Appendix 4.15A

Modelling Assumptions and Calculation Methodology

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Item	Details of Assumptions/Methodology
Modelling Assumptions	• Rolling Noise: At 0.9m above top of rail level • Structure Re-radiated Noise : At 1m below top of rail level and 1m away from parapet wall horizontally • Air-Conditioning Noise: At 4m above top of rail level(1) • Rolling Noise through vent at A16 Station: SWL of 53.5 dB(A) per unit area • Air-Conditioning Noise from stationary train at TMS Station: Time factor of 50%(2) (with trains swap to park in each platform in turn, and thus stationary train will stay about 50% of time) • Openings of the sidings at A16 Station: 1.5m in height • Operation mode within sidings: Train will not idle in the sidings (i.e. train will be shut down after arrival / will be started only before launching to mainline) • At least 50% of the sidewall of the sidings provided with acoustic panel with a minimum absorptive coefficient of 0.7. • Mainline completely segregated from the sidings with solid walls such that the noise from the mainline will not break out via the openings of the sidings • Maximum train speed within sidings limited to 25kph • Ceiling roof of TMS Station with acoustic panels • Building structure of about 23.4mPD at both ends of TMS Station
Calculation Methodology	• Rolling Noise (Line Source): CRN(3) • Structure Re-radiated Noise (Line Source): CRN(3) • Air-Conditioning Noise for running train (Line Source): CRN(3) • Air-Conditioning Noise for stationary train (Point Source): ISO 9613 • Rolling Noise through vent at A16 station, Area Source(4): ISO 9613 • Gap Size Correction: +10 log(G/250) • Speed Correction: 20 log10 (V/Vref) where V = Train speed, Vref = Reference train speed • Train Frequency Correction: +10 log10 (N) where N = Train frequency per 30 min per Direction • Distance Correction (CRN): Cdist = – 10 log10 (dist/25) where dist is the perpendicular slant distance of track segment to NSR in meters • Screen Correction: CRN Chart 6(a) • Angle of View Correction: Cangl = $10 \log_{10} [\pi\theta/180 - \cos 2\alpha \sin \theta] - 5$ where θ is angle subtended by the segment at NSR, and α is orientation of the segment along the trajectory of the track (Ref: CRN Chart 7) • Air Absorption Correction: Cair = 0.2 – 0.008 x d' where dist is slant distance from track to NSR (Ref: CRN Chart 4)

Item	Details of Assumptions/Methodology
	• Reflection Correction: 1.5 (θ'/θ) dB(A) where θ' is the sum of the angles subtended by all reflecting facades on the opposite side of the railway facing the receiver point and θ is the total angle subtended by the source line at the receiver point, +1.5dB maximum correction for each reflection (Ref: CRN Clause 31.2) • Façade Correction: +2.5 dB(A) • Rail and Rolling Stock Condition Deterioration: +3 dB(A) • Joint/Turnout Correction: +7 dB(A)
Gap Size	(see table below)

Alignmnet	Curve No.	TML Chainage Start	TML Chainage End	Outside Curve: Hori. Distance between Train Floor and Walkway (mm)	Inside Curve: Hori. Distance between Train Floor and Walkway (mm)
Up Track	1	137+776.121	137+874.997	286	270
	2	137+924.729	138+004.944	279	263
	3	138+274.444	138+513.017	368	330
	4	138+585.560	138+690.664	332	300
A16-STATION					
	5	138+969.066	139+116.175	400	380
	6	139+265.977	139+412.218	318	282
TURNOUT	7	139+667.577	139+702.562	336	336
	8	139+716.485	139+778.994	315	315
TMS-STATION					
Dn Track	1	137+774.245	137+895.503	358	326
	2	137+920.548	138+032.236	351	317
	3	138+274.812	138+545.449	367	333
	4	138+585.648	138+698.869	371	339
A16-STATION					
	5	138+942.868	139+089.978	400	380
	6	139+270.410	139+415.994	319	281
TURNOUT	7	139+671.438	139+706.423	336	336
	8	139+720.346	139+782.855	315	315
TMS-STATION					
Dn Track					
TURNOUT	1	0+000.493	0+035.478	336	336
	2	0+061.671	0+221.300	390	390
Up Track					
TURNOUT	1	0+000.493	0+035.478	336	336
	2	0+053.242	0+113.647	278	278

Notes:

(1) There would be 2 A/C units at the roof of each car. For a 8-car train, there would be a total of 16 A/C units.

(2) The assumption of time factor (i.e. 50%) of Air-Conditioning Noise from stationary train at TMS station is based on worst-case scenario as confirmed by the MTRC.

(3) The train source term adopted in this noise assessment was made reference from the noise measurement for the existing viaduct of West Rail. Given that the Project would adopt same multi-plenum system, the corrections for slab-track, bridges and viaduct, and ballast would not be required.

(4) Prediction of noise emission from the openings is provided in Appendix 4.15A-1

A16 Siding Train Noise Emission from Openings

No. of Car	n	8
Train Length (m)	L	200
Ref. Train Speed (km/h)	Vr	130
Ref. Setback Distance (m)	D	25
Ref. SEL (dBA)	SELr	81.4
Train Speed (km/h)	V	25
Track wear correction	Cw	3
SEL (dBA)	SEL=SELr+20*LOG(V/Vr)+Cw	70.1
No. of passby	N	1
SPL Leq,30min (dBA)	SPL = SEL-10*log(30*60)+10*log(N)	37.5
Line source power density (dBA)	Lw' = SPL+8+10*log(D)-10*log(2*atan(L/2D))	55.7
Line source power for whole train (dBA)	Lw = Lw'+10*log(L)	78.7

Ref: Transportation Noise Reference Book equation 2.19

SPL of Train in Siding

Siding Room Internal Dimension

	Length L	Width W	Height H
m	300	6.4	7

Absorption coefficient

Material	Concrete Finishes	Open End	Acoustic Panel
α	0.02	1.00	0.70

Internal walls inside the siding

Side Wall				**Open End at Exit**		**Closed End Wall**		**Ceiling**		**Floor**	
S	α	S	α	S	α	S	α	S	α	S	α
LxH		LxH		WxH		WxH		LxW		LxW	
sq.m	50% Concrete Finishes	sq.m	50% Acoustic Panel	sq.m	Open End	sq.m	Concrete Finishes	sq.m	Concrete Finishes	sq.m	Concrete Finishes
1050.0	0.02	1050.0	0.70	44.8	1.00	44.8	0.02	1920.0	0.02	1920.0	0.02

Room Absorption			
Total S	Total Sα	Average α	R
sq feet			
8129.6	1634.5	0.201	2045.8

Distance to Opening	Directivity	SPL of Train in Siding
r	Q	Lp
m		dBA
6	4	53.5

Ref Formula: general equation for calculating sound pressure from sound power in reverberant room.

Lp=Lw+10log(Q/(pi*r*L)+4/R)

SWL for One Train at Opening of Siding

Length	Height	S	SWL at opening	SWL per unit area at opening
L	H	LxH		
m	m	sq m	dBA	dBA/sq.m
200	1.5	300.0	78.2	53.5

Facade Correction	CadnaA Input of SWL per unit area at opening
dB	dBA/sq.m
2.5	56.0

Legend:

Lw: Sound Power Level dB re 10-12 W

SPL (or Lp): Sound Pressure Level dB re 20μPa

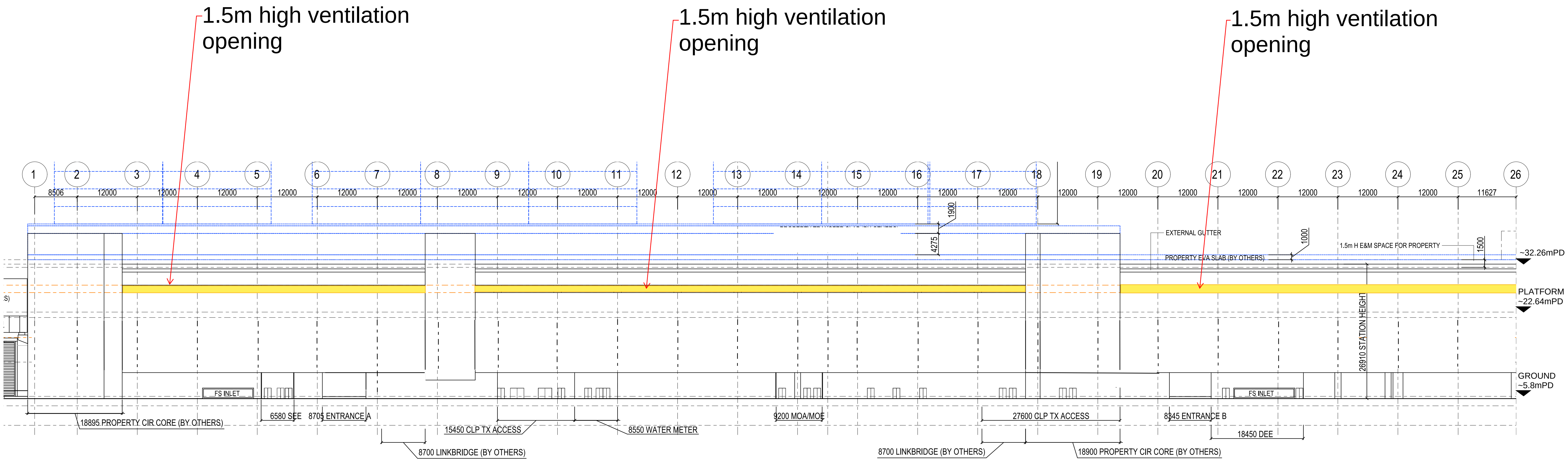
α: Absorption coefficient of wall/ceiling/opening

S: Surface area

R: Room constant

r: Setback from train inside the siding to opening

Q: Directivity factor



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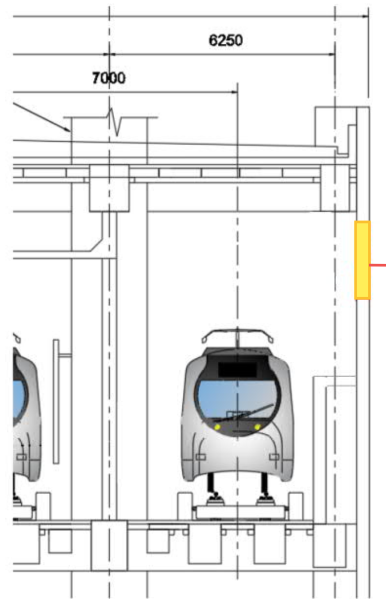
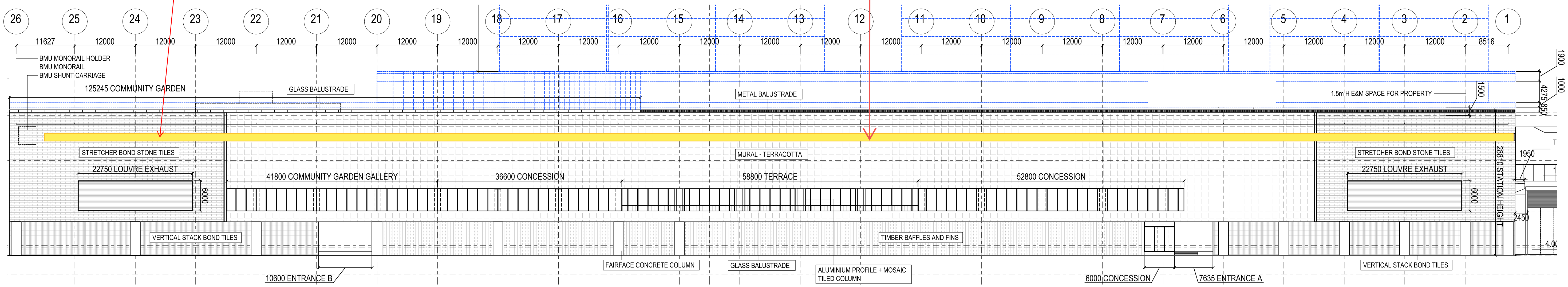
TYPICAL SECTION OF SIDING



1.5m high ventilation opening



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