TABS (THERMALLY <u>A</u>CTIVE <u>B</u>UILDING <u>S</u>YSTEMS)

Feedback from research driven practice

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What is TABS?

TABS = thermally activated building system

CCA = Concrete Core Activation

- Concrete floors/ceilings of a building are activated by embedding water tubes in the concrete and forcing warm/cold water through the tubes
- High temperature cooling (> 15°C) and low temperature heating (< 35°C)
- Surface temperature very close to room temperature
- More than 50% of heat transfer by radiation



What is TABS?





Prefab woven pipe modules









On site 'weaving'

Prefabricated slab

Practical integration

Between hollow airdeck floors

Close up



Pressure control on site







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What is TABS?

TABS = thermally activated building system

CCA = Concrete Core Activation

- Thermal capacity of concrete presents storage capacity (thermal inertia, large time constant)
- Difficult to control since heat/cold transfer to building rooms is governed by $\Delta {\rm T}$
- Self regulating effects



Why?

STRENGTHS

- Water supply temperatures:
- < 35°C for heating
- > 15°C for cooling
- Exploiting environmental energy: (ground coupled) HP, direct cooling, night cooling
- Thermal energy storage thanks to large thermal capacity: shift TABS operation to periods when heat/cold production is most energy or cost efficient
- Increased thermal comfort by radiation heat exchange
- Reduced building height compared to buildings with full airconditioning
- No visible installations in the room, no chimney



Why hesitate?

WEAKNESSES

- Limited average thermal power output of 40-50 W/m²
- Allow temperature drifts within the specified comfort range or provide an additional fast reacting system
- Limited individual room control
- Not useful to change set-point during a day
- Acoustic comfort limited suspended ceiling
- Drilling in the ceilings should be carried out with care



Acoustical solutions









Herman Teirlinck building (Neutelings-Riedijk)



Torhout city administration (G Debruyne architecten)



group Van Roey HQ (arch R Schellen)



Looking forward

• **OPPORTUNITIES**

- Suitable for low-energy, passive or zero-energy buildings
- Increased share of efficiently generated heat and cold
- Less energy and more energy efficient form of cooling than airconditioning
- Thermal energy storage increase in flexibility of energy system decouples heat/cold production and heat/cold emission



Looking forward

TABS points of attention

- \Rightarrow Careful incorporation in overall building design
- \Rightarrow Adaption in building's operation
- \Rightarrow Integration with other systems

INTEGRATED DESIGN PROCESS:

Feasibility study

Pre-design

Detailed design

Need for assistance by dynamic simulations in the design and commissioning phase to assess the predicted performance and behaviour



Projects in practice?

2006-... offices, steeply growing









2015- ...



2017 Provant Antwerpen 25,000 m² (XDGA architecten – provincie Antwerpen)





Xavier Degeyter Architects









2015-





2017 Herman Teirlinck building Brussel 62,000 m² (Neutelings-Riedijk architecten – Vlaamse overheid)

2006-... health care buildings





Results



first year of operation group Van Roey, nZEB building

-cooling: 17.5 kwh/m²

- heating: 27.6 kwh/m²

- Installed HP-power 26 W/m²

- energycost year 1: 1€/m²









2012 Solarwind Windhof (Progroup-Schulerimmo-Pavlowski-Boydens luxembourg)



Results

nZEB 3 years in operation: Solarwind Building

- cooling: 17.3 kwh/m²

- heating: 23.4 kwh/m²



Solarwind (Darius Pawlowski)

practice oriented research path

Towards hybrid supply supported by optimal control (MPC)

