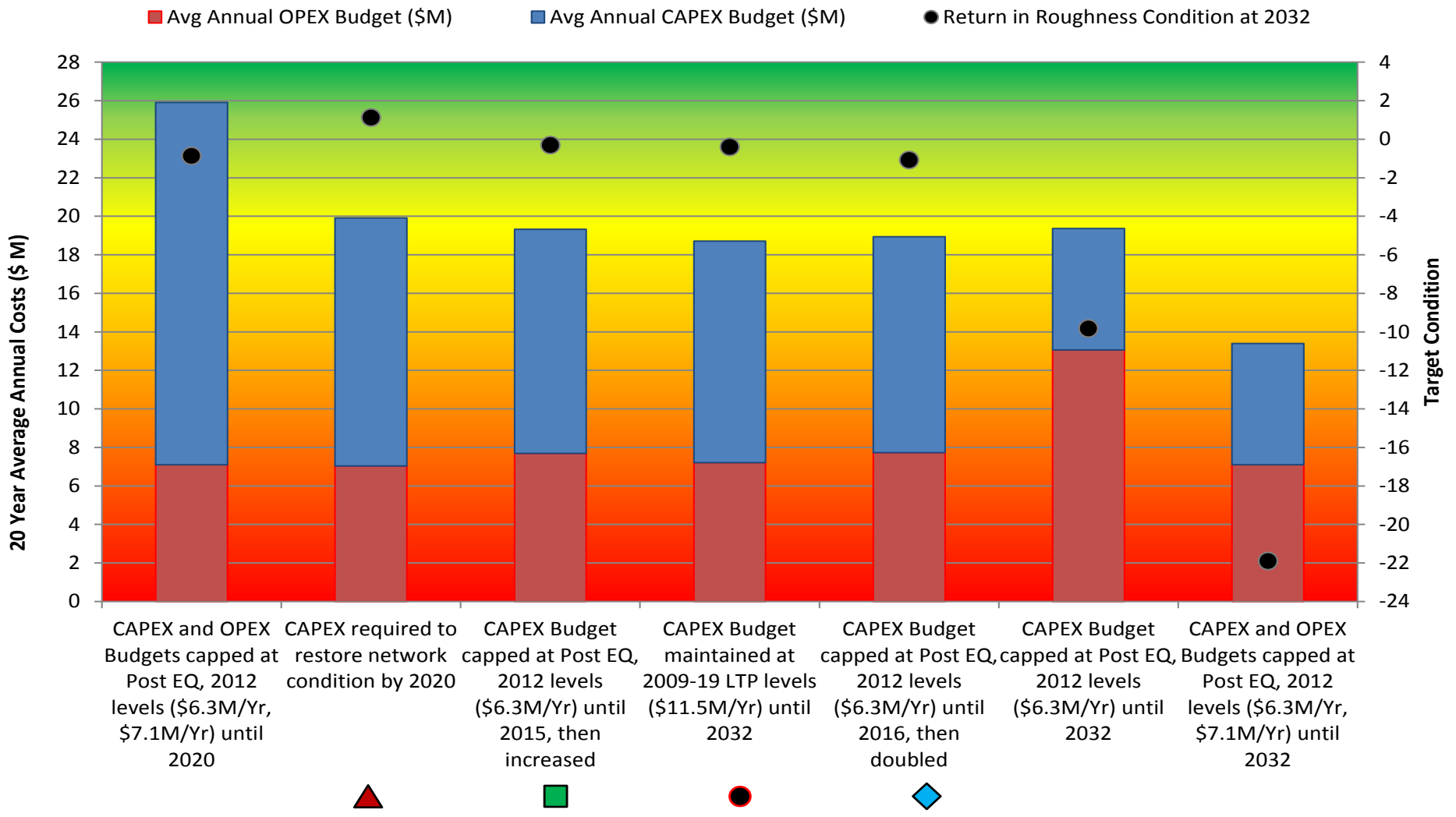
Funding Scenarios

- 7 Scenarios completed
- Only 4 were considered for putting forward to the Council board
- Outcomes were
  - Funding required to achieve desired Levels of Service defined in long term plan
  - Highlight the impact of doing no work on the network during the Rebuild phase

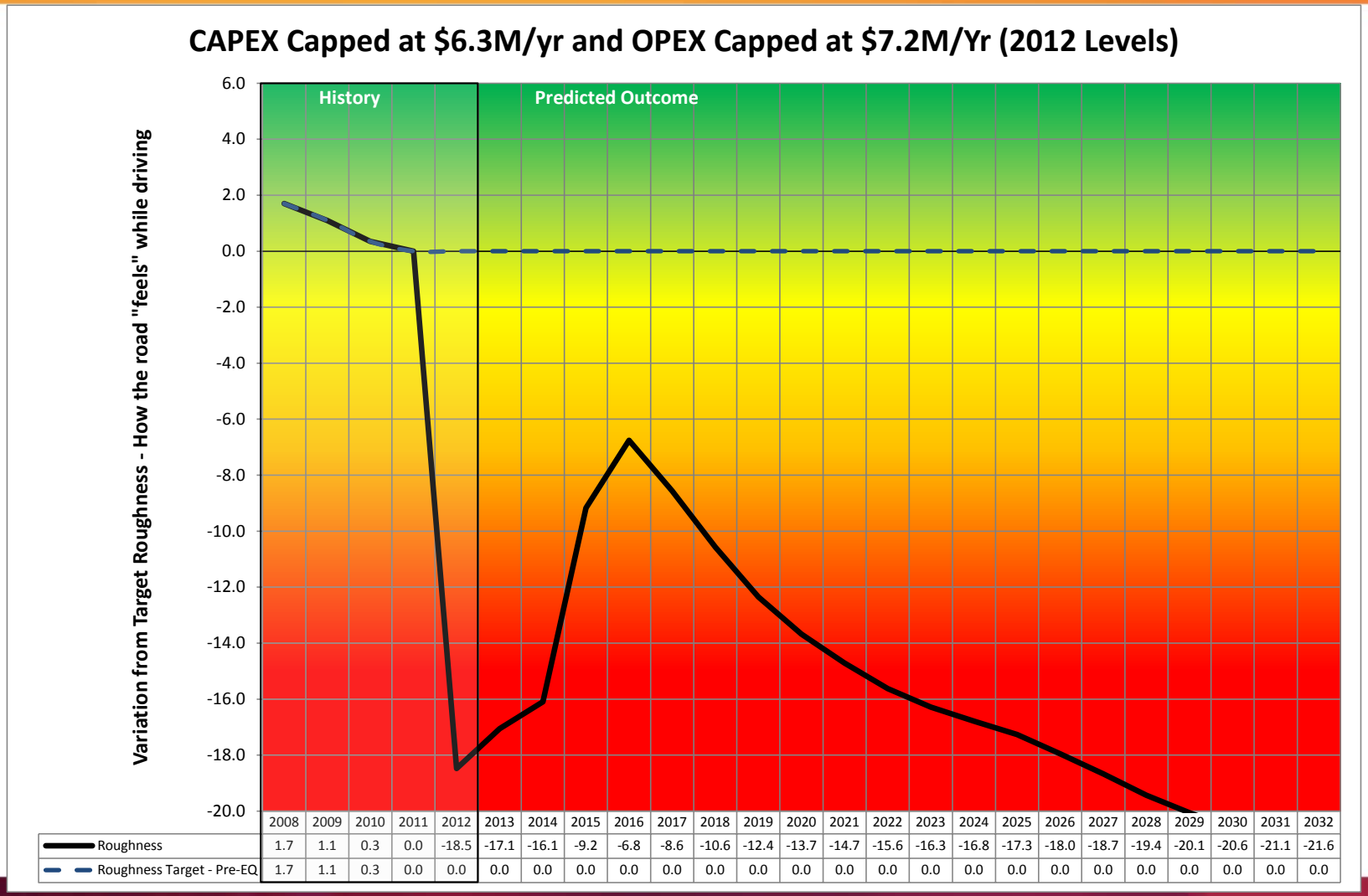
Funding Scenarios

Funding Scenario	Average Annual CCC CAPEX Budget Levels ($M)	Average Annual CCC OPEX Budget Levels ($M)	Total CCC Annual Cost for 20 years (CAPEX and OPEX)	Return in Roughness Condition at Year 20
Scenario 1	$11.50 M	$ 7.21 M	$18.71 M	111
Scenario 2	$6.30 M	$13.06 M	$19.36 M	120
Scenario 3	$6.30 M	$7.10 M	$13.40 M	132
Scenario 4	$12.87 M	$7.04 M	$19.91 M	109
Scenario 5	$11.64 M	$7.69 M	$19.33 M	110
Scenario 6	$11.21 M	$7.73 M	$18.94 M	111
Scenario 7	$18.81 M	$7.10 M	$25.91 M	111

Funding Scenarios

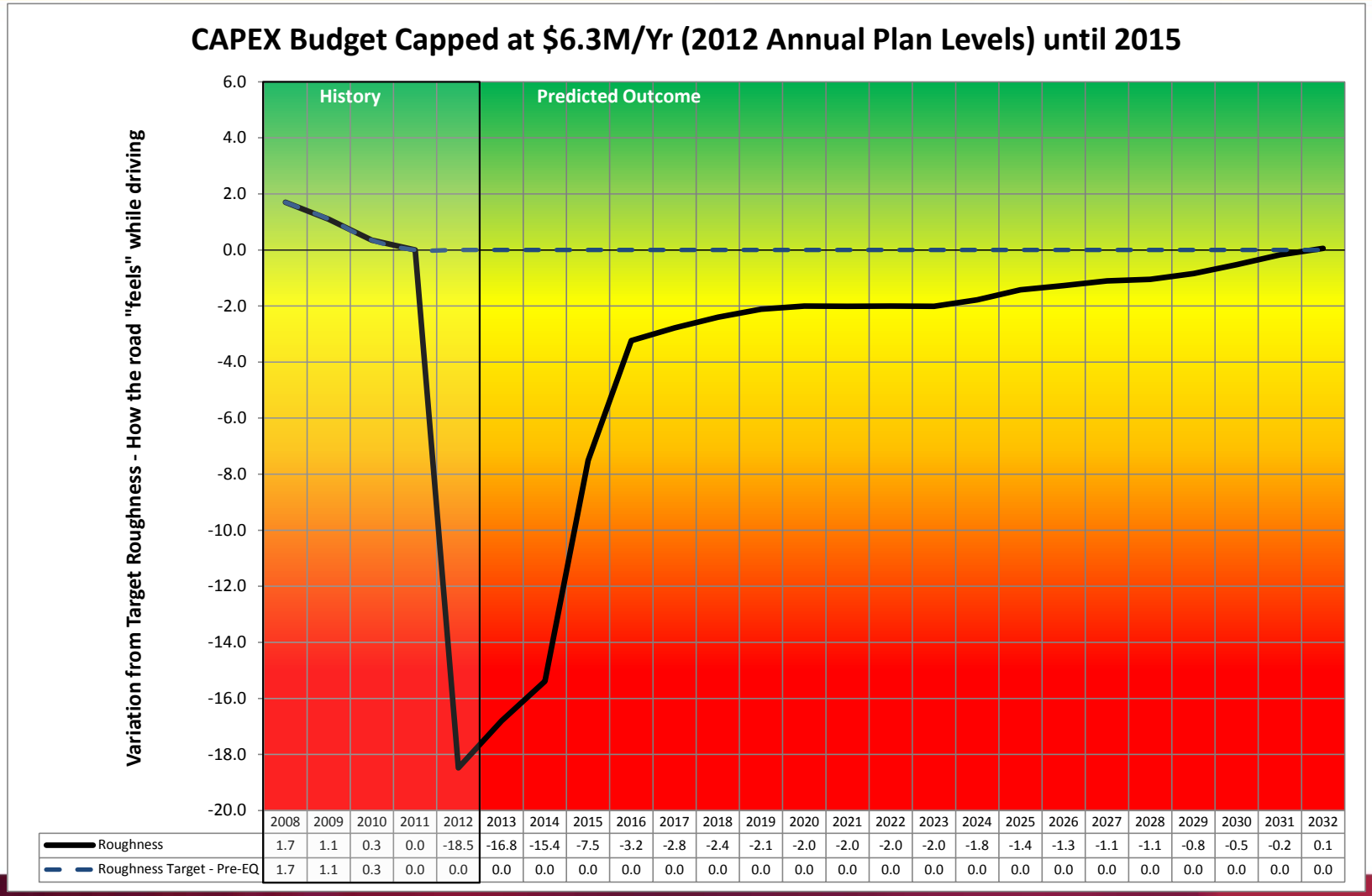


Impact of reduced funding during Rebuild

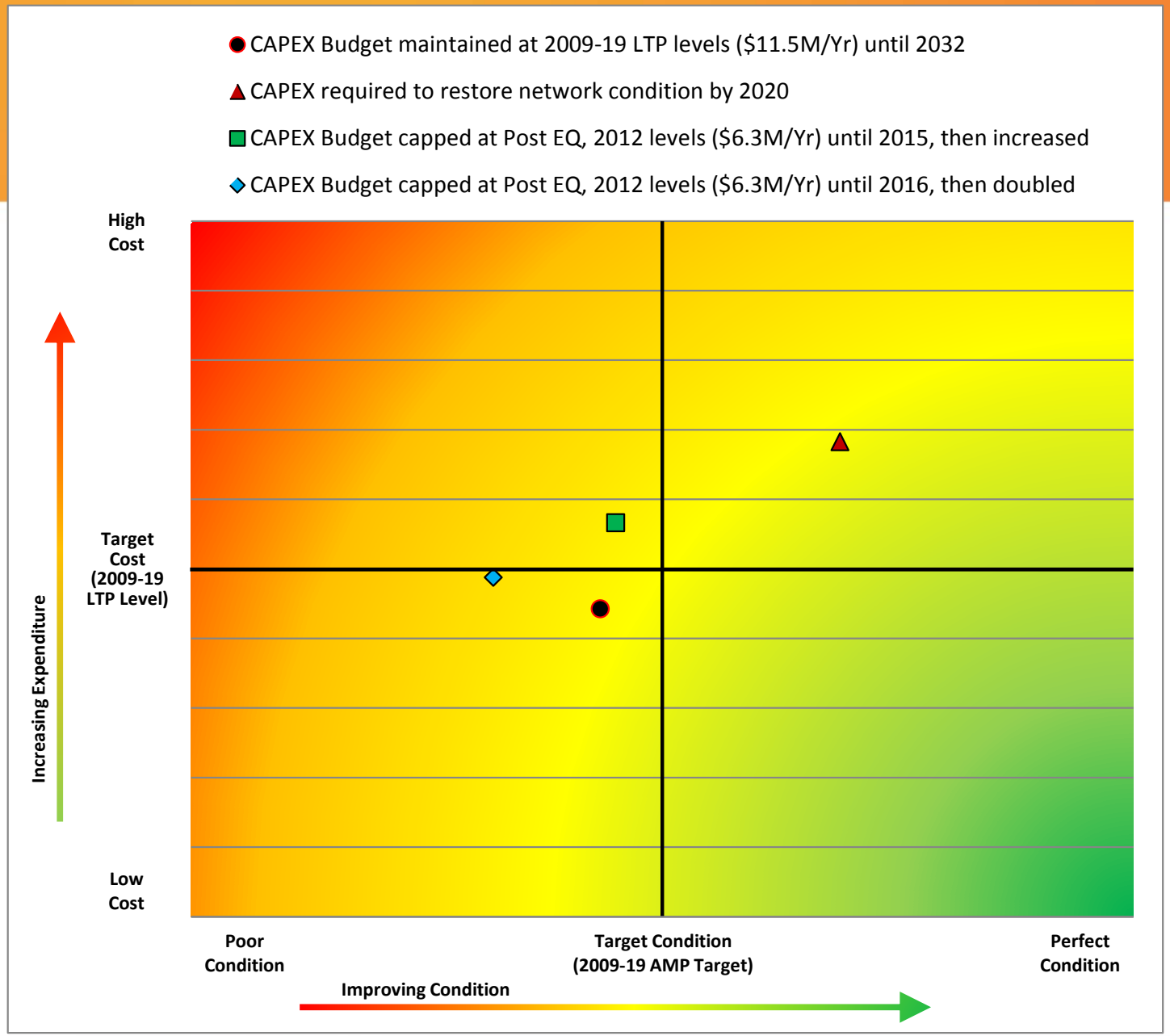


	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Roughness	1.7	1.1	0.3	0.0	-18.5	-17.1	-16.1	-9.2	-6.8	-8.6	-10.6	-12.4	-13.7	-14.7	-15.6	-16.3	-16.8	-17.3	-18.0	-18.7	-19.4	-20.1	-20.6	-21.1	-21.6
Roughness Target - Pre-EQ	1.7	1.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Impact of holding funding during Rebuild



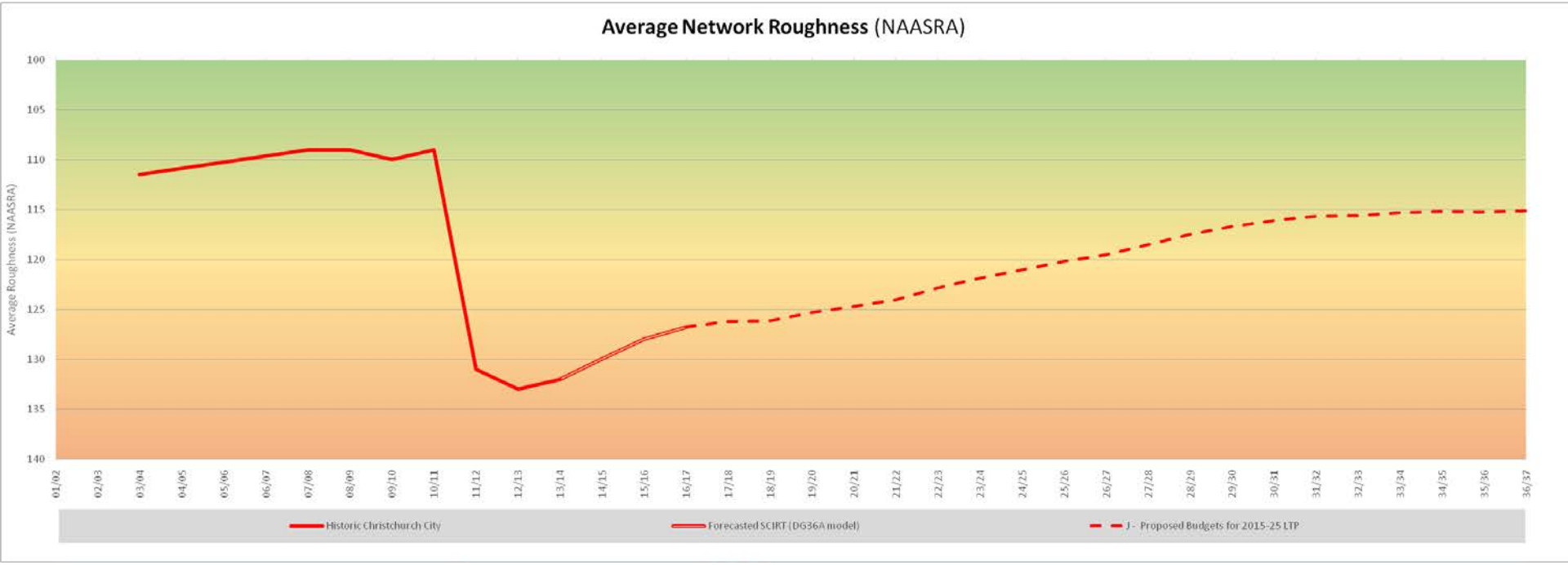
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Roughness	1.7	1.1	0.3	0.0	-18.5	-16.8	-15.4	-7.5	-3.2	-2.8	-2.4	-2.1	-2.0	-2.0	-2.0	-2.0	-1.8	-1.4	-1.3	-1.1	-1.1	-0.8	-0.5	-0.2	0.1
Roughness Target - Pre-EQ	1.7	1.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

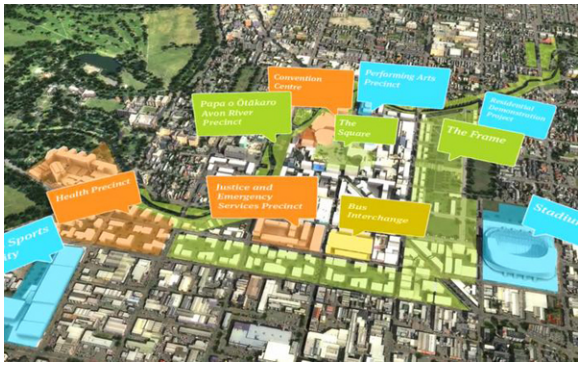

CAPEX Budget maintained at 2009-19 LTP levels ($11.5M/Yr) until 2032
CAPEX required to restore network condition by 2020
CAPEX Budget capped at Post EQ, 2012 levels ($6.3M/Yr) until 2015, then increased
CAPEX Budget capped at Post EQ, 2012 levels ($6.3M/Yr) until 2016, then doubled
High Cost
Target Cost (2009-19 LTP Level)
Low Cost
Increasing Expenditure
Poor Condition
Target Condition (2009-19 AMP Target)
Perfect Condition
Improving Condition

What has Happened?

- Pavement rebuild is very slow in uptake, due to underground work completion
- Funding is an issue
- Programme Review has been completed
- CCC now has EQ damaged roads back
- But, CCC have continued to maintain the non-affected network over the past 4 years
- Further work to determine requirements

It will take a while to get back





Acknowledgements

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- **New Zealand Transport Agency (NZTA)**
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