Before the Independent Hearing Panel
appointed by Environment Southland and
Gore District Council

Under	the Resource Management Act 1991
In the matter of	an application by Gore District Council for resource consent to establish the Longford Bridge across the Mataura River

Statement of evidence of Daniel Anthony Crocker

2 December 2020

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Introduction

1 My full name is Daniel Anthony Crocker.

2 I have over 16 years' experience designing bridges in Australasia, Europe, South America, and Asia. I am a Chartered Engineer (CEng) of the Institution of Civil Engineers (UK) and a Chartered Professional Engineer (CPEng) with Engineering New Zealand NZ (EngNZ) with a speciality in bridge design. I am also an International Professional Engineer (IntPE). I have designed over 30 bridges in NZ, ranging from concept all the way through to construction. These designs include the majority of materials and structural forms including prestressed concrete beams, post-tensioned concrete beams, long-span steel composite beams, and glu-laminated timber beams. I have also led the design of sophisticated bridges forms such as cable-stay bridges, suspension bridges, and tied arch bridges.

3 I have previously worked for Rambol (formerly Gifford and Partners) and Atkins PLC in the UK. I spent eight years working for the Beca Ltd Civil Structures Team as a Senior Bridge Engineer and then Associate Bridge Engineer. I am the Technical Director and Managing Director of DC Structure Studio, which I founded in 2016.

4 I previously held the role of Chairman for the Auckland Structural Group (**ASG**) with its plus 1,000-strong membership of structural engineers and have served on the board of the Structural Engineering Society on NZ (**SESOC**).

5 I am contracted by Gore District Council (**GDC** or **Council**) as the lead bridge engineer and bridge architect for the Longford Cable-stayed Footbridge.

6 I was the author of the following documents attached to the application or provided as further information:

(a) *Longford Shared Path Design Statement* (Rev E, July 2020), attached as Appendix 1 to the Application;

(b) Longford Shared Path – Mataura Cyclebridge Drawings GDC_2019-11_S001 to S151 (Rev E, July 2020) attached as Appendix 1 to the Application;

(c) *Longford Shared Path South Cycleway Drawings GDC_2019-11_C101 TO C108* (Rev C, Nov 2020) issued 6 November 2020 as part of the further information response; and

(d) *Longford Shared Path North Cycleway Drawings GDC_2019-11_C110 TO C112* (Rev B, Nov 2020) issued 6 November 2020 as part of the further information response.

7 I also provided input into the preparation of the following documents attached to the application or provided as further information:

(a) *Longford Cable Stayed Bridge - Aeroelastic Assessment of Cables,* (Rev A, 14 Oct 2020), Ingenuim Aero Consultancy, attached to the further information response of 6 November 2020; and

(b) *Lighting Design and Environment Report for Longford Bridge and Shared Pathway – Gore* (Revision C, 6 Nov 2020), Essential Lighting Consultancy Ltd (**ELC**), attached to the further information response of 6 November 2020.

8 In preparing this statement of evidence, I have considered the following documents:

(a) the application and further information, particularly as listed above;

(b) submissions relevant to my evidence; and

(c) the section 42A report.

Code of Conduct for Expert Witnesses

9 While this is not a hearing before the Environment Court, I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014. I have complied with it in preparing this evidence, and I agree to comply with it in presenting evidence at this hearing. The evidence that I give is within my area of expertise except where I state that my evidence is given in reliance on another person's evidence. I have considered all material facts that are known to me that might alter or detract from the opinions that I express in this evidence.

10 This evidence addresses:

(a) bridge form;

(b) noise effects from the bridge;

(c) design of bridge for wind demands;

(d) overall cycleway connection;

(e) bridge maintenance;

(f) lighting plan;

(g) shovel ready stop-bank raising; and

(h) response to submissions.

Executive summary

11 The following summary applies to the evidence in response to concerns raised during the notification phase of the consenting process related to the design of the Longford Cable-stay Bridge and/or design of the connecting cycleways:

(a) I agree that either a cable-stayed footbridge or a tied arch bridge would have been suitable from a construction perspective in this location. Noting that my engagement with GDC was derived from a competetive design orientated tender format, I made the decision to leverage our more recent cable-stayed footbridge design experience.

(b) I do not consider the current design to be uneceesarily "ostentatious" or "dramatic". To date, the bridge has not been embellished beyond its required function.

(c) It was determined that the most likely occurrence of noise generated by the bridge would be due to wind causing resonance of stay cables. The noise produced by the bridge is summarised in the "*Longford Cable-Stayed Bridge - Aeroelastic Assessment of Cables"* report. Overall, no significant noise effects were identified.

(d) The bridge has been designed and independently peer reviewed to confirm adequate strength and dynamic performance when subjected to wind effects. Wind effects are considered in the design as documented in the "*Longford Shared Path Design Statement"*.

(e) Cycleway connections do not form part of this application and are subject to final design. However current drawings indicate how the connections to the proposed bridge could be provided in this location. The proposed route achieves full connectivity between Hyde Park (in the south), and connects with both Woolwich Street and Huron Street (in the north). The current design also makes provisions for vision impared users and is consistent with NZ Building Code D1 "accessible pathway" requirements.

(f) Ongoing inspection requirements and expected maintenance during the life of the bridge have been considered in the design and are

specifically addressed in the notes and maintenance table of drawing S101 for easy reference by maintenance and inspection engineers.

(g) GDC has confirmed that the proposal only relates to the functional lighting of the bridge. The proposed functional lighting of the bridge will be achieved by incorporating small LED lighting units embedded inside the handrail system. These low wattage warm light (3000K) units will be directed downward and at an angle of circa 45 degrees toward the centre of the deck. The glare and upward loss (light spill) has been assessed to comply with standards.

(h) Aviation beacons are not required and are not being proposed.

12 In summary, the concerns raised that relate to structural and/or cycleway design matters have been addressed either in the original design and/or in subsequent addendums.

13 An email was received from Environment Southland dated 3rd November 2020 confirming that they had been awarded "shovel-ready" funding to increase stop-banks by 500mm in height. In summary, the main outcome of increasing stop-bank levels is to increase the amount of debris forces that the bridge will need to accommodate. Two options are proposed that could be incorporated with minimal overall impact to the proposed scheme:

(a) lifting the bridge by 500mm; or

(b) strengthening the bridge to resist increased debris forces.

Bridge form

14 On behalf of DC Structure Studio my engagement began with a competitive design tender. As part of the tendering process all potential tenderers were asked by GDC to deliver a bridge concept (with 3D visualisations and indicative costing) for the proposed Longford Shared Path. During the tender phase the requested bridge was shown at the location consistent with the current construction drawings and geotechnical investigation results for the alignment were provided. GDC requested that only single span options with no permanent supports in the river be considered. We understand Council's driver for the single span option was the desire to reduce overall environmental impact and minimise the related consenting complexity. It was noted by GDC that single span options would be a permitted activity as per Environment Southland guidelines.

15 Conventional bridge forms such as concrete and/or steel beams bridges and/or truss bridges would likely have needed additional supports in the river in order to traverse the full 90m span. Any support placed in the river

channel and/or flood plain would have needed to have been substantially sized in order to resist the large flood and associated debris forces that are required by the design codes (most notably NZTA Bridge Manual and Australian bridge loading code AS5100.2).

16 A clear span of 90m by normal cycleway/footbridge standards is considered a long-span bridge. To my knowledge there are three footbridge design options capable of spanning 90m:

(a) suspension bridge;

(b) cable-stayed bridge; or

(c) tied arch bridge

17 Suspension bridges are structures synonymous with the Department of Conservation for spanning large distances in often remote regions of NZ. These bridges have been designed in NZ to span up to 170m. The mast height of a suspension bridge is typically 1/10th the span length ≈ 9m high for a 90m span. However, this solution was quickly discounted as it would require anchors either in the Huron Street stop-bank and/or (more likely) in the middle of Huron Street. This was regarded as unfeasible.

18 I agree that either a cable-stayed footbridge or a tied arch bridge would have been suitable from a construction perspective. DC Structure Studio's engagement began with a competitive design tender. Since my team had directly relevant experience designing and delivering the most recently constructed cable-stayed bridge in NZ – the *Water of Leith Cable-stayed Footbridge* in Dunedin - the decision was made by my team that refining our current design practices in this field would be our main commercial/technical advantage over other tenderers.

19 I am aware that one of the contractors tendering the construction phase tendered a tied arch alternative. They had recent experience constructing an arch network bridge, so it made commercial sense for them to leverage such experience, and reflects that this was an alternative option for a bridge in this location.

20 Overall, both the cable-stayed bridge option and the tied-arch bridge option were found to be workable solutions of a similar order of magnitude in cost.

21 In terms of visual impact, it should be noted that the tied-arch bridge would have needed an arch fabricated from tubular steel of circa 100m in length (measured along the curve). This is in direct contrast to the cable-stayed bridge needing only a 40m long mast formed from similar tubular steel

members. In this sense, the cable-stayed bridge has less solid form (when considered above the deck level).

22 I note a number of submissions describe the bridge as unnecessarily "ostentatious" or "dramatic". At this stage, I do not consider this to be the case. A cable-stay bridge is a proven solution for bridging large spans. To date, the bridge has not been embellished beyond its required function.

23 I do note that during recent discussions with Hokonui Runanga (4th November 2020), opportunities were presented and discussed regarding the potential for a "cultural overlay" which would result in architectural embellishment of the current raw form. The intention of these embellishments is to help connect the bridge to its surroundings and community. For instance, we discussed with Riki Parata the potential to add patterns of eels indigenous to the Mataura River to the stiffener plates of the mast. This would be a symbolic and educational representation of the natural wildlife in the river. This opportunity, and others, for participation in the bridge's design narrative, are currently being discussed and considered by Hokonui Runanga.

Noise effects from the bridge

24 The noise produced by bridges is not normally an issue and is not covered by conventional bridge design codes. However, in response to the submissions, I worked with Peter Coysh (an international expert in aerodynamics) to develop a scope and modelling approach for assessing noise generated by the bridge. It was determined that the most likely occurrence of noise would be due to wind causing resonance of stay cables (as also suggested by the majority of the submissions). The methods and outcomes to our study are summarised in the "*Longford Cable-Stayed Bridge - Aeroelastic Assessment of Cables"* report.

25 Overall, I summarise the outcomes of the study as follows:

(a) only two Cables, 1S and 1N (main-span cables closest to the mast), exhibit significant resonance;

(b) the onset frequency for these worse affected cables is expected to develop a similar sound to that of an E5 note from a violin;

(c) this worse-case noise event occurs at a 21m/s (76km/hr) wind speed which is estimated to occur during 14 days of any given year; and

(d) the estimated peak noise level, when measured at the nearest properties is only 28.2dB(A) and I note that this is still well below the local planning limit of 40dB(A).

Design of bridge for wind demands

26 Wind effects are considered in the design as documented in the "*Longford Shared Path Design Statement"*. Wind loads applied to the bridge have been derived based on the NZ wind loading code NZS1170.2 to include for regional and localised factors (including orientation and height of structure above ground). The demands are as discussed in Section 5.13 of the design statement. This approach is aimed at confirming the bridge has the adequate structural capacity to prevent collapse in extreme events and thus considers overall safety in regard to lives and property.

27 Not only have I assessed the static forces caused by wind, but I have also done a rigorous investigation of wind dynamics. The purpose of this approach is to confirm dynamic behaviour does not create uncontrolled bridge excitations and/or the resultant excitations are within normally acceptable user comfort levels. "Aerodynamics and Wind Performance" are discussed in section 7.5 of the Design Statement.

28 Overall, I can confirm:

(a) the bridge is designed to the most up-to-date loading codes for wind loading (NZS1170.2 and NZTA Bridge Manual v3);

(b) wind effects consider regional and localised factors including orientation and height of structure above ground;

(c) wind effects were also considered as part of the independent structural peer review by Beca Ltd;

(d) dynamic effects have been considered based on wind tunnel testing using state of the art computational fluid dynamics (CFD), and it was confirmed that no aerodynamic instabilities are expected; and

(e) vertical accelerations at mid-span are only expected to reach 1.5m/s^2. As per "*Design of Lightweight Footbridges for Human-Induced Vibrations (JRC-ECCS, 2009)*" 1.5m/s^2 is close to what would normally be considered medium comfort. It should also be noted that this is expected to occur when the wind is 9.3m/s which is a 33km/hr wind. In such winds, some discomfort would be expected when setting out for a walk or traversing a bridge.

Overall cycleway connection

29 Cycleway connections do not form part of this application and are subject to final design. However current drawings indicate how the connections to the proposed bridge could be provided in this location. Please refer to

drawings GDC_2019-11_C101 to C108 and C110 to C112 (attached to the further information response of 6 November 2020), for details of the southern and northern cycleway routes, connecting to the bridge respectively.

30 I note:

(a) the proposed route achieves full connectivity between Hyde Park (in the south), and connects with both Woolwich Street and Huron Street (in the north);

(b) the proposed route does not require users to traverse SH1 or railway. The route goes safely under these existing busy networks;

(c) the cycleway design drawings (and bridge drawings) have been independently reviewed for safety aspects by WSP Limited as part of a NZ Transport Agency Road Safety Audit (RSA) process. This is the highest level of safety audit I am aware of;

(d) in response to the RSA team recommendations, vision-impaired tactiles were added at all key junctions and crossing points. These are indicated on the latest set of drawings. On this basis it is considered that the scheme accommodates blind/vision impaired pedestrians;

(e) all cycleway gradients have been limited to 7%. We note that D1 of the NZ Building Code permits gradients of up to 8.3% (1V:12H) for “accessible" use. In this respect it can be considered that the cycleway can be used by wheelchairs, elderly, prams, etc.; and

(f) the western embankment approaching the bridge has been set to 9% gradient in an attempt to limit the overall footprint in the flood plain (refer drawing S104). A rest-stop has been incorporated at mid-height to help break-up the ascent of users. Overall, adopting 9% is considered a suitable compromise given the site constraints and would still permit reasonable use for pedestrians requiring “accessible" access (noting it is only fractionally outside the recommended 8.3% gradient).

Bridge maintenance

31 Design life and the whole of life value are discussed in Section 2.12 of the “*Longford Shared Path - Design Statement*”.

32 Ongoing inspection requirements and expected maintenance during the life of the bridge have been considered in the design and are specifically

addressed in the notes and maintenance table of drawing S101 for easy reference by maintenance and inspection engineers.

33 A summary of the approach:

(a) all below ground concrete elements such as piles and abutments beams are expected to require negligible ongoing maintenance over the 100-year life of the bridge;

(b) the bridge steelwork and mast has used extra long-life 40-year corrosion protection systems as endorsed by NZTA; and

(c) the protection system employed for cables are a mix of 95% zinc and 5% aluminium and designed to last 100 years with no maintenance.

Lighting Plan

34 A number of submitters have expressed concerns that a lighting plan was not submitted and/or the effects of bridge lighting not assessed. A lighting design and assessment are contained in *Lighting Design and Environment Report for Longford Bridge and Shared Pathway – Gore* as provided in the additional information submitted 6 November 2020.

35 The report focussed on three distinct elements for the overall lighting scheme:

(a) Functional lighting of the bridge;

(b) Feature lighting of the bridge;

(c) Functional lighting for connecting pathways.

36 GDC has subsequently confirmed that it is pursuing only functional lighting of the bridge.

37 The proposed functional lighting of the bridge will be achieved by incorporating small LED lighting units embedded inside the handrail system. These low wattage warm light (3000K) units will be directed downward and at an angle of circa 45 degrees toward the centre of the deck. The units will be spaced at 10m centres on both side of the bridge.

38 As noted in the report the glare and upward loss (environmental light spill) has been assessed to comply with standards.

39 I note that this solution is consistent to what was recently done on the Water of Leith Cable-stayed Footbridge in Dunedin.

40 Brodie Costello (Planner, Landpro Ltd.) has confirmed that no warning beacons will be needed at the top of the bridge mast and/or atop any construction cranes below 60m in height in this location. I understand this was confirmed via email and telephone conversations with Iain Fraser (Technical Specialist – Aeronautical Services, Civil Aviation Authority of New Zealand) in September 2020. I can confirm that the bridge mast (including the western embankment) will not exceed 46m in height above the flood plain (as shown on drawing S101). The construction team have confirmed to me directly that no cranes for use in the bridge construction will exceed 60m in height. On this basis, I can confirm that aviation beacons are not required and are not being proposed.

Shovel ready stop-bank raising

41 An email was received from Environment Southland dated 3rd November 2020 confirming that they had been awarded "shovel-ready" funding to increase stop-banks by 500mm in height. I understand the intention of this change is to reduce the risk of widespread flooding of Gore should floods exceeding the recent 2020 event occur.

42 In terms of the existing design basis, and likely consequences of raising the stop-banks by 500mm, I note the following:

Consideration of stop-bank raising in the design:

(a) it was noted in the hydrology report that there is a risk that the stop-banks could be raised within the bridge's 100-year life;

(b) the NZTA Bridge Manual (bridge design basis) permits that a bridge can be lifted in the future to improve clearances to accommodate future events. This was the assumed approach for accommodating a future/unknown stop-bank increase;

(c) at no stage (prior to the email of 3rd November 2020 confirming approval of their shovel ready funding) was a specific date and/or level of flood bank raising discussed; and

(d) raising of bridges normally incurs reasonable costs associated with design, consenting and capital costs. Having this occur in Year #25 incurs much less cost than Year #2 (based on ability to forward plan and use of industry-accepted NZTA discount factors). We note that raising of the bridge during the design phase (prior to commencement of construction) will incur significantly less costs and complexity than upgrading/modifying an already constructed bridge.

Impact on Bridge Clearances:

(a) the NZTA Bridge Manual requires that footbridges be designed to clear the 1/50 year flood (SLS) event with a freeboard of at least 600mm;

(b) a 1200mm freeboard was adopted wherever possible (as recommended by ES) because logs are expected in the debris. The NZTABM minimum of 600mm was only adopted adjacent to the East stop bank to permit better tie-in;

(c) for the design we adopted a 1/50 flood level of 75.8m RL which includes climate change; and

(d) the 1/50 design level is not affected by stop-bank raising, and the current bridge clearances will conform with the NZTA Bridge Manual if stop-banks are lifted.

Bridge Debris loading:

(a) the Australian Bridge Loading Code AS5100.2 (as referenced by the NZTA Bridge Manual for flood design), requires that a bridge must clear the 1/500 year ULS flood event by at least 600mm, or otherwise it will need to resist load caused by floating debris;

(b) the 1/500 year ULS flood levels were extremely high and overtopped the flood-banks and flooded the entire Gore Township;

(c) it was not considered feasible/economic to make the bridge high enough to clear the 1/500 year event by more than 600mm;

(d) the ULS event was capped at 200mm above the existing stop-bank level. Beyond 200mm the hydrology reports confirmed that the stop-banks would fail (and thus levels would drop);

(e) as such the design is based on flood debris loads from an event 200mm above the stop-banks;

(f) initial assessment by Riley has confirmed that if stop-banks increase by 500mm the resultant ULS levels will increase by circa 500mm and the velocities will also increase;

(g) the bridge is currently designed to resist debris forces as contained in Table 5-1 of the *Longford Shared Path Design Statement* (Rev E, July 2020); and

(h) these will need to be re-assessed in light of new flood levels and velocities, as discussed further below.

43 In summary, the main outcome of increasing stop-bank levels is to increase the amount of debris forces that the bridge will need to accommodate. Two options are available to mitigate this outcome:

(a) lifting the bridge by 500mm; or

(b) strengthening the bridge to resist increased debris forces.

Option 1: The bridge is lifted 500mm everywhere

44 This will include increasing the western embankment by 500mm, increasing pile lengths by 500mm, and increasing the height of the dead-man anchors by 500mm. It is also expected that the foundations of the dead-man anchor surrounds will need to increase to resist the increased overturning demands. These changes are indicated in the figure below. At this stage rather than increasing the overall footprint of the embankment and anchor surround we would steepen the side batter of the “zone 1" rip rap extents (zone 1 is indicated on drawing S106) from 1V:2H to 1V:1.5H. This approach will need to be confirmed by detailed geotechnical stability analysis.

45 At this stage, I would estimate that a 500mm increase in both the western embankment and dead-man surround would increase quantities as follows:

(a) west embankment fill = +480m^3;

(b) west embankment rip rap = +260m^3;

(c) anchor fill = +105m^3;

(d) anchor Rip Rap = +105m^3; and

(e) eastern stop-bank tie-in fill = +20m^3.

(f) Bridge Piling = +3.5m.

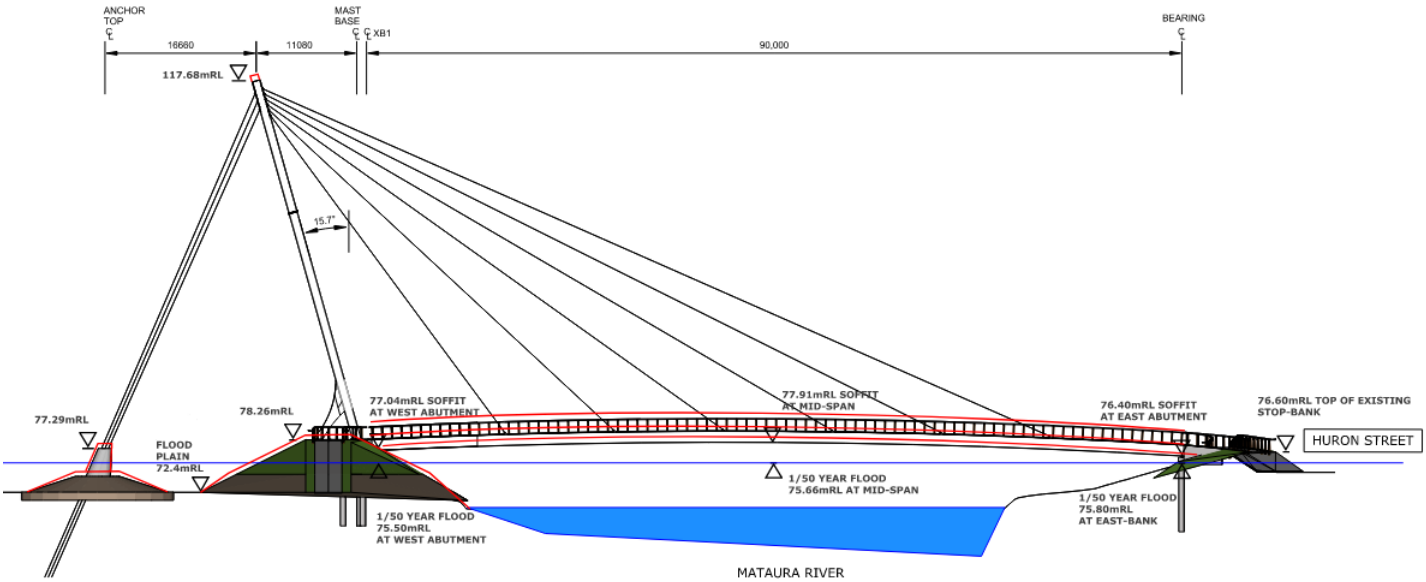

Figure 1 (above) – Long-section showing indicative changes (drawn to scale) caused by lifting bridge by 500mm.

Option 2: The bridge is strengthened

46 It might be possible to leave the bridge geometry and alignment "as is" if the bridge were strengthened to resist higher flood debris loads. At this stage, I would expect an incremental section size increase of the structural bracing members, bracing connections, the hold-down bolts, and bridge piles. These anticipated strengthening requirements are highlighted in the figure below. I do not expect this to change the overall geometry of the bridge.

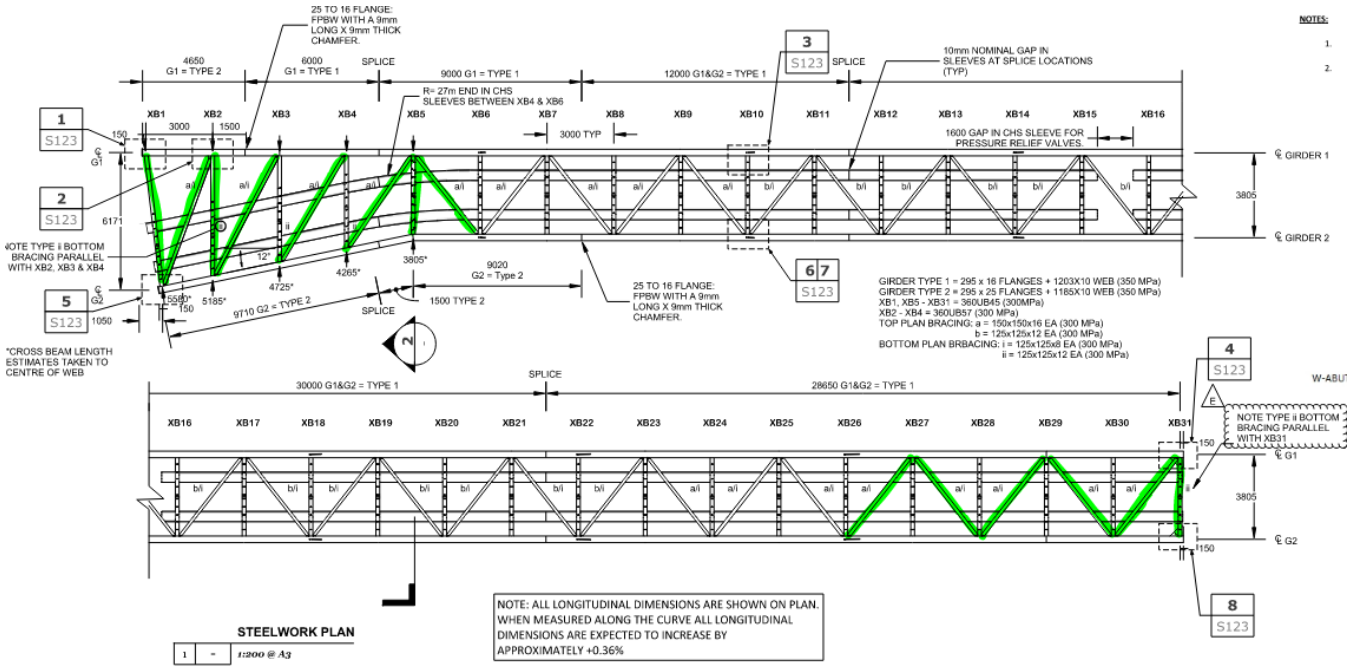

Figure 2 (above) – Plan showing steelwork elements likely to require strengthening when increased debris loads are applied (TBC by detailed analysis).

47 Overall, it is envisaged that either of the two options discussed above could be incorporated with minimal overall impact to the proposed scheme.

Direct Response to submissions

48 The below summaries of concerns are taken directly from the GDC s42A Report (Nov 2020) prepared by Nigel Bryce.

Rodney Bell:

49 **Concern raised:** GDC has failed in its requirements to provide a lighting plan for the bridge and associated shared pathways.

50 **Witness response**: This has been considered in the design. Refer to “Lighting Plan" section above.

51 **Concern raised:** The potential for noise pollution in the environment is a distinct possibility, and probability, from the highly tensioned wire, supports for the proposed bridge.

52 **Witness response**: This has been considered in the design. Refer to “Noise effects from bridge" section above.

53 **Concern raised:** The proposed construction does not provide an inclusive environment for use by all community members. There is no allowance in the submitted application for use by blind or sight-impaired persons.

54 **Witness response**: This has been considered in the design. Refer to “Overall cycleway design" section above.

David & Carmel Bone

55 **Concern raised:** No evidence of any assessments of the noise pollution that the cables poles and bridge itself may create due to high wind zone and it stands to reason that there will be noise created from the bridge's wire cables and possibly from the pole as well.

56 **Witness response**: This has been considered in the design. Refer to “Noise effects from bridge" section above.

57 **Concern raised:** No details on the lighting plan for the bridge, which could have a significant impact, not only on the natural environment, but also on residents. Submitter concerned about loss of night sky amenity.

58 **Witness response**: This has been considered in the design. Refer to “Lighting Plan" section above.

59 **Concern raised:** No plan in place in regard to access and egress points for the bridge and submitters has significant safety concerns about this as it is one of the most important parts of the project and an integral reason as to why the bridge is being built.

60 **Witness response**: This has been considered in the design. Refer to “Overall cycleway design" section above.

61 **Concern raised:** On the other side of the bridge where it exits onto Surrey Street there are no cycle lanes, and the street ends on Hokonui Drive which is State Highway 94 and an extremely busy road.

62 **Witness response**: This has been considered in the design. Refer to “Overall cycleway design" section above.

Sean Burke:

63 **Concern raised:**The position of the bridge is questionable - if the bridge was less ostentatious design and placed in the wider (and therefore slower moving) area of the river upstream, say off Maitland Street, it would cause less interference with flood flows, and also require a much shorter pipeline.

64 **Witness response**: Placing the bridge in a wider part of the river would lead to a longer span and thus a taller mast. The bridge is instead a proven structural form for long-span situations and at this stage has not been

designed to include features or embellishments beyond functional requirements. Refer to “Bridge form" section for more information.

Ivan Butel

65 **Concern raised:** Considers that the main Gore Bridge is more than adequate for the purpose and has served residents on both sides of the river well. Another bridge is not required, and can only see danger and maintenance if it was to be built.

66 **Witness response**: This has been considered in the design. Refer to “Bridge Maintenance" section above.

David and Lynn Gray

67 **Concern raised:** The structure represents a hazard that is a significant risk to property and life.

68 **Witness response**: The bridge has been designed to the NZTA Bridge Manual which I consider to be the highest standard for footbridge design in NZ (other standards are available that require the design to lesser loading and lesser factors of safety). Furthermore, the design has been independently peer-reviewed by Beca Ltd. I do not consider the bridge is a hazard to life and/or property (beyond normally accepted design practices).

69 **Concern raised:** The application fails to address the “End to End Journeys" and improve the safety of cyclists and pedestrians. Gore District Council does not address pathways in this application; we have a bridge leading to nowhere.

70 **Witness response**: This has been considered in the design. Refer to “Overall cycleway design" section above.

71 **Concern raised:** GDC have not submitted a lighting plan.

72 **Witness response**: This has been considered in the design. Refer to “Lighting Plan" section above.

Jason Harvey

73 **Concern raised:** The bridge height will create excessive noise in high winds which will be heard by near-by residents.

74 **Witness response**: This has been considered in the design. Refer to “Noise effects from bridge" section above.

Erin Howes

75 **Concern raised:** Support the bridge and its primary function to improve the water supply issues of Gore, and like that it connects the cycle trial from North Gore to East Gore, however, it is in the wrong place, and its dramatic design is just way over the top.

76 **Witness response**: The bridge is not considered dramatic and is instead a proven structural form for long-span situations. Refer to “Bridge form" section for more information.

77 **Concern raised:** The Council to amend the proposed position of the where the bridge is to be built to Maitland Street extended and that the design is dialled back.

78 **Witness response**: “Dialling back" the design is not an option given the form is a direct response to its function. Refer to “Bridge form" section for more information.

Desmond Horrell:

79 **Concern raised:** Concerns that lighting around the bridge will affect the submitter's lounge and bedroom which are both situated at the front of the submitter's house.

80 **Witness response**: This has been considered in the design. Refer to “Lighting Plan" section above.

81 **Concern raised:** Concerns around the wires supporting the bridge. The high winds could cause vibration noise from the cable wires.

82 **Witness response**: This has been considered in the design. Refer to “Noise effects from bridge" section above.

Peter Kemp:

83 **Concern raised:** Unnecessary additional visual obstruction when there are good viable alternatives that preserve the beauty of the countryside around Gore. The height is intrusive.

84 **Witness response**: Unless piers are placed in the river and/or flood plain, the viable alternatives for a bridge are likely to require large above deck structures that would have a similar visual intrusion. Refer to “Bridge Form" section above. The only non-intrusive solution (from a visual perspective) is an underground piping solution, this option is addressed in the evidence of Matthew Bayliss.

85 **Concern raised:** The bridge would presumably have to have lighting which would go against the Gore DC efforts to reduce the night light of Gore.

86 **Witness response**: This has been considered in the design. Refer to “Lighting Plan" section above.

87 **Concern raised:** If approved, make a condition that the maximum height of bridge construction should be no more than 5 metres.

88 **Witness response**: We do not believe such a constraint is feasible. A 5.9m high embankment is required on the western side simply to lift the bridge landing point above the flood water. Above this, we then need a structural form to bridge the 90m clearance. Likely options are Cable-stayed bridge (as proposed), Tied Arch (as per alternative) and a suspension bridge. All of these have considerable “above structure" heights.

Peter Kempthorne

89 **Concern raised:** Placement in the river floodplain. Size. Height. Sail area to the prevailing southerly wind.

90 **Witness response**: Wind design for this specific location, orientation, and structural form are considered in the design. Refer to “Design of bridge for wind demands" section above.

Ernest MacManus

91 **Concern raised:** Risk to aviation from cable pole directly in the Ambulance helicopter flight path. Pilots that use the river for reference in times of fog or mist in an emergency.

92 **Witness response**: Civil Aviation Authority has confirmed that no warning beacon is required for structures in this location below 60m in height.

93 **Concern raised:** No provision for mobility-impaired persons.

94 **Witness response**: This has been considered in the design. Refer to “Overall cycleway design" section above.

95 **Concern raised:** Uncertain that the cable bridge can withstand the strong winds experienced at that location. The bridge will pose a danger to users in times of high winds.

96 **Witness response**: This has been considered in the design. Refer to “Design of bridge for wind demands" section above.

Kathleen Matheson

97 **Concern raised:** Lighting will also be an issue as the whole of the bridge will be in sight of the submitter's home and any lighting attached to the bridge will impact submitter's home.

98 **Witness response**: This has been considered in the design. Refer to “Lighting Plan" section above.

John McIntyre

99 **Concern raised:** No evidence of futureproofing of the project.

100 **Witness response**: As shown on Section X1 of drawing S102, two additional 160mm diameter PVC empty conduits are to be placed under the bridge. These will be watertight and permit the use for additional water carrying capacity and/or fibre networks in the future of the bridge.

Adam Newton

101 **Concern raised:** Council go back to the drawing board and come up with a less obtrusive properly thought-out solution through the proper engagement of the community.

102 **Witness response**: The bridge design has been done to the highest standards and has been independently peer-reviewed. I believe the bridge design does represent a “properly thought-out solution" designed and reviewed by specialists in the field of footbridge design. The design basis has been clearly documented on drawings and in the Design Statement.

Diane and Barry Perkins

103 **Concern raised:** Have not been told if any modelling has been done to check on likely problems with wind on such a high and exposed bridge.

104 **Witness response**: This has been considered in the design. Refer to “Design of bridge for wind demands" section above.

Bruce and Margaret Thomson

105 **Concern raised:** Lighting plan requested that includes the effects on parties.

106 **Witness response**: This has been considered in the design. Refer to “Lighting Plan" section above.

107 **Concern raised:** There will be increased wind noise from the cables of the bridge. Also, believe the strong winds will be highly dangerous to bridge users.

108 **Witness response**: This has been considered in the design. Refer to “Noise effects from bridge" and “Design of bridge for wind demands" sections above.

109 **Concern raised:** Considers that the ongoing maintenance costs will add to the burgeoning ratepayers' bills.

110 **Witness response**: This has been considered in the design. Refer to “Bridge Maintenance" section above.

Waimea Plains Landscape Preservation Society

111 **Concern raised:** There has been no effort made in the design of the proposal to avoid, remedy, or mitigate effects on the landscape. To the contrary, the proposal represents an intentionally dominant statement-structure.

112 **Witness response**: Form is a direct result of function. Refer to “Bridge Form" section above. Visual impacts are considered and discussed by others in their evidence.

Gary and Wendy Weir

113 **Concern raised:** Concerned that there have been no investigations into the possible effects of wind noise from the pole, bridge, and cables.

114 **Witness response**: This has been considered in the design. Refer to “Noise effects from bridge" section above.

115 **Concern raised:** There is not a current lighting plan for this bridge and fear that the number of lights needed and the need for an aviation beacon will severely impact our night-time view.

116 **Witness response**: This has been considered in the design. No aviation beacon is required. Refer to “Lighting Plan" section above.

117 **Concern raised:** On the West side where they must cross a heavy traffic bypass or enter SH1.

118 **Witness response**: This has been considered in the design. Refer to “Overall cycleway design" section above. I note the design intention is to go safely under exisitng SH1 bridge and that the overall design prevents pedestrians and cyclists needing to use SH1.

Conclusion

119 In summary, the concerns raised that relate to structural and/or cycleway design matters have been addressed either in the original design and/or in subsequent addendums. Cycleway design sits outside this application and is subject to the final design.

Dated this 2nd day of December 2020

Dan Crocker