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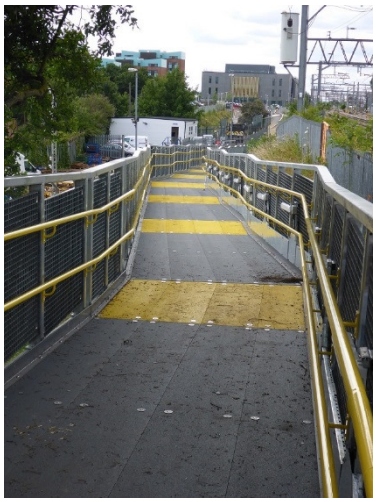
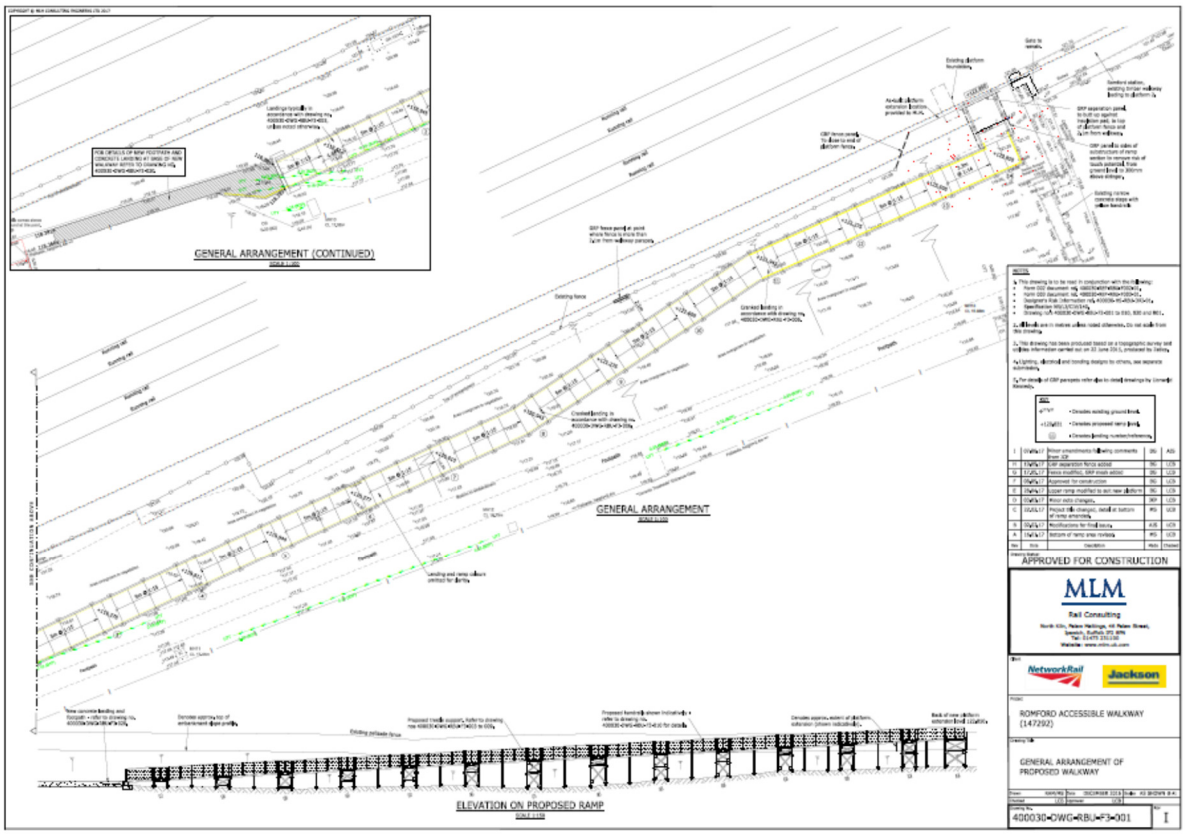
Case Study – Romford Accessible Walkway Foundations
NWR Project Number 14297





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Brief Project Summary

The walkway shown in the drawing above was required to allow direct access from the newly constructed NWR Training Centre to Romford station.

The route of the walkway was a historic 'made ground' embankment directly adjacent to the mainline with no mechanical access from below. Initial discussions about the construction of foundations for the walkway revolved around track possessions and likely line blockages to enable a road/rail piling rig to access the embankment from above. However, based on the extremely long leadtime to arrange this, the level of commuter disruption and cost of this type of construction another solution was sought.

MLM Group, NWR approved civil engineers, who had been instructed by the PC for this project proposed a Track Screw solution. MLM had some experience with Track Screw Anchors from the exploratory work completed with Thales on 4LM in 2015/16.

After initial discussions and review of predicted loading Track Screw issued MLM product details on the Krinner KSF V series screw and MLM proceeded with their calculations.

The KSF V screw was selected based on its 5.0mm was thickness & minimum average 120µm galvanised coating, providing a NWR accepted 60-year design life in the ground conditions found at the Romford embankment. Additionally, the KSF V screws are extendable from 2.15m to 3.5m, allowing the same screw type to be installed across the entire site with different loadings at various node points.

Track Screw Ltd enquired with the selected civil contractor, Jackson Civil Engineering Ltd, if they had produced an estimate for the project using traditional methods. They provided the following statement: -

> 'We didn't work up a price for any other methods as we could see that by inspection it would be more expensive. The issue at Romford was purely around access, there is nowhere to stand a rig of any sort apart from at the rear of the platform at the top of the embankment. The level of temporary works to get any plant of any size in a position to install anything substantial was prohibitive. A major design house had designed a scheme but both Volkerfitzpatrick and ourselves could see know way to construct it without blockades of the railway and extensive temporary works.'

This statement makes it clear that Track Screw was the only available technology to allow this project to be built.

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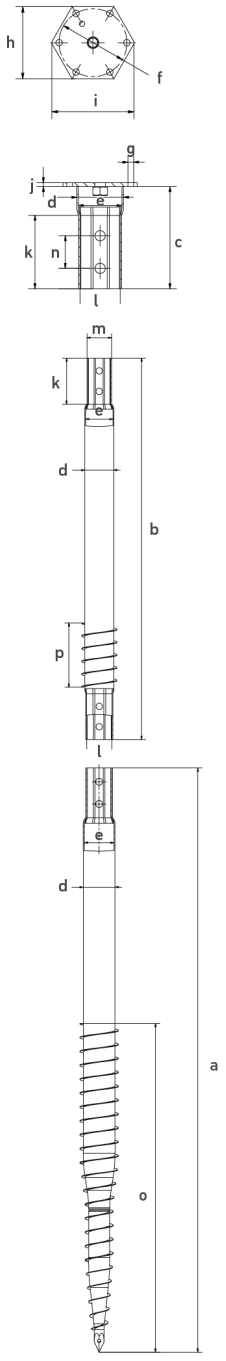
Screw Information Technical Information – Krinner KSF V

KRINNER
The Ground Screw

Technical Data

	KSF V 114x2100-PT	KSF V 114x1500-ET	KSF V 114-M24
a	Length PT (mm)		
	2100	–	–
b	Length ET (mm)		
	–	1500	–
c	Length M24 (mm)		
	–	–	250
d	Shaft outer diameter (mm)		
	114.30	114.30	114.30
e	Inner diameter (mm)		
	107.10	107.10	107.10
f	Pitch circle diameter (mm)		
	–	–	150
g	Pitch circle holes (mm)		
	–	–	6 x Ø 14
h	Flange wrench size (mm)		
	–	–	160
i	Flange outer diameter (mm)		
	–	–	182
j	Flange thickness (mm)		
	–	–	10
k	Octagon connection height (mm)		
	180	180	180
l	Octagon female inner diameter (mm)		
	–	98.40	98.40
m	Octagon male outer diameter (mm)		
	96.70	96.70	–
n	Octagon hole center distance (mm)		
	80	80	80
o	Thread length PT (mm)		
	1100	–	–
p	Thread length ET (mm)		
	–	250	–



Design Process

Following receipt of the technical information on the KSF V product from Track Screw, MLM independently completed the calculations, CAT1B checking, all required drawings, completed and submitted NWR Form 2 & 3, which received NWR approval. Copies of the F002 & F003 are in the appendix of this Case Study.

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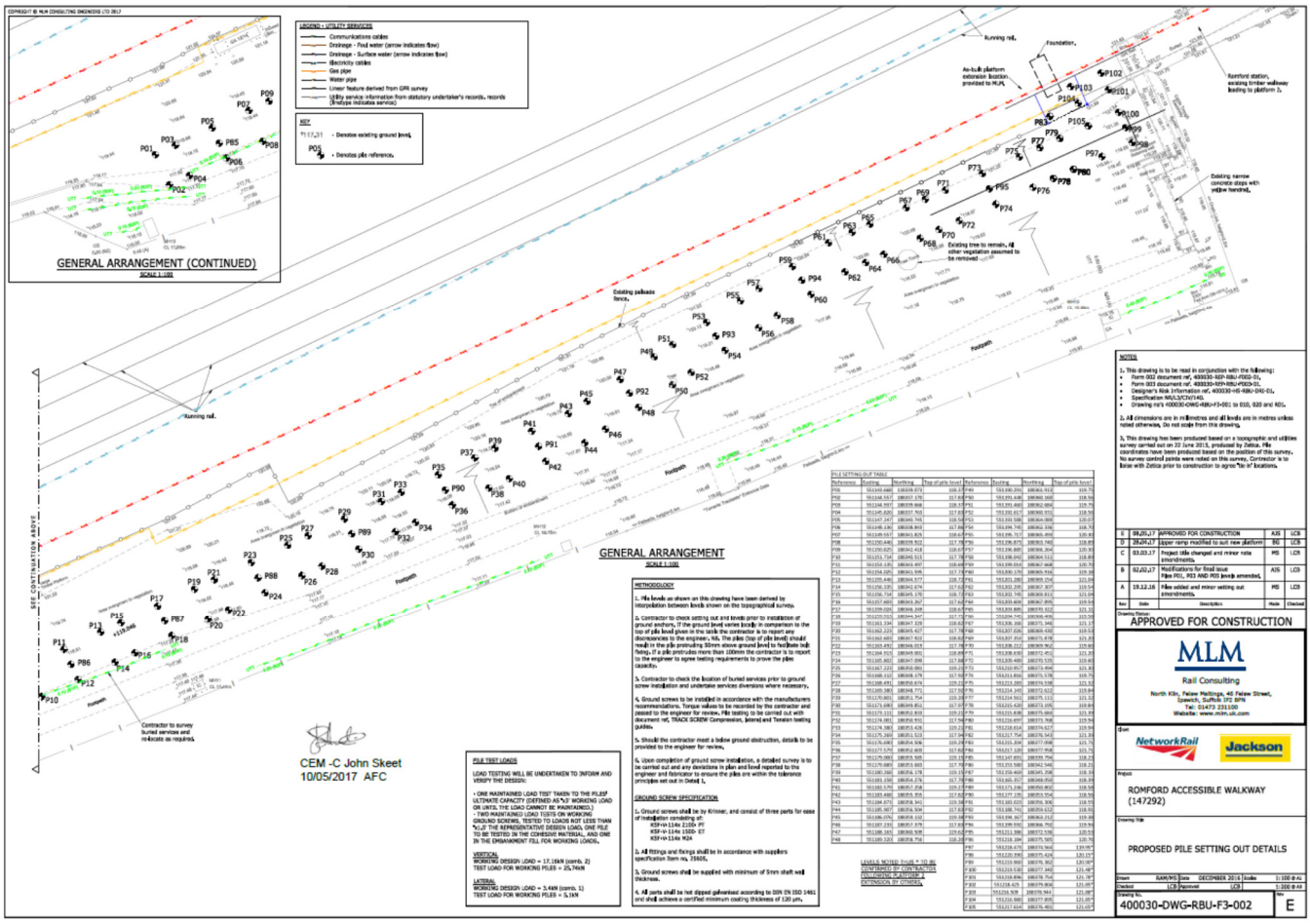
Installation



The installation contractor for the project contacted Track Screw to arrange training of their staff in the use of the TSL DA1 18V tooling. Track Screw completed 2 No single day courses training a total of 9 operatives.

The contractor ordered all the screw materials required for the project, including a pair of additional screws to be used for destructive testing. All these elements were delivered to the customer within 5 weeks.

They then hired 2 tools with additional batteries to prevent down time.

The drawing above shows the 98 final screw positions.

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The photos above illustrate the issues with the installation area that led the PC to seek an alternative solution.

The installation of the 98 screws was completed in a 3-week period, during standard 5-day working week shifts with only a 4-man installation team on site at any one time. The fact that all materials and machinery used could be manually carried on to site meant that no track possessions were needed to complete the Track Screw install.

The initial design was based on limited geotechnical data gathered from only 2 boreholes completed on the embankment. This data suggested a soft ground requiring the majority of the screw positions to require 3.5m screws. However, during the installation stage a number of the early screws installed met early refusal, even using the maximum 5,400Nm of torque available from the TSL DA1 tool.

As the KSF V screw is supplied in sections the contractor were simply able to install the 2.1m lead section and then fit the cap piece. In the end 14 No of the 3.5m screws needed to be installed in the areas of softer ground, while the remaining 85 No screws were installed as 2.25m.

Testing

Following the installation, the PC employed the services of an independent testing company attend site and complete 150% SWL tests (compression & lateral loads) on a random selection of 10% of the working screws. The two additional sacrificial screws were also tested to 300% of the SWL. All the screws tested passed with minimal deflection under the test loading and showing good recovery of deflection after the test loading was removed. A sample of the test reports are included in the appendix of this Case Study.

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Summary of the Benefits of Track Screw Over Concrete Foundations

Quicker & Safer – **Up to 90%+ savings in Labour**
Lighter Installation Equipment & Lighter Materials – **Nothing over 25kg in weight**
Less Manpower Required
No Excavation, No Spoil, No Wet Trades, No Curing Time
Quieter, No Generator, No Fumes, No Fuel, No Vibration
Environmental Savings, 1m³ of Concrete = 250kg of CO_2, 1 Track Screw = 20kg CO_2 – **Up to 85% less CO_2**

- **Survey Requirements**
  - Traditional ground survey, e.g. bore holes, cost £1k+, require heavy plant & take 1-week+ to book
  - For Track Screw, you only need soil density numbers & soil classification to 1.5m depth. This can be taken on the day of install using a had held CBR probe and hand auger

- **Speed & Manpower**
  - 1m³ concrete pad will take a 4-man team a day to construct and 1-week to cure
  - One Track Screw can give same capacity, be installed in 10-mins by 2-men & loaded immediately
  - 5m³ concrete pad will take a 6-man team 3-days to construct and 1-week to cure
  - 4 No Track Screws with a transfer grillage installed by a 4-man team in 2-hrs & loaded immediately

- **Tooling**
  - Installation contractors can hire TSL's unique 18V Lithium Ion battery powered screw installation tool, the kit includes all parts required to install screws from 600mm to 1800mm long in to any ground conditions
  - Even installing the longest screws into the hardest ground, the tool will complete multiple screws with a single battery, shorter screws into softer ground will allow significantly more installs per battery, each tool is hired out with 4-batteries & a charger, each battery weighs less than 1kg
  - The tool itself weighs less than 20kg in its transport box. All other elements of the installation kit weigh less than 18kg and so can be easily carried & handled
  - TSL have exclusive licence from the global patent holder of the tooling for the UK rail sector
  - TSL offer a full training course for installers and a technical assistance team to provide installation advice

- **Track Screw Anchors**
  - Single piece screws, lengths from 600mm to 2100mm, final diameters from ø60.3 to ø139.7
  - Maximum capacities from single screw 45kN tension & compression, 20kN shear & 15kNm moment
  - Rail Spec screws have 110mµ galv coating giving assumed service life of 40-years, 25-year warranty
  - TSL can also offer screws made from 304 Stainless Steel giving 70+ year lifespan
  - TSL offer a fully technically assured service, calcs & warranties
  - TSL can offer on-site testing of installed screws or train operatives to complete testing
  - TSL have exclusive licence from 2 largest manufactures for screw supply for the UK rail sector

- **Savings**
  - Recent install of 56 screws in place of concrete showed 94% saving in labour & 85% saving in CO_2

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Project title	**Romford Accessible Walkway**		
Project Number	**147297**		
CR-T Ref. Number		**Statement Ref**	**Rev.**
Location	Between London end of platform 2 at Romford Station and ROC building		
ELR	LTN1	Mileage	12m 30ch (Romford Station)
OS grid reference	TQ512884	Structure Number	n/a

MLM reference: 400030-REP-RBU-F002A

PART 1: DETAILS

1.1 Scope of Design works

As set out in the Contracts Requirement Technical (CR-T), this submission relates to the Design of the following altered or new asset(s).

Description of asset	Permanent or Temporary Works
New walkway leading off the back of the new platform 2 extension, traversing along and down the embankment before tying in with the existing concrete footpath.	Permanent Works

For further detailed description of the proposed works refer to Form F001 reference 400030-REP-RBU-F001.

It should be noted that the design within this Form F002 is for the elevated walkway section only. The remainder of the walking route has not been reviewed/investigated at this stage.

Coordination with the Mechanical and electrical designers will be undertaken to ensure compatibility of the designs and a holistic approach.

The tie-in to the platform 2 extension will be completed to coincide with the as-built detail itself, but it is proposed to incorporate an expansion joint to ensure separation of the two structures. This will limit any interaction between the two scheme designs, however they will need to be coordinated on site from a practical point of view.

1.2 Proposals for the staging of the Design and Design Check submissions

The Form 003 document, drawings, and calculations package, which will include a Category 1B check in accordance with NR/L2/CIV/003, will be submitted as a combined package with this Form 002.

1.3 Design statement

Superstructure

To keep the weight being imposed on the embankment to a minimum, a solid GRP decking with integral anti slip finish is proposed and shall be supported by a steel frame structure and intermediate steel supports. The decking is to be designed for an imposed load of 5kN/m^2, in accordance with section 4.2 of NR/L3/CIV/020 and section 6.3.7 of BS EN 1991-2. The design shall also consider the effects of wind load and horizontal handrail loads in accordance with Eurocodes. The steelwork frame shall be designed using normal elastic theory, and checked for bending, shear and deflection as well as localised effects. Thermal effects will be accommodated within the superstructure with suitable expansion methods to accommodate predicted thermal movement.

Double height handrails (for disability use, with appropriate colour contract and 'touch' finishes) will be provided in accordance with standard heights, and the design assumes that existing site boundary fencing arrangements are adequate for overall security to the railway. The clear ramp width is to be 1800mm and landings are to be 1500mm long. Ramp gradient, to suit levels and geometry, will be in accordance with DoT Design Standards for Accessible Railway Stations.

The ramp/landing edge steelwork shall be supported on steel columns, likely to be 4No. per landing and adequately braced against lateral effects. The columns shall be supported on individual ground screws via a bolted plate connection, with the top of the ground screw effectively tied together to provide lateral 'grouping' with regards to stability. Due to the bracing, the structural steelwork members will be designed with pin end connections and the overall system checked for deflection. An intermediate ramp support shall consist of a lateral steel member supported on steel columns, that in turn shall be supported on individual ground screws via a bolted plate connection. The columns shall be braced against lateral effects as required.

At the lower end of the ramp the walkway will be supported on a concrete bankseat foundation with a small upstand retaining wall to accommodate the variation in ground levels.

It is proposed to apply a galvanised protective system to the new steel elements, supporting the GRP decking, to achieve a design life in excess of 60 years.

Ground Screw Foundations

<u>Introduction and Loading</u>

The superstructure steelwork will be modelled using CADS 3D with pinned supports representing the piles in the model. The lateral and vertical reactions will be extracted from the model to use for the design of the piles. Due to the trestle arrangements and the bracing arrangement, the lateral effects will be redistributed between the connected piles at each location to reflect the global behaviour of the structure. From the site investigation the ground conditions vary along the length of the walkway and some piles will be embedded in cohesive material and others within the embankment granular fill. The pile capacity will be calculated for both cohesive and granular

material to ensure the suitability of the piles for the applied forces and ground conditions along the length of the walkway. The ground parameters will be based on the GIR data with the key design parameters outlined in geotechnical section of this Form F002.

To permit access for connecting the base plate of the column to the top of the pile shall finish 50mm will be above ground level. To allow for disturbance of the ground during installation and for the slope variability the first 300mm of the pile shaft within the ground will be discounted when calculating capacity. Therefore the embedded depth of the pile will be measured from 350mm below the top of the pile to the toe. When calculating overburden pressure, this will be taken from ground level at the centre of the pile diameter.

The combined lateral and vertical applied forces will be used to determine the moments and forces induced within the ground screw along with the interaction between the pile and soil utilising Birch-Hansen theory. The induced moments and forces will be compared to published data tables to select the appropriate ground screw.

In accordance with BS EN 1997-1 and the National Annex (NA) for design the following will be used:

- Design approach 1
- For combination 1
    - Set A1 as per NA A2.2.4 (B) in BS EN 1990 NA for loading factors
    - The leading variable is the pedestrian loading
    - The wind loading will be treated as other variable and as per note 5 can be reduced to 1.55 factor from 1.7 as the design life is under 120 years if required will consider as 1.7 factor in first instance.
    - As pile resistances will be verified by testing and the ground parameters are based on ground investigation and testing the model factor will be taken as 1.2
- For combination 2
    - Set A2 as per NA A2.2.4 (C) in BS EN 1990 NA for loading factors
    - The leading variable is the pedestrian loading
    - The wind loading will be treated as other variable and as per note 5 can be reduced to 1.3 factor from 1.45 as the design life is under 120 years if required will consider as 1.45 factor in first instance.
    - As pile resistances will be verified by testing and the ground parameters are based on ground investigation and testing the model factor will be taken as 1.2
    - For pile resistances R4 verified factors for the base and shaft resistances will be used as suitable testing will be under taken to verify the design.
    - For pile resistances M1 set of factors will be used and M2 set of factors will be used for unfavourable effects in accordance with NA A.NA.4 for the soil properties

Distribution

Due to the trestle and bracing arrangements, the lateral and vertical effects can be redistributed between the connected piles at each location to reflect the global behaviour of the structure. The re-distribution of forces will occur due to the bracing and connections being sufficiently stiff. This process involves:

- Taking the loading from the model for the combinations listed above, and checking against the resistances calculated for lateral and vertical actions in accordance with Eurocode 7.
- Then rechecking by taking from the model the vertical loading for combination 1 and 2 without wind loading. Then the vertical loading can be averaged for connected piles at the landing to reflect the distribution via the steelwork ground frame which is not fully reflected in the CADS 3D due to the nature of modelling software.
- The wind load effect will be calculated by taking the model reaction for combinations with wind loading and deducting the model reaction for combinations with no wind loading.
- The calculated wind load effect can then be added to the averaged pile loading.

  This then can be compared to the calculated resistance.

Pile Resistance

For piles within granular material e.g. embedded in the embankment fill, the vertical capacity of the piles will be calculated utilising:

- In accordance with ArupGeotechnics Screwfast Foundations Ltd, Design Screw Piles, Assessment of Pile Design Methodology.
- The last helix before the toe to determine end bearing capacity
- For skin friction the diameter of the helix due to the close proximity of the helices to one another resulting in the surface of the pile been effectively the helix perimeter.
- Ks = 0.7 based on density of the granular material in accordance with Flemming, Piling Engineering.
- For the pile smooth pile shaft length $\delta=20^{\circ}$ for granular/steel interface in accordance with Tomlinson Pile foundations.
- For section with helices $\delta=32^{\circ}$ angle of shearing resistance based on the GIR data and the enhanced friction between the helix and soil.
- For the section of the pile that is tapered the skin friction capacity can be enhanced to reflect the additional ground resistance due to the vertical component of ground support acting on the tapered section. This is in accordance with Nordlund.
- For piles within cohesive material e.g. embedded in the underlying strata to the embankment the vertical capacity of the piles will be calculated utilising:

- In accordance with ArupGeotechnics Screwfast Foundations Ltd, Design Screw Piles, Assessment of Pile Design Methodology.
- The last helix before the toe to determine end bearing capacity.
- For skin friction the diameter of the helix due the close proximity of the helices to one another resulting in the surface of the pile been effectively the helix perimeter.
- For the pile skin friction in accordance with Tomlinson Pile foundations using the Cu for each strata passed through.

The structural analysis will be further supported by insitu testing for lateral and vertical resistance, and torque values recorded during installation. The test and torque values will be used to correlate the theory to the actual resistances and torque values to determine an empirical installation guide related to torque installations, with factors of safety. The testing will be in accordance with the supplier's specification.

It is further assumed that load testing will be undertaken to inform and verify the design and in support of a proposed reduction of certain factors, in accordance with the UK National Annex to Eurocode 7:

- one maintained load test taken to the required, unfactored ultimate resistance, to support the selection of a model factor value of 1.2, instead of 1.4; and
- two maintained load tests on working ground screws, tested to loads not less than 1.5 times the representative design load, to support the selection of the set of lower R4 partial resistance factor values. One pile will be tested in the cohesive material and one in the embankment fill for working loads.

The ground screws will be installed by mechanical means, drilled into the existing ground. The screws will be galvanised to protect against corrosion and torque test values used to correlate capacity, along with insitu testing to prove theoretical structural capacity.

Material Properties (ground screw):

- Min. flange steel grade S355, shaft 5mm barrel wall thickness.
- Galvanised protective coating to suit ground conditions, min. 120 microns
- Bolts grade 8.8

Where a pile fails to achieve specified torque values or load testing, concrete collars will be installed to enhance the end bearing of the pile. These will be determined on as required basis but are proposed to consist of steel plates welded to the top of the pile shaft and at the base of proposed collar ensure the collar acts monolithically with the pile. Ife needed, the collar is expected to be mass concrete and 300mm diameter and 300mm depth. These would be post installed by excavating around the pile and site welding the plates to the pile shaft and pouring mass concrete then back filling the collar. The collars will increase the area bearing onto the ground thus enhancing capacity by providing additional bearing area. The collar would be connected to the pile so that the pile and concrete act compositely.

Concrete Base for End of Ramp

At the lower end of the ramp the walkway will be supported on a concrete bankseat foundation with a small upstand to accommodate the variation in ground levels. The foundation will be designed as a spread footing and checked in accordance with Eurocode 7 for combination 1 and 2 for; bearing, sliding, overturning and settlement.

The structural design of the foundations will be undertaken to Eurocode 2, using elastic theory.

The temporary case prior to the ramp installation and the permanent case will be checked with appropriate M1, R1, R2 partial factors. The foundation will be designed to account for pedestrian, self-weight of the ramp, and foundation, wind in accordance with the appropriate Eurocodes and NR/L3/CIV/020.

The ramp columns will be connected via holding down bolts to the foundation with base plates incorporating slotted holes to permit thermal movement.

The holding down bolts will be resin anchors and will be designed using proprietary software with the loading derived as described for the foundation.

Design Life

The design life is 60 years. The minimum design life of 60 years has been achieved by specifying the sacrificial zinc coating thickness to be 120µm, along with a review of the ground environment to provide a more accurate assessment of likely corrosion rate of the ground screws. This is to be calculated to predicted the design life based on the site conditions and galvanising for this project. The wall thickness of the ground screw will also be specified to be 5mm, to incorporate permissible steel loss of 1.4mm before the structural capacity is affected.

A detailed review of all the available ground investigation test results has been carried out to assess the corrosivity classification of the soils at the site. The assessment is based on the criteria set out in the tables from both BD 42/00 and BD12/01 of the DMRB.

Whilst there are no resistivity values available for the site, guidance from the Institute of Electrical and Electronics Engineers, Inc. (IEEE) document Grounding of Industrial and Commercial Power Systems (2007), gives a range of values for different soil types. This guidance has also been used to provide resistivity values for the different soil types encountered, which correlates to a corresponding corrosivity rating.

In summary, the stratum the ground screws will be embedded in will be no worse than either non aggressive (typically the sands and gravels) or aggressive (polluted to Eurocode 1993-1) (clays) rating.

Based on information from the Galvanisers Association and European studies, galvanising losses will be calculated combined with permissible steel section loss given by the enhanced ground screw wall thickness, permitting 1.4mm sacrificial steel loss prior to the structural capacity been effected. .

This will ensure the required structural capacity of the ground screw will be maintained throughout the design life of the piles, hence inspection will not be required.

The loss of the galvanising protection has been conservatively taken at the greatest predicted rate for aggressively corrosive contaminated soils in both cases. It is probable that for this site that the galvanising will offer greater protection than calculated. Also rates of corrosion in buried structures vary and reduce with embedment depth due to the reduction in available oxygen for corrosion processes, hence the above this will result in a conservative design life calculation. In addition the majority of the ground screws will be within the embankment fill therefore within a non aggressive environment. Thus, the actual service life of the ground screw is likely to considerably longer than 60 years.

Concrete base design life will be 60 years.

The steel frame is also to be galvanised in accordance with BS EN ISO 1461, to achieve a minimum 60 year service life (for above ground galvanised members).

The GRP elements design life will be in excess of 60 years.

Material properties

- The ground screws are Krinner KSF-V-114-2100 PT, KSF-V-114-1550-PT, KSF-V-114-M24 as per data sheets included in calculations in Form F003 pack.

- GRP are in accordance with appropriate manufacturer's specification as per data sheets included in calculations in Form F003 pack.

- Concrete to be C40/50.

- All new steelwork to be grade S355J2 apart from guardrails, handrails and uprights forming parapets which shall be grade S275 J2.

- All bolts class Grade 8.8.

- Hollo bolts in accordance with Lindapter specification.

- GRP decking for landings shall be yellow and for ramps light grey.

Geotechnical

The design incorporates geotechnical parameters detailed in the ground investigation report (GIR), reference 400030-REP-ENV-001. A generalised strata sequence of the soils encountered on site and the geotechnical characteristics and/or derived parameters which have been reported in the GIR are provided below.

Generalised Strata Sequence

Stratum	Depth range (m bgl)		Proven Thickness range (m)
	Top	Base	
Embankment Fill	GL	3.70 to 4.20	3.70 to 4.20

Made Ground	GL to 4.20	3.70 to 6.45*	2.20 to 5.70
Alluvium	3.80 to 5.40	5.45 to 7.45*	0.05 to 1.65
River Terrace Deposits	5.20	7.45	2.25

* Base of stratum not proven in all holes

Relevant Geotechnical Characteristic/Derived Parameters

Stratum	Parameter	Result range		Characteristic Values	Justification / Notes
		Minimum	Maximum		
Embankment Fill	Angle of shearing resistance (Φ) (°) – coarse soils	29	32	32	Average value
	Weight Density (kg/m³) – coarse soils	-	-	17	Assumed
Made Ground	Angle of shearing resistance (Φ) (°) – coarse soils	28	32	32	Average value
	Weight Density (KN/m³) – fine soils	-	-	18	Assumed
	Weight Density (kN/m³) – coarse soils	-	-	16	Assumed
	Undrained cohesion (c_u) (kN/m²)	25 45	55 130	25 - 65	Range of values; design to consider lateral and depth variations in shear across site.
Alluvium	Weight Density (KN/m³)	-	-	18	Assumed
	Undrained cohesion (cu) (kN/m2)	23	110	4m to 9m = 20 (+ 15 per m)	Increasing with depth
River Terrace Deposits	Angle of shearing resistance (Φ) (°) – coarse soils	30	41	37	Average value
	Weight Density (KN/m³) – coarse soils	-	-	18.6	Assumed

To determine the ability of the embankment to safely withstand the loads imposed by the proposed structure, slope stability analyses will be undertaken, using a 2D model of the existing slope which will be produced using Geosolve Slope software.

Sections representing the steepest profile of the embankment will be produced using site levels obtained from a topographical survey.

Geological strata and groundwater levels will be modelled using the data detailed in the GIR, and summarised above. Soil parameters will be applied to the geological strata.

Surcharges representing train vehicle loading will be applied at the location of the running rails on the crest of the embankment. A partial factor of safety will be applied to this surcharge in accordance with BS EN 1997.

A typical section of the embankment model generated in the Geosolve Slope software is included as Figure 1.

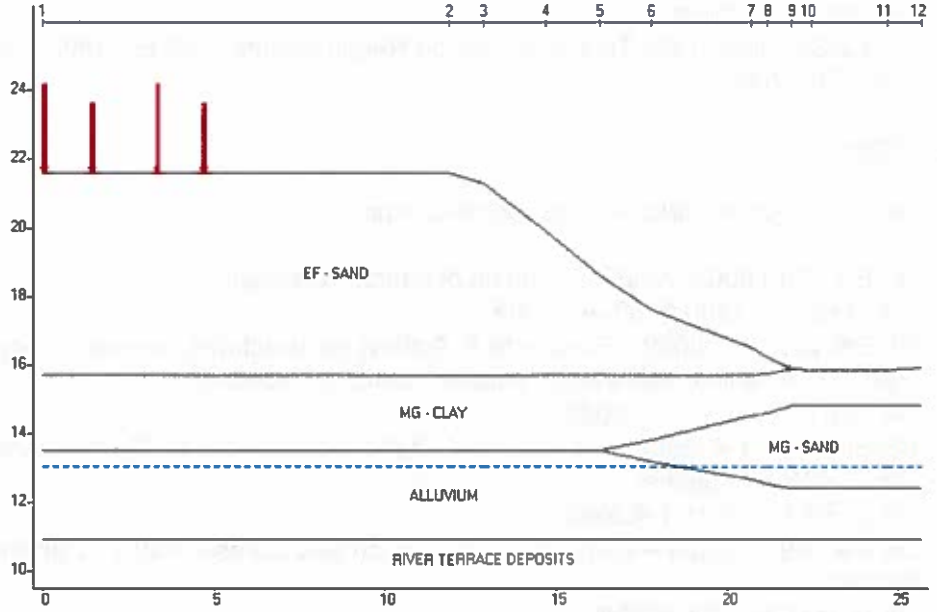

Figure 1 – Typical Section from Slope Stability Model

A back analysis of the embankment slope model will be undertaken by modifying the geotechnical parameters until an equilibrium state is reached, which will then be used to represent the existing scenario of the embankment.

Once the existing scenario has been established, the proposed structure's foundations (ground screws) will be added to the model and the slope stability analysis undertaken. The applicable combination of partial factors of safety for the relevant design approach will be applied in line with BS EN 1997 standards.

1.4 Standards to be used in the Design

Date of standards freeze

November 2016

List of Design standards

Network Rail

- NR/L2/CIV/003 – Engineering Assurance of Building and Civil Engineering Works.
- NR/L3/CIB/140 – Model clauses for civil engineering works
- NR/L3/CIV/003 – Engineering assurance of building and civil engineering work
- NR/L3/CIV/020 – Design of Bridges.
- NR/L3/CIV/040 – Specification for the use of protective coating systems.
- NR/L2/CIV/003/F1990 Technical Design Requirements – BS EN 1990 Basis of Structural Design.

- NR/L2/CIV/003/F1991 Technical Design Requirements – BS EN 1991 Actions on Structures.
- NR/L2/CIV/003/F1992 Technical Design Requirements – BS EN 1992 Design of Concrete Structures.
- NR/L2/CIV/003/F1993 Technical Design Requirements – BS EN 1993 Design of Steel Structures.

Eurocodes

All relevant Eurocodes and National Annexes apply.

- BS EN 1990:2002+A1:2005 – Basis of structural design
- NA to BS EN 1990:2002+A1:2005
- BS EN 1991-1-1:2002 – Eurocode 1: Actions on structures General Actions – Part 1-1 Densities, self-weight, imposed loads for buildings
- NA to BS EN 1991-1-1:2002
- BS EN 1991-1-4 :20002 – Eurocode 1: Actions on structures: General Actions – Part 1-4 Wind Actions
- NA to BS EN 1991-1-4:2005
- BS EN 1991-2:2003 – Eurocode 1 Actions on Structures – Part 2 - traffic loads on bridges
- NA to BS EN 1991-2:2006
- BS EN 1992-1-1:2004 – Eurocode 2: Design of concrete Structures – Part 1-1 General rules and rules for buildings
- BS EN 1991-2:2003 – Actions on structures – Traffic loads on bridges
- NA to BS EN 1991-2:2003
- NA to BS EN 1992-1-1-2004
- BS EN 1993-1-1:2005 – Eurocode 3: Design of steel structures – part 1-1: general rules and rules for buildings
- NA to BS EN 1993-1-1:2005
- BS EN 1993-2:2006 – Eurocode 3: Design of steel structures – part 2 steel bridges
- NA to BS EN 1993-2-2006
- BS EN 1997-1:2004 – Eurocode 7 Geotechnical design – part 1: general rules
- NA to BE EN 1997-1:2004
- BE EN 1997-2:2007 – Eurocode 7 Geotechnical design – part 2 ground investigation and testing
- NA to BS EN 1997-2:2007
- BS EN 1090-2 2008 Execution of steel structures and aluminium structures. Technical requirements for execution of steel structures
- BS EN 10025-2:2004 – Hot rolled products of structural steel.
- BS EN 1992-1-1 Design of concrete structures
- BS EN 1993 1-8 Design of joints
- BS EN 1993 1-5 Eurocode 3 – Design of Steel Structures – Part 5 piling
- NA to BS EN 1993-5

Other Relevant Standards/Document

- Accessible Train Station Design for Disabled People: A code of Practice – Department for Transport
- Steel Designers Manual Seventh Edition
- Tata Blue BookArupGeotechnics Screwfast Foundations Ltd, Design Screw Piles, Assessment of Pile Design Methodology.
- Flemming, Piling Engineering.
- Tomlinson pile design and construction practice
- Nordlund bearing capacity of piles in cohesionless soils
- Murthy Advanced foundation Engineering

1.5 Derogations and Temporary Non Conformances to standards

Accessible Train Station Design for Disabled People: A code of Practice – Department for Transport S1. Ramps clause 12. states that landings should be provided at foot and head of ramp that is a minimum 1600mm long and the width of the ramp. However due to site constraints it is not possible to comply with this requirements for the following reasons:

- At the head of the ramp it ties into a new platform extension that is understood to have a cross fall
- There is a mature tree that has to be avoided
- The foot of the ramp ties into an existing footpath that is narrower than the ramp width

Hence to provide a landing at the head of the ramp would require the entire walkway to be moved further away from the new platform extension, this would then mean the walkway would clash with the tree. In order to avoid the tree the walkway would have to be moved closer to the existing footpath resulting in a significantly more substantial structure due to the topography of the embankment. Also to achieve a tie in at the foot of the walkway due to the level differences would require substantial regrading and realignment of the existing footpath.

Providing a landing at the foot of the walkway would require cutting into the toe of the embankment and requiring retaining walls to be utilised to ensure the stability of the embankment. Also a landing would result in significant regrading and realignment of the existing footpath due the level difference.

As a pragmatic solution it is proposed to tie the walkway directly to the new platform extension using a short ramp with a gradient to permit the walkway to be positioned to avoid the tree whilst minimising the required structure. At the foot of the walkway a landing will be provided that has a shallow cross fall to aid drainage and aid tie in to the surrounding earthworks with a length of 1.8m to match width of steel walkway between handrails. This will allow a cost effective solution to providing access to the ROC for workers from Romford Station and ensure the remainder of the walkway is compliant apart from these minor points. Also by limiting the regrading and realignment of the footpath it permits all the works to be within existing boundaries of Network Rail owned land and minimises disruption to works by limiting construction programme.

The overall solution is therefore pragmatic and cost effective.

1.6 Any other relevant information

Hidden/partially hidden parts/elements for the purposes of examination/inspection

The structural steelwork and GRP deck will be visible for inspection from ground level, however it will be situated on an existing steep embankment. Hands on inspection may require scaffold access in the future to provide a safe working platform.

The foundations (Ground Screws) will be buried and only the top flange plate will be visible along with the connections for the column baseplate. Connections will be accessible from ground level for inspection and for maintenance if required.

The new concrete foundation will be mostly buried with a design to ensure durability throughout the proposed design life. The holding down bolts will be only partially visible as the majority will be cast into the foundations.

1.7 Matters to be considered in the Design

The matters that do not apply to the Works to meet the particular CR-T are to be struck out by the Contractor's Responsible Engineer appointed for the relevant Design phase

1. So far as is reasonably practicable, the Asset affected will be safe in use when used in accordance with its intended purpose.
2. Hazards are managed in accordance with requirements of the CDM Regulations. Residual risks are documented in a Risk Register. Risks to both (a) health and safety during construction, maintenance, use, railway operations, and (b) occupational health and safety, are as low as reasonably practicable or better.
3. The provisions for examination, maintenance, and eventual renewal/removal are satisfactory.
4. The overall Design concept and the appearance of the infrastructure are appropriate for their purpose, location, and site conditions.
5. Where the proposal includes the strengthening, partial renewal, or removal of structures, the stability of the whole structure and all its parts/elements at all stages of the Works are addressed, including the long-term adequacy of the remaining parts/elements of the structure and supporting soil.
6. The effects of the proposals on existing infrastructure are adequately considered.
7. Arrangements for liaison and consultation with external bodies (such as Local Authorities, statutory undertakers, the Environment Agency, and landowners) are satisfactory, and the likely effects of the proposals on external organisations are addressed. Required Permissions/Approvals have been obtained to support the proposals.
8. The impact of the proposals on services and service routes is adequately investigated and appropriate mitigation measures have been agreed with the appropriate Authority

and incorporated into the Design.

9. The effects on other rail engineering disciplines including track, signalling (including signal sighting), telecommunications, electrification, lighting, and other operational electrical and mechanical equipment have been satisfactorily considered.
10. The requirements/recommendations of Railway Group Standards and Network Rail standards have been addressed, and proposed departures from these standards are identified and justified.
11. The requirements of the Building Regulations are met.
12. The proposed Design loadings are appropriate, and any non-standard accidental loadings are correctly identified.
13. The requirements of **NR/L2/CIV/003/F1990** to **F1997** have been considered, and the selected options/choice recorded.
14. The proposed Design standards and methods of Design are suitable.

~~For a Design that requires a Category 3 Design Check~~:

15. A Geotechnical Design Report (which meets the requirements of **BS EN 1997**) is available. That Report justifies the selection of the Geotechnical Design parameters, and outlines any further work required for implementation.
16. The Design complies with structure clearance and platform stepping distance requirements.
17. Important Design matters not covered by standards are identified.
18. The proposals are appropriately economic and sustainable.
19. The proposed works will not compromise the structural robustness of any existing structures.
20. All Materials specified in the design of structures are compatible with the intended application and environment.

    This includes, but is not limited to - fixing metallic structures to masonry with studs bonded with resin, grout or other chemical bonding products.

    Fixing design are to current standards and guidance.

    Design and installation comply with manufacturer's requirements, are compatible with substrate and includes appropriate verification testing.

    Suitable and sufficient investigation, as far as reasonably practical, has been carried out to determine that materials to be used will be compatible.

PART 2: DESIGNER'S SUBMISSION

I confirm that the criteria specified in **NR/L2/CIV/003** have been considered, and

(a) this Statement of Design Intent is submitted on behalf of MLM Consulting Engineers Ltd., North Kiln, Felaw Maltings, 46 Felaw Street, Ipswich, IP2 8PN and,

(b) unless identified in 1.2 and 1.5, (i) the Design will comply with all relevant standards and will be delivered in accordance with the CR-T, and (ii) the deliverables identified within the CR-T will be completed and submitted in support of this submission.

Signed	Title Managing Director - Rail, BEng, CEng, MICE
Name (print) Lee Bowker	Date 03/03/2017
To be signed by the Contractor's Responsible Engineer appointed for the relevant Design phase.	

PART 3: CONSTRUCTION ORGANISATION'S ACKNOWLEDGEMENT OF SUBMISSION BY A SUB-CONTRACT DESIGNER

The organisation named in **PART 2** is engaged as a sub-contractor to the organisation stated below. I acknowledge this submission to Network Rail in support of our contract obligation for the provision of this Statement of Design Intent on behalf of

Jackson Civil Engineering Group Limited
30 White House Road
Ipswich
Suffolk
IP1 5LT

I confirm that, unless stated in PART 2, the submission complies with the CR-T.

Signed	Title SENIOR CONTRACTS MANAGER
Name (print) S.J. CHRISTIAN	Date 4 MAY 17
To be signed by the Contractor's Responsible Engineer appointed for the Construction phase.	

PART 4: PROJECT ENGINEER'S COMMENTS

I have considered the submission and confirm that the information specified in **NR/L2/CIV/003** and the CR-T is included in the submission. My comments on the submission are as follows:

I have reviewed the submission and confirm that, unless stated in **PART 2**, it complies with the Approval in Principle, and the Asset Manager's requirements for this project as set out in the PRS.

I confirm that the Design is to be checked in accordance with the following Categories.

Description of asset	Design Check Category
New walkway leading off the back of the new platform 2 extension, traversing along and down the embankment before tying in with the existing concrete footpath.	1b

Unless this submission warrants a more onerous requirement (for example, due to a change in anticipated complexity) the Categories are to align with the requirements of the Approval in Principle for this Project. For Temporary Works, where no Approval in Principle is in place, the Project Engineer (B&C) shall state the expected Design Check Category.

Signed	A Whiteland	Title	Project Engineer (Civils)
Name (print)	Alison Whiteland	Date	22/06/2017
To be signed by the Project Engineer (Building and Civil Engineering).			

For comments please refer to DRN no: NRDRN-IPSOU-BDG-147297-001403

I support Alison's review

PART 5: ASSET MANAGER'S APPROVAL

I have considered the submission and confirm that the proposed deviations to the PRS are acceptable subject to any comments listed below being addressed within the detailed Design.

Signed	Title
Name (print)	Date
To be signed by the Asset Manager (Structures).	

Signed	Title
Name (print)	Date
To be signed by the Asset Manager (Geotechnical).	

Signed	Title Senior Asset Engineer
Name (print) Ron Hommings	Date 23/08/17
To be signed by the Asset Manager (Buildings).	

Document Review Notice

Version No. 1

Project Number: 147297
Project Name: Romford Accessible Walkway (147297)
Project Manager: Barma, Mr Kenneth Hugh (Ken)
Principal Contractor: VolkerFitzpatrick Ltd
Site Specific UID: Romford Accessible Walkway
Engineering Deliverables Owner: MLM
DPE Name: Paul Verdon (paul.verdon@networkrail.co.uk)
Submission Discipline: Building & Civils
CEM Name: Stephen Christian (SChristian@jackson-civils.co.uk)
CRE Name: Lee Bowker (lee.bowker@mlm.uk.com)
PEM Area: IP South - Anglia
Risk Review Level: Detailed
Delivery Group: IP - Southern
Route To Gold Category: Silver

DRN Number: NRDRN-IPSOU-BDG-147297-001403
DRN Subject/Title: Romford Accessible Walkway Civils F002 F003 Rev A DRN

Document Transmittal/Submission No: 40003-REP-RBU-F003-RevA
Date Received: 14-03-2017
Date Return Required: 28-03-2017

DOCUMENT DETAILS:-

Number: 40003-REP-RBU-F002-RevA	**Title:** Romford Accessible Walkway Civils F002 Rev A DRN	**File Type:** PDF	**Revision:** 2
Number: 40003-REP-RBU-F003-RevA	**Title:** Romford Accessible Walkway Civils F003 Rev A DRN	**File Type:** PDF	**Revision:** 2

LEAD REVIEWER:-

Name	Position	Discipline	Signature
Alison Whiteland (alison.whiteland@networkrail.co.uk)	Project Engineer	Building & Civils	*Commented (2017-04-27)*

REVIEWERS:-

Name	Position	Discipline	Signature
Paul Verdon (paul.verdon@networkrail.co.uk)	Project Engineer M&E	Building & Civils	*No Action*
John Skeet (john.skeet@volkerfitzpatrick.co.uk)	CEM	Building & Civils	*No Action*
Sean Cavanagh (Sean.Cavanagh@volkerfitzpatrick.co.uk)	Construction Interface Manager	Building & Civils	*No Action*

DISTRIBUTION LIST (of completed review):-

Name	Position	Action Required

DOCUMENT REVIEW:-

Overall DRN Category	Rejected Non-compliant to contract	Accepted	Accepted with Amendments	Not Accepted Revise & Resubmit
2	**0**	**1**	**2**	**3**

» The acceptance of these documents by Network Rail shall not be deemed as validation of the submission and nor does it infer their fitness for purpose. Network Rail does not accept any liability for the submission.

» Any changes to the documents should be undertaken in accordance with your organisation's approved change control procedures. Such variations must be formally recorded and evidence should accompany any resubmission.

» Without relieving the originating organisation of their contractual responsibilities my comments are as follows:
  - Overall DRN Category 0 rejected and a category 3 non acceptance requires the whole document(s) to be revised and resubmitted to address the comments. Prior to any re-work a way forward shall be agreed between supplier and the Designated Project Engineer.
  - Overall DRN Category 2 acceptance with amendments requires the appropriate responses with additional information to be submitted to address the comments.
  - Comment types 2A, 2B, 3A and 3B require a written response & Comment type 4 is for information only

» For comments types 2 or 3 a suffix is added to the comment type: **A**) Quality of Supplier's submission or **B**) Client preference/changes.

DOCUMENT SIGNATURES:-

Lead Reviewer Signature:		CEM Signature:	*No Signature.*

COMMENTS:-

Network Rail (NR)					Supplier			NR
No	**Comments**	**By**	**Type**	**Integration Activity**	**Comment Accepted**	**Responses**	**By**	**Response Accepted**
1	Towhat extent will the top section of ramp at the platform extension interface beGRP to prevent touch potential? *(2017-04-27 18:23:43)*	A W	4	No	Yes	All elements above the stringer will be GRP. Parapet posts, top rail and mesh infill to final ramp section perpendicular to the platform from gate to gridline pile 79 & 82. *(2017-05-03 10:40:29)* Agreed *(2017-05-03 14:56:30)*	SC	Yes
2	Drawing001D – what bonding arrangements will be in place where the existing palisadefence is modified at the top of the elevated ramp? *(2017-04-27 18:23:43)*	A W	4	No	Yes	Thebottom rail of the existing fence will be left continuous and GRP mesh providedlocally to the substructure to prevent touch potential and access under thefinal ramp section to the rear of platform 2 from gridline pile 79 & 82. *(2017-05-03 10:40:29)* Agreed *(2017-05-03 14:56:30)*	SC	Yes
3	Note:Final tie-in section design at top of elevated ramp to be submitted as separateaddendum to this submission. *(2017-04-27 18:23:43)*	A W	4	No	Yes	Agreed. *(2017-05-03 10:40:29)* Agreed *(2017-05-03 14:56:30)*	SC	Yes
4	Note: 'at Grade' section of scheme will be submitted as a separate F002/F003 submission *(2017-04-27 18:23:43)*	A W	4	No	Yes	Agreed *(2017-05-03 10:40:29)* Agreed *(2017-05-03 14:56:30)*	SC	Yes
5	400030-REP-RBU-F002-RevA– Part 3 has not been signed *(2017-04-27 18:23:43)*	A W	2A	No	Yes	SJC to sign and forward. *(2017-05-03 10:40:29)* Agreed *(2017-05-03 14:56:30)*	SC	Yes
6	400030-REP-RBU-F003-RevA– Part 3 has not been signed *(2017-04-27 18:23:43)*	A W	2A	No	Yes	SJC to sign and forward. *(2017-05-03 10:40:29)* Agreed *(2017-05-03 14:56:30)*	SC	Yes
7	400030-REP-RBU-F003-RevA– 1(c) drawings listed includes two Geotechnical Reports;400030-REP-ENV-002-GDR-Rev1 and 400030-REP-ENV-002-GIR. Please provide these. *(2017-04-27 18:23:43)*	A W	2A	No	Yes	SJC to forward. *(2017-05-03 10:40:29)* Agreed *(2017-05-03 14:56:30)*	SC	Yes

NR/L2/CIV/003/F003: CERTIFICATE OF DESIGN AND CHECK		
Issue number	2	Page 1 of 5
Issue date	19th February 2015	

Project title	**Romford walkway, Anglia Platform Extensions**		
Project Number	**14297**		
CR-T Ref. Number			
Location	Between London end of platform 2 at Romford Station and ROC building		
ELR	LTN1	Mileage	12m 30ch (Romford Station)
OS grid reference	TQ512884	Structure Number	n/a

MLM reference: 400030-REP-RBU-F003A

PART 1: DETAILS

Design organisation

MLM Consulting Engineers Limited
North Kiln
Felaw Maltings
46 Felaw Street
Ipswich
IP2 8PN

I certify that reasonable professional skill and care have been used with the objective of checking that the Design

(a) complies with the Statement of Design Intent reference 400030-REP-RBU-F002...

signed by ..LEE BOWKER.....on..3 MARCH 7.

(b) complies with the Design standards, codes and methods stated in the Statement of Design Intent, with the following additions

None.

(c) is accurately described by the following drawings, schedules, performance, materials and workmanship specifications, testing and inspection plans and other documents that have been prepared for issue as Approved For Construction pending the completion of **PART 4** of Form 1, and **PART 5** of Form 2, and incorporates feedback from Network Rail on the submission.

MLM Documents

- Designers Calculation Pack: 400030-REP-RBU-F003-CALC
- Designers Risk Information: 400030-HS-RBU-DRI-F003
- Geotechnical Design Report: 400030-REP-ENV-002-GDR-Rev1
- Geotechnical Design Report: 400030-REP-ENV-002-GIR
- 400030-DWG-RBU-001 Rev D: General arrangement of walkway
- 400030-DWG-RBU-002 Rev C: Proposed pile setting out details
- 400030-DWG-RBU-003 Rev B: Typical trestle and intermediate support details
- 400030-DWG-RBU-004 Rev B: Typical trestle details at top of ramp

- 400030-DWG-RBU-005 Rev B: Typical trestle details at bottom of ramp
- 400030-DWG-RBU-006 Rev B: Cranked landing details
- 400030-DWG-RBU-007 Rev B: General trestle setting out
- 400030-DWG-RBU-008 Rev B: Construction details 1 of 3
- 400030-DWG-RBU-009 Rev B: Construction details 2 of 3
- 400030-DWG-RBU-010 Rev B: Construction details 3 of 3
- 400030-DWG-RBU-020 Rev B: General arrangement of proposed footpath work
- 400030-DWG-RBU-F3-R01: Bankseat reinforcement details
- 400030-SCH-RBU-F3-R01-01: Bankseat reinforcement bar bending schedule

Documents Produced by Others

- Track Screw Limited: Compression Testing
- Track Screw Limited: Lateral Testing
- Track Screw Limited: Tension Testing

(d) the following matters have been considered during the Design

The matters that do not apply to the Works to meet the particular CR-T are to be struck out by the Contractor's Responsible Engineer appointed for the relevant Design phase

1. So far as is reasonably practicable, the Asset affected will be safe in use when used in accordance with its intended purpose.
2. Hazards are managed in accordance with requirements of the CDM Regulations. Residual risks are documented in a Risk Register. Risks to both (a) health and safety during construction, maintenance, use, railway operations, and (b) occupational health and safety, are as low as reasonably practicable or better.
3. The provisions for examination, maintenance, and eventual renewal/removal are satisfactory.
4. The overall Design concept and the appearance of the infrastructure are appropriate for their purpose, location, and site conditions.
5. Where the proposal includes the strengthening, partial renewal, or removal of structures, the stability of the whole structure and all its parts/elements at all stages of the Works are addressed, including the long-term adequacy of the remaining parts/elements of the structure and supporting soil.
6. The effects of the proposals on existing infrastructure are adequately considered.
7. Arrangements for liaison and consultation with external bodies (such as Local Authorities, statutory undertakers, the Environment Agency, and landowners) are satisfactory, and the likely effects of the proposals on external organisations are addressed. Required Permissions/Approvals have been obtained to support the proposals.
8. The impact of the proposals on services and service routes is adequately investigated and appropriate mitigation measures have been agreed with the appropriate Authority and incorporated into the Design.
9. The effects on other rail engineering disciplines including track, signalling (including signal sighting), telecommunications, electrification, lighting, and other operational electrical and mechanical equipment have been satisfactorily considered.

10. The requirements/recommendations of Railway Group Standards and Network Rail standards have been addressed, and proposed departures from these standards are identified and justified.
11. The requirements of the Building Regulations are met.
12. The proposed Design loadings are appropriate, and any non-standard accidental loadings are correctly identified.
13. The requirements of **NR/L2/CIV/003/F1990** to **F1997** have been considered, and the selected options/choice recorded.
14. The proposed Design standards and methods of Design are suitable.
15. A Geotechnical Design Report (which meets the requirements of **BS EN 1997**) is available. That Report justifies the selection of the Geotechnical Design parameters, and outlines any further work required for implementation.
16. The Design complies with structure clearance and platform stepping distance requirements.
17. Important Design matters not covered by standards are identified.
18. The proposals are appropriately economic and sustainable.
19. The proposed works will not compromise the structural robustness of any existing structures.
20. All Materials specified in the design of structures are compatible with the intended application and environment.

    This includes, but is not limited to - fixing metallic structures to masonry with studs bonded with resin, grout or other chemical bonding products.

    Fixing design are to current standards and guidance.

    Design and installation comply with manufacturer's requirements, are compatible with substrate and includes appropriate verification testing.

    Suitable and sufficient investigation, as far as reasonably practical, has been carried out to determine that materials to be used will be compatible.

Signed 	Title Managing Director - Rail, BEng, CEng, MICE
Name (Print) Lee Bowker	Date 03/03/2017
To be signed by the Contractor's Responsible Engineer appointed for the relevant Design phase.	

PART 2: CHECK

Checking organisation

MLM Consulting Engineers Limited
North Kiln
Felaw Maltings
46 Felaw Street
Ipswich
IP2 8PN

I certify that reasonable professional skill and care have been used in checking the Design identified in **PART 1** of this Certificate, with the objective of checking that the Design

(a) complies with the Statement of Design Intent reference 400030-REP-RBU-F002.....

signed by LEE BOWKER ..... on 3 MARCH 17...

(b) complies with the Design standards, codes and methods stated on the above Statement of Design Intent (including any stated deviations or dispensations), and with any additions stated in **PART 1** of this Certificate: the justification given for these additions is acceptable.

I confirm that the Design was checked as stated below, and that the Design Check has been carried out with the level of independence specified in **NR/L2/CIV/003**.

Description of asset	Design Check Category
New walkway leading off the back of the new platform 2 extension, traversing along and down the embankment before tying in with the existing concrete footpath. Permanent Works.	1b

Signed	Title Principal Engineer
Name (print) Susan Chappelow	Date 06/03/2017
To be signed by the Checker.	

PART 3: CONSTRUCTION ORGANISATION'S ACKNOWLEDGEMENT OF SUBMISSION BY A SUB-CONTRACT DESIGNER

The Design organisation named in **PART 1** is engaged as a sub-contractor to the organisation stated below. I formally acknowledge the submission of this Certificate to Network Rail in support of our contract obligation for provision of the Design on behalf of.

Jackson Civil Engineering Group Limited
30 White House Road
Ipswich
Suffolk
IP1 5LT

Signed	Title SENIOR CONTRACTS MANAGER
Name (print) S.J. CHRISTMAS	Date 4 MAR 17
To be signed by the Contractor's Responsible Engineer appointed for the Construction phase.	

PART 4: ACCEPTANCE ON BEHALF OF NETWORK RAIL

I accept that, so far as can reasonably be ascertained from the information submitted, the relevant procedures for the Design and Design Check as specified in **NR/L2/CIV/003** have been followed properly.

I have considered the Design Check statement provided in accordance with **5.7** of **NR/L2/CIV/003** and confirm that the stated method of checking was suitable.

I have reviewed the submission and confirm that it fulfils the Project Requirements Specification, and (where required) **NR/L2/CIV/003/F001** and **NR/L2/CIV/003/F002** PART 5.

Signed A Whiteland	Title Project Engineer (Civils)
Name (print) Alison Whiteland	Date 22/06/2017
To be signed by the Project Engineer (Building and Civil Engineering).	

The drawings referenced in Part 1(c) of this document have since been updated and re-submitted including several resubmissions of the drawings illustrating the connection to the back of Platform 2 at Romford Station. The updated list of drawings is as follows:

400030-DWG-RBU-F3-001	Rev I
400030-DWG-RBU-F3-002	Rev E
400030-DWG-RBU-F3-003	Rev D
400030-DWG-RBU-F3-004	Rev G
400030-DWG-RBU-F3-005	Rev C
400030-DWG-RBU-F3-006	Rev C
400030-DWG-RBU-F3-007	Rev C
400030-DWG-RBU-F3-008	Rev C
400030-DWG-RBU-F3-009	Rev C
400030-DWG-RBU-F3-010	Rev C
400030-DWG-RBU-F3-020	Rev C
400030-DWG-RBU-F3-030	Rev B
400030-DWG-RBU-F3-031	Rev B

For other comments please see DRN no: NRDRN-IPSOU-BDG-147297-001403

I support Alison's review James Hudson 2017.06.28 14:42:44 +01'00'

Document Review Notice

Version No. 1

Project Number: 147297
Project Name: Romford Accessible Walkway (147297)
Project Manager: Barma, Mr Kenneth Hugh (Ken)
Principal Contractor: VolkerFitzpatrick Ltd
Site Specific UID: Romford Accessible Walkway
Engineering Deliverables Owner: MLM
DPE Name: Paul Verdon (paul.verdon@networkrail.co.uk)
Submission Discipline: Building & Civils
CEM Name: Stephen Christian (SChristian@jackson-civils.co.uk)
CRE Name: Lee Bowker (lee.bowker@mlm.uk.com)
PEM Area: IP South - Anglia
Risk Review Level: Detailed
Delivery Group: IP - Southern
Route To Gold Category: Silver

DRN Number: NRDRN-IPSOU-BDG-147297-001403
DRN Subject/Title: Romford Accessible Walkway Civils F002 F003 Rev A DRN

Document Transmittal/Submission No: 40003-REP-RBU-F003-RevA
Date Received: 14-03-2017
Date Return Required: 28-03-2017

DOCUMENT DETAILS:-

Number: 40003-REP-RBU-F002-RevA	**Title:** Romford Accessible Walkway Civils F002 Rev A DRN	**File Type:** PDF	**Revision:** 2
Number: 40003-REP-RBU-F003-RevA	**Title:** Romford Accessible Walkway Civils F003 Rev A DRN	**File Type:** PDF	**Revision:** 2

LEAD REVIEWER:-

Name	Position	Discipline	Signature
Alison Whiteland (alison.whiteland@networkrail.co.uk)	Project Engineer	Building & Civils	*Commented (2017-04-27)*

REVIEWERS:-

Name	Position	Discipline	Signature
Paul Verdon (paul.verdon@networkrail.co.uk)	Project Engineer M&E	Building & Civils	*No Action*
John Skeet (john.skeet@volkerfitzpatrick.co.uk)	CEM	Building & Civils	*No Action*
Sean Cavanagh (Sean.Cavanagh@volkerfitzpatrick.co.uk)	Construction Interface Manager	Building & Civils	*No Action*

DISTRIBUTION LIST (of completed review):-

Name	Position	Action Required

DOCUMENT REVIEW:-

Overall DRN Category	Rejected Non-compliant to contract	Accepted	Accepted with Amendments	Not Accepted Revise & Resubmit
2	**0**	**1**	**2**	**3**

» The acceptance of these documents by Network Rail shall not be deemed as validation of the submission and nor does it infer their fitness for purpose. Network Rail does not accept any liability for the submission.

» Any changes to the documents should be undertaken in accordance with your organisation's approved change control procedures. Such variations must be formally recorded and evidence should accompany any resubmission.

» Without relieving the originating organisation of their contractual responsibilities my comments are as follows:
  - Overall DRN Category 0 rejected and a category 3 non acceptance requires the whole document(s) to be revised and resubmitted to address the comments. Prior to any re-work a way forward shall be agreed between supplier and the Designated Project Engineer.
  - Overall DRN Category 2 acceptance with amendments requires the appropriate responses with additional information to be submitted to address the comments.
  - Comment types 2A, 2B, 3A and 3B require a written response & Comment type 4 is for information only

» For comments types 2 or 3 a suffix is added to the comment type: **A**) Quality of Supplier's submission or **B**) Client preference/changes.

DOCUMENT SIGNATURES:-

Lead Reviewer Signature:		CEM Signature:	*No Signature.*

COMMENTS:-

Network Rail (NR)					Supplier			NR
No	**Comments**	**By**	**Type**	**Integration Activity**	**Comment Accepted**	**Responses**	**By**	**Response Accepted**
1	Towhat extent will the top section of ramp at the platform extension interface beGRP to prevent touch potential? *(2017-04-27 18:23:43)*	A W	4	No	Yes	All elements above the stringer will be GRP. Parapet posts, top rail and mesh infill to final ramp section perpendicular to the platform from gate to gridline pile 79 & 82. *(2017-05-03 10:40:29)* Agreed *(2017-05-03 14:56:30)*	SC	Yes
2	Drawing001D – what bonding arrangements will be in place where the existing palisadefence is modified at the top of the elevated ramp? *(2017-04-27 18:23:43)*	A W	4	No	Yes	Thebottom rail of the existing fence will be left continuous and GRP mesh providedlocally to the substructure to prevent touch potential and access under thefinal ramp section to the rear of platform 2 from gridline pile 79 & 82. *(2017-05-03 10:40:29)* Agreed *(2017-05-03 14:56:30)*	SC	Yes
3	Note:Final tie-in section design at top of elevated ramp to be submitted as separateaddendum to this submission. *(2017-04-27 18:23:43)*	A W	4	No	Yes	Agreed. *(2017-05-03 10:40:29)* Agreed *(2017-05-03 14:56:30)*	SC	Yes
4	Note: 'at Grade' section of scheme will be submitted as a separate F002/F003 submission *(2017-04-27 18:23:43)*	A W	4	No	Yes	Agreed *(2017-05-03 10:40:29)* Agreed *(2017-05-03 14:56:30)*	SC	Yes
5	400030-REP-RBU-F002-RevA– Part 3 has not been signed *(2017-04-27 18:23:43)*	A W	2A	No	Yes	SJC to sign and forward. *(2017-05-03 10:40:29)* Agreed *(2017-05-03 14:56:30)*	SC	Yes
6	400030-REP-RBU-F003-RevA– Part 3 has not been signed *(2017-04-27 18:23:43)*	A W	2A	No	Yes	SJC to sign and forward. *(2017-05-03 10:40:29)* Agreed *(2017-05-03 14:56:30)*	SC	Yes
7	400030-REP-RBU-F003-RevA– 1(c) drawings listed includes two Geotechnical Reports;400030-REP-ENV-002-GDR-Rev1 and 400030-REP-ENV-002-GIR. Please provide these. *(2017-04-27 18:23:43)*	A W	2A	No	Yes	SJC to forward. *(2017-05-03 10:40:29)* Agreed *(2017-05-03 14:56:30)*	SC	Yes

Document Review Notice

Version No. 1

Project Number: 147297
Project Name: Romford Accessible Walkway (147297)
Project Manager: Barma, Mr Kenneth Hugh (Ken)
Principal Contractor: VolkerFitzpatrick Ltd
Site Specific UID: Romford Walkway
Engineering Deliverables Owner: MLM
DPE Name: Paul Verdon (paul.verdon@networkrail.co.uk)
Submission Discipline: Building & Civils
CEM Name: Stephen Christian (SChristian@jackson-civils.co.uk)
CRE Name: Lee Bowker (lee.bowker@mlm.uk.com)
PEM Area: IP South - Anglia
Risk Review Level: Detailed
Delivery Group: IP - Southern
Route To Gold Category: Silver

DRN Number: NRDRN-IPSOU-BDG-147297-001550
DRN Subject/Title: Romford Accessible Walkway Elevated Section addendum

Document Transmittal/Submission No: 147297-NRS-TRN-PDC-000002
Date Received: 13-06-2017
Date Return Required: 27-06-2017

DOCUMENT DETAILS:-

Number: 400030-DWG-RBU-F3-001I	**Title:** General Arrangement of Proposed Walkway	**File Type:** PDF	**Revision:** I
Number: 400030-DWG-RBU-F3-004G	**Title:** Typical trestle detail at top of ramp	**File Type:** PDF	**Revision:** G

LEAD REVIEWER:-

Name	Position	Discipline	Signature
Alison Whiteland (alison.whiteland@networkrail.co.uk)	Project Engineer	Building & Civils	*Commented (2017-06-22)*

REVIEWERS:-

Name	Position	Discipline	Signature
Paul Verdon (paul.verdon@networkrail.co.uk)	Project Engineer M&E	Building & Civils	*No Action*
John Skeet (john.skeet@volkerfitzpatrick.co.uk)	CEM	Building & Civils	*No Action*
Sean Cavanagh (Sean.Cavanagh@volkerfitzpatrick.co.uk)	Construction Interface Manager	Building & Civils	*No Action*

DISTRIBUTION LIST (of completed review):-

Name	Position	Action Required

DOCUMENT REVIEW:-

Overall DRN Category	Rejected Non-compliant to contract	Accepted	Accepted with Amendments	Not Accepted Revise & Resubmit
1	0	1	2	3

» The acceptance of these documents by Network Rail shall not be deemed as validation of the submission and nor does it infer their fitness for purpose. Network Rail does not accept any liability for the submission.
» Any changes to the documents should be undertaken in accordance with your organisation's approved change control procedures. Such variations must be formally recorded and evidence should accompany any

resubmission.

» Without relieving the originating organisation of their contractual responsibilities my comments are as follows:
  - Overall DRN Category 0 rejected and a category 3 non acceptance requires the whole document(s) to be revised and resubmitted to address the comments. Prior to any re-work a way forward shall be agreed between supplier and the Designated Project Engineer.
  - Overall DRN Category 2 acceptance with amendments requires the appropriate responses with additional information to be submitted to address the comments.
  - Comment types 2A, 2B, 3A and 3B require a written response & Comment type 4 is for information only

» For comments types 2 or 3 a suffix is added to the comment type: **A**) Quality of Supplier's submission or **B**) Client preference/changes.

DOCUMENT SIGNATURES:-

Lead Reviewer Signature:		CEM Signature:	*No Signature.*

COMMENTS:-

Network Rail (NR)					Supplier			NR
No	**Comments**	**By**	**Type**	**Integration Activity**	**Comment Accepted**	**Responses**	**By**	**Response Accepted**
1	Acceptance of revised addendum to elevated walkway design which now addresses previous touch potential design issues *(2017-06-22 15:35:40)*	AW	4	No	Yes	Agreed *(2017-06-22 15:45:14)* Agreed *(2017-06-22 15:45:17)*	SC	Yes