144 Oxley Island Road
Oxley Island NSW 2430
P: 61 (2) 6553 2577
E: info@matrixthornton.com.au
W: www.matrixthornton.com.au
ABN: 61 002 929 857
Structural ▸ Civil ▸ Mechanical ▸ Acoustic

THE POINT COMMUNITY CHURCH

ACOUSTIC ASSESSMENT

Report No.	M24170.01a
Site:	171 John Oxley Drive Port Macquarie, NSW 2444
Reviewed by:	Philip Thornton BE(UNSW) MIEAust CPEng NER, MAAS Acoustic Consultant
Date:	10 September 2024

SUMMARY

The report assesses the acoustic impact of a proposed church at 171 John Oxley Drive, Port Macquarie.

Acoustic performance of the roof and glazing is given to minimise noise breakout to residential neighbours and achieve suitable levels of traffic noise within the rooms.

Some management of noise from the carpark is required for services that finish after 6pm

Traffic noise due to extra traffic generated by the proposal is predicted to comply with the guidelines.

CONTENTS

FIGURES

TABLES

1 INTRODUCTION

A new church is proposed at 171 John Oxley Drive, Port Macquarie, NSW 2444.

Pre-lodgement advice from Port Macquarie Hasting Council is that an acoustic report should be prepared to address the following:

- the potential impacts of traffic noise on the operation of the church with an expectation there may be some recommendations with respect to the design of the church to ensure it is fit for purpose.
- The potential impacts of noise from the operation of the church and its facilities on adjoining residential properties to the east. This may include recommendations with respect to the hours of operation which will be discussed as the assessment is being prepared.

This acoustic report addresses those concerns following guidelines and recommendations of the NSW Road Noise Policy (RNP) and Noise Policy for Industry (NPfI).

2 DESCRIPTION OF THE DEVELOPMENT

2.1 SITE LOCATION AND NOISE SENSITIVE RECEIVER

The site is located at 171 John Oxley Drive as shown in Figure 2-1.

Residential receivers are located immediately east and west of the site. Receivers 1 to 4 are shown as representative of the potentially worst noise impact from the church. They are:

Receiver 1 – 89 Anabella Drive
Reciever 2 – 9 Fresia Place
Receiver 3 – 37 Lewin Circuit
Receiver 4 – 1 Fresia Place

Receivers 1 and 2 are most potentially impacted by carpark and traffic noise from the proposal. Receivers 3 and 4 are most potentially impacted by noise from church activities.

Receivers 1 and 3 are also representative of any future houses built on currently empty blocks on Anabella Drive.

There are no nearby receivers to the north, however the report will address potential impact to any future receivers built directly across John Oxley Drive. It has been noted that the land is zoned E4 General Industrial West and RU1 Primary Production; therefore, residential buildings are unlikely to be built in the near future.

The church itself is exposed to traffic noise from John Oxley Drive, and the Oxley Highway located, as can be seen on the figure, approximately 165m north of the site.

Figure 2-1 Location of Receivers and Noise Logging

2.2 DESCRIPTION OF THE DEVELOPMENT

The proposed church layout is shown on Figure 2-2. The at-grade carpark is at the south end of the site. The northern part of the site has the two buildings: the main auditorium where services take place, and a second building with church hall and multi-purpose rooms.

Figure 2-3 shows a section through the two buildings showing the relation of the building to Receivers 1 and 2.

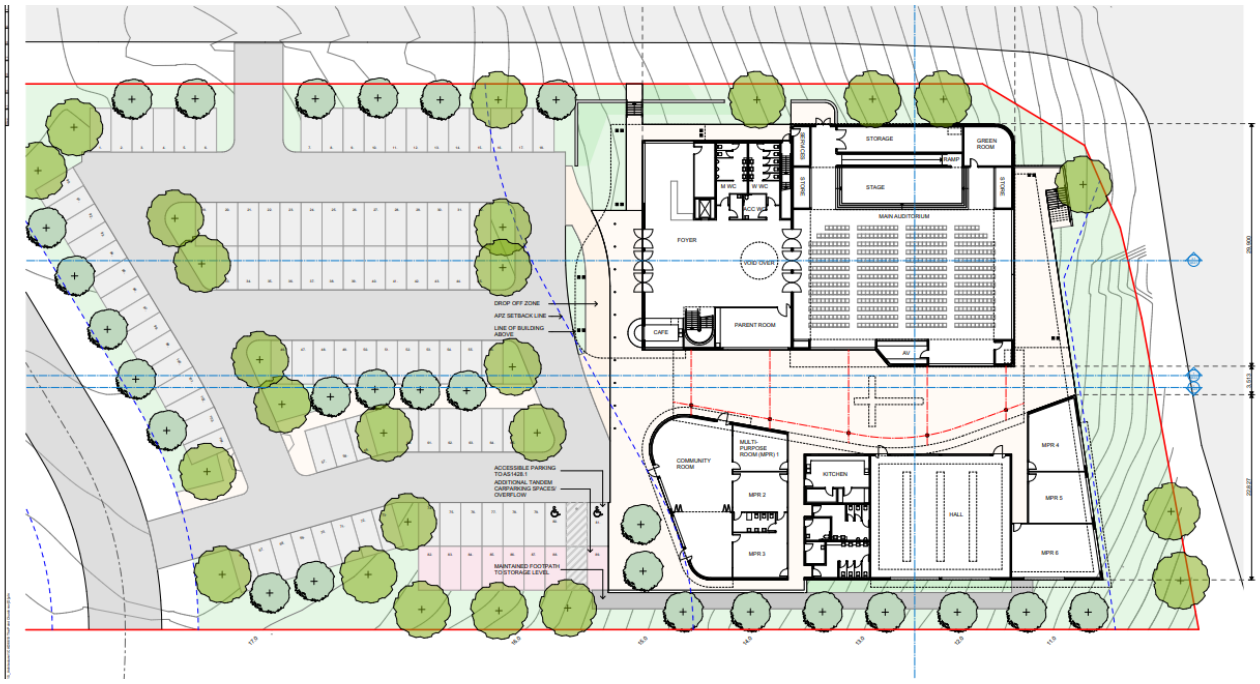


Figure 2-2 Ground Floor Plan and Carpark

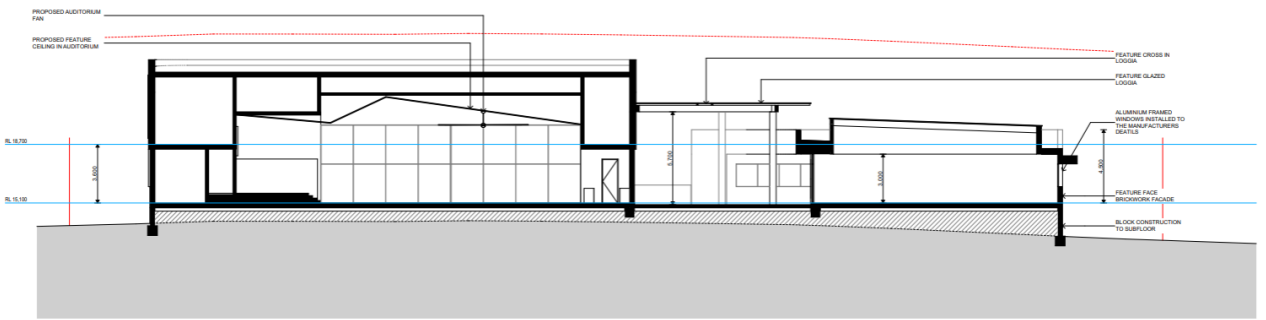


Figure 2-3 Section across the two buildings

3 NOISE MEASUREMENTS

Noise measurements were conducted at the proposed site to determine the existing long-term background noise levels, between 23 July to 1 August 2024. Location shown in Figure 2-2.

Long term background noise measurements were recorded using a Type I integrating sound level meter (SLM), model EL-316X, manufactured by Acoustic Research Labs.

Additional short-term measurements were done using a Svan 958A Type I SLM.

A Lutron sound level calibrator, model SC-941, was used as a reference sound source immediately before and after measurements were taken. Both instruments are in current calibration from a NATA registered laboratory. An integrating sound level meter can process a continuous, variable, intermittent or impulsive signal to give a single integrated level or L_{Aeq} for the sampling period. This equipment complies with AS 1259 'Acoustics-Sound level meters", Part 2 "Integrating-Averaging" and the testing procedure with AS 2659 "Guide to the use of sound measuring equipment

Appendix B shows the daily noise charts. Periods of excess wind or rain have been excluded as per NPfI recommendations. Table 3-1 shows the measured background noise levels

Period	RBL
Daytime	46
Evening	42
Night-time	30

Note: Daytime is defined as 7.00am to 6.00pm, Monday to Saturday; 8.00am to 6.00pm Sunday and Public Holidays.
Evening is defined as 6.00pm to 10.00pm, Monday to Saturday and Public Holidays.
Night is defined as 10.00pm to 7.00am, Monday to Saturday; 10.00pm to 8.00am Sunday and Public Holidays.

Table 3-1 Measured background A-weighted sound pressure levels

3.1 SHORT TERM MEASUREMENTS

Short term measurements were done to determine existing traffic noise impact across the site. Measurements were done at the logger location, and at 10m from John Oxley Drive.

Location	Date and Time	Noise Level, LAeq,15min dBA
10m from John Oxley Drive	23 July, 1.39pm	64dBA
Logger Location	23 July 12:45pm	48dBA
	1 August 11:15am	51dBA
	1 August 11:45am	49dBA

Table 3-2 Short-Term Traffic Noise Measurements LAeq,15min dBA

4 NOISE POLICY FOR INDUSTRY

Various types of noise are emitted from churches, including noise from traffic, carparking, mechanical services and noise from within the auditorium, hall and multi-purpose rooms. Assessment criteria are discussed in the New South Wales Noise Policy for Industry (NPfI). The NPfI gives a procedure for setting "trigger" noise levels. If noise is above a trigger level, a residual noise impact may exist. Depending on the severity of the residual noise impact mitigation or management needs to be considered. The trigger levels from the NPfI are appropriate to use for such noises as a mechanical services and traffic.

For assessment of this Church, we will use the NPfI trigger levels. The policy discusses "intrusiveness" and "amenity" levels which are a set based on the existing noise environment, and the type of residential area. The project specific trigger levels become the most stringent of the two.

4.1 INTRUSIVENESS NOISE LEVEL

For assessing intrusiveness, the background noise level (L_{A90}) is measured, and the Rating Background Level (RBL) determined. The intrusiveness of an industrial noise source may generally be considered acceptable if the equivalent continuous noise level (L_{Aeq}) of the source (measured over a 15-minute period) does not exceed the RBL by more than 5 dB.

4.2 AMENITY NOISE LEVEL

The amenity assessment is based on noise criteria specific to land use and associated activities. The criteria relate only to industrial-type noise and do not include transportation noise.

The amenity noise level aims to limit continuing increases in noise levels which may occur if the intrusiveness level alone is applied to successive development within an area.

The recommended amenity noise level represents the objective for total industrial noise at a receiver location. The project amenity noise level represents the objective for noise from a single industrial development at a receiver location.

To prevent increases in industrial noise due to the cumulative effect of several developments, the project amenity noise level for each new source of industrial noise is set at 5 dB below the recommended amenity noise level. While amenity is assessed over the entire 13-hour daytime period, under the NPfI it can be compared directly to the 15-minute assessment of intrusiveness by adding 3 dB to the period level.

Amenity noise levels are not used directly as regulatory limits. They are used in combination with the project intrusiveness noise level to assess the potential impact of noise, assess mitigation options and determine achievable noise requirements.

An extract from the NSW NPfI that relates to the amenity noise levels for surrounding receivers is given in Table 4-1 and applies to all receivers in this study.

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level dB
Residential	Suburban	Day	55
		Evening	45
		Night	45

Note: Daytime is defined as 7.00am to 6.00pm, Monday to Saturday; 8.00am to 6.00pm Sunday and Public Holidays.
Evening is defined as 6.00pm to 10.00pm, Monday to Saturday and Public Holidays.
Night is defined as 10.00pm to 7.00am, Monday to Saturday; 10.00pm to 8.00am Sunday and Public Holidays.

Table 4-1 Recommended amenity criteria from the NSW Noise Policy for Industry.

4.3 PROJECT NOISE TRIGGER LEVELS

The project noise trigger levels are given in Table 4-2. The NPfI gives guidance on assessing the noise impact if the noise from industry exceeds the trigger level. Receiver 3 is considered an isolated residence in an industrial/commercial district and has a trigger level for all periods of $L_{Aeq,15min}$ 62 dBA. This report will also assess noise to Receiver 3 against the Intrusiveness level. As seen in Table 4-2, trigger levels for this project are based on the intrusiveness level.

Period	Rating Background Level $L_{A90,15min}$ (dBA)	Intrusiveness Noise Level[1] $L_{Aeq,15min}$ (dBA)	Project Amenity Noise Level[2] $L_{Aeq,15min}$ (dBA)	Project Trigger Levels $L_{Aeq,15min}$ (dBA)
Daytime	45	50	53	50
Evening	42	47	43	43
Night-time	30	35	38	35

Note 1: Intrusiveness noise level is LAeq,15min ≤ RBL +5 dB
Note 2: Project amenity noise level (PANL) is suburban ANL minus 5dBA plus 3dBA to convert from a period level to a 15-minute level.

Table 4-2 Project trigger levels for all Receivers

5 PREDICTED NOISE LEVELS FROM DEVELOPMENT AND ASSESSMENT

5.1 NOISE PREDICTIONS

Noise modelling was done using Soundplan software which takes into account the source noise level and noise propagation conditions, such as acoustic barriers.

5.2 NOISE FROM THE AUDITORIUM

Services in the auditorium constitute the main risk of noise disturbance. From a noise breakout perspective, the building is well designed: the main path for noise to escape is through the ceiling.

For a large congregation and a service with a rock band at the front, noise levels at the ceiling of auditorium could be 90dBA and 95dBC. Assuming any windows in the western façade are closed, and that the ceiling has an acoustic performance of R_w 40, the predicted noise levels are as in Table 5-1.

An acoustic performance of R_w 40 can be achieved in many ways, for example: Colorbond roof, 150mm airgap with acoustic insulation, 16mm plasterboard ceiling. We recommend this be rechecked at CC stage once all architectural details can be confirmed.

Receiver	Noise Level $L_{Aeq,15min}$ dBA
1	33
2	23
3	27
4	24

Table 5-1 Noise Levels from Auditorium

Currently there are no noise sensitive receivers nearby to the north across John Oxley Drive. But as the area is developing quickly, there may eventually be more receivers across the road.

To protect the amenity of the area directly across John Oxley Drive we recommend the glazing in the northern façade be equivalent to 6.38mm laminated glass with an acoustic performance of R_w 32 and remain closed during loud activities. The predicted level at a typical receiver location across the road would be 41dBA, which is satisfactory.

5.3 NOISE FROM HALL AND MULTI-PURPOSE ROOMS

The activity in the hall and multi-purpose rooms will vary, but even with music would not typically be more than 85dBA. Assuming a ceiling of R_w 35 and 6mm glass in the eastern façade windows, the predicted level are given in Table 5-2.

Receiver	Noise Level $L_{Aeq,15min}$ dBA
1	27
2	25
3	45
4	21

Table 5-2 Noise from Hall and Multi-Purpose Rooms

These levels are satisfactory, but to protect the amenity of Receiver 2 the windows would need to be closed for any noisy activity in the Hall or room MPR 6.

5.4 CARPARK NOISE LEVELS

Based on the Traffic Report (see Section 7) the worst case flow in the carpark would be 94 cars and 2 buses in or out in an hour. For carparks the assessment period is 1 minute, so the worst case would be 23 cars and 1 bus in (or out) in an hour.

While most of the carpark activity will take place during daytime hours, the departure from the afternoon service will take place after 6pm. The carpark noise should be assessed against the evening noise trigger, $L_{Aeq,15min}$ 43dBA.

The sound power level of a car arriving or leaving a car park (based on previous measurements) is $L_{WAeq,15min}$ 75 dBA. For a minibus driving through the site, the predicted source level is $L_{WAeq,15min}$ 92 dBA.

The houses bordering the site to the east (Receiver 2 and 4) have rear fences, providing acoustic shielding. The predicted noise levels from the carpark are given in Table 5-3.

Receiver	15min Noise Levels	
	Just Cars	Cars + Bus
1	40	46
2	36	40
3	47	51
4	45	49

Table 5-3 Predicted Levels of Carpark $L_{Aeq,15min}$ dBA

The predicted levels generally comply with the daytime trigger level of 50dBA, except for the 1dBA exceedance at Receiver 3. The NPfI consider a 1 dBA "residual" exceedance as a negligible impact.

For activity after 6pm on Sunday the noise levels are compared to the evening trigger level of 43dBA, showing significant exceedances at Receivers 3 and 4.

In considering the impact of the predicted exceedance, note that the carpark activity takes place just after the transition from daytime to evening, when the trigger level drops from 50 to 43dBA due to the definition of time periods in the NPfI. From the logger charts it can be seen that Sunday background levels are dropping gradually through the period.

We recommend the following noise mitigation guidelines:

- Service attendees should be encouraged to leave as soon after 6pm as possible.
- Minibuses should not dwell with engines on. The path of the bus through the carpark should avoid the south-eastern corner of the carpark as southern eastern section is adjacent to a dwelling. The south-western corner of the will be separated by a road's width from the nearest adjacent dwelling.
- Signage should be erected in the car park and near exits of the buildings reminding users to be courteous, reduce noise and depart promptly.
- Neighbours should be notified of any events that require significant use of the carpark after 7pm.

6 NOISE INTO THE DEVELOPMENT

The main auditorium and rooms on the northern part of the site are impacted by traffic noise. From our measurements, the typical traffic noise level at the location of the façade is $L_{Aeq,1hour}$ 64dBA.

6.1 Design Goals

The NSW Road Noise Policy (RNP) recommends an internal noise level of $L_{Aeq,1hour}$ 40dBA for classrooms and places of worship, this level will be adopted for the multi-purpose rooms in this development. This is a design level when assessing new traffic generating developments and new roads.

Australian Standard 2107-2016 *Acoustics Recommended Design Sound Levels*, recommends the following, where the lower number is *satisfactory* and the higher number is *maximum*:

- Teaching spaces – 35-45dBA.
- Places of Worship with speech amplifications systems 35-40dBA.
- Auditoriums – 35-40dBA.

With these in mind a design goal of 35dBA for traffic noise intrusion will lead to satisfactory outcomes in all spaces.

The auditorium will require acoustic design. The ultimate noise level inside from traffic noise will depend on the materials of the façade, and the internal acoustics. If the auditorium is designed to be acoustically "dead", the traffic noise level will be lower. AS2107 gives recommended reverberation times for auditoriums for speech, teaching and music. The acoustic design of the auditorium is beyond the scope of this report, but based on a room volume of 2000 to 2500m^3, a typical design reverberation would be 1.3s for an auditorium used for speech. We will assume this design goal for predicting traffic noise intrusion.

6.2 Predicted Internal Noise Levels

Auditorium

In Section 5.2 we recommended 6.38mm laminated glass for the auditorium's northern façade. Based on an external level of 64dBA, and 6mm laminated glazing, the predicted traffic noise level in the auditorium is 31-35 dBA, depending on the location of the listener. This achieves the recommended goal. We recommend this prediction be reviewed once the design of the auditorium is finalized.

Multi-purpose rooms

There are three multi-purposes on the northern façade: MPR 4, MPR 5 and MPR 6.

The predicted internal levels with windows closed are:

- With 6.38mm laminated glass – 41dBA; and
- With 10.38mm laminated glass – 38dBA.

Both noise levels are within the range specified in AS2107.

7 Traffic Noise Assessment

7.1 Traffic Noise Assessment Criteria

The EPA's Road Noise Policy (RNP) sets out criteria for assessment of noise from vehicles on public roads. The RNP sets out noise criteria for 'arterial', 'sub-arterial' and 'local roads'. Criteria for existing residences affected by additional traffic due to land developments are shown in Table 7-1. John Oxley Drive is considered a sub-arterial road for noise assessment. The carpark is accessed from Annabella Drive, Lewin Circuit, part of the local road network.

Where predicted noise levels exceed the project-specific noise criteria, an assessment of all feasible and reasonable mitigation options should be considered. The RNP states that an increase of up to 2dB represents a minor impact that is considered barely perceptible to the average person.

Road Category	Assessment Criteria – dBA	
	Day (7am-10pm)	**Night** (10pm-7am)
Freeway / arterial / sub-arterial roads	$L_{Aeq15hr}$, 60 (external)	$L_{Aeq,9hr}$ 55 (external)
Local Roads	L_{Aeq1hr}, 55 (external)	$L_{Aeq,1hr}$ 50 (external)

Table 7-1 *RNP* Criteria for Traffic Noise due to Land Use Development

7.2 TRAFFIC GENERATION TO THE DEVELOPMENT

Predicted traffic development for the project has been provided by SCT Consultants for Sunday Services, as shown in Table 7-2. The buses would be "Coaster" type minibuses with approximately 22 seats.

Time Period	Inbound	Outbound
Before 9.30am	94 cars / 2 buses	-
After10.30am	-	94 cars / 2 buses
Before 5 pm	81 cars / 1 buses	-
After 6pm	-	81 cars / 1 buses

Table 7-2 Predicted Traffic Generation

7.3 PREDICTED TRAFFIC NOISE

Using these volumes, traffic noise to typical houses was predicted using the CoRTN algorithms for traffic noise prediction. These algorithms are verified and accepted throughout New South Wales. It was assumed that the typical setback to the front facades of houses was 10m.

Table 7-3 shows the predicted noise level to a typical house during the morning hours before 9am and after 10.30am. The pm predictions would be approximately 0.5dBA lower.

	Existing Traffic Nois	Additional Noise from Church Traffic	Total Traffic Noise
John Oxley Drive, assuming all church traffic	64 $L_{Aeq,15hour}$	48 $L_{Aeq,15hour}$	64 $L_{Aeq,15hour}$
Annabella Drive or Lewin Circuit assuming half	Approx. 48 $L_{Aeq,1hour}$	53 $L_{Aeq,1hour}$	54 $L_{Aeq,1hour}$

church traffic goes half to each			

Table 7-3 AM Peak hour traffic noise levels dBA

7.4 TRAFFIC NOISE ASSESSMENT

Review of the predictions in Table 7-3 shows the following:

- For houses on John Oxley Drive, the additional traffic noise due to the project is insignificant and will not increase traffic noise, even if all traffic from the church travelled the same local roads to enter John Oxley Drive, which is unlikely.
- On local roads, Annabella Drive and Lewin Circuit, there is some existing traffic noise due to local traffic, and the nearby arterial roads. The additional traffic from the proposal will lead to increase in traffic noise for some hours on Sunday.
- If half the traffic came from the west, and half the east, the typical level at facades on local roads is predicted to be 54dBA, 1 dBA below the criterion.

8 CONCLUSION

The report assesses the acoustic impact of a proposed church at 171 John Oxley Drive, Port Macquarie. It addresses potential traffic noise effects on church operations and noise from church activities on nearby residential areas. Recommendations for noise mitigation are provided, adhering to the NSW Noise Policy for Industry guidelines.

Noise from the development buildings

To minimize breakout noise from the auditorium the ceiling/roof should have a minimum acoustic performance of R_w 40dBA. 6.38mm laminated glass is recommended for the glazing on the north façade. This will reduce noise breakout to any future receivers across John Oxley Drive.

To minimize breakout noise from the hall the ceiling/roof should have a minimum acoustic performance of R_w 35dBA. The windows of the hall and rooms MPR6 should be minimum 6mm glass on the eastern façade and be closed when noisy activities take place.

Traffic noise into the development buildings

The 6.38mm laminated glass recommended for the northern façade of the auditorium will lead to satisfactorily low traffic noise levels in the auditorium.

To minimize traffic noise into rooms MPR 4, MPR 5 and MPR6, those rooms should have minimum 6.38mm laminated glass on the northern facade.

Carpark

The following recommendations concern the carpark:

- Service attendees should be encouraged to leave as soon after 6pm as possible.
- Minibuses should not dwell with engines on. The path of the bus through the carpark should avoid the south-eastern corner of the carpark as southern eastern section is adjacent to a dwelling. The south-western corner of the will be separated by a road's width from the nearest adjacent dwelling.
- Signage should be erected in the car park and near exits of the buildings reminding users to be courteous, reduce noise and depart promptly.
- Neighbours should be notified of any events that require significant use of the carpark after 7pm.

Traffic noise

Traffic noise due to extra traffic generated by the proposal is predicted to comply with the guidelines.

P. Thornton

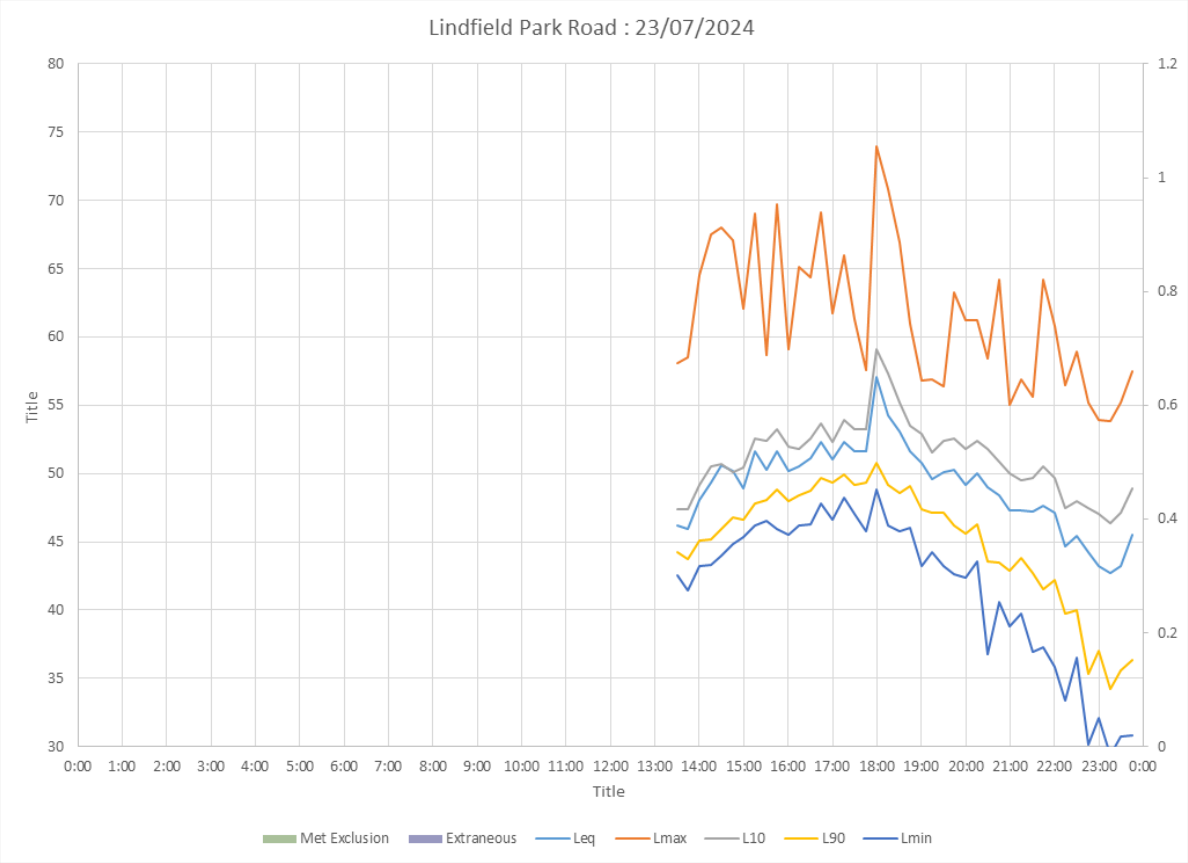
Philip Thornton BE(UNSW) MIEAust CPEng NER RPEQ, MAAS
Principal Engineer & Director
National Professional Engineers Register No. 295662

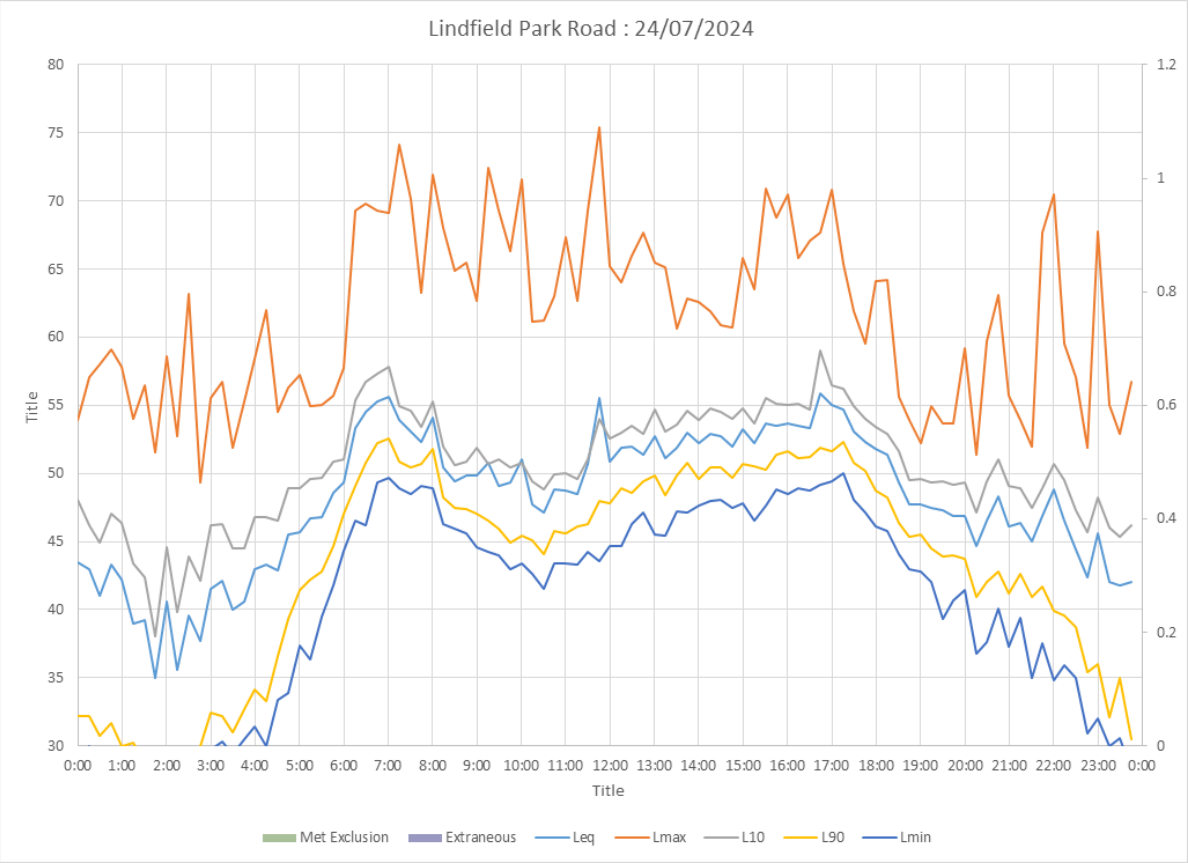
ENGINEERS AUSTRALIA
Chartered Professional Engineer
MEMBER

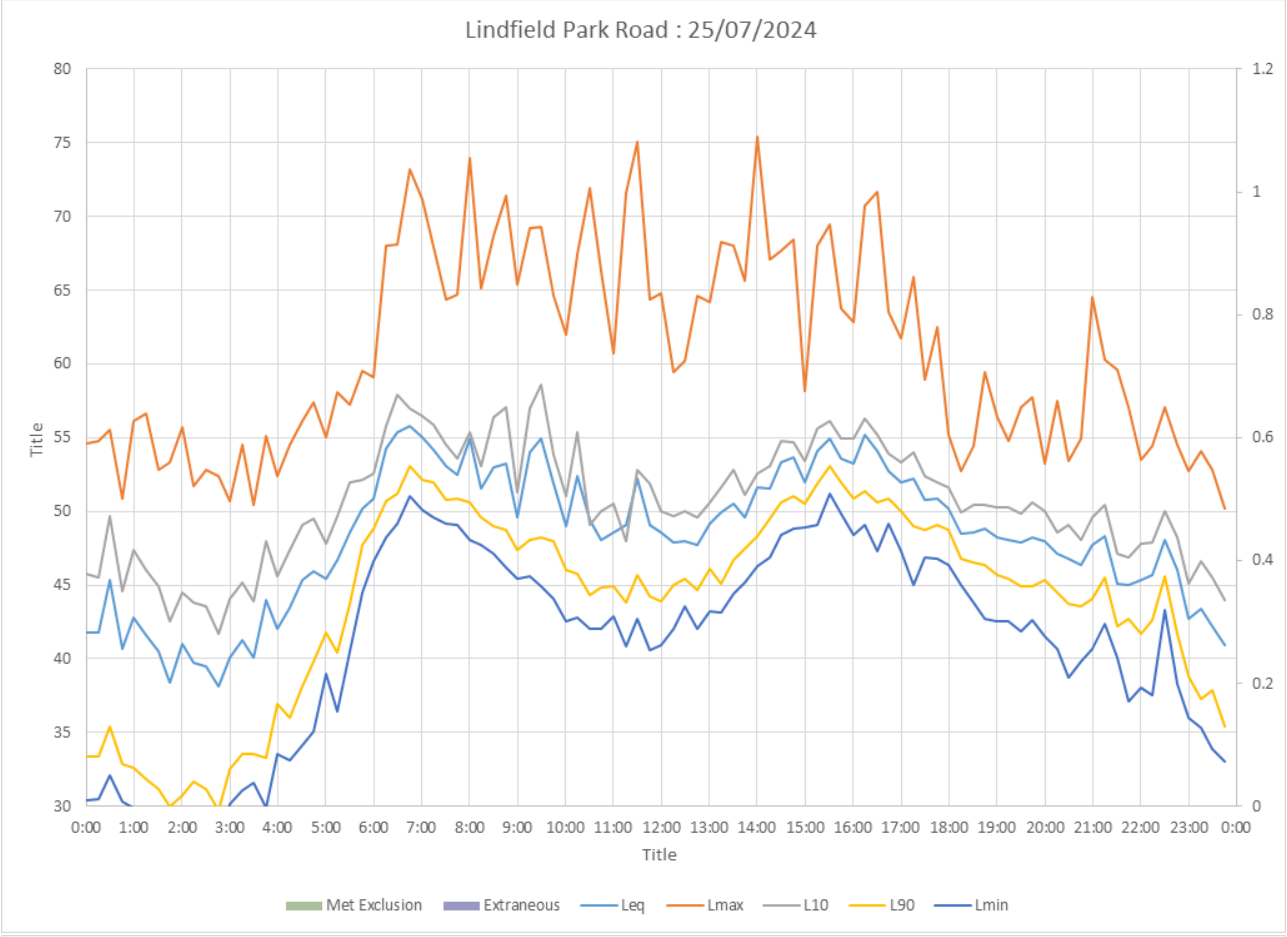
APPENDIX A: GLOSSARY OF ACOUSTIC TERMS

Assessment Period	The period in a day over which assessments are made.
dB(A)	Unit of sound level in A-weighted decibels. The A-weighting approximates the sensitivity of the human ear by filtering these frequencies. The dB(A) measurement is considered representative of average human hearing.
L_{Aeq}	The A-weighted equivalent continuous sound pressure level, used to quantify the average noise level over a time period.
L_{A10}	The A-weighted sound pressure level exceeded for 10% of the measurement period. It is usually used as the descriptor for intrusive noise level.
L_{A90}	The A-weighted sound pressure level exceeded for 90% of the measurement period. It is usually used as the descriptor for background noise level.
$L_{Aeq15min}$	Refers to the A-weighted energy averaged equivalent noise level over a 15 minute time period.
L_{Cpeak}	The highest instantaneous C-weighted sound pressure level over the measurement period. It is usually used for high impulsive noise.
L_{Amax}	The maximum A-weighted sound pressure level for the measurement period.
Loudness	A 3dB(A) change in sound pressure level is just noticeable or perceptible to the average human ear; a 5dB(A) increase is quite noticeable and a 10dB(A) increase is typically perceived as a doubling in loudness.
RBL	The overall single figure background level representing the assessment period over the whole monitoring period. For the short-term method of assessment, the RBL is the measured $L_{A90,\ 15min}$ value, or where a number of measurements have been made, the lowest $L_{A90,\ 15min}$ value.

APPENDIX B: NOISE LOGGER CHARTS



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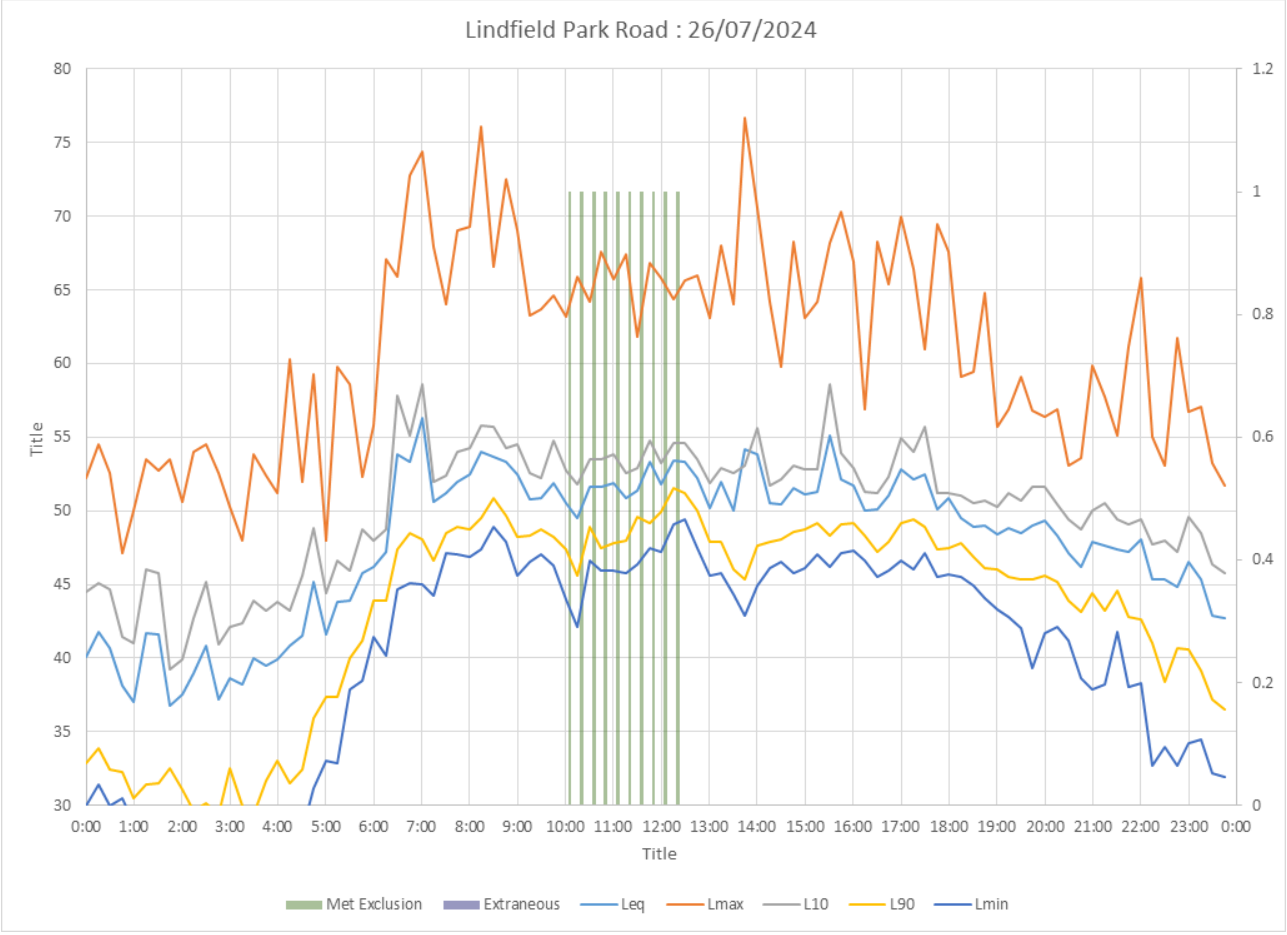
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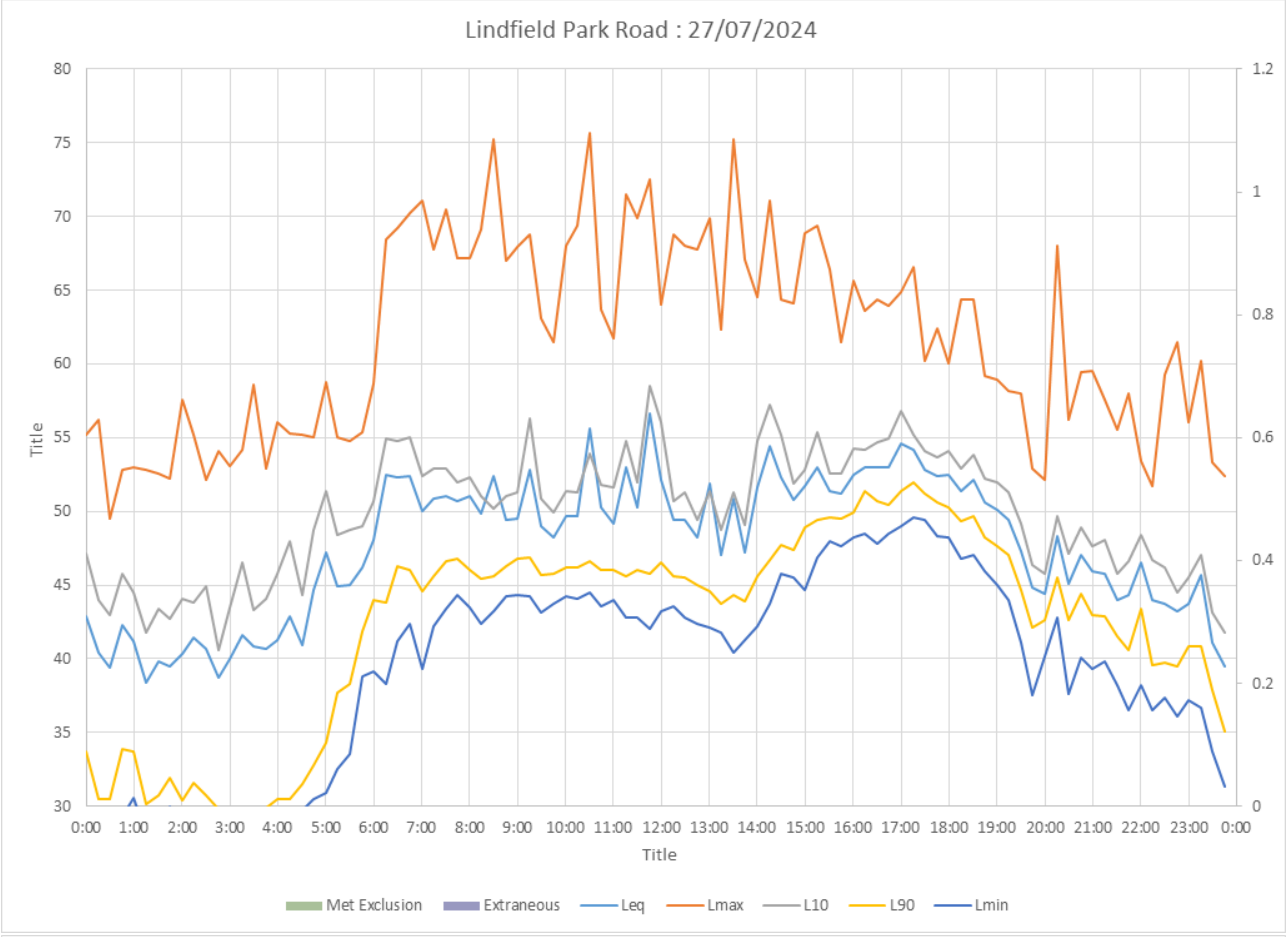
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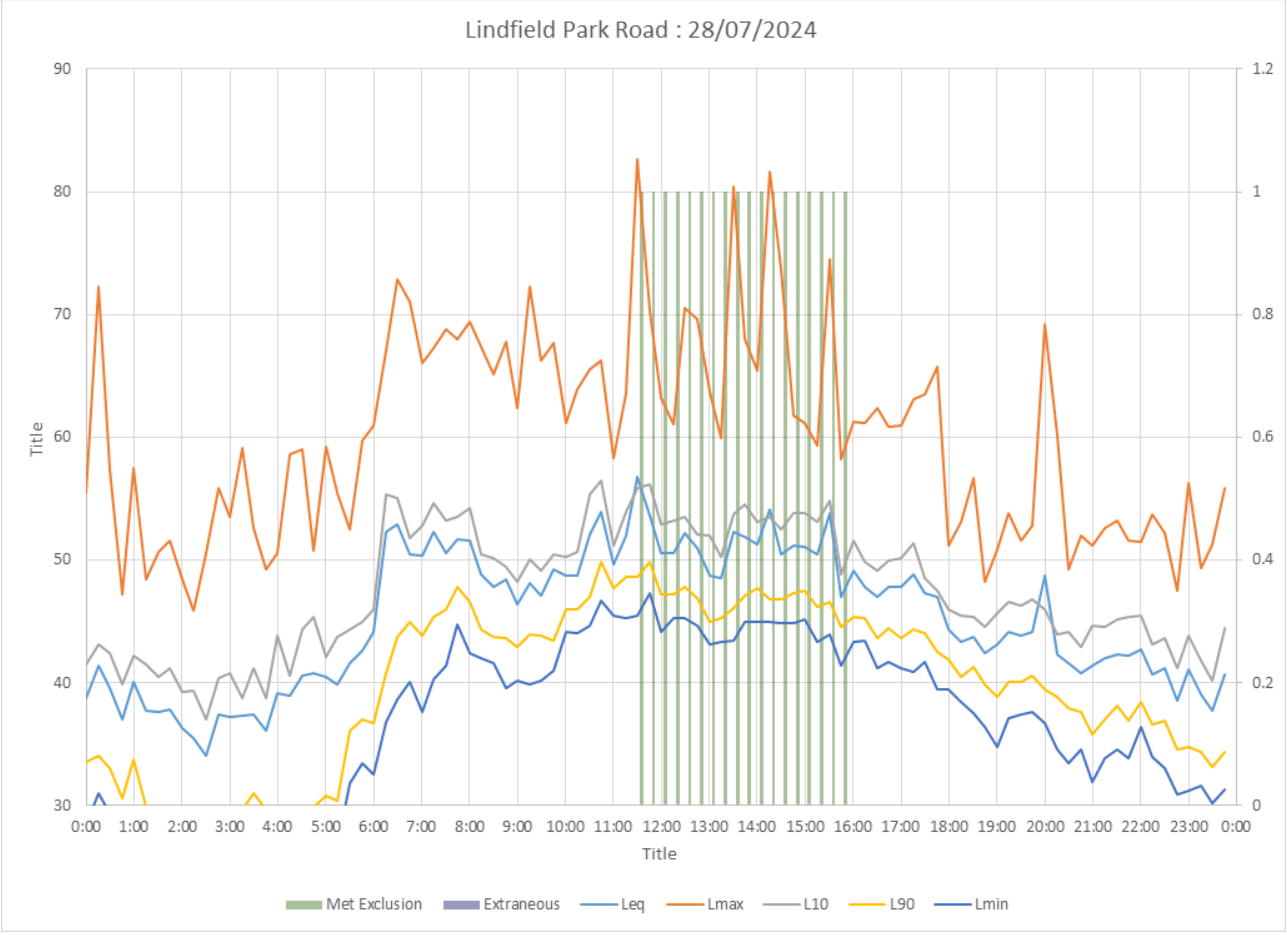
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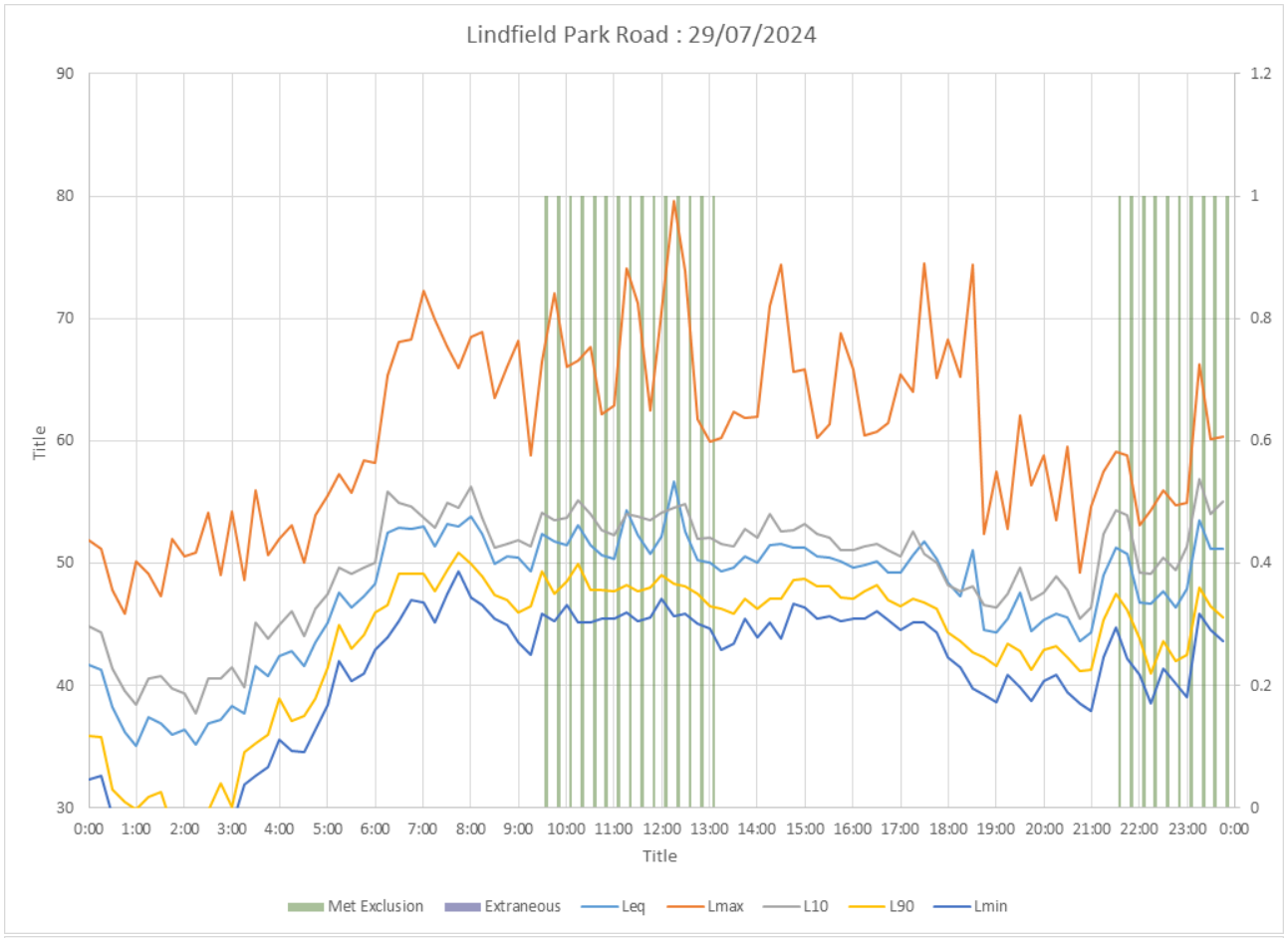
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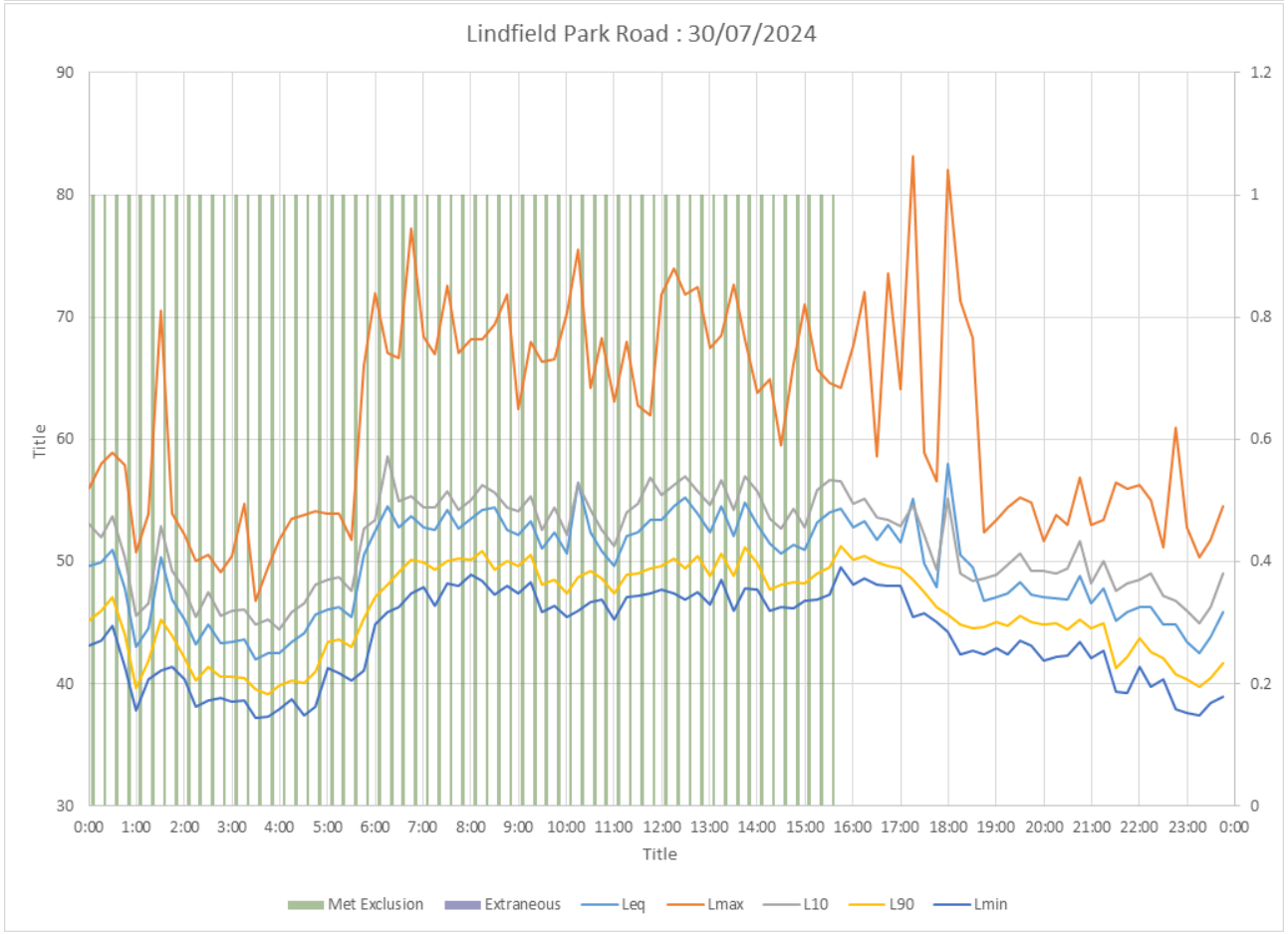
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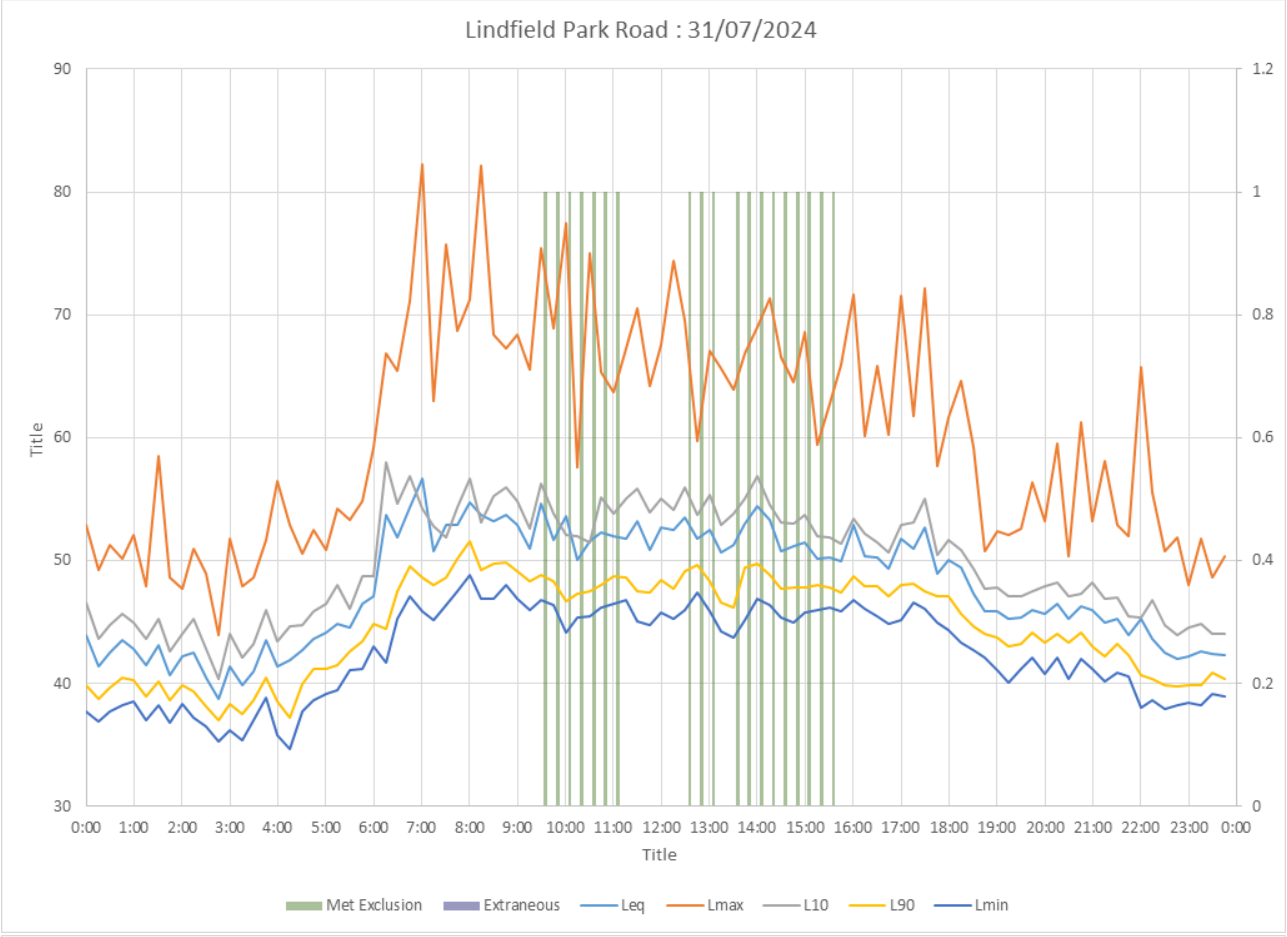
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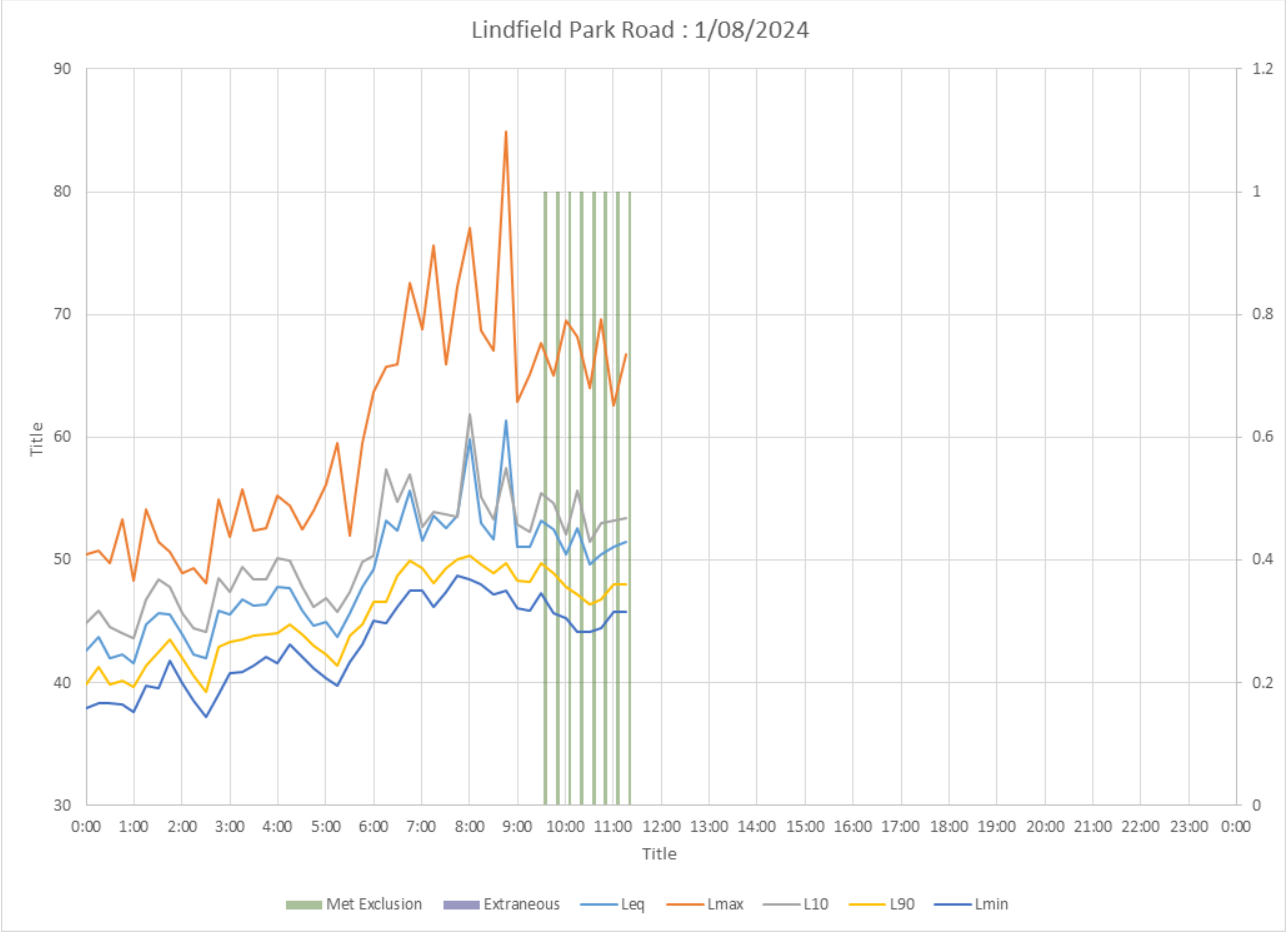
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