## The Collaborative for High Performance Schools (CHPS):

Responding to California's Need for Sustainable Schools

**Charles Eley, FAIA, PE**

CHPS Executive Director
President, Eley Associates

the collaborative for high performance schools

## Some Numbers on the California School System

- California educates one out of every eight students in America
- Enrollment rates are four times the national average
- Hundreds of schools are being built each year to house more than 100,000 new students and to accommodate state-mandated class-size reductions
- Over 30% of existing facilities are in need of major renovation
- California schools are spending more than $500 million per year on energy
- The California public school system is quite diverse.
  - At one extreme, the Los Angeles Unified School District has 732,000
  - At the other extreme are the 600 small school districts with an average daily attendance of less than 2,500 students

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## Spending on School Construction

- Construction and maintenance spending was neglected for years following the Jarvis-Gann initiative
- Proposition 1A provided about $9 billion in state matching funds which went quickly
- Proposition 47 passed (last November 2002) provides another $13 billion in state matching funds.
- Another state ballot initiative is scheduled for March 2004 would provide another $12 billion in state matching funds
- Local ballot initiatives are passing at record pace (LAUSD alone passed $3.5 billion local bond issue)
- California is expected to spend $50 to $75 billion in the next 3-5 years

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## CHPS = Collaborative for High Performance Schools

- Charter Board Members
  - California Energy Commission
  - California Integrated Waste Management Board
  - Pacific Gas and Electric
  - Southern California Edison
  - San Diego Gas and Electric
  - Southern California Gas Company
  - Sacramento Municipal Utility District
  - Los Angeles Department of Water and Power
- Other Board Members
  - California Department of Education
  - Division of the State Architect
  - Office of Public School Construction
  - School Districts
  - Private Architects

 Kickoff

## California School Funding and Approval Process

**School District** → **CDE** → **DSA** → **OPSC** → **SAB**

Districts originate construction process hire architects and provide local matching funds

California Department of Education (CDE) verifies minimum education specifications and coordinates with DTSC on site approval.

Division of the State Architect (DSA approves school plans verifies plans meet all applicable codes. DSA is the building department.

The Office of Public School Construction (OPSC) recommends specific funding to SAB

The State Allocation Board (SAB) distributes the state matching share of funding

 Volume I - Planning 5

## What is a High Performance School?

the collaborative for high performance schools

## What Is a High Performance School?

- Healthy
- Comfortable
  - Thermally
  - Visually
  - Acoustically
- Efficient
  - Energy
  - Materials
  - Water
- Easy to Maintain and Operate
- Commissioned
- Environmentally Responsive
- A Teaching Tool
- Safe and Secure
- A Community Resource
- Stimulating Architecture



What is a High Performance School? 7

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What is a High Performance School? 8

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What is a High Performance School? 9

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What is a High Performance School? 10

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http://www.tropicana.com/biz/about/environ.htm


What is a High Performance School? 12

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What is a High Performance School? 13

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What is a High Performance School? 16

## Why Are High Performance Schools Important?

- Increased Student Learning and Teacher Performance.
- Increased Average Daily Attendance (ADA).
- Increased Teacher Satisfaction and Retention.
- Reduced Operating Cost.
  - Energy
  - Water
  - Maintenance
- Reduced Liability.
- Reduced Environmental Impact.



What is a High Performance School? 17

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What is a High Performance School? 18

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http://www.ps.vt.edu/employment/blacksburg/


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http://alldesign.com/benefits.htm


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http://www.niu.edu/pubaffairs/stepahead/9/


What is a High Performance School? 21

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http://www.obriencounty.com/


What is a High Performance School? 22

## CHPS Programs & Resources

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## Best Practices Manual

- Volume I – Planning
  - Descriptive and process information for school districts, superintendents, board members, and others.

- Volume II – Design
  - Detailed technical information and guidelines for architects, engineers, school planners, contractors and other building professionals.

- Volume III – Criteria
  - A flexible "yardstick" for measuring whether or not a school qualifies as "high performance".

- Volume IV – Maintenance and Operations
  - Being developed now. Expected to be ready in Spring of 2003.


CHPS Programs & Resources 24

## The Process

- Develop high performance goals early.
- Include them in the educational and district specifications.
- Hire an architect that can achieve your goals.
- Use financial incentives to offset incremental costs.
- Hire a contractor that understands your goals.
- Commission the building to ensure the facility has been designed and built as you expect and deserve.
- Properly train the staff and maintain the systems.


Volume I - Planning 25

## Understanding High Performance Schools

**Characteristics**

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**Benefits**

- Increased Student Learning and Teacher Performance.
- Increased Average Daily Attendance (ADA)
- Increased Teacher Satisfaction and Retention.
- Reduced Operating Cost
  - Energy
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  - Maintenance
- Reduced Liability
- Reduced Environmental Impact


Volume I - Planning 26

## Health and Productivity Issues

- Daylighting.
- Indoor Air Quality.
- Acoustics.
- Commissioning.
- Maintenance and Operations.
- Relocatable Classrooms.


Volume I - Planning 27

## National Clearing House for Educational Facilities

- "Do School Facilities Affect Academic Outcomes" By Marc Schnelder
- A very thorough literature review showing the connection with:
  - Indoor air quality, ventilation and thermal comfort
  - Lighting
  - Acoustics
  - Building age, quality and aesthetics
  - School size
  - Class size
- www.edfacilities.org


Relationship to Productivity 28

## Capistrano Analysis

- Comparison of Spring to Fall Test Scores
- Excellent demographic data
- Typical California one-story schools:
  - 50's daylit "finger plan"schools
  - 70's open plans (w/ no windows)
  - 5 types of skylights in 7 schools
  - package AC, retro AC, wall units
  - fixed and operable windows, clear or tinted
- Portables at all school sites
  - 40% of classrooms
  - A variety of daylighting conditions within each school site


Daylighting & Productivity 29

## 50 Variables Examined in Model:

- **Physical Conditions**
  - Vintage
  - SF per school
  - Classroom Type
  - Daylight availability
  - Skylight type
  - Window area and tint
  - Operable Window
  - Air Conditioning type
- **School Site** (accounts for:)
  - PTA or staff morale at site
  - neighborhood, or special programs, or principal...
- **Grade Level**
- **Socioeconomic**
  - Free & reduced lunch clsrm %
  - Absences and tardies
  - Gifted and talented
  - English as a second language
  - Ethnicity
  - Gender
- **School and Class Size**
  - Students per class
  - Students per school
  - Bilingual program
  - Year round schedule


Daylighting & Productivity 30

**Capistrano**
Window Code 1

**Capistrano**
Open Classroom
Window Code 2

Photo Heschong Mahone Group

**Capistrano --**
Open Classroom
Window Code 0

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**Daylighting & Productivity** 31

**Capistrano**
Single Loaded
Finger Plan School
Window Code 5

Photos Heschong Mahone Group

©2002 CHPS, Inc

**Daylighting & Productivity** 32

## Capistrano Delta Regression

- Significant (beta order)
  - Grade Level
  - GATE
  - **Daylight Codes**
  - School Site
  - Students per School
  - Language Program
  - **Operable Windows**
  - # of Absences
- Not Significant
  - Ethnicity
  - Socio-Econ Status
  - Age of School
  - Gender
  - Number of Tardies
  - Air Conditioning
  - Year Round Sched.
  - Type of Classroom

**Reports available from:**
- www.pge.com
- www.h-m-g.com

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**Daylighting & Productivity** 33

## Financing High Performance Schools

- Life-Cycle Costing.
- Reduced Operating Expenses.
- Increased ADA Related Operating Funds.
- Financial Assistance and Technical Assistance Programs.
- Avoided Cost and Litigation Risk.

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**Volume I - Planning** 34

## Discussion Guide

| Each key aspect of high performance … | … is investigated at each phase of design… | … to create a set of questions. |
|---|---|---|
| Daylighting. | Goal setting | **Schematic Design** |
| Indoor Air Quality. | Selecting the designers | ***Air quality*** |
| Acoustics. | Site Analysis | • Will the HVAC system provide adequate ventilation? |
| Commissioning. | Schematic Design | • Are operable windows and HVAC intakes away from sources of exhaust? |
| Maintenance and Operations. | Design Development | • Are the preliminary selected materials low in VOCs and other pollutants? . . . . |
| Relocatable Classrooms. | Construction Documents | |
| | Bidding and Negotiation | |
| | Construction Administration | |

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**Volume I - Planning** 35

## Case Studies

Oakridge High School

Capistrano Unified School District

Ross School

Newport Coast Elementary

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**Volume I - Planning** 36

## Volume II: Design

- Goal
  - To provide design professionals and project managers with detailed technical information about all aspects of high performance design.
- Contents
  - Overview
  - Commissioning
  - General Conditions
  - Site Planning
  - Interior surfaces
  - Electric Lighting
  - Daylighting
  - Building Envelope and insulation
  - HVAC
  - Other systems

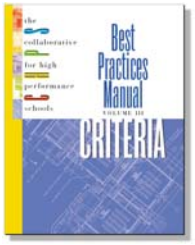


Volume II - Design
37

## Volume III: Eligibility Criteria

Criteria

- Explicitly defines a 'high performance school'
  - Easy to specify.
  - Menu of credits allows districts to highlight specific areas.
  - Flexible.
- System of pre-requisites and credits
  - 81 possible / 28 required.
- Categories
  - Site 14 points.
  - Water 5 points.
  - Energy 24 points.
  - Materials 11 points.
  - IEQ 17 points.
  - District 10 points.





Volume III - Criteria
38

## Volume IV: Maintenance and Operations

- Landscaping
- Roofing
- Parking Lots and Garages
- Building Equipment
- HVAC Systems
  - Basic Maintenance
  - Retrofits
- Lighting Systems
  - Basic Maintenance
  - Retrofits
- Cleaning
  - Procedures
  - Product Selection
- Commissioning and Re-Commissioning
  - Performance Monitoring and Diagnostics
- Control Systems
  - Energy Management Systems
  - Other Controls
- Training and User Information



Volume IV – Maintenance and Operations
39

## Demonstration Schools

Tahoe/Truckee (CEC)
Los Altos
Manteca
Oakland (CEC)
Western Christian
Portables
LAUSD (2)
Pomona Unified
Newport Coast
Santa Ana
Solana Beach
Sorrento Hills
San Pasqual



CHPS Programs & Resources
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## More Money from the State Allocation Board (SAB)

- The new state-funding program offers an additional 5% of state funding for schools that are 15% better than minimum compliance with the California building energy efficiency standards
- Some school districts have made the CHPS Criteria an integral part of their education specification (LAUSD, Vacaville, others)


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## The CHPS Classroom

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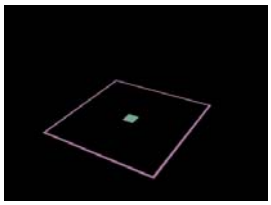
## The CHPS Classroom




## High Ceilings

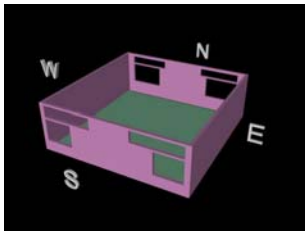
- Average classroom is 30' x 30'.
- High ceilings enhance space and provide better illumination, ventilation. and acoustics.
- Floor-to-ceiling height should be at least 10'.






## Window Orientation

- Windows should be oriented either north or south.
- Locate windows at edges of room to prevent dark corners and wash teaching wall.

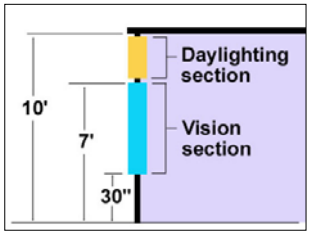






## Window Sections

- Daylighting section allows sunlight in to illuminate room.
- Vision section glass should be double glazed and should be operable.

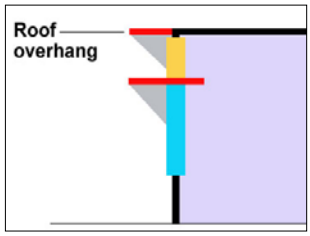






## Roof Overhangs

- Overhangs should be added to south-facing windows to prevent glare and to reduce solar heat gain.

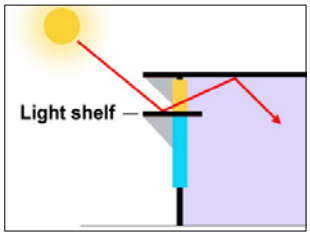






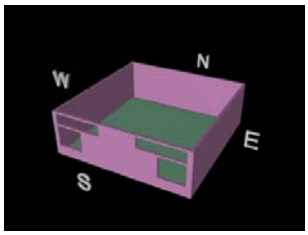
## Light Shelves

- A light shelf should be added to reflect light onto the ceiling and into classroom.
- Light shelf also acts to shade the vision section of the window.



## Skylights

- Skylights or clearstories should be used to illuminate the back wall of the classroom. Light shelf also acts to shade the vision section of the window.
- Use skylights with glazing to diffuse light.

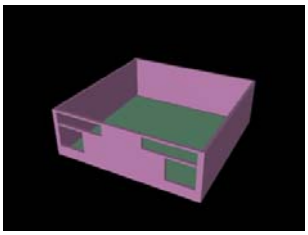




The CHPS Classroom 49

## Electric Lighting

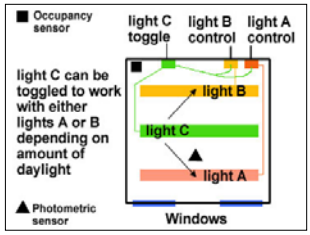
- Three rows of pendant-mounted electric lights are positioned parallel to the window wall.




The CHPS Classroom 50

## Lighting Control

- Occupancy sensors shut off lights if room is unoccupied.
- Separate controls for each light based on daylighting availability.

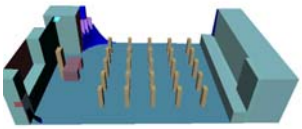




The CHPS Classroom 51

## Displacement Ventilation

- Fresh cool air is slowly supplied near the floor.
- Air rises as it warms.
- Air is exhausted near the ceiling.



Courtesy H. L. Turner Group


The CHPS Classroom 52

## Furnishings & Materials

- Choose flooring materials that are resource efficient.
- Avoid particle board.
- Use low-emitting paint and adhesives, and apply them before installation of carpet or ceiling tiles.
- Ceilings and upper walls should be light in color with 80%+ reflectance.


The CHPS Classroom 53

## An Action Plan for School Districts

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## Funding Opportunities from CHPS Partners

- Savings By Design
- Sacramento Municipal Utility District (SMUD)
  - Rebates, financing and promotions
- State Allocations Board (SAB) supplementary funding for energy efficiency
- California Energy Commission
  - Energy Financing
  - Bright Schools
  - Energy Partnership Program
  - Solar Shade Screens
  - Cool Roofs
  - Cash for kW
  - PIER
  - Renewable Energy Buydown
- California Integrated Waste Management Board (CIWMB)
  - Various Programs
- U. S. DOE – Renewable Energy Production Incentive (REPI)
- State Water Resources Control
  - Numerous programs
- See also DGS handout: "Monetary Resources for K-12 Sustainable School and Public Building Construction in California"
- Leasing


School District Action 55

## Adopt/Incorporate the CHPS Design Criteria

- Make it clear to all involved that your schools shall be high performance
  - Architect, engineer and design team
  - Construction managers and cost estimators
  - Facilities and operations personnel
  - Building committee(s)
- Reference or incorporate the CHPS Criteria in:
  - District specifications
  - Educational specifications
  - Owner-architect agreement
- Engage a commissioning authority
- Require that the design team complete the CHPS Scorecard at:
  - Pre-design (use scorecard to set goals)
  - Schematic design
  - DSA filing
  - SAB/OPSC filing


School District Action 56

## Benefits of Adopting CHPS District-wide?

- Reduced Maintenance and Operation Costs
  - Annual energy, water and garbage bills
  - Standardize on high performance equipment
  - Simpler for maintenance personnel
- Leverage with Suppliers and Vendors
  - Incorporate into District specifications
  - Quantity discounts
  - Manufacturers to perform product IAQ testing
- Save Construction Time
  - Plan ahead
  - Becomes standard practice
- Reuse High Performance School Designs
- Obtain Certain CHPS Credits
  - District resolutions for up to 10 points
- The CHPS Scorecard can be partially filled out in advance (LAUSD example)
- Fully Realize CHPS Benefits
  - Test scores
  - Savings
  - Teachers
  - Every student deserves a CHPS school


School District Action 57