Designing With Vision…

A Technical Manual for Material Choices in Sustainable Construction

Revised July 2000

California Environmental Protection Agency
Integrated Waste Management Board

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Preface

About This Manual

Sustainable Construction Practices, Concepts, Evaluation, and Practices

This manual highlights sustainable waste management principles for planning, design, and construction of large-scale residential and commercial projects. Sustainability considers the environmental consequences of building practices to eliminate or minimize long-term damage to and depletion of the earth's resources. The concepts shape both individual and community life.

This manual's sustainability concepts focus on:

- Dimensional planning—use of standard dimensions and simple structural footprint.
- Construction waste reduction techniques, including reuse and recycling.
- Use of modular/preconstructed elements as a resourceful building technique.
- Environmentally responsible demolition practices.
- Environmentally friendly product choices with emphasis on recycled-content products.

Target Audience

The target audience for this help manual includes architects, builders, contractors, project developers and owners, and other building professionals who are interested in evaluating sustainable principles for project planning, design, and construction. The City of Los Angeles, Bureau of Sanitation, Solid Resources Citywide Recycling Division (SRCRD) and the California Integrated Waste Management Board combined their expertise to create this reference manual. The manual provides guidelines, product specifications, and product data that generally promote sustainable building practices, including integrated waste management principles.

Benefits

By using the recommended sustainability guidelines, data and product specifications, there are several benefits:

- Reduced up-front capital costs, annual operations, and maintenance expenses.
- Improved building value.
- Improved occupant health and productivity.

Background

The original impetus for preparing this reference manual was the Playa Vista Development Project (Playa Vista) located in the City of Los Angeles. Playa Vista's lead developer at the time, Maquire Thomas Partners, had previously participated in discussions with both SRCRD and the Board concerning the development of an Integrated Waste Management Plan including construction and demolition waste recycling and the use of recycled-content building products. During the summer of 1996, the SRCRD and the Board agreed to prepare a reference manual to assist Maquire Thomas Partners and their contractors in evaluating "green"building opportunities. A public workshop on sustainable building practices was planned for in conjunction with the start of project design and construction, which was initially planned for 1997. The manual was to be released in time for the workshop and used as a reference document. However, prior to the completion date, Playa Vista experienced major management and financial restructuring, which significantly delayed the progress of construction. With the public workshop postponed indefinitely, SRCRD and the Board are releasing the manual for general circulation. The information contained in this reference manual is transferable to other construction projects.

About the Playa Vista Project

Playa Vista will be a residential and commercial development on the largest land parcel in the City of Los Angeles—30 percent larger than New York's Central Park. It is located just north of the Los Angeles International Airport, adjacent to the Westside communities of Santa Monica, Venice, Marina Del Rey, and Westchester. Phase I construction will involve the demolition of about 11 large industrial buildings, the restoration of a salt water marsh, the construction of about 3,000 residential structures, and a major motion picture studio.

Adding excitement to the development is DreamWorks, SKG, the first new studio to be built in Los Angeles in 75 years. DreamWorks, SKG is one of the most creative and entrepreneurial groupings of partners in the history of the entertainment business. The principals—Steven Spielberg, Jeffrey Katzenberg and David Geffen—are luminaries in the entertainment industry. Studio, production, and office facilities will span 100 acres at the eastern end of Playa Vista.

Acknowledgements

The City of Los Angeles, Bureau of Sanitation, Solid Resources Citywide Recycling Division (SRCRD), in the civic center of Los Angeles, is organized within the Bureau of Sanitation to develop and implement effective source reduction, reuse, and recycling programs. SRCRD fosters public/private partnerships and helps to develop new markets for recyclable products and materials. SRCRD can be reached at:

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The Integrated Waste Management Board in Sacramento is the State agency responsible for the implementation of the California Integrated Waste Management Act (IWM Act). Passed in 1989 and implemented in 1990, the IWM Act created a new waste management philosophy in California. The emphasis continues on conservation of natural resources through a hierarchy of management methods to reduce, reuse, and recycle solid waste. Statutory waste diversion goals were set at 25 percent by the year 1995 and 50 percent by the year 2000.

The Board's mission is to protect public health and safety and the environment through waste prevention, waste diversion, and safe waste processing and disposal. This mission can be accomplished only by cultivating effective relationships with local governments and private industry. Through public information and education programs, the Board is laying a foundation to change the public's daily habits and routines. It is critical to impact the decision-making processes of businesses and local government so that they reflect an awareness of the environmental and economic consequences of excessive waste generation. The Board's challenge is to motivate Californians away from a wasteful society toward a resourceful one.

Those Who Helped

The City of Los Angeles Solid Resources Citywide Recycling Division (SRCRD) and the California Integrated Waste Management Board were assisted by the following groups and individuals:

1. Clean Washington Center (CWC) of Seattle is the primary State of Washington organization responsible for developing markets for recycled materials.

2. Deborah Allen of the River City Resource Group of Portland, Oregon is an environmental consultant for the City of Los Angeles Solid Resources Citywide Recycling Division.

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Disclaimer

The identification of individuals, companies, and products in this manual is provided for informational purposes only and does not constitute endorsement by the Board or the SRCRD of any business entity, service, or product.

The amount of postconsumer or preconsumer recycled-content listed for products in this manual is based on information contained in the following directories: The Clean Washington Center's *Recycled Product Directory* (206/464-7040) and *the Harris Directory of Recycled-Content Building Materials* (206/682-4042) or individual manufacturers. The SRCRD or the Board has not independently verified the recycled content of products presented in this manual.

The list of recycled-content building products included in this manual does not contain all recycled-content products that are available or all of the distributors of the products listed. It focuses on specific product categories and, whenever possible, on geographical locations near Playa Vista, the project that catalyzed the manual development. For additional sources of products in other geographical regions, see Chapter 4.

Reader's Guide

This reader's guide will assist you in selecting chapters relevant to your area of interest. Please reference the three reader-guide categories and the four "relevancy" color codes.

Architects/Specifiers **Builders/Contractors** **Developers/Owners**

Not Relevant Fairly Relevant Relevant Very Relevant

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Chapter 1. Why Choose Sustainable Design?

The Double Meaning of Greening

Building "green," or building with environmental considerations in mind, is one important facet of the overall concept of sustainable design. Building green means constructing structures that are designed, built, renovated, operated, and reused in an ecological and energy-efficient manner.

Until recently, most people assumed that building green and building with maximum profits in mind were mutually exclusive. Now they are an interlocking necessity. Building green has many monetary and environmental benefits. It pays to start with practical considerations and summarize these benefits first.

Cost Savings

Before and During Construction

The cost-savings potential of green building strategies can only be fully realized when they are incorporated from the beginning of design through construction, with the assistance of an integrated team of professionals. When buildings are "greened" from start to finish, the potential for monetary savings is enormous. Some green strategies include:

- Siting, building, layout, and massing for solar heat and light use.
- Windows, lightshelves, and shading to reduce lighting and cooling costs.
- Cross-ventilation and sun control to eliminate or reduce air conditioning.
- Capture and reuse of heat from normal building equipment, such as washers and dryers, to reduce heating needs even further.
- Use of material for basic construction that can function as finish, eliminating the need for costly finishing materials.
- Recycling construction and demolition waste to save disposal costs.

During Building Operation

The monthly costs of operating a green building can be reduced from 20 to 75 percent, compared with buildings that operate by standard procedures. The amount of savings depends on how aggressively passive design features are built into the project.

For leased space, depending on how utilities are metered, either the developer sees greater profits from rent, or the tenant benefits from lower utility costs. If the benefits go to the tenant, the cost savings can be used as a significant marketing tool. For spaces to be sold, lower monthly operating costs mean money in the owner's pocket, or those savings can be used to justify up-front increased sales costs.

During Property Sale

There is also growing evidence that energy-efficiency and environmental features, when done well, add value to housing. Green housing sells consistently faster, and at higher prices, than comparable housing.

Financing

Recent surveys also imply that environmental homes have a market edge. Many national polls indicate that most U.S. citizens think of themselves as environmentalists (e.g., a Harris Poll showed 78 percent). Mortgages designed for energy-efficient homes are a possible financing vehicle that can boost sales.

Environmental Savings

The impact of buildings on the environment is staggering. Every year, building construction:

- Consumes 25 percent of the global wood harvest.
- Consumes 40 percent of the materials entering the global economy.
- Consumes 3 billion tons of raw materials, turned into foundations, walls, pipes, and panels.
- Consumes 50 percent of the copper used in the United States.
- Generates 50 percent of the global output of greenhouse gases and the agents of acid rain.

As the critical component of a habitat, buildings affect their proximate and surrounding areas, sometimes creating unwanted impacts on residents and the community. Building with sustainability in mind can dramatically lessen negative impacts.

High Levels of Environmental, Economic, and Engineering Performance

Green buildings reflect high levels of performance. They are energy efficient and conserve resources and materials. They promote good indoor environmental quality and the health of the building's occupants. They improve the exterior environment, including air, water, land, finite resources, and ecosystems. They are designed with a special emphasis on waste prevention and the use of recycled-content products. Renovation and deconstruction are done in a manner that reduces solid waste and captures significant cost savings.

Energy Efficiency

Building with energy efficiency in mind decreases the need to expand utility plants, which ultimately means more money in the pocket of the ratepayer. It reduces air emissions, including greenhouse gases, contributing to better air quality for everyone who lives and breathes in the local environment. Energy-efficient buildings cost less to operate, and in the larger scope, the less energy we use, the less the U.S. is dependent on foreign energy sources and the less our government has to contend with the complex issues that dependency can create.

Indoor Air Quality

By building with attention to interior air quality, builders encourage manufacturers to improve their materials and products to be more compatible with human health, comfort, and safety. Increased fresh air filtration amplifies health and well being at every level. High regard for air quality issues also encourages improved building operations and maintenance.

Materials Reuse and Recycling

Integrated waste management encompasses prevention of waste whenever possible, reuse or recycling whenever practical, disposal only of what is left, and buying products made out of materials that people recycle. Materials reuse and recycling boasts these benefits:

- Prevents pollution and waste generation.
- Saves money through prevention.
- Creates new (recycling) industries.
- Reduces landfill disposal and expansion, and where it is used for disposal, waste incineration and its associated air pollution.

Sustainable design and building is visionary. It challenges us to see the big picture and to plan for both the long- and short-term impact of our stopover on Earth. The philosopher Thoreau is often quoted on the benefits of ecologically designed buildings: “What is the use of a house if you haven’t got a tolerable planet to put it on?”

California’s Waste Reduction Mandates and Responsible Building

If there weren’t already enough reasons to build green, the State of California takes waste reduction so seriously there is a law against maintaining the status quo. In 1989, the California Integrated Waste Management Act (AB 939, Sher, Chapter 1095, Statutes of 1989) was implemented. It requires local governments to divert 25 percent of their waste from landfills by 1995 and 50 percent by 2000. Local jurisdictions are now facing the bigger challenge: making the 50 percent mark. This goal cannot be attained without support from industry.

The location of the Playa Vista project in the most urbanized city in California evokes more than the usual need for responsible building. Los Angeles is well known for its serious air quality and other environmental challenges—issues the City has continued to address with special building requirements and other creative solutions. This begs the

question: Would Los Angeles have these problems if building with strong environmental considerations had always been the norm? We can't undo yesterday, but we can plan for tomorrow. The Playa Vista project is an opportunity for designers and builders to erect a new kind of community, one that reflects learning from the past with an eye to a brighter future.

The Focus of This Document

Sustainability includes many elements—air, water, energy, soil. This manual concentrates on solid waste management, including building strategies for:

- Waste reduction and recycling.
- Use of recycled-content products.
- Use of environmentally friendly products.

Because this technical manual is intended for use beyond the Playa Vista project, we view it as a living document and welcome your feedback to improve future editions. To provide comments or suggestions, see the table of contributors on page vi. Both the SRCRD and the Board house a wealth of information on the application of IWM principles to construction. Please call us and let us share what we know with you. Together, we can take our current body of knowledge to the next higher level.

Last but not least, those working on the Playa Vista project and other building projects with high visibility can be proud of their efforts to showcase a whole new way of looking and building the world—one where doing the right thing is also easy, cost-effective, and the only way to go.

Chapter 2. Choosing Recycled-Content Building Products

Introduction

A recycled-content building product (RCBP) is one that contains the highest amount of postconsumer material practical or, when postconsumer material is impracticable for a specific type of product, contains substantial amounts of postindustrial recovered material. This building product may either "close the loop" by utilizing material from the building and construction industry or may be manufactured from feedstock originating from outside the building industry sector. While the manufacture of recycled-content products has proliferated in recent years, beginning with the "environmental movement" in the early seventies, the trend should not be viewed as an entirely incipient activity. Some recycled-content manufacturers are well established, having produced recycled-content building products for many decades. For example, the Homasote Company of West Trenton, New Jersey has been producing building panels from recycled newsprint since 1916.

Acceptance of Recycled-Content Building Products

In recent years more builders than ever are embracing alternative building products. Generally, relatively simple conventional products are being replaced by more processed, value-added products. Escalating costs for conventional building materials, in particular solid sawn wood products, have driven this movement. Also, many builders perceive that these products offer superior performance compared to conventional building materials. Advanced alternative building products are sometimes engineered to serve multiple functions and often incorporate diverse material types. (For example, a composite structural stress skin panel may provide structural support, insulation and soundproofing.) Alternative building products can optimize performance because they are often specifically designed and engineered for the application. This trend in building product selection should ultimately result in more recycled-content products entering the marketplace. Engineered composites have more potential to incorporate recovered materials than most conventional products.

At present there is little evidence of widespread acceptance of recycled-content products among the mainstream building community. Experience has shown that most building professionals and/or commercial/residential building owners who select recycled-content products (i.e., over nonrecycled products) are motivated primarily by the tangible advantages offered by those products, such as a lower price, functional superiority or greater durability. While there is currently a wide variety of high quality recycled-content building products on the market which offer some or all of these advantages, the

building industry is inherently conservative and therefore slow to accept these products. One major reason is that recycled-content products are often produced by small to medium sized companies that are less capable of meeting the product availability and selection choices required by large-volume consumers. (Chapter 3 of this manual contains a more complete discussion of barriers to the use of recycled-content building products.)

While "recycled-content" alone does not provide a significant marketing advantage for a building product manufacturer, there is some evidence that societal/environmental issues are an emerging factor in the acceptance of recycled-content building products. Nationally, a green movement is occurring among mostly high profile companies which involves the formation of "buy recycled" business alliances. In response to public concerns about waste management and pollution issues, business and government groups have adopted green procurement policies, including "buy recycled" programs for building materials. Private corporations may adopt positive procurement policies to enhance their public image and to set an example for the private sector. Government entities, charged with reducing the detrimental impacts of solid waste, may adopt these procurement policies to set an example for the private sector and other government entities.

Architects and interior designers are also showing an increasing interest in green building strategies, which often include the use of recycled-content products. This trend can be measured by the ever growing number of completed green building projects. Leaders in both government and private sectors are in a position to drive this movement once they become aware of the life cycle advantages of building green.

Environmental Claims

Consumers often want some verification of the recycled content contained in a specific building product. The recycling symbol (chasing arrows inside a dark circle) appears on hundreds of products. However, green marketing claims by vendors remain a source of confusion in the marketplace. Manufacturers, retailers and consumers are often not familiar with the meaning of green marketing claims and enforceable standards for these claims are often lacking. Even if a product is labeled or advertised as having "recycled-content," it does not guarantee that the product will meet the customer's requirements.

Sales staff (manufacturing representatives and retail staff) is usually not the most reliable source of information. However, a consumer may often obtain accurate product specifications (including recycled-content) by contacting a manufacturer's "technical department." Some companies may even certify their environmental claims through an independent environmental claims verification service.

Buyer/User Benefits from Using Recycled-Content Building Products

There are many benefits to using recycled-content building products, including the following ones:

- Reduces the disposal of recyclables and creates markets for recovered materials
- Convinces manufacturers to use more recycled materials
- Creates jobs and economic development opportunities

- Satisfies legislative mandates
- Sets an example for the private sector
- Enhances an organization's image
- Saves money

Benefits to Society from Using Recycled-Content Building Products

- Provides a proactive rather than a reactive approach to the waste management problem
- Conserves resources and energy
- Creates new markets

Categories of Recycled-Content Products by Application

Once a decision has been made by a building project team to consider the use of recycled-content building products (RCBP), the team then develops a preliminary list of product categories applicable to building type or construction project. The task of identifying appropriate RCBPs for evaluation can be simplified by organizing them into categories. The successful team identifies a manageable number of RCBPs for evaluation based on cost, availability, and quality. A sample list of RCBPs (Chapter 6) has only 36 product categories selected for evaluation by the Playa Vista project team.

RCBPs are much more common in some building and construction categories than in others. List evaluation sifts out good candidates for demonstrating RCBPs. For example, many RCBPs fall under the category of interior finish products; therefore, this would be useful information in evaluating product availability for an interior office remodeling project. Dividing RCBPs into categories helps to focus the search for appropriate RCBPs so that a decision-maker's time is not wasted.

This chapter divides construction and building products according to *CSI MasterFormat*, the construction industry's standard developed by the Construction Specifications Institute (CSI). CSI's standard formatting is used throughout the construction industry to format construction specifications in contracts. *CSI MasterFormat* has 16 divisions. Each division contains a number of sections. Each section is divided into three parts—General, Products, and Execution.

The following discusses applicable products in each division.

Division 2: Sitework

Availability of many products in this division will vary with geographic location. For example, recycled aggregate base and recycled paving and surfacing materials are readily available in urban centers, particularly in Southern California.

Earth Retainer

Sound walls are made from a variety of recycled materials, such as postconsumer plastic and crumb rubber from old tires. A 12-foot high sound wall can use up to 250,000 lb. of postconsumer tire rubber per mile in installation.

Paving and Surfacing

Recycled construction products for paving and surfacing include recycled asphalt concrete, modified asphalt, and rubberized asphalt. Availability of these products varies throughout California. For example, recycled asphalt concrete is not readily available in Northern California.

Rubberized asphalt contains approximately 1 percent-2 percent PC crumb rubber by dry weight of total aggregate mix. The crumb rubber used in the asphalt binder itself is about 20 percent in typical formulation. Asphalt/rubber binder is normally 6-8 percent by dry weight of aggregate. Caltrans has used rubberized asphalt in approximately 130 projects throughout the State. The environmental benefits of rubberized asphalt include: (1) reduced scrap tire disposal; (2) less material (asphalt, aggregate, etc.) used because rubberized asphalt can be used in thinner sections to achieve performance that is equivalent to conventional asphalt; (3) reduced road noise; and (4) longer pavement life for equivalent section (thickness) versus conventional asphalt. Specifications for rubberized asphalt are project and location specific. Companies selling rubberized asphalt can assist in developing specifications for a particular project.

Recycled asphalt concrete (RAC) can replace a percentage of virgin asphalt in paving applications. While the percentage of recycled-content can go much higher using experimental techniques, recycled asphalt concrete normally contains up to 15 percent reclaimed asphalt pavement (old asphalt pavement that has been processed) in the virgin mix. *The Standard Specifications for Public Works Construction* (*Greenbook*) lists specifications for recycled asphalt concrete in Sections 203-7.

Recycled asphalt concrete may cost about 50 to 75 cents less per ton than virgin asphalt concrete, because of the reuse of aggregates and oil. Use of recycled asphalt concrete conserves diminishing aggregate and petroleum. It also reduces construction and demolition (C&D) disposal, which is currently 28 percent of California's wastestream and 13 percent of the disposed waste stream in Los Angeles.

Adding an asphalt reinforcement product made from postindustrial carpet fiber material produces modified asphalt. Tests show that this: (1) decreases permanent deformation, (2) increases tensile strength ratios, and (3) decreases pavement moisture sensitivity.

Paving and Surfacing/Pavement Marking

Glass beads made from 100 percent recycled-content glass are used to provide reflectivity for painted and thermoplastic traffic stripes and pavement markings for highway delineation. The specification requires approximately 5 pounds of beads per gallon of paint.

Road Base

Recycled aggregate base (or crushed miscellaneous base) is used under the wearing surface of a road or paved surface. The material is made from crushed demolition concrete and/or asphalt concrete, which can replace class A virgin aggregate for road base and subbase. For many regions throughout California that have acceptable (meet specifications) native materials for base, no economic advantage is derived from using recycled aggregate base. However, the use of recycled aggregate base is particularly cost-effective in areas where large quantities of inert material are stockpiled and a limited supply of local virgin resources is available. Crushed miscellaneous base is available for

under $4.00 per ton in Los Angeles, compared to $7.50 per ton for virgin aggregates, not including transportation cost savings.

For example, in both the Los Angeles and San Jose regions local materials do not generally meet Caltrans standards. However, recycled Class 2 aggregates do meet Caltrans standards. These are examples of regions where recycled aggregate base is available and typically sells for substantially less than virgin aggregates.

Where large quantities of concrete debris are being generated from demolition activity and the material can be used on site as base or sub-base, there may be an economic advantage to crushing inert demolition debris at the project location. The economy of on-site crushing depends on several variables. These include cost to mobilize crushing equipment, the rock stockpile available from demolition activities, the capacity of the crushing equipment available (tons per hour), comparison with local tipping fees for inert materials, the haul distance to local inert landfills and the total cost of importing virgin or recycled aggregate base to the construction site. For example, one larger crushing operation (capable of crushing 4,800 tons per day) indicated that on-site crushing would normally be economically viable for their operation when inert debris stockpiles reach 60,000 to 100,000 tons. Another smaller crushing operation indicated that on-site crushing becomes an option when a customer has a minimum of 8,000 tons of debris, 3 to 5 acres and is willing to pay a processing charge of $2.50 to $3.00 per ton.

The use of aggregate base can prevent a number of adverse environmental consequences, such as the impacts associated with the hauling of inert demolition material to a stockpile and the mining and processing of virgin aggregate. The California Department of Transportation (Caltrans) has published specifications in the *Standard Special Provisions* that allow reclaimed asphalt, concrete, and glass in Classes 2 and 3 aggregate base. The *Greenbook*, used in Southern California, allows recycled aggregate in crushed miscellaneous base (CMB) and processed miscellaneous base (PMB).

Sanitary Sewage

Examples of available RCBPs are a septic tank system made from 75 percent high-density polyethylene (HDPE), and drainage and sewer pipes containing postconsumer and postindustrial plastic.

Walk, Road, and Parking Appurtenances

Several manufacturers produce plastic parking stops, bollards, and speed bumps from postconsumer plastic. These products generally are lower maintenance than similar products made from conventional materials. Guardrail spacers from postconsumer plastic are being used in some states.

Division 3: Concrete

Concrete Accessories

Expansion joint filler made from postconsumer fiber and/or wood waste is available at about the same cost as equivalent products made from virgin materials.

Concrete Materials

Fly ash is a coal combustion by-product that can be used as a replacement for 25 percent of the Portland cement in concrete foundations. Concrete containing fly ash is smoother

and cures to a greater strength than conventional concrete and contains less embodied energy than 100 percent Portland cement concrete.

Concrete Reinforcement

Steel reinforcement bars from postconsumer scrap are available.

Permanent Formwork

Molded insulating block-like forms are made from recycled polystyrene, cement and additives containing up to 80 percent postconsumer and postindustrial plastic. The material provides excellent insulation value. The system reduces labor costs since the block forms are glued together without using mortar. The lightweight elements can be handled without cranes, and the "workability" is better than wood, since openings for architectural features can be cut with a chain saw before the cement is poured to create a monolithic structure.

Division 4: Masonry

Concrete Masonry Units

Concrete masonry units made with recycled-content include 2.5ft x 2.5ft x 5ft blocks from leftover cement are available. These blocks can be used for retaining walls, head walls, and bridge abutments.

Division 5: Metals

Steel is often taken for granted as a recycled-content product because it is a mature recycling market with a well developed infrastructure of collectors and processors. Many building products made from metal are produced with some postconsumer materials. Because of recent advances in electronic steel mill technology, there has been a tremendous increase in the amount of recycled scrap steel being used for domestically produced steel. For example, approximately 40 percent of American steel was made from scrap steel during 1995 compared to only 10 percent during 1993. According to American Iron and Steel Institute, steel made by the “basic oxygen furnace”method must use about 70 percent virgin ore, while steel made by the electric arc method can be produced using much less virgin ore (e.g., much higher recycled-content steel).

Cold Formed Metal Framing

Wood shortages are forcing the residential construction industry to consider alternative framing systems. As the result, some residential builders are shifting from conventional wood framing to light gauge steel systems. Steel systems for residential construction weigh less than wood, which can translate into transportation cost savings. Since the various elements can be fabricated and sized in the factory, there is normally less construction waste generated at the building site compared to traditional methods, which can result in disposal cost savings. The downside of using steel framing is that steel creates tremendous heat loss through structural studs in the absence of an external thermal barrier. Also, light gauge steel studs have high embodied energy and are made with relatively low recycled-content steel. (Light gauge steel studs are only about 28 percent recycled-content because they must be made using the “basic oxygen furnace” method.) For additional information on light gauge steel framing, see Chapter 8 of this manual—Strategies to Reuse Material/Reduce Material Use in Construction.

Division 6: Wood and Plastics

A large number of RCBPs fall under this CSI Division. Examples include:

Board Paneling

Decorative panels made from old newspapers are available.

Finish Carpentry

Solid sawn redwood or fir exterior trim is available from re-milled salvaged lumber. Exterior trim is also being fabricated from rigid postconsumer polystyrene, which simulates natural wood.

Plastic Lumber (Marine Applications)

This is a construction category in which RCBPs are fairly common. Marine products must be resistant to moisture damage, mechanical abrasion, chemical attack, and destruction by marine animals. As might be expected, the most common recycled-content marine products are made from inert secondary and postconsumer materials, including high-density polyethylene, scrape tires, crumb rubber, fiberglass and cement. Examples include plastic lumber timber fenders (which protect bridge supports and pier pilings from runaway barges); floating marinas and fish pens made from polystyrene foam and scrap tires; steel reinforced plastic pilings used for fenders and load bearing pilings; and marinas, piers, and walkways made from plastic lumber and plastic composites.

Plastic Lumber

Decks and park benches made from recycled-content plastic lumber are available in place of more conventional, often less durable wood products. Plastic lumber products may contain postconsumer and/or postindustrial plastic and may be either a single plastic type or co-mingled plastics. Plastic lumber composites incorporate combinations of distinct material types, such as postconsumer plastic and postindustrial wood fiber or crumb rubber and postconsumer plastic. For additional information on plastic lumber, see Chapter 8 of this manual, entitled "Strategies to Reuse Material/Reduce Material Use in Construction."

Rough Carpentry

Engineered wood products (EWP) use less wood for equal or greater load bearing characteristics. Examples of EWP are glulams, laminated trusses, I-joists, laminated veneer lumber and oriented strand board. Generally, these products are not recycled-content products but, rather, include materials recovered at timber mills. However, most EWP are considered to be sustainable building materials in as much they are resource efficient and are made from second and third growth trees rather than old growth. These products also require less material to manufacture compared to solid sawn lumber products for the same application. Because they are premanufactured, they generate little or no on-site construction waste. Engineered wood members tend to cost more than traditional systems and may have environmental drawbacks. For additional information on EWP, see Chapter 8.

Structural Panels

Structural and insulated panel systems (panels) are a material and labor saving alternative to traditional "stick" construction methods. A primary advantage is that each panel is uninterrupted by studs, providing a thermally efficient wall. While structural insulated panels are suitable for floors and roof elements, the most common building application is wall panels, including both load bearing and non-load bearing applications. Since panel system manufacturers usually custom design panel systems from building plans, job site waste is often greatly reduced. Reduced labor cost is often another major advantage of panels, which can be quickly erected by unskilled workers.

The most common type of panel has an expanded polystyrene foam core faced with oriented strand board made from fast growing second growth trees. The I-beam construction provides for superior loading stresses of a structure while the bonded foam core keeps the skins aligned and provides excellent insulation values. In some cases, the foam core is made from recycled polystyrene. Plastic lumber, used for the panel's top and bottom plate, contains postconsumer plastic.

Another type of structural panel uses Kraft paper in a honeycomb configuration (treated with phenolic resins) and facer material such as oriented strand board. Honeycomb panels perform like multiple I-beams. The facers withstand bending loads, and the honeycomb core acts as the web to absorb the shear loads placed on the panels. Honeycomb panels are an efficient use of material (typically the core is 5 percent paper and 95 percent air) and have very high strength to weight ratios. The Kraft paper part of the panel contains recycled material. Despite the enormous potential, this technology has not been widely used in the housing industry. Additional information on structural panels is provided under "Modular and Preconstructed Panels" in Chapter 8 of this manual.

Solid Polymer Fabrications

There are a variety of countertops available that are made from postconsumer and postindustrial plastic.

Division 7: Thermal and Moisture Protection

Building Insulation

Recycled building products are very common in weatherization products, such as cellulose made from old newspapers and fiberglass batt insulation. Fiberglass insulation sold in California is subject to minimum content law (requires a minimum of 30 percent postconsumer glass content).

Shingles and Roofing Tiles

Currently there are many types of recycled-content metal roofing products on the market, which can replace more conventional, often less durable asphalt composition or wood shake roofing shingles. These products include sheet metal roofing, metal shingles, shakes and tile made from postconsumer aluminum and steel. In addition, there are a variety of cement composites, containing recovered materials, such as fly ash and wood fiber. There are even roofing shingles made from postconsumer rubber, plastic and glass. Other examples of recycled roofing products include roofing mats (walkway pads) and roof membranes made from postconsumer plastic and roofing felt paper made from postconsumer paper.

Siding

Engineered wood siding is sometimes made from wood waste using various binders, such as linseed oil. Recycled-content vinyl siding is also available that incorporates a substrate made from postconsumer plastic. Wall panels can be made from aluminum, steel or copper ranging between 35 percent to 95 percent postconsumer metal. Siding is also made from Portland cement composites that use silica cellulose fiber containing some postconsumer paper. Solid sawn redwood or fir siding is also available from various manufacturers of re-milled salvaged lumber.

Division 8: Doors and Windows

Doors Windows/ Skylights

Windowsills and door jams made from rigid postconsumer polystyrene are available and simulate natural wood. Door rails and windowsills are made using a postconsumer plastic composite substrate. Windows and skylights are also being fabricated from postconsumer aluminum, plastic and postindustrial glass. Door moldings are being made from densified polystyrene, which not only simulates natural wood, but also has solid color and solid grain.

Division 9: Finishes

Many RCBPs fall under the general category of interior finish products. Examples include:

Acoustical Ceiling Tiles

For a number of years, several major manufacturers have been producing acoustical ceiling tiles made from postconsumer materials including old newsprint and mineral wool.

Carpet and Carpet Underlayment

Carpet is made from discarded plastic beverage bottles. Carpet padding is made from tire scrap, postconsumer plastic or postindustrial fiber and from scraps from furniture and car seat manufacturers and carpet layers. Broadloom and carpet tiles are available in level loop and open weave fiber configurations.

Ceramic Tile

Floor tile made from old auto windshields for both residential and commercial use is on the market. The tile is available in a variety of hues and tones.

Gypsum Board

Wallboard from postconsumer paper facing and backing and postconsumer and/or postindustrial gypsum is available at about the same cost as virgin wallboard products.

Painting Materials

A variety of recycled paints are made from remanufactured paint from municipal paint recycling programs. High quality recycled paint is available, often at considerably less cost than comparable virgin paint products.

Division 10: Specialties

Toilet Compartment

Floor mounted overhead braced or ceiling mounted toilet compartments made from recycled, high-density polyethylene are readily available on the market.

Identifying Devices

Plastic signs are available from postconsumer plastic for indoor and exterior applications.

Chapter 3. Overcoming Barriers to Purchasing Recycled-Content Building Products

Though recycled building products are becoming more common, there are still many barriers to overcome before they can be used routinely. The construction industry as a whole tends to be conservative, relying on traditional products with long histories. Some caution is justified—the industry is responsible for public safety and vulnerable to lawsuits; and, profit margins can be very slim. However, many barriers can be overcome by education and access to information. And solutions exist that can be incorporated into the typical process of planning, design and construction.

Following is a list of potential barriers to the purchasing of recycled-content building products (RCBP) and suggestions to overcome them.

Cost, Availability, Quality, and Product Knowledge

Limited Availability*

Many new products are produced on a small scale, and therefore suppliers may not be able to provide large quantities in the required time frame.

Solution—Before specifying a product, find out what a supplier has in stock and/or how long it would take to manufacture the required amount. A specifier may consider requiring in the contract that the contractor submit a construction schedule that includes dates when specific materials will be ordered. This may require some work, but inevitably solves many problems.

Limited Options

Some construction products do not have recycled-content counterparts, and many new RCBPs have a limited selection of colors, sizes and other features.

Solution—As markets for RCBPs expand, selections will continue to increase. In the meantime, a purchaser can obtain lists of RCBPs to learn what products are available now, and contact the manufacturer to learn the range of available features. (See Chapter 4 for lists of RCBPs.)

* A Kitsap County, Washington project found that limited availability and limited options are larger barriers than cost. See Acknowledgements.

Perceived High Cost

Many people believe that RCBPs always cost more than traditional products. In many cases, this is a false perception, as many RCBPs are cost-competitive with virgin products, and some are even less expensive.

Solution—Obtain price quotes from suppliers, and compare prices of virgin products versus comparable recycled products. Be sure to compare "apples and apples" by comparing the same quantities and the same performance.

Also, many traditional products have recycled content, although they are not marketed as recycled. For example, drywall backing paper is 100 percent recycled. Find out if a traditional product you want to purchase is already made from recycled materials.

Considering that raw materials extraction is often subsidized with tax credits, land giveaways and grants, the prices for recycled products are actually quite competitive, and should improve further if and when these subsidies are phased out.

Higher Initial Costs

Some RCBPs do cost more initially, but may save money over the life of the product because of lower maintenance costs and/or a longer life span.

Solution—When comparing the price of virgin versus recycled, do a simple life-cycle analysis of each by calculating the anticipated cost to purchase, install, maintain, and dispose of the product after its life. Then compare the two products over the same time span. For example, if a wooden bench lasts 15 years and a bench made of plastic lumber lasts 30 years, the two product costs can be compared as in the following table. (the numbers used are fictitious).

		Wood	Plastic Lumber
First 15 Years	Purchase	$150	$400
	Installation	$50	$70
	Maintenance	$400	$100
	Disposal	$50	——
Second 15 Years	Purchase	$200	——
	Installation	$60	——
	Maintenance	$500	$100
	Disposal	$70	$20
Total		**$1,480**	**$690**

Lack of Knowledge About New Products

Many products are selected by designers because of past experience and from word of mouth from other professionals. New products take time to investigate, and time is very limited during a project.

Solutions—

- Network with experienced professionals. Before the project starts, designers can contact design groups that may have experience with certain products, for example a local chapter of Architects, Designers, and Planners for Social Responsibility, or the American Institute of Architects' Committee on the Environment. To contact C&D recycling organizations, order the list *C&D Recycling—-Organizations/Publications* (CIWMB Publication #431-96-019) from the Board's Hotline at (800) 553-2962, or through the Board's on-line publications catalog at www.ciwmb.ca.gov/gra/opa/publist/pubframe.htm. In addition, the Internet is becoming a more and more valuable source of networking.

- Schedule time for education during a project.

- Be sure that product literature and samples are obtained from the manufacturer or distributor and made available to the design team throughout the project.

Diffuse Decision-Making Process

Each person in the construction decision process has an opportunity to suggest substitute products. Decision-makers may include owners, developers, future tenants, designers, architects, specifiers, engineers, contractors, sub-contractors, suppliers, building inspectors and public works inspectors. A designer can specify a product early in the project, and the product can then be de-selected at a later stage.

Solution—Be sure that the owner and the design team are committed to using RCBPs and that the players communicate with each other throughout design and construction. Write a general goal statement to the contractors bidding on the project.

Perceived Lower Quality

Many people in the building industry assume that RCBPs have a lower quality than virgin products. However, with modern technology and quality control, this is much less of a concern than in past years.

Solution—Be sure that the products selected have been tested to meet industry standards and that they meet building codes and other requirements, as described below.

Industry Standards, Building Codes, and Road Specifications

Some new RCBPs may not meet industry standards, building codes or government specifications. Other new products could meet the requirements if tested, but the manufacturer may not have funds for testing to demonstrate compliance.

For a more detailed discussion of industry standards and building codes, order the fact sheet *Construction Product Approval Process* (pub #431-96-021). For a more detailed discussion of pavement specifications, order fact sheets *Recycled Aggregate* (pub #431-95-052) and *Asphalt Pavement Recycling* (pub #431-95-067). These fact sheets are available on the Internet at www.ciwmb.ca.gov/mrt/cnstdemo or can be ordered through the CIWMB Publications Clearinghouse/Hotline at (800) 553-2962. (From outside of California call (916) 341-6300.)

Industry Standards

Architects, specifiers, and other purchasers expect a product to meet certain minimum quality standards. These standards are established through industry associations. Although many standards are not legally binding, products must still meet them to compete in the marketplace. Some product standards are developed to protect public health and safety, and the environment and must be met in most jurisdictions. Also, all product standards become legally binding when they are cited in a contract.

Solution—When considering a RCBP, ask the manufacturer for product specification sheets that list the industry standard tests performed on the product. Industry associations can give guidance on minimum standards. Also, ask several manufacturers what the key advantages of their products are, and discuss these key issues among their competitors.

Building Codes

Building codes are minimum performance standards for the regulation of the design, construction, and quality of building materials. Their main purpose is to protect public health and safety. Examples of minimum standards include fire ratings and strength requirements.

Building codes are written by model code agencies, which are voluntary, non-governmental organizations. The codes become law only when they are accepted and enforced by a state or local government. The model code agency used by the western United States is the International Conference of Building Officials (ICBO), which writes the Uniform Building Code (UBC). Most California governments use the UBC in whole or in part.

ICBO's Evaluation Service approves products after evaluating independent test results. After a product is tested and approved, ICBO gives it a report number. However, if a product is not yet approved by ICBO, local building officials may still allow its use. UBC Section 104.2.8 states as follows: "Provided the building official finds that the proposed design is satisfactory and complies with the provisions of this code and that the material, method or work offered is at least the equivalent of that prescribed in this code in suitability, strength, effectiveness, fire resistance, durability, safety and sanitation." The local official may also require testing. The official's main interest is in seeing that someone is willing to take the liability.

Some new products are whole new categories and not covered in the UBC, such as straw bale construction and plastic lumber. Many of these categories of products do not yet have product-specific standard tests developed to demonstrate their quality. However, they can still be tested with traditional methods for fire, sound, shear, gravity loads, etc.

Solutions—

- To determine whether the product is ICBO-approved, request an ICBO report number from the manufacturer or from ICBO.
- If it is not approved, ask the manufacturer to work with the local building official to obtain local approval.
- If you prefer to meet with the building official, gather as much information as possible about the product, including information from the manufacturer.

Building officials will be particularly interested in test results from independent laboratories.

- For new categories of products, check with the American Society for Testing and Materials (ASTM) to see if standard tests are being developed.

Note: The International Code Council™ (ICC) is in the process of developing the International Building Code™ (IBC) with joint participation of the three U.S. model code agencies.

Road Specifications

Caltrans

The California Department of Transportation (Caltrans) designs transportation structures according to its *Standard Specifications*, July 1992 (English units) or July 1995 (metric units). However, there are also products approved by Caltrans that are not mentioned in the standard book, but written instead as standard special provisions (SSP).

An SSP is a specification approved by Caltrans that may be used routinely on Caltrans projects. It is not in the standard book, either because it has not been used long enough, or because it must be modified for each project. An example of a product allowed in a Caltrans SSP is recycled Class 2 and 3 aggregate base.

When a product or method is being tested, before it reaches the SSP stage, the specification is first written as a special provision (SP). An SP is not yet a method or product approved by Caltrans for routine use, though it may be used in specific Caltrans projects if requested. An example of a product allowed only in a Caltrans SP is recycled hot-mix asphalt concrete.

Solutions—

- Local government public works departments and private road builders can become familiar with Caltrans' SSPs, and those pending. They can obtain the SSP for aggregate base, either hard copy or downloaded from the Internet, as instructed in the CIWMB fact sheet entitled *Recycled Aggregate*.

- Contractors can request from the owner, such as Caltrans or the local public works department, permission to add recycled material, provided that the standards for the virgin product are otherwise met.

- Local public works departments can obtain the Special Provisions for recycled hot-mix asphalt from the Caltrans Lab, and have a materials engineer modify the SP as needed for the project. (This is what the Caltrans districts do when they use recycled asphalt on a job.)

Greenbook

The *Greenbook* is officially called the *Standard Specifications for Public Works Construction* and is used by the City and County of Los Angeles and 200 other local governments and agencies in the Los Angeles area. The *Greenbook* was written by the Southern California chapters of the American Public Works Association and Associated General Contractors of California.

The *Greenbook* allows 15 percent reclaimed asphalt pavement (RAP) in asphalt concrete, or more if test data support a higher percentage. The *Greenbook* also allows 100 percent recycled aggregate base in their Crushed Miscellaneous Base (CMB) and Processed Miscellaneous Base (PMB).

Solution—Use the *Greenbook* to specify recycled hot-mix asphalt, and select CMB and PMB (recycled) for aggregate base. Obtain the new edition, published in November 1996, for $49.95 through BNI Building News, 1612 S. Clementine St., Anaheim, CA 92802, at (714) 517-0970.

Local Government

Though local public works departments are free to develop their own specifications, most of them depend heavily on Caltrans specifications.

Solution—Local public works departments and private developers could use alternative sources for specifications that Caltrans has not yet completed. For example, hot-mix asphalt specifications can be obtained from the *Greenbook* or from the Asphalt Institute.

Government Procurement Specifications

Local and State government purchasing departments have written guidelines to purchase products for government business. Many of these specifications are required to maintain quality and keep costs down. Some government procurement specifications are written as "material" or "design specifications," which describe the materials required in the product. An alternate method is to use "performance specifications," which describe the required function or performance only. This method allows a variety of materials. An example of a material specification would be a picnic table made of redwood, which would preclude plastic lumber. A performance specification would be a picnic table passing a particular durability test, which would allow lumber to compete with redwood.

The wording of a specification may also preclude RCBPs unintentionally, such as one government's infamous "brightness" requirement for toilet paper.

Solution—

- A government can review procurement specifications and modify them to allow RCBPs while still maintaining quality and low cost. If appropriate, material specifications may be changed into performance specifications.

- A government can set policies that encourage and even require recycled product procurement. An example of this is the City of Los Angeles. On March 24, 1995, the Los Angeles City Council passed a motion that required the use of 100 percent recycled miscellaneous base and 15 percent recycled asphalt concrete on all City projects. (See Chapter 5 for contract language used by the City of Los Angeles for base and asphalt.)

Chapter 4.
Locating Recycled-Content Building Products

There is a wide selection of recycled-content building products (RCBP) available on the market. After the building team has developed a preliminary list of potential product categories, a variety of recycled-content product directories can be referenced to locate specific products. These guides range from national directories listing recycled-content products in general to regional guides that include only recycled-content building products available in a specific geographical area. Some of these guides are organized in *CSI MasterFormat* and others are not. Most of the guides do not contain price and availability data because of the temporal nature of this information. The following is a brief description of some of these directories.

Recycled-Content Product Directories

The California Integrated Waste Management Board's Recycled-Content Product Database

The IWMB manages a recycled-content product database with over 10,000 recycled-content product listings. This directory has a national focus. Although the general product list includes a large selection of recycled-content building products, recycled-content building products are not organized in *CSI MasterFormat*. It can now be accessed directly from the Internet at www.ciwmb.ca.gov/rcp/. The database can be queried on several different fields to focus searches and returns a random sample of up to five companies that meet the search criteria. This directory is continuously updated.

IWMB's Recycled-Content Construction Product Database

The IWMB also maintains a database (currently containing approximately 450 manufacturers) of recycled-content construction product manufacturers that sell in California. Product categories include aggregate, asphalt, masonry, structural, flooring, walls, insulation, fixtures, paint, roofing, wood substitutes (e.g., plastic lumber) and outdoor. This database has some overlap with the previously mentioned RCP database; however, the information is also available in a printout version (a 9-page spreadsheet) in which the products are not described in detail. It can be accessed on the Internet at www.ciwmb.ca.gov/cgi-shl/foxweb.exe/rcpmenu@constdmo/crcpmain as a searchable database, or for a printed version, call the IWMB Hotline at (800) 553-2962 and ask for Publication #431-96-018.

The Official Recycled Products Guide

Published by Recycling Data Management Inc., this is a national directory of recycled-content products. The guide includes a large selection of recycled-content building products, but the listings are not organized in *CSI MasterFormat*. The guide is updated quarterly. The guide lists more than 650 manufacturers and distributors marketing more than 4,000 products in 700 classifications. The guide is continuously updated, and is available in hard copy or diskette. The entire directory can also be accessed on the Internet through an on-line service provider. Contact Recycling Data Management, Inc. for details concerning the annual subscription fee and other service charges.

Recycling Data Management Inc.
P.O. Box 577
Ogdensburg, NY 13669-0577
(800) 267-0707

Construction Products Containing Recovered Materials

Published by the U.S. Environmental Protection Agency, this is a national guide containing manufacturers and suppliers of various recycled-content building products. The guide is not organized by *CSI MasterFormat*, but the listings are ordered according to EPA Regions 1-10.

The guide can be accessed over the Internet at http://www.epa.gov/epaoswer/non-hw/. Hard copies can be ordered by contacting EPA's RCRA Hotline at (800) 424-9346.

Recycled-Content Building Product Database

The Alameda Waste Management Authority publishes this directory. Available in electronic format, this directory lists mostly recycled-content products available within Alameda County. However, the directory also includes some national listings. This general directory includes a section on recycled-content building products, which is organized in *CSI MasterFormat*. The Bay area vendor listings are updated on an ongoing basis.

Alameda Waste Management Authority
777 Davis Street, Suite 200
San Leandro, CA 94577
(510) 639-2498

Guide to Resource Efficient Building Elements

Published by the Center for Resourceful Building Technology, this is a national directory of recycled-content building products containing about 450 product listings. The directory is organized by building components rather than by *CSI MasterFormat*. Last updated in 1997. For details, contact:

Center for Resourceful Building Technology
P.O. Box 3866
Missoula, MT 59806
(406) 549-7678

A Resource Guide to Recycled-Content Construction Products

Published by the City of Los Angeles, this directory lists a number of selected recycled-content building products. The guide is organized in *CSI MasterFormat*.

Solid Resources Citywide Recycling Division
Bureau of Sanitation
433 South Spring Street, 5th Floor
Los Angeles, CA 90013
(213) 847-1444

The Harris Directory

Published by B.J. Harris, Inc., this national directory of recycled building products contains approximately 5,000 listings. Available in electronic format, it can be queried on several different fields. The directory is organized in *CSI MasterFormat* and is published twice a year. It is available in hard copy or can be delivered on diskette, which allows the database to be queried on several different fields. The directory/database is also available on the Internet.

B.J. Harris Inc.
522 Acequia Madre
Santa Fe, NM 87501
(888) 844-0337

National Park Service's Sustainable Design and Construction Database

Available on diskette, the database contains more than 1,300 product listings from over 550 manufacturers. It can be queried by manufacturing plant location, CSI division, or product type. Products are rated in 14 environmental factors. The database can also be downloaded from the Internet at: http: //www.nps.gov/dsc/dsgncnstr/susdb/.

National Park Service
P.O. Box 25287
Denver, CO 80225
(303) 969-2466

A Guide to Recycled Building and Construction Products

Published by the Solid Waste Management Department of Metro, the directory of recycled-content building products is organized in *CSI MasterFormat*. Metro is a regional government entity that serves several counties in the Pacific Northwest.

Metro
Solid Waste Management Department
600 NE Grand Ave.
Portland, OR 97232
(503) 797-1650

Recycled Products Directory

Published by the City of San Diego Environmental Services Department, this directory identifies local sources of recycled-content products.

The City of San Diego
Environmental Services Department
Environmental Programs Division
9601 Ridgehaven Court
San Diego, CA 92123
(619) 467-0903

Garden and Landscape Recycled-Content Product Source Book

Published by the American Plastics Council, this directory includes a number of construction-related products used in landscaping. The products made from recycled-content plastic are listed alphabetically in a separate section. The product source book can be ordered by calling the American Plastics Council at (800) 243-5790.

Other Sources of Recycled-Content Product Information

The California Recycling Market Development Zone (RMDZ) program is implemented by the California Integrated Waste Management Board. The Board assists recycled-content product manufacturers by offering low interest loans up to $1 million, technical assistance on financing strategies, and marketing assistance both nationally and internationally. RMDZ coordinators in any of 40 areas of the state can often identify local recycled-content product manufacturers that may not be listed in directories. The zone contact person for the City of Los Angeles is Steve MacDonald at (213) 485-6154.

For additional information on the RMDZ Loan Program, call the Board's Recycling Business Assistance Branch at (916) 341-6537.

Chapter 5. Sample Contract Language and Specifications for Recycled-Content Building Products

As mentioned in Chapter 2, CSI's standard formatting is used throughout the construction industry to format construction specifications in contracts. CSI's MasterFormat has 16 divisions. Each division contains a number of sections. Each section is divided into three parts—general, products, and execution.

Product Alternates in the Bid Process

Before selecting a recycled-content building product (RCBP), a designer or owner may want to collect more information about cost and availability. One way to do this is to write into the bid document a number of proposed products called "alternates." The contractor then submits a multiple bid that reflects those product alternatives. The CSI format lists alternates in two sections:

1. Section 00400 is the Supplement to Bid Forms. Section 00460 simply lists the alternate products.

2. Section 01031 is a draft section written by the Los Angeles Chapter of CSI and is called "Environmental Bid Alternates." Following is a brief example of Section 01031 (see Appendix A for the full text):

Section 01031
Environmental Bid Alternates

Part 1 General

1.4 Schedule of Alternates

C. Alternates describe environmental requirements. Requirements for performance, appearance, workmanship, and materials not modified under the Alternate Bids shall conform to Drawings and Specifications, except as exceeded by Code.

1. Alternate Bid Number 1: State the amount to be added to or deducted from the Base Bid if crushed miscellaneous base and processed miscellaneous base containing 100 percent postconsumer asphalt and concrete are provided for base as specified in Section 92500, Paving and Surfacing.

Add: _____ dollars, or Deduct: _____ dollars

Specifier Note: (Name of Supplier) at ( ) (phone number)
(Name of Supplier) at ( ) (phone number)
(Name of Supplier) at ( ) (phone number)

2. Alternate Bid Number 2: State the amount to be added to or deducted from the Base Bid if rubber-modified asphalt containing recycled tires is provided for asphalt paving as specified in Section 02500, Paving and Surfacing.

Add: _____ dollars, or Deduct: _____ dollars

Specifier Note: (Name of Supplier) at ( ) (phone number)
(Name of Supplier) at ( ) (phone number)
(Name of Supplier) at ( ) (phone number)

3. Alternate Bid Number 3: State the amount to be added to or deducted from the Base Bid if gypsum board scraps are salvaged during construction, crushed, and used as soil amendment (30-40 percent to compost) in lieu of calcium sulfate as specified in Section 02900, Landscaping.

Add: _____ dollars, or Deduct: _____ dollars

Specifier Note: (Name of Supplier) at ( ) (phone number)
(Name of Supplier) at ( ) (phone number)
(Name of Supplier) at ( ) (phone number)

"Brand Name or Equal" Specifications

Many contracts specify certain products by brand name "or equal." This allows the contractor to purchase either the brand name product cited, or a different but "equivalent" product. This flexibility becomes important when the cited product is unavailable, or when an equivalent product is discovered that is lower in cost. If both the brand name product and the equivalent product must have recycled-content, then this should be clearly stated in the specification.

Subcontracts

The general contractor (GC) hires subcontractors to construct specialized portions of the project. (Two typical examples of subcontracted work are concrete pouring and installation of irrigation systems.) The GC writes a separate contract for each subcontractor, which outlines that portion of the work. If the GC is to require the "subs" to purchase recycled products, the main contract should clearly state this. The GC can write an "incentive/penalty" clause into their contracts with subs that stipulates, for example, less payment for purchasing virgin products when comparable recycled products are available.

Contract Language Examples

To include RCBPs in the contract, it is helpful to take contract language that is already written and modify it for your needs. Two excellent sources of sample language are (1) the *GreenSpec: Guideline Specifications for Environmentally Considered Building Materials & Construction Methods* (*GreenSpec*), which was prepared by Siegal & Strain Architects for the Alameda County Source Reduction and Recycling Board in 1996, and (2) City of Los Angeles specifications for city projects.

GreenSpec

This guide covers many environmentally desirable products, including recycled products. Each product or product type is described in a separate section. Each section is organized in CSI format: Part 1: General, Part 2: Products, and Part 3: Execution. Part 1 typically begins with "environmental considerations." These considerations do not necessarily have to be written into the contract. Part 1 may continue with such topics as definitions, references, and quality assurance. Part 2 describes the product and may include topics such as materials and accessory materials, and may list required product specifications and standard tests. Part 3 typically includes installation and waste management.

The following is an abbreviated specification for gypsum board to illustrate *GreenSpec's* typical section format. (For *GreenSpec's* complete gypsum board example, see Appendix F.)

You may order *GreenSpec* from Environmental Building News (EBN) via its Web site at www.buildinggreen.com, or by calling (800) 861-0954. The guide is $59 for EBN subscribers and $79 for nonsubscribers.

Section 09250
Gypsum Board

Part 1—General

1.01 Environmental Considerations (Inclusion of this section in the contract is optional.)

A. Qualities:

B. Problems:

C. Recommendations:

1.02 Quality Assurance

A. Industry Standards:

Part 2—Products

2.01 Gypsum Board

Specify gypsum board containing recycled gypsum content if available, and 100 percent recycled paper. Specify manufacturers that take back scrap for recycling.

2.02 Fiber Gypsum Board

2.03 Related Materials

A. Adhesives:

B. Fasteners:

C. Joint Treatment Materials:

D. Acoustical Sealant and Joint Tapes:

Part 3—Execution

A. Materials Handling

B. Application of Gypsum Board

3.03 Application of Fiber Gypsum Board

A. Taping and Finishing

3.05 Waste Management

City of Los Angeles

The following sample contract language for plastic wheel bumpers is from the City of Los Angeles:

Section 02507
Plastic Wheel Bumpers

Part 1 General

1.1 Summary

Furnish and install plastic wheel bumpers (wheel tape) as indicated on the drawings and specified.

Documents affecting Work and this Section include, but are not necessarily limited to, the GENERAL CONDITIONS, and Sections in DIVISION 1—GENERAL REQUIREMENTS of these Specifications.

1.2 Submittals

Comply with provisions of SUBMITTALS SECTION 01340 of DIVISION 1 GENERAL REQUIREMENTS of these Specifications.

Product Data: Submit information describing the materials used in the manufacture of the wheel bumpers.

Part 2 Products

2.1 Materials

Bumpers shall be plastic formed on one-piece, extruded or injection molded, high-impact plastic in color selected by Architect, with weather and oil resistant surface, and formed to the profile indicated, manufactured by EcoTech, or approved equal. Contact manufacturer's representative: Environmental Specialty Products, (909) 390-8800.

Adhesive for Securing Bumpers in Place: Provide an epoxy, two-component type, long curing, manufactured by Edeco, Furance, Andrew Brown, Adhesive Engineering Company, or equal.

Part 3 Execution

3.1 Installation on Portland Cement Concrete Pavements

Secure bumpers in place as recommended by the manufacturer with 2-component epoxy adhesive. Surfaces to receive the bumper shall be free from dirt, loose particles or other foreign matter that might adversely affect the bonding properties of the adhesive.

For additional contract language from the City of Los Angeles, see Appendix E, which includes the following operations and products:

- Rock crushing operations
- Demolition
- Site clearing
- Erosion control

- Plastic wheel bumpers
- Asphaltic concrete paving
- Reinforced membrane waterproofing
- Solid plastic partitions

Chapter 6. Annotated Listing of Potential Recycled-Content Building Products

Notes:

This is a sample annotated list containing 36 product categories developed for the Playa Vista project. This chapter divides the construction and building products according to *CSI MasterFormat*.

Disclaimers:

1) The identification of individuals, companies and products in these materials does not constitute endorsement by the IWMB or SRCRD and is provided for informational purposes only. The IWMB is distributing this information in an effort to increase public awareness and knowledge about this important topic.

2) Recycled content and product characteristics are per information from product manufacturers and/or various recycled product directories. Neither IWMB nor SRCRD has independently verified this information.

CSI Division 2—Sitework

Division 2—Sitework
Section 02511—Recycled Asphalt Concrete

Building Product Category: Recycled asphalt paving
(Geographical parameters of search for building category: Los Angeles Region)

A. Manufacturing Information

Building Application: Paving applications to replace virgin asphalt/aggregate paving materials

Product Name: N/A

Manufacturer:	Blue Diamond Materials
Address:	11462 Penrose St. Sun Valley, CA. 91352
Contact:	N/A
Phone:	(818)983-0161
Fax:	N/A
Toll Free:	N/A

Environmental Considerations: While the percentage of recycled content can go much **higher** depending on plant conditions and test lab procedures, recycled asphalt concrete usually contains up to 15 percent reclaimed asphalt pavement (old asphalt pavement that has been processed) in the virgin mix and conserves diminishing resources of aggregates and petroleum products. If using "cold-in-place" recycling, transportation costs can be reduced as well.

Specifications: The *Greenbook* (*Standard Specification for Public Works Construction*) has specifications for recycled asphalt concrete in Section 203-7.

Advantages: Often less expensive

Other Listings Within Geographical Location:

Blue Diamond Materials
11462 Penrose St.
Sun Valley, CA. 91652
Phone: (213) 773-5155
Various site locations

Industrial Asphalt
11447 Tuxford Street
Sun Valley, CA 91352
Phone: (818) 767-7119
Various site locations

Division 2—Sitework
Section 02540—Synthetic Surfacing

Building Product Category:
(Geographical parameters of search for building category: West Coast)

A. Manufacturing Information

Building Application: Synthetic surfacing for exterior sports surfaces and playgrounds

Product Name: Everlast Rubber Tile

Manufacturer:	Dodge-Regupol
Address:	P.O. Box 989 Lancaster, PA 17608-0989
Contact:	John Hollern
Phone:	(717) 295-3400
Fax:	(717) 295-3414
Toll Free:	(800) 322-1923

Environmental Considerations: Made from 84 to 98 percent postconsumer rubber from used tires

Specifications: N/A

Advantages: Reduces injuries and improves site drainage.

B. Manufacturing Information

Building Application: Synthetic surfacing for various applications

Product Name: Safety Deck II or Safety Tred II

Manufacturer:	The Mat Factory, Inc.
Address:	760 W. 16th St. Suite E Costa Mesa, CA 92627
Contact:	Roger Maloney
Phone:	(714) 645-3122
Fax:	(714) 645-0966
Toll Free:	(800) 628-7626

Environmental Considerations: Product contains 100 percent postconsumer tire rubber and PVC plastic derived from electric cable covers

Specifications: N/A

Advantages: Reduces injuries and improves site drainage

C. Manufacturing Information

Building Application: Synthetic surfacing

Product Name: RB Rubber Matting

Manufacturer:	RB Rubber Products, Inc.
Address:	904 East 10th Ave. McMinnville, OR 97128
Contact:	Mark Parker
Phone:	(503) 472-4691
Fax:	(800) 888-1183
Toll Free:	(800) 525-5530

Environmental Considerations: Made from 100 percent postconsumer feedstock from re-cap tires

Specifications: ASTM

Advantages: Specifically sized rubber particles used to enhance the cushion and drainage of outside areas

Other Listings Within Geographical Location:

Atlas Track and Tennis
19495 SW Teton Ave.
Tualatin, OR 97062
Phone: (800) 423-5875

Bartron Corp.
441 S. 48th St #107
Tempe, AZ 85281
Phone: (800) 992-9949

Rubber Granulators
P.O. Box 692
Snohomish, WA 98291
Phone: (360) 658-7754

Distributors:

Active Packing and Gasket
1400 W Lambert Rd Unit B
Brea, CA 92621
Phone: (562) 905-5330

Division 2—Sitework
Section 02546—Rubber Modified Asphalt

Building Product Category: Paving and Surfacing. Rubberized Asphalt.
(Geographical parameters of search for building category: Los Angeles Region)

A. Manufacturing Information

Building Application: Paving applications to replace virgin asphalt/aggregate paving materials

Product Name: N/A

Manufacturer:	Manhole Adjusting Contractors, Inc.
Address:	P.O. Box 250 Monterey Park, CA 91754
Contact:	John Corcoran
Phone:	(323) 725-1387
Fax:	N/A
Toll Free:	N/A

Environmental Considerations: (1) Promotes recycling of tire rubber; and (2) uses less material (asphalt, aggregate) because rubberized asphalt can be used in thinner sections to achieve the equivalent performance of conventional asphalt (source reduction).

Specifications: Specifications for rubberized asphalt are project and location specific. The supplier can assist in developing specifications for a particular project.

Advantages: (1) Reduced road noise, and (2) longer pavement life for equivalent section (thickness) versus conventional asphalt. Formulas for rubberized asphalt contain approximately 1 to 1.7 percent postconsumer crumb rubber by dry weight of total aggregate mix. About 20 percent postconsumer crumb rubber is used in the asphalt binder in a typical formulation. Asphalt/rubber binder is normally 6 to 8 percent by dry weight of aggregate.

Other Listings Within Geographical Location:

Cyclean, Inc.
11549 Bradley Ave.
San Fernando, CA 91340
Phone: (818) 837-5047

Industrial Asphalt
2715 E. Washington Blvd.
Los Angeles, CA 90065
Phone: (323) 258-2777

Ruiz Engineering Co.
P.O. Box 4177
Long Beach, CA 90804
Phone: (562) 439-3070

Division 2—Sitework
Section 02721—Aggregate Base Course

Building Product Category: Recycled Aggregate Base
(Geographical parameters of search for building category: Los Angeles Region)

A. Manufacturing Information

Building Application: Replaces virgin aggregate base used for paving.

Product Name: N/A

Manufacturer:	See list below.
Address:	
Contact:	
Phone:	
Fax:	
Toll Free:	

Environmental Considerations: Prevention of several environmental impacts associated with hauling of inert demolition material to a stockpile and the mining and processing of virgin aggregate.

Specifications: The *Greenbook* is a public works specification book commonly used in the Los Angeles area. The *Greenbook* includes standardized specifications for crushed concrete and asphalt in two of its three aggregate base categories. The California Department of Transportation (Caltrans) has published specifications that include reclaimed asphalt, concrete, and glass in Class 2 and 3 Aggregate Base, and also in Class 1, 2, and 3 Aggregate Sub-base. (For more discussion of aggregate base, see *Recycled Aggregate* fact sheet, CIWMB publication #431-95-052.)

Advantages: Less expensive than virgin aggregate in the Los Angeles area. There also may be an economic advantage to crushing concrete and asphalt demolition debris on site, where the material can be used on site as base or sub-base. The economy of on-site crushing depends on several variables including the amount of rubble stockpiled, the capacity of the crushing equipment available (tons per hour), local tipping fees for the inert materials, the haul distance to local inert landfills, and the total cost of importing virgin or recycled aggregate base to the construction site.

Other Listings Within Geographical Location:

25th Street Recycling Inc.
2121 East 25th Street
Los Angeles, CA 90058
Phone: (818) 767-3088

Blue Diamond Materials
1100 E Orangethorpe, Suite 200
Anahiem, CA 91706
Phone: (800) 300-4240

CalMat/Industrial Asphalt
3200 N. San Fernando Rd.
Los Angeles, CA 90065
Phone: (323)258-2777

Community Recycling
9147 DeGarmo Ave.
Sun Valley, CA 91352
Phone: (818) 767-7511

Dan Copp Crushing
12017 Greenstone Ave.
Santa Fe Springs, CA 90670
Phone: (714) 777-6400

Dan Copp Materials, Inc.
1300 North Hancock St., Ste. B
Anaheim, CA 92807
Phone: (714) 777-6400

Granite Construction Co.
7010 E. Avenue M
Little Rock, CA 93543
Phone: (805) 726-4447

Newman and Sons, Inc.
9005 Bradley Avenue
Sun Valley, CA 91353
Phone: (323) 875-1622

Shamrock Base
3100 N. Broadway
Los Angeles, CA 90031
Phone: (323) 223-2366

Valley Base Materials
9050 Norris Ave.
Sun Valley, CA 91352
Phone: (818) 767-3088

Division 2—Sitework
Section 02830—Fences and Gates

Building Product Category: Fencing
(Geographical parameters of search for building category: United States)

A. Manufacturing Information

Building Application: Fencing made with recycled plastic

Product Name: N/A

Manufacturer:	Hammer's Plastics Recycling Corporation
Address:	1651 West Foothill Blvd. Upland, CA 91786
Contact:	N/A
Phone:	(909) 391-1600
Fax:	N/A
Toll Free:	N/A
Distributor:	ESP Products, Inc. (909)390-8800

Environmental Considerations: Contains 100 percent postconsumer plastic

Specifications: N/A

Advantages: Product has low maintenance requirements

B. Manufacturing Information

Building Application: Fencing made with recycled plastic

Product Name: N/A

Manufacturer:	Recycled Plastics Industries, Inc.
Address:	1820 Industrial Drive Green Bay, WI 54302
Contact:	N/A
Phone:	(414) 468-4545
Fax:	(414) 468-4765
Toll Free:	N/A
Distributor:	ESP Products, Inc. (909) 390-8800

Environmental Considerations: Contains 100 percent postconsumer plastic

Specifications: N/A

Advantages: Product has low maintenance requirements

C. Manufacturing Information

Building Application: Fencing made with recycled plastic

Product Name: N/A

Manufacturer:	Rancho Recycled Products
Address:	27840 Del Rio Road, Suite C Riverside, CA 92519
Contact:	N/A
Phone:	N/A
Fax:	(909) 676-0108
Toll Free:	N/A

Environmental Considerations: Made from up to 100 percent postconsumer recycled plastic

Specifications: N/A

Advantages: Product has low maintenance requirements

D. Manufacturing Information

Building Application: Fencing made with recycled plastic

Product Name: N/A

Advantages: Product has low maintenance requirements

Manufacturer:	American Ecoboard
Address:	200 Finn Ct. FarmingDale, NY. 1173
Contact:	Ron Kwiatkowski
Phone:	(631) 753-5151
Fax:	(631) 753-5163
Toll Free:	N/A
Distributor:	N/A

Environmental Considerations: Contains 100 percent postconsumer recycled plastic

Specifications: N/A

Advantages: Product is durable and has low maintenance requirements. Life cycle cost savings.

E. Manufacturing Information

Building Application: Fencing made with recycled plastic

Product Name: N/A

Advantages: Product has low maintenance requirements

Manufactuer:	N.E.W. Plastics Corporation
Address:	P.O. Box 480 Luxemburg, WI 54217
Contact:	Lonnie Vincent
Phone:	(920) 845-2326
Fax:	(920) 845-2723
Toll Free:	N/A
Distributor:	N/A

Environmental Considerations: Contains 95 percent recycled plastic material.

Specifications: N/A

Advantages: Product is durable and has low maintenance requirements. Life cycle cost savings.

Other Listings Within Geographical Location:

Al-Fla Plastics, Inc.
P.O. Box 70166
Mobile, AL 36618
Phone: (800) 523-3904

All Fiberglass Products, Inc.
P.O. Box 2278
Joliet, IL 60434
Phone: (800) 438-7395

Eagle Recycled Products
1201 W. Katella Ave.
Orange, CA 92867
Phone: (800) 448-4409

Enviroedge Products Co.
15171 Pipeline Ln.
Huntington Beach, CA 92649
Phone: (800) 549-3343

International Plastics Corp.
1300 New Circle Rd.
Lexington, KY 40505
Phone: (606) 388-9116

Inteq Corp.
5124 Mayfield Rd.
Cleveland, OH 44124
Phone: (216) 442-3557

Tenax Corp.
4800 E. Monument St.
Baltimore, MD 21205
Phone: (800) 356-8495

Jarco, Inc.
345 W. 62nd Ave. Unit D
Denver, CO 80216
Phone: (303) 428-4149

Division 2—Sitework
Section 02832—Sound Absorbing Walls

Building Product Category: Sound wall
(Geographical parameters of search for building category: United States)

A. Manufacturing Information

Building Application: Sound walls for railroad and freeway right-of-ways

Product Name: Carsonite Sound Wall

Manufacturer:	Carsonite International Corp.
Address:	#10 Bob Gifford Blvd. Early Branch, SC 29916
Contact:	Noni Beck
Phone:	(803) 943-9115
Fax:	(803) 943-3375
Toll Free:	(800) 648-7916

Environmental Considerations: Load bearing structural composite tongue and groove building planks (non-recycled) filled with shredded postconsumer tires. A 12-foot-high sound wall can use up to 250,000 lbs. of postconsumer rubber tire per mile of installation.

Specifications: The wall meets ASTM Ei84 and has a class A rating.

Advantages: The Carsonite wall can contain a fire retardant when requested. The shell is a fiberglass-reinforced composite, which will not support combustion. Shell wall can be painted. *Note:* The City of Long Beach has recently purchased this product for construction of 33,000 feet of sound wall.

B. Manufacturing Information

Building Application: Sound wall barrier

Product Name: Eviro-Pro, Sound Wall & Tascon Spray On

Manufacturer:	Tascon Inc.
Address:	P.O. Box 41846 Houston, TX. 77214
Contact:	Jim Adamoli
Phone:	(713) 937-0900
Fax:	(713) 937-1496
Toll Free:	N/A

Environmental Considerations: Contains 85 percent total recycled content.

Specifications: 85 percent post consumer corrugated cardboard.

Advantages: N/A

C. Manufacturing Information

Building Application: Sound wall barrier

Product Name: Infinity Initiative Product

Manufacturer:	Collins and Aikman
Address:	311 Smith Industrial Blvd. Dalton, GA 30720
Contact:	N/A
Phone:	(706) 259-9711
Fax:	(706) 259-2099
Toll Free:	(800) 248-2878

Environmental Considerations: Contains 70 percent postconsumer plastic

Specifications: Can meet various tests according to design

Advantages: Increased strength, durability, and extended life cycle

Other Listings Within Geographical Location: None found

Division2—Sitework
Section 02840—Walk, Road, and Parking Appurtenances

Building Product Category: Wheel stops/Road signage/Traffic barriers
(Geographical parameters of search for building category: United States)

A. Manufacturing Information

Building Application: Recycled composite plastic wheel stops for use in parking lots to replace concrete wheel stops made from virgin materials

Product Name: N/A

Manufacturer:	Eagle Recycled Products
Address:	1201 W. Katella Ave. Orange, CA 92867
Contact:	Philip Thompson
Phone:	N/A
Fax:	N/A
Toll Free:	(800) 448-4409

Environmental Considerations: Contains 100 percent postconsumer plastic

Specifications: Contact manufacturer.

Advantages: Concrete stops often crack after only a few years of use. This product will not crack, require painting, or require maintenance. Sold with a life service warranty. No forklift required during installation because product can be dropped off the back of a truck without damage. Since the product weighs much less than cement parking stops, there are labor saving advantages during installation. Some purchasers have reported that the recycled plastic car stops are often stolen from parking lots, but using the appropriate adhesive can prevent this problem.

B. Manufacturing Information

Building Application: Wheel stops for use in parking lots

Product Name: Parking Stops

Manufacturer:	Durable Corporation
Address:	75 N Pleasant St. Norwalk, OH. 44857
Contact:	Angela Niederhofer
Phone:	(419) 668-8138
Fax:	N/A
Toll Free:	(800) 537-6287

Environmental Considerations: Contains 50 percent post consumer co-mingled plastic, 50 percent recovered co-mingled plastic, 100 percent total recycled content.

Specifications: Contact manufacturer.

Advantages: Same as above.

C. Manufacturing Information

Building Application: Wheel stops for use in parking lots

Product Name: Power Stop

Manufacturer:	Collins & Aikman Floor Covering Division
Address:	311 Smith Industrial Blvd. Dalton, GA 30722
Contact:	N/A
Phone:	(706) 259-9711
Fax:	(706) 259-2099
Toll Free:	(800) 248-2878
Distributor:	E-Spec (510) 536-2600

Environmental Considerations: Contains 50 percent used Collins & Aikman carpet, 35 percent postconsumer stretch/shrink wrap, and 15 percent carpet scrap. Old carpet is a significant contributor to landfill waste. Long life promotes source reduction.

Specifications: ASTM (various), and EPA 1311.

Advantages: Same as above.

D. Manufacturing Information

Building Application: Road signs, parking signs, and traffic barriers

Product Name: N/A

Manufacturer:	Amazing Recycled Products, Inc
Address:	P.O. Box 312 Denver, CO. 20201
Contact:	Mary Jarrett
Phone:	(800) 241-2174
Fax:	N/A
Toll Free:	N/A

Environmental Considerations: Contains 100 percent recycled plastic

Specifications: N/A

Advantages: Low maintenance

Other Listings Within Geographical Location:

Amazing Recycled Products, Inc.
P.O. Box 312
Denver, CO 80201
Phone: (800) 241-2174

American Earth Friendly, Inc.
21610 Guadalajera Ave.
Boca Raton, FL 33433
Phone: (561) 394-4463

American Recreational Products
3505 Veterans Memorial Heights Ste Q
Ronkonkoma, NY 11779
Phone: (800) 663-4096

Amour Fiber Core, Inc.
P.O. Box 42
Sultan, WA 98294
Phone: (360) 793-0146

Barco Products
11 N. Batavia Ave.
Batavia, IL 60510
Phone: (630) 879-0084

Bedford Industries, Inc.
P.O. Box 39
Worthington, MN 56187
Phone: (800) 533-5314

BTW Industries
3939 Hollywood Blvd., Suite 3B
Hollywood, FL 33021
Phone: (954) 962-2100

Carsonite International Corp.
10 Bob Gifford Blvd.
Early Branch, SC 29916
Phone: (800) 648-7974

Earth Care Products
2600 West Roosevelt
Chicago, IL 60608
Phone: (800) 653-2784

Inteq Corp.
5124 Mayfield Rd.
Cleveland, OH 44124
Phone: (216) 442-3557

Jarco, Inc.
345 W. 62nd Ave., Unit D
Denver, CO 80216
Phone: (303) 428-4149

Kay Park Recreation Corp.
1301 Pine St.
Janesville, IA 50647
Phone: (800) 553-2476

Pawling Corp.
P.O. Box 200
Wassiac, NY 12952
Phone: (800) 431-3456

Plastic Recycling, Inc.
10252 Hwy. 65
Iowa Falls, IA 50126
Phone: (800) 338-1438

Scientific Developments, Inc.
P.O. Box 2522
Eugene, OR 97402
Phone: (800) 824-6853

The Plastic Lumber Co.
115 W. Bartges St.
Akron, OH 44311
Phone: (800) 886-8990

Traffic & Parking Control
800 Wall St.
Elm Grove, WI 53122
Phone: (800) 236-0112

Distributors:

American Plastic Lumber Distributors
P.O. Box 514
Cameron Park, CA 95682
Phone: (916) 677-7700
(Distributes various wheel stops)

Division 2—Sitework
Section 02870—Site and Street Furnishings

Building Product Category: Outdoor Bench
(Geographical Parameters of Search for Building Category: United States)

A. Manufacturing Information

Building Application: Outdoor park bench

Product Name:

Manufacturer:	Eagle Recycled Products
Address:	1500 East, Suite 10 Orange, CA 92867
Contact:	Phillip Thompson
Phone:	(714) 633-4130
Fax:	(714) 997-3400
Toll Free:	(800) 448-4409

Environmental Considerations: Contains 100 percent postconsumer plastic. Picnic table uses 50 percent wood waste and 50 percent postconsumer plastic.

Specifications: Various ASTM

Advantages: Plastic lumber benches are generally less expensive to maintain. They won't rot, decay, splinter, or crack. They do not require painting, treating, or sanding and are resistant to graffiti. However, plastic lumber benches often require more supporting structure to prevent deformation.

B. Manufacturing Information

Building Application: Recycled plastic bench

Product Name: RecycleDesign

Manufacturer:	EagleBrook Plastics
Address:	2600 W. Roosevelt Rd. Chicago, IL 60608
Contact:	Jim O'Brien
Phone:	(773) 638-0033
Fax:	(773) 638-2567
Toll Free:	N/A
Distributor:	E-Spec (510) 536-2600

Environmental Considerations: Contains 100 percent postconsumer plastic

Specifications: Various ASTM (density, compressive, shear, tensile, weathering)

Advantages: Wide selection in colors of natural green, white, and gray. Plastic lumber benches often require more support structure to prevent deformation.

C. Manufacturing Information

Building Application: Custom recycled concrete bench

Product Name: N/A

Manufacturer:	Quick Crete Products Corp.
Address:	731 W. Parkridge Ave. Norco, CA 91760
Contact:	N/A
Phone:	(909) 737-6240
Fax:	N/A
Toll Free:	N/A

Environmental Considerations: Standard recycled bench contains 21 percent postconsumer material including rebar and clinker, which is an industrial waste product from cement kilns. The company also offers a bench, which is 93 percent recycled content, including postconsumer aggregate and sand material.

Specifications: N/A

Advantages: No advantage over concrete bench

Other Listings Within Geographical Location:

A.E.R.T., Inc.
HC 10 Box 116
Junction, TX 76849
Phone: (915) 446-3430

American Ecoboard, Inc.
200 Finn Ct.
Farmingdale, NY 11735
Phone: (631) 753-5151

Amour Fiber Core, Inc.
P.O. Box 42
Sultan, WA 98294
Phone: (360) 793-0146

BTW Industries
7939 Hollywood Blvd., Suite 3B
Hollywood, FL 33021
Phone: (954) 962-2100

Distributions, Inc.
1710 Steffens Way
Green Bay, WI 54311
Phone: (800) 245-0524

Doty and Sons Concrete Products, Inc.
1275 E. State St.
Sycamore, IL 60178
Phone: (800) 233-3907

Du Mor, Inc.
P.O. Box 142
Mifflintown, PA 17059-0142
Phone: (800) 598-4018

Earthstar Energy Systems
65 Washington Rd.
Waldoboro, ME 04572
Phone: (207) 832-6861

Envirosafe Products Corp.
355 Eisenhower Pkwy. #206
Livingston, NJ 07039
Phone: (973) 535-1414

Falcon Products, Inc.
9387 Dielman Industrial Dr.
St. Louis, MO 63132
Phone: (800) 873-3252

Florida Playground and Steel Co.
4701 S. 50th St.
Tampa, FL 33619
Phone: (800) 444-2655

Janus et Cie
8687 Melrose Ave. #B146
W. Hollywood, CA 90069
Phone: (800) 245-2687

Kay Park Recreation Corp.
1301 Pine St.
Janesville, IA 50647
Phone: (800) 553-2476

Litchfield Industries
4 Industrial Dr.
Litchfield, MI 49252
Phone: (800) 542-5282

New World Furniture
P.O. Box 20937
San Jose, CA 95160
Phone: (408) 268-9040

Obex, Inc.
P.O. Box 1253
Stamford, CT 06904
Phone: (800) 876-8735

Phoenix Recycled Plastic
301 Randolph St.
Anbler, PA 19002
Phone: (610) 940-1590

Plastic Recycling
10252 Hwy. 65
Iowa Falls, IA 50126
Phone: (800) 338-1438

Polywood, Inc.
3615 Kennedy Rd.
South Plainfield, NJ 07080
Phone: (800) 915-0043

R.J. Thomas Manufacturing Co., Inc.
P.O. Box 946
Cherokee, IA 51012-0946
Phone: (800) 762-5002

Recycled Plastic Man, Inc.
P.O. Box 3368
Venice, FL 34293
Phone: (800) 253-7742

Redi Buildings
P.O. Box 1469
Mitchellville, MD 20716
Phone: (301) 805-7179

Reeski
P.O. Box 781
Aspen, CO 81612
Phone: (800) 826-5447

Spray Control System
431 4th Ave. SE
Blooming Prairie, MN 55917
Phone: (800) 248-3855

The Plastic Lumber Co.
540 S. Main St Blvd. #7
Akron, OH 44311
Phone: (800) 886-8990

Yemm and Hart
1417 Madison #308
Marquand, MO 63655-9610
Phone: (573) 783-5434

Distributors:

AI-FLA
P.O. Box 70166
Mobile, AL 36670
Phone: (334) 471-1130

Division 2—Sitework
Section 02950—Soil Amendments

Building Product Category: Soil amendments made from wood waste, green waste, and/or composted biosolids
(Geographical parameters of search for building category: Los Angeles region)

A. Manufacturing Information

Building Application: Soil amendments used in landscaping

Product Name: TOPGRO®

Manufacturer:	Organix Supply, Inc.
Address:	P.O. Box 1505-A Shafter, CA 93263-1505
Contact:	N/A
Phone:	N/A
Fax:	N/A
Toll Free:	N/A
Distributor:	All Fedco stores are distributors

Environmental Considerations: TOPGRO® is made entirely from yard trimmings and biosolids collected by the City of Los Angeles.

Specifications: N/A

Advantages: This product is an important part of the city's "Full Cycle Recycle Program," which produces a value-added product from "waste."

B. Manufacturing Information

Building Application: Soil amendments used in landscaping

Product Name: N/A

Manufacturer:	Kellog Supply Inc.
Address:	350 W. Sepulveda Blvd. Carson, CA 90745
Contact:	N/A
Phone:	(310) 830-2200
Fax:	N/A
Toll Free:	N/A

Environmental Considerations: Contains 100 percent recycled wood shavings and grindings mixed with biosolids and other organic material

Specifications: N/A

Advantages:

Other Listings Within Geographical Location:

America's Best Landscape Supply
12819 E. Garvy
Baldwin Park, CA 91706
Phone: (877)476-9797

Angeles Sawdust Products
1516 Grande Vista Ave.
Los Angeles, CA 90023
Phone: (323) 269-2195

Artesia Sawdust
13434 Ontario Ave.
Ontario, CA 91761
Phone: (909) 947-5983

Bradley Landfill and Recycling Center
9227 Tujunga Ave.
Sun Valley, CA 91352
Phone: (818) 767-6180

Chino Valley Sawdust, Inc.
13434 Ontario Ave.
Ontario, CA 91761
Phone: (909) 923-0563

CSI Division 3—Concrete

Division 3—Concrete
Section 03100—Concrete Formwork

Building Product Category: Concrete forms
(Geographical parameters of search for building category: United States)

A. Manufacturing Information

Building Application: Foundation drainage

Product Name: Form-A-Drain

Manufacturer:	Certainteed Corp.
Address:	P.O. Box 860 Valley Forge, PA 19482
Phone:	(610) 341-7000
Fax:	(610) 341-7055
Toll Free:	(800) 274-8530

Environmental Considerations: Plastic formwork substitute for wood lumber made from 100 percent recycled PVC

Specifications: N/A

Advantages: Outlasts wood formwork

Note: Product not yet distributed in California

B. Manufacturing Information

Building Application: Concrete cylinder forms such as support columns for buildings or for site drainage system.

Product Name: Sonotube Fiber Form

Manufacturer:	Sonoco Products Company
Address:	P.O. Box 160 Mail Stop NO3 Hartsville, SC 29551-0160
Contact:	Danny Yanken (Tech)
Phone:	(803) 383-7000
Fax:	(803) 383-7997
Toll Free:	(800) 532-8248

Environmental Considerations: Made from a minimum of 80 percent postconsumer paper fiber

Specifications: N/A

Advantages: Saves labor, eliminates spiral and vertical markings. Available in 4 inch to 60 inch diameters with a variety of lengths.

C. Manufacturing Information

Building Application: Concrete cylinder forms

Product Name: Sleek Tube (for columns) and Sleek Void (for drainage pipe)

Manufacturer:	Jefferson Smurfit Corp.
Address:	Evergreen Industrial Park Beardstown, IL 62618
Contact:	Dale Weller
Phone:	(217) 323-5225
Fax:	(217) 323-1994
Toll Free:	N/A

Environmental Considerations: Contains 90 percent postconsumer and 10 percent postindustrial paper, including corrugated, newsprint and mixed paper.

Specifications: N/A

Advantages: Forms can be left intact for in-ground use. Poly-coated sheet on surface exposed to concrete keeps concrete from adhering to form material.

Other Listings Within Geographical Location: None found

Division 3—Concrete
Section 03130—Permanent Formwork

Building Product Category: Concrete insulating forms
(Geographical parameters of search for building category: Arizona and California)

A. Manufacturing Information

Building Application: Cement and Styrofoam molded into insulating block like forms

Product Name: Rastra Block

Manufacturer:	Rastra Block USA
Address:	5776 N. Mesa El Paso, TX 79912
Contact:	Bernard Penanetta
Phone:	(915) 587-8885
Fax:	(915) 587-8555
Toll Free:	N/A

Environmental Considerations: Rastra Block is made from recycled polystyrene, cement, and additives containing up to 80 percent postconsumer and postindustrial plastic.

Specifications: R-36.44 insulation value, for 10" coated wall. Various ICBO guidelines. Four-hour fire rating without added fireproofing. Contact manufacturer for details.

Advantages: Rastra Block is fire, rodent, and termite proof. The material provides excellent insulation value. The system reduces labor costs since the block forms are glued together. There is no mortar required. The lightweight wall can be handled without cranes.

"Workability" of the product is better than wood because openings for architectural features can be cut with a chain saw before the cement is poured to create a monolithic structure.

B. Manufacturing Information

Building Application: Cement and styrofoam molded into insulating block like forms

Product Name: Ener-Grid

Manufacturer:	Ener-Grid
Address:	6847 S. Rainbow Rd. Buckeye, AZ 85326
Contact:	N/A
Phone:	N/A
Fax:	N/A
Toll Free:	N/A
Distributor:	Big Fish Design (916) 721-3474

Environmental Considerations: Up to 80 percent postconsumer and postindustrial plastic. Product's low weight reduces transportation pollutants.

Specifications: ASTM, ANSI/UL, UBC, 2 hour UL, and R-36.44 insulation value

Advantages: Reduces noise, fire resistant, rodent, and termite proof. Easy assembly saves money on labor.

C. Manufacturing Information

Building Application: Cement molded into insulating block-like forms

Product Name: Cempo Form

Manufacturer:	Castle Block
Address:	N/A
Contact:	Rob Teckker
Phone:	N/A
Fax:	N/A
Toll Free:	(800) 672-7872

Environmental Considerations: 86 percent recycled polystyrene and 14 percent cement

Specifications: Contact manufacturer for details.

Advantages: Cempo Form is a low-cost, stay-in-place concrete form.

Other Listings Within Geographical Location: None found

Division 3—Concrete
Section 03150—Concrete Accessories

Building Product Category: Expansion joint filler
(Geographical parameters of search for building category: United States)

A. Manufacturing Information

Building Application: Expansion joint filler for concrete

Product Name: Homex 300

Manufacturer:	Homasote
Address:	23203 Burbank Blvd. Woodland Hills, CA 91367
Contact:	Kent Harned
Phone:	(818) 888-0193
Fax:	N/A
Toll Free:	N/A

Environmental Considerations: Made from 100 percent postconsumer newsprint. Product is nontoxic and resource efficient.

Specifications: ASTM (various)

Advantages: Will not extrude in hot weather or crack in cold weather. Termite proof.

B. Manufacturing Information

Building Application: Expansion joint for concrete

Product Name: Conflex

Manufacturer:	Masonite
Address:	1 South Wacker Chicago, IL 60606
Contact:	Andy Faulhaber
Phone:	(312) 750-0900
Fax:	N/A
Toll Free:	N/A

Environmental Considerations: Undetermined postconsumer paper and wood waste.

Specifications: ASTM (various), and ASHTO.

Advantages: Will not extrude in hot weather or crack in cold weather. Termite proof.

Other Listings Within Geographical Location: None found.

Division 3—Concrete
Section 03210—Reinforcing Steel

Building Product Category: Steel reinforcing bar
(Geographical parameters of search for building category: Southern California)

A. Manufacturing Information

Building Application: Concrete reinforcement

Product Name: N/A

Manufacturer:	Tamco
Address:	12459 Arrow Hwy. Rancho Cucamonga, CA 91739
Contact:	Leonard Robinson
Phone:	(909) 899-0660
Fax:	N/A
Toll Free:	N/A

Environmental Considerations: Contains 100 percent recycled steel. Sources for used material are confiscated firearms, tire cords, and other steel waste.

Specifications: ASTM (various)

Advantages: Only California steel mill

Other Listings Within Geographical Location: None found

CSI Division 4—Masonry

Division 4—Masonry
Section 04200—Brick Masonry

Building Product Category: Reused brick
(Geographical parameters of search for building category: Los Angeles Region)

A. Manufacturing Information

Building Application: Reused clay brick for various applications

Product Name: Reused clay brick

Manufacturer:	(See list below)
Address:	
Contact:	
Phone:	
Fax:	
Toll Free:	

Environmental Considerations: Contains 100 percent reused brick

Specifications: N/A

Advantages: Antique appearance

Other Listings Within Geographical Location:

Bourget Brothers Building Materials
1636 11th Street
Santa Monica, CA 90404
Phone: (310) 450-6556

Sepulveda Building Materials
2936 Sepulveda Blvd.
Torrance, CA 90505-2173
Phone: (310) 325-2173

CSI Division 5—Metals

Division 5—Metals
Section 05400—Light Gauge Steel Framing

Building Product Category: Steel framing systems
(Geographical parameters of search for building category: Los Angeles Region)

A. Manufacturing Information

Building Application: Composite Structural Framing System for residential and commercial buildings

Product Name: "E" Building Systems

Manufacturer:	"E" Building Systems
Address:	1436 E. 6th Street Corona, CA 91719
Contact:	Stephen Carlin or Bob Dresslar
Phone:	(916) 662-4852
Fax:	N/A
Toll Free:	(800) 922-2221

Environmental Considerations: The steel framing elements contain at least 28 percent postconsumer. The expanded polystyrene (EPS) contains 50 percent recycled material, mostly postindustrial feedstock.

Specifications: Various ICBO and ASTM

Advantages: ESP provides thermal barrier. Panel system may save labor.

Other Listings Within Geographical Location:

Fabricators:

Advanced Metal Systems, Inc.
15162 Goldenwest Cir.
Westminster, CA 92683
Phone: (714) 896-0042

California Expanded Metal Co.
263 Covina Lane
City of Industry, CA 91744
Phone: (818) 369-3564

Design Shapes in Steel
10315 East Rush
South El Monte, CA 91733
Phone: (626) 579-2032

Western Metal Lath
6510 General Dr.
Riverside, CA 92509
Phone: (909) 360-3500

Distributors:

Calply, Inc.
8535 E. Flourence, Suite 100
Downy, CA 90240
Phone: (562) 949-5421

Cal Wal Gypsum Supply
9770 San Fernando Rd.
Sun Valley, CA 91352
Phone: (818) 890-1897

Contractors Building Materials
2905 Exposition Place
Los Angeles, CA 90018
Phone: (213) 299-9180

Frontier Building Materials
P.O. Box 658
North Hollywood, CA 91603
Phone: (818) 765-3865

Oxnard Building Materials
P.O. Box 348
Oxnard, CA 93032
Phone: (805) 487-3841

Thompson Building Materials
P.O. Box 5406
Orange, CA 92667
Phone: (714) 637-7373

Westside Building Materials
11 East Howell St.
Anaheim, CA 92805
Phone: (714) 385-1644

Westwood Building Materials
15708 Inglewood
Lawndale, CA 90260
Phone: (310) 643-9158

CSI Division 6—Wood and Plastics

Division 6—Wood and Plastics
Section 06120—Structural Panel

Building Product Category: Structural wall panels
(Geographical parameters of search for building category: California)

A. Manufacturing Information

Building Application: Intended for use as nonload-bearing and load-bearing panels for roofs, floors, and walls components

Product Name: Reclaimed architectural timbers, paneling, fencing.

Manufacturer:	The G.R. Plume Co.
Address:	1373 W. Smith Rd. #A1 Ferndale, WA 98248
Contact:	Gordon Plume
Phone:	(360) 384-2800
Fax:	(360) 384-0335
Toll Free:	N/A

Environmental Considerations: 100 percent reclaimed timbers

Specifications: Millwork fabricated from reclaimed Douglas Fir

Advantages: N/A

B. Manufacturing Information

Building Application: Structural wall panels

Product Name: Design Wall

Manufacturer:	Homasote Company
Address:	P.O. Box 7240 W. Trenton, NJ 08628
Contact:	Manker Mills
Phone:	(609) 883-3300
Fax:	(609) 530-1584
Toll Free:	N/A

Environmental Considerations: 100 percent post consumer industrial newspaper, nontoxic, and resource efficient.

Specifications: N/A

Advantages: Design Wall fabric is in stock and comes in custom colors.

C. Manufacturing Information

Building Application: Interior wood wall paneling

Product Name: Paneling

Manufacturer:	Carlisle Restoration Lumber
Address:	1676 Route 9 Stoddard, NH 03464
Contact:	Don Carlisle
Phone:	(603) 446-3937
Fax:	(603) 446-3540
Toll Free:	N/A

Environmental Considerations: 100 percent reclaimed wood

Specifications: Antique Pines, Chestnut, Southern Longleaf Pine, and Hemlock.

Other Listings Within Geographical Location: None found

Division 6—Wood and Plastics
Section 06124—Fiberboard Sheets and Decking

Building Product Category: Fiberboard decking
(Geographical Parameters of Search for Building Category: United States)

A. Manufacturing Information

Building Application: Sheathing for decks

Product Name: Easy Ply Roof Decking and 4-Way Floor Decking

Manufacturer:	Homasote
Address:	P.O. Box 7240 W. Trenton, NJ 08628-0240
Contact:	N/A
Phone:	(609) 883-3300
Fax:	N/A
Toll Free:	(800) 257-9491
Distributor:	Charles G. Hardy, Inc. (310) 634-6560

Environmental Considerations: Contains 100 percent postconsumer newsprint

Specifications: BOCA, SBCC, ICBO, CMHC

Advantages: Products are nontoxic

B. Manufacturing Information

Building Application: Sheathing for roofs

Product Name: Fiberboard Sheathing

Manufacturer:	Temple-Inland Forest Products
Address:	P.O. Drawer N Dibold, TX 75941
Contact:	Richard Kenley
Phone:	(409) 829-5511
Fax:	(409) 829-1731
Toll Free:	(800) 231-6060

Environmental Considerations: 7 percent postconsumer paper

Specifications: Contact manufacturer for details.

Advantages: Product is lightweight and has consistent flat surface

C. Manufacturing Information

Building Application: Sheathing and Subflooring

Product Name: Comply Sturd-I-Floor

Manufacturer:	Advanced Wood Resources
Address:	34363 Lake Creek Dr. Brownsville, OR 97327
Contact:	Terry Froemming
Phone:	(503) 466-5177
Fax:	(503) 466-5559
Toll Free:	(800) 533-3374

Environmental Considerations: 42 percent to 70 percent postindustrial wood

Specifications: A.P.A. rated

Advantages: No urea formaldehyde emissions. Available in various thickness.

Other Listings Within Geographical Location:

Celotex Corp.
6400 Stevenson
Fremont, CA 94538
Phone: (800) 227-1216

Ludlow
P.O. Box 2002
Doswell, VA 23047
Phone: (804) 876-3135

Simplex Products Div.
P.O. Box 10
Adrian, MI 49221
Phone: (800) 345-8881

Division 6—Wood and Plastics
Section 06200—Finish Carpentry

Building Product Category: Various finish carpentry
(Geographical parameters of search for building category: United States)

A. Manufacturing Information

Building Application: Finish carpentry composite

Product Name: Environ Biocomposites

Manufacturer:	Phoenix Biocomposites
Address:	1511 North Gault Street St. Peter, MN 56082
Contact:	N/A
Phone:	(507) 931-9787
Fax:	N/A
Toll Free:	(800) 324-8187

Environmental Considerations: Contains 40 percent postconsumer newsprint and 40 percent postindustrial soybean flour

Specifications: ASTM various, Class 2 fire rating

Advantages: Product is nontoxic

B. Manufacturing Information

Building Application: Millwork and prefinished panels

Product Name: Endura Hardwoods

Manufacturer:	Endura Hardwoods
Address:	P.O. Box 1276 Bend, OR 97709
Contact:	N/A
Phone:	(541) 383-5003
Fax:	N/A
Toll Free:	N/A

Environmental Considerations: Wood is from sustainably harvested or recycled sources

Specifications: N/A

Advantages: N/A

C. Manufacturing Information

Building Application: Prefinished panels for substrate/Recycled paper board paneling/Custom panel work

Product Name: Shetka stone wall panels

Manufacturer:	All Paper Recycling
Address:	502 4th Ave. NW #7 New Prague, MN 5607
Contact:	David Saltman
Phone:	(612) 758-6577
Fax:	(612) 758-6751
Toll Free:	N/A

Environmental Considerations: Contains 100 percent postconsumer paper fiber

Specifications: N/A

Advantages: Versatile product.

Other Listings Within Geographical Location:

Jefferson Lumber
P.O. Box 696
McCloud, CA 96057
Phone: (916) 235-0609

Marlite (prefinished hardboard paneling)
202 Harger St.
Dover, OH 44622
Phone: (330) 343-6621

Willamette Industries, Inc. (board paneling)
P.O. Box 428
Albany, OR 97321
Phone: (541) 928-3341

Division 6—Wood & Plastic
Section 06500—Plastic Lumber

Building Product Category: Decking/plastic lumber
(Geographical parameters of search for building category: United States)

A. Manufacturing Information

Building Application: Can replace lumber and pressure treated lumber in many non-structural applications such as piers, boardwalks, deck planks, sign posts, etc.

Product Name: Rumber

Manufacturer:	Rumber Materials Inc.
Address:	3420 Executive Center Dr. Austin, TX 78731
Phone:	(940) 759-4181
Fax:	N/A
Toll Free:	N/A
(Note: Currently manufactured in Munster, Texas. Plans to open a plant in Buena Park, CA)	

Environmental Considerations: Contains 100 percent postconsumer HDPE and tires. Long life span reduces waste (source reduction).

Specifications: Coefficient of thermal expansion = 1.1 x 10

Advantages: Available in colors. Termite proof. Will not dry rot. Resistant to weathering.

B. Manufacturing Information

Building Application: Can replace lumber and pressure-treated lumber in many nonstructural applications, such as piers, boardwalks, deck planks, sign posts, etc.

Product Name: Trex

Manufacturer:	The Trex Company
Address:	20 S. Cameron St. Winchester, VA 22601
Contact:	N/A
Phone:	(540) 678-4070
Fax:	N/A
Toll Free:	(800) 289-8739

Environmental Considerations: Contains 50 percent postconsumer plastic (HDPE) and 50 percent postindustrial wood fiber.

Specifications: ASTM

Advantages: Outlasts wood in marine applications. Termite proof. Will not dry rot. Resistant to weathering.

C. Manufacturing Information

Building Application: Can replace lumber and pressure treated lumber in many nonstructural applications such as piers, boardwalks, deck planks, sign posts, etc.

Product Name: TriMax

Manufacturer:	TriMax of Long Island
Address:	2076 5th Ave. Ronkonkoma, NY 11779
Contact:	Dennis Hurley
Phone:	(516) 474-7777
Fax:	N/A
Toll Free:	(800) 471-7862

Environmental Considerations: Contains 75 percent postconsumer plastic (HDPE) and 20 percent postindustrial fiberglass.

Specifications: ASTM

Advantages: Outlasts wood in marine applications. Termite proof. Will not dry rot. Resistant to weathering.

Other Listings Within Geographical Location:

A.E.R.T., Inc.
HC 10 Box 116
Junction, TX 76849
Phone: (915) 446-3430

Amazing Recycled Products, Inc.
P.O. Box 312
Denver, CO 80201
Phone: (800) 241-2174

American Earth Friendly, Inc.
1450 S.W. 10th St. #2
Delray Beach, FL 33444
Phone: (561) 276-4152

American Ecoboard, Inc.
200 Finn Ct.
Farmingdale, NY 11735
Phone: (631) 753-5151

Amour Fiber Core, Inc.
P.O. Box 42
Sultan, WA 98294
Phone: (360) 793-7955

Bedford Industries, Inc.
P.O. Box 39
Worthington, MN 56187
Phone: (800) 533-5314

BTW Industries
7936 Hollywood Blvd., Suite 3B
Hollywood, FL 33021
Phone: (954) 963-4778

Cycle Masters
P.O. Box 467
Sweetser, IN 46987
Phone: (765) 384-4336

Eaglebrook Plastics
2600 W. Roosevelt Road
Chicago, IL 60608
Phone: (773) 638-0033

EarthCare Products of TN, Inc.
P.O. Box 537
Sharon, TN 38255
Phone: (901) 456-2681

U.S. Plastic Lumber
763 Skippack Pike, Suite 200
Bluebel, PA 19422
Phone: (888) 853-2784

Environmental Recycling, Inc.
8000 Hall St.
St. Louis, MO 63147
Phone: (314) 382-7766

Epic Plastics
1880 Garden Track Rd.
Richmond, CA 94801
Phone: (510) 235-9339

Inteq Corp.
5124 Mayfield Rd.
Cleveland, OH 44124
Phone: (216) 442-3557

International Plastic Corp.
2029 Buck Ln.
Lexington, KY 40511
Phone: (606) 388-9116

Master Mark Div. Of Avon Plastics
P.O. Box 662
Albany, MN 56307-0662
Phone: (800) 535-4838

MBX Packing Specialists
P.O. Box 929
Wausau, WI 54402-0929
Phone: (715) 845-1171

New Plastic Corp.
P.O. Box 480
Luxemburg, WI 54217
Phone: (920) 845-2326

Phoenix Recycled Plastic
225 Washington St.
Conshohocken, PA 19428
Phone: (610) 940-1590

Plastic Pilings, Inc.
1485 S. Willow Ave.
Rialto, CA 92376
Phone: (909) 874-4080

Polywood, Inc.
125 National Rd.
Eddison, NJ 08817
Phone: (732)915-0043

Re-Source Building Products
1685 Holmes Rd.
Elgin, IL 60213
Phone: (800) 231-9721

Recycled Plastic Man, Inc.
P.O. Box 3368
Venice, FL 34293-3368
Phone: (800) 253-7742

RPM
2829 152nd Ave. NE
Redmond, WA 98052
Phone: (425) 867-3200

Superwood of Alabama, Inc.
P.O. Box 2399
Selma, AL 36702-2399
Phone: (334) 874-3781

Syntal, Inc.
P.O. Box 46
Dibold, TX 75941
Phone: (800) 237-9935

The Plastic Lumber Co.
540 S. Main St. Bldg. #7
Akron, OH 44311
Phone: (800) 886-8990

U.S. Plastic Lumber
2300 Glade Rd., Suite 440W
Boca Raton, FL 33431
Phone: (800) 653-2784

U.S. Plastic Lumber
1011 McDonalds St.
Green Bay, WI 54303
Phone: (920) 433-0900

Wolters and Son, Inc.
1906 Christopher Rd.
West Plains, MO 65775
Phone: (417) 256-2598

Distributors:

Distribution, Inc.
1710 Steffens Way
Green Bay, WI 54311
Phone: (800) 245-0524

Janus et Cie
8687 Melrose Ave., Ste. B146
West Hollywood, CA 90069
Phone: (310) 652-7090
Distributor for Eaglebrook

CSI Division 7—Thermal and Moisture Protection

Division 7—Thermal and Moisture Protection
Section 07120—Fluid Applied Waterproofing

Building Product Category: Fluid materials used in roofing and waterproofing
(Geographical parameters of search for building category: United States)

A. Manufacturing Information

Building Application: Rubberized asphalt used in roofing and waterproofing

Product Name: Monolithic Membrane 6125—EV

Manufacturer:	American Hydrotech, Inc
Address:	303 E. Ohio St. Chicago, IL 60611-3387
Contact:	N/A
Phone:	(714) 898-3510
Fax:	(714) 373-0127
Toll Free:	N/A
Distributor:	Keel Corporation (714) 898-3510

Environmental Considerations: Contains 25 percent postconsumer reclaimed rubber and recycled oil.

Specifications: Los Angeles Research Report No. 25168

Advantages: N/A

Other Listings Within Geographical Location: None Found

Division 7—Thermal and Moisture Protection
Section 07210—Building Insulation

Building Product Category: Insulation
(Geographical parameters of search for building category: California)

A. Manufacturing Information

Building Application: Insulation (cellulose) used for thermal protection

Product Name: R-PRO

Manufacturer:	Greenstone Industries
Address:	5854 88th St. Sacramento, CA 95828
Contact:	Larry Brandon
Phone:	(916) 387-9754
Fax:	N/A
Toll Free:	(800) 655-9754

Environmental Considerations: Made from 85 percent old newsprint

Specifications: The R-factor of blown-in cellulose insulation is about 3.8 per inch (by comparison, blown-in fiberglass insulation typically has an R-factor of 2.2 per inch). ASTM, and UL.

Advantages: The product can be blown in for easy insulation. The manufacturer claims that the R-factor of cellulose insulation does vary with density and may increase as temperatures drop.

B. Manufacturing Information

Building Application: Insulation (fiberglass) used for thermal protection

Product Name: N/A

Manufacturer:	CertainTeed Corp.
Address:	P.O. Box 205 Chowchilla, CA 93610
Contact:	N/A
Phone:	(714) 680-5814
Fax:	N/A
Toll Free:	(800) 441-9850
(Note: Currently manufactured in Munster, Texas, however plans to open a plant in Buena Park.)	

Environmental Considerations: Contains 30 percent or more postconsumer cullet. Uses less energy to melt cullet than to make fiberglass from raw materials.

Specifications: ASTM (various), BOCA, SBCC, and ICBO

Advantages: The product can be blown in for easy installation. Standard unfaced, Kraft faced, foil faced, and flame scrim Kraft (FSK) faced fiberglass insulation in both batts and rolls. FSK is fire resistant.

C. Manufacturing Information

Building Application: Insulation protection board

Product Name:

Manufacturer:	BMCA Insulation Products
Address:	300 N. Haven Ave. Ontario, CA 91761
Contact:	Hugh Brav
Phone:	(909) 390-8611
Fax:	N/A
Toll Free:	(800) 858-8868

Environmental Considerations: Contains 25 percent to 28 percent postconsumer newspaper collected from curbside programs

Specifications: ASTM, UL, and FM

Advantages: Contains waterproofing agents

Other Listings Within Geographical Location:

International Cellulose Corp.
12315 Robin Blvd.
Houston, TX 77045
Phone: (800) 444-1252

Owens-Corning Fiberglass
960 Central Express Way
Santa Clara, CA 95050
Phone: (408) 727-3535

Division 7—Thermal and Moisture Protection
Section 07300—Shingles & Roofing Tiles

Building Product Category: Roof shingles and shakes
(Geographical parameters of search for building category: United States)

A. Manufacturing Information

Building Application: Metal roofing made of aluminum, steel, or copper

Product Name: Slate Shingle

Manufacturer:	ATAS International, Inc.
Address:	6612 Snowdrift Rd. Allentown, PA 18106
Contact:	Jim Bush
Phone:	(610) 395-8445
Fax:	N/A
Toll Free:	(800) 468-1441

Environmental Considerations: Contains 30 percent to 40 percent and up to 95 percent postconsumer metal

Specifications: Class A fire rating with proper substrate. ICBO # 4623. Los Angeles Research Report No. 25055.

Advantages: Fireproof, won't rot, split, crack or warp. Lasts longer than composition shingle. Available in metal tiles, shingles, and panels. Nine different roofing systems available in a variety of colors. Product weighs 35 lbs. to 110 lbs. per square depending on material and style.

B. Manufacturing Information

Building Application: Roof shakes made out of fly ash, Portland cement, and wood

Product Name: Nature Guard Roof Shakes

Manufacturer:	Louisiana Pacific Corp.
Address:	5 Center Point, Suite 500 Lake Oswego, OR 97035
Contact:	NA
Phone:	(503) 624-9044
Fax:	N/A
Toll Free:	(800) 579-5401

Environmental Considerations: Contains 10 percent fly ash. Low cement content reduces atmospheric CO2 buildup.

Specifications: ASTM (various)

Advantages: Class A fire protection. 25-year warranty.

C. Manufacturing Information

Building Application: Roofing tiles and shingles

Product Name: Eco-Shake

Manufacturer:	Re-New Wood Inc.
Address:	104 N. 8th PO Box 1093 Wagoner, OK 74467
Contact:	NA
Phone:	(918) 485-5803
Fax:	N/A
Toll Free:	(800) 420-7576

Environmental Considerations: 100 percent recycled plastics and recycled wood.

Specifications: Class A fire resistant.

Advantages: 50-year warranty. High resistance to moisture, UV protected, no cracking or deterioration, and no maintenance.

Other Listings Within Geographical Location:

Accurate Exterior Designs
8371 La Palma "K"
Buena Park, CA 90620
Phone: (714) 773-5385

Atlas Roofing Corp.
1775 The Exchange
Atlanta, GA 30339
Phone: (800) 388-6134

CertainTeed Corp.
P.O. Box 860
Valley Forge, PA 19482
Phone: (800) 274-8530

Classic Products, Inc.
P.O. Box 701
Piqua, OH 45356
Phone: (800) 543-8938

Gerard Roofing Techniques
955 Columbia St.
Brea, CA 92821-2923
Phone: (800) 237-6637

Globe Building Materials
2230 Indianapolis Blvd.
Whiting, IN 46394
Phone: (800) 950-4562

Inteq Corp.
5124 Mayfield Rd.
Cleveland, OH 44124
Phone: (216) 442-3557

Re-New Wood, Inc.
104 N.W. 8th St.
Wagoner, OK 74467
Phone: (800) 420-7576

Tamko Roofing Products, Inc.
P.O. Box 1404
Joplin, MO 64802-1404
Phone: (800) 641-4691

Zappone Manufacturing
N. 2928 Pittsburg St.
Spokane, WA 99207
Phone: (800) 285-2677

Distributors:

Accurate Exterior Designs
8371 La Palma "K"
Buena Park, CA 90260
Phone: (714) 773-5385
Distributor for Classic Products

Division 7—Thermal and Moisture Protection
Section 07500—Membrane Roofing

Building Product Category: Membrane roofing
(Geographical parameters of search for building category: United States)

A. Manufacturing Information

Building Application: Roofing pad to protect roofs

Product Name: Roof-Gard

Manufacturer:	Humane Manufacturing Co.
Address:	805 Moore St. Baraboo, WI 53913
Contact:	N/A
Phone:	N/A
Fax:	N/A
Toll Free:	(800) 369-6263
Distributor:	All Roofing and Building (800) 625-5766

Environmental Considerations: Contains 100 percent postconsumer rubber

Specifications: N/A

Advantages: Protects roof from foot traffic during installation

Other Listings Within Geographical Location: None found

CSI Division 8—Doors and Windows

Division 8—Doors and Windows
Section 08200—Wood and Plastic Doors

Building Product Category: Doors and windows
(Geographical parameters of search for building category: United States)

A. Manufacturing Information

Building Application: Wood doors

Product Name: HPL Door

Manufacturer:	Marlite
Address:	202 Harger St. Dover, OH 44622
Contact:	N/A
Phone:	(440) 343-6621
Fax:	N/A
Toll Free:	N/A

Environmental Considerations: Door substrate contains 65 percent postindustrial wood waste

Specifications: ASTM

Advantages: N/A

B. Manufacturing Information

Building Application: Reclaimed doors and shutters

Product Name: Doors and shutters

Manufacturer:	Albany Woodworks, Inc.
Address:	P.O. Box 729 Albany, LA 90711-0729
Contact:	Richard Woods
Phone:	(504) 567-1155
Fax:	N/A
Toll Free:	N/A

Environmental Considerations: 100 percent reclaimed wood prepared for reuse

Specifications: N/A

Advantages: Antique heartwoods, heart pine, and heart cypress are available

C. Manufacturing Information

Building Application: Door components

Product Name: Door Core, Honeycomb

Manufacturer:	Hexacomb, Inc.
Address:	75 Tri-State, Ste. 200 Lincolnshire, IL 60069-4459
Contact:	N/A
Phone:	(708) 317-1991
Fax:	N/A
Toll Free:	N/A

Environmental Considerations: Contains up to 100 percent postconsumer kraft paper

Specifications: N/A

Advantages: N/A

Other Listings Within Geographical Location: None found.

Division 8—Doors and Windows
Section 08620—Unit Skylights

Building Product Category: Skylights
(Geographical parameters of search for building category: United States)

A. Manufacturing Information

Building Application: System for natural lighting

Product Name:

Manufacturer:	Kalwall Corp.
Address:	P.O. Box 237 Manchester, NH 03105
Contact:	Bruce Keller
Phone:	N/A
Fax:	N/A
Toll Free:	(800) 258-9777

Environmental Considerations: Undetermined postindustrial glass and 65 percent postconsumer aluminum. An energy-conserving product that reduces the need for artificial lighting.

Specifications: ASTM, L.A. Research Report #22094, and UL. Can tailor specifications to the job

Advantages: Highly insulated, diffused light transmitting building system. Used in windows, walls, and sky roofs.

Other Listings Within Geographical Location: None found

Division 9—Finishes
Section 09250—Gypsum Board

Building Product Category: Wallboard/gypsum board
(Geographical parameters of search for building category: United States)

A. Manufacturing Information

Building Application: Commercial and industrial buildings where durable wallboard is required

Product Name: Fiberbond

Manufacturer:	Louisiana Pacific Corp.
Address:	5 Centerpoint Dr., Suite 500 Lake Oswego, OR 97035
Contact:	Peter McArron
Phone:	(503) 624-9044
Fax:	N/A
Toll Free:	(800) 411-2500

Environmental Considerations: Fiberbond wallboard contains up to 15 percent postconsumer cellulose from newsprint, gypsum, and perlite

Specifications: ASTM (various) and CSA

Advantages: More durable than conventional wallboard

B. Manufacturing Information

Building Application: Gypsum wallboard for residential, commercial and industrial buildings

Product Name: N/A

Manufacturer:	Pabco Gypsum Co.
Address:	1973 N. Nellis Blvd. #328 Las Vegas, NV 89115
Contact:	Rich Ladwig
Phone:	(702) 643-1016
Fax:	N/A
Toll Free:	N/A

Environmental Considerations: Recycled product contains 7 percent to 10 percent postconsumer and postindustrial gypsum from clean construction waste, while 100 percent postconsumer and postindustrial facing paper accounts for 2 percent of total product.

Specifications: Meets each ASTM specification associated with this product.

Advantages: Manufacturer believes product is improved with recycled-content materials because additional paper fibers increase product strength and flexibility during workmanship.

C. Manufacturing Information

Building Application: Gypsum wallboard for residential, commercial, and industrial buildings

Product Name: N/A

Manufacturer:	U.S. Gypsum Co.
Address:	125 S. Franklin St. Chicago, IL 60606
Contact:	N/A
Phone:	(312) 606-4000
Fax:	N/A
Toll Free:	(800) 321-9622

Environmental Considerations: Gypsum wallboard made from both natural and synthetic sources. Synthetic gypsum is a waste byproduct of the exhaust gas desulfurization process at local coal burning power plants. The facing paper is made from 100 percent recycled paper.

Specifications: ASTM (various), CSA

Advantages: See environmental benefits.

Other Listings Within Geographical Location:

Georgia-Pacific Gypsum (Domtar)
P.O. Box 460
Antioch, CA 94509
Phone: (800) 824-7503

Temple-Inland Forest Products
P.O. Drawer N
Diboll, TX 75941
Phone: (800) 231-6060

The Celotex Corp.
4010 Boy Scout Blvd.
Tampa, FL 33607
Phone: (813) 873-4027

Division 9—Finishes
Section 09270—Gypsum Board Accessories

Building Product Category: Wallboard installation hardware
(Geographical parameters of search for building category: United States)

A. Manufacturing Information

Building Application: Replaces wood backing used in gypsum board installation

Product Name: The Nailer

Manufacturer:	The Millennium Group, Inc.
Address:	PO Box 1848 Estes Park, CO. 80517
Contact:	N/A
Phone:	N/A
Fax:	N/A
Toll Free:	(800) 280-2304

Environmental Considerations: Contains 25 percent postconsumer plastic and 75 percent postindustrial waste

Specifications: N/A

Advantages: Labor saving product

Other Listings Within Geographical Location: None found

Division 9—Finishes
Section 09300—Tile

Building Product Category: Countertops
(Geographical parameters of search for building category: United States)

A. Manufacturing Information

Building Application: Solid surface countertops and tabletops

Product Name: Syndecrete

Manufacturer:	Syndesis
Address:	2908 Colorado Ave. Santa Monica, CA 90404
Contact:	David Hertz
Phone:	(310) 829-9932
Fax:	N/A
Toll Free:	N/A

Environmental Considerations: Contains up to 20 percent recovered fly ash and up to 41 percent postconsumer materials. The product's relatively low weight saves transportation costs.

Specifications: ASTM (various). Written specifications available upon request.

Advantages: Syndecrete, which is one half the weight and has twice the compressive strength of standard concrete, is used in a wide variety of architectural applications, both interior and exterior. Uses include countertops, tiles, fireplaces, fountains, landscape elements, sinks, bathtubs, and showers. Comes in 11 standard colors and over 250 custom colors, plus a 5-year warranty.

B. Manufacturing Information

Building Application: Solid surface countertops and moldings

Product Name: Blazestone

Manufacturer:	Bedrock Industries
Address:	3410 Woodland Park Ave. N. Seattle, WA 98103
Contact:	Maria Ruano
Phone:	(206) 283-7625
Fax:	(206) 632-1485
Toll Free:	N/A

Environmental Considerations: Contains 100 percent postconsumer glass, 100 percent postindustrial glass, or 100 percent mixed. Glass is collected from window manufacturer waste. All materials were diverted from landfills.

Specifications: Contact manufacturer.

Advantages: Over 20 colors available.

C. Manufacturing Information

Building Application: Solid surface countertops and moldings

Product Name: Syndecrete

Manufacturer:	Syndecrete
Address:	2908 Colorado Ave. Santa Monica, CA 90404
Contact:	N/A
Phone:	(310) 829-9932
Fax:	(310) 829-5641
Toll Free:	N/A

Advantages: Up to 30 percent recycled materials.

Specifications: Recycled polypropolene

Advantages: Syndecrete is lighter, stronger and more durable than concrete.

Other Listings Within Geographical Location:

Manufacturer:

Terra Green Ceramics
1650 Progress Dr.
Richmond, IN 47374
Phone: (765) 935-4760

Distributor:

Morena Tile
1900 E. Gene Autry Way
Anaheim, CA 92805
Phone: (714) 937-5151
Distributor for Terra Green Ceramics

Division 9—Finishes
Section 09510—Acoustical Ceilings

Building Product Category: Acoustical ceiling tile
(Geographical parameters of search for building category: United States)

A. Manufacturing Information

Building Application: Ceiling tiles made from post consumer glass

Product Name: Ceiling tiles—acoustical

Manufacturer:	Ottawa Fibre Inc.
Address:	3985 Belgreen Dr. Ottawa, ONT K1G3N2 Canada
Contact:	Nicholas Holownia
Phone:	(613) 736-1215
Fax:	(613) 736-1150
Toll Free:	N/A

Environmental Considerations: Contains 60 percent post consumer glass.

Specifications: N/A

Advantages: The tiles are flexible, washable, easy to install, available in two different finishes, and acoustical.

B. Manufacturing Information

Building Application: Acoustical and specialty ceiling tiles

Product Name: Minaboard/Minatone, Fire Guard and Travertone

Manufacturer:	Armstrong World Industries, Inc.
Address:	P.O. Box 3001 Lancaster, PA 17604
Contact:	Karen Shifflett (Sales Representative) (800) 448-1405 ext. 8140
Phone:	(717) 397-0611
Fax:	N/A
Toll Free:	(800) 448-1405

Environmental Considerations: Contains 18 percent to 88 percent postconsumer newspapers and slag wool collected at a steel industry

Specifications: ASTM (various), UL

Advantages: Complete line of specialty ceilings to meet a wide variety of design and performance criteria

C. Manufacturing Information

Building Application: Acoustical ceiling tiles and panels

Product Name: Softone, Hytone, and Celotone

Manufacturer:	Celotex Corp.
Address:	P.O. Box 31602 Tampa, FL 33631
Contact:	Debbie Morallis
Phone:	(818) 873-4000
Fax:	N/A
Toll Free:	(800) 227-1216

Environmental Considerations: Contains up to 21 percent postconsumer newspapers and 48 percent to 90 percent total recycled-content from sugar cane fiber and chips. Also contains metal wool that is normally discarded at steel mills.

Specifications: Meets ASTM standards (various) and UL

Advantages: Does not resonate and has excellent acoustical properties

Other Listings Within Geographical Location:

Hunter Douglas Architectural Products
5015 Oakbrook Parkway
Norcroff, GA 30093
Phone: (800) 366-4327

The Gage Corp., International
803 S. Black River St.
Sparta, WI 54656
Phone: (800) 786-4243

Division 9—Finishes
Section 09650—Resilient Flooring

Building Product Category: Rubber flooring
(Geographical parameters of search for building category: United States)

A. Manufacturing Information

Building Application: Rubber tiles

Product Name: Dinoflex Rubber Safety Tiles

Manufacturer:	Dinoflex Manufacturing, Ltd.
Address:	P.O. Box 3309 Salmon Arm, BC Canada V1E-4S1
Contact:	Dale Ukrainer
Phone:	(250) 832-7780
Fax:	N/A
Toll Free:	N/A

Environmental Considerations: Contains 60 percent to 93 percent postconsumer rubber.

Specifications: ASTM (various) CSA

Advantages: Reduces injuries

B. Manufacturing Information

Building Application: Rubber tiles

Product Name: Dura-tile

Manufacturer:	Pawling Corp.
Address:	P.O. Box 200 Wassaic NY 12592
Contact:	Bob Collette
Phone:	(914) 373-9300
Fax:	N/A
Toll Free:	(800) 431-3456

Environmental Considerations: Contains 100 percent postconsumer rubber from old tires

Specifications: ASTM (various)

Advantages: Reduces injuries

C. Manufacturing Information

Building Application: Rubber tiles

Product Name: N/A

Manufacturer:	RB Rubber Products
Address:	904 E. 10th Ave. McMinnville, OR 97128
Contact:	N/A
Phone:	(503) 472-4691
Fax:	N/A
Toll Free:	(800) 525-5530

Environmental Considerations: 100 percent recycled rubber products

Specifications: Shore A

Advantages: Reduces injuries

Other Listings Within Geographical Location:

Manufacturer:

Dodge-Regupol
P.O. Box 989
Lancaster, PA 17608-0989
Phone: (800) 322-1923

Flexo Company
P.O. Box 55
Tuscumbia, AL 35674
Phone: (800) 633-3151

Mats, Inc
P.O. Box 839
Stroughton, MA 02072
Phone: (800) 628-7462

Oscoda Plastics
5585 North Huron Ave.
Oscoda, MI 48750
Phone: (517)739-6900

Pacific Mat Company
6807 South 216th St., Building A
Kent, WA 98032
Phone: (800) 345-6287

Renewed Materials Industries, Inc.
621 Division St.
Muenster, TX 76252
Phone: (940) 759-4181

Yemm & Hart Green Materials
RR 1 Box 173
Marquand, MO 63655-9610
Phone: (573)783-5434

Distributors:

Active Packing and Gasket
1400 West Lambert Rd., Unit B
Brea, CA 92621
Phone: (562)905-5330
Distributor for Dodge-Regupol

EcoCarpet Associates
6205 Van Nuys Blvd.
Van Nuys, CA 91401-2785
Phone: (818) 786-0681
Distributor for Mats, Inc.

E-Spec
P.O. Box 16175
Oakland, CA 94610-6175
Phone: (510) 536-2600
Distributor for Turtle Plastics

Tri-West, Ltd.
12065 E. Pike Street
Santa Fe Springs, CA 90670
Phone: (800) 669-6696
Distributor for Flexo Company

Division 9—Finishes
Section 09680—Carpet

Building Product Category: Carpet
(Geographical parameters of search for building category: United States)

A. Manufacturing Information

Building Application: Long-life commercial floor cover

Product Name: Powerbond

Manufacturer:	Collins and Aikman
Address:	311 Smith Industrial Blvd. Dalton, GA 30720
Contact:	N/A
Phone:	N/A
Fax:	N/A
Toll Free:	(800) 248-2878

Environmental Considerations: Carpet backing is recycled content; however, the face is made from virgin nylon. The total carpet is 70 percent recycled content by volume and up to 50 percent postconsumer by weight. According to the manufacturer, this long-life commercial carpet can outlast standard commercial broadloom carpet by three to five times (source reduction). Saves energy and uses less resources to manufacture the product. The manufacturer will take the carpet back at the end of its useful life and will recycle it back into new carpet backing (i.e., closed loop system).

Specifications: N/A

Advantages: It can be easily repaired using a special cutting tool and self-welding process. No padding is needed. The backing has an adhesive layer for easy installation. Warranty of up to 15 years available. Wears better than polyester carpet.

B. Manufacturing Information

Building Application: A long-life commercial carpet tile

Product Name: N/A

Manufacturer:	Interface Flooring Systems
Address:	P.O. Box 1503 LaGrange, GA 30241
Contact:	Claire Winters
Phone:	(706) 882-1891
Fax:	N/A
Toll Free:	(800) 336-0225

Environmental Considerations: Carpet face contains 19 percent postindustrial scrap yarn. Saves energy and uses less resources to manufacture the product.

Specifications: N/A

Advantages: Carpet tiles are easy to repair. Carpet available on a 7- to 10-year leasing program.

C. Manufacturing Information

Building Application: Residential and commercial floor covering

Product Name: Envirotech, Class E, Habitat (commercial line)

Manufacturer:	Image Industries, Inc.
Address:	P.O. Box 5555 Armuchee, GA 30105
Contact:	Doug Ensley
Phone:	N/A
Fax:	N/A
Toll Free:	(706)235-8444
Distributor:	EcoCarpet Associates (818) 786-0681

Environmental Considerations: Contains 100 percent postconsumer plastic (polyethylene terephthalate [PET]). Saves energy and uses less resources to manufacture the product.

Specifications: N/A

Advantages: Available in solids and multicolors.

Other Listings Within Geographical Location:

Appleseed Wool Corp.
55 Bell St.
Plymouth, OH 44865
Phone: (800) 881-9665

Cameo Fibers
P.O. Box 310
Conover, NC 28613
Phone: (828) 459-7064

Dixie Manufacturing Corp.
110 Colley Ave.
Norfolk, VA 23510
Phone: (757)625-8253

Global Technology
P.O. Box 25
Trevor, WI 53179
Phone: (262) 558-3206

Homasote
P.O. Box 7240
W. Trenton, NJ 08628-0240
Phone: (800) 257-9491

Legget & Platt
100 Leggett Dr.
Villa Rica, GA 30180
Phone: (800) 237-9640

Milliken Carpet
201 Lukken Industrial Dr. W.
LaGrange, GA 30240
Phone: (800) 241-4826

Permafirm Pad Co.
1248 Palmetto St.
Los Angeles, CA 90013
Phone: (231)626-6261

Shaw Industries, Inc
P.O. Drawer 2128
Dalton, GA 30722-2128
Phone: (800) 441-7429

Talisman Mills, Inc.
6000 W. Executive Dr.
Mequon, WI 5309
Phone: (800) 482-5466

The Fairmont Co.
2245 W. Pershing Rd.
Chicago, IL 60609
Phone: (800) 621-6907

Distributors:

Paul Singer & Associates
5170 Sepulveda Blvd., Ste. 300
Sherman Oaks, CA 91403
Phone: (818) 789-2600
Distributor for Talisman Mills

Note: Milliken carpet takes back its own carpets for cleaning, retexturing, and restyling.

Division 9—Finishes
Section 09682—Carpet Cushion Accessories

Building Product Category: Carpet cushion/underlayment
(Geographical parameters of search for building category: Los Angeles Region)

A. Manufacturing Information

Building Application: Carpet padding

Product Name: Duracushion and Protector

Manufacturer:	Perma Firm Pad Company
Address:	1248 Palmetto Street Los Angeles, CA 90013
Contact:	Ted Stein
Phone:	(213) 626-6261
Fax:	N/A
Toll Free:	N/A

Environmental Considerations: Company has two carpet pad products. One contains 100 percent postindustrial carpet scrap and the other contains 100 percent postconsumer rubber tires.

Specifications: ASTM, Class B fire rating.

Advantages: Long life span, used in quality commercial operations.

B. Manufacturing Information

Building Application: Carpet Padding

Product Name: Comfort base

Manufacturer:	Homasote company
Address:	PO Box 7240 W. Trenton, NJ 08628
Contact:	Manker Mills
Phone:	(609) 883-3300
Fax:	(609) 530-1584
Toll Free:	N/A

Environmental Considerations: 100 percent post consumer recycled content.

Specifications: 100 percent post consumer ONP

Advantages: Product reduces sound transmission & insulates

Other Listings Within Geographical Location: None found

Division 9—Finishes
Section 09900—Paint

Building Product Category: Recycled latex paint
(Geographical parameters of search for building category: California)

A. Manufacturing Information

Building Application: Interior/exterior finish

Product Name: E-Coat

Manufacturer:	Kelly-Moore Paints
Address:	5101 Raley Blvd. Sacramento, CA 95673
Contact:	Ray Julian
Phone:	(916) 921-0165
Fax:	N/A
Toll Free:	N/A

Environmental Considerations: E-coat recycled-content latex paint contains 50 percent to 90 percent postconsumer

Specifications: Meets federal specification number TT-P-2846

Advantages: Available in high quality grades. E-Coat paint is completely remanufactured to assure consistent performance, coverage, and color consistency. Stocked in six colors and custom colors are available with special orders.

B. Manufacturing Information

Building Application: Interior/exterior

Product Name: Eco Paint

Manufacturer:	ECO Paint Company
Address:	1842 E. 29th Street Signal Hill, CA 90806
Contact:	Everett Hodges
Phone:	(310) 426-9091
Fax:	N/A
Toll Free:	N/A

Environmental Considerations: Contains 50 percent postconsumer content. Saves energy and uses less resources during production.

Specifications: ASTM (various) and GSA approved

Advantages: Available as water-based flat latex as well as low-gloss and semigloss enamel. Manufacturer has also developed a yellow striping for parking areas and a very low cost gray and/or brown graffiti paint.

Other Listings Within Geographical Location:

Amazon Environmental
1812 Conejo Ln.
Fullerton, CA 92833-1810
Phone: (800) 566-2396

Contract Coatings Corp.
707 E. Main St.
Stockton, CA 95202
Phone: (209) 465-2634

Pacific Resource Recovery
3150 East Pico Blvd.
Los Angeles, CA 90023
Phone: (800) 499-7145

San Luis Paints
3490 Broad St.
San Luis Obispo, CA 93401
Phone: (805) 543-1206

Stiles Paint Manufacturing
21595 Curtis St.
Hayward, CA 94545
Phone: (510) 887-8868

CSI Division 10—Specialties

Division 10—Specialties
Section 10150—Toilet Compartment

Building Product Category: Restroom partition
(Geographical parameters of search for building category: United States)

A. Manufacturing Information

Building Application: Shower and bath partition

Product Name: Poly-Mar HD, Poly-Marble HD, and Poly-Granite HD

Manufacturer:	Santana Products
Address:	P.O. Box 2021 Scranton, PA 18501
Contact:	Service Oriented Sales (Sales Rep.)
Phone:	(805) 375-6599
Fax:	N/A
Toll Free:	(800) 368-5002

Environmental Considerations: Contains 20 percent postconsumer and 30 percent postindustrial plastic. Black color contains highest recycled content.

Specifications: D2843, D1929-77, D635-81, ASTM (various)

Advantages: Product is low maintenance and graffiti/vandal resistant

B. Manufacturing Information

Building Application: Restroom partition system

Product Name: Poly-Pro, Poly-Stone

Manufacturer:	Capitol Partitions
Address:	9199 Red Branch Road Columbia, MD 21045
Contact:	Jim Arnaz
Phone:	(410) 740-8870
Fax:	N/A
Toll Free:	N/A

Environmental Considerations: Contains 20 percent to 30 percent recycled polyethylene and polypropylene plastic

Specifications: Tensile strength and elongation

Advantages: Product is unbreakable and graffiti resistant. Scratches are easily buffed out. Partitions are unaffected by water and do not rust.

C. Manufacturing Information

Building Application: Toilet and shower partitions

Product Name: Poly-Pro and Poly-Stone

Manufacturer:	Yemm & Hart Ltd.
Address:	1417 Madison #308 Marquand, MO 63655-6910
Contact:	David Yemm
Phone:	(573) 783-5434
Fax:	N/A
Toll Free:	N/A

Environmental Considerations: Contains 100 percent postconsumer plastic detergent bottles received from curbside collection programs

Specifications: ASTM (various)

Advantages: Unique product available in nonstandard thickness and dimensions.

Other Listings Within Geographical Location:

Inteq Corporation
202 Harger St.
Cleveland, OH 44124
Phone: (216) 442-3557

Laforce Hardware
1060 W. Mason St.
Green Bay, WI 54303
Phone: (800) 236-8858

Marlite
5124 Mayfield Rd.
Dover, OH 44622
Phone: (800) 377-1221

Division 10—Specialties
Section 10400—Identifying Devices

Building Product Category: Indoor/outdoor signs
(Geographical parameters of search for building category: California)

A. Manufacturing Information

Building Application: Indoor and outdoor signs

Product Name: N/A

Manufacturer:	Eagle Recycled Products
Address:	1201 W. Katella Ave. Orange, CA 92867
Contact:	Phillip Thompson
Phone:	(714) 997-3400
Fax:	N/A
Toll Free:	(800) 448-4409

Environmental Considerations: Contains 100 percent postconsumer plastic

Specifications: N/A

Advantages: Extremely long life span and graffiti resistant. Available in a variety of styles.

B. Manufacturing Information

Building Application: Plastic signs

Product Name: N/A

Manufacturer:	Amazing Recycled Products, Inc.
Address:	P.O. Box 312 Denver, CO 80201
Contact:	N/A
Phone:	(800) 241-2174
Fax:	N/A
Toll Free:	N/A

Environmental Considerations: Product is recyclable and contains 4 to 12 percent postconsumer recycled plastic.

Specifications: N/A

Advantages: Low maintenance

Other Listings Within Geographical Location:

Syndesis
2908 Colorado Ave.
Santa Monica, CA 90404
Phone: (310) 829-9932

CSI Division 12—Special Use

Division 12—Special Use
Section 12900—Decorative Furnishings

Building Product Category: Fireplace mantels
(Geographical parameters of search for building category: United States)

A. Manufacturing Information

Building Application: Fireplace surrounds

Product Name: N/A

Manufacturer:	J Squared Timberworks, Inc.
Address:	449 N. 34th Street Seattle, WA 98103
Contact:	Margaret Cleary
Phone:	N/A
Fax:	N/A
Toll Free:	(800) 598-3074

Environmental Considerations: Contains 100 percent reclaimed timbers. Lessens impact on old growth forests.

Specifications: Can meet desired specifications upon design

Advantages: Very hard and stable wood (mostly redwood and Douglas fir) which can be made into any desired structure

B. Manufacturing Information

Building Application: Fireplace surrounds

Product Name: N/A

Manufacturer:	Wood Floors, Inc.
Address:	P.O. Box 1522 Orangeburg, SC 29116
Contact:	Raymond Sifly
Phone:	(803) 534-8478
Fax:	N/A
Toll Free:	N/A

Environmental Considerations: Contains 100 percent reclaimed and remilled heart pine lumber

Specifications: 10 percent to12 percent moisture content

Advantages: Wood gives old authentic appearance

C. Manufacturing Information

Building Application: Fireplace surrounds

Product Name: Quinstone

Manufacturer:	Quinstone, Inc.
Address:	P.O. Box 1026 Quincy, FL 32351
Contact:	Norman Freestone
Phone:	N/A
Fax:	N/A
Toll Free:	(800) 621-0565

Environmental Considerations: Contains 45 percent to 50 percent postindustrial paper fiber waste, gypsum, and resin

Specifications: ASTM (various), "0" smoke and flame rating

Advantages: Can be cut with a saw and installed with a hammer, glue and nails. Company also makes moldings, flat wall panels, and custom profiles

Other Listings Within Geographical Location:

Jotul USA, Inc.
P.O. Box 1157
Portland, ME 04104
Phone: (207) 797-5912

Vermont Castings
1000 E. Market St.
Huntington, IN 46750
Phone: (800) 525-1898

Chapter 7
Green Building Case Studies

Building with the environment in mind is still a relatively new goal for many companies. It is also a new focus for builders without prior experience in developing projects with green issues as part of their blueprints. That means green building still has its pioneers, and those who have broken ground with this new slant on construction are the best resource for those who wish to follow suit.

Case studies are not only a practical "how to," but they also allow architects, specifiers, builders, contractors, developers, and owners to envision completed green projects, enabling them to get a broader view of how this focus contributes to a finished product. Following are a number of case studies that demonstrate energy conservation, material reuse, and use of specific recycled-content building products. They were chosen to represent a broad range of green building applications and, hopefully, to inspire readers on where they may take green building in their own projects—and in the future.

Environmental Showcase Home Greens the Desert and Saves "Green" with a $30/Month Energy Bill

Project: Environmental Showcase Home

Contact: Arizona Public Service (APS), Phoenix, Arizona

Location: 60th Street and Greenway Road in Northeast Phoenix

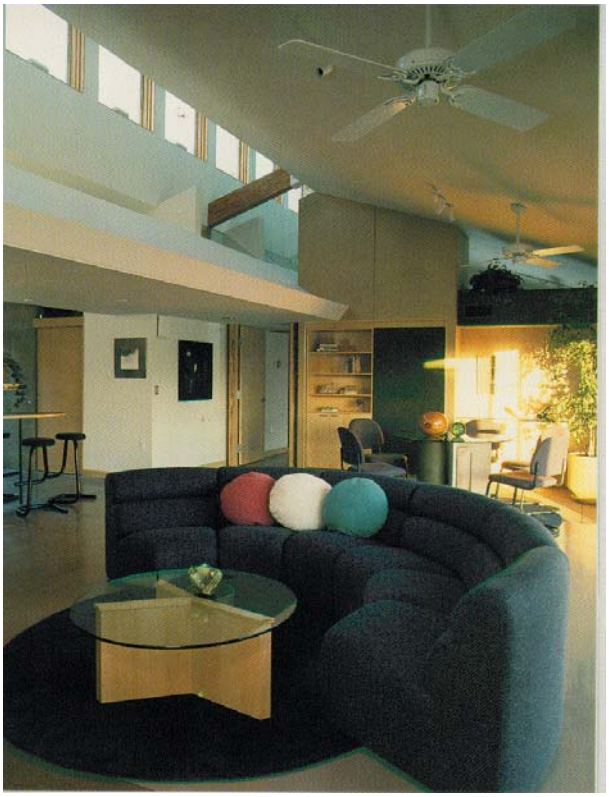
Demonstration

Energy efficiency, water conservation and sustainable design.

Project Description

The Arizona Public Service (APS) is a utility concerned about future levels of energy consumption, water use, and waste in its service area. The Environmental Showcase Home (ESH) was born from this concern and completed in February 1995. The 2,640 square-foot home features four bedrooms, three baths, a triple garage with electric vehicle charging station, a swimming pool, and four outdoor living areas. Its average energy bill is about $30 per month using the home's 2.7-kilowatt photovoltaic system.

The ESH was intended as a supermarket of ideas and new building practices, not as a model home. It contains over 150 technologies, strategies, concepts and materials, many of which are redundant. For example, the ESH has three different water heating systems. This approach increases the potential to demonstrate the wide range of choices available today. The home features mostly off-the-shelf technology and housing concepts that are appropriate for the desert climate. In a rapidly growing and competitive housing market, which is often too price-sensitive to incorporate a lot of environmental features, there is evidence that the ESH has had some positive influence on local builders. Nearly every local builder has toured the home and several developers are incorporating some of the ESH's building concepts and technologies in newer developments. The home would cost an estimated $170,000 in the current housing market. However, cost comparisons to similar conventional homes are not possible because cost and quality vary widely.



The light and airy interior of the Environmental Showcase Home in Phoenix, Arizona.

Energy and Water Saving Strategies

Active Energy Systems Feature Three Heat Pumps and Cool Appliances

The ESH demonstrates three different heat pump applications for heating, cooling, and water heating. A stand-alone heat pump used in the home—the most efficient water heater ever made—can reduce water-heating costs by up to 60 percent. Another high-efficiency, low-maintenance heat pump for space heating and cooling uses a single-speed compressor with a

variable speed fan to reduce noise levels. Finally, a triple-function heat pump combines space heating, cooling, and water heating. This system is capable of using warm interior air during the hot summer months to heat water, providing low-cost hot water during the air conditioning season (usually April–September).

The ESH also features multiple zone control (four zones) using a single heat pump. Home appliances are designed to minimize radiant heat. For instance, the kitchen cooktop uses a high frequency, electronically controlled induction coil under smooth glass to create a safe electromagnetic field for heating iron cookware. Since the cooktop itself never gets hot, the appliance does not warm up the kitchen.

The ESH uses 50 percent of the energy needed to light a typical home with standard lighting technologies. Daylighting from the clerestory windows reduces the need for artificial light and a low-heat-gain skylight (Sola-tube) helps reduce the need for electrical lighting in the entryway. Conventional incandescent lights are virtually eliminated and fluorescent, compact fluorescent, and halogen light fixtures are strategically placed to light critical areas—not the entire room. The energy-efficient features of this home would prevent 540,000 pounds of air pollution over 30 years. The ESH uses forty-two 44- by 20-inch, roof-mounted photovoltaic modules to produce a total of 2.7 kW of electricity—about half the electrical energy requirements of the home.

Passive Solar Systems and Varied Shading Balance Natural Lighting

The ESH is oriented on an east-west axis to minimize heat gain where sun exposure is heaviest. Each window in the ESH is designed for its specific placement. Clerestory windows on the north side collect the less harsh sunlight from the exposure, which provides natural light to the interior below. Fabric shade screens flanking each of these windows reflect light into the home for a more diffused, aesthetically pleasing result. Windows on the east, west, and south sides are shaded to protect from harsh sunlight. South-facing windows in the bedrooms are recessed and shaded by landscaping or overhangs. Large south-facing patio doors allow for a sweeping view of the pool area from the great room. Because of their size, the patio doors are shaded in a number of ways, including a trellis and a fabric awning system that automatically extends or retracts according to the requirement for more or less sunlight. All exterior windows are one-inch thick, high-performance glass systems, with an overall R-4 insulation rating. The high-performance glass system consists of clear or tinted outer panes (depending on the exposure) and a clear inner pane with a low-emissivity coating to reflect heat.

Block Walls Allow Better Insulation

The eight-inch, recycled-content masonry wall unit (Integra Block) used for most of the exterior walls of the ESH was selected for the special design that minimizes "thermal bridging" and which also permits more cavity space for insulation compared to conventional cement block. The block walls are injected with foam insulation to provide an excellent thermal envelope that rates an R factor of 24 (Superlite Block Company, Phoenix).

Appliances Conserve 70 Percent of Energy and 16,000 Gallons of Water

The appliances selected for the ESH are all energy-efficient (and in some cases water-efficient) compared to standard equipment. For instance, the Amana DU7500 dishwasher saves 70 percent of the energy of standard dishwashers and uses only eight gallons of water per load, conserving 1,000 gallons of water per year over standard models. The Westinghouse LT 350R clothes washer is 33 percent more energy-efficient than standard top-loading models because the horizontal axis design uses less water; and, therefore, requires less energy to heat. This appliance could save a family of four up to 15,000 gallons of water per year compared to standard models. When all of the ESH's energy-efficient appliances are used exclusively, 770 kWh are saved over standard, inefficient appliances.

Gray Water/Rain Water System Recycles Water

ESH features a gray water system to capture the portion of the home's waste water (about 65 percent) which does not contain organic matter. The gray water is collected in an underground

storage tank and pumped to an aboveground tank, where it is then used as landscape irrigation water. Over a 30-year period, a family living in the ESH would use 2.3 million gallons less water than a family living in a conventional home.

In addition, the ESH demonstrates a rainwater harvesting system. The system captures rainwater at each corner of the house, feeds it along two gutters leading to four grated cement slabs. The rainwater then flows into a recycled plastic underground storage tank that is also used to hold the graywater.

Plumbing and Landscape Features Use Less than Half the Water of Other Homes

Indoor water systems in the ESH feature low-flow showerheads, bathroom fixtures, and low-water-use toilets. For instance, the master suite bathroom showerhead (made by Resources Conservation, Inc. of Connecticut) uses only 2.25 gallons per minute compared to 3 gallons per minute used by a standard showerhead. The Rialto Pressure Lite toilet by Kohler also used in the master suite bathroom uses 1.6 gallons or less per flush compared to 3.5 gallons per flush for a standard toilet.

Xeriscape landscaping used at the ESH will conserve about 33 percent of the water consumption used in typical turf landscaping. Even without using the gray water for irrigation, the ESH saves 52 percent of indoor and outdoor water use of a typical residence in the area.

Examples of Recycled-Content Building Products

- **Carpet:** The Enviro-Tech carpet in the ESH is 100 percent postconsumer plastic from old soda bottles (Image Industries, Inc., Armuchee, GA). The ESH uses a combination of smooth-surface floors made from integrally colored concrete and carpeting. The carpet uses no adhesives and a carpet pad made from jute fiber with a non-toxic binder.
- **Ceramic Bath and Shower Tile:** Bath tiles used are made from 70 percent-recycled glass, primarily from automobile windshields. It should be noted, however, that the selection of recycled bath tiles might not be an entirely environmentally efficient choice when embodied energy is considered. The production of glass and ceramic tiles is a relatively energy-intensive process (Stoneware Tile Company, Richmond, IN).
- **Concrete Floor Slab, Sidewalks, Curbs, and Gutters:** Fly ash replaces about 25 percent of the concrete used in the ESH. The fly ash is a by-product of APS's coal-fired power plants. Replacing cement with fly ash conserves energy (Portland cement is among the most energy-intensive of building materials) and strengthens the concrete. While there are heavy metals in fly ash, the cement binds these hazardous materials and prevents them from leaching (Phoenix Cement Company, Phoenix, AZ).
- **Countertops:** The guest bath countertops are Poly-Mar HD, a durable solid polymer panel made from 50 percent recycled-content plastic, 20 percent postconsumer and 30 percent postindustrial (Santana Products, Scranton, PA).
- **Drywall Support:** The nailer—a recycled plastic clip (25 percent postconsumer and 75 percent postindustrial) that supports drywall at the interior corners—is used wherever drywall finish is applied in the ESH. The plastic clip replaces wood backing for drywall (The Millennium Group, McHenry, IL).
- **Exterior Siding:** Trex composite lumber was used as siding on the exterior frame made of concrete block. Trex is 50 percent postindustrial wood fiber and 50 percent postconsumer plastic. Trex is resistant to rot and mold (Mobile Chemical Company, Norwalk, CT).
- **Frame Wall and House Roof Insulation:** Cellulose insulation for exterior walls and the roof of ESH is Nature Guard, made from 85 percent postconsumer newsprint (Louisiana Pacific Corp., Portland, OR).
- **Insulation Board: Amofoam** RCY insulation board, made from 25 percent postconsumer plastic and 25 percent postindustrial plastic, was used in the

perimeter slab to minimize heat gain from the soil near the edge of the home, because of temperature differences between the slab and the soil.
(Amoco Foam Products, Atlanta, GA).

- **Interior Accents:** Prefinished interior accent paneling in the office work areas are made from 100 percent postconsumer newsprint panels covered with natural jute fabric. (Homasote, W. Trenton, NJ).
- **Kitchen Floor Tile:** The Armstone Confetti kitchen tiles are made from 90 percent postindustrial marble chips from Tennessee (PermaGrain Products, Inc., Newton Square, PA).
- **Patio Door:** The Norwood Series 3050 patio door used in the ESH is made from recycled aluminum. Since the production of aluminum from bauxite is very energy-intensive, a primary environmental benefit from the recycling of aluminum is energy conservation (Fleetwood Aluminum Products, Inc., Corona, CA).
- **Standing Seam Shingles:** The steel roof contains 60 percent postconsumer recycled content. Independent assessments by Scientific Certification Systems of California, which compared two roofing systems specified by APS, indicated that the steel roof of the ESH uses 56 percent less wood and 83 percent less ores and minerals than an alternative cement tile roof system. Since the material is very light weight (half as much as an asphalt shingle and only 15 percent of the weight of clay or cement tile), there is a savings in the materials needed for structural support of the ESH (ATAS Aluminum Corporation, San Diego, CA).
- **Steel Studs:** Steel studs used in the interior walls of the ESH are 60 percent recycled-content material. The use of steel studs helps conserve old growth forests. Steel studs also produce straighter walls, (there is less warping and twisting compared to wood studs), and are 100 percent recyclable. However, the amount of energy needed to manufacture a 2,000-square foot house is 28 percent greater for steel framing compared to wood framing. The conductivity of steel is 1,100 times greater than wood; therefore, steel framing must incorporate design features to prevent heat loss. This is particularly true for exterior walls (American Studco, Phoenix, AZ).
- **Stucco:** The finish for the few exterior wall sections where block was not used (frame walls) is an integrally colored, three-coat, cementitious stucco with fly ash added to provide embodied energy reduction benefits (Phoenix Cement Company, Phoenix, AZ).
- **Wall Blocks:** Fly ash also replaces 25 percent of the cement used to make the concrete walls selected as the ESH's envelope, which results in stronger blocks that use less embodied energy to produce, compared to all cement blocks (Superlite Block Company, Phoenix).
- **Wall Board:** Wall board used as interior finish of painted walls is USG gypsum wallboard. The face sheets are 100 percent recycled paper fiber and may contain recycled content in some areas of the country (United States Gypsum Company, Chicago, IL).

Examples of Environmentally-Friendly Building Products

Cabinets: The accent door fronts of the ESH's kitchen cabinets are Environ Biocomposite fiberbond, a monolithic resin product made from soy flour and recycled paper. Environ Biocomposite is non-toxic, looks like granite, and works like hardwood (Phoenix Biocomposites, Inc., Mankato, MN).

- **Driveway Surface:** Stabilized decomposed granite was selected for the driveway surface rather than concrete, to allow for infiltration of water and to reduce runoff. The selection of stabilized decomposed granite for this application is environmentally friendly compared to concrete, based on embodied energy. Concrete is among the most energy-intensive of building materials since production involves not only mining, but also the calcination process. The production of stabilized decomposed granite, on the

other hand, does not involve energy-intensive production processes after the material is mined (Stabilizer, Phoenix, AZ).

- **Engineered Wood Products:** Roof framing used in the ESH is a single continuous parallel strand lumber beam (Parallam ridge beam) with Microlam I-joists spanning up to it from the outside walls. In addition, the fascia and subfascia are laminated strand lumber and laminated veneer lumber, both engineered wood products. These engineered wood products (EWP) usually cost up to 15 percent more than solid-sawn lumber, based on the cost per linear foot. However, EWPs have several advantages over dimensional lumber, which often make EWPs more economical, allowing for labor and waste considerations. EWPs are made from second- and third-growth trees, rather than old-growth trees. They allow more of the tree to be used, can accommodate longer spans, and can be prefabricated to exact lengths to prevent waste. Some EWPs, such as I-joists, are half the weight of solid-sawn joists, which can significantly reduce labor costs. (Truss Joist MacMillan, Boise, ID). Oriented strand board, another engineered wood product, was used as roof sheathing, exterior wall framing, and garage roof sheathing in the ESH (Potlatch Corporation, Spokane, WA).
- **Integrally Colored Concrete:** Adding color and texture to the concrete floor slab created an attractive finished floor. In some cases, the finish floor eliminated the need for energy and resource-intensive floor finishes such as vinyl tile and wall-to-wall carpeting (Bowman Concrete, Mesa, AZ).
- **Kitchen and Bathroom Cabinets:** Medite II fiberboard was used as substructure for cabinets and interior wall board, interior door frames and selected interior trim. This product is made from sawdust particles bonded together with a formaldehyde-free binder. It is a safe, resource-efficient product that is strong and long lasting for these applications (Medite Corporation, Medford, OR).
- **Polyurethane Foam Insulation:** Supergreen Foam was used for insulation. A polyurethane foam that does not depend on a blowing agent with hydrochloro-fluorocarbons (HCFC), the likely cause of atmospheric ozone depletion. This medium was used to insulate the blocks in most of the exterior walls (see "wall blocks" above) (H.C. Fennell, Inc., North Thetford, VT).

Comments

Every aspect of the ESH embodies the concepts of energy, water, and resource-efficiency without sacrificing comfort and aesthetics. The result is a home that uses 60 percent less energy and 60 percent less water than a typical energy-efficient home. In addition, resource-efficient and/or recycled products were selected whenever possible for use in the ESH. In particular, APS claims that recycled materials used in the home were readily available and often were as strong or stronger than their original counterparts.

Gas Company Recycles Itself and Pilots Energy-Efficient, Recycled Products Showcase

Project: Energy Resource Center (ERC)

Contact: Southern California Gas Company

Location: 9240 East Firestone Blvd.
Downey, California 90241-5388

Demonstration

The ERC is a shining example of energy efficiency and sustainable design. It incorporates extensive building material reuse and state-of-the art recycled-content building products.

Project Description

An addition to the 30-year-old Southern California Gas Company's office complex, the ERC is the result of a major renovation project. The new construction meant demolishing one-third of the old facility. It was replaced by the two-story addition, increasing the total floor area of the existing building from 32,000 to 44,572 sq. ft.

The ERC is an excellent example of building material reuse; a significant portion of the 550 total tons of demolition materials generated during construction were either reused in the new structure or given to other builders for their use. Other demolition materials were hauled to recycling centers. The gas company estimates that 60 percent of the demolition materials were reused or recycled in this way.

The ERC's energy efficiency exceeds California Title 24 building code requirements by 45 percent. The Environmental Protection Agency has listed the ERC as an "Energy Star Showcase Building" in recognition of its energy-saving measures.

The Energy Resource Center in Downey, Calif.

Examples of Reused Materials

- **Ceiling Tiles:** Undamaged ceiling tiles were cleaned and trimmed down to 11x24 inches.

Other Reused Products

The following used materials from the old buildings were either used in construction of the ERC, sent to recycling centers, or given to builders who could use them:

- Asphalt
- Metal
- Glass
- Concrete
- Wood
- Porcelain plumbing fixtures
- Debris
- Lamp ballasts
- Paper

Examples of Recycled-Content Products

- **Wood Floor:** The entire wood floor in the Energy Resource Center's reception area was milled from Douglas fir beams and posts from the old Banana Republic

warehouse in San Francisco (Oregon Lumber, (800) 824-5671).

- **Carpeting:** Tile carpeting featured at the ERC uses 50 percent recycled material in the face of the carpeting. At the end of the carpet's useful life, the manufacturer will reclaim the product for recycling. The carpet can be recycled because the structured backing allows the carpet face to be separated from it (Interface Flooring, (800) 336-0225).
- **Reinforcement Bars:** These are made from unique sources—confiscated weapons and used oil filters (Tamco, (909) 899-0660).
- **Staircase:** Although modified to meet safety codes, the staircase has already seen a lot of action. It was salvaged from the set of blockbuster movie "Disclosure" (Warner Brothers).
- **Accent Wall:** The ERC's reception area features an internal wall made from recycled aircraft aluminum and Gridcore made from 100 percent-recycled fiber (Peter Carlson Enterprises, (818) 767-0791).
- **Entry Walkway:** Scraps of PVC pipe, used by the gas company to transport natural gas, were added to the concrete mix to add color.
- **Desk Countertop:** The decorative countertop of the reception desk is made of 100 percent-recycled glass (Glass Tech, (310) 202-6002).
- **Panels for Exhibits:** People get their money's worth when they see an exhibit at this facility! The ERC features several displays that are mounted on Gridcore made from federal reserve notes.

Examples of Energy-Efficient Measures

- **State-of-the Art Lighting:** The overhead lighting at the facility will use 1 watt/sq. ft (compared to 1.5 watts used in most buildings). This upgraded lighting at the facility is projected to save $21,000 to $30,000 annually in electricity.
- **Use of Old Facility:** By using the old facility, the gas company estimates that it saved $3.2 million in land, utility infrastructure, and building material costs. (Design and construction costs totaled $7.9 million.)

Energy efficiency = Co$t savings: Going "green" makes cents (that add up to a lot of dollars)…

Monterey Waste Management Authority Doesn't Just Talk Trash: They Build With It

Project: The Monterey Regional Waste Management District Administration Building

Contact: Monterey Regional Waste Management District (MRWMD)

Location: 14201 Del Monte Boulevard Marina, CA 93933-0609

Demonstration

The MRWMD headquarters building is a showcase of high quality, affordable, recycled-content and/or environmentally friendly building materials.

Project Description

The project involved the expansion and remodeling of the Monterey Regional Waste Management District's (MRWMD) original 2,500-square-foot administration building and various site improvements within the 9-acre grounds. The existing 7,780-square-foot, two-story office complex was completed during March of 1994.

Additions to the first floor of the building include a board meeting room, a kitchen, a staff lounge, rest rooms, an equipment room, an electrical room, and an elevator. Additions to the second floor include four new offices, three engineering rooms, a conference room, a library, rest rooms and an elevator. Other site improvements include a scale house and truck scales, upgraded roadways and parking lots, landscaping, and a septic system.

Two broad categories of recycled-content products are exhibited: building and construction products and landscaping materials. In addition, several building products in application demonstrate source reduction by design and/or represent low-impact, environmentally friendly products.

Examples of Recycled-Content Building Products

- **Fiberglass Insulation:** The fiberglass insulation used in the walls contains 30 percent cullet from recycled glass, which is equivalent to 1,800 glass bottles (Schuller International; Denver, CO; (800) 654-3103).
- **Cellulose Insulation:** 1,530 pounds of insulation from 100 percent-recycled newspapers was used in the attic to reduce heating loss (Louisiana-Pacific; Lake Oswego, OR; (800) 777-0749).
- **Floor Tiles:** The floor tiles in the entryway are made from 70 percent postconsumer and postindustrial windshield glass. (Stoneware Tile Company; Richmond, IN; (317) 935-4760).
- **Wall Paneling:** The fabric-covered paneling in the board room and conference room is made from 100 percent postconsumer newspapers (Homasote Company; Woodland Hills, CA; (818) 888-0193).
- **Restroom Partitions:** The core material used to make the toilet partitions contains 35 percent recycled polypropylene plastic, including yogurt containers, margarine tubs, plastic screw-on lids, and industrial scrap plastic. The recycled plastic is used in the center of the partition to provide strength, while the outer covering requires new plastic to ensure the uniformity of color and texture. (Capitol Partitions, Inc.; Columbia, MD; (410) 381-7060).
- **Roof Shakes:** The roof shakes are made from a mixture of cement and postindustrial wood fiber (American Cemwood; Albany, OR; (800) 367-3471).
- **Carpeting:** The 590 square yards of carpeting is made from 100 percent

postconsumer PET (polyethelene terephthalate) plastic from 2-liter soda bottles and recycled rubber tires. (Image Industries Inc; Armuchee, GA; (800) 722-2504).

- **Roadbase:** Six million pounds of inert material from the old parking lot, roads, and sidewalks was crushed and used as aggregate base for the new building and parking lot (MRWMD).
- **Parking Stops:** The wheel stops used in the new parking lot are made from a 70 percent composite mix of postconsumer plastic such as milk jugs, detergent bottles, plastic bags, and clear food wrap (Barco Products Company; Batavia, IL; (800) 338-2697).

Examples of Recycled-Content Landscaping Products

Compost: MRWMD used compost made from redwood sawdust, bark, and waste products from lumber mills to enrich the soil around the roots of plants on the grounds. (Sunland Garden Products)

Mulch: Tree prunings, grass clippings, and pine needles were coarsely ground and used as mulch in the landscaped areas. (MRWMD)

Examples of Source Reduction and Environmentally Friendly Building Products

- **Truss Joists:** Rather than using solid lumber beams to support the second story floor of the main building, truss joists were used. Truss joists, which are constructed from several pieces of wood, use 50 percent less wood than solid beams for the same load-bearing application. This demonstrates source reduction by design. (Truss Joist MacMillan; Soquel, CA; (408) 479-1104)
- **Linoleum:** The flooring is made primarily from renewable resources, such as linseed oil, pine resins, jute, and wood wastes. This type of flooring is environmentally friendly because it is an excellent substitute for vinyl flooring, which is made from petroleum products (Forbo Industries; Cerritos, CA; (800) 526-1627).
- **Oriented Strand Board (OSB):** This environmentally friendly product can be substituted for plywood applications such as underlayment for carpets, flooring, and roofing shakes and as a sidewall sheathing material. Plywood comes from vintage trees, which represent a limited resource. OSB, on the other hand, is made from small, fast-growing trees which can be raised on tree farms (Louisiana-Pacific; Conroe, TX; (800) 231-1292).
- **Decorative and Structural Beams:** These beams are an environmentally friendly product because they substitute for solid wood beams that normally come from old growth trees, a limited resource (Truss Joist MacMillan; Soquel, CA; (408) 479-1104).

Comments

The MRWMD claims that the choice of these products did not result in additional expense and that, in some cases, the recycled-content products were of higher quality than comparably priced items with no recycled content.

Real Goods Trading Corp. Builds A Really Good Showroom for Trend-Setting Eco-Design

Project: Solar Living Center

Contact: Real Goods Trading Corporation

Location: Hopland, CA

Demonstration

The Solar Living Center (SLC) was designed as a model of sustainable building practices, including renewable energy and energy efficiency, self-sufficiency, and the use of environmentally friendly building products and recycled-content products.

Project Description

Completed in April 1996, the 5,000 square foot building may be the largest straw bale structure in the US. The SLC is located on 12 acres, sandwiched between the Russian River, Highway 101 and Fetzer Vineyards.[1] The building serves as the showroom for Real Goods Trading Company and a learning center for sustainable living practices. The campus for the Institute for Solar Living is located in the center as well as classrooms for instruction in such diverse subjects as organic gardening, straw bale construction, and building a renewable energy home.

The SLC's curved roof is the ideal shape for evenly distributing the reflected daylight. The expansive glazed south facade provides both passive solar gain and daylighting. Excess solar radiation is controlled during the hot weather months through a combination of overhangs and manually controlled hemp awnings. Reflective light scoops are used throughout the building to balance light levels and reduce the need for artificial light. The rear wall is built using straw bales coated with PISE™, which offer an exceptional insulating value (R-57). An acronym for pneumatically impacted stabilized earth, PISE™ is produced by combining cement, water, and earth, which is sprayed onto the walls with a gunite process.

The building is powered by a series of wind generators and photovoltaic panels, which generate excess power to sell back to the utility. Solar powered evaporative coolers serve as a backup air conditioning system and are used to flood the building with cool night air and to store the "coolth" in the building's six hundred tons of thermal mass (walls, columns and floor).

All construction materials are nontoxic and recycled or sustainably harvested. Construction materials were also selected for their efficiency and educational value.

Examples of Reused and Recycled-Content Building Products

- **Interior/Exterior Wood:** Most of the wood used in the SLC is recovered redwood from an old lumber mill or from old wine barrels (Recycled Lumberworks, Ukiah, CA).
- **Cellulose Insulation:** The blown-in "NatureGuard" attic insulation is 85 percent postconsumer newsprint (Louisiana Pacific Corporation, Portland, OR).

- **Trellis for Outdoor Arbor:** The trellis is made from salvaged redwood from an old lumber mill (Recycled Lumberworks, Ukiah, CA).
- **Showroom Display and Architectural Fixtures:** Recovered redwood from old wine barrels from the Serashio Winery of Healdsburg, CA provides a rough-hewn texture to the shelving. In addition, recovered Douglas fir and pine were used for interior work (Recycled Lumberworks, Ukiah, CA).
- **Wainscoting in Bathrooms:** The bathroom walls are tiled with old toilet tank lids (Recycletown at the Sonoma County landfill).

Examples of Sustainably Harvested or Environmentally Friendly Building Products

- **Rice Straw Bales:** The north and east walls are made from 800 bales of rice straw (California Rice Industries Association, Sacramento, CA).
- **Exterior Finish:** The rice straw bales (north and east walls) were covered with PISE™, a mixture of soil and concrete (Rammed Earthworks of Sonoma, CA).
- **Exterior Finish:** The white exterior paneling (south and west walls) is Hardipanel, a sustainably harvested fiber and cement panel.
- **Glulams:** The large beams that support the roof of the building are glulams from sustainably harvested fir. Glulams, made from several pieces of wood, use 50 percent less wood for the same load-bearing function compared with solid-sawn beam (harvested by the Institute for Sustainable Forestry and manufactured by Standard Structures, Windsor, CA).
- **Fascia:** The exterior fascia is made from sustainably harvested redwood glulams (wood from Ukiah Recycled Lumberworks and manufactured into glulams by Standard Structures, Windsor, CA).
- **Soffits:** The soffits are also made from Hardipanel, a sustainably harvested fiber and cement (James Hardie Building Products, Fontana, CA).
- **Concrete Floor Finish:** The concrete floor finish was treated with an environmentally friendly iron oxide wash rather than an acid wash. Most concrete had 10-25 percent industrial waste content (fly ash) to reduce the amount of Portland cement (Otto Design Group, San Rafael, CA).

1. Fetzer Vineyards is winner of the CIWMB Waste Reduction Awards Program (WRAP) and the focus of another CIWMB Case Study. To receive a Recycled Products and Practices Case Study on Fetzer Vineyards, call the CIWMB Recycled Products Section at (916) 341-6300. Ask for Publication #422-95-073.

Waste Management's "Future" Is at the Box Office: Eco-Building Recycles Old Movies, Cuts Costs by 12 Percent

Project: The Office of the Future

Contact: Waste Management Inc. of Torrance, CA

Location: Downtown Biltmore Tower
500 S. Grand, Ste. 1710
Los Angeles, CA

Demonstration

Energy efficiency and sustainable design. Primary emphasis on showcasing high quality, affordable, recycled-content office products, including recycled-content building materials.

Project Description

The Office of the Future is a total of seven rooms, including a lunch room and a conference room—approximately 1,250 square feet of office space. The suite, which was remodeled in 1995, is the working office for environmental services giant Waste Management, Inc., including its recycling service, Recycle America. It also serves as a demonstration project for environmentally responsible work space (tours can be arranged). Almost everything in the office is reused or recycled. Four categories of recycled-content products are exhibited: office furniture, office supplies, construction products, and accessories.

The office also features several examples of energy efficient and/or environmentally friendly equipment, suitable for the office work environment.

A unique aspect of the office is that much of the furniture is made from salvaged movie sets—box office hits like *Apollo 13, Clear and Present Danger, Batman Forever,* and *Congo.* If they hadn't been salvaged, these movie sets would have gone to a landfill.

Examples of Recycled-Content Products

Construction

- **Drywall:** Gypsum-board drywall throughout the office uses 100 percent recycled paper for the backing material. The filler material contains about seven percent postconsumer and three percent postindustrial gypsum (Domtar, Gypsum Drywall, (310) 435-7711).
- Carpet: Carpet used throughout the office is made from 100 percent recycled rubber tires and PET bottles (Image Industries Carpet, (310) 652-4102).
- **Ceiling Panels**: Fiber and wood ceiling panels are made from approximately 85 percent postconsumer content, including fiber from old newspapers and slag from the steel industry (Armstrong, (800) 292-6308).
- **Steel Studs:** Steel construction supports used for internal walls throughout the office are 67 percent postconsumer steel. (Steel Recycling Institute, (412) 922-2772)
- **Lighting:** High-efficiency lighting used throughout the office provides 30 percent more light than standard fixtures, while saving 10 to 15 percent in energy costs.

Furniture

- **Custom Conference Table**: Made from panels composed of 100 percent postconsumer cardboard and brown paper bags. The panels are lightweight, durable, very strong, and non-toxic (Gridcore, (310) 901-1492).
- **Desks, Entertainment Center, and Shelves:** Same as conference table.

- **Bookshelves, Hall Credenza, and "Log Cabinet":** Made from salvaged movie set. (Spin-offs, (310) 320-7523).
- **Armchair Cushions:** Made from scrap metal, the arm rests and cushions are made from hemp, an environmentally friendly agricultural fiber compared to furniture made from synthetic fibers or even cotton fibers. A tough weed, hemp is grown without pesticides, herbicides or fungicides (Rising Star Futons, (503) 382-4221).

Office Supplies

Examples of recycled-content office supplies typically used include copy paper, letterhead, envelopes, paper clips, pens, pencils, and flatware (Treeco, (310) 399-TREE).

Accessories and Equipment

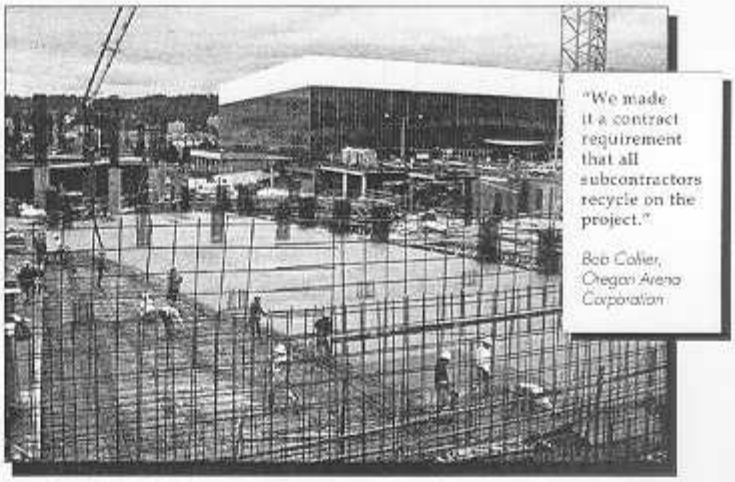
- **Filing Cabinets**: Similar to steel studs, made from 67 percent postconsumer steel (Treeco; (310) 399-TREE)
- **Artwork**: Made from various recycled or reused materials.
- **Refrigerator:** Demonstrates an energy efficient design without the use of freon or CFC refrigerants (Real Goods Inc., (800) 762-7325).
- **HEPA Filters:** High-efficiency particulate air (HEPA) filters help to trap airborne particulate (HEPA, (800) 258-6003).
- **Office Equipment:** Copier, fax machine, computers, coffee maker, and microwave are all energy-efficient models produced by major manufacturers. Note: Copiers that have two-sided capability can reduce costs significantly, considering labor, material, postage, and maintenance expenses. (Savings of five cents per copy or more are typical.)
- **Office Plant/Biofilter:** This air filter is disguised as a planter. Combines activated carbon and other filtering media with living plants and microorganisms to reduce odors and pollutants in the air (BioSolutions Biofilters, (818) 865-1961).
- **Water Filter System:** Uses a five-stage, ultraviolet, reverse-osmosis water filter to remove bacteria, contaminants, and fungi (FM Water Conditioning Water Filter, (310) 949-6966).

Comments

Who says a blockbuster building has to cost megabucks? According to Waste Management Inc., the design of the office, using recycled products, trimmed 12 percent off project costs without sacrificing quality. Ecology is big business, not just because it's the right thing to do, but because it makes cents that add up to big dollars.

JOB SITE RECYCLING

AT 25 PERCENT COMPLETE, ARENA SAVES $81,000



"We made it a contract requirement that all subcontractors recycle on the project."

Bob Collier, Oregon Arena Corporation

OREGON ARENA PROJECT

Recycling Contact
Joe Stinolis, project manager, Drake/Turner Joint Venture, (503) 238-0407

Client Contact
Oregon Arena Corporation, Bob Collier, senior project manager, (503) 731-9310

Project Description
The project is a combination of demolition and new construction. Demolition included a car wash manufacturing facility, part of the Memorial Coliseum exhibit space and a road. The new construction portion was about 25 percent complete as of May 1994.

Recycling
Metal scrap went to Zusman or Schnitzer Steel Products Co.

Wood went to Bredl Saw Works for hog fuel and furnish for composite particle board or to Wastech for hog fuel.

Concrete and rubble went to Porter-Yett or was used as clean fill at Portland International Raceway (PIR) and Portland Meadows.

Site-clearing debris went to Wastewood Recyclers and American Compost. Excavated dirt was reused on site or sent to PIR, Portland Meadows, a Portland Development Commission project and St. Johns Landfill for cover.

Estimated Savings
Standard disposal of metal, wood and cardboard construction and demolition waste would have cost about $69,300 for tipping fees alone. Recycling cost $7,850 in fees and earned $19,600 in rebates for metals. Note that rubble was not included in savings estimates.

Printed on 100% recycled content paper, 20% post-consumer waste, processed chlorine free.

KEY FACTS

Commercial Construction
- 1.7 million-square-foot sports entertainment complex
- Northeast Portland
- $262 million project budget
- November 1993 – October 1995

Prime Contractor
Drake/Turner Joint Venture

$81,000 Recycling Savings
At 25 percent project completion:

Estimated cost of disposal	$69,300
Rebates for metal scrap	$19,600
Actual cost of recycling	$7,900

845 Tons Recycled

Metal	301 tons
Wood	538 tons
Cardboard	6 tons

25,800 Tons Rubble
Concrete and asphalt rubble recycled for clean fill and road surfacing

2,500 Tons Soil
Soil used for clean fill

499 Tons Disposed
Mixed waste disposal is only 2 percent of total waste

Recycling Initiated By
Prime contractor

METRO

For your free Construction Site Recycling Guide, call Metro Recycling Information, **234-3000.**

Check with your local government for applicable hauling and recycling regulations.

JOB SITE RECYCLING

KEY FACTS

Major Commercial Renovation and Addition
- 198,500-square-foot office
- Northeast Portland
- $14.1 million budget
- January 1992-April 1993

Prime Contractor
Hoffman Construction

$35,000 Recycling Savings

Budget for hauling and disposal	$50,000
Actual cost of recycling and disposal	$15,000

725 Tons Recycled

Drywall	111 tons
Metal	406 tons
Wood	203 tons
Cardboard	5 tons

155 Tons Salvaged

Wood	124 tons
Flooring	20 tons
Carpet	9 tons
Doors and fixtures	2 tons

265 Tons Disposed
Rubble was used as clean fill at several sites in the area. Seventy-six percent of all other waste was recycled.

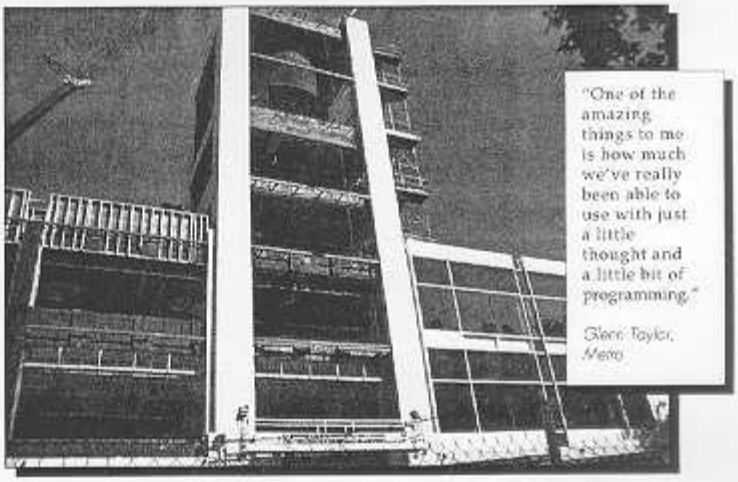
Recycling Initiated By
Metro

METRO

For your free Construction Site Recycling Guide, call Metro Recycling Information, **234-3000.**

Check with your local government for applicable hauling and recycling regulations.

COMMERCIAL PROJECT SAVES $35,000



METRO HEADQUARTERS

Recycling Contact and Client
Metro Solid Waste Department, Jim Goddard, (503) 797-1650

Prime Contractor Contact
Hoffman Construction, Bart Eberwein, vice president, (503) 221-8811

Project Description
A Sears department store building was renovated into new office headquarters for Metro. Demolition involved a complete gutting of the existing building, leaving only the reinforced concrete frame. New construction included exterior infill wall and glazing system, fixtures, HVAC ductwork, partitions and all interior finishes.

Recycling
Drywall scraps were taken by drywall subcontractors to Gypsum Wallboard Recycling in Tualatin.

Wood was taken by the demolition subcontractor or a commercial hauler to Bredl Saw Service in Portland to be used as boiler fuel.

Mixed metals were piled on site and loaded for transport by a cleanup hauler in exchange for scrap revenues paid by several different metal recyclers in the Metro area.

Corrugated cardboard was source separated by subcontractors and transported by commercial hauler to Wastech in Portland.

Estimated Savings
Recycling costs included additional labor for separating materials and self-hauling to recycling processors. Lower disposal fees for recycled materials and payments received for salvaged materials accounted for most of the savings.

Printed on 100% recycled-content paper, 20% post-consumer waste, processed chlorine free

JOB SITE RECYCLING

KEY FACTS

Project Description
- 3,200-square-foot, five-bedroom house
- Tigard area
- October 1995 completion

Prime Contractor
Rosewood Development Co., Mike Humphrey

Resource Efficiency
- Foam/concrete wall system
  KEEVA Form
- Engineered floor trusses
  Tecton Laminates Tec-Lam
- OSB subfloor
  Weyerhaeuser Gold Edge
- Composite trim
  Medex fiberboard
- Blown-in insulation
  United Fibers Cordex cellulose
- Recycled PET carpet
  Image Industries
- Acrylic stucco exterior finish
  Dryvit Co.

Energy Efficiency
- Geothermal heat pump
  Water Furnace International
- Fresh air ventilator
  Nutech Lifebreath 200
- High-efficiency windows
  EPI Heat Mirror
- R-49 ceiling/R-30 floor
  United Fibers Cordex cellulose

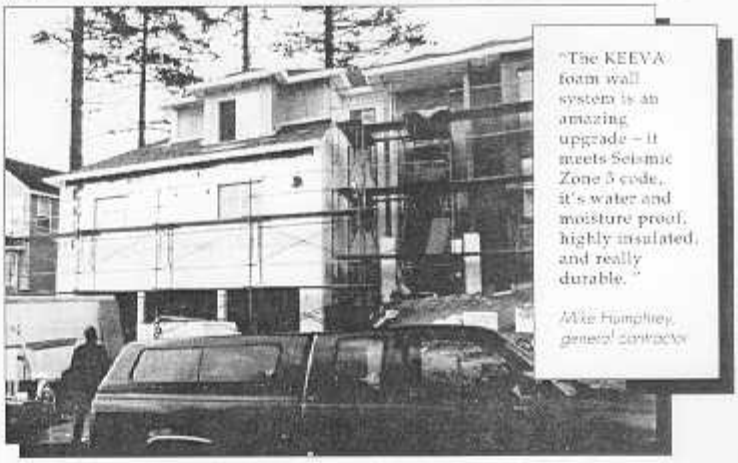
PGE Earth Smart Home
PGE-certified environmental features.

METRO

For your free Construction Site Recycling Guide, call Metro Recycling Information, **(503) 234-3000.**

Check with your local government for applicable hauling and recycling regulations.

FOAM WALL SYSTEM REPLACES WOOD FRAMING



"The KEEVA foam wall system is an amazing upgrade – it meets Seismic Zone 3 code, it's water and moisture proof, highly insulated, and really durable."

Mike Humphrey, general contractor

RESOURCE AND ENERGY EFFICIENT NEW HOME

Contractor and Foam Wall Contacts
Mike Humphrey, Rosewood Development, (503) 590-9737
Allen Leonard, KEEVA Form, (503) 968-7606

Project Description
The builder's goal is a healthier, environmentally responsible house with strong buyer appeal. A key feature is the KEEVA Form foam block and concrete wall system, which offers higher strength, durabilty and insulating qualities than conventional framing. The wall uses almost no wood, except for window and door bucks, helping conserve forest resources.

Resource and Energy Efficiency Features
The exterior finish is acrylic stucco. Unlike wood siding, stucco requires no painting and minimal maintenance for a long service life. In structural headers, beams and joists, engineered wood replaces lumber joists. The subfloor is an oriented strand board (OSB) warrantied against edge swelling, so it does not need to have underlayment before carpet is installed. Interior trim is painted composite fiberboard, made with scrap wood.

Typical new houses produce 4 to 7 pounds of waste per square foot of area, about half of it wood scrap. This house produced only a small amount of wood waste.

The foam walls have an R-value of 34, compared to typical R-19. Ceilings and floors are insulated with blown-in recycled cellulose. Windows use special high-efficiency glazing. A geothermal heat pump uses the earth to provide heating, cooling and hot water for an annual cost estimated at $370.

An add-on ventilator unit provides fresh air while exhausting stale air. The ventilator ensures year-round clean, comfortable air distribution throughout the house. Common indoor pollutants have been reduced or eliminated.

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JOB SITE RECYCLING

WAREHOUSE DEMOLITION RECYCLES 98 % OF BUILDING

KEY FACTS

Warehouse Demolition
- Approximately 720 feet x 120 feet
- Port of Vancouver, Wash.
- Heavy timber construction
- $265,000 budget
- September 1994 - February 1995

Prime Contractor
Dan Obrist Trucking and Excavating

1,537 Tons Recycled/ Salvaged

Recycled wood	570 tons
Salvaged lumber	678 tons
Recycled metals	201 tons
Concrete	88 tons

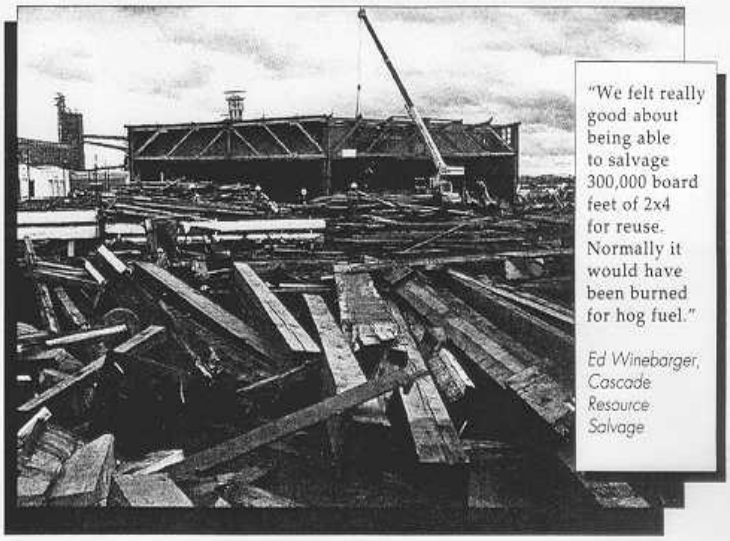
29.4 Tons Disposed
Mixed waste disposal for this demolition project was only 2 percent of the total weight of all materials. The majority of landfilled waste was non-recyclable asbestos roofing.

Recycling Initiated By
Port of Vancouver and Dan Obrist Trucking and Excavating

METRO

For your free Construction Site Recycling Guide, call Metro Recycling Information, **234-3000.**

Check with your local government for applicable hauling and recycling regulations.



"We felt really good about being able to salvage 300,000 board feet of 2x4 for reuse. Normally it would have been burned for hog fuel."

Ed Winebarger, Cascade Resource Salvage

HEAVY TIMBER WAREHOUSE DEMOLITION AND SALVAGE

Recycling and Contractor Contacts
Dan Obrist, Dan Obrist Trucking and Excavating, (503) 667-4042
Ed Winebarger, Cascade Resource Salvage, (503) 695-5640

Owner's Contact
Marty Irwin, Port of Vancouver, (503) 289-8824

Project Description
An 720-foot x 120-foot warehouse and attached outbuildings were demolished. The structure was heavy timber construction, with an interior concrete fire wall. Roof deck was constructed of solid 2 x 4s on edge. Wall infill material was lightweight sheet metal on particle board spanning between 2 x 8s.

Recycling
Miscellaneous metals, including sheet metal panels, iron pipe and other scrap were recycled at Schnitzer Steel Products. Concrete was broken up, trucked off-site, crushed by machine and returned to the owner for use as clean gravel base. Heavy timbers were salvaged and stored for regrading and sale. The 2 x 4 roof deck was disassembled in sections by crane and sent to Mexico where labor costs allowed for hand sorting and nail removal. The 2 x 4s will be sold for reuse in that country.

Estimated Savings
Recycling scrap metals saved about $22,400 compared to landfill costs. Recycling concrete saved $530, when value as gravel base is included. Savings on recycling wood scrap was about $21,600. Savings on salvage of lumber and heavy timbers is difficult to estimate, but was at least $90,000 when compared to the much lower value this material would have if it was chipped for recycling. Total savings from recycling and salvage are estimated at $134,500.

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JOB SITE RECYCLING

KEY FACTS

Project Description
- 54,500-square-foot office building
- $5 million project budget
- Tanasbourne area, Hillsboro (Washington County)
- March 1996 completion

Prime Contractor
McCormack Pacific

Salvage Wood
- Apatong hardwood flooring
  Environmental Building Supply

Sustainably Harvested Wood
- Maple veneer over Medite II panels
  Endura Hardwoods

Recycled Content Materials
- Interior primer paint
  Long Paint
- HDPE toilet partitions
  Santana Poly-Marble HD
- Ceramic tile
  Cementics Milestone
- Fabric-covered acoustic wallboard
  Homasote DesignWall
- Carpet
  BASF 6ix Again recycling program
- Sports floor
  RB Rubber Products

Construction Site Recycling
The general contractor is recycling construction waste.

METRO

For your free Construction Site Recycling Guide, call Metro Recycling Information, **(503) 234-3000.**

Check with your local government for applicable hauling and recycling regulations.

NORM THOMPSON USES RECYCLED PRODUCTS

NORM THOMPSON CORPORATE HEADQUARTERS OFFICE

Project Designer Contact
Cheryl Rask, JKS Architects, (503) 227-5616

Environmental Consultant Contact
Debbi Allen, River City Resource Group, (503) 248-4550

Project Description
The Norm Thompson company markets quality clothing through a nationwide chain of retail stores and by mail order. In designing its new headquarters offices, the company directed its architects and interior designers to develop a strong image of quality. Environmental responsibility was seen as a key part of this goal.

Salvage Wood
The main lobby flooring is apatong, a hardwood salvaged from railroad freight cars, where it was used for its strength and hardness. The refinished wood will look like new wood flooring.

Sustainably Harvested Wood
Wood paneling in the lobby is maple from a certified sustained-yield forest, veneered over a smooth fiberboard panel, Medite II. Seven Islands Land Co.'s minimal-impact harvesting ensures long-term forest health and wood supplies.

Recycled Content Materials
Interior primer is recycled latex paint from Long Paint, the painting contractor. Bathroom partitions are made from recycled HDPE polyethylene plastic. Initially more costly than metal partitions, the high-strength, rust-proof and graffiti-proof panels pay back with savings on maintenance and replacement. Walls are finished with fabric-covered acoustical panels made from 100 percent recycled cellulose. Trim includes ceramic tile made with recycled auto glass. Carpet will be recycled by its manufacturer at the end of its service life.

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JOB SITE RECYCLING

TENANT IMPROVEMENT SAVES $310

KEY FACTS

Tenant Improvement
- 6,000-square-foot office
- Downtown Portland
- Third floor, office building
- $61,700 project budget
- 30-day schedule

Prime Contractor
Design Systems

$310 Recycling Savings

Cost of standard hauling and disposal	$1,460
Cost of recycling	$1,150
Savings	$ 310

8.8 Tons Recycled

Drywall	10,000 pounds
Wood	7,200 pounds
Metal	300 pounds
Total	17,500 pounds

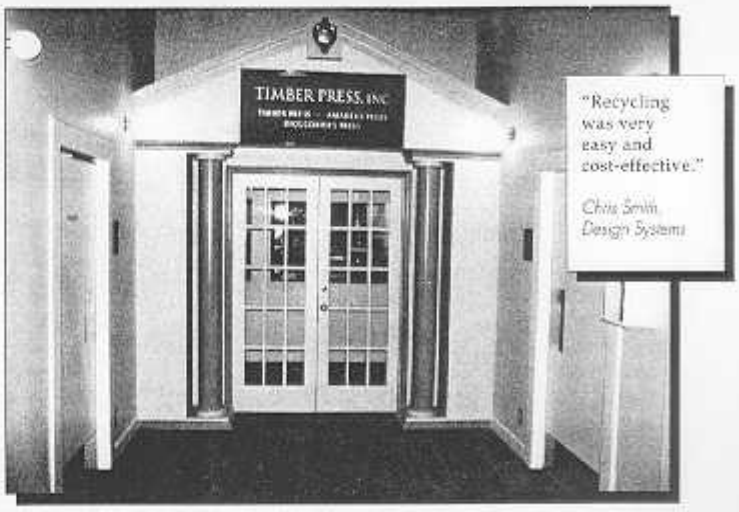
.20 Tons Disposed

Recycling Initiated By
General Contractor

METRO

For your free Construction Site Recycling Guide, call Metro Recycling Information, **234-3000.**

Check with your local government for applicable hauling and recycling regulations.



TENANT IMPROVEMENT

Recycling Contact
Mark McGregor, Clean It Up Mark, (503) 639-8440

Project Description
This was a typical office tenant improvement project. The old office was gutted and remodeled. The job had to be completed as quickly as possible.

Recycling
Recycling saved money and time, and it simplified the job. The recycling contractor hauled out in the evenings, so there was no slowdown in the daily schedule for cleanup. The recycling contractor hauled out small loads, which saved the cost and complications of using a chute and on-street drop boxes.

Wood, including solid wood and composites, went to Grimm's to be recycled into boiler fuel.

Drywall went to Gypsum Wall Recycling to be made into new drywall. Metals went to Schnitzer Steel Products.

Estimated Savings
Out of 17,500 pounds of waste materials, approximately 98 percent was recycled. Most of the savings came from the reduced fees for recycling wood and drywall compared to disposal.

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JOB SITE RECYCLING

KEY FACTS

Project Description
- Two 1,290-square-foot tract homes
- Tigard area subdivision
- $116,900 sale price
- April-June 1994 (70 days)

Prime Contractor
Stone & Company

House 1 – Savings

Hauling/ disposal cost	$671
Recycling cost	$355
Savings	$316

3.8 Tons Recycled

Drywall	1,450 pounds
Wood	6,000 pounds
Cardboard	135 pounds
Total	7,585 pounds

.5 Tons Disposed

Mixed waste	936 pounds

House 2 – Savings

Hauling/disposal cost	$732
Recycling cost	$355
Savings	$377

4.9 Tons Recycled

Drywall	1,210 pounds
Wood	8,400 pounds
Cardboard	125 pounds
Total	9,735 pounds

0.4 Tons Disposed

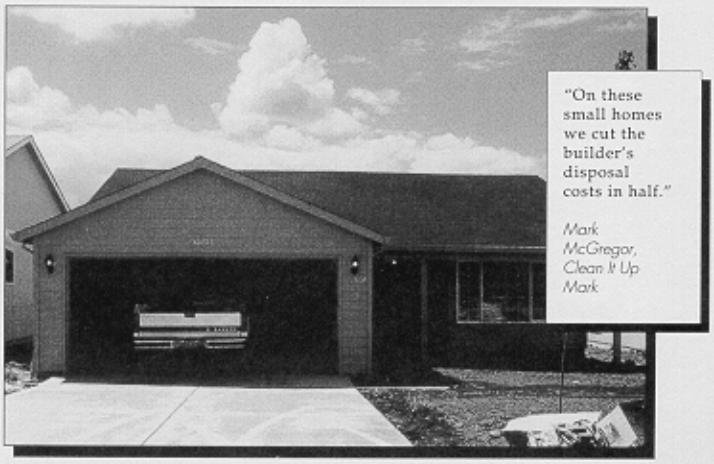
Mixed waste	850 pounds

METRO

For your free Construction Site Recycling Guide, call Metro Recycling Information, **234-3000.**

Check with your local government for applicable hauling and recycling regulations.

TWO TRACT HOMES SAVE $316 AND $377



NEW TRACT HOMES

Recycling Contact
Mark McGregor, Clean It Up Mark, (503) 639-8440

Contractor Contact
Jerry Janek, Stone and Company, general contractor (503) 642-5654

Project Description
Both houses are the same 1,290-square-foot, three-bedroom plan, built in the same subdivision. The contractor has built this house several times. The amount of wood waste and savings differed because one house was built on a sloped lot using a framed pony wall.

Recycling
The specialty contractor does not require separation of waste materials by the crew or subtrades, which saves them time.

Drywall scrap went to Gypsum Drywall Recycling.

Solid wood and composite scrap went to Grimm's for boiler fuel. Cardboard went to Far West Fibers for new cardboard.

Estimated Savings
In House 1, standard hauling and disposal of construction waste would have cost $671. House 2 would have cost $732.

In House 1, actual recycling cost, including additional labor for separating materials and hauling to recycling processors was $355. Approximately 88 percent of all waste materials was recycled. In House 2, recycling cost was also $355. Approximately 92 percent of all waste was recycled.

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Chapter 8. Strategies to Reuse Materials and Reduce Material Use in Construction

8.1 Benefit of Reducing Material Use

The concept of reducing material use and reusing construction materials has been in play for quite some time throughout both the construction and recycling industries. It is the basis behind resourceful or green building techniques and has been the subject of many conferences and seminars. The theory is valid and promises numerous benefits, including reducing the amounts of natural resources used to create raw building products, reducing the energy needed to create and assemble the products and materials, increasing the efficiency and productivity of manufacturing the building elements and construction of structures themselves, reducing building costs, and creating more healthy structures and environments for those that occupy these spaces.

These are all noble goals, and each warrants further investigation into resourceful building techniques on its own merit. However, the Integrated Waste Management Board's primary duty is to reduce the amount of waste going to landfills such that communities in California achieve the 50 percent waste reduction mandate by the year 2000. As such, this chapter will focus on the waste reduction benefits of promoting resourceful building techniques. Although the waste reduction benefits will be addressed, contractors and builders should consider all the potential benefits, beyond waste reduction, of alternative building techniques and materials when evaluating their potential use in a structure.

One would assume with all the potential benefits mentioned above, implementation of resourceful building techniques would be commonplace. Unfortunately, because of the life span of its products, the construction industry is a conservative business, and new techniques, technologies, and materials are incorporated into the mainstream very slowly. Because of the inherent skepticism in the industry, successful resourceful or green techniques need to be promoted aggressively for the mainstream building community to adopt them in a timely and widespread fashion.

To offer practical options for resourceful building techniques, this chapter will not address less traditional building techniques, such as straw bale buildings. The focus will be on the more traditional building methods that employ waste reduction and

minimization techniques that have been used in model and real world applications. These methods are likely to be used, in part or whole, by mainstream builders. Some of the materials and techniques mentioned in this chapter have also been addressed in Chapter 2, "General Categories of Recycled-Content Products by Application" and Chapter 4, "Locating Recycled-Content Building Products."

8.2 Waste Estimates

Data Exist to Estimate a Wide Variety of Construction and Conditions

To address and to reduce the amount of waste being generated at a construction site, and in turn reduce material and disposal costs, a basic understanding of the types and amounts of material being generated is needed. Since there are so many different types of structures, varieties of climates in which they are being built, and techniques to construct them, it would be impossible to quote definitive values for the types and amounts of waste generated during the construction of a structure. However, there have been data collected estimating the amounts of waste generated during construction of various types of buildings that seem to fall within a reasonable range. These data can be used as guidelines for general construction waste generation estimates.

Construction Consumes Resources: Waste Reduction Saves Money

It is estimated that new home construction consumes two-fifths of all the lumber and plywood used in the United States. Based on this fact, it is clear that waste reduction efforts employed in the construction industry have the potential to reap great benefits in reducing the amount of materials used and waste generated. Reducing waste and increasing efficiency at a construction site can also render financial benefits for a builder.

Rules of Thumb for Waste Generation Estimates

Of the metropolitan areas that have collected data on the generation of construction and demolition waste, Portland, Oregon's Metro program contains some of the best documentation. Metro estimates that approximately four pounds of waste is generated for every square foot of new residential construction. Of that waste the vast majority is wood (up to 35 percent), followed by drywall (approximately 15 percent), and 12 percent cardboard. The disposal costs for a builder can represent 3 percent to 5 percent of the overall budget of the project. With competitive bidding, it makes economic sense to minimize costs associated with waste generation and disposal.

Another excellent source of construction waste generation and cost data is the North American Home Builder's Association (NAHB). Through its representatives, the NAHB has been able to collect data nationally and develop average costs and volume estimates on construction wastes. Based on its data, the NAHB estimated that a typical homebuilder pays $511 per house for construction waste disposal. This cost will rise as landfill tipping fees increase. Some 85-90 percent of construction waste is recyclable. This indicates that not only could the disposal costs be significantly reduced through recycling construction wastes, but also potential income could be realized through the sale of these materials.

The NAHB compiled estimates on the amounts of wastes generated during construction on a "typical" 2,000 square foot home. These estimates are based on the assumption that

three sides of the home's exterior are covered with vinyl siding and the front facade is brick veneer. Table 1 contains NAHB's data in this typical home.

Table 1:
NAHB Construction Waste Estimate of a Typical 2000-Sq-Ft House

Material	Weight (lb)	Volume (yd^3)
Solid Dimensional Wood	1,600	6
Engineered Wood	1,400	5
Drywall	2,000	6
Cardboard	600	20
Metal	150	1
PVC	150	1
Masonry	1,000	1
Hazardous Materials	50	—
Other	1,050	11
Total	**8,000**	**50**

It should be noted that the amounts listed in Table 1 can vary depending on the type and location of construction and that the waste volumes noted in the right hand column are highly variable because of the compressibility and captured air space in the waste materials.

Although the NAHB developed waste generation estimates as a composite from data collected nationwide, the information contained in Table 1 cannot possibly be representative of the wide variety of construction projects that occur. To expand on the NAHB data in Table 1, data have been compiled from a variety of cases from various communities throughout the United States and Canada. The cases include information from both commercial and residential new construction, a renovation, and information from a materials recovery facility. The data are compiled on Table 2 on the following page.

Table 2: Construction Waste Generation Estimates

#	Type	Wood	Gypsum	Mixed	Cardboard	Metal	Masonry	Other
1	Resid. New	21-38%	10-20%		5-15%	<1%	1-8%	
1	Commer. New	20-30%	5-10%		5-10%	1-8%	11-25%	
2	Single Home	46%	25%	15%	5%	6%	2%	
2	6 unit Apt.	44%	25%	18%	6%	3%	3%	
3a	New Home	80%	12%	3% (Trash)	4%	1%		
3b	New Home	59%	12%	10% (Trash)	2%	1%	3%	
3c	New Home	50%	28%	7% (Trash)	2%	15	12%	
4a	Resid New Homes	64%	22%	12% (Waste)	2%	<1%		
4b	Resid. Renovat	31%	7%	17% (Waste)	<1%	<1%	21% Rubble	23% Salvage
5	Resid. low-rise	31.1%		10.7% Building mat'l	Paper 3.9%Paperbrd7.8 %	12.2%	23.1%	7.2% Plastic
5	Res/Comhigh-rise	55.2%		3% Building Mat'l	Paper 6.4% paperbrd 2.2%	5.8%	7.4%	11.5% glass
5	Comm low rise	8%		40% Building mat'l	Paper2.9% paperbrd 9.8%	9.2%		
5	Renovation	34.8%		21.1 Building Mat'l	Paper 1.9% paperbrd 1.6%	5.5%	36%	2.4% plastic
6	Fla MRF% vol	32%		23% Misc	17.8% paper prods	7%	2.5%	13% roofing

The following sources were used to compile the data contained in Table 2:

1. Metro Council of Twin Cities, *Construction Materials Recycling Guidebook: A Guide to Reducing and Recycling Construction and Demolition Waste*.

2. Fisher, HF McHenry. County Dept. of Solid Waste Management, Woodstock Ill, interview, October 1992.

3. Metro Solid Waste Dept. (Portland, OR), Construction Industry Recycling Project, July 30, 1993:

   a) Morissette Homes, 2,900 sq ft house generating 11,799 lb of waste (4 lb/sq ft).

   b) Hjorth & Co., 2,200 sq ft home generating 8,234 lb of waste (3.7 lb/sq ft).

   c) Eco+Tech Construction, 3,000 sq ft custom home generating 13,776 lb of waste (4.5 lb/sq ft).

4. Metro Solid Waste Dept. (Portland, OR), *Developing a Construction and Demolition Debris Recycling System for Disaster Debris Management*, January 1994:

   a) 37-home project, average size 2080 sq ft, 3.8 lb/sq ft., *Characterization of Construction Site Waste, Final Report*, by Mark McGregor, Howard Washburn, Debbi Palermini, Report to Metro, Portland, OR, July 30, 1993.

   b) 3-unit residential renovation project averaging $38,000 with 3 percent salvaged, Residential Remodeling Waste Reduction Demonstration project, by O'Brien & Assoc., and Palermini & Assoc., report to Metro, Portland, OR, June 1993.

5. "Metropolitan Toronto Waste Composition Study at Metro Landfills 1991." SWANA, *Construction Waste & Demolition Debris Recycling—A Primer*, October 1993.

6. "Percent volume of construction waste entering Kimmins Recycling Facility in Florida." SWANA, *Construction Waste and Demolition Debris Recycling—A Primer*, October, 1993. Source: Woods, Randy, "C&D Debris: A Crisis is Building," *Waste Age*, January, 1992.

It should also be noted that item #5 in Table 2 contains information from a waste composition study in Toronto, Canada which currently bans gypsum from landfill disposal. As such, the entry under gypsum for this study was left blank.

The data contained in Table 2 is somewhat consistent with the information in Table 1. Although the percentages vary significantly between cases and building types, both tables seem to agree that the primary components of construction waste include wood, gypsum, and masonry, with the lesser components including cardboard, metal, and various mixed debris.

In order to minimize the amount of waste generated at a construction site, planning is necessary on the front end of the project. It essentially boils down to the "three Rs" of waste reduction: reduce, reuse, and recycle. Although there are definite economic benefits to reducing the amount of waste hauled off site, it may require the design team to stipulate, in the contract, that certain waste reduction practices be adhered to in the contract and enforce these stipulations with the construction manager. This may be the most effective way to convince a construction crew, that is used to dumping waste in a single roll off container, to separate and recycle the waste generated during construction.

In evaluating the process of erecting a structure with the intent of minimizing the amount of waste generated during that process, maximum efforts can be focused in three general areas: (1) dimensional planning, (2) material reuse and recycling, and (3) use of modular/preconstructed elements with and other resourceful building techniques. All three areas take some forethought to implement, but the amount of material used in the construction project and corresponding amounts of waste generated will be reduced.

8.3 Dimensional Planning

Standard Dimensions

The first area in which waste prevention techniques can be incorporated into the construction process is through dimensional planning. This requires forethought on the part of the designers of a structure to ensure a building that creates less construction waste solely on its dimensions and structural design. Specifically, rooms can be designed on 4 foot multiples, since wallboard and plywood sheets come in 4- and 8- foot lengths. Furthermore, one dimension of a room can be designed on 6- or 12- foot multiples to correspond with the length of carpet and linoleum rolls. There will always be some exceptions that will prohibit a designer from adhering to standard sizes. However, an 8-foot by 12-foot room will certainly create less waste than a 7.5-foot by 12.5-foot room. In the design stages of a structure, a great deal of potential waste generation will be avoided by reducing the number of cut-offs and scraps being produced. At the very least, rooms should be designed whenever possible with 2-foot incremental dimensions.

On large-scale projects, designers should also consider repetitive design elements. By using redundant dimensions throughout the design of a project, the materials that need to be cut can be done in large batches in a single location. This minimizes waste and increases efficiency by precutting all the elements at once and consolidating all the cut-off in one area. Redundancy of design throughout a development can be offset with exterior ornamentation and landscaping.

Structural Footprint

The shape and size of the footprint of a structure is also directly related to the amount of materials used to construct it, and as a result, the relative amount of waste generated during that construction. Since corners and angles generate the most waste throughout the construction process, it would be most efficient to minimize the amount of corners in a structure. As round structures are not necessarily practical, the resulting footprint that is most efficient is a rectangle. A cube-shaped building of standard dimensions is probably the most efficient design from a waste minimization perspective. Admittedly, a cube is probably not the designer's first choice for the most aesthetically appealing structure, and that designer will probably gravitate towards more elaborately shaped structures with intricate angles. However, with some forethought, a structure can be designed with the objective to reduce unnecessary corners and angles. This will in turn reduce cut-off and resulting waste.

Similarly, it takes less material to build a structure upward than it does to increase the footprint. A two-story structure requires less roofing material and less foundation than a single story structure of the same square footage. In the end, ultimate efficiency must be balanced against architectural beauty. As such, compromises must be made on both fronts. However, if consideration is given to resourcefulness in the design and planning of a structure or complex, a designer can create a building that is aesthetically pleasing while incorporating elements that make it a far more efficient product in the end.

Preconstructed Elements

Traditional residential construction still performs the majority of framing and finishing operations on site in phases. The preconstruction of some elements of the frame, such as trusses, has become more commonplace in larger developments. As acceptance of this practice becomes more widespread, along with more manufacturers preconstructing elements, greater portions of a residential construction project will occur off-site and be delivered to the job-site for assembly.

By having certain elements of a building preconstructed at the factory, the waste generated during this process is eliminated at the job site. This is not just transferring the waste from one site to another. When components of a building are constructed at a factory, less waste is generated because the elements used are dimensionally equivalent to or close to the measurements needed for the component being assembled. Furthermore, any waste that is generated is more likely to be recycled because of economies of scale and consolidation of the scraps.

As indicated, the most commonly used preconstructed element in residential housing is preassembled trusses. These are built in an assembly plant and brought to the construction site to be fastened to the framed walls of the building. Other preconstructed elements that are finding their way into the market place are precut door frame/header systems, prebuilt structural panels, and non-structural interior wall systems.

To use preconstructed frames, or to just have more efficient framing on site, detailed plans are necessary for the framers and constructors to make better use of the materials or preassembled element. Again, this requires forethought and planning on the part of the designers and architects.

Modular and Preconstructed Panels

Preconstructed wall panels, or stressed skin panels, are not widely used throughout the construction industry in traditional construction projects. They are, however, being manufactured by more industries and meeting standards for a variety of applications. As such, these materials may find wider use in the future if they can overcome the barriers of a conservative construction industry.

Many of these prebuilt elements, such as structural panels, are more energy efficient, relatively simple to erect, and reduce labor costs when compared to traditional wood framed construction. The panels can be custom fabricated from the factory using building plans, which would greatly reduce the amount of waste generated on the construction site. Modular panels used to form the walls of a structure can be manufactured for both structural and non-structural purposes. This would require detailed plans and drawings to construct proper dimension panels.

An option for commercial applications is modular wall units for the interior of buildings. Preconstructed wallboard skinned wall units are an excellent alternative to fixed walls in office spaces. These units become particularly cost effective if any rearrangement of the interior rooms and working space is needed or planned after initial construction is completed. The units can be moved without creating new waste, using new building material, or adding to renovation costs. Renovation time is also dramatically reduced.

The most common type of structural panel currently manufactured is constructed of oriented strand board (OSB) outer layers with foam core insulation sandwiched between them. The cores of these panels can vary in composition with the most common including polystyrene and urethane. It is feasible that other materials, such as agricultural and paper wastes could be incorporated as insulation into the construction of these panels once their use is widely accepted in the construction industry.

Panels are also fabricated using a stud framework. The studs can be made of wood, engineered wood, metal, both, or even a polymer. Any of these materials, with the exception of sawn wood studs, could contain a very high-recycled material content. These panels can be designed to be both load and non-load bearing elements. Panels can also be designed to be load bearing without internal studs.

The preconstructed panels can have either an outer skin or bare foam sides ready for both inner and outer surface treatments. There are a large variety of structural panel manufacturers in the United States offering a variety of manufacturing approaches and applications. The advantages of structural panels include improved thermal efficiency, custom fabrication to meet specifications, reduced assembly time, and reduction of waste generated at the job site. The panels could require a lower skill level to assemble and thus cost less than comparable wood frame construction. This would result in a lower final cost of the structure to both the consumer and builder.

Structural and nonstructural panels can be prewired or plumbed as desired. The recyclability of the panels varies. Often the foam core material can be recycled at the manufacturer. The skins, however, vary by material. OSB has limited recyclability. Any metal scraps retrieved from the panels would have a high potential to be recycled because of the well-established scrap metals market. Other outer skin material, such as polymer based materials, would generally depend on the manufacturer's willingness to

accept scraps. There is an additional discussion of structural and insulated panel systems in Chapter 2.

8.4 Resourceful Framing Materials and Techniques

The intent of this section is to briefly touch on some alternative building elements and techniques to traditional stud frame and poured concrete and steel construction. Some of the elements that are mentioned in this section may not be practical or cost effective for every building scenario. However, it benefits any builder to be aware of the available alternatives to traditional construction materials and techniques so that they can be evaluated and implemented if they prove to be economical.

Lumber is the primary material used in today's building industry. This is based on cost, material availability, and a labor force skilled in the assembly process. As such, it is appropriate to review stud construction using materials other than sawn lumber or variations on sawn lumber stud construction that may offer waste savings alternatives.

Lumber Framing

Since sawn lumber framing is still the most prevalent form of construction for residential housing, it is appropriate to evaluate sustainable techniques of construction using this material before evaluating less prevalent construction materials and techniques.

One option is to use less material in that building. Less material use generally translates into less waste generated. If local building codes allow load bearing walls with 24-inch centers between the studs rather than the standard 16-inch centers, a designer and builder could use this option to reduce material use, and a proportional amount of waste generated, by one third on long runs of walling. This would still allow designing rooms to accommodate standard dimension materials such as drywall, plywood, and carpeting. If building codes require 2- by 6-inch studs instead of 2- by 4-inch studs when going to 24-inch centers, more material would actually be required to construct similar buildings and no waste reduction would be realized. One result of using 2- by 6-inch studs is a larger wall cavity would be created for insulation purposes. Therefore, if a higher thermal performance is required or desired in the building, then 2- by 6-inch studs on 24-inch centers may be a desirable option.

Engineered Wood Framing

As the price of traditional lumber continues to rise, the use of engineered wood in framing has gained wider acceptance throughout the construction industry. Engineered woods include oriented-strand board (OSB), glue-laminated beams, wood I-joists, laminated veneer lumber, and various configurations of plywood and particle boards. Engineered wood members are manufactured from wood fibers and chips and formed into studs, I-beams, sheets, and joists using resins and glues to bind the materials. The final product, if designed so, can be stronger than conventional wood members because of the uniformity of the material and tendency to resist warping and bowing. These products can be engineered to save raw materials or use feedstock that grows more quickly. Preconstructed I-beams can span greater lengths using less material and, as a result, weigh less. They can be custom ordered to size, resist warping (which reduces the tendency to cause squeaky floors), and can come with predrilled knockouts to simplify installation of utilities. The cost of engineered wood members tends to be somewhat

higher than conventional sawn wood, but the costs can be offset by reduced labor costs. The labor savings are realized because engineered wood elements can be framed much quicker using longer spans that are lighter than conventional lumber. Furthermore, headers, joist, architectural elements, and other elements of a framed structure can be manufactured to specification reducing cutting time and waste on the job site.

There are some considerations when using engineered wood elements beyond the potential higher cost. Knockouts on I-beams may not be ideally located and special hangers and fasteners may be needed for installation. Some of the laminates, glues, and adhesives used in the manufacture of the engineered materials may emit volatile organic compounds that should be considered when used on the interiors of buildings. Additionally, some of the strandboards, particle boards, and waferboards are heavier than corresponding plywood, may not have the same structural strength, and may swell or disintegrate under wet conditions. Becoming familiar with the properties of each of the available materials will be a great advantage to the designer/builder by expanding his/her options when choosing building materials.

The use of engineered wood elements will become more prevalent in mainstream construction given the escalating cost of dimensional lumber. Dimensional lumber prices are increasing because of a national shortage of vintage forest stock. At the same time, there is an increase in the availability of more sustainably grown trees (e.g., trees grown on tree farms). The cost for these products will undoubtedly become more competitive. There is additional information on engineered wood elements in Chapter 2.

Plastic Lumber

Plastic and composite lumber elements have been manufactured for several years under a variety of processes, names, and intended applications. The markets for these materials have fluctuated significantly throughout the years that they have been available. Because of the inconsistencies of supply, demand, and quality of composite and plastic lumber, these materials have not been standardized or received wide acceptances in the industry compared to sawn lumber elements. More specifically, these materials have not been used to any significant extent as framing material because of their inherent properties. Plastic lumber elements are also discussed in Chapter 2.

Plastic and composite lumber, as a group, offer both advantages and disadvantages when compared to traditional lumber elements. The disadvantages can include the fact that plastic and composite lumber tends to weigh more per board foot and require shorter spans to support equivalent loads when compared to traditional lumber framing. Plastic lumber also tends to expand and contract with temperature fluctuations more than sawn lumber elements. Because of the wide variety of manufacturers of composite lumber, the qualities and performance of these materials can vary significantly.

These materials do, however, offer several advantages over traditional wooden lumber. As plastic lumber is manufactured, it can be made in custom dimensions. This would reduce the amount of scraps generated at the work site. Additionally, the scraps that are generated can be recycled. The recyclability of the scraps would, however, depend entirely on the type of material used and markets available as well as the manufacturer's willingness to accept the scrap material.

The greatest attributes of using plastic and composite lumber are its outstanding weather resistant properties. Because of these properties, composite and plastic lumber elements

have most widely been used as decking and marine applications where the higher cost of the material and additional material needed is offset by the longer life span than can be expected in harsh elemental conditions. It should also be noted that most plastic lumber products have a high-recycled content. As such, these building materials offer an additional market outlet for recycled plastic.

It is difficult to estimate what the future of the plastic lumber industry will be. As traditional sawn lumber prices increase, manufacturers will continue to develop and evaluate alternatives and develop specifications. This may offer expanded applications for plastic lumber. The economics of wood framed structures will change, which will lead to more specifications for alternative building materials. This may result in composite and plastic lumbers being applied to structural framing in the future. Battelle Memorial Institute, a non-profit research laboratory in Ohio, began a three-year program in the fall of 1996 to develop specifications and guidelines for plastic lumber in structural applications. The project is being coordinated with the American Society for Testing and Materials (ASTM).

Light Gauge Steel

An alternative to lumber as a framing material is light gauge steel. This material has been readily accepted as a substitute for wood framing throughout the building industry. The use of light gauge steel for housing as a framing material has increased significantly over the past few years, indicating both its advantages and acceptance by the construction industry.

As with any material, the use of light gauge steel as a framing material has both benefits and drawbacks. Benefits to steel framing include the fact that headers, joists, and other framing material can be fabricated to desired lengths and dimensions. This translates into reduced waste at a job site. Scrap steel has a highly developed market, which would ensure almost no disposal cost for the cut-offs and would most likely generate income for the material. Not only is the steel recyclable, but also often contains significant recycled content further fostering markets for scrap material.

Steel studs are also lighter than comparable wood framing resulting in lower transportation and assembly costs. Finally, steel will not loose moisture and shrink like wood and has more predictable quality than wood.

There are also some disadvantages to using light gauge steel in lieu of wood framing. Steel can cost more than wood, but with the amount of new developments using steel studs in Northern California and the fluctuations in lumber prices, the costs can be comparable. The assembly of steel is different than wood and many workers are not accustomed to the procedures. This in turn, would probably translate into increased labor costs, at least until the workers become accustomed and more efficient in the assembly process. The structural standards vary for steel, which will result in various assembly procedures, until a standard is developed. Steel, unlike wood, has a high thermal conductivity, which requires unique steps to be taken to minimize heat transfer through exterior walls. Additionally, grommets are needed when running wires and plumbing through steel studs to avoid chaffing.

Regardless of the current economics, as the technology and economy of building materials change, light gauge steel framing will become a more accepted practice and it would benefit any general contractor to become familiar with the construction and

assembly of steel framed structures. Once workers grow accustomed to using self-tapping screws and bolts to assemble the frame of a building in lieu of hammers and nails, the labor will no longer be considered specialized and the labor costs should decrease. Chapter 2 contains additional information on light-gauge steel stud construction.

8.5 Other Resourceful Construction Elements

The construction and finishing of a residential or commercial structure involves a multitude of stages and materials to arrive at a finished product. The elements involved in building a structure include everything from interior and exterior treatment, trim, flooring, roofing, coatings, utilities, and finishes. With such a vast array of applications, there are undoubtedly far too many alternatives available for construction materials and techniques than could be addressed here.

However, some alternatives to traditional construction elements will be briefly discussed here, allowing the resourceful builder or designer to further investigate options that may warrant consideration in future projects.

The North American Homebuilders have developed several case studies using both recycled-content building products and innovative construction techniques. One study featured a two-and-one-half-story house built at the Armstrong Innovation Center in Lancaster, Pennsylvania, called the Susquehanna House 1. The demonstration home used such elements as structural foam panels in lieu of wood studs, moveable interior walls, a roof built on the ground and hoisted into place, surface mounted wiring for easy installation and relocation, and flexible air distribution through floor plenums. These type of ideas often surface in model or demonstration products and are later incorporated into mainstream construction. Other ideas that have been either tested or used in larger scales are listed below.

Floor Coverings

Floor coverings represent a significant amount of material that goes into a construction project and must be addressed, from both a material use and waste generation standpoint, in almost all residential and commercial structures in one fashion or another. There are an incredible number and variety of floor coverings that employ a vast array of unique and recycled materials. These could include tiles made from recycled plastics and glass, to wood and wood composite tiles and pieces composed of recycled wood, polymers and other components. Only the imagination, budget, and information sources available to the builder and designer limit the options.

Carpeting is a typical choice of floor covering because of its insulating nature and ability to lower the impact of hard flooring compounded by the variety of colors and textures available to the public. There are only a few options currently available in recycled carpets. This is unfortunate since, according to the U.S. Environmental Protection Agency, in 1993 around two million tons of used carpets and rugs were generated in the United States. Although carpet recycling is not a widespread practice, there are a few options available to a builder when choosing a carpet to install or replacing an existing carpet.

When removing a carpet for replacement, a contractor should consider alternatives to disposal, such as donating the carpet to an organization such as Habitat for Humanity.

Habitat for Humanity accepts carpet that is in good shape in minimum quantities of around 800 square feet. Phone numbers for Habitat for Humanity can be obtained in the local phone directory or by calling the CIWMB Recycling Hotline at (800) 553-2962 and asking for *Construction and Demolition—Recyclers, Processors, and Receivers* (Publication #431-96-017).

Other options to installing new carpet and disposing of the old carpet include recycling the removed carpet, refurbishing the existing carpet, or leasing carpet rather than purchasing it. Information can be obtained on these options by getting the CIWMB fact sheet on carpets by contacting the Hotline number listed in the previous paragraph and asking for the construction and demolition fact sheet, *Carpet* (Publication # 443-96-027).

Insulation

Choosing the type and amount of insulation to use will be dictated by the price of materials, R value, installation requirements, available airspace, building codes, and depending on the application - its resistance to the elements and moisture. Therefore, contractors should be aware of the various materials available for insulating purposes. Among others, the most widely used building insulation types can include polystyrene materials, rock wool, and fiberglass products. There are also insulating materials made from cellulose derived from recycled newspapers and insulation made from recycled glass. The R values and costs will vary and some research may be necessary on the part of the builder in order to make an educated choice on insulation products. If the builder is interested in choosing an insulating product with a recycled content, the Harris Directory is an excellent resource for recycled products of all kinds, including building products. The IWMB also has an on-line database of recycled-content products, including construction materials. This information is available through the IWMB's home page at http://www.ciwmb.ca.gov/rcp.

The information on the database may be printed, but not downloaded. For any questions or comments on the database, contact Ron Weber at (916) 341-6300.

Roofing Products

There is a wide variety of roofing materials available on the market that range from traditional asphalt based materials to various composite, cementitious, and metal content roofing materials. Each has benefits and drawbacks associated with both the roofing material and its installation. For instance, concrete based shingles can have a significant recycled content, can be recycled, and last a very long time. They also can be manufactured to appear like traditional wood or clay shingles. However, additional structural requirements may be needed to withstand the additional weight associated with the concrete. A builder interested in preventing waste on the job site should be aware of the variety of accepted roofing materials available on the market, and make an appropriate informed decision. Information on roofing products is further discussed in Chapter 2.

Masonry/Pavement

Another area of construction that offers a variety of choices of building materials is in the use of masonry and pavement of a structure and surrounding property. Many building projects have incorporated fly ash into the concrete mix in lieu of Portland cement. This

increases the overall strength and workability of the concrete without increasing the price. As a bonus, a waste material is used to produce a beneficial product.

When specifying materials for the foundation of buildings, there are many variations and alternatives to the conventional concrete slabs and walls. The alternatives include expanded polystyrene foam blocks and formwork, interlocking forms and blocks, sandwiched foam and concrete forms and blocks, and various cellular and aerated blocks. These systems are generally well understood, they meet building codes, and use far less concrete because of the fillers in the system. These building materials also generally have a high R-value, allow modular construction, and often the scraps can be recycled.

When paving driveways or parking lots, asphalt cement is the typical choice of designers and builders. When using asphalt as a pavement, feedstocks using recycled materials should be considered. These include asphalt with recycled asphalt, crumb rubber and asphalt shingles in the mix. Driveways have also been made of porous tiles made from recycled tires.

These tiles allow rainwater to drain through the driveway while the rubberized construction results in a softer medium that can breakup ice in colder climates. For parking lots of larger commercial and industrial structure, parking stops made from recycled plastics and other materials should be considered in lieu of traditional concrete stops. There is additional discussion of use and reuse options available for asphalt and concrete contained in Chapter 2.

8.6 Reuse of Materials and Reduction of Waste

In most cases, large-scale reuse of building materials is not considered mainstream or practical on the conventional construction site. However, reuse opportunities will present themselves in particular instances and phases of a project. Materials that can be reused, to minimize the amount of waste going to disposal, include framing, forms, masonry, drywall, flooring, insulation, and damaged finished products such as cabinets and doors. It is therefore up to the builder and subcontractors to recognize these opportunities and take advantage of them whenever possible.

Forms

One instance where reuse of an entire structural element is possible while meeting codes (verify this locally) is through the reuse of plywood forms. Typical construction practices use plywood forms when pouring concrete walls or foundations. It has been documented where the plywood used in these forms can be reused for roofing sheets. This requires some additional labor and time to remove the forms carefully, as not to damage them, and clean them. As these sheets are covered with tar paper and shingles, their appearance is of little consequence. Another option is to reuse the forms as often as the material allows throughout the construction site. Again, additional care is needed in removal to maximize the reuse of the forms. Similar applications for used plywood may also be discovered with a little forethought.

Framing and Blocking

Although it is a common practice at construction sites to use shorter dimension lumber pieces when needed, it is always helpful to remind workers to use cut-offs for blocking,

shims, and bracing whenever possible. It is helpful to have a central, accessible location to put useful cutoffs for use by all the workers. This is discussed in a little more detail in the following section on recovery of waste.

Preplanning and good housekeeping on site will often reduce the amount of waste generated. For example, a minimum amount of material will be lost to weather damage or warping where arrangements are made for careful storage and timely deliveries.

Masonry

Broken and excess masonry and concrete is good inert fill. It can be used in the bottom of chimney foundations or under sidewalks and driveways. If space permits, excess concrete can be crushed on site and used as aggregate on another part of the site or on another construction job. There is very little justification to haul off concrete waste and pay a tipping fee to dispose of it in a landfill.

Walling and Insulation

Because of increasingly stringent building codes, more and higher performance insulation is needed in the wall space and attics of new construction. Increased use of any material in construction will generally translate into increased waste generation. Although insulation scraps do not weigh much, the low density of the material reduces the amount of space available in a dumpster. An alternative to disposal of insulation scraps is to add it to attic space to increase the thermal efficiency of the structure while reducing the amount of waste on the job site. Pieces of insulation can also be added to voids in interior walls adding both thermal efficiency and sound deadening between rooms.

Drywall can represent a significant part of the waste generated at a construction site. Construction associations have estimated that approximately one pound of drywall waste is generated for every square foot of new construction. This will vary on the size and type of construction. The Canadian Home Builder's Association and NAHB have both recommended placing drywall scraps into the walls of homes to add thermal mass to the interior, noninsulated walls. Care should be taken that the pieces are secured to prevent rattling and that wall cavities are used with no wiring or plumbing in them. Furthermore, the use of wall cavities in closets, basements, and garages would be less likely to interfere with potential future renovations.

Flooring

Linoleum and carpet scraps can add up to a significant amount of waste on large structures or multi-unit construction sites. Unfortunately, there are limited reuse and recycling options available for these types of materials as mentioned in the previous section. However, if scraps are large enough, a contractor can role up the scrap and leave it for the homeowner or occupant to use for repairs in the future.

Other Elements

Cosmetically damaged finished products can be donated to nonprofit organizations. This donation can often be used as a tax benefit of a charitable donation. Check the local telephone directory or contact the CIWMB hotline for listings.

Utility scraps can be used on site or brought to another site for use. Copper tubing scraps can be used as shock absorbers to prevent water hammers ahead of faucets rather than

cutting a piece from new stock. Ducting scraps can be used when odd lengths or sizes are needed or used on another site. When pieces are too small to use, they should be collected and combined with scraps from other jobs as metal scraps have a relatively high recycle value. Granted, scraps of copper tubing and metal do not represent a great deal of material, but over the long term, it could accumulate to a reasonable amount. Furthermore, the mindset of waste prevention applied to various jobs will carry over to all aspects of the project and combine to yield significant savings in both materials and disposal costs

Although this section primarily addresses the structural elements of a building, the builder should not forget to apply reuse and waste prevention techniques towards the landscaping aspects of a construction site. Rocks and boulders unearthed during the land clearing activities can be incorporated into the landscaping of the area. Removed topsoil can be set aside for fill and landscaping later in the project. Even though rocks and soil are inert fill and can usually be disposed at reduced costs, it is far cheaper to reuse these materials on site.

8.7 Recovery of Waste

Regardless of how successful a builder is at reducing construction waste, eventually some waste will be generated. When this occurs, it is generally cost effective for the contractor to separate the materials for recycling. This can be achieved with separate bins for the different materials that are generated. As each bin is filled during that corresponding stage of construction, the local recycler or processor can empty it. With several easy access bins, source separation is far more likely than with a few large centralized disposal rolloffs.

Waste Audits

A contractor who truly wants to reduce the amount of waste generated at the construction site should have a fairly good understanding of the types and amounts of waste generated and phases of the project that the majority of that waste is generated. A contractor or builder that has been working to minimize waste during construction will probably know most of these issues. However, if a builder were just starting to consider minimizing waste on the job site, a waste audit would probably be helpful in maximizing use of resources and recovery of cost saving materials. An audit does not have to involve extensive resources and time consuming studies. It could be as simple as documenting, in a log at a central collection place, the items that are discarded, when they are discarded, and by whom. This will enable the contractor to maximize efforts in the areas that will show the greatest results. Knowing how much of a material is being discarded and during which phase of the project allows the contractor to plan ahead and use local recyclers, if available, based on the expected tonnage.

Reuse Area

Another option to minimize disposal is to fence off an area of the site for discards that is accessible during working hours. This eliminates the "out of sight, out of mind" syndrome that occurs with large roll off bins with 6-foot-high sides. If a worker tosses a piece of lumber in the bin and later thinks that it may be useful for blocking, it is far less likely that he will climb into the bin to retrieve it. Furthermore, with a fenced area others can inspect the pile for useful building elements. A centralized cutting area also

maximizes reuse and recycling of the cutoffs. Workers need to be educated on what recycling efforts are expected of them.

Wood Waste

Most construction occurs in phases, which increases the likelihood of recycling the materials generated because of the ease in separating these materials. The untreated wood generated at construction sites, which is the largest component of the construction waste stream, is homogeneous and of a high quality. As such, it is coveted by wood waste processors. It can be used for fuel in biomass plants or be used as a feedstock for engineered wood products such as fiberboard and particleboard. Since separated construction wood waste has more markets available to it than mixed urban wood waste, it will still be desirable even when the wood waste markets are saturated.

Processors of wood waste can be located through the local phone directory, or a list of over 100 statewide processors can be obtained by contacting the California Integrated Waste Management Board hotline at (800) 553-2962. (Ask for *C&D Recyclers—Processors & Receivers*, Pub. #431-96-017). The SRCRD also has a resource guide: *Wood You Recycle?* Use of a wood waste processor may reduce disposal fees. Some wood waste processors offer drop-off or pickup service of wood waste and should be contacted for information. If there is no local processor interested in small scraps that cannot be used on site, consider offering them to the public for kindling. This will reduce your final disposal volume and cost. Be careful, however. Burning green wood can be hazardous to your health.

Drywall Waste

The second largest fraction of the construction waste stream, drywall, is less marketable than clean wood waste. However, drywall can be recycled into new drywall, as well as used as an agricultural amendment. To reduce disposal costs of unused drywall, contractors should investigate recycling options prior to commencement of the job. A list of drywall recyclers is available through the CIWMB hotline listed earlier. (Ask for the *Drywall Recycling* fact sheet, Publication #431-95-069.) On site recycling of drywall as a soil amendment should also be investigated for an option on larger jobs.

Other Materials

The other major components of the construction waste stream, such as cardboard, metals, and plastic, have fairly well established markets throughout California. As long as these materials are separated, nominal incomes can be generated for these materials from recyclers to compound the avoided disposal costs. If collection and transportation of recyclables, such as cardboard and pallets from packaging, is a concern, the contractor may want to consider requesting the suppliers or subcontractors to take back the packaging.

If the suppliers deal in large volumes, they may already be recycling the material at a central location and the addition of one more load may be welcome. If large suppliers are not taking back packaging, contractors should suggest it. In a competitive marketplace, the supplier that offers this service may be the one that gets the contracts. Additionally, ordering materials in large bulk will also reduce the amount of packaging left at the end of the project.

If there are limited local markets for recycling and processing recovered materials, builders should investigate the locations of local salvage and reuse facilities, such as Habitat for Humanity. These operations may accept usable building materials, which could result in a tax advantage to the donor. It is also worth the time to ask the supplier of building materials if they take back scraps, or if they are aware of recyclers or processors in the area since they may be dealing with the recyclers for their own production or warehouse scraps.

8.8 Advertise Efforts

Regardless of the amount of money, time, and/or materials saved, a contractor should always promote any green or resourceful efforts that were undertaken during a job. This will show the community that thought and care were taken in the choice of materials used and the techniques employed in constructing the buildings under consideration. If certain materials were used that resulted in higher costs, attention should also be brought on these efforts. Today's consumers are far more aware of environmental implication and many are willing to pay marginally more for materials and structures that are perceived to be friendlier to the environment.

Additionally, individual health is a strong concern for today's consumers. If materials such as low-VOC paints, adhesives, and materials are used that would result in healthier living environments at a marginally higher cost, most consumers would be willing to accept that. However, they must be made to understand the efforts employed by the contractor to meet these more stringent and environmentally friendly techniques. In general, from a waste generation standpoint, any material or structure that is designed to last longer, be designed as a modular component and can be reused, is recyclable, or contains a significant amount of recycled material is beneficial. In the long run these types of materials, components, and structures will ultimately reduce the amount of waste going to disposal. The key behind all their uses however, is planning.

Chapter 9:
Managing Job-Site Waste

Many types of construction and demolition waste can be reused or recycled. Estimates generated from case studies indicate that over 80 percent of this type of waste potentially is reusable or recyclable, depending upon the type of project and local markets for recycled materials.

There are three categories of materials generated during a construction project, depending on the type of projects: new construction waste, salvageable materials and demolition waste. See Table A for a description of wastes typically generated during a new construction project.

9.1 Opportunities for Salvage

In the past, scavengers salvaged at the local dump for a profit. This practice all but ended with the development of large landfills. Interest in reuse and salvage has recently increased because of increasing tipping fees, limited landfill space and the depletion of traditional building materials. Key considerations should be given to reusing existing buildings when possible, identifying salvage opportunities, developing salvage contracts, scheduling time for salvage and looking for additional salvage opportunities.

Salvage waste.

During a demolition project, there are many opportunities to look for salvageable materials and components before the "wrecking crew" arrives. But keep in mind that salvage opportunities are only as good as the markets for resale or reuse of the materials. This makes it critical to survey the building with someone experienced in local salvage markets. In some areas these people may be located in the Yellow Pages under "Demolition Contractors," "Salvage" or "Building Materials—Used." Placing a classified newspaper ad in the "building materials" section may attract other groups interested in salvaging. Below are a few key steps to take before starting a salvage or demolition project.

Develop salvage contracts.

Salvage operations are different from other construction or demolition activities. Salvagers generally pay for salvaged items or provide labor to remove them in exchange for the items. A separate agreement may need to be developed with the salvagers. Include appropriate insurance and licensing requirements in these agreements. See the “Sample Salvage Agreement” on page 135.

Schedule time for salvage.

The prime opportunity to maximize salvage of materials is in the planning before construction begins. Contracts must allow for salvage operations once the construction or demolition contract has been signed. Scheduling time for salvage becomes much more difficult after project permits have been issued.

Look for additional salvage opportunities.

As a project progresses, additional salvageable items may be discovered. It is critical to act quickly since resulting construction delays can easily overshadow the value of the salvaged materials. Contractors may need to adjust their work areas to accommodate salvagers. In some cases, it may be most efficient for the general contractor to remove materials and set them aside for the salvager to pick up, reducing the contractor's liability.

9.2 Opportunities for Construction and Demolition Site Recycling

Creating and carrying out a waste management plan requires early planning and a commitment to follow through. "Waste management" includes many steps, including writing waste management specifications, determining the economic feasibility of recycling, and monitoring progress. Some suggested steps or considerations are listed below. The order of these steps may vary. Various professionals, including specification writers and/or contractors, may perform them.

Solid waste management is sometimes called "solid resources" management, as these "wastes" are actually resources for new products.

Step 1—Plan the project.

Each construction project and job site presents a different set of challenges. Develop a "solid resources management plan" for each project. An effective plan outlines job site waste reduction goals, identifies targeted materials, describes specific waste reduction actions to be implemented on a project, and identifies reuse, recycling, or disposal facilities to which materials will be taken. This is an extremely important part of the materials management plan. The plan should be outlined in the bid and contract specifications, as described in Step 2.

Step 2—Incorporate solid resources management in specifications.

One of the most important tools for assuring that contractors implement the goals and objectives of your waste management plan is to put it right up front in the bid package. The bid specification should outline the procedures and specifications required for salvage, reuse or recycling. There are two excellent sources of model language for waste management that specifiers can use when writing contracts, as described below:

1. Solid resources management specifications from the City of Los Angeles describe the waste management plan required by a project, including recycling methods, definitions and reporting forms. A copy is located in Appendix C.

2. *WasteSpec—Model Specifications for Construction Waste Reduction, Reuse, and Recycling* is model specification language for job site waste management, written in the 16-division format of Construction Specifications Institute (CSI). WasteSpec was prepared by the nonprofit organization Triangle J Council of Governments, P.O. Box

12276, Research Triangle Park, North Carolina, 27709, (919) 549-0551. It is sold at cost for $28, which includes a notebook and computer disk. The electronic file allows the user to copy and paste text into a contract. See their Web page at http://www.state.nc.us/TJCOG/solidwst.htm#wastdocs. Division 6, Wood and Plastics, is reproduced in Appendix B as a sample.

Step 3—Coordinate recycling by project phase.

Different materials are generated at different phases of the project. Use your construction schedule to coordinate recycling by project phase and by trade. A fast-paced job could decrease the amount of materials recycled, since many activities will be happening simultaneously and site recovery efforts may be placed on the back burner. Careful planning can help minimize this problem. A slow job could decrease the rate of materials collection below that which is cost-effective. This problem can be minimized if there is space to store the materials on site.

Step 4—Estimate amount of waste expected.

Estimate the types and quantities of waste that are expected from the project. See "Types of Materials Typically Recovered Successfully" on page 137 for a list of possible materials.

Step 5—Determine what is cost-effective to recycle.

Select several material types that are typically recycled, such as wood, cardboard, concrete, and metals. Though labor costs are often higher for recycling, the lower tipping fees at recycling facilities can often more than compensate. For example, concrete and asphalt recycling may cost $5 per ton, versus $35 per ton for landfilling. If the concrete recycler's location is not too much farther than the landfill, the project could save a significant amount of money. To determine the cost-effectiveness of recycling, calculate each material's cost per ton for recycling versus landfilling by estimating labor costs, transportation costs, and tipping fees. The "Economics Worksheet" in Appendix D is a convenient tool for this calculation. (Note: This worksheet is a draft and may require revisions over time. Please contact IWMB staff to suggest improvements, and/or obtain an updated version.)

Step 6—Consider hiring a recycling service.

Consider working with either (1) your hauler, (2) a professional full-service recycling contractor, or (3) a waste management consultant to help you identify what types of materials can be cost-effectively recycled from your project. See "Sample Provisions for a Full-Service Recycling Agreement With a Waste Hauler," page 138, for information on contract language and sample provisions to use when hiring a full-service recycling contractor or hauler.

Step 7—Consider space constraints.

Most jobs have moderate to severe space constraints. Develop a plan to "stage" the job site for the most effective method for storing and collecting both recyclables and waste, and position recycling bins at the most convenient location for the various trades to use. See "Tips for Recycling Bin Use," page 139.

Step 8—Work with haulers to plan collection.

Work with haulers to develop a plan for collecting materials. Identify "peak generation" times early in the process. Determine what types of containers are available to collect the materials. Different containers may be needed at different phases of the project in coordination with the various trades. For example, a large 40-yard (cubic yard) dumpster may be needed for wood, but only a 20-yard dumpster is needed for steel studs.

Step 9—Get “buy in” up front.

For the program to be successful, it is important to establish a high level of commitment from the contractor, subcontractors, cleanup personnel, and waste haulers up front. Some contractors have waste management training as part of their prebid, preconstruction, and safety training meetings. Hold your subcontractors accountable for implementing the solid resources management plan outlined in the bid package. Provide a package of information on the recycling program to each new subcontractor when they come on board.

Step 10—Expect a learning curve.

When dealing with contractors and subcontractors, who are inexperienced with waste reduction and recycling practices, expect some errors and inefficiencies because of the learning curve. Set recycling goals that are realistic for personnel who are learning new skills. It's better for morale to exceed the goals than to miss them.

Step 11—Reward participation.

It's important that field personnel know how their efforts are paying off. Communicate the success of the reuse/recycling program with subcontractors. One idea would be to put up a status graph to show on a monthly or weekly basis how much waste has been diverted from the landfill, and how much savings have accrued to the project because of their waste management efforts. Another idea would be to provide incentives such as t-shirts or mugs, when goals are met. Also, encourage everyone's ideas and suggestions.

Step 12—Monitor and track for quality control.

One contaminated box can really add costs to a successful recycling program. It is helpful to track on a monthly basis the type, amount and cost of all materials being recycled or landfilled from the job site. A simple tracking form is provided in the "Solid Resources Management" specification in Appendix C (Attachment B), called "Summary of Solid Waste Disposal and Diversion." This form can be used to develop a spreadsheet that gives you an up-to-date report that will identify how many clean dumpsters went off site for reuse and recycling and how many contaminated and costly dumpsters were taken to the landfill.

Step 13—Promote your success.

Put out press releases on the success of your project. Clearly identify the job site with signs that tell the public you are reducing, reusing, and recycling your waste. Let the public know you are committed to being resource efficient.

Sample Salvage Agreement

The purpose of this Memorandum of Understanding is to define the limits and responsibilities between _____ and _____, for the removal of salvageable building materials from _____.

(Demolition Contractor/Subcontractor)_____Responsibilities:

1. Show proof of Business License to perform the work.

2. Show proof of general liability insurance and worker's compensation insurance.

3. Remove items to be salvaged (listed in Table 1) from their installed locations; remove them from the building. Any additions or deletions from the list must be approved in writing by _____. No unlisted materials may be taken.

4. Transport the items from the site within 24 hours of removal.

5. Provide all labor, tools, equipment, and consumable materials required to remove the listed items at no cost to _____.

6. Coordinate with_____ the hour in which listed items will be removed, access to the building will be necessary, and any other requirements related to the salvage activities at least two days in advance.

7. Provide payment to _____ for the items removed, based on the prices shown in Table 1.

8. Leave all utilities, work area and remaining item in a safe and secure condition.

9. Attempt to resell or otherwise promote reuse of the removed items by the building industry or public.

10. Purchase and maintain, at its own expense, general liability insurance for all periods relevant to the salvage performed at the site, for its employees and agents.

11. Comply with _____ Regulations for all employees who work in the State of _____ for more than 10 days. Provide _____ with certification of worker's compensation insurance including employer's liability.

12a. Ownership of all materials removed from the building by _____shall pass to _____ upon removal from the site. All materials removed are accepted by _____ AS IS, WITH NO WARRANTIES.

12b. All work shall be completed within five (5) calendar days of execution of the Memorandum of Understanding.

13. Indemnification: _____ agrees to indemnify, hold harmless and defend the _____, its elected officials, officers, directors, agents, and employees from and against any and all liabilities, damages, actions, costs, losses, claims, and expenses (including attorney fees) on account of injury, death or damage to or loss of negligence, fault or violation of law or ordinance by _____ or its employees, agents, or subcontractors. Such indemnification by _____ shall apply unless such damage or injury results from the sole negligence or willful misconduct or _____.

(Owner/Contractor)_____ Responsibilities:

1. Turn off potable water supply to the building.
2. Provide access to the building during the hours of work.
3. Verify the quantities of materials removed.

_____ _____

Signature Signature

Name:

Title:

Date:

Types of Materials Typically Recovered Successfully
(Sorted by Construction Phase)

New Construction Site	Demo/Remodel Project Site
• Asphalt • Brick and aggregate material • Land-clearing debris	• Asphalt • Concrete • Landclearing debris • Brick • Rebar • Scrap metal
Construction Phase • Cardboard • Ferrous metal • Nonferrous metal • Wood • Form wood • Pallet • Plastics	***Construction Phase*** • Cardboard • Electrical—wire and metal • Framing • Insulation • Plumbing fixtures and piping • Formed wood • Pallet
Finishing Phase • Cardboard • Carpet and pad • Drywall • Pallets • Plastic/films	***Finishing Phase*** • Appliances • Cabinets • Cardboard • Doors • Heating ducts • Millwork • Siding • Windows—glass and frames • Wood flooring
Site Operation • Glass • Aluminum beverage cans • Cardboard • Office paper • Plastic	
Note: The type and volume of recyclable materials will vary during the life of the project.	

Sample Provisions for a Full-Service Recycling Agreement With a Waste Hauler

- Provision for performing labor related to the resort of missorted materials. Fee for this service should be called out in the agreement.
- Requirements for the timely supply of adequate equipment, including containers and appropriate (clear and understandable) signage.
- Requirement to level off and tarp loads to maximize efficient and safe transport.
- Requirement to use only acceptable (permitted and/or legal) receiving sites for the materials.
- Site protocol for recycling activity on the site, such as relocation of the bins or other recycling equipment.
- Provision for allocating responsibility for damage because of normal wear and tear or gross negligence of field personnel.
- A list of materials targeted for recycling with clear definitions of what types and conditions of materials are acceptable.
- Requirement to document recycling including the provisions of regular and meaningful data to allow easy tracking of results.
- Requirement to perform all labor related to recycling, including preparation of leads for pick-up, location of recycling bins, and pickup of materials. Fee for this labor can be called out, or included in cost per cubic yard or ton of material recycled.
- A rate schedule for recycling materials by cubic yard or ton.
- Establish response time to calls for pickup or other services.
- Provision for on-site training and field orientation (frequency and nature of these training sessions should be outlined).

Tips for Recycling Bin Use

1. Bins can be lifted by crane to upper decks, for multistory buildings.
2. Set up more, smaller, or mobile bins as necessary. Small surplus "cages" can be used as intermediate bins. Bins can have back wheels making them easier to move around the site.
3. Use bins with divided sections for materials, if appropriate (i.e., different materials may not be serviced by the same vendor).
4. Use removable (but sturdy) signs for bins so bins can be quickly allocated to different materials, if necessary.
5. Use clear and easy-to-read signs on bins. Make bilingual or pictorial, if necessary.
6. Avoid damage to recycling bins by treating them as you would any other equipment. Damaged containers cost money and time.
7. Avoid contamination of recyclables by making sure there's always a convenient trash option along with recycling bins. Consider requiring violators to pull contaminants out. They will likely only do it once.
8. Avoid unnecessary pickups (and charges) by making sure containers are full before site crews start using empty or half-full ones. Evaluate how many pickups per week/month are needed.
9. Avoid extra steps. Make sure containers are as close as possible to where the materials are being generated. Advise crew to notify forklift operator or recycling contractor to move bins if they are not convenient.
10. Avoid moving materials unnecessarily. Advise crews to put targeted recyclables directly into a final bin or other container whenever possible instead of moving them twice.

Bibliography

1. Correspondence between Deborah Weintraub, AIA, Co-Chair for the AIA/LA Committee on the Environment, and Dennis Bottum, Member of the AIA/LA Committee on the Environment, to William Holland, Los Angeles City Architect, 9/24/96.

2. *GreenSpec: Guideline Specifications for Environmentally Considered Building Materials Construction Methods*, Alameda County Recycling Board.

3. Roodman, David and Lenssen, Nicholas, *How Ecology and Health Concerns are Transforming Construction*, Worldwatch Institute, March 1995,. Specific quotations of resource statistics are found in Chapter 1 under "Environmental Savings."

Glossary

Composting
The controlled biological decomposition of organic materials such as leaves, grass clippings, brush, and food waste into a soil amendment.

Construction and Demolition Waste
Includes all nonhazardous solid resources resulting from construction, remodeling, alterations, repair, and demolition operations.

Disposal
Acceptance of solid wastes at a legally operating facility for the purpose of landfilling. Includes Class III landfills and inert fills.

Grasscycling
The natural process of recycling grass by leaving clippings on the lawn while mowing.

Inert Backfill Site
A location, other than an inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring, or other soil engineering operation.

Inert Fill SIte
A facility that can legally accept inert waste, such as asphalt and concrete, exclusively for the purpose of disposal.

Inert Solids/Inert Waste
Nonliquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water quality objectives established by a regional Water Board pursuant to Division 7 (Section 13000 et seq.) of the California Water Code and does not contain significant quantities of decomposable solid resources.

Mixed Debris
Loads that include commingled recyclable and nonrecyclable materials generated at a construction/demolition site.

Mixed Debris Recycling Facility
A solid resource processing facility that accepts loads of commingled construction and demolition debris for the purpose of recovering reusable and recyclable materials and disposing of the nonrecyclable residual materials.

Off-Site Recycling
Materials hauled to a location and used in an altered form in the manufacture of a new product.

On-Site Recycling
Materials that are sorted and processed for use in an altered form at the site (e.g., concrete is crushed for use as base for a parking lot on the site).

Permitted Waste Hauler
A company that possesses a valid and current permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.

Pollution Prevention
Preventing all forms of pollution, including toxics and other pollutants emitted into air, water, and land. Waste prevention is a subset of pollution prevention.

Postconsumer Material
Material that has been used by consumers, has undergone recycling, and has been incorporated into a new product (such as recycled paper used to make cardboard). Information on the percentage of postconsumer content can usually be found on product packaging.

Postindustrial and Postcommercial Material
Generally the same as preconsumer material.

Preconsumer Material
Material or byproducts generated after the manufacture of a product is completed but before the product reaches the end-use consumer. Preconsumer material does not include mill and manufacturing trim, scrap, or broke which is generated at a manufacturing site and commonly reused on site in the same or another manufacturing process.

Examples:

- Urban wood
- Wood waste/debris
- Nonyard wood
- Lumber waste
- C&D wood waste/debris
- Agriculture and forest waste

Precycling
Making purchasing decisions that will reduce waste such as buying goods with less packaging (e.g., goods in bulk or concentrated form), choosing products that will last longer, and avoiding single-use or disposable products.

Recovered Material
Fragments of products or finished products of a manufacturing process which has converted a resource into a commodity of real economic value, and includes preconsumer and postconsumer material, but does not include excess resources of the manufacturing process.

Note 1: Examples of "excess resources" include:

- Paper—Fibrous wood discards generated during the manufacturing process, fibers recovered from waste water, mill broke, trimming of paper machine rolls, manufacturer's obsolete inventory, wood slabs, chips, sawdust, or other wood residue.
- Glass—Scrap (or cullet) generated within the plant.

- Plastic and rubber—"Sprues" and "runners" from the molding processes, rework, internally generated regrind, or "off-spec" resin from producers.
- Steel and aluminum—"Runaround" scrap within the mill.

Note 2: The "recovered material" definition is based on the State of California's definition for "secondary material." This is a stricter definition than the federal definition for "recovered material." Use of this State-based version will also assure compliance with the federal requirement.

Note 3: The name for the "recovered material" category varies widely in local, State and federal laws. "Secondary discards," "secondary materials," and "secondary waste" are corresponding terms.

Recycled Material

A material that has been processed, treated, or reconstituted so that it can be used again.

Note: "Preconsumer material" refers to scraps produced in the process of making a product before it reaches its intended end user. Examples include printer's waste, unsold magazines, and scraps left over from processes that mold plastic into bottles or cut metal sheets into cans. "Postconsumer material" refers to discards after a product reaches its end user. Examples include brochures used by a consumer, packaging received at an industrial site, magazines from someone's home or office, and used plastic bottles or aluminum cans. Preconsumer and postconsumer materials are mutually exclusive. They are both included within the "recovered material" category.

Recycled Product

A product that contains the highest amount of postconsumer material practicable or, when postconsumer material is impracticable for a specific type of product, contains substantial amounts of recovered material.

A product that meets the recycled-content policy objectives for postconsumer, preconsumer, and recovered material.

Note: This definition relies on an explicit official recycled-content product purchasing policy. An official policy that sets parameters is more straightforward than establishing policy through definitions.

Recycling

The process of collecting, sorting, cleansing, treating, and reconstituting materials that would otherwise become solid waste, and returning them to the economic mainstream in the form of raw material for new, reused, or reconstituted products that meet the quality standards necessary to be used in the marketplace. Recycling does not include burning, incinerating, or thermally destroying solid waste.

Recycling Facility

An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of a new product. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit from the CIWMB or be regulated by the LEA.

Remanufactured Product
Any product diverted from the supply of discarded materials by refurbishing and marketing said product without substantial change to its original form.

Reuse
The recovery or reapplication of a package or product for uses similar or identical to its originally intended application, without manufacturing or preparation processes that significantly alter the original package or product. Refers also to salvage, in which materials are recovered for reuse and sold or donated to a third party.

Reused Product
Any product designed to be used many times for the same or other purposes without additional processing, except for specific requirements such as cleaning, painting, or minor repairs.

Solid Waste
Material that has been designated as nonrecyclable and is discarded for the purpose of disposal.

Source Reduction
See Waste Prevention.

Source-Reduced Product
A product that results in a net reduction in the generation of waste, and includes durable, reusable, and remanufactured products; products with no, or reduced, toxic constituents; and products marketed with no, or reduced, packaging.

Source-Separated Materials
Materials that are sorted at the site of generation by individual material type for the purpose of reuse or recycling, i.e., loads of concrete that are source separated for delivery to a base course recycling facility.

Sustainable Design
Providing for the needs of the present without detracting from the ability to fulfill the needs of the future.

Total Recycled Content
The total amount of recycled material (pre- and postconsumer) incorporated into a new product. Information on percentages of total recycled content can usually be found on product packaging.

Transfer Station
A facility that can legally accept solid wastes for the purpose of temporarily storing the materials for reloading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for reuse or recycling. Transfer stations must be permitted by the CIWMB and regulated by the LEA.

Vermicomposting
See Worm Composting.

Waste Diversion
As defined in California statute, is the combined effort of waste prevention, reuse, and recycling practices.

Waste Management Hierarchy
The order of preferences for solid waste management practices that prioritizes reduction, then reuse, and finally recycling.

Waste Minimization
Refers to eliminating, reducing, and recycling of hazardous waste.

Waste Prevention
Preventing waste before it is created. Any action undertaken by an individual or organization to eliminate or reduce the amount or toxicity of materials before they enter the municipal solid waste stream. This action is intended to conserve resources, promote efficiency, and reduce pollution.

Waste Reduction
The combined efforts of waste prevention, reuse, composting, and recycling practices. (Some groups use this term synonymously with source reduction so check how it is being used to avoid confusion.)

Worm Composting
Worms feed on slowly decomposing materials (e.g., vegetable scraps) in a controlled environment to produce a nutrient-rich soil amendment.

Xeriscaping
The practice of landscaping with slow growing, drought-tolerant plants.

Appendices

Appendix A: Sample Format for Product Alternatives in the Bid Process

Specifier Note: Edit to Suit Location and Project

Part 1: General

1.1 Summary

A. Section includes: Alternate Bids to be submitted to Owner.

1. Alternate Bids shall state the net amount to be added to or deducted from the Base Bid.

Specifier Note: Coordinate With Bid Form

B. It is intended that the reference in the Bid Forms to Alternate Bids shall refer directly to this Section. Information included is provided for use of bidders in completing their Bid Proposals, and will not be repeated on the Bid Forms.

1.2 Submission Requirements

A. Extent of Alternate Bids: Bidders shall determine the full extent of Work affected by proposed Alternate.

B. Costs: Include under each Alternate Bid net amount of all changes in cost, whether additive or deductive, resulting to the work of all Sections affected by Alternate Bids.

1.3 Selection and Award of Alternates

A. Acceptance or Rejection: Alternates quoted on Bid Forms will be reviewed and accepted or rejected at the Owner's option. None, any, or all Alternates may be accepted or rejected by the Owner.

B. Accepted Alternates will be identified in the Owner-Contractor Agreement.

1.4 Schedule of Alternates

Specifier Note: Edit Below to Suit Project

A. For each Alternate product proposed, submit manufacturer's product data, and test reports with Bid.

1. Submit materials safety data sheets (MSDS) as applicable. MSDSs are not required for articles.

a. Articles: Finished products which are manufactured off-site and shipped to the project for installation while conforming to Title 29 of the Code of Federal Regulations. OSHA Hazard Communication Regulation 29CRF 1910.1200, Section (b) 5 and Section (c) are defined as articles.

2. Submit information on product contents:

a. List recycled materials by type. Provide percentage amounts.

b. List renewable resources by type. Provide percentage amounts.

c. Provide a complete chemical profile of the item; identify biocides and carcinogens listed by recognized authorities, such as the Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (IARC).

3. Submit information on manufacturer's environmental policy:

a. Environmental Statutory Compliance: Does the manufacturer meet all federal, State, and local environmental laws for air emissions, waste water treatment, and solid waste disposal/treatment? Has the manufacturer met the above criteria for five years? List these applicable standards.

b. Corporate Environmental Policy: Provide manufacturer's stated environmental policies. Provide company contact, telephone, and fax numbers for environmental information.

4. Submit information on embodied energy: Provide an embodied energy study of the proposed Alternate extending from extraction of raw materials through production, assembly, and transportation to the point of use. If this type of report is unavailable, provide an estimate for this category in terms of total number of BTU's required per pound of finished products.

5. Submit life cycle information:

a. Maintenance of materials: Describe the recommended cleaning and maintenance procedures for the proposed alternate, using products that have minimal VOC emission.

b. Reuse and Recycling: Elaborate on the practicality of possible recycling and direct use of the proposed Alternate at the time of project demolition.

Waste Disposal: Describe the recommended method(s) for proper disposal of Alternate.

B. Data submitted for Alternate Bid will be held in confidence by the Owner and the Architect when requested in cover letter submitted with Alternate Bid.

Specifier Note: Schedule of alternates includes possible options. Products and manufacturers are examples only and no warranty of suitability is given by their inclusion herein. Edit to suit project.

C. Alternates describe environmental requirements. Requirements for performance, appearance, workmanship and materials not modified under the Alternate Bids shall conform to Drawings and Specifications, except as exceeded by Code.

1. Alternate Bid Number 1: State the amount to be added to or deducted from the Base Bid if crushed miscellaneous base and processed miscellaneous base containing 100 percent postconsumer asphalt and concrete are provided for base as specified in Section 92500, Paving and Surfacing.

Add: _____ dollars, or Deduct: _____ dollars

Specifier Note:

Name of Supplier at ( ) (phone number)

Name of Supplier at ( ) (phone number)

Name of Supplier at ( ) (phone number)

2. Alternate Bid Number 2: State the amount to be added to or deducted from the Base Bid if rubber-modified asphalt containing recycled tires is provided for asphalt paving as specified in Section 02500, Paving and Surfacing.

Add: _____ dollars, or Deduct: _____ dollars

Specifier Note:

Name of Supplier at ( ) (phone number)

Name of Supplier at ( ) (phone number)

Name of Supplier at ( ) (phone number)

3. Alternate Bid Number 3: State the amount to be added to or deducted from the Base Bid if gypsum board scraps are salvaged during construction, crushed, and used as soil amendment (30-40 percent to compost) in lieu of calcium sulfate as specified in Section 02900, Landscaping.

Add: _____ dollars, or Deduct: _____ dollars

Specifier Note:

Name of Supplier at ( ) (phone number)

Name of Supplier at ( ) (phone number)

Name of Supplier at ( ) (phone number)

4. Alternate Bid Number 4: State the amount to be added to or deducted from the Base Bid if plastic car stops containing 100 percent postconsumer recycled plastic are provided in lieu of concrete car stops as specified in Section 02800, Site Improvements.

Add: _____ dollars, or Deduct: _____ dollars

Specifier Note:

Name of Supplier at ( ) (phone number)

Name of Supplier at ( ) (phone number)

Name of Supplier at ( ) (phone number)

5. Alternate Bid Number 5: State the amount to be added to or deducted from the Base Bid if gypsum board scraps are salvaged during construction, crushed, and used as soil amendment (30-40 percent to compost) in lieu of calcium sulfate as specified in Section 02900, Landscaping.

Add: _____ dollars, or Deduct: _____ dollars

Specifier Note:

Name of Supplier at ( ) (phone number)

Name of Supplier at ( ) (phone number)

Name of Supplier at ( ) (phone number)

6. Alternate Bid Number 6: State the amount to be added to or deducted from the Base Bid if panels containing 100 percent postconsumer recycled paper fiber are provided in lieu of plywood sheathing as specified in Section 06100, Rough Carpentry.

Add: _____ dollars, or Deduct: _____ dollars

Specifier Note:

Name of Supplier at ( ) (phone number)

Name of Supplier at ( ) (phone number)

Name of Supplier at ( ) (phone number)

Part 2 Products

Not used

Part 3 Execution

Not used

Appendix B: Sample Model Specification Language for Job-Site Waste Management

(Sample Specification Reprinted With Permission)

Triangle J Council of Governments *WasteSpec*[1]
Division 6: Wood and Plastics

Refer to the following related specification documents and sections for technical support, procedures, and coordination when using this *WasteSpec* division:

00000 Documents
Div 1 General Requirements
01010 Summary of the Work
01094 Definitions
01505 Construction Waste Management

Significant factors in the generation of waste in this division include wood rejects and off-cuts, corrugated cardboard, packing materials, field conditions, temporary bracing, protection, plastics, metals, and estimating errors.

This division has very good potential for the incorporation of products and materials with recycled content. Over one hundred products are available.

Under the following or similar headings, insert applicable statements.

Part 1 General

Related Sections
A. Section 01500 Construction Facilities

B. Section 01505 Construction Waste Management

Part 2 Products

Environmental Considerations
[This is an appropriate location for additional language pertaining to environmental issues beyond the scope of this *WasteSpec*, such as the following provisions.]

A. Where hardwoods or tropical or endangered woods specified, only those with written certification of sourcing from sustainably managed forests will be accepted. Acceptable certifiers are: [Edit to suit project.]

Part 3 Execution

Waste Management
[Corrugated cardboard is one of the largest sources of construction waste. Check your specific project location for recycling options and regulations.]

A. Separate corrugated cardboard in accordance with the Waste Management Plan and place in designated areas for recycling.

---

[1] *WasteSpec: Model Specifications for Construction Waste Reduction, Reuse, and Recycling,* Triangle J Council of Governments.

[Wood is one of the largest sources of construction waste. Check your specific project location for recycling options, markets, and regulations.]

B. Do not burn scrap at the project site.

C. Separate wood waste in accordance with the Waste Management Plan and place in designated areas in the following categories for recycling: [Edit to suit project and location.]

1. Solid wood/ softwood/ hardwood. [Edit to suit project.]
2. Composite wood, (for example, plywood, OSB, LVL, I-Hoist, parallel strand, MDF, Particleboard). [Edit to suit project.]
3. Treated, painted, or contaminated wood.

D. Separate wood waste in accordance with Waste Management Plan and place in designated areas in the following categories for recycling: [Edit to suit project.]

1. Sheet materials larger than [2 square feet] [Specify Size]
2. Framing members larger than [24"] [Specify Size]
3. Multiple off-cuts of any size larger than [12"] [Specify Size]

E. Set aside damaged wood for acceptable alternative uses, for example use as bracing, blocking, cripples, or ties.

F. Sequence work to minimize use of temporary HVAC to dry out building and control humidity.

G. Use the least toxic sealant, adhesives, sealers, and finishes necessary to comply with the requirements of this section.

Specific Sections

[Sections for which the same additional provisions are applicable are shown grouped. Insert the following additional provisions under Part 3: Execution, waste management, unless otherwise noted.]

06100—Rough Carpentry
06170—Prefabricated Structural Wood

Environmental Considerations

[This is an appropriate location for additional language pertaining to Environmental issues beyond the scope of this *WasteSpec*, such as the following provisions.]

A. Vertical studs to be of engineered wood, e.g., finger jointed studs.

B. Beams and girders to be of engineered wood, e.g., LVL, parallel strand.

C. Long span joists to be of engineered wood, e.g., wood I-joists, truss joists.

D. Store, protect, handle, and install prefabricated structural elements strictly in accordance with manufacturer's instructions. Keep products off the ground and protected. Pay particular attention to requirements for stacking, lifting, bracing, cutting, notching, and special fastening requirements.

E. Fold up metal banding, flatten, and place in designated area for recycling.

F. Store separated reusable wood waste convenient to cutting station and area of work.

06200—Finish Carpentry
06400—Architectural Woodwork

Shop fabricated and prefinished work, specified in Section 06400, can provide greater opportunities for waste reduction and environmental control than on-site work.

Environmental Considerations

[This is an appropriate location for additional language pertaining to environmental issues beyond the scope of this *WasteSpec*, such as the following provision]

A. All Substrate materials to be manufactured without the use of urea formaldehyde additives or permanently sealed to prevent outgassing.

B. Use nontoxic sealant, adhesives, sealers, and finishes.

06500—Structural Plastic

[This is an appropriate section to specify plastics with up to 100 percent recycled content for limited structural applications such as plastic lumber for decking. Content can include plastic, wood, and other fibers from postconsumer or postindustrial waste. Content can be targeted, e.g., milk jugs.]

A. Set aside off-cuts to be returned to manufacturer for recycling into new product. Place in designated area or provide for delivery to collection point. Use when supplier has recycling program.

06600—Plastic Fabrications

This is an appropriate section to specify plastic panels with up to 100 percent recycled content. Content can include plastic, wood, and other fibers from postconsumer or postindustrial waste. Content can be targeted, e.g., carpet.

A. Set aside off-cuts to be returned to manufacturer for recycling into new product. Place in designated area or provide for delivery to collection point. Use when supplier has recycling program.

Appendix C: Solid Resources Management Specifications

(Sample specification provided by SRCRD, edit to suit project)

Solid Resources Management

Part One—General

1.1 Description

A. This Section Includes: Procedures for ensuring optimal diversion of solid resources generated by the Work within the limits of the Construction Schedule, Contract Sum, and available materials, equipment, and products.

1. AB 939, California Integrated Waste Management Act, requires that localities throughout the state develop source reduction, reuse, recycling, and composting programs, to reduce the tonnage of solid waste disposed in landfills 50 percent by the year 2000. Construction, demolition, and land-clearing debris generated by the development are among the materials targeted by the City of Los Angeles to achieve these diversion rates.
2. CONTRACTOR shall participate in promoting efforts of the CITY to create a resource-efficient and environmentally sensitive structure and to effect optimum control of solid waste and recoverable resources generated in the Work.
3. Pursuant to the CITY'S Recycled Product Procurement Ordinance and Amendments (CF 93092) and Clinton Executive Order (Federal Acquisition, Recycling, and Waste Prevention), CONTRACTOR shall use products with postconsumer recycled content to the greatest extent feasible.

   Refer to the most recent Issue at the date of bid of *A Resource Guide to Recycled-Content Construction Products,* published by the Solid Resources Citywide Recycling Division of the Bureau of Sanitation (call 213-847-1444 to obtain a copy).

B. Related Sections: Documents affecting works of this Section include, but are not necessarily limited to, the following Contract Specifications:

1. Site Clearing in Section 02230.
2. Demolition in Section 02050.
3. Earthwork in Section 02200.

1.2 Definitions

A. Class III Landfill: A landfill that accepts nonhazardous resources such as household, commercial, and industrial waste, resulting from construction, remodeling, repair, and demolition operations. A Class III landfill must have a solid waste facilities permit from the California Integrated Waste Management Board (CIWMB) and is regulated by the Local Enforcement Agency (LEA).

B. Construction and Demolition Waste: Includes all nonhazardous solid resources resulting from construction, remodeling, alterations, repair, and demolition operations.

C. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of landfilling. Includes Class III landfills and inert fills.

D. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring, or others soils engineering operation.

E. Inert Fill: A facility that can legally accept inert waste such as asphalt and concrete exclusively for the purpose of disposal.

F. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete, that do not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional Water Board pursuant to Division 7 (Section 13000 et seq.) of the California Water Code and that do not contain significant quantities of decomposable solid resources.

G. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.

H. Mixed Debris Recycling Facility: A solid resources processing facility that accepts loads of commingled construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing the nonrecyclable residual materials.

I. Permitted Waste Hauler: A company that possesses a valid and current permit from the Los Angeles County Department of Public Health, to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal in Los Angeles County.

J. Recycling: The process of sorting, cleansing, treating and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.

1. On-Site Recycling: Materials that are sorted and processed for use in an altered form in the Work (e.g., concrete is crushed for use as base for a parking lot on the site).
2. Off-Site Recycling: Materials hauled to a location and used in an altered form in the manufacture of a new product.

K. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of a new product. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a Solid Waste Facilities permit from the CIWMB or be regulated by the LEA.

L. Reuse: Materials that are recovered for use in the same form. This includes materials that are reused on-site or off-site. Refers also to **Salvage,** in which materials are recovered for reuse and sold or donated to a third party.

M. Source-Separated Materials: Materials that are sorted at the site of generation by individual material type for the purpose of reuse or recycling, i.e., loads of concrete that are source-separated for delivery to a base course recycling facility.

N. Solid Waste: Materials that have been designated as nonrecyclable and are discarded for the purposes of disposal.

O. Transfer Station: A facility that can legally accept solid wastes for the purpose of temporarily storing the materials for reloading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for reuse or recycling. Transfer stations must be permitted by the CIWMB and regulated by the LEA.

1.3 Substitutions

Should the CONTRACTOR desire to use materials, equipment, or products which meet the requirements of these specifications but are more environmentally sensitive, the CONTRACTOR shall submit these substitutions in accordance with **SUBSTITUTIONS** and **"OR EQUAL" SUBMITTAL** of the General Requirements.

1.4 Submittals

A. Solid Resources Management Plan

1. CONTRACTOR shall conduct a site assessment and estimate the types and quantities of materials under the Work that are anticipated to be feasible for on-site processing, source separation for recycling or reuse, and shall note the procedures intended for a recycling, reuse, or salvage program. Refer to the most recent issue of the *Construction and Demolition Waste Recycling Guide,* and the *Wood You Recycle?* guide, published by the Solid Resources Citywide Recycling Division of the Bureau of Sanitation, City of Los Angeles, for a partial list of facilities that accept these materials for recycling.

2. After award of Contract and prior to the commencement of the Work, the ENGINEER shall schedule and attend a meeting with a representative of the CITY'S Solid Resources Citywide Recycling Division and the CONTRACTOR, to discuss the CONTRACTOR'S proposed Solid Resources Management Plan. This Plan shall be submitted for information purposes, and to allow the CITY and the CONTRACTOR an opportunity to develop a mutual understanding regarding the recycling, reuse, and recycled-content procurement programs. Not more than 20 working days after the meeting, CONTRACTOR shall prepare and submit to the ENGINEER, with a copy to the Solid Resources Citywide Recycling Division, a written Solid Resources Management Plan including, but not limited to the following (submit in format provided herein as Attachment A):

    a. Contractor and project identification information

    b. Procedures to be used

    c. Materials to be reused and recycled

    d. Estimated quantities of materials

    e. Names and locations of reuse and recycling facilities/sites

3. Per the CITY'S review and comment, revise and resubmit Solid Resources Management Plan in coordination with the representative of the ENGINEER and the CITY'S Solid Resources Citywide Recycling Division.

    a. The CITY'S review and comment on the CONTRACTOR'S Solid Resources Management Plan will not otherwise relieve the CONTRACTOR of responsibility for adequate and continuing control of pollutants and other environmental protection measures.

B. Required Submittal of Summary of Diversion and Disposal With Each Application for Progress Payment: A summary shall be submitted with each progress payment of recyclables and solid resources generated by the construction and demolition operations on the form provided herein (Attachment B). Failure to submit the form and its supporting documentation may render the application for progress

payment incomplete and delay progress payments. Include manifests, weight tickets, receipts, and invoices specifically identifying the Project and materials sent to:

1. Source-Separated Recycling Facilities
2. Mixed Debris Recycling Facilities
3. Class III Landfills
4. Inert Materials accepted at Class III Landfills as daily cover
5. Inert Fills
6. Inert Backfill Sites other than Inert Fills

With each submittal of CONTRACTOR'S application for process payment, the CONTRACTOR is required to submit to the INSPECTOR the attached "Summary of Solid Waste Diversion and Disposal," quantifying all materials generated in the Work, disposed in Class III Landfills, or diverted from disposal through recycling. Indicate zero (0) if there is no quantity to report for a type of material. As indicated on the form:

a. Report disposal or recycling *either* in tons *or* in cubic yards: if scales are available at disposal or recycling facility, report in **tons**; otherwise, report in **cubic yards**.

b. Indicate locations to which materials are delivered for disposal, recycling, accepted as daily cover, or taken for inert backfill.

c. The Summary Form must be accompanied by legible copies of weigh tickets, receipts, or invoices that specifically identify the project generating the material. Said documents must be from recyclers and/or disposal site operators that can legally accept the materials for the purpose of reuse, recycling, or disposal.

d. Indicate the Project title, CITY Work Order Number; progress payment number; name of the company completing the Summary Form and compiling backup documentation; the printed name, signature, and daytime phone number of the person completing the form, the beginning and ending dates of the period covered on the Summary Form; and the date that the Summary Form is completed.

1.5 Recycling, Reuse, and Salvage Procedures

A. Recycling, Reuse, and Salvage Facilities: The most recent issue of the *Construction and Demolition Waste Recycling Guide* and the *Wood You Recycle?* guide, published by the City's Solid Resources Citywide Recycling Division, are incorporated herein by reference. For more information, contact the City's Solid Resources Citywide Recycling Division, 433 South Spring Street, 5th Floor, Los Angeles, CA 90013, (213) 847-0143; fax (213) 847-3054. These guides are updated regularly.

B. Development and Implementation of Recycling Procedures: Based upon the Contract Documents, the CONTRACTOR'S Solid Resources Management Plan, estimated quantities of available materials, and availability of recycling facilities, CONTRACTOR shall develop and implement procedures to reuse, salvage, and recycle materials *to the greatest extent feasible.* Procedures shall include source-separated recycling, as well as mixed recycling efforts. Procedures shall include consideration of on-site recycling.

1. **On-Site or Off-Site Recycling of Source-Separated Materials:** CONTRACTOR shall develop and implement a program to include source separation of solid resources, ***to the greatest extent feasible***, of the following types:

   a. Asphalt

   b. Concrete, concrete block, slump stone (decorative concrete block), and rocks

   c. Dirt

   d. Metal, ferrous and non-ferrous

   e. Wood

   f. Green materials (i.e., tree trimmings)

   g. Other materials, as appropriate, such as red clay brick and corrugated cardboard

Off-site recyclables shall be legally transported to a source separated or mixed debris recycling facility. On-site recycling program shall produce a quality product to meet specifications identified in the Contract Documents, subject to approval of the ENGINEER. On-site recycling plans shall also estimate the amount to be used in the Work and include a program for off-site recycling of any excess material that cannot be used in the Work.

2. **Mixed Debris Recycling:** Develop and implement a program to transport loads of commingled construction and demolition materials that cannot be feasibly source separated to a mixed recycling facility. These facilities are listed in the most recent issue of the *Construction and Demolition Waste Recycling Guide,* published by the City's Solid Resources Citywide Recycling Division.

3. **Salvageable Items:** Perform a site preassessment, identify materials that are feasible for salvage, determine requirements for site storage, and transportation of materials to a salvage facility. A partial list of facilities is included in the most recent issue of the *Construction and Demolition Waste Recycling Guide,* published by the City's Solid Resources Citywide Recycling Division.

4. **Disposal Operations:**

   a. Using a permitted waste hauler or its own trucking services, CONTRACTOR shall legally transport and dispose of materials that cannot be delivered to a source separated or mixed recycling facility, to a transfer station or disposal facility that can legally accept the materials for the purpose of disposal.

   b. Do not burn, bury or otherwise dispose of solid waste on the project job-site.

5. **Hauling:**

   a. CONTRACTOR is responsible for arranging collection of materials, by a permitted waste hauler or using its own trucks, to facilities that can legally accept construction and demolition materials for purpose of reuse, recycling, or disposal.

   b. Prior to delivering materials, CONTRACTOR shall familiarize itself with the specifications for acceptance of construction and demolition materials at recycling facilities. The most recent issue of *Construction and Demolition*

Waste Recycling Guide, published by the City's Solid Resources Citywide Recycling Division, includes a partial list of these facilities.

C. Participate in Reuse Programs: Implement a reuse program *to the greatest extent feasible*. Alternatives include:

1. California Materials Exchange (CalMAX) Program sponsored by the California Integrated Waste Management Board. CalMAX is a free service provided by the California Integrated Waste Management Board, designed to help businesses find markets for materials that traditionally would be discarded. The premise of the CalMAX Program is that material discarded by one business may be a resource for another business. To obtain a current materials listings catalog, call CalMAX at (916) 341-6603 or the California Integrated Waste Management Board's Publications Clearinghouse at (800) 553-2962.
2. Habitat for Humanity: Los Angeles (HFH-LA), a non-profit housing organization that rehabilitates and builds housing for low-income families. HFH-LA sites requiring donated materials vary. Contact HFH-LA at (213) 975-9757.
3. Other reuse organizations or activities.

D. Revenue: Revenues or other savings obtained from recycled, reused, or salvaged materials shall accrue to CONTRACTOR unless otherwise noted in the Contract Documents.

Attachment A
Contractor's Solid Resources Management Plan

Project Title:	W.O. Number:
Contractor's Name: Street Address: City, State, ZIP: Phone:	Fax:
Date Submitted:	

These are **procedures** to be used for reusing, salvaging, or recycling materials. Indicate the procedures (by number), types of materials, and estimated quantities that will be recycled or disposed in the sections below:

1. Hand-wrecking to recover salvageable materials
2. On-site concrete and asphalt crushing for use on-site
3. On-site concrete and asphalt crushing for use off-site
4. Source separation of materials and separately hauling to recyclers
5. Hauling mixed recyclables to a mixed debris recycling facility
6. Other (please describe): _____

I. Reuse/Salvage/Recycling of Materials

Type of Material	Number of Procedure to Be Used (as above)	Facility to Be Used/Location	Estimated Quantities (whenever available)		
			Tons	Cubic Yards	Units
Example: Concrete	4	ABC Recyclers Los Angeles	120		
Asphalt					
Concrete					
Soils (clean)					
Wood/Green					
Scrap Metal					
Salvage Items Describe:					
Other Describe:					
Misc. Construc-tion Debris					

II. Disposal of Materials

Project Title: W.O. Number:

Type of Material	Facility to Be Used/Location	Estimated Quantities (whenever available)		
		Tons	**Cubic Yards**	**Units**
Example: Miscellaneous Construction Debris	XYZ Disposal Los Angeles	60		
Asphalt				
Concrete				
Soils (clean)				
Wood/Green Materials				
Scrap Metal				
Other (e.g., cardboard, red clay brick) Please describe:				
Misc. Construction Debris				

Attachment B
Solid Waste Management Information Sheet

Assembly Bill 939. Pursuant to the California Integrated Waste Management Act of 1989, the City of Los Angeles is required to reduce the amount of solid waste disposed in landfills 25 percent by 1995 and 50 percent by the year 2000. Contracts that include work that will generate solid waste, including construction and demolition debris, have been targeted for participation in source reduction, reuse, and recycling programs. The CONTRACTOR is urged to manage solid waste generated by the work, to divert waste from disposal in landfills, particularly Class III landfills, and to maximize source reduction, reuse, and recycling of construction and demolition debris.

CONTRACTOR may contact the Solid Resources Citywide Recycling Division of the Bureau of Sanitation at (213) 847-1444 for information about recycling construction and demolition materials.

Reporting Disposal and Diversion of Solid Waste. Upon submittal of its applications for progress payment, CONTRACTOR is required to submit to the INSPECTOR the attached summary of solid waste generated by the work, quantifying all solid waste materials disposed in Class III landfills, diverted from disposal through recycling, accepted at Class III landfills as daily cover, disposed in inert fills, or taken for inert backfill. As indicated on the Summary Form:

a. Report disposal or recycling in tons *or* cubic yards: If trucks are weighed at disposal or recycling facility, report in **tons**; otherwise report in **cubic yards**. Indicate zero (0) if there is no quantity to report for a type of material.

b. Indicate all locations to which materials are delivered for disposal, recycling, accepted as daily cover, or taken for inert backfill.

c. The Summary Form must be accompanied by legible copies of weigh tickets, receipts, or invoices that specifically identify the project generating the material. Said documents must be from recyclers and/or disposal site operators that can legally accept the materials. If materials are taken to an inert backfill site and weigh tickets, receipts, or invoices are not available, CONTRACTOR shall provide documentation *on its letterhead* identifying the address to which materials were taken, name of owner/operator, type of materials, and tons or cubic yards disposed, specifically identifying the project generating the materials.

d. Indicate the name of the company completing the Summary Form and compiling backup documentation; the printed name, signature, and daytime phone number of the person completing the form, the beginning and ending dates of the period covered on the Summary Form; and the date that the Summary Form is completed. Indicate Progress Payment Number with which Summary is submitted in the space provided.

Summary of Solid Waste Disposal and Diversion

Project Title: _____W.O.# _____ Progress pmt. #____

Type of Material	(a) Disposed in Class III Landfills		(b) (circle one) Diverted from Class III Landfills by Recycling or Accepted as Daily Cover		(c) Disposed in Inert Landfills		(d) Taken to Inert Backfill Site	
	Tons	CY	Tons	CY	Tons	CY	Tons	CY
Asphalt Name of Facility/Site Where Taken:								
Concrete Name of Facility/Site Where Taken:								
Metal Name of Facility/Site Where Taken:								
Other Segregated Materials: Describe: Name of Facility/Site Where Taken:								
Miscellaneous Construction Waste Name of Facility/Site Where Taken:								
Total								

Company name: _____Date of report: _____

Name of person completing form: (please print): _____

Signature:_____Title:_____

Daytime phone: ( ) _____

Period covered in this report: from _____ to _____

Summary of Solid Waste Disposal and Diversion – Continuation Sheet

Project Title: _____W.O.# _____ Progress pmt. #____

Type of Material	(a) Disposed in Class III Landfills		(b) (circle one) Diverted from Class III Landfills by Recycling or Accepted as Daily Cover		(c) Disposed in Inert Landfills		(d) Taken to Inert Backfill Site	
	Tons	CY	Tons	CY	Tons	CY	Tons	CY
Asphalt Name of Facility/Site Where Taken:								
Concrete Name of Facility/Site Where Taken:								
Metal Name of Facility/Site Where Taken:								
Other Segregated Materials: Describe: Name of Facility/Site Where Taken:								
Miscellaneous Construction Waste Name of Facility/Site Where Taken:								
Total								

Company name: _____ Date of report: _____

Name of person completing form: (please print): _____

Signature: _____ Title: _____

Daytime phone: ( ) _____

Period covered in this report: from _____to _____

Appendix D: Recycling vs. Disposal Economics Worksheet

Introduction

Would you like to recycle debris from your construction or demolition (C&D) project, but you don't know if it will save money or cost money? The economics of recycling on a project depends on many variables, including proximity of recyclers and landfills, wages, hauling costs, and the current economic value of the materials.

This worksheet. This worksheet can help you determine if recycling will save money on your project. The instructions are on page 1, the worksheet is on pages 2 and 3, and on page 4 is a sample completed worksheet to illustrate how the form is used.

Project size. This worksheet is most appropriate for residential and small commercial projects. A large commercial project may require a more extensive worksheet, such as the one in Minnesota's *Construction Materials Recycling Guidebook.*

Units of Measurement. This worksheet uses tons as the standard unit of measurement. You may substitute cubic yards for tons if it is used consistently throughout the worksheet.

Part A—Segregated Materials

1. Find recyclers in the project area by ordering the recyclers list *Construction and Demolition Recyclers—Processors and Receivers* (publication #431-96-017) from the CIWMB Hotline at 1-800-553-2962, or you may access the same list as a searchable database on the CIWMB Internet site at www.ciwmb.ca.gov/ConDemo.
2. Choose a few materials that are easily separated and recycled. Don't overwhelm yourself at the beginning by trying to do it all. This worksheet has been set up to evaluate only four commonly recycled materials: wood, cardboard, concrete, and metals. If necessary, you may substitute other materials.
3. For each material, calculate the estimated labor costs (per ton), hauling costs (per ton), and tipping fees (per ton) and add together to determine the cost per ton to recycle that material if it is source-separated.

Part B—Recycling Mixed Materials

A materials recovery facility (MRF) accepts mixed debris and removes the marketable materials, usually by a combination of hand and machine sorting.

1. Determine if there is a MRF in your area that accepts C&D debris by contacting Boxing Cheng by phone at (916) 341-6434 or by e-mail at bcheng@ciwmb.ca.gov.
2. If there is no MRF nearby, skip Part B. If there is, calculate the estimated labor costs (per ton), hauling costs (per ton), and tipping fees (per ton) and add together to determine the cost per ton to recycle mixed debris at the MRF.

Part C—Landfill

1. Locate the landfill nearest the project that accepts C&D debris by consulting your local phone book or by contacting your Local Enforcement Agency for solid waste management.
2. Fill in the blanks for labor costs (per ton), hauling costs (per ton), and tipping fees (per ton) and add together to determine the cost per ton to dispose of mixed debris.

Part D—Comparison

To determine the most cost-effective option for each material, transfer cost information from Part A (segregated recycling), Part B (MRF recycling), and Part C (landfilling), and compare costs per ton of material.

CIWMB Contact

For questions, comments, and suggestions on this worksheet, contact CIWMB staff.

Project _____ Date _____

Prepared by _____

Part A–Segregated Materials

Wood: _____ tons

Labor:	Time to separate one ton		_____ hours	
	x Labor to separate one ton	x	$_____/hour	= $_____
Hauling:	Travel time to recycler		_____ hours	
	x Hauling vehicle cost	x	$_____/hour	
	÷ Tons per haul	÷	_____ tons	= $_____
Tipping:	Recycler's tipping fee per ton		$_____	= $_____
			TOTAL=	$.

Cardboard: _____ tons

Labor:	Time to separate one ton		_____ hours	
	x Labor to separate one ton	x	$_____/hour	= $_____
Hauling:	Travel time to recycler		_____ hours	
	x Hauling vehicle cost	x	$_____/hour	
	÷ Tons per haul	÷	_____ tons	= $_____
Tipping:	Recycler's tipping fee per ton		$_____	= $_____
			TOTAL=	$.

Concrete: _____ tons

Labor:	Time to separate one ton		_____ hours	
	x Labor to separate one ton	x	$_____/hour	= $_____
Hauling:	Travel time to recycler		_____ hours	
	x Hauling vehicle cost	x	$_____/hour	
	÷ Tons per haul	÷	_____ tons	= $_____
Tipping:	Recycler's tipping fee per ton		$_____	= $_____
			TOTAL=	$.

Metals: _____ tons

Labor:	Time to separate one ton		_____ hours	
	x Labor to separate one ton	x	$_____/hour	= $_____
Hauling:	Travel time to recycler		_____ hours	
	x Hauling vehicle cost	x	$_____/hour	
	÷ Tons per haul	÷	_____ tons	= $_____
Tipping:	Recycler's tipping fee per ton		$_____	= $_____
			TOTAL=	$.

Part B–Recycling Mixed Materials: _____ tons

Labor:	Time to place one ton in bin		_____ hours	
	x Labor to place one ton in bin	x	$_____/ hour=	$_____
Hauling:	Travel time to MRF		_____ hours	
	x Hauling vehicle cost	x	$_____/ hour	
	÷ Tons per haul	÷	_____ tons	= $_____
Tipping:	MRF tipping fee per ton		$_____	= $_____
			TOTAL=	$.

Part C–Landfill: _____ tons

Labor:	Time to place one ton in bin		_____ hours	
	x Labor to place one ton in bin	x	$_____/ hour=	$_____
Hauling:	Travel time to landfill		_____ hours	
	x Hauling vehicle cost	x	$_____/ hour	
	÷ Tons per haul	÷	_____ tons	= $_____
Tipping:	Landfill tipping fee per ton		$_____	= $_____
			TOTAL=	$.

Part D–Cost Comparison

To determine the most cost-effective option for each material, transfer cost information from Parts A, B, and C, and compare costs per ton of material.

From **Part A - Segregated**:

Wood per ton $_____

Cardboard per ton $_____

Concrete per ton $_____

Metals per ton $_____

From **Part B - MRF**: $_____

From **Part C - Landfill**: $_____

Appendix E: Sample Contract Language

(Sample specifications, edit to suit project)

Section 02145
Erosion Control

Part 1 General

1.1 Summary
Provide erosion control during and after construction as indicated on the drawings and specified, or as directed by the City Engineer or Consultant.

1.2 Reference Standards
Standard Specifications for Public Works Construction, current edition.

Part 2 Products

2.1 Materials
The Contractor shall provide plants, earth materials previously removed from excavation, or imported fill material as required for erosion control.

Part 3 Execution

3.1 Protective Measures
A. All earthwork shall be planned and conducted to minimize the duration of exposure of unprotected soils.

B. Reduce the exposure of erodable soils to undue rainwater runoff.

1. Retardation and Control of Runoff: Runoff from the construction site shall be controlled by construction of diversion ditches, benches, and berms to retard and divert runoff to protected drainage courses.
2. Erosion Control Devices: The Contractor shall construct or install temporary and permanent erosion control features as indicated on the drawings. Temporary erosion control measures such as berms, dikes, drains, sedimentation basins, grassing and mulching shall be maintained until permanent drainage and erosion control facilities are completed and operative.
3. Mechanically retard and control the rate of runoff from the construction site. This includes construction of diversion ditches, benches, and berms to retard and divert runoff to protected drainage courses.

C. Protect slopes by accelerated growth of permanent vegetation, temporary vegetation, mulching, or netting.

Section 02230
Base Course

Part 1 General

1.1 Description

A. Work Included: Furnish and install base material for structures, paving, and elsewhere indicated on the drawings.

****

NOTE: On March 24, 1995 the City Council passed a motion to use 100 percent recycled miscellaneous base on all City projects. The Contractor shall provide recycled base in accordance with said motion (applies to city-owned project only.)

****

B. Related Sections:

1. Documents affecting works of this Section include, but are not necessarily limited to, the General Conditions, and Sections in Division 1—General Requirements of these Specifications.
2. Other Sitework in Division 2.

1.2 Quality Assurance

A. Labor: Use adequate numbers of skilled laborers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with specified requirements and the methods needed for proper performance of the work of this Section.

B. Equipment: Use equipment adequate in size, capacity, and numbers to accomplish the work of this Section in a timely manner.

C. In addition to complying with governmental agencies having jurisdiction, comply with the directions of the Soil Engineer.

D. Comply with applicable provisions of Section 300 of the *Standard Specifications for Public Works Construction* and *Standard Plan, City of Los Angeles, Notice To Contractors—Comprehensive*.

E. Required: The Contractor shall fully coordinate the work operations of this Section with that of other trades involved and with the City Engineer and the Consultant to assure proper sequence of work, methods and time of work are carried out.

1.3 Protections

A. General: Comply with provisions of Section 25 in the General Conditions. Protect and guard all excavations against damage to life, limb and property as prescribed by L.A. City Departments of Building and Safety, and the Construction Safety Orders issued by the Division of Industrial Safety, State of California.

B. Protections: Provide and install signs, lights and barricades at danger points on and off the job site to guard against accidents.

C. Dewater: Divert water or pump out of all excavations until pavement and other items are placed therein, forms removed and backfilling is completed.

1.4 Inspection

A. Required: All excavations and trenches will be inspected by the Consultant, Inspector or the Soils Engineer designated by the Engineer or the Consultant before filling, backfilling and/or other subsequent work is placed therein.

1.5 Soils Information

A. Information on the Contract Drawings or in the Soils Information Report not a guarantee of Uniformity of soils conditions over the job site.

B. Copies of Foundations Investigation and Soils Report prepared by the Bureau of Engineering, Department of Public Works are available at the Architectural Division, Room 200, 600 South Spring, Los Angeles, CA 90014, and herein made a part of these Specifications.

1.6 Material Handling

A. Delivery: All materials, tools, equipment, etc. To be delivered to the job-site where directed by the City Engineer or the Consultant in such a manner coordinated with progress of work of this section.

B. Storage: Where directed by the City Engineer or the Consultant as not to interfere with work operations and City Employee operations on the premises.

1.7 Disposal of Excess Materials

A. Required: Remove from the job site all excess excavated and imported materials not used for fill or backfill and all waste and debris.

1.8 Reference Standards

A. *Standard Specifications for Public Works Construction* (SSPWC). Current edition.

Part 2 Products

2.1 Recycled Base Materials

A. Provide recycled crushed miscellaneous base in conformance with the requirements of Section 200—"Rock Materials" of the *Standards Specifications for Public Works Construction*.

B. Material supplied shall be approved by the Soils Engineer or the authorized representative prior to placing.

Part 3 Execution

3.1 Installation

A. Compaction Prior to Placement of Base: The upper six inches of subgrade soil, whether fill or natural soil, shall be compacted to 90 percent relative compaction in accordance with Section 301-1 of SSPWC.

B. Subgrades: Scarify for asphalt paving to a depth of 6 inches, bring to optimum moisture content and then recompact to at least 95 percent maximum density as per ASTM D1557—"Method of Compaction" B. Prepare Subgrade in accordance with Section 301-1 of the *Standard Specifications*.

C. Spread, level, moisten, and roll or tamp base material in layers not exceeding 4" in thickness. Use 2 tandem power roller weighing not less than 8 tons. Continue cutting or filling, watering and rolling until the surface is true to grade and cross section.

D. Dust Control: Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the job site.

E. Approval of Subgrade: By the Soils Engineer prior to placing fill.

F. Corrections: Required of all unauthorized excavations made below indicated depths, as recommended by the Soils Engineer at no added cost to the City.

G. Locations: Place select base beneath concrete and asphalt concrete yard paving, beneath concrete driveway aprons and concrete gutters in yard areas, building floor slab on grade and elsewhere to thickness noted on the Contract Drawings.

Section 02045
Rock Crushing Operations

Part 1 General

1.1 Summary

A. Provide all labor, plant, tools, materials, and supplies required to perform the rock crushing operations specified.

B. Rock materials generated while performing earthwork operations shall be segregated from the remainder of the soil materials, stockpiled and crushed, and used as aggregate materials for the construction of aggregate bases.

C. Related Work Sections:

1. Documents affecting works of this Section include, but are necessarily limited to, the General Conditions, and Sections in General Requirements of Division 1 of these Specifications.

2. Other Sitework in Division 2.

1.2 Quality Assurance

A. Labor: Use adequate numbers of skilled laborers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Codes and Regulations: Comply with all applicable Government Codes and Regulations of the County and City of Los Angeles, especially meeting safety standards and regulations of CAL/OSHA. Provide additional measures, added materials and devices as may be needed as directed by the City Engineer or the Consultant, at no added cost to the City.

1.3 Work Plan

A. Submit a rock-crushing plan to the City Engineer in accordance with Section 01340. Indicate the procedures planned and proposed for the accomplishment of the rock crushing work. The procedures shall provide for safe conduct of the work and coordination with other work in progress.

B. The plan shall show the location and layout of the crushing plant. Indicate contemplated haul routes.

C. The plan shall include a detailed description of the crusher equipment, its capacities and operating characteristics. Indicate the manufacturer of all major equipment, and whether the plant will be fixed or portable.

1.4 Crusher Plant, Equipment, Machines, and Tools

A. The crusher plant shall be of such capacity to produce the quantities of aggregate mixtures required for the project. Hauling equipment, screening machines, miscellaneous equipment, and tools shall be provided in sufficient number and capacity, and in proper working condition to place the crushed rock at a rate necessary to complete the Contract on time.

B. Screens shall be provided to eliminate oversize rock from fill or crusher feeds, and separate materials in appropriate sizes.

C. Washers shall be provided to remove clay or other deleterious materials from the rock products. Construct suitable drains to convey wash water into the natural drainage channels.

1.5 Handling Of Materials

A. Crushed rock shall be handled and stockpiled in such manner as to preclude fracturing of aggregate particles, segregation, or contamination of different materials in the stockpiles.

Part 2 Products

2.1 Crushed Rock

A. Rock shall be crushed and reduced in sizes to produce aggregate that will meet the specifications for aggregate base (Section 02230). Aggregate shall consist of rock that is native to the area and shall be that uncovered in the course of excavating for structures, paving, or utilities. Rock may include crushed stone, crushed gravel, sand, and mineral filler, as it occurs.

B. The crushing operations shall result in crushed rock materials that will pass as 3/4" screen, and are retained on the No. 4 sieve which shall be known as coarse aggregate, and a portion passing the No. 4 sieve and retained on the No. 200 sieve known as fine aggregate, and the portion passing the No. 200 sieve as mineral filler.

Part 3 Execution

3.1 Inspection And Testing

A. Inspection of Contractor's operations will be made by the City Engineer. The City Engineer will make such tests as necessary to determine whether aggregates being produced meet requirements specified for aggregate bases.

B. If a sample of materials fails to meet specification requirements, the material represented by the sample shall not be used as base but may be used as common fill or backfill material.

Section 02050
Demolition

Part 1 General

1.1 Summary

A. Carefully demolish all existing structures and improvements indicated or noted on the Contract Drawings to be demolished and remove them from the premises.

B. Related Work Sections:

1. Documents affecting work of this Section include, but are not necessarily limited to, the General Conditions, and Sections in General Requirements of Division 1 these Specifications.
2. Other Sitework in Division 2.
3. Concrete Work in Section 03300.

1.2 Quality Assurance

A. Labor: Use adequate numbers of skilled laborers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Codes and Regulations: Comply with all applicable Government Codes and Regulations of the County and City of Los Angeles, especially meeting safety standards and regulations of CAL/OSHA. Provide additional measures, added materials and devices as may be needed as directed by the City Engineer or the Consultant, at no added cost to the City.

1.3 Miscellaneous General Requirements

A. General: Comply with the following as specified in the General Conditions and Division 1.

1. Erections and maintenance of protections.
2. Dust Control.
3. Repair of Damages.
4. Cleaning and removal of rubbish and debris.

B. Notifications Concerning Utilities: All Utility Companies owning conduit, pipes and sewers running to and from City properties to be notified to make arrangements for their removal or capping in accordance with instructions from the City Engineer or the Consultant.

1. Notify the City when utilities should be turned off or vacated for demolition purposes.
2. Repair damaged or broken existing utilities subject to the approval of the City Engineer or the Consultant as applicable.

C. Protection of Site Improvements: As required by approved methods as and as authorized by the City Engineer or the Consultant as follows as applicable:

1. Protect all existing improvements that are to remain in place.

2. Remove all protection when work is completed and when authorized by the City Engineer or the Consultant.

D. Repair of Damage:

1. Repair any damage to existing improvements that may have been caused by the Contractor's operations outside the scope of work of this Section, at the Contractor's expense.

2. Methods: Repair or replace existing damaged improvements with new materials as necessary for restoration of damaged areas or surfaces to a condition equal to and matching that existing prior to damage occurrence, to the full satisfaction and approval of the City Engineer or the Consultant.

E. Scheduling of Work Operations: Submit demolition and removal schedule and procedures to the City Engineer or the Consultant within 15 days after date of City-Contractor Agreement.

F. Non-Interference: Conduct demolition and removal operations in a manner to minimize interference with City operations in adjacent areas. Maintain protected egress and access at all times during Contracted Work operations.

G. Control the generation of dust by wetting down materials that are susceptible to the production of particulate matter. Use an approved dust palliative where appropriate.

1.4 Work Plan

A. Submit a demolition work plan to the City Engineer in accordance with Section 01340. The procedures shall provide for safe conduct of the work, careful removal and protection of property which is to remain undisturbed, coordination with other work in progress, and timely disconnection of utility services.

B. The plan shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of operations.

Part 2 Products

(Not Applicable)

Part 3 Execution

3.1 Site Condition

A. Examine the job site areas and conditions under which work of this Section will be performed.

B. Correct conditions detrimental to timely and proper completion of Contracted Work as directed by the City Engineer or the Consultant. Do not proceed with Contracted Work until detrimental conditions have been corrected.

3.2 Demolition

A. Prior to start of demolition operations, carefully study the Contract Drawings and these Specifications. In the company of the City Engineer of the Consultant visit job-site as necessary to further verify the extent of the work to be performed under this Contract.

B. Discovery of Hazardous Substances: Conform to provisions of Section 56 in the General Conditions.

C. Coordination: Fully coordinate work of this Section with other Contracted Work operations so as not to interfere with City operations on the job site.

3.3 Salvageable Materials

A. All materials equipment and fixtures that are not indicated to remain on the premises shall become the property of the Contractor and shall be promptly removed from the job site.

B. The City assumes no responsibility for salvageable items removed from the residences or the premises or vandalized during the bidding period.

3.4 Storage of Salvageable Materials at Site

A. On-site storage of salvageable materials will not be permitted beyond brief accumulation awaiting pick-up by removal trucks.

B. Salvageable materials and equipment shall not be stored at the job site but shall be hauled away promptly; delay in removing such materials and equipment from the site will be permitted for a short duration subject to approval of the City Engineer or the Consultant.

3.5 Replacements

A. In the event of demolition of items not so scheduled to be demolished or removed, promptly replace such items to the approval of the City Engineer or Consultant, at no added cost to the City.

3.6 Clean Up And Disposal

A. Comply with applicable provisions specified in Section 01710 in Division 1 General Requirements of these Specifications.

3.7 Protection of Trees

A. Trees within the project site which might be damaged during demolition and which are indicated to be left in place shall be protected by a 6-foot high fence. The fence shall be securely erected a minimum of 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees.

B. All trees that are to remain that is damaged during the work under this contract shall be replaced in kind or as approved by the City Engineer.

3.8 Burning

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

3.9 Use Of Explosives

Use of explosives will not be permitted.

Section 02110
Site Clearing

Part 1 General

1.1 Summary

A. Perform all site clearing on the job site noted on or indicated on the Contract Drawings and in these specifications.

B. Related Sections:

1. Documents affecting work of this Section include, but are not necessarily limited to, the General Conditions, and Sections in Division 1—General Requirements of these specifications.
2. Demolition in Section 02050
3. Earthwork in Section 02210
4. Landscape
5. Landscaping in Section 02900

1.2 Quality Assurance

A. Labor: Use adequate numbers of skilled laborers thoroughly trained in site clearing operations and experienced in the necessary crafts and completely familiar with the specified requirements and methods needed for the proper performance of the work of this section.

B. Codes and Regulations: Perform all work of this Section in strict accordance with applicable Government Codes and Regulations, especially meeting all safety standards and requirements of CAL/OSHA, County and City of Los Angeles. Provide additional measures, added materials as may be needed as directed by the City Engineer or the Consultant at no added cost to the City.

C. Miscellaneous Requirements:

1. Erection and maintenance of protections
2. Dust Control
3. Cleaning and Removal of Rubbish

Part 2 Products

2.1 Materials

A. Provide materials not specifically described but required for completion of the work as selected by the Contractor subject to the approval of the City Engineer or the Consultant.

Part 3 Execution

3.1 Site Conditions

A. Examine the job site and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper site-clearing operations, as directed by the City Engineer or the Consultant. Do not proceed until such detrimental conditions have been corrected.

3.2 Protection

A. Protect Existing Structures and Site Improvements: (Indicated to remain) from damage by approved methods and/or as authorized by the City Engineer. Removal of all protections shall be when work of this Section is completed or when so authorized by the City Engineer or the Consultant.

B. Protect Existing Utilities indicated or made known to remain traversing the job site and serving existing adjacent facilities.

C. Protect Existing Trees and Shrubs indicated to remain by providing temporary surrounding fencing so located a sufficient distance away so that trees and shrubs will not be damaged by site-clearing operations.

D. Protection of Person and Property (existing structures and site improvements):

1. Provide barricades, canopies, warning signs at open depressions and holes on adjacent property and public accesses.
2. Provide operating warning lights during hours from dusk to dawn each day or as otherwise required.
3. Protect existing remaining structures, utilities, sidewalks, pavements, and other facilities from damage as caused by settlement, undermining, washout or other hazards created by-site clearing operations of this Section.

E. Use means necessary to prevent dust from becoming a nuisance to the public, to neighbors, and to others performing work on or near the job site.

F. Maintain access to the job site at all times.

3.3 Site Clearing

A. Prior to starting job-site clearing operations, carefully study the Contract Drawings and these Specifications.

B. In the company of the City Engineer or the Consultant, prior to starting site clearing operations, visit the job site and verify the extent of work to be done under this Contract.

C. Site Clearing Operations

1. Where indicated on the drawings, or as directed by the Engineer, remove all vegetable growth, including trees and shrubs, on the job site within property lines.
2. Clean out all roots one inch and larger to a depth of a least two feet below finish grade or existing ground surface or new graded surface whichever is lower or to a depth where settlement will not occur as caused by decomposition of roots.
3. Treat roots remaining in the soil with a weed killer approved and as directed by the City Engineer or the Consultant.
4. Remove all rubbish and debris existing and resulting from work operations of this Section as soon as possible, do not allow to pile up. Do not burn rubbish and debris on the job site.
5. Where active utility lines need to be capped or plugged, perform such work in accordance with requirements of the Utility Company or agency having jurisdiction and conform to provisions specified hereinbefore.

6. When working near or below utility lines, inform the utility company and perform work in accordance with their requirements.

3.4 Cleanup

A. Contractor shall comply with the provisions of Division 1 of these Specifications.

3.5 Storage of Materials at the Job Site

A. Storage not permitted beyond brief accumulation awaiting pick-up by removal trucks.

B. Delays in the removal of site-clearing materials from the job site shall be subject to the approval of the City Engineer or the Consultant.

C. Do not store materials or equipment below utility lines.

Section 02507
Plastic Wheel Bumpers

Part 1 General

1.1 Summary

A. Furnish and install plastic wheel bumpers (wheel tape) as indicated on the drawings and specified.

B. Documents affecting Work and this Section include, but are not necessarily limited to, the General Conditions, and Sections in Division 1—General Requirements of these Specifications.

1.2 Submittals

A. Comply with provisions of Submittals Section 01340 of Division 1—General Requirements of these Specifications.

B. Product Data: Submit information describing the materials used in the manufacture of the wheel bumpers.

Part 2 Products

2.1 Materials

A. Bumpers shall be plastic formed on one piece, extruded or injection molded, high-impact plastic in color selected by Architect, with weather and oil resistant surface, and formed to the profile indicated, manufactured by EcoTech, or approved equal. Contact manufacturer's representative: Environmental Specialty Products (909) 390-8800.

B. Adhesive for Securing Bumpers in Place: Provide an epoxy two component type, long curing, manufactured by Edeco, Furance, Andrew Brown, Adhesive Engineering Company, or equal.

Part 3 Execution

3.1 Installation On Portland Cement Concrete Pavements

A. Secure bumpers in place as recommended by the manufacturer with 2-component epoxy adhesive. Surfaces to receive the bumper shall be free from dirt, loose particles or other foreign matter that might adversely affect the bonding properties of the adhesive.

Section 02513
Asphaltic Concrete Paving

Part 1 General

1.1 Summary

A. Provide all labor, materials and equipment necessary to install asphaltic concrete paving as indicated on the Contract Drawings and in these Specifications.

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Note: On March 24, 1995 the City Council passed a motion to use 15 percent recycled asphalt concrete on all City projects. The Contractor shall provide recycled base in accordance with said motion.

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B. Related Sections:

1. Documents affecting Work of this Section include, but are not necessarily limited to the General Conditions, and Sections in Division 1—General Requirements of these Specifications.
2. Excavating, Backfilling, and Compaction for Paving, Section 02220.
3. Base Course in Section 02230.
4. Portland Cement Concrete Paving in Section 02520.
5. Pavement Marking in Section 02580.

1.2 Quality Assurance

A. Employees: Use adequate number of skilled Contractor's employees who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for the proper performance of the work of this Section.

B. Asphaltic Concrete Producers Qualifications: Use only materials furnished by a bulk asphaltic concrete producer regularly engaged in production of hot-mix, hot laid bituminous concrete.

C. Materials and Installations: In accordance with the following documents referred to as the *Standard Specifications*.

1. *Standard Specifications for Public Works Construction*, *1991 Edition,* and *City of Los Angeles Department of Public Works/Standard Plan (Latest Edition) Notice to Contractors—Comprehensive*.
2. City of Los Angeles, Department of Building and Safety, General Specifications, Form B-164 Standard Drawings."

1.3 Submittals

A. Comply with provisions of Submittals Section 01340 of Division General Requirements of these specifications.

Product Data:

1. Mix Design for asphaltic concrete prepared by a materials laboratory under the direction of a California Registered Engineer or a standard mix design proven in actual performance.

2. The mix design will be subject to approval by the City Engineer and the Consultant.

C. Certificates: Signed by the materials producer and the asphalt paving subcontractor, stating that materials meet or exceed the specified requirements.

D. Certificate of Weigh Masters or certified delivery tickets for each truckload of asphaltic material delivered to the jobsite.

1.4 Delivery, Storage, and Handling

A. Deliver asphaltic concrete to the job site, in canvas covered truck if necessary, to maintain the specified spreading temperatures.

1.5 Environmental Conditions

A. Apply bituminious primer, paint primer and seal coat only when the ambient temperature is above 50 degrees F and when the temperature has not been below 35 degrees F for 12 hours immediately prior to application.

B. Do not apply bituminous materials when the base surface is wet or contains an excess of moisture which would prevent uniform distribution and the required penetration.

C. Construct asphaltic concrete surface course only when the ambient temperature is above 40 degrees F when the underlying base is dry and when it is not raining.

1.6 Protection

A. Furnish, erect and maintain fences, barrier lights and signs as necessary to adequately protect the public, existing work and work under this Contract as prescribed by the Los Angeles City Department of Building and Safety, *Standard Specifications for Public Works Construction*, and W.A.T.C.H.

B. Protect this asphaltic concrete paved area from traffic until the sealer is set and cured and does not pick up under foot or wheeled traffic.

1.7 Alterations, Repairs and Replacement

A. As required for complete construction of the project; materials and construction to match existing adjacent work in quality and to conform to applicable provisions of these specifications.

Part 2 Products

2.1 Materials

A. Fifteen percent (15 percent) of the recycled asphalt concrete (RAC) used in this project shall consist of recycled asphalt pavements, as provided in Section 203.7 of the *Standard Specifications for Public Works Construction*, latest edition.

B. Aggregates: conform to *Standard Specifications*, Article 203-6.3 for the gradations specified. Aggregates shall consist of crushed stone, gravel, sand or other sound durable, mineral materials processed and blended and naturally combined.

C. Base Course: As specified in Section 02230.

D. Soil Treatment for Weed Control in Section 02280.

E. Prime Coat: *Standard Specifications*, Article 203-2 for Classification SC-250 liquid asphalt.

F. Paint Binder: *Standard Specifications*, Article 203-3 for Classification SS1H anionic asphalt emulsion.

G. Asphalt Concrete Surface Course: *Standard Specifications* Article 203-6 for hot plate mixed aggregate and asphalt, produced by a commercial asphalt paving plant, except as modified hereinafter:

   1. Asphalt Cement: *Standard Specifications* Article 203-1, for steam refined paving asphalt, AR8000 Viscosity Grade, mixed with the aggregate at a rate specified in Article 203-6.3

H. Asphalt Surface Sealer: AAHTO Designation SS-1h emulsion type.

I. Concrete Materials: Materials, form work and reinforcing shall be furnished in accordance with applicable requirements specified in Section 03300—Cast-In-Place Concrete.

J. Headers and Stakes: Redwood, Construction Grade, in dimensions shown on the contract Drawings or as required for the use where dimensions are not shown on the Drawings in conformance to *Standard Specifications* Section 302.5.4. Headers to be 2- by 6-inch size with 2- by 4-inch stakes.

Part 3 Execution

3.1 Surface Conditions

A. Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until detrimental conditions are corrected.

3.2 Final Preparation of Subgrades

A. After preparation of subgrade as specified in another Section of these specifications, thoroughly scarify and sprinkle the entire area to be paved, and then compact to a smooth, hard, even surface of 95 percent compaction to receive the aggregates in conformance to Section 301 of the *Standard Specifications*.

B. Soil Treatment: Apply treatment for weed control to the entire area to be paved with asphalt concrete paving. Adhere to the manufacturer's application recommendations.

3.3 Construction of Asphalt Concrete Paving

A. In accordance with the *Standard Specifications for Public Works Construction*, latest edition.

   1. Laying: In accordance with Section 302-5 of *Standard Specifications*.

   2. Tack Coat: Apply to surfaces of concrete improvements abutting new work at least 24 hours prior to laying of new work.

   3. Apply suitable binder continuously on concrete surfaces to which asphalt concrete is placed, abutted or joined to provide tight bond at joints, which shall be neat, straight-line and close.

   4. Pavement Edging: Place headers and stakes at all edges of the asphalt paving abutting other asphalt and/or concrete surfaces.

5. Grade paving evenly without low spots, hollows or irregularities and to provide proper drainage to new concrete catch basins.

B. Thickness and Courses:

1. Thickness shall be as indicated on the Contract Drawings.

C. Flood Tests: After completion of the paving and prior to acceptance of the work, a water flood test shall be made in the presence of the City Engineer.

1. The flooding shall be done by water tank truck, or the water distribution system constructed under the Contract; provided such system is operational and the City Engineer approves of its use.

2. All depressions where the water ponds to a depth of more than 1/8-inch shall be filled or the slope shall be corrected to provide proper drainage to catch basins. Filling shall be done with hot asphaltic materials only.

D. The edges of the fill shall be feathered and smoothed so that the joint between the fill and the original surfacing is practically undetectable.

3.4 Asphalt Paving Seal Coat

A. Apply seal coat on asphalt paving. Prepare the surfaces, mix the seal coat material, and apply in accordance with the manufacturer's recommendations as approved by the City Engineer or the Consultant.

B. Apply one coat of the specified sealer.

C. Achieve a finished surface seal which, when dry and thoroughly set, is smooth, tough, resilient, of uniform black color, and free from coarse textured areas, lap marks, ridges, and other surfaces.

Section 10160
Solid Plastic Partitions

Part 1 General

1.1 Summary

A. Provide and install solid plastic partitions and urinal screens in toilet rooms and shower stalls where indicated on the Contract Drawings and as specified herein as needed for complete and proper installation.

B. Related Section:

1. Documents affecting work of this Section include, but are not necessarily limited to, the General Conditions, and Sections in Division 1—General Requirements of these specifications.
2. Lath and Plaster in Section 09200.
3. Ceramic Tile in Section 09330.
4. Toilet Room Accessories in Section 10800.

C. Toilet compartments shall be floor anchored, overhead braced.

D. Screens shall be wall hung.

E. Toilet accessories, such as toilet paper holders, and grab bars are specified elsewhere in Division 10.

1.2 Submittals

A. Product Data: Submit manufacturer's detailed technical data for materials, fabrication, and installation, including catalog cuts of anchors, hardware, fastenings, and accessories.

B. Shop Drawings: Submit shop drawings for fabrication and erection of toilet partition assemblies not fully described by product drawings, templates, and instructions for installation of anchorage devices built into other work.

C. Samples: Submit full range of color samples for each type of unit required. Submit 6" square samples of each color and finish on same selections have been made.

1.3 Quality Assurance

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible, to ensure proper fitting of work. However, allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay work.

B. Coordination: Furnish inserts and anchorages, which must be built into other work for installation of toilet partitions and related work; coordinate delivery with other work to avoid delay.

Part 2 Products

2.1 Materials

A. Manufacturer: Subject to compliance with specified requirements, provide products as manufactured by Santana Products Co., or approved equal.

1. Recycled plastic materials content, whether provided by manufacturer or approved equal, shall be between 50 percent and 90 percent in solid plastic partitions.

B. Provide materials that have been selected for surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other irregularities on finished units are not acceptable.

C. Solid Plastic: High density, solid polyethylene with homogenous color throughout. Provide material not less than 1" thick, seamless construction with edges eased.

1. Color shall be as selected by the Architect.

2. Colors shall extend throughout the panel thickness. Exposed finish surfaces shall be smooth, waterproof, non-absorbent, and resistant to staining and marking with pens, pencils, or other writing devices. Solid plastic partitions shall not show any sign of deterioration when immersed in the following chemicals and maintained at a temperature of 80 degrees F for 30 days:

Acetic Acid (80 percent)	Hydrochloric Acid (40 percent)
Acetone	Hydrogen Peroxide (30 percent)
Ammonia (liquid)	Isopropyl Alcohol
Bleach (12 percent)	Lime Sulfur
Borax	Nicotine
Caustic soda	Soaps
Chlorine Water	Sodium Bicarbonate
Citric Acid	Trisodium Phosphate
Copper Chloride	Urea; Urine

D. Concealed Anchorage Reinforcement: Minimum 12-gage galvanized steel sheet.

E. Concealed Tapping Reinforcement: Minimum 14-gage galvanized steel

F. Pilaster Shoes: ASTM A 167, Type 302/304 stainless steel, not less than 3" high, 20 gage, finished to match hardware.

G. Stirrup Brackets: Manufacturer's standard design for attaching panels to walls and pilasters, either chromium-plated non-ferrous cast allow ("Zamac") or anodized aluminum.

H. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories of chromium-plated non-ferrous cast alloy ("Zamac").

I. Overhead-Bracing: Continuous extruded aluminum, anti-grip profile, with clear anodized finish.

J. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, chromium-plated steel, or brass finished to match hardware, with theft-resistant type head and nuts. For concealed anchors, use hot-dip galvanized, cadmium-plated, or other rust-resistant protective-coated steel.

2.2 Fabrication

A. Stirrup Brackets: Manufacturer's standard design for attaching panels to walls and pilasters fabricated for partition system, unless otherwise indicated. Furnish units with cutouts, drilled hotels, and internal reinforcement to receive partition-mounted hardware, accessories, and grab bars, as indicated.

B. Door Dimensions: Unless otherwise indicated, furnish 24" wide in-swinging doors for ordinary toilet stalls and 36" wide (clear opening) out-swinging doors at stalls equipped for use by handicapped.

C. Hardware: Furnish hardware for each compartment in partition system, as follows:

   1. Hinges: Cutout inset type, adjustable to hold door open at any angle up to 90 degrees. Provide gravity type, spring-action cam type, or concealed torsion rod type, to suite manufacturer's standards.

   2. Latch and Keeper: Manufacturer's standard surface mounted latch unit, designed for emergency access, with combination rubber-faced door strike and keeper.

   3. Coat Hook: Manufacturer's standard unit, combination hook and rubber-tipped bumper, sized to prevent door hitting mounted accessories.

   4. Door Pull: Manufacturer's standard unit for out-swing doors.

Part 3 Execution

3.1 Installation

A. Comply with the manufacturer's recommended procedures and installation sequence. Install partitions rigid, straight, plumb, and level.

B. Provide clearances of not more than 1/2" between pilasters and panels, and not more than 1" between pilasters and panels, and not more than 1" between panels and walls. Secure panels to walls with not less than two stirrup brackets attached near top and bottom of panel. Locate wall brackets so that hoes for wall anchorages occur in masonry or tile joints. Secure panels to pilasters with not less than two stirrup brackets located to align with stirrup brackets at wall. Secure panels in position with manufacturer's recommended anchoring devices.

C. Overhead-Braced Partitions: Secure pilasters to floor, and level, plumb, and tighten installation with devices furnished. Secure overhead-brace to each pilaster with not less than two fasteners. Hang doors and adjust so that tops of doors are parallel with overhead-brace when doors are in closed position.

D. Screens: Fasten screens with concealed anchoring devices, as recommended by manufacturer to suit supporting structure. Set units to provide support and to resist lateral impact.

3.2 Adjust and Clean

A. Hardware Adjustment: Adjust and lubricate hardware for proper operation. Set hinges on in-swinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors (and entrance swing doors) to return to fully closed position.

B. Clean exposed surfaces of partition systems using materials and methods recommended by manufacturer, and provide protection as necessary to prevent damage during remainder of construction period.

Section 07116
Reinforced Membrane Waterproofing (215 mil)

Part 1 General

1.1 Summary
A. Furnish and install reinforced membrane waterproofing, 215 mils thick, as indicated on the drawings and specified. The work includes pedestals and pavers specified in Section 02515.

1.2 System Description
A. Furnish and install a completed waterproofing assembly including surface conditioner, a monolithic, rubberized asphalt membrane, protection course, flashing, extruded polystyrene insulation (if required), drainage course (if required) and pavers (where required). To ensure total system compatibility, all products must be purchased from a single-source manufacturer.

1.3 Submittals
A. Certification from an approved independent testing laboratory experienced in testing this type material, that the material meets the ASTM standards for rubberized asphalt membranes.

B. Certification showing full time quality control of production facilities and that each batch of material is tested to insure conformance with the manufacturer's published physical properties.

C. Certification showing that all waterproofing components are being supplied by a single-source manufacturer.

1.4 Quality Assurance
A. The Waterproofing Contractor must be approved by the membrane manufacturer and show evidence that they have had experience with rubberized asphalt systems for a minimum of five years.

The rubberized asphalt membrane product shall contain an inert clay filler to enable the product to be resistant to acids (fertilizers, building washes and acid rain).

C. Membrane Manufacturer shall have available an in-house technical staff to assist the contractor, when necessary, in application of the products and final inspection of the assembly.

D. Membrane Manufacturer must have a minimum of 10 continuous years in the manufacture of the rubberized asphalt membrane for use as a waterproof membrane.

E. PreConstruction Conferences. The manufacturer will meet with the necessary parties at the job site to review and discuss project conditions as it relates to the integrity of the waterproofing.

1.5 Delivery, Storage and Handling
A. Deliver materials in original unopened containers of packaging clearly labeled with manufacturer's name, brand name, instruction for use, and all identifying numbers.

B. Materials shall be stored in a neat, safe manner, not to exceed the allowable structural capacity of the storage area.

C. Store materials in a clean, dry area protected from water and direct sunlight.

D. Over its service life, do not expose membrane or accessories to a constant temperature in excess of 1800 degrees F (820 degrees C). (i.e., hot pipes and vents or direct steam venting).

E. Adhesives contain petroleum distillates and are extremely flammable. Do not breathe vapors or use near an open fire. Do not use in confined areas without adequate ventilation. Consult container or packaging labels and Material Safety Data Sheets (MSDS) for specific safety information.

F. Do not allow waste products (petroleum, grease, oil, solvents, vegetable or mineral oil, animal fat, etc.) to come in contact with the waterproofing membrane. Any exposure to foreign materials or chemical discharges must be presented to membrane manufacturer for evaluation to determine any impact on the waterproofing membrane assembly performance.

G. Contractor shall assure adequate protection during installation of the waterproofing assembly.

1.6 Project Conditions

A. Application of the membrane shall not commence or proceed during inclement weather. All surfaces to receive the membrane shall be free of water and dew.

B. Application of membrane shall not commence or proceed when the ambient temperature is below 0 degrees F (-17.7 degrees C).

C. Preparation and application of membrane must be conducted in well ventilated areas.

D. Over its service life, do not expose membrane or accessories to a constant temperature in excess of 180 degrees F (82 degrees C). (i.e., hot pipes and vents or direct steam venting).

E. Adhesives contain petroleum distillates and are extremely flammable. Do not breathe vapors or use near an open fire. Do not use confined areas without adequate ventilation. Consult container or packaging labels and Material Safety Data Sheets (MSDS) for specific safety information.

F. Do not allow waste products (petroleum, grease, oil, solvents, vegetable or mineral oil, animal fat, etc.) to come in contact with the waterproofing membrane. Any exposure to foreign materials or chemical discharges must be presented to membrane manufactured for evaluation to determine any impact on the waterproofing membrane assembly.

G. Contractor shall assure adequate protection during installation of the waterproofing assembly.

1.7 Warranty

A. Warranty shall be in accordance with the General Conditions of the Contract.

   1. Warranty Duration: Two years

Part 2 Products

2.1 Materials

A. Subject to compliance with specified requirements, reinforced membrane waterproofing shall be as manufactured by American Hydrotech, Inc., MM6125EV, or an "Or Equal" product by one of the following manufacturers:

1. The Barrett Company
2. Tremco, Inc.

B. The rubberized asphalt membrane shall contain not less than 25 percent recycled content.

C. Membrane shall be a hot, fluid applied, rubberized asphalt membrane meeting the following physical properties:

Property	Test Method	Requirement/Results
Flash Point	ASTM D-92	500°F
Water Vapor Permeability	ASTM E-96 Procedure E	1.7 NG/PA (s) M2 max. (0.027 perm)
Penetration	ASTM D-1191	77°F
Flow	ASTM D-1191	140°F
Softening Point (82°C)	ASTM D-36	180°F
Elongation	ASTM D-1191	1000% min.
Resiliency	ASTM D-3407	40% min.
Bond to Concrete (0°F, -18°C)	ASTM D-3408	Pass
Acid Resistance Procedure 7.1 (N-8)	ASTM D-896-84 Sulfuric Acid	Pass, Nitric Acid
Solid Content		100%, no solvents
Shelf Life		10 years (sealed)
Specific Gravity		1.23 p. .02

D. Surface Conditioner

1. A surface conditioner for concrete surfaces.

E. Flashing/Reinforcing

1. 60 mil (1.5 mm) thick, uncured neoprene flashing/reinforcing sheet.
2. Spunbonded polyester fabric reinforcing sheet.

F. Adhesives/Sealant

1. Contact adhesive to bond flashing together.
2. Contact adhesive to bond flashing to an approved substrate.
3. Sealant to seal flashing seam edge.

G. A fiberglass reinforced rubberized asphalt sheet.

H. Prefabricated Drainage Course (if required).

1. A composite drainage system consisting of a three-dimensional, crush-proof, drainage core and non-woven needle punched filter fabric meeting the following physical properties.

Property	Test Method	Values
Core:		
Comprehensive Strength	ASTM D-1621	30,000 psf (14.66 kg/cm^2)
Thickness	ASTM D-1777	.22 in (.56 cm)
Flow Q at 3600 psf and hydraulic gradient of 1 302 - 5.5. gpm/ft/width (68.30 1pmin/m width) 1000 - 7 gpm/ft/width (86.93 1 pmin/m width)	ASTM D-4716	300 - 7 gpm/ft/width (86.93 1pmin/m width)
Fabric:		
Flow	ASTM D-4491	205 gpm/ft^2 (8349.62 $1pmin/m^2$)
UV Resistance	ASTM D-4355	Fully stabilized
Apparent Opening Size	CW-02215	70-100
Grab Tensile	ASTM D-4632	90 lb (40.82 kg)

I. Insulation: An extruded polystyrene rigid board insulation meeting the following physical properties.

1. Insulation shall be Styrofoam, or equal, and meet ASTM C-578, Type VI or VII.
2. Minimum compressive strength, ASTM D-1621, 40 or 60 psi (276 or 414 kpa) (variance by type of product).
3. Maximum water absorption by volume per ASTM C-272, 0.1 percent.
4. Water vapor permeance for 1" product per ASTM E-96, 1.0 perm (max.) (63 ng/pa/s/m2).
5. Insulation shall have an R value of 5.0 F ft 2 h/Btu/in (0.88) k m2/w) of thickness when tested at 750 F (23.90C) mean temperature in accordance with ASTM C-518).

J. Filter Fabric Sheet: Water permeable polymeric fabric.

K. Supportive Pedestals: As specified in Section 02515.

L. Paver Materials: As specified in Section 02515.

Part 3 Execution

3.1 Inspection

A. The waterproofing contractor shall examine all surfaces to receive the waterproofing assembly to verify it is acceptable and proper for the application of the membrane.

B. The waterproofing contractor shall not proceed with the installation of the waterproofing membrane assembly until all deck defects have been corrected.

3.2 Preparation

A. All surfaces must be dry, smooth, free of depressions, voids, protrusions, clean and free of unapproved curing compounds, form release agents and other surface contaminants.

   1. Cast-in-place concrete/composite deck

      a. Poured-in-place concrete must be monolithic, smooth, free of voids, spalled areas, laitance, honeycombs, and sharp protrusions.

B. Substrate cleaning

   1. Thoroughly sweep the substrate that is to receive the waterproofing membrane.

   2. Substrate must also be blown clean using an air compressor to remove any remaining loose debris.

   3. Final check to determine if concrete has been properly cleaned is to apply a test patch to the surface and check its adhesion.

3.3 Installation

A. Surface conditioner application (to concrete)

   1. Apply the surface conditioner to the concrete using a hand held sprayer evenly at a rate of 300 to 600 Sf/gallon (7.4 - 14.7 m2/L) depending on surface texture. Surface conditioner should “tan” the surface, not blacken it.

   2. Allow sufficient time for the surface conditioner to thoroughly dry prior to the membrane application.

B. Membrane preparation

   1. The membrane shall be heated in double jacketed, oil bath melter with mechanical agitation, specifically designed for the preparation of a rubberized asphalt membrane.

   2. Heat membrane until membrane can be drawn-free flowing at a temperature range between 3500 F (1760C) and 4250F (2180 C).

C. Detailing /Flashing

   1. All detailing and flashing shall be done in accordance with the manufacturer’s standard guideline details.

   2. All detailing and flashing shall be completed before installing the membrane over the field of the substrate.

D. Membrane Application

1. Apply the rubberized asphalt membrane at a rate to provide a continuous, monolithic coating of 90 mil minimum (approx. 2.3 mm), into which is fully embedded a layer of the spunbonded polyester fabric reinforcing sheet, followed by another continuous monolithic coat of membrane at a minimum thickness of 125 mil (approx. 3.2 mm). Total membrane thickness is to be 215 mils (approx. 5.5 mm).
2. Overlap fabric reinforcing sheet one to two inches (25.4 mm - 50.8 mm) with membrane between sheets.

3.4 Separation/ Protection Layer Installation

A. Separation/Protection layer shall be installed as follows:

1. Embed the separator sheet into the membrane while it is still hot to insure a good bond.
2. Overlap adjoining sheet edges (dry) a minimum of two to three inches (50.8 mm - 76.2 mm) to insure complete coverage.
3. The separator sheet must be covered by insulation, fabric and ballast as soon as possible, within 30 days of membrane installation.

3.5 Water Test

A. It is strongly recommended that the deck area or portions thereof be water tested by ponding water a minimum depth of 2" (950.8 mm) for a period of 48 hours to check the integrity of the membrane installation.

B. Verify that the structure can support the deadload weight of a watertest before testing.

C. If leaks should occur, the water must be drained completely and the membrane installation repaired to the satisfaction of the City Engineer.

3.6 Drainage Course/Insulation/Filter Fabric Sheet/Paver Placement

A. General

1. Contractor shall examine the deck area to be covered with subsequent topping materials in order to insure that all deck areas have received the membrane, the membrane is free of damage, it is properly protected, and all flashing has been properly installed, before placing the insulation.
2. It is recommended that the drainage course (if required), insulation (if required), and other subsequent topping materials be installed as each section is completed.

B. Prefabricated Drainage Placement

1. Install drainage course on horizontal and vertical surfaces in accordance with the manufacturer’s recommendations.
2. Layout and position drainage course and allow to lay flat. Cut and fit drainage course to perimeter and penetrations.
3. Bond all geotextile overlap edges to adjacent drainage course geotextile with an acceptable adhesive to insure geotextile integrity.
4. Place subsequent topping materials as soon as possible.

C. Insulation Placement

1. Loose lay in a staggered manner and tightly butt together all insulation boards. The maximum acceptable opening between insulation boards is 3/8" (9.5 mm). Insulation must be installed within 3/4" (19 mm) of all projections and penetrations.

2. When multilayer insulation applications are involved the bottom layer of insulation must be the thickest layer and must be a minimum of two inch thick (50.8 mm). All layers shall be installed unadhered to each other and all joint in relation to underlying layers staggered.

D. Architectural Finish Paver Placement: Install architectural finish pavers on Terra-Tabs or Terr-Adjust as manufactured by American Hydrotech, Inc., Chicago, Illinois, or City approved equal pedestals in accordance with manufacturer's recommendations and architectural layout.

3.7 Job Completion

A. Contractor and a representative of the membrane manufacturer shall inspect the waterproofing assembly and notify the contractor of any defects. All defects must be corrected and documented in writing.

B. Clean up all debris and equipment.

Appendix F : Sample Recycled-Content Product Specification

GreenSpec[1]

Section 09250
Gypsum Board

Part 1 General

1.01 Environmental Considerations

A. Qualities:

1. Abundant resource (conserve limited resources)
2. Recycled paper backing (conserve resources)
3. Inert non-toxic material (minimum pollution)

B. Problems:

1. Mining of materials (contribute to dust, soil erosion, destruction of habitats)
2. High embodied energy (approximately 2,600 Btus per sq ft)
3. Difficult to recycle (contribute landfill)

C. Recommendations:

1. Minimize waste (conserve resources).
2. Utilize recycled content materials (conserve resources).
3. Avoid pre-mixed joint compounds containing additives (indoor air quality and pollution problems).
4. Select products that minimize framing (conserve resources).

1.02 Quality Assurance

A. Industry Standards: Work shall comply with the applicable requirements of Gypsum Association (GA) publication GA-216, "Recommended Specifications for the Application and Finishing of Gypsum Board."

Part 2 Products

2.01 Gypsum Board

A. Specify gypsum board containing recycled gypsum content if available, and 100 percent recycled paper. Specify manufacturers that take back scrap for recycling.

1. Regular Gypsum Board: ASTM C36
2. Fire-Rated Board: ASTM C36, Type X
3. Gypsum Sheathing: ASTM C79, Type X, 5/8 inch thick
4. Ceiling Board: 1/2" controlled density gypsum board can span 24"

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5. Water-Resistant Gypsum Board: ASTM C630. May be difficult to recycle.
6. Fire-Rated Water-Resistant Gypsum Board: ASTM C630, complying with requirements of ASTM C36, Type X. May be difficult to recycle.
7. Glass Fiber Reinforced Gypsum Board: Difficult to recycle.

2.02 Fiber Gypsum Board

A. Fiber gypsum wall board panels: Recycled newspaper and gypsum over recycled newspaper, gypsum and perlite core. High moisture tolerance. Heavier and more durable than regular gypsum board with a dense, hard surface. 1/2 inch can span 24 inches. Has to be cut or scored on both sides.

1. Thickness: 1/2 inch and 5/8 inch
2. Fire resistance: 1/2-inch and 5/8-inch panels equivalent to Type X, ASTM E119 and CAN/ULC-S101. Class 1 flame spread, smoke development, and fuel contribution, ASTM E84 and CAN/ULC-S102.
3. Moisture tolerance: After wetting, regains original strength upon drying.

2.03 Related Materials

A. Adhesives: Certified in accordance with ASTM C557 and complying with required VOC regulations. Not recommended, contributes to pollution and indoor air quality problems, and makes recycling unfeasible.

B. Fasteners: Drywall screws

C. Joint-Treatment Materials: Lime compound. All purpose joint and texturing compound containing inert fillers and natural binder. Most of the pre-mixed compounds contain antifreeze, vinyl adhesives, preservatives, biocides, and other slow releasing compounds. Avoid if feasible.

D. Acoustical Sealant and Joint Tapes:

Part 3 Execution

3.01 Materials Handling

A. Protect gypsum products from moisture and contaminants, including solvents and kerosene heaters.

3.02 Application of Gypsum Board

A. Comply with ASTM C840 and GA-216, except where exceeded by other requirements.

1. Layout panels to minimize waste; reuse cutoffs whenever feasible.
2. Provide panel sizes to minimum waste.

3.03 Application of Fiber Gypsum Board

A. Comply with ASTM C840 and GA-216, except where exceeded by other requirements.

1. Layout panels to minimize waste; reuse cutoffs whenever feasible.
2. Provide panel sizes to minimum waste.

3. Half-inch ceiling board and 5/8-inch fiber gypsum board may be installed over framing at 24 inches on center.

3.04 Taping and Finishing

A. Apply compounds in accordance with manufacturer's directions.

B. Finishes: In accordance with GA and industry association recommended specification, "Level of Gypsum Board Finish."

C. Tool joints as smoothly as possible to minimize sanding and dust.

D. Protect workers, inhabitants, and HVAC systems from gypsum dust.

3.05 Waste Management

A. Separate clean waste gypsum products from contaminants for recycling in accordance with Waste Management Plan. Do not include wood, plastic, metal, a asphalt impregnated gypsum board or any gypsum board coated with glass fiber, vinyl, decorative paper, paint or other finish. Place in designated area and protect from moisture and contamination.

B. Clean waste gypsum products are to be recycled by:

1. Hauling to gypsum board manufacturer in lieu of landfill.
2. Hauling to alternative use manufacturer in lieu of landfill.
3. Placing small scrap in wall cavities. Adds thermal mass and sound insulation. Check added weight and mass with structural engineer.
4. Pulverize and apply on site as soil amendment in accordance with landscape specifications. Do not use products containing glass fiber. Protect granular material from moisture.
5. Separate metal waste in accordance with the Waste Management Plan and place in designated areas for recycling or reuse.