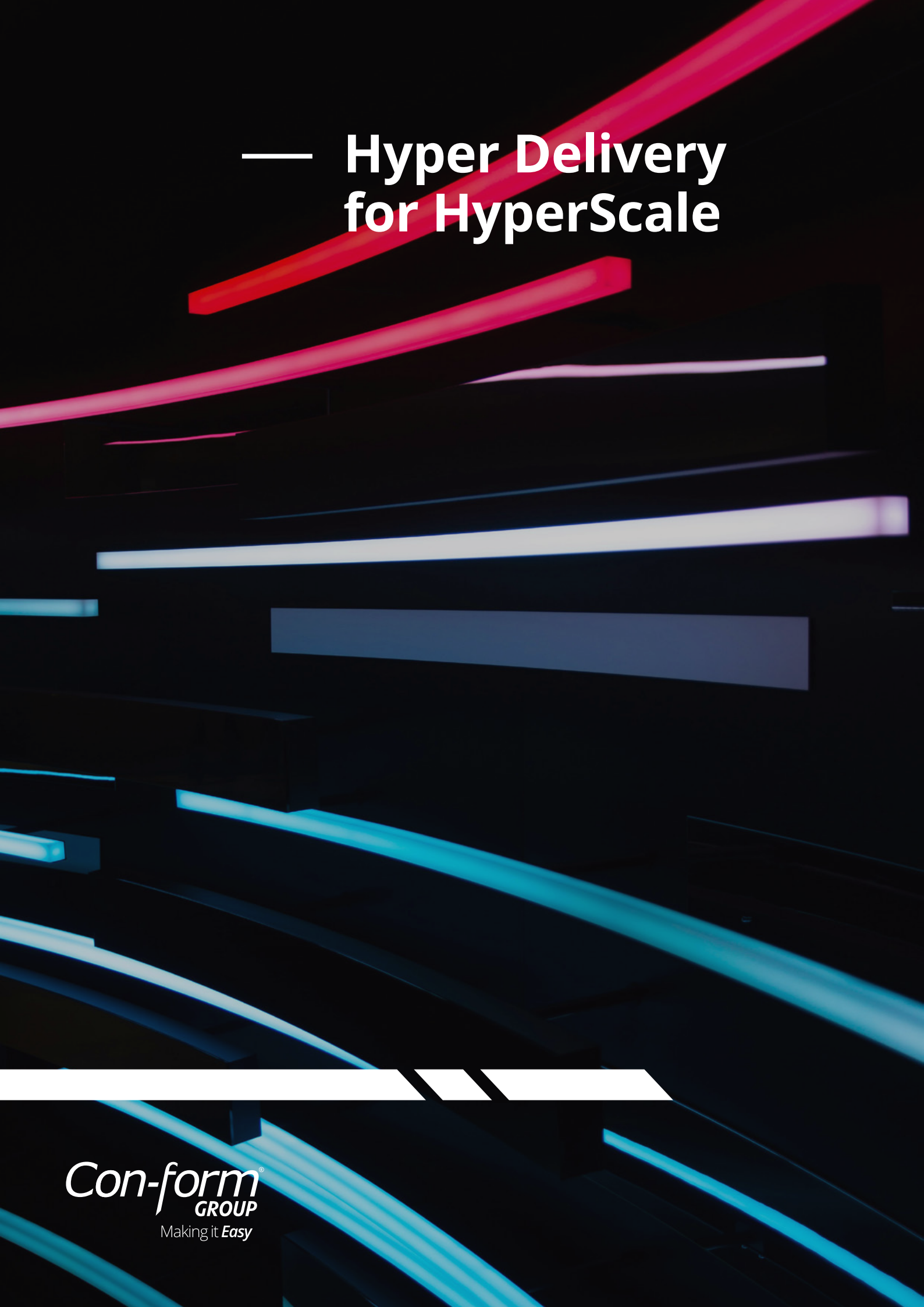




— Hyper Delivery for HyperScale

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Hyper Delivery for HyperScale



Nigel Cro
Managing Director
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Introduction

Welcome to Con-form Group, a unique privately owned Australian company which has led the roof-based platform and screen sector of the construction industry for over two decades.

We were the nation's first fully fledged specialist to design and manufacture a new generation of ultra-lightweight HVAC&R plant equipment platforms, architectural and acoustic screens, louvre walls and access systems.

We are continually innovating and this is welcomed by our data centre customers who come to us in need of site-specific solutions.

Our passion for new ideas and product excellence... our goal to deliver highly efficient, cost effective and longer lasting fit for-purpose solutions... our turn-key design to-installation process... and our desire to provide outstanding customer service have enabled us to maintain our leadership role after completing over 20,000 projects.

We have the manufacturing capacity to comfortably supply every data centre project right up to hyperscale proportions.

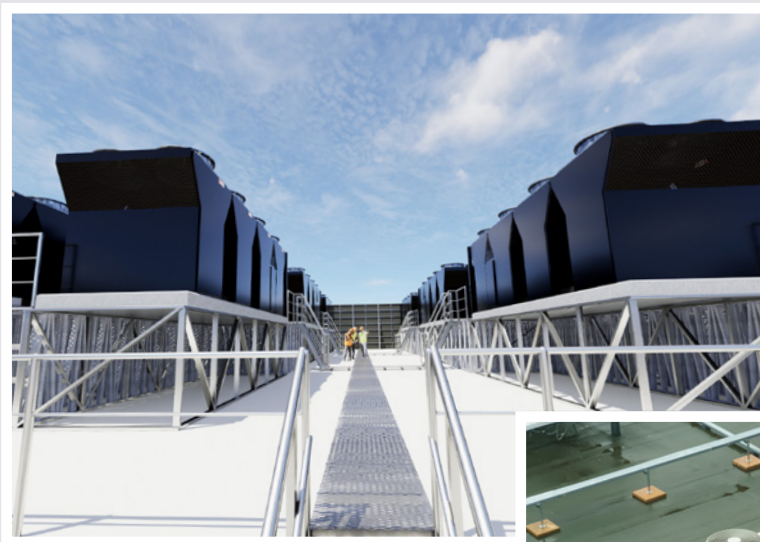
This is why we have become the go-to solution provider to the likes of Microsoft, Amazon, Air Trunk and CDC.

Since we completed our first data centre project all those years ago we have identified a number of worsening challenges facing building companies. The first one is about unwanted sound. This issue is escalating each year and we set out on a mission to find a cost-effective remedy.

As you'll find in this book we succeeded in our mission...through breakthrough technology and educating the market. The latter is an ongoing journey.

As data centres increased in size the other challenges had to do with being able to rapidly deliver large volumes of products to site and install them in a tight time frame. Success has come through several years of change management, lean manufacturing processes, investment in advanced machinery and clever product design.

We look forward to contributing to the success and profitability of your next data centre project.





The Acoustic Challenge

A Rapidly Growing Nation

Australia is experiencing a population boom via a dramatic upturn in immigration numbers. We're on track to hit 28,000,000 people.

Between 2020-2021 the capital cities grew by more than 205,000 people. At the end of 2023, the Australian Bureau of Statistics reported that migrant arrivals had increased by 73% to 737,000 people. Our nation grew by 2.5% in the same year to more than 26,000,000 people.

This trend is not expected to slow down. Australia is anticipated to grow by 11,800,000 between now and 2046. Three quarters of this growth will be experienced in Sydney, Melbourne, Brisbane and Perth.

More people...more mobile phones, tablets and computers.

More data flow. More requirement for data storage.

Plus, with the rapid use of AI that demand for high speed data has escalated.

With the need for data centres has come a pattern of placing them in close proximity to their users. In other words, in the midst of suburbia.

Australia currently boasts 306 data centres. This sector is expected to grow by another 3.6% at least between now and 2029.

Microsoft announced it is investing \$5 billion in the construction of these vital hubs. It is their biggest investment project outside the U.S. They still have another 29 yet to commence.

Amazon Web Services plans to invest \$13 Bn in Australia.

With the adoption of AI the JLL Report – using data from analysis by Mandala Partners – claims the use of artificial intelligence along with cloud computing will double demand for new data centres, with an extra 175 new facilities needed by 2030.

In NSW the state planning minister told the Financial Review Property Summit in 2025, "We have 90 data centres approved and another 20 under assessment, but we need more."

The NSW Government has created the Investment Delivery Authority which is expected to fast-track 30 major projects worth more than \$1 billion each year, most of which will be data centres.



Unwanted Gold Medal

If there was an Olympics for noise generation then data centres would win the gold medal.

This is because, when it comes to Heating-Ventilation-Air Conditioning-Refrigeration (HVAC&R), data centres are the noisiest buildings in the nation.

The industry terminology for this is “unwanted sound”.

What is the main contributor? It is the chillers.

A typical data centre could have 100 chillers in rows on its roof. The proposed 1-gigawatt Mamre Road Data Centre Campus in Western Sydney will have four data buildings with a total of 936 cooling units.

They have to operate 24 hours a day. This is because it is imperative that interior temperatures are maintained at between 18-27 degrees Celsius. Anything outside this range can lead to computer systems malfunctioning and data being lost.

Chillers circulate large amounts of water which in turn cool the air before it is sent into the building space.

They are preferred over clusters of smaller AC units because they are very efficient in cooling large volumes of air and they are more cost-effective to run. The downside is that chillers are enormous and extremely noisy due to their rows and rows of fan units.

HVACR systems are made up of a variety of mechanical components as well as many metres of ducting which snakes across the rooftop space. The main components include the:

- Compressor
- Condenser coil
- Condenser fan
- Expansion valve
- Evaporator coil
- Evaporator fan

They combine to operate in a cyclic manner.

The compressor pushes warm refrigerant to the condenser where its fan draws in ambient air across the coil. This is mixed with super charged vapour and the hot air is ejected into the atmosphere. After travelling through the expansion valve the newly chilled refrigerant arrives at the evaporator. Here, the fan blows colder air out into the atmosphere and then the refrigerant continues back to the compressor for its next circuit.



What's All The Noise About?

HVAC&R plant equipment emits mechanical noises of various frequencies and volumes. For example, a 250-300kg condensor with a single fan will emit an average of 80 decibels. Adding a second fan increases this to as much as 90 dB.

On top of this, air drawn into fans and ducts produces induction noise.

Air movement noise occurs when the air passes along the ducts. When that air echoes inside the ducting or leaks out through the walls of the ducts it is called breakout noise.

Duct fittings and elbows can create aerodynamic noise.

Noise following an indirect path is known as flanking noise.

Flanking noise refers to the ability of sounds to deviate and not follow a linear path. An example of this would be HVACR mechanical sounds moving across an open space, transmitting through ducting walls and into the chambers, then exiting some distance from the source via the duct opening. It includes primary reflections and secondary reflections which generate new source paths in even more directions.

When these sound fields clash or overlap each other they create an unstable zone called a Near Field.

A typical HVACR system produces some or all of those noise types in a variety of directions. With a range of frequencies.

One side of the building can be louder than another. It is not consistent throughout the 360-degree space.

Noise follows the First Law of Thermodynamics – the Law of Energy Conservation. Noise energy cannot be destroyed. It can only be transferred or transformed.

That is why a solid sound barrier (eg. fibrous cement, composite timber, concrete block, brickwork, polystyrene) is unable to reduce or cancel out the noise. It simply reflects it in another direction.

To prevent noise escaping from the rooftop environment a specific type of acoustic barrier is required.

A traditional method of arresting noise was to use sound blankets.

The blankets would decay over time because they were exposed to the elements and therefore would have to be replaced. They were attached to heavy frames and this was not suitable for some roof structures which were unable to support a lot of weight from above. The wetter the blankets became the heavier they were.



The other disadvantage was that the blankets weren't tuneable. They provided the same level of soundproofing to all sides of a building and that meant that higher levels of noise could not be captured.

Acoustic engineers like to specify membrane material as a barrier.

Porous materials trap air inside them and trap high and low frequencies. Fibre diameter is significant. Air trapped between the fibres reacts with sound energy and is converted to heat.

The more fibres per square metre of insulation the greater the surface area for absorption. This is why two insulation membranes of the same density and thickness can vary in their acoustic performance due to having fibres of different thickness.

Con-form Group utilises a porous polyester fibre membrane material for our acoustic barriers. It is moisture- and UV-resistant as well as being fire retardant.

It comes with a 10-year warranty.

Plus, it is 'green' as it is manufactured from recycled drink bottles (!).

Because these membranes are extremely lightweight they can be used liberally in acoustic screens.

Best Practice

Best practice is to engage with an Acoustical Consultant at the outset of the building project – or in the very least invite Con-form Group to advise the stakeholders of the potential risks and explain cost-effective solutions.

An Acoustical Consultant will plot an Acoustic Map of the rooftop space showing the variety of outbound frequencies, volumes and directions. From this they will determine a number of key parameters.

The foundational factor in sound measurement is the decibel (named after inventor Alexander Graham Bell).

A fluctuation in noise of plus or minus 1 decibel is not perceptible to the human ear. Changes become noticeable at plus/minus 5 decibels.

Sounds between 50-70 decibels are deemed to be Moderate. From 70-90 decibels they are called Noisy.

An example is an electric lawnmower which generates approx. 80 decibels. From 90 dB (a noisy factory) to 100 dB (pneumatic hammer) and 110 dB (accelerating motorbike) is labelled Very Noisy. Above that, Extreme (110-130 dB) includes such noises as a plane taking off or a music concert.



The performance of sound absorptive material is described by the Noise Reduction Co-efficient or NRC rating of the product. This is a simplified single number that is the arithmetic average of four frequencies:

- 250 Hz
- 500 Hz
- 1000 Hz
- 2000 Hz

The higher the NRC number the greater the sound absorption. The highest rating is 1.0.

Con-form Group manufactures acoustic barriers with an NRC of 0.75 for less noisy spaces and others with an NRC of 1.05 for the harshest environments including data centres.

Other criteria the Acoustical Consultant will investigate are:

- RW
- Ctr
- RC Mark II Noise Flanking Noise
- Sound Transmission Class

Rw (or Weighted Sound Reduction Index) is a laboratory measured value defined by ISO 717-1. It is a measure of how effective an acoustic barrier is.

An increase of 1 Rw point is equivalent to a reduction of 1 decibel in noise transmission through an element (i.e. a wall). The higher the index the better. For example, double glazed windows have an average Rw of 29, and go as high as 43 Rw, compared to 24 for 3mm single pane glass.

An effective acoustic barrier should be up around Rw of 50. In some applications the Rw doesn't account for all noises on the rooftop, especially low frequency bass noises.

The Ctr value is used to more accurately pinpoint the required sound insulation performance.

Rw + Ctr is influenced by the material properties of the acoustic barrier membrane. That is, the type of material, weight and thickness.

The higher the Rw + Ctr value the more effective the acoustic barrier is at reducing high, midrange and low frequency sound transmission.

STC refers to the ability of building materials to transmit noise.



The Government Connection

The HVAC&R industry has to comply with Building Code of Australia regulations. Namely AS/NZS 1170.1.2.4, AS1657 and AS1664.1. However, there is no reference to sound attenuation of mechanical plant machinery in Standards Australia documentation.

In Victoria, the State Environmental Protection Policy (SEPP N-1) in Class 5, 6 and 9 Buildings offers a guideline for acceptable base noise limits and typical noise limits for residential, commercial and industrial properties.

It states that 45 decibels (dB) is the base noise limit for during the day, 40 dB for evenings and 35 dB for night time. It goes on to show that typical noise limits for residential areas are 50-54 dB in the day, 44-48 dB in the evening and dropping to 39-43 dB at night. The limits for commercial areas are 54-59 / 48-52 / 43-47 dB. As expected, industrial limits are higher: 63-68 / 57-61 / 42-56 dB.

New South Wales councils refer to the EPA's Noise Guide for Local Government.

Councils tend to have their own Noise Pollution Laws and these change from region to region. There isn't a blanket 'norm' for all locations. For example, one Council has stipulated that the noise coming from an HVAC&R system cannot exceed background noise level by more than 5 decibels at the property boundary.

For this reason, building developers need to collaborate with local government in the planning stages of their projects to ensure their structures will comply with their acoustical requirements.

From our perspective, given the number of projects we have witnessed which strike problems, this is something that is not adhered to across the board.



Finding Out Too Late

The traditional construction process for a new data centre reveals why so many projects end in grief when it comes to HVAC&R unwanted sound and acoustic management.

Stage One is initiated when the developer comes up with the idea to produce (a data centre, shopping centre, hospital, etc.). They search for suitable land – we have already noted that this is often near residential housing.

An architect is commissioned to draw up a Basic Plan. This is devoid of a lot of the detail of the final plans and displays a simple interpretation of the developer's vision.

The Basic Plan is submitted to Council for review. It is approved and then the land is purchased.

Next, the architect prepares the Scope of Works which includes the detailed design of the building, shadows, run off, sewer, roads, etc. The developer and architect approach the necessary stakeholders such as the Geotech Engineer, Structural Engineer, etc

From the team's combined expertise comes the tender document which is then distributed. The builder and other contractors (plumbing, electrical, air conditioning) are selected.

The building is constructed and the developer goes to Council for final approval and the Occupancy Certificate.

This is when the building company is shocked and amazed at being knocked back! Council has determined – after conducting its own acoustic audit - that the building is not acoustically compliant!!!

It goes without saying that there are multiple risks which could be experienced by the builder in this stage.

They could range from the landlord being forced to delay their retail opening and therefore losing large amounts of revenue....

to angry tenants demanding access to the building and threatening legal action...

to the discovery that the roof does not have the structural integrity to support additional weight (of an acoustic barrier) and therefore it requires additional bracing at even more expense before a solution can be added.

At Con-form Group we have lost count of the number of times we have had building companies come to us in a panic and say, "I wish we had met you earlier"!

This is why the matter of rooftop acoustics needs to be raised at the early stages of a project and costed in before work commences.



A Simple Solution

Our advice is to allow us to brief the stakeholders in the early stages of the project. We will explain the acoustic scenario and recommend that a solution be costed into the project from the outset.

What is the financial investment going to be? Particularity when the HVAC&R equipment hasn't even been chosen yet?

Experience on past data centres has given us a range of typical noise parameters which we can refer to.

Our exclusive Tunable Technology© features 5 different surface densities which absorb-reflect different noise volumes. A practical proposal is to suggest costing in the middle-ground (Option B or C) system. In virtually all cases this will be the right solution and for the few in which there is a greater noise issue we can easily upgrade the wall panels accordingly during manufacturing. With a minimal cost uplift.

By doing this the project has future proofed itself for when it arrives at the HVAC&R installation stage.

No ugly surprises. No unnecessary panic. No spike in costs.



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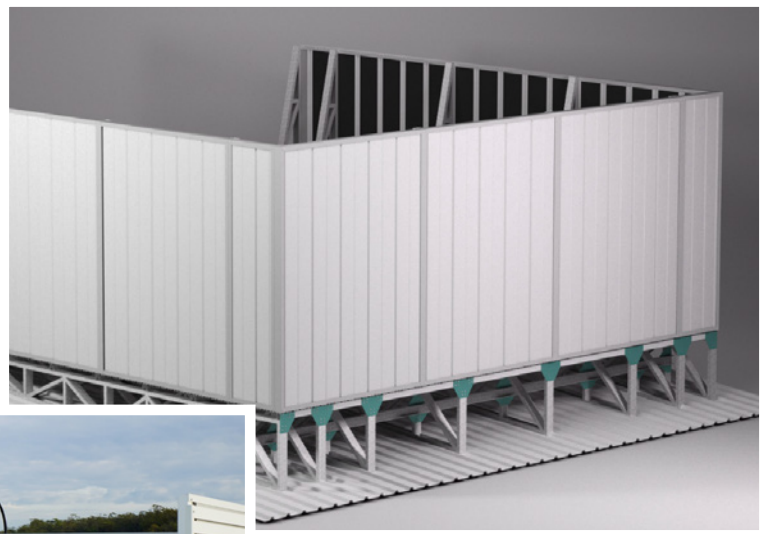
Working with Con-form Group has been a faultless experience... The team were able to adapt and create a solution that worked perfectly for our project - one that wasn't straightforward and resulted in a lot of last-minute changes which Con-form Group were able to quickly and proactively make. There was a lot of coordination between the engineers, myself, and Con-form Group designers to come up with a solution and the team just nailed it. The most impressive part of all was that we needed the plant deck quite urgently - so the team fabricated the deck and organised transport within 48 hours - they were also the only contractor who met our crane on time. The key to what we at Hutchinson Builders look for in services is the ability to evolve around and adapt to what the builder requires because, at the end of the day, we deal with many different parties with all their different agendas and interests. It's just about working together with all those different parties and Con-form Group made that a lot easier for us. Honestly, it was just a good system, good process and good people.

Oliver Macklin

Hutchinson Builders

”







Acoustic Criteria

Alright, you've made the decision to cost the acoustic system into your data centre project. Good.

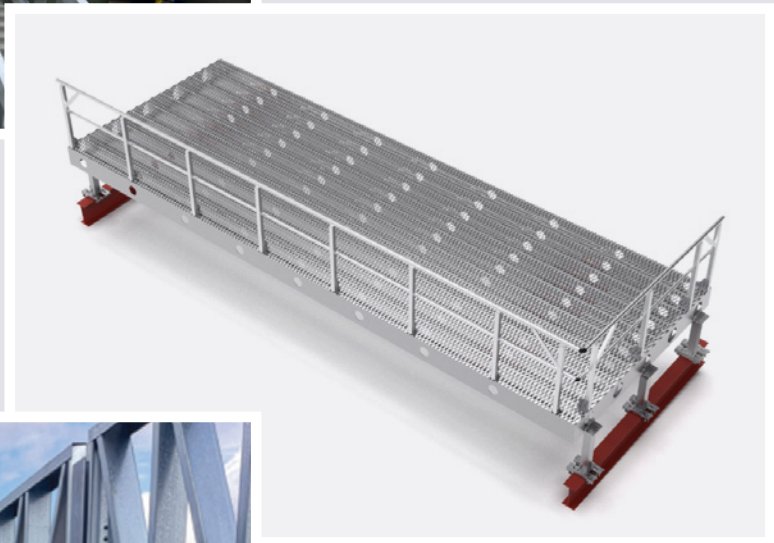
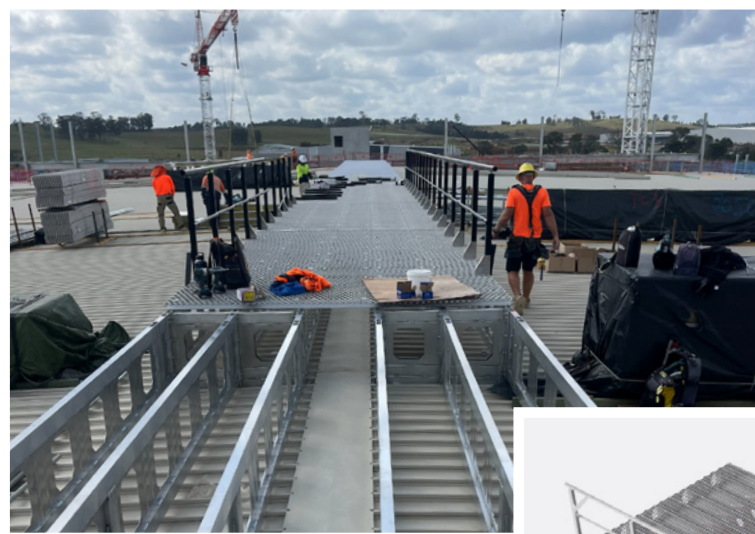
What does a benchmark system look like?

What are the features you will require?

Here is a checklist for you. The product you select must be:

- Tuneable – offering different performance based on the noise types and levels coming from each direction of the HVAC&R system
- Variable – available in a range of heights and widths to provide the right amount of mass and to properly fit the available roof space
- Scalable – it can be cost-effectively added to later on (if the HVACR system is upgraded or expanded)
- Lightweight – have frames and panels as light as possible so that the builder doesn't have to reinforce or rebuild the roof structure
- Reflect and absorb noise (2 methods)
- Easily attached to the roof – metal or concrete, of variable pitches

And, of course, it needs to be cost-effective.





Easy Access

The brief from the data centre builder centred on the need for maintenance and service teams to be able to access elevated HVAC equipment... but such a system did not exist.

The engineering parameters included:

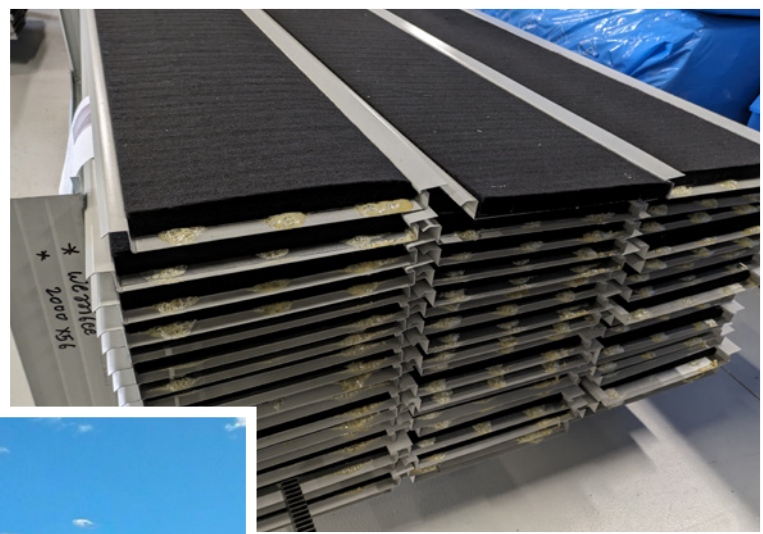
- A structure more than a metre high with the strength to support personnel and their equipment (such as replacement components)...
- Which would not compromise the existing roof structure and lead to the need to add costly bracing...
- With access points at each end...
- Which could be attached to the concrete roof surface

Faced with this mathematical challenge our R&D and Engineering teams referred to our existing equipment platforms, namely the EasyMech MR and CR.

Despite being manufactured from light gauge steel the frames are able to support industrial loads of 5.0 kPa or more due to their mathematically-calculated triangulation. And, they weigh a mere 14kg per square metre.

The Industrial Design team adopted the same load bearing configuration and the end result was this Raised Walkway.

Since its launch it has become a standard feature on our data centre projects with some of them being up to half the length of a football field. Due to its incredibly light weight it doesn't require any additional structure being added to the roof rafters or purlins.



Hyper Delivery



As Albert Einstein once said – the only source of knowledge is experience. He probably copied Julius Caesar who was refuted to have said experience is the teacher of all things.

The bottom line is that after having completed more than 20,000 projects across the nation, Con-form Group definitely had the experience to draw on when it came to developing products that are specific to the data centre market. And, getting those products to market in a timely manner.

Not only do we understand what physical structures are required (HVAC platforms, acoustic screens and louvres, concealment walls, raised walkways, etc.), we know about the unique construction requirements in this niche sector of the construction industry.

For example, (a) typical data centre projects require a lot of products to be designed and manufactured. This impacts production capacity. Plus, (b) there is typically a small window of time provided for the installation of these products.

If we access the roof space after the chillers (and sometimes solar panels) have been installed - for a project such as acoustic screens and raised walkways - the roof space is cramped. This impacts the installation by making it more difficult for our team to move about.

Production runs are a lot bigger than average projects and there is real urgency to have them delivered.

Firstly, we developed fit-for-purpose solutions then secondly we ensured that all of our methodologies and systems from the initial concept through to installation were as seamless and swift as possible.

The end result was... Hyper Delivery.

2 Part Process

Part One of this exercise led to what we now call the P.A.C. System© – platforms, acoustics and concealment.

This is an integrated group of solutions which have been developed for data centres. For example, the acoustic screen and acoustic louvres feature the highest-possible Noise Reduction Coefficient available. A perfect score of 1.05.

Another demonstration of technical collaboration: the acoustic and concealment screens can be mounted directly to a steel or concrete roof... and also to our purlin-mounted or rafter-mounted platforms. Whichever works best.

You'll read more about this later on.

Part Two was our HyperDelivery© method. A rapid process involving all of our teams.



The Foundation

Con-form Group utilises best-of-breed Enterprise Resource Planning software to integrate and manage every part of our business. This includes sales, product design, finance, HR, supply chain, manufacturing, project management, delivery and installation.

It provides us with daily visibility and real-time data which enables us to make quick decisions and always be prepared for when the next data centre project arrives.

We have long been students of Lean Manufacturing principles, Material Resource Planning and the logic of Eliyahu M Goldratt, the originator of the Optimized Production Technique, Theory of Constraints, Thinking Processes and Critical Chain Project Management, and author of the highly acclaimed book, "The Goal".

Common Materials

One aspect of 'lean' is a reduction in the variety of raw materials. A simplification of stock which results in less wastage and reduced costs.

This is evident in the suite of data centre products (i.e. Easy Mech CR© and EasyMech MR© surface-mount platforms, Span+© rafter-mount platform, Acoustic+ Wall©, Acoustic+ Ultra Wall©, Acoustic+ LouvreWall©, Conceal Wall©, Conceal AeroWall© and Raised Walkway) which are all made from light gauge steel.

Engineering our products this way enables us to order larger quantities of coils of the same steel types from the mills and pass on those cost efficiencies to our customers. By placing bigger orders we always have an abundance of stock should a data centre project suddenly appear.

A roll-on benefit is that the line-up of roll-formers in our Manufacturing Centre of Excellence© don't have to be changed very often. You lose time every time you have to remove a half-used coil, select a new one and re-feed the machine. By having similar stock loaded on the roll-formers it means we can also engage multiple lines to produce common product components should a large-urgent order arrive.



Modular Design

Having agreed that light gauge steel is our preferred material it made sense that a platform or screen which has to be installed in days (not months as per traditional steel solutions) should be modular and prefabricated.

If we could deliver a partially assembled platform to site our installation team would only need to bolt a few components together. No cutting or welding (which is a standard part of a structural steel or aluminium product).

That determined the design of each product. They had to be made up of a family of common parts and the ease of how they came together was also a big priority.

The next focus was how to deliver the products to site in the most efficient manner – time wise as well as cost.

This led to the system we use each day. Sections are bundled together as flat packs which makes loading of the trucks very easy. It also improves the “Tetris” process of placing as many flat packs as possible on a single load for economical transportation.

If a project requires platforms and screens the flat packs are arranged to be a certain size and shape to allow them to go on the same load.

Factory Layout

Workflow is a crucial aspect of being able to rapidly produce products. There is an exact science to the layout of workstations and assembly areas in our factories.

Workstations across the Con-form Group factories are located to increase efficiency and speed of manufacture. Shorter distances between them mean less carrying and walking from task to task.

As the roll-formers spit out their lengths of profiled steel the prefabrication crews are ready to go. They move the pieces to an adjacent assembly zone where the necessary tools and work benches are positioned so that each section is quickly completed.

Two parallel factories have large exits - big enough to accommodate the longest spans – facing each other with the semi-trailer loading bay in between. This allows for forklifts to load trucks from both sides at the same time thus speeding up the process.



Manufacturing Equipment

Fit-for-purpose is a phrase we use a lot when describing our products and it is also pertinent to rapid (hyper) delivery.

Con-form Group sourced manufacturing equipment which is designed for high-speed output. A number of these machines have been custom-built to specifically suit our products.

Installation

At the work site the flat packs are swiftly placed on the roof in one or two loads – and the crane is a lot smaller (and cheaper) than what conventional steel requires. This is a dramatic comparison to structural steel projects which require the crane to remain on site throughout installation because the sections are too heavy for people to carry.

Being so light, our platform and screen sections can easily be picked up and carried across the roof to their exact location by just a couple of installers.

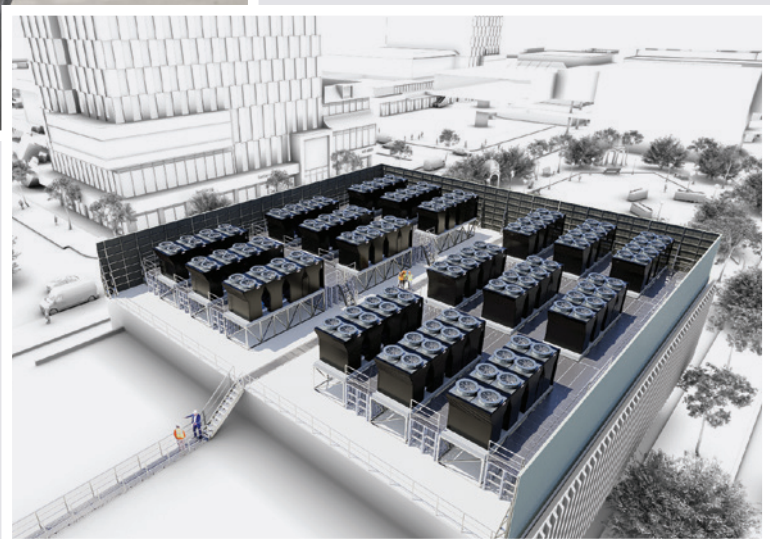
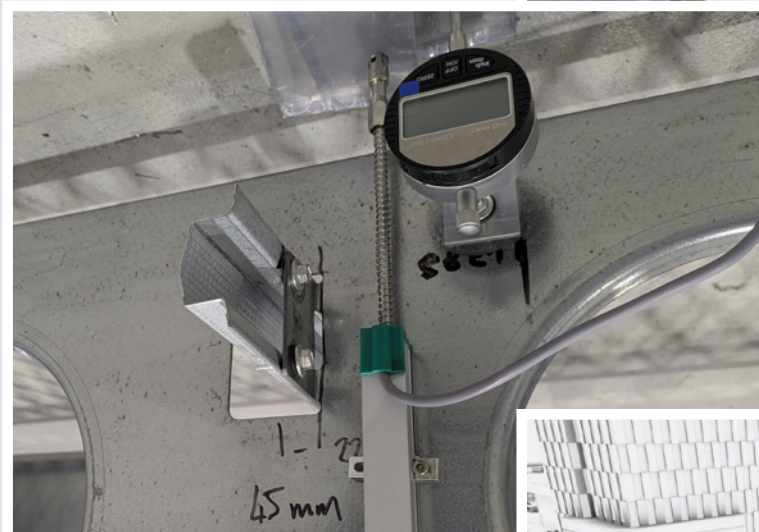
Another time-saver is the final assembly process.

Traditional structural steel platforms require cutting and welding of beams on the roof. Our prefabricated sections simply bolt together like a giant Meccano set. The installers are armed with a tape measure and battery hand drill.

Every now and then we decide to crane the complete platform to the roof. This cuts down the installation time even more.

At times where there is no crane access to the roof we simply call in a helicopter and it lowers the platform at the right location.

There you have it. An intricate, inter-connected, scientifically planned methodology which delivers fit-for-purpose data centre products of the highest quality to site in the least required time.





P.A.C. System for Data Centres

Acoustic+Wall©

sound barrier Con-form Group developed in collaboration with acoustic engineers and industry experts

Australia's first and only tuneable system

can be adjusted to suit the variety of noise levels

unique 3-phase operation which absorbs-reflects-absorbs noises

5 surface densities from 7 kilograms per square metre for lesser noises to a maximum of 31 kg per square metre

NRC of .75

the product of choice for hospitals, schools, shopping centres, aged care homes, universities, sporting facilities, medical centres, fast food outlets, service stations, office buildings

polyester absorptive material wrapped in durable light gauge steel

fire retardant

moisture & UV resistant

lightweight steel frame

attached to steel and concrete roofs

a range of popular Colorbond colours

can be made more aesthetically appealing by including acute angles, chamfers, curves, rounded corners, wave pattern...

meets Australian Standards AS/NZS1170.1, AS1170.2, ASV1170.4, AS1657, AS1664.1 and relevant clauses of the Building Code of Australia

certified for wind regions A, B & C

25-year warranty



Acoustic+ Ultra Wall©

best-in-class acoustic barrier

NRC rating of 1.0

other technical features are identical to Acoustic+Wall

Acoustic+ Louvre Wall©

angled louvres contain the same polyester absorptive material as used in Acoustic+ Ultra Wall

NRC of 1.0

mounting the panels back-to-back and creating a chevron-effect dramatically increases noise mitigation

louvres can be angled either up or down (sending exhausted air skyward or towards the ground)

available in popular Colorbond colours

installed on metal and concrete roofs

EasyMech MR©

purlin-mounted steel platform

installed on a metal roof

penetration-free

suits pitches as acute as 20 degrees (or more)

lightweight design @ 14kg/m²

evenly distributes weight

live load rating of 5.0 kPa (and more)





Span+©

rafter-mounted platform installed on a metal roof

when purlins are not capable of supporting the platform

stub columns inserted with minimal access (“keyhole surgery”) and fastened to the rafters

lightweight modular

evenly distributes weight between rafters

suits pitches as acute as 20 degrees (or more)

live load rating of 5.0 kPa (and more)

EasyMech CR©

concrete-mount platform

sits on top of engineer- certified seismic (sound and shock) EasyFoot CR system

12 kilograms per square metre

live load rating of 5.0 kPa (and more)

ScreentoRoof©

frame system for metal and concrete roofs where a platform is not required

certified for wind regions A, B and C

25-Year Warranty



Sustainable Steel



More and more, sustainability has become a critical factor of each construction project.

We're all on a mission to reduce emissions and achieve a good Green Star rating.

As you would be aware this goal has a massive impact on the choice of materials. When you select light gauge steel products from Con-form Group you are choosing the most environmentally responsible steel product on the market.

A quick history lesson...

The World Steel Association was founded in 1967 with a focus on environmental standards. It published them in 1972 followed by a sustainable development policy in 1993.

Since 2004 the WSA has been collecting data on the sustainability performance of steel and more recently it formed the Climate Action Group – which is supported here in Australia by the likes of Bluescope and Liberty Steel.

In 2015 the United Nations created the Agenda for Sustainable Development and established sustainability goals for construction materials. Since then, the European Union has announced the goal of reducing greenhouse gas emissions in construction materials by 55% by 2030.

Here in Australia the Australian Steel Institute came out with its Environmental Sustainability Charter.

The global construction industry produces approximately 39% of the world's CO₂ gas emissions - from materials including concrete, glass, aluminium, timber, brick and steel.

Worldwide steel production generates 7% of global greenhouse gas emissions. This equates to 2.6 billion tons of CO₂ per year.



Structural Steel

To understand how to improve sustainability in construction it is necessary to know how different materials are made. Let's start with structural steel.

The process begins with the mining of iron ore which is placed into either a Basic Oxygen Furnace – also known as a blast furnace – or an Electric Arc Furnace.

The Basic Oxygen Furnace is used for three-quarters of global steel making.

It uses coke – a pure form of coal – as its fuel source.

Limestone is added to purify the iron.

To purify the iron it needs temperatures as high as 1280 degrees Celsius.

Sometimes recycled steel is added... typically 25 – 30%.

Light Gauge Steel

Compare this to how Light Gauge Steel is made.

A mixture which contains as much as 100% of scrap steel and recycled steel is placed into an Electric Arc Furnace. The minimum for recycled content is 25% but it is usually 90-100%.

Electrodes are lowered into the furnace which create electric arcs hot enough to melt the steel.

The United States uses EAF for 70% of its steel production.

In the EU 44% of steel is made using EAF compared to 56% of steel made using the Basic Oxygen Furnace.



Comparing The Numbers

Let's look at some of the figures regarding sustainability. Firstly, structural steel.

For every 1 ton of structural steel produced by the Basic Oxygen Furnace it consumes 20-25 gigajoules of energy.

It is hot rolled into I beams, L beams, H beams, universal beams and universal columns.

It is so thick it needs hundreds of tonnes of pressure exerted in the roll formers to form the profiles. Sometimes the steel, such as hollow sections, are welded together to make longer lengths.

The process here is High Frequency Electric Resistance Welding where a current is fed through the ends to fuse them together... and this requires additional energy use.

5-7 gigajoules is needed to manufacture 1 ton of Light Gauge Steel with an Electric Arc Furnace. Roughly a quarter of what is needed in the BOC.

Light Gauge Steel is cold formed at room temperature.

It doesn't require the massive heat of structural steel, and because it is so thin, being typically between 0.5mm – 3mm, there is not a lot of pressure required by the roll formers, and they require limited energy.

The steel is wound into a coil or formed into C, Z and S profiles.

Add another 1-2 gigajoules of energy to power the roll formers and you have a combined total of 7-9 gigajoules per 1 ton of steel coil.

Which is still only 1/3 of what is generated by the structural steel process.

Obviously, with less iron ore content there is less requirement on mining and the costs of delivering the ore to the mill.

Interestingly, this energy consumption is 50% less than what was required 40 years ago.

That speaks to the effectiveness of global sustainability efforts.

Here in Australia our steel producers make 4,500,000 tonnes per year.

They moved from 100% ingot casting to 100% continuous casting which led to an energy saving of 25%.

Another point to add to this topic is that Light Gauge Steel offers high levels of thermal performance.



When it is integrated with proper insulation in a building it reduces thermal bridging – the heat transfer from walls or roof materials. This leads to reducing the heat of the building and therefore reduces cooling demands.

It also lowers the carbon emissions of the building itself.

So, this is another positive for using Light Gauge Steel.

Compare the previous chapter to energy-hungry aluminium.

In the process of refining and smelting it, it consumes 75 gigajoules per ton.

It uses the Bayer Process for bauxite refining and the Hall-Heroult Process for smelting.

The electrolysis process which changes the alumina into aluminium metal runs at 950 degrees Celsius and requires 60 gigajoules of energy per ton.

The molten aluminium is cast into ingots, slabs and billets at 700 degrees Celsius.

A local example is the Tomago aluminium smelter in New South Wales. It operates 24 hours a day and produces 37% of the nation's aluminium - 590,000 tonnes. It consumes approx. 10% of the state's electricity or 950 megawatts.

A serious ecological issue with aluminium is that for every 1 ton produced there is 4 tons of toxic waste containing lead, cadmium and mercury.

This is stored in tailing ponds.

Another common building material for data centres is concrete.

It requires 5-6 gigajoules of energy to make 1 ton of cement.

One reason for this is because of the temperature in the kiln which makes the cement – it runs at 1450 degrees Celsius.

Cement is mixed with aggregate and water to make concrete. These materials have their own energy-consumption figures from extracting and transporting the materials to the concrete manufacturing facility.

Those extra figures need to be taken into consideration too.



Greenhouse Gas Emissions

When it comes to CO₂ gas emissions during production a Basic Oxygen Furnace generates between 1.7-1.8 metric tonnes of carbon emissions to make 1 ton of steel.

Versus 0.4-0.8 metric tonnes of emissions from an Electric Arc Furnace.

The global steel production industry generates 7-9% of all greenhouse gas emissions and 80% of this comes from the Basic Oxygen Furnace.

Globally, in 2020, the average ton of steel produced led to 1.89 metric tonnes of CO₂ in the atmosphere. This represents a 50% reduction due to ongoing sustainability improvements.

In the US the Environmental Protection Agency and Department of Energy have praised the steel industry for its reductions and efficiencies.

The Embodied Carbon Footprint represents emissions from the production, transportation and installation of steel.

In this, Light Gauge Steel has a smaller footprint than structural steel.

In contrast, Chinese steel produces 50% more emissions than steel made in the US, Europe and India.

China is the only country in the world using pig iron in steelmaking which puts out 3x more CO₂ emissions.

Aluminium production generates approximately 12 metric tonnes of emissions to make 1 ton of material.

Concrete produces about 0.9 metric tonnes of emissions per ton of material.



Weight

The density of steel leaving the furnace is 7850 kg per cubic metre. Then it is turned into structural or Light Gauge Steel and this is where the differences occur.

Rule of thumb is that structural steel will weigh 8-10x more for same dimensions.

For example, a 10-metre long solid beam made of structural steel – with 200mm I beam, 100mm flange and 8mm thickness - weighs approx. 600 kg.

A 10-metre Light Gauge Steel beam – 100mm deep C-section made of 2mm thickness – weighs approx. 60 kg.

Light Gauge Steel is 60% lighter than concrete.

The Con-form Group Product Development Centre used software to determine the weight of one of our purlin-mounted rooftop HVACR platforms made from Light Gauge Steel versus old-school structural steel.

The platform measured 17.2m x 8.57m.

It was for a 3-degree roof pitch and had a live load rating of 2.5kPa.

The mass of the structural steel platform was 9572.7 kg.

Our Light Gauge Steel version was only 1544 kg.

A variation of 83%!!!!

That means you could make 4 platforms from Light Gauge Steel compared to 1 structural steel platform, using the same weight of material.

Because it weighs less Light Gauge Steel requires less energy to take it from the mill to the work site. Less fuel and less emissions – from the ship, dock crane, road transport, rail and the site crane.

As an example, we only require a light crane to lift our Light Gauge Steel flat pack... or complete platform... on to the roof top. After that the crane can go home.

Our platform joists and beams can be carried around by hand by just a couple of installers.

With structural steel being so heavy, you need a bigger crane which produces more emissions, and you need it to stay onsite much longer for every time you want to move a piece of steel into place.

It is too heavy for installers to carry.

To ship 1000 tons of steel halfway around the world... a distance of approximately 10,000 km... generates a carbon footprint of 79 metric tonnes. If you use our ratio of 4:1 here it means that 4x more Light Gauge Steel platforms can be sent in each ship than structural steel ones.



Corrosion

Structural steel is made of iron which rusts when exposed to moisture – be it rain or ambient humidity. It can rust to the point of failure.

Some steel is painted but the weather can crack the paint and the moisture gets in the cracks. Thus it needs to be replaced which leads to a doubling of energy consumed/emissions released.

Zincalume G550 – the high tensile steel preferred by Con-form Group for our platforms, screens, louvres and frames – is hot dipped in aluminium/zinc alloy to protect it from corrosion.

This method offers a 4x longer life expectancy than traditional galvanising.

Light Gauge Steel has a self-healing quality. When the steel is cut, the protective film creeps over the exposed surface and covers it up.

We have visited platforms we installed over 10 years ago and there is not a mark on them.

We offer a 20-Year Warranty for our products exposed to the elements and 50 years for internal framing.

Wastage

Usually, structural steel is cut to length onsite leading to some wastage.

Light Gauge Steel frame sections are cut exactly to size by our roll-formers so there is nothing left over.

Zero wastage.



Recycling

Steel is 100% recyclable. It is the most recycled product in the world.

It is a circular economy which reduces the need for virgin steel and minimises waste going to landfill.

Globally 80%+ is recycled; here in Australia that figure is 82%.

Compared to 74% of concrete being reused, and 38% of glass in Australia.

In North America 80,000,000 tons of scrap metal is made into new products each year.

A pipe can become a car door then a refrigerator then a wall frame then a soup can.

It never loses its structural integrity.

It can be recycled without limit.

The steel mills recycle their own scrap steel and also source it from downstream product manufacturing.

They also recycle almost all of the water they use in a closed loop system.

Less than 270 litres of water is needed to produce 1 ton of structural steel.

Since 1990 technical advances in steelmaking have led to 27% reduction in energy required and 33% reduction in GHG emissions per ton.

EAF furnaces use up to 100% of old steel to make new Light Gauge Steel.

For every 1 ton of steel that is recycled it conserves 1200 kg of iron ore, 700 kg of coal and 60 kg of limestone.

Light Gauge Steel prefabricated frames and structures are very easy to disassemble without any loss of material.

In comparison, structural steel faces losses from corrosion and it is typically cut into pieces with welding torches which requires more energy use and gas emissions.

In Australia, 80% of blast furnace slag (1,600,000 million tonnes per year) is used as a cement substitute for making concrete and for road base.

The local mills clean, cool and reuse 90% of their water...the other 10% is lost to evaporation.

In the same way aluminium is infinitely recyclable without any loss of its unique properties.

Nearly 75% of all of the aluminium ever produced is still in use today in other products.

Just 20% of concrete is crushed and recycled in new concrete.



Life Cycle

Longevity of material is an extension of its recyclability. The longer it performs the less need there is to replace it.

Steel can expand and contract without cracking.

It is resistant to fire, mould, termites... it won't rot, bend or warp.

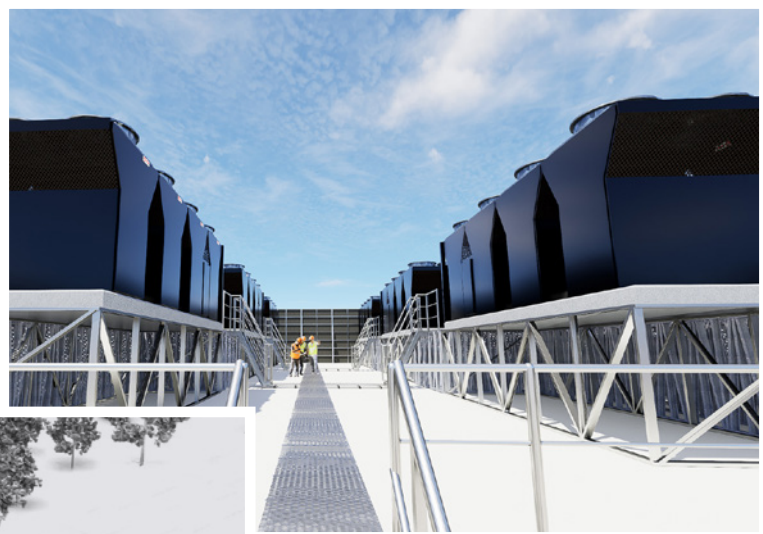
There are buildings, bridges, water towers and other structures which are still in use 100 years after they were made.

However, going back to Corrosion...

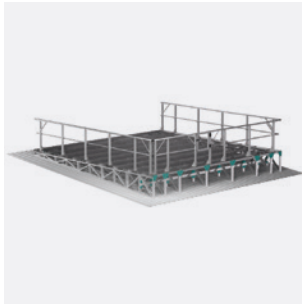
Unless steel is meticulously looked after (like the Sydney Harbour Bridge which is always kept painted to prevent rust) structural steel will corrode.

At Con-form Group we offer a 20-Year Warranty on the Light Gauge Steel we use for our outdoor products which are subjected to the elements...and a 50-Year Warranty for internal frames.

	Light Gauge Steel	Structural Steel	Aluminium	Concrete
Energy Consumption (per ton)	7-9 gigajoules	20-25 gigajoules	75 gigajoules	5-6 gigajoules
Method	Electric Arc Furnace	Basic Oxygen Furnace	Electrolysis	Kiln
CO2 Emissions	0.4-0.8 metric tonnes	1.7-1.8 metric tonnes	12 metric tonnes	0.9 metric tonnes



Product Overview



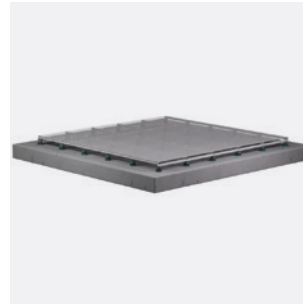
EasyMech **MR**®

Purlin-Mounted
HVAC+R Deck



Span+ **Platform**®

Rafter-Mounted
HVAC+R Deck



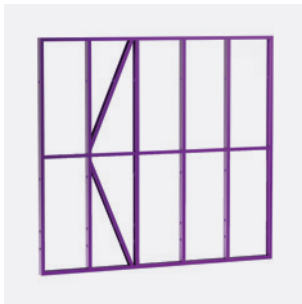
EasyMech **CR**®

Concrete Mounted
HVAC+R Deck



Con-form **Access**®

Roof Access Systems &
Walkways



Con-form **Frames**®

Wall Enveloping &
Internal Walls & Ceilings



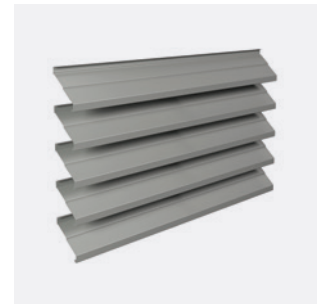
Con-form **Floors**®

Mezzanine &
Sub-Floor Frames



Conceal **Wall**® &
Conceal **AeroWall**®

Premium Visual Barriers
with Airflow options



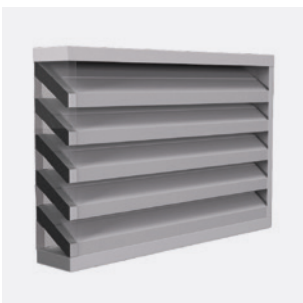
Louvre
Wall®

Visual Barriers
with Airflow



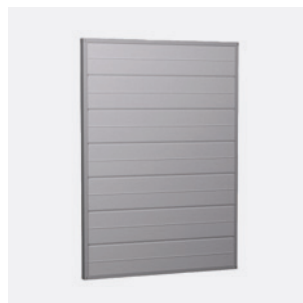
Acoustic+
Wall®

Tunable Acoustic
Visual Barriers



Acoustic+
LouvreWall®

Acoustic Visual Barriers
with Airflow



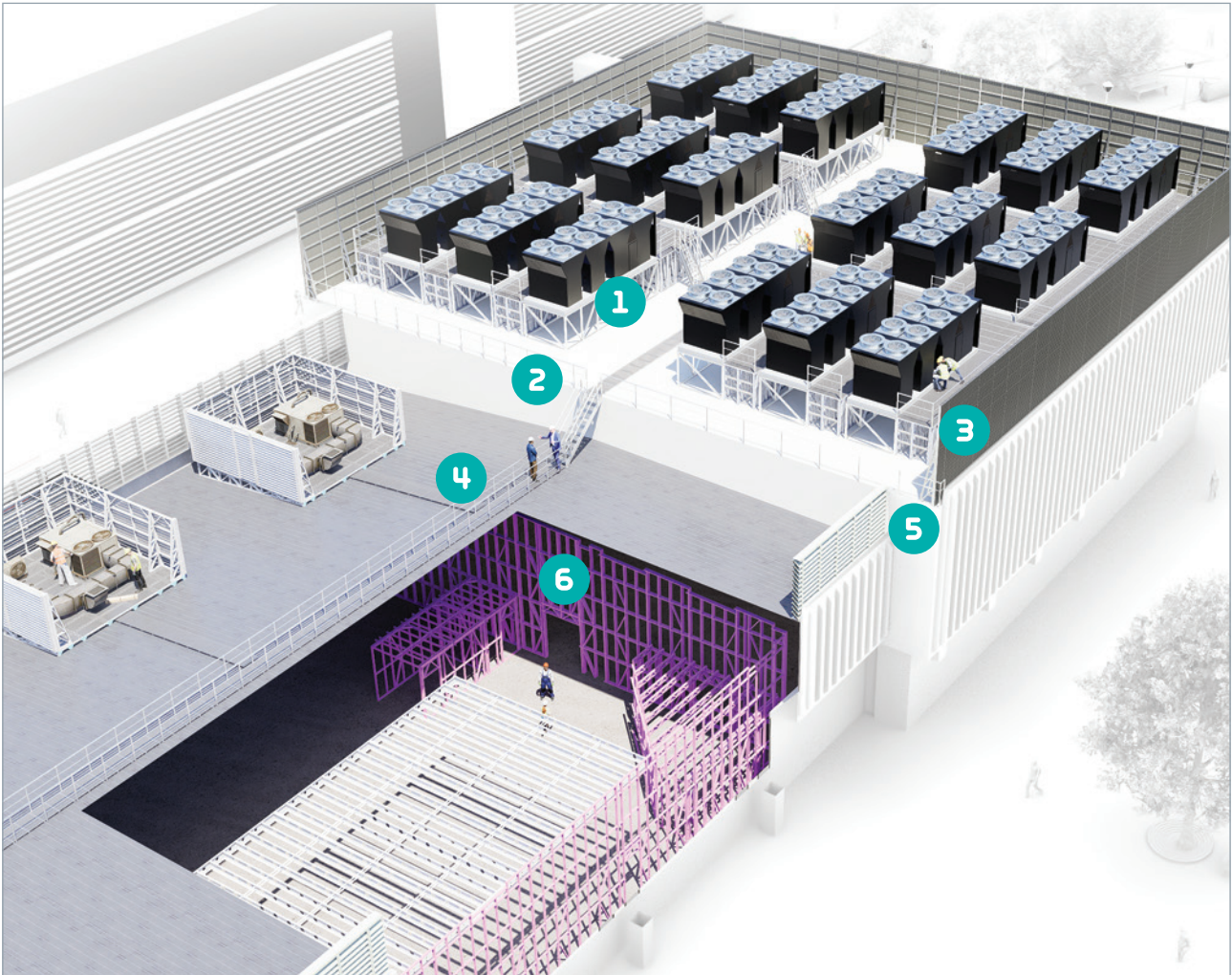
Acoustic+
UltraWall®

Premium Acoustic
Visual Barriers



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