## Douglas County Prototype School

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| **Project Type:** | Elementary School Prototype |
| **Owner:** | Douglas County School District |
| **Construction Cost:** | $10 - 12 million |
| **Building Size:** | 73,000 sf |
| **Site Size:** | 10 – 12 acres |
| **Number of Floors:** | 2 |

**Project Team:**

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| Architect: | RB+B / Hutton Architects |
| Civil Engineer: | JVA, Inc |
| Electrical | Consulting Engineers, Inc., RMH Group |
| Mechanical: | Shaffer Baucom Engineering |
| Structural: | Sheflin Group |
| Landscape: | Design Concepts |
| Energy Modeling: | Shaffer Baucom, Group 14, AEC Engineering, EMC Engineers, |

Information/photos courtesy of Hutton Architecture Studio

## the power of the prototype

### high performance goals

- Utilize a project prototype to build on lessons learned for energy savings and building performance to benefit ongoing operations and maintenance.
- Create a quality environment for occupant satisfaction.
- Increase overall energy savings.
- Adapt plan to a variety of site conditions.

### project description

Douglas County School District (DCSD) has utilized building prototype designs to reduce construction costs, minimize design fees, and save time. Motivated by higher occupant satisfaction, energy savings, and operational / maintenance savings, DCSD hosted a competition to create a new, efficient, and adaptable prototype. The winning design was the basis of a new sustainable elementary school prototype that would continually build on lessons learned for ever-higher building performance.

### integrated project process

Any prototype design must incorporate district approved recommendations and operations procedures. It was critical that the design team develop and update the new prototype with the full participation of administrators, educators, facility operators, and district management. This integrated effort resulted in a projected energy use for the prototype at only 46 kBtu/sq ft/year and the sustainable design features noted below.

During construction, school principals participated in the weekly progress meetings. After construction, training was provided to personnel to explain the high performance features of the school. Staff learned about lighting controls, tubular daylighting devices, ice storage, and displacement ventilation. Operations staff learned the building automation system and the maintenance procedures.

### geo charrette

As DCSD continued to update and complete seven new schools (by 2011), they were also open to new energy saving strategies. A full day design charrette was hosted by the Governor's Energy Office and Xcel Energy. The resulting collaborative refinements helped to reduce the projected energy use of the latest prototype to 35 kBtu/sf/year.

### high performance features

**site plan adaptability:**

The prototype site plan was designed so that it could be flipped both north and south or mirrored east and west to allow maximum site plan flexibility. In addition, on sloping sites, the two-story classroom wing could be placed at the same elevation as the administration wing, or located a half or full story lower.

**site water use:**

Irrigation systems were designed with sub metering, zoning, and rain gauges to reduce water use.

**building orientation:**
The building is orientated on an east west axis to maximize north and south lighting in the classrooms. Proper orientation saves energy by reducing the need for electrical lighting and additional cooling, while providing higher quality daylighting opportunities.

**daylighting:**
Glazing, tuned to orientation, provides glare free daylighting and views to the outdoors. Heat gain and direct glare of the southern sunlight is diffused through translucent shades. With this approach, over half of the classrooms in the prototype achieve required light levels without any artificial lighting for most of the day. The remaining hours require only about 30% supplemental lighting that is controlled with daylight sensors. Second floor classrooms capitalize on both side lighting and sky-lighting, while first floor classrooms depend solely on perimeter window side lighting. Future updates may include extending tubular daylighting devices through the second floor to first floor classrooms. The media room and cafeteria feature shaped ceilings, to distribute window daylight evenly, and tubular daylighting devices with lay in ceiling diffusers. The pendant electrical lights are rarely needed during daylight hours.

**building envelope:**
Care was taken to provide high insulation values in the walls and roof. Computer modeling was used to help analyze paybacks. The current prototype utilizes a layer of continuous spray foam insulation in order to reduce thermal bridging and provide improved performance.

**indoor air quality:**
Quality of the indoor environment is critical to staff and student satisfaction, health, and performance. Care was taken to reduce noise, utilize products with little off gassing, and eliminate water infiltration and sources for mold growth.

**hvac systems:**
The higher quality thermal envelope, extensive daylighting, and proper building orientation result in lower cooling needs. Lower cooling loads reduced the quantity and size of the HVAC equipment. Quiet and low energy use heating and cooling was delivered using displacement ventilation.

### additional high performance design features

- Exterior sunshades.
- Clerestory windows maximize natural light penetration.
- View windows below clerestories provide connection to the outdoors.
- Low-flow toilet fixtures.
- Shared parks and parking, where possible, with other organizations.
- Artificial turf fields reduce water use.
- Ice storage to reduce peak demand (first five buildings)
- Evaporative cooling (2010 prototype)

## evolution of energy savings

- **46 kBtu/sf/year** – projected energy use for first generation prototype. Nearly half of the 80 kBtu/sf/year of the district's existing facilities.
- **35 to 42 kBtu/sf/year** – actual energy use of the first five buildings.
- **35 kBtu/sf/year** – projected energy use for the next generation prototype that includes the refinements developed in charette with the GEO and Xcel Energy. Based on actual use and experience from the first prototype, the energy use is expected to be lower than this projection.