ISPT Pty Ltd

Clunies Ross Street,
SSD 10399- Prospect Logistics Estate
Greystanes

Noise Impact Assessment

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Document Control

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1 Introduction

White Noise Acoustics has been engaged to undertake the Noise Impact Assessment of the proposed warehouse development located at 44 Clunies Ross Street, 615A Great Western Highway and Lot 107 in DP1028208 (the Site), Greystanes.

The proposed project includes the following

1. 5buildings with 5 warehouses.
2. Associated parking and truck loading areas.

This assessment includes the acoustic investigation into the potential for noise impacts from the operation of the completed project as well as potential noise impacts from traffic movements on surrounding streets.

Additionally, construction noise management strategies are included in this report.

The proposed development is detailed in SBA Architects drawings, which include the typal floor plan for the development which is included below.

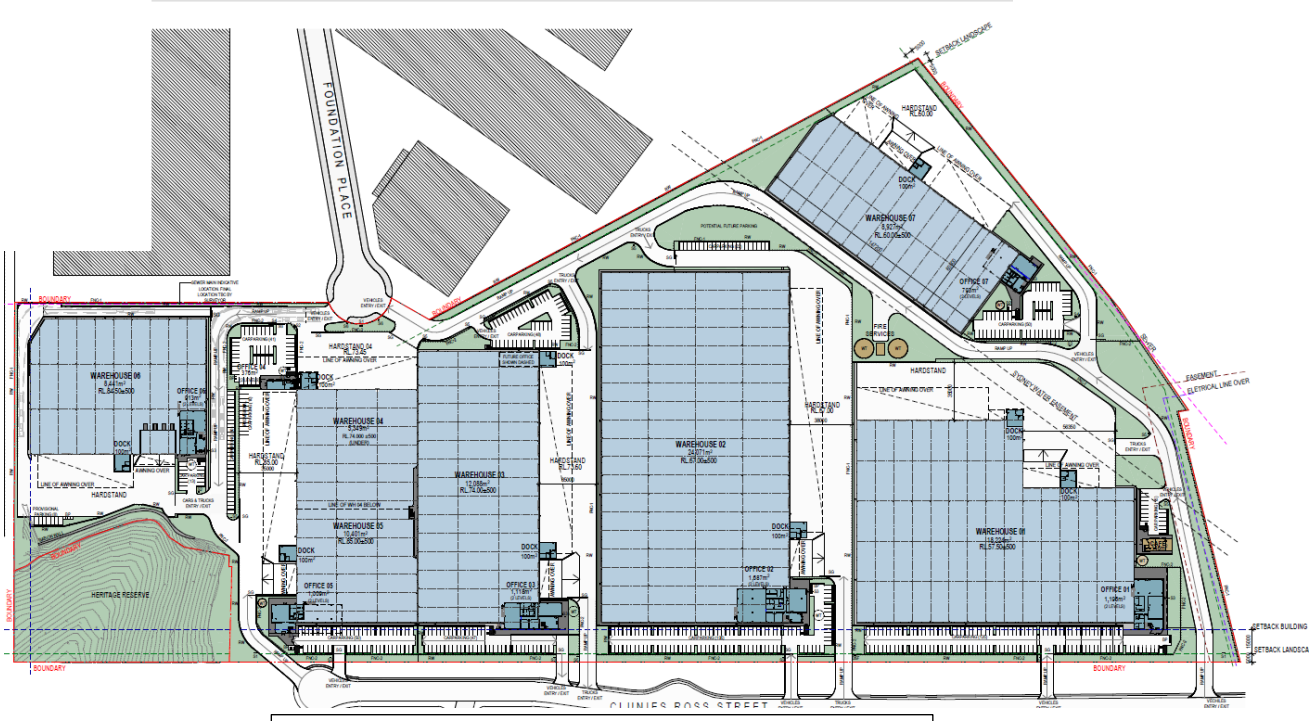


Figure 1 – Proposed development site plan

1.1 Development Description

The site is located on the western side of Clunies Ross Street which carries traffic accessing the local residential areas to the east including buses and heavy vehicles servicing the exiting industrial facilities on the site.

The surrounding area includes the following:

1. Existing commercial/industrial receivers to the north, north-east, south and west of the site.
2. Residential receives to the east of the site opposite on Clunies Ross Street.

An acoustic noise barrier exists on the eastern side of Clunies Ross Street between the north residential receivers and Wombat Street.

The site location is detailed in Figure 2 below.

Figure 2 – 44 Clunies Ross Street, 615A Great Western Highway and Lot 107 in DP1028208Site Location

2 Proposed Development

The proposed site includes the following

1. Seven warehouse buildings
2. 2. Associated car parking and truck loading areas
3. 3. Internal estate road
4. 4. Small cafe

The site is located within the Blacktown City Council region.

3 Existing Acoustic Environment

The site is located to the western side of Clunies Ross Street which carries low traffic numbers associated with carrying local traffic including public transport buses and heavy vehicles servicing the existing industrial facilities.

To the north of the site and approximately 200m from the site is the M4 and Great Western Motorways which carries high volumes of traffic which is impacting the northern portion of the site. The site is located within an area which is classified as a *Urban* area as defined in EPA's Noise Policy for Industry and includes the following:

1. Has through-traffic with characteristically heavy and continuous traffic flows during peak periods.
2. Is near commercial districts or industrial districts

The exiting noise levels at the site are predominantly as a result from existing industrial facilities and traffic noise within the vicinity of the site including the Clunies Ross Street and the M4 and Great Western Motorways. Existing receivers within the vicinity of the site include industrial receivers to the north, north-east, south and west and residential receiver's east opposite on Clunies Ross Street.

The residential receivers opposite to the site on Clunies Ross Street and to the north of Wombat Street are protected from the site by an existing acoustic barrier.

As part of this assessment an acoustic survey of the existing acoustic environment at the site was undertaken. The survey included attended noise level measurements at the site, during various times of the day on the 31st January 2020 as well as long term unattended noise logging at two locations which was undertaken between the 31st of January and the 7th February 2020. During the testing periods of inclement weather have not been included in the assessment.

Noise logging was undertaken using a Rion NL-42EX type noise monitors with the following serial numbers and calibrations:

1. Logger 1 – Serial number 396932 and calibration number C19465
2. Logger 2 - Serial number 396931 and calibration number C19644A

The noise logger locations include representative locations to the north and south of the site to obtain existing noise levels on the site as detailed in Figure 2 above. Both loggers were positioned such that it did not include façade corrects.

Attended noise level testing was conducted using a Bruel and Kjaer 2236C type meter. The meter was calibrated before and after testing and no significant drift was recorded.

3.1 Noise Survey Results

The attended and unattended noise locations were selected to obtain suitable noise levels for the assessment of background noise levels ($L_{90\,(t)}$) as well as the impact from traffic movements ($Leq_{(t)}$). The results of the acoustic survey are detailed in the tables below which have been used as the basis of this assessment.

Table 1 – Results of the Attended Noise Survey at the Site

Measurement Location	Time of Measurement	$L_{Aeq,\ 15min}$ dB(A)	$L_{A90,\ 15min}$ dB(A)	Comments
Attended noise measurement location, Northern Location	9.05am to 9.20am	58	54	Noise level at the site dominated by vehicle movements on Clunies Ross Street the Motorways and existing industrial facilities
Attended noise measurement location, Southern Location	9.25am to 9.40am	54	44	

Table 2 – Results of the Noise Logging at the Site

Measurement Location	Time of Measurement	Maximum Repeatable $L_{Aeq,\ 15min}$ dB(A)	Representative Background noise Level (RBL) $L_{A90,\ 15min}$ dB(A)
Northern noise logger location, see figure 2 above	Day	58	52
	Evening	54	50
	Night	52	44
Southern noise logger location, see figure 2 above	Day	52	48
	Evening	51	46
	Night	44	40

4 Internal Noise Level Criteria

Internal noise levels within the future development have been based on the relevant noise levels as detailed within the Australian Standard AS2107:2000 *Acoustics - Recommended design sound levels and reverberation times for building interiors*.

The recommended levels for various areas of the project are detailed in the following table. The recommended noise levels for packing and delivery areas of industrial developments detailed within AS2107:2016 have been used as the basis of this assessment.

Table 3 - design Recommended design sound levels

Type of Occupancy/Activity	Design sound level maximum ($L_{Aeq,t}$)
Industrial packaging and delivery areas	60
Note: The relevant time period (t) for all areas detailed is 15 minutes.	

5 Environmental Noise Intrusion Assessment

This section of the report details the assessment of environmental noise intrusion into the proposed development and the recommended acoustic treatments to ensure the recommended internal noise levels detailed in the Sections above are achieved.

Internal noise levels within the future areas of the development will result from the noise intrusion into the building through the external façade including glass, and other façade elements. Typically, the acoustic performance of building elements including the relatively light weight elements of the building façade, including glass and/or plasterboard constructions, will be the determining factors in the resulting internal noise levels.

Calculations of internal noise levels have been undertaken based on the measured environmental noise levels at the site and the characteristics of the building, including window openings, buildings constructions and the like.

5.1 External Glass Elements

The recommended acoustic constructions to the buildings external façade glass elements are detailed in the table below to ensure the recommended internal noise levels detailed above are achieved, with the façade building openings closed.

Table 4 – External Glass Acoustic Requirements

Façade Orientation	Level	Room Type	Recommended Glass Construction	Minimum Façade Acoustic Performance[1]
All Façade Orientation	All Levels	All Areas	4mm Float/Toughened	Rw 28
Note 1: *The acoustic performance of the external façade includes the installed glazing and frame including (but not limited to) the façade systems seals and frame. All external glazing systems are required to be installed using acoustic bulb seals.*				

The recommended glass constructions detailed in the table above include those required to ensure the acoustic requirements of the project are achieved. Thicker glazing may be required to achieve other project requirements such as structural, thermal, safety or other requirements and is to be advised by others.

5.2 External Building Elements

The proposed external building elements including standard light weight walls and roof construction are acoustically acceptable without additional acoustic treatment.

5.3 External Roof

The proposed standard light weight metal deck roof is acoustically acceptable to ensure internal noise levels are achieved without additional treatments.

6 External Noise Emission Assessment

This section of the report details the relevant noise level criteria for noise emissions generated on the site once completed.

The relevant authority which provides the required noise level criteria for noise levels generated on the site includes the NSW Environmental Protection Authority's (EPA) Noise Policy for Industry (NPfI).

6.1 NSW Environmental Protection Authority, Noise Policy for Industry

The NSW Environmental Protection Authority (EPA) Noise Policy for Industry (NPfI), previously Industrial Noise Policy, details noise criteria for the control of noise generated from the operation of developments and the potential for impact on surrounding receivers.

The NPI includes both intrusive and amenity criteria which are summarised below.

1. Intrusive noise level criteria, The NPfI states the following:

   'The intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source (represented by the LAeq descriptor), measured over a 15minute period, does not exceed the background noise level by more than 5 dB when beyond a minimum threshold. This intrusiveness noise level seeks to limit the degree of change a new noise source introduces to an existing environment.'

2. Amenity noise level criteria, The NPfI states the following:

   'To limit continuing increases in noise levels from application of the intrusiveness level alone, the ambient noise level within an area from all industrial noise sources combined should remain below the recommended amenity noise levels specified in Table 2.2 where feasible and reasonable. The recommended amenity noise levels will protect against noise impacts such as speech interference, community annoyance and some sleep disturbance.'

   Project amenity noise level for industrial developments = recommended amenity noise level (Table 2.2) minus 5 dB(A)

   Where the resultant project amenity noise level is 10 dB or more lower than the existing industrial noise level. In this case the project amenity noise levels can be set at 10 dB below existing industrial noise levels if it can be demonstrated that existing industrial noise levels are unlikely to reduce over time.

The LAeq is determined over a 15-minute period for the project intrusiveness noise level and over an assessment period (day, evening and night) for the project amenity noise level. This leads to the situation where, because of the different averaging periods, the same numerical value does not necessarily represent the same amount of noise heard by a person for different time periods. To standardise the time periods for the intrusiveness and amenity noise levels, this policy assumes that the LAeq,15min will be taken to be equal to the LAeq, period + 3 decibels (dB), unless robust evidence is provided for an alternative approach for the particular project being considered.

Project amenity noise level (ANL) is urban ANL (Table 2.1) minus 5 dB(A) plus 3 dB(A) to convert from a period level to a 15-minute level (dB = decibel; dB[A] = decibel [A-weighted]; RBL = rating background noise level).

Noise level used in the assessment of noise emission from the site have been based on the noise level survey conducted at the site and detailed in this section of the report.

Consequently, the resulting noise level criteria are summarised in the table below. The criteria are nominated for the purpose of determining the operational noise limits for the operation of the site including mechanical plant associated with the development which can potentially affect noise sensitive receivers and operational noise levels from the future tenancies. For each assessment period, the lower (i.e. the more stringent) of the amenity or intrusive criteria are adopted. The calculated *Project Amenity Noise Level* includes either the Recommended Amenity Noise Level minus 5 dB(A) plus 3 dB(A) (for a 15minum period) or the measured existing Leq noise level – 10 dB if this is greater as determined by the NPfI.

Table 5 – External Noise Level Criteria in Accordance with the NSW NPfI

Location	Time of Day	Project Amenity Noise Level, $L_{Aeq, period}$ [1] (dBA)	Measured $L_{A90, 15\ min}$ (RBL) [2] (dBA)	Measured $L_{Aeq, period}$ Noise Level (dBA)	Intrusive $L_{Aeq, 15\ min}$ Criterion for New Sources (dBA)
Urban residences Northern Locations	Day	58	58	52	**57**
	Evening	**48**	54	50	55
	Night[4]	**43**	52	44	49
Urban residences Southern Locations	Day	58	52	48	**53**
	Evening	**48**	51	46	51
	Night[4]	**43**	44	40	45

Note 1: Project Amenity Noise Levels corresponding to "Suburban" areas, recommended noise levels.
Note 2: L_{A90} Background Noise or Rating Background Level including façade corrections
Note 3: Project Noise Trigger Levels are shown in bold

6.2 Sleep Disturbance

This section of the report details the relevant sleep disturbance noise level criteria for the assessment of noise emissions from the site during night-time hours. The assessment of sleep disturbance includes intermittent noise levels from operations such as deliveries and vehicle movements on the site during night-time periods.

The EPA's *Industrial Noise Policy for Industry* (NPfI) and the *NSW Road Noise Policy (RNP)* includes suitable criteria for the assessment of potential sleep awakening events, which have been used as the basis of this report.

The NPfI includes the following commentary regarding possible sleep awakening events:

> ***2.5 Maximum noise level event assessment***
>
> *The potential for sleep disturbance from maximum noise level events from premises during the night-time period needs to be considered. Sleep disturbance is considered to be both awakenings and disturbance to sleep stages.*
> *Where the subject development/premises night-time noise levels at a residential location exceed:*
>
> - *$L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or*
> - *L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,*
>
> *A detailed maximum noise level event assessment should be undertaken. The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period. Some guidance*

on possible impact is contained in the review of research results in the NSW Road Noise Policy.

The RNP includes the following comments regarding sleep disturbance:

From the research on sleep disturbance to date it can be concluded that:

- *maximum internal noise levels below 50–55 dB(A) are unlikely to awaken people from sleep*
- *one or two noise events per night, with maximum internal noise levels of 65–70 dB(A), are*

not likely to affect health and wellbeing significantly.

Based on the details of the relevant standards detailed above a summary of the sleep disturbance noise level criteria is detailed in the following table.

Table 6 – Sleep Disturbance Criteria

Type of Receiver	Location	Policy	Description	Noise Level
Residential Receiver	Within the residential dwelling	Road Noise Policy	1 or 2 events unlikely to awaken people from sleep	65-70 dB(A) Lmax
			Maximum internal noise unlikely to awaken people from sleep	50-55 dB(A) Lmax
	External Noise levels	Noise Policy for Industry	The potential for sleep disturbance from maximum noise level events	$L_{Aeq,15min}$ 40 dB(A) or $L_{Aeq,15min}$ 49 dB(A)
				L_{AFmax} 52 dB(A) Or L_{AFmax} 59 dB(A)

Based on the details included within the NPfI and the RNP in the event a noise level of 55-59 dB(A) Lmax or 49 $L_{Aeq\ 15\ min}$ does not occur as a result of the use of the operation of the property (internally within the residential receiver) then noise levels are *unlikely to awaken people from sleep* and compliance with the requirements of the NPfI and the RNP regarding sleep disturbance would be achieved.

7 Noise Impact Assessment

An assessment of noise generated on the site has been undertaken on this section of the report. The assessment of noise levels generated on the site are summarised below:

1. **Mechanical Services Equipment** – At this stage of the project, the location of major plant items have been selected, however the exact selection to be installed is not known. As such a detailed assessment of noise associated from engineering services cannot be undertaken.

   To ensure that future selections of plant items meet external noise levels at neighbouring properties a proof of concept approach has been considered.

   In our experience, for this type of development the following mechanical systems may be installed, and their associated sound power levels are outlined below.
   - Ventilation fans – 80dB(A) (Lw)
   - Toilet exhaust fans – 45dBA (Lw)
   - Air Conditioning Condensers – 80dBA (Lw)
   - Chiller equipment for specific warehouses, which is assessed in the following point.

   For the proposed ventilation systems, it is anticipated that the physical fans would be installed on a plant area of the roof of the project with mechanical ductwork moving air from the warehouses areas to the roof as required. A dedicated plant deck area will be provided on the roof of each warehouse.

   On the assumption of the Sound Power Level above and the ductwork that is installed is acoustically treated with 50mm internal lining or attenuators (depending on the exact location), compliance would be achieved.

   Toilet exhaust fans for the units will individually discharge from the amenity areas of the future warehouses using in ceiling or roof top mounted fans. It is recommended that 1m with acoustic flexible ducting is used on the intake and discharge side of the fan or a section of internally lined ductwork, on this assumption compliance would be achieved.

   Roof op plant areas for individual warehouse amenities (office areas) would be provided using condensers located on the roof or ground level. It is expected that each warehouse will include a number of administration areas which will require condenser equipment. Providing this equipment is located on ground level with a line of sight barrier to neighbouring residential properties, or an acoustic screen is included to any condenser equipment located on the roof then the resulting noise emissions will comply with the relevant noise emission criteria.

Details of the required mechanical services equipment and acoustic treatments to ensure the relevant noise level criteria is achieved will be provided as part of the CC submission of the project.

Experience with similar projects confirms that the acoustic treatment of mechanical services is both possible and practical to ensure noise emission criteria is achieved.

2. **Cold Storage Equipment (significant equipment)** – The proposed site includes the use as cold storage including Warehouse 1 to be a high-bay fridge/freezer and Warehouse 2 to be temperature controlled (1-5 degrees). The location of the warehouses and assumed locations of the future external chiller/condenser locations are detailed in the figure below.

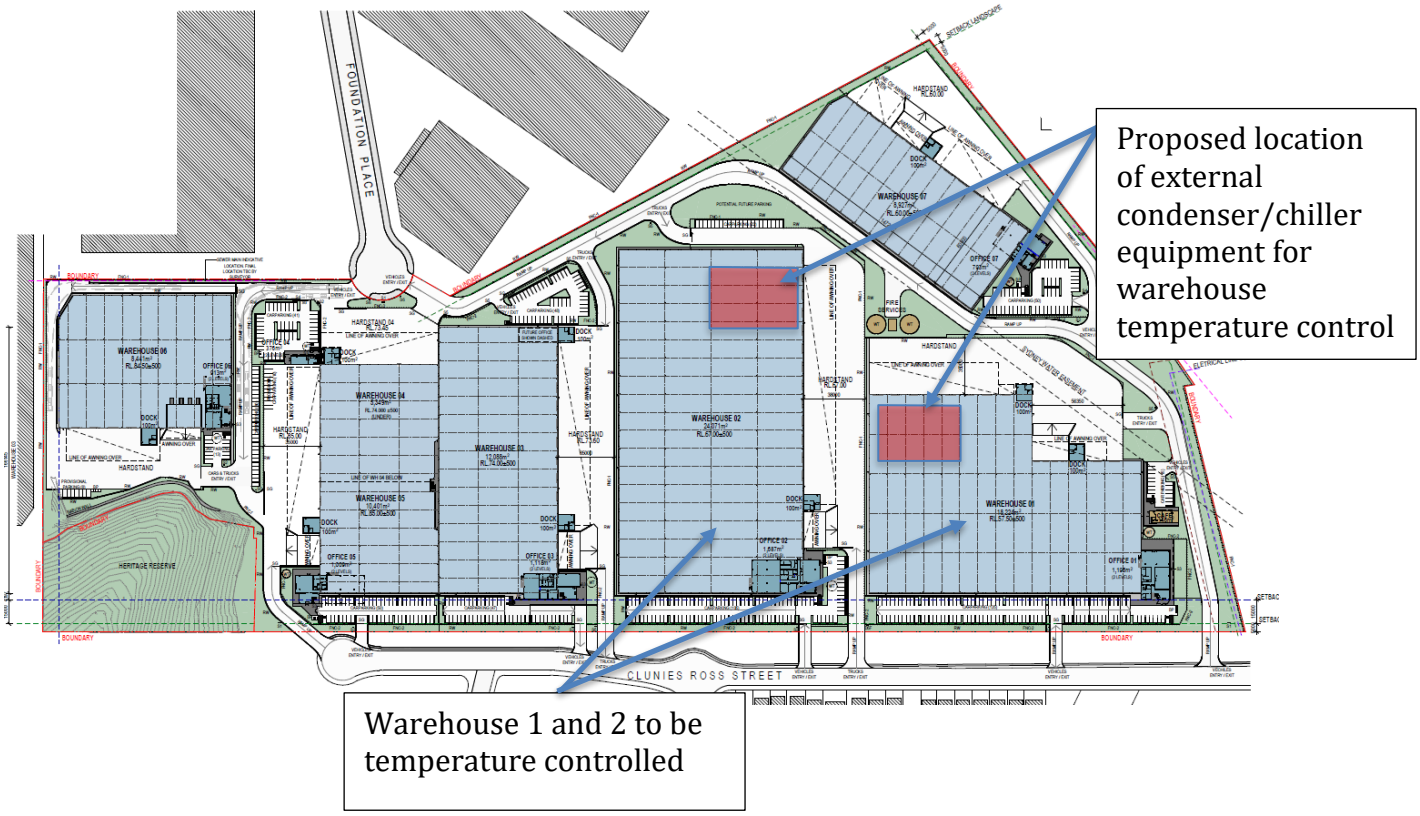


Figure 3 – Propose Cold Storage and Equipment Locations

Based on proposed temperature controlled/chilled warehouse facility it has been assumed that the required external chiller/condenser equipment will include a bank of air-cooled chillers or the like. The expected noise levels of this equipment is up to 100 dB(A) Sound Power Level (SWL).

Based on the location of the surrounding receivers to the site which include the residence to the east of the site with a distance of approximately 130m from the future equipment.

Based in proposed equipment the following noise levels have been calculated:

a. Source Noise of Air Cooled Chillers - 95 dB(A) SWL)
b. Distance correction (130m)- -50 dB
c. Acoustic Screening - -10 dB

Calculated Noise Level - **35 dB(A)**

Night Time Noise Criteria **43 dB(A)**

Based on the results of the acoustic assessment detailed above acoustic screening to the proposed chiller equipment may be required. The acoustic screen should consist of the following:

1. A solid screen including a construction which includes the following:
    a. Solid material including FC sheet, Sheet Metal, Masonry or the like with a minimum acoustic performance of Rw 15.
    b. Screen to be installed to a minimum height of the chiller/condenser equipment.
    c. Screen to be constructed such that a line of sigh barrier exists between the equipment and the residential receivers located to the east of the site.

It is noted that the assessment above assumes that the required chiller equipment will be operating at 100% during night timer periods. It is likely that the operational capacities of the equipment will not be required to operate at 100% during night-time periods and a further reduction in the predicted noise levels above would result.

Based on the assessment of the proposed warehouses which include air controlled/freezer areas the resulting noise levels from the proposed equipment to be included on the site will be acoustically acceptable ad compliant with the relevant noise assessment criteria detailed in this report.

3. **Use of the Warehouses** – The proposed future use of the warehouses will include spaces with the potential for materials movement and storage. The future use of each warehouse will include the potential for the following equipment of the site, including expected noise levels:
    - Material handling equipment (forklifts) for each warehouse, with a noise levels of up to 90 dB(A) (SWL).
    - Heavy and light vehicle movements to each warehouse with a noise level of up to 95 dB(A).

    For the purpose of this assessment it has been assumed that the use of the equipment above could be undertaken internally within the future warehouses and externally on the warehouse areas within the hardstand areas as detailed in the figure below.

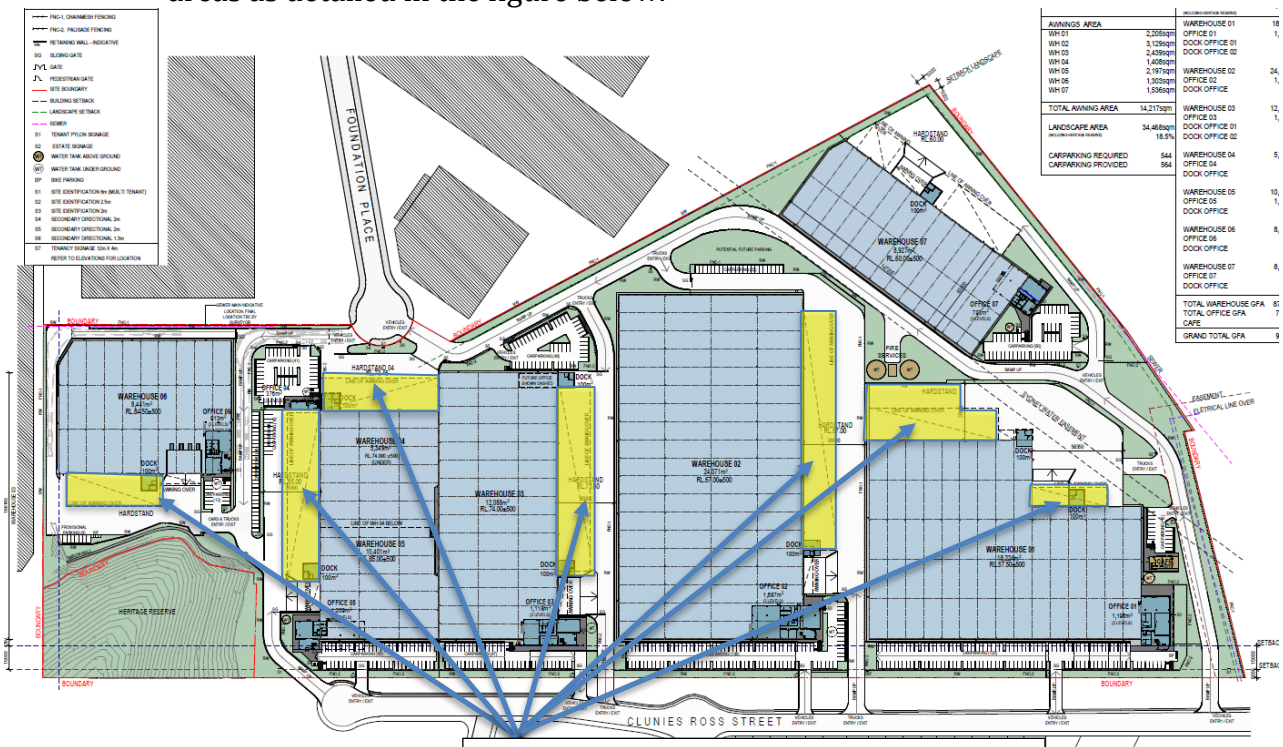


Figure 4 – Proposed Hardstand External Areas

7.1 Predicted Noise Emissions

This section of the report details the resulting predicted noise emissions from the operation of the proposed site to the surrounding residential receivers, including the sources detailed in the section above.

The assessment includes the potentially worst-case periods including the following:

1. All plant and equipment is operational simultaneously for all warehouses.
2. The hard stand areas for each warehouse is being used simultaneously including 1 forklift and 1 heavy vehicle moving in a 15min period.
3. All warehouses are being used for internal use simultaneously.

Predictions include the assessment to the receiver's locations as detailed in Figure 2 of this report.

Predictions have been undertaken for the operation of activities undertaken within the future warehouse areas as well as the external traffic movements. Predictions have included the contributions of the warehouses individually as well as cumulative and are detailed in the following table.

Table 7 – External Noise Emission Predictions – Internal Activities

Location	Time of Day	Predicted Noise Emissions $L_{Aeq, 15min}$ (dBA)							Cumulative Predicted Noise Levels $L_{Aeq, 15min}$ (dBA)	Project Noise Level Criteria $L_{Aeq, 15min}$ (dBA)
		Warehouse Source								
		1	2	3	4	5	6	7		
Urban residences Northern Locations	Day	21	21	19	>14	>14	>14	>14	26.4	57
	Evening	21	21	19	>14	>14	>14	>14	26.4	48
	Night	21	21	19	>14	>14	>14	>14	26.4	43
Urban residences Southern Locations	Day	>14	24	25	>14	25	21	>14	30.4	53
	Evening	>14	24	25	>14	25	21	>14	30.4	48
	Night	>14	24	25	>14	25	21	>14	30.4	43

Calculated noise emissions from the use of internal areas of the warehouses with maximum expected noise levels within each warehouse of up to 80 dB(A) $L_{eq\ 15min}$ as a Sound Pressure Level within each warehouse.

Predictions have been undertaken for the contribution of noise from the external activities for each warehouse, including vehicle movements on the site. Predictions have included the contributions of the warehouses individually as well as cumulative and are detailed in the following table.

Table 8 – External Noise Emission Predictions – External Activities and Vehicle Movements including Forklifts

Location	Time of Day	Predicted Noise Emissions $L_{Aeq, 15min}$ (dBA)							Cumulative Predicted Noise Levels $L_{Aeq, 15min}$ (dBA)	Project Noise Level Criteria $L_{Aeq, 15min}$ (dBA)
		Warehouse Source								
		1	2	3	4	5	6	7		
Urban residences Northern Locations	Day	31	31	29	>20	>20	>20	>20	35.7	57
	Evening	31	31	29	>20	>20	>20	>20	35.7	48
	Night	26	26	23	>15	>15	>15	>15	30.5	43
Urban residences Southern Locations	Day	>15	34	36	>15	36	30	>15	40.6	53
	Evening	>15	29	31	>15	31	26	>15	40.6	48
	Night	>15	29	31	>15	31	25	>15	35.7	43

Predicted external noise levels from external operations including viceless movements and delivery truck entry and exit on the site

Predictions have been undertaken for the contribution of noise from the expected mechanical equipment on the site. Predictions have included the contributions of the warehouses individually as well as cumulative and are detailed in the following table.

Table 9 – External Noise Emission Predictions – Mechanical Equipment

Location	Time of Day	Predicted Noise Emissions $L_{Aeq, 15min}$ (dBA)							Cumulative Predicted Noise Levels $L_{Aeq, 15min}$ (dBA)	Project Noise Level Criteria $L_{Aeq, 15min}$ (dBA)
		Warehouse Source								
		1	2	3	4	5	6	7		
Urban residences Northern Locations	Day	35	35	30	>20	>20	>20	>20	38.9	57
	Evening	35	35	30	>20	>20	>20	>20	38.9	48
	Night	35	35	30	>20	>20	>20	>20	38.9	43
Urban residences Southern Locations	Day	25	25	30	25	30	>20	>20	35	53
	Evening	25	25	30	25	30	>20	>20	35	48
	Night	25	25	30	25	30	>20	>20	35	43

Predicted external noise levels from external operations including viceless movements and delivery truck entry and exit on the site

Based on the results of the predicted noise levels from the various noise sources on the site the cumulative noise impacts to the surrounding receivers are detailed in the table below.

Table 10 – External Noise Emission Predictions – Cumulative Noise Impacts

Location	Time of Day	Predicted Noise Emissions $L_{Aeq, 15min}$ (dBA)			Cumulative Predicted Noise Levels $L_{Aeq, 15min}$ (dBA)	Project Noise Level Criteria $L_{Aeq, 15min}$ (dBA)
		Noise Source				
		Internal	External	Plant Noise		
Urban residences Northern Locations	Day	26.4	35.7	38.9	40.8	57
	Evening	26.4	35.7	38.9	40.8	48
	Night	26.4	30.5	38.9	39.7	43
Urban residences Southern Locations	Day	30.4	40.6	35	42	53
	Evening	30.4	40.6	35	42	48
	Night	30.4	35.7	35	39	43

Cumulative noise levels passed on the predictions for each noise source elements detailed in Tables 6, 7 and 8 above.

Based on the results of the noise level predictions noise emissions from all elements of the site will comply with the relevant noise emission criteria.

It is noted that predictions have been based on the possible maximum operating conditions and in the event the site does not include possible maximum conditions a reduction in the predicted noise levels above will result.

7.1.1 Sleep Disturbance Assessment

Based on the proposed use of the site an assessment of potential for a sleep disturbance event has been undertaken. The assessment includes the potential for a maximum noise level from a heavy vehicle on the site within the closest proximity of the site to neighbours opposite the site. The sample calculation for potential maximum sleep disturbance noise levels are included below.

Table 11 – Sleep Disturbance Noise Calculation to Residential Receiver

	Noise Level
Noise Source – Car Stacker in Use	95 dB(A) Lmax
Distance Correction (25m)	-36
Correction for open window of neighbours building	-6
Resulting Noise Level within bedroom	53 dB(A) Lmax
unlikely to awaken people from sleep Noise Level	55 dB(A) Lmax

Based on the results of the assessment detailed above the resulting maximum noise level from the operation of the site will comply with the relevant criteria for sleep disturbance and will be acceptable.

The assessment includes the assumption that the is no line of sight barrier and the activity is being used at the closest location on the site. In the event there is an additional distance or a line of sight barrier from activities on the site then the resulting maximum noise levels will be less than that detailed in the table above.

7.2 Recommended Acoustic Mitigations

The recommended mitigations and management controls should be included in the design, construction and operation of the site (in addition to those included in the sections above) to ensure suitable on-going operation of the site include the following:

1. All external hardstand, driveways and the like should include flat services.
2. Any grates or metal drainage points should be securely fixed to prevent movement as vehicles pass over.
3. All surfaces being used for vehicles and forklifts should be brush finishes (ie not polished or painted).
4. Any expansion joints should include flush finishes including cover plates where vehicles pass over.
5. A site contact should be provided to residence for complaints.
6. Acoustic certification testing should be undertaken to confirm resulting noise emissions comply with the relevant criteria. Testing should be undertaken within 6 months of the facility being in operation. In the event noise levels are in excess of noise criteria additional acoustic mitigation and/or control to be specified and adopted to ensure noise emission criteria is achieved.

8 Additional Traffic Noise on Surrounding Roadways

This section of the report details the assessment of future traffic noise on surrounding streets as a result of vehicles using the site.

The suitable noise criteria for the assessment of road traffic noise generated by vehicles using the site are set out in the NSW Government's NSW Road Noise Policy (RNP). Table 3 of the standard details the assessment criteria to be applied at residences potentially impacted by additional traffic volumes based on the road category and land use. The relevant noise criteria is detailed in the table below.

Table 3 Road traffic noise assessment criteria for residential land uses

Road category	Type of project/land use	Assessment criteria – dB(A)	
		Day (7 a.m.–10 p.m.)	Night (10 p.m.–7 a.m.)
Freeway/ arterial/ sub-arterial roads	1. Existing residences affected by noise from **new** freeway/arterial/sub-arterial road corridors	$L_{Aeq,\ (15\ hour)}$ 55 (external)	$L_{Aeq,\ (9\ hour)}$ 50 (external)
	2. Existing residences affected by noise from **redevelopment** of existing freeway/arterial/sub-arterial roads 3. Existing residences affected by **additional traffic** on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,\ (15\ hour)}$ 60 (external)	$L_{Aeq,\ (9\ hour)}$ 55 (external)
Local roads	4. Existing residences affected by noise from **new** local road corridors 5. Existing residences affected by noise from **redevelopment** of existing local roads 6. Existing residences affected by **additional traffic** on existing local roads generated by land use developments	$L_{Aeq,\ (1\ hour)}$ 55 (external)	$L_{Aeq,\ (1\ hour)}$ 50 (external)

Note: Land use developers must meet internal noise goals in the Infrastructure SEPP (Department of Planning NSW 2007) for sensitive developments near busy roads (see **Appendix C10**).

In addition to the table above the RNP includes criteria for sites where existing noise levels exceed those levels detailed in the table above. Section 3.4.1 *Process of applying the criteria* includes the following:

> *For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'.*

Based on the exiting noise levels measured at the site and detailed in this report the relevant criteria for additional traffic noise will be based on the 2 dB objective above exiting noise levels and are detailed in the table below.

Table 12 – Additional Traffic Noise Criteria

Measurement Location	Time of Measurement	Maximum Repeatable $L_{Aeq, 15min}$ dB(A)	Sub arterial Road Criteria	Resulting Additional Traffic Noise Criteria
Northern residential receivers	Day	58	60	60
	Night	52	55	55
Southern residential receivers	Day	52	60	60
	Night	44	55	55

Based on the proposed development and potential traffic generated by use of the site the following assumption have been made:

1. Day time Worst 1 hour periods:
    a. Additional car and small vans using the site – Up to 50
    b. Heavy trucks and semi reticulated trucks – Up to 10

2. Night time Worst 1 hour periods:
    a. Additional car and small vans using the site – Up to 15
    b. Heavy trucks and semi reticulated trucks – Up to 4

Based on the expected use of the site the calculated future traffic noise levels are detailed in the table below. Note that calculated noise levels include those levels at the façade of existing residential receivers including the existing acoustic barrier located to the eastern side of Clunies Ross Street at the façade of the properties adjacent the site.

Table 13 – Calculated Future Additional Traffic Noise Levels

Measurement Location	Time of Measurement	Additional Traffic Noise Criteria $L_{Aeq, 1\ hr}$ dB(A)	Calculated Traffic Noise Levels $L_{Aeq, 1\ hr}$ dB(A)
Northern residential receivers	Day	60	56.2
	Night	55	<50
Southern residential receivers	Day	60	53.1
	Night	55	47.5

Based on the results of the additional traffic assessment the proposed development will be compliant with the relevant RNP criteria.

9 Construction Noise and Vibration Management Plan

This section of the report details the assessment of noise associated with the proposed demolition activities associated with the development. The assessment has been undertaken to assess the potential noise impacts from construction and demolition on surrounding receivers to the site.

The proposed construction and demolition activities to be undertaken on the site include the removal of the existing buildings and construction of the new development. The development will then be constructed using normal construction processes.

The EPA's Interim Construction Noise Guideline defines normal day time hours as the following:

2.2 Recommended standard hours

The recommended standard hours for construction work are shown in Table 1; however, they are not mandatory. There are some situations, as described below, where construction work may need to be undertaken outside of these hours. The likely noise impacts and the ability to undertake works during the recommended standard hours should be considered when scheduling work.

Table 1: Recommended standard hours for construction work

Work type	Recommended standard hours of work*
Normal construction	Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays
Blasting	Monday to Friday 9 am to 5 pm Saturday 9 am to 1 pm No blasting on Sundays or public holidays

* The relevant authority (consent, determining or regulatory) may impose more or less stringent construction hours.

9.1 Proposed Appliances

The proposed appliances which will be used as part of the demolition required as part of the development are detailed in the table below (including internal strip out/demolition):

Table 14 – Noise Level from Expected Demotion Appliances

Tasks	Equipment	Sound Power Levels per task dB(A) L_{10}	Aggregate Sound Power Level per Task dB(A) L_{10}
Site Demolition and Earth works	Jack hammer mounted on skid steer	118	122
	Hand held jack hammer	111	
	Concrete saw	119	
	Skid steer	110	
	Power hand tools	109	
	Excavators	115	
	Trucks	110	
	Earth Rollers	112	
Construction Works	Piling	115	120
	Welder	101	
	Saw cutter	109	
	Dump truck	109	
	Concrete saw	119	
	Power hand tools	109	
	Cranes	110	

Notes: Noise levels of proposed equipment to be used on the site based on the Australian Standard AS2436-2010 and noise level measurements previously undertaken of similar equipment on construction sites.

9.2 Construction Noise Criteria

This section of the report details the relevant construction noise criteria which is applicable to the site.

9.2.1 Interim Construction Noise Guideline

Noise criteria for construction and demolition activities are discussed in the *Interim Construction Noise Guideline* (ICNG). The ICNG also recommends procedures to address potential impacts of construction noise on residences and other sensitive land uses. The main objectives of the ICNG are summarised as follows:

- Promote a clear understanding of ways to identify and minimise noise from construction works;
- Focus on applying all "feasible" and "reasonable" work practices to minimise construction noise impacts;
- Encourage construction to be undertaken only during the recommended standard hours unless approval is given for works that cannot be undertaken during these hours;
- Streamline the assessment and approval stages and reduce time spent dealing with complaints at the project implementation stage; and
- Provide flexibility in selecting site-specific feasible and reasonable work practices in order to minimise noise impacts.

The ICNG contains a quantitative assessment method which is applicable to this project. Guidance levels are given for airborne noise at residences and other sensitive land uses.
The quantitative assessment method involves predicting noise levels at sensitive receivers and comparing them with the Noise Management Levels (NMLs). The NML affectation categories for receivers have been reproduced from the guideline and are listed in the table below.

Table 15 – Noise Management Levels from Construction – Quantitative Assessment

Receiver Type	Time of Day	Noise Management Level LAeq(15minute)1,2	How to Apply
Residential	Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured LAeq(15minute) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
		Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences. 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
	Outside recommended standard hours	Noise affected RBL + 5 dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community.

Table 9 – Continued

Receiver Type	Time of Day	Noise Management Level LAeq(15minute)1,2	How to Apply
Industrial Receivers	When is use	LAeq (15 min) 75 dB(A)	During construction, the proponent should regularly update the occupants of the commercial and industrial premises regarding noise levels and hours of work.
	Note 1 *Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.*		
	Note 2 *The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours). The term RBL is described in detail in the NSW Industrial Noise Policy (EPA 2000).*		

Based on the table above the suitable construction noise management levels for works undertaken on the site is detailed in Table 14 below.

Table 16 – Site Construction Noise Management Levels

Noise Source	Time Period	Receiver Type	Construction Noise Management Level	'High Noise Affected' Level
Construction Noise	Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Residential	63 dB(A) $L_{Aeq\ (15min)}$	75 dB(A) $L_{Aeq\ (15min)}$
	When in Use	Industrial Receivers	75 dB(A) $L_{eq\ (15\ min)}$	
Note 1: Construction noise management levels based on the Interim Construction Noise Guideline				

9.3 Construction Vibration Criteria

Effects of ground borne vibration on buildings may be segregated into the following three categories:

- Human comfort – vibration in which the occupants or users of the building are inconvenienced or possibly disturbed. Refer to further discussion in Section 7.3.1.
- Effects on building contents – where vibration can cause damage to fixtures, fittings and other non-building related objects. Refer to further discussion in Section 7.3.2 and 7.3.3.
- Effects on building structures – where vibration can compromise the integrity of the building or structure itself. Refer to further discussion in Section 7.3.2 and 7.3.3.

9.3.1 Vibration Criteria – Human Comfort

Vibration effects relating specifically to the human comfort aspects of the project are taken from the guideline titled *"Assessing Vibration – A Technical Guideline"*. (AVTG) This type of impact can be further categorised and assessed using the appropriate criterion as follows:

- Continuous vibration – from uninterrupted sources (refer to Table 17).
- Impulsive vibration – up to three instances of sudden impact e.g. dropping heavy items, per monitoring period (refer to Table 16).
- Intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously (refer to Table 19).

Table 17 Continuous vibration acceleration criteria (m/s2) 1 Hz-80 Hz

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day or night-time	0.020	0.014	0.040	0.028
		0.04	0.029	0.080	0.058
Workshops	Day or night-time	0.04	0.029	0.080	0.058

Table 18 Impulsive vibration acceleration criteria (m/s2) 1 Hz-80 Hz

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day or night-time	0.64	0.46	1.28	0.92
Workshops	Day or night-time	0.64	0.46	1.28	0.92

Table 19 Intermittent vibration impacts criteria (m/s1.75) 1 Hz-80 Hz

Location	Daytime		Night-time	
	Preferred Values	Maximum Values	Preferred Values	Maximum Values
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

9.3.2 Vibration Criteria – Building Contents and Structure

The vibration effects on the building itself are assessed against international standards as follows:

- For transient vibration: British Standard BS 7385: Part 2-1993 "Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration" (BSI 1993); and
- For continuous or repetitive vibration: German DIN 4150: Part 3 – 1999 "Effects of Vibration on Structure" (DIN 1999).

9.3.3 Standard BS 7385 Part 2 - 1993

For transient vibration, as discussed in standard BS 7385 Part 2-1993, the criteria are based on peak particle velocity (mm/s) which is to be measured at the base of the building. These are summarised in Table 20 and illustrated in the Figure below.

Table 20 Transient vibration criteria as per standard BS 7385 Part 2 - 1993

Line in Figure below	Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4 Hz to 15 Hz	15 Hz and Above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Standard BS 7385 Part 2 – 1993 states that the values in Table 20 relate to transient vibration which does not cause resonant responses in buildings. Where the dynamic loading caused by continuous vibration events is such as that results in dynamic magnification due to resonance (especially at the lower frequencies where lower guide values apply), then the values in Table 20 may need to be reduced by up to 50% (refer to Line 3 in the Figure below).

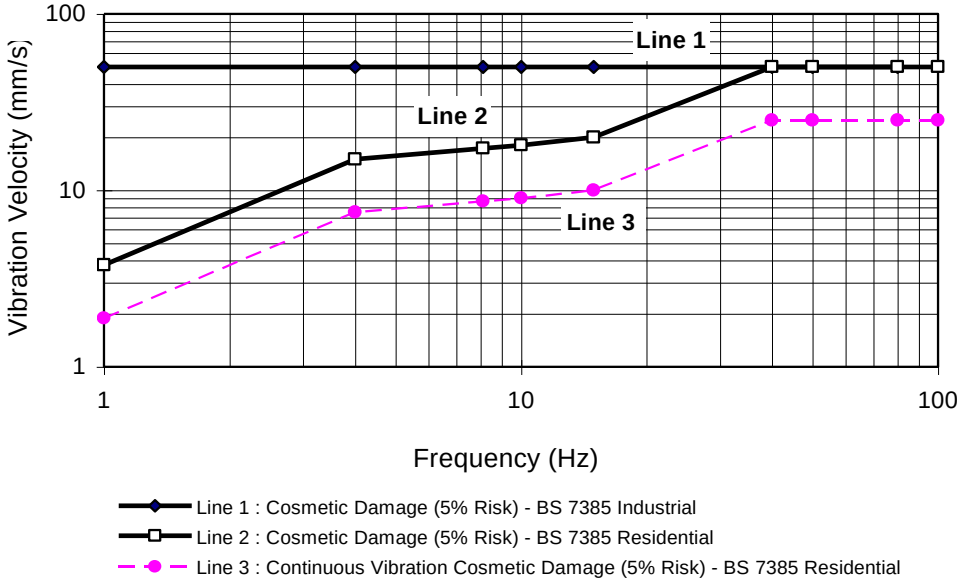


Figure 10 - BS 7385 Part 2 – 1993, graph of transient vibration values for cosmetic damage

In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the recommended values corresponding to Line 2 are reduced. Below a frequency of 4 Hz where a high displacement is associated with the relatively low peak component particle velocity value, a maximum displacement of 0.6 mm (zero to peak) is recommended. This displacement is equivalent to a vibration velocity of 3.7 mm/s at 1 Hz.
The standard also states that minor damage is possible at vibration magnitudes which are greater than twice those given in Table 20, and major damage to a building structure may occur at values greater than four times the tabulated values.
Fatigue considerations are also addressed in the standard and it is concluded that unless calculation indicates that the magnitude and number of load reversals is significant (in respect of the fatigue life of building materials) then the values in Table 20 should not be reduced for fatigue considerations.

9.3.3.1 Standard DIN 4150 Part 3 - 1999

For continuous or repetitive vibration, standard DIN 4150 Part 3-1999 provides criteria based on values for peak particle velocity (mm/s) measured at the foundation of the building; these are summarised in Table 21. The criteria are frequency dependent and specific to particular categories of structures.

Table 21 Structural damage criteria as per standard DIN 4150 Part 3 - 1999

Type of Structure	Peak Component Particle Velocity, mm/s			
	Vibration at the foundation at a frequency of			Vibration of horizontal plane of highest floor at all frequencies
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz[1]	
Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
Structures that, because of their sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

Note 1: For frequencies above 100Hz, at least the values specified in this column shall be applied.

9.4 Construction Noise Management – Qualitative Assessment

Based on the assessment conducted of the expected construction noise levels generated from the construction of the project noise levels are generally expected to require the building contractor to engage in management of activities on the site.

The following management controls are recommended to mitigate construction noise levels on the site:

1. All plant and equipment are to be maintained such that they are in good working order.
2. A register of complaints is to be recorded in the event of complaints being received, including location, time of complaint, nature of the complaint and actions resulting from the complaint.
3. If required a noise level measurement of the offending plant item generating complaints is to be conducted and noise mitigations undertaken to reduce noise levels to within Noise Management levels in the event magnitude of noise levels is found to be above suitable levels.
4. The use of percussive and concrete sawing should be undertaken behind a closed façade when possible.
5. The use of high noise generating equipment including hydraulic hammers, rock cutters or the like should not be undertaken prior to 8am Monday to Friday or 8.30am Saturdays.
6. The loading of trucks should be conducted such that there is not a requirement to stack truck on the roadways adjacent to the residential receivers.

In addition to the recommended mitigations above details of the proposed construction (including demolition) works to be conducted on the site, including type of activities to be conducted as well as the expected duration of activities should be provided to the neighbouring receivers.

A detailed construction noise and vibration management plan is to be provided by the building contractor as part of the construction certificate.

9.5 Construction Noise Assessment – Quantitative Assessment

A quantitative assessment of the construction noise levels resulting from the proposed works to has been undertaken.

The assessment has been based on the expected noise levels to be generated on the site including those detailed in Section 8.1 above. Calculations of the resulting construction noise levels of the residential receivers within proximity to the site is detailed in the table below.

Table 22 Quantitative Assessment of Construction Noise to Neighboring Residence

Source Noise	Equipment	Sound Power Levels dB(A) L_{10}	Aggregate Sound Power Level dB(A) L_{10}	Calculated Construction Noise Levels
Site Demolition works	Jack hammer mounted on skid steer	118	122	Up to 65 dB(A) when items used externally
	Hand held jack hammer	111		
	Concrete saw	119		
	Skid steer	110		
	Power hand tools	109		
	Excavators	115		
	Trucks	110		
	Earth Rollers	112		
Construction Works	Piling	115	120	Up to 60 dB(A) when items used externally
	Welder	101		
	Saw cutter	109		
	Dump truck	109		
	Concrete saw	119		
	Power hand tools	109		
	Cranes	110		

Based on the qualitative assessment of construction noise suitable management controls and community notifications are required to be conducted.

The required management of construction noise impacts are include in Section 9.4 above.

Subject to the implementation of these management measures, acoustic impacts during construction of the proposal will be acceptable.

9.6 Construction Vibration

Construction vibration may occur during the earthworks particularly if outcrops of dolerite are encountered. Safe working distances for building damage will be complied with at all times and vibration monitoring will be undertaken to ensure acceptable levels of vibration are satisfied.

Based on the location of the site there are significant separation of areas where construction activities will be conducted from surrounding building. Based on the location of works that will be conducted there will be safe working distances relating to continuous vibration from construction equipment. Most construction activities will have intermittent vibration emissions and therefore, higher vibration levels occurring over shorter periods are acceptable for intermittent events.

Construction vibration is not expected to generated magnitudes of vibration with the potential to exceed the criteria applicable for human comfort and therefore the nearest residential receivers are not likely to experience adverse vibration impacts.

10 Conclusion

This report details the Noise Impact Assessment of the proposed development at 44 Clunies Ross Street, 615A Great Western Highway and Lot 107 in DP1028208.

This report details the required acoustic constructions of the building's façade, including external windows, to ensure that the future internal noise levels comply with the relevant noise levels of the Australian Standard AS2107:2016. Providing the recommended constructions detailed in this report are included in the construction of the project the required internal noise levels will be achieved.

External noise emissions from the site have been assessed and detailed in accordance with the NSW Environmental Protection Authorities Noise Policy for Industry (previously the Industrial Noise Policy). The future design and treatment of all building services associated with the project can be acoustically treated to ensure all noise emissions from the site comply with the EPA NPfI criteria. Details of the equipment and associated acoustic treatments will be provided as part of the CC submission of the project.

An assessment of additional traffic noise generated by vehicles using the site has been undertaken and calculated noise levels comply with the requirements of the EPA's *Road Noise Policy.*

A construction noise and vibration assessment of the expected construction activities required to be used to complete the project has been undertaken and mitigation measures to be applied during the construction stage of the project. Subject to the undertaking these management measures, the project will have acceptable noise levels during the construction period.

For any additional information please do not hesitate to contact the person below.

Regards

Ben White
Director
White Noise Acoustics

11 Appendix A – Glossary of Terms

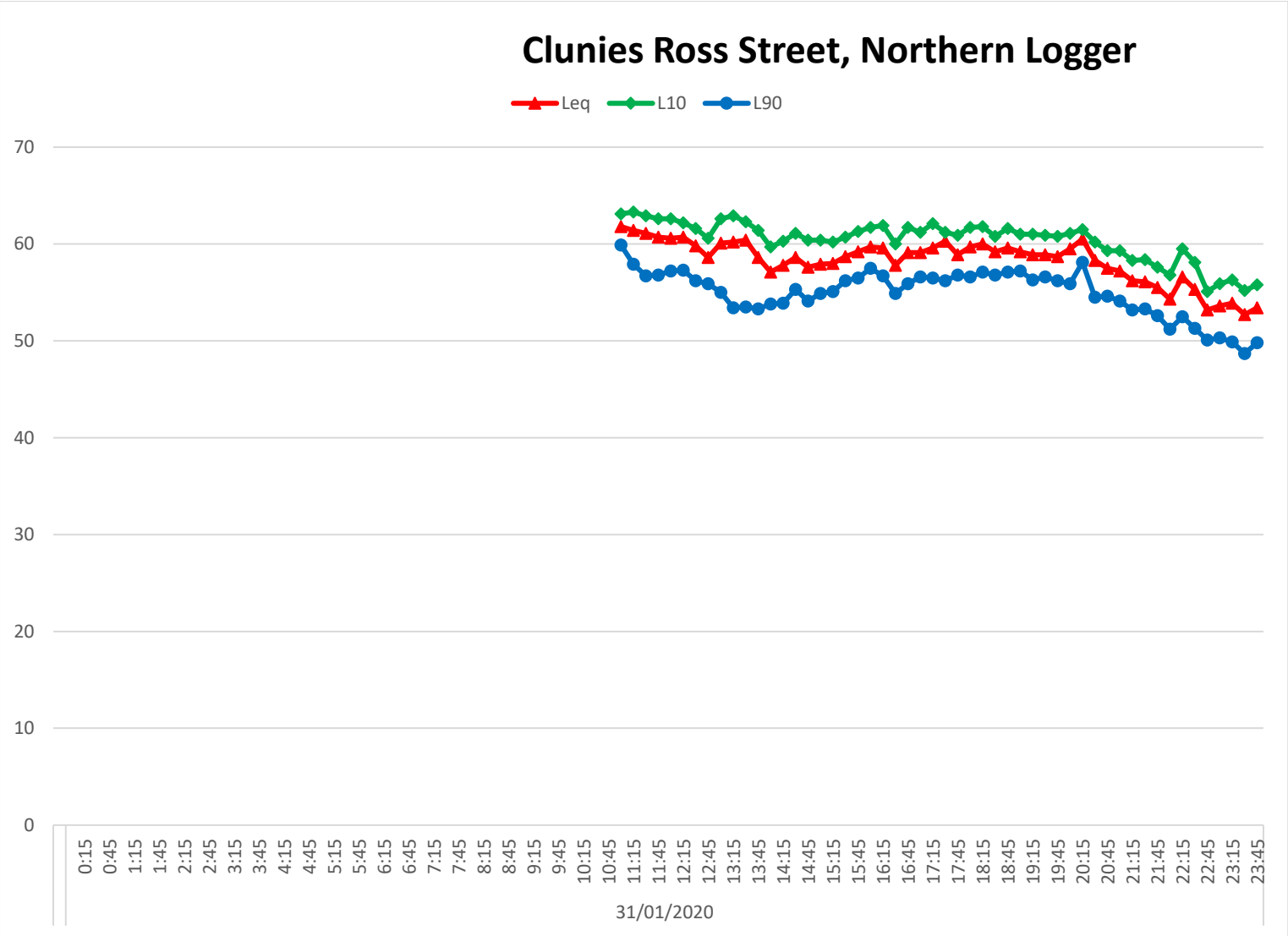
Ambient Sound	The totally encompassing sound in a given situation at a given time, usually composed of sound from all sources near and far.
Audible Range	The limits of frequency which are audible or heard as sound. The normal ear in young adults detects sound having frequencies in the region 20 Hz to 20 kHz, although it is possible for some people to detect frequencies outside these limits.
Character, acoustic	The total of the qualities making up the individuality of the noise. The pitch or shape of a sound's frequency content (spectrum) dictate a sound's character.
Decibel [dB]	The level of noise is measured objectively using a Sound Level Meter. The following are examples of the decibel readings of every day sounds;

0dB	the faintest sound we can hear
30dB	a quiet library or in a quiet location in the country
45dB	typical office space. Ambience in the city at night
60dB	Martin Place at lunch time
70dB	the sound of a car passing on the street
80dB	loud music played at home
90dB	the sound of a truck passing on the street
100dB	the sound of a rock band
115dB	limit of sound permitted in industry
120dB	deafening

dB(A)	*A-weighted decibels* The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter. The sound pressure level in dB(A) gives a close indication of the subjective loudness of the noise.
Frequency	Frequency is synonymous to *pitch*. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Loudness	A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L_{90} noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Background Sound Low	The average of the lowest levels of the sound levels measured in an affected area in the absence of noise from occupants and from unwanted, external ambient noise sources. Usually taken to mean the L_{A90} value
Ctr	A frequency adaptation term applied in accordance with the procedures described in ISO 717.
dB (A)	'A' Weighted overall sound pressure level

Noise Reduction	The difference in sound pressure level between any two areas. The term “noise reduction” does not specify any grade or performance quality unless accompanied by a specification of the units and conditions under which the units shall apply
NR Noise Rating	Single number evaluation of the background noise level. The NR level is normally around 5 to 6 dB below the “A” weighted noise level. The NR curve describes a spectrum of noise levels and is categorised by the level at 1000 Hz ie the NR 50 curve has a value of 50 dB at 1000 Hz. The NR rating is a tangential system where a noise spectrum is classified by the NR curve that just encompasses the entire noise spectrum consideration.
R_w	Weighted Sound Reduction Index - Laboratory test measurement procedure that provides a single number indication of the acoustic performance of a partition or single element. Calculation procedures for Rw are defined in ISO 140-2:1991 “Measurement of Sound Insulation in Buildings and of Building Elements Part 2: Determination, verification and application of precision data”.
R'_w	Field obtained Weighted Sound Reduction Index - this figure is generally up to 3-5 lower than the laboratory test determined level data due to flanked sound transmission and imperfect site construction.
Sound Isolation	A reference to the degree of acoustical separation between any two areas. Sound isolation may refer to sound transmission loss of a partition or to noise reduction from any unwanted noise source. The term “sound isolation” does not specify any grade or performance quality and requires the units to be specified for any contractual condition
Sound Pressure Level, L_P dB	A measurement obtained directly using a microphone and sound level meter. Sound pressure level varies with distance from a source and with changes to the measuring environment. Sound pressure level equals 20 times the logarithm to the base 10 of the ratio of the rms sound pressure to the reference sound pressure of 20 micro Pascals.
Sound Power Level, L_W dB	Sound power level is a measure of the sound energy emitted by a source, does not change with distance, and cannot be directly measured. Sound power level of a machine may vary depending on the actual operating load and is calculated from sound pressure level measurements with appropriate corrections for distance and/or environmental conditions. Sound power levels is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 picoWatt
Speech Privacy	A non-technical term but one of common usage. Speech privacy and speech intelligibility are opposites and a high level of speech privacy means a low level of speech intelligibility. It should be recognised that acceptable levels of speech privacy do not require that speech from an adjacent room is inaudible.
Transmission Loss	Equivalent to Sound Transmission Loss and to Sound Reduction Index in terminology used in countries other than Australia. A formal test rating of sound transmission properties of any construction, by usually a wall, floor, roof etc. The transmission loss of all materials varies with frequency and may be determined by either laboratory or field tests. Australian Standards apply to test methods for both situations.

12 Appendix B – Noise Logging Results, Northern Logger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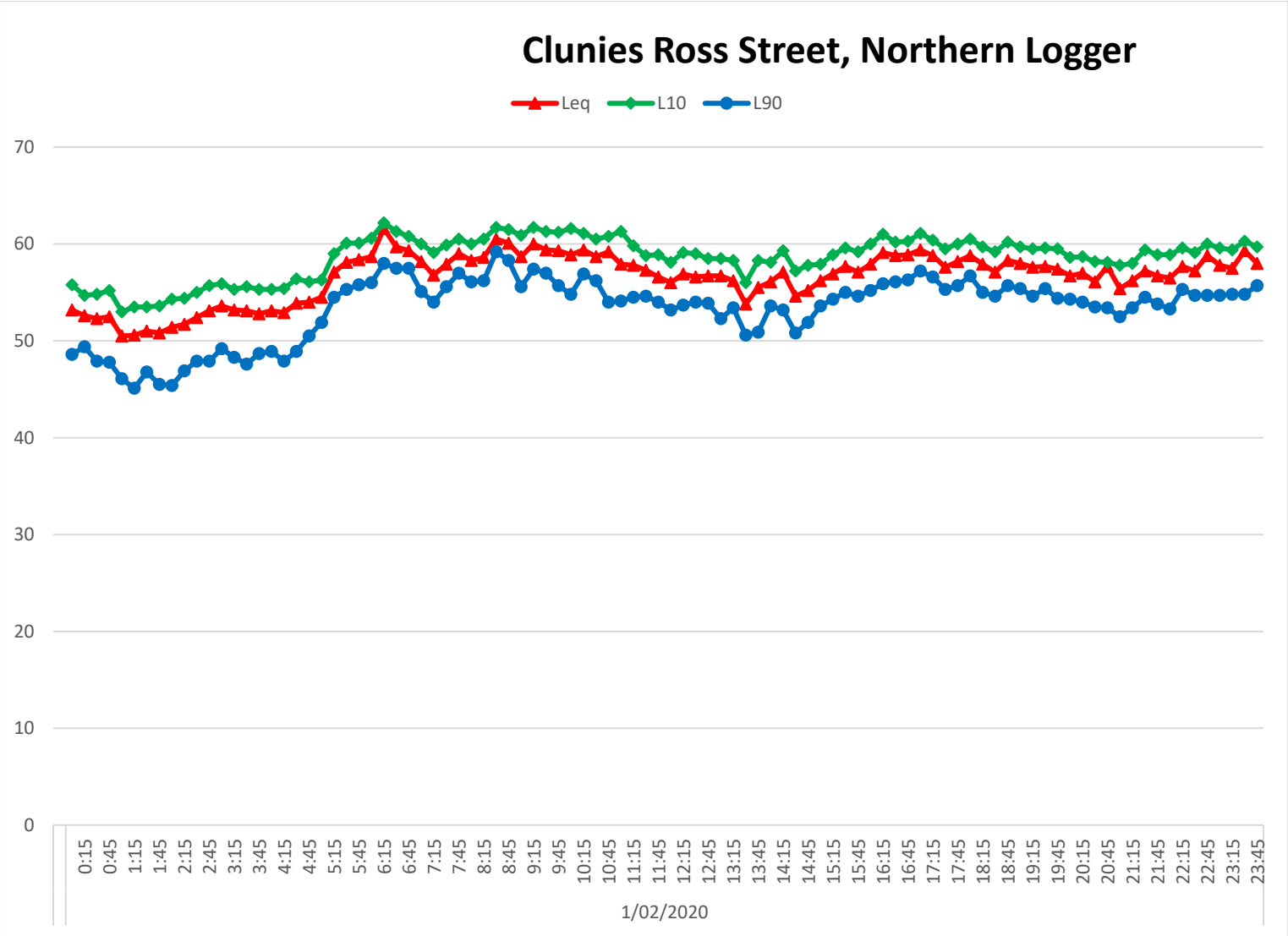
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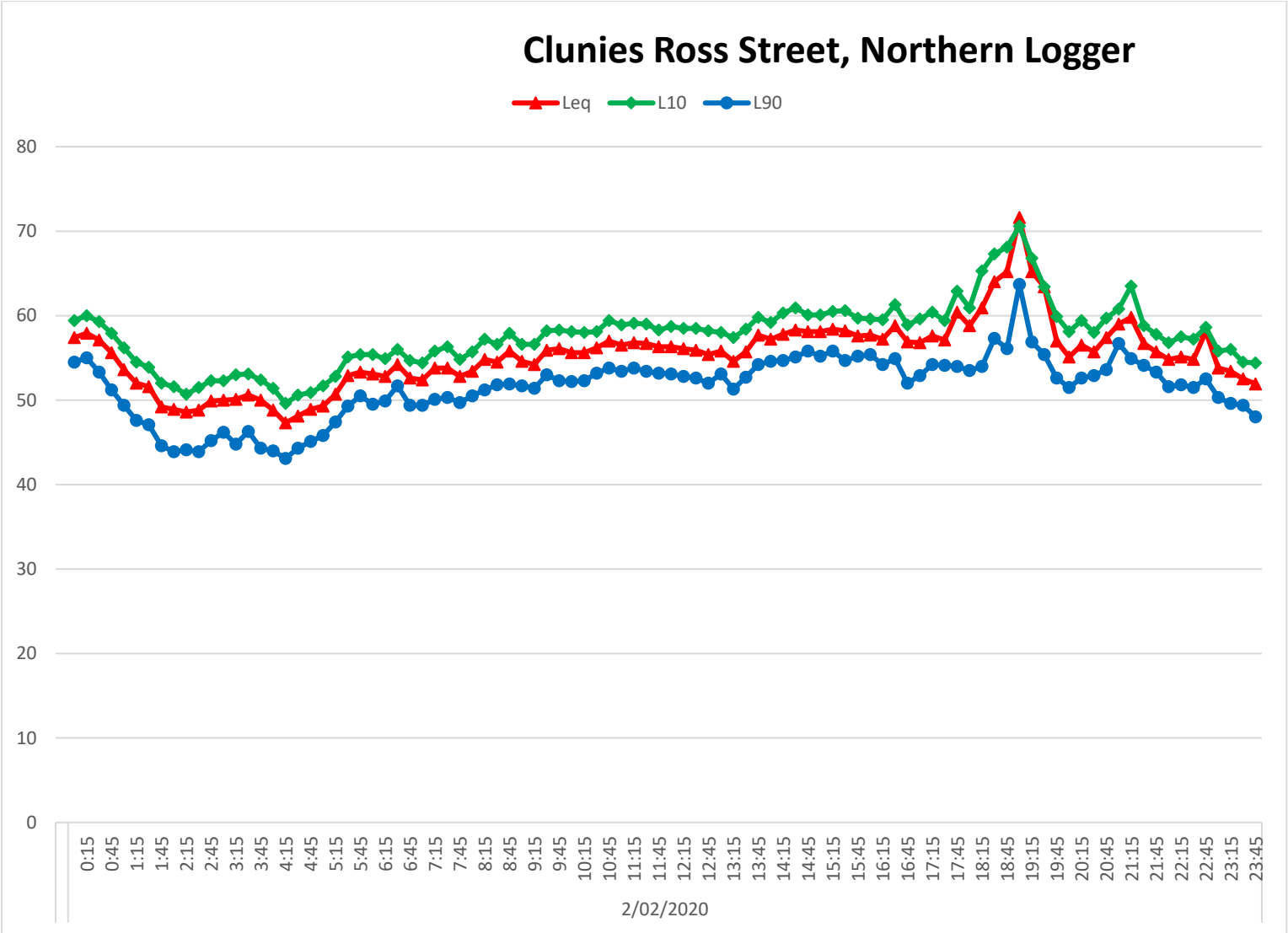
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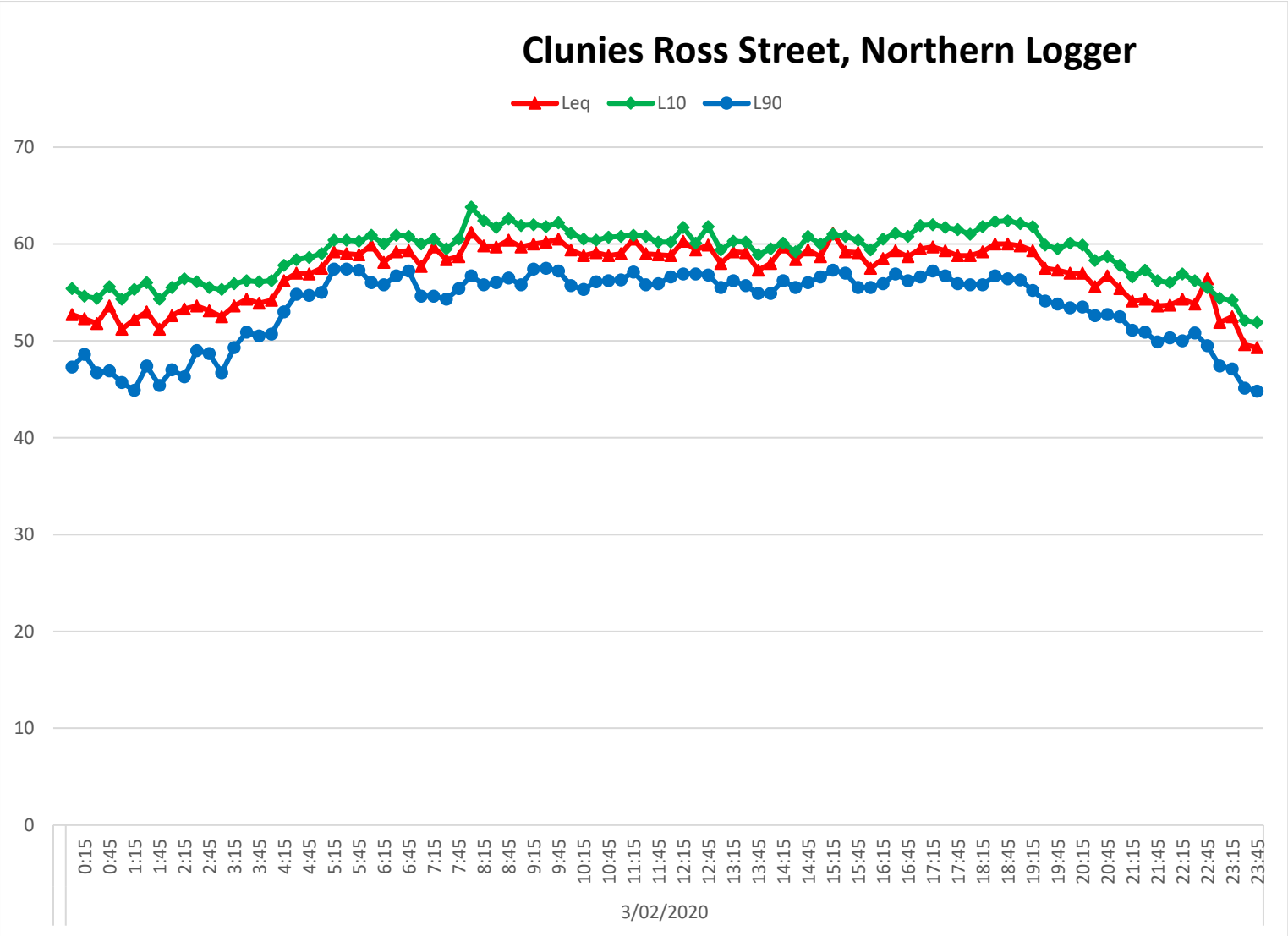
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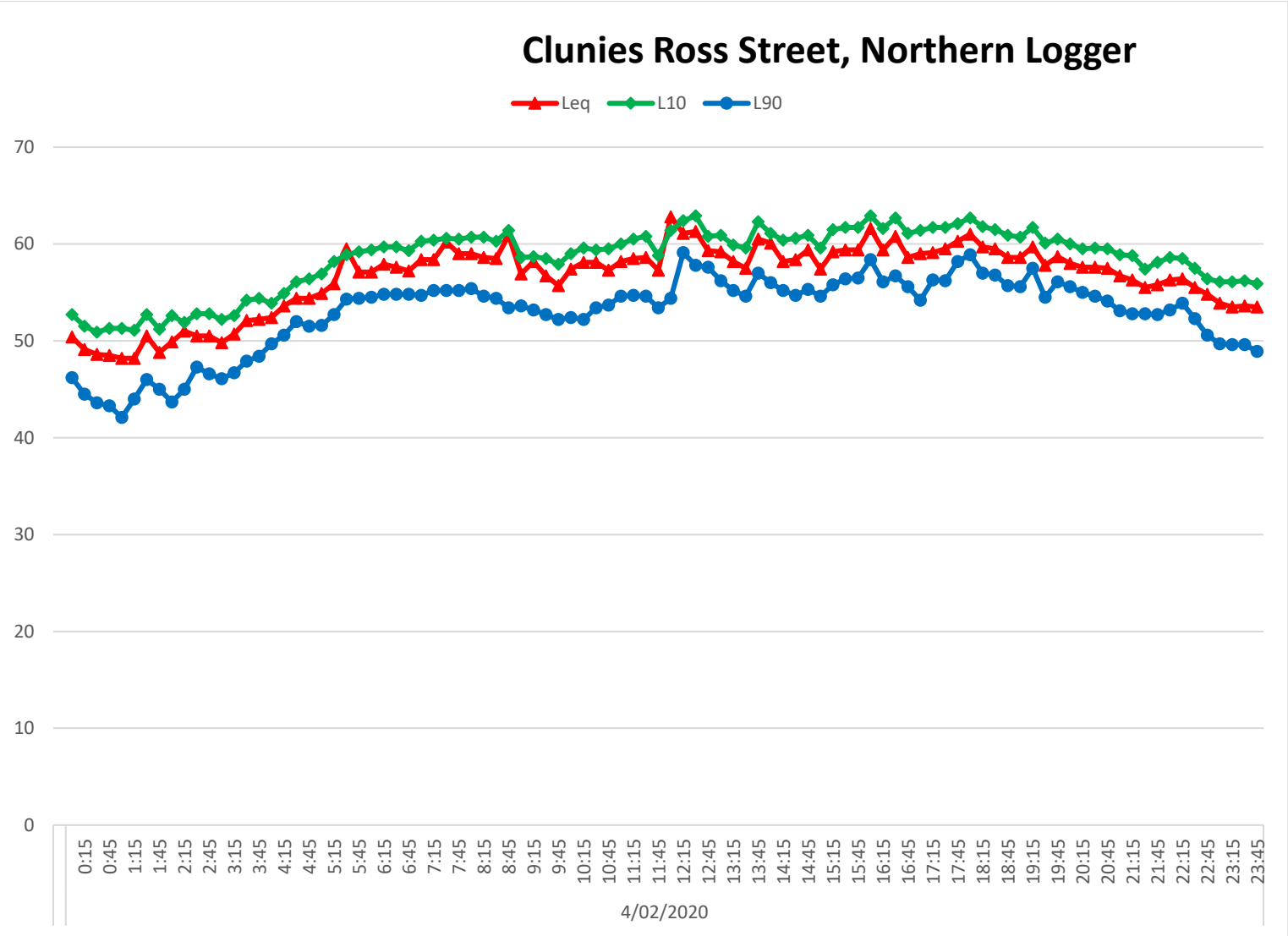
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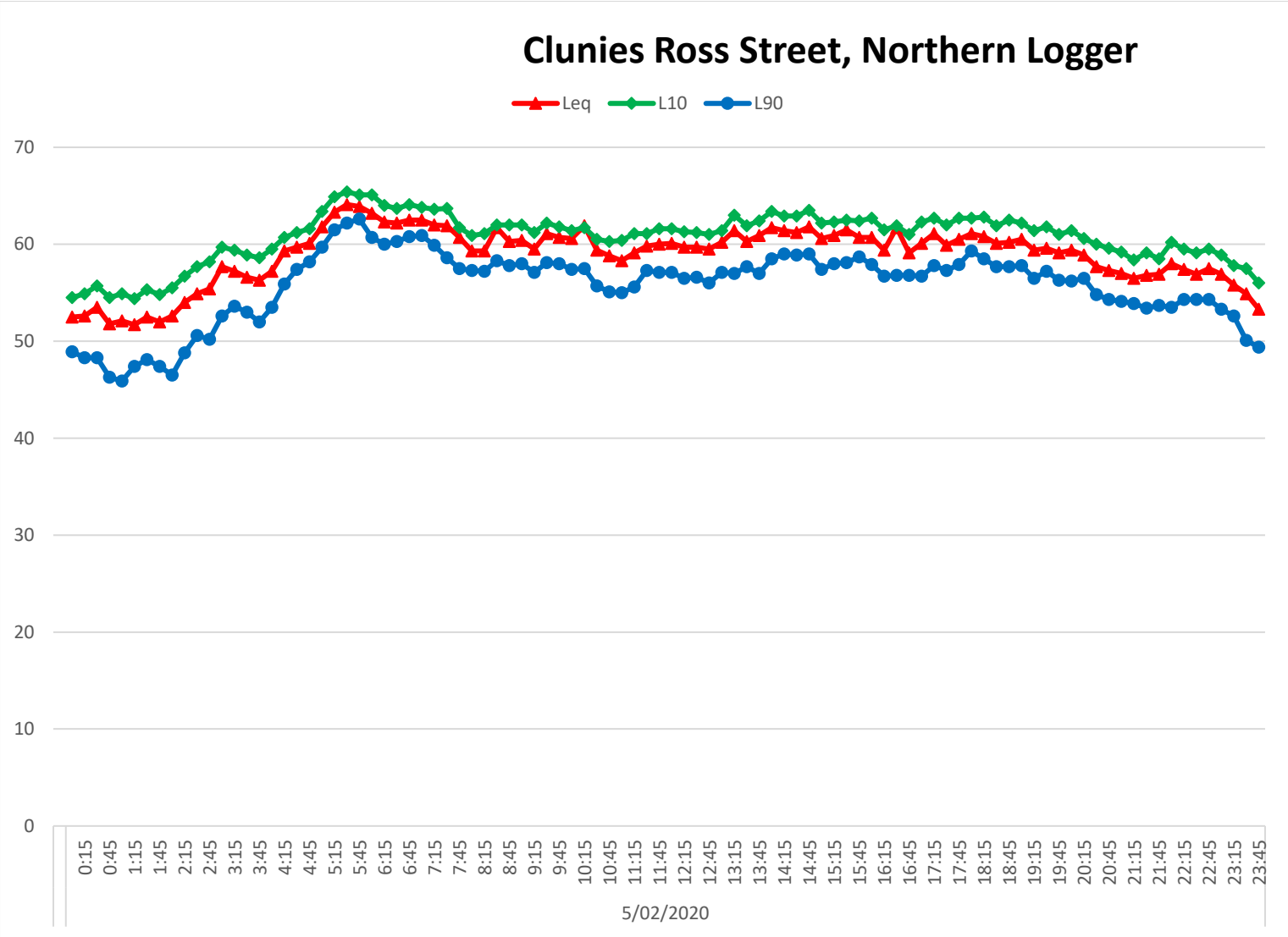
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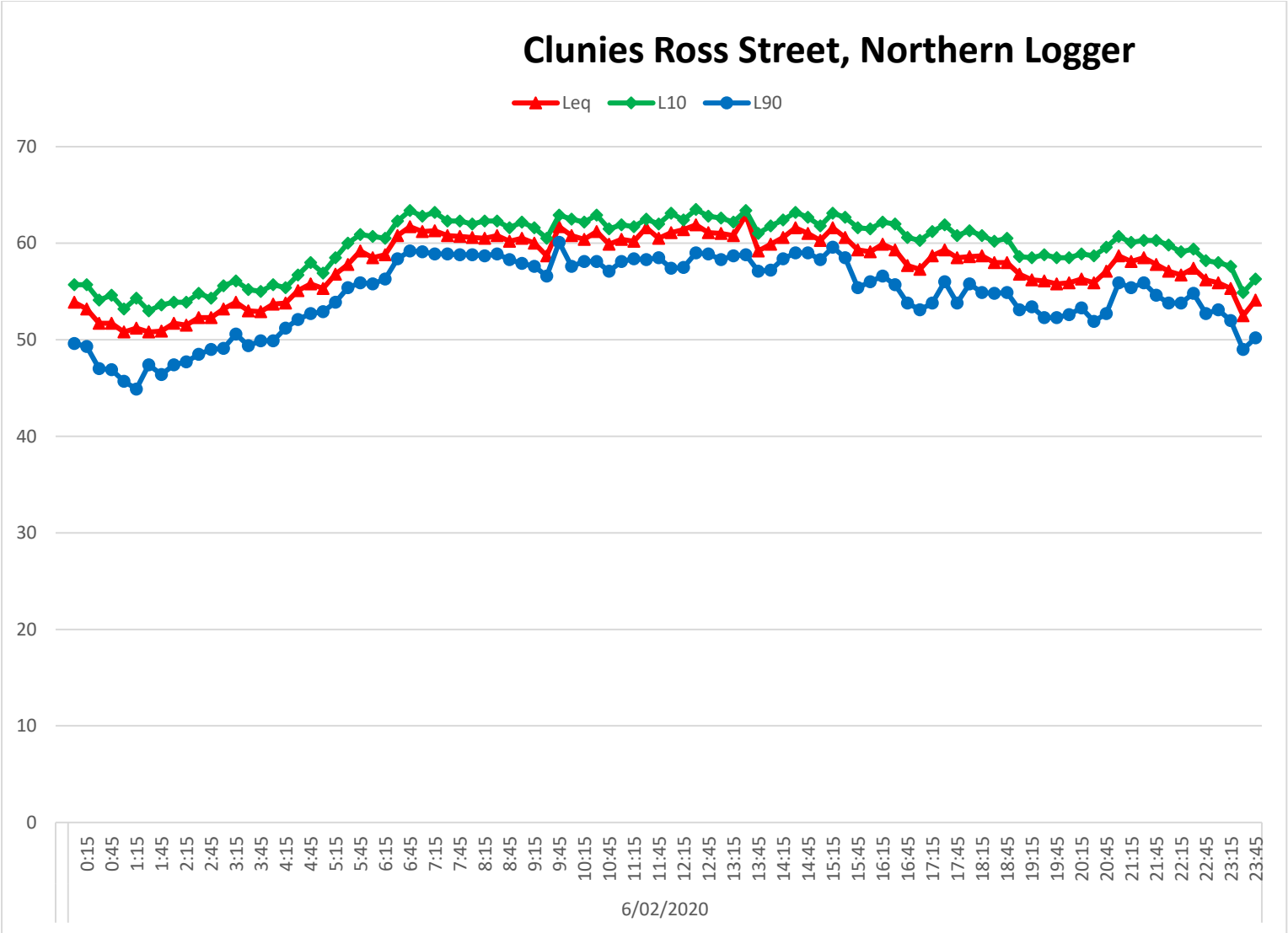
5/02/2020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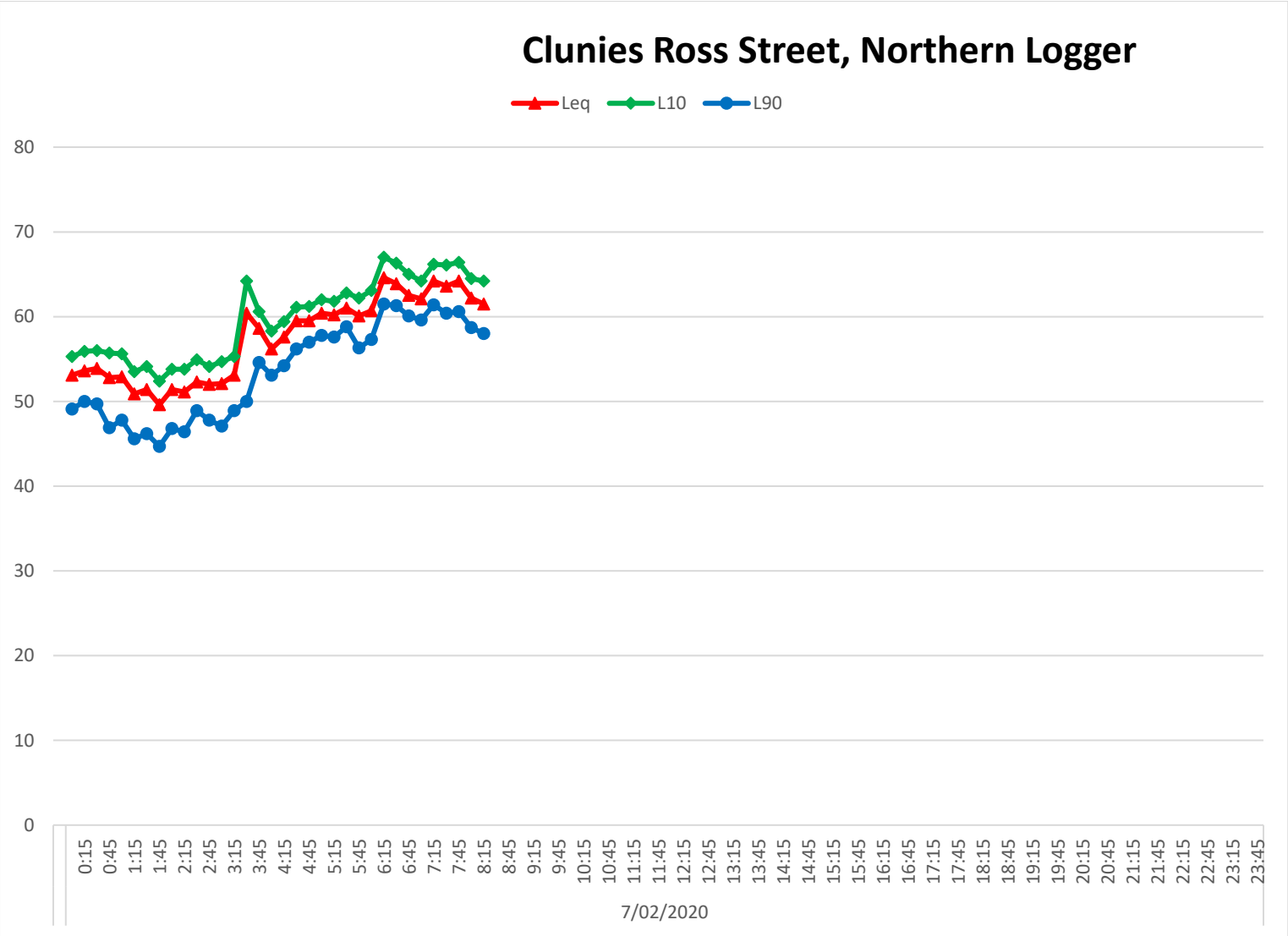
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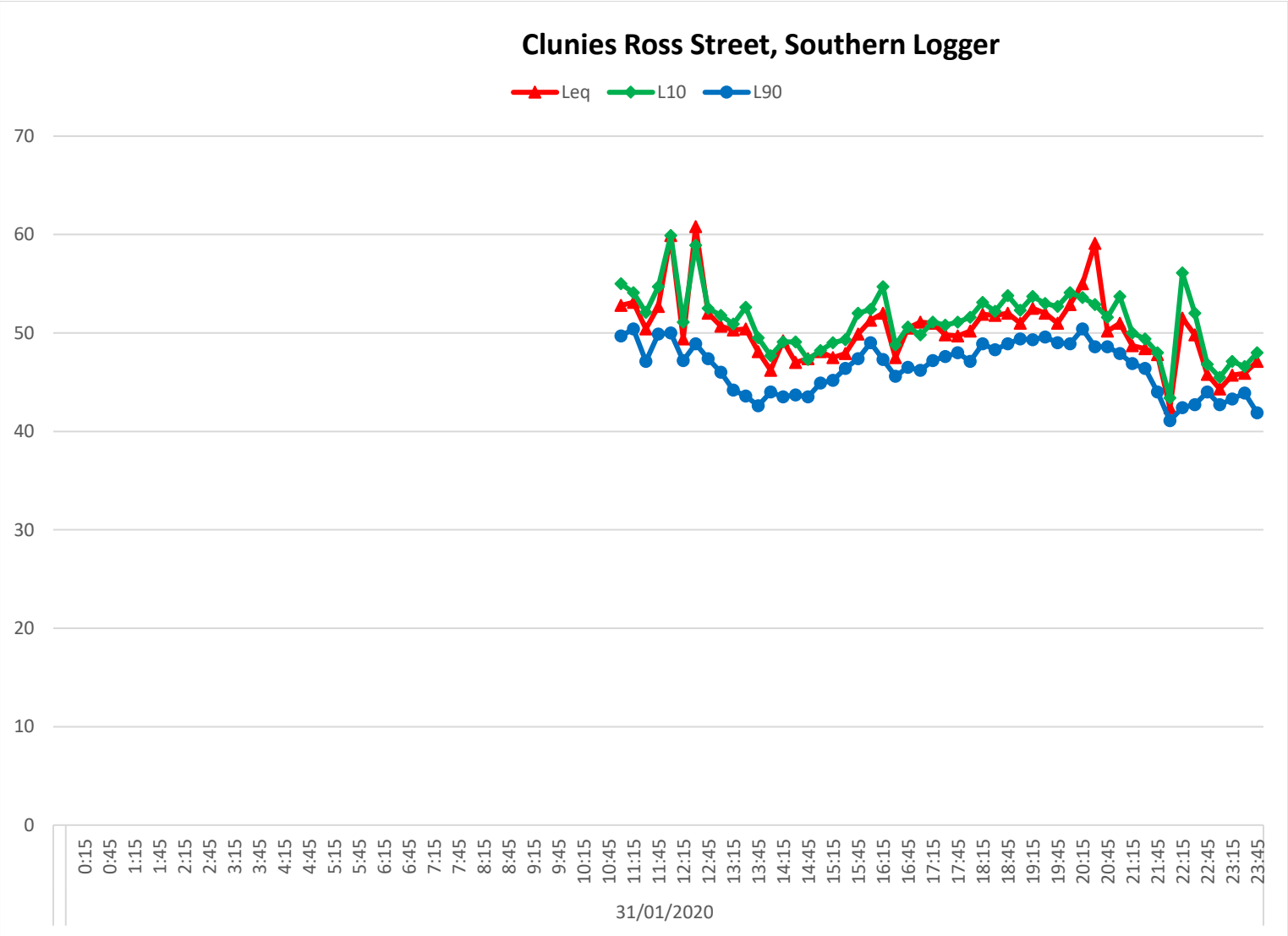
7/02/2020

13 Appendix C – Noise Logging Results, Southern Logger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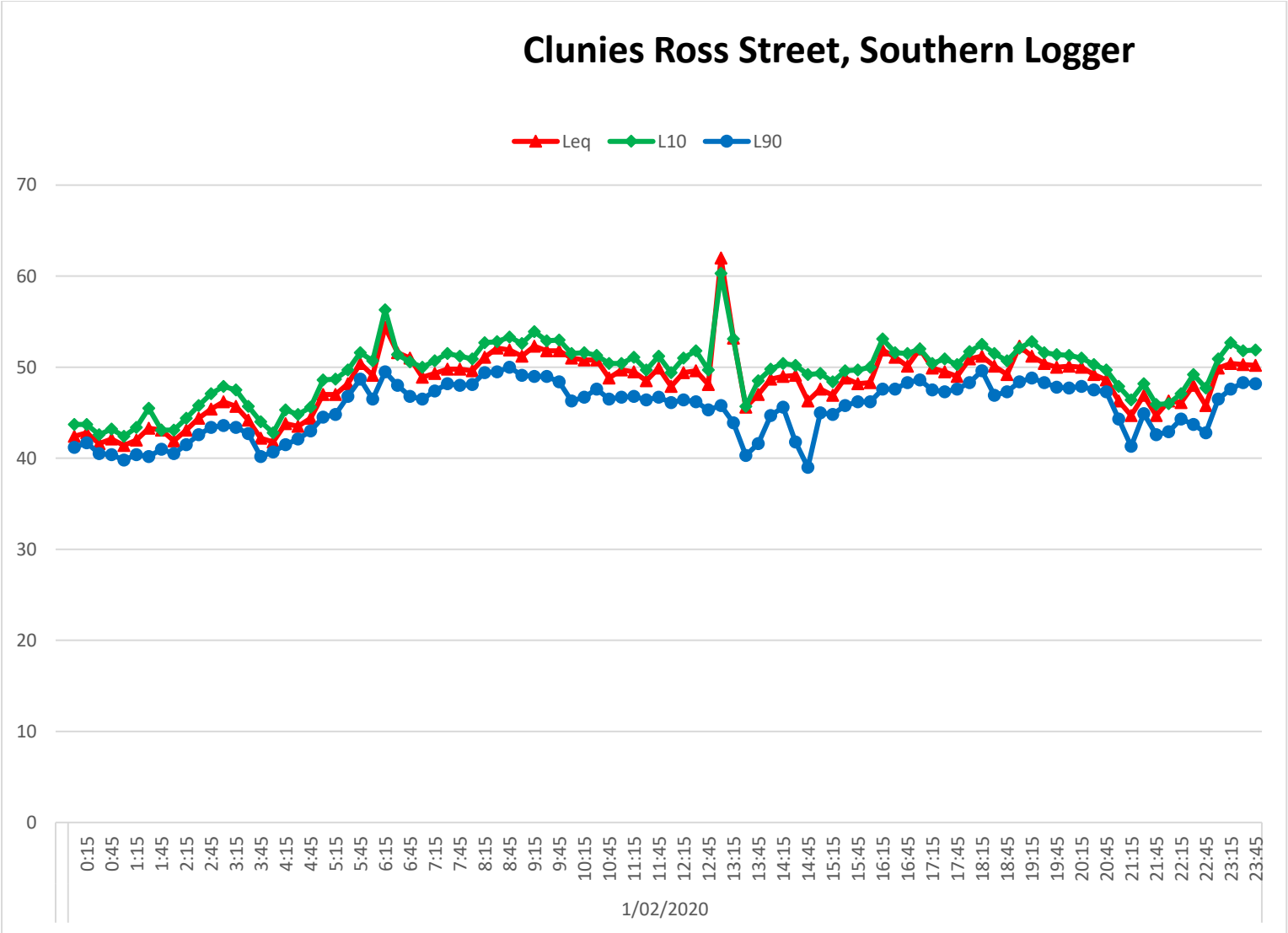
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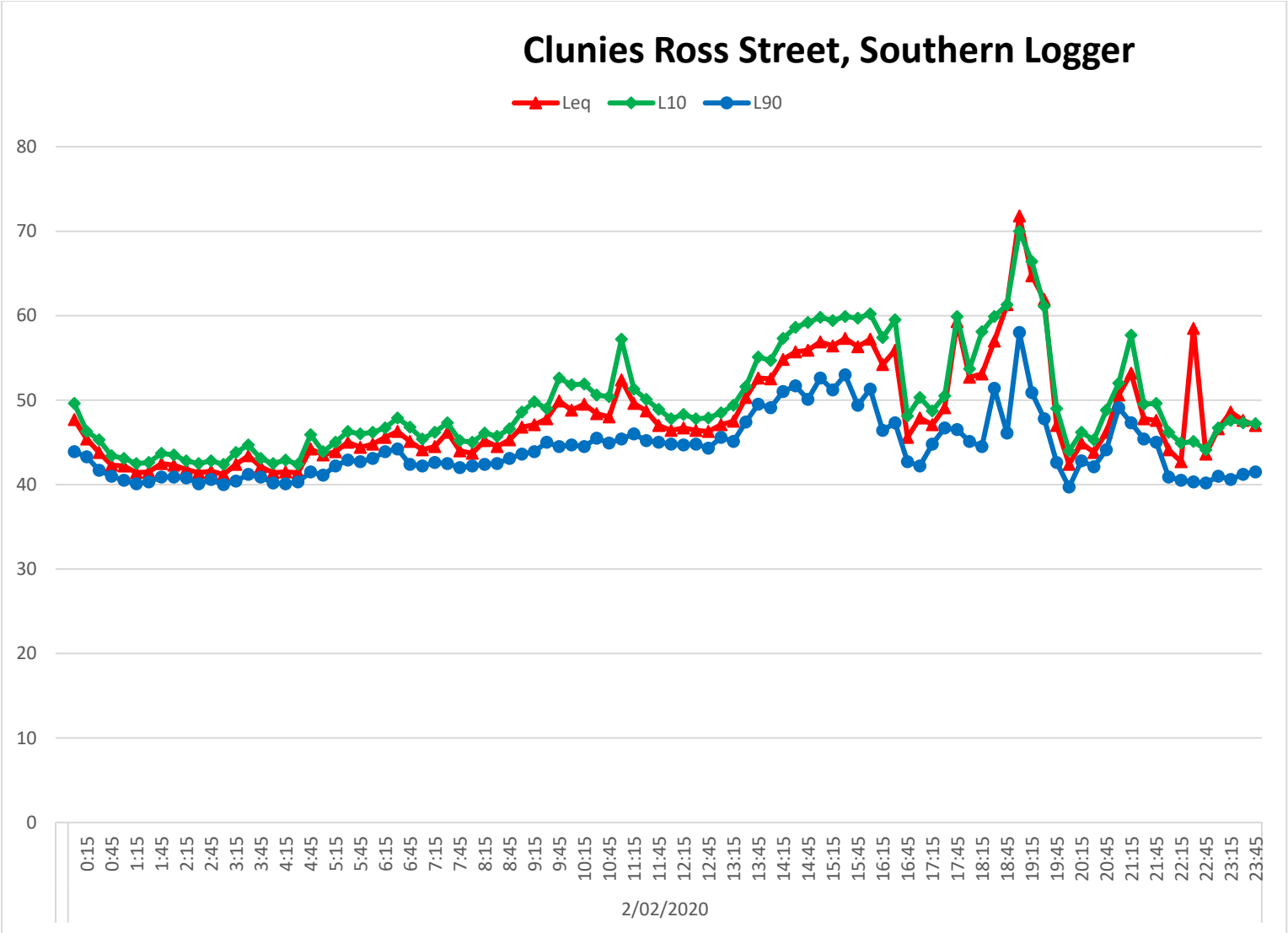
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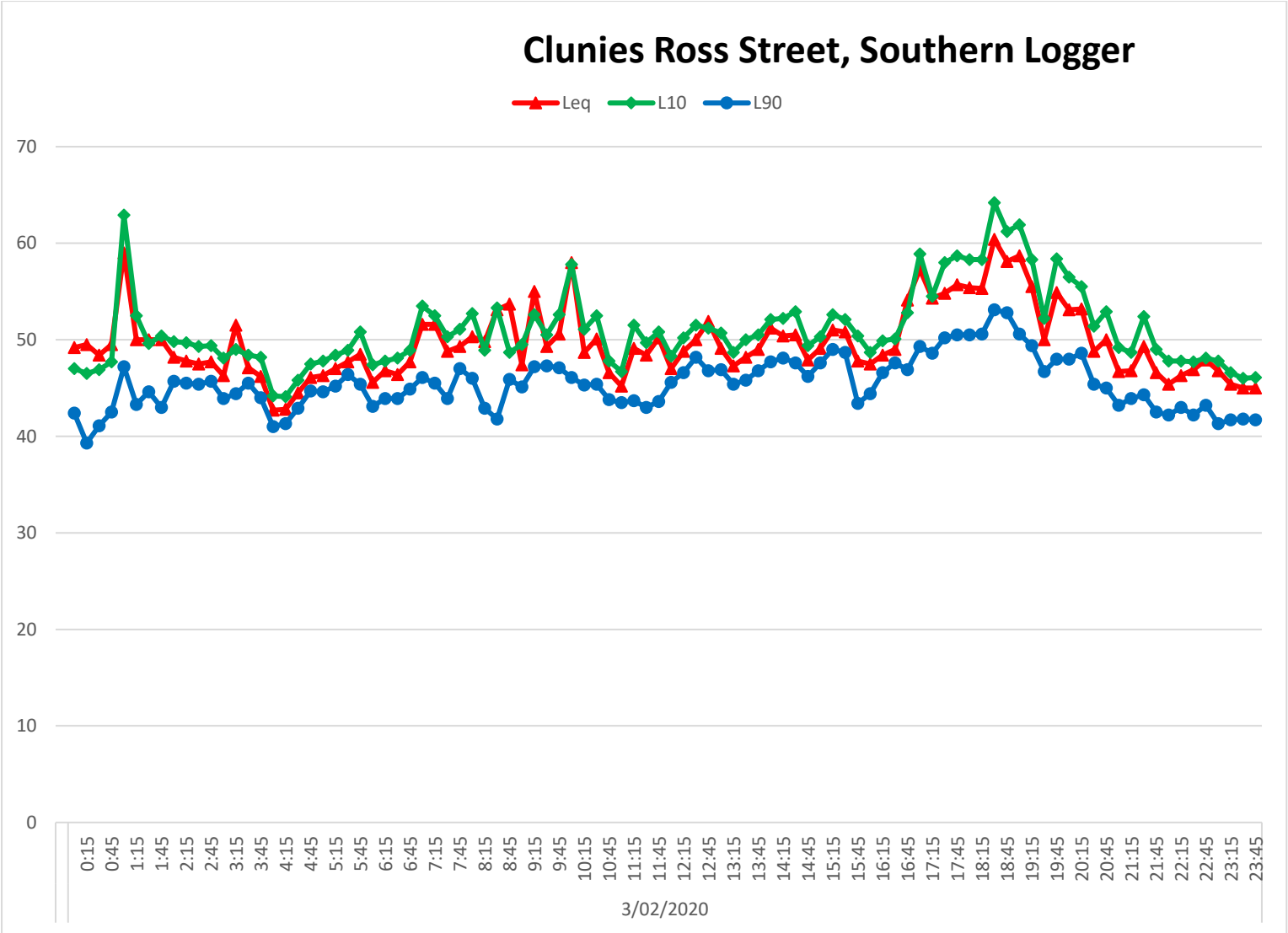
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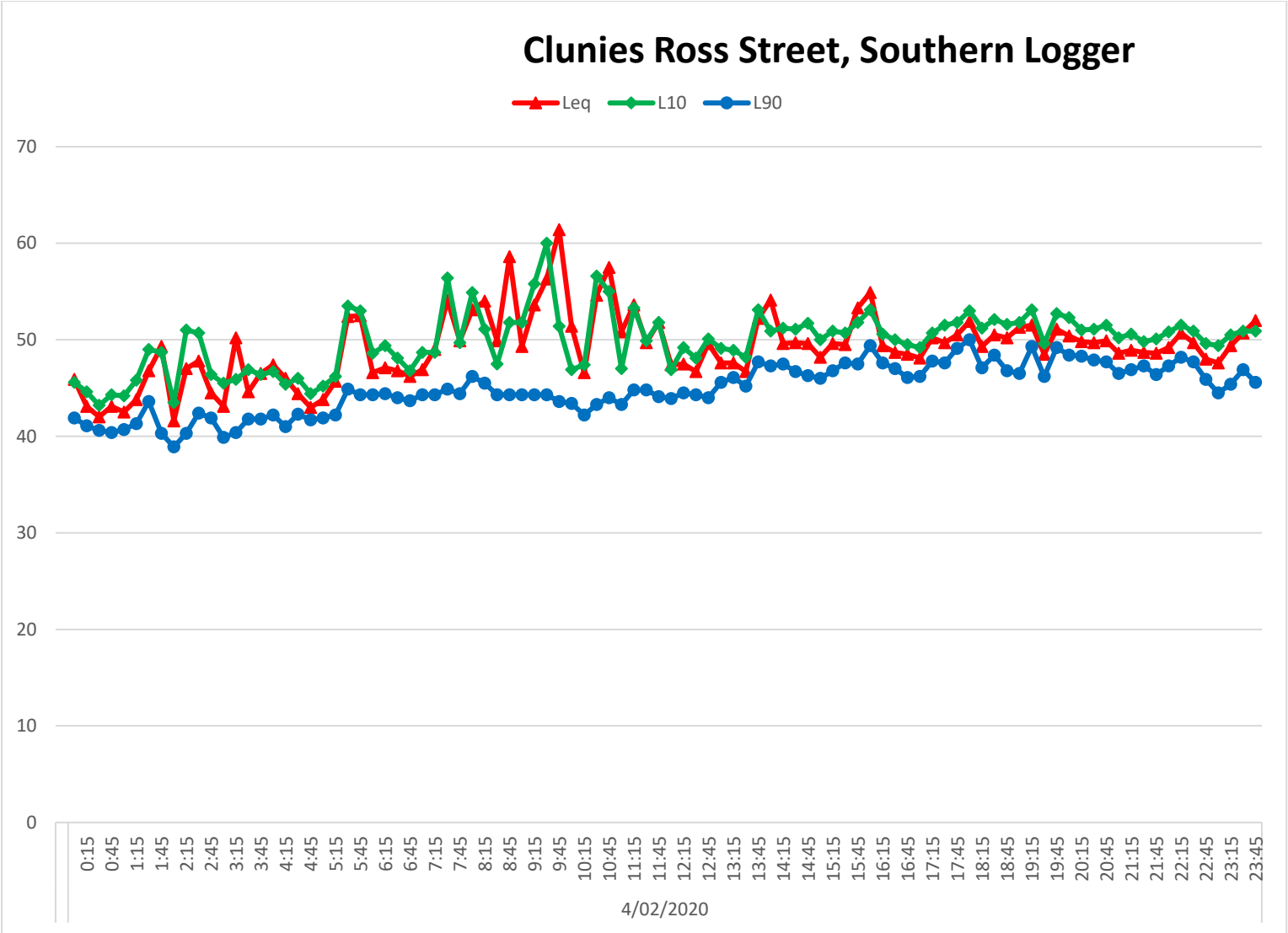
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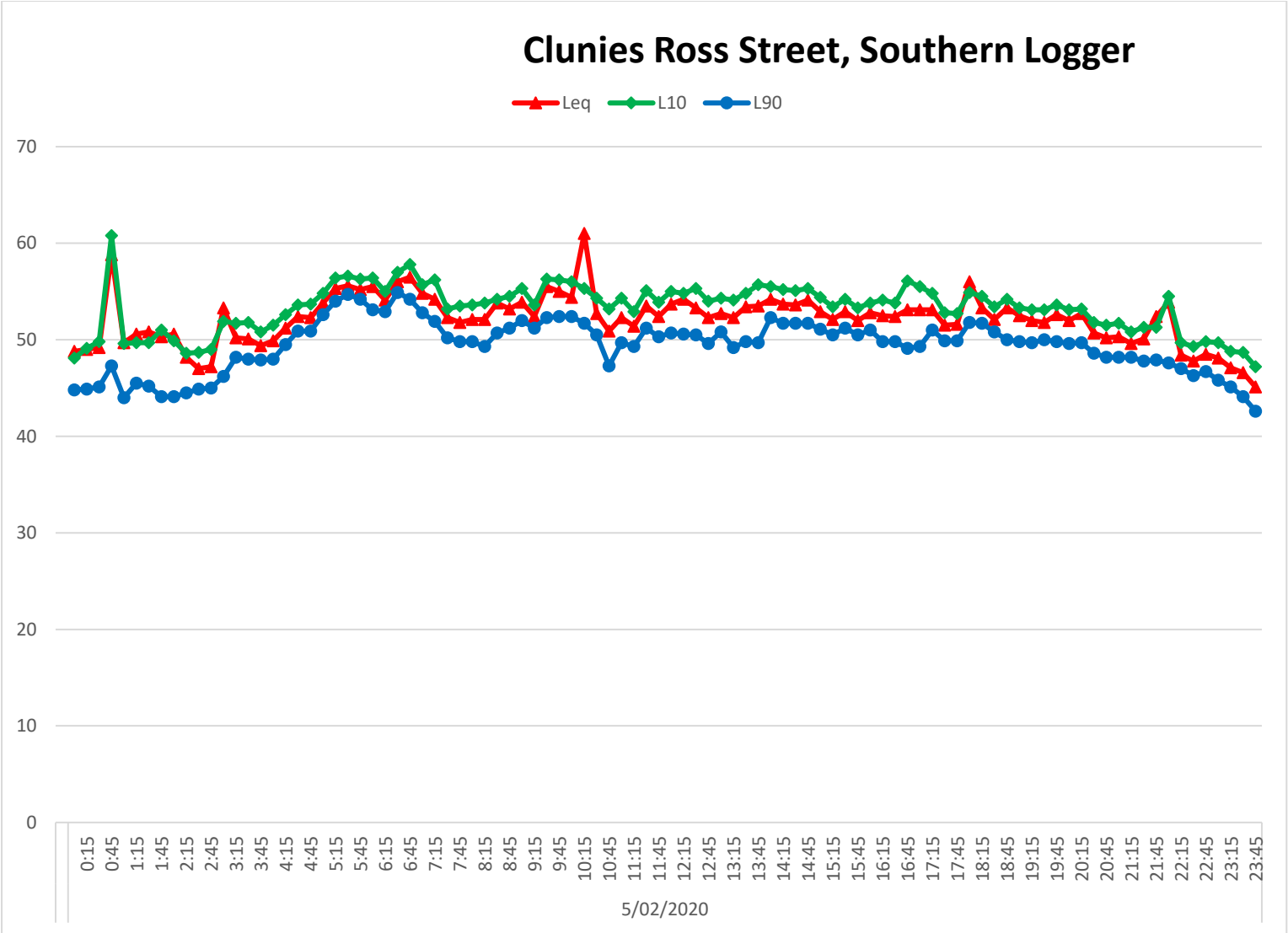
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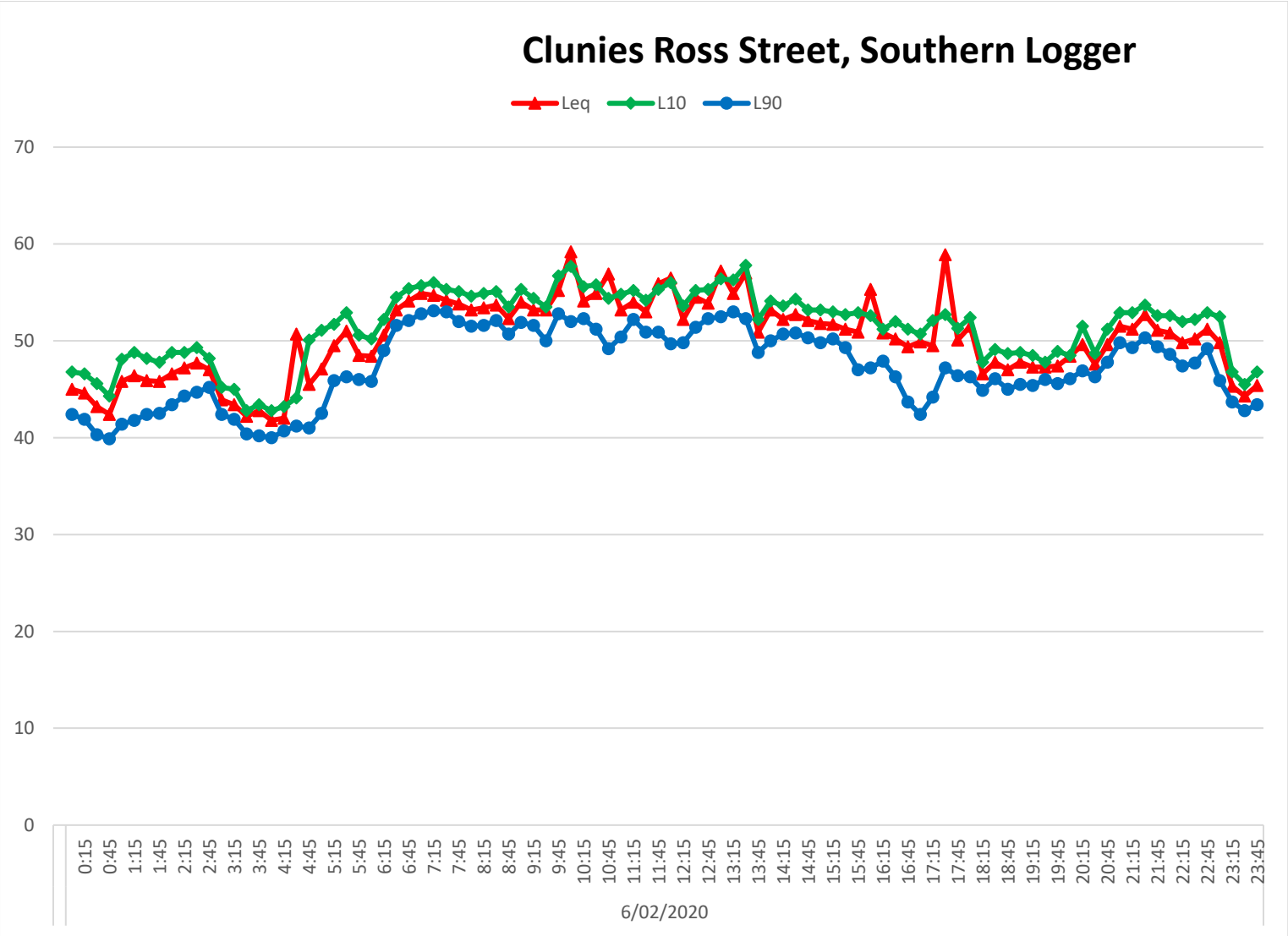
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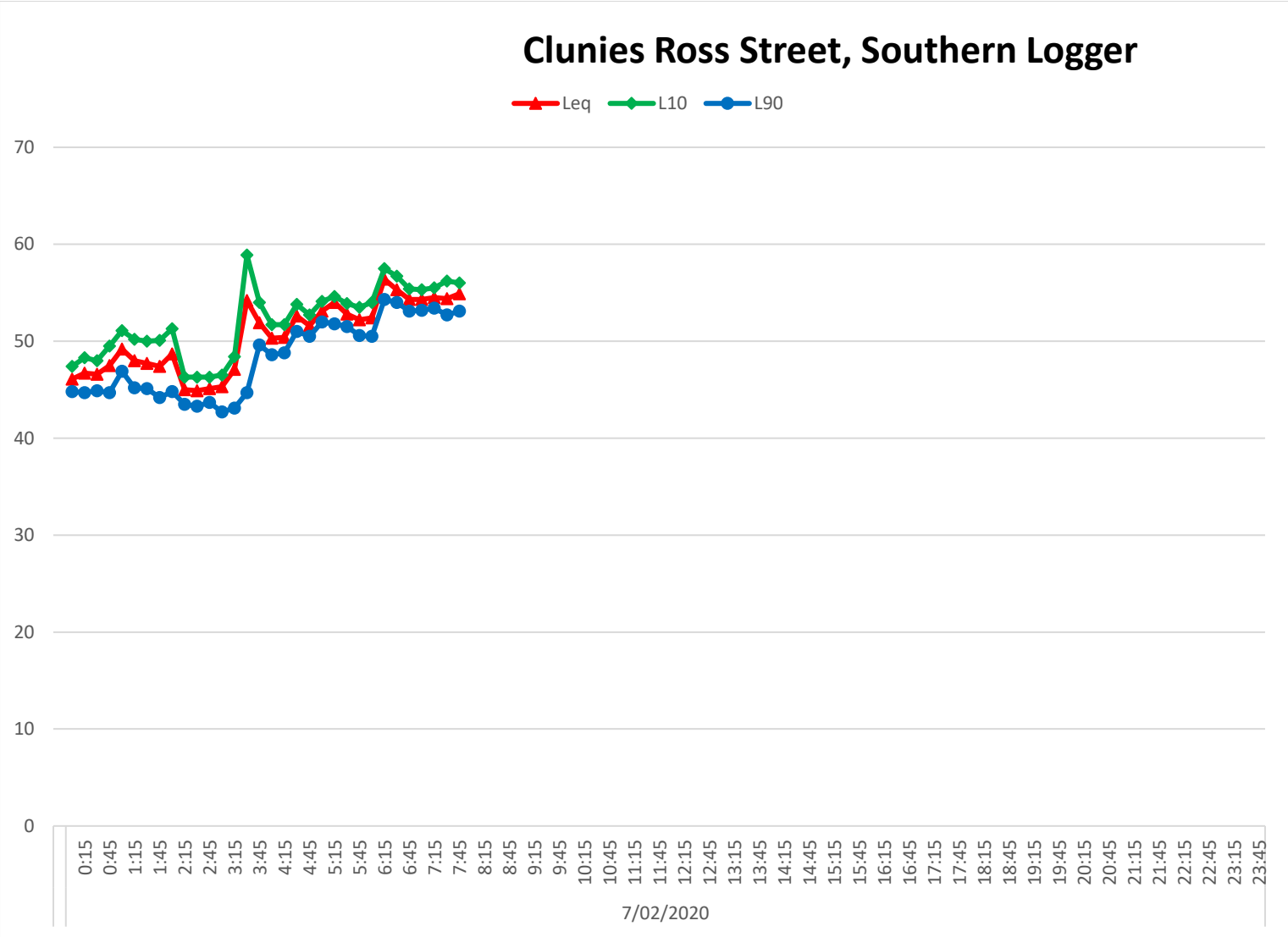
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