Sustainable Buildings

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Sustainable Buildings Guidelines

Introduction

This course aims to explain all the checklist items, some of which may be unfamiliar to some users, and to describe the major benefits and approaches to green. Many items on the checklist and in these guidelines are fairly simple, inexpensive, and easy to accomplish. Almost every project should try to do these practices. Others are more expensive or require a larger departure from some conventional building systems, but offer correspondingly large rewards. We hope that more and more San Mateo County building owners will explore and develop these strategies.

Who is this course for?

This course is intended for people planning new construction and renovation projects. The environmental impacts of construction – and the opportunities to benefit from handling them well – are proportional to every project, from a small addition to your house to a large new office building. Every project is unique, so if some checklist items do not fit with the specifics of your site or program, focus on accomplishing ones that are appropriate for your project. The right-hand columns on the checklist identify items that are appropriate to each building type.

This course is also for members of the building industry: architects, engineers, building contractors, and others. Green building is a relatively new part of what clients are asking for, and professionals are at different levels of skill in providing green buildings. This course may introduce new ideas or serve as a jumping-off point for discussions with clients, colleagues, and consultants. We have solicited the input of many building industry members from San Mateo County and beyond in compiling this information, and we hope that their experience will be helpful to you.

What is green building, and why do it?

Green building means taking the environment into account during design and construction. Green buildings aim for harmony with the local environment: they benefit from it, and protect and respect it. In general, green buildings are energy efficient, water conserving, durable and nontoxic, with high-quality spaces and high recycled-content materials.

Building impacts on the environment are substantial. Construction in the United States consumes 25% of all wood that is harvested, 40% of all raw stone, gravel and sand, pro-

duces 25% of the carbon dioxide added to the atmosphere, and generates 2 to 2.5 pounds of waste per square foot. Better building practices and materials can significantly reduce these impacts and, at the same time, reduce construction costs and lifetime operating costs, saving you money and reducing burdens on local infrastructure.

In addition, green buildings generally have more comfortable indoor conditions, natural lighting, connections, views to the outside, and healthier indoor air. Because green buildings are healthier and more pleasant to be in, their occupants consistently show lower absenteeism, higher productivity, and, in schools, higher testing scores. For homeowners, the increase in quality of life is always worth this investment, as documented in better resale values and satisfaction among green homeowners. For commercial building owners, increases in productivity can easily total more than a project's entire construction cost over the life of the building.

Planning Ahead

The most important part of the building process happens before ground is broken – the design stage. The decisions made in design have impacts for the life of the project (or even beyond) and on every building user. Studying alternatives is easy to do during design and is a good way to find cost-effective solutions to the needs of your particular project; by contrast, making changes during construction is the most common reason for projects to exceed their budgets.

In a green design process, you will still meet conventional design needs: providing useful space, fire exits, disability access, structural support, and the like. Considering environmental issues – site orientation, energy efficiency, indoor air quality, etc. – may seem an added complication, but it actually offers a larger and richer area in which to view your project. Enlarging the scope of your design offers more ways to understand your goals, and can help you find more efficient alternatives.

Photo: Philippe Cohen

The Leslie Shao-ming Sun Field Station was designed with a goal of net zero carbon emissions on an annual basis, a goal which they are monitoring and reaching. To accomplish this, the lower set of solar collectors on the building have a dual role: heating the building in the winter and shading the windows in the summer. The roof mounted photovoltaic panels turn sunlight into electricity for the building. The integrated design of both passive and renewable sources of heat and energy resulted in a building where only the herbarium requires air conditioning.

The Leslie Shao-ming Sun Field Station at Jasper Ridge Biological Preserve, winner of Sustainable San Mateo County's Green Building Award for 2002, makes an excellent example of the benefits of planning ahead. For instance, although initial estimates for the building project called for building 12,000 square feet, by careful analysis of the actual space needed to house all the researchers and functions, the design team fit all "the building's planned uses into 9,800 square feet. This reduced the construction cost by 18%, as well as reducing the consumption of energy and building materials by an equal amount.

Conventional stud construction can also become less costly and more efficient by planning ahead. Laying out a standard wood-framed house around the conventional 2- foot dimensions of milled lumber allow for a savings of $1.20 per square foot, which amounts to almost $3,000 for a typical home. In many of the strategies suggested in the checklist, alternatives to conventional heating and cooling systems or other building parts are suggested, which can save substantial amounts of energy and money for your building in construction and operation. These decisions cannot be made once ground is broken, when a project is already committed to its overall size, materials, and systems. Planning ahead is the only way to realize these efficiency benefits.

Integrated Design

Integrated design, or "whole building design," means thinking about how all aspects of a building are interrelated – the structural components, heating and cooling systems, lighting, windows, walls, interior finishes, etc. By recognizing the connections between these systems, integrated design offers many benefits. For example, when operable windows (instead of sealed windows) are considered as part of a building's ventilation system, expensive ductwork and air handlers can be made smaller and less expensive. Planning on the "thermal mass" of concrete structural members to slow down indoor temperature changes can also reduce the need for conventional air conditioning.
These kinds of "passive" or low-energy design strategies can only be effective if the whole building's energy performance is studied together, as is explained for many of the checklist descriptions below.

The Leslie Shao-ming Sun Field Station is an excellent example of integrated design right here in San Mateo County. The building's sloping roof allows in daylight, and also funnels rainwater to a storage tank for irrigation. Solar thermal panels provide three-quarters of the building's heating needs in winter and function as sun shades to keep the building cool in summer. Through a variety of passive cooling techniques, no air conditioning is necessary (except in the climate-controlled herbarium), and the scientists who use it say it exceeds their expectations for indoor comfort.

Building integration requires close collaboration between various members of the design team. For example, if daylighting is being used to reduce electricity consumption in lighting, the architect (who will specify the windows) would have to coordinate with the lighting designer and the electrical engineer (who determine the power and controls for the lighting), and all of them would coordinate with the mechanical engineer (who designs the ventilation and air conditioning system). Coordination of this kind is necessary to produce integrated lighting and ventilation systems that are less expensive both to build and to operate. This is another way that planning ahead, as stressed above, is central to achieving both the cost benefits and reduced environmental impacts of green building.

How to use the rest of the course

This course and the associated checklist are organized into thirteen areas, which roughly follow the course of a typical construction project – starting with site work, and moving through foundation work to interior finishing. This is intended to allow you to understand what you can do to be green at various points in your project, even though many of these strategies must be planned for in advance. Most construction contracts also include written specifications (details about specific materials and methods to be used), which are also usually arranged in this sequence. As noted throughout these guidelines, specifications present many opportunities to bring green materials and systems into your project through writing them down as project requirements in advance.

Within each area, we suggest one or more green goals that can benefit you and the environment. Some goals are relevant to more than one area – for instance, saving wood is relevant to both framing and interior wood use. Some projects will lend themselves more to some goals than others, although we hope that you will find all the goals worthy of serious consideration. Within each goal, we describe one or more individual green strategies– these make up the items on the checklist. The following chapters should help you know what to ask of the building industry and design professionals so that your projects can be part of building a better, greener world here in San Mateo County.

Purchase this course to see the remainder of the technical materials.