Design & Construction of the Lynch, Dickey & Singleton Dental Clinic

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June 17, 2014

DESIGN AND CONSTRUCTION OF THE LYNCH, DICKEY & SINGLETON DENTAL CLINIC

SUSTAINABILITY DELIVERED - LOW ENERGY, MARKET RATE AND FUNCTION

STRUCTURES *Building with interest*

Virginia?

What, Where??

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Project Summary

Location: Roanoke, Virginia
Client: Drs. Lynch, Dickey and Singleton
*The **First** in the world dental clinic built to Passivhaus Standards*

Size: 5500 ft^2 Gross
4,460 ft^2 TFA
Construction: 5B, non-sprinkled
Final air test: 0.29 $ACH_{50\ (Pressurized)}$, 0.25 $ACH_{50\ (Depressurized)}$

Modeled heat demand: 0.86 kBTU/(ft2yr) ~ 3 kWh/(m^2yr)
Modeled cooling demand: 8.84 kBTU/(ft^2yr) ~ 28 kWh/(m^2yr)
Modeled Specific Primary Energy Demand: 67.1 kBTU/(ft^2yr) ~ 212 kWh/(m^2yr)

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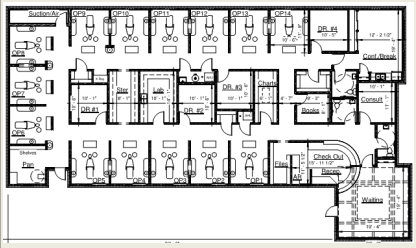
The Basics



- Light timber construction
- Simple usage pattern
- Significant thermal comfort requirements
- Mixed humid climate
- Slab – R 18.0
- Wall (Brick) – R 37.3
- Wall (Siding) – R 36.5
- Wall (EIFS) - R 42.4
- Ceiling – R 66.3
- Window Average – R 6.8, SHGC 0.6
- Glass Block Assem. – R 4.9, SHGC 0.66

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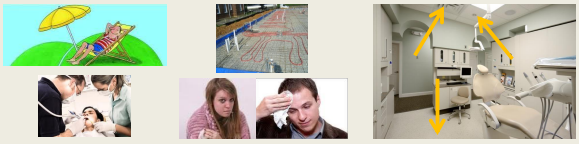
THERMAL COMFORT

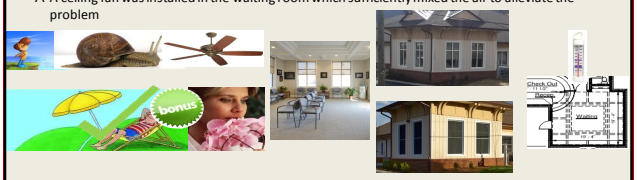
#1 Focus THERMAL COMFORT

- One consistent area of concern in all clinics is the thermal comfort of the doctor and patient
- Doctors generally complain of being too hot and often patients complain of being too cold
- When one has a dental procedure, one typically has a nervous patient, a working doctor, an assistant and a dental light. When calculating the heat load in the small work area it becomes clear that the heat generated by the people and light is significant
- Three Pronged Strategy:
  - Preconditioned fresh air along the ceiling of each operatory space at a very low velocity
  - Separate low velocity forced air conditioning system directed behind the dental chair
  - 100 ft^2 passive cooling loops around each dental chair to take radiant heat from the bodies in the space



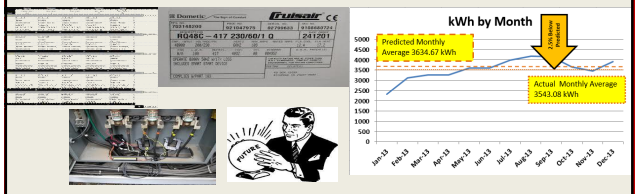
Thermal Comfort Results – Intended and Unintended

- The doctors report that the operatory thermal comfort is exceptional
- The doctors report that the fresh air exchange has eliminated the "dental clinic smell"
- The waiting room was overheating in the summer
  - West facing reception room rose as high as 76°F, well above the 72°F set point
  - The 80% reduction solar screens that we designed for the glazing in the waiting room were not being used
    - The doctors said that they did not like the look of the screens
  - Good amount of fresh air supply to this space (60 CFM)
    - The very low velocity the warm air felt stagnant
  - The ceiling in this area is 14 ft. while the balance of the space is 9 ft.
  - A ceiling fan was installed in the waiting room which sufficiently mixed the air to alleviate the problem



Energy

- After first year building energy use is 2.5% below predicted
- Fairly easy building to predict the energy use
  - Existing practice and we were able to set up energy monitoring on the existing dental equipment prior to running our models.
  - Did not have to depend on the plate rated energy usage of the equipment for our models.
  - Very consistent occupant usage



Energy

	Passivhaus Dental Clinic - Calculated	Passivhaus Dental Clinic - Measured Results	2009 International Energy Code [1]	CEBECS Average (United States) [2]	CIBEUS Average (Canada) [3]
kBTU/ft^2	27.55	26.86	53.4	81.49	88.94
% Difference vs Measured Results	2.50%		49.70%	67.04%	69.80%
% Difference vs Calculated Results		-2.50%	48.41%	66.19%	69.02%

1. Energy code EUI was derived by modeling the as built design with current code requirements.
2. CEBECS EUI was extrapolated by averaging data for the following CEBECS data sets:
   a. Building square footage: 5,001-10,000
   b. Principal building activity: Healthcare – Outpatient
   c. Principal building activity: Office
   d. Year Constructed: 2000-2003
   e. Census Region and Division: South Atlantic
   f. Climate Zone: 30-Year Average: 4,000-5,499 HDD
   g. Number of Floors: One
3. CIBEUS EUI was extrapolated by averaging data for the following CIBEUS data sets:
   a. Ambulatory Surgical Center
   b. Medical Office
   c. Outpatient Rehabilitation/Physical Therapy
   d. Urgent Care/Clinic/Other Outpatient

Saving the Best for Last

- Our experience with dental clincs over the past decade (12 projects) has shown that dental clinics in our region range from $150 to $200 per ft².
- This clinic was delivered for **$155** per ft². Low market rate! Once again proving the cost effectivness of the Passivhaus methodology!

$aving$ How do you do that

HIGH PERFROMANCE AT MARKET RATE

1. Recognize and eliminate the inefficiencies we build into our current Design/Construction system
2. Leverage those savings for high performance design and construction
3. Aggressively employ true integrated design
4. The building must be conceptualized as a holistic system
5. Synergies within this system should are identified and maximized
6. Rigorous field quality control implemented (**Commissioning is VITAL to success**)
7. Operational monitoring to fine tune systems

Questions & Contact

Thank you!

PASSIVSCIENCE *Knowledge saves power*

QUANTUM ARCHITECTS — HIGH PERFORMANCE DESIGN —

STRUCTURES *Building with integrity*

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