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Innovative, Cost Effective and Energy Efficient Design for New Construction at a Texas High School

Presented by:

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Presentation Overview

- Introduction
- Design for Energy Efficiency
- Brief overview of MEP systems
- HVAC & Controls
  - Dual Duct (DD) VAV System
  - Single Zone (SZ) Systems
  - Chilled water
- Conclusion
- Discussion and/or Questions

Introduction

- TEESI
  - Energy Assessments, MEP Design, Construction Management and Commissioning
- Nixon High School
  - Laredo Independent School District
  - South Texas
  - Climatic conditions
    - Predominately cooling required year round. Design features suited for Laredo's unique climate, where cooling is required the vast majority of the year, while still maintaining acceptable first cost

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Facility Description

- Nixon High School
  - 200,000 sf of new construction replacing around 40 year old structures, two story building
  - Design & construction of temporary campus while constructing new facility
  - Student population approx. 2,000
  - Integrating new facility into other more recently built existing buildings
  - Besides MEP the project includes many Architectural design features

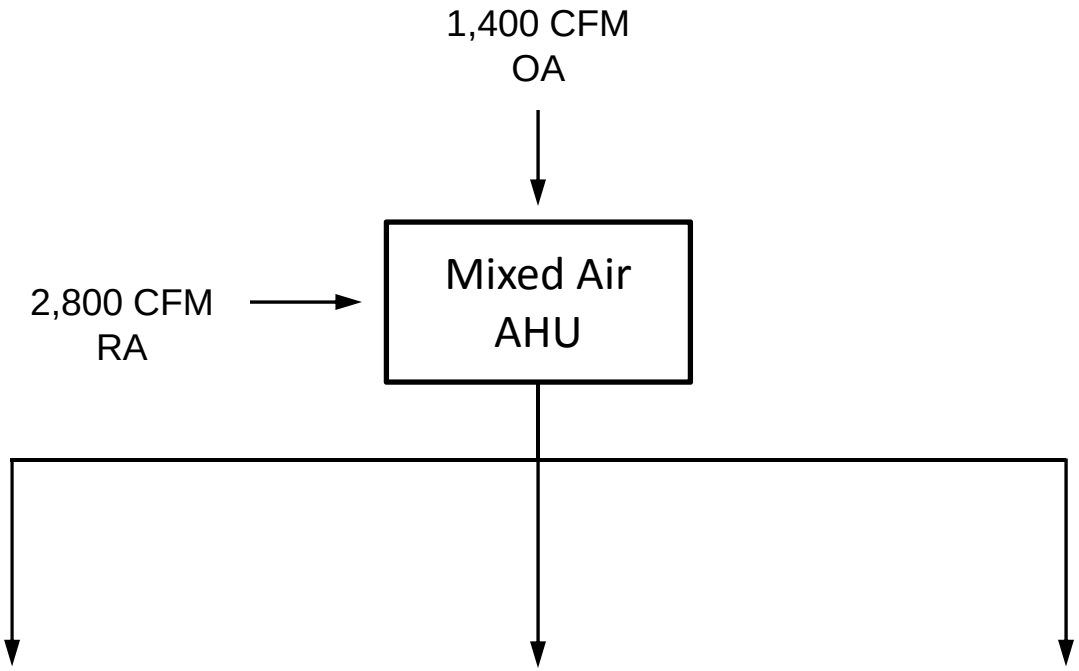
MEP System Description

- Nixon High School New Construction Design Features Overview
  - HVAC - Air Side
    - **Unique Dual Duct VAV system application**
      - **Approximately 60%**
    - Single Zone VAV
    - Outside air units
    - All electric heat !
  - HVAC - Water Side
    - Air-cooled chilled water system
    - Large DX system with energy recovery for remote locations
    - Small DX system for specific areas (server / comm. rooms)
    - Dual (DX & Chilled water) Air handler at admin area
  - DDC controls
  - Lighting Systems
    - Interior and exterior all LED
    - Integrated controls
  - Water conservation measures
    - Low flow fixtures
    - Faucets time control

Dual Duct (DD) VAV

- Traditional DD boxes for separate hot and cold air
- In our design, hot deck side of each box served by separate dedicated outside air unit, while cold deck side served by air handlers for space-sensible loads
  - Pressure-independent boxes allow for precise control of treated outside air delivery
  - Motion activated staging and flow controls
- Traditional VAV system, all zones in the system are dependent on zone requiring highest percentage of outside air, wasting energy on cooling and dehumidification
- Sample illustration figures on following pages

Traditional VAV System

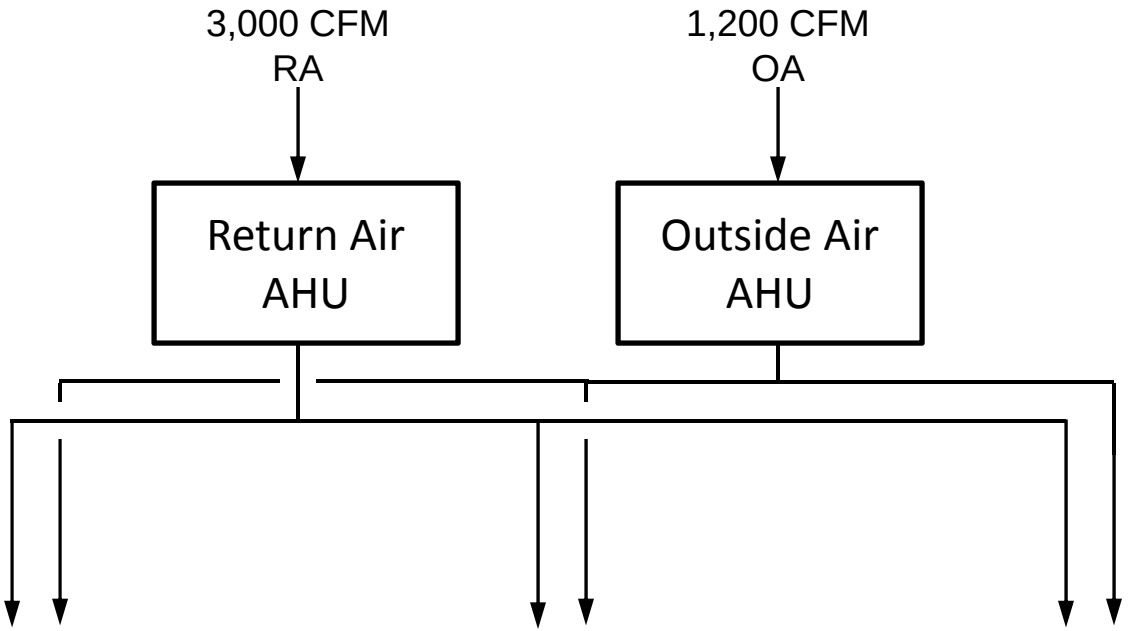


<u>Zone 1</u>
Cooling CFM Required: 1,200
OA CFM Required: 400
%OA Required: 33%
Actual %OA: 33%
Actual Design OA CFM: 400

<u>Zone 2</u>
Cooling CFM Required: 1,400
OA CFM Required: 400
%OA Required: 29%
Actual %OA: 33%
Actual Design OA CFM: 465

<u>Zone 3</u>
Cooling CFM Required: 1,600
OA CFM Required: 400
%OA Required: 25%
Actual %OA: 33%
Actual Design OA CFM: 535

Dual Duct VAV System (Current Design)



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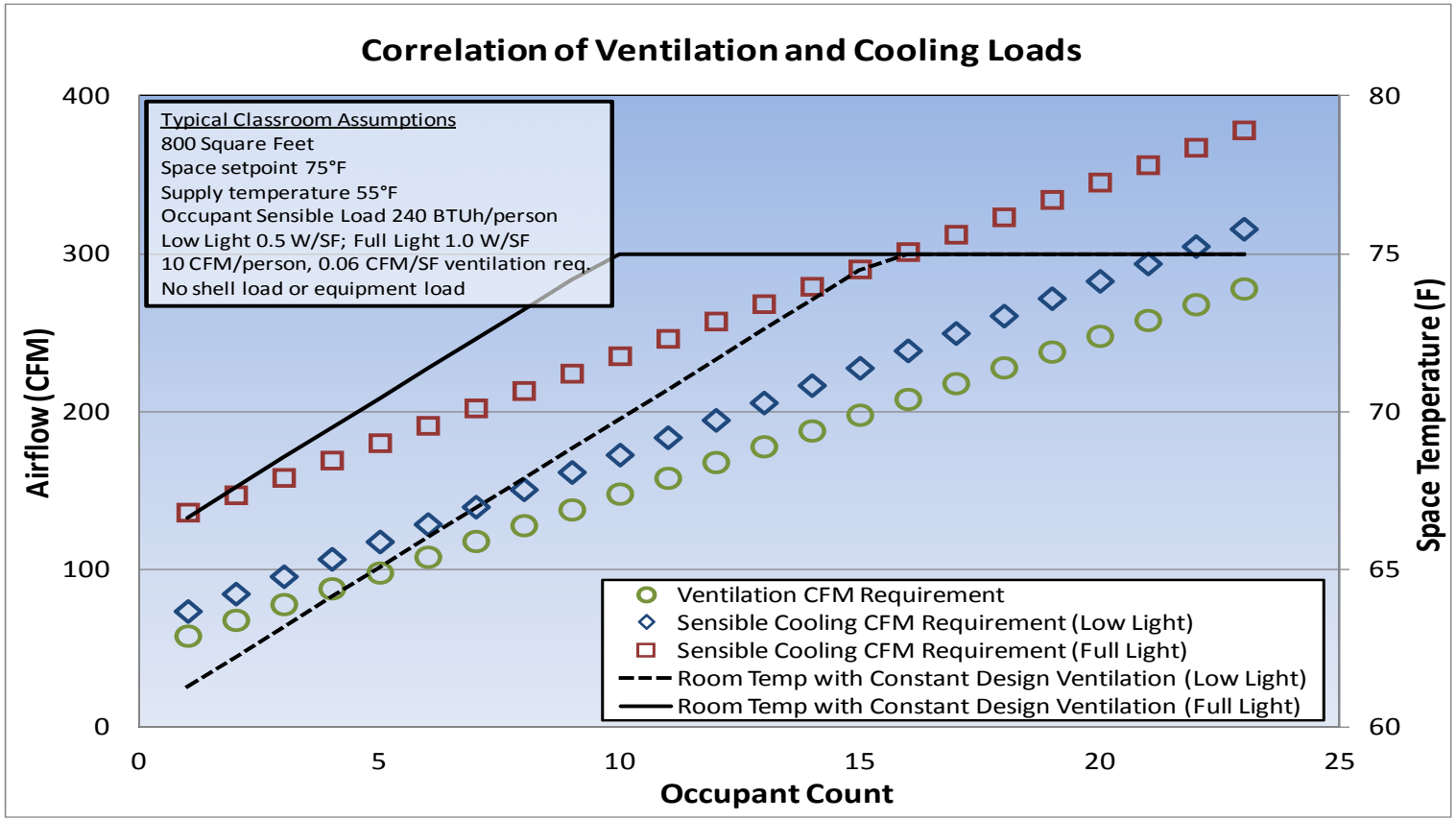
<u>Zone 3</u>
Cooling CFM Required: 1,600
OA CFM Required: 400
Actual Design OA CFM: 400

Ventilation & Loads

- Analysis of ventilation and cooling CFM correlation for a "worst case" over-ventilation/over-cooling scenario in a typical classroom



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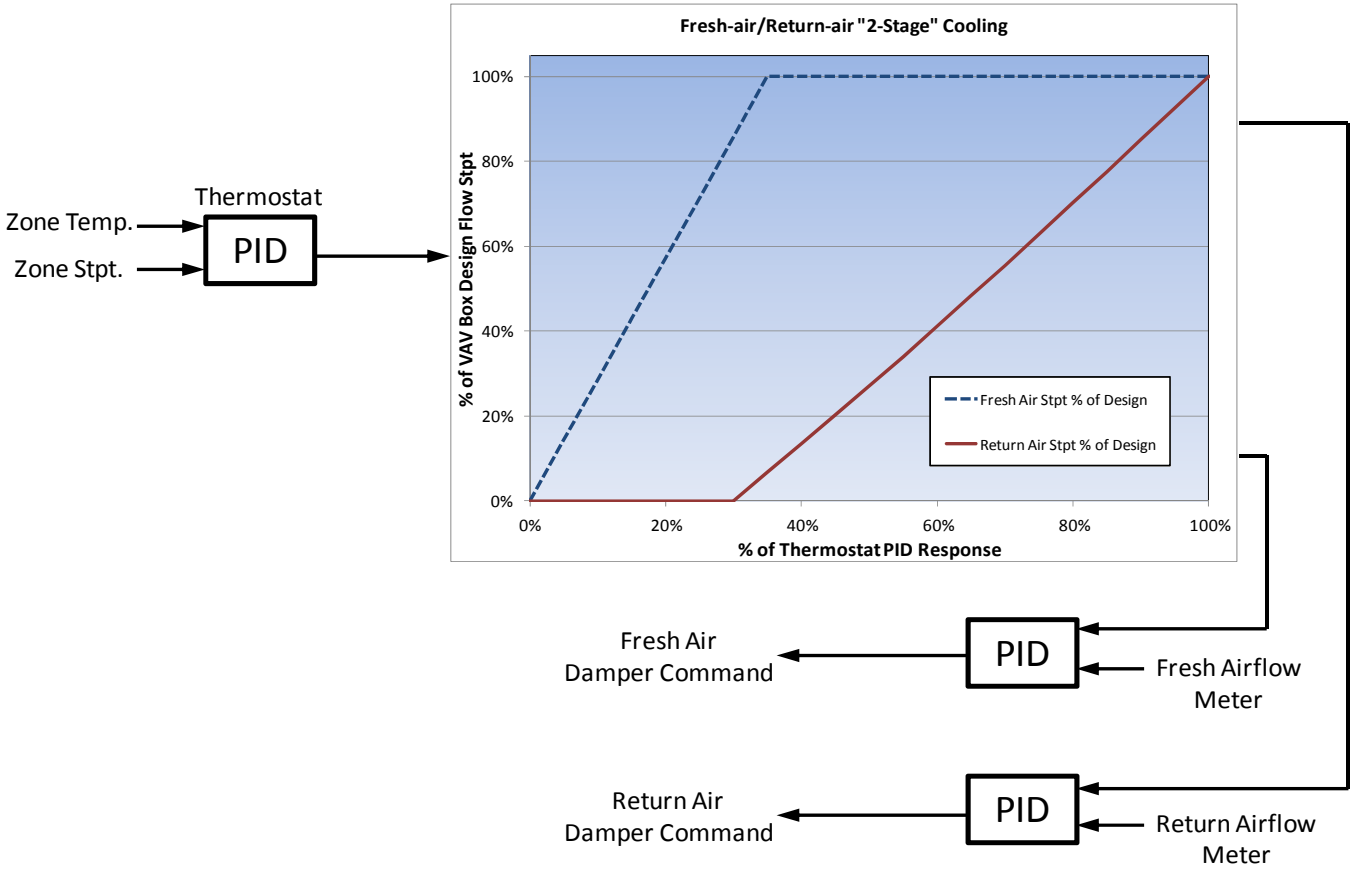
DD VAV Logic Schematic

- Space Dual Duct VAV box control logic schematic in occupied mode when motion is sensed in the zone.



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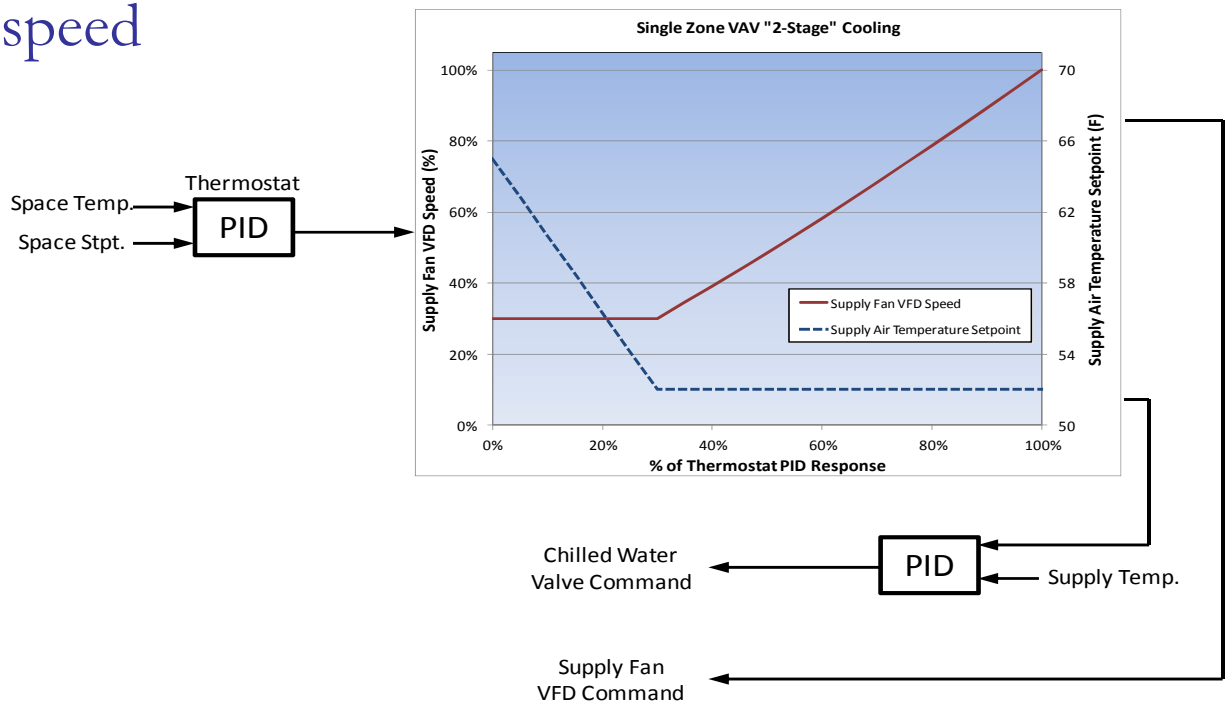
DD VAV Summary

- As the cooling load decreases from design (i.e., the maximum CFM), the space sensible air CFM will be reduced as needed to a minimum of zero (damper fully closed).
- As cooling load decreases even further, pre-treated outside air CFM will then be reduced from design levels down to a minimum of zero (when motion sensor detects zero occupants).
- This system allows for essentially zero minimum flow for each VAV zone without violating ventilation codes, something that is unattainable for most traditional VAV systems.
- *When there are relatively few occupants and relatively little ventilation required, two-stage cooling design reduces the amount of hot outside air that has to be cooled, saving energy and money.*
- System employs "economizer mode" when outside conditions are favorable

Single Zone VAV

- Large spaces (gym, library, theater) use variable air volume capable single zone units equipped with VFDs
- System uses two stage cooling approach: As cooling requirement increases, open chill water valve to decrease air temperature. If additional, cooling is required after min. temperature reached, increase fan speed



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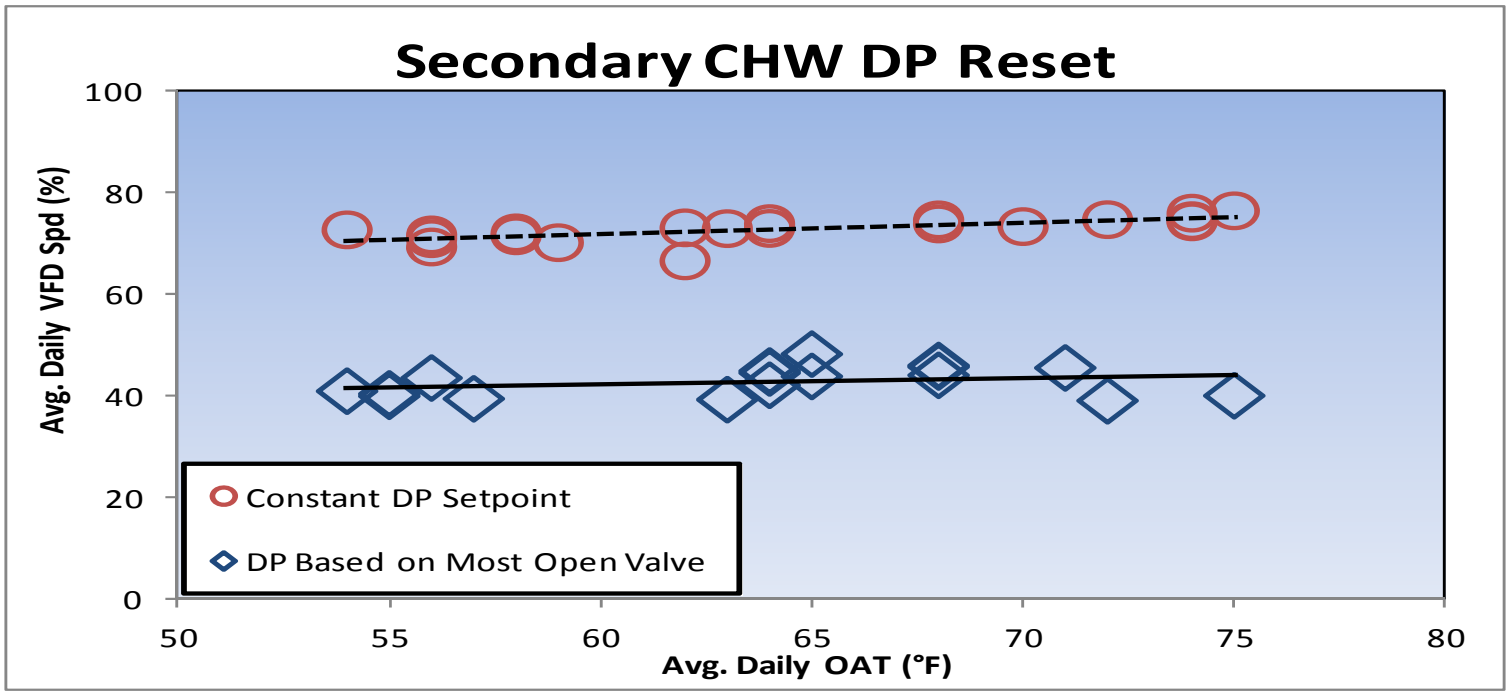
Hydronic System

- Air-cooled Chilled Water
  - Two primary (total 500 tons) and one small chiller (120 tons)
  - Primary secondary pumping systems, with dynamic differential pressure rest



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Conclusions

- MEP design for Nixon High School strongly considered energy efficiency, while satisfying budget and occupant comfort requirements
- Customized dual-duct VAV system designed for Laredo climate is anticipated to reduces energy used to treat outside air and provide more precise comfort control
- Staged cooling and heating design features will reduce energy used to satisfy cooling & heating requirements (dynamic)
- High-efficiency chillers, lighting, and plumbing fixtures provide additional efficiency
- Maintenance staff training and commissioning recommended

Discussion and/or Questions?

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