# INSPECTION & TEST PLAN

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| Inspection and Test Plan and Number | OP06\_f01 Inspection & Test Plan Workbook | | |
| Project Name | **Kiwirail – North Auckland Line Recovery – CH 125.603** | **Version:** | 1 |
| Date: | 20/02/24 | **Approved in RFI#:** | TBC |
| Documents / Specifications Referenced: | ENGEO NAL 125.603KM PRELIMINARY IFC DESIGN | | |

| **ITP#** | **Work Pack Element(s)** | **Drawing / Specification Ref.** | **Specification Detail Summary** | **Acceptance Criteria** | **Test Spec & Frequency** | **Control Type i.e. Checksheet / IANZ Records** | **Hold /**  **Witness** | **Internal / External** | **PS3 Owner** | **Hold /**  **Witness** | **PS4 Owner Sign Off** |
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| **1.0 PRE-CONSTRUCTION** | | | | | | | | | | | |
| 1.01 | Check IFC Drawings | Awaiting IFC Drawings | Ensure latest revision is being used | Correct drawings | Prior to works, updated accordingly based on formal correspondence | Controlled IFC drawings being used – Checkpoint on QA | HOLD | Internal | JFC | WITNESS | ENGEO |
| 1.02 | Erosion and Sediment Control | ENGEO – NAL CH 125.603: Drawing 15 Section 1.1 | The contractor is responsible for protecting earthworks and erosion control measures and must develop a site-specific Environmental Control Plan (ESCP) that KiwiRail must review before construction begins. | Contractor to ensure effective erosion and sedimentation control measures shall be installed and maintained in accordance with Auckland Council Resource Consent Requirements, and the ESCP. | Before construction begins | ESCP Documentation, Photos, Daily and Weekly Audits | HOLD | External | JFC | HOLD | ENGEO |
| 1.03 | Pre-start meeting – Construction Methodology (Drilling) | ENGEO – NAL CH 125.603: Drawing 15 Section 1.0 | A pre-start meeting with Engineer and Contractor is needed to ensure understanding of construction methodology, review work plan and methodology for Geotechnical Professional with specific attention to the drilling methodology and ensure safety measures are in place. | Construction methodology (drilling) agreed between Contractor and Engineer | Prior to commencement of works | Written Confirmation of Engineer’s approval | HOLD | External | JFC | HOLD | ENGEO |
| 1.04 | Pre-start Meeting - Retaining Wall Construction) | ENGEO – NAL CH 125.603: Drawing 15 Section 1.1 | Pre-start meeting and health and safety plan for retaining wall construction | Construction methodology of retaining wall and health and safety plan agreed between Contractor and Engineer | Prior to commencement of works | Written Confirmation of Engineer’s approval | HOLD | External | JFC | HOLD | ENGEO |
| 1.05 | Survey and Setting Out | ENGEO – NAL CH 125.603: Drawing 15 Section 1.1 | Contractor responsible for survey or set out required. Engineer shall be given opportunity to witness the works | Acceptable as-built tolerance for the locations of the pile holes +- 75mm. | Engineer notified 48 hours in advance | Written Confirmation from Engineer, Survey Records | HOLD | External | JFC | HOLD | ENGEO |
| 1.06 | Locations of Steel Posts, Anchors, and Walers | ENGEO – NAL CH 125.603: Drawing 15 Section 1.0 | The Engineer shall confirm on-site the locations of steel posts, anchors, walers and proposed retained heights as set out by the Contractor | Locations and proposed retaining heights confirmed by the Engineer. | Prior to installation of steel posts, anchors, and walers. | Written Confirmation from Engineer, Survey Records, QA Checksheet(s) | HOLD | External | JFC | HOLD | ENGEO |
| **2.0 STORMWATER DRAINAGE** | | | | | | |  | | | **ENGINEER** | |
| 2.01 | Materials | ENGEO – NAL CH 125.603: Drawing 13-14 | Materials as per the design drawings | All drainage materials comply with the drawings | Prior to use of materials on site | Dockets, QA Checksheet(s), Photos | HOLD | External | JFC | REVIEW | ENGEO |
| 2.02 | Installation | ENGEO – NAL CH 125.603: Drawing 13-14 | Drainage works to be installed in accordance with the design drawings. | Drainage works constructed in accordance with the drawings | Engineer to check prior to backfill of drainage items | Photos, QA Checksheet(s), Written Confirmation of Engineer’s Approval | HOLD | External | JFC | REVIEW | ENGEO |
| 2.03 | Swale Improvement | ENGEO – NAL CH 125.603: Drawing 13 | Swale improvement as per the design drawings | Swale improvement comply with C-ST-CD-4102 | For every section of swale improvement works | Photos, QA Checksheet(s) | HOLD | External | JFC | REVIEW | ENGEO |
| **3.0 RETAINING WALL CONSTRUCTION** | | | | | | |  | | | **ENGINEER** | |
| 3.01 | Material - Steel | ENGEO – NAL CH 125.603: Drawing 15 Section 1.5.1 | · Steel piles shall be grade 300 and pile lengths and spacing shall be as detailed on the design drawings.  · Steel components, excluding UB piles, must be galvanized with hot dip galvanising to HDG600, following AS/NZS 2312:2002, and UB piles should be coated with epoxy before installation.  · Steel cuts must be painted with approved zinc-rich primer and “black beauty” within one day, with a protective layer and malthoid as a separation between the two materials. | All steel supplied and installed comply with drawings and specifications | For all supplied and installed steel | Dockets, Photos, QA Checksheet(s) | HOLD | External | JFC | REVIEW | ENGEO |
| 3.02 | Material - Timber | ENGEO – NAL CH 125.603: Drawing 15 Section 1.5.2 | · All lagging shall be radiata pine treated to specification H5, SG8 (wet) verified timber.  · Timber must be marked with TPA identification brands upon delivery to the site and protected against damage during storage and handling.  · Avoid timber cutting whenever possible and if necessary, flood exposed surfaces with a copper napthenate wood preservative. | All timber supplied and installed comply with drawings and specifications | For all supplied and installed timber | Dockets, Photos, QA Checksheet(s)+ | HOLD | External | JFC | REVIEW | ENGEO |
| 3.03 | Material - Concrete | ENGEO – NAL CH 125.603: Drawing 15 Section 1.5.3 | · Concrete for foundation backfill shall be ordinary grade concrete complying with NZS 3109 and with a 28-day strength of 17.5 MPa  · Concrete should be placed under and around piles, compacted by vibrating, and temporarily propped and protected against disturbance for at least two days after placement. | All concrete supplied and installed comply with drawings and specifications | For all concrete supplied and placed | Dockets, Photos, QA Checksheet(s) | HOLD | External | JFC | REVIEW | ENGEO |
| 3.04 | Material - Geotextile Fabric | ENGEO – NAL CH 125.603: Drawing 15 Section 1.9 | The geotextile fabric should be placed according to the drawings and must be of unwoven strength Class B, such as Bidim A19 or Duraforce AS280. The lap width of adjacent strips of geotextile sheets shall be a minimum of 1m. | Geotextile material and installation in accordance with the drawings and specifications  Engineer shall inspect the lagging and drainage fabric prior to placement of backfill | For all supplied and installed geotextile material  Engineer shall inspect the lagging and drainage fabric prior to placement of backfill | Dockets, Photos, QA Checksheet(s) | HOLD | External | JFC | HOLD | ENGEO |
| 3.05 | Material – Timber Railing and Fixing | ENGEO – NAL CH 125.603: Drawing 15 Section 2.1 | Rails (or lagging) must be made from Radiata Pine, bore, cut, machined, processed, and treated to H5 according to the drawings  Timber lagging shall be rough EX sizing, e.g. 150 x 50mm not 145 x 45mm dressed sizes. | All timber rails and fixing comply with drawings and specifications | For all supplied timber rails and fixings | Dockets, Photos, QA Checksheet(s) | HOLD | External | JFC | REVIEW | ENGEO |
| 3.06 | General Tolerances | ENGEO – NAL CH 125.603: Drawing 15 Section 1.6 | The assembly of component parts must adhere to the specified tolerances, ensuring they are not twisted or damaged.  General tolerances:  · Straightness 2mm / 500mm length  · Structural dimensions + 3mm  · Plan position of structural members 5mm  · Level of structural members + 40mm  · Pile toe level + 25mm Vertically 1H:75V | Tolerances specified on the drawings and specifications always adhered to. | For all assembled components | QA Checksheet(s), Survey As-buitls | HOLD | External | JFC | REVIEW | ENGEO |
| 3.07 | Excavation and pile install | ENGEO – NAL CH 125.603: Drawing 15 Section 1.1 | Engineer shall inspect the installation of the posts once holes have been augered to depth. | Pile excavation and install approved by the Engineer | Once holes have been augered to depth and once piles installed. | QA Checksheet(s), Photos, Written Confirmation of Engineer’s approval | HOLD | External | JFC | HOLD | ENGEO |
| 3.08 | Backfilling | ENGEO – NAL CH 125.603: Drawing 15 Section 2.0 | Backfilling shall be undertaken as indicated on the drawings.  Backfill requiring compaction should be placed behind the retaining wall and compacted using lightweight equipment in lifts no thicker than 200mm within the upper 1m.  Allow for 7 days concrete curing of pile holes prior to backfilling.  A perforated subsoil drain should be placed and surrounded by free draining material with an invert below ground levels, connected to a uPVC pipe and outlet via a rock splashpad in the site plan's approximate location. | Backfill compaction requirements: >90% MDD (NDM) and/or CIV 20 (Cleggs)  Engineer approval of the lagging and drainage fabric prior to placement of backfill | Bckfill tested every 500mm (vertical)  Engineer shall inspect the lagging and drainage fabric prior to placement of backfill. | QA Checksheet(s), NDM and/or Clegg Results | HOLD | External | JFC | HOLD | ENGEO |
| 3.09 | Timber Rail and Fixings | ENGEO – NAL CH 125.603: Drawing 15 Section 2.1 | Timber lagging should start at the wall's bottom, with careful selection and placement of horizontal timbers to maintain minimum thickness near the base and achieve neat lines at the top.  Surfaces exposed to pressure treatment, including bolt holes, should be protected with a liberal brush application of copper naphthenate, colored to leave a visible stain. | Timber rails and fixings constructed in accordance with the drawings and specifications. | For every section of timber rail and fixings installed  Engineer shall observe installation of the PFC walers | Photos, QA Checkshee(s) | HOLD | External | JFC | HOLD | ENGEO |
| 3.10 | Inspection of Completed Wall | ENGEO – NAL CH 125.603: Drawing 15 Section 1.0 | The engineer will inspect the finished wall, while the contractor will provide as-built drawings detailing the final construction of remedial works, including any amendments made during construction. | Finished wall approved by the Engineer  End details of the wall agreed with the Engineer and constructed accordingly. | Upon completion of wall | Photos, QA Checkshee(s), As-builts | HOLD | External | JFC | HOLD | ENGEO |
| **4.0 ANCHOR INSTALLATION** | | | | | | |  | | | **ENGINEER** | |
| 4.01 | Materials – Anchor | ENGEO – NAL CH 125.603: Drawing 16 Section 1.1 | Refer to design drawings for specific detail of the anchors at each location. | Anchors adheres to design drawings | For every anchor installed | Photos, Dockets, QA Checksheet(s) | HOLD | External | JFC | REVIEW | ENGEO |
| 4.02 | Materials – Anchor Components | ENGEO – NAL CH 125.603: Drawing 16 Section 1.2 | ·The anchor components and accessories must adhere to the manufacturer's specifications and installation guidelines.  ·AS/NZS 4680 requires hot dip galvanization of steel plates, brackets, nuts, and bearing wedge plates to HDG900.  ·All anchors shall be epoxy coated | Anchor components adheres to the specifications | For every anchor components | Photos, Dockets, QA Checksheet(s) | HOLD | External | JFC | REVIEW | ENGEO |
| 4.03 | Materials – Grout | ENGEO – NAL CH 125.603: Drawing 16 Section 1.3 | ·The cement rich grout shall comprise ordinary Portland cement with potable water.  · Water cement ratio shall not be less than 0.35 or greater than 0.45.  · Standard cured compressive strength shall not be less than 25 MPa at 7 days and 40 MPa at 28 days. | Grout adheres to the specifications.  Compressive strength test results for grout at 7 days min 25MPa and 28 days min 40MPa | For every anchor grouting works | Dockets, QA Checksheet(s), Concrete Test Results | HOLD | External | JFC | REVIEW | ENGEO |
| 4.04 | Anchor Drilling | ENGEO – NAL CH 125.603: Drawing 16 Section 2.1 | ·Anchor holes must be drilled to align with the required anchorage locations, as per drawings and site assessment by a Geotechnical Professional.  ·Drilling fluids other than air should not be used during drilling unless agreed upon with the Geotechnical Designer beforehand.  ·Anchors must be drilled and grouted within a day, and their holes should not remain open overnight.  ·The drill bit's diameter must not be less than the specified diameter as depicted in the design drawings. | Anchor drilling adheres to the specifications. | For every anchor drilling works | Photos, QA Checksheet(s) | HOLD | External | JFC | REVIEW | ENGEO |
| 4.05 | Anchor Drilling – Drilling Log | ENGEO – NAL CH 125.603: Drawing 16 Section 2.1 | The Driller shall maintain a drilling log for each anchor recording the following:  a. Anchor location or number.  b. Date and time of the start and finish of drilling.  c. Depth, diameter and inclination of hole.  d. Length of bar installed.  e. Flushing medium.  f. Method of drilling hole.  g. Water losses from hole.  h. Water seepage from hole.  i. Ground conditions encountered and ease of drilling.  j. Nominal and actual volume of grout placed.  k. Length of casing used (if any).  l. Problems such as caving that occurred during drilling.  m. Drilling equipment used.  n. In situ material type description and comment on any material changes or interfaces  o. Rate of penetration during drilling  p. moisture content of material and any changes to moisture content during drilling | The drilling logs maintained and logs adhere to the specifications.  Approval of drilling logs by the Geotechnical Professional. | The Geotechnical Professional must receive a drill log within 24 hours of drilling each anchor hole. | Drilling Log | HOLD | External | JFC | REVIEW | ENGEO |
| 4.06 | Anchor Insertion | ENGEO – NAL CH 125.603: Drawing 16 Section 2.2 | ·The anchor must be inserted into the hole within two hours of drilling, unless agreed upon by the Engineer. If the anchor becomes jammed, the hole must be grouted and the anchor cut off. A new hole must be drilled within 300mm of the jammed anchor. | Anchors inserted as per the specification.  Insertion approved by the Engineer. | For every anchor insertion  Engineer shall observe installation of tie-back anchors. | QA Checksheet(s), Photos | HOLD | External | JFC | HOLD | ENGEO |
| 4.07 | Anchor Grouting | ENGEO – NAL CH 125.603: Drawing 16 Section 2.2 & 2.3 | · Grouting should occur during or after anchor installation to prevent hole collapse or restriction, and no hole should remain open overnight without Engineer's approval. Contractor must provide grouting methodology to ensure full grout return and minimize 'birds peaks'.  · Anchor installation does not anticipate grout loss, and if over 300% of theoretical hole volume is lost, the Geotechnical Engineer must be notified. Proposed measures must be approved by the Designer. | Grouting methodology approved by the Engineer and adhered to by the Contractor.  Proposed measures for grouting loss (if required) approved by the Engineer.  Compressive strength test results for grout at 7 days min 25MPa and 28 days min 40MPa | For every anchor grouting works  Compressive testing at 7 and 28 days for grout placed.  Engineer shall observe installation of tie-back anchors. | Grouting Methodology Submission, Concrete Lab Test Results @ 7 and 28 days, Written Confirmation from Engineer | HOLD | External | JFC | HOLD | ENGEO |
| **5.0 ANCHOR TESTING** | | | | | | |  | | | **ENGINEER** | |
| 5.01 | Anchor Testing – General | ENGEO – NAL CH 125.603: Drawing 16 Section 3.1 | ·Load cells calibrated within the last 6 months are used for sacrificial and production anchor testing, conducted by a qualified laboratory. Calibrations must be certified.  ·The sacrificial and production anchor load tests will only be conducted once the grout has reached the specified 7-day strength.  ·Design loads are specified in the design drawings attached.  ·The construction team is required to record all data and provide it to the Geotechnical Professional within two working days of the tests' completion. | Anchor testing adheres to the specifications | Data submitted to the Geotechnical Professional within two working days of test completion | QA Checksheet(s), Test Results, Photos | HOLD | External | JFC | REVIEW | ENGEO |
| 5.02 | Sacrificial Anchor Testing | ENGEO – NAL CH 125.603: Drawing 16 Section 3.2 | Sacrificial anchor tests demonstrate tieback anchor failure load and grout bond stress in soil and rock masses, not mesh anchors. Engineering sign off and PS4 provided after completion of the following:  · Contractor shall submit a proposed test methodology prior to work commencing  · The displacement of the sacrificial anchors are to be measured at each of the loading points outlined in Table 3 (snippet below)  · The locations of the anchors to be tested shall be decided onsite with the Geotechnical Professional.  · Sacrificial test anchors drill hole diameter is to be the same as production anchors.  · The locations of the anchors to be tested shall be decided onsite with the Geotechnical Professional.  · Sacrificial testing is to be completed a minimum 7 days after installation or when grout has reached 25 MPa as confirmed by grout cube testing.  · Bond lengths shall be confirmed by the Engineer.  · Testing Schedule is given in Table 4 (snippet below)  · Items to be recorded on the load testing sheet shall include:  1. Name of company undertaking test.  2. Anchor number and location.  3. Name of person supervising test.  4. Date and time of start of test  5. Jack and pump model and number and calibration details.  6. Hole diameter.  7. Bond length.  8. Free length (measures from top of jack to top of bond).  9. Hole inclination.  10. Bond material type.  11. Proposed and achieved loads and cell pressures before and after each load step.  12. Time of each loading step.  13. Duration of each load step. | Sacrificial anchor testing adheres to the specifications.  Anchor test results, sacrificial and proof tests, including load vs displacement plots in accordance with Tables 3 and 4 (snippet below)  Proposed test methodology reviewed and approved by the Engineer and adhered to by the Contractor.  Test locations agreed between Contractor and Geotechnical Professional.  Sacrificial Testing only completed once grout has reached 25MPa  Load Testing sheet includes all necessary details as listed on the specification and filled out to its entirety.  Approval of testing and results by the Engineer (PS4) | · Sacrificial anchor tests are to be carried out before works commence  · Proposed test methodology submitted at least 2 working days prior to work commencing.  · Sacrificial testing is to be completed a minimum 7 days after installation or when grout has reached 25 MPa as confirmed by grout cube testing.  · Engineer shall observe testing of tie-back anchors.  · The locations of the anchors to be tested shall be decided onsite with the Geotechnical Professional.  · All stressing data shall be recorded by the Constructor and issued to the Geotechnical Designer within 2 working days of the completion of the stressing of each anchor. | QA Checksheet(s), Photos, Approved Test Methodology, Load Testing Sheet, Written Confirmation from Engineer/Geotechnical Professional | HOLD | External | JFC | HOLD | ENGEO |
| ***Snippets from ENGEO – NAL CH 125.603: Drawing 17*** | | | | | | | | | | | |
| 5.03 | Production Anchor Testing | ENGEO – NAL CH 125.603: Drawing 16 Section 3.3 | The acceptance testing aims to demonstrate that the anchor can withstand the design loading. The following must be completed for Engineering sign off (and PS4) to be provided:  · 15% of the anchors shall be proof tested. The displacement of the production anchors are to be measured at each of the loading points outlined in Table 4 (snippet below)  · The locations of the anchors to be tested shall be decided onsite with the Geotechnical Professional.  · Test loads will be supplied by the Designer prior to acceptance testing.  · Anchor testing criteria in accordance with New Zealand Ground Anchor design Guideline Section 7.4.5 of the 'FHWA-IF-99-015-Ground Anchors and Anchored Systems'. Anchors must meet the following acceptance criteria:  1. In order for the load test to be considered stable the total movement measured during the required load hold at the design test load should not exceed 1 mm between 1 to 10 minutes. If it is greater than 1 mm the load shall be held for an additional 50 minutes - in this time the creep shall not exceed 2 mm between 6 to 60 minutes. If creep is greater than 2 mm following this time period contact the Geotechnical Designer or design team representative for guidance.  2. The apparent free length shall not be greater than the jack length plus 100% of the unbonded length plus 50% of the bonded length. The apparent free length is back calculated from the elastic movement measured during the load test, contact the geotechnical designer or design team representative for guidance | Acceptance testing adheres to the specifications.  Test results comply with The New Zealand Ground Anchor Design Guidance - Figure 73 in 'FHWA-IF-99-015-ground anchors and anchored systems'  Test locations agreed between Geotechical Engineer and Contractor  Test loads supplied by the Designer used for the acceptance testing.  Approval of testing and results by the Engineer (PS4) | 15% of the anchors shall be tested. Locations to be decided on site with the Geotechnical Professional | QA Checksheet(s), Photos, Testing Results, Written Confirmation from Engineer/Geotechnical Professional | HOLD | External | JFC | HOLD | ENGEO |
| ***Snippet from ENGEO – NAL CH 125.603: Drawing 17*** | | | | | | | | | | | |
| **6.0 FORMATION CONSTRUCTION** | | | | | | |  | | | **ENGINEER** | |
| 6.01 | Structural Fill (for CBR <3%) | ENGEO – NAL CH 125.603: Drawing 15 | 900mm thick structural fill (GAP65 or GAP40 with geogrid) | Compaction min CIV = 25 | Clegg Hammer Tests  Frequency not specified – to be confirmed by Engineer | Photos, Clegg Test Results | HOLD | External | JFC | REVIEW | ENGEO |
| 6.02 | Structural Fill (for CBR <3%) | ENGEO – NAL CH 125.603: Drawing 15 | 300mm thick bus-ballast (GAP40) | Compaction min CIV = 30 | Clegg Hammer Tests  Frequency not specified – to be confirmed by Engineer | Photos, Clegg Test Results | HOLD | External | JFC | REVIEW | ENGEO |
| 6.03 | Construction of formation | ENGEO – NAL CH 125.603: Drawing 15 | Formation construction as per Kiwirail Standard C-ST-FO-4110 Formation | Kiwirail Standard C-ST-FO-4110 Formation for construction compliance | For every section of formation as shown on the drawings | QA Checksheet(s), Photos | HOLD | External | JFC | REVIEW | ENGEO |

### Sub-contractor ITPs (Refer to OP06\_f09 ITP Index for Subcontractors)

| **ITP#** | **Work Pack Element(s)** | **Drawing / Specification Ref.** | **Specification Detail Summary** | **Acceptance Criteria** | **Test Spec & Frequency** | **Control Type i.e. Checksheet / IANZ Records** | **Hold /**  **Witness** | **Internal / External** | **PS3 Owner** | **Hold /**  **Witness** | **PS4 Owner** |
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| **Sub Activity 1 (INSERT QA SHEET NAME)** | | | | | | | **(ENTER SUBCONTRACTOR)** | | | **ENGINEER** | |
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| **Sub Activity 2 (INSERT QA SHEET NAME)** | | | | | | | **(ENTER SUBCONTRACTOR)** | | | **ENGINEER** | |
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### ITP Induction Sign On

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