P2 Through Adaptive Use of Historic Facilities

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ABSTRACT

The construction industry consumes a tremendous amount of our natural resources. Demolishing serviceable buildings and hauling the debris to a landfill makes no sense from the standpoint of reducing solid waste and conserving natural resources. Wastes associated with new construction (such as concrete, bricks, asphalt (rubble), particleboard, plywood, wood products, metals, plastics/polyresins, and insulation – some of which contain toxic constituents) approximately comprise of 15 to 30 percent of all wastes disposed in landfills. Furthermore, today's buildings are constructed for relatively short–term physical usefulness based on economic investment: buildings constructed today are engineered for a twenty to forty year use with limited flexibility for upgrades and improvement. Federal tax laws suggest that building incorporating new construction practices lose their economic value after 31.5 years. Surprisingly though, new building construction accounts for about 40% of the raw material (natural resources) consumption and 11% of total energy consumption each year. Ultimately, more natural resources and energy need to be reinvested into the demolition and re-construction of functional facilities. Rehabilitation, which is the process of making an efficient compatible use or adaptive re-use of a property through repair, alterations, and additions, can conserve natural resources, cultural resources, energy, and landfill space. Admittedly, adaptive re-use of a building is much more labor intensive than new construction, but much less material and energy intensive. Energy that is embodied in a building is completely sacrificed during demolition, and more energy must be incorporated into the process of demolition, debris removal and disposal. Rehabilitation or adaptive re-use of existing facilities can sustain the natural and cultural environment through the "recycling" of physical features of the structure, the supporting infrastructure, the character of our cultural past, and the energy resources that still exist in the facility.

INTRODUCTION

Throughout the United States, including military installations, an awareness has been emerging to become "green" by sustaining the natural environment through pollution prevention efforts. On military installations, these recycling efforts have been limited to activities centered around recycling household/office products, industrial metals, fluids (such as petroleum, oils, and lubricants), water, and the acquisition of products made from recycled materials. Little has been done to promote the tangible benefits of "recycling" existing facilities. Awareness alone is not

enough to achieve pollution prevention in any medium; knowledge, technology and policy are the key to forging and implementing pollution prevention initiatives. As other societies have shown, adaptive use, preservation, and rehabilitation of existing structures can be a significant means of preventing pollution, conserving natural resources and reducing energy consumption.

The culture, politics, and economics of historic preservation and adaptive reuse of facilities have long been implemented in Europe. Despite ravishing wars which all but demolished entire cities, the preservation, restoration and adaptive reuse of facilities (some dating back to the Middle Ages) are common occurrences and most of the time preferred over demolition and new construction. This preference stems from three primary factors: knowledge, available technology, and policy development. These factors espouse the economic efficiency of restoration/adaptive use over demolition and new construction, the desire to maintain socio-culture elements and the value that these structures contribute to society, and the need to preserve the environment through natural resource and energy conservation.

HISTORICAL BUILDINGS

The National Historic Preservation Act (NHPA) states that a building that is typically older than 50 years and/or meets other "historically significant" criteria must be considered and assessed when certain undertakings such as demolition, alteration, or reuse are to occur. The impact of the NHPA can be significant on military installations where 60% to 70% of the buildings are older than 50 years which is the case on Mare Island Naval Base and the Presidio in San Francisco. Many facilities have unique historical, cultural, and architectural values whereas other facilities such as war-time barracks and temporary buildings are more generic and would not be considered a cultural resource. Challenges arise when considering how best to use these historically, culturally, or architecturally significant buildings or the land on which they sit. Initial challenges may consist of seismic or structural strengthening, toxic substance removal/encapsulation (i.e. lead-based paint and friable asbestos), and infrastructure that does not meet current building codes. Frequently, these manageable challenges are transformed into political and social battles buttressed by unsubstantiated economic claims that the preservation, rehabilitation, or renovation of a historically significant building is too costly. There are economic as well as social and cultural advantages to recycling existing buildings for new uses:

- may require less consumption of natural resources
- may require less energy consumption and save energy already embodied in the existing structure
- may be more labor-intensive resulting in more jobs available for the community
- reduces the burden on landfills with construction and demolition debris
- may preserve cultural identity of community/military installation

Adaptive use of existing buildings builds upon an existing building's fabric, thereby conserving some natural resources by reducing the amount of materials that would be needed for new construction. Adaptive use also utilizes the existing physical energy embodied in the structure

thereby saving energy since little regard is given toward the energy requirements for the conversion of natural raw materials into building materials. Much of today's new construction has neither long-term economic value (it is conventional wisdom that the service life of some construction barely exceeds the mortgage or initial-lease term) nor cultural value.

The task at hand needs to be the generation and maintenance of the existing environment, both natural and man-made. The capacity to do this is contingent upon knowledge and understanding of ecological, socio-cultural, economical, and political issues which are predicated on informed decision-making, ownership of resources, and sustainable development. Due to these dynamics, both internal and external to an installation and the mission, the capability to respond to change needs to be addressed by adaptive strategies for the built-up environment. Currently, adaptive strategies exist at military installations and are functionally implemented when changes occur in productive activities, organizational structure, and installation rules/regulations; however, adaptive strategies have not necessarily been established for reuse/renovation and sustainable development. Positive and functional adaptive strategies for historic facility reuse can lead to sustainable development. Negative and dysfunctional adaptive strategies can lead to the depletion of natural, cultural, and economic resources. The creation of policies for the adaptive re-use of existing facilities (or more specifically, historic facilities) is an important means of sustainable development and pollution prevention.

KNOWLEDGE, TECHNOLOGY, POLICY

Three key factors (knowledge, science/technology, and policy structures) must be integrated and support economic efficiency, socio-cultural elements, and ecological integrity in order to achieve pollution prevention through sustainable development and the adaptive use of historic facilities. One of the keys to pollution prevention is knowledge. Knowledge is not just cerebral, but includes attitudes, beliefs, and practices. There may be a great deal of knowledge in areas such as the environment, soils, plants, animals, and human health as well as land utilization practices, hazardous waste management, and hazardous material reduction, but limited knowledge, practice and attitude of historic preservation inhibit the adaptive re-use of existing facilities. The promotion of knowledge, skill, and value of adaptive use and the assimilation of these principles into practice can lead to the success of pollution prevention in the construction realm on military installations. Rehabilitation or adaptive re-use of existing facilities can sustain the natural and cultural environment through the "recycling" of physical features of the structure.

Awareness and knowledge are key factors in forming the adaptive re-use ethic, but science and technology play an important role as well. There is a huge body of technical knowledge and products available for local/site specific adaptive use scenarios that are cost efficient, socio-culturally pleasing, and integrate existing structures and landscaping with the natural environment. Both the natural environment and the man-made environment need to work together. The land and buildings must be unified and promote contextualism, hard and soft infrastructure must meet the current requirements of the organization as well as have the flexibility and durability to endure changes, and surrounding uses must apply land-based planning and design for sustainable development. Through proper assessment, new developments

and technologies can be added to existing facilities to meet changing missions and organizational structures. A degree of flexibility built into the structure of new construction and existing facilities is the key to its future ability to accommodate changing missions and new technologies. Traditionally, historic facilities have used durable materials in construction in contrast to some new construction which has an expected service-life of twenty to forty years. Federal tax laws suggest that building incorporating new construction practices lose their economic value after 31.5 years. The value of using durable materials to create long-lasting buildings is obvious; however, even though the awareness of the value of durable construction and its emphasis exists in military regulations, the lowest cost usually takes precedence in practice. Generally, adaptive reuse is quickly dismissed as a viable option to meet new technological and space requirements. Proper economic analysis of the adaptive reuse option for historic facilities can lead to achieving the benefits of durable construction, lower costs, and sustainable development.

On the traditional scale, architects have the abilities for design and adapting existing structures to meet current needs, engineers have the abilities to develop/upgrade the needed infrastructure and technical systems, and policy planners/developers have the implementation skills. All disciplines that are involved in the adaptive use of historic properties have formal knowledge and technical skills that can contribute to policy formation, development planning and decision-making. Policy and/or regulations generally comprise organizational arrangements which refer specifically to political and economic externalities that impinge upon the land use planning and facility development at an installation.

It is important that knowledge, science, and policy about sustainable development, ecosystem dynamics, and historic resource management are used to support economic efficiency, socio-cultural elements, and ecological integrity. Buildings should be viewed as integrated systems rather than a set of independent components. Incorporating a systems engineering perspective into the designing, planning, and building/renovation stages can have significant effects on the decision-making aspects and ultimately the final outcome of the final product. Applying system engineering principles to historic preservation enables the integration of the architectural and cultural integrity of the structure with up-to-date technologies (i.e., HVAC, communication systems, lighting devices) and space requirements set by the organization while being cost effective, preventing pollution through natural and cultural resource conservation, and developing a sustainable environment.

RECYCLING

Adaptive re-use of historic facilities is an example of stewardship and promotes sustainable development and pollution prevention. Methods and techniques have been established to make building disassembly and salvage cost-competitive with complete demolition. Cost-competitive disassembly makes historic preservation and the adaptive re-use of properties the preferred option for sustainable development and pollution prevention. Admittedly, adaptive re-use of a building is much more labor intensive than new construction, but much less material and energy intensive. New building construction accounts for about 40% of the raw material consumption and 11% of total energy consumption each year. Energy that is embodied in a building is

completely sacrificed during demolition, and more energy must be incorporated into the process of demolition, debris removal and disposal. Adaptive re-use of a property through repair, alterations, and additions can conserve natural resources, cultural resources, energy, and landfill space. Adapting historic structures to meet changing military operations and organizational structures can sustain the natural and cultural environment through the "recycling" of physical features of the structure, the supporting infrastructure, the character of our cultural past, and the energy resources that still exist in the facility.

Tearing down serviceable buildings and disposing the wastes in landfills increase the amount of solid waste generated on a military installation and requires an increase in consumption of natural resources. Some beliefs hold that remodeling a historic facility generates more waste per square foot than new construction's estimated 3-4 lbs/ft^3 ; however, this statistic does not take into account the wastes from the demolition and removal of an existing structure on the site of the new construction. Common sense dictates that material reuse diverts construction materials from landfills and disposal. Demolition and dew construction (as well as renovation, but a lesser amount) can consist of all types of construction and demolition (C & D) debris: fixtures, finished building materials, building supplies, painted drywall, communication wires/cables, flooring materials, joists, roofing materials asphalt, concrete, etc. Since 15-30 percent of all wastes disposed of in landfills is C & D debris, a significant opportunity for reducing waste is through renovation. Not only can adaptive re-use of facilities reduce C & D debris, but renovation techniques tailored for historic building can also prove cost effective. Remolding project present the greatest potential for recycling materials and energy already embedded in the existing structure. Structural elements (i.e., footings, floors/ floor systems, concrete slabs, exterior walls/supporting walls, and roof systems), infrastructure (i.e., sewer lines, electrical/communication conduits, and stormwater/drainage areas), finished building materials (i.e., windows, doors, light fixtures, and bathroom fixtures), and building supplies (i.e., framing studs [metal and wood], joists, rafters, flooring materials, and headers) can be reused and/or retrofitted to renovate the existing structure to meet current organizational demands and new building requirements. Furthermore, any materials that do not have a potential to be used in the actual renovation of an historic facility, have the potential to be recycled into other products. Two such examples of high value waste products are metal, copper and aluminum, and cardboard. Other C & D debris such as wood, drywall, vinyl, and asphalt roofing can be recycled, but the availability and cost effectiveness of recycling these wastes varies by location.

CONCLUSION

Adaptive re-use of historic structures maintains the architectural and cultural integrity of structures while integrating modern technologies, new space requirements and sustainable development principles which are cost effective and prevent pollution. Knowledge, available technology, and policy development support the economic efficiency of restoration and adaptive use of historic properties as opposed to the demolition of an existing facility and new construction. The value that these renovated structures contribute to society and military installations is maintained in the socio-culture fabric that these historic buildings embody, the natural resources which are conserved, the energy which is saved, and the amount of solid waste

(in the form of C & D debris) which is diverted from landfills. The positive benefits of pollution prevention as well as sustainable development can be achieved by "recycling" the physical features, the supporting infrastructure, the character of our cultural past, and the existing energy resources that are present in historic properties.

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