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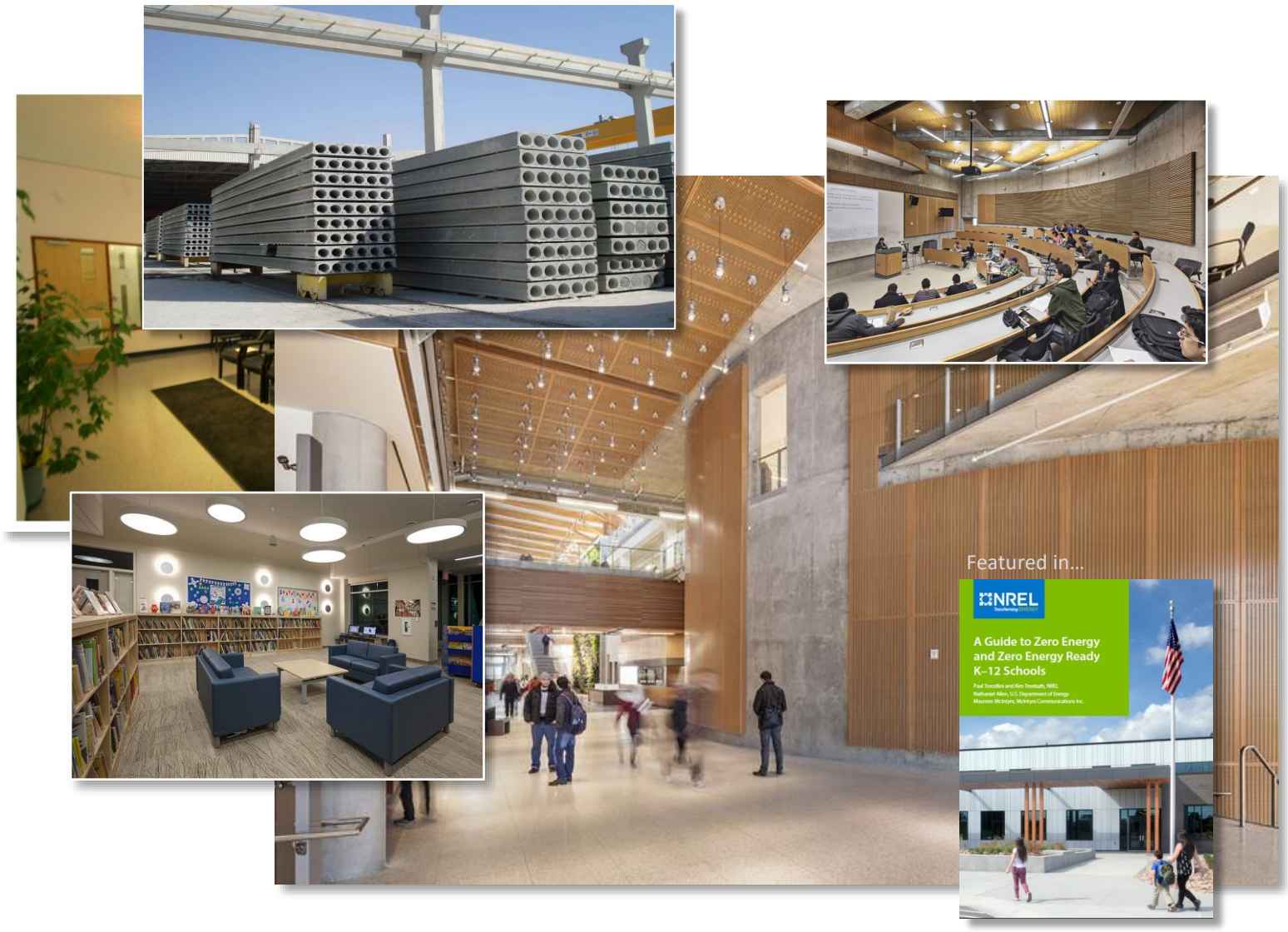
Sustainability Guide

Value add to Sustainability Challenges in Buildings

with ***Integrated Ventilation Design***



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Sustainability Guide

Overcoming Sustainability Challenges in Buildings

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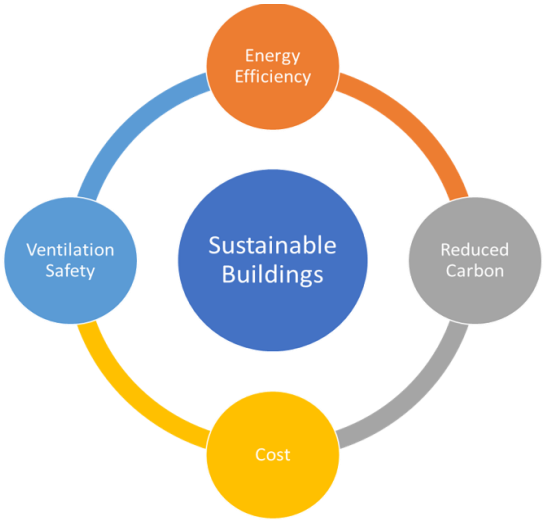
Sustainability is a challenge that can be met with Integrated Ventilation Design

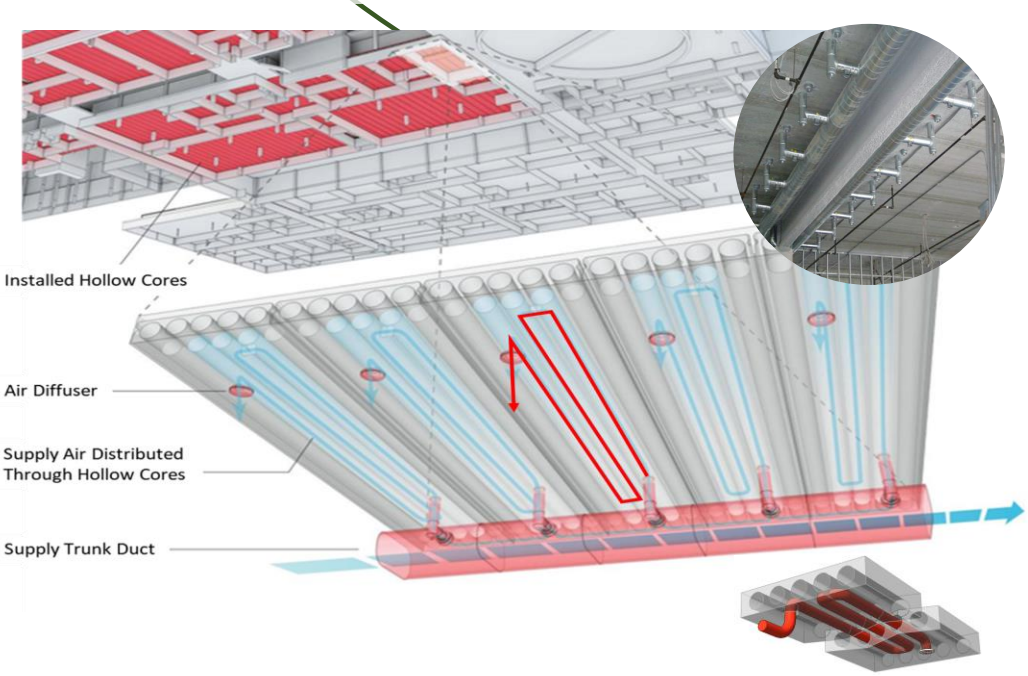
This Sustainability Guide introduces **Integrated Ventilation Design** which helps to solve some of the most pressing issues of designing and retrofitting buildings today through guaranteed simplification.

Making buildings more sustainable will help the world achieve its broader sustainability goals of increasing global ***energy efficiency*** while minimizing both ***embedded and operational carbon*** at a reasonable ***cost***. The recent pandemic has also elevated ***ventilation safety*** as an important construction (and renovation) consideration from this point forward.



Integrated Ventilation Design is a guaranteed engineering design assist that combines the concrete structure of a building with its ventilation system to take advantage of the powerful, but usually dormant thermal properties present in almost all buildings.

Year Round Thermal Energy Storage Without a Power Use Penalty



Integrated Ventilation Design **feeds air** through ducts created in the concrete floors (hollow core or cast in place) to take full advantage of the thermal properties of concrete. It combines four systems into one: heating, cooling, fresh air ventilation, and thermal energy storage.

Integrated ventilation takes advantage of night and daytime opportunities to capture advantageous temperature deltas to "charge" the concrete flooring slabs. This captured thermal energy can then be used to heat or cool the building - largely using fans versus turning on the HVAC system itself.

How massive is this opportunity for achieving sustainable buildings? According to the UK Concrete Trade Association (part of the Mineral Products Association (MPA)), the effect of accessing the thermal mass of buildings can save up to 14% of electricity consumption in the UK by 2050.

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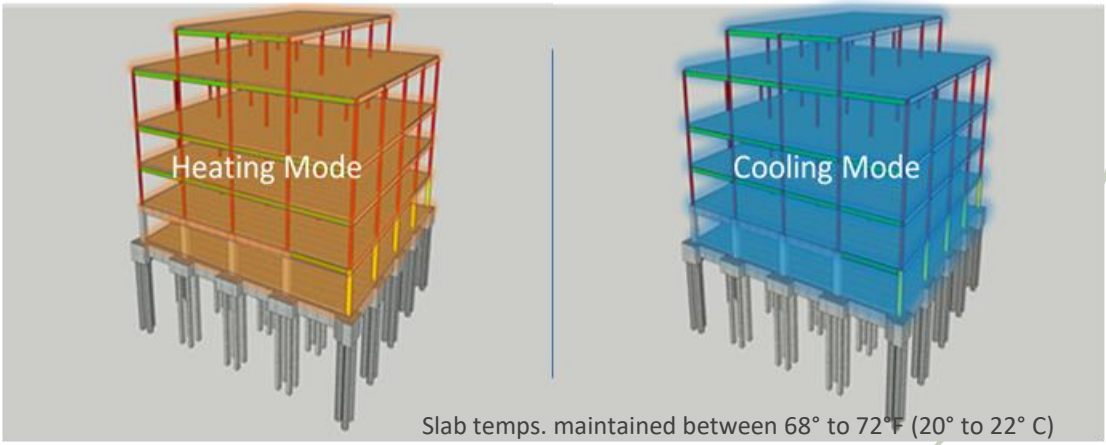
Integrated ventilation achieves “Net Zero Ready” status as a baseline.

Energy Efficiency

When the concrete structure of a building is paired with the heating and cooling system of a building, energy consumption reductions of 35% - 50% can be achieved with no moving parts, no new equipment, and no complex software applications.

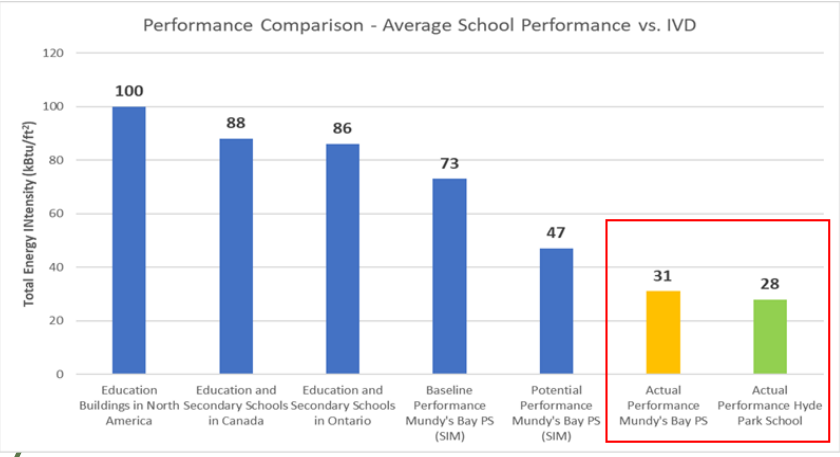
A Super Efficient Thermally Charged Structure



No moving parts No new equipment No complex software

*Actively managing the temperature of the concrete floors **with outside air** at strategic times during the day and night using simple fan motors allows this system to maintain comfort levels in the building without utilizing the heating or cooling elements of the HVAC system itself.*

Integrated Ventilation Design Real World Performance

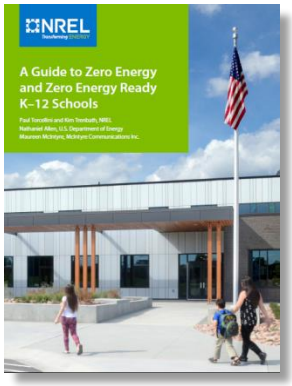


Integrated ventilation significantly outperforms standard school designs in the US and Canada

The best way to prove a system works is with real world examples and performance results. Over the past 15+ years, integrated ventilation applications have amassed a significant track record of over 35 successful projects and ~2M square feet.

Energy Savings	HVAC Capacity Reduction	OPEX Savings
35% - 50%	40% - 50%	40%

Integrated ventilation powers the two most efficient schools in Canada, and a net positive campus in South Carolina. These schools were discussed in a recent NREL research report on Net Zero K-12 Schools.



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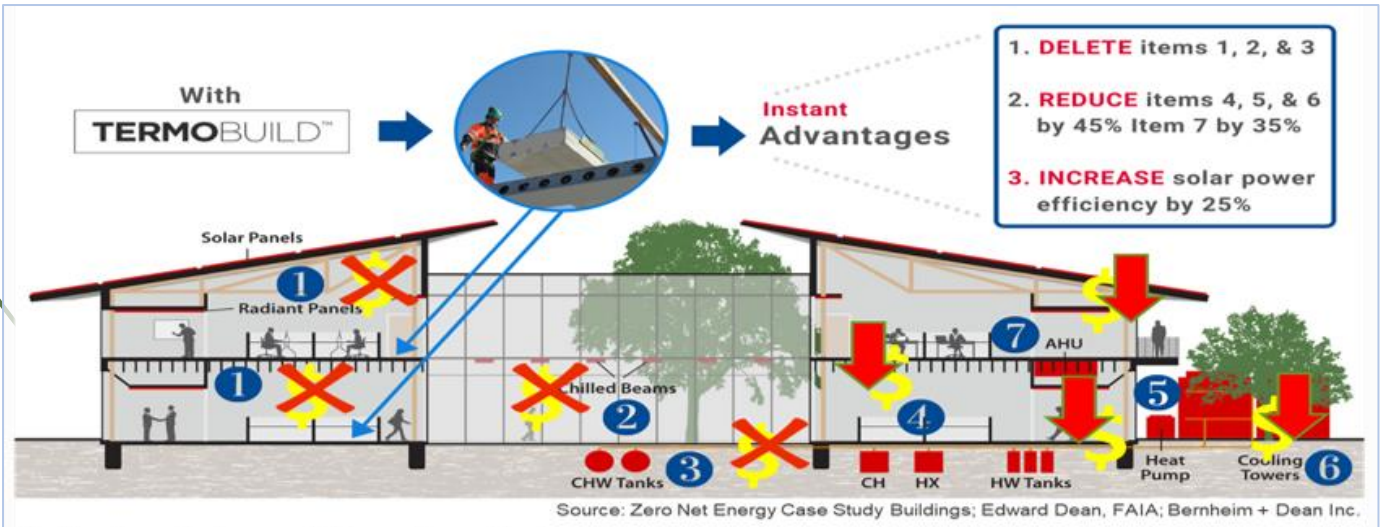
Integrated ventilation achieves better performance for less CAPEX and OPEX.

Cost

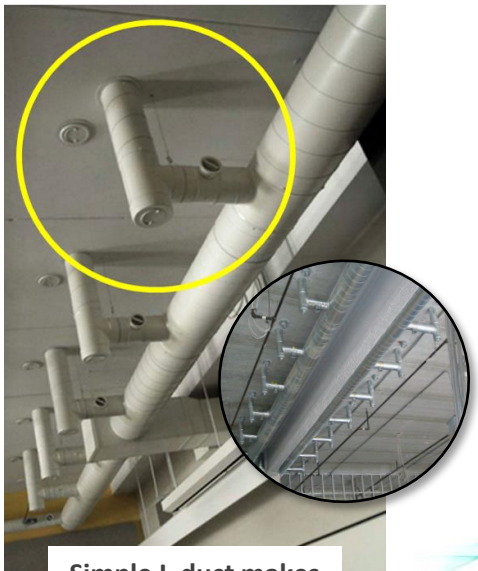
Better Performance for Less Cost and Complexity

Integrated ventilation costs from **$10 - $50 per square foot less than standard buildings of the same design, mainly due to building simplification and equipment eliminations**.



Source: Zero Net Energy Case Study Buildings; Edward Dean, FAIA; Bernheim + Dean Inc.

In the Bernheim and Dean Case Study example above, modeled performance of integrated ventilation was 10% more efficient than the modeled performance of the building with all of the advanced energy conservation measures installed (19.4 kBtu/sf/yr vs. 17.5 kBtu/sf/yr for integrated ventilation). Both of these designs are extremely efficient, however, integrated ventilation design allows for significant cost avoidance and downsizing of equipment reducing cost, complexity, and carbon.



Simple L-duct makes the connection

Simplicity Saves Money

Integrated ventilation is enabled by the simple L-shaped duct, pictured to the left, that connects the flooring system with the HVAC system.

Buildings with integrated ventilation look largely the same as any standard building, except for the fact that many of the mechanical systems, including the HVAC system, can be reduced in size or eliminated

Areas of Cost Avoidance:

- ✓ Eliminate Drop Ceilings
- ✓ Eliminate Raised Floors
- ✓ No Perimeter Ducting,
- ✓ No Advanced Energy Conservation Measures,
- ✓ No Software Fees /Subscriptions,
- ✓ Lower Maintenance/Parts Cost,
- ✓ Lower Maintenance Personnel Cost

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Ventilation safety and energy efficiency don't have to be mutually exclusive goals.

Ventilation Safety

With radiant systems, people are cooled by radiant heat transfer from their bodies to adjacent surfaces and ceilings whose temperatures are held a few degrees cooler than ambient.

Warm air has buoyancy. Integrated ventilation allows the air to transport itself upward, placing treated air where people are located – closer to the floor.

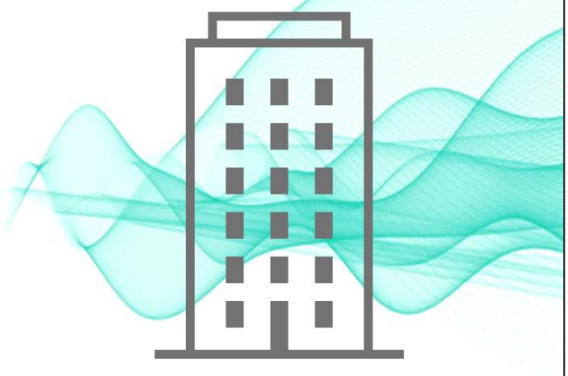
Ventilation Safety Without Compromising Efficiency

Forced air systems enhance conditions for the spread of disease

Integrated ventilation provides enhanced safety and comfort

Re-circulation of stale air is rarely necessary, preventing sick building syndrome and the potential spread of infectious diseases. Year-round, non-hydronic radiant comfort provides an enhanced occupant experience.

Building Balance



The aim of Integrated Ventilation is to balance the building's indoor environment with the outdoor environment as naturally as possible.

Cooling Season

During occupied hours, heat from internal loads is transferred to the hollow core slabs through radiation.

During unoccupied hours, cool nighttime air is circulated through the slab to remove heat and pre-cool the space for the next day. The slab temperatures are set to also allow cooling during the following day.

Heating Season

During occupied hours, heat from internal loads is transferred to the hollow core slabs through radiation.

During unoccupied hours, the air handling system utilizes the free heat captured in the hollow core slabs during the day to heat the building through the night and the next day.

Integrated ventilation utilizes efficient fans and outside air with no heating/cooling elements required throughout most of the year and in most climate zones

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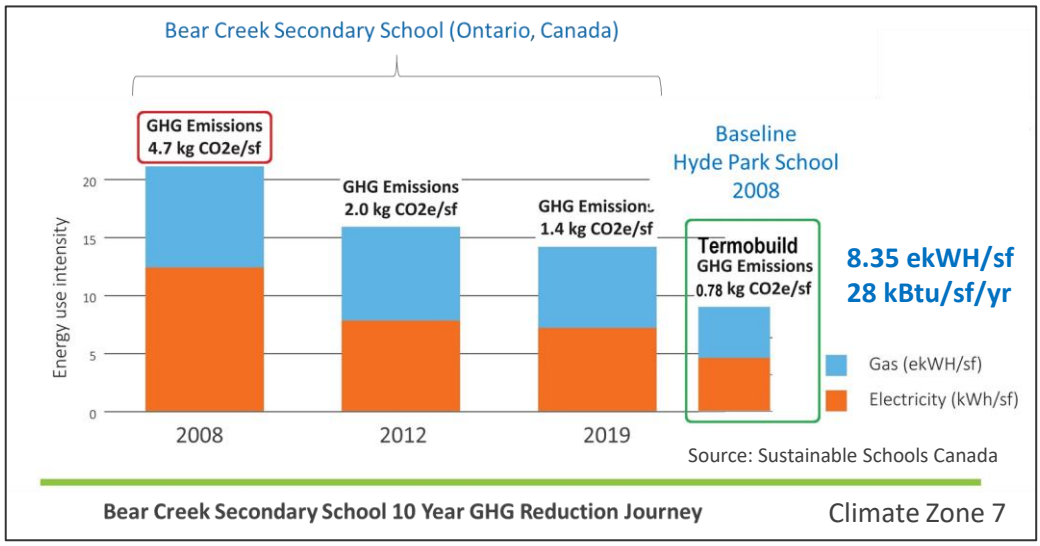
Integrated Ventilation naturally reduces embodied and operational carbon.

Reduced Carbon

The graphic to the right depicts the decade long journey of the Bear Creek secondary School in Ontario Canada. This school did an exemplary job of reducing carbon emissions over time. More notable, however, is the performance of the Hyde Park School (also in Ontario). The as-built baseline performance of this school has about half the emissions of other high performing schools in Canada and elsewhere.

Reduced Embedded and Operational Carbon Emissions



50 Year GHG Savings: 1.7M kg CO_2e/sf (Hyde Park School)

Integrated Ventilation is 15% - 30% less GHG intensive than Mass Timber
(Embedded and Operational Carbon)

Integrated Ventilation simplifies mechanical systems – reducing embedded and operational Carbon


HVAC


DOAS


Chilled Beams


Ice Storage


Sensors


Radiant in Floor

Integrated ventilation significantly reduces both embedded and operational carbon.

Reducing energy consumption of carbon-based fuels reduces operational carbon. The more efficient the building, the less operational carbon gets released into the environment.

Embedded carbon Is reduced through simplification of mechanical systems. Simplification is achieved through reduction in size or elimination of pieces of mechanical equipment that are not needed anymore. Elimination of equipment not only reduces the operational carbon, it also eliminates the embedded carbon footprint of those pieces of equipment.

Integrated Ventilation can be implemented in both **new construction** and **retrofit** projects.

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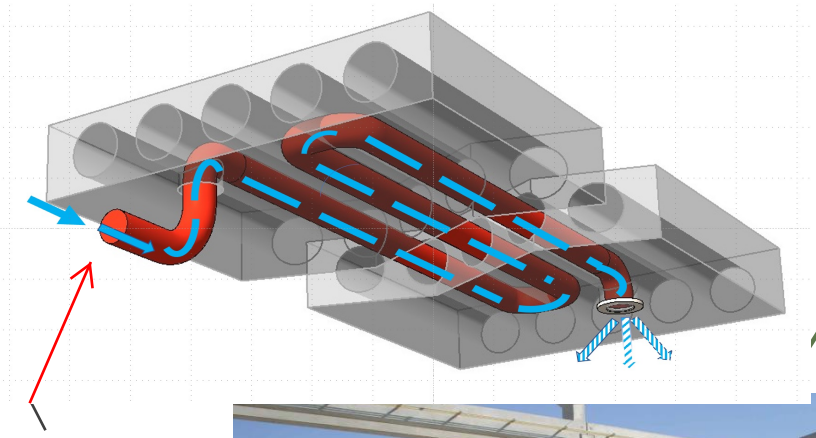
Concrete is the driving force behind the success of Integrated Ventilation.

Concrete

Concrete is one of the best materials for year round thermal energy storage. The ancillary benefits of concrete, such as building longevity, resilience, radaiant comfort and ventilation safety, only add to its value.

Integrated ventilation allows the structure of the building to realize significant value through timely storage and release of captured thermal energy for both heating and cooling the building.

Modified Hollow Core Slab



Branch Duct Connection to HVAC

Summary

Many technologies in this world are evolving toward digitization, artificial intelligence, and greater sophistication. These technologies can do amazing things; however, they can also add complexity and cost to a project.

Integrated ventilation brings things back to simplicity - yet accomplishes as much or more than solutions that are more complex and costly up front and across the building's lifecycle.

It only makes sense to capitalize on the immense stranded value inherent in the building's structure as electrical grid enabled buildings– and there are real world results to back this up.

Please feel free to reach out to TermoBuild with any questions you may have. We will provide detailed answers with data from our 15 years of experience to back them up.

Concrete… Did you Know?

- ✓ Concrete is used on ALL construction projects – no exceptions!
- ✓ Concrete absorbs carbon throughout its life.
- ✓ Concrete is fully recyclable.
- ✓ Concrete is the 2nd most used substance on earth next to water.
- ✓ Concrete is produced locally.
- ✓ Concrete is safe.
- ✓ Concrete adds longevity to a building.
- ✓ Concrete adds resilience.

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Ventilation safety and energy efficiency don't have to be mutually exclusive goals.

Gallery

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