Can Chilled Beams Contribute to Green Design?

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Guidance for Green Design?

LEED®-NC
Green Building Rating System
For New Construction & Major Renovations
Areas of Green Design where Chilled Beams may generate points

- Sustainable Sites: *not likely*
- Water Efficiency: *not likely by themselves*
- Energy and Atmosphere: *yes*
- Materials and Resources: *possibly*
- Indoor Environmental Quality: *yes*
- Innovation & Design process: *possibly*

Chilled beam introduction

- Chilled beams are not what they sound like:  *i.e. a cold I beam!*
- Chilled beams come in two forms, and are widely available from European manufacturers:
  - Passive
  - Active
- First used by Willis H. Carrier (then called induction boxes)
Passive Chilled Beam-example

All Values in inches. (Not to Scale)

1/2" NPT Male
Extend 2" from coil bends

Nominal Coil Fin Length
Overall Beam Case Length

Passive Chilled Beam-Example

Free Air 50%

Warm Room Air
Cool Air
Cool Air
Warm Room Air
Perforation

Minimum Width
required for Supply and Return Area.
Beam must be in center.

12"
17.4" Minimum

12"
**Active Chilled Beam-Example**

![Diagram of Active Chilled Beam]

DOAS air

Induction Nozzle

Sen Cooling Coil

Room air

**Passive Chilled Beam-Performance**

\[ Q_{\text{Total}} = \text{up to 128-268 Btu/hr-linear ft cooling} \]

Fluid in, 62-52F

Fluid out, 66-56F

12"

17.4"

Minimum

12"

24"

Free Air 50%

Cool Air

Cool Air

Warm Room Air

Warm Room Air

Minimum Width 75F, 40% Perforation

required for Supply and Return Area.

Beam must be in center.

32-46 fpm draft 3 ft below ceiling
Performance Summary:

- Thermal performance: Good
- Comfort: Good, with design care in the areas of noise and air motion. Better than VAV, not as good as ceiling radiant cooling.
- Condensation, Always a control need.
- Is a good parallel system, since it needs a ventilation and dehumidification system--DOAS!
- What might that system look like?
DOAS with passive chilled beam

Ventilation can be introduced with overhead high induction diffusers, UFAD as illustrated, or displacement ventilation.

DOAS Unit W/ Energy Recovery → Cool/Dry Supply

Parallel Passive Chilled Beam

Building With Sensible and Latent cooling decoupled

DOAS with active chilled beam

20-70% less OA, than VAV

DOAS Unit W/ Energy Recovery → Cool/Dry Supply

Parallel Sen. Cooling Chilled Beam

Building With Sensible and Latent cooling decoupled
**Attributes gained with the addition of DOAS**

- Ventilation performance enhanced significantly
- The enthalpy wheel required by Std. 90.1, for most cases, greatly reduces:
  - Cooling and heating plant sizes (first cost)
  - Energy use and demand (operating cost)
  - Humidification (first and operating costs)
- No air is recirculated, offering distinct benefits with respect to transporting contagious pathogens or other undesirable agents (i.e. CBR) throughout the building.
- Greatly reduces the incidence of mold and other IAQ issues by decoupling the latent and sensible loads.

**Compare with a Ceiling Radiant Cooling Panel**
Where may the points come from when Chilled Beams and DOAS are integrated?

- **Water use reduction**: In some climates the reduced water consumption for humidification can reduce water use by 20%.

- **Optimize energy performance**: The chilled beam-DOAS system will reduce the energy used by the mechanical system in excess of 50%, so some points would be earned. The extent of points is a function total building energy percent reduction.
Where may the points come from when Chilled Beams and DOAS are integrated?

- **Recycled Content**: The aluminum, copper and steel in the chilled beams could have recycled content.
- **Regional Materials**: This will be possible in some cases in the future, when state side manufacturing becomes more common.
- **IEQ**: Up to 5 categories could harvest points:
  - Outdoor air delivery monitoring,
  - Increases ventilation,
  - Zoning for enhanced thermal comfort,
  - Thermal comfort design as a result of controlled temperature, air motion, and humidity.
  - Thermal comfort verification, i.e. no more than 20% dissatisfied. With chilled beams, dissatisfaction runs well below that.

Where may the points come from when Chilled Beams and DOAS are integrated?

- **Innovation**: Since DOAS does not recirculate air, thus promoting health and safety, it may qualify for a point.
**Conclusion:**

- Chilled beams, active or passive, have the potential to generate green design points when used with DOAS to provide the required ventilation.
- Chilled beams represent a significant improvement over currently employed all-air systems in the areas of energy use and demand, IEQ, and they are challenging in the area of first cost.
- Chilled beams, at present, seem to be a little more cost competitive than ceiling radiant cooling panels.
- Unfortunately, ASHRAE literature is silent on the subject.
  - When this short coming is resolved, I expect to see much greater use of chilled beams.