OPERATIONALLY COGNISANT DESIGN THE CAPITAL PROCESS

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17th ANNUAL CONFERENCE

NZ TRANSPORT AGENCY WAKA KOTAHI & new zealand nz:iht institute of highway technology

BACKGROUND

CAPITAL JOURNEYS

OPUS Fulton Hogan

NZ TRANSPORT AGENCY WAKA KOTAHI

HIWAY GROUP

The Site(s)

Motorway Environment

- SH1 1050 / 2.760 – 3.810 D R2
- National Strategic High Volume
- Single lane treatment

CJP191 South of Whitford Brown

- Traffic
  - AADT = 27,863
  - HCV = 8%
  - DESA = 3.54 x 10^7
- Pavement
  - Lane R2 (outer)
  - Bound by R1 & Shoulder
  - Pavement 600mm+
  - Cracking & pothole repairs

Primary Failure Indicators

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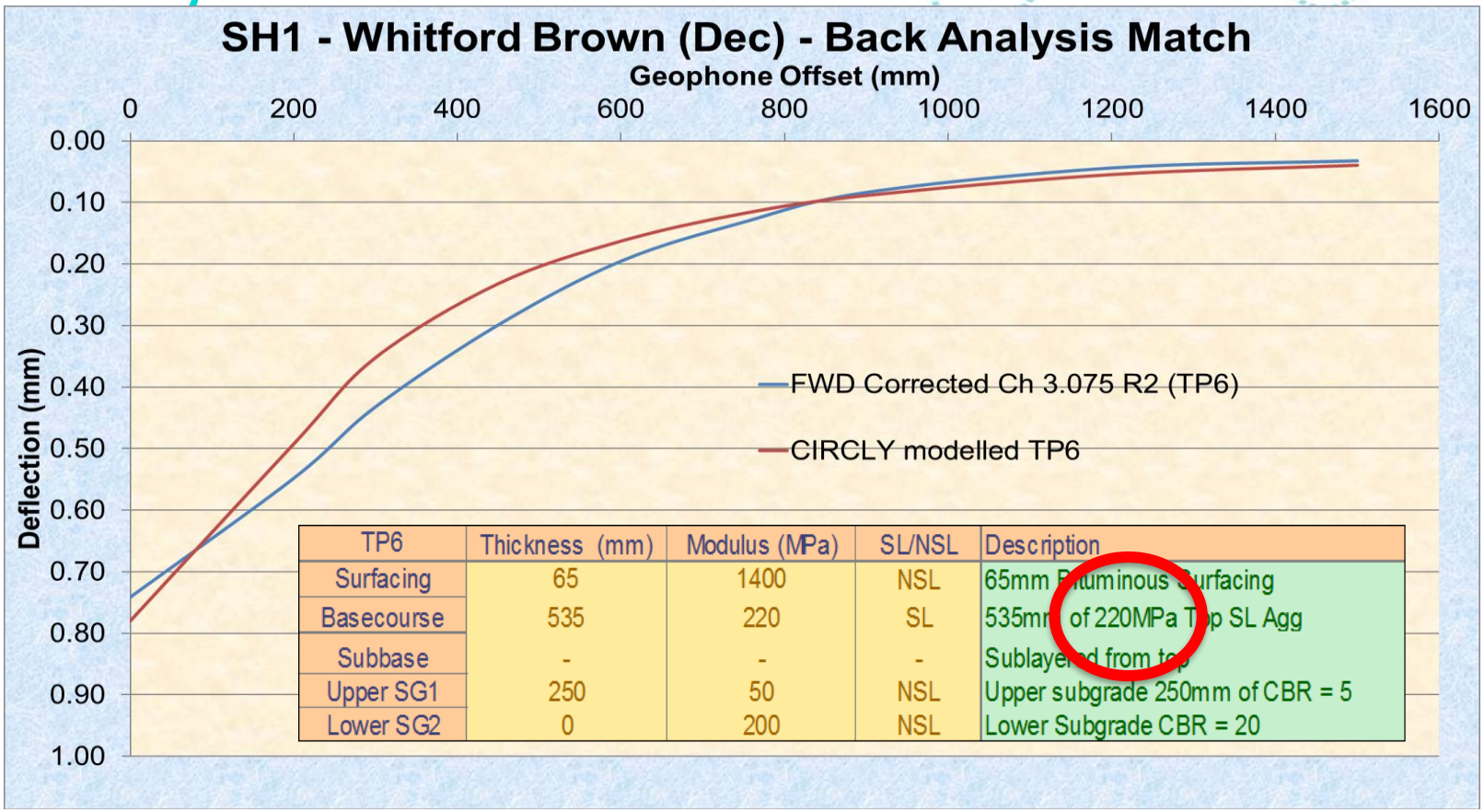
Primary Material Concerns

% passing finest sieve obtained by difference	
Plasticity Index	
Sample PI	13 ± 2
Specification	<= 5

R 2	Defl (mm)	Curv (mm)
Average	0.48	0.12
95% ile	0.68	0.19
Std Dev	0.12	0.04
COV%	25	35

Sample description:		Existing Subbase	Existing Basecourse
History		Air Dried	As received
Passing mm (-19mm)	%	68	72
Cement additive	%	0	0
Curing time	days	n/a	n/a
Surcharge mass	kg	4	4
Sample condition:		Soaked	Soaked
Soaking time	days	4	4
Swell	%	0	0
W/c as rec'd (whole)	%	4.4	n/a
W/c as comp. (-19mm)	%	5.2	4.1
Dry density	t/m³	2.30	2.27
Compaction	%	NZ Vib H[1]	NZ Vib H[1]
W/c after test	%	6.2	5.4
Penetration	mm	2.5	2.5
CBR value	%	225	250

Primary Material Concerns



TP6	Thickness (mm)	Modulus (MPa)	SL/NSL	Description
Surfacing	65	1400	NSL	65mm Bituminous Surfacing
Basecourse	535	220	SL	535mm of 220MPa Top SL Agg
Subbase	-	-	-	Sublayered from top
Upper SG1	250	50	NSL	Upper subgrade 250mm of CBR = 5
Lower SG2	0	200	NSL	Lower Subgrade CBR = 20

Drainage Issues

Depth (mm)	Pavemen
0	OGPA with nothing notable RWP
30	Asphalt mix 15
130	Sandy fine to (40mm) GRAVEL tightly packed; wet, well graded; angular sand fine to coarse, fines low plasiticity.
260	Fine to coarse (60mm) GRAVEL, with s tightly packed; wet; well graded; subang sand fine to coarse, fines low plasiticity.
500	Becomes very wet.
600	End of pit

Failure Mode

TP6 - 3.54×10^7	Thickness (mm)	Modulus (MPa)	SL/NSL	Critical Strain	Critical Damage Factor
Surfacing	65	1400	NSL	**5.57E-04**	**2.96E+02**
Basecourse	535	220	SL	n/a	n/a
Subbase	-	-	-	n/a	n/a
Upper SG1	250	50	NSL	6.26E-04	2.67E-01
Lower SG2	0	200	NSL	1.08E-04	1.21E-06

Traffic

- Lane MUST be open to AM peak
- Single central lane treatment - no steps transverse or longitudinal
- Need to ensure it’s safe
- Speed intended to be 50km/h

The Options

Cement – No

- Traffic loading
- Moisture sensitivity
- Possible reversion to unbound
- Risk of cracking if bound
- Sensitive to cement%

AC – Maybe

- Status Quo for expressway single lane work
- Low design/construct risk
- Small productivity for multiple lifts
- Expensive sqm rate

Foamed Bitumen - Maybe

- Perceived risk over performance on motorways
- Materials respond well to mix design
- Able to be trafficked
- Substantially cheaper on sqm rate with improved productivity

Checked Reactivity

Test Pit 2 (TP17) (RP 3.579 LWP)	40% Existing Basecourse + 30% Granulated Surfacing + 30% Winstones Belmont AP40	Foamed Bitumen Testing	2nd Phase Modulus 1,342MPa
Test Pit 1R (TP16R) (RP 3.800 RWP)	70% Existing Basecourse + 30% Horokiwi AP40	Foamed Bitumen Testing	2nd Phase Modulus 1,273MPa

How to Build It?

Mill off Surfacing

Import AP40 & Foamed Bitumen Stabilise to **250mm**

Compaction

How to Build It?

Run Traffic at low speed and VMS requesting HCV's use other lane (R1)

Typically 48 hours until milling

Mill off 50mm, tidy up and surface with membrane & OGPA

Finished Product

Learnings

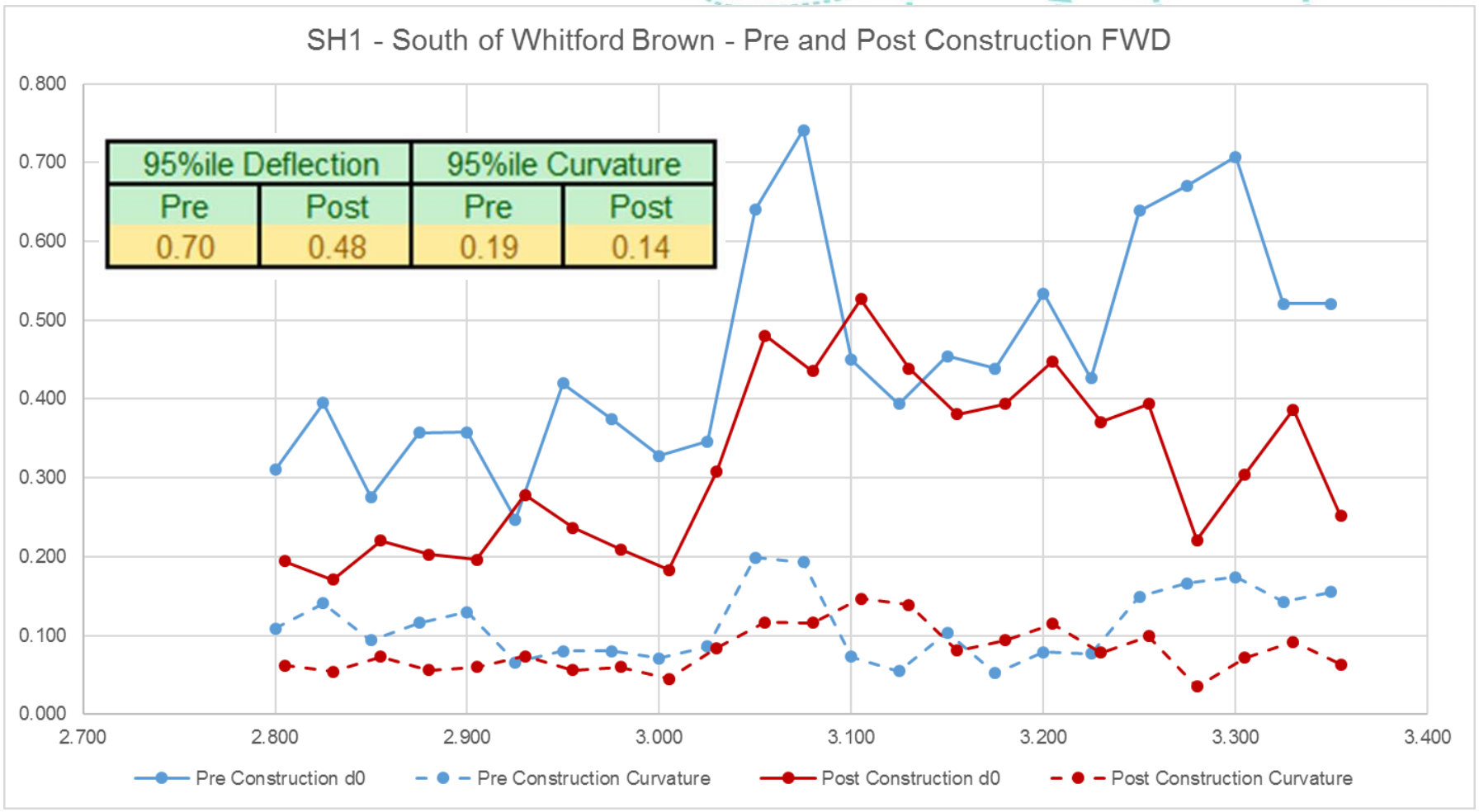
Milling off the 50mm found surface texture rougher than hoped, but to be expected with 40mm aggregate and not strongly bound

Some minor ravelling acceptable as long as loose material removed quickly

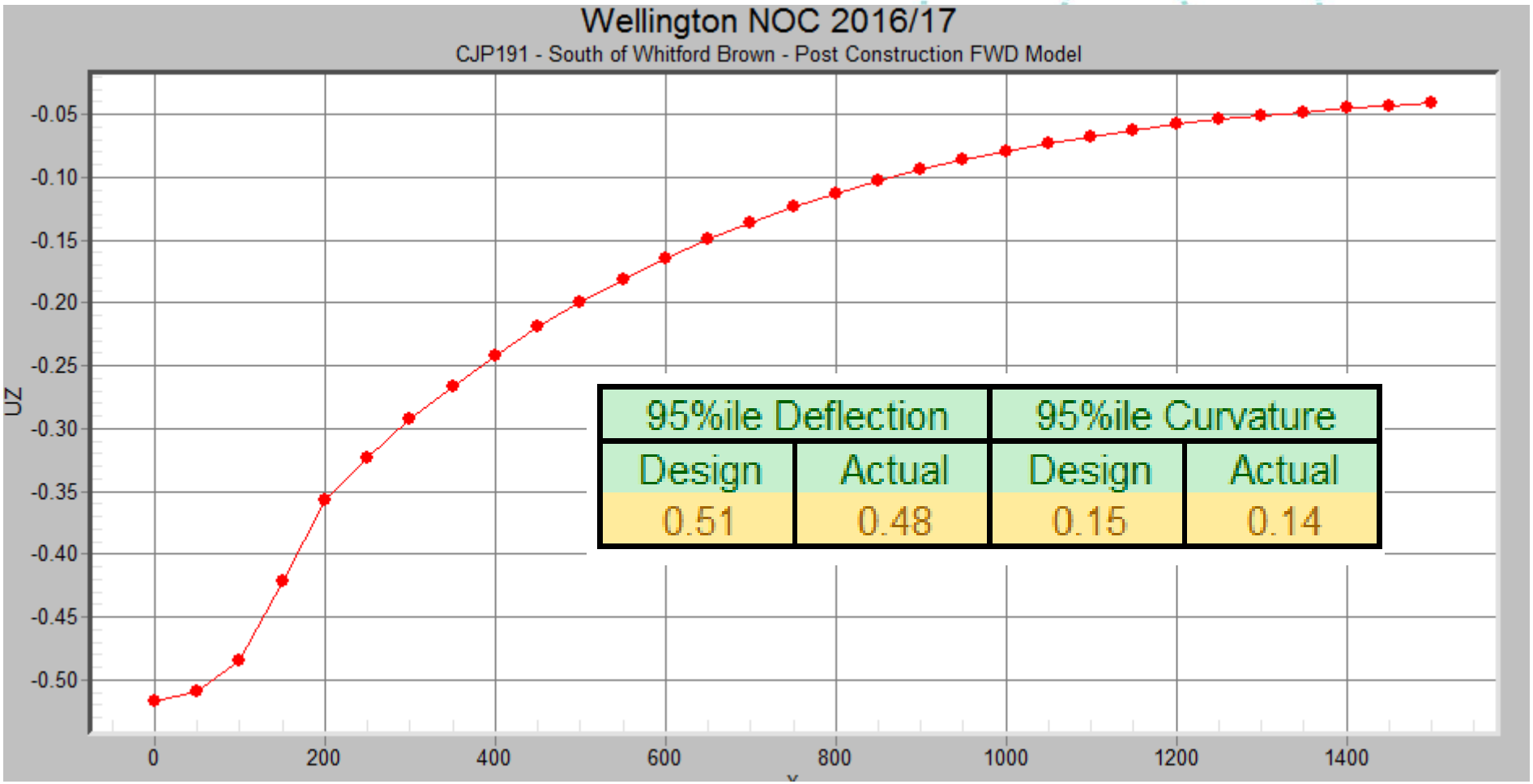
Traffic was speeding so bumper strips introduced

Performing well

Performance



Performance



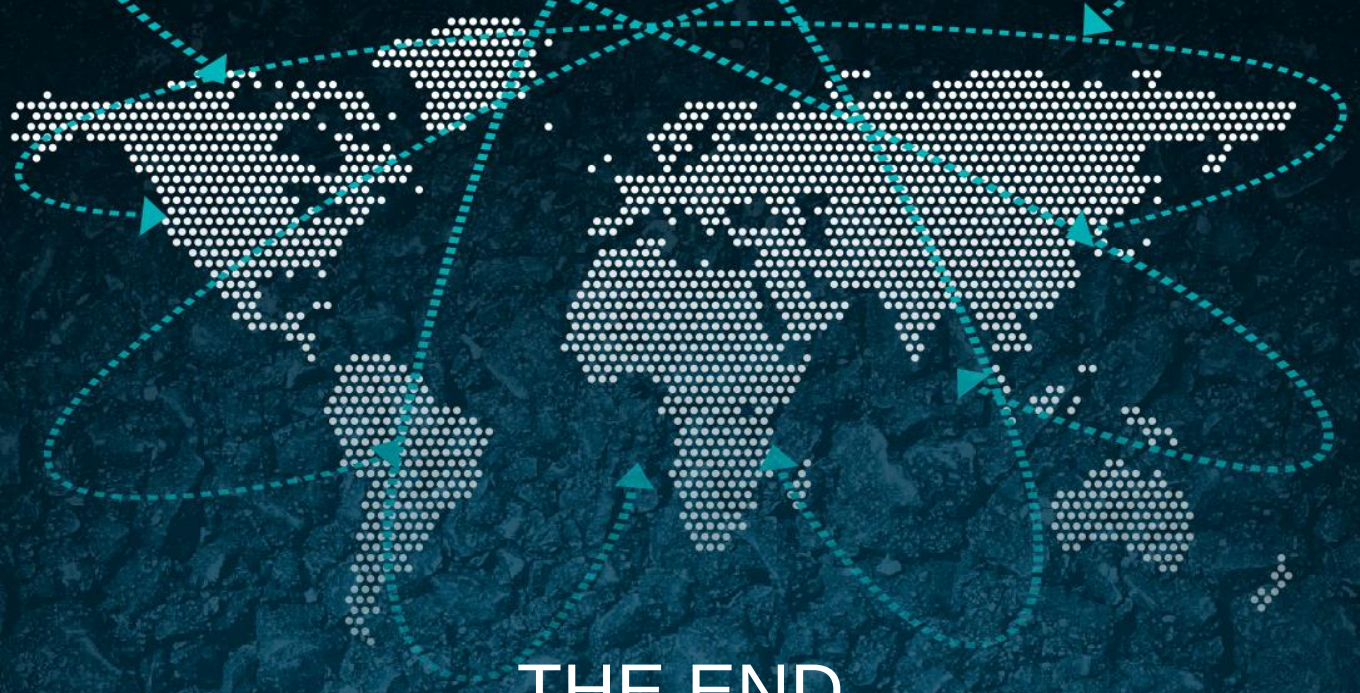
95%ile Deflection		95%ile Curvature	
Design	Actual	Design	Actual
0.51	0.48	0.15	0.14

What Next?

Continue with this successful treatment this season

Try finishing the stabilised layer to underside of surfacing – traffic constraints to be resolved

Ongoing monitoring



THE END

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