APPENDIX H – NOISE AND VIBRATION ASSESSMENT

Noise Perception and Terminology

Between the quietest audible sound and the loudest tolerable sound there is a million to one ratio in sound pressure (measured in pascals, Pa). Because of this wide range a noise level scale based on logarithms is used in noise measurement called the decibel (dB) scale. Audibility of sound covers a range of approximately 0 to 140 dB.

The human ear system does not respond uniformly to sound across the detectable frequency range and consequently instrumentation used to measure noise is weighted to represent the performance of the ear. This is known as the 'A weighting' and annotated as dB (A) or L_{pA} dB. Table A.1 below lists the sound pressure level in dB (A) for common situations.

The noise level at a measurement point is rarely steady, even in rural areas, and varies over a range dependent upon the effects of local noise sources. Close to a busy road, the noise level may vary over a range of 5 dB(A), whereas in a suburban area this may increase up to 40 dB(A) and more due to the multitude of noise sources in such areas (cars, dogs, aircraft etc.) and their variable operation. Furthermore, the range of night-time noise levels will often be smaller and the levels significantly reduced compared to daytime levels.

Table 0-1. Noise Levels for Common Situations

Typical noise level, dB(A)	Example
0	Threshold of hearing
30	Rural area at night, still air
40	Public library, refrigerator humming at 2m
50	Quiet office, no machinery
60	Normal conversation
70	Telephone ringing at 2m
80	General factory noise level
90	Heavy goods vehicle from pavement
100	Pneumatic Drill at 5m
120	Discotheque – 1m in front of loud speaker
140	Threshold of pain

The equivalent continuous A-weighted sound pressure level, L_{Aeq} dB (or L_{eq} dBA), is the single number that represents the average sound energy measured over that period. The L_{Aeq} is the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period.

When considering environmental noise, it is necessary to consider how to quantify the existing noise (the ambient noise) to account for these second-to-second variations. A parameter that is widely accepted as reflecting human perception of the ambient noise is the background noise level, L_{A90}. This is the noise level exceeded for 90% of the measurement period and generally reflects the noise level in the lulls between individual noise events. Over a one-hour period, the L_{A90} will be the noise level exceeded for 54 minutes.

Human subjects are generally only capable of noticing changes in steady levels of no less than 3 dB(A). It is generally accepted that a change of 10 dB(A) in an overall, steady noise level is perceived to the human ear as a doubling (or halving) of the noise level. (These findings do not necessarily apply to transient or non-steady noise sources such as changes in noise due to changes in road traffic flow, or intermittent noise sources).

Figures

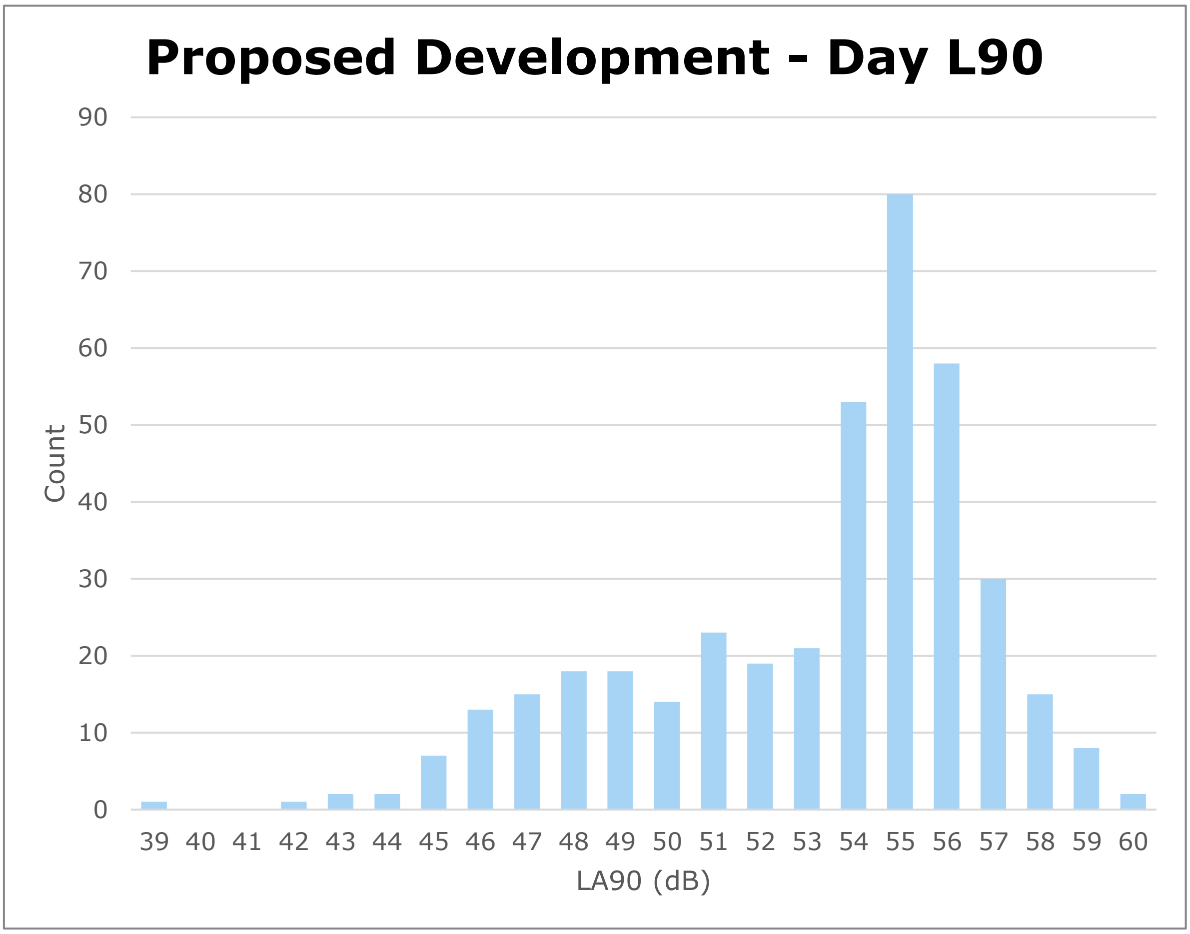
Proposed Development boundary (red) and receiver locations (blue)

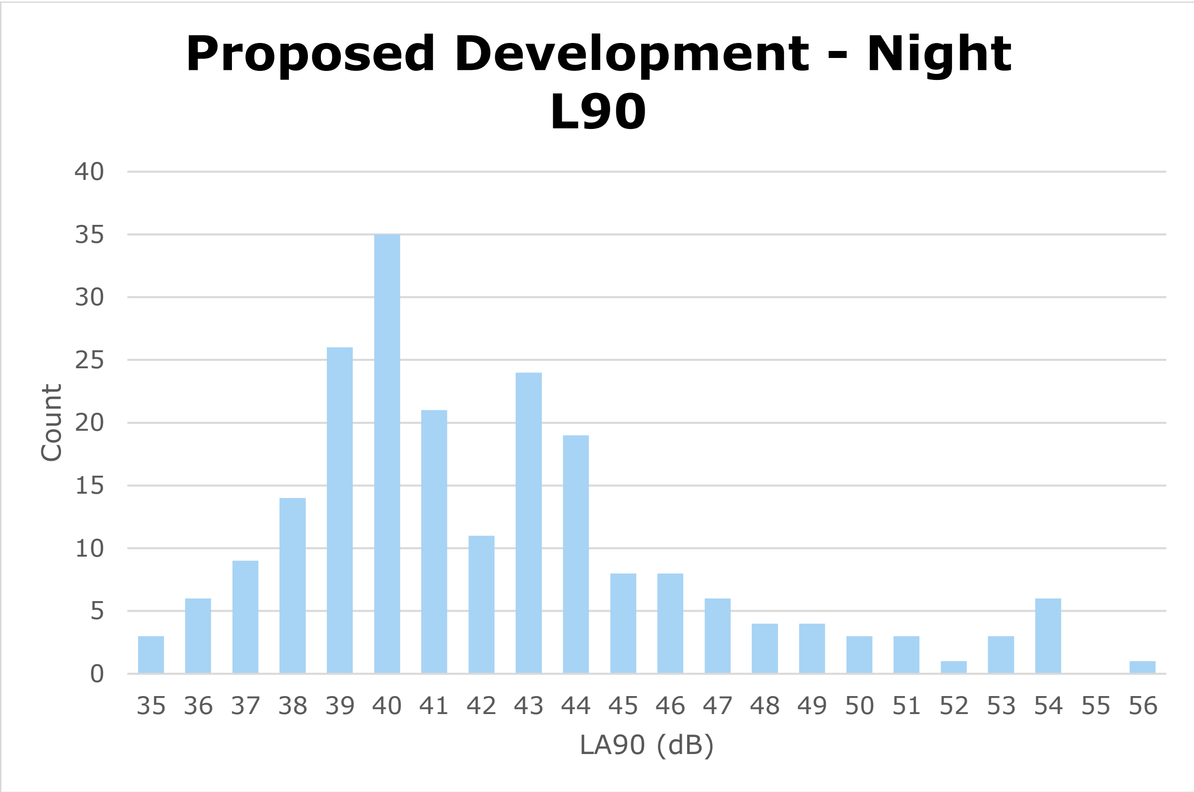
Baseline Survey Measurements

M1 – Proposed Development North Lot				LA90	LA90
	Date	L_{AEq}	L_{AFMAX}	MODE	Mean
Day	31/01/2025	66	85	55	50
	01/02/2025	66	101	54	52
	02/02/2025	64	85	55	51
	03/02/2025	66	86	56	55
	04/02/2025	65	80	56	53
	05/02/2025	66	85	55	54
	06/02/2025	66	94	54	54
	07/02/2025	68	84	57	56
Night	31/01/2025	59	86	40	39
	01/02/2025	59	84	44	41
	02/02/2025	58	87	40	43
	03/02/2025	57	79	41	43
	04/02/2025	60	88	43	44
	05/02/2025	59	80	44	44
	06/02/2025	58	81	39	42
	07/02/2025	n/a	n/a	n/a	n/a

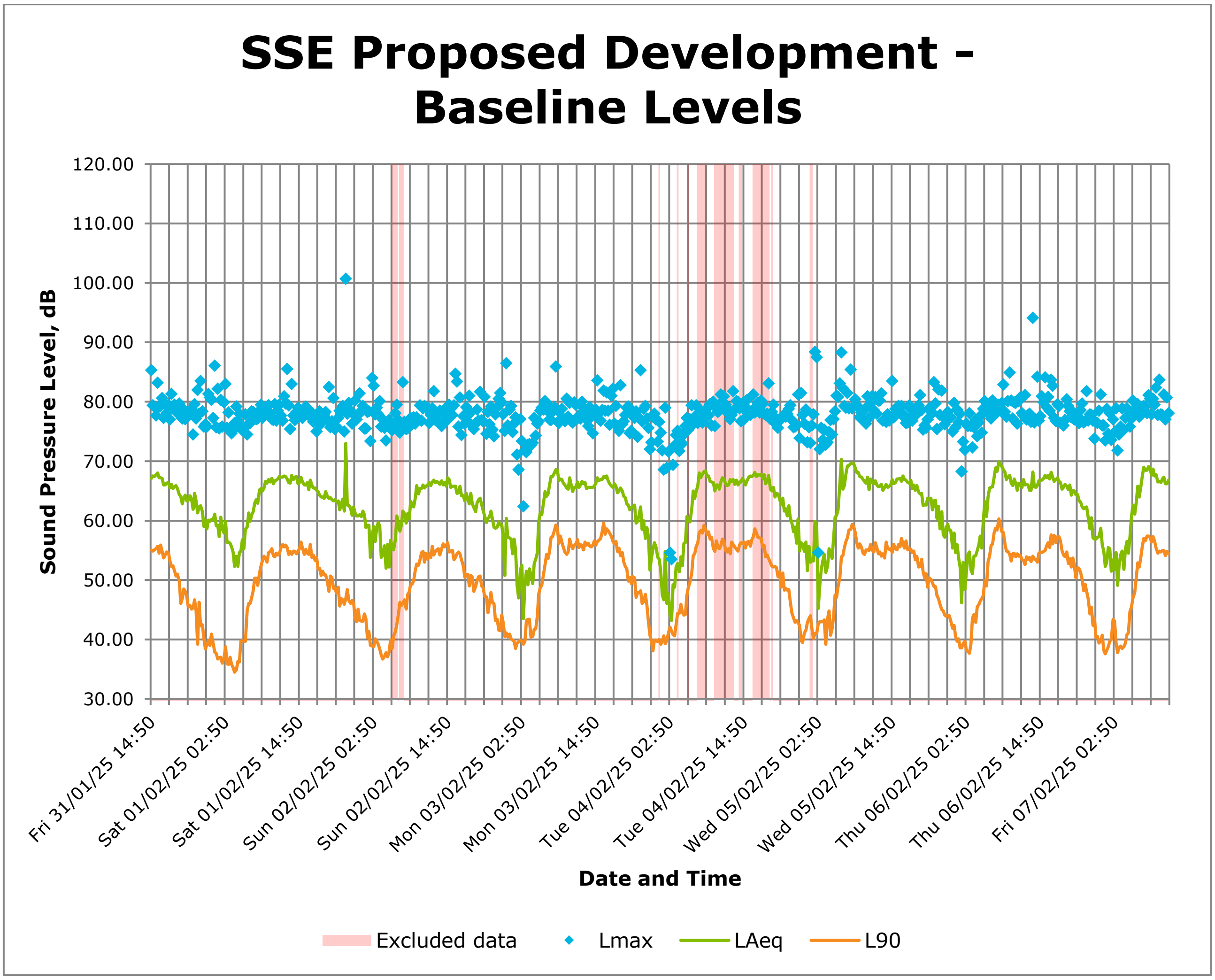
n/a – Equipment dismantled during the day of the 7th. Data gathered is not representative of full night period

LA90 Histograms





Baseline Time History



Acoustic Modelling Details

Prediction Methodology

Modelling of sound levels from the development have been undertaken using CadnaA acoustic modelling software. This software implements the sound propagation calculation methodology set out in the ISO 9613-2:2024 – 'Attenuation of sound during propagation outdoors'. The propagation model described in this standard provides for the prediction of sound pressure levels based on either short-term downwind (i.e. worst case) conditions or long-term overall averages. The highest sound levels at NSRs occur under down wind conditions (wind blowing 1 to 5 m/s from the site towards the nearby receptors), and these have been adopted within the model. When the wind is blowing in the opposite direction, sound levels may be significantly lower than those predicted.

Settings

Acoustic modelling has been undertaken using the following model settings:

- Maximum search radius of 1000m (this is to the maximum source to receiver distance which is considered in the calculations)
- Maximum number of reflections: 3
- Point calculations carried out at first floor level for daytime and night-time operational noise.
- Receptor heights were assumed to be 4.0 m for first floor.
- Heights of existing buildings in surrounding area assumed to be 6.5 m for two storey buildings.

Uncertainty

It should be noted than any predictions of sound levels have an associated degree of uncertainty. Modelling and measurement processes have been carried out in such a way to reduce such uncertainty; it is unavoidable that some remains. In particular, the following sources of uncertainty have been noted:

- Sound source spectra have been based on measurements of typical equipment plant under the operating conditions expected, data provided in BS 5228-1 and data provided by the Applicant. Under other operating conditions, it is possible that source levels may differ.
- Predictions of sound pressure levels according to ISO 9613 are based on an assumption of moderate downwind propagation, and hence could be considered as a worst-case calculation. However, the standard also indicates an estimated accuracy of ±3 dB in predicted levels.

Acoustic Modelling Input Data

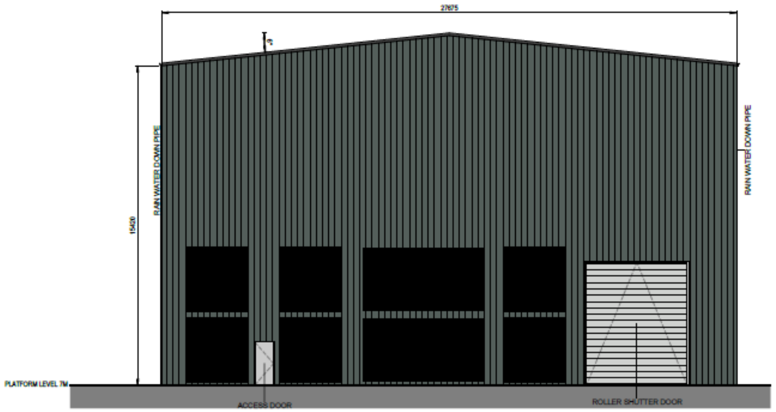
All plant has been modelled as point sources which is considered appropriate due to the distance to sensitive receptors. The sound power levels for proposed new plant items assessed in this report are provided in the following table. Receiver points are modelled at 1.5 m for the ground floor and 4 m for the first floor. Point sources are positioned in the centre of the top of each item of plant. Heights are provided in the table below.

Plant Name	Broadband L_{WA}
Traction Transformer	78
Grounding Transformer	78
Cooling Fan	83

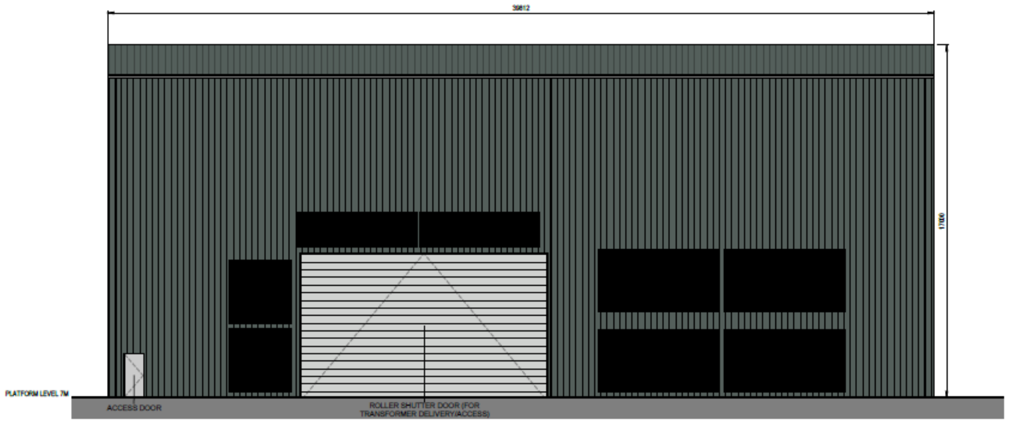
Provided by SSEN's design team

Plant Name	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000
Traction Transformer	-	-	-	73	71	81	101	82	74	93	74	75	88	75	76	75	71	70	66	58	57	53	50	49	46	46	50
Grounding Transformer	-	-	-	73	71	81	101	82	74	93	74	75	88	75	76	75	71	70	66	58	57	53	50	49	46	46	50
Cooling Fan	33.2	34.9	39.3	44.2	49.6	54.3	61.2	62.3	61	63	65.1	65.3	66	68.7	69.2	69.4	70.1	70.5	68.6	67.7	67	65.7	62.4	59.8	56.6	53.6	47.7

GT Building – Dimensions



GT BUILDING - WEST ELEVATION



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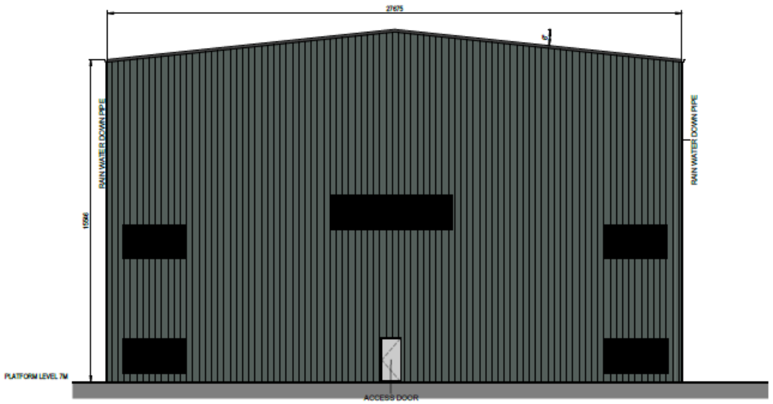
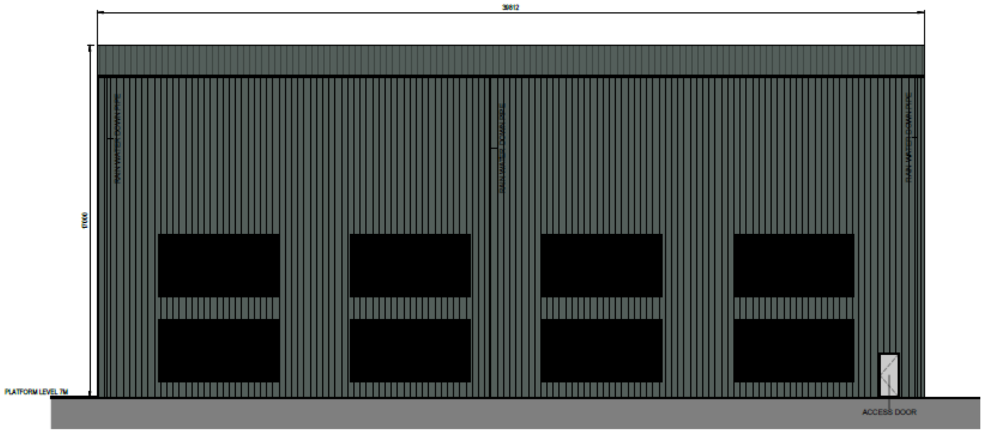
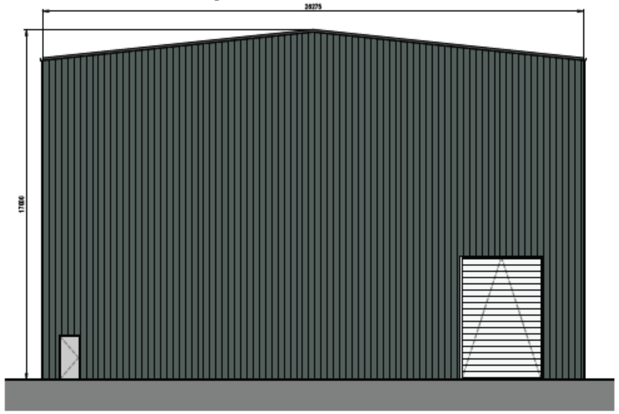


GT BUILDING - EAST ELEVATION

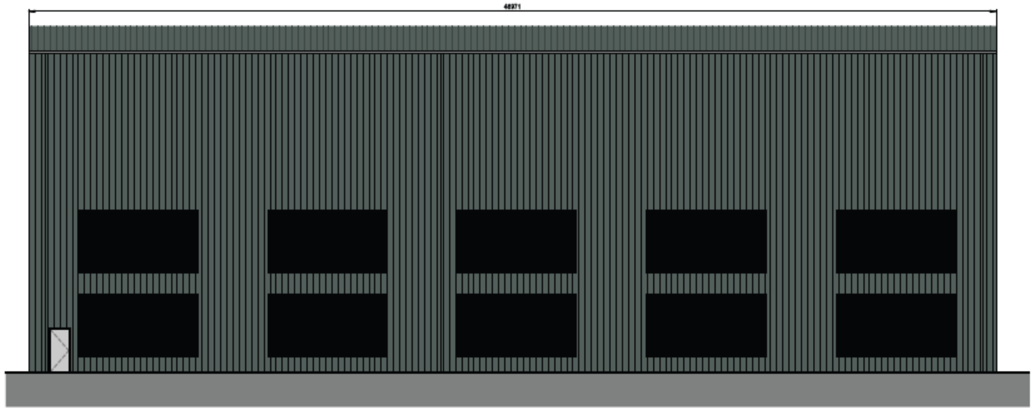


GT BUILDING SOUTH ELEVATION

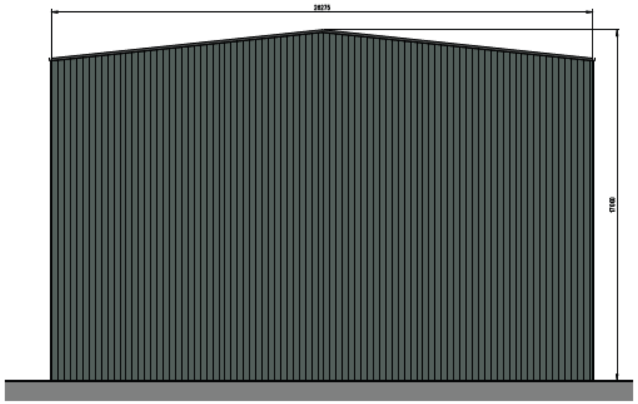
TR Building - Dimensions



TRACTION BUILDING - WEST ELEVATION



TRACTION BUILDING - NORTH ELEVATION



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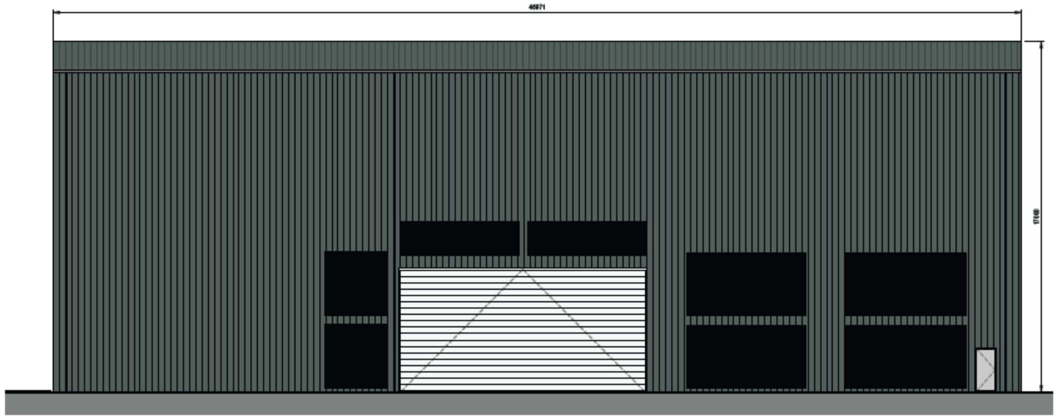

TRACTION BUILDING - SOUTH ELEVATION