

APPENDIX V1-3.2: FURTHER ENGINEERING DESIGN INFORMATION

This appendix provides the following information to support **Volume 1, Chapter 3: Project Description**:

- Schematic of L7 Towers (see Plate 1);
- Typical Underground Cable Working area (see Plate 2);
- Cable Link Box Structures - Photographs and Plans (see Plate 3);
- Access Track Cross Sections (Indicative) (see Plate 4);
- Typical Bellmouths (see Plate 5); and
- Access Track Matrix (see Table 1).

Plate 1: Schematic of L7 Towers (Standard Height) from left to right: Suspension Tower, Tension Tower x 2, Terminal Tower)

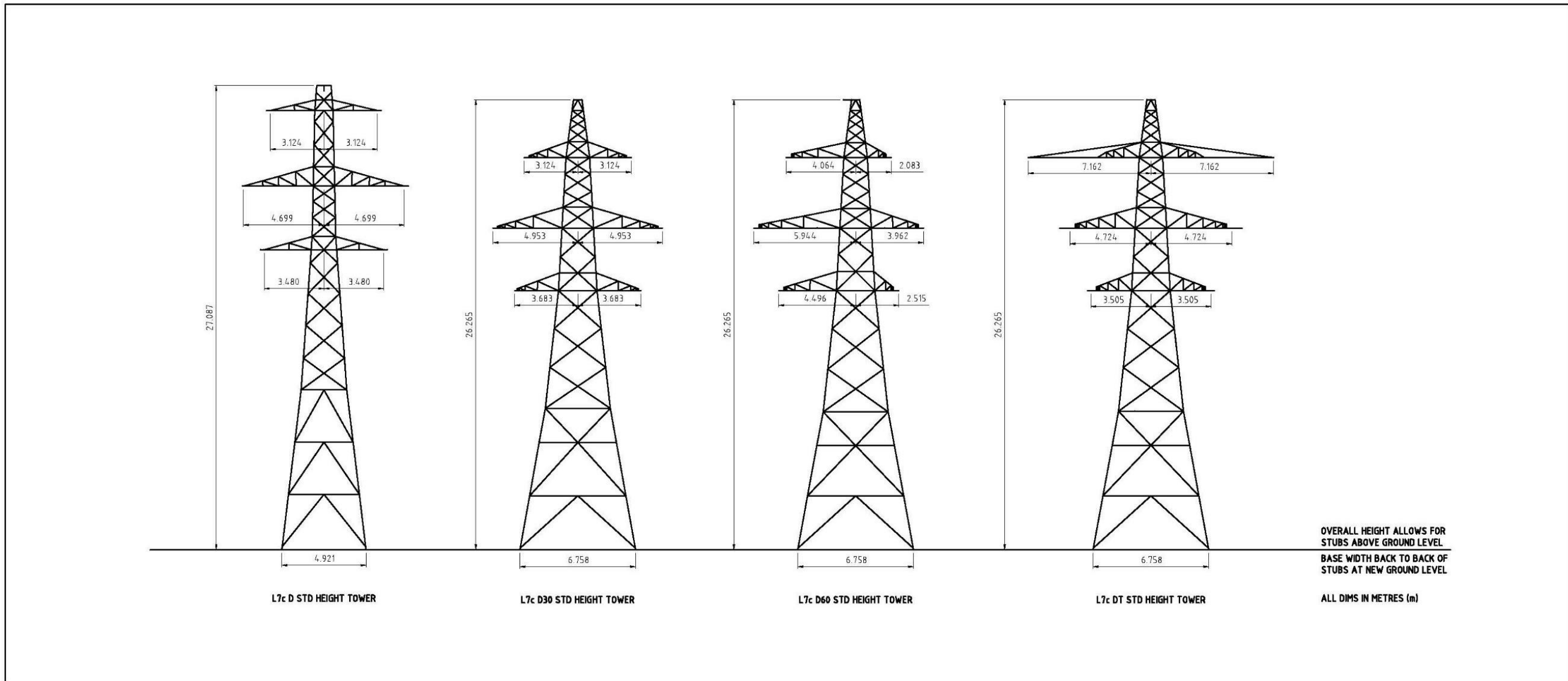
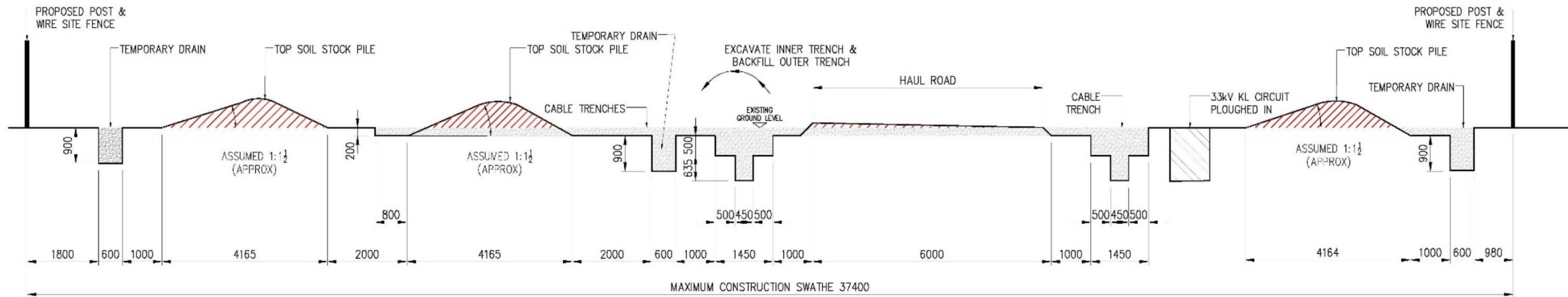


Plate 2: Typical Underground Cable Working Area



TYPICAL 37.4m SWATHE ALONG GENERAL ROUTE

Plate 3: Cable Link Box Structures - Photographs and Plans

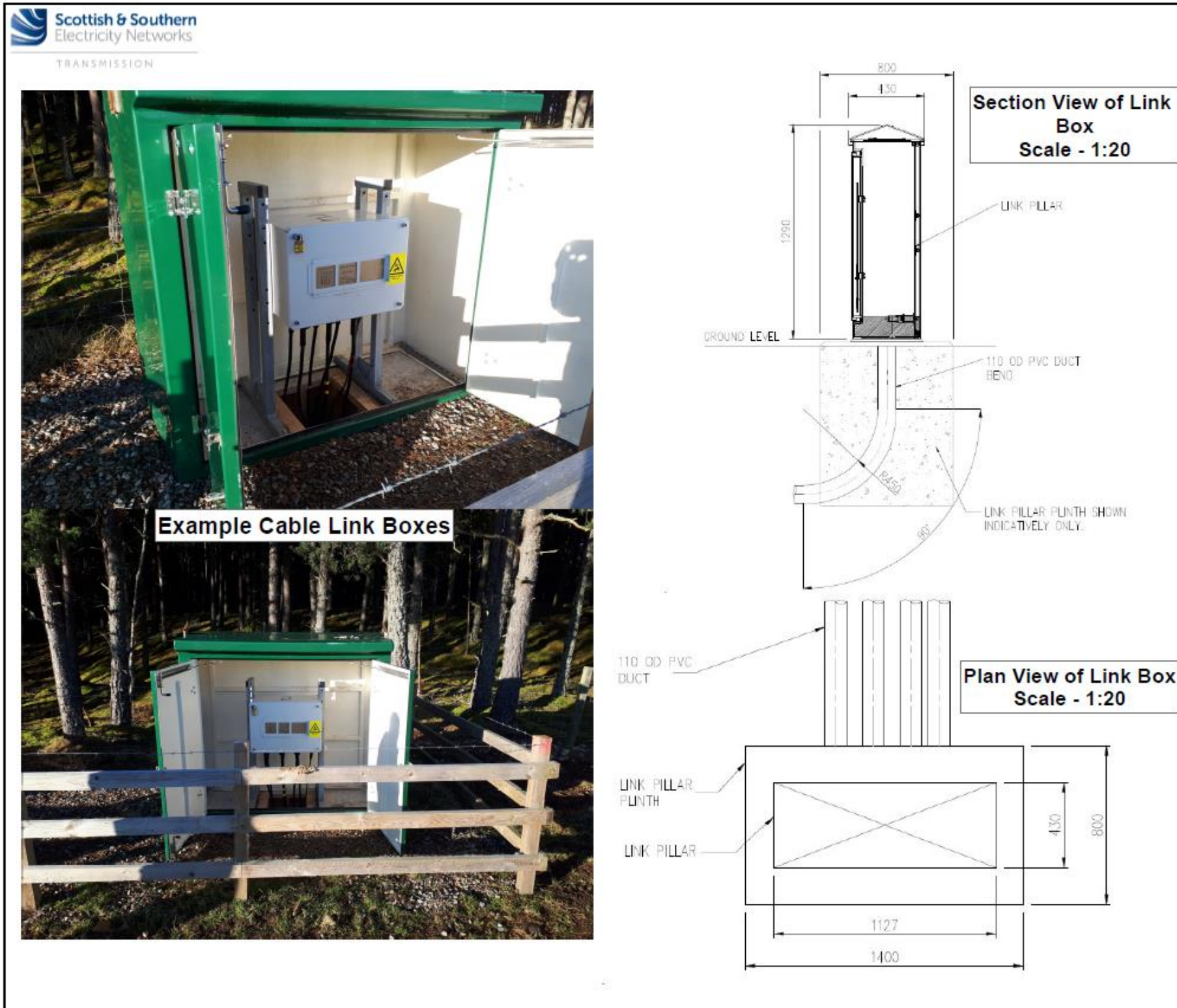
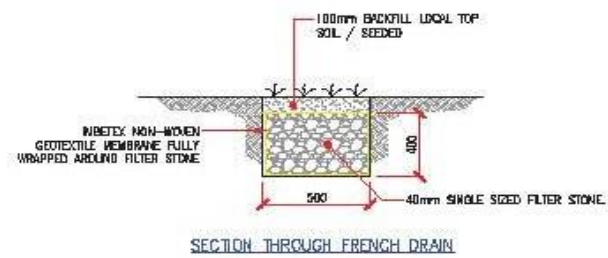
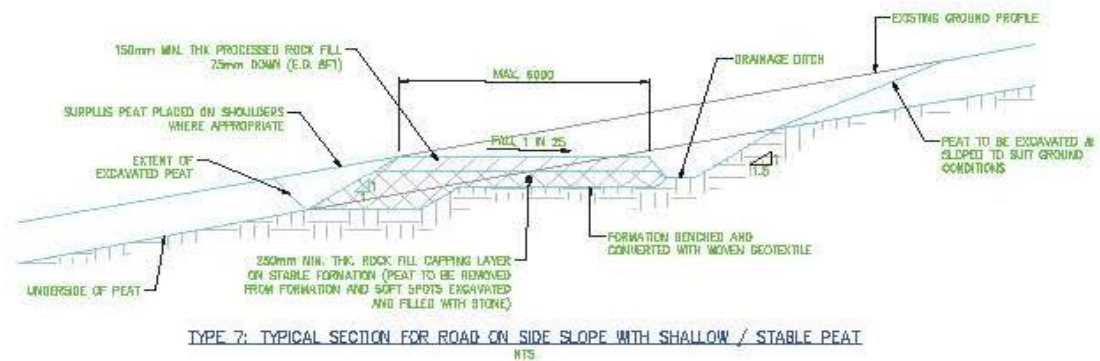
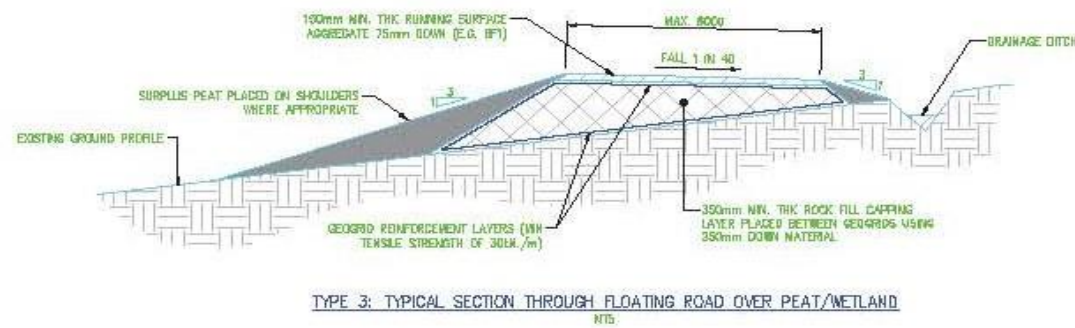
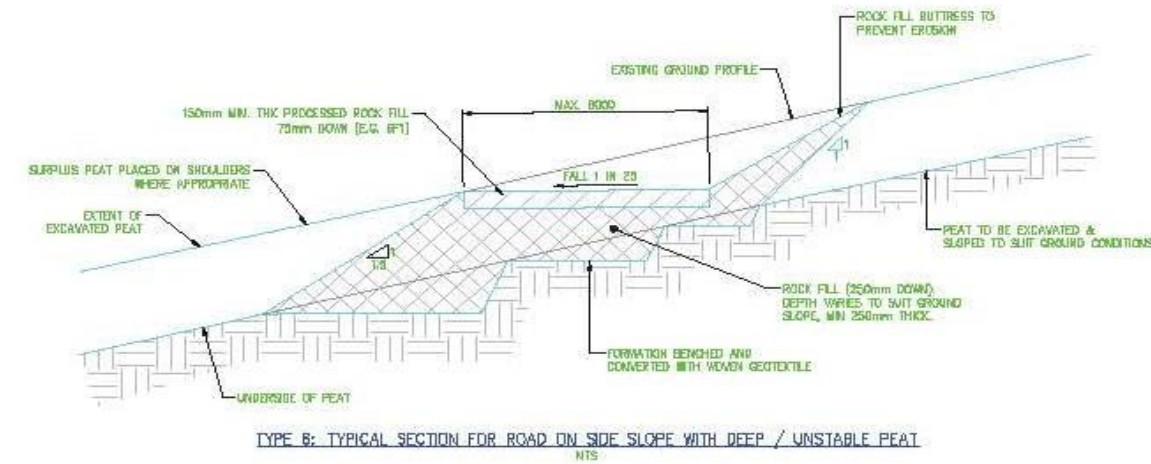
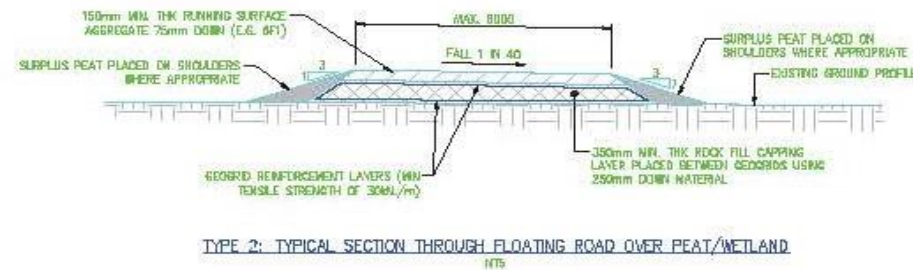
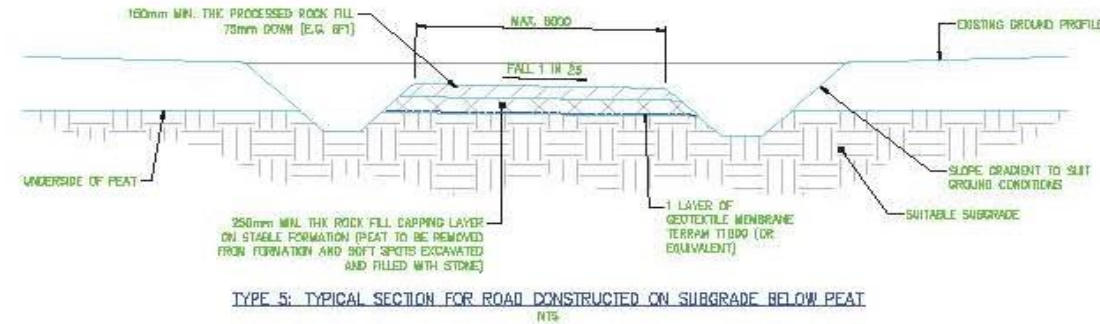
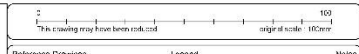
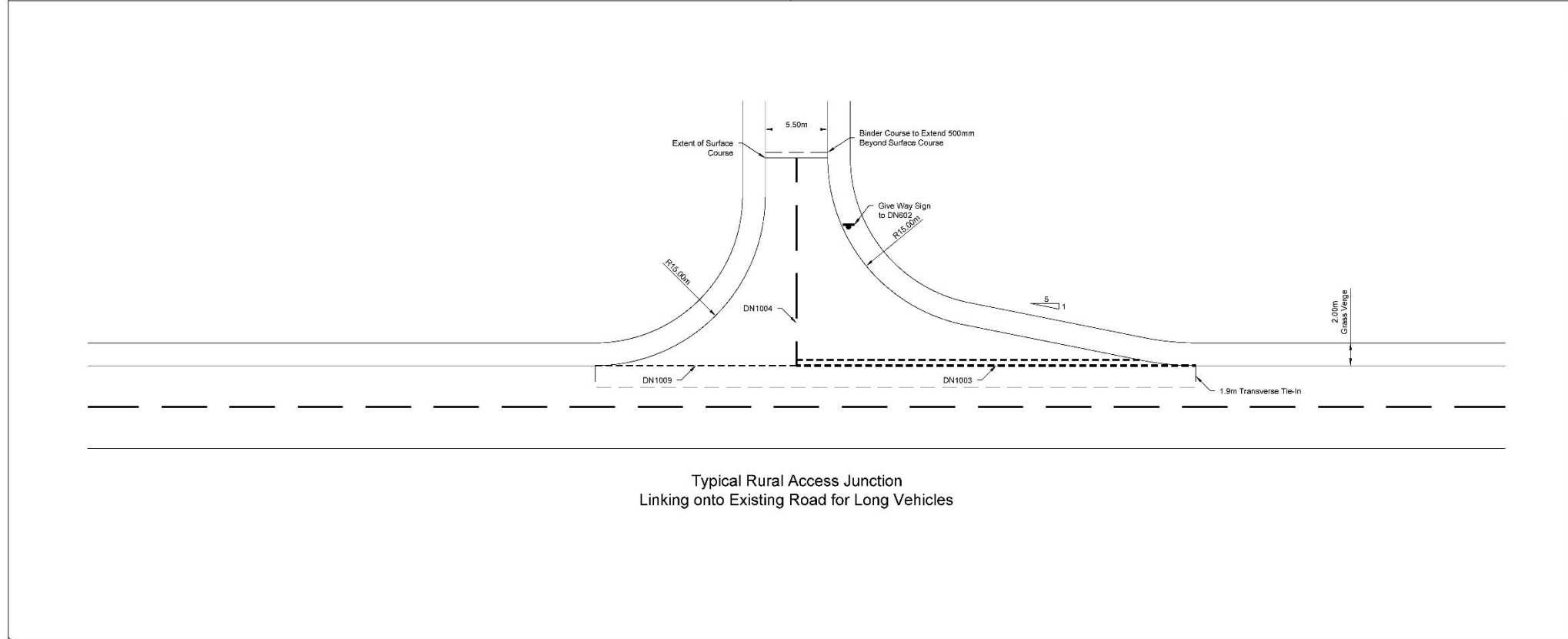
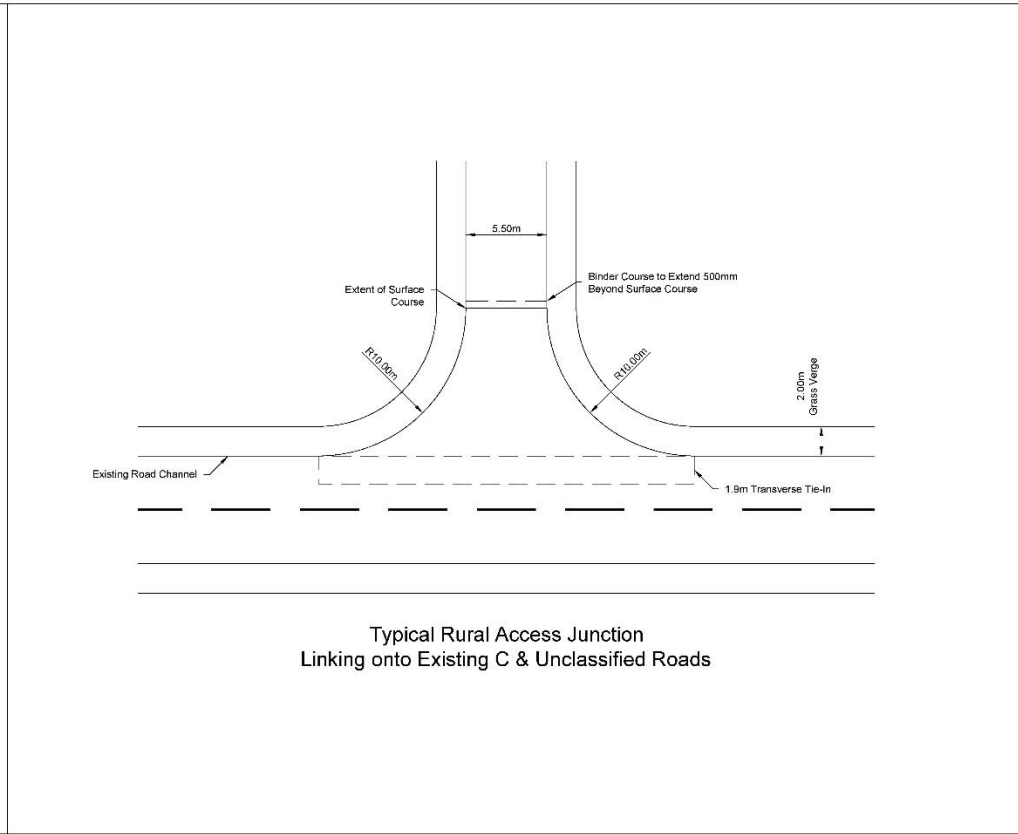
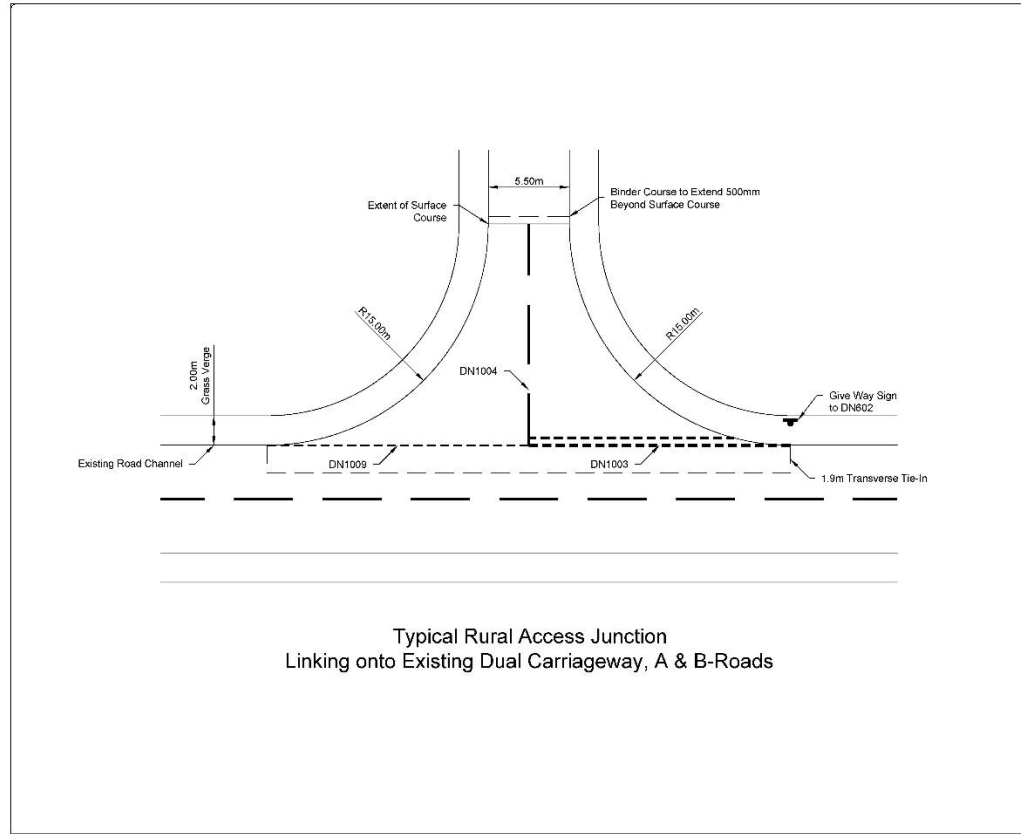


Plate 4: Access Track Cross Sections (Indicative)



NOTE: MAKE-UPS ARE INDICATIVE ONLY AND SUBJECT TO DETAILED DESIGN ONCE VEHICLE TYPES ARE FINALISED

Plate 5: Typical Bellmouths



Reference Drawings	Legend	No. of
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- Notes:
- All dimensions are shown in mm and levels in MAOD unless otherwise stated.
 - This drawing is to be read in conjunction with all relevant drawings.
 - Asphalt surface course to be provided to proposed tangent points or an absolute minimum of 6.0m from existing carriageway edge.
 - Access gate to be provided at delineation point between public & private land, delineation point to be determined by longest vehicle to use the access.
 - Access points typically utilised where permanent maintenance access is required or High HGV volumes are required during the construction phase.
 - Where a ditch exists, pipes to be installed beneath width of bellmouth. Diameter to be no smaller than existing ditch width.
 - Lane widths & junction radii taken from Highland Council's - Road & Transport Guidelines for New Developments. See Chapter 5, Tables 5.2 & 5.4 for relevant information.
 - Detailed swept path analysis to be undertaken prior to detailed design stage to determine extent of bellmouth required to provide access at each junction location.
 - All road markings & signage to be in accordance with Traffic Signs Regulations & General Directions 2016 (TSRGD).

FOR INFORMATION

For Information	Drawn GA	Checked RH	Approved GJ
Revision	Date	Date	Date



Project: LT91
FORT AUGUSTUS TO SKYE OHL REFURBISHMENT
Title: TYPICAL BELLMOUTH LAYOUTS

Scale: 1:200	Drawn GA	Checked RH	Approved GJ
(when plotted @ A1)	Date: 10/06/2021	Date: 10/06/2021	Date: 10/06/2021

MORGAN SINDALL
TRANSMISSION
MSVE Transmission Corporation Street
Rugby
Warwickshire
CV21 2DW
Tel: 01789 204 288

MSVE Project No.	MSVE Drawing No.
18501	N/A

SSEN Project No.	SSEN Drawing No.
LT000091	N/A

Table 1: Access Track Matrix

Type	Options	Typical Applications	Appropriate Vehicle Use	Advantages	Disadvantages	Environmental Mitigation	
Cut (Cut tracks are constructed by excavating very weak overburden down to rock or a suitable, solid substrate and then building the track up again using solid fill. This type of track usually has a solid construction and is capable of taking very heavy loads).	C1	Stone access road	General construction sites	Suitable for lightweight traffic (Argo-cats) up to HGVs and heavy plant	<p>Solid construction</p> <p>Capable of taking very heavy loads</p> <p>Flexible re-alignment to: avoid obstructions, habitats, peatland, gradients, crossing points.</p> <p>Minimise stone-fill dependent on bearing ground</p> <p>Durable and straightforward to maintain</p> <p>Reduce volume of construction traffic on Public Road Network</p> <p>Potential legacy opportunities of retention for landowners and potential access for future operation use (where appropriate)</p> <p>Primary means of access/egress in the event of Emergency Response/evacuation in all weather conditions</p> <p>Reduced programme risk with the certainty stone access provides</p> <p>Commercially advantageous dependent on duration of access requirement.</p>	<p>May require a large amount of fill material dependent on sub-formation - the depth of the road is designed to suit both the ground conditions and the usage/ required load. Any technique to install a track would require to account for the conditions and the impact would vary accordingly</p> <p>Potential landslip issues - This is true for all temporary track solutions. Tracks to be designed to avoid this including alignment, a well-constructed temporary stone road should offer better stability for construction vehicles than other techniques or existing ground</p> <p>Loss of habitat and potential damage to peatland - this is true for all temporary track solutions during the duration of the works. Floating road solution on peatland minimises long-term impact.</p>	<p>Advanced peatland restoration programme</p> <p>Implementation and adherence to peat management plan</p> <p>Reinstatement carried out following works, Installation of drainage ditches, silt fencing</p> <p>Opportunity to source stone locally from borrow pits and can be returned upon completion of works and reinstatement</p>
	C2	In-situ strata	Light construction	Tracked low ground-bearing machinery	<p>Removing topsoil may expose better ground, depending on existing ground conditions, and assist with reinstatement works</p> <p>Removal of topsoil provides corridors for tracked machinery to operate within, and limits damage to ground</p> <p>Commercial betterment on access construction costs</p>	<p>Even favourable in-situ strata likely to be suitable only for low-ground bearing plant, not suitable for lifting operations. Helicopters required for lifting.</p> <p>Limited use for heavy construction traffic.</p> <p>Unable to negotiate obstructions such as streams - no ability to bridge</p> <p>No ability to level out undulations or gradients to provide stable access.</p> <p>Increased volume of construction traffic on Public Road Network</p> <p>Restricted access for Emergency Response/Evacuation</p>	<p>Long-term scarring/damage to surface. Negative visual impact on reinstatement</p> <p>Not suitable for peatland/soft ground conditions</p> <p>Potential cross-contamination between topsoil/subsoil</p>

Type	Options	Typical Applications	Appropriate Vehicle Use	Advantages	Disadvantages	Environmental Mitigation	
					<p>Restricted access for future operations</p> <p>Resistance from landowners of potential long-term damage</p>		
Surface (Surface tracks are constructed on the existing ground surface, directly on top of the existing vegetation, and are generally relatively thin structures i.e. <1m thick overall. Surface tracks normally incorporate a proprietary geosynthetic or mattress of forest residue material when crossing areas of soft or wet ground. These are laid along the route of the track to provide additional structural strength whilst reducing the depth of sub-base that is required to carry a given load).	S1	Upgrade existing track	Existing tracks are to be used where feasible to minimise impact. Extent of works largely dependent on existing track condition and intended use.	Suitable for lightweight traffic (Argo-cats) up to HGVs and heavy plant	<p>Advantages as per new stone track plus:</p> <p>No / limited tree-felling</p> <p>No reinstatement required</p> <p>Lasting legacy for landowner</p> <p>Preferred solution for Planning Authorities</p> <p>No / limited increase in visual impact</p> <p>More cost-effective than new track</p>	<p>Disadvantages as per new stone track plus:</p> <p>Shared access with other users</p> <p>Potential overall increase of travel time dependent on location in relation to the new works</p> <p>Access times may be limited</p> <p>Sections of track may be subject to re-build</p> <p>Potential replacement of existing bridges following assessment</p> <p>Responsibility for maintenance on shared access</p>	Potential increase on noise pollution (proximity to local dwellings)
	S2	Geotextile separation layer	Typically a separating membrane would be used in construction of access roads, stone/ floating	Suitable for lightweight traffic (Argo-cats) up to HGVs and heavy plant	<p>Advantages as per new stone track plus:</p> <p>Reduced thickness of track depth</p> <p>Greater stability & longevity</p>	Disadvantages as per new stone track	<p>Plastic contamination of stone upon removal and reinstatement</p> <p>Potential plastic contamination on reinstated ground</p>
	S3	Truckpave	Permanent applications, less visual impact than hard surfacing, allows drainage through without installation of surface water drainage system	Can be designed to suit, up to HGV's	<p>Advantages as per new stone track plus:</p> <p>Remain as permanent for future access for operational purposes</p>	<p>Disadvantages as per new stone track</p> <p>Expensive, not typically used for temporary works applications</p> <p>Still requires a subbase layer</p> <p>Restricted gradients in application - requires level prepared sub-layer</p> <p>Restricted alignment</p> <p>Risk of damage during construction phase due to volume of heavy construction plant</p> <p>Programme impact due to production rate longer than laying stone track</p>	<p>TruckPave units are less than 50% weight of concrete alternatives substantially reducing manual handling risk.</p> <p>TruckPave has tongue and groove interlock- additional stability.</p> <p>Flexible and resistant to cracking unlike concrete alternatives</p> <p>Low permeability of the cell walls ensure soil fill remains hydrated with better grass growth.</p> <p>Non- toxic and inert material harmless to plants and animals.</p> <p>Manufactured from recycled mixed polymers- very low carbon footprint.</p> <p>Manufactured from recycled plastics</p>
	S4	Grasscrete	Similar to Truckpave, but for lighter applications. Typically more open than Truck Pave,	Typically light vehicle access tracks		<p>Disadvantages as per new stone track</p> <p>Expensive, not typically used for temporary works applications</p> <p>Still requires a subbase layer</p>	

Type	Options	Typical Applications	Appropriate Vehicle Use	Advantages	Disadvantages	Environmental Mitigation
		allows grass to grow through.			<p>Restricted gradients in application - requires level prepared sub-layer</p> <p>Restricted alignment</p> <p>Risk of damage during construction phase due to volume of heavy construction plant</p> <p>Programme impact due to production rate longer than laying stone track</p> <p>Not proven on long haul roads</p>	
	S5 Smart Surface (Eco pro-active)	Marketed by MacKenzie for light applications or repair of existing roads	Typically footways, cycle paths, bridle paths. Light temporary access tracks.	Does not require importing of stone	<p>Not suitable for significant loads</p> <p>Highly dependent on ground conditions</p> <p>Requires specialist product and plant</p> <p>Still requires removal of topsoil</p> <p>Weather dependent on application (5 degrees and rising)</p> <p>Programme impact due to production rate longer than laying stone track</p> <p>Not proven on long haul roads</p>	
	S6 Surface stone (light track for 4x4)	4x4, light construction and maintenance				
	S7 Roadcem	Road pavement layer, large area floor slab (car-park or industrial flooring)	Road legal vehicles & large construction plant	Solid Construction Capable of taking heavy loads/plant	<p>Surface layer required to protect Roadcem</p> <p>Lab testing required to inform mix design to meet ground conditions</p> <p>Ground levelling & pre-compaction required prior to placement</p> <p>Placed with towable stabiliser 2.5m wide and 5t in weight (mix 6m wide prepper area required to form 5m strip) mix placed in hopper by tanker</p> <p>Follow-up static & dynamic compaction required</p> <p>Surface may require wetting to avoid shrinkage cracks</p> <p>Multiple activities</p> <p>Sub-formation needs to be suitable for Roadcem installation, including plant</p> <p>Programme impact due to production rate longer than laying stone track</p>	<p>Has no granular material (it is just rotted organic material) so doesn't stabilise well</p> <p>Is acidic so stabilisation changes soil chemistry and potential alkali leaching</p> <p>Stabilisation does not work in wet conditions.</p> <p>When being reinstated requires complete destruction of the soil structure</p> <p>Likely to increase the run-off from the road would be increased and if this would have a high pH. High risk in locations with watercourses & private water supply</p>

Type	Options	Typical Applications	Appropriate Vehicle Use	Advantages	Disadvantages	Environmental Mitigation	
	S8	Use existing ground	ATV use for operational infrequent operational access, Suitable routes marked on maps	Argocat	No engineering works on existing landscape.	Suitable for only small ATV type vehicles and recommend infrequent use.	
Floating (surface) (Most commonly used to cross areas of deeper peat, where excavated methods of track construction are impractical or undesirable. Floating tracks are constructed on the existing ground surface, normally with one or two layers of geogrids interlocked with crushed rock aggregates)	F1	Geogrid, interlocked with crushed rock aggregate	Wind farm tracks, forestry tracks, constructed over peatland	Suitable for lightweight traffic (Argo-cats) up to HGVs and heavy plant	Advantages as per new stone track plus: Provide access across areas of very soft deposits (peat) Finished track level above existing which assists in snow drift accumulation	Disadvantages as per new stone track plus: Floating road construction requires road construction to be significantly wider overall with increased depth. Not suitable for steeply sloping areas (although unlikely to be significantly steep soft ground /peat areas) Subject to compaction and settlement Reinstatement and regeneration period Removal of all stone	Provision of adequate drainage Underlying vegetation may suffer under long duration of temporary track
	F2	Trackway	Typically for more short-term applications	Suitable for most construction traffic if designed to suit	May reduce sub-base requirement May be a solution to provide spurs to towers, typically when access required short-term and / or where adjacent spurs and Trackway can be moved to suit operations	Expensive - hired from supplier Needs to be lifted/ moved/ stored on site Not suitable on wet peatland and steep gradients Not suitable on rocky outcrops Dependent on gradients, advanced levelling required prior to laying Latent damages Increased risk of slips/trips/fall in icy conditions Doesn't offer permanent solution for Operational access	Impervious - helps with spills