Appendix F: Noise Assessment

Dowsing Concrete

Noise Emissions Compliance of Inert Material Crushing Activity

Assessment Report

16 FEB 2015

Sealhurst.com.au

ABN 086 161 563 551 ACN 161 563 551
PO BOX 1082, BALCATTA, WA 6914

Dowsing Concrete

Dowsing Inert Recycling Facility

Acoustics - Noise Emissions Compliance of Inert Material Crushing Activity

QA INFORMATION	
Project No	SEA-2013-028
Project Name	Dowsing Inert Recycling Facility
Client	Dowsing Concrete
Report Title	Acoustics - Noise Emissions Compliance of Inert Material Crushing Activity
Filename	SEA-2013-028 RPT001
Revision	[Category]
Reason For Issue	Client Comment
Authorised By	
Issue Date	12 FEB 2015

PROJECT PARTNERS

Discipline	Entity	
Client	Dowsing Concrete	
Lead Consultant	TALIS Consultants	

EXECUTIVE SUMMARY

Sealhurst were appointed by TALIS Consultants (on behalf of their client, Dowsing Concrete) to provide acoustic assessment, modelling and design consultancy relating to "Phase 2" operations at the Dowsing Inert Recycling Facility, proposed to be constructed on Berkshire Road in FORRESTFIELD, Western Australia.

Phase 1 operations relate to delivery and storage of inert material in preparation for Phase 2 operations, which relates to the crushing of inert material into recycled material for to produce more sustainable environmental building products. This formal report presents detailed assessment and compliance advice on the use of a preferred enclosure design for Client Comment issue - a summary of our report findings are presented below:

NOISE MITIGATION

A detailed study of proposed operations has been undertaken in consultation with Dowsing Concrete and lead consultant TALIS Consultants in order to determine a feasible and practical noise mitigation strategy for crushing screening processing of inert materials at the Berkshire Road site.

A series of noise mitigation options and scenarios have been investigated – the final preferred course of selected mitigation is comprised the construction of a 5m 3 –sided enclosure to an area of the processing yard where crushing and screening operations will take place. Crusher screening plant will be fed from higher level via excavator on an earth ramp – indicative arrangement shown in Section 4.7.3.

COMPLIANCE STATEMENT

In assessment of processing of inert material at Dowsing Concrete's proposed facility on Berkshire Road, processing operations are determined to be able to comply with the Assigned Noise Level limits (adjusted for tonality -5dB(A)) applicable at the identified NSR, agreed as the Caretaker residence property, (deemed to be "Industrial" as per DER direction), when undertaken with a 5m, 3-sided enclosure wall around the "PROCESSING" area of the facility.

Noise prediction modelling indicates noise emissions received at all site boundaries under this scenario will also be able to comply, save for a minor exceedence at the northern-most boundary, to "Bush Forever" land.

Further recommendations are presented, with noise monitoring recommended post-completion to demonstrate the as-built operation si able to comply with predicted noise levels.

TABLE OF CONTENTS

1 INTRODUCTION

1.1 General Appreciation

1.1.1 Progress to Date

Sealhurst were appointed by TALIS Consultants (on behalf of their client, Dowsing Concrete) to provide acoustic assessment, modelling and design consultancy relating to compliance with environmental noise emissions limits for proposed operations from activities at the Dowsing Inert Recycling Facility, proposed to be constructed on Berkshire Road in FORRESTFIELD, Western Australia.

The project has been addressed at previous planning application stages, in 2013-2014, with operational activities and consequent noise emissions considered in two phases:

- "Phase 1" operations relate to unloading and storage of inert building materials via articulated road transport in preparation for processing; And,
- "Phase 2" operations, which includes the crushing of inert material into recycled material intended to produce sustainable environmental building products.

1.1.2 Phase 1 – Compliant Noise Emission Operations Summary

Phase 1 noise emissions assessments and the development of compliance criteria were provided in previously submitted works (*SEA-2013-028 LTR001_Rev1*, *SEA-2013-028 LTR002* and *SEA-2013-028 LTR003_Rev1*), included in Appendix A. The findings and compliant operations plan identified therein was reviewed and accepted by DER through a process of detailed consultation on the basis of:

- An agreed fixed limit of 65dB L_{A10} (adjusted to 60dB L_{A10} for tonality) at the nearest noise sensitive receiver premises (NSR), identified as an Industrial "caretaker residence" property, on the adjacent property, addressed as 257 Berkshire Road, FORRESTFIELD WA;
- Time-limited (24 minute) allowance for operation of material delivery trucks (once on site) passing the NSR at a nearest distance of 12m within any given 4 hour period of fixed items of plant with associated noise emission profile(s) WITH additional 5dB(A) penalty applied for tonality; And,
- Movement of inert material into rubble piles using an 8t Skid Steer wheeled loader from Dowsing's vehicle inventory at distances greater than 29m from the NSR.

1.1.3 Phase 2 – Operations to Be Assessed

Phase 2 noise emissions are characterised by the addition of mobile crushing and screening plant to an identified "Processing" area, shown green on Site Layout Plan (*Ref: TE14019DG001*), see Appendix C.

We understand that specific crushing and screening plant will be provided as follows, (See Appendix C):

- Powerscreen XR400 S
- Powerscreen XH320 S; And,
- Tracked Excavator

The combined crushing screening operation is for inert material to be fed into crushing plant hopper at high level via tracked excavator, from which material will pass through the crushing/screening plant body, to be output into stockpiles via crushing/screening plant conveyor belt, ready for storage.

Equipment, noise data and operational details for the processing have been provided by Dowsing Concrete.

1.1.4 Report Aims

Our report is intended to collate crushing and screening process data in terms of noise emissions, assess predicted noise emissions based upon the input data, and determine compliance with the applicable State legislation. In the case where noise emissions from crushing are predicted to exceed the applicable limits, requirement(s) and method(s) of mitigation to achieve the applicable limits are presented.

1.2 Project Inputs

1.2.1 Concept Drawings, Operational Plan, Equipment Data

The assessment has been carried out based upon the latest available concept drawings, operational plan and proposed equipment data supplied by TALIS Consultants, on behalf of the Principal client, Dowsing Concrete.

Design advice contained in this report to achieve environmental noise emissions compliance (where required) is based upon this documentation - details are current at the date of this report (12 FEB 2015).

2 PROJECT CONTEXT

2.1 Development Definition

2.1.1 Proposed Development

Dowsing Concrete propose to develop an inert materials processing facility at their development site, addressed at 261 Berkshire Road Industrial Estate, in the FORRESTFIELD/HIGHWYCOMBE area of WA.

The facility will be used to store and process inert materials, which we understand to be (typically) spent or demolished rubble from existing buildings, and conduct recycling processing to refine and convert waste materials into components suitable for the production of new, sustainably-produced building materials.

The facility will encompass delivery, loading/unloading, storage and processing elements, as well as house a workshop/warehouse and administrative office building.

Delivery trucks are to enter and depart the site using an efficient one way system to minimise use of reverse beepers (if required), and access is possible to the site from Berkshire Road (primary site entry) and rear laneway to the north east boundary of the site.

2.1.2 Site Location and Surrounds

The schematic image of the site shown above (*Ref: Appendix C* for more details) is roughly 360m at its longest aspect and approx. 60m at the Berkshire Road entrance. Neighbouring sites on the north side of Berkshire Road are cleared land for sale, or are currently undergoing industrial type construction and development.

Existing property and land uses to the south side of Berkshire Road are primarily existing industrial, warehouse, transport and logistics uses, with a high percentage heavy vehicle road traffic passing along Berkshire Road, connecting Roe Highway and Dundas Road.

We understand the site is located within a larger area of land currently undergoing major change, gazetted to the local planning scheme via formal amendment to re-classify as a light industrial zone, allowing the establishment and development of a centralised and dedicated logistics and transportation precinct with excellent access to existing State primary road infrastructure.

This report is intended to appreciate and assess the requirement to control noise to adjacent land classified "Industrial" use, and to demonstrate the proposed operations are able to meet the applicable noise emissions criteria once operational at the proposed site.

3 NOISE EMISSIONS TO ENVIRONMENT

3.1 Applicable Criteria

3.1.1 Environmental Protection (Noise) Regulations (1997)

All sources of noise introduced as part of a new or refurbished development, must be demonstrated to comply with the noise emissions limits applicable under Western Australian State Environmental Law.

The *Environmental Protection (Noise) Regulations 1997 (inc amendments)* is the applicable legislative instrument governing all sources of noise emissions, through the application of noise emission limits, referred as "Assigned Noise Level" (ANL) limits, applicable at the nearest noise-receiving property.

The *Regulations1997* prescribe a specific methodology from which to calculate the ANL, which is based upon an appraisal of the percentage of Commercial (C) and Industrial (I) land use surrounding the nearest noise sensitive receiver (NSR), and the volume and composition of road traffic in the vicinity of two concentric radii drawn at 450m (outer) and 100m (inner) boundary areas surrounding the designated NSR.

3.1.2 Identification of Nearest Noise-Sensitive Receiver (NSR)

Previous works have been undertaken (Ref: Appendix A) in consultation with DER, which identified the nearest noise-receiving property (NSR) to be a building located within the 257 Berkshire Road property boundary. The diagram left locates the property and shows the proposed recycling facility site boundary.

The NSR (shown orange) is classified as a "caretaker residence" property on an Industrial land use, hence a specific set of Assigned Nosie Limits apply, shown in the Table below:

Part of Premises Receiving Noise	Time of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Industrial and Utility premises	All hours	65	80	90

Appendix A contains previous works whereby the Assigned Noise Level limits were established.

3.1.3 Separation Distance to NSR

A separation distance of approx. 12m exists between the nearest property boundary to the caretaker residence building.

In order to determine compliance with the Assigned Noise Level (ANL) calculation for processing operations, the identified (nearest) NSR is taken to be the point of compliance. Assessment has also been considered at each site boundary in order to ensure compliance with potential future industrial neighbouring properties.

3.1.4 Noise Source Character

In addition to the ANL limits, particular noise sources can attract additional punitive dB levies based upon the noise source characteristics. *Regulation 7* prescribes that the noise character must be "free" of annoying characteristics - specifically:

(i) tonality (e.g. whining, droning)
(ii) modulation (e.g. cyclical change in character, such as a siren)
(iii) impulsiveness (e.g. banging, thumping)

Penalties apply up to a maximum of +15dB, for tonality (+5dB), modulation (+5dB) and impulsiveness (+10dB), where the noise source is NOT music.

3.1.5 Applied Penalties

Phase 1 works was attributed a +5dB penalty for tonality, due to anticipated noise associated with inert material delivery trucks passing by the caretaker residence.

Phase 2 works have been assessed with a similar +5dB penalty in mind, associated with the engine noise from crushing/screening plant and tracked excavator feed – noise sources and general understanding of the proposed crushing/screening operations is covered in Section 4.

3.2 Assessment Methodology

3.2.1 Detailed Prediction Modelling of Processing

Given the range of noise and noise sources, it was determined that a detailed prediction model of the proposed process would be the most efficient way to assess noise emissions and noise mitigation, if found to be required. Noise modelling offers the opportunity to investigate a number of processing scenarios, based upon the realistic function of proposed operations at the site. Detailed input was provided by Dowsing in terms of equipment layout, on and off times of equipment, durations and anticipated load.

Section 4 details site layout, proposed operations and introduces processing plant and data used to predict likely noise impacts from processing. Subsequent compliance is derived from comparison of predicted levels at the site boundary with the ANL limits (inclusive of penalties) defined above.

4 SITE LAYOUT, EQUIPMENT & INPUT SOURCE NOISE LEVELS

4.1 Site Layout

4.1.1 Proposed Processing Operations

The site schematic below demonstrates the proposed flow of inert material from acceptance, processing and storage via a one-way truck loop, accessed from Berkshire Road:

Our understanding of a typical processing operation can be summarised as follows:

1. Laden dump trucks enter site at western entry, passing inspection platform, following one-way loop to material "ACCEPTANCE" area, indicated yellow on schematic site plan above. Trucks then unload rubble as appropriate in preparation for processing operations;

2. Crushing and screening plant equipment will be located in the central "PROCESSING" area, indicated green on the schematic site plan above. A single tracked excavator will be used to load a rubber-lined "hopper" feeding into the crushing and screening plant, which will process inert material feed (building rubble) into finer grade material, exported from crushing screening plant via extended conveyor belt;

3. Once processed, material suitable for use in sustainable building products will be stockpiled in the "RECYCLED PRODUCT" area, indicated purple on the schematic site plan above.

4.2 Crushing Plant & Processing Equipment

Specialist equipment is required to undertake the crushing and screening element of the inert material processing operation. The following equipment details have been supplied by Dowsing Concrete as representative of the plant setup. Reference drawings and process information for the proposed setup is included in Appendix C:

4.2.1 Tracked Excavator

As per steps 1 – 3 in Section 4.1.1, once inert material is accepted, a tracked excavator will load the crushing screening plant via elevated hopper. We understand the tracked excavator EX02 is to be used, from Dowsing Concrete existing inventory. Part of the acoustic study for this project involved a series of specific noise measurements, taken of this item of equipment undertaking loading of inert material to increase accuracy and reliability of predicted noise levels from plant operations – details in Section 4.6.

4.2.2 TEREX Powerscreen XR400S Jaw Crusher

Detailed information has been provided for the TEREX Powerscreen XR400S jaw crusher, to undertake the initial phase of the two-stage processing of inert material (Ref. Appendix C.2). We understand from operations information that the jaw crusher is the marginally smaller of two TEREX units when operating at ~15m in length, 4.3m wide and up to 4.1m at working height.

Full plant details are included in Appendix C.2 as referenced input informations.

4.2.3 TEREX Powerscreen XH320X Horizontal Impactor

Detailed information has been provided for the TEREX Powerscreen XR400S jaw crusher, to undertake the initial phase of the two-stage processing of inert material (Ref. Appendix C.2). The unit is up to 16m in length, 8.6m wide and up to 4.5m in height when operating with lateral conveyor attached.

Full plant details are included in Appendix C.2 as referenced input informations.

4.3 Input Source Noise Levels

Critical data for any prediction noise model is objective and reliable sound power data for each plant equipment item and process. The table below presents octave band sound power levels for each processing plant item used in preliminary prediction modelling. Where manufacturer noise levels were considered, reference noise data from the DEFRA UK national reference database for similar process equipment was used to ensure representative noise emissions were accounted for:

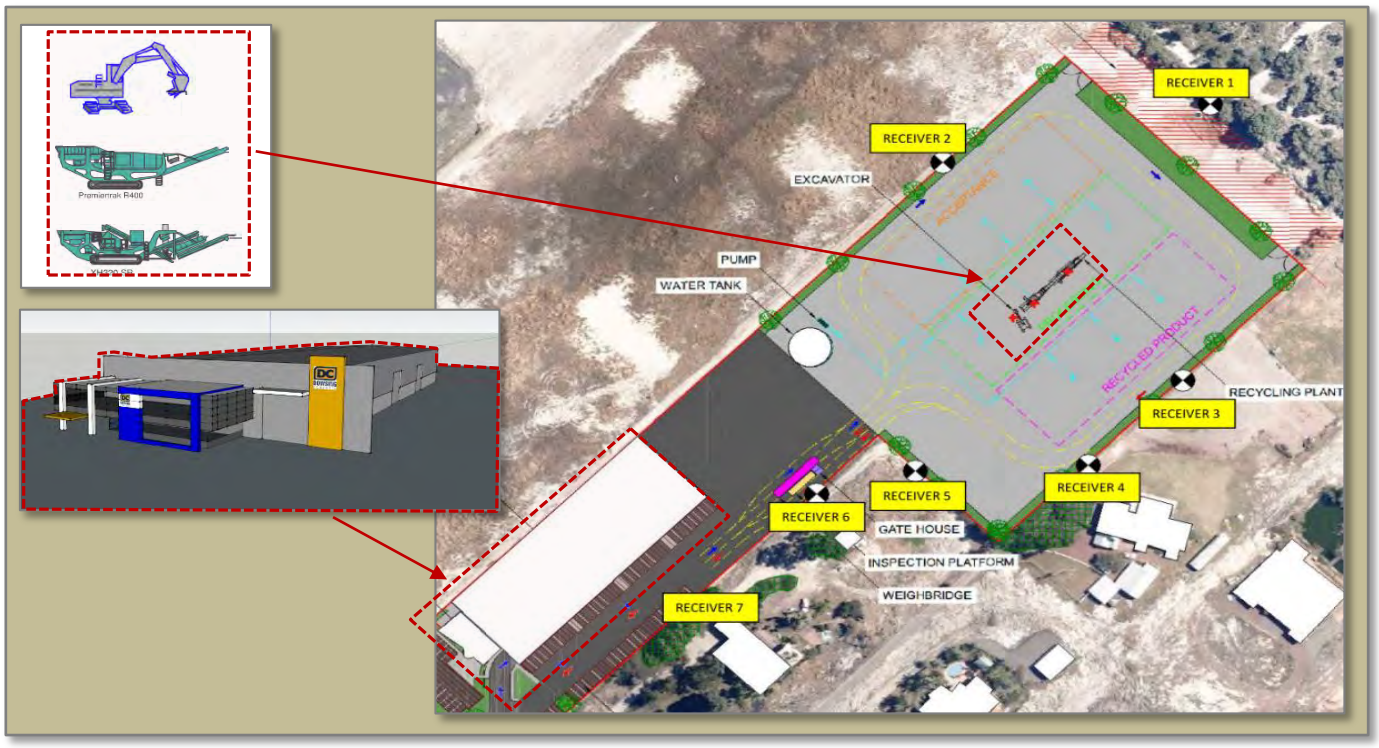
Item	Octave Band Sound Power Level (dB)									
	63	125	250	500	1kHz	2kHz	4kHz	8kHz	dB(A)	dB(lin)
TEREX Powerscreen XR400S	72.0	92.0	97.0	100.0	106.0	97.0	93.0	85.0	**108.0**	**112.6**
TEREX Powerscreen XH320X	72.0	92.0	95.0	99.0	105.0	97.0	93.0	84.0	**107.1**	**111.9**
Tracked Excavator (Clearing Site) (Ref: DEFRA Database)	108.0	111.0	104.0	101.0	100.0	98.0	97.0	94.0	**105.9**	**114.0**
Tracked Excavator (Loading Truck) Ref: DEFRA Database)	110.0	106.0	110.0	109.0	109.0	106.0	100.0	92.0	**113.0**	**116.5**

4.4 Preliminary Assessment Model – Base Inputs, No Mitigation

4.4.1 Site Layout

To assess the base "do nothing" scenario, a 3D modelled environment was created in the CADNA noise modelling software suite. Modelled inputs of the form of plant items, nearby (existing and proposed) buildings, land form (contour) data, ground type, foliage and any other acoustically-relevant elements were input and rendered into a realistic representative environment to assess noise propagation from the communicated processing operations.

Receiver locations were established at site boundaries to the north-east, north-west and south-east, referred R1 – R7 as per the schematic diagram below:



4.4.2 Environment Noise Modelling Parameters

In accordance with In accordance with Environmental Protection Authority Guidance Note 8, the modelling process must take account of the following meteorological input parameters:

Parameter	Daytime Conditions (0700 – 1900)	Night time Conditions (1900 – 0700)
Wind Speed	$4ms^{-1}$	$3ms^{-1}$
Temperature Inversion Lapse Rate ["Pasquill Stability"]	"E"	"F"
Temperature	20°C	15°C
Relative Humidity	50%	50%

The underpinning calculation process uses the environmental noise propagation calculation procedure outlined in the ISO 9613 methodology. For the purposes of this assessment, predicted levels are derived from continuous sound power level data, though are presented as L_{A10} values to provide a worst case evaluation.

NB: No wind "Amplification" of noise when wind direction is strongly towards North is accounted for;

4.4.3 Preliminary Assessment Model – Results

Noise emissions from crushing screening plant and tracked excavator operations are anticipated to exceed the applicable Assigned Noise Level (ANL) limits, adjusted for tonality penalties, of L_{A10} 60dB. The table below presents predicted results at each noted Receiver Location (1 – 7):

NB Receiver Location 6 is representative of the site boundary conditions adjacent to the Caretaker Residence property, identified in Section 3.1.2 on 257 Berkshire Road, and the principle location of compliance assessed in this report.

Receiver Ref. No.	Location ID	Predicted Level (dB(A))	EPA Regulation Limits			Receiver Coordinates		
			L_{A10} (dB(A))	Penalty (dB(A))	Resultant L_{A10} (dB(A))	X (m)	Y (m)	Z (m)
REC1	Bush Forever Boundary	62.6	65.0	-5.0	60.0	50405530.49	6463068.68	1.50
REC 2	North-west Boundary	66.8	65.0	-5.0	60.0	50405440.82	6463046.71	1.50
REC 3	South-east Boundary (1 of 4)	67.2	65.0	-5.0	60.0	50405521.19	6462964.40	1.50
REC 4	South-east Boundary (2 of 4)	66.7	65.0	-5.0	60.0	50405489.48	6462932.51	1.50
REC 5	South-east Boundary (3 of 4)	65.7	65.0	-5.0	60.0	50405431.43	6462930.46	1.50
REC 6	Adjacent to Caretaker Property **[NSR]**	**62.5**	65.0	-5.0	60.0	50405398.55	6462921.72	1.50
REC 7	South-east Boundary (4 of 4)	58.0	65.0	-5.0	60.0	50405364.84	6462876.90	1.50

4.5 Iterations of Design

4.5.1 Potential Mitigation Options

In terms of design from noise mitigation, the modelled environment offers a unique and efficient methodology to identify primary contributions of noise at the receiver iteratively assess potential mitigation options in order to find the most appropriate project solution.

The principle site layout was determined during Phase 1 and accommodates compliance of truck noise as passing by the Caretaker Residence NSR (Rec 6). A wide range of measures were assessed for noise reduction performance, practicality, suitability to practical processing operational requirements, truck and plant mobility safety, practicality, feasibility and project cost.

Modelled attenuation measures assessed as follows:

1. 3m, 4m 5m, 3-sided barrier enclosure to crushing screening plant, no roof;
2. Perimeter barrier to 60m x 30m "PROCESSING" area, no roof;
3. Removal of earth to lower "PROCESSING" area ground level by 3m;
4. As (3) supplemented with 3m, 4m 5m barrier enclosure to perimeter of "PROCESSING" area, no roof;
5. Shifting of Primary "PROCESSING" location north towards Bush Forever reserve;
6. 5m 3-sided barrier enclosure with access ramp for excavator;

4.5.2 Summary Table of Modelled Mitigation and Resultant Outputs

Model Ref.	Mitigation Elements	Excavator Source Input (dB (lin))	Result @ NSR (Rec 6)		
			LIMIT (dB(A))	Predicted (dB(A))	RESULT
Rev1 Sc. 01	None;	116.5dB	60.0	62.5	DOES NOT COMPLY
Rev1 Sc. 02	None;	114.0dB	60.0	58.9	PARTIAL COMPLIANCE*
Rev1 Sc. 03	5m, 3-sided enclosure around crusher plant; Excavator operating OUTSIDE enclosure	116.5dB	60.0	63.4	DOES NOT COMPLY
Rev1 Sc. 04	5m, 3-sided enclosure around crusher plant; Excavator operating OUTSIDE enclosure;	114.0dB	60.0	57.1	PARTIAL COMPLIANCE*
Rev1 Sc. 05	Ground area in "PROCESSING" lowered by 3m to form bunded area; Excavator operating OUTSIDE enclosure;	116.5dB	60.0	61.3	DOES NOT COMPLY
Rev1 Sc. 06	Ground area in "PROCESSING" lowered by 3m to form bunded area; Excavator operating OUTSIDE enclosure;	114.0dB	60.0	58.2	PARTIAL COMPLIANCE*
Rev1 Sc. 07	Ground area in "PROCESSING" lowered by 3m to form bunded area PLUS 3m 3-sided enclosure to crushing screening plant; Excavator operating OUTSIDE enclosure;	114.0dB	60.0	52.7	COMPLIES**
Rev1 Sc. 08	Ground area in "PROCESSING" lowered by 3m to form bunded area PLUS 3m 3-sided enclosure to crushing screening plant; Excavator operating OUTSIDE enclosure;	116.5dB	60.0	54.3	COMPLIES**
Rev1 Sc. 09	Shifted crushing screening operations zone North; No enclosure;	116.5dB	60.0	59.5	PARTIAL COMPLIANCE*
Rev1 Sc. 10	Shifted crushing screening operations zone North; 5m 3-sided enclosure around crusher plant; Excavator operating OUTSIDE enclosure;	116.5dB	60.0	60.3	DOES NOT COMPLY
Rev1 Sc. 11	5m, 3-sided enclosure around crusher screening operations AND Excavator;	116.5dB	60.0	56.3	PARTIAL COMPLIANCE*
Rev1 Sc. 12	5m, 3-sided ***REDUCED PROCESSING AREA*** enclosure around crusher screening operations AND Excavator;	116.5dB	60.0	55.7	PARTIAL COMPLIANCE*
Rev1 Sc. 13	Fully Enclosed Building 6m Height inc. crusher screening AND Excavator; Non-absorptive construction, no ventilation openings	116.5dB	60.0	53.5	COMPLIES
Rev1 Sc. 14	No Enclosure, No Excavator	n/a	60.0	57.5	PARTIAL COMPLIANCE*
Rev1 Sc. 15	No Excavator, 5m 3-sided enclosure around crusher screening plant;	n/a	60.0	51.6	COMPLIES**
Rev1 Sc. 16	5m 3-sided enclosure around crusher screening plant; **Reduced Noise Excavator** operating OUTSIDE enclosure; Use of earth access ramp to load crusher screening plant	105.8dB	60.0	53.5	COMPLIES**

NOTE

* - Predicted noise emissions demonstrate PARTIAL COMPLIANCE at NSR (Receiver 6) but do not comply at ALL site boundary receiver locations;

** - Predicted noise emissions COMPLY at all receivers, save for minor exceedance (<1dB(A)) at "Bush Forever" site boundary (Receiver 1) (e.g. no physical noise-sensitive receivers present);

Scenarios - waffle text to show many avenues were sought:

4.5.3 Developing Compliant Operations

During the course of extensive detailed modelling of noise emissions over Scenarios 1 – 16 patterns of exceedence became apparent, with the following areas examined:

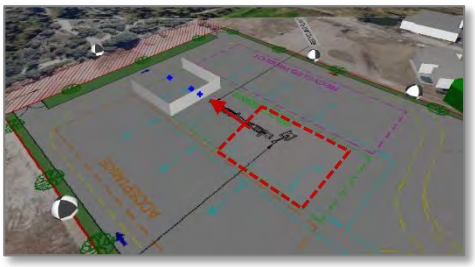
SOURCE HEIGHTS

Source heights for crushing screening plant are allocated at 4.1m as determined during analysis of proposed plant equipment and operational use of crushing machinery. The effective source height significantly reduced enclosures of heights below 4m, rendering lower height barriers as ineffective when assessed at boundary receiver locations at 1.5m above ground level.

Increasing the height of barriers increases wind loading/resistance requirements, safety and cost parameters, hence an alternative was sought to improve attenuation.

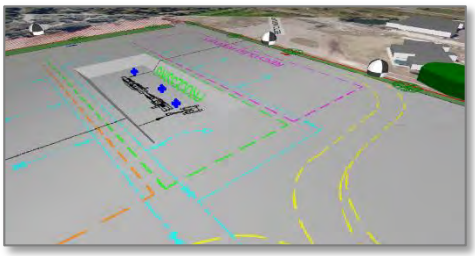
SHIFTING SOURCE AWAY FROM NSR

Moving the crushing screening location reduced noise at the NSR location by increased distance separation but did not improved noise at other site boundary locations. Additionally, shifting the area was not practical as Dowsing Concrete's logistics plan and layout had been developed previously to avoid the use of truck reverse beepers (noise) at NSR (Receiver 6) by utilising a one-way loop in order to comply with Phase 1 inert material delivery and storage operations.

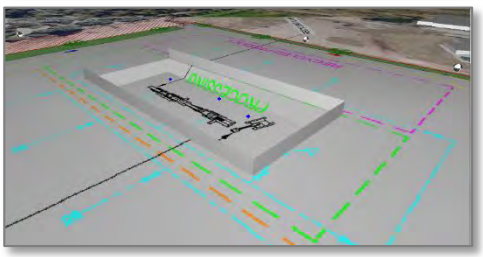


EARTHWORKS TO LOWER PROCESSING GROUND LEVEL

Attempts to increase effective barrier performance involved investigating the potential (in terms of practicality/feasibility) to use earthwork plant to remove 3-4m depth of earth, effectively "lowering" the ground floor level of the "PROCESSING" area, thereby lowering the source heights to increase effective barrier height (and consequent reductions) as observed at site boundary.



Combination lowering earthworks and 3m height, 3-sided barrier enclosure to crushing screening plant AND tracked excavator operations optimised this arrangement, allowing compliant noise levels at all boundaries. However, practicalities of retaining the earthworks, supplemented by a 3m height enclosure wall limited the feasibility of this approach to operations.



4.6 Assessing Actual Sound Power from Excavator Operations

4.6.1 Reference Database Sound Power Input

Particular variance in predicted noise level and resultant compliance was observed in terms of input tracked excavator noise used in each model scenario. Reviewing predicted results showed in a number of scenarios, crushing and screening plant noise emissions were able to comply with ANL limits at the site boundary alone.

It was found that specific impact upon ANL-compliant operations (e.g. non-compliance) could be determined as noise contributions emanating from the specific excavator sound power data used in predictions. Further research indicated that excavator size, load, motor power rating, material drop height were all variables affecting sound power.

Initial models use tracked excavator sound power data for tracked excavators significantly larger in size than the proposed excavator to be used at Berkshire Road. It was therefore determined that measurements would be taken of the proposed specific excavator unit to be used, thus determining actual sound power levels from sound pressure measurements, in accordance with *ISO 3746:1996 Acoustics – Determination of sound power levels of noise sources using sound pressure – Survey method using an enveloping measurement surface over a reflecting plane*.

This approach allows the model to more accurately predict resultant noise emissions from excavator noise emissions, at Rec's 1- 7, and at the NSR.

4.7 Sound Power Measurements of Proposed Excavator CAT 392D [EX02]

4.7.1 Site Measurement Methodology

Sealhurst attended site Friday 6th February 2015 to determine appropriate sound power input data for prediction modelling of excavator noise. Dowsing Concrete provided a tracked excavator model CAT 392D (Ref: EX02") and dump truck to simulate precise rubble loading operations, Ref: images (right).

Several source conditions were assessed - Excavator idling; Excvator and dump truck idling; Excavator loading inert material into dump truck; Excavator unloading inert material from dump truck to stock pile nearby. Sound pressure level measurements were taken at 8 key microphone positions on radial points of a hemisphere of 5m radius at appropriate heights to account for spherical surface. 5m was chosen for safety reasons, with measured sound pressures representative of the source operations only.

Background noise levels were >10dB(A) lower than measurements taken in proximity to operational plant equipment. Environmental conditions were calm with no discernible wind, and no precipitation during measurements.

Reference details of the measurement methodology are contained in Annex B of *ISO 3746:1996*.

4.7.2 Results

Measured sound level data was processed in accordance with the methodology described under *ISO 3746:1996* to determine actual sound power level spectrum. Results are presented in the table below, presented with preliminary modelling sound power level data for comparison:

Item	Octave Band Sound Power Level (dB)									
	63	125	250	500	1kHz	2kHz	4kHz	8kHz	dB(A)	dB(lin)
CAT 329D "EX02" SWL as determined in accordance with *ISO 3746:1996*	102.0	98.1	95.5	99.0	95.9	93.4	90.7	84.6	**101.1**	**106.2**
Tracked Excavator (Clearing Site) (Ref: DEFRA Database)	*108.0*	*111.0*	*104.0*	*101.0*	*100.0*	*98.0*	*97.0*	*94.0*	***105.9***	***114.0***
Tracked Excavator (Loading Truck) Ref: DEFRA Database)	*110.0*	*106.0*	*110.0*	*109.0*	*109.0*	*106.0*	*100.0*	*92.0*	***113.0***	***116.5***

As is evident, actual sound power levels of the CAT 392D are significantly lower than those of larger excavator plant contained within DEFRA reference database used in preliminary modelling assessment. As could be expected, predicted noise findings in the preliminary analysis demonstrated the excavator noise source, located outside of any proposed enclosures, had a significant effect upon compliance at particular site boundaries. Use of lower sound power emissions is anticipated as having two outcomes:

(i) Positive benefit to the amended prediction model in terms of reduced level(s);
(ii) Increased accuracy/reliability in predictions, by demonstration of best practice in terms of obtaining correct data;

Actual sound power data for CAT 392D excavator above was subsequently added in as source data to the amended noise emissions model.

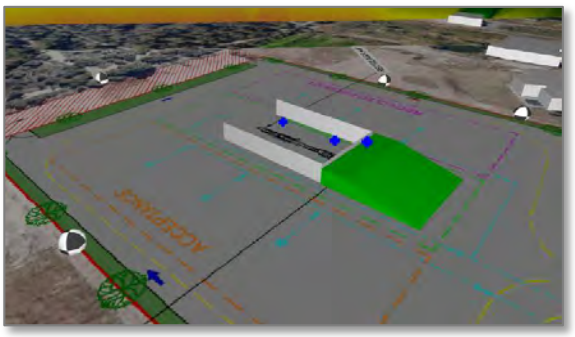
4.7.3 Amended Noise Mitigation – Client Input and Approach

In consultation with lead consultant, TALIS, proposed noise mitigation was discussed. During data collection and analysis for sound power adjustments, Dowsing Concrete undertook a process of consolidation of proposed noise mitigation measures in order to select an appropriate solution for processing operations, acknowledging impacts upon effectiveness, safety, feasibility, practicality of operations, time and cost.

The final preferred mitigation selection was determined based upon practicality and feasibility, as follows:

(i) 5m, 3-sided enclosure in original "PROCESSING" area location;
(ii) Sound power data for CAT 392D excavator input as source data;
(iii) Earthen ramp to be created to allow excavator access to hopper;

The image (right) shows the arrangement in the modelled environment, with sources shown as blue cross icons. Source heights are at 4.1m for crushing screening plant, and 7m for excavator plant;



5 FINAL OPERATIONS MODEL

5.1 Mitigation & Measured Input Data Results

5.1.1 Final Operations Model - Results

Noise emissions from crushing screening plant and tracked excavator operations are anticipated to comply with the applicable Assigned Noise Level (ANL) limits, adjusted for tonality penalties, of L_{A10} 60dB. The table below presents predicted results at each noted Receiver Location (1 – 7):

Receiver Ref. No.	Location ID	Predicted Level (dB(A))	EPA Regulation Limits			Receiver Coordinates		
			L_{A10} (dB(A))	Penalty (dB(A))	Resultant L_{A10} (dB(A))	X (m)	Y (m)	Z (m)
REC1	Bush Forever Boundary	61.2	65.0	-5.0	60.0	50405530.49	6463068.68	1.50
REC 2	North-west Boundary	59.0	65.0	-5.0	60.0	50405440.82	6463046.71	1.50
REC 3	South-east Boundary (1 of 4)	59.0	65.0	-5.0	60.0	50405521.19	6462964.40	1.50
REC 4	South-east Boundary (2 of 4)	58.4	65.0	-5.0	60.0	50405489.48	6462932.51	1.50
REC 5	South-east Boundary (3 of 4)	56.2	65.0	-5.0	60.0	50405431.43	6462930.46	1.50
REC 6	Adjacent to Caretaker Property **[NSR]**	**53.5**	65.0	-5.0	60.0	50405398.55	6462921.72	1.50
REC 7	South-east Boundary (4 of 4)	49.8	65.0	-5.0	60.0	50405364.84	6462876.90	1.50

NB Receiver Location 6 is representative of the site boundary conditions adjacent to the Caretaker Residence, identified in Section 3.1.2 as 257 Berkshire Road, and the principle location of compliance assessed in this report.

5.2 Compliance Statement

5.2.1 Final Operations Model – Interpreting Results & Compliance Statement

In assessment of processing of inert material at Dowsing Concrete's proposed facility on Berkshire Road, processing operations are determined to be able to comply with the Assigned Noise Level limits (adjusted for tonality -5dB(A)) applicable at the Caretaker residence property, (deemed to be "Industrial" as per DER direction), when undertaken with a 5m, 3-sided enclosure wall around the "PROCESSING" area of the facility.

Noise prediction modelling indicates noise emissions received at all site boundaries under this scenario will also be able to comply, save for a minor exceedence at the northern-most boundary, to "Bush Forever" land.

It is important to understand the predicted noise levels are based upon fixed sound power levels as reported – processing operations are anticipated to be functioning at certain times of the day and will not be "on" at all times – such as is deemed to occur at construction sites.

Compliance is therefore presented as a "worst case" with all sources operating.

It is also important to understand that Compliance does not infer inaudible – as should be expected, activity noise will be audible, within the agreed applicable limits.

5.2.2 Further Recommendations

In order to ensure operations are able to comply in the as-built facility, we would recommend a period of noise monitoring post-completion. Any changes to the proposed schedule of processing equipment should be assessed for potential impacts to noise emissions as are currently predicted. Sound power levels used in this assessment should be considered as a "maximum" level, against which any future or replacement equipment may be judged – lower sound power level emissions would imply compliant operations.

A. PHASE 1 – BASIS OF COMPLIANCE & PREVIOUS REPORTS

A.1 SEA-2013-028 LTR001_Rev1

Sealhurst Pty Ltd
PO Box 704, W PERTH, WA 6872
ABN: 86 161 563 551
ACN: 161 563 551

16 OCT 2013

F.A.O Ronan Cullen
Waste Management Section Leader
TALIS CONSULTANTS
Level 1, Unit 8 / 663 Newcastle Street
LEEDERVILLE
WA 6007

Dowsing Inert Recycling Facility - Phase 1
WA Environmental Protection (Noise) Regulations 1997 (inc amendments)
Assigned Noise Level limits - Calculations and Compliance Assessment

Dear Ronan,

Further to our environmental noise assessment scope of works, regarding Phase 1 of the proposed Dowsing Inert Recycling Facility, Sealhurst have prepared the following statement of assessment, calculated result(s) and implication outcomes for this Phase of the project.

PROJECT APPRECIATION

Dowsing Recycling propose to store inert recycling materials at their Lot address on Berkshire Road Industrial Estate, in High Wycombe, WA. As part of the proposal, noise emissions from delivery trucks transporting inert materials will generate noise emissions to surrounding Lots. Surrounding land use is industrial, however Sealhurst understand there may be some concerns that individual receivers on Industrial Lots may be deemed "Residential" and therefore subject potentially more stringent noise emissions limits.

In terms of noise emissions, the appropriate applicable noise emissions limits have been determined under the prescribed calculation methodology contained within the *WA Environmental Protection (Noise) Regulations 1997* for both "Industrial" and "Residential" receivers, which apply to the unloading of rubble operations anticipated for Phase 1 of the recycling facility.

Compliance has been demonstrated via objective noise spectra and prediction at the Noise Sensitive Reciever. A range of operational principles are considered in our acoustic advice which acknowledges the validity and integrity of the prescribed calculation methodology; preservation of the nearest existing (noise receiving) properties' acoustic amenity; cost-versus-performance of acoustic treatments for the enclosure; and methods to minimise the potential for disturbance of routine services/activities noise into the surrounding commnunity.

Our conclusions are as follows:

1. "Unloading rubble" operations are able to comply with the calculated noise emissions limits at the nominated NSR (e.g. 60dBL_{A10}) during weekday daytime hours of operation (0700 - 1900), provided unloading operations are conducted a minimum distance of 48m from the site boundary adjacent to the NSR building.
2. "Unloading rubble" operations are also able to comply with the fixed noise emission limit of 65dBL_{A10} at the nearest industrial and utility premises, identified as 78m west, to the property boundary with 263, Berkshire Road.
3. Notwithstanding any non-acoustical requirement to provide reverse beepers, the use of reverse beepers as a safety strategy is recommended to be replaced with alternative visual safety devices, or established delivery truck routes which minimise the routine use of reverse beepers. Guidelines and literature for alternative safety management of vehicles are identified in this report.

Sealhurst Pty Ltd
PO Box 704, W PERTH, WA 6872
ABN: 86 161 563 551
ACN: 161 563 551

4. The immediate area surrounding the Site is zoned as Industrial Development according to the Shire of Kalamunda Local Planning Scheme No.3. This will increase the calculated Influencing Factor (IF), when adjacent "neutral" land use Lots are developed for Industrial use(s).

The following pages present our calculation methodology and detailed recommendations to be incorporated into the operational Phase as the project matures through the approvals process to practical completion.

If you have any queries, please feel free to contact me direct,

Kind Regards

Daryl Thompson
Director
Sealhurst Pty Ltd

APPLICABLE CRITERIA

Environmental Protection (Noise) Regulations (1997)

The *Environmental Protection (Noise) Regulations 1997 (inc amendments)* is the applicable legislation governing all sources of noise emission which can be introduced when a new building or development is constructed; in this case noise emissions from trucks unloading inert materials for storage at the proposed inert materials recycling facility.

The *Regulations* seek to regulate noise emission by the prescription of limits deemed "allowable" and applied at an identified nearest Noise Sensitive Receiver (NSR). Schedule 3 of the *Regulations* prescribes a specific methodology to calculate a set of Assigned Noise Level (ANL) limits, based upon standard values of "allowable" noise (e.g. 45dB L_{A10}) PLUS the addition of an Influencing Factor (IF).

The "IF" accounts for any site specific circumstances surrounding the NSR, identified as part of the calculation process, and is formulated via a detailed appraisal of the percentage Commercial "C" and Industrial "I" land use within two concentric radii, at 450m (outer) and 100m (inner) distances surrounding the identified nearest NSR. A Transport Factor (TF) is also calculated to account for volume (AAWT) of road traffic in these two zones. The combined calculation provides a site-specific and practical relevance to each case.

Identification of Nearest Noise Sensitive Receiver (NSR)

When calculating an Assigned Noise Level (ANL) limit, a nearest noise-sensitive receiving premises is selected, deemed to be the defining receiving location for noise emissions from a new development. *Schedule 1 Part C, Environmental Protection (Noise) Regulations 1997* prescribes the applicable definitions of noise sensitive premises.

The initial view and site appraisal showed surrounding land to be 100% Industrial use, as verified by site inspection and photographs (see Appendices). Consequently, all adjacent NSR's could be deemed to be "Industrial". Under these circumstances, the Assigned Noise level limits are fixed under Schedule 3 of the *Regulations* and the ANL limits applied according to TABLE 1, PART 2, clause (8).

However, we understand the current landowner is using this Lot for industrial purposes while leasing out the residential property. Under the prescribed calculation methodology, residential receivers are deemed "noise sensitive", therefore the closest building which could be deemed to be noise sensitive has been identified as 257 Berkshire Road, indicated above (orange). Furthermore, 257 Berkshire Road is currently on the market for sale for industrial use, and is anticipated to be sold in the near future.".

The area surrounding Dowsing Recycling's Lot on Berkshire Road remains predominantly "Industrial" use, though a more detailed calculation must now be undertaken. In order to maximise efficiency of any calculation(s), only the nearest NSR is considered during the assessment, with the implied logic that all receivers at greater distance(s) e.g. at any noise sensitive properties further from the inert material storage, will also comply with the *Regulations*.

Application of Assigned Noise Level Limits

Under the prescribed calculation methodology, an Influencing Factor (IF) has been calculated as **+15**, determined by the presence of Roe Highway (N of Berkshire Road) as a "Major" road[1], within the 450m Outer circle; 58% Industrial Land Use* in the Inner Circle, and 72% Industrial Land Use* in the Outer Circle.

* Industrial Land Use was calculated using a combination of site observation, actual land use, geospatial data recognition and planning mapping to determine land area(s) of particular identified uses. The predominant existing land use is almost entirely Industrial, with industrial construction developments in progress on a number of adjacent Lots. Given the potential concerns for the adjacent Lot 257 Berkshire Road containing buildings deemed "residential", this land has been ascribed a "neutral" land use classification, thereby not included in the Influencing Factor calculation.

The Influencing Factor (IF) is site-specific to this project and is added to the base value(s) to arrive at the Assigned Noise Level limits, applicable at the identified NSRs. In all cases where land use has been questioned, we have erred on the side of conservatism and ascribed the land use as neutral. Land use mapping and percentage area details and all calculation inputs are presented in Technical Appendices at the end of this report.

The Table below presents the ANLs applicable to the nearest NSR:

Part of Premises Receiving Noise	Time of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises at locations within 15m of a building directly associated with a noise sensitive use	0700 to 1900 hours Monday to Saturday	**60**	**70**	**80**
	0900 to 1900 hours Sundays and public holidays	**55**	**65**	**80**
	1900 to 2200 hours all days	**55**	**65**	**70**
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	**50**	**60**	**70**
Noise sensitive premises at locations further than 15m of a building directly associated with a noise sensitive use	All hours	**60**	**75**	**80**
Commercial premises	All hours	**60**	**75**	**80**
Industrial and Utility premises	All hours	**65**	**80**	**90**

[1] "Major" roads as defined under *WA Environmental Protection (Noise) Regulations 1997 (inc amendments)* as having AAWT traffic flows of >15,000 vehicles per day);

Noise Source Character

In addition to the ANL limits, particular noise sources can attract additional punitive dB levies based upon the noise source characteristics. *Regulation 7* prescribes that the noise character must be "free" of annoying characteristics - specifically:

(i) tonality (e.g. whining, droning)
(ii) modulation (e.g. cyclical change in character, such as a siren)
(iii) impulsiveness (e.g. banging, thumping)

Penalties apply up to a maximum of +15dB, for tonality (+5dB), modulation (+5dB) and impulsiveness (+10dB), where the noise source is NOT music.

IDENTIFICATION AND ASSESSMENT OF IDENTIFIED NOISE SOURCE

Having established the limiting criteria applicable under statutory legislation, noise sources anticipated as part of the Phase 1 facility must now be identified and objectively assessed regarding compliance with the applicable noise limits. The primary noise source associated with inert material storage proposed for Phase 1 has been identified as "unloading rubble" from delivery trucks.

Assessment of "Unloading Rubble"

Reference sound data was obtained from our construction noise source database for calculation. Sealhurst's noise database references sound power level, and sound pressure level data from a range of measured data from Australian and International standards and guideline documents, designed to assist in noise planning matters. The following octave band noise spectra was obtained from the DEFRA (UK) construction noise database, item (11), which defines the following noise spectra and resultant sound pressure level data, used in our assessment:

(Ref No.) Equipment Item	Sound Pressure Level (dB) Ref: $L_{p,10m}$								
	Octave Band Centre Frequency (Hz) (dB_{Lin})								$L_{Aeq,T}$ (dB)
Brick Rubble	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	
(11) Articulated Dump Truck	94	76	77	75	76	73	68	63	**80**

The subjective sound of "unloading rubble" is broadband, and can be likened to construction site-type noise emissions, which are not usually subject to additional penalties when assessing compliance. An example would be during construction noise management planning, unless a distinct tonal source is identified. Observations during site assessment revealed a number of intermittent noise sources attributable to existing industrial premises on Berkshire Road, as well as construction site noise at a number of industrial development construction sites currently active in the vicinity.

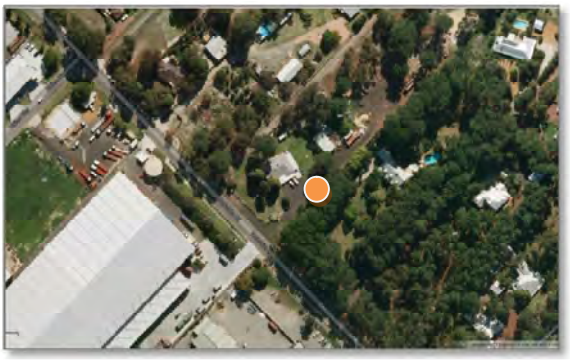
Sealhurst have deemed it appropriate to attribute no additional penalties regards "unloading rubble" noise source, given the site and surroundings, existing premises noise emissions and current activities local to the Lot.

TIMING AND FREQUENCY OF UNLOADING RUBBLE OPERATIONS

The proposed unloading operations will only be undertaken during day time hours (0700 - 1900), therefore avoiding the potential for increased sensitivity (i.e. lower applicable limits) in the evening (1900-2200) and night time (2200-0700) hours, or weekend and public holidays.

Frequency of operations is yet to be determined, therefore individual unloading operations ONLY have been assessed.

EXISTING ACOUSTIC CLIMATE



To provide a practical context and indication of the existing acoustic climate, Sealhurst attended site and conducted a series of noise measurements in locations representative of the existing NSR. Measurement positions are located in the images (right), which also show in greater detail the extent of Industrial land use in the area.

Senior engineering staff undertook measurements at various times of the day, observing conditions and recording L_{Aeq}, L_{A10}, L_{AMAX} and L_{A90} values over consecutive 15-minute interval periods.

Noise sources were identified as road traffic along Berkshire Road, and audible traffic from Roe Highway, some 350-400m south-east of field measurement location(s); Construction site noise from Industrial buildings currently being erected on adjacent Lots between the Roe Highway and Dundas Road ends of Berkshire Road; And existing activities at the Thellman Worldwide Logistics industrial premises immediately opposite field measurement location(s).

Attended measurements were recorded using a Bruel & Kjaer 2260 Investigator Type 1 Sound Level Meter. The meter complies with all relevant specification standards for Type 1 integrating sound measurement equipment and was within a valid laboratory-calibration period at the time of survey. The meter also satisfies all relevant and applicable Australian Standards for acoustic measurement devices, including Schedule 4 clauses contained within *Environmental Protection (Noise) Regulations 1997.*

The meter was field-calibrated before and after the measurement series, which consisted of a number of 15min uninterrupted sample periods. All measurements were taken in accordance with the relevant guidance in *AS1055.1-1997: Acoustics – Description and Measurement of Environmental Noise, Part 1: General Procedures*.

Details and calibration certificates of this equipment are included in the Technical Appendices of this report.

MEASURED FIELD DATA

A summary of the broadband field measurement data is presented below:

Measurement Location	Period	L_{Aeq},T (dB)	L_{A10} (dB)	L_{A1} (dB)	L_{Amax} (dB)
Location #1 25m from Berkshire Road on boundary between Lots 257 and 253	Day time (0900-1100hrs)	61.4	65.0	73.0	76.6
	Day time (1100-1300hrs)	64.5	69.0	74.2	78.8
	Day time (1300-1500hrs)	57.9	60.0	69.8	74.9

NB Data is for a comparative reference only. Results in each identified daytime sub-period are averaged across a number of measurements.

COMPLIANCE STATEMENT

Sealhurst have prepared a calculation model based upon the available information presented herein, taking a conservative account of surrounding geometry, barrier effect(s) between source and receiver, ground absorption and meteorological input.

Our calculation model predicts that the unloading of inert recyclable rubble operations are able to comply within the identified Assigned Noise Level limits (60dBL_{A10}) at the nearest NSR building identified at 257, Berkshire Road IF operations are conducted a minimum distance of 48m from the site boundary adjacent to the "residential" building, creating an overall separation distance of 72m to the identified NSR, where the limit applies.

Compliance is based upon a predicted L_{Aeq} value of 50.8dB(A) from the unloading rubble noise source, at a minimum distance 72m from the NSR. The L_{Aeq} data is not directly comparable to the L_{A10} parameter per se, though by predicting a -9dB(A) at a minimum distance, this is a strong indication that compliance would be achieved in the absence of proofing measurements. Site measurements of the documented intermittent construction site-type noise sources show a difference of 3-4dB(A) between measured L_{Aeq} and L_{A10} therefore applying this principle indicates compliance.

A map is included over the page to demonstrate the 72m zone from the property, within which unloading rubble is **not recommended** in order to meet the *Regulations*.

Our opinion and practical advice to retain noise emissions compliance during storage activities would be to establish a designated rubble unloading area, for example towards the north west (rear) boundary of the Lot, away from the "residential" NSR. Given the site and dimensions, an appropriate site planning exercise should be undertaken by Dowsing as part of the site development to ensure this minimum separation distance case is able to be satisfied. This approach represents the most practical noise control at this stage of development.

At completion, a noise survey is recommended to determine compliance of a representative unloading operation to demonstrate this has been achieved.

Map Indicating Area of Sensitivity

R = radius

CHANGE TO INDUSTRIAL CLASSIFICATION

With consideration to the agreed Forrestfield/High Wycombe Industrial rezoning plan, it is anticipated that all receivers will be eventually deemed to be "Industrial" in nature, as the current construction sites reach completion and commence operations. The Assigned Noise Level limits for all Industrial receivers are fixed at 65dB L_{A10}, with appropriate adjustments for L_{A1} and L_{AMAX} values.

ADDITIONAL OPERATIONAL CONSIDERATIONS

TRUCK SPEED LIMIT

To avoid any unnecessary engine noise (not assessed) delivery trucks should be speed limited to <20km/hr whilst travelling on site to the unloading zone.

TIMING OF DELIVERIES

As part of inert materials delivery management strategy, the time(s) of delivery should be managed to occur between the hours of 7am and 7pm, where practicable, to minimise potential disturbance, and expressly **NOT** to coincide with periods with more stringent noise emissions limits (e.g. evening and night time) where possible.

DELIVERY TRUCK REVERSE BEEPERS

Heavy goods delivery vehicles are required to produce safety warning signals when reversing in industrial applications as a strategy to minimise human injury and increase vehicle movement safety, particularly in confined spaces. One common signal type is reverse beepers which, as an additional noise source can be more likely to

cause annoyance and potential complaint, particularly at more noise-sensitive times i.e. evening and night time periods.

Regards reverse beepers, there exists a reasonable amount of literature[1], [2] regards alternative safety devices and management principles which can be employed to avoid this precise acoustical issue - as the issue is one of safety (with an acoustical annoyance outcome), by removing the reverse beeper alarm source in place of an alternative (e.g. visual) alarm, the problem can be removed.

Such strategies are employed in existing high noise scenarios, where audio warnings have limited value - for example high noise plant rooms, off shore installations etc where noise levels of warning sirens/signals may not be overheard and/or could approach levels which would otherwise induce hearing damage in order to be heard. Typically staff in such areas may already be wearing ear defenders, therefore the principle is able to be implemented where certain constraints apply.

The use of reversing cameras, visual alarms signals (e.g. specific vehicle reverse lights) and safety management techniques such as the use of spotters should be considered as part of the noise management strategy for the facility. Alternatively, a delivery "loop" could be employed to ensure inert material delivery trucks do not routinely emit "reverse beeper" noise, as this has not been assessed as a noise source.

TECHINCAL APPENDICES

The following pages present the detailed calculation methodology and input data used as part of our assessment.

[1] SAFE WORK AUSTRALIA - Draft guide Traffic Management: Construction Work;
[2] ROADING NEW ZEALAND - Guideline for Controlling Reversing Vehicles DEC 2009;

CALCULATION OF NOISE EMISSIONS LIMITS

An Assigned Noise Level is calculated for each noise sensitive receiver using a combination of environmental factors local to the receiver. A standard set of ANL's exist to provide a base level of acoustic amenity, as shown in the Table below. These levels are modified by an Influencing Factor (IF) to reflect noise sensitivity in the specific environment relative to the subject development.

To calculate the additional Influencing Factor (IF), concentric circles are drawn around the nearest noise-sensitive reception point; one at 450m radius and one at 100m radius. Percentages are calculated for the amount of land area within the circles used for noise emitting purposes (e.g. industrial or commercial uses) which are compared to the total area encompassed by the concentric circles.

Traffic volume is taken into account in order to reach an acceptable ANL, or noise reception level, appropriate for the area in which the receiver is to be situated.

Part of Premises Receiving Noise	Time of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{AMAX}
Noise sensitive premises at locations within 15m of a building directly associated with a noise sensitive use	0700 to 1900 hours Monday to Saturday	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sundays and public holidays	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	35 + influencing factor	45 + influencing factor	55 + influencing factor
Noise sensitive premises at locations further than 15m of a building directly associated with a noise sensitive use	All hours	60	75	80
Commercial premises	All hours	60	75	80
Industrial and Utility premises	All hours	65	80	90

CALCULATION OF INFLUENCING FACTOR (IF)

The Influencing Factor (IF) is calculated using the following equation:

Influencing factor (IF) = I + C + TF

Where;

I = (% of industrial land usage within 100m + %industrial land usage within 450m) x 1 / 10

C = (% of commercial land usage within 100m + %commercial land usage within 450m) x 1 / 20

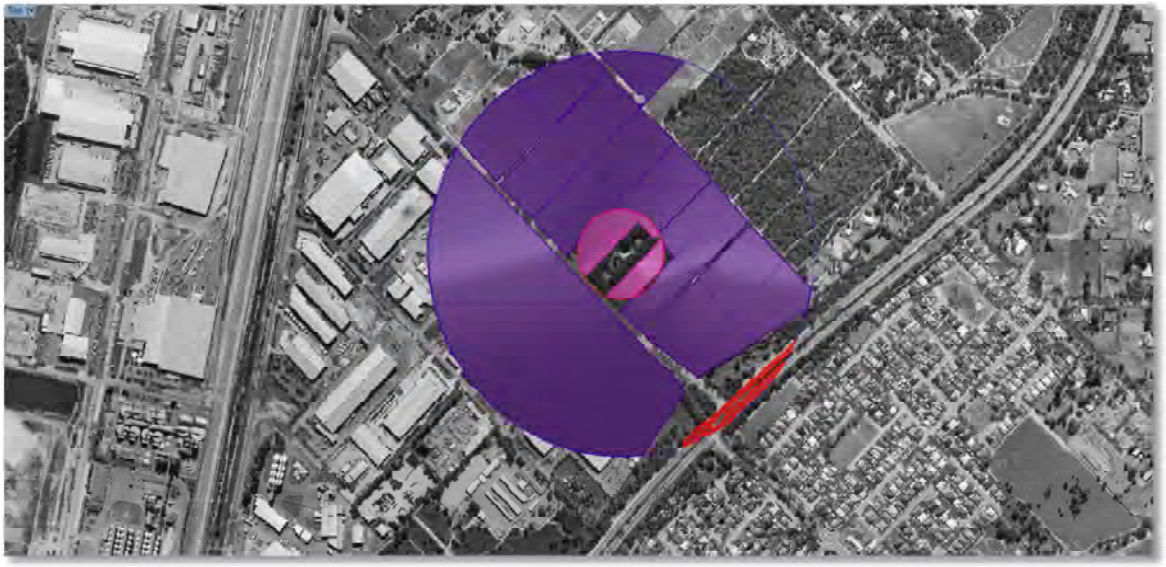
TF = +6 if there is a "Major" road within 100m of the development
+2 if there is a "Major" road within 450 m of the development
+ 2 if there is a "Secondary" road within 100m of the development

The maximum value the transport factor (TF) can reach is 6;

A "Major" road is defined as having Annual Average Weekday Traffic (AAWT) flows in excess of 15,000 vehicle movements per day. A "Secondary" road is defined as having Annual Average Weekday Traffic (AAWT) flows in excess of 6,000 vehicle movements per day.

IDENTIFICATION OF LAND USE

The image below shows our calculation of land use in the vicinity of the nearest Noise Sensitive Receiver (NSR), identified at the existing property at 257 Berkshire Road, High Wycombe. Confirmed Industrial land use in the OUTER circle is shown purple, and pink in the INNER (100m) circle; Roe Highway is classified as a Major Road and shown as red to the south-east of the development. No Commercial land use was identified.

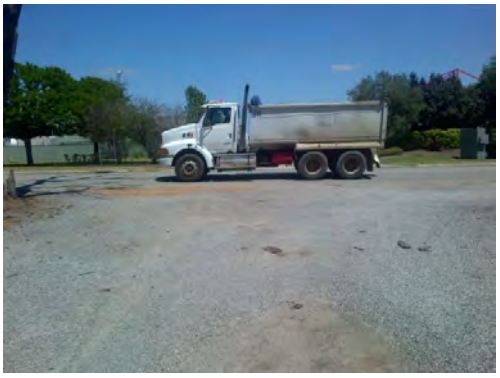


Land Use Type & IF Calculation					
Industrial					"I"
% Area in Inner Circle	58%				+12.95
% Area in Outer Circle	72%				
Commercial					"C"
% Area in Inner Circle	0%				+0.00
% Area in Outer Circle	0%				
Roads	**Location**	**Estimated vehicle Movements per day**	**Classification**	**Result**	"TF"
Roe Highway (N of Berkshire Road)	Outer Circle	44,170	Major	+2	2
INFLUENCING FACTOR					+14.95

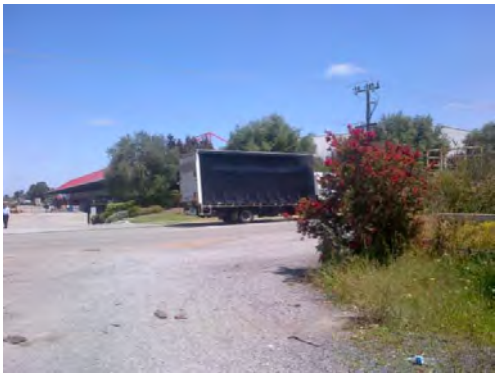
The resultant IF therefore equals **15**, determining the Assigned Noise Level limits.

SITE PHOTOGRAPHS


253


FOR SALE
3 PRIME LOTS
SOLD
9353 6613




MAERSK


FLAME TREE

FIELD MEASUREMENT EQUIPMENT DETAILS

Equipment Type/Model	Serial No.	Calibration Cert. No.	Last Calibration Date
Bruel & Kjaer 2260	2234562	SCC - C2159S1S118	17 JAN 2013
CIRRUS	59311	CCC - 1096C151	22 JAN 2013

Instrulabs Pty. Ltd.

SOUND LEVEL METER CALIBRATION CERTIFICATE

THIS IS TO CERTIFY THAT THE SOUND LEVEL METER

MAKE : Bruel & Kjaer
MODEL : 2260
SERIAL : 2234562
HAS BEEN CALIBRATED ON : 17-Jan-13

OWNED BY : Resonate Acoustics
: 97 Carrington Street
Adelaide SA 5000
NEXT CALIBRATION DUE : 17-Jan-15

SUMMARY

Acoustic stimuli for the calibration tests were generated by a Bruel & Kjaer 4226; electrical stimuli for the calibration tests were generated by a National Instruments 6221 using proprietary software. Both stimulus sources have current NATA endorsed calibration documentation

CALIBRATION INSTRUMENTS USED

Bruel & Kjaer Acoustic Calibrator Type 4226	s/n 2692340	Recalibration due	29-Jul-13
NI USB-6221-BNC Multifunction DAQ	s/n 14E9DD2	Recalibration due	02-Aug-13

CERTIFIED QUANTITIES

Pass	AS1259.1 cl 8.9, 8.10 - Indicator Linearity	Pass	AS1259.1 cl 10.4.3 - Impulse time weighting
Pass	AS1259.1 cl 10.2.2 - Absolute acoustic sensitivity	Pass	AS1259.1 cl 10.4.4 - Peak time weighting
Pass	AS1259.1 cl 10.2.3 - Acoustic frequency weighting	Pass	AS1259.1 cl 10.4.5 - RMS Performance, rectangular
Pass	AS1259.1 cl 10.2.3 - Electrical frequency weighting	Pass	AS1259.1 cl 10.4.5 - RMS Performance, tone burst
Pass	AS1259.1 cl 10.3.2 - Overload indication test	Pass	AS1259.2 cl 9.3.2 - Time averaging
Pass	AS1259.1 cl 10.3.3 - Level range	Pass	AS1259.2 cl 9.3.3 - Indicator Linearity
Pass	AS1259.1 cl 10.3.4 - Self-generated noise	Pass	AS/NZS 4476 cl 4.4 - Relative attenuation, 1/1 Oct
Pass	AS1259.1 cl 10.4.2 - Time weighting Fast and Slow	Pass	AS/NZS 4476 cl 4.4 - Relative attenuation, 1/3 Oct

Signature _____ **Signature** _____

Calibrated by Jason Dixon
Lab manager, NATA Signatory

Checked by Erik Fry
WA manager, NATA Signatory

NATA
WORLD RECOGNISED ACCREDITATION

LABORATORY ACCREDITATION NUMBER 1943 - Since 1985
Mail : PO Box 1211, East Victoria Park WA 6102
Lab : 3 Hopkinson Way, Wilson WA 6107
Ph +61 8 9356 7999 Fax +61 8 9356 9444
email: info@instrulabs.com.au web : www.instrulabs.com.au

Accredited for compliance with ISO/IEC 17025:2005
This document is issued in accordance with NATA's accreditation requirements
Approved for issue by Erik Fry, 28th of January 2012. Document ID number: C012
Report printed 22/01/2013 12:49:05 PM

Report# SCC-C2159S1S118

Instrulabs Pty. Ltd.

ACOUSTIC CALIBRATOR CALIBRATION CERTIFICATE

THIS IS TO CERTIFY THAT THE ACOUSTIC CALIBRATOR

MAKE : Cirrus
MODEL : CR515
SERIAL : 59311

OWNED BY : Instrulabs
: 19 Argyle Street
: Bentley W.A. 6102

HAS BEEN CALIBRATED ON : 22-Jan-13

SUMMARY

A sound level meter connected to a digital acquisition system is adjusted to a known reference sound pressure level, then the digital acquisition system records the frequency and sound pressure levels of the acoustic calibrator under test. All instruments used have current NATA endorsed calibration documentation

CALIBRATION INSTRUMENTS USED

Rion NA-28 Sound Level Meter	s/n 01270691	Recalibration due 22-Nov-14
Bruel & Kjaer Acoustic Calibrator Type 4226	s/n 2692340	Recalibration due 29-Jul-13
NI USB-6221-BNC Multifunction DAQ	s/n 14E9DD2	Recalibration due 02-Aug-13

CERTIFIED QUANTITIES

Frequency - AS IEC 60942-2004 clause B3.5
Limits +/- 2%, Uncertainty +/- 0.14% k=2
Frequency: 1000.0 Hz Pass

THD+N - AS IEC 60942-2004 clause B3.6
Limits +/- 4%, Uncertainty +/- 0.7% k=2
THD+N: 1.5 % Pass

SPL - AS IEC 60942 clause B3.4.3.2
Limits +/- 1.5dB, Uncertainty +/- 0.3dB k=2
Amplitude: 93.92 dB Pass

Signature _____ **Signature** _____

Calibrated by Jason Dixon
Lab manager, NATA Signatory

Checked by Erik Fry
WA manager, NATA Signatory

NATA
WORLD RECOGNISED ACCREDITATION

LABORATORY ACCREDITATION NUMBER 1943 - Since 1985
Mail : PO Box 1211, East Victoria Park WA 6102
Lab : 3 Hopkinson Way, Wilson WA 6107
Ph +61 8 9356 7999 Fax +61 8 9356 9444
email: info@instrulabs.com.au web : www.instrulabs.com.au

Accredited for compliance with ISO/IEC 17025:2005
This document is issued in accordance with NATA's accreditation requirements
Approved for issue by Erik Fry, 28th of January 2012. Document ID number: C010
Report printed 22/01/2013 10:48:15 AM

Report# CCC-C1096C151

PHASE 1 DEVELOPMENT APPLICATION - LAND STATUS

LEGEND

- Leased House
- Owner Occupied House
- Roads
- 200m Buffer
- Site Boundary
- Cadastre

Sale Status

- Bush Forever Site
- Currently being developed for Industrial Use
- For Sale for Industrial Development
- Industrial Development by Current Owner
- Purchased for Industrial Development
- Seeking Approval
- Unknown
- No Residents/Vacant Block

LAND STATUS
PHASE 1 DEVELOPMENT APPLICATION
DC Recycling

N

0 100 200 400 600 800 1,000

Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

Scale @ A3: 1:7,000	Prepared: R P Cullen	Project No: TS13009	talis delivering solutions
Date: 16/10/2013	Checked: N King	Figure 1	
	Reviewed: R M Cullen		

Document Path: \\server\Talis\SECTIONS\Waste\PROJECTS\TW2013\TW13009 - Dowsing Approvals\GIS\Maps\7. Land Ownership\Figure 1 - Lot Status_RevB.mxd

A.2 SEA-2013-028 LTR002

Sealhurst Pty Ltd
PO Box 1082, BALCATTA, WA 6914
ABN: 86 161 563 551
ACN: 161 563 551

11th APR 2014

F.A.O Ronan Cullen
Waste Management Section Leader
TALIS CONSULTANTS
Level 1, Unit 8 / 663 Newcastle Street
LEEDERVILLE
WA 6007

Dowsing Inert Recycling EIA (Noise) – WA Environmental Protection (Noise) Regulations 1997 (inc amendments) Assigned Noise Level Limits - Revised Response

Dear Ronan,

Following a detailed consultation process with DER, Sealhurst have prepared the following revised report setting out the basis of compliance with the Assigned Noise Level limits prescribed under the *Environmental Protection (Noise) Regulations 1997 (inc amendments)*, as applicable to Phase 1 of the proposed Dowsing Inert Recycling Facility, in Berkshire Road, HIGH WYCOMBE, WA.

PROJECT APPRECIATION

Dowsing Recycling propose to store inert recycling materials at their Lot address on Berkshire Road Industrial Estate, in HIGH WYCOMBE. As part of the requisite approvals process(s) for the project, noise emissions have been examined over a number of scenarios to attempt to satisfy the *Regulations* in terms of delivery truck noise, movement of inert recycling materials, and the determination of classification of buildings on adjacent Lots.

In terms of compliance of noise emissions, the appropriate Assigned Noise Level (ANL) noise emissions limits must be determined and applied in accordance with the *WA Environmental Protection (Noise) Regulations 1997 (inc amendments).* Compliance therefore references two primary elements - the nearest noise-receiving property, and, the predicted noise level at the nearest receiving property as a product of anticipated noise emissions. Evaluation must show the limits will not be breached, hence comply with the *Regulations*.

Our previous report, Ref: *SEA-2013-028 LTR001_Rev1* (16 OCT 2013) detailed our understanding following direction at that time, to consider the nearest noise-receiving building to be classified as “Residential” under *Schedule 1 Part C* of the *Regulations*; Noise emissions were to be comprised of unloading of inert materials at predetermined storage locations. Noise associated with unloading materials operations were ascribed objective referenced octave band sound power level values, and consequent minimum distances were provided to ensure the calculated Assigned Noise Level limits were not breached at the nearest noise-receiving building.

Following this assessment, both the classification of the nearest noise-receiving building (determining limits) and the format of operations (determining noise emissions) were subject to a number of queries and clarifications. This led to a consultation period over recent months to determine the most appropriate assessment model to demonstrate compliance with the *Regulations* as required for approval. Revised direction regarding the classification of the nearest noise-receiving premises has been received from DER, and a more detailed understanding of operations and operational noise emission sources has been provided by Dowsing Recycling.

Sealhurst Pty Ltd
PO Box 1082, BALCATTA, WA 6914
ABN: 86 161 563 551
ACN: 161 563 551

The consultation period has allowed an agreed path for compliance of noise emissions for the Phase 1 development, which can be summarised as follows:

1. The nearest noise-receiving premises has been determined by DER as "Industrial", defined as industrial caretaker building implying a change in the Assigned Noise Level limits applicable at the property boundary.
2. Recycling operations have been formally advised by Dowsing Recycling as two delivery trucks delivering inert material to storage areas, with fixed period of storage area maintenance/movements following deliveries over each representative 4 hour period.
3. Objective definitions have been agreed for Assigned Noise Level limits' indices "L_{A10}", and "L_{A1}" in terms of their meaning over each representative 4 hour period – i.e. L_{A10} = 24 minutes, that is the noise level exceeded for 10% of the representative period; L_{A1} = 2.4 minutes, that is the noise level exceeded for 1% of the representative period;
4. The acceptance of low frequency "tonal" components as part of truck engine noise emissions, as anticipated to be received at the nearest noise-receiving building, adding a further 5dB penalty to the Assigned Noise Level limits.

As with our previous works, compliance has been demonstrated via objective noise spectra and prediction at the nearest noise-receiving building. The assessment now includes allowances for type and number of recycling operations over an agreed 4 hour representative period.

Our conclusions are as follows:

1. Compliance with the revised Assigned Noise Level limits is able to be achieved at all times of the day from the truck movements and inert material storage operations defined in Dowsing Recycling's operations plan. The basis of the calculation for truck movements is for 2 x 32T, 254kW delivery trucks passing the nearest noise-receiving building at a closest distance of 12m, which is predicted to exceed the L_{A10} value of 65dB(A) for an anticipated period of 116 seconds per 4 hour period, when travelling at 5km/hr. The exceedence period may be halved when truck speed is increased to 10km/hr.
2. Wheeled loader movements are anticipated to occur for ten minutes following each delivery of inert materials, and for up to ten additional minutes per day for any routine maintenance and tidy up operations within the identified storage areas only. Potential exceedences are therefore limited to a period of thirty minutes per 4-hour period. Wheeled loader movements are to commence once delivery trucks have left the site via Berkshire Road exit.

   Two storage areas exist – referred here as North east and North west. Both North east and North west storage areas are over 100m from the identified nearest noise-receiving building, hence compliance is possible at all times. Storage Areas are shown clearly in the Technical Appendices. The North east storage area has proximity to a second noise-receiving building, at some 25m, therefore noise activity periods should be limited to <24 minutes in this location to comply.
3. Notwithstanding any non-acoustical requirement to provide reverse beepers, the use of reverse beepers as a safety strategy for wheeled loader vehicles is recommended to be replaced with alternative visual safety devices to minimise any additional disturbance. Guidelines and literature for alternative safety management of vehicles are identified in this report.

Sealhurst Pty Ltd
PO Box 1082, BALCATTA, WA 6914
ABN: 86 161 563 551
ACN: 161 563 551

The following pages present input details, calculation methodology and recommendations to be incorporated into the operational Phase as the project matures through the approvals process to practical completion.

If you have any queries, please feel free to contact me direct,

Kind Regards

Daryl Thompson
Director
Sealhurst Pty Ltd

APPLICABLE CRITERIA

Environmental Protection (Noise) Regulations (1997)

The *Environmental Protection (Noise) Regulations 1997 (inc amendments)* is the applicable legislation governing all sources of noise emission which can be introduced when a new building or development is constructed; in this case noise emissions from delivery trucks and wheeled loaders unloading and moving inert materials for storage at the proposed inert materials recycling facility.

The *Regulations* seek to regulate noise emission by the prescription of limits deemed "allowable" at an identified nearest noise-receiving building. The nearest building has been classified as "Industrial". Under these circumstances, the Assigned Noise level limits are fixed under Schedule 3 of the *Regulations* and the ANL limits applied according to *TABLE 1, PART 2, Clause (8)*.

Identification of Nearest Noise-Receiving Building(s)

The nearest noise-receiving building(s) are shown in the image below, deemed to be the defining receiving locations for noise emissions from the new recycling facility. The buildings have been determined by DER as "Industrial caretaker buildings" as is consistent with our understanding of the buildings' uses.

Demonstrating compliance with the *Regulations* at the nearest point, implies the logic that any receiver(s) further away from the source will also comply. *Schedule 1 Part C,* of the *Regulations* prescribes the applicable definitions of noise sensitive premises.

Application of Assigned Noise Level Limits

The table below presents the revised ANLs applicable to the nearest noise-receiving building:

Part of Premises Receiving Noise	Time of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Industrial and Utility premises	All hours	**65**	**80**	**90**

Noise emissions from recycling operations must comply with the limits defined above.

ASSESSMENT OF IDENTIFIED NOISE SOURCES

Having established the limiting criteria applicable under statutory legislation, noise sources anticipated as part of the Phase 1 facility must now be identified and objectively assessed regarding compliance with the applicable noise limits. The primary noise sources associated with inert material storage proposed for Phase 1 are identified as delivery truck noise, unloading materials, and material movements using wheeled loaders.

Assessment of Identified Nosie Sources

Reference sound data was obtained for each representative noise emissions activity and applied to our revised noise model to determine compliance. The following octave band sound power level spectra were used in our assessment:

Noise Emission -	Sound Power Level (dB)									
	Octave Band Centre Frequency (Hz) (dB_{Lin})								SWL	
Equipment Item	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB**	**dB(A)**
Hino 700 Series FS1ELKD Dump truck	121	107	104	102	101	100	97	94	**121**	**107**
Articulated Dump Truck (dumping material)	122	104	105	103	104	101	96	91	**122**	**108**
Wheeled Loader (material movements)	117	114	115	105	106	105	101	96	**120**	**112**

Noise Source Character

In addition to the ANL limits, particular noise sources can attract additional punitive dB levies based upon the noise source characteristics. *Regulation 7* prescribes that the noise character must be "free" of annoying characteristics - specifically:

(i) tonality (e.g. whining, droning)
(ii) modulation (e.g. cyclical change in character, such as a siren)
(iii) impulsiveness (e.g. banging, thumping)

Penalties apply up to a maximum of +15dB, for tonality (+5dB), modulation (+5dB) and impulsiveness (+10dB), where the noise source is NOT music.

ASSESSMENT OF TONALITY

The subjective sound of unloading material and material movements is generally broadband, and can be likened to construction site-type noise emissions, which are not usually subject to additional penalties when assessing compliance. However, where delivery trucks pass by nearest noise-receiving buildings, low frequency noise from the truck engine at low speeds is likely to cause tonal noise to be received. **Sealhurst have deemed it appropriate to attribute a tonal penalty of 5dB(A) to truck engine noise passing close to nearby noise receiving buildings. No additional penalties regards "unloading material of material movements have been applied.**

TIMING AND FREQUENCY OF OPERATIONS

Consultation between TALIS, Sealhurst and DER has resulted in a 4 hour period of operations to be examined as representative. In response, Dowsing have advised the following planned operations for site activity over a 4 hour period:

> *"It is proposed that in any four hour period there will be:*
>
> *Two delivers of loads by Hino 700 Series FS1ELKD Tip Truck which should not take any more than 10 mins each*
>
> *There will be 1 wheeled loader on site which will work for about 10 mins after each load and then some general site maintenance etc to be ~10 mins within a similar period. Therefore, it is anticipated that the loader will be operational for 30 mins every 4 hours"*

REFERENCE SITE PLAN

The Technical Appendices at the end of this report contains annotated site plans from which critical sound propagation distances pertinent to noise emissions compliance were obtained. The following distances and exposure times are fundamental to our assessment:

- 12m – nearest point of passage of delivery trucks leaving the recycling plant site;
- 80m – minimum propagation distance to meet Assigned Noise Level limits from delivery truck noise, inclusive of -5dB(A) penalty;
- 58 seconds – time taken for single truck to pass nearest noise-receiving property to a zone whereby noise emissions are predicted to be below the required limit at 5km/hr, inclusive of penalty;
- 29 seconds – time taken for single truck to pass nearest noise-receiving property to a zone whereby noise emissions are predicted to be below the required limit at 10km/hr, inclusive of penalty;

ASSESSMENT

On the basis of the above and analysis of the site plan, (see Appendices) the following assessment was undertaken:

- Sound Power Level (SWL) data used to calculate corresponding sound pressure levels at nearest noise-receiving building in octave bands using inverse square propagation model;
- Resulting sound pressure levels compared to Assigned Noise Level (ANL) limits of L_{A10} 65dB and L_{A1} 80dB with allowance for additional -5dB(A) tonal penalty;
- Where exceedence of the tonal penalty corrected L_{A10} 60dB(A) is identified, exposure times were estimated based upon delivery truck speeds, whereby total exposure time for exceedence was compared against an "allowable" 24 minute period in any 4 hour period defined for L_{A10}, or an "allowable" 2.4 minute period in any 4 hour period defined for L_{A1}, beyond which exceedence would constitute a non-compliance;

COMPLIANCE STATEMENT

Sealhurst have prepared a cumulative calculation model based upon the information presented herein. The resultant calculation model predicts that noise emissions from Dowsing Recycling's proposed operations plan are able to meet the applicable Assigned Noise Level limits at the nearest noise-receiving building, provided the timing and measured distances are applied to the project during operations.

ADDITIONAL OPERATIONAL CONSIDERATIONS

TRUCK SPEED LIMIT

Noise emissions compliance and allowable periods of "exceedence" are based upon the advised truck speed of 5km/hr. Estimated time taken for trucks to drive 160m through the "Exceedence Zone" at incremental speeds are as follows:

Truck Speed	Time Taken to pass through Exceedence Zone	Resultant Exceedence time per 4 hour period (2 trucks)
5km/hr	116 seconds	3 minutes, 52 seconds
10km/hr	58 seconds	1 minute, 56 seconds
15km/hr	39 seconds	1 minute, 18 seconds
20km/hr	29 seconds	58 seconds

Provided safe operations can be maintained at higher speeds, e.g. 10km/hr, it would be possible for Dowsing to increase their 4-hourly truck movement quota during busy periods and remain compliant with the *Regulations* based upon ensuring the exceedence periods remain LESS THAN 24 minutes for the tonal penalty corrected 60dB L_{A10} OR LESS THAN 2.4 minutes. This is inclusive of wheeled loader movements, which are proposed to occur over 100m away, hence are not anticipated to be subject to timed exceedence limits.

TIMING OF DELIVERIES

As part of inert materials delivery management strategy, the time(s) of delivery should be managed to occur between the hours of 7am and 7pm, where practicable, to minimise potential disturbance.

DELIVERY TRUCK REVERSE BEEPERS

It is anticipated that delivery vehicles and wheeled loaders are required to produce safety warning signals when reversing in industrial applications as a strategy to minimise human injury and increase vehicle movement safety, particularly in confined spaces. One common signal type is reverse beepers which, as an additional noise source can be more likely to cause annoyance and potential complaint.

Regards reverse beepers, there exists a reasonable amount of literature[1], [2] demonstrating alternative safety devices and management principles which can be employed to avoid this precise acoustical issue - as the issue is one of safety (with an acoustical annoyance outcome), by removing the reverse beeper alarm source in place of an alternative (e.g. visual) alarm, the problem can be removed.

Such strategies are employed in existing high noise scenarios, where audio warnings have limited value - for example high noise plant rooms, off shore installations etc where noise levels of warning sirens/signals may not be overheard and/or could approach levels which would otherwise induce hearing damage in order to be heard. Typically staff in such areas may already be wearing ear defenders, therefore the principle is able to be implemented where certain constraints apply.

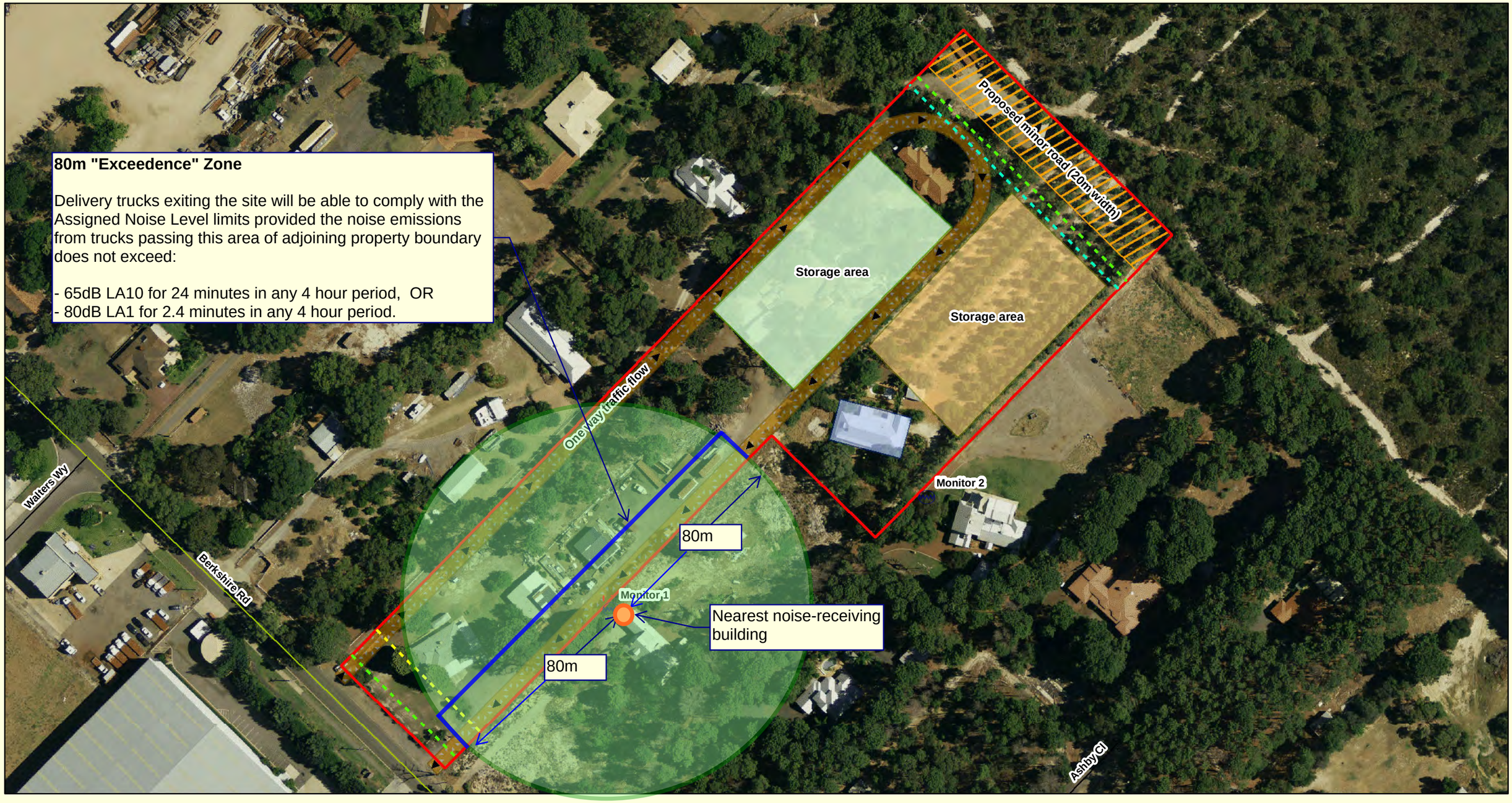
The one-way delivery route for trucks presented by Dowsing/TALIS shows reverse beepers will not be required by trucks. Alternative safety strategy(s) for wheeled loader vehicles could be the application and use of reversing cameras, visual alarms signals (e.g. specific vehicle reverse lights) and safety management techniques such as the use of spotters, to be considered as part of the noise management strategy for the facility.

REFERENCED LITERATURE

[1] SAFE WORK AUSTRALIA - Draft guide Traffic Management: Construction Work;
[2] ROADING NEW ZEALAND - Guideline for Controlling Reversing Vehicles DEC 2009;

TECHNICAL APPENDICES

SITE LAYOUT MARK UP



LEGEND

- Site Boundary
- Access Roads
- Caretaker Residence
- New Minor Road
- Area to be cleared
- Storage Area
- Traffic Flow

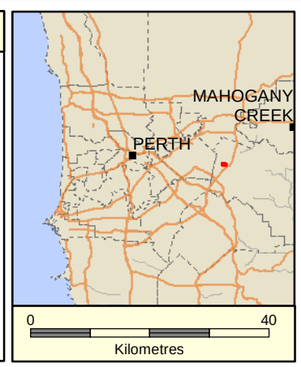
Setbacks

- 10m minimum setback line (minor road)
- 20m minimum setback for buildings
- 6m minimum landscaping requirements
- Noise Monitors

Roads

Heirarchy

- Access Road
- Distributor A
- Distributor B
- Local Distributor
- Primary Distributor
- Regional Distributor



LOCATION OF NOISE MONITORS
DUST AND NOISE COMMISIONING MONITORING PLAN
Dowsing Concrete

N

0 25 50 100 150 200 250

Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

Scale @ A3: 1:1,500	Prepared: J Botterill	Project No: TW13009	talis delivering solutions
Date: 09/05/2013	Checked: N King	Figure 6	
	Reviewed: R M Cullen		

Document Path: \\server\Talis\SECTIONS\Waste\PROJECTS\TW2013\TW13009 - Dowsing Approvals\GIS\Maps\9. Dust & Noise\Figure 6 - Location of Noise Monitors.mxd

A.3 SEA-2013-028 LTR003_Rev1

Sealhurst Pty Ltd
PO Box 1082, BALCATTA, WA 6914
ABN: 86 161 563 551
ACN: 161 563 551

01 MAY 2014

F.A.O Andrew Mack
Waste Management Section Leader
TALIS CONSULTANTS
Level 1, Unit 8 / 663 Newcastle Street
LEEDERVILLE
WA 6007

Dowsing Inert Recycling EIA (Noise) – Revised Equipment & Operations Schedule

Dear Andrew,

In response to DER query regarding compliance with the Assigned Noise Levels at their inert recycling facility, Sealhurst have prepared the following summary statement regarding operation period (T) and sound power level (SWL) data contained within Dowsing's proposed operations plan for their proposed inert recycling facility at Berkshire Road, HIGH WYCOMBE WA.

The statement is provided to resolve potential compliance/noise emissions exceedence issues relating to wheeled loader use, following DER queries regards specific equipment items and duration of use. Our advice is intended to be supplementary to our previous detailed compliance advice letter, (*Ref: SEA-2013-028 LTR002*) whereby compliance with the applicable limits were derived on an allowable emissions/operating time basis.

GENERAL APPRECIATION

Previous advice and assessment utilised sound power level data and timed noise emissions to demonstrate noise emissions compliance for the delivery and storage of inert materials in preparation for recycling processing. An operations plan was presented whereby compliance is based upon objective sound power levels over known distances to neighbouring receiving properties, and the application of time-limited operation controls in order to remain compliant; i.e. to remain within the allowable Assigned Noise Level limits (L_{A10}, L_{A1}, L_{AMAX}) applicable to the site.

We understand concerns were received relating to the level and duration of noise emission from specific wheeled loader equipment initially proposed to move inert material to stockpiles following inert material delivery.

In order to demonstrate an alternative compliance strategy, Dowsing have provided a n inventory list of alternative options to expedite inert material movement/storage which Sealhurst have reviewed in view of each equipment item's sound power level. Anticipated usage periods were also reviewed in order to determine a more efficient (i.e. time limited) process for storage, in order to meet the required Assigned Noise Levels during operations when assessed over a representative 4 hour period.

ALTERNATIVE SOUND POWER & TIMED EMISSIONS

Dowsing have a number of alternative vehicles and equipment able to complete the operations, as evidenced by the inventory included in the Technical Appendices of this report.

The originally proposed wheeled loader is to be supplemented with an alternative skid steer type unit where inert material movement operations are anticipated to take >24 minutes to remain compliant with the Assigned Noise Level limits. The unit has significantly lower sound power level, and is able to complete specific lift/unload operations in a shorter time period, thus reducing time spent manoeuvring inert material.

This amendment is to be included in Dowsing's facility operations plan.

Sealhurst Pty Ltd
PO Box 1082, BALCATTA, WA 6914
ABN: 86 161 563 551
ACN: 161 563 551

Sound power levels of the new 8T skid steer and the larger capacity Wheeled Loader unit are presented below:

Noise Emission -	Sound Power Level (dB)									
	Octave Band Centre Frequency (Hz) (dB_{Lin})								SWL	
Equipment Item	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB**	**dB(A)**
Wheeled Loader (material movements)	117	114	115	105	106	105	101	96	**120**	**112**
Skid Steer 8t Loader (material movements)	100	91	95	95	91	90	84	78	**103**	**97**

TONALITY

We understand DER have deemed the emissions from inert material movements to be tonal when received at the nearest receiver, implying an additional penalty of +5dB to noise emissions. Using the alternative skid steer equipment sound power levels, we are able to calculate noise emissions to be <60dB(A) at distance above 29m, which using the accepted calculation basis, provides the closest distance for emissions to occur before timed emissions become part of the compliance strategy.

As a direct comparison, sound power emission predictions from the significantly larger capacity Wheeled Loader unit calculated a level of 75dB(A) at an equivalent distance.

AMENDED OPERATIONS PLAN

- Inert material movements (general) – Skid Steer;

  Where noise/time-sensitive inert material movement operations occur:

- Inert material movements greater than 24 minutes in any 4 hour period – Skid Steer;
- Inert material movements less than 24 minutes in any 4 hour period – Wheeled Loader (if required);

On this basis we believe the proposed operations plan is now compliant with the Assigned Noise Level limits in any 4 hour period.

Should further concerns infer an exceedence of the Assigned Noise level limits, all inert material movement operation duration times would be limited to <24 minutes in any 4 hour period, in order to remain complaint.

If you have any queries, please feel free to contact me direct,

Kind Regards

Daryl Thompson
Director
Sealhurst Pty Ltd

DOWSING EQUPMENT INVENTORY LIST

Bobcats, Excavators and Forklifts		
2013 Toyota Skid Steer SDK8 Loader	1ECH792	SL15
2013 Toyota Skid Steer SDK8 Loader	1EHT456	SL16
2013 Toyota Skid Steer SDK8 Loader	1EFY219	SL17
2012 PT50 Series 3 Terex	1ECE626	SL14
2012 PT80 Series 3 Terex	1DZD909	SL13
2010 JCB Backhoe Wheel Loader	1DXU932	WL03
2010 SDLG LG936L Wheel Loader	1DJF283	WL01
2009 Cat Skid Steer 226B Loader	1DJF282	SL10
2007 Toyota Skid Steer SDK8 Loader	1DBG182	SL12
2006 Cat Skid Steer 226B Loader	1CJU839	SL07
2006 Takeuchi TB014 Mini Excavator	1CJA182	EX01
2005 Cat Skid Steer 950 Loader	BY75453	WL02
2001 Komatsu FD 25T Forklift		FL02

B. CALCULATION OF NOISE EMISSIONS LIMITS

An Assigned Noise Level is calculated for each noise sensitive receiver using a combination of environmental factors local to the receiver. A standard set of ANL's exist to provide a base level of acoustic amenity, as shown in the Table below. These levels are modified by an Influencing Factor (IF) to reflect noise sensitivity in the specific environment relative to the subject development.

To calculate the additional Influencing Factor (IF), concentric circles are drawn around the nearest noise-sensitive reception point; one at 450m radius and one at 100m radius. Percentages are calculated for the amount of land area within the circles used for noise emitting purposes (e.g. industrial or commercial uses) which are compared to the total area encompassed by the concentric circles.

Traffic volume is taken into account in order to reach an acceptable ANL, or noise reception level, appropriate for the area in which the receiver is to be situated.

Part of Premises Receiving Noise	Time of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises at locations within 15m of a building directly associated with a noise sensitive use	0700 to 1900 hours Monday to Saturday	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sundays and public holidays	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	35 + influencing factor	45 + influencing factor	55 + influencing factor
Noise sensitive premises at locations further than 15m of a building directly associated with a noise sensitive use	All hours	60	75	80
Commercial premises	All hours	60	75	80
Industrial and Utility premises	All hours	65	80	90

C. PROPOSED CRUSHING EQUIPMENT & OPERATIONS PLAN

C.1 Site Plan & Operations Layout

talis
delivering solutions
www.talisconsultants.com.au

ASSET MANAGEMENT
ENVIRONMENTAL SERVICES
SPATIAL INTELLIGENCE
WASTE MANAGEMENT

8/663 Newcastle Street, Leederville WA 6007
PO Box 454, Leederville WA 6903
T: 1300 251 070
E: admin@talisconsultants.com.au

Client: DC Recycling

NOTES

1. This drawing is the property of Talis Consultants Pty Ltd. It is a confidential document and must not be copied, used, or its contents divulged without prior written consent.
2. All levels refer to Australian Height Datum.
3. DO NOT SCALE, use figured dimensions only, if in doubt please contact Talis Consultants.

No.	Date	Drawn / Chk	Amendment / Issue	App.
A	21/11/14	AU / KG	Issue for Report	KR

Project: Environmental Assessment Management Plan

Title: Site Layout Plan

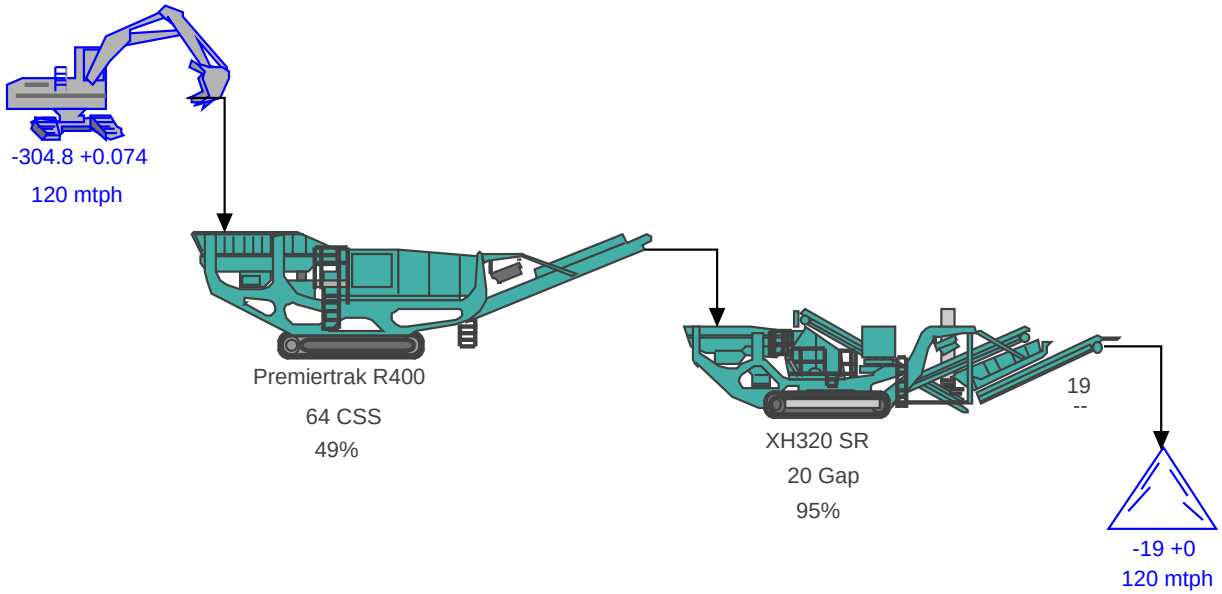
Drawn by:	AU	Job No:	TE14019
Checked by:	RC	File No:	TE14019DG001
Approved by:	AM	Drg. No: 001	Rev: A
Scale:	1:1250		
Date:	19/11/14		

C.2 Ref: LPE301150 Dowsing Concrete Recyclers – Plant Setup #1

Feed Material: C&D/Clean Demolition Concrete

Bulk Desnity: 2.3mt/m^3

SG: 2.65



Lincom Group

LPE301150

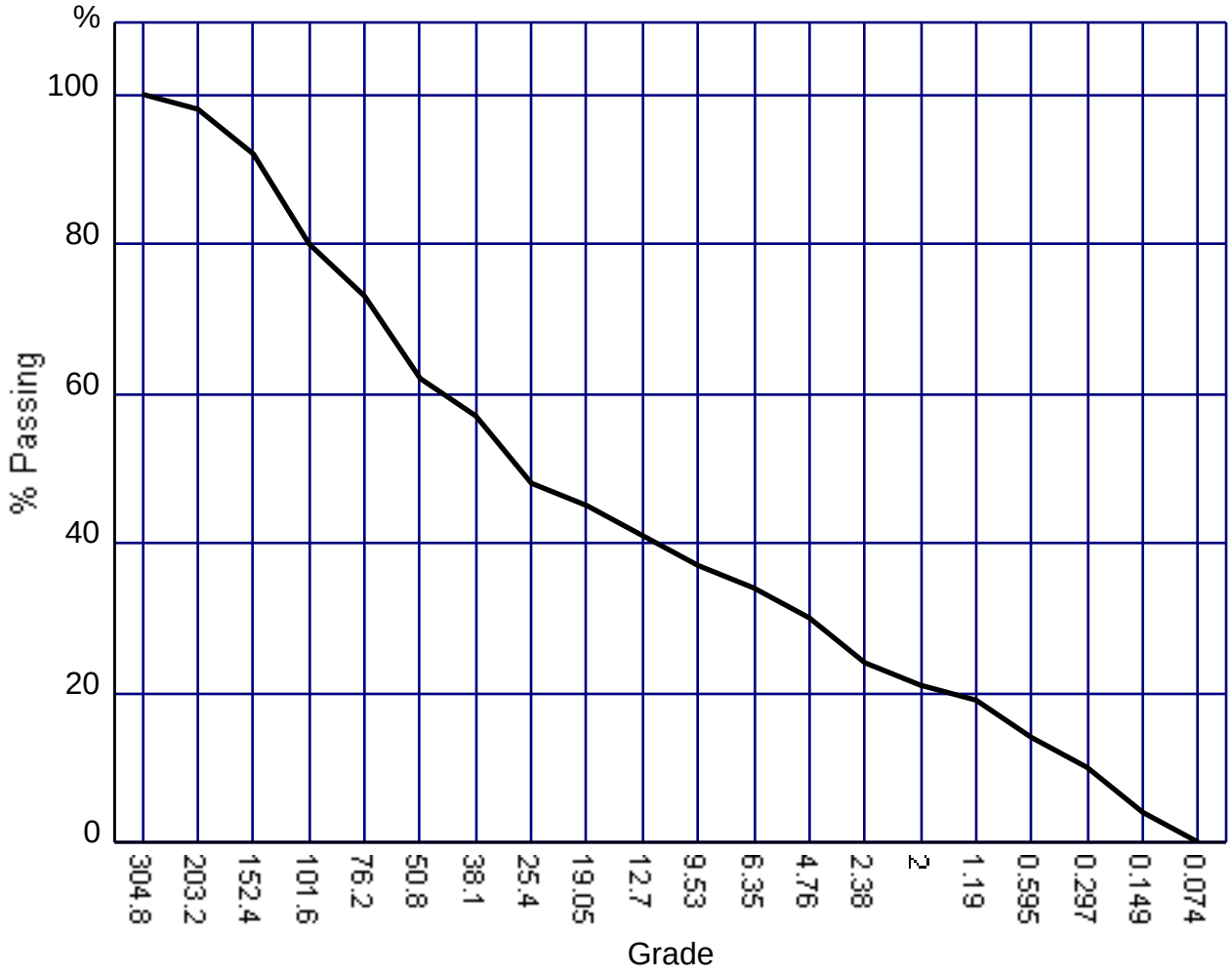
Alex Cabrera

Plant Setup #1: Pa

Project #: 10790 Version #: - Date: 3/November/2014

Feed Grading
Material: C&D/Clean Demolition Concrete

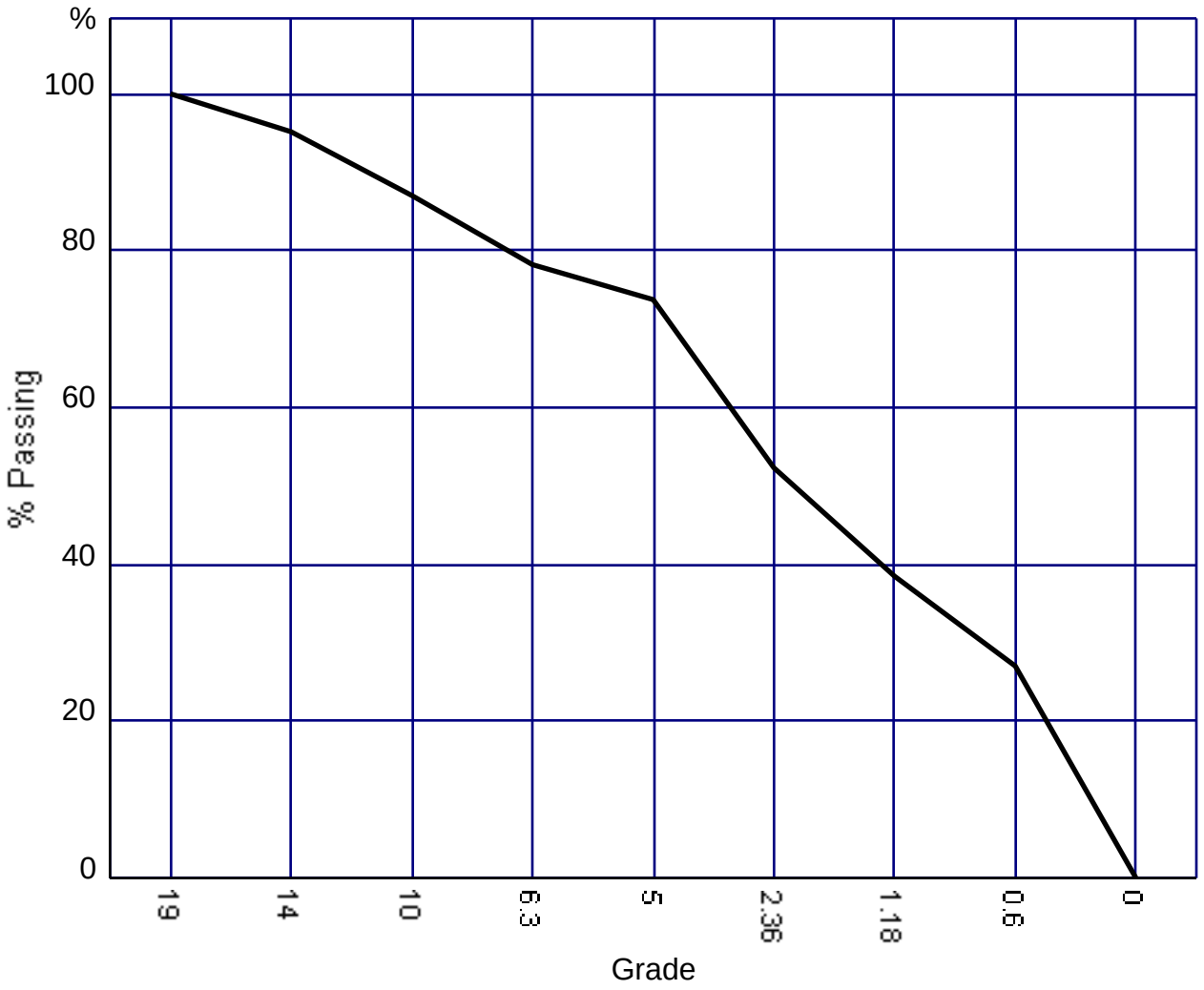
Grading	% Pass	% Ret.	TPH
304.8	100.0	0	0
203.2	98.0	2.0	2.4
152.4	92.0	6.0	7.2
101.6	80.0	12.0	14.4
76.2	73.0	7.0	8.4
50.8	62.0	11.0	13.2
38.1	57.0	5.0	6.0
25.4	48.0	9.0	10.8
19.05	45.0	3.0	3.6
12.7	41.0	4.0	4.8
9.53	37.0	4.0	4.8
6.35	34.0	3.0	3.6
4.76	30.0	4.0	4.8
2.38	24.0	6.0	7.2
2	21.0	3.0	3.6
1.19	19.0	2.0	2.4
0.595	14.0	5.0	6.0
0.297	10.0	4.0	4.8
0.149	4.0	6.0	7.2
0.074	0.0	4.0	4.8
Total	- -	100.0	120



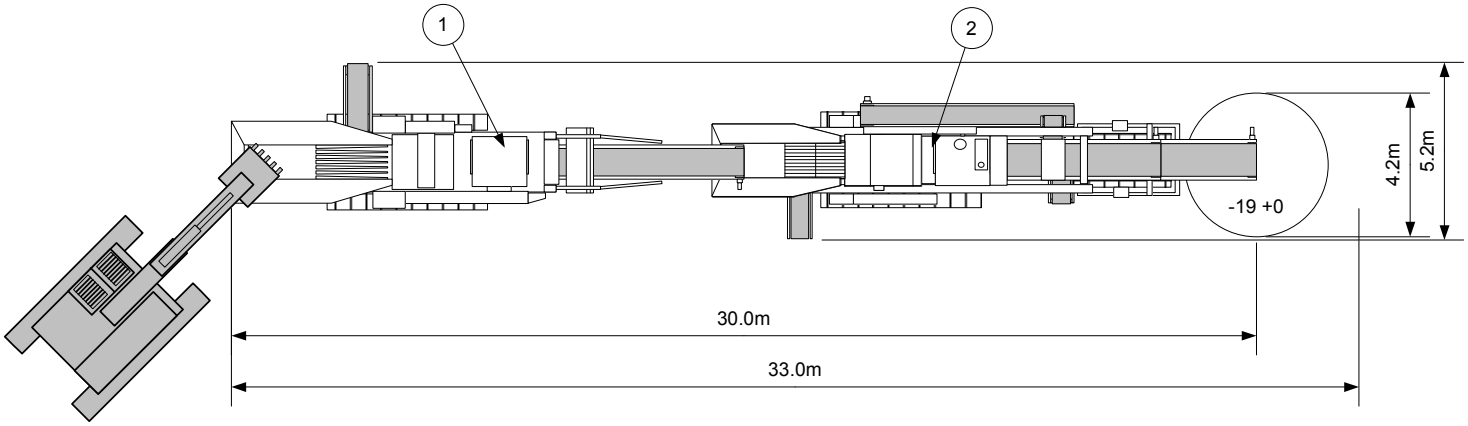
Lincom Group
LPE301150
Alex Cabrera
Plant Setup #1: Page #1
Project #: 10790 Version #: - Date: 3/November/2014

-19mm Roadbase

Grading	% Pass	% Ret.	TPH
19	100.0	0	0
14	95.2	4.8	5.8
10	87.0	8.1	9.7
6.3	78.2	8.8	10.6
5	73.8	4.5	5.4
2.36	52.3	21.4	25.7
1.18	38.5	13.8	16.6
0.6	27.0	11.5	13.7
0	0.0	27.0	32.4
Total	- -	100.0	120



Lincom Group
LPE301150
Alex Cabrera
Plant Setup #1: Page #1
Project #: 10790 Version #: - Date: 3/November/2014



Key to Figure	
1	Premiertrak 400S
2	XH320SR

SCALE: 1:200

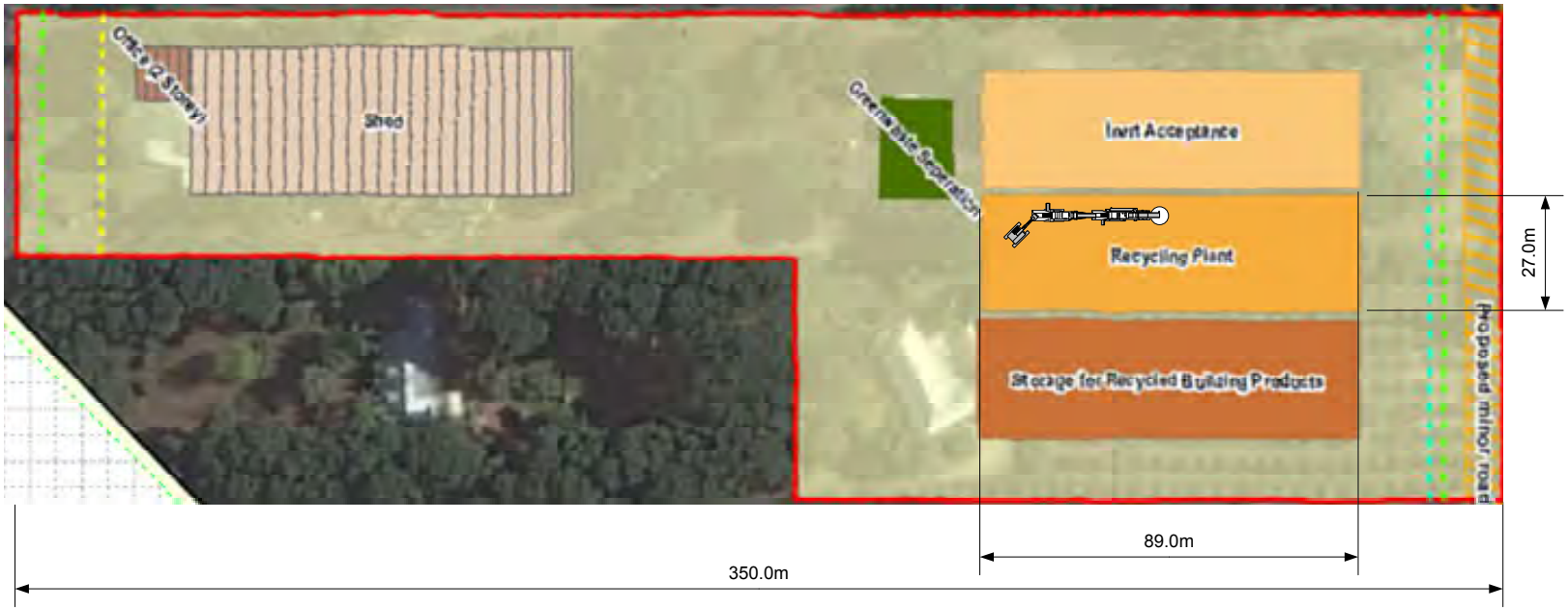
Drawing Title

Dowsing Concrete Recyclers
Plant Setup #1

Drawn By	Date	Drawing Nos.
A.Cabrera	03/10/2014	LPE301150

LINCOM GROUP
Lincom Pacific Equipment Pty Ltd
Lincom Equipment Rentals Pty Ltd
Lincom NZ Pty Ltd
Lincom Pacific Materials Pty Ltd
Worbark Pacific Pty Ltd

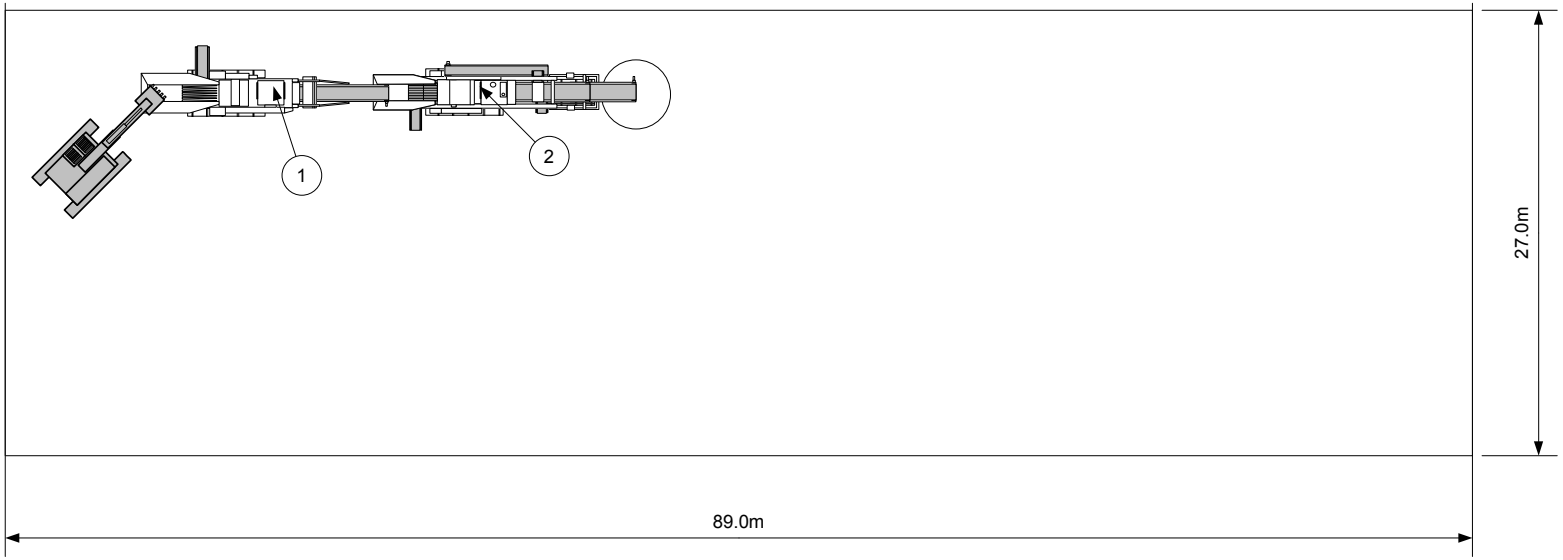
92 Potassium Street, Narangba, Qld. 4504
Tel: 07 3293 0888 Fax: 07 3293 0688
www.lincom.com.au e-mail:- sales@lincom.com.au



SCALE: 1:1500

Drawing Title		
Dowsing Concrete Recyclers Plant Setup #1 – Full Site Plan		
Drawn By	Date	Drawing Nos.
A.Cabrera	03/10/2014	LPE301150

LINCOM GROUP
Lincom Pacific Equipment Pty Ltd
Lincom Equipment Rentals Pty Ltd
Lincom NZ Pty Ltd
Powerscreen Australasia Pty Ltd
Mobark Pacific Pty Ltd
92 Potassium Street, Narangba, Qld. 4504
Tel: 07 3293 0888 Fax: 07 3293 0688
www.lincom.com.au e-mail:- sales@lincom.com.au



Key to Figure	
1	Premiertrak 400S
2	XH320SR

SCALE: 1:400

Drawing Title

Dowsing Concrete Recyclers
Plant Setup #1 – Recycle Plant Plan

Drawn By	Date	Drawing Nos.
A.Cabrera	03/10/2014	LPE301150

LINCOM
Lincom Pacific Equipment Pty Ltd
Lincom Equipment Rentals Pty Ltd
Lincom NZ Pty Ltd
Powerscreen Australasia Pty Ltd
Morbark Pacific Pty Ltd

92 Potassium Street, Narangba, Qld. 4504
Tel: 07 3293 0888 Fax: 07 3293 0688
www.lincom.com.au e-mail:- sales@lincom.com.au

C.3 Proposed Plant Equipment

Powerscreen® XR400S

Jaw Crusher

SPECIFICATION - Rev 4. 01/08/2012

POWERSCREEN®
A TEREX BRAND

Specification		XR400S
Total weight		44,750kg (98,656lbs) including magnet & dirt conveyor
Transport	Length	15.2m (49' 10")
	Width	2.8m (9' 2"), 4.3m (14' 1") including dirt conveyor
	Height	3.4m (11' 2")
Working	Length	14.9m (49' 10")
	Width	4.3m (14' 1") with dirt conveyor
	Height	4.1m (13' 6")
Crusher type:		Single toggle jaw, feed opening 1100mm x 700mm (44"x28")
Powerunit:		Caterpillar C9 ACERT 194kW (260hp) or Scania DC9 070A 202kW (275hp)
Paint colour:		RAL 5021

Features & Benefits

The Powerscreen® X400S range of high performance primary jaw crushing plants are designed for medium scale operators in quarrying, demolition, recycling & mining applications.

The range includes the XA400S with hydraulic adjust & the XR400S with hydraulic release. User benefits include track mobility for a quick set-up time, hydraulic crusher setting adjustment for total control of product size & crusher overload protection to prevent damage by un-crushable objects.

- Output potential up to 400tph (440 US tph)
- Hydraulic folding feed hopper with wedge fixing system
- Heavy duty wear resistant feed hopper
- Stepped self-cleaning grizzly feeder with under feeder screen option
- Deep fines chute to reduce material blockages
- Aggressive crushing action with high swing jaw encouraging material entry into crushing chamber
- Hydraulic crusher overload, ideal for applications with un-crushable material in feed, up to 200mm3
- Hydraulic crusher setting adjustment
- Improved manganese liner retention, protects jaw supports on both swing & fixed jaws
- Excellent under crusher access for removal of wire with hydraulic raise lower product conveyor
- Angle adjustable product conveyor, 3.9m discharge height, lowers for transport
- Low fuel consumption due to highly efficient direct drive system
- Easy access powerunit canopy
- PLC control system with auto start facility
- Remote control via umbilical
- Dust suppression system
- Easily set up

Applications

Aggregate

- Sand & gravel
- Blasted rock
- River rock

Recycling

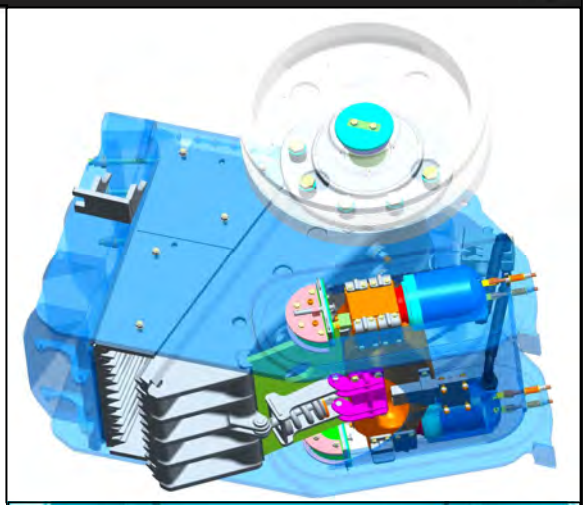
- C&D waste
- Overburden
- Foundry waste

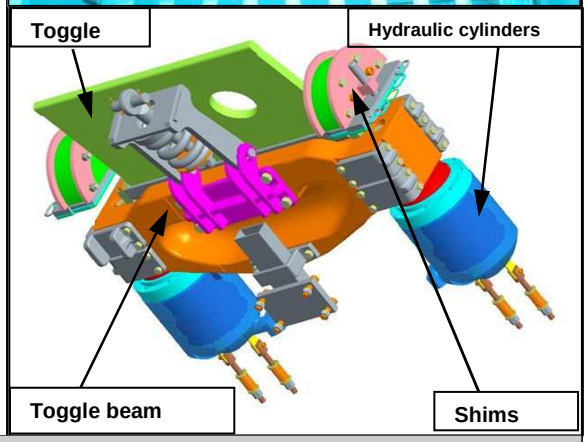
Mining

- Processed ores
- Processed minerals

Jaw Crusher

Crusher type:	**Single toggle jaw with hydraulic setting adjustment**
Feed opening:	**1100mm x 700mm (44” x 28”)**
Bearings:	**Self aligning spherical roller**
Lubrication:	**Grease**
Drive:	**Wedge belts with screw tension adjustment on engine**
Pre-set:	**75mm (3”) closed side setting (CSS)**
Minimum setting:	**50mm (2”) CSS recycling 75 mm (3”) CSS quarry All settings measured from root to tip & subject to suitability of feed material. This plant is designed for recycling applications but can be used on quarry applications where appropriate. If in doubt please contact your dealer or Powerscreen.**
Maximum setting:	**125mm (5”) CSS**
Hydraulic adjustment:	**Fitted as standard**
Hydraulic overload:	**System designed to prevent damage caused by tramp metal up to 200mm (8”) lump size (maximum edge length) Any downstream plant must be capable of accepting oversize from dumped condition**
Controls:	**When overload occurs, feeder will stop, crusher & product conveyor will continue to operate until re-set**





Chamber Features

- Quick & easy setting adjustment
- Drawback rod adjustments not required during setting changes
- Jawstock supported on both sides, even stress distribution
- Strong frame construction, no welding in critical areas
- Cylinders mounted in line with side plates
- Cartridge type bearings
- Overlap jaw protects tip of jawstock/pitman
- One piece fixed jaw support
- Proven manganese liner retention

Hopper

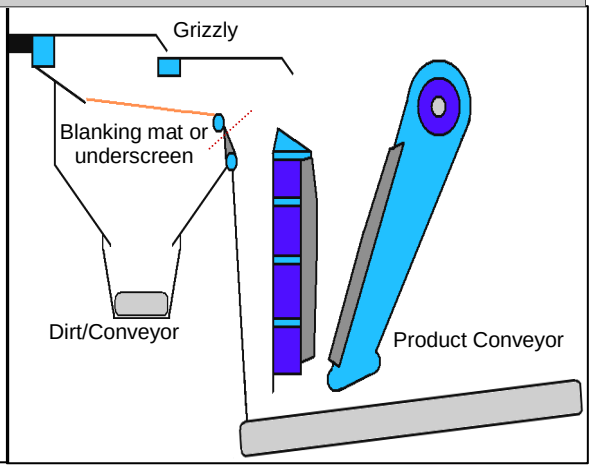
Hopper type:	**Boltless hydraulic folding hopper, over centre struts & wedge lock**
Hopper length:	**4.9m (16' 1")**
Hopper width:	**2.4m (7' 11")**
Hopper capacity:	**10m^3 (13 cu. yd.)**
Hopper body:	**15mm thick wear resistant steel plate, mild steel reinforcing ribs**
Control:	**Variable speed control through a proportional flow control valve**

Vibrating Grizzly Feeder

Type:	**Spring mounted vibrating pan & grizzly feeder**
Vibrating Unit:	**Twin heavy-duty cast eccentric shafts running in spherical roller bearings, gear coupled at drive end**
Drive:	**Flange mounted hydraulic motor**
Feeder length:	**4.08m (13' 5")**
Feeder width:	**1.06m (3' 6")**
Grizzly:	**2 replaceable 1.60m long stepped cartridge type grizzlies 50mm nominal aperture, self cleaning**
Grizzly length:	**2.12m (7')**
Under-screen:	**Rubber blanking mat fitted as standard. Can be substituted for optional wire meshes, use in conjunction with optional side conveyor.**

Plant Chute-work

Crusher feed chute:	**One piece fabrication with 12mm thick mild steel plate sides with 20mm thick bottom plate**
Grizzly fines/ bypass chute:	**2-way dirt chute provided to discharge to product conveyor or optional dirt conveyor when fitted. Fabricated from 6mm mild steel, complete with hand operated flap door to direct grizzly fines to either dirt conveyor or product conveyor.**



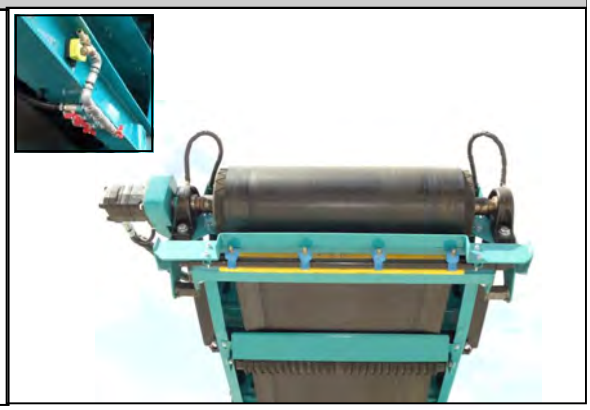
Product Conveyor

Conveyor type:	**Troughed belt conveyor**
Design:	**Hydraulic raise & lower facility to aid rebar removal & transportation. Can be raised or lowered whilst crushing. Fully removable modular unit to aid access & maintenance.**
Belt type:	**EP630/4 with 6mm top & 2mm bottom cover, vulcanised**
Belt width:	**1000mm (39")**
Discharge height:	**3.9m (12' 9")**
Stockpile volume:	**89m^3 (116 cu. yd.)**
Max. clearance:	**472mm (jaw to belt - lowered) 747mm (engine to belt - lowered)**
Drive:	**Direct drive hydraulic motor**
Tunnel:	**Conveyor fitted with tunnel & side covers to minimise rebar snagging**
Feedboot:	**Mild steel plate with abrasion resistant steel liners at feed point**
Belt adjustment:	**Screw adjusters at head drum**
Belt covers:	**Canvas type removable dust covers fitted to head section beyond magnet**
Belt scraper:	**Polyurethane blades as standard**
Lubrication:	**Remote head drum grease points located under shedder plate**
Skirting:	**Wear resistant rubber skirts along entire conveyor length**

Dust Suppression System

Sprays bars with atomiser nozzles mounted over crusher mouth, product conveyor feed & discharge points. Piped to an inlet manifold for client's pressured water supply.

Type:	**Clean water multi atomising nozzles**
Inlet:	**Single filtered inlet point on chassis**
Pressure:	**2.8 bar (42 psi)**
Frost protection:	**Via system drain valves**
Pump:	**Optional extra**



Powerunit

EU Stage IIIA / US Tier 3:	**Caterpillar C9 ACERT, 6 cylinder, direct injection 194kW (260hp) at 1600rpm ***
Operating conditions:	**Ambient temp. +40℃ & –12℃ (104F & 10F) altitudes up to 1000m (3281ft) above sea level #**
Operating rpm range:	**1600rpm**
Typical fuel consumption:	**N/A**
Plant drive:	**High quality pumps driven via belts**
Fuel tank capacity:	**410 L (108 US G) - sufficient for a 12 hour shift**
Hydraulic tank capacity:	**340 L (116 US G)**

EU Stage IIIB / US Tier 4i :	**Scania DC9 080A 5 cylinder, turbo, 202kW (275hp) at 2100rpm**
Operating conditions:	**Ambient temperature +40℃ & –12℃ (104F & 10F) at altitudes up to 1000m (3281ft) above sea level #**
Operating rpm range:	**1600rpm**
Typical fuel consumption:	**N/A**
Emission control technique:	**Selective Catalytic Reduction (SCR)**
Reductant tank size:	**60 L (16 US G)**
Plant drive:	**High quality pumps driven via engine PTO's**
Fuel tank capacity:	**450 L (119 US G) - sufficient for a 12 hour shift**
Hydraulic tank capacity:	**445 L (117 US G)**

EU Stage IIIB / US Tier 4i

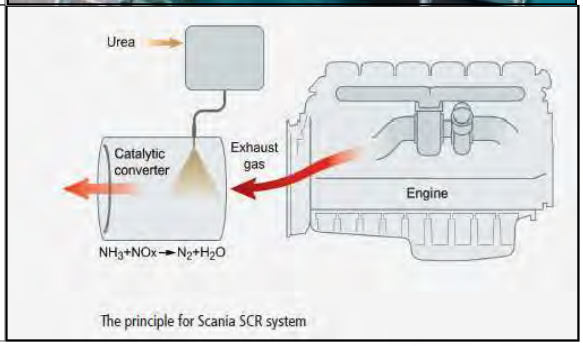
Clutch type:	**Highly efficient, self-adjusting HPTO 12 dry plate clutch with electro hydraulic operation**
Crusher drive:	**Direct drive via wedge belts, Clutch pulley diameter 212mm (8.3") Crusher pulley diameter 1260mm (4' 2")**
Drive tensioning:	**Manual screw tensioners located beside powerunit**

 # For applications outside this range please consult with Powerscreen as the plant performance / reliability may be affected

Selective Catalytic Reduction (SCR)

SCR technology is used for Stage IIIB & Tier 4i to reduce the NOX content in the exhaust gases. A chemical process is started by injecting reductant, a urea & water mixture, into the exhaust gas stream. During injection the water evaporates & the urea breaks down to form ammonia. The ammonia then reacts with the nitrogen gases in the catalytic converter & forms harmless products such as nitrogen gas & water.

Through the use of SCR the exhaust gases are purged of poisonous levels of NOX in the best possible way. The reductant tank holds 60 litres & is heated by the engine's cooling system in order to avoid freezing of the urea solution, urea freezes at -11℃.



The principle for Scania SCR system

Crawler Tracks

Type:	**Heavy-duty tracks**
Pitch:	**190mm**
Longitudinal centers:	**3715mm**
Track width:	**500 mm**
Climbing grade:	**25° maximum**
Speed:	**0.9kph (0.56mph)**
Drive:	**Hydraulic motors**
Tensioning:	**Hydraulic adjuster, grease tension**

Guarding

Wire mesh or sheet metal guards are provided for all drives, flywheels, pulleys & couplings

The guards provided are designed & manufactured to meet CE & ANSI standards

Hinged access guards are provided on the top, side & both ends of the engine

Platforms

A detachable access ladder is provided to gain access to each side of the powerunit

A maintenance platform is provided on one side of the feeder with double row handrails & access ladders.
A platform is also included to gain access between the crusher & the powerunit.

EU Stage IIIA / US Tier 3 only

Plant Controls

Full PLC control panel

Full system diagnostics

Controls fitted to the plant include:

Sequential start up

- **Engine (start/stop/speed)**
- **Crusher (start/stop)**
- **Optional dirt conveyor (start/stop)**
- **Product conveyor (start/stop & raise/lower)**
- **Feeder (start/stop/speed) controls, located on the side of the plant**

Umbilical Control

An umbilical control unit is also supplied as standard with the plant.

Controls tracking function & has a stop button for the plant.

Chassis

Heavy duty I-section welded construction, provides maximum strength & accessibility

Optional Extras

- **Extended hopper**
- **Wire mesh for underscreen**
- **Super tooth or multi tooth jaw plates**
- **Deflector plate under crusher**
- **Dirt conveyor**
- **Magnet prepared**
- **Single pole overband magnetic separator**
- **Twin pole overband magnetic separator**
- **Belt weigher**
- **Electric refuelling pump**
- **Hydraulic water pump**
- **Radio remote control**

(For pricing please refer to your local dealer)

Powerscreen® XR400S Options

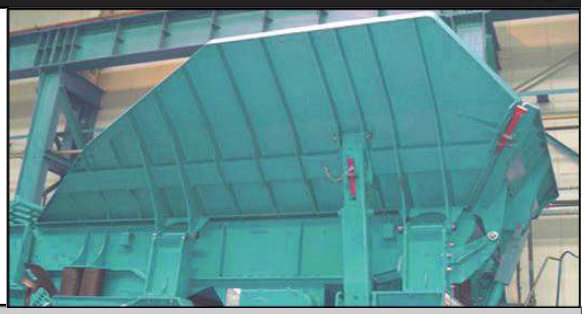
Hopper Extensions

Hopper type: Hydraulic folding extended hopper with over centre struts & wedge-lock system

Hopper length: 4915mm (16' 1")

Hopper width: 3815mm (12' 6")

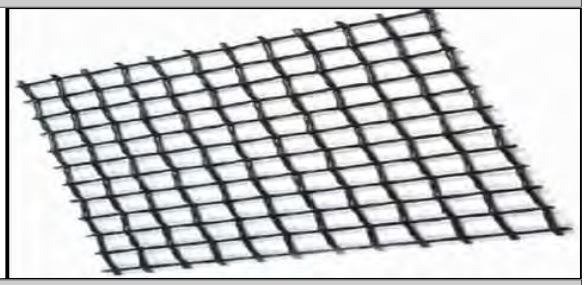
Hopper body: 15mm wear resistant plate, steel ribs



Feeder Under Screen Mesh

Position: Removable wire meshes fitted in lieu of the standard rubber blanking mat, use in conjunction with optional dirt conveyor

Width: 1075mm (3' 6")
Length: 1250mm (4' 1")

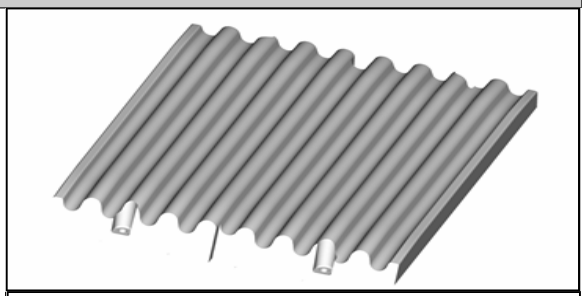


Jaw Profiles

A choice of jaw profiles are available to maximise performance across all applications. All jaw profiles supplied in 18% Manganese as standard. This is the proven material for quarry & recycling applications with an initial hardness of around 230BHN (Brinell Hardness).

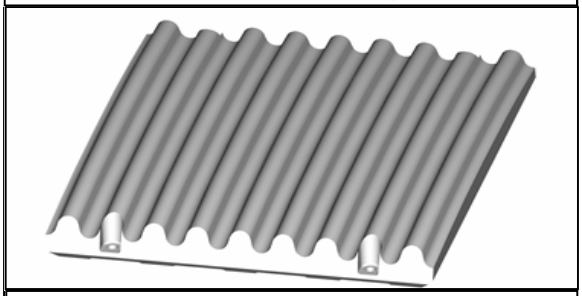
Premium Jaws (Standard offering)

Premium jaws are fitted as standard in all XR400 jaw crushers. They are suitable for most quarry & recycling applications & give an excellent cost per tonne crusher.



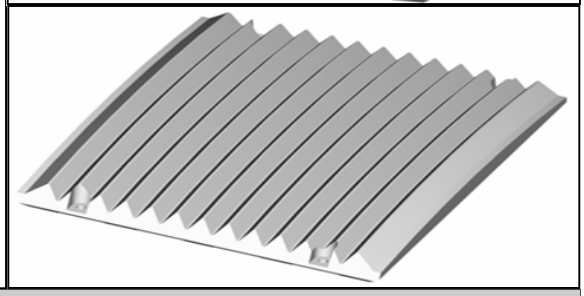
Super Tooth Jaws

For extended life across most quarrying applications. Super tooth has a significantly increased wear life using a deeper profile without comprising strength or product shape.



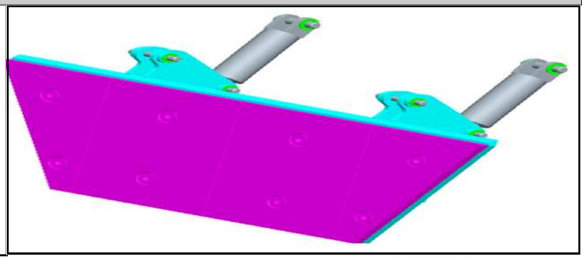
Multi Tooth Jaws

The industry choice for many recycling applications. The "sharper" profile makes the Multi tooth ideal for most recycling applications, particularly those involving concrete. It is also more tolerant when recycling asphalt. Wear life will be reduced on abrasive applications.



Under Crusher Deflector Plate

A hydraulic adjustable deflector plate, increases belt protection on recycling applications. Situated immediately below the crusher outlet point & is fitted with a 15mm thick wear resistant plate. Deflector plate working angle can be adjusted from the PLC control system.

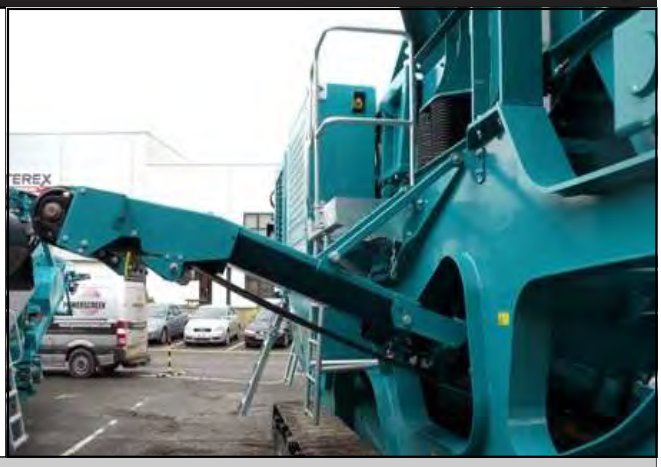


Powerscreen® XR400S Options

SPECIFICATION - Rev 4. 01/08/2012

Dirt Conveyor

Conveyor type:	**Troughed belt conveyor, folds hydraulically for transport**
Width:	**600mm (23.6”)**
Discharge height:	**2.0m (6’5”)**
Stockpile volume:	**12m^3 (16 cu. yd.)**
Drive:	**Direct drive hydraulic motor**
Position:	**Discharge on RHS of plant**



Magnet

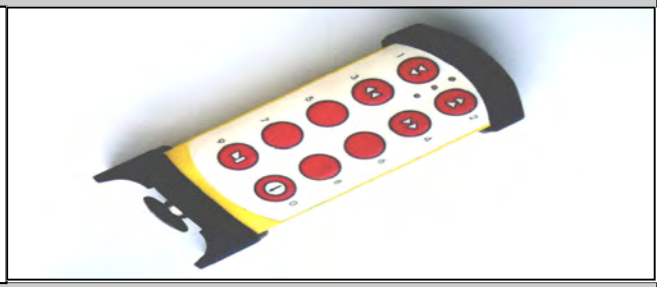
Options:	**Magnet prepared Terex TX440 single pole (S.P.) Terex TX440X twin pole (T.P.)**
Belt width:	**750mm (30”)**
Centres:	**1700mm (67”)**
Drive / Control:	**Direct drive hydraulic motor, pre-set variable speed**
Discharge:	**LHS via stainless shedder plate**
Weight:	**S.P. 975kg (2150lbs) T.P. 1470kg (3240lbs)**

Radio Remote Control

Complete with integrated tracking functions & plant stop button. NB - Only available in certain countries where type approval has been obtained.

Remote can also be used to:

- **Feeder (start/stop)**



Belt Weigher

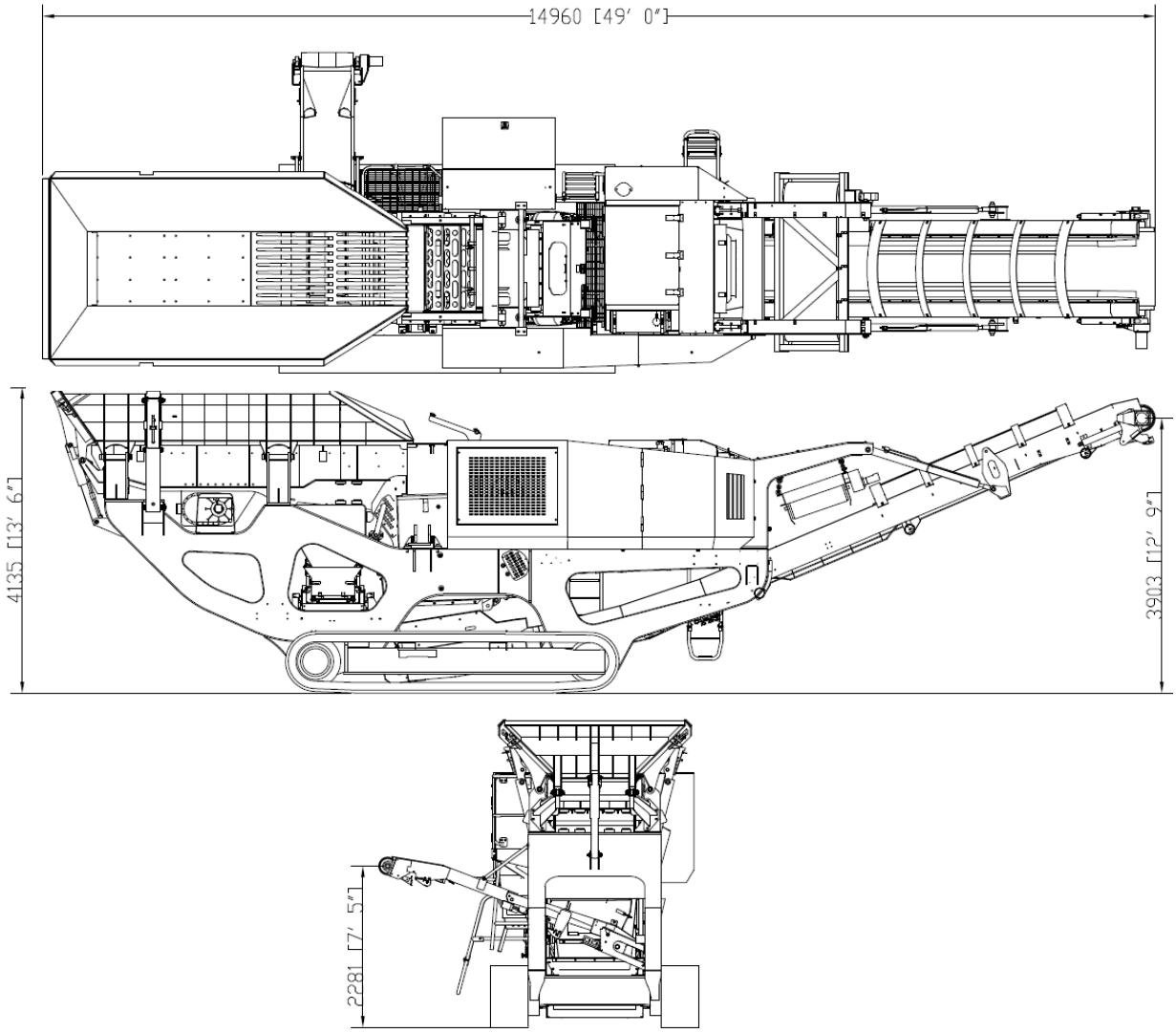
Type:	**Modular scale with stainless load cells, single idler speed wheel & display unit**
Accuracy:	**± 1.0 + 0.5%**
Load cells:	**2 temperature compensated parallelogram-style, stainless steel**
Display:	**Separate read out near control panel**

All specifications subject to change without prior notice

Approximate Plant Weight & Dimensions

Working length:	**14.96m**	**(49’ 0”)**
Working height:	**4.13m**	**(13’ 6”)**
Working width:	**2.8m**	**(9’ 2”)**
	4.3m	**(14’ 1”) including dirt conveyor**
Transport length:	**15.2m**	**(49’ 10”)**
Transport width:	**2.80m**	**(9’ 2”)**
Transport height:	**3.4m**	**(11’ 2”)**
Total plant weight:	**44,750kg**	**(98,656lbs) including magnet & dirt conveyor**
Paint colour:	**RAL 5021**	

XR400S
Working Dimensions



Powerscreen equipment complies with CE requirements.

Please consult Powerscreen if you have any other specific requirements in respect of guarding, noise or vibration levels, dust emissions, or any other factors relevant to health and safety measures or environmental protection needs. On receipt of specific requests, we will endeavour to ascertain the need for additional equipment and, if appropriate, quote extra to contract prices.

All reasonable steps have been taken to ensure the accuracy of this publication, however due to a policy of continual product development we reserve the right to change specifications without notice.

It is the importers' responsibility to check that all equipment supplied complies with local legislation regulatory requirements.

Plant performance figures given in this brochure are for illustration purposes only and will vary depending upon various factors, including feed material gradings and characteristics. Information relating to capacity or performance contained within this publication is not intended to be, nor will be, legally binding.

Terex GB Ltd.
200 Coalisland Road
Dungannon
Co. Tyrone
Northern Ireland
BT71 4DR

Tel: +44(0) 28 8774 0701
Fax: +44(0) 28 8774 6569

E-Mail: sales@powerscreen.com
Web: www.powerscreen.com

Powerscreen® XH320X

Horizontal Impactor

SPECIFICATION - Rev 0. 01-06-2012

POWERSCREEN®
A TEREX BRAND

Specification		XH320X
Total weight		36,540kg (80,469lbs)*
Transport	Length	14.4m (47’ 3”) *
	Width	2.55m (8’ 5”) *
	Height	3.4m (11’ 2”) *
Working	Length	16.15m (53’ 0”) *
	Width	8.60m (28’ 3”) with side conveyor deployed
	Height	4.56m (15’ 0”)
		* = c/w Tier 4 Engine with Pan Feeder & Pre-screen, Hopper, Dirt and Product Conveyor extensions, Magnet
Crusher type:		Twin apron 4 bar impact crusher, feed opening 1130 x 800mm (44.5” x 31.5”)
Powerunit:		Caterpillar C9 ACERT 242 kW (325hp) or Scania DC9 070A 257 kW (350hp)
Paint colour:		RAL 5021

Features & Benefits

The Powerscreen® XH320X Horizontal Shaft Impactor is a highly compact tracked crusher designed to offers both excellent reduction & high consistency of product yield.
The Powerscreen® XH320X is designed to give optimum performance in both quarry & recycling applications & is an ideal mid size contractors machine due to it’s compact design & mobility.

- Output potential up to 320 tph (353 US tph)
- Double deck grizzly feeder with under screen
- Load management system to control feeder speed
- Suitable for a variety of feed materials
- Proven Terex Impact Crusher with hydraulic overload protection, 4 bar rotor & twin apron design
- Crusher speed variation through user friendly PLC control system
- Fully independent under crusher vibrating pan feeder
- Modular conveyor with raise/lower facility to aid clearance of rebar
- Powerful overband magnet (optional)
- Designed to give optimum performance in both quarry, demolition & mining applications
- Latest generation powerunits that meet EU Stage IIIB / US Tier 4i & EU Stage IIIA / US Tier 3 emissions legislation
- Hydraulically operated clutch & highly fuel efficient direct drive system
- SR X configuration optional with 2 deck 3.3m x 1.5m (11’ x 5’) post screen with detachable 2 deck post screen and fines conveyor

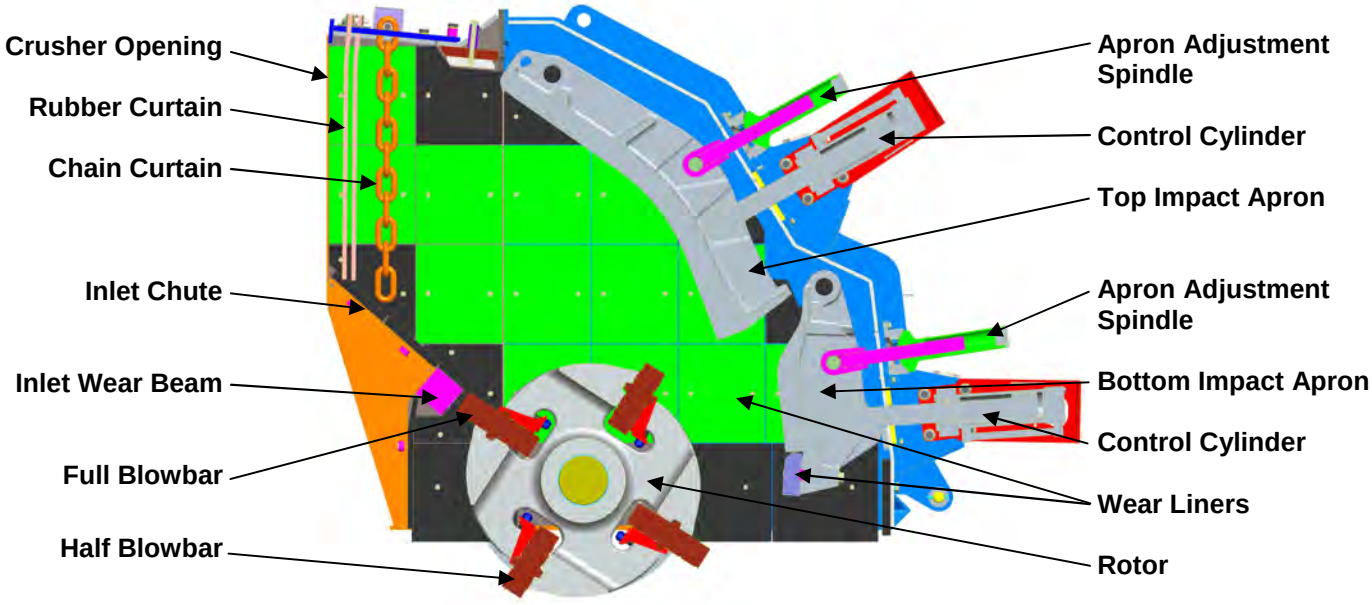
Application

Aggregate
- Blasted rock
- River rock

Recycling
- C & D waste
- Foundry waste

Mining
- Processed ores
- Processed minerals

Principal components of the Powerscreen® XH320X Impact Crusher



Principles of Operation

Material enters via crusher opening & slides down the inlet chute where it is struck by the blowbars fixed within the rotor. This initial impact breaks the material which is then accelerated towards the top apron where more reduction takes place on impact. This material then falls back onto the blowbars & the cycle is repeated until the material is small enough to pass between the top apron & blowbar. Further reduction occurs on the bottom apron until the material can again pass through the gap & discharge from the underside of the crusher.

Should an un-crushable object enter the chamber, the overload cylinders will relieve & allow the object to pass. The cylinders will then return to the pre-set crushing position. The pre-set gap is adjusted by turning the adjustment spindle whilst the weight of the apron is held on the cylinder (hydraulic assist).

The hydraulic cylinders are pre-loaded to minimise apron bounce & wear on the cylinders. This arrangement also greatly reduces the oversize produced & is Patent Pending GB2455203

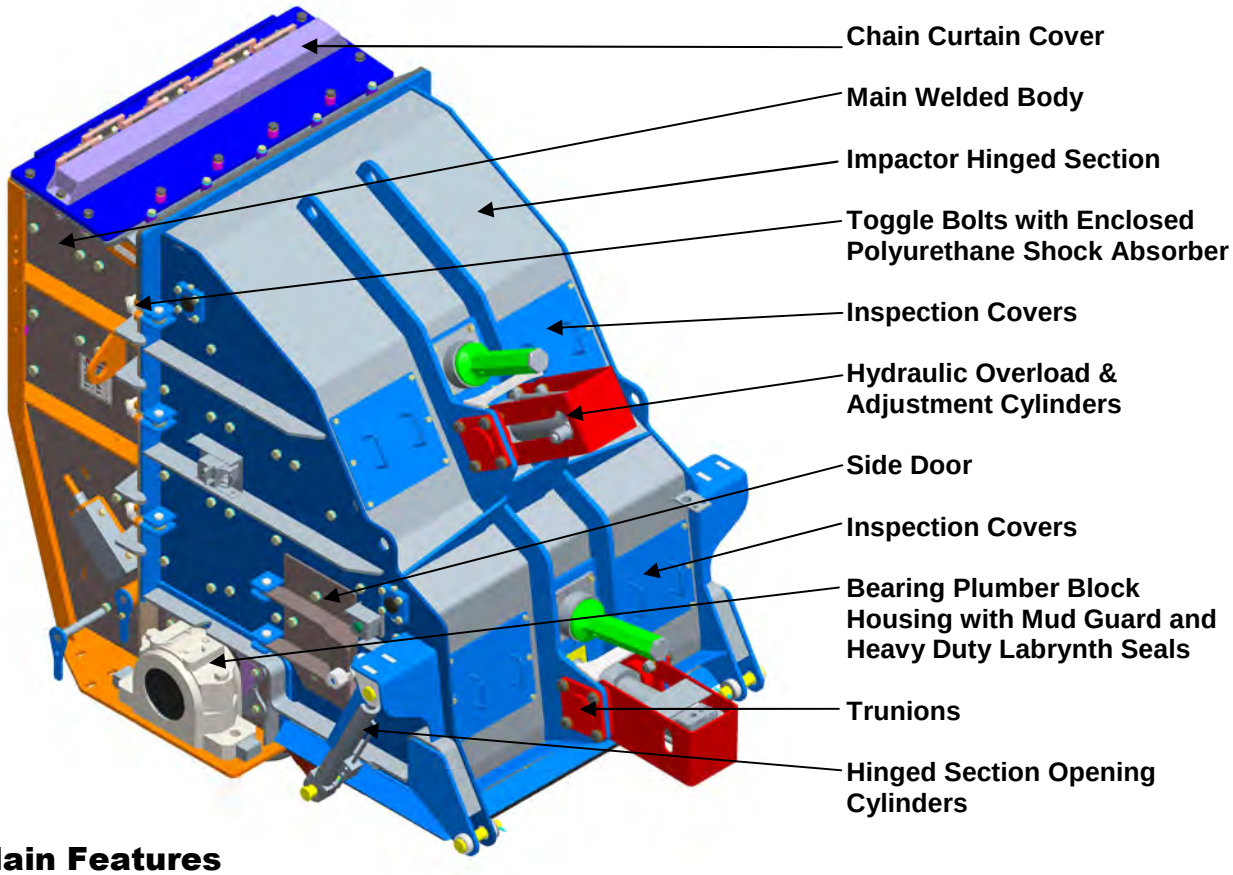
Crusher Specification

- **Feed opening:** 1130mm x 800mm (44.5” x 31.5”)
- **Maximum piece size*** 450mm^3 (18in^3) / 780mm (31”) diagonally / 800x500x250mm (31x20x10”) slab
- * depending on material & blowbar spec
- **Rotor width:** 1100mm (43.3”)
- **Rotor diameter:** 1040mm (41”)
- **Number of aprons:** 2
- **Maximum Clearance:** 180mm (7”) on both aprons
- **Maximum OSS setting:** 150mm (6”) upper apron, 75mm (3”) lower apron
- **Minimum CSS setting:** 50mm (2.4”) upper apron, 20mm (0.75”) lower apron
- **Number of blowbars:** 4
- **Blowbar removal:** Vertically
- **Blowbar configuration:** 2 full & 2 half (Optional 4 full)
- **Setting adjustment:** Hydraulic assist
- **Overload protection:** Hydraulic
- **Rotor speeds:** 606 - 740rpm (33 - 42 m/s) (108 - 137 ft/s)
- **Applications:** Demolition/Recycling/Quarry
- **Crusher weight:** 8500kg (18,740lbs)
- **Full Blowbar weight:** 220kg (485lbs)
- **Side liners:** 20mm (0.75”) thick, abrasive resistant steel

All specifications subject to change without prior notice

POWERSCREEN® A TEREX BRAND

Powerscreen® XH320X - Impact Crusher



Main Features

Crusher body:	**Precision Fabricated from structural steel plate & fully lined with replaceable 500 HB abrasion resistant liner plates. Hinged side door allows access to apron tips & rotor for gap measurements & inspection. Complete hinged section opens hydraulically to allow blowbar removal & replacement, apron & liner replacement or major maintenance**
Rotor:	**Structural steel & fitted with four reversible, replaceable & fully clamped blowbars**
Bearings:	**Double row self aligning spherical roller bearing fitted each end of rotor**
Aprons:	**Cast manganese steel with replaceable 500 HB abrasion resistant wear plate on tip of bottom apron**
Drive:	**Direct through wedge belts with tensioning system on powerunit**
Lubrication:	**Grease lubricated rotor bearings fitted with inner & outer independently lubricated heavy duty labyrinth seals**
Blowbars:	**Martensitic steel come as standard, High chrome & Ceramic Blowbars optional**

This plant is designed for both demolition & quarrying applications. When fitted with Martensitic or Ceramic Blowbars the crusher will tolerate small quantities of steel reinforcing bar in the feed.
However, the machine is not designed to accept large pieces of steel or other un-crushable objects, & the feed material should be assessed / inspected for suitability prior to crushing. It is vitally important that large pieces of steel or similar un-crushable objects are not allowed to enter the crushing chamber as severe damage & injury may occur.
When high chrome bars are fitted *all* steel should be removed from the feed material. The machine should only be used on quarry applications or clean materials such as asphalt.

Available Options for Powerscreen® XH320X - Impact Crusher

Blowbar Jib Crane

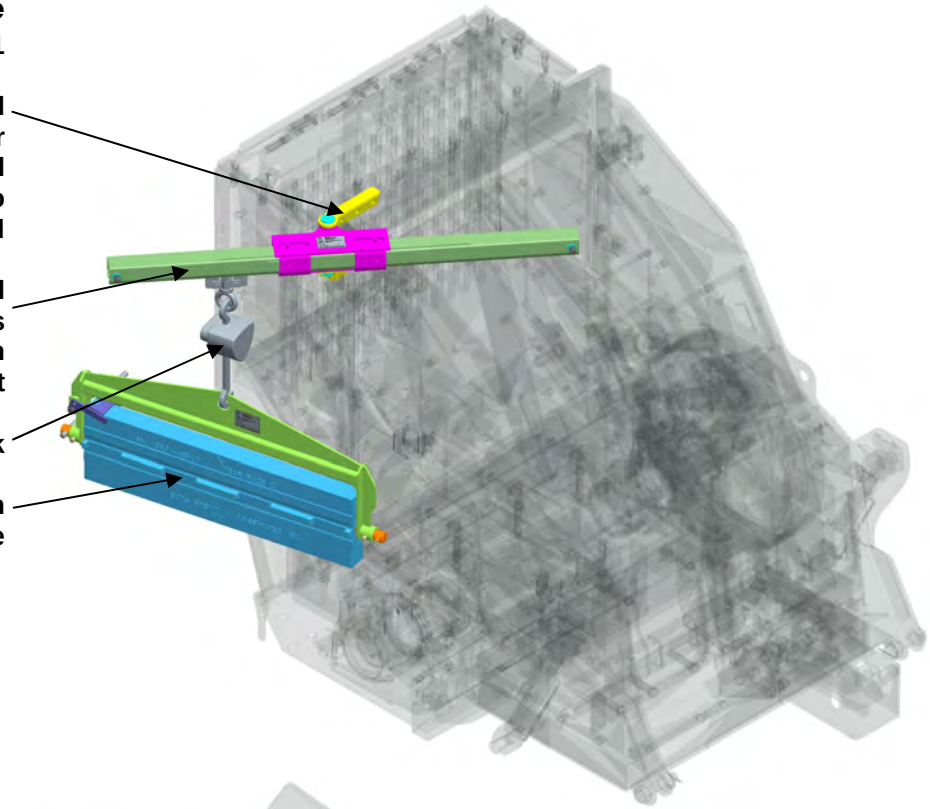
Part No. CR014-054-601

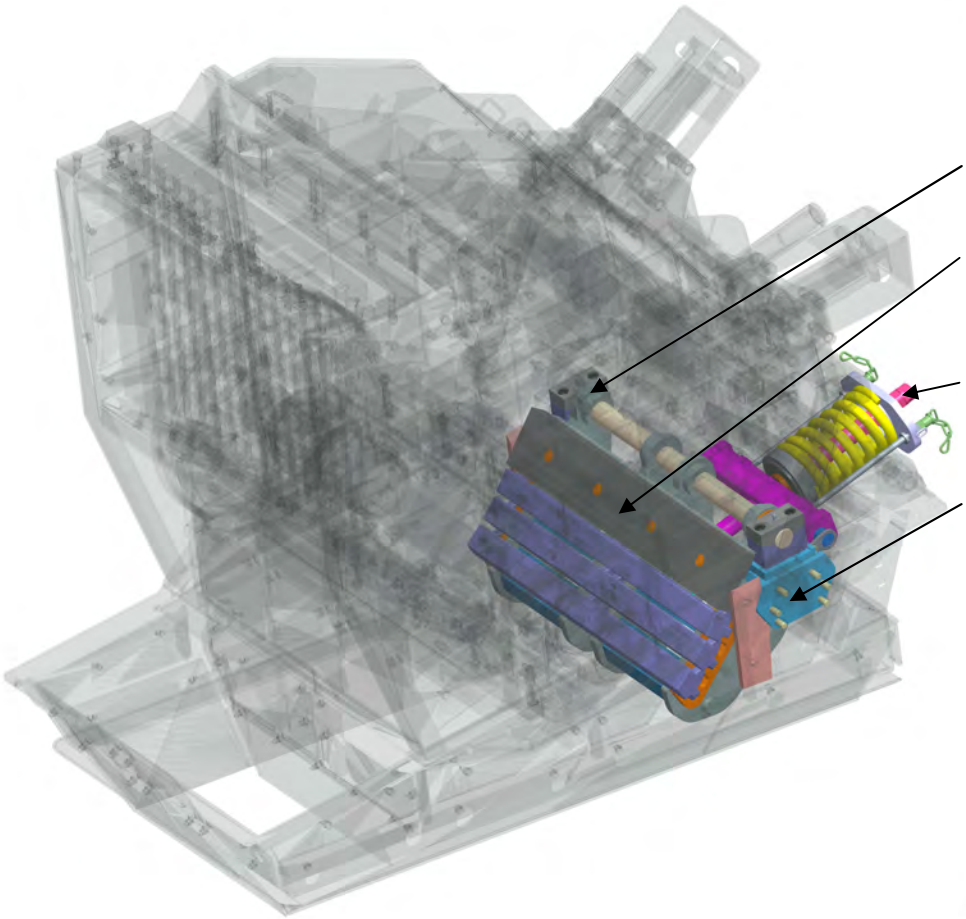
Fixes to pre-existing allocated mounting points on chamber fixed body- Kit provides all necessary parts with no rework required

Pivot and track facilitates full access to blowbar and swings clear of body during operation with minimal footprint

500 kg s.w.l. pulley block

Designed to work with chamber blowbar cradle





Grinding Path

Part No. CR014-193-601

Lubricated split pivot blocks for ease of maintenance

Self retained manganese steel grinding rails with AR steel top plate

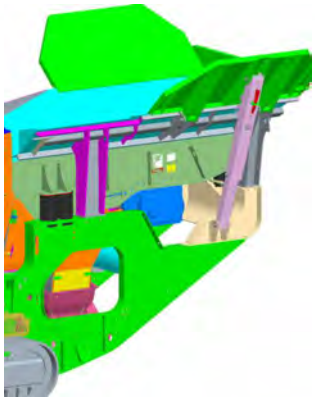
Lubricated adjusting spindle with provision to fit socket for ease of adjustment

Kit provides all necessary parts to retrofit to existing feedboot with no rework required

Hopper

Low profile hopper as standard, rigid hopper sides, no setup required, mounted directly to chassis.

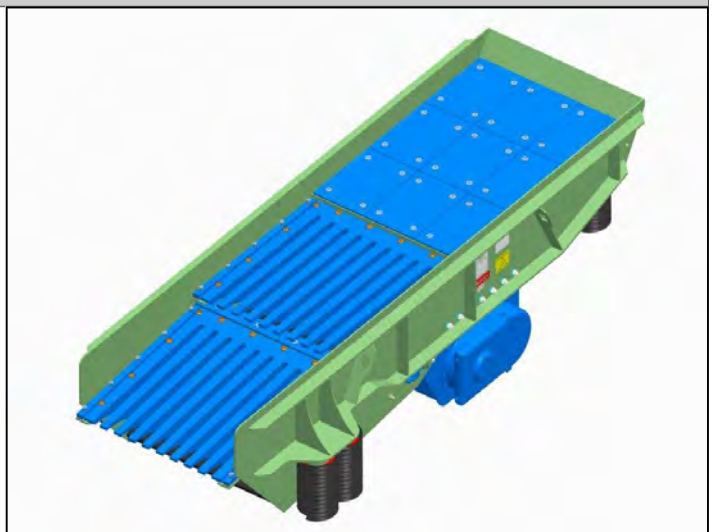
Hopper length:	**4.04 m (13’ 3”)**
Hopper width:	**2.1 m (83”)**
Hopper capacity:	**3.6m^3 (4.7 cu. yd.) level**
Hopper body:	**8mm (0.31”) thick abrasion resistant steel plate**



Grizzly Feeder

Vibrating grizzly feeder pan with efficient, self cleaning integral two stage grizzly section.

Type:	**Fully sprung vibrating pan**
Length:	**3.87m (12’ 8”)**
Width:	**1080mm (42.5”)**
Pan:	**10mm (0.4”) thick abrasion resistant base plate**
Drive unit:	**Twin heavy duty cast eccentric shafts, running in spherical roller bearings, gear coupled at drive end**
Drive:	**Flange mounted hydraulic motor**
Grizzly:	**Two stepped bolt in cartridge sections with 950mm (37.4”) long self cleaning fingers set at 42mm (1.65”) nominal spacing. Optional Grizzly cartridges 30mm & 60mm, Optional Punch Plate Cartridges 30mm, 45mm & 60mm.**
Screen:	**Removable rubber blanking mat fitted as standard, mesh screens optional**
Control:	**Variable speed control via control panel & on optional radio remote where specified**
Chute:	**Plant features bypass chute with internal two way flap door that controls the direction of fines, either forward onto product belt or down onto optional side conveyor where specified**



Product Conveyor

Common features:	**Conveyor is shallow troughed with rollers at the lower end & a stainless steel tray design below magnet discharge area, fully tunnelled with minimal snag areas**
Belt specification:	**EP630/4 with 6mm top & 2mm bottom heavy duty rubber covers, vulcanised joint**
Belt width:	**1000mm (40")**
Feedboot:	**Fabricated steel with abrasion resistant steel liners**
Impact area:	**Low friction impact bars (Under crusher pan feeder optional)**
Skirting:	**Fully skirted in wear resistant rubber up to magnet discharge area**
Drive:	**Hydraulic motor direct to head drum**
Lubrication:	**Centralised greasing bank, for shaft bearing lubrication**
Dust covers:	**Aluminium removable dust covers are fitted over the exposed section of the conveyor. Optional head drum hood available**
Belt adjustment:	**Belt tensioning using screw adjusters at head drum**
Pressure sensor:	**Designed to stop plant feed if the discharge conveyor slows or stops**

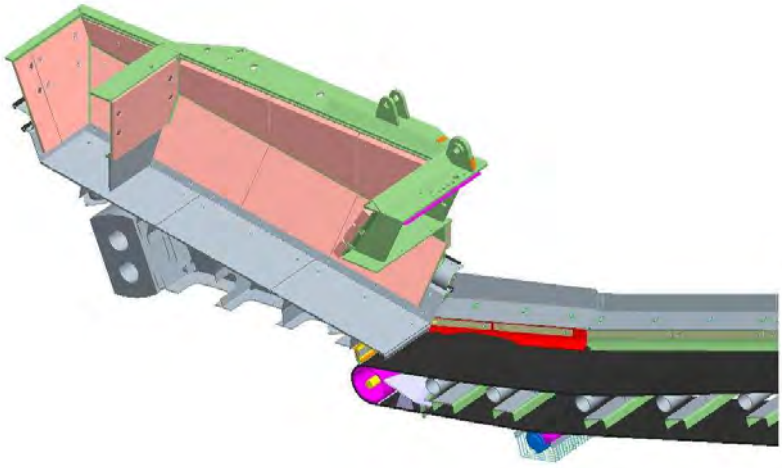
Product Conveyor Standard Configuration

Conveyor features:	**Fully removable modular unit**
	Hydraulic raise & lower facility to increase clearance & aid rebar removal
	Hydraulic raise & lower facility can be operated whilst crushing
Discharge height:	**3.45m (11' 4") in fully raised position**
Stockpile volume:	**61m^3 (80 cu. yd.)**
Discharge height:	**4.0m (13' 2") in fully raised position (extended conveyor)**
Stockpile volume:	**61m^3 (80 cu. yd.)**

Product Conveyor SR X Configuration

Conveyor features:	**Fully removable modular unit**
	Manual hydraulic raise & lower facility

Product Conveyor & Pan Feeder Interface



Vibrating Pan Feeder

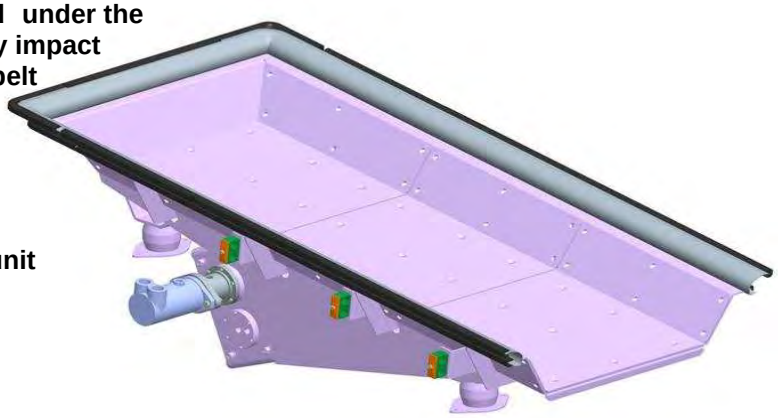
Type: Steel bodied vibrating feeder fitted with abrasion resistant liners, mounted under the crusher & designed to prevent any impact damage to the product conveyor belt

Width: 990mm (39”)

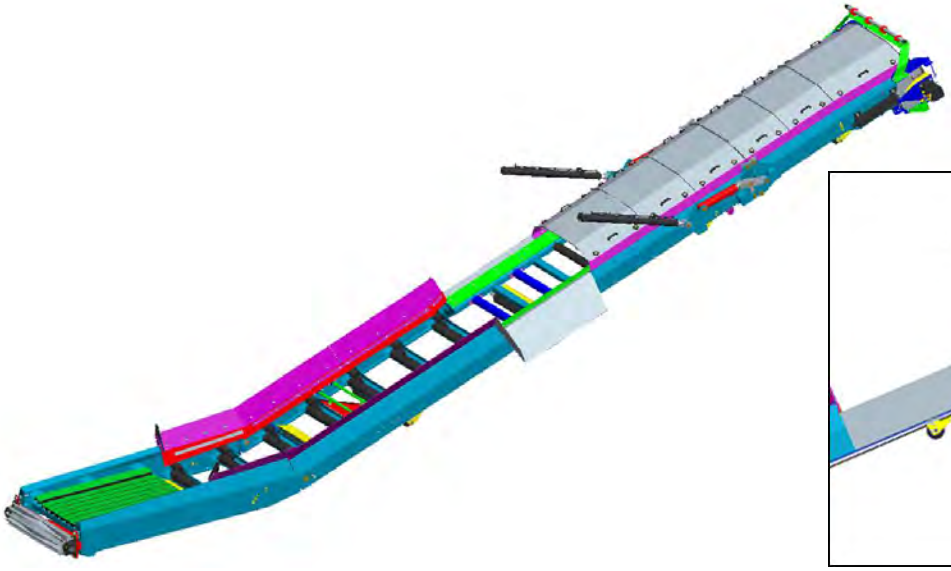
Length: 2.44m (8’)

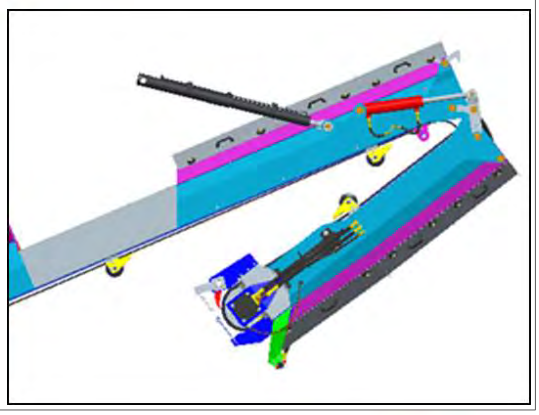
Drive: Hydraulic, out of balance exciter unit

Speed: 1150 - 1200rpm fixed



Full Length Product Conveyor





Crawler Tracks

Type:	**Heavy duty, 2 speed, bolt on**
Track centres:	**XH320: 3300mm (10' 10")** **XH320SR: 3840mm (12' 7")**
Shoe width :	**400mm (16")**
Gradient:	**30˚maximum**
High speed :	**1.0kph (0.62 mph)**
Low speed :	**0.3kph (0.2 mph)**
Drive :	**Hydraulic**
Tensioning:	**Hydraulic adjuster, grease tensioned**

Guarding

Wire mesh or sheet metal guards are provided on all drives, flywheels, pulleys & couplings

The guards provided are designed & manufactured to CE & ANSI standards

Platforms

Platforms are provided for maintenance on one side of the feeder & Impactor. These are fitted with double row handrails & access ladders

Platforms are also provided to gain access to the rear of the crusher & the powerunit
Galvanised walkways as standard

Dust Suppression System

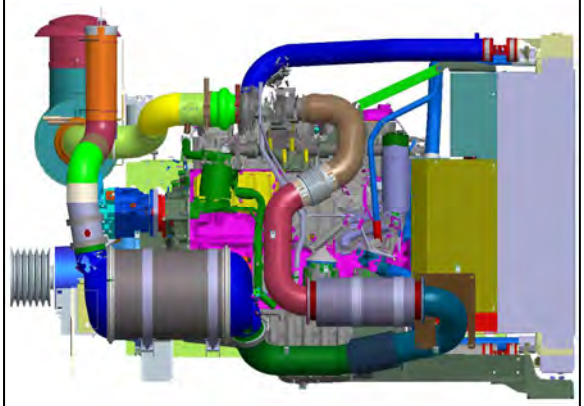
Spray bars with atomiser nozzles are mounted over the product conveyor feed & discharge points, piped to an inlet manifold for customer water supply or optional pump

Type:	**Clean water multi atomising nozzles**
Inlet:	**Single point**
Inlet pressure:	**3 Bar (44 psi)**
Water supply:	**24 L/min (6.34 G/min) minimum**
Frost protection:	**Via system main valves**
Pump:	**Optional**

Powerunit

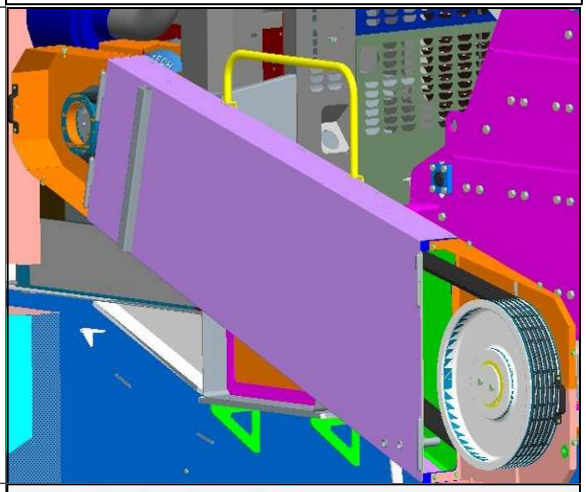
EU Stage IIIA / US Tier 3:	**Caterpillar C9 ACERT**, 6 cylinder, direct injection 242 kW (325hp) at 2000rpm *
Operating Conditions:	Ambient temp. +40℃ & –12℃ (104ºF & 10ºF) altitudes up to 1000m (3281ft) above sea level. #
Operating rpm range:	1700 - 2100rpm
Typical fuel consumption:	38 L/hr (10 G/hr) Up to 6.5 tonnes tons of crushed product per litre of fuel consumed (25 tons/G)
Plant drive:	High quality pumps driven via belts from engine
Fuel tank capacity:	500L (132 US G) - Sufficient to run a 12 hour shift

EU Stage IIIB / US Tier 4i :	**Scania DC09** 083A 5 cylinder, turbo**,** 257 kW (350hp) at 2100rpm,
Operating Conditions:	Ambient temp.+40℃ & –12℃ (104ºF & 10ºF) at altitudes up to 1000m (3281ft) above sea level. #
Operating rpm range:	1700 - 2100rpm
Typical fuel consumption:	N/A
Emission control technique:	Selective Catalytic Reduction (SCR)
Reductant Tank Size:	60L (16.8 US G)
Plant drive:	High quality pumps driven via engine PTO's
Fuel tank capacity:	500 L (132 US G) - Sufficient to run a 12 hour shift



Hydraulic tank capacity:	550 L (145 US G)
Clutch type:	Highly efficient, Self-adjusting HPTO 12 dry plate clutch with electro hydraulic operation.
Crusher drive:	Direct drive via wedge belts, Clutch pulley diameter 280mm (11") Crusher pulley diameter 800mm (31.5") Crushing performance can be tuned, by changing engine speed between 1700 - 2100rpm on the PLC without significant loss of engine performance
Crusher drive tensioning:	Manually adjustable screw tensioners located under Powerunit

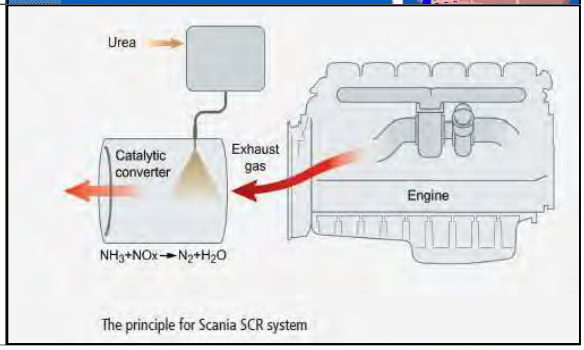
For applications outside this range please consult with Powerscreen as theplant performance / reliability may be affected.



Selective Catalytic Reduction (SCR)

SCR technology is used for Stage IIIB & Tier 4i to reduce the NOX content in the exhaust gases. A chemical process is started by injecting reductant, a urea & water mixture, into the exhaust gas stream. During injection the water evaporates & the urea breaks down to form ammonia. The ammonia then reacts with the nitrogen gases in the catalytic converter & forms harmless products such as nitrogen gas & water.

Through the use of SCR the exhaust gases are purged of poisonous levels of NOX in the best possible way. The Reductant tank holds 60 litres & is heated by the engine's cooling system in order to avoid freezing of the urea solution, urea freezes at -11℃.



The principle for Scania SCR system

Chassis

Heavy Duty I-Section welded construction, provides maximum strength & accessibility

8mm thick web
15mm thick flange

Modular chassis between Pre-Screen & VGF

Plant Controls

Full PLC control system

320 x 240 pixel backlit screen

Complete pictorial user controls

Multi-function backlit menu buttons

High definition screen

Full system diagnostics

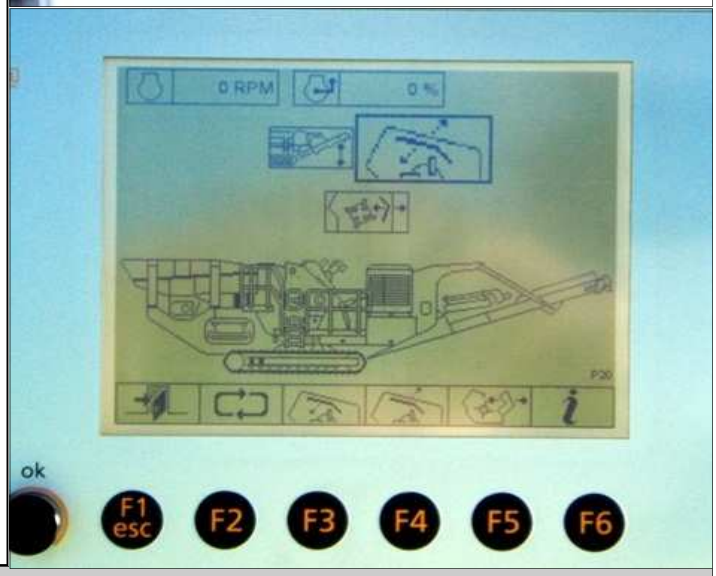
A navigation wheel is fitted onto the control system to operate the following items:

Sequential start up

- **Engine/Crusher speed**
- **Feeder (Start/Stop/Speed)**
- **Product conveyor & pan feeder (Start/Stop)**
- **Product conveyor Raise/Lower**
- **Dirt conveyor**
- **Crusher control**

(SR X Configuration)

- **Screen & Fines**
- **Recirculating conveyor, cross conveyor & optional stockpiling conveyor**



Umbilical Control

An Umbilical Control Unit is supplied as standard with the plant

Controls tracking function & has a stop button for the plant

Sizing Screen

Type:	**4 Bearing, Double deck vibrating screen**
Size:	**3350mm x 1525mm (11’ x 5’)**
Location:	**Beneath product conveyor**
Drive:	**Hydraulic drive**
Top deck: **Bottom deck:**	**45mm aperture fitted as standard** **Optional mesh**
Lubrication:	**Grease nipples (4 in total)**
Access:	**Screen & Fines conveyor can be lowered for maintenance**

Top deck - Transfer Conveyor

Belt type:	**Plain Belt, EP400/2 with 5mm top & 1.5mm bottom rubber covers & vulcanised joint**
Belt Width:	**500mm (20”)**
Drive:	**Direct drive hydraulic motor**
Lubrication:	**Grease nipples on bearings**

Oversize - Recirculation Conveyor

Conveyor type:	**Chevron type troughed belt.**
Belt type:	**EP400/3 with 3mm top & 1.5mm bottom rubber covers, 25mm cleats & vulcanised joint**
Conveyor:	**Returns oversize material from the top deck back to the impactor for crushing** **Conveyor can be slewed to enable oversize material to be stockpiled at the side of the plant**
Width:	**500mm**
Drive:	**Direct drive hydraulic motor**
Lubrication:	**Grease nipples on tail shaft bearing, remote grease nipples for head drum**

Fines - Product Conveyor

Conveyor type: Plain troughed belt

Belt type: EP400/2 with 5mm top & 1.5mm bottom covers, vulcanised joint

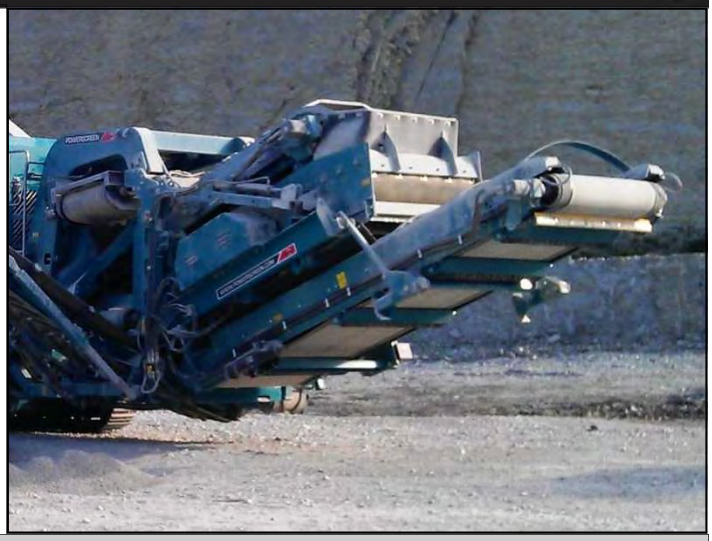
Width: 1400mm (55")

Discharge height: 2.92m (9' 7")

Stockpile volume: 37m^3 (48 cu. yd.)

Drive: Direct drive hydraulic motor

Lubrication: Head drum - remote greasing, nipples on tail shaft bearings



Bottom Deck - Transfer Conveyor

Function: Transfers material from bottom deck of sizing screen to optional plant mounted stockpiling conveyor or re-circulating conveyor

Belt type: EP400/2 with 5mm top,1.5mm bottom covers, vulcanised joint

Width: 500mm (20")

Drive: Direct drive hydraulic motor

Lubrication: Grease nipples on head & tail shaft bearings

Optional Extras

- Four full size hammers in lieu of two full & two half hammers
- High chrome blowbars
- Ceramic Blowbars
- Hydraulic folding extended hopper
- Single pole overband magnetic separator
- Twin pole overband magnetic separator
- Dirt conveyor
- Magnet Prepared
- Plant lighting
- Radio remote control
- Refuelling pump
- Optical belt weigher
- Hydraulic water pump for dust suppression (For pricing please contact your local dealer)

Feeder Underscreen Mesh

Position: Replaces standard blanking mat, used in conjunction with optional side conveyor

Sizes: 10,20,30,40,50mm

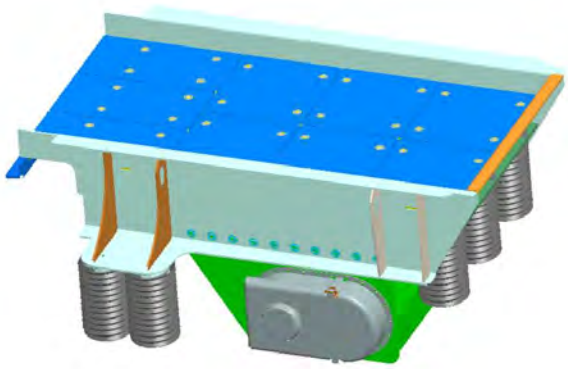
Powerscreen® XH320X Options

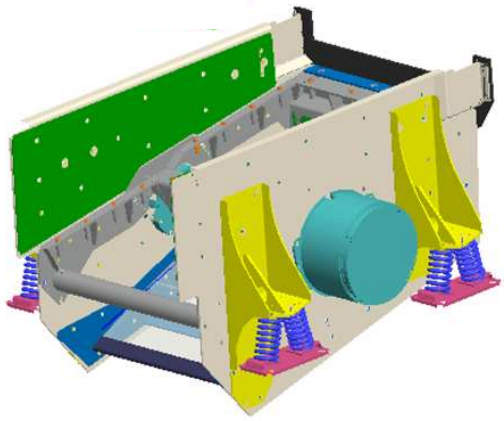
Pan Feeder

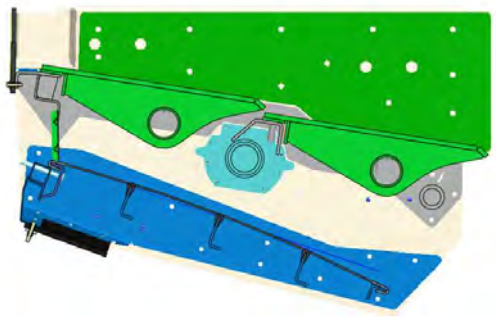
Pan type:	**Sprung vibrating pan**
Vibrating unit:	**Twin heavy duty cast eccentric shafts running in spherical roller bearings, gear coupled at drive end, flange mounted hydraulic motor**
Dimensions:	**Length: 2.15m (7') Width: 1.08mm (3' 6")**
Pan:	**12mm thick replaceable abrasion resistant liners**

Live Pre-screen

Pre-screen:	**Sprung vibrating unit with stepped finger bofor deck**
Vibrating unit:	**Single shaft, out of balance weights, flange mounted hydraulic motor**
Bofor deck:	**2 stepped bolt in cartridges 50mm (2") nominal spacing 9mm throw 1000rpm screen speed**
Dimensions:	**Length: 2.0m (6' 7") Width: 1.06m (36")**
Mesh deck:	**38mm (1.5") nominal spacing 17º incline**
Dimensions:	**Length: 1.57m (5' 2") Width: 1.06m (36")**
Chute:	**Bypass chute with internal 2 way flap door fitted, to control direction of fines, either forward onto the product belt or onto the optional side conveyor (if blanking mat is fitted)**
Modular section:	**Hopper & feeder mounted on removable modular sub frame**



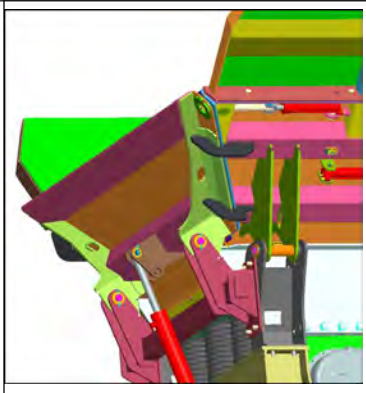


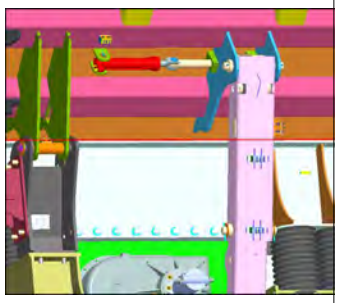


Pre-Screen Hopper

Hydraulic folding hopper with over centre struts Hydraulic hopper lock system operated at ground level

Hopper width:	**2.54 m (8' 4")**
Hopper capacity:	**6.25m^3(8.2 cu. yd.)**
Hopper body:	**8mm (0.31") thick abrasion resistant steel plate**





Pre-Screen Hopper (Extensions)

Hydraulic folding hopper with over centre struts Hydraulic hopper lock system operated at ground level

Hopper width:	**4.0 m (13' 2")**
Hopper capacity:	**9.0m^3(11.7 cu. yd.)**
Hopper body:	**8mm (0.31") thick abrasion resistant steel plate**

Dirt Conveyor

Conveyor type:	**Steel troughed roller, hydraulic folding**
Width:	**650mm (26")**
Discharge:	**2.6m (8' 6")**
Stockpile volume:	**26m^3 (85 cu. yd.)**
Drive:	**Direct drive hydraulic motor**
Position:	**Discharge on RHS of plant std LHS variant available**

Extended Dirt Conveyor

Conveyor type:	**Steel troughed roller, hydraulic folding**
Width:	**650mm (26")**
Discharge:	**3.7m (12' 2")**
Stockpile volume:	**75m^3 (85 cu. yd.)**
Drive:	**Direct drive hydraulic motor**
Position:	**Discharge on RHS of plant LHS variant available**

Powerscreen® XH320X Options

Midsize - Stockpiling Conveyor

Function:	**Stockpiles material from bottom deck, via side transfer conveyor**
Conveyor type:	**Chevron type troughed belt**
Belt type:	**EP400/3, 3mm top, 1.5mm bottom covers, 25mm cleats, vulcanised**
Width:	**500mm (20”)**

Discharge Height: 4.45m (14’ 7”)

Stockpile volume: 131m^3 (171cu. yd.)

Drive:	**Direct drive hydraulic motor**
Lubrication:	**Head drum - remote greasing, nipples on tail shaft bearings**

Overband Magnet

Magnet type:	**Terex TX440 Single Pole (S.P.) & Twin Pole (T.P.) available.**
Belt width:	**750mm (30”)**
Centres:	**1700mm (67”)**
Magnet block:	**S.P. 1050mm x 530mm (41” x 21”) T.P. 1042mm x 672mm (41” x 26”)**
Drive/Control:	**Direct drive hydraulic motor / Pre-set variable speed**
Weight:	**S.P. 975kg / T.P. 1470kg**

Blowbars

Two full size Martensitic & two half size Manganese blowbars

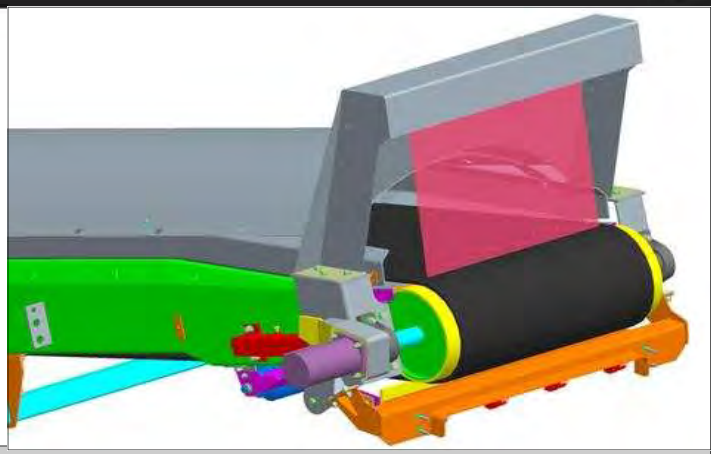
Two further options are available:

High Chrome:	**Suitable for medium to hard rock applications with no steel present in feed. Good wear characteristics**
Ceramic:	**Suitable for applications with limited steel in feed. Improved wear characteristics over standard martensitic**
4 full blowbars:	**Available in all options**

Belt Weigher

XH320X:
Optical belt scale, monitors material volume
Can be converted into mass & downloaded to hand held PDA unit via Bluetooth
PDA unit included in kit

XH320SR X:
Single idler belt weigher with integrator &
Speed-sensing wheel fitted to fines conveyor



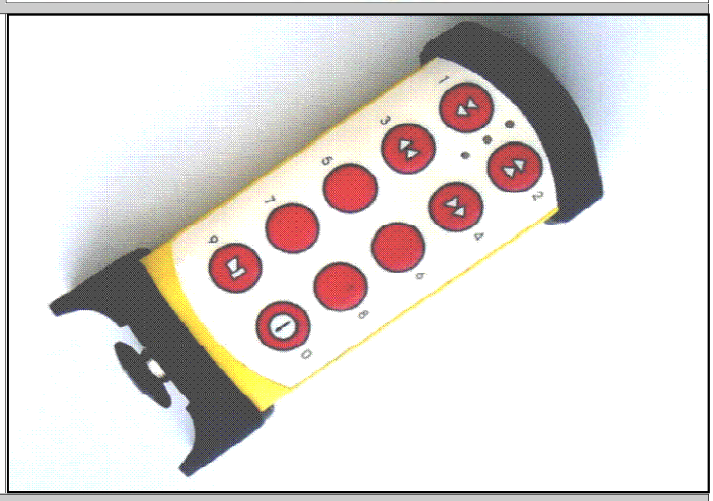
Radio Remote Control

Complete with integrated tracking functions & plant stop button

NB - Only available in certain countries where type approval has been obtained

Remote can also be used for:

- **Feeder (stop/start/speed)**
- **Product conveyor (raise/lower)**
- **Open top apron**



Electric Refuelling Pump

A 24 volt refuelling pump, allows fuel to be drawn from a remote source. Fuel transfer rate is 50 L/min (13 G/min)

Plant Lighting

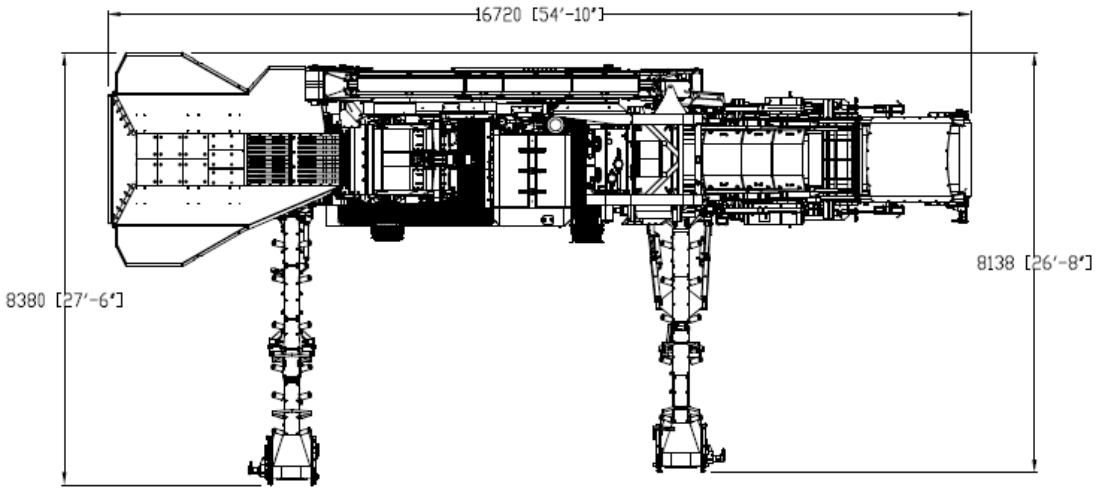
Plant lighting kit available, contains two bi-directional working lamps.

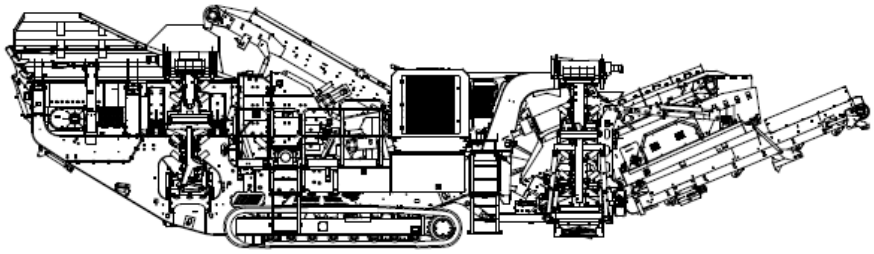
Both activated remotely from control panel

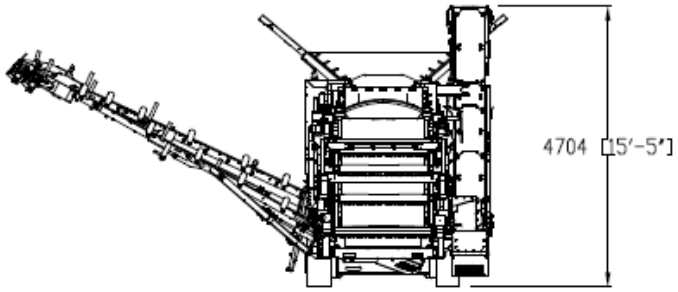
Approximate Plant Weights & Dimensions

Working length:	**16.15m (53' 0")**
Working height:	**4.56m (15' 0")**
Working width:	**8.6m (28' 3") with extended dirt conveyor deployed**
Total plant weight:	**36,540kg (80,469lbs) ***
	*** = c/w Tier 4 Engine with Pan Feeder & Pre-screen, Hopper, Dirt and Product Conveyor extensions, Magnet**
Paint colour:	**RAL 5021**

XH320X
Working Dimensions





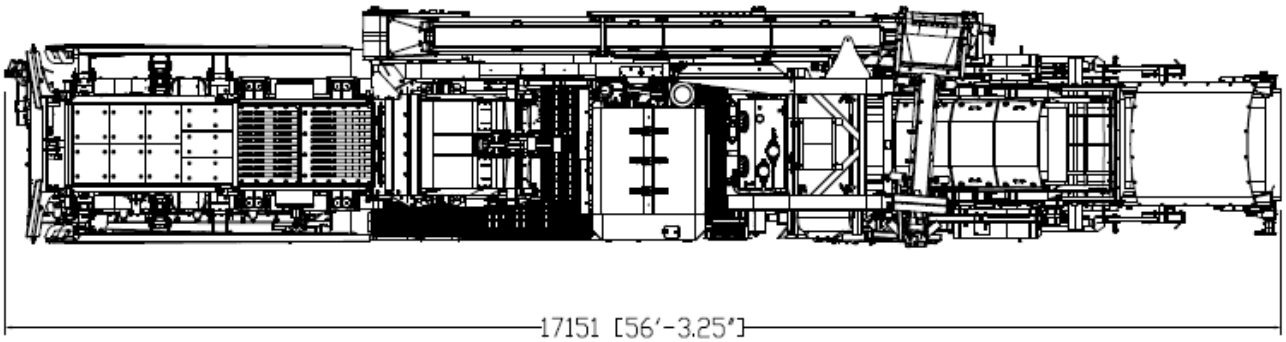


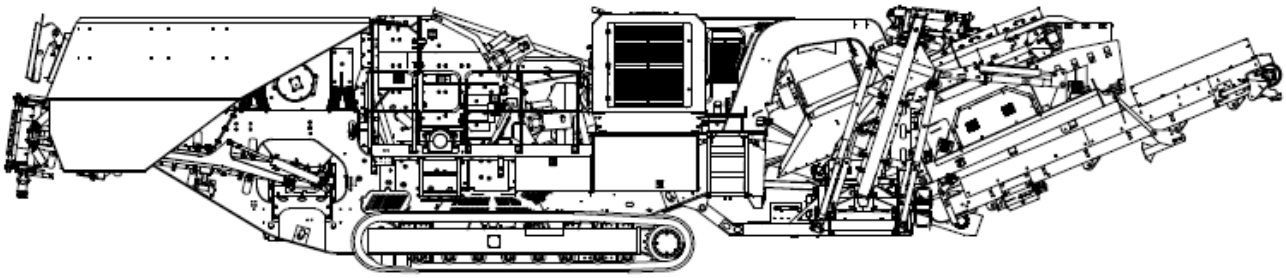
Approximate Plant Weights & Dimensions

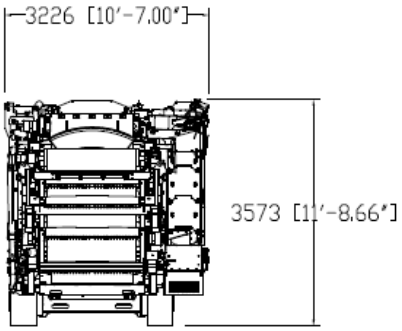
Transport length: **17.15m (56’ 3”)**
Transport height: **3.4m (11’ 2”)**
Transport width: **3.58m (11’ 9”)**

Paint colour: **RAL 5021**

XH320SR X
Transport Dimensions







Powerscreen equipment complies with CE requirements.

Please consult Powerscreen if you have any other specific requirements in respect of guarding, noise or vibration levels, dust emissions, or any other factors relevant to health and safety measures or environmental protection needs. On receipt of specific requests, we will endeavour to ascertain the need for additional equipment and, if appropriate, quote extra to contract prices.

All reasonable steps have been taken to ensure the accuracy of this publication, however due to a policy of continual product development we reserve the right to change specifications without notice.

It is the importers' responsibility to check that all equipment supplied complies with local legislation regulatory requirements.

Plant performance figures given in this brochure are for illustration purposes only and will vary depending upon various factors, including feed material gradings and characteristics. Information relating to capacity or performance contained within this publication is not intended to be, nor will be, legally binding.

Terex GB Ltd.
200 Coalisland Road
Dungannon
Co. Tyrone
Northern Ireland
BT71 4DR

Tel: +44(0) 28 8774 0701
Fax: +44(0) 28 8774 6569

E-Mail: sales@powerscreen.com
Web: www.powerscreen.com

D. EQUIPMENT CALIBRATION CERTIFICATES

E. NOISE DURING CONSTRUCTION PHASE

E.1 Extract from Appendix D AS 2436 - Section 4.6

AS2436:2010 Appendix D

Section 4.6

In demolition work alongside occupied premises there should, if possible, be a break in solid connections, e.g. concrete paving, between the working area and the adjoining buildings. This will reduce the transmission of vibration and structure-borne noise. Care should be taken that any such break is of no structural significance in relation to the planned system of demolition. The break could result in premature collapse due to lack of continuity or restraint. Care should be taken not to drop materials from a height either into or out of trucks. The surfaces on to which the materials are being moved should be covered by some resilient material. Particular care should be taken during the loading and unloading of scaffolding. Where material cannot be lowered in skips or by other means, it is recommended that properly constructed and damped chutes be used. The effectiveness of noise enclosures and screens can be partially lost if they are used incorrectly. For example, the noise being enclosed should be directed into and not out of the enclosure. There should also be no reflecting surfaces opposite the open side.

4.5.5 Maintenance of equipment Increases in plant noise are often indicative of future mechanical failure. Regular and effective maintenance of plant and equipment including vehicles is essential and will do much to maintain noise levels near to that of new plant. Maintenance should be carried out only by trained persons. Where maintenance work has to be done at night, precautions may be necessary to minimize any nuisance. Vibration from machinery with rotating parts can be reduced by attention to proper balancing. Frictional noise from the cutting action of tools and saws may be reduced if the tools are kept sharp. Other noises caused by friction in machines, conveyor rollers and trolleys can be reduced by proper lubrication.

4.6 CONTROLLING THE SPREAD OF NOISE

4.6.1 General

If noisy processes cannot be avoided, then the amount of noise reaching the receiver should be minimized. Two ways of doing this are either to increase the distance between the noise source and the receiver or to introduce noise reduction measures such as screens. Physical methods to reduce the transmission of noise between the site works and residences, or other sensitive land uses, are generally suited to works where there is longer-term exposure to the noise. Practices that will reduce noise from the site include: (a) Increasing the distance between noise sources and sensitive receivers. (b) Reducing the line-of-sight noise transmission to residences or other sensitive land uses using temporary barriers (stockpiles, shipping containers and site office transportables can be effective barriers). (c) Constructing barriers that are part of the project design early in the project to afford mitigation against site noise. (d) Installing purpose built noise barriers, acoustic sheds and enclosures.

4.6.2 Distance

Increasing the distance is often the most effective method of controlling noise. This may not be possible where work takes place on fixed structures, e.g. railway tracks. The effect of distance on noise levels is explained in Appendix B. Stationary plant such as compressors and generators can be located away from the work area so as to avoid being close to any noise-sensitive area.

4.6.3 Screening

On sites where distance is limited, the screening of noise may be of benefit and this should be taken into account at the planning stages. Appendix B illustrates the effect of the screen in reducing the noise level and Appendix D describes the performance of different types of acoustic screens and enclosures and the materials they are made of. If structures such as stores, site offices and other temporary buildings are situated between the noisiest part of the site and the nearest dwellings, some of the noise emission from the site can be reduced. If these buildings are occupied, then sound insulation measures may be necessary to protect workers in them.

A hoarding that includes a site office on an elevated structure offers a superior noise reduction when compared with a standard (simple) hoarding. This performance is further enhanced when the hoarding is a continuous barrier. Storage of building materials or the placement of shipping containers between the noise source and any noise-sensitive area may also provide useful screening and the same is true of partially completed or demolished buildings.

Noisy stationary plant can be put in a basement, the shell of which has been completed, provided reverberant noise can be controlled. Where compressors or generators are used in closed areas, it is necessary to ensure that the exhaust gases are discharged directly to the outside air and that there is good cross-ventilation to prevent the build-up of poisonous carbon monoxide fumes and to allow an adequate air supply to maintain efficient running.

Where such noise barriers are not practicable, a worthwhile reduction in noise can be obtained by siting the plant behind and as close as possible to mounds of earth, which may effectively screen the plant from any noise-sensitive areas. These can often be designed into the construction schedule or site arrangement for future landscaping. Water pumps, fans and other plant and equipment that operate on a 24-hour basis may not be a source of noise nuisance by day but can create problems at night. They should therefore be effectively screened either by being sited behind a noise barrier or by being positioned in a trench or a hollow in the ground provided this does not generate reverberant noise. In such cases, however, adequate ventilation should also be ensured.

Long, temporary earth embankments can provide quite an effective noise screen for mobile equipment moving, for example, on a haulage road. When the earthworks are complete, the earth mounds should be removed if possible with smaller, quieter excavators. A noise barrier may be a more reliable method of noise control than the imposition of restrictions on throttle settings. In many cases it will not be practicable to screen earthmoving operations effectively, but it may be possible to partially shield construction plant or to build-in at the early stages protective features ultimately required to screen traffic noise. Where earth noise barriers are not a practical proposition because of lack of space, consideration should be given to the possibility of constructing temporary screens from wood or any of the materials suggested in Appendix D.

The usefulness of a noise barrier will depend upon its length, its height, its position relative to the source and to the listener, and the material from which it is made. A barrier designed to reduce noise from a moving source should extend beyond the last property to be protected to a distance of not less than ten times the shortest measurement from the property to the barrier. A barrier designed to reduce noise from a stationary source should, where possible, extend to a distance beyond the direct line between the noise source and the receiver to a distance equal to ten times the effective barrier height, which is the height above the direct line between source and receiver. If the works are predominately within nominally closed structures, careful consideration should be given to reducing noise breakout at any openings.

4.7 CONTROL OF NOISE AT THE RECEIVER

In cases where noise emissions cannot be adequately controlled at the source or by controlling the spread of noise, consideration should be given to control of noise received at nearby sensitive locations. Provision of treatments at the affected residence or other sensitive land use is normally only suited to addressing noise from longer term construction projects at a stationary site, or where the work site is relatively isolated, or where only a few residences or other sensitive land uses are affected.

Practices that will mitigate the impacts of noise include: (a) Providing localized noise barriers adjacent to the receiving location. (b) Providing acoustic insulation to reduce airborne noise entering buildings, for example, heavyweight glazing or double glazing. (c) Providing ventilation to enable windows and doors to remain closed. (d) Providing access to temporary relocation for noise-affected occupants for short periods, for example, when high noise levels from construction occur at night and there are no feasible and reasonable ways of reducing noise levels.

4.8 CONTROL OF VIBRATION

4.8.1 General

Vibration can be more difficult to control than noise, and there are few generalizations that can be made about its control. It should be kept in mind that vibration may cause disturbance by causing structures to vibrate and radiate noise in addition to perceptible movement. Impulsive vibration can, in some cases, provide a trigger mechanism that could result in the failure of some building component that had previously been in a stable state. It can also trigger annoyance being elevated into action by occupants of exposed buildings, and should therefore be included in planning of communication with impacted communities.

It should be remembered that failures, sometimes catastrophic, can occur as a result of conditions not directly connected with the transmission of vibrations, e.g. the removal of supports from retaining structures to facilitate site access. BS 7385-2 provides information on managing groundborne vibration and its potential effects on buildings.

Where site activities may affect existing structures, a thorough engineering appraisal should be made at the planning stage. General principles of seeking minimal vibration at receiving structures should be followed in the first instance. Predictions of vibration levels likely to occur at sensitive receivers is recommended when these are relatively close, depending on the magnitude of source of the vibration or the distance involved. Relatively simple prediction methods are available in texts, codes of practice or other standards, however it is preferable to measure and assess site transmission and propagation characteristics between source and receiver locations.

Comparison of predicted levels of vibration with preferred or regulatory levels will indicate when either more detailed predictions are required or mitigation of transmitted vibration is advisable or necessary. Guidance in measures available for mitigation of vibration transmitted can be sought in more detailed standards, such as BS 5228-2 or policy documents, such as the NSW DEC Assessing Vibration: A technical guideline.

Identifying the strategy best suited to controlling vibration follows a similar approach to that of noise—of avoidance, control at the source, control along the propagation path, control at the receiver, or a combination of these. It is noted that vibration sources can include stationary plant (pumps and compressors), portable plant (jackhammers and pavement vibrators), mobile plant, pile-drivers, tunnelling machines and activities, and blasting, amongst others. Unusual ground conditions, such as a high water-table, can also cause a difference to expected or predicted results, especially with piling.

F. ACOUSTIC GLOSSARY

Acoustic Measurement Parameter Definitions

dB

Decibel: a logarithmic scale applied to acoustic units such as sound pressure and sound power. Decibels are always the ratio between two numbers. Sound Pressure in Pascals becomes "Sound Pressure Level re $2x10^{-5}$ Pa" in decibels. Sound Power in watts becomes "Sound Power Level re 10^{-12} W" in decibels. It is

also used for sound reduction or sound insulation and is the ratio of the amount of sound energy incident upon a partition and the proportion of that energy which passes through the partition. The result is stated as a "decibel reduction".

dB(A)

A- weighting: This is an electronic filter which attenuates sound levels at some frequencies relative to the sound levels at other frequencies. The weighting is designed to produce the relative response of a human ear to sound at different frequencies. The A-weighted sound level is therefore a measure of the subjective loudness of sound rather than physical amplitude. A- weighting is used extensively and is denoted by the subscript A as in L_{A10}, L_{Aeq} etc. (Levels given without the subscript A are linear sound levels without the A- weighting applied, e. g. L_{10}, L_{eq} etc.).

$L_{Aeq,T}$

The “A” weighted equivalent continuous sound pressure level. This may be thought of as the "average" sound level over a given time “T”. It is used for assessing noise from various sources: industrial and commercial premises, construction sites, railways and other intermittent noises.

$L_{A90,T}$

The “A” weighted sound pressure level that is exceeded for 90% of the time T. It reflects the quiet periods during that time and is often referred to as the "background noise level". It is used for setting noise emission limits for industrial and commercial premises.

L_{Amax}

The maximum "A" weighted sound pressure level during a given time on fast or slow response.

L_{pA}

The "A" weighted sound pressure Level. The sound pressure level is filtered through a standard frequency weighting known as A-weighting. This filter copies the frequency response of the human ear, so that the resulting sound level closely represents what people actually hear.

R

Is the sound reduction index of a construction element in octave or $^1/_3$ octaves and can only be measured in a laboratory. There must be no flanking transmission.

R'

Is the sound reduction index of a construction element in octave or $^1/_3$ octaves measured on site, and normally includes flanking transmission (ie where sound travels via paths other than straight through the element being tested, such as columns, ducts, along external walls, etc).

R_w

To get the weighted sound reduction index (R_w) of a construction, the R values are measured in octave or $^1/_3$ octave bands covering the range of 100Hz to 3150Hz. The curve is adjusted so that the unfavourable deviation (or shortfall of the actual measurements below this standard curve) averaged over all the octave or $^1/_3$ octave bands is not greater than 2dB. The value of the curve at 500Hz is the R_w.

R'_w

The apparent sound reduction index, which is determined in exactly the same way as the R_w but on site where there is likely to be some flanking transmission.

D

This is the "level difference". It is determined by placing a noise source in one room and measuring the noise levels in that room (the "source room") and an adjacent room (the "receiver room"). The level difference is calculated by simply deducting the "receiver" noise level (dB) from the "source" noise level (dB).

D_w

This is the weighted level difference. D is measured on site in octave or $^1/_3$ octave bands covering the range of 100Hz to 3150Hz. The D values are compared to a standard weighting curve. The curve is adjusted so that the "unfavourable deviation" (or shortfall of the actual measurements below this standard curve) averaged over all the octave or $^1/_3$ octave bands is not greater than 2dB. The D_w is then the value of the curve at 500Hz.

D_{nw}

This is the weighted normalised level difference. D is measured on site in octave or $^1/_3$ octave bands covering the range of 100Hz to 3150Hz. As the level difference is affected by the area of the common wall/ floor and the volume of the receiving room, as well as the amount of absorption in the receiving room, in the case of the $D_{nT,w}$, the results are "normalised" by a mathematical correction to 10m^2 of absorption (D_n). The same weighting curve as for D_w is used to obtain the single figure: D_{nw}.

Acoustic Performance Guide

$D_{nT,w}$

This is the weighted standardised level difference. D is measured on site in octave or 1/3 octave bands covering the range of 100Hz to 3150Hz. As the level difference is affected by the area of the common wall/ floor and the volume of the receiving room, as well as the amount of absorption in the receiving room, in the case of the $D_{nT,w}$, the results are "standardised" by a mathematical correction a reverberation time, usually 0.5 seconds (D_{nT}). The same weighting curve as for D_w is used to obtain a single figure "$D_{nT,w}$"

$D_{nT(Tmf, max),w}$

This is the weighted BB93 standardised level difference corresponding to a Building Bulletin 93 reference value reverberation time in a receiving room. It is measured on site in accordance with BS EN ISO 140- 4: 1998.

$D_{n,c}$

Suspended ceiling normalised level difference. This is the sound level difference between two rooms, separated by a suspended ceiling, normalised to a reference value of absorption in the receiving room (10m2 for the Laboratory as specified in ISO 140- 9 : 1985). It is measured in 1/3 octave or octave frequency bands.

$D_{n,c,w}$

Weighted suspended ceiling normalised level difference. This is a single number quantity representing the sound reduction between two rooms separated a suspended ceiling. It is obtained by applying specified weightings to the 1/3 octave band suspended ceiling normalised level differences in the frequency range 100Hz to 3150Hz.

C_{tr}

Spectrum adaptation term: Value, in decibels, to be added to a single- number rating (e. g. Rw) to take account of the characteristics of particular sound spectra. Ctr is calculated using an A- weighted urban traffic noise spectrum as defined in BS EN ISO 717- 1 : 1997.

NR

Stands for Noise Rating. (It is NOT noise reduction). It is (e. g. NR30, NR35 etc.) a single number, which represents the sound level in a room and takes account of the frequency content of the noise. The lower the NR value, the quieter the room will be. It is mainly used for assessing noise from mechanical services systems. In leisure developments it is used as a standard for noise break- in to rooms from external noise sources such as traffic.

NC

Stands for Noise Criteria. It is very similar to NR but (e.g. NC30, NC35 etc.) uses slightly different frequency weightings.

NRC

Stands for Noise Reduction Coefficient. The noise reduction coefficient of a material is the average, to the nearest multiple of 0.05, of the absorption coefficients at 250Hz, 500Hz, 1kHz and 2kHz.

α

Stands for Absorption Coefficient, which represents the proportion of incident sound energy arriving from all directions that is not reflected back into the room. It ranges between 0 and 1, where 0 is reflective and 1 is totally absorptive.

α_w

Stands for Weighted Absorption Coefficient. Single- number frequency dependent value which equals the value of the reference curve at 500Hz after shifting it as specified in EN ISO 11654 :1997.

α_p

Stands for practical absorption factor. It is a frequency dependent value of sound absorption coefficient which is based on measurements in one- third- octave bands in accordance with ISO 354 and which is calculated in octave bands in accordance with EN ISO 11654 : 1997. It is the arithmetic mean of the three 1/3 octave sound absorption coefficients within the octave being considered. The mean value is calculated to the second decimal place and rounded in steps of 0.05 up to a value of 1.0.

Class X

Stands for the Absorption Class between 250 and 4kHz, as defined by EN ISO 11654. Class A is the best classification representing the highest level of absorption, and Class E offers to lowest classification.

RT or T_{60}

Reverberation Time is a measure of the echoic nature of a room. It is normally measured in 1/3 octave or 1/1 octave bands by creating a loud noise and measuring the time it takes for that noise to decay by 60dB. The longer the reverberation time, the more 'echoey' a room sounds. For dwellings, a reverberation time of 0.5 seconds or less is normal. Cinema auditoria will have reverberation times of 1.0 second or below when fitted out, but up to 9 seconds at shell completion.

When designing acoustically sensitive areas such as concert halls or lecture theatres, it is necessary to design the room finishes to achieve optimum reverberation times. These will vary depending on the type of activity in the room and the room volume.

T_{mf}

Stands for the arithmetic average of the reverberation times in the 500Hz, 1kHz and 2kHz octave bands, for the type of receiving room, as defined in UK Schools design manual, Building Bulletin 93.


Sealhurst
Acoustic Design
& Engineering