Private School with a Green Vision for deconstruction and maintaining lifecycle value

Completed in 2006, Chartwell School was built to provide a high performance educational environment and to showcase design and construction practices that enable deconstruction of building materials for reuse or easy replacement.

**Business benefits**

- The school board adopted an integrated, life cycle approach which demonstrated to donors that they were investing their money - rather than simply donating. This approach led to a 25-40% increase in funding for the school.
- $312/sq ft total construction costs although at the time the average cost of constructing a school in California was $350/sq ft.
- $53/sqft/annum reduction in operating costs.
- LEED Platinum certificate awarded.

**Project background**

Chartwell School is located on a 26 acre site of a former military barracks that was demolished as part of developing the school. The school is privately run and all the development costs were secured from private individuals or foundations.

Major repairs, renovations or replacements of school buildings is common, causes disruption and requires new materials. With this in mind and to reduce the associated costs, the school board’s Executive Director developed a ‘Green Vision’ for the school to focus on the building’s ease of maintenance and potential for adaptability and disassembly. The Green Vision called for integrating design by involving engineers and the FM Manager much earlier than usual. The board and private funders began to see the school building as an investment rather than an outlay.

**Project details**

- **Location**: Seaside, California, USA
- **Client**: Chartwell School

### Designing for deconstruction and flexibility

The board's Green Vision approach led the project team to focus on the material life cycles for all major building components and developed a matrix to evaluate the impact of designing for deconstruction. The matrix considered:

- estimated quantities of materials;
- embodied carbon;
- the relative ease of dismantling and salvaging key construction materials; and
- a forecast of the value of that material at the time of recovery.

Once the most valuable components were identified, the design team focused on how to ensure these could be recovered at the end of the buildings life. The salvage value combined with the ease of recovery identified several important materials for disassembly. This process led to a number of selections including employing a timber frame and replacing 70% of the
cement in the concrete flatwork with blast furnace slag.

Furthermore, a deconstruction guide was produced for future record and referral, which includes detailed drawings and labelling of key structural properties. The deconstruction guide remains in the school’s facility management offices.

**Materials quantity and wastage**
- 30% of framing lumber saved through the use of a simple modular frame. Stud size for the frame was reduced by lowering the roof by two foot.
- The number of required connections in the roof frame was reduced by the selection of Structural Insulated Panels (SIPS).
- Alternate window details to make it easier and cheaper to replace windows.
- The view of most of the utilities is exposed, making access simple for future changes or maintenance. There is no need to remove and waste covering materials.
- Disentangling services from the structure also makes it simpler to recover piping and cables.

**Recycled content**
- Recycling the materials from the existing military barracks was deemed essential. This limited the carbon footprint of the building.
- A large car park (approximately 3 acres) of asphalt was recycled and reused as fill on the site of the new school building.
- Internal wall panelling for multi-use room is Douglas Fir also recovered from the old barracks.

**Embodied carbon**
- Matrix of major building materials included estimation of carbon (embodied carbon per unit).
- A timber frame was selected as it had the greatest potential reuse value when balanced against its carbon footprint.

**Water use**
Design stage consideration of in-use water efficiencies informed procurement for the project and has reduced the predicted water use by 60%.
- Water efficient taps
- Dual flush toilets
- Waterless urinals
- An 8,700 gallon rainwater harvesting tank to collect rainwater for flushing toilets.

- Landscaping with native and food-producing plants & natural drainage.

**Life span (e.g. durability)**
The design team referred to research documents on designing for deconstruction. Measures included to enhance durability of the building are listed below.
- Single ‘utility raceway’ minimises service runs through stud walls. This means the stud walls are not damaged when the utilities are required to be accessed.
- The interior shear walls (primarily along hallways) have been “over” designed, so additional openings can be cut into the walls in the future. This will allow additional interior doors/windows to be fitted in future without having to upgrade the walls.
- Non-structural internal walls can be moved and reconfigured to change classroom layouts.
- The weatherproofing and flashing details to windows were redesigned to enable the windows to be easily replaced without causing damage to surrounding materials.

**End of life potential**
- The matrix of likely and typical construction materials and components allowed a focus on detailing valuable components, even if they were usually difficult to extract from the building. Construction techniques to avoid damaging the materials were employed. For example, fewer high capacity fasteners were used to reduce the holes drilled into the wooden structure.
- The building’s structure and systems are separated and exposed, to increase the potential for recovering high value components.
- The importance of providing information for future project teams to facilitate deconstruction was recognised. A ‘library’ of information has been provided and elements in the building are permanently labelled (e.g. roof trusses are labelled with key structural properties).
- The roof covering is a panelised SIPS solution with roof sheathing, insulation and ceiling finish in a single assembly. The SIPS panels were fastened in place using screws that enable ease of disassembly at end of life.
- The utility raceway prevents the need to drill holes in stud walls, which would otherwise damage their recovery value.
Further developments

The Green Vision’s focus on the building’s ease of maintenance and potential for adaptability and disassembly was considered a success by the school board. Although the financial benefits will not be realised for many years, they agreed the same approach should be adopted on all their projects.

This commitment is seen in two modular buildings added to the Chartwell campus in 2009, to serve the growing number of high school students. The brief for these two facilities maintained the Green Vision and the principles of designing for flexibility and deconstruction.

The modular buildings, which are certified to the Collaborative for High Performance Schools (CHPS) standard, have the adaptability to be retrofitted into teacher residential accommodation when no longer required for academic classes.

Timber frame, the timber frame with exposed connections will facilitate disassembly in future years

Temporary facilities, portable classrooms that can be converted to teacher residential accommodation once a permanent extension to the main school is built