REPORT

Tonkin+Taylor

Pre-construction Pavement Condition Assessment

Omāroro Reservoir, Mt Cook, Wellington

Prepared for
HEB Construction Ltd
Prepared by
Tonkin & Taylor Ltd
Date
September 2020
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Table of contents

1 Introduction 1

2 Condition survey methodology 2

2.1 Common pavement defects and terminology 2

2.2 Visual inspection 3

2.3 Deflection testing 3

2.3.1 Falling weight deflectometer (FWD) 4

2.3.2 Benkelman Beam 4

2.3.3 Deflection testing interpretation 4

3 Results 6

3.1 Visual inspection 6

3.1.1 Rolleston Street 6

3.1.2 Wallace Street 6

3.1.3 Salisbury Terrace 7

3.1.4 Lower field public access way and parking areas 7

3.1.5 Hargreaves Street 8

3.2 Deflection testing interpretation 8

3.2.1 Rolleston Street 8

3.2.2 Wallace Street 11

3.2.3 Salisbury Terrace, Lower field public access way and parking areas and Hargreaves Street 11

4 Conclusions 12

5 Applicability 13

Appendix A : Survey Plans

Appendix B : Observation Register

Appendix C : Deflection testing results

Appendix D : Photo and video files

1 Introduction

The Omāroro reservoir project involves the construction of a new water supply reservoir for WCC at the Prince of Wales Park. The proposed reservoir will be a fully buried circular concrete structure with an approximate capacity of 35,000 m^3 and includes various pipeline connections to the adjacent water network.

This report details the findings of pre-construction condition surveys of a number of local roads that will be used by construction traffic during the construction of the reservoir by HEB Construction Ltd (HEB). The main objectives of this survey are as follows:

- To meet the requirements of Designation Condition 24 (a), Licence Condition 74 and Section 7.4.1 of the Omāroro Reservoir CTMP (Revision A, August 2020);
- To record, document and comment on all observed pre-existing pavement conditions for the local roads to be used for construction access prior to start of construction; and
- At the request of HEB, the assessment also includes the kerbs and footpaths associated with each road.

HEB have identified the following roads, associated kerbs and footpaths as the local access roads subject to this condition survey (refer also to location plans shown in Figures 1 to 3 in Appendix A):

- **Rolleston Street** (full length). Expected main access for heavy vehicles;
- **Wallace Street** (intersection with Rolleston Street). Expected turn in for vehicles to Rolleston Street;
- **Salisbury Terrace** (entire length). Expected main access for light vehicles;
- **Lower field public access way and parking area** (entire length). Expected main access for light vehicles; and
- **Hargreaves Street** (top 40 m). Adjacent to the project site.

These roads are owned and maintained by Wellington City Council (WCC).

These surveys have been undertaken by Tonkin and Taylor Ltd (T+T) in accordance with our proposal dated 4 December 2019 and Variation Order 01 approved 24 July 2020.

2 Condition survey methodology

2.1 Common pavement defects and terminology

Over time, pavements will develop a range of defects for a variety of reasons which are typically addressed through appropriate and timely maintenance interventions. The formation of pavement defect is often complex and a range of factors need to be considered to determine the likely cause or causes of any defect. Examples of factors to consider when determining cause of pavement defects include, but are not limited to, one or more of the following:

- Pavement construction quality assurance;
- Age of pavement and oxidative hardening of the bituminous binder;
- Pavement design traffic versus actual traffic loading;
- Sub-surface conditions;
- Pavement layer materials properties and thicknesses;
- Road geometry and use;
- Environmental factors; and
- Water ingress.

This report does not directly address the likely cause of any defects noted but does highlight common defects, terminology used and in a broad sense possible causes for each defect type. Table 2.1 outlines some of the common defects, observations and terminology used throughout this report.

Table 2.1: Common pavement defects

Defect type (not exhaustive)	Defect description	Common cause
Crocodile cracking	Visible interlocking series of cracks in the pavement surface, usually in wheel tracks	• Fatigue failure (structural) under repeated traffic loading • Oxidative cracking
Longitudinal cracking	Longitudinal crack on pavement surface	• Fatigue failure • Reflective cracking • Poor joint construction
Transverse cracking	Transverse crack on pavement surface	• Reflective cracking (shrinkage) • Shrinkage crack (if stabilised subsurface layers) • Environmental factors • Poor construction
Potholes	Localised bowl-shaped defect extending into granular pavement layers	• Lack of waterproofing • Poor bond between surfacing and underlying pavement • Poor surface shape and ponding water (ingress) • Poor pavement materials • Water pumping through pavement layers under traffic
Edge cracking/breaking	Visible cracking in pavement surface at the pavement edges	• Poor drainage next to pavement • Lack of edge support

Defect type (not exhaustive)	Defect description	Common cause
Rutting	Visual longitudinal depression, usually in wheel tracks	• Densification of pavement layers • Plastic shear failure (poor materials) • Inadequate subgrade strength
Local depressions, shove and heave	Visible depression, shove or heave of pavement surface	• Basecourse shear failure • Poor materials and/or construction
Ravelling in asphalt	Asphalt aggregate loss	• Mix too cold when laying • Poor compaction and high air voids • Oxidation of binder
Stripping of chip from chip seal	Visible chip loss to chipseal, usually in wheel tracks	• Inappropriate seal design and/or construction • Poor chip adhesion to binder • Oxidation of binder
Flushing	Chipseal or asphalt binder flushes to top of running surface	• Chip breakdown/loss • Moisture induced binder rise • Inappropriate asphalt mix design or seal design • Chip embedment to underlying basecourse • Softening of binder in hot weather • Excessive binder in asphalt mix

2.2 Visual inspection

The visual survey undertaken by an experienced T+T Civil Engineer comprised visual observations, photographic and video records for each road and associated footpath, kerbs and channels. Pavement observations and any identified defects are recorded on the observations register (Appendix B) and the locations of the defects are shown on Figures 1 to 3 (Appendix A).

The visual inspection For Rolleston Street, Hargreaves Street, Wallace Street, Salisbury Terrace and the lower field accessway and carpark was completed 20 and 31 July 2020. A further inspection of the Dojo carpark and access from the lower field parking area was completed on 8 September 2020.

All photographic and video file records captured during the survey have been provided to HEB as an additional electronic file via USB drive.

2.3 Deflection testing

Deflection testing provides a measure of the structural capacity of a road by applying a load to the pavement surface and measuring the amount of deflection caused by that load. The Falling Weight Deflectometer (FWD) and the Benkelman Beam are two standard devices used for measuring pavement deflection.

Typically the left wheel path (i.e. the wheel path closer to the edge of the pavement) records higher deflection values due to moisture ingress through the edge of the pavement and governs pavement strength.

Both Austroads[1] and Waka Kotahi NZ Transport Agency guidance ignore the impact of passenger cars and light commercial vehicles as these have negligible effect on the loss of structural capacity of a

[1] Austroads (2017) Guide to Pavement Technology – Part 2: Pavement Structural Design (AGPT02-17)

road over its design period. As such, deflection testing has only been undertaken on the heavy vehicle route for this project (Rolleston Street).

2.3.1 Falling weight deflectometer (FWD)

The FWD is a non-destructive testing device that is used to assess the structural capacity of pavements. The FWD incorporates a 300 mm diameter loading plate and a series of geophones which are arranged at intervals along a support arm. The geophones are arranged at a spacing of 0 mm, 200 mm, 300 mm, 450 mm, 600 mm, 750 mm, 900 mm, 1200 mm and 1500 mm from the centre of the load plate.

The device operates by lowering the load plate onto the pavement surface and then raising a pre-determined load, typically 40 kN, through a constant height and allowing it to free fall onto the load plate. The vibrations generated by the impact are recorded by the geophones which are also lowered onto the pavement surface. The peak particle velocities recorded by the geophones are then converted into deflections which can be used to assess the integrity of the pavement.

2.3.2 Benkelman Beam

The Benkelman Beam test uses a vehicle on which the rear axle is a dual tyred single axle (standard axle) loaded to 80kN to assess the strength of the pavement. The tip of the measuring beam is located between the dual tyres and records the rebound deflection of the surface as the vehicle moves away from the tip of the beam. measures the pavement response (in terms of pavement deflection) as the wheel rolls over the pavement

2.3.3 Deflection testing interpretation

Falling weight deflectometer (FWD) and Benkelman Beam tests have been completed by HEB along Rolleston Street and provided to T+T for assessment of pavement condition and remaining design life. These results are attached in Appendix C.

The residual life of the pavement in terms of Equivalent Standard Axle (ESA) repetitions has been determined from AGPT05-19[2] Figure 9.2 which provides a relationship between the calculated characteristic maximum deflection value and the traffic loading expressed as ESAs.

Where the resulting number of ESA is less than the anticipated traffic loading for the nominated design period it is likely that the pavement will exhibit excessive rutting due to overstressing of the pavement or subgrade within the design period. Conversely, where the resulting number of ESA is greater than anticipated traffic loading the pavement is considered to have adequate strength and hence permanent deformation (i.e. rutting) is likely to be kept to an acceptable level.

Characteristic curvature values have also been assessed from FWD data and provide an indication of the stiffness of the existing pavement. The stiffness of the pavement is relevant when considering the design of asphalt overlays as rehabilitation treatments, however the AGPT05-19 methodology cannot be used to predict residual life in terms of fatigue of existing asphalt layers or the performance of other surfacings (such as chip seals) which is independent of the pavement strength.

In the absence of any information on the composition of the existing pavement, the analysis has been undertaken on the understanding that the existing pavement comprises of unbound granular materials with a thin bituminous surfacing (i.e. chip seal). Benkelman beam data has been provided

[2] Austroads (2019) Guide to Pavement Technology - Part 5: Pavement Evaluation and Treatment Design (AGPT05-19)

along each lane, alternating between left and right wheel paths whilst a single FWD run was undertaken in each direction in the perceived outer wheelpath.

For the purpose of this analysis and to provide a representative value of the residual life for each road section, the following approach was adopted:

- The FWD data was normalised to a pressure of 566 kPa pressure and standardised in accordance with the Austroads methodology. As the Austroads methodology is based on the Benkelman Beam, no normalisation or standardisation of this data was required.
- For each device the deflection measurements for both traffic directions have been combined to provide sufficiently large data sets to enable determination of characteristic maximum deflection and curvature values for the road section.
- Figure 9.2 of AGPT05-19 has been used to relate the characteristic maximum deflection values to the permissible design traffic (measured in Equivalent Standard Axles (ESAs)) before unacceptable rutting is likely to occur.
- On the understanding that the pavement is a thin bituminous-surfaced granular pavement the characteristic curvature values has been ignored in the residual life assessment.
- The permissible traffic loading in terms of ESAs for each section of road has been used to estimate the remaining life of the pavement in years based on the AADT , the nature and proportion of heavy vehicles and other parameters outlined in Table 3-2.
- We understand that trucks utilising the road will primarily comprise of three axle rigid tip trucks and due the width of the road may be inclined to travel more centrally along the road particularly at the south western end which may result in wheel loads being more concentrated a where wheel paths may overlap for both directions of travel, hence have adopted a direction factor of 1.0 as been adopted to allow for overlapping wheel paths.

The estimates of residual life require that the existing pavement is periodically maintained and remains waterproof throughout the nominated design period. Poor maintenance or late intervention will likely result in a more rapid reduction in pavement strength.

3 Results

3.1 Visual inspection

3.1.1 Rolleston Street

As noted in Section 1, Rolleston Street is expected to be the main heavy vehicle access route during construction. The full length of Rolleston Street was assessed in this visual inspection, refer also Figure 2 in Appendix A for the visual survey extent.

The road surface is chipseal with asphalt cement (AC) footpaths and concrete kerbs and channels. The general chipseal surface is in reasonable condition (refer to electronically attached video). Some 44 observations were recorded along the 362 m length of road, with a further 26 observations noted along both footpaths. Most observations relate to the presence of service trenches, in various levels of condition due to intermittent upgrading of wastewater, water, fibre and electrical services. However, isolated areas of notable pavement defects were also observed, which have been listed below (refer to Figure 2, Appendix A for location and Appendix B for observation details):

- Item 5 – 20 mm rutting for 15 m length in wheel track;
- Item 14 – 25 mm rutting for 10 m length, a cluster of services with cracking, and a local depression;
- Items 16 & 17 – Cluster of cracks and depressions around service trenches;
- Item 33 – Joint cracks and a consolidation of a service trench;
- Item 35 – Cluster of edge/longitudinal cracks and a local depression;
- Item 38 – longitudinal cracks, consolidation and edge cracks around service trench;
- Item 40 & 42 - Cracks on road surface, edge and service joints; and
- Item 41 – Crocodile cracking on road surface indicating potential structural failure.

Notable footpath and kerbs/channels defects include:

- Item 52 – Surface cracks;
- Item 55 – Extensive crocodile cracks and structural failure along the 30 m extent of the property development;
- Item 60 – potholes and edge break along kerb edge;
- Item 62 – Cracks around service trenches;
- Item 63 – Cluster of potholes and cracks;
- Item 68 – Cracks at the edge of a drive; and
- Item 69 – Cluster of potholes and cracks between a garage and drive out indicating structural failure of entire footpath width.

3.1.2 Wallace Street

As noted in Section 1, the Wallace Street / Rolleston Street intersection is expected to be the turn in for vehicles to Rolleston Street. Only the intersection with Rolleston Street was assessed in this visual inspection, refer also Figure 3 in Appendix A for the visual survey extent.

A portion of the road was obscured by stormwater upgrade works in the eastbound lane during the visual inspection. Consequently, a visual inspection could not be completed in full for the Rolleston and Wallace Street intersection. Having discussed with the Contractor on site (Gerry Friel), the

stormwater upgrade works will include service trench reinstatement and resurfacing for part of the road and footpath and therefore a secondary visual observation is recommended to confirm the final pavement condition after the stormwater upgrade works are completed.

From what could be viewed on the day of the inspection, the pavement surfaces are in generally good condition however no video could be captured due to the construction works. Some 11 road and 6 footpath observations were observed for a 64 m length of road (refer to Figure 3, Appendix A for location and Appendix B for observation details). Areas of notable pavement defects been listed below:

- Item 8 – Longitudinal cracks in the vehicle wheel paths for 15 m length;
- Item 11 - Longitudinal cracks in between vehicle wheel paths;
- Item 14 – Edge cracks visible on AC; and
- Item 15 – Crocodile cracking and depression around an asphalt patch repair, likely indicating isolated structural failure.

3.1.3 Salisbury Terrace

As noted in Section 1, Salisbury Terrace is expected to be the main access for light vehicles during construction. The full length of Salisbury Terrace was assessed in this visual inspection, refer also Figure 1 in Appendix A for the visual survey extent.

Salisbury Terrace pavements are in generally condition. Some 6 road observations and 14 footpath observations were noted for the approximately 88 m length of road (refer to electronically attached video). No areas of notable defects were noted along Salisbury Terrace.

3.1.4 Lower field public access way and parking areas

As noted in Section 1, the lower field public access way is expected to be the main access for light vehicles during construction. The full length of the lower field public access way, lower field parking, dojo parking areas and link driveway between them were assessed in this visual inspection, refer also Figure 1 in Appendix A for the visual survey extent and observations in Appendix B.

The lower field public access way, lower field carpark, dojo carpark and carpark link driveway pavements are variable condition, with 44 observations noted for the approximately 230 m length of road (refer to electronically attached video). However, extensive damage and areas showing signs of structural failure of the pavement is evident along the accessway and in isolated locations within both the lower field and dojo carparks (Ch0 – Ch34 and Ch0 – Ch130, Figure 1, Appendix A with observation details in Appendix B). Areas of notable pavement defects been listed below:

- Item 9 – Cluster of cracks and potholes at carpark/field accessway;
- Item 12 to 15 – Edge cracks, deformation, isolated crocodile cracking along 76 m of road/field bank interface. Isolated areas of structural failure;
- Item 23 to 26 – Cluster of longitudinal cracks, extensive crocodile cracks, potholes and patch repairs along 33 m length of road indicating widespread structural failure of the pavement in wheel tracks;
- Item 51 – Cluster of potholes, crocodile cracking, local depressions and patch repairs;
- Item 56 – Deep, large pothole in parking wheel track;
- Item 57 – Cluster of potholes with minor unravelling and crocodile cracking, and patch repairs; and
- Item 61-63 – Clusters of potholes, local depressions, edge breaks repairs, unravelling crocodile cracking and patch/pothole repairs.

3.1.5 Hargreaves Street

As noted in Section 1, Hargreaves Street is not expected to be used by construction traffic but is located adjacent to the project site. Only the top 40m immediately adjacent to the project site was assessed in this visual inspection, refer also Figure 3 in Appendix A for the visual survey extent.

Ongoing road and pavement resurfacing were evident for the entire survey extent of Hargreaves Street. The 5 observations noted are related to construction activity and are not considered to be defects or areas of concern (refer to the electronically attached video, Figure 3, Appendix A for location and Appendix B for observation details).

Due to the resurfacing works at the time of the inspection, a secondary visual observation is recommended to confirm the final pavement condition after the resurfacing works are complete.

3.2 Deflection testing interpretation

3.2.1 Rolleston Street

3.2.1.1 Design traffic loading

The design traffic loading has been calculated adopting a 20 year design life which is typically adopted for flexible pavement design using the daily traffic volumes and vehicle count data. Table 3.1 provides a summary of the traffic data used for assessment.

Table 3.1 Traffic data

Description	Traffic
Rolleston Street (excluding Construction activity) Source MobileRoad.org	Two-way Annual Average Daily Traffic (AADT); 640 vehicles Heavy vehicles 3% of AADT Count date 2019 (est.)
Rolleston Street (Construction Traffic) Refer Section 5 of the Omāroro Reservoir CTMP Revision A dated August 2020	Estimated 6,500 heavy vehicle trips (13,000 movements) Construction Period; September 2020 to August 2022. Equates to approximate AADT of 18 trucks per day over 2 year period.

The traffic loadings have been calculated using the traffic data and published typical values of other traffic parameters provided in the AGPT02 for each respective scenario. We understand that truck will travel loaded in one direction and unloaded in the other direction. Due to the nature of the road we expect that vehicles are likely to travel centrally along the road

A summary of the calculated design traffic loadings and adopted design parameters is provided in Table 3.2.

Table 3.2 Calculation of Design Traffic Loadings

Traffic Load Parameter	**Rolleston Street (without Construction Traffic)**	**Rolleston Street (Additional construction Traffic)**	**TOTAL**
AADT (Vehicles per day)	640	18	
Year of AADT	2019	N/A	
Design Period (years)	20	2	
Direction Factor	1.0	1.0	
Annual Growth Rate (%)	1.0	0.0	
Lane Distribution Factor	1.0	1.0	
% Heavy Vehicles (HV)	3.0	100.0	
Average N_{HVAG}/HV	2.0	2.0	
Average ESA/HV	0.4	2.8	
Final Design ESA	**6.2×10^4**	**2.6×10^4**	**8.8×10^4**
Design Deflection (mm)	1.64		1.58

Note:

1 AADT: Annual Average Daily Traffic

2 ESA: Equivalent Standard Axles where a Standard Axle is a dual-tyred single axle loaded to 8.2 t

3 HVAG: Heavy Vehicle Axle Groups

3.2.1.2 Deflection Analysis

The Deflection data has been analysed and assessed using the methodology outlined in Section 2.3.

The characteristic maximum deflection has been calculated as follows:

- Characteristic Deflection: $CD = \mu + f$s, where:
  - μ = Mean Maximum Deflection
  - f = 1.31
  - s = Standard Deviation of Maximum Deflections

The characteristic maximum deflection value is defined as the value that is exceeded by only 10% of the measured deflection values. I.e. 90% of the measured values should be equal to or less than the characteristic value, on the understanding that the data is normally distributed. This would typically require the co-efficient of variation (CoVAR) to be less than 0.25, however in this instance for both data sets have produced a CoVAR that this is greater, thus the dataset should be further subdivided if it is to be used statistically for the purpose of rehabilitation design so that the co-efficient of variation is reduced to less than 0.25.

Results for each data set have been summarised in Table 3.3. A plot of the adjusted deflections versus chainage is also provided in Figure 3.1 and a discussion on the analysis is provided summarised in the following sub-sections.

Table 3.3 Deflection Analysis

Dataset	Mean Maximum Deflection (D_0) mm	Standard Deviation of Maximum Deflection (D_0) mm	Characteristic Maximum Deflection (D_0) mm	Theoretical Structural Capacity (ESA's)	Theoretical Structural Capacity (Years)
Rolleston St FWD Testing	1.06	0.40	1.56	9.76×10^4	20
Rolleston St Beam Testing	0.89	0.39	1.40	2.34×10^5	20+

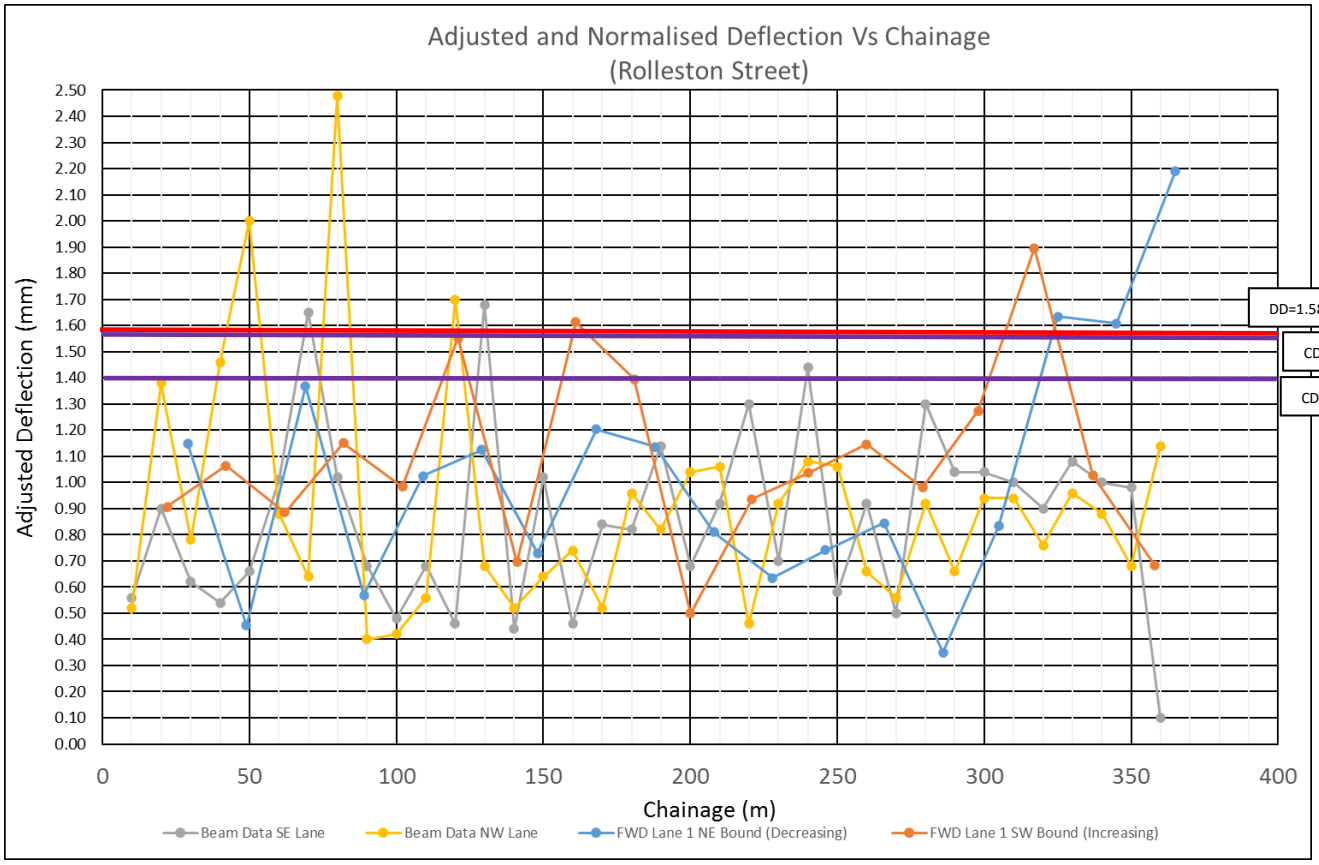

Figure 3.1 Normalised and Standardised Deflection Data

3.2.1.3 Discussion

Based on the analysis of the provided data it has been determined that the characteristic deflection values from both the FWD and Benkelman beam data sets are less than the tolerable (design) deflection value for both the cases with and without additional construction traffic (1.58 mm and 1.64 mm respectively). Therefore, it is concluded that the majority of the road pavement has sufficient strength to accommodate the predicted design traffic loading including the additional construction traffic. It is noted however that in some areas that individual deflection results were greater than the deflection values which may indicate localised areas of pavement weakness that may exhibit unacceptable deformation or distress within the nominated assessment period. However as previously noted this assessment is on the presumption that the road pavement is adequately maintained and remains waterproof throughout.

The structural analysis is also unable to predict the performance of the existing pavement surfacing which can be influenced by a number of factors including the type of surfacing (materials such as binder type) and the age. Over time asphalt and chip seal surfacings will oxidise and become brittle and be prone to cracking under repeated vehicle loadings and environmental movement. Hence whilst the majority of the pavement may have been assessed to have adequate strength form a pavement structural perspective, the performance of the existing surfacing cannot be reliably predicted and if the surface was to deteriorate, a reduction in pavement strength is also likely. It is also likely that any existing defects will deteriorate further and expand in size.

3.2.2 Wallace Street

As noted in Section 2.3 of the Prince of Wales/Omāroro Reservoir Transport Assessment[3] carries approximately 20,950 vehicles per day (count date June 2016) with 3% heavy vehicles. This equates to some 630 heavy vehicles per day.

The expected construction traffic (as noted in Table 3.1, an average of approximately 37 heavy vehicles movements per day) is only a small proportion of the existing heavy vehicle traffic on Wallace Street. As such, no structural assessment has been considered necessary for Wallace Street as existing traffic volumes are not expected to change significantly as a result of construction traffic.

3.2.3 Salisbury Terrace, Lower field public access way and parking areas and Hargreaves Street

As noted in Section 2.3, passenger cars and light commercial vehicles are considered to have negligible damaging effect on the structural capacity of a road. As such, no structural assessment has been considered necessary for these routes which will not carry construction related heavy vehicles.

[3] CH2M Beca Ltd, dated September 2017

4 Conclusions

The pre-construction pavement survey carried out on 30 and 31 July and 8 September 2020 identified a number observations for all roads, kerbs and footpaths subject to the survey. The survey found the roads, footpaths and kerb/channels to be in variable condition with a number of notable observations and defects documented on Rolleston, Salisbury and Wallace. A small section of isolated structural failure was observed on Rolleston Street, while the Lower field accessways suffered from extensive signs of distress and areas of structural failure. Outside of these areas, pavements were generally in good condition.

Construction works in the road corridors on Wallace and Hargreaves Streets partially obscured the survey extent. The road and footpath surfaces at both locations are expected to be resealed upon completion of these works and we recommended that a follow up survey is carried out to confirm pavement condition on completion of these works.

Benkelman beam and falling weight deflectometer testing was carried out by HEB and assessed as part of this condition assessment. The existing pavement along Rolleston Street was found to be mostly structurally adequate based on the measured deflection results and predicted vehicle movements, however some isolated areas are considered to have insufficient strength and may exhibit distress and may need to be rectified. The particulars of the existing surfacing are unclear and its likely performance cannot be predicted. Should the existing surface perform poorly, this may have a subsequent and direct impact on the structural performance of the pavement.

Photos and videos of pavement surfaces were captured to demonstrate the general pavement condition and have been provided electronically to HEB Construction.

A post-construction pavement survey is recommended to enable a comparative assessment of the impact of construction-related traffic for the Omāroro Reservoir on the local roads, footpaths and kerbs/channels.

5 Applicability

This report has been prepared for the exclusive use of our client HEB Construction Ltd with respect to the particular brief given to us. We also understand and agree that this report will be used by Wellington City Council in undertaking its regulatory functions in connection with the Designation and License Conditions for the Omāroro Reservoir at Prince of Wales Park. It may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Report prepared by:

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Reviewed by:

.....

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Authorised for Tonkin & Taylor Ltd by:

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Project Director

Deflection testing interpretation undertaken by Colin Dailey and reviewed by David Mangan.

ALGO

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Appendix A: Survey Plans

- **Figure 1: Salisbury Terrace and carparks Survey Plan**
- **Figure 2: Rolleston Street Survey Plan**
- **Figure 3: Hargreaves Street and Wallace Street Survey Plan**

L:\1011137\1011137.3000\WorkingMaterial\CAD\FIG\1011137.3000-F1_F2.dwg 2020-Sep-06 9:10:44 pm Plotted By: BILLY RODENBURG

NOTES:
1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATE DATUM: NZGD2000, NEW ZEALAND TRANSVERSE MERCATOR (NZTM2000).
3. AERIAL PHOTO SOURCED FROM LINZ DATA SERVICE <https://data.linz.govt.nz/layer/95524-wellington-010m-urban-aerial-photos-2017/> , LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 04/08/2020.

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PROJECT No.	1011137.3000	
DESIGNED	ALGO	Aug.20
DRAWN	LIWA	Aug.20
CHECKED	SJG	Sept 20
E. Breese	14.09.20	
APPROVED	DATE	

CLIENT **HEB CONSTRUCTION**
PROJECT **OMĀRORO RESERVOIR PRE-CONSTRUCTION PAVEMENT SURVEY**
TITLE SALISBURY TERRACE SURVEY PLAN
SCALE (A3) 1:1000 FIG No. FIGURE 1 REV 2

L:\1011137\1011137.3000\WorkingMaterial\CAD\FIG\1011137.3000-F1_F2.dwg 2020-Aug-05 11:15:30 am Plotted By: LIXIA WANG

LEGEND

EXTENT OF ROAD AND FOOTPATH

CHAINAGE ALIGNMENT

No. FOOTPATH DEFECT ITEM REFERENCE

No. ROAD DEFECT ITEM REFERENCE

BIDWILL ST

ROLLESTON ST

WALLACE ST

HARGREAVES ST

WRIGHT ST

PRINCE OF WALES PARK (UPPER FIELD)

20 Ch105-Ch112

26 Ch175-Ch190

14 Ch45-Ch55

5 Ch15-Ch30

24 Ch155-Ch175

4 Ch10-Ch35

21 Ch110-Ch140

35 Ch260-Ch270

36 Ch280-Ch290

A3 SCALE 1:1000

0 5 10 15 20 30 40 50 (m)

ORIGINAL IN COLOUR

NOTES:
1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATE DATUM: NZGD2000, NEW ZEALAND TRANSVERSE MERCATOR (NZTM2000).
3. AERIAL PHOTO SOURCED FROM LINZ DATA SERVICE <https://data.linz.govt.nz/layer/95524-wellington-010m-urban-aerial-photos-2017/> , LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 04/08/2020.

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PROJECT No.	1011137.3000	
DESIGNED	ALGO	Aug.20
DRAWN	LIWA	Aug.20
CHECKED	SJG	Sept 20
APPROVED	E. Breese	DATE 14.09.20

CLIENT **HEB CONSTRUCTION**

PROJECT **OMĀRORO RESERVOIR PRE-CONSTRUCTION PAVEMENT SURVEY**

TITLE ROLLESTON STREET SURVEY PLAN

SCALE (A3) 1:1000 FIG No. FIGURE 2 REV 1

L:\1011137\1011137.3000\WorkingMaterial\CAD\FIG\1011137.3000-F3.dwg 2020-Aug-05 11:14:46 am Plotted By: LIXIA WANG

LEGEND

EXTENT OF ROAD AND FOOTPATH

CHAINAGE ALIGNMENT

No. FOOTPATH DEFECT ITEM REFERENCE

No. ROAD DEFECT ITEM REFERENCE

Note: This area was undergoing road works when the survey was conducted. Asphalt reseal-ing was partially complete and a follow up survey is recommended

HARGREAVES ST

PRINCE OF WALES PARK (UPPER FIELD)

1 Ch0-Ch42

3 Ch0-Ch42

5

4

2

0m

10m

20m

30m

40m

42m

A3 SCALE 1:500

0 5 10 15 20 25 (m)

ORIGINAL IN COLOUR

Note: This area was undergoing road works when the survey was conducted. The survey area was partially obscured by stormwater upgrade works. A follow up survey is recommended

Area obscured by stormwater up-grade works

ROLLESTON ST

WALLACE ST

8 Ch0-Ch15

15 16 14 17 13 12 11 10 9

4 5 6 7 3 2 1

64m 60m 50m 40m 30m 20m 10m 0m

NOTES:

1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATE DATUM: NZGD2000, NEW ZEALAND TRANSVERSE MERCATOR (NZTM2000).
3. AERIAL PHOTO SOURCED FROM LINZ DATA SERVICE <https://data.linz.govt.nz/layer/95524-wellington-010m-urban-aerial-photos-2017/> , LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 04/08/2020.

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PROJECT No.	1011137.3000	
DESIGNED	ALGO	Aug.20
DRAWN	LIWA	Aug.20
CHECKED	SJG	Sept 20
	E. Breese	14.09.20
	APPROVED	DATE

CLIENT **HEB CONSTRUCTION**

PROJECT **OMĀRORO RESERVOIR PRE-CONSTRUCTION PAVEMENT SURVEY**

TITLE HARGREAVES STREET AND WALLACE STREET SURVEY PLAN

SCALE (A3) 1:1000 FIG No. FIGURE 3 REV 1

Appendix B: Observation Register

Date: 31/07/2020 & 08/09/2020

Road: Salisbury Terrace, Rolleston Street, Hargreaves Street, Wallace Street and Lower field carparks and accessways

Inspector(s): Alistair Gordon, Simon Grundy

Acronyms:
CS = Chipseal
AC = Asphaltic Cement

Item Ref	Observations						
	Chainage	Location	Surface Type	Defect type	Length (m)	Width (m)	Comment
Lower field public access way and parking area - Road Observations							
1	-	Carpark edge	CS	Edge crack	3000	N/A	Edge crack occurring at the interface between the carpark chip seal and embankment.
2	-	Carpark edge	CS/AC	Patch repair	4600	500	AC patch repair sits parallel to the edge of the carpark and grassed area. Joint is sand sealed
				Local depression	N/A	N/A	Minor depression in CS next to AC patch
				Edge crack	1500	N/A	Edge crack from the edge of AC patch into the CS of the carpark.
3	-	Carpark edge	AC	Patch repair	14 000	5000	Patch repair sits along the wall belonging to adjacent property no.1. Sand sealed at edge but visible cracks sit along and adjacent to the joints.
4	-	Carpark	CS	Potholes	200	200	Small pothole with no CS. Basecourse exposed.
5	-	Carpark	CS	Pothole	1000	700	Small pothole with no CS.
6	-	Carpark	CS/AC	Pothole	1000	750	Small pothole with no CS.
				Patch repair	500	800	Small patch repair next to pothole. No edge seal.
7	-	Carpark	CS	Pothole	1200	650	Small pothole with no CS.
8	-	Carpark edge	CS	Pothole/chip seal loss	3000	2000	Loss of CS across entire area. Basecourse exposed. Area at base of an embankment.
9	-	Carpark edge	CS/AC	Potholes/chip seal loss	6000	1500	Various defects at the vehicle entrance from the carpark to the lower field of Prince of Wales park. AC patch repairs with no edge seal surrounded by sporadic potholes and chip loss the interface between CS an field.
				Patch repair			
10	-	Carpark edge	AC	Patch repair	5000	4000	AC patch repair at the corner of the carpark. Unsealed edge with cracks in the corner of carpark
11	-	Carpark	AC	Patch repair	1000	700	AC patch repair with unsealed edges.
12	-	Carpark	CS	Crocodile and edge cracks	5000	1500	Combination of crocodile and edge cracks along the boundary and presence of moisture indicates structural failure of the pavement.
13	Ch3	Carpark speedbump	CS	Transverse and crocodile cracks	5000	600	Transverse cracking along the edge of speedbump and surrounding CS surface. Crocodile cracking between the speedbump and the edge of the field indicated isolated structural failure of the pavement.
14	Ch5	Lower Field Accessway	CS	Longitudinal crack and chip loss	5000	1000	Longitudinal crack runs adjacent to edge of the lane. Chip loss with basecourse exposed from the edge of the track to the crack.

Item Ref	Observations						
	Chainage	Location	Surface Type	Defect type	Length (m)	Width (m)	Comment
15	Ch7	Lower Field Accessway	CS	Crocodile cracks and Edge cracks Longitudinal cracks	13 000	N/A	Various defects in the LH and RH wheel path. Structural failure of the pavement is evident along the LH edge and wheel path, adjacent to the field embankment
				Rutting	2000	1000	30 mm deep rut along the LH wheel path with chip loss and edge cracking surrounding the rut. One of the components of the failure of the pavement on the LH edge of the road.
16	Ch4-80	Lower Field Accessway (speedbump to speedbump)	CS	Edge, longitudinal and crocodile cracks	76 000 (speedbump to speedbump)	N/A	From speedbump to speedbump the LH edge of the road suffers from sustained cracking in the form of longitudinal, crocodile and edge cracks. Pavement failure is adjacent to the field embankment and is likely due to water entering the edge of the pavement from the field, compromising the basecourse integrity and resulting in failure of the chip seal layer.
17	Ch35	Lower Field Accessway	CS	Longitudinal and edge cracks	4000	N/A	Edge cracking along a 4 m length of the RH side of the road. Lichen growth is also present indicating moisture in the pavement. Longitudinal crack in the wheel path.
18	Ch44	Lower Field Accessway	CS	Pothole	150	150	Small pothole in chip seal. Basecourse exposed.
19	Ch4-80	Lower Field Accessway	CS	Chip loss	76 000 (speedbump to speedbump)	N/A	Chip loss along the RH side of the road. Moisture and lichen growth along the pavement adjacent to property fence lines is evident.
20	Ch48	Lower Field Accessway	CS/AC	Pothole repair and edge crack	800	800	Poor pothole repair at the LH edge of the road has edge cracking at the road/field interface. Small AC portion of the patch is unsealed and in poor condition.
21	Ch64	Lower Field Accessway	CS	No edge support	8000	N/A	No edge support of the pavement is evident along an 8 m length right at the fence line of adjacent properties. Chip loss at the edge is regressing towards the RH wheel path.
22	Ch75	Lower Field Accessway	CS	Manhole	N/A	N/A	Minor depression of pavement surrounding manhole.
23	Ch80-105	Lower Field Accessway	CS	Crocodile cracks potholes edge cracks Patch repairs Unravelling	25 000	LH Edge of pavenment adjacent to the field	Extensive pavement failure. A range of crocodile cracking, unravelling and potholes indicates structural failure of the pavement adjacent to the field embankment. Water entering the pavement from the field is considered a likely cause of failure.
24	Ch80-105	Lower Field Accessway	CS/AC	Edge cracking and chip loss Patch repair	25 000	RH egde of pavement at fenceline	Edge cracks and lack of edge support along full 25 m length adjacent to the fence line. An AC patch repair has been implemented along the edge. Patch is unsealed and has cracking along the joints.
25	Ch80-105	Lower Field Accessway	CS	Crocodile cracks Potholes Longitudinal cracks Unravelling Patch repairs	25 000	Centre width of the road	Extensive pavement failure. A range of crocodile cracking, unravelling and potholes indicates structural failure of the pavement adjacent to the field embankment.

Item Ref	Observations						
	Chainage	Location	Surface Type	Defect type	Length (m)	Width (m)	Comment
26	Ch105-118	Lower Field Accessway	CS/AC	Crocodile cracks	13 000	Entire width	Crack patterns and chip loss in both wheel paths indicating structural failure
				Longitudinal cracks			
				Unravelling			
				Rutting			
				Patch repairs	Varies	Varies	Five AC patch repairs of varying size and condition. Noe are edge sealed.
				Potholes	1000	500	Two potholes exposing basecourse
Salisbury Terrace - Road Observations							
27	Ch122	Salisbury Tce - main road	AC	Service trench	2500	1500	AC service patch for water services. Sealed and in ok condition.
28	Ch128	Salisbury Tce - main road	AC	Service trench	N/A	N/A	AC service trench for water services across road. Sealed and in ok condition.
29	Ch132	Salisbury Tce - main road	CS	Flushing	N/A	N/A	Flushing on chip seal still present around service trench repair. In ok condition.
30	Ch153	Salisbury Tce - main road	AC	Edge crack and unravelling	N/A	N/A	Edge cracking along the joint between two AC surfaces at the entrance of Salisbury avenue. Minor unravelling and loss of AC at the joint.

Item Ref	Observations						
	Chainage	Location	Surface Type	Defect type	Length (m)	Width (m)	Comment
31	Ch190	Salisbury Tce - main road	AC	Oil spill and uneven surface	N/A	N/A	Oil spill surrounding the entrance to the garage at property no 5. Uneven step down from the concrete drive out slab to the AC road surface.
32	Ch134-218	Salisbury Tce - main road	AC	General comment			Dense mix AC is in good condition for the remaining extent of the road. Minimal sign of distress or defects and all services and manholes have AC patches with sand seals in good condition.
Salisbury Terrace - Footpath Observations							
33	Ch217	Salisbury Tce - RH footpath	AC/concrete	Unravelling	N/A	N/A	Minor unravelling of AC at the joint between the AC road surface and the concrete walk-out from the footpath.
34	Ch210	Salisbury Tce - RH footpath	AC	Cracking and unravelling	N/A	N/A	Cracking and AC damage around sign post foundation.
35	Ch193	Salisbury Tce - RH footpath	AC	Pothole and edge crack	N/A	N/A	Small 100mm x 100mm pothole in AC. Poor joint with cracks between concrete drive out and AC footpath surface.
36	Ch189	Salisbury Tce - RH footpath	AC	Unravelling	N/A	N/A	AC unravelling around sign post foundation.
37	Ch183	Salisbury Tce - RH footpath	Concrete	Kerb damage	N/A	N/A	Loss of kerb block grout - ok condition.
38	Ch178	Salisbury Tce - RH footpath	AC	Service trench	2000	N/A	AC patch for water toby. Sand sealed edge - ok condition. Adjacent masonry wall located at the boundary of property no. 3 rotating towards the footpath.
39	Ch171	Salisbury Tce - RH footpath	AC	Transverse cracks and kerb damage	N/A	N/A	Transverse cracks across the footpath. Cracks protrude for the edge of the rotating masonry wall located at the boundary of property no. 3. Kerb and channel dips at the location and the crack. The interface between the AC surface and kerb block is undermined with a hole in the AC. Possibly related to tree roots under the footpath.
40	Ch159	Salisbury Tce - RH footpath	AC	Service trenches with transverse cracking	N/A	N/A	AC patch repair for service trench. Partially sand sealed with minor joint cracks - condition ok. Transverse cracks adjacent to service trenches. Cracks likely related to tree roots and the rotating wall located on the boundary of property no. 5.
41	Ch150-Ch175	Salisbury Tce - RH footpath	AC	Edge cracking and kerb damage	N/A	N/A	Edge cracking and wear of the kerb is evident along the section of the kerb at to corner of Salisbury avenue and terrace. Protective steel cap on kerb in ok condition.
42	Ch132	Salisbury Tce - RH footpath	AC	Radial cracking and service trench	N\A	N/A	Radial cracking in AC surface around water service trench. Trench is unsealed with minor joint cracks.
43	Ch138	Salisbury Tce - LH footpath	Concrete	Kerb damage	7000	N/A	Loss of kerb block grout with some depression and rotation of kerb blocks. Channel in ok condition.
44	Ch160	Salisbury Tce - LH footpath	AC	Unravelling	N/A	N/A	Minor unravelling and loss of AC at sign post foundation. AC loss surrounding the 110 dia stormwater outfall into the kerb and channel. Gap in between the kerbs around the outfall.

Item Ref	Observations						
	Chainage	Location	Surface Type	Defect type	Length (m)	Width (m)	Comment
45	Ch182	Salisbury Tce - LH footpath	AC	Edge cracking	N/A	N/A	Minor cracking along the joint between footpath AC and concrete pad along the boundary of property no. 2A.
46	Ch192	Salisbury Tce - LH footpath	Concrete	Channel cracking and unravelling	2000	N/A	Cracking and breaking of concrete along channel. Kerb in ok condition.
Dojo public carpark and link driveway - Road Observations							
47	-	Dojo carpark	CS/AC	Loose chip	2.5	6	Loose chip present on CS surface.
				Patch repair	N/A	N/A	AC patch repair in south east corner of the carpark is unsealed and the surface has undergone shoving.
48	-	Dojo carpark	CS/Basecourse	Service trench	0.5	6	Stormwater service trench with no pavement surface. Basecourse is exposed and partially spilling on to the surrounding CS.
49	-	Dojo carpark edge	CS/AC	Patch repair	45	0.5	The western edge of the carpark surface has a 45 m long, 0.5 - 2 m wide AC patch repair. The interface between the AC and carpark CS is unsealed. Sporadic longitudinal and transverse cracks are present in the AC surface with a cluster of small potholes along the length of the patch.
				Potholes			
				Transverse cracking			
				Longitudinal cracking			
50	-	Dojo carpark	CS	Loose chip	17	5	General area has loose chip present on CS surface.
51	-	Dojo carpark	CS/AC	Crocodile cracks	N/A	N/A	0.5m x 0.5m area of cracking with two adjacent potholes.
				Potholes			Two pothole adjacent to croc cracking 0.5m x 0.5m and 1m x 0.5m respectively, both with localised depressions. Third small pothole adjacent to an old unsealed AC patch.
				Patch repairs			Five AC patch repairs of varying size and condition. Three with edge seals, others are unsealed.
				Local depressions			Localised depressions in potholes and general undulations in CS surface.
52	-	Dojo carpark	AC	Patch repairs	N/A	N/A	Two AC patch repairs. One is raised above the surrounding pavement surface with dimensions of 1.5m x 0.75m. Old AC patch 4.5m x 2.5m with an old sealed edge with joint cracks. Undulation in the surface of the older AC patch. One small pothole present in older AC patch.
				Pothole			
53	-	Dojo carpark	AC/CS/Concrete	Patch repairs	N/A	N/A	One unsealed AC patch repair with 30 mm local depression. Some cracking at CS/AC interface. Concrete patch repair with unsealed edges.
				Local depression			
54	-	Dojo carpark	CS	Chip loss	4	0.2	Strip of CS missing chip and exposing bitumen layer.
55	-	Dojo carpark	CS/AC	Potholes	N/A	N/A	Cluster of four small potholes.
				Edge cracking			2 m length of edge cracking where there is no edge support between the dojo walkway and CS surface.
				Patch repair			AC patch repair, 0.5m x 1m, unsealed.
56	-	Dojo carpark	CS/AC	Patch repair	N/A	N/A	AC patch 1.2m x 1m sealed with minor edge cracking.
				Potholes			4m x 1.5m pothole with minor crocodile cracking at edges. Basecourse and soils are shoved out of the pothole.
				Crocodile cracking			
57	-	Dojo carpark	CS/AC	Crocodile cracking	N/A	N/A	Sporadic cracking adjacent to a number of the potholes
				Potholes			Nine potholes all approx. 0.3m x 0.3m in size. Base course below exposed for all potholes.
				Patch repairs			Seven AC patch repairs. Three sealed, other unsealed.
				edge cracking			Cracking along the interface between the adjacent grass bank and CS.

Item Ref	Observations						
	Chainage	Location	Surface Type	Defect type	Length (m)	Width (m)	Comment
				Chip loss			Sporadic loss of chip surrounding potholes with general undulation in surface.
58	Ch0	Carpark link driveway	CS/AC	Patch repair	N/A	N/A	Two AC patch repairs sealed. 0.5m x 0.3m and 0.4m x 0.6m respectively.
59	Ch0-Ch34	Carpark link driveway	CS	Edge cracking	34	0.2	Left hand edge of the drive (walking from Ch0-Ch34) suffers from edge cracking at the interface between the CS and the top of the grass bank. Some moisture ingress is visible.
60	Ch0-Ch35	Carpark link driveway	CS	Edge cracking	34	0.2	Item 56
61	Ch15-Ch20	Carpark link driveway	CS/AC	Patch repair Local depressions pothole crocodile cracking	N/A	N/A	Two local depressions at Ch15 and Ch20 either side of the speed hump. Depressions approx. 30 mm deep. Minor crocodile cracking around the edge of depressions with a small pothole, exposing basecourse, at the edge of the depression at Ch20. AC patch repair, sealed, with a small pothole at one end.
62	Ch24-Ch34	Carpark link driveway	CS/AC	Crocodile cracking potholes Patch repairs Chip loss	N/A	N/A	Three AC patch repair, two sealed, one unsealed both with joint cracks. Crocodile cracks at the end of one patch repair. Some chip loss between patch repairs and edge of CS. Pothole with minor local depression 0.5m x 0.3m at Ch34.
63	Ch12-Ch24	Carpark link driveway	CS/AC	Patch repairs Crocodile cracking potholes	N/A	N/A	Four AC patch repairs, two sealed with joint cracks and two unsealed. Croc cracking in the first patch (walking from Ch12-Ch24). Pothole 0.3m x 0.3m.
64	Ch34	Carpark link driveway	CS	Pothole	0.3	0.4	Pothole with some basecourse exposed.
Rolleston Street - Road Observations							
1	Ch2	Rolleston Street	CS	Chip loss	N/A	N/A	Minor loss of chip from chip seal in the uphill lane
2	Ch5	Rolleston Street	CS/AC	Service trench	1	1	700 mm wide water service trench with unsealed joint. Some minor cracking around the patch joints. Minor cracking around the edge of the stormwater sump.
3	Ch8	Rolleston Street	CS	Transverse crack	1.7	N/A	Crack across the centre of the road. Minor chip loss of chips seal around the crack on the uphill lane.
4	Ch10-Ch35	Rolleston Street	CS	Flushing	N/A	N/A	Minor flushing of chip seal surface for approximately 25 m length of the road.
5	Ch15-Ch30	Rolleston Street	CS	Rutting	15	N/A	Rut of approx. 20 mm depth in wheel path on the uphill lane next to the centreline
6	Ch20	Rolleston Street	CS/AC	Service trench	N/A	N/A	Radial cracking around 220 mm x 220 mm AC patch surrounding a service lid.
7	Ch35	Rolleston Street	CS	Chip loss	N/A	N/A	Minor chip loss in parking area.
8	Ch30	Rolleston Street	CS/AC	Service trench with cracking	4	N/A	AC service trench with cracking along joints
9	Ch35	Rolleston Street	CS/AC	Manhole patch	1.5	1.5	AC service patch around manhole lid. Radial cracking around the lid. Some minor cracking along sand sealed joints.
10	Ch38	Rolleston Street	CS	chip loss	2.5	0.3	Chip loss in parking area on uphill lane. Previous CS layer exposed.

Item Ref	Observations						
	Chainage	Location	Surface Type	Defect type	Length (m)	Width (m)	Comment
11	Ch40	Rolleston Street	CS/AC	service trench with transverse cracking	4	0.3	CS service trench with transverse cracking along the unsealed joint
12	Ch40	Rolleston Street	CS	chip loss	0.6	0.5	Chip loss in parking area on uphill lane.
13	Ch42	Rolleston Street	CS	Service trench with cracking	N/A	0.6	Old CS trench full width of road. Cracks evident near crown of the road and at the edge of trench.
14	Ch45-55	Rolleston Street	CS	Service trench with cracking	N/A	N/A	Old CS trench full width with minor cracking along joints.
				AC patch repairs			Cluster of AC patch repairs in okay condition
				Rutting and Local depressions			Minor rutting for 15 m length. Rut depth approx. 25 mm. Local depression about 8 m uphill of cluster of path repairs.
				Manholes			Two service manholes. One will concrete patch in okay condition. The other with CS surround and some loss of chip surrounding manhole lid.
15	Ch60	Rolleston Street	CS	Patch repair with depression	4	1.5	Sand sealed AC patch repair with visible consolidation from CS surface.
				Longitudinal crack			300 mm long longitudinal crack from the corner of the patch repair
16	Ch65	Rolleston Street	CS/AC	crocodile cracking	N/A	NA	Crocodile cracking adjacent to edge cracking
				edge cracking			Edge cracking adjacent to AC service trench (water main) opposite vehicle accessway
17	Ch75	Rolleston Street	CS	Service trench with transverse cracking	N/A	0.6	600 mm wide old CS service trench with transverse cracking at joints.
				Patch repair	1	2	Small AC patch repair in okay condition
				Local depression	N/A	N/A	15mm deep local depression just downhill of the service trench
18	Ch90	Rolleston Street	CS/AC	Service trench	3	0.6	Sealed patch repair in okay condition.
19	Ch100	Rolleston Street	AS	Service trench with cracking	3	N/A	3 m length of the service trench cracked along sand seal joint.
20	Ch105-Ch112	Rolleston Street	CS/AC	Patch repair	4	7	AC patch repair with sand seal in okay condition
				Service trench with depression			Old service trench with irregular shape and slight depression from regular CS seal surface.
21	Ch110-Ch140	Rolleston Street	CS/AC	Service trenches with manholes	N/A	N/A	Two manholes with irregular AC patches around lids.
22	Ch130	Rolleston Street	AC	Service patch	N/A	N/A	Fire hydrant in AC service patch - okay condition
23	Ch145	Rolleston Street	AC	Service trench	N/A	M/A	600 mm wide service trench across full width of road. Sand sealed with minor cracking along joint.
24	Ch155-Ch175	Rolleston Street	AC	Service trenches	N/A	N/A	Five AC service trenches across full width of road with sealed joints. Some minor joint cracks otherwise in okay condition.
25	Ch180	Rolleston Street	CS/AC	Pothole	N/A	N/A	Small pothole in CS
				Service trenches			Small AC service trench with sand seal. In okay condition
26	Ch175-Ch190	Rolleston Street	AC	Lichen growth	15	N/A	Lichen growth on downhill lane is extensive, indicating sustained moisture on the pavement surface.

Item Ref	Observations						
	Chainage	Location	Surface Type	Defect type	Length (m)	Width (m)	Comment
27	Ch190	Rolleston Street	AC	Patch repairs	N/A	N/A	1500 x 800 AC patch repair with sand seal. 1200 x 500 AC patch repair with sand seal. Both in okay condition
28	Ch215	Rolleston Street	AC	Patch repair	2	1	Patch repair adjacent to water main service trench. Sand sealed joint in okay condition
29	Ch225	Rolleston Street	AC	Patch repair	3	2	AC patch repair with smaller internal patch repair in side the extent of the larger one. Okay condition
30	CH235	Rolleston Street	CS	Chip loss	N/A	N/A	Minor chip loss in carparking area on downhill side
31	Ch240	Rolleston Street	CS	Manhole with cracks	N/A	N/A	Manhole with surrounding CS. Minor cracks around lid. Okay condition
32	Ch245	Rolleston Street	CS	Chip loss	N/A	N/A	Minor chip loss in carparking area on downhill side
33	Ch250	Rolleston Street	CS/AC	Service trench with cracks and depression	N/A	N/A	AC service trench with transverse cracking along sand sealed joint. 10 mm depression in trench
34	Ch255	Rolleston Street	CS	Manhole with cracks	N/A	N/A	Manhole with cracks around square CS patch surround. Fire hydrant with sand sealed C patch and minor joint cracking.
35	Ch260-Ch270	Rolleston Street	CS	Longitudinal cracks	N/A	N/A	7m long longitudinal crack next to 2 m AC patch with no seal. 1m longitudinal crack in uphill wheel path.
				Transverse cracks			1m transverse crack across the crown of the road
				Local depression			30 mm localise depression next to 2 m AC patch with no seal
36	Ch280-Ch290	Rolleston Street	CS	Manhole	1	1	Manhole with square cracking in chip seal surround.
				Patch repair	1	1	AC patch with sand seal. Minor joint cracks. Okay condition.
				longitudinal crack	N/A	N/A	8 m long longitudinal crack next to AC patch.
37	Ch280	Rolleston Street	CS/AC	Patch repairs	N/A	N/A	Two AC patch repairs with sand seals. Minor joint cracks along edge of seals but in okay condition
				Transverse cracks			0.5m transverse cracks from edge of AC patch repair towards centre of road
38	Ch290	Rolleston Street	CS	Longitudinal crack	5.5	N/A	crack along centre of road
				Local depression	N/A	N/A	Depression of approx. 300mm deep at water service trench

Item Ref	Observations						
	Chainage	Location	Surface Type	Defect type	Length (m)	Width (m)	Comment
39	Ch295	Rolleston Street	CS	Manhole	N/A	N/A	Manhole with surrounding CS. Okay condition.
				Transverse cracking with chip loss			Approx. 3m length of surface with sporadic chip loss. Transverse crack from the edge of kerb into the uphill lane
40	Ch300	Rolleston Street	CS/AC	Longitudinal cracks	N/A	N/A	Series of longitudinal and transverse cracks around AC patch repairs with some minor crocodile cracking in one corner
				Transverse cracks			
				Crocodile cracks			
				Patch repairs			AC patch repairs with sand seals. Minor joint cracking and minor consolidation to patch.
41	Ch305	Rolleston Street	CS	Crocodile cracks	1.5	2	Area in between service trenches is suffering from crocodile cracks. Structural failure of the pavement evident.
				Transverse cracks	N/A	N/A	Cracking across CS surface approx. 2m uphill from croc cracks
				Edge cracks with chip loss	6.5	N/A	Edge cracking along service trench on uphill side of the road with minor chip loss surrounding the cracked area
42	Ch330	Rolleston Street	CS	Service trench with depression	N/A	N/A	Old CS service trench suffering from minor localised depression.
				edge cracking			Edge cracking along the joint of the service trench and kerb line
43	Ch340	Rolleston Street	CS	Service trench	N/A	N/A	Trench across the road with some cracking at sand sealed joints
				Edge cracking			Edge cracking of road for approx. 2 m
44	Ch350	Rolleston Street	CS/AC	Chip loss	N/A	N/A	Chip loss at bellmouth where vehicle turn around. Unusual rippling of AC surface of bellmouth but structurally intact.
Rolleston Street - Footpath Observations							
45	Ch345-Ch355	Rolleston footpath LH	AC	Crocodile cracks	N/A	N/A	Footpath surface consists of 25 mm thick asphalt that is showing minor crocodile and transverse cracks. Edge break and cracks around 220mm valve cover. Upstand kerb blocks and grout in poor condition around the turn in to the bellmouth
				Transverse cracks			
				Edge breaks			
46	Ch335-Ch345	Rolleston footpath LH	AC	Service trench with crocodile cracks and depression	N/A	N/A	Crocodile cracks on the surface of an old service trench. Trench for stormwater outfall has a depression of the surface indicating isolated consolation and structural failure
				Edge cracks			10 m of footpath with a lack of edge support. Edge cracking adjacent lack of support.
47	Ch295-Ch310	Rolleston footpath LH	AC	Service trenches	N/A	N/A	Cluster of service trenches and patches. All sand sealed with some minor cracks around joints - okay condition
48	Ch285-Ch295	Rolleston footpath LH	AC	Service trenches	N/A	N/A	Cluster of service trenches and patches. All unsealed with some minor cracks around joints - okay condition
49	Ch270-Ch290	Rolleston footpath LH	AC	Crocodile cracks	N/A	N/A	Cracks adjacent to the concrete drive out and along old service trench to the exposed stormwater outfall.
				Potholes			Single pothole exposing basecourse located in the centre of the old service trench
				Service trench			Cluster of service trenches with sand sealed joints and minor cracking. Old service trench with cracks as described above.
50	Ch230-265	Rolleston footpath LH	AC	Crocodile cracking	N/A	N/A	Crocodile cracking at the kerb edge with some loss of grout and rotation around the upstand blocks at the stormwater outfall
				Service trenches			Some AC service trenches with sand seals. Minor cracks along joints but in okay condition.

Item Ref	Observations						
	Chainage	Location	Surface Type	Defect type	Length (m)	Width (m)	Comment
51	Ch220	Rolleston footpath LH	AC	Heave crack	N/A	N/A	Heave crack in AC surface. Related to tree roots from property no. 55
				Patch repair			AC patch repair with sand seal. Minor joint cracks but in okay condition
52	Ch195-Ch210	Rolleston footpath LH	AC	Crocodile crack	N/A	N/A	Edge cracks, with adjacent crocodile cracks, along concrete drive out outside property no. 53.
				Edge crack			
				Patch repair			AC patch repair with sand seal. Minor joint cracks but in okay condition
53	Ch160-Ch195	Rolleston footpath LH	AC	Edge cracks	N/A	N/A	Minor edge and crocodile cracking along concrete drive out - okay condition. Radial cracking and depression at sign post foundation outside property 49.
				Crocodile cracks			
				Service trenches			AC service trenches with sand seal. Minor cracks along joint but in okay condition.
54	Ch140-Ch160	Rolleston footpath LH	AC	Edge cracks	N/A	N/A	Concrete drive out with two stormwater outfalls and minor crocodile cracking at downhill end.
				Crocodile cracks			Edge cracking around the outfall pipes with some loss of grout at the kerbs either side of the
				Patch repair			AC patch repair with two small potholes. Sand sealed joints with minor cracking - okay condition.
55	Ch115-Ch140	Rolleston footpath LH	AC	Crocodile cracks	N/A	N/A	Extensive cracking with kerb and channel broken up due to earthworks at new development
56	Ch75-Ch115	Rolleston footpath LH	AC	Edges cracks	N/A	N/A	Minor edge cracking along the kerb - okay condition
				Patch repairs			Two clusters of AC patch repairs and service trenches with sand sealed edges in okay condition.
				Service trenches			
57	Ch55-Ch75	Rolleston footpath LH	AC	Service trench with depressions	N/A	N/A	New AC trench in good condition. Old service trench with depression and unsealed joints.
				Crocodile cracks			Minor cracks adjacent to the kerb and channel. Some kerb upstands breaking away.
				Crushed outfall			Stormwater outfall outside property no. 15 is crushed with joints cracks along connecting old service trench.
58	Ch0-Ch55	Rolleston footpath LH	AC	Lichen growth	N/A	N/A	Minor lichen growth along the kerb edge of the pavement surface
				Service trench with depression			Cluster of surface trenches with and without sealed joints. Trenches have minor cracking around joints. Old service trench has depression and minor crocodile cracking. Cracking around foundation of sign post -okay condition.
				Crocodile cracks			
59	Ch340-Ch362	Rolleston footpath RH	AC	Crocodile cracks	N/A	N/A	Minor crocodile cracks adjacent to kerb.
				Edge cracks			Unsupported edge cracking and loss of AC at the uphill end of the footpath. 5 m length of edge cracking adjacent to kerb with some loss of grout around kerb upstands.
				Service trenches			Trench with unsealed joints and some edge cracks - okay condition.
60	Ch310-Ch340	Rolleston footpath RH	AC	potholes	2000	400	Large pothole adjacent to the kerb. Base course exposed by loss of AC. Kerb upstand rotating into channel. Minor pothole in second downhill service trench.
				edge cracking	2000	N/A	Cracking starts approx. 1 m downhill of the pothole and runs adjacent to the kerb
				service trenches	N/A	N/A	Three AC service trenches, unsealed joints but in okay condition.
				Longitudinal cracking	1000	N/A	Minor crack along the second most downhill service trench
61	Ch265-Ch310	Rolleston footpath RH	AC	Service trenches	N/A	N/A	Six services trenches. Five sand sealed with minor joint cracking - okay condition. Other Trench unsealed but in okay condition.
				Slumping grate sump			Grate sump with minor slumping. Breakings and cracking in surrounding bricks and mortar.

Item Ref	Observations						
	Chainage	Location	Surface Type	Defect type	Length (m)	Width (m)	Comment
		footpath RH		Edge cracking			Small pothole with edge cracking and some minor crocodile cracks adjacent to the kerb. Minor rotation of the kerb. Cluster of defects located outside property no. 74.
				Crocodile cracking	6000	4000	
62	Ch235-Ch265	Rolleston footpath RH	AC	Service trenches	N/A	N/A	Four service trenches, two sand sealed. All with minor joint cracking but in okay condition.
				Edge cracking			7 m crack with a small pothole and minor channel cracking adjacent to the concrete drive out at property no. 72. Further 8m of cracking, with minor kerb rotation of loss of grout between
				Potholes			
				crocodile cracking			Minor cracks adjacent to the edge of service trench
63	Ch215-Ch225	Rolleston footpath RH	AC	Service trenches	N/A	N/A	Three trenches, two unsealed and one sealed. All in okay condition
				Edge cracking	N/A	N/A	Minor edge cracking and loss of AC around stormwater outfall. Further cracking adjacent to concrete drive out opposite property no. 64.
				Concrete patch repair	1000	1500	Concrete path repair with joint cracks and loss of AC surrounding the edges.
				crocodile cracking	200	400	Cracking and the downhill end of the drive out opposite property no. 64.
				Longitudinal cracking	2500	N/A	2500 crack in AC between properties no. 66 and no. 64.
64	Ch200-Ch215	Rolleston footpath RH	AC	Service trench	N/A	N/A	Four trenches. Two sand sealed, two not. Minor cracking at joints but in okay condition.
				edge cracking			Crack adjacent to kerb approximately 1 m downhill of concrete drive out. Minor edge cracking along second concrete drive out.
				grate sump			Grate sump in channel in okay condition.
65	Ch175-Ch200	Rolleston footpath RH	AC	Lichen growth	N/A	N/A	Sporadic lichen growth indicating moisture in the pavement
				Service trenches			Five trenches. One unsealed, all in okay condition.
				Patch repair			10 m long AC patch repair downhill. Unsealed with minor joint cracks but in okay condition
66	Ch150-Ch175	Rolleston footpath RH	AC	Service trenches	N/A	N/A	Five trenches - three sand sealed, two unsealed. All in okay condition.
				Edge cracking			Minor cracking around the stormwater outfall at properties no.46/44. Further minor cracks adjacent to the kerb opposite properties no.42/40.
67	Ch105-Ch150	Rolleston footpath RH	AC	Edge cracking	N/A	N/A	Minor edge cracking at stormwater outfall outside property no. 32. Minor cracks between the joints on the three concrete drive outs downhill of property no. 33.
				Service trenches			Cluster of trenches from property no. 36 to property no. 28. Varies between sand sealed and unsealed. Some minor cracks at joints but all in okay condition.
68	Ch85-Ch105	Rolleston footpath RH	AC	Service trenches	N/A	N/A	Cluster of trenches from property no. 26 to property no. 20. Varies between sand sealed and unsealed. Some minor cracks at joints but all in okay condition. One concrete trench with joint cracks outside property no. 22.
				Patch repair with pothole			Two sealed patches in okay condition outside property no. 26. One AC repair adjacent to the kerb outside property no. 16 next to 200mm x 200mm pothole.
				Longitudinal cracking			Two 0.5 m long cracks outside property no. 24.
				Crocodile cracks			cracking adjacent to the concrete drive out
				Channel cracks			Minor cracking the channel adjacent to the concrete drive out outside property no. 22.
				Patch repairs			AC patch repair adjacent to where the kerb transitions from upstand and grout to extruded.

Item Ref	Observations						
	Chainage	Location	Surface Type	Defect type	Length (m)	Width (m)	Comment
69	Ch75-Ch85	Rolleston footpath RH	AC	Potholes	N/A	N/A	200mm x 200mm pothole next to patch repair. Cluster of potholes embedded among cracks outside property no. 14.
				Crocodile cracking			2m x 2m cracking adjacent to the concrete drive out. Drive out in okay condition. Extensive cracking between the garage and drive out at property no. 14.
				Service trenches			Cluster of service trenches with varying seal types. All in okay condition.
70	Ch0-Ch75	Rolleston footpath RH	AC	Lichen growth	N/A	N/A	Approx. 10m length of growth outside property no. 10.
				Service trenches			Six trenches with varying seals all in okay condition.
				Edge cracking			Cracking at the stormwater outfall with some loss of grout outside property no 8. Minor cracking along the joints of concrete drive outs.
				Potholes			200 mm x 200 mm adjacent to power pole outside property no. 12. Two potholes (approx. 300 mm x 200 mm each) outside property no. 4.
Hargreaves Rd - Road and Footpath Observations							
1	Ch0-Ch42	Hargreaves Footpath	AC	Re-surface pavement	42	N/A	Entire width of pavements, including kerb and channel, has be resurfaced. The AC was observed to be brand new and in excellent condition. The kerb and channel is extruded in excellent condition.
2	Ch40	Hargreaves road	Aggregate	Exposed basecourse	6	5	Patch that goes to the top of the cul de sac has no pavement surface. Basecourse is exposed.
3	Ch0-Ch42	Hargreaves road	AC	service trench	42	1.5	New AC trench for water services in excellent condition
4	Ch35-Ch40	Hargreaves road	aggregate	Exposed basecourse	5	5	Parking area for residents consists of exposed aggregate base course. Contractor on site indicated that parking area would be removed and replace by a new kerb/channel and footpath
				Longitudinal cracks	4	N/A	Cracks along the wheel path of the road, down to the AC service path surrounding MH. Some

Item Ref	Observations						
	Chainage	Location	Surface Type	Defect type	Length (m)	Width (m)	Comment
5	Ch18	Hargreaves road	AC	Service trench	N/A	N/A	Cracks along the wheel path of the road, down to the AC service path surrounding MH. Some base course is exposed surrounding manhole
				Patch repair	N/A	N/A	
Wallace Street - Road and Footpath Observations							
1	Ch5	Wallace road RH	AC	Service trench	3	2	Hole in road surface with steel covering. Trench in place for upgrades to services.
2	Ch7	Wallace road RH	AC	Service trench	N/A	N/A	AC trench across section of the flush median. Minor joint cracks but in okay condition.
3	Ch10	Wallace road RH	AC	Patch repair	0.5	0.5	AC patch repair on the edge of median - okay condition.
4	Ch55	Wallace footpath RH	Concrete	Loss of concrete	1	N/A	Minor damage to concrete kerb and channel.
5	Ch48	Wallace footpath RH	AC	pothole	2	1.5	Small pothole and minor edge cracking.
				edge cracking			
6	Ch30	Wallace footpath RH	AC	Service trench	N/A	N/A	AC trench with sand seals - in good condition.
7	Ch18	Wallace footpath RH	Concrete	Drive out	N/A	N/A	Dropped concrete vehicle drive out. Unsealed with some minor joint cracks - okay condition
8	Ch0-Ch15	Wallace Road LH	AC	Longitudinal crack	15	N/A	Crack along the wheel path in the LH lane driving from CH0-Ch15
9	Ch8	Wallace Road LH	AC	Service trench	N/A	N/A	Unsealed patch around water valve - okay condition
10	Ch12	Wallace Road LH	AC	Service trench	0.3	0.8	AC pothole repair. Possible for services. Good condition
				Patch repair	0.4	0.4	Unsealed small AC patch repair - okay condition
11	Ch25	Wallace Road LH	AC	Transverse cracking	0.4	N/A	Crack in between wheel path
12	Ch28	Wallace Road LH	AC	Edge cracking	N/A	N/A	4 cracking on AC surface
13	Ch30	Wallace Road LH	AC	Edge cracking	N/A	N/A	2.5 length of cracking as AC approaches the CS of Rolleston road.
14	Ch40-Ch45	Wallace and Rolleston interface	AC/CS	Transverse cracking	N/A	N/A	0.3m crack opposite the entrance to Rolleston street. Here the chip seal transitions to AC.
				Service trenches			One AC sealed trench in okay condition. AC service patch unsealed but in okay condition
				Patch repair	0.3	0.5	AC patch unsealed but in okay condition
15	Ch60	Wallace road RH	AC	Crocodile cracking	2	1.5	AC patch repair with minor depression. Crocodile cracks on the edge of the patch closest to the centre of the road. Joint cracks around edge of the unsealed patch
				Patch repair with depression			
16	Ch55	Wallace footpath LH	AC	Service trench	N/A	N/A	Cluster of service trenches and patches - all sealed and in okay condition.
17	Ch40	Wallace footpath LH	AC	Kerb damage	N/A	N/A	Minor joint cracks between the concrete kerb and AC pavement surface on the corner of Rolleston and Wallace. Some damage to concrete kerb along radius.

Appendix C: Deflection testing results

- **Rolleston Street AG:AM/T006 Pavement Deflection Measurement with a Falling Weight Deflectometer (FWD) (test date 24/08/20)**
- **Rolleston Street T/1:1977 Benkelman Beam Deflection Measurements (test date 25/08/2020)**

Auckland Laboratory
Private Bag 14925 Panmure, Auckland 1741
09 580 2494

Laboratory No: A20/2355
Report Date: 26-Aug-2020

TEST REPORT

Client:	HEB Construction Ltd	**Start Chainage (km):**	0
Client Address:	PO Box 226, Drury, South Auckland	**End Chainage (km):**	0.365
Client Reference:	Mark O'hare	**Target Load (kN):**	40
Road Name:	Rolleston St (Wellington)	**Target Stress (MPa):**	566
Wheelpath:	Outer Wheeltrack	**Test Date:**	24-Aug-2020

Test Methods: AG:AM/T006 Pavement Deflection Measurement with a Falling Weight Deflectometer (FWD)

Results:

Chainage (m)	Direction	Lane	Latitude	Longitude	Surface Temperature (°C)	Air Temperature (°C)	Stress (kPa)	Load (kN)	D0 (µm)	D200 (µm)	D300 (µm)	D450 (µm)	D600 (µm)	D900 (µm)	D1200 (µm)	D1500 (µm)	D1800 (µm)	D0 - Normalised (µm)	D200 - Normalised (µm)	D300 - Normalised (µm)	D450 - Normalised (µm)	D600 - Normalised (µm)	D900 - Normalised (µm)	D1200 - Normalised (µm)	D1500 - Normalised (µm)	D1800 - Normalised (µm)
29	Dec	L1	-41.302626	174.774114	18	15	570	40.3	1053	836	626	398	246	119	72	48	36	1046	830	621	395	244	118	72	47	36
49	Dec	L1	-41.302686	174.773891	23	15	580	41.0	422	392	367	328	291	214	144	87	52	412	382	358	320	284	208	141	85	51
69	Dec	L1	-41.302751	174.773668	19	15	567	40.0	1244	898	695	436	281	131	77	52	43	1243	897	694	436	281	131	76	52	43
89	Dec	L1	-41.302806	174.773446	22	15	579	40.9	529	463	395	311	235	140	86	61	46	517	453	386	304	230	137	84	59	45
109	Dec	L1	-41.302861	174.773220	20	16	584	41.3	962	742	545	359	242	134	82	56	39	932	718	528	348	234	129	79	54	38
129	Dec	L1	-41.302923	174.772995	22	15	574	40.6	1038	850	681	496	359	204	127	82	50	1023	837	671	489	354	201	125	80	50
148	Dec	L1	-41.302983	174.772776	18	15	591	41.7	693	537	393	245	154	72	44	31	24	664	515	376	235	148	69	42	29	23

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Chainage (m)	Direction	Lane	Latitude	Longitude	Surface Temperature (°C)	Air Temperature (°C)	Stress (kPa)	Load (kN)	D0 (µm)	D200 (µm)	D300 (µm)	D450 (µm)	D600 (µm)	D900 (µm)	D1200 (µm)	D1500 (µm)	D1800 (µm)	D0 - Normalised (µm)	D200 - Normalised (µm)	D300 - Normalised (µm)	D450 - Normalised (µm)	D600 - Normalised (µm)	D900 - Normalised (µm)	D1200 - Normalised (µm)	D1500 - Normalised (µm)	D1800 - Normalised (µm)
168	Dec	L1	-41.303042	174.772552	21	15	583	41.2	1127	713	415	228	90	41	10	10	10	1094	693	403	221	87	40	9	10	10
188	Dec	L1	-41.303103	174.772329	19	15	573	40.5	1046	720	510	258	113	29	18	15	14	1033	711	504	254	112	28	18	15	14
208	Dec	L1	-41.303156	174.772107	19	16	585	41.4	762	586	436	273	167	71	38	24	15	737	567	421	264	161	69	37	23	14
228	Dec	L1	-41.303213	174.771881	16	16	585	41.3	596	455	330	236	191	133	100	64	57	577	441	319	229	185	129	97	62	55
246	Dec	L1	-41.303311	174.771685	20	16	576	40.7	686	560	451	341	245	125	71	38	27	674	550	443	335	241	122	70	37	26
266	Dec	L1	-41.303474	174.771583	24	16	580	41.0	788	660	561	400	332	178	113	75	53	768	644	547	390	324	173	110	74	52
286	Dec	L1	-41.303639	174.771482	21	16	592	41.9	333	285	261	220	184	131	95	73	57	318	272	250	211	176	125	91	69	54
305	Dec	L1	-41.303805	174.771415	21	16	584	41.3	782	612	471	328	225	120	78	56	46	758	593	456	317	218	116	75	55	45
325	Dec	L1	-41.303970	174.771316	22	16	575	40.6	1510	1506	961	600	334	174	103	76	60	1486	1483	946	591	329	171	101	75	59
345	Dec	L1	-41.304114	174.771182	19	16	577	40.8	1491	1049	816	525	305	127	75	46	34	1462	1028	800	515	299	125	74	45	33
365	Dec	L1	-41.304287	174.771095	18	16	581	41.1	2046	1443	1012	611	315	154	99	69	52	1992	1404	985	595	307	150	96	67	51
22	Inc	L1	-41.302629	174.774204	18	15	581	41.0	845	693	573	434	325	186	106	58	40	824	675	559	423	317	181	103	56	39
42	Inc	L1	-41.302697	174.773981	22	15	570	40.3	974	758	607	436	316	172	103	64	44	968	753	603	433	314	171	102	64	43
62	Inc	L1	-41.302752	174.773756	22	15	581	41.1	827	571	378	212	129	53	30	22	17	806	556	368	207	126	51	30	21	16
82	Inc	L1	-41.302815	174.773532	21	15	567	40.1	1048	811	616	434	329	193	122	72	48	1046	809	615	433	328	193	122	72	47
102	Inc	L1	-41.302871	174.773309	21	15	572	40.4	904	749	602	470	380	239	154	102	75	895	742	596	465	376	236	152	101	74
121	Inc	L1	-41.302931	174.773091	21	16	555	39.2	1384	1007	720	447	297	169	110	73	52	1412	1027	734	456	303	172	112	75	53

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Chainage (m)	Direction	Lane	Latitude	Longitude	Surface Temperature (°C)	Air Temperature (°C)	Stress (kPa)	Load (kN)	D0 (µm)	D200 (µm)	D300 (µm)	D450 (µm)	D600 (µm)	D900 (µm)	D1200 (µm)	D1500 (µm)	D1800 (µm)	D0 - Normalised (µm)	D200 - Normalised (µm)	D300 - Normalised (µm)	D450 - Normalised (µm)	D600 - Normalised (µm)	D900 - Normalised (µm)	D1200 - Normalised (µm)	D1500 - Normalised (µm)	D1800 - Normalised (µm)
141	Inc	L1	-41.302991	174.772867	22	16	578	40.9	646	513	415	300	219	112	64	38	26	632	502	406	293	215	110	63	37	26
161	Inc	L1	-41.303043	174.772639	23	15	573	40.5	1484	1082	766	440	231	70	30	18	14	1466	1069	757	435	228	69	29	18	14
181	Inc	L1	-41.303097	174.772416	21	15	568	40.2	1274	762	503	269	124	66	41	28	20	1269	759	501	268	123	66	41	27	20
200	Inc	L1	-41.303152	174.772198	20	15	587	41.5	470	364	273	174	115	68	41	24	16	454	351	264	167	111	66	40	23	15
221	Inc	L1	-41.303221	174.771973	20	14	572	40.4	860	654	505	345	237	124	71	41	27	851	647	500	341	235	123	71	40	26
240	Inc	L1	-41.303285	174.771767	21	14	573	40.5	954	786	637	466	343	193	117	78	53	942	777	629	460	338	191	115	77	53
260	Inc	L1	-41.303440	174.771658	22	15	561	39.7	1033	830	667	473	335	169	105	73	55	1042	836	672	476	337	171	105	73	55
279	Inc	L1	-41.303601	174.771565	23	15	569	40.2	896	698	547	391	290	187	137	102	79	891	694	544	389	289	186	136	102	79
298	Inc	L1	-41.303747	174.771437	20	15	568	40.1	1162	894	696	492	347	193	126	89	70	1158	892	694	491	346	192	126	89	70
317	Inc	L1	-41.303894	174.771329	21	15	566	40.0	1724	1292	954	621	415	190	126	99	78	1724	1291	953	620	415	190	126	99	78
337	Inc	L1	-41.304052	174.771227	23	14	574	40.6	948	680	502	314	195	99	62	45	32	934	671	494	310	192	97	61	44	32
358	Inc	L1	-41.304233	174.771152	20	15	577	40.8	633	480	366	253	184	115	82	61	46	620	471	359	248	181	113	81	59	45

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Jasen Schaaf
Approved Signatory
Laboratory Technician
Date of Issue: 01-May-1984
IANZ Accreditation No: 240

ACCREDITED LABORATORY

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Road Science
Leading Transport Technology

WELLINGTON LABORATORY
Kiwi Point, Ngauranga, P O Box 50465, Wellington 5020
Phone: (04) 815 8398, Fax (04) 477 4930

Laboratory N°: W20/1858
Report Date: August 31, 2020

TEST REPORT

CLIENT: HEB
ADDRESS: 48-50 Wainui Road Gracefield Wellington
CLIENT REF: **CH 0-350 - Mark O'Hare**
JOB LOCATION: Rolleston Street
MATERIAL: **Asphalt Pavement - In-situ Pavement**
REAR AXLE LOAD: 8.28 tonnes
TRUCK REGO: ZJ6818
TEST DATE: 25/08/2020 11:00am
TESTED BY: Caleb Hay and Nicholas Chandler-Yates

TEST METHODS: 1. T/1:1977 Standard Test Procedure for Benkelman Beam Deflection Measurements

RESULTS:

Test	Chainage (m)	Wheel Track Position	Rebound Deflection (mm)	Remark/ Lane
1	0	R	0.56	SE Lane
2	10	L	0.90	
3	20	R	0.62	
4	30	L	0.54	
5	40	R	0.66	
6	50	L	1.01	
7	60	R	1.65	
8	70	L	1.02	
9	80	R	0.68	
10	90	L	0.48	
11	100	R	0.68	
12	110	L	0.46	
13	120	R	1.68	
14	130	L	0.44	
15	140	R	1.02	
16	150	L	0.46	
17	160	R	0.84	
18	170	L	0.82	

Test	Chainage (m)	Wheel Track Position	Rebound Deflection (mm)	Remark/ Lane
19	180	R	1.14	SE Lane
20	190	L	0.68	
21	200	R	0.92	
22	210	L	1.30	
23	220	R	0.70	
24	230	L	1.44	
25	240	R	0.58	
26	250	L	0.92	
27	260	R	0.50	
28	270	L	1.30	
29	280	R	1.04	
30	290	L	1.04	
31	300	R	1.00	
32	310	L	0.90	
33	320	R	1.08	
34	330	L	1.00	
35	340	R	0.98	
36	350	L	0.10	

	Specifications
Average Rebound Deflection (mm)	0.89
Maximum Rebound Deflection (mm)	2.48
Minimum Rebound Deflection (mm)	0.10
Overall 90th Percentile Deflection (mm)	1.37

NOTES:
1. Readiness for testing, material type, source and chainages were advised by Mark O'Hare of HEB.
2. Readings taken at 10m intervals on alternating wheeltracks as advised by HEB.
3. Beam truck and driver were provided by HEB Centreport.
4. Pavement temperature requirement is not applicable.
5. Chainage start was advised by client's site representative. All following chainages are inferred from 10m intervals.
6. Lanes were inferred from centrelane provided by site representative

Approved Signatory
Caleb Hay - Senior Laboratory Technician

Road Science
Leading Transport Technology

WELLINGTON LABORATORY
Kiwi Point, Ngauranga, P O Box 50465, Wellington 5020
Phone: (04) 815 8398, Fax (04) 477 4930

TEST REPORT

CLIENT: HEB
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CLIENT REF: **CH 0-350 - Mark O'Hare**
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TEST DATE: 25/08/2020 11:00am
TESTED BY: Caleb Hay and Nicholas Chandler-Yates
TEST METHODS: 1. T/1:1977 Standard Test Procedure for Benkelman Beam Deflection Measurements
RESULTS:

Test	Chainage (m)	Wheel Track Position	Rebound Deflection (mm)	Remark/ Lane
37	0	R	0.52	NW Lane
38	10	L	1.38	
39	20	R	0.78	
40	30	L	1.46	
41	40	R	2.00	
42	50	L	0.88	
43	60	R	0.64	
44	70	L	2.48	
45	80	R	0.40	
46	90	L	0.42	
47	100	R	0.56	
48	110	L	1.70	
49	120	R	0.68	
50	130	L	0.52	
51	140	R	0.64	
52	150	L	0.74	
53	160	R	0.52	
54	170	L	0.96	

Test	Chainage (m)	Wheel Track Position	Rebound Deflection (mm)	Remark/ Lane
55	180	R	0.82	NW Lane
56	190	L	1.04	
57	200	R	1.06	
58	210	L	0.46	
59	220	R	0.92	
60	230	L	1.08	
61	240	R	1.06	
62	250	L	0.66	
63	260	R	0.56	
64	270	L	0.92	
65	280	R	0.66	
66	290	L	0.94	
67	300	R	0.94	
68	310	L	0.76	
69	320	R	0.96	
70	330	L	0.88	
71	340	R	0.68	
72	350	L	1.14	

	Specifications
Average Rebound Deflection (mm)	0.89
Maximum Rebound Deflection (mm)	2.48
Minimum Rebound Deflection (mm)	0.10
Overall 90th Percentile Deflection (mm)	1.37

NOTES:
1. Readiness for testing, material type, source and chainages were advised by Mark O'Hare of HEB.
2. Readings taken at 10m intervals on alternating wheeltracks as advised by HEB.
3. Beam truck and driver were provided by HEB Centreport.
4. Pavement temperature requirement is not applicable.
5. Chainage start was advised by client's site representative. All following chainages are inferred from 10m intervals.
6. Lanes were inferred from centrelane provided by site representative

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SITE DIAGRAM

CH 0-350 - Mark O'Hare

Chainage marks represent approximate test locations. SE lane marked in red, NW lane marked in green.
Map not drawn to scale.

Appendix D: Photo and video files

- **All photographic and video file records captured during the survey have been provided to HEB as an additional electronic file via USB drive to accompany this report. Specifically provided;**
    - **Photographic record of each defect observed**
    - **Video file of road and footpath surveys**

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