

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

Presented by Adam J. Cohen, Architect, CPHC NA & EU, LEED AP



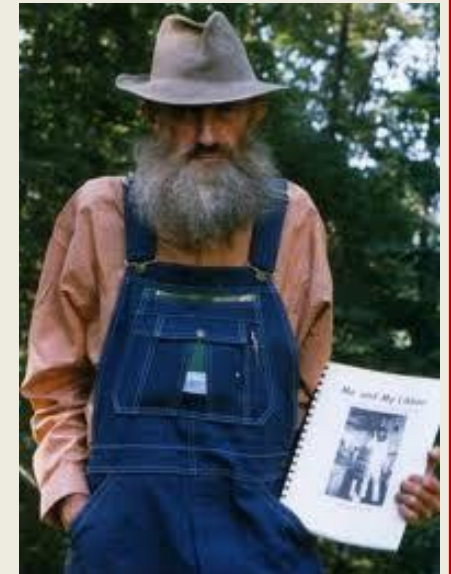
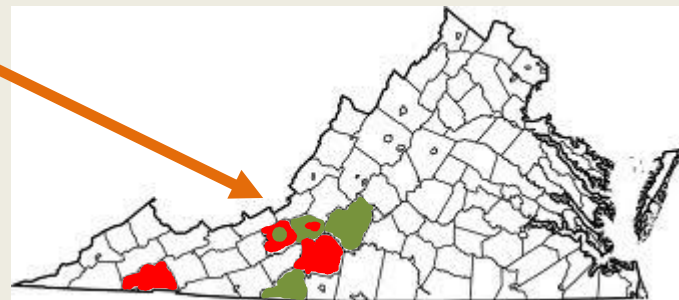
9<sup>th</sup> Annual  
North American  
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Bay Area, California September 10-14, 2014

**DESIGN AND CONSTRUCTION OF THE LYNCH,  
DICKEY & SINGLETON DENTAL CLINIC**  
SUSTAINABILITY DELIVERED - LOW ENERGY, MARKET RATE AND  
FUNCTION



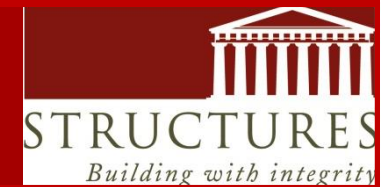
# Virginia?

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<sup>2</sup> Gross  
4,460 ft<sup>2</sup> TFA

Construction: 5B, non-sprinkled

Final air test: 0.29 ACH<sub>50</sub> (Pressurized), 0.25 ACH<sub>50</sub> (Depressurized)

Modeled heat demand: 0.86 kBTU/(ft<sup>2</sup>yr) ~ 3 kWh/(m<sup>2</sup>yr)

Modeled cooling demand: 8.84 kBTU/(ft<sup>2</sup>yr) ~ 28 kWh/(m<sup>2</sup>yr)

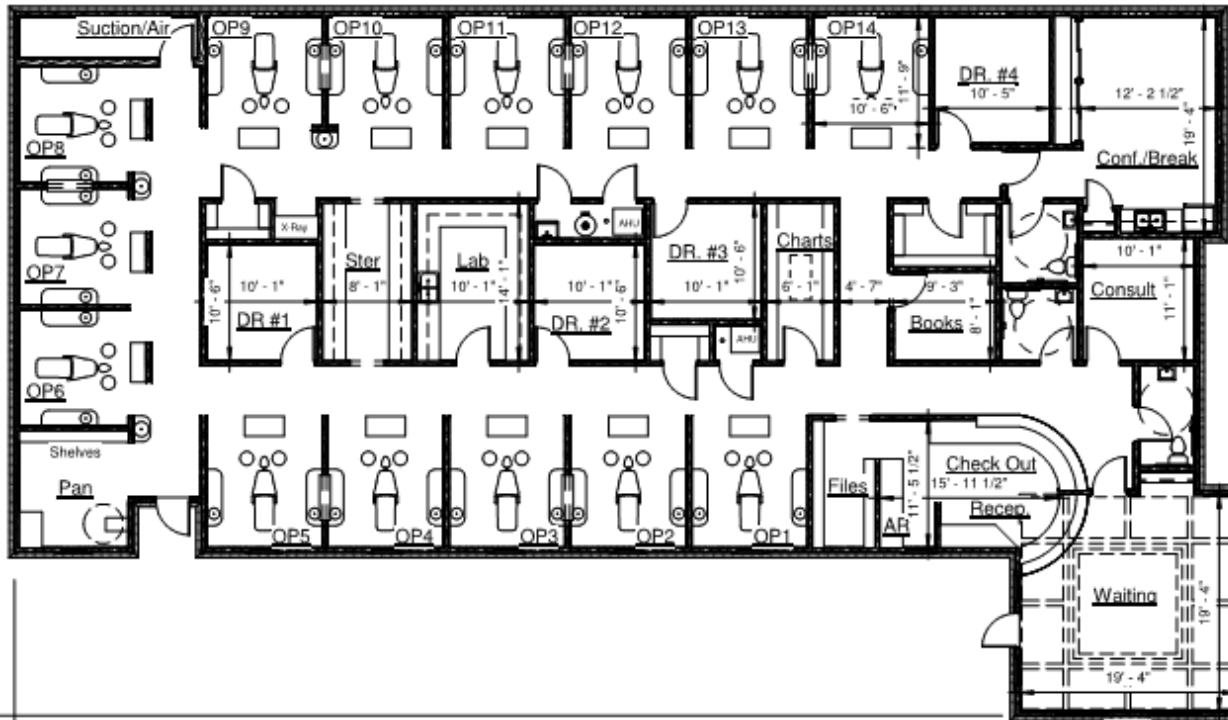
Modeled Specific Primary Energy Demand: 67.1 kBTU/(ft<sup>2</sup>yr) ~ 212 kWh/(m<sup>2</sup>yr)



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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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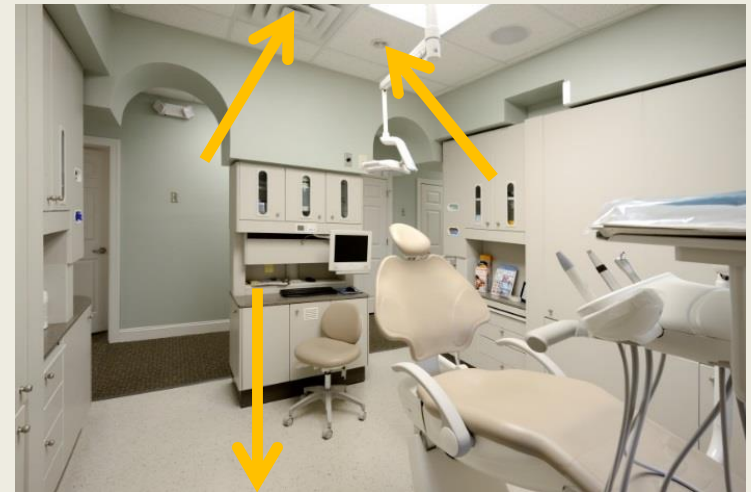
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# THERMAL COMFORT

## #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<sup>2</sup> passive cooling loops around each dental chair to take radiant heat from the bodies in the space



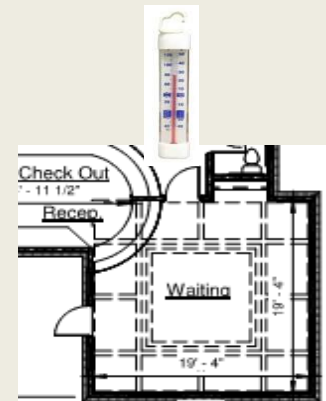
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# Thermal Comfort Results – Intended and Unintended

- “ 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



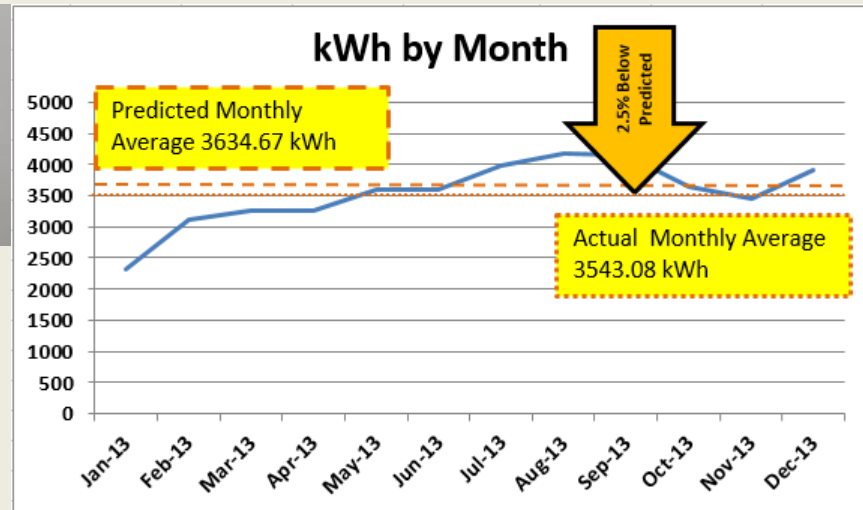
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# Energy

- “ 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

Quantity	Description	Quantity	Description	Quantity	Description	Quantity	Description	Quantity	Description
4	4000K Lux	4	4000K Lux	4	4000K Lux	4	4000K Lux	4	4000K Lux
2	4000K Lux	2	4000K Lux	2	4000K Lux	2	4000K Lux	2	4000K Lux
2	4000K Lux	2	4000K Lux	2	4000K Lux	2	4000K Lux	2	4000K Lux



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# Energy

	Passivhaus Dental Clinic - Calculated	Passivhaus Dental Clinic - Measured Results	2009 International Energy Code <sup>1</sup>	CEBECS Average (United States) <sup>2</sup>	CIBEUS Average (Canada) <sup>3</sup>
kBTU/ft <sup>2</sup>	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



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# Saving the Best for Last

- “ Our experience with dental clinics over the past decade (12 projects) has shown that dental clinics in our region range from \$150 to \$200 per ft<sup>2</sup>.
- “ This clinic was delivered for **\$155** per ft<sup>2</sup>. Low market rate! Once again proving the cost effectiveness of the Passivhaus methodology!



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# \$aving\$ How you do that

## HIGH PERFORMANCE 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 be identified and maximized
6. Rigorous field quality control implemented (**Commissioning is VITAL to success**)
7. Operational monitoring to fine tune systems



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# Questions & Contact

Thank you!



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