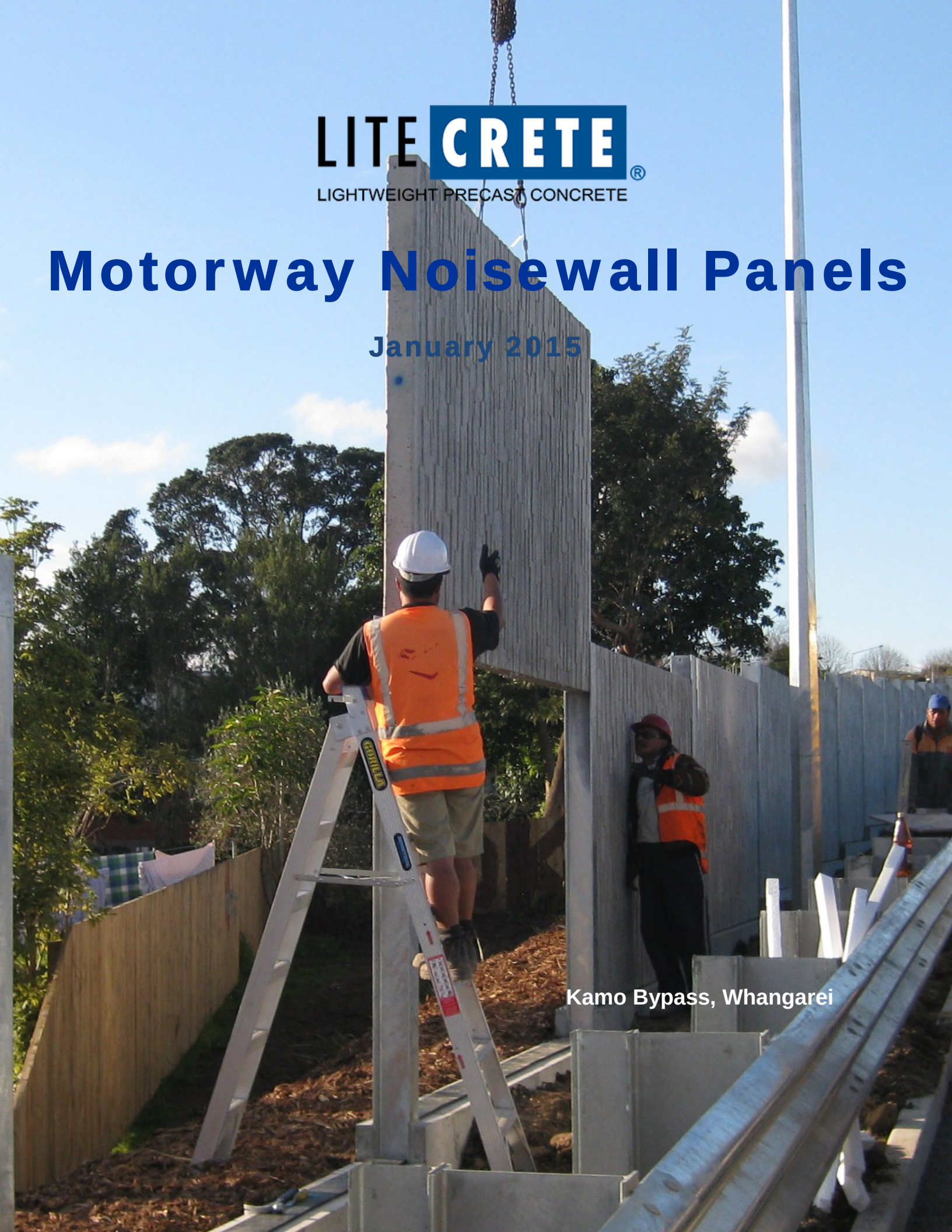
LITE CRETE®

LIGHTWEIGHT PRECAST CONCRETE

Motorway Noisewall Panels

January 2015



Kamo Bypass, Whangarei

Why Litecrete lightweight precast?

Litecrete noisewall barrier panels have many advantages over competing materials. The strength of Litecrete lightweight precast concrete gradually increases over time. Other materials can deteriorate, delaminate, lose strength, deflect and may not be able to withstand vehicular impacts. The load-carrying capacity of Litecrete lightweight precast concrete is derived from its own structural qualities. Studies have shown that precast concrete products can provide a service life in excess of 100 years.

We're talking quality

Because Litecrete lightweight precast concrete noisewall panels are made in a controlled factory environment, they exhibit high quality and uniformity. Problems affecting quality typically found on a job site, such as temperature, curing conditions, poor craftsmanship and material quality are virtually eliminated in a factory environment.

Installation is easy

Installing Litecrete noisewall barrier panels is easy because they do not require special rigging to avoid structural damage. Lifting eyes are set in the top edge of the panels during the casting process and once delivered to the construction site a spreader bar is simply attached to the lifting eyes and the panels are lifted up and slotted into the galvanised steel UC supports.

Keep it quiet

Litecrete noisewall barrier panels reduce the sound level by shielding the straight line path of noise from the source to receiver. The received noise level is significantly reduced due to the shielding effect. Using modelling software, acoustic engineers can determine the optimum height, length and placement of Litecrete panels to effectively minimise noise levels.

Noise can be readily attenuated by 5-10 decibels (dB) with a motorway noise barrier. A reduction of 10 dB typically reduces the perceived loudness by half.

Aesthetically pleasing

The aesthetic options for precast concrete noise barriers are virtually limitless. Litecrete may be coloured by using integral colour pigments or by staining once the panels are installed.
Textures or designs can be created on the traffic side or the residential side of the panels using formliners. Some transport planning groups utilise the versatility of precast concrete to capture and preserve a community theme or identity within the Litecrete noisewall panel.

Graffiti resistance

Like other man-made noisewall systems Litecrete should be treated with a graffiti-resistant coating after the panels have been installed and prior to public access availability.

No comparison

Research has shown that concrete provides the highest sound transmission loss value when compared with common noise wall materials. In addition, Litecrete noisewall barrier panels require a considerably smaller footprint compared with earth berms.

How does the height of the noise barrier affect its noise reduction capabilities?

Typically, a 5 dB reduction in noise can be expected for a noise barrier that just blocks the line of sight of the roadway. A variation of between 1–3 dB of additional attenuation can typically be expected for each metre of barrier height above the line of sight, depending on the distance to the receiver and roadway.

How does the length of the noise barrier affect its noise reduction capabilities?

Barriers are typically designed to cover a horizontal angle of 160° when looking towards the roadway from the receiver position (angle of view). Shorter than this and the barrier effectiveness is reduced.

Surface density & Transmission Loss

The surface density of 150 mm thick Litecrete is 187 kg/m² (130 mm thickness is 162 kg/m²) and has a theoretical Sound Transmission Class (STC, the standard measure of sound attenuation by partitions) of 48 dB.

Wall installation

The final and critical step to the completion of a precast noisewall is proper wall installation. It is essential that the installation guidelines are complied with, particularly acoustic sealing. The engineer's specifications will generally cover site preparation, excavation, levelling pad preparation, drainage considerations and placement of additional courses.

Site Examination

Verify that site conditions are ready to receive work and that field measurements are shown on drawings. Prior to beginning earthworks and the project, stake the wall location in the field and establish the final ground-line elevations at the barrier walls. Use these elevations to develop the shop drawings, including a complete elevation view of each wall indicating top and bottom elevations as well as the roadway grade.

Preparation

Prepare support equipment for the erection procedure, temporary propping and induced loads during erection.

Construction method

- Protect the final ground elevations established in the field for the duration of the project, and do not adjust without prior approval of the engineer. Keep to a minimum the clearing, grubbing and trimming of trees as necessary to construct the walls.
- Erect steel members without damage to structural capacity, shape or finish. Replace or repair damaged members.
- Align and maintain uniform horizontal and vertical joints as erection progresses.
- Provide temporary props as lateral support to prevent bowing, twisting or warping of members.
- Set vertical units dry without grout on a 10 mm thick neoprene-type gasket.
- Seal both sides of panels at steel I-beam/panel joints with acoustic sealant.

Sustainability

Made from natural materials

Besides water, concrete is the most used material on earth. It is non-toxic and environmentally safe. Litecrete is additionally beneficial because it is made from natural materials. The pumice aggregate is a volcanic rock, formed by the effervescence of gases and rapid cooling of molten granite during an eruption. Pumice is a virtual waste product available in large deposits in the central/upper North Island. The air cells in the pumice provide convenient lightness and ease of use. The combination of pumice, cement and polypropylene fibre gives Litecrete its light weight and durability. Concrete products are used throughout the world as part of noisewall systems in nearly every modern city and precast concrete is the material of choice. Litecrete precast noisewall barrier panels are produced in a quality-controlled environment and are ready to install immediately upon arrival at the job site. The panels are manufactured to be durable during storage and transportation, easy to install, less vulnerable than competing products to damage, and are environmentally safe during operation.

Reduced Site Impact

Since Litecrete noisewall barrier panels are manufactured off site and delivered on demand, there is a significant reduction in truck traffic, dust, noise and debris from formwork associated with cast-in-place products. Because Litecrete panels are modular and standardised, they are able to be rapidly installed, which results in reduced construction times and energy usage, reduced noise and emissions from on-site equipment and reduced site impact.

Reduced truck movements

Because Litecrete panels are half the weight of normal precast concrete noisewalls, twice the volume can be shipped at each truck movement, thus reducing traffic volumes and $C0_2$ emissions. The panels can be lifted straight off the Hiab truck and installed into the I beams.

Recycling

Precast plants reuse formwork, in itself a conservationist move, and in doing so reduce construction waste that would otherwise be generated at a job site. Waste water can be recycled for use in manufacturing. The steel reinforcing bars/mesh are manufactured by NZ Steel in a carbon-neutral, gas-fired steel plant, which also has a high post-consumer recycled steel content.

Natural Materials

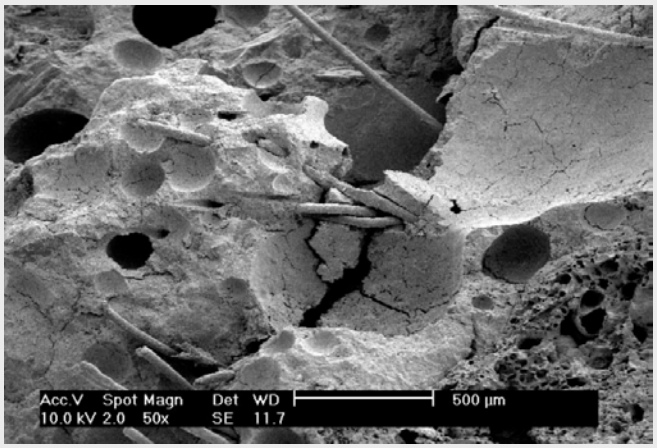
The cement used in concrete is made of natural materials. Pumice aggregates used in the manufacture of Litecrete sound wall systems are extracted and processed locally.

Durability

Litecrete noisewall barrier panels are strong and durable and have a 50-year warranty. They will not rust, rot or burn. Litecrete noisewall barrier panels are manufactured in a factory environment and delivered to the site ready to place and they require very minimal site disturbance to install. Because Litecrete panels are precast off-site and delivered to the site ready to install, the panels themselves require no on-site adaptation prior to installation. The vast majority of materials that go into the construction of Litecrete panels are procured within a 200-mile radius of the precast plant.

Litecrete concrete mix

Litecrete uses pumice as an aggregate, which reduces the weight of the concrete yet provides the required strength. This combination of pumice and cement, steel mesh reinforcing and trim bars, together with polypropylene fibre reinforcement, gives Litecrete its unique strength-to-weight ratio. The inclusion of the polypropylene fibres also assists in fire damage prevention on the basis that, as the concrete is heated by fire, the fibres melt, creating passageways along which water vapour can dissipate, thus avoiding a build-up of pressure. The image below, from an electron-scanning microscope at x50, shows a Litecrete sample after a compression test, with the fibre still binding the crushed pumice concrete together.



Mix Components
Pumice aggregate:
65-75% Si02, 10-20% Ai203.
Cement: GP General Purpose Cement (Portland).
Plasticiser: Sika ViscoCrete® 5-500.
Polypropylene fibre: Specter, Monofilament concrete fibre, manufactured to comply with ASTM C-1116.

Dimensions
The advantage of precast concrete is that a variety of sizes can be accommodated. Litecrete noisewall barrier panels can be manufactured up to a maximum panel size of 7 metres x 3.5 metres.

Mass
Litecrete 150 mm thick noisewall barrier panels weigh 190 kg/m² (165 kg/m² 130 mm thick).
Note: This weight is calculated using a concrete density of 1350 kg/m³ and includes typical steel reinforcing of 664 mesh and D12 trim bars.

Precast NZ Certified Plant

Litecrete noisewall barrier panels are manufactured by Wilco Precast Ltd, a Precast NZ certified plant, established in 1962. From start to finish, the Precast NZ Plant Certification Program sets the highest standards for plant facilities, production operations and quality control procedures. To maintain their Precast NZ credentials, the Wilco plant must pass periodic on-site certification inspections. The Plant Certification Program enables quality-conscious agencies, architects, engineers and users to identify and select high-quality precast concrete manufacturers. At no cost to specifiers, you save money because you do not need to spend valuable time and resources inspecting a plant to ensure that its products will meet or exceed your expectations. You also save time when you work with certified precast plants, because products arrive on time at the job site ready for installation. As a Precast NZ certified plant, Wilco is required to maintain an active plant safety program that meets or exceeds local, and Central Government regulations, including Occupational Safety and Health requirements. Wilco also has a TELARC Registered quality assurance programme.

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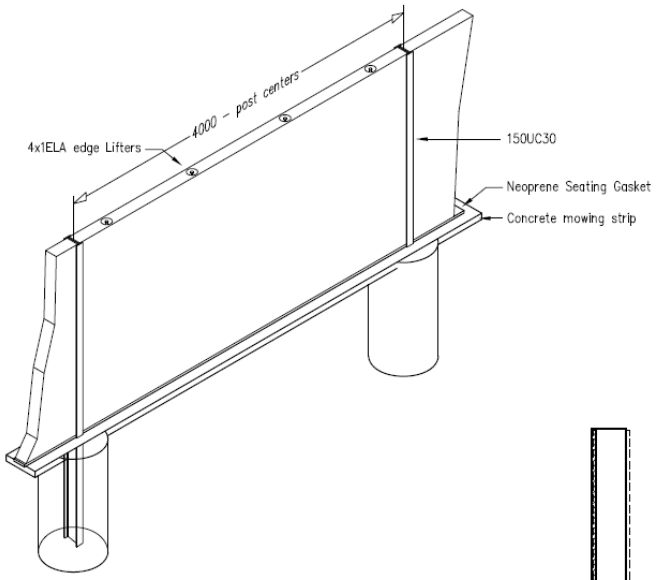
PRECAST NEW ZEALAND INC. CERTIFIED PLANT

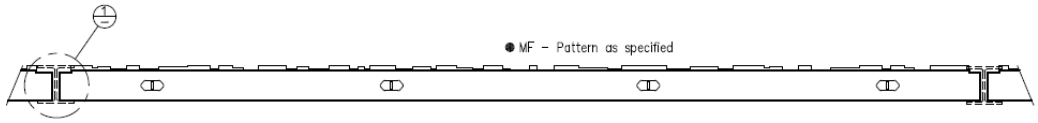
TELARC REGISTERED ™
Telarc Q-Base Code

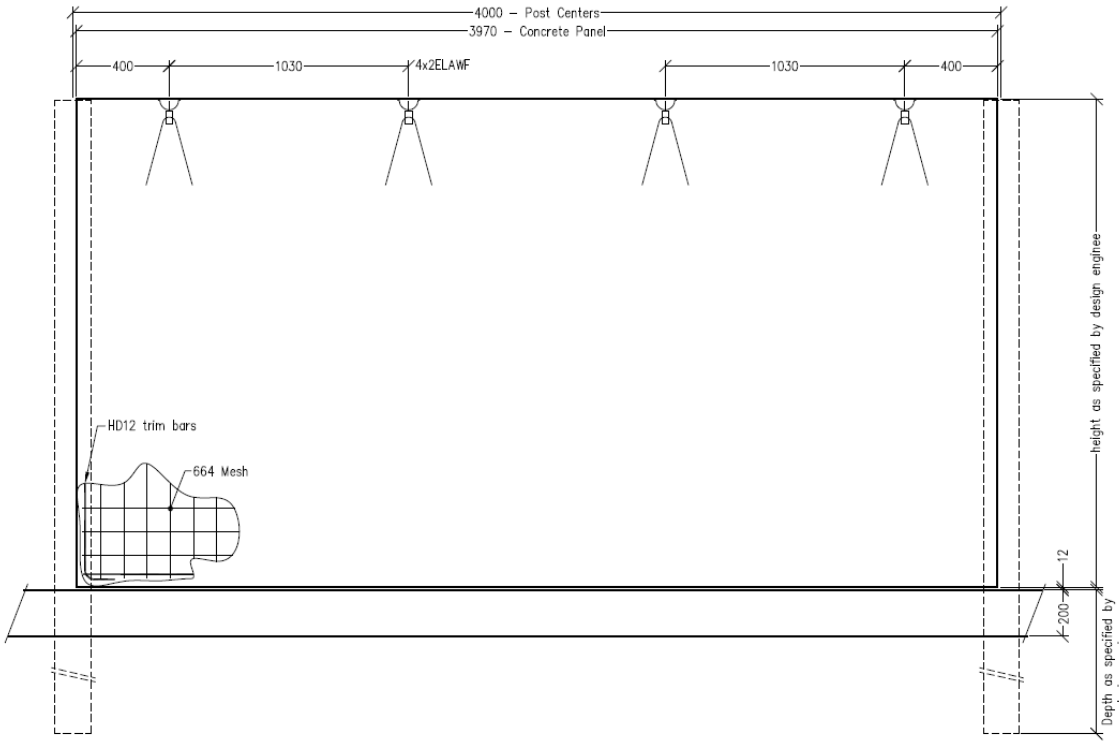


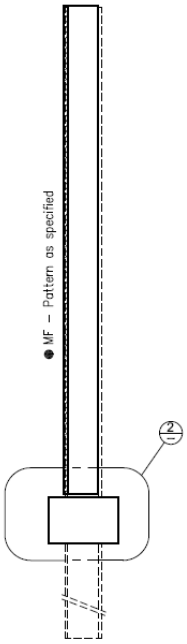
QUANTITY	- off
AREA	8.34 m²
VOLUME	1.13 m³
WEIGHT	1.69 tonne
FINISH	U4 & F5
LITECRETE	12 MPa

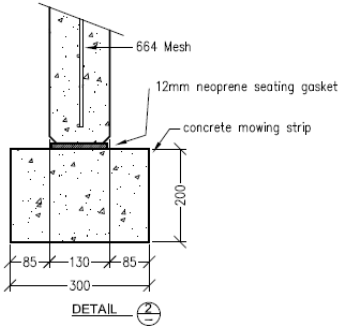
NOTES:

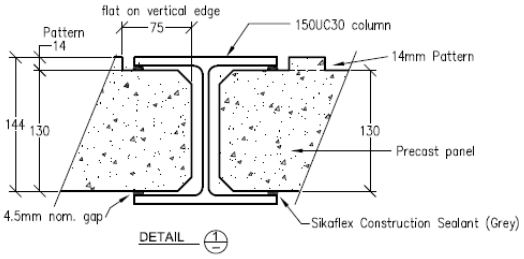
- Concrete strength to be 12MPa
- Concrete cover to be 50mm, u.n.o.
- Refer to NZ 3109:1997 table 5.1 for precast tolerances
- Mould face finish, use Reckli formliner or as specified.
- Top face finish to be U3 u.n.o.
- Edge details are as noted.











For Approval	A	
Revision	Mk	Date

LITECRETE

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130mm NOISEWALL

Typical Installation Details

Date		Job No
Scale	1:20	
Drawn	E.L.I.	
Sheet	1 of 1	Dwg No NW1

Test	Standard	Criteria	Results
FIRE PERFORMANCE:			
Fire Spread and Burning		Maximum temp rise of 36C° above 750C°	0
Smoke Development	ASTM E84	No flaming	0
Smoke Generation	ASTM D136	Weight loss not to exceed 20%	0
Combustibility	CAN/ULC-S114-M80		Material classified as Non Combustible
Fire Resistance Rating	AS 1530.4 1997	Resistance to heat	Refer BRANZ Fire Resistance Test FR 3524: Structural Adequacy - 240 minutes Integrity - 240 minutes without failure Insulation - 240 minutes without failure
PHYSICAL PROPERTIES:			
Sorptivity/Initial Rate of Water Absorption	ASTM C1585.04	mm/sec^0.5	Litecrete = 0.0107 @ 12Mpa; normal concrete = 0.0215 @ 20MPa
Vapour Flow Resistance	ASTM E96	N/A	2.5 MNs /g
Thermal Conductivity (k) Value Thermal resistance (R) Value	AS/NZS 4859.1 AS/NZS 4859.1	0.32 +/- 0.003 $Wm^{-1}K^{-1}$ 0.12 +/- 0.6 m^2KW^{-1} (for 40 mm)	Tests conducted at Curtin University of Technology, Perth. Incorporating ASTM C-177, ASTM C-653, ASTM C-167. Meets Code requirement for a Solid Wall ($R= 0.6m^2KW^{-1}$)
Environmental Compatibility	EPA M 1311	No pollution	No detrimental effects.
Mould and Mildew	MIL STD 810E	Susceptibility	Does not support fungal growth. Rated: 0
Modulus of Elasticity	ASTM-C469-02	N/A	4580 MPa (28 days)
Modulus of Rupture	NZS 3112 P2	N/A	1.45 MPa (28 days)
Coefficient of Thermal Expansion	ASTM C531	N/A	5.51 (AVE) x 10^{-6}/ F°
Shrinkage	NZS 3151:1974	N/A	< 1000 με (microstrains)
Compressive Strength	NZS 3151:1974	N/A	> 10 MPa (28 days)
Density	NZS 3112 P3	N/A	1500 kg/m^3 at delivery (14 days) 1250 kg/m^3 (28 days) 1350 kg/m^3 (28 days) reinforced
Tensile Strength	NZS 3112 P2	N/A	1.3 MPa (28 days)
Bracing Units		Opus	2400x1200x150 mm panel = 400 BU's
Sound Transmission Class (STC)		48 dB	150 mm thickness
Surface density		162 kg/m^2	130 mm thickness

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Noisewall Barriers – Typical Specification

Noisewall barriers shall be 150UC30 Posts (or size as specified by the design engineer) and 130 mm thick Litecrete lightweight precast concrete panels (or thickness as specified by the design engineer) to the height and location as documented in the tender drawings.

Design Life

Litecrete noisewall panels shall achieve a minimum serviceable life expectancy of 50 years with minimal maintenance.

Wind loading

Design loads on the Litecrete noisewall panels shall be in accordance with AS/NZS 1170.2. Horizontal deflection of the noise barrier panels under the permissible wind loading shall not be more than 1% of the panel span between posts.

Steel Posts

The steel posts used in the noise barrier shall be 150UC30 (or size as specified), manufactured in accordance with AS/NZS 4600. The posts shall extend full height of the noise barrier and stop flush with the top of the noise barrier panels.
The Litecrete noisewall panels are contained at each end in the H section provided by the UCs.
Steel posts shall be hot-dip galvanised in accordance with the requirements of AS/NZS 4680, with an average coating mass of 600 g/m□ on each face.

Thickness and density of Litecrete panels

The thickness of the Litecrete noisewall panels shall be 130 mm (or thickness as designed) which will ensure that the panels can be craned in from above and fitted into the steel H section posts, achieve the acoustic requirements of the noise wall and satisfy the structural and engineering design requirements. For acoustic purposes the Litecrete noisewall panels at 130 mm thick have a surface density of 162 kg/m^2. Sound Transmission Class (STC) is 48 dB at 150 mm thickness.

Acoustic Seals

All acoustic seals shall be neoprene or EPDM rubber with:

1. hardness = 55-70 Shore “A”
2. elongation at break = 200% minimum
3. All seals shall be compressed by a minimum of 10% when installed. No seal may be thicker than 25 mm.

After the Litecrete noisewall panels are installed, Sika Firerate PU or similar exterior grade acoustic sealant shall be applied to both sides of each vertical Litecrete / UC joint.

Footings

The posts shall be mounted in concrete footings to a depth as specified by the design engineer. If set directly into the concrete footing, the base of the steel post shall be set nominally 100 mm from the bottom of the footing. The UC posts shall have a maximum deviation from vertical of no more than 5 mm per metre and no more than 10 mm at any height.

The footings shall be designed to withstand the wind loadings specified by the design engineer.

The entire top of the concrete footing shall not be lower than ground level and shall be shaped such that water flows away from the post. Where the noise wall is located on or immediately adjacent to a grassed or landscaped area, the footing shall include a concrete mowing strip, flush with finished ground level and extending 300 mm each side of the barrier, for the full length of the barrier.

Acoustic seals (as per the above specification), 10-12mm thick x 130 mm wide, shall be provided between the top of the concrete footing and the Litecrete panels to ensure that there are no unsealed gaps at the base of the barrier.