METROLINK
Integrated Transport. Integrated Life.

A5.16 Track Laying

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List of Abbreviations

Acronym	Meaning
CEMP	Construction Environmental Management Plan
DANP	Dublin Airport North Portal
DASP	Dublin Airport South Portal
EIAR	Environmental Impact Assessment Report
HGV	Heavy Goods Vehicles
M&E	Mechanical & Electrical
SCL	Sprayed Concrete Lining
STMP	Scheme Traffic Management Plan
TBM	Tunnel Boring Machine

1. Introduction

The MetroLink trains are designed for 'end evacuation'. This means that in the event of an incident requiring the evacuation of a train, the end of the car opens, with a ramp lowered to track level. The passengers, when directed, leave the area by foot, walking between the rails.

This system makes a number of demands of the track bed:

- The track bed must all be concrete to provide a level trip-hazard free surface. Whilst a concrete track bed is standard in tunnels, ballasted track is more usual for surface railways. MetroLink will have concrete track bed throughout;
- There must be no step between track bed and sleeper, as this would form a trip hazard. A "standard" concrete track bed would have the sleeper slightly raised above the track bed; and
- The drainage system between the tracks must be covered – there cannot be any open drainage channels or access points without covers.

The installation of track and track bed must also necessarily include the drainage system and any ducts required for services to pass beneath the tracks.

This Appendix sets out the activities required to install the first stage track bed concrete, to install the track, and to place the second stage concrete track bed that provides the final finished surface.

This is a 'routewide' report (i.e. installation of the track and securing it within a concrete track slab, is required along the whole alignment):

- Section 2 describes the operations required to install the track in the TBM driven running tunnel; and
- Section 3 describes the differences applicable to the other sections of the route (at grade, retained cut, cut and cover, bridge and viaduct).

2. Twin-track Running Tunnels

The design shows the twin-track secured within a concrete bed for the whole alignment. In the 8.5m internal diameter bored tunnels, the top of rail is approximately 2.2m above tunnel invert, and the area beneath the rails (the track bed) is shown as mass concrete.

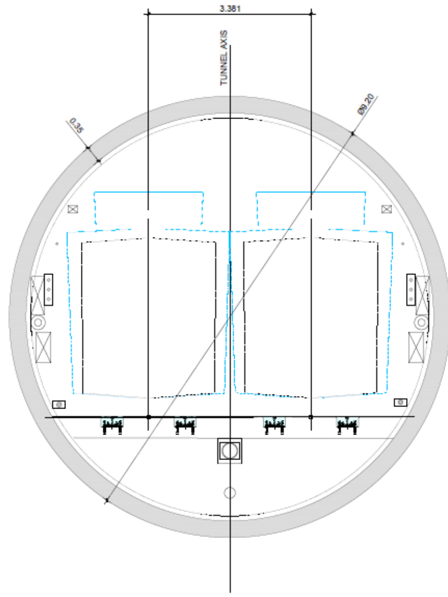

Diagram 2.1: Cross Section of the Twin-Track Tunnel

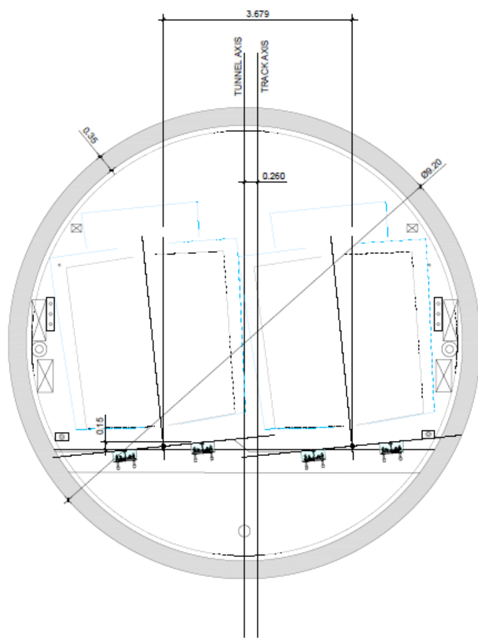

Diagram 2.2: Cross Section on a Curve Showing Cant on the Track

Track bed in tunnels is usually constructed in two stages with stage one providing a flat surface on which the sleepers and rail are installed and stage two a concrete fill around the sleepers to ensure they cannot move during operation. Sheer connectors can be provided in the form of ‘U’ bars set into the stage one concrete if required.

For the proposed Project, a two-piece sleeper is proposed (i.e. a sleeper beneath each rail, rather than a single sleeper spanning beneath the track). The two-part sleeper does not provide the gauge restraint (maintaining the distance of one rail from the other) that is provided by a one-part sleeper, and so this restraint must be provided by the second stage track bed. In the temporary case, the gauge is maintained by tie rods between the two sleepers.

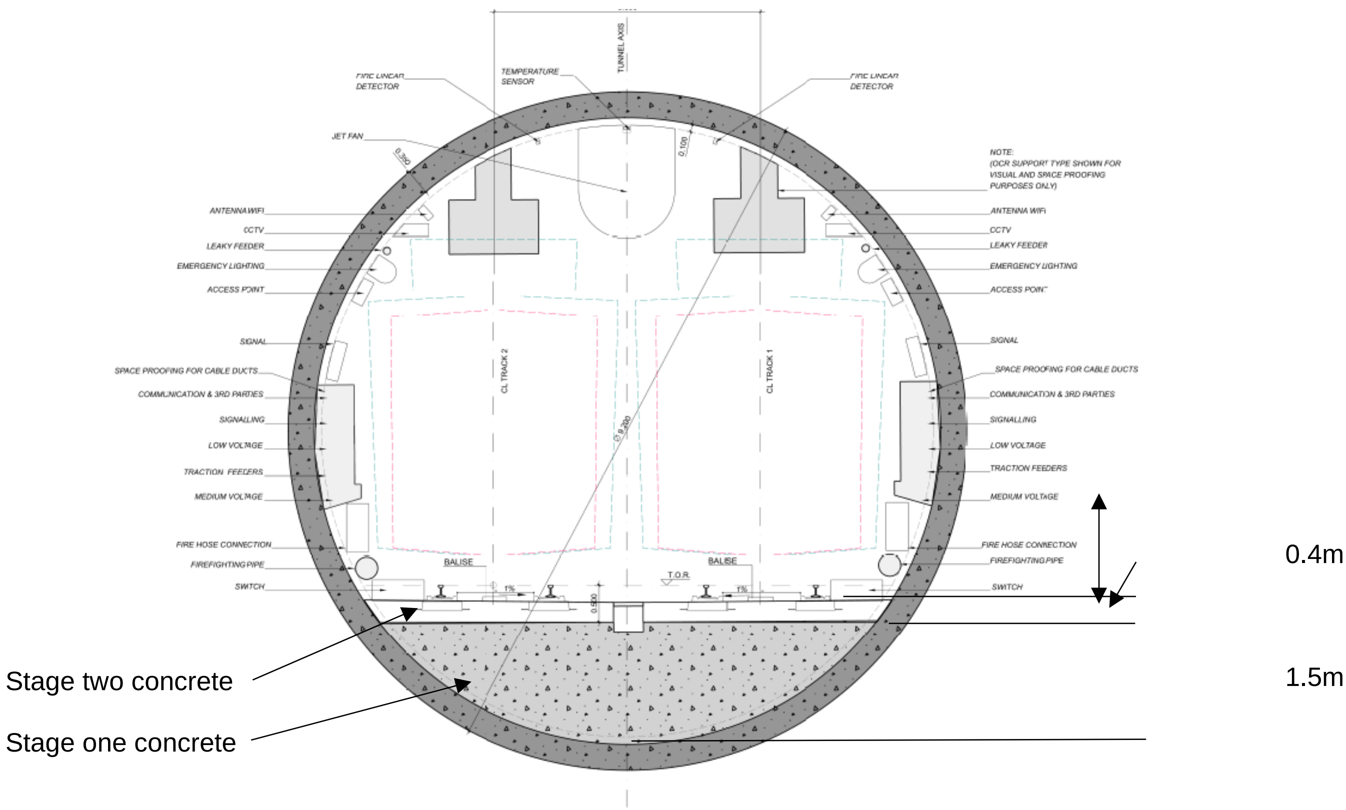

Diagram 2.3: Typical Cross-Section Through TBM Tunnel with Stage One Concrete in the Invert and Stage Two Cast Around the Sleepers

The concreting split is shown as:

- Stage one: 1.5m deep (6.75m^3 per linear meter); and
- Stage two: 0.4m deep (2.7m^3 per linear meter).

This allows most of the concrete to be placed prior to the rail, making installation of the rail easier.

A ‘top-up’ second stage is poured around the sleepers after the installation and welding of the track. The second stage concrete will contain the stray current protection (continuous pieces of rebar, welded together and checked for continuity), the drainage channels and manhole access to drainage and cable pits.

The proposed sequence of works is:

- Complete TBM drive;
- Clean tunnel;
- Ring repairs and/or leak sealing as necessary;
- Install first stage track bed, drainage and cross-ducts;
- Install tracks;
- Lift, secure and fix track in position; and
- Install second stage track bed.

2.1 Stage One Track Bed

The assumed methodology for the Stage One track bed is as follows. Installation of the Stage One track bed will take place following tunnel clean-out, from the tunnel drive site (Dublin Airport South Portal or Northwood) plus from Griffith Park to provide programme savings, as follows:

- South of Charlemont to Griffith Park with concrete supplied from Griffith Park;
- Griffith Park to Northwood with concrete supplied from Northwood; and
- Dublin Airport North Portal (DANP) to Dublin Airport South Portal (DASP) with concrete supplied from Dublin Airport South Portal.

The concreting operation will work towards the supply point (starting at the furthest point).

Concrete is placed using a Gomaco four-track concrete slipform paver or similar. A slipform paver is a self-propelled machine into which wet concrete is placed, in a hopper at the front. The concrete is fed into the mould underneath or to the side and compacted. As the machine moves forward, the finished concrete is extruded at the back. The mould can be almost any shape to provide the required profile. Pavers are frequently used to form drainage channels or central reservation barriers and are capable of casting several hundred cubic meters of concrete in an eight or 10-hour shift.

Diagram 2.4: Slipform Paver in Use on the Surface

The 'four track' simply means a paver with four caterpillar tracks, on which the paver drives forwards. Most pavers are of a three-track design, but for working in a tunnel, a four-track design is necessary.

The paver must be modified for working in a tunnel by using:

- Tracks modified to run on the tunnel sides (see Diagram 2.5 and Diagram 2.6) to prevent damage to the tracks and the tunnel;
- Diesel engines modified with particulate filters and fitted with a fire suppression system;
- Guidance system to ensure alignment, level and cant (the difference in level across the rails to help the train corner) are correct; and
- Suitable adaptation of the tunnel ventilation system to ensure a safe and healthy atmosphere will remain in place while the concrete works are carried out.

A specification sheet for a Gomaco Commander III four-track paver with noise information is in Appendix A.

Diagram 2.5: Typical Paver in a Tunnel

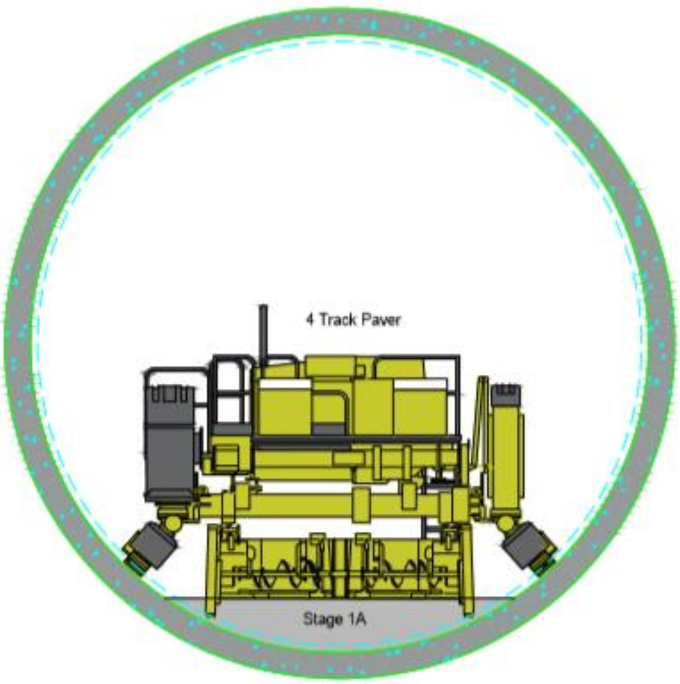

Diagram 2.6: Sketch Showing a Paver Working in a Tunnel

To ensure the paver legs are in a suitable position on the tunnel ring, it may be necessary to construct the stage one track bed in two passes, Stage 1A and Stage 1B.

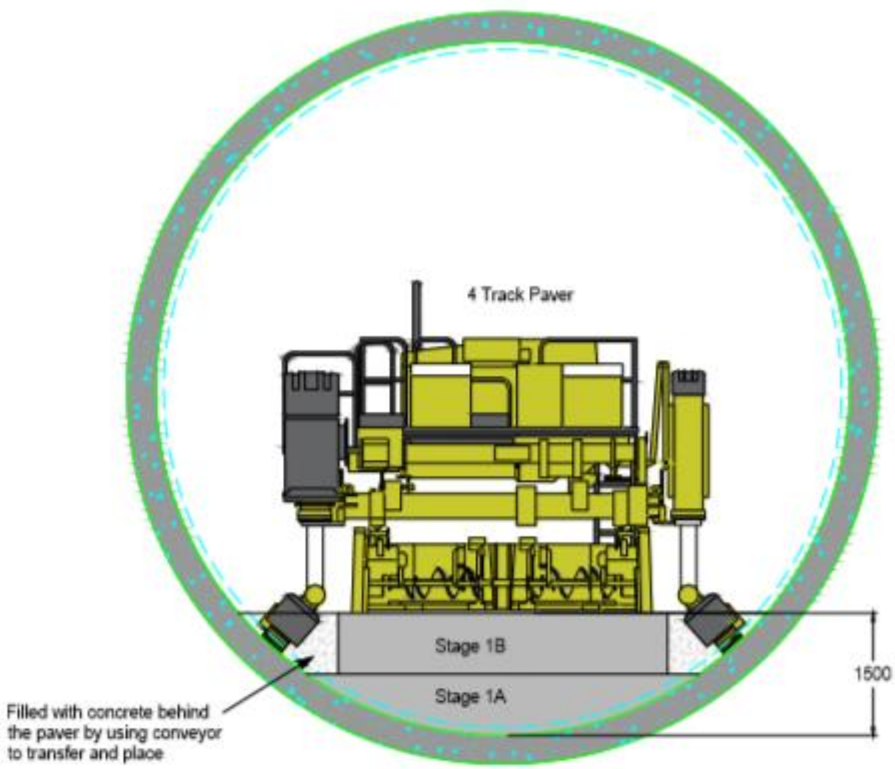

Diagram 2.7: Stage 1A and 1B Constructed in Two Passes

The section at the sides of Stage 1B will be cast using concrete transferred to the back of the paver using a conveyor belt (not shown) with personnel working from a platform cantilevered from the back of the paver.

Balises will be installed between the rails, (as shown in Diagram 2.3) at regular intervals along the whole route on both tracks. These may need to be installed flush to the finished surface to avoid a tripping hazard and can be installed from the cantilevered platform by cutting out a small area of concrete.

A balise is an electronic beacon set between the rails as part of the Automatic Train Protection system and typically needs no power supply (as shown in Diagram 2.8).

Diagram 2.8: Balise on a Wooden Sleeper

Any cable ducts required to cross from one side of the tunnel to the other will need to be securely fixed to prevent them from moving due to the large forces inside the shutter during compaction. However, they can only be fixed shortly before being concreted in place as otherwise they would obstruct the concrete supply vehicles.

The type of duct will need to be selected to withstand the compaction forces. Single-walled ducts and pipes are likely to deform under the loading from the paver, so a minimum of double wall type pipes should be assumed until tests demonstrate an alternative is sufficient. However, the issue of flexibility arises when using twin-walled pipes, so consideration should be given to procuring radiused pipes and ducts to allow easy fixing to the tunnel segments.

Fixing brackets can be bespoke manufactured to suit, with any chambers and draw pits either prefabricated or of a sturdy timber construction. Whatever is used, it is important to clear away the placed concrete before it has time to reach full strength. The main drainage channel will be created with the slipform paver. Cast-in holes in the segments can significantly reduce the amount of drilling required to fix the brackets and hence reduce the workforce exposure to hand-arm vibration syndrome (HAVS) and dust.

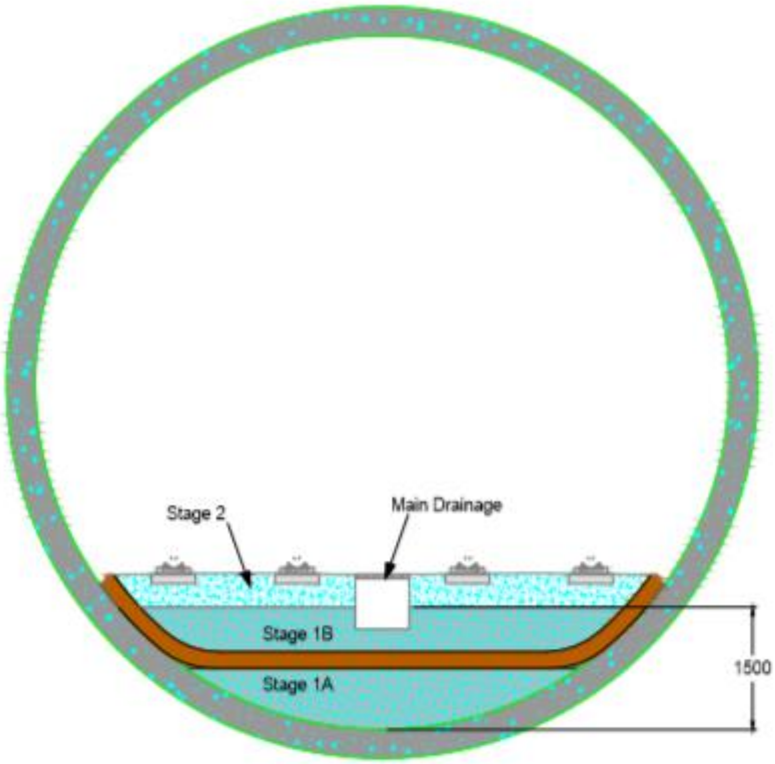

Diagram 2.9: Cross-Section Showing Cable Duct

The quality of the finished surface of the stage one track bed will make setting of the sleepers and rails a simple task as the alignment and cant can be accurately controlled with the paver, reducing any packing required under the sleepers. The surface can be brush-finished to provide shear resistance to the Stage Two track bed, and if additional shear resistance is required, rebar shear connectors can be installed behind the paver (though this needs to be done straight away before the concrete cures).

The location of cable ducts and drainage manholes are marked (set out) by the site engineers and survey team. Clear and concise setting-out details, along with material schedules, will be required to ensure that cross ducts or manholes are not missed out. They should be identified well in advance of the track bed works to allow for material delivery. Installation can only take place a few metres ahead of the paver to allow the trucks delivering concrete to run in the tunnel.

The use of a paver will necessitate the use a very dry concrete mix that can hold its shape once it has left the paver mould. The production of this dry mix requires a batching plant of very high torque in the mixing chamber and this would require a new mixer on a conventional batch plant.

The concrete is carried through the tunnel in bi-directional trucks which discharge into a storage hopper at the front of the paver. These are trucks either with a single driving position where the driver sits at 90 degrees to the direction of travel and looks to left or right accordingly, or with two driving positions, one for forward and the other for backwards, the driver's seat rotating to access one of two sets of controls so the driver is always looking in the direction of travel.

Diagram 2.10: Concrete Delivery Truck During Paving in the Channel Tunnel Rail link (CTRL)

A tracked excavator feeds the concrete into the paver hopper, from where the concrete is fed into the mould by a conveyor where it is compacted and forms the shape of the mould. As the paver moves forward, the finished profile concrete emerges from the back of the mould. Trucks are able to cross at stations and so are able to provide a near continuous concrete supply to the paver.

Diagram 2.11: Front of the Paver Where Concrete is Placed by the Excavator (Which is Behind the Camera)

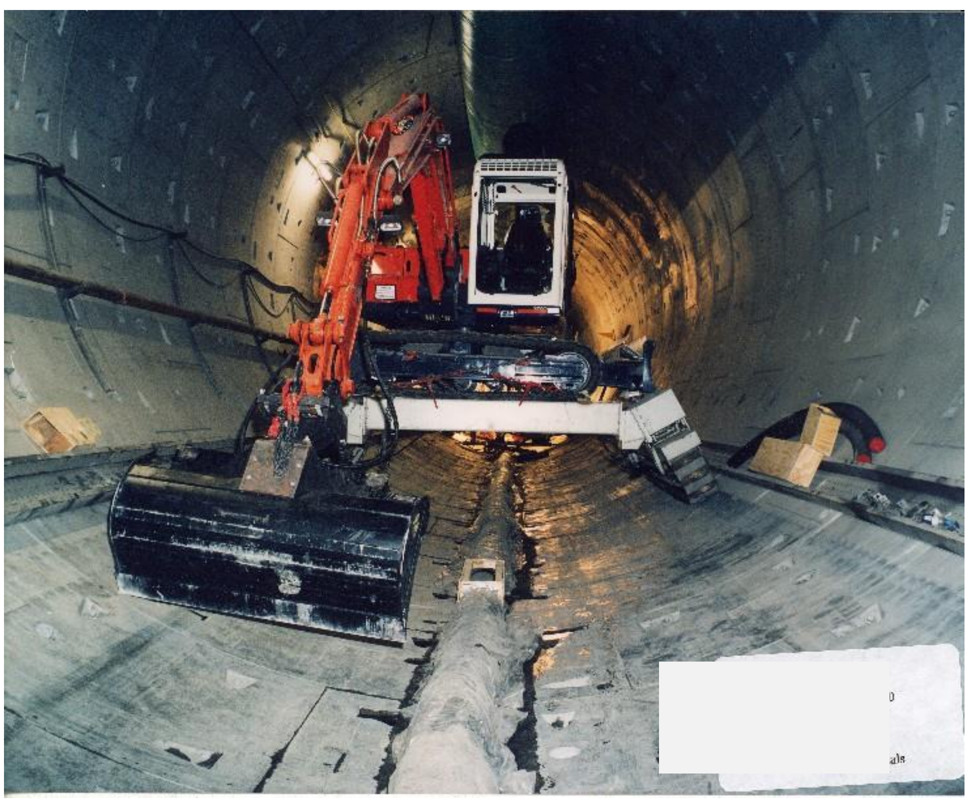

Diagram 2.12: Excavator in the Tunnel Which Places the Concrete in Front of the Paver

Diagram 2.13: Example of a Concrete Delivery Truck, Able to Drive in Each Direction Without Turning

Concrete will be site-batched at Northwood, Griffith Park and Dublin Airport South Portal and delivered to the work sites in mixer trucks. Concrete batching will be 24/7 with deliveries to the batching plant on day shift only.

2.2 Track Laying

Installation of the sleepers and rails will be carried out following the completion of a section of the stage one track bed concrete that can be accessed from the 'railhead' yard (see Section 4).

Sleepers, rail and clips will be delivered by road lorries to the railhead, (a construction site that has road access and also access to the railway under construction) and offloaded and stored. They will be laid out in a fixed pattern by placing into a 'jig' which ensures they are all placed in the correct positions. This can be in the form of box-outs in a concrete slab which ensures the correct spacing. The rail mounting points or chairs are cast into the sleeper at the manufacturer's facility. The steel rails are lifted into place and the holding clips inserted, fixing the rail in place. The sleepers are in two sections, one under each rail and are kept at the correct gauge (distance apart) by tie rods. Various systems are available and will be detailed in the design. Completed sections of track will then be loaded onto flatbed rail cars for delivery through the tunnel to the work location.

Sections of track are then lifted and carried forward using a purpose-made multi-use travelling gantry running on the Stage One concrete (see Diagram 2.14). For the double track to be used on the proposed Project, the gantry would span both tracks and run on the Stage 1B concrete. Each section is lifted over and past the previous piece laid and the sections are bolted together. Once in place, the sections of rail are welded together using a purpose-designed welding machine. Once welded, the track is still flexible enough to be set in its final position before concrete is poured. At 75m/day, 12 sets of 12m-long track will be required, with 24 welds needed. Using two welding machines working at four welds per hour, this should take approximately 6 hours. The track is thus laid in this manner, and the operation rapidly travels down the tunnel, moving away from the supply point.

Diagram 2.14: Multi-Use Gantry Laying Sleepers for Crossrail. Note this is a Single-Track System, not Twin, as for the Proposed Project

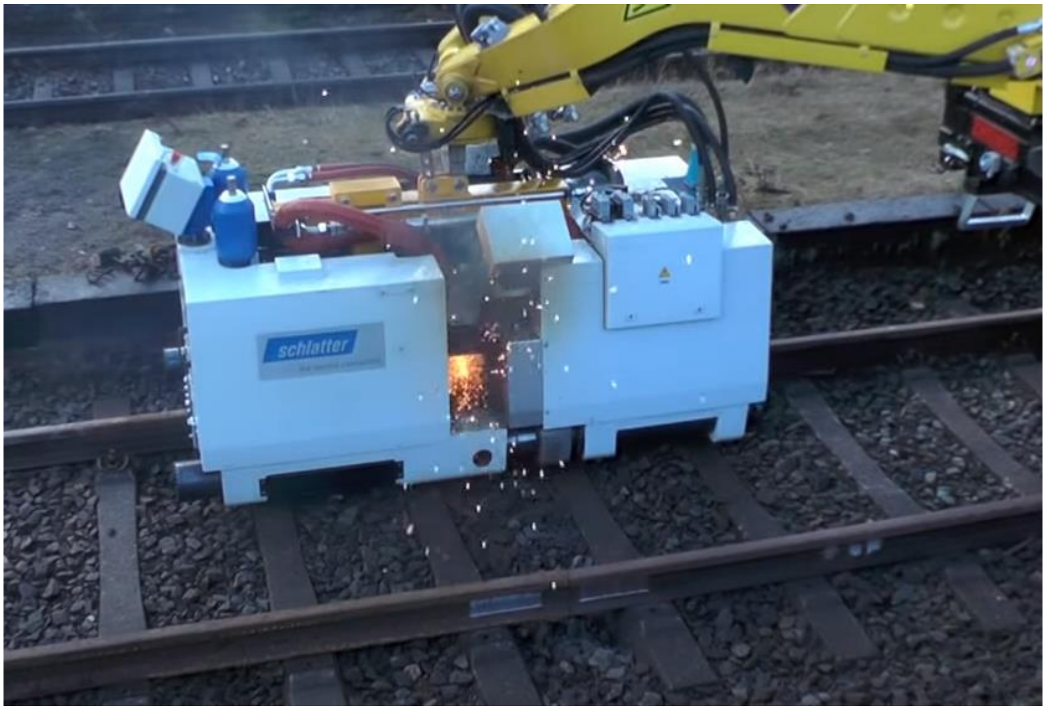

Diagram 2.15: Track Welding

In this operation, there is usually a severe restriction placed on the speed of tracklaying because a supply train, (which may perhaps carry 12 lengths of track each 12m (=144m)), must travel back to the railhead to pick up another load. However, the twin-track tunnels of MetroLink allow a second train to wait immediately behind the first, but on the other track, allowing continuous tracklaying.

The first option allows for the making up of rails in a yard away from the work site with the advantage of larger laydown areas/storage and conventional plant to lift and place the sleepers and rails ready to be assembled. However, this requires a larger number of HGVs to deliver.

Alternatively, the constituent parts can be delivered directly to the installation location and assembled *in situ*. In this case, the rails are usually installed first by pulling long sections, 100m plus, into the tunnel and placing to one side. These long rails are made up on the surface from short sections delivered by road transport. Sleepers are then placed using the multi-use gantry. Using the same gantry, the rails are lifted and set on the sleepers. The rails can then be welded and the concrete placed. This allows for most of the welding to take place on the surface.

2.3 Stage Two Track Bed

The sleepers will be placed on packers in approximately the correct position. One of two sequences is usually followed:

Sequence 1. After the installation of a set number of sections of track, the track installation train is removed, and the final position of the rails set (see

- Diagram 2.16). A concreting train is then brought into the tunnel. This train has a number of concrete-carrying containers (re-mixer cars or 'bullets' – see Diagram 2.17) which deliver the concrete to a concrete pump which is on a separate train. This pumps the concrete though a pipe running on lightweight track-mounted wheelsets and discharging through a flexible hose into the Stage Two track bed area. As the concrete is placed the train drives forwards moving the discharge point. In this way the second stage concrete is laid working away from the supply point. In this sequence, the locomotive, concrete supply bullets, and concrete pump do not drive over freshly placed concrete.

Diagram 2.16: Final Positioning of Rail

Diagram 2.17: Concrete Remixer Cars or Bullets

Diagram 2.18: Concrete Pump Line on Light Weight Wheels

Diagram 2.19: Bullet Discharging Concrete to the Pump

- Sequence 2. The track is laid as before until a section has been completed. A concrete train similar to that described in the first option is then used, but as the concrete is placed, the train moves gradually backwards towards the last section that has been concreted. In this way the second stage concrete installation progresses towards the supply point.

Both methods use the previously laid track for delivery of materials to the work sites using rail mounted equipment such as diesel locomotives, concrete bullets, manriders and flatbed wagons. These should be appropriately sized and specified for working in the tunnels. Concrete for Stage Two track bed is supplied from batching plants at Estuary and Dardistown Depots.

As the proposed Project's running tunnels contain double track, it is assumed that this will be made use of, ensuring a much more rapid installation of both track and second stage concrete than would be the case for a single-track tunnel. By making use of the crossovers, two concrete pump trains can be used, each consisting of:

- A flatbed with concrete pump, spare pipeline and tools;
- Several bullets, one behind another (bullets can be chain-linked so that one discharges into the one in front, which in turn discharges into the one ahead of it, and so on);
- Flatbeds with a manriding unit, a canteen unit and toilets; and
- The diesel locomotive.

As the tracklaying train leaves, the first concreting train can already be in position on the other track. The second concreting train waits at the first crossover and drives in as soon as the tracklaying train passes it.

The volume of concrete for Stage Two is $2.7m^3$ per metre of tunnel, so at a rate of 75m/day, approximately $200m^3$ will be required. By using two concrete pump trains, the rate of pour will be approximately $10m^3$ per hour per pump over a 10-hour period. When all of the concrete in one train has been discharged, the locomotive can depart with the empty bullets and additional bullets (which would be waiting at the first crossover) can be delivered.

During concreting operations, the multi-purpose gantry and welding units are taken forward to keep them out of the way.

Diagram 2.20 shows a schematic of the concrete train.

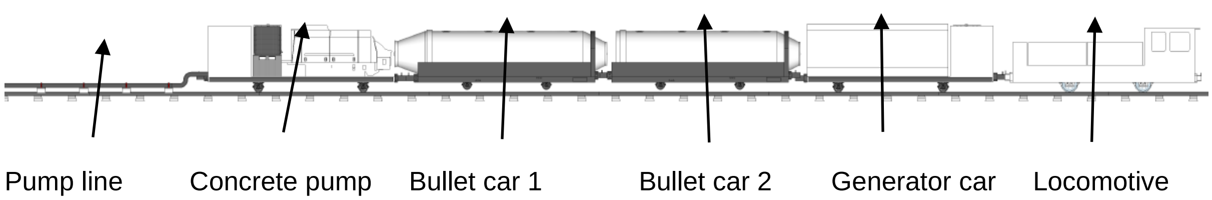

Diagram 2.20: Concrete Train Layout

3. Other Structures

For all of the structures described in this section, the tracklaying and second stage track bed concrete will be installed in the same manner as described for the bored tunnel.

3.1 Cut and Cover Tunnels/Retained Cut/At Grade

Within these locations, the first-stage track bed can be formed at any point up to the time the track is to be installed, and it can be considered either:

- A local operation where sections of track bed are cast as sections of the structure are completed; or
- A global operation where long lengths are formed in a continuous operation (probably using the same method, crew, and equipment as would have been used in the bored tunnels.

All drainage and ducts, and any foundations e.g. for the overhead gantry posts and signal posts, will be installed before the concrete is placed.

3.2 M50 Viaduct

For these structures, the stage one concrete track bed may be incorporated within the pre-cast units, or as the binding slab placed over these.

3.3 Crossings

Crossings will generally consist of a central diamond crossing and four turnouts (one on each track on either side of the central diamond). These will be delivered to the installation area in the same manner as the normal track. Each crossover is likely to take several days to deliver, install, fix, and concrete.

It is likely that the first stage concrete will need to be a little lower in these areas to accommodate deeper support members and additional ducts.

3.4 Floating Track Slab

Slab track is proposed along the length of the alignment in both open and tunnel sections, in areas of particular sensitivity, as outlined in Chapters 13 (Airborne Noise & Vibration) and 14 (Ground-borne Noise & Vibration), sections of floating track slab will be required in order to mitigate noise and vibration. There are different types of these depending on the mitigation required.

4. Railheads

Railheads are work sites that have road access and also rail access to the under-construction railway. Service yards at the railheads will be used to supply the working areas. Two such sites are proposed:

- Adjacent to Dardistown Depot; and
- Adjacent to Estuary Station.

4.1 Dardistown Depot Railhead

It will be necessary to service the works described here from the Dardistown Depot site at the same time as the construction of the depot itself. Therefore, much of the railhead site has been positioned on land adjacent to the depot.

The Dardistown Depot Railhead site has been positioned such that tracklaying activities can take place concurrently with trial running operations:

- Trial running operations can take place using the northbound exit track from the depot, and single track running on the northbound track as far as the first crossover north of Dublin Airport South Portal, and thereafter on the double track; and
- Track installation activities can take place using the southbound entry track from the depot, with trains driving onto the southbound track at Dardistown Station and thereafter reversing south on either track.

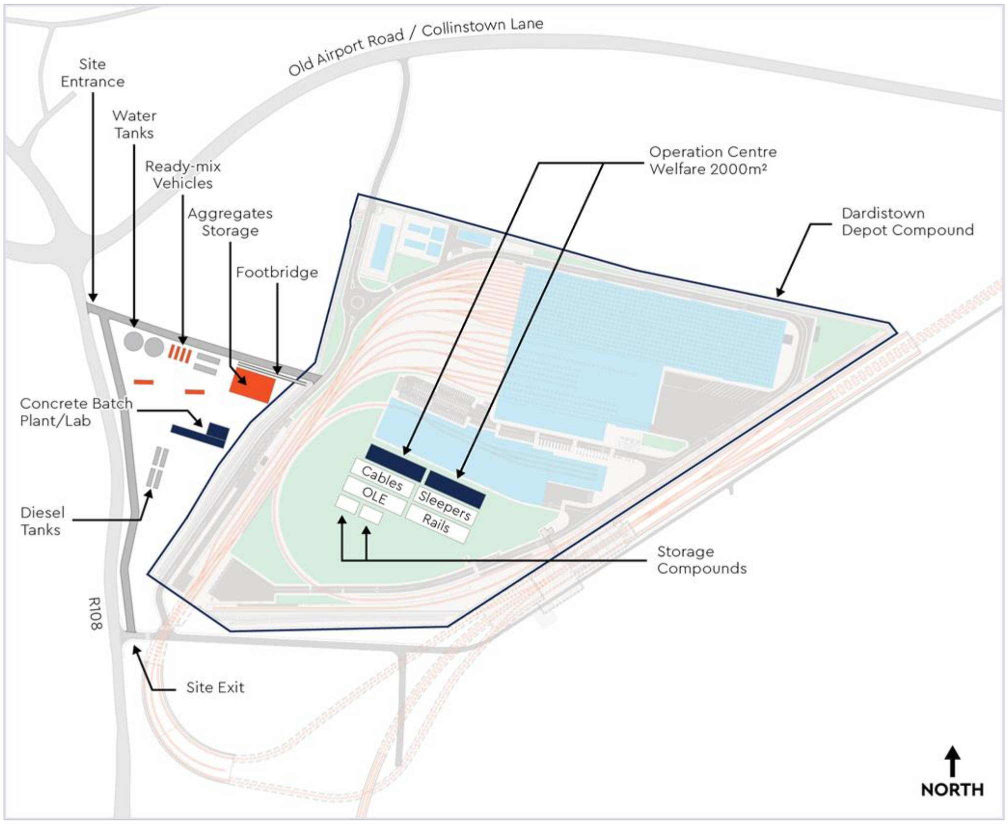

Diagram 4.1: Dardistown Depot and Railhead Site – Proposed Site Layout (During Construction)

4.2 Estuary Railhead

The Estuary Railhead site is required to allow:

- The installation of track to commence prior to the completion of the links from the main line to the depot at Dardistown; and
- The installation of track north of the Airport Tunnel to commence before that tunnel is completed.

Together, these allow the mechanical, electrical and plumbing (MEP) installation north of Dardistown to be completed very much earlier than would otherwise be the case. This in turn allows early testing and commissioning and trial running to commence on this section of track, significantly shortening the overall programme.

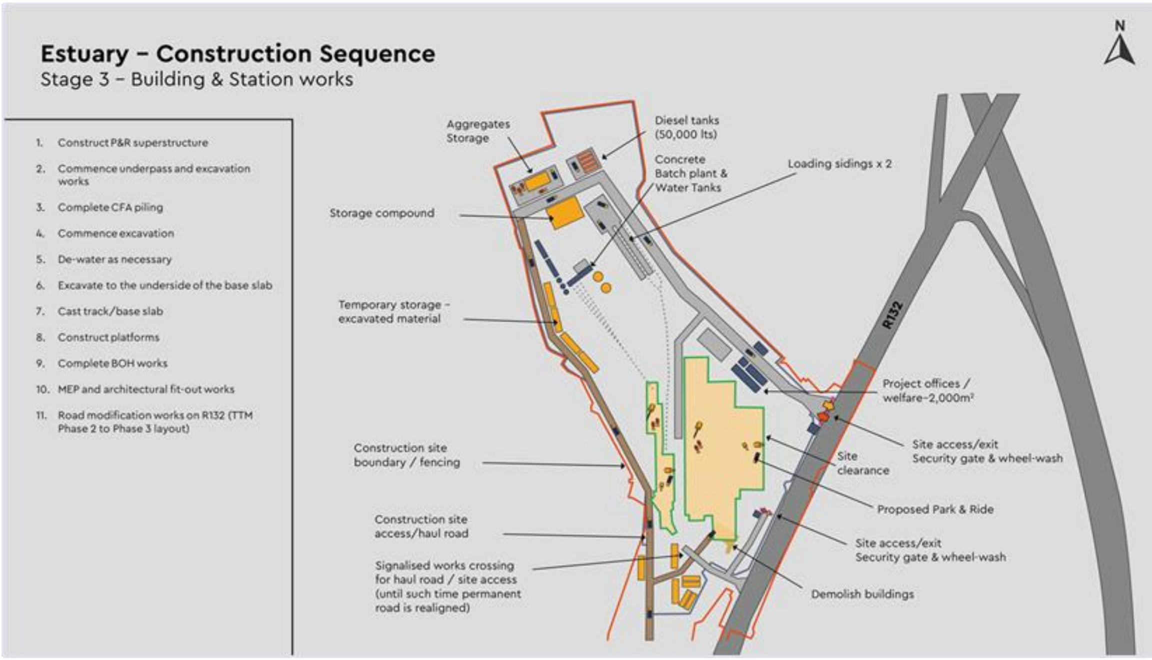

Diagram 4.2: Estuary Railhead Site – Proposed Site Layout (During Construction)

4.3 Track Installation Sequence

The track will be installed, working away from the railhead sites at Estuary and Dardistown Depot. This is likely to be in a number of phases, as sections are released by the civils contractors. For example:

- The temporary trackwork for the railhead and the connection to the permanent works at both sites;
- The twin track for the northern section, from Estuary to Dublin Airport North Portal;
- The single track from the depot connecting to the alignment via the northbound connection branch;
- The twin-track from the Dardistown connection to the Dublin Airport South Portal;
- The track for the permanent works at Dardistown Depot (this item is not critical and can be carried out to suit the other works);
- The single track from the depot connecting to the alignment via the southbound connection branch and the twin-track connecting through the future Dardistown Station;
- The twin-track to the south as far as Northwood Station;
- The twin-track through the Airport Tunnel; and
- The twin-track through the City Tunnel, to the turnback south of Charlemont Station.

With the installation of the systems largely following the same sequence, this releases sections for testing and trial running at the earliest opportunity.

5. Environmental

5.1 Working Hours

It is anticipated that the track laying operations (first and second stage) will take place 24-hours per day seven days per week. Concrete batching will take place 24 hours, 7 days, with the exception of Ballymun which will operate during standard hours only. Deliveries to the batching plant will be during standard working hours. Working hours are described in more detail in Section 5.2.4 of Chapter 5 (MetroLink Construction Phase).

The majority of the works take place at the working place which moves along the alignment. Each working place will be supported by one supply site. The supply sites are:

- Dublin Airport South Portal: Stage 1 track bed for the Airport Tunnel;
- Northwood Portal: for the Stage 1 track bed from Griffith Park to Northwood;
- Griffith Park: for the Stage 1 track bed from south of Charlemont to Griffith Park Station;
- Estuary: for the track installation and Stage 2 concrete from Estuary to Dublin Airport North Portal; and
- Dardistown Depot: for the track installation and Stage 2 concrete from Dardistown Depot to Dublin Airport North Portal and from Dardistown Depot to south of Charlemont.

5.2 Plant and Equipment

Plant to be used on the track laying will be a multi-use mobile gantry, diesel locomotives with flat cars delivering the track and sleepers, plus diesel locomotives for the concrete pump trains and concrete bullets. Welding machines are usually fitted to 16-18 tonne 360-degree wheeled excavators converted to run on both road and rails, known as road rail vehicles (RRV). In the tunnel sections, it is assumed that power for the concrete pumps will be from electrical distribution points located along the alignment, with the possible exception of the welding machines which may require a stand-alone generator. On surface sections, additional generators will be required for gantry, lighting, and for water mist sprays for dust suppression. All diesel plant will use the latest low emission engines and particulate filters and fire suppression system for use in the tunnel. Any diesel required to be held on site will be stored with appropriate secondary containment.

Slipform paving will be carried out in the tunnel only. Details for a typical slipform paver machine are shown in Appendix A.

No cutting of rails or concrete is envisaged during the operation but dust from roadways will be controlled by mist sprays and by damping down.

The placing of concrete will require that vibrating pokers are to be used to ensure the wet concrete encapsulates the sleepers and stray current protection steel. Noise from this operation will be mitigated by using portable noise barriers. The use of welded rails eliminates the need to tamp ballast which is a very noisy operation.

Noise and vibration from tracklaying activities are assessed within the EIAR in Chapters 13 (Airborne Noise & Vibration) and 14 (Ground-borne Noise & Vibration). The final Construction Environmental Management Plan (CEMP) will encompass a Noise and Vibration Management Plan which will be formulated for the Construction Phase and used by all contractors based on the mitigation measures outlined in these chapters.

Diagram 5.1: Road Railer with Welding Machine

Diagram 5.2: Dust Suppression for Roadways

Concrete Batching Plants for the Stage 1 track bed will be set up before the slipform paving starts. These will be mobile plants with enough capacity for the proposed production rates. Mobile plants are quick to set up and will only be in place during paving.

Diagram 5.3: Liebherr Mobilmix 2.5-C 115m3/hour Mobile Batching Plant

Batching plants will be used at Dublin Airport South Portal, Northwood and Griffith Park. They will be located close to the tunnel portal to allow quick loading of the concrete delivery trucks.

Concrete batching plants for the stage 2 track bed will be at the Estuary and Dardistown Railhead Sites and are shown in Diagram 4.1 and Diagram 4.2.

Diagram 5.4 shows a typical section through a batching plant with the plan layout shown in Diagram 5.5. A plan area of approximately 4,200m^2 will be required for the plants.

Wastewater from concrete batching will be recycled where possible or reused (e.g. for dust suppression or grout mixing). Water that cannot be recycled or reused will require disposal by discharge to sewers or watercourses. Where this is not possible, wastewater will need to be tankered off site to a suitably licensed treatment facility.

Further detail on water management is contained in Chapter 18 (Hydrology), the draft CEMP (Appendix A5.1 of this EIAR) and the Construction Water Management Technical Note (Appendix A5.11 of this EIAR).

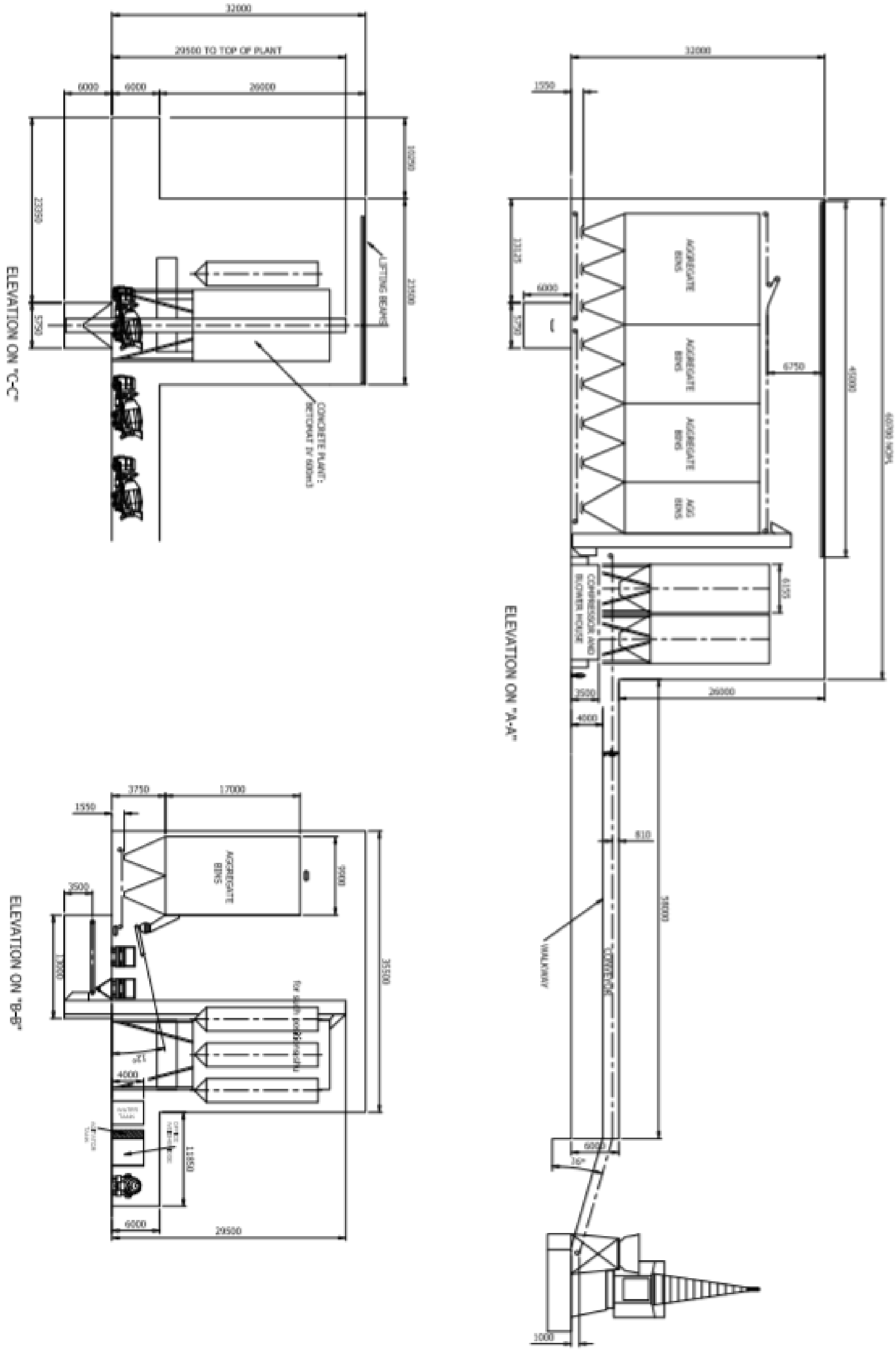

Diagram 5.4: Section Through Typical Batching Plant

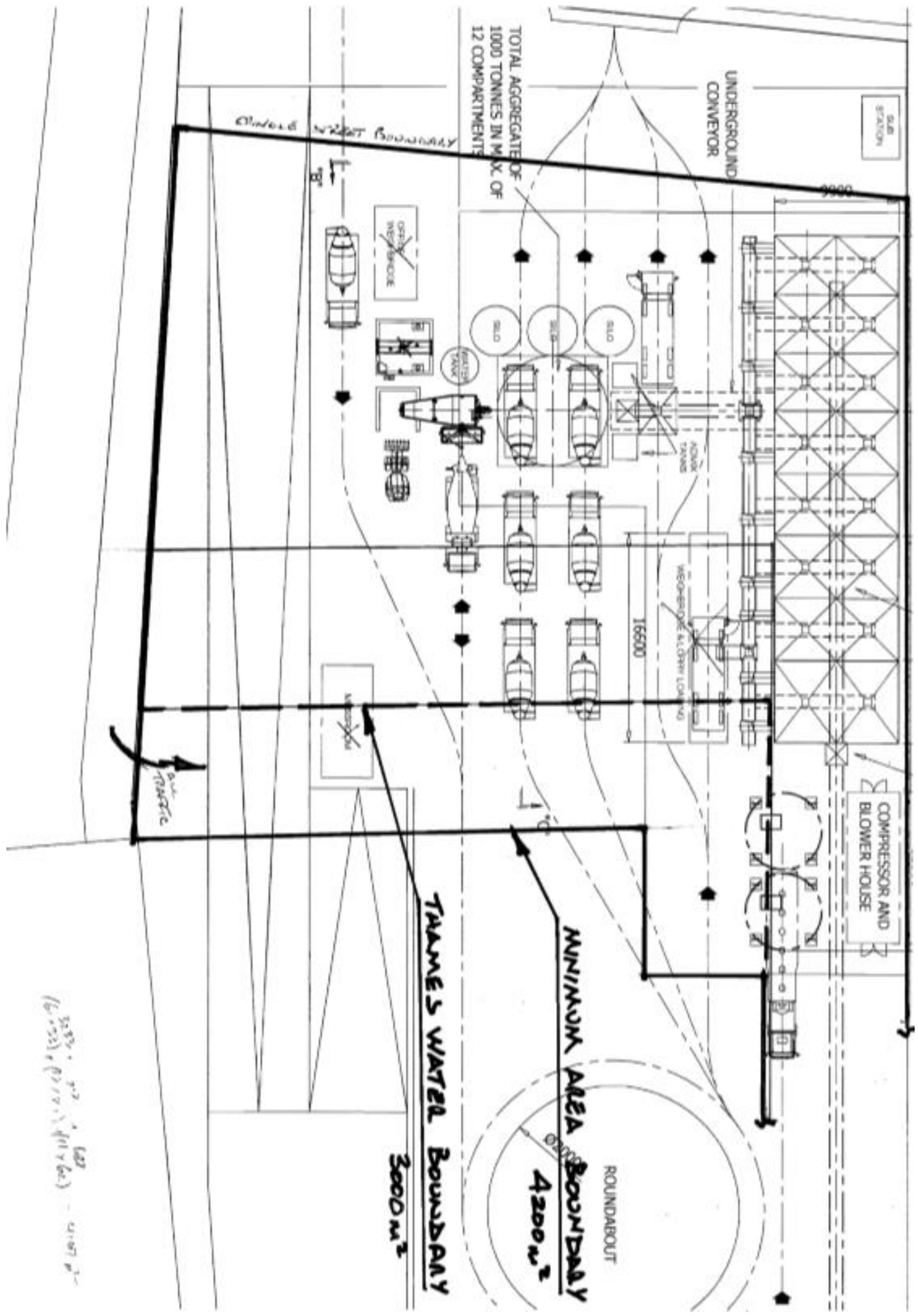

Diagram 5.5: Plan Area of Typical Batching Plant

Appendix A. Typical Slipform Paver Machine

Extract from Gomaco Commander III Specification. The full specification can be found at:
http://www.gomaco.com/Resources/commander_4t.html

Commander III Specifications

ENGINE
Consult for options available.

SERVICE CAPACITIES
Fuel reservoir: 88 gal. (333 L).
Hydraulic oil reservoir: 162 gal. (613 L).

AUTOMATIC CONTROL SYSTEM
Type: Electronic-over-hydraulic.
Controls: GOMACO's exclusive G+® control system for paving accuracy and ease of operation. It features multi-language, metric or imperial settings, and a 6.5 in. (165 mm) anti-glare display screen.
Control indicators: Color graphical performance indicators allow operator to monitor control signals for machine guidance on stringline or 3D.

WATER SYSTEM
Type: High-pressure water system.
Capacity: 110 gal. (416 L) tank, hose, and nozzle.

SLIPFORM MOLD
Curb and gutter mold: One curb and gutter mold standard. Optional molds available for curb and gutter, monolithic sidewalk and curb and gutter, barrier, parapet, irrigation canal, and more.

VIBRATORS
Type: Hydraulically powered, motor-in-head, variable speed, independently controlled.
Quantity Three-Track: Eight hydraulic circuits and four hydraulic vibrators with mounts included are standard.
Quantity Four-Track: Sixteen hydraulic circuits and four hydraulic vibrators with mounts included are standard.

MOLD DRAWBAR & HOLD-DOWN ASSEMBLY
Hydraulic lift: 18 in. (457 mm) pressure-compensated hydraulic vertical adjustment with 6 in. (152 mm) manual vertical adjustment, allowing up to 24 in. (610 mm) of vertical adjustment.
Sideshift distance: 36 in. (914 mm) hydraulic sideshift.

SUBGRADE TRIMMER (sectionalized)
Sectionalized trimmer: Internal hydraulic drive system and 24 in. (610 mm) diameter trimming wheel.
Trimmer wheel rotation: Upward cut.
Width: 42 in. (1067 mm) sectionalized trimmerhead includes one 24 in. (610 mm) drive section with hydraulic internal drive and 18 in. (457 mm) extension.
Sideshift and vertical adjustment: The trimmerhead mount for the three-track machine has 36 in. (914 mm) hydraulic sideshift, 18 in. (457 mm) of hydraulic vertical adjustment and 6 in. (152 mm) of manual vertical adjustment, allowing up to 24 in. (610 mm) of vertical adjustment.

CHARGING CONVEYOR
Type: Hydraulically powered, reversible with charging hopper.
Length: 17.1 ft. (5.21 m) between pulley centers.
Width: 24 in. (610 mm).
Belt speed: Variable to 362 fpm (110 mpm).
Conveyor mount: 36 in. (914 mm) hydraulic slide adjustment with 6 in. (152 mm) hydraulic tilt cylinder and manual pivoting mount (slide and tilt) for negotiating discharge from the ready-mix truck and negotiating grade variations. Allows truck positioning to front or side of machine. Hydraulically powered mount controls conveyor angle.
Belt wiper: Features special blades on adjustable spring steel rods for superior cleaning results. The unique, no-maintenance troughing rollers are greaseless and self-cleaning.

TELESCOPING FRAME (four-track)
Telescoping: Frame hydraulically telescopes on the left side up to 6 ft. (1.83 m).

TRACK SYSTEM
Type: Hydraulically powered gear-driven crawler tracks.
Track length: 5.1 ft. (1.55 m). Overall length with fenders 6 ft. (1.83 m).
Track pad width: 11.8 in. (300 mm).
Track speed: For the three-track machine, up to 49.5 fpm (15.2 mpm) paving, and auxiliary up to 131 fpm (39.9 mpm); for the four-track machine, up to 37.1 fpm (11.3 mpm) paving; and auxiliary, up to 98 fpm (29.9 mpm).
Track tension: Fully automatic, hydraulically locks in on machine start-up, maintaining a steady tension on the track chain.
Leg height adjustment: Each leg adjustable in 4 in. (102 mm) increments for 28 in. (711 mm) manual adjustment with 42 in. (1067 mm) hydraulic adjustment.
Telescoping leg for positioning right front track: Hydraulically controlled, allows 36 in. (914 mm) lateral track adjustment range.
Power-slide leg for positioning rear track: Hydraulically controlled, allows 6.5 ft. (1.98 m) lateral track movement.
Power-swing leg for positioning left front track on the Commander III: Hydraulically controlled, allows track positioning from straight ahead to 13.5, 26, and 36.8 in. (343, 660, and 935 mm) to left outside of main frame or 13.5 and 26 in. (343 and 660 mm) to right toward center of main frame.
Power-swing leg for positioning left front track on the Commander IIIx: Hydraulically controlled, electronically sensored allows track positioning from straight ahead to 33.4 in. (848 mm) to left outside of mainframe or 5.3 in. (135 mm) to right toward center of mainframe.

THREE-TRACK MACHINE DIMENSIONS
Overall length: 23.3 ft. (7.1 m) without the conveyor.
Overall width: 9.7 ft. (2.96 m).
Overall height: 9.3 ft. (2.83 m).
Transport height: 8.6 ft. (2.62 m) without the mold.
Transport width: 8.5 ft. (2.59 m) without ladder.
Transport length: 27.9 ft. (8.5 m) with conveyor (measurement varies with conveyor tilt, positioning and length) and 23.3 ft. (7.1 m) without conveyor.

FOUR-TRACK PAVER DIMENSIONS
Overall length: 21.3 ft. (6.49 m).
Overall width: 25.1 ft. (7.65 m) extended and 19.1 ft. (5.82 m) retracted with ladder mounted.
Operational height: 11.6 ft. (3.54 m) with 3100 series mold and 10 in. (254 mm) paving depth.
Transport height: 9.7 ft. (2.96 m) without mold and stack, and 10.75 ft. (3.28 m) with 3100 series mold and without stack.
Transport width: 9.5 ft. (2.9 m) without ladder.
Transport length: 29.1 ft. (8.87 m).

THREE-TRACK WEIGHT (approximate)
Standard curb and gutter machine weight: 29,500 lbs. (13,381 kg).

FOUR-TRACK WEIGHT (approximate)
Standard four-track paver with 12 ft. (3.66 m) 3100 series mold weight: 49,500 lbs. (22,453 kg).
Note: Transport and operational weights and dimensions are variable, depending on machine options.

OPTIONS
Barrier/parapet sidemount or centermount.
Monolithic sidewalk and curb and gutter package.
Trimmerhead extensions.
Left-hand discharge trimmerhead.
48 in. (1219 mm) charging conveyor extension to accommodate longer conveyor requirements.
Conveyor truss assembly required on 24 ft. (7.32 m) long conveyors.
Auger provides fast and efficient concrete delivery.
Additional vibrator circuits and controls.
Hold-over assembly, hydraulically powered, required when paving adjacent to existing concrete slab.
Swinging drawbar extension, for use with molds wider than 48 in. (1219 mm).
Slipform molds, consult factory.
V2 paving mold.
24 in. (610 mm) section with supported or self-supported power transition adjuster (PTA).
Auto-Float® attachment.
Polyurethane track pads.
Wireless remote for G+ curb and gutter machines.
3D package for stringless control.
GOMACO Remote Diagnostics (GRD).
On-Board Camera.

Other options are available to customize machine to accommodate applications and customer needs.

The three-track Commander IIIx slipforms monolithic sidewalk and curb and gutter.

Intelligent All-Track Positioning (ATP) on the GOMACO Commander IIIx includes a smart hydraulic cylinder on each of the three legs. The smart cylinders allow G+ to know the position of all three tracks and make steering adjustments as needed.

-- DESIGNED FOR SAFETY --

The Commander III is carefully designed to give years of dependable and safe service. Emergency stop (E-Stop) buttons are located on strategic areas of the machine. The E-Stops are on the operator's console and on corners of the machine, or can be positioned at various points on the machine providing optimal use for specific applications. Other safety features include track guards, warning decals, an operator's manual, and a safety manual. GOMACO machines are also designed to provide the operator maximum visibility over the entire paving operation.

Cover Photo: CG-071710-D6

Manufactured under one or more of the following U.S. or foreign patents: 6,450,048; 7,044,680; 7,284,472; 7,517,171; 7,845,878; 7,850,395; CA2,864,902; CA2,591,177; 8,855,967; 8,682,622; 9,051,696; 9,180,909; 9,200,414; 9,404,228; 9,428,869; 9,458,581; 9,464,716; 9,541,195; 9,567,715; 9,624,626; 9,637,872; 9,644,328; 9,633,162; 9,670,627; 9,739,019; 9,764,762; 9,869,063; 9,982,399; 9,963,836; 10,005,489; 10,206,016; AU2018100400; AU2019100743; and patents pending.

Printed in U.S.A. © 2019 (12 Printco 5000)
GOMACO Corporation Order #0400-0A10103

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The Worldwide Leader in Concrete Paving Technology

GOMACO Corporation's Quality Management System Is ISO 9001 Certified By The American Systems Registrar.

Quality Policy: We Shall Meet Or Exceed Our Customers' Expectations.

Sound Test Report for Gomaco Paving Equipment.
Paver-Finishers equipped with High Compaction Screeds
Tested in Accordance with ISO3744
Reporting Requirement of EN 2000/14/EC Article 13

Manufacturer:	Gomaco
Address:	119 E. Hwy 175 Ida Grove, IA 51445 USA
Model	Commander III 3-track
Description	A Commander III is a piece of paving equipment used to slipform various concrete structures such as curbs and gutters, barrier walls, and sidewalks. A Commander III is a self-powered machine which moves with the use of three or four crawler tracks. Commander III's have various adjustable frame components. It is typically equipped with a conveyor for moving concrete, a trimmer for cutting grade, and some sort of mold for the concrete. A Commander III can be classified as a paver-finisher with a high-compaction screed.
Serial Number:	900100-1156
Shipping Destination:	Spain
Test Radius Used:	16 (m)
Engine Power Rating:	129 (kW)
Engine Speed	2200 (RPM)
Max. Fan Speed	1300 (RPM)
Total Sound Power:	105 (dB_A ref. 1 pW) determined in accordance with 2000/14/EC
Operator Sound Pressure: (A weighted)	86.0 (dB_A ref. 20 μPa) measured over 16 s for each ear and averaged
Operator Sound Pressure: (C-weighted)	90.8 (dB_A ref. 20 μPa) measured over 16 s for each ear and averaged

Sound Power rating measured and marked on machine in accordance with Article 13 of 2000/14/EC for each unit being shipped into the European Community. The test procedure, test data, and relevant calculations for the determination of the sound power should be attached to this report.

Each unit bound for the European Community is tested, so no uncertainty due to production variation is present.

Test report completed by:	Lex Jacobson
Date:	9 December 2019

Sound Power Calculations 900100-1156 12/9/2019

Enter the test radius, R, in meters: 16
Surface Area (m^2): 1608.50

Enter the two highest pressures for each point that differ by less than 1 dB.
If there is no high and low measurement state, enter the same values in both tables.

Background Sound Pressures A-weighted (dB)			
1	2	Mean	$10^{.1L}$
55.8	54.9	55.30	3.3884E+05
53.6	53.1	53.33	2.1503E+05
52.6	52.6	52.61	1.8218E+05
54.1	53.3	53.69	2.3388E+05
55.7	54.9	55.33	3.4119E+05
55.0	54.1	54.53	2.8379E+05

Source Sound Pressures (low state) A-weighted (dB)			
1	2	Mean	$10^{.1L}$
71.7	72.2	71.95	1.5668E+07
70.0	70.5	70.23	1.0532E+07
72.2	72.6	72.40	1.7378E+07
74.1	74.0	74.02	2.5235E+07
69.0	70.2	69.62	9.1517E+06
75.6	75.5	75.55	3.5892E+07

Source Sound Pressures (high state) A-weighted (dB)			
1	2	Mean	$10^{.1L}$
71.7	72.2	71.95	1.5668E+07
70.0	70.5	70.23	1.0532E+07
72.2	72.6	72.40	1.7378E+07
74.1	74.0	74.02	2.5235E+07
69.0	70.2	69.62	9.1517E+06
75.6	75.5	75.55	3.5892E+07

Average Background Sound Pressure (dB) 54.25

Average Source Sound Pressure, low (dB) 72.78

Average Source Sound Pressure, high (dB) 72.78

Total Average Source Sound Pressure (dB) 72.78

Background Correction Factor, K_1 (dB) 0.061

Surface Sound Pressure (dB) 72.72

Total Sound Power (dB) 104.78

Enter total number of vibrators: 8
Enter sound power per vibrator: 82.80

Total Vibrator Sound Power: 91.83

Total Machine Sound Power: 105.00

OperatorA	High	86.00	Total	86.00
	Low	86.00		

On road pavers, add a 1 dB safety factor to operator values measured without vibes.

OperatorC	High	90.80	Total	90.80
	Low	90.80		

On road pavers, add a 1 dB safety factor to operator values measured without vibes.

The Worldwide Leader in Concrete Paving Equipment

GOMACO
PO Box 151
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Ida Grove, IA 51445 USA

EU DECLARATION OF CONFORMITY WITH COUNCIL DIRECTIVE 2006/42/EC			
Issue Details:	Date: 12/11/2019	Place: Ida Grove, IA; USA	DoC Number: DC-053-168
Directives:	Machinery Safety Directive 2006/42/EC		
Conforming Machinery:	**GOMACO**		
Model Number:	**Commander III**		
Serial Number:	**900100-1156**		
Manufacturer:	**GOMACO Corporation** 121 E. State Highway 175 PO Box 151 Ida Grove IA 51445; USA		
Authorised Representative & Person, established within the Community, responsible for compiling the Technical File:	**Rory Keogh** **GOMACO International Ltd** Units 14 & 15, Avenue 1 Station Lane Witney, Oxford OX28 4XZ; UK		
Harmonised Standards & Other Technical Standards/Specifications Applied or Referenced:	EN 500-1, EN 500-6, EN 1037, EN ISO 12100, EN 13850, EN 13857, EN 60204-1, EN 60529, EN 61310-1, EN 61310-2, EN 61310-3		
Provisions with which Conformity is Declared:	Essential Health and Safety Requirements of Annex 1 of the Machinery Directive		
Declarations of Conformity to other Relevant EU Directives:	2004/108/EC Electromagnetic Compatibility 2000/14/EC Noise Directive		
Declared values relevant to Directive 2000/14/EC	Measured Sound Power: 105 dBA Guaranteed Sound Power: 107 dBA Net Installed Engine Power: 129 kW at 2200 RPM		
We hereby certify that the machinery described above conforms to the provisions of Council Directive 2006/42/EC on the approximation of the laws of the Member States relating to the safety of machinery.			
Signed:	[signature]		
Signatory:	Grant Godbersen Vice President, Manufacturing		