1. Introduction

This Construction Methodology Statement (CMS) has been prepared in association with a proposal to establish and operate a new ski lift within the Remarkables Ski Area. This CMS supports the installation of a new 1.1 km long Sugarbowl chairlift involving a new top and bottom stations, lift towers, cable and other associated structures as well as the formation of a vehicle access track.

The proposed Sugarbowl lift will be in the south-west facing basin area located the existing ski area, and will replace the existing Sugarbowl quad chairlift, on a new alignment.

2. Design Methodology

The proposed lift alignment has been developed via a collaborative process including a comprehensive analysis;

- the characteristics of the terrain over which the installation travels, particularly with regard to evacuation
- the geological and hydrological conditions of the subsoil
- natural hazards (for example avalanches, rock falls, meteorological conditions)
- potential ecological and landscape effects
- skier terrain and flow

The proposed lift is a six-seat detachable chairlift lift, with a bottom drive tension station and a fixed top return station, with 10 intermediate towers and 53 chairs. The chairlift is located to transport skiers from the base area to the top of the Sugarbowl basin, where it provides access to the whole basin for skiers. The ropeway is designed to the latest and highest international standards and of first class materials.

3. Health and Safety

A site-specific safety plan will be created prior to any works, and submitted to NZ Ski for their reference. This plan will outline the following;

1. Site specific Health and Safety Agreement
    a. PCBU – NZ Ski Ltd; in charge of complete site, including other possible works
    b. PCBU 1 – Doppelmayr; in charge of ropeway site, including all customer contractors
2. Site Hazard register
3. Safe work method statement register, which will include
    a. General excavations
    b. Tower foundations
    c. Concrete placement with helicopter
    d. Top station foundations
    e. Bottom station foundations
    f. Workings at heights
    g. Tower mechanical assembly
    h. Tower assembly with helicopters
    i. Station assembly
    j. Electrical assembly
4. Hazardous substances register
5. Training and competency register
6. Emergency response plans

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7. Site inspection plan
8. Site incident and injury register
9. Hazardous works notification
10. Risk assessment matrix and hierarchy of controls

The project will introduce the following risks to the current environment

- Heavy vehicle movements
- Open excavations
- Helicopter operations
- Hazardous substances
- Heavy lifting
- Traffic movements on access road
- Cranes
- Working at heights
- Electrical

3.1. Traffic Management

The traffic management plan and road maintenance on the ski area access road will be responsibility of the customer. We expect to contribute the following number of heavy vehicle movements

Construction machinery and equipment	approx. 12 trips
Concrete deliveries	approx. 95 trips
Ropeway equipment deliveries	approx. 35 trips

The Car Park and Access Road are areas shared with both construction workers and customers. Construction workers will come to site together in provided light vehicles, which will reduce vehicles in this area.

Doppelmayr will have a dedicated, fenced off area for construction vehicles. All transportation trucks and vehicles associated with the various construction projects are made aware of summer operations staff prior to arrival. Speed limits will be in place and escorts used (if required) for any larger vehicles such as concrete trucks/cranes.

4. Environmental Management

The following sections detail our approach to environmental management, as well as other sustainability initiatives to be implemented during design, construction and operation of the ropeway.

4.1. Soil Management

To protect the integrity of topsoil and reduce the impact of vehicle movement on the site the following protocols have been established, and will be reinforced with construction personnel as part of tool box meetings and with contractors delivering materials to site:

- **Dust minimisation:** All deliveries are to call the project manager prior to assent coming onto site to ensure that dust suppression and/or monitoring is in place if needed.
- **Vehicle movement on the site:** all vehicles are to clear movement on-site with the project manager prior to arrival. All vehicles will travel on the designated path with supervision from the Project Manager or delegate.

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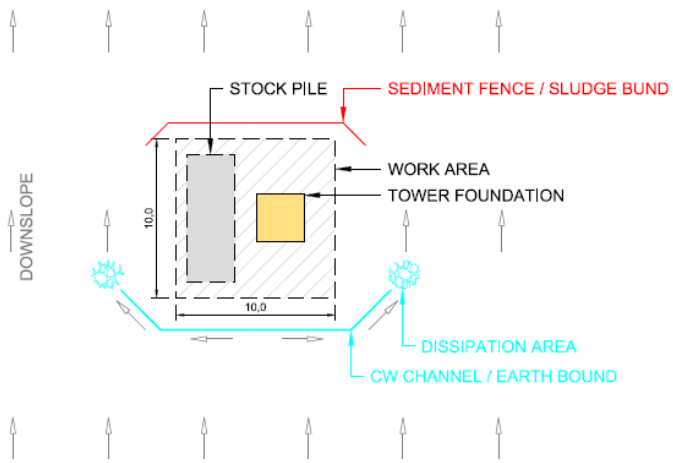
- **Check before you dig:** prior to digging in an area which has not been impacted by the project, team members will confirm the area with the Project Manager as well as confirm site-specific actions for soil stockpiling and/or reuse and tussock preservation (where applicable).

4.2. Sediment controls

All earthworks will be completed in accordance with the consent holder's sediment control requirements. The weather will be constantly monitored and considered prior to opening up any excavation or earthworks. The control measures will be adapted to suit each site and remain in place as required.

Typical controls:

- Surface water open drain diversion
- Earth bund for diversion/ control of surface water
- Stock piles covered with fabric for rain events/ dust control
- Sediment fences
- Haybale catchment fencing
- Deluge bunds/ holes to manage sediment settlement



4.3. Refuelling

- All light vehicles will be refuelled in areas designated or off site.
- Heavy machinery will be completely fuelled before travelling up the mountain. If further refuelling is required, this will be completed via mobile tanks, with a maximum capacity of 400L.
- Spill kits will be carried with mobile tanks and machines moved on access roads.
- Re fuelling sites will be agreed to prior to use in accordance with the consent authority.

4.4. Waste

The waste associated with the project includes:

- General landfill waste	approx. 24 m³
- Soft packing plastic	approx. 12 m³

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- Packing timber (heat treated) approx. 60 m³
- Steel approx. 2 tonnes

The following targets have been set for waste:

- 80% by volume of construction waste reused or recycled
- 80% by volume of office waste reused or recycled
- Target 3 skips to landfill for the project

Proirities are to:

- not bring waste (or things that end up as waste) to site
- reuse waste on-site whereever possible
- recycle what cannot be reused

Protocols around waste disposal and locations of bins will be covered in the site induction and at toolbox talks.

Recycling facilities will be provided in the staging area for:

- Metal
- Timber
- Soft plastics
- General waste

The Project Manager (or delegate) will inspect bins on a weekly basis (including documenting with photos). Any obvious contamination will be rectified (where it is safe to do so) and non-conformances discussed at the next toolbox meeting to ensure that all team members are aware where recycling bins are and what can be recycled. Opportunities to improve waste management will also be discussed with the team as part of toolbox talks.

Volumes of waste leaving the site will be recorded and reviewed by the project team.

Non-conformances and corrective actions will be reported to the project team as part of the weekly report.

5. Preconstruction Activities

This section describes the pre-construction and installation activities required for the project

5.1. Site set out

Prior to construction, a registered surveyor would survey the complete length of the ropeway and stake all tower sites and station locations, all possible hazards and major terrain changes are to be marked (i.e. power lines, roads, streams). Access roads and work areas will also need to be assessed by the customer. The construction areas, which include the footprints of the structures, plus temporary work and storage locations, would be staked.

The construction area generally consists of the following;

- Top Station; 25 m long x 20 m wide, includes the drive equipment, foundations and installation area for vehicle movements
- Tower locations; 12 m diameter circle from the centre, includes foundations, and installation area
- Bottom Station; 25 m Long x 20m wide, includes foundations, drive equipment, operator rooms, and installation area

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- Where ever possible, the construction areas will be reduced on a site-specific basic to minimise disturbance and avoid natural features and water bodies

5.2. Geotechnical assessments

Geotechnical assumptions were made for all sites for the estimation of foundation design. If detailed geotechnical work is required for the final design and construction, this is the customer's responsibility. In areas where foundations are placed on fill, a geotechnical engineer will be required to certify the minimum ground pressure

5.3. Staging/ Laydown area

A flat staging area will be required near the bottom station, for the arrival of approx. 35 x 40 ft. containers over a period of 2 months - containers will be unloaded immediately and returned to port. The staging area is to be suitably graded, and gravelled to provide good access, and working conditions in all-weather events.

The size of the laydown area required is approximately 70m long by 35m wide. Preparing this site will be the customer's responsibility.

6. Construction Phasing

The chairlift will be constructed during summers months and will have no effect on the ski areas operations. The total project duration is estimated to be 8 months.

Generally, it will occur in the following sequence:

1.	Tower foundations	approx. 10 weeks
2.	Communications cable/ Trenching	approx. 2 – 3 weeks
3.	Top station foundation	approx. 4 weeks
4.	Bottom station foundations	approx. 4 weeks
5.	Top station mechanical assembly	approx. 4 weeks
6.	Tower mechanical assembly	approx. 4 weeks
7.	Bottom station mechanical assembly	approx. 4 weeks
8.	Haul rope installation and splicing	approx. 2 weeks
9.	Carrier assembly and installation	approx. 1 week
10.	Electrical installation	approx. 4 weeks
11.	Testing and commissioning	approx. 2 weeks

Snow and access conditions will determine the exact start position.

The general hours of work will be 7am – 6pm Monday to Saturday.

7. Construction Method

7.1. Foundations

The foundations for the towers and stations designed as poured-in-place reinforced concrete raft foundations with a large pad, generally poured neat into the earth, and boxed column which protrudes the current ground levels by approx. 150 mm.

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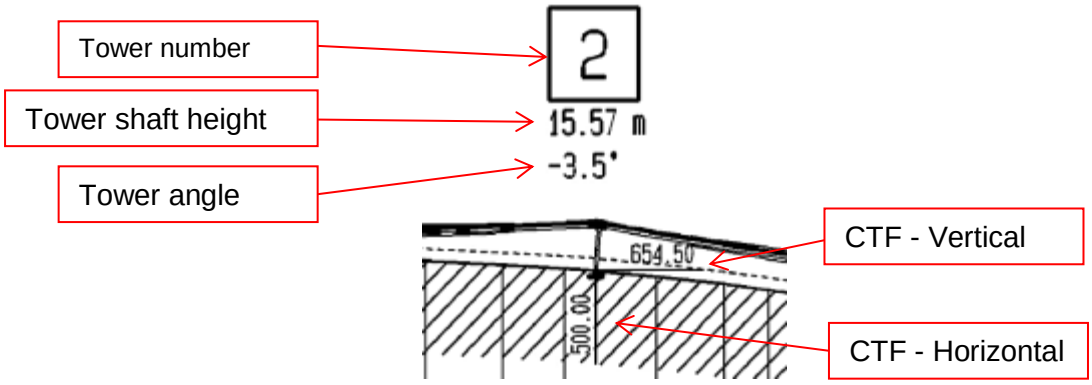
The backfill of the foundation is engineered to provide hold down weight for the tower foundation and may require the backfill to be placed with compaction or supplementation with other material if the soil density is not sufficient.

The longitudinal profile describes the location of each foundation regarding the centreline of the ropeway (CTF = Centre Top of Foundation).



An excavator would perform the excavation of the foundations; drilling and blasting may be required, or rock anchoring may be used if suitable. Surface material would be stripped and stockpiled (topsoil separate from subsoil).

Each tower excavation would take approximately two to three days. Construction of each tower foundation (formwork, rebar placement and concrete pour) is expected to be completed within accumulative time of one week. Tower foundations are approx. 4 m wide and 4 m long and 1.5 m below the current surface

Each station excavation would take approximately one week. Construction of each station foundation (formwork, rebar placement and concrete pour) is expected to be completed within 4 weeks. Station foundations are approx. 4 m wide by 18 m long and 2.5 m below the current surface.

The foundations would then need to cure for approximately 28 days prior to full loading. The foundation itself would then be backfilled and compacted with stockpiled subsoil and/or clean fill. The excavated material is only allowed for placement back at the excavated site, no removal from site has been allowed for and would be the customers responsibility.

If bedrock is encountered close to the surface it would be removed by mechanical digger or explosives to the necessary depth required for the foundation. The customer would be responsible for the removal and disposal of the rock if it cannot be placed directly next to the excavation.

The concrete required for the foundation construction would be provided via a commercial facility located near the project. Mixing trucks would be used to transport the concrete to the sites, or suitable staging areas for flying.

The customer would be responsible for specifying wash down areas for concrete trucks on site. A dumping area may be required if bad weather is encountered during flying operations.

The DNZ installation team will complete the foundations with the assistance of sub-contractors to operate specialist equipment. A New Zealand civil engineer will be engaged to supervise the construction and provide a suitable producer statement. A surveyor will provide a control survey (as built) of the foundations once complete.

Total timeframe for installation of the foundations/ concrete works is expected to be 4 months.

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Helicopter Operations

Foundations for towers 3 – 9 may need to be poured via a helicopter due to restricted access for concrete trucks. The preferred staging area is an available car park at the base area.

The helicopter operator will also be responsible for providing the concrete buckets. The operator will also be responsible for supply and management of re-fuelling.

7.2. Communications cable

The communications cables will be on or under the ground where possible. All cables will be either steel wire armour or in suitable conduit. Where the cable crosses trails or roads its will be buried approx. 600mm below the surface, and in sensitive areas (i.e. from tower 4 down) it will be laid above ground and anchored. Galvanised earth wire will connect all towers and stations.

7.3. Tower assembly

The towers are shipped as individual components and full onsite assembly is required. The towers will be pre-assembled to a maximum liftable weight for installation then transported to individual sites.

The tower shafts that have limited access (T3,4,5,6,7,8,9) will be fabricated in sections with a maximum weight of 1500 kgs per section for helicopter lifting. The towers in close proximity to the stations will be installed by crane.

All towers are installed on a levelling (concave/ convex) washer system that eliminates the need for grouting tower bases.

The crossheads will be pre-assembled to a liftable weight (image below) then installed by crane or helicopter. The sheave assemblies will be installed separately by helicopter, crane or winch from the rope lifter.

Alignment of the towers will be completed in place by theodolite and a control survey (as built) completed. A final alignment of the sheaves will be completed following the installation of the haul rope.

The electrical communication cables will come up the tower to a terminal box (approx. 1.2m from ground), then run internally to the top of the tower for connection to the sheave assembly safety wiring. The cables will be run within the foundation in conduit and then be protected below the terminal box by a steel cover.

Construction process:

- Preassembly in staging area
- Placement via crane - Towers 1, 2 and 10
- Placement via helicopter (1,500 kg max load) Towers 3 – 9
- Electrical installation
- Final assembly
- Final alignment adjustments with survey

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7.4. Station assembly

Each station will take approx. 4 weeks in total to complete. The assembly of all the main components will take place over 1 week utilizing a crane (generally max load 5,000 kg). The roofing and enclosure will take approx. 2 weeks to complete with the assistance of a Hiab crane.

Assembly process:

- Front mast and longitudinal beams (alignment to be completed with a surveyor for accurate positioning)
- Detachable conveyor system and walk ways
- Bullwheel and machine frame
- Mechanical components
- Roof structure and cladding
- Final adjustments and alignment of running equipment (following haul rope installation)
- Electrical installation
- Carrier installation via maintenance rail

7.5. Haul rope install

Rope pulling is one of the most specialist jobs in ropeway construction. Taking one – two weeks to complete. The process will be with several pulls, starting with a small rope, and working our way up to the full-size rope.

Before rope pulling can start the following must be completed;

- Clear site with no obstructions the length of the ropeway
- Area at the bottom station for rope reels and pulling equipment
- Trees or plants removed or protected along ropeway Line (Customer responsibility)
- Alpine scrub areas will not be needing to be cleared, rollers may be placed on the ground to aid the pulling process. Some of the larger scrub bushes may need to be individually removed to allow for a safe operation.
- Doppelmayr will supply all specialist rigging equipment and expertise to install the haul rope.

7.6. Electrical installation

Electrical installation is due to start once station assembly starts and is expected to take approximately 8 weeks. All electrical installation works are completed by Doppelmayr New Zealand registered electricians, according to NZ electrical regulations. A Certificate of compliance will be provided to the customer

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7.7. Testing and Commissioning

The testing and commissioning will take approx. 2 weeks. This will involve two ropeway technicians from Doppelmayr Seilbahnen GmbH testing will be in accordance with;

- EN 1709 Safety requirements for cableway installations designed to carry persons - Precommissioning inspection, maintenance, operational inspection and checks
    - Section 5; Verifications and pre-commissioning inspection

Throughout the entire commissioning and load test period, an uninterrupted power supply must be guaranteed.

A passenger ropeways inspector will be present for the acceptance tests as required

The customer will be responsible for providing all necessary fuel, electric power, ballast needed for the load test and test run

Training for operators and service staff will be during the testing stage.

7.8. Training

The following training will be provided following the installation:

- Mechanical and electrical training on-site with a Doppelmayr technician
- For the first 2 weeks of public operation, a Doppelmayr NZ technician will be on site to train and assist with the operation of the ropeway.

Additional training courses are available regularly at our training centre in Wolfurt, Austria. Training courses in New Zealand and Australia are planned for the near future.

8. Equipment

The following equipment is proposed to be used in the construction of the passenger ropeway;

	Quantity	Description	Duration
	3 x	4WD Pickup / Van for assembly team for transportation to and on site	40 weeks
	1 x	Tele-handler / Fork-lift for 6 tonnes	40 weeks
	1 x	All terrain forklift for use in carpark 2.5 T 4x4	40 weeks
	1 x	Truck 20 tonnes with boom for 4.5 tonnes	40 weeks
	1 x	Mobile crane type (TBA) tonnes, inclusive driver (sub-contractor)	4 weeks

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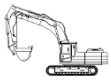
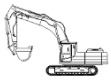
	1 x	20t Excavator	40 weeks
	1 x	35t Excavator	8 weeks
	3 x	20ft tool and office containers	40 weeks

Equipment is subject to change at Doppelmayr's discretion

9. Subcontractors and Suppliers

The following subcontractors are planned, and are subject to change at Doppelmayr's discretion

Scope	Company	Contact Details
Civil Engineering	Stantec New Zealand	Derek Chinn PO Box 13-052 Christchurch 8141 134A Gorge Road, Queenstown
Reinforcing materials	Fletcher Reinforcing	Jake Elliot 12 Harraway Rd, Green Island, Dunedin 9018 03-478 8105
Concrete supply	Allied Concrete, Queenstown	Shane Tell 63 Grant Rd, Frankton, Queenstown 9300 03-441 3635
Earthworks	Base Contracting	Julian Kinnaird 6A Arrow Ln, Arrowtown 9371 03-409 8280
Helicopter operation	Heliworks (Customer supply) *for concrete and general lifting*	Tex Smith Ln, Frankton, Queenstown 9349 03-441 4011
Heavy lifting helicopter operations	Beck Helicopters *Specifically, for tower placement*	Allan Beck 4512 Mountain Rd, Ngaere 4394 06-764 7073
Logistics	Icon logistics	Nic Abernethy 220 Fryatt St, Dunedin, 9016 03-477 9595

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