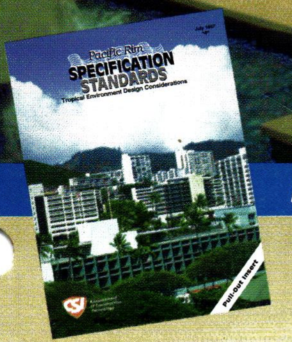
July 1997/$3.00

Hawaii Pacific Architecture

The Big Estates



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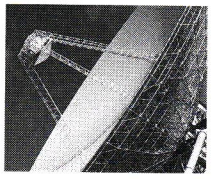

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The City of Kapolei
A New Direction

A development of The Estate of James Campbell

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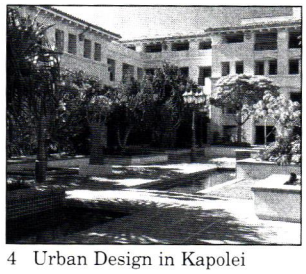
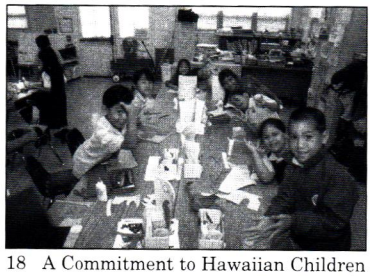
THE BIG ESTATES



4 Urban Design in Kapolei

WINDOWS AND DOORS

DEPARTMENTS



18 A Commitment to Hawaiian Children

IN THIS ISSUE ...

Hawaii's large estates have had a strong influence on land use issues in the Islands. Do the estates fulfill their commitments to the people of Hawaii with responsible planning and architectural design? Several thought-provoking articles in this issue attempt to answer this question. (*Ed. note:* It is impossible in a magazine of this length to cover all of Hawaii's estate land holders. We have attempted to achieve a balance among the articles we received for the issue.)

COVER: Campbell Square, headquarters for The Estate of James Campbell, has been recognized for design that reflects a Hawaiian sense of place.
Photo by Sandy Putt

Clarification

In an article in the June 1997 issue of *Hawaii Pacific Architecture*, "The Retail Explosion on Guam," **James B. Tucker & Associates**, Honolulu, was inadvertently omitted as the designer of the interior of the Liberty House Tumon. TRS+A/Taniguchi-Ruth-Smith+Associates, Guam, coordinated, stamped and signed drawings and performed field inspections.

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The Campbell Estate commits to "Hawaiian" design

Urban Design in Kapolei

by Henry Eng, AICP

The Campbell Estate's Kapolei development must be cohesive, dynamic and serve the needs of the area. It must also function economically to the benefit of those who invest there.

The design review process established in the City of Kapolei Urban Design Plan and Guidelines, prepared by Group 70 International, has been in operation for five years. Its objectives reflect the estate's desire to create a coherent and attractive urban environment and to shape the design of Kapolei. The guidelines help to establish a sense of place and a sense of vitality.

The estate believes that the guidelines enhance the quality of architecture and design in Kapolei, and that established quality will attract more quality, thereby creating a favorable climate within which to create meaningful solutions to urban needs. While Kapolei is a new city, the estate recognizes the importance of preserving our past, providing for the present and planning for the future. Links to Hawaii's unique cultural heritage are important, especially in architecture and urban design. It is equally important to maintain flexibility to respond to changing needs.

Several architects, whose work has contributed to the design quality at Kapolei, have commented on their experiences with the building design process at Kapolei.

Francis Oda, Group 70 International
Chair, Kapolei Design Advisory Board

"Kapolei's Urban Design Plan and Design Guidelines were developed for use by owners, developers, architects and engineers to mani-

Campbell Square
Photo by Augie Salbosa

fest the vision of a livable and vital Hawaiian garden city. They illuminate the vision by establishing functional, formal and spatial vocabularies which are employed by the builders of the city to craft their contributions to a quilt which will be more holistic (much like a Hawaiian quilt) rather than patchwork. Many of the world's great cities have evolved in this way, shaped by criteria imposed by tradition, culture, technology and enlightened patronage. Kapolei is no different.

"A board of design professionals assists developers and designers to interpret the plan and guidelines through a review process. While some project teams might not have initially appreciated this 'assistance,' I think all have experienced its value in achieving a common vision. While different voices with creativity and variety are encouraged, all are to sing from the same complex score."

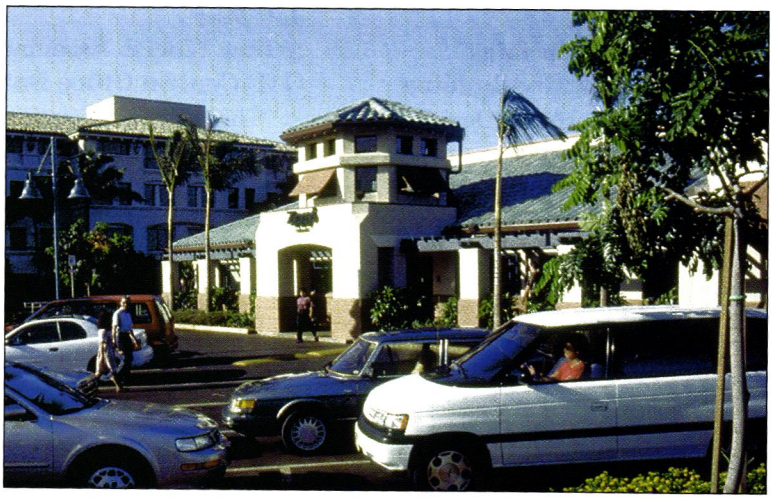
Kurt Mitchell,
Kober/Hanssen/Mitchell Architects
Campbell Square

"Campbell Square was designed during the development of the guidelines. This allowed for testing of the guidelines so when finalized, they would truly enhance the quality of design for Kapolei and establish the standards and guidelines as a meaningful tool. This was reflected in the design of Campbell Square, headquarters for The estate of James Campbell. While providing the estate with state-of-the-art offices, it defines the Estate's cultural heritage and commitment to quality architecture. KHMA has taken to heart the essence of the guidelines in its other Kapolei projects – Kapolei Shopping Center, Palailai Mall and Kapolei Entertainment Center. This tradition continues as KHMA designs the city's new Kapolei Civic Center."

Charles Lau, AM Partners
Zippy's Kapolei

"The Kapolei Urban Design Guidelines provided the basis for the local 'Hawaiian' character of the building which was in keeping with the regional theme and the established design standards. Typically, the facilities for Zippy's are created within the eclectic urban fabric of less planned development. Working within Kapolei's master planned environment provided the opportunity to take advantage of the synergy of the surrounding area rather than trying to create a facility which worked within a less cohesive setting.

"One of the project features which was realized working with the guidelines was the creation of a pleasing entry sequence which incorporates a colonnade. This feature provided a functional sunshade which is appropriate to the climate and enhances the curb appeal of the building. Materials and colors are attractive and functional. Continuity of design was also carried into the interiors, creating a pleasing dining experience which continues the 'sense of place' created by the exterior elements."



Zippy's Kapolei
Photo by Sandy Putt

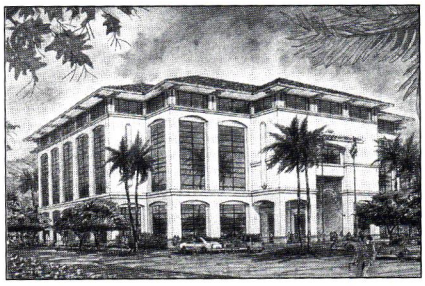
Sid Char, Wimberly Allison Tong & Goo
Bank of Hawaii

"The Kapolei Design Guidelines influenced our design solution for the Bank of Hawaii Kapolei building. Having an old Hawaiian theme enabled us to incorporate some of the indoor/outdoor courtyard arrangements and the informal landscaping as a part of the ambiance of the facility. The guidelines established a goal for the architectural character. Our challenge was incorporating the building program within the low building envelope. The design guidelines also help to facilitate architectural compatibility among neighboring buildings." *(Continued on next page)*

Bank of Hawaii
Photo by Olivier Koning

Steve Wong,
Mitsunaga & Associates
Kapolei State Office Building

"The Kapolei Urban Design Plan suggests an architectural vocabulary language that reflects the strengths of our community. We

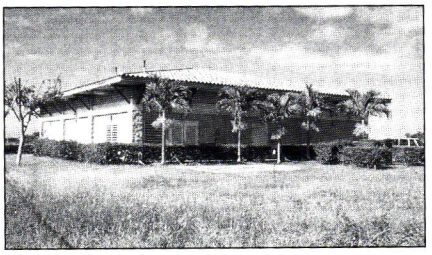


sought to bring these guidelines to life in the Kapolei State Office Building. While allowing for individuality and creativity, the various components of Kapolei can relate to one another and grow in harmony. The design review process ensures that our projects fulfill this goal and contribute to Kapolei's development as a garden city, sensitive to our lifestyle, traditions and natural environment."

Jeff Mori,
Arthur Mori & Associates
GTE Central Office Building

"The Urban Design Guidelines provided the opportunity to take a telephone switch facility/central office building which can be and is often built as a 'concrete box' and create something which expresses the unique sense of place and architectural style that all of us in our profession are trying to achieve in the islands.

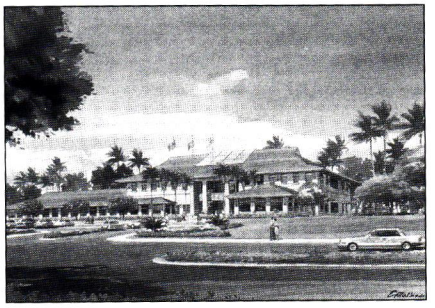
"We viewed the guidelines not as a set of restrictions to hinder design but as a reasonable and flexible set of recommendations, well thought-



out, that when applied will allow the City of Kapolei to become truly the 'garden city' it was meant to be."

Stan Yasumoto,
Architects Hawaii
Kapolei Police Facility (proposed)

"To us, 'kamaaina' implies an expression of neighborhood, a friendly scale, a generosity in the treatment of facades, an open quality in the public lobbies and a luxurious use of landscaping. These are qualities which we have incorporated in the design of the Kapolei Police Sta-



tion. The entry lobby will contain a two-story skylit atrium space, which opens out to a lushly landscaped courtyard and serves as a landmark. Visitors easily find their way to the various departments which are accessible to the public."

The Urban Design Guidelines, prepared for The Estate of James Campbell, benefit the design profession by nurturing the character and traditions of Hawaiian architecture and enhancing the quality of architecture and urban design in the rapidly growing city of Kapolei.

Early buildings at Kapolei have established a strong foundation of good design which will be maintained and enhanced by future projects. The end result will be an attractive and functional urban core, respectful of the past while serving present and future needs. If James Campbell were alive today, those of us who have been entrusted with the management of his lands believe he would be proud of this accomplishment.

Henry Eng is manager of land planning for The Estate of James Campbell.

Would Hawaiian sovereignty affect estate land?

Who Owns the Land?

by Oswald K. Stender

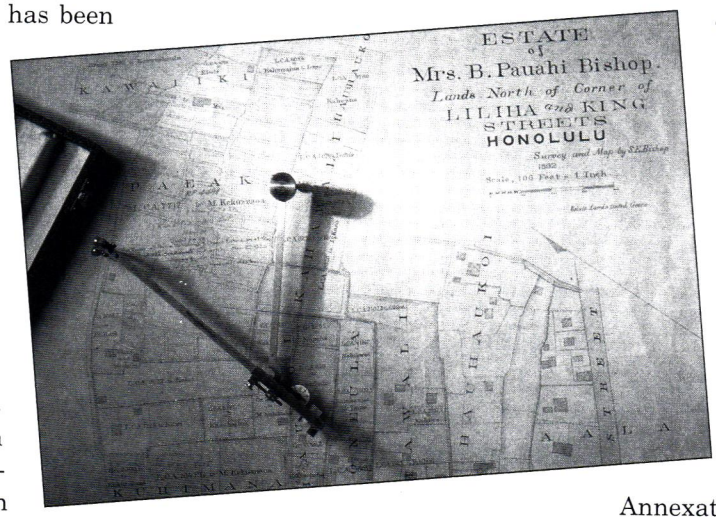
As the Hawaiian sovereignty movement takes shape, is there concern for major landowners and the estates with regard to their ownership of large tracts of land? Will the ceded lands debate question the large estates' ownership title to land acquired for the period 1840 to 1900?

I am not an expert in land titles, but merely someone who has been keenly interested in the sovereignty movement and ceded land issues. These intertwined elements have created great hopes for Hawaiians and yet great concern for others who must find a balance for all people of Hawaii.

In order to understand these issues, we must determine if the Hawaiian people were at a disadvantage in dealing with Westerners in formulating new land ownership policies for Hawaii. Were strategies regarding land ownership contrived so that their appearance gave opportunities for Hawaiians to own land but in fact created greater opportunities for Westerners to acquire most of those lands?

Prior to Western contact, Hawaiians had developed a stable land tenure system that supported a population of more than 400,000 people. Everyone shared a subsistence lifestyle managed by one or more chiefs. Land was viewed as a communal resource and not a commodity – contrary to Western culture.

As Westerners became more entrenched in Hawaii, they pressured the king to adopt a land tenure system to Western modes. Thus, in 1840 Kamehameha III proclaimed the first constitution of the Kingdom of Hawaii. While the document acknowledged that the king controlled all the land, it implied that the king could convey land fee simple – hence began the end of the traditional Hawaiian land tenure system.



The Great Mahele of 1848 set the stage for the Hawaiian sovereign lands being transferred to Westerners with the promise that the common people could own their own land through the Kuleana Act of 1850. However, the common people ultimately received less than 1 percent of the lands set aside for them.

As Westerners continued to wrest political control, they coerced King Kalakaua to sign the "Bayonet Constitution" of 1887 which stripped the king of his powers and disenfranchised Native Hawaiians. Queen Lili'uokalani planned to promulgate a new constitution to restore the power of the monarch, but Westerners overthrew the Hawaiian Kingdom in January of 1893, confiscating crown and government lands in the process.

The Spanish-American war fueled the United States' desire for a permanent military base at Pearl Harbor. However, due to widespread disapproval of the circumstances under which Hawaii was then being offered to the United States, a second treaty of annexation was unable to pass the Senate. Annexationists therefore proceeded to annex Hawaii via joint resolution of both houses, known as the Newlands Resolution.

Under the Newlands Resolution, the Republic of Hawaii ceded sovereignty of Hawaii to the United States along with all of its public lands (the confiscated crown and government lands, which amounted to almost 1.75 million acres and valued at $5.5 million). Congress provided that all revenue from Hawaii's public lands, with the exception of lands used for civil, military or local government pur-

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James Campbell's wife, Abigail (Maipinepine) Campbell, was one of the first trustees to administer his estate.

poses, "shall be used solely for the benefit of the inhabitants of the Hawaiian Islands for educational and other public purposes." In 1899, the U.S. Attorney General rendered an opinion that the public lands in Hawaii were subject to "a special trust." The Newlands Resolution was thus the implicit origin of the ceded lands trust.

Under the Organic Act of 1900, Congress established Hawaii's territorial government. The United States retained "legal" title to the ceded lands trust for the people of Hawaii, and gave the Territory "beneficial" title to possession, use and control of the ceded lands. Prior to annexation, some public lands had been opened for homesteading. After annexation, some 188,000 acres of other public lands were set aside under the Hawaiian Homes Commission Act of 1921. Finally, even more public lands were set aside for federal purposes: during the Territorial period, the United States had acquired a total of 432,725.91 acres.

These undisputed historical events give rise to the cry by the Hawaiian people today for sovereignty and return of the ceded and crown lands. They also raise questions of legal ownership of Hawaii's lands and the beneficiaries of the public lands. As these lands have been exchanged, transferred between governments and sold over the years, ownership is being challenged by sectors of the sovereignty movement and the Perfect Title Company.

Are the Estate Lands in Question?

The issue is whose and which lands are in question? The commonality of purpose of those involved in the sovereignty movement is that the "Ali'i Trust Lands" – the Lunalilo Estate, Bishop Estate, Lili'uokalani Estate, Queen Emma Estate – are to be protected and managed to the benefit of their beneficiaries – the Hawaiian people – as their benefactors intended. These trusts were established by their benefactors who acceded the title through royal family lineage.

These titles were affirmed by the 1865 Act which designated crown lands to be inalienable. Thus, the Damon Estate lands (gifted to Samuel Damon by Ke Ali'i Bernice Pauahi) and Campbell Estate lands (much of it purchased from King Lunalilo and the chiefs of ahupua'a who received title through the Mahele of 1848) would be free from legal questions of ownership. It is interesting to note that many of the estate lands are still owned by descendants of the ali'i and chiefs of the ahupua'a, 'ili, and konohiki, e.g., the Brown (I'i), Robinson, Campbell and Castle estates.

In conclusion, because of the commonality of purpose of the sovereignty movement and the "Ali'i Trust Lands" and the fact that most large estates are owned by Hawaiians and descendants of ali'i, the questions of legal land ownership do not directly affect Hawaii's large estates. However, it is still critical that we bring closure to the questions raised by the ceded lands issues and sovereignty.

Oswald "Oz" Stender, an alumnus of Kamehameha Schools, is a trustee of the Kamehameha Schools Bernice Pauahi Bishop Estate. He was formerly chief executive officer for The Estate of James Campbell and also served as senior advisor to the Campbell Estate Board of Trustees.

Does concentrated land ownership benefit Hawaii's people?

The Ancient Land Use Debate

by Tom Dinell, AICP

Does the high concentration of land ownership in Hawaii, particularly among the estates, translate into good outcomes for the people of Hawaii?

There are two diametrically opposed hypotheses about the desirability of concentrated land ownership grounded in two different perspectives, which may be the reason the resulting dialogue is often unproductive. The first focuses on social, political and economic phenomena. The second focuses on development of land and the consequences thereof for society.

The first position maintains that concentrated land ownership is undesirable because it leads to wealth and political power in the hands of the few who then become an aristocracy or even an oligarchy. The members of this aristocracy or oligarchy, in turn, behave in an arrogant manner with little consideration for the environment or well-being of the people who live in the communities dominated by the large landowners. Since all major decisions are made by private landowners seeking private gain, the public interest is a non-entity. Highly-concentrated land ownership may even lead to social unrest, as has occurred in many parts of the world.

Further, such concentrated ownership creates a non-competitive situation with respect to the availability of land. Monopolistic and oligopolistic land ownership patterns can lead to inflated prices for land which in turn leads to a lack of affordable housing. Finally, it is argued that broad-based land ownership and an educated populace are critical requirements for the maintenance of a democratic society.

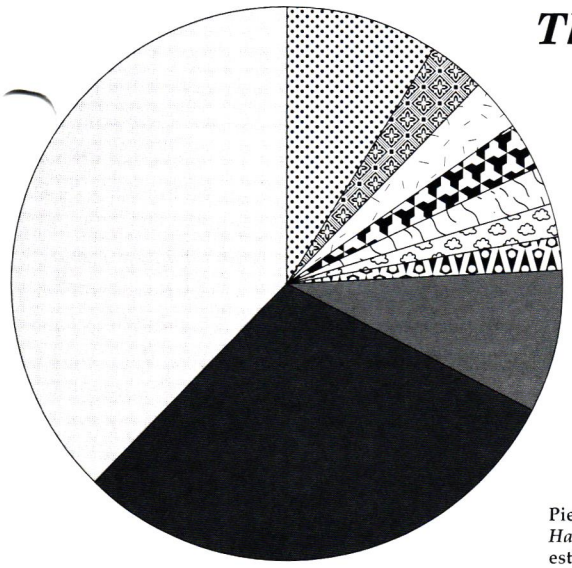
The second position holds that concentrated land ownership is beneficial to the larger community. It facilitates the development of projects that require large areas of vacant land, such as the Kaanapali resort area, which in turn become an income source for the community.

Furthermore, these major projects can be developed in an integrated manner which can minimize deleterious environmental impacts, reduce unit infrastructure costs, achieve economies of scale, share common assets, provide attractive facilities and, perhaps most importantly, assure there is land available when required for new developments. Because land required for such projects is already under single ownership, the difficult and expensive process of assembling large areas of land is avoided. Also, land use shifts, from residential to commercial for example, can be more easily accomplished if land ownership is concentrated.

Further, since the large landowner has a vested stake in the economic well-being of the community, he will work for improvement of the community. Finally, concentrated land ownership minimizes the generation of a multiplicity of small subdivisions and small-scale developments that occur when land ownership is widely dispersed and each individual owner seeks to maximize his own economic return. This might happen if the land in an estate is distributed among 100 heirs. It is also the reason primogeniture survived so long.

No Easy Answer

The debate as to whether concentrated land ownership is beneficial to the larger community has been going on since at least the Enlightenment. It has not been resolved and in fact should be continued. This article seeks to stimulate discussion as to whether Hawaii has suffered the ravages of concentrated land ownership that its opponents suggest, or has reaped the rewards of con-



The Seven Largest Private Landowners in the State of Hawaii

- Bernice P. Bishop Estate (367,509 acres)
- Richard S. Smart (140,000 acres)
- Dole Food Company, Inc. (121,982 acres)
- Samuel M. Damon Estate (121,608 acres)
- Alexander and Baldwin, Inc. (90,800 acres)
- C. Brewer and Company, Ltd. (81,997 acres)
- James E. Campbell Estate (71,678 acres)
- Federal (345,321 acres)
- State and County (1,225,067 acres)
- All Other (1,545,004 acres)

Pie chart by PMP Co. Data on seven largest landowners based on 1995 data from *The State of Hawaii Data Book*, 1996 issue (forthcoming). Distribution of all other landowners based on estimations from 1988 data, the latest data available. All figures are approximate.

centrated land ownership that its proponents proclaim.

Some Success and Non-Success Stories

A great deal of thought and planning has gone into the development of Kapolei. From very early on, the Campbell Estate retained the noted Hawaii planner, the late Donald Wilbrink, to generate conceptual plans to guide development of its Ewa lands. Similarly, Castle and Cooke, a corporate entity, engaged in a great deal of planning in the development of Mililani. American Factors (now AMFAC/JMB Hawaii) invested much effort in planning the development of its Kaanapali Coast lands including arranging for relocation of the highway, an essential step in making the makai lands available for development as a resort destination area.

On the other hand, Bishop Estate assigned the master lease for Hawaii Kai to Henry J. Kaiser and his successor entities, and it is they who guided the planning and development of that area, lively battles between the Bishop Estate and Kaiser entities notwithstanding. One consequence of this arrangement is the almost complete lack of churches in the Hawaii Kai area, even though churches are a critical community-building block. Another is the almost haphazard way in which commercial endeavors have been located. It is only more recently, as Bishop Estate has desired to develop its Queen's Beach and adjoining lands, that it has become an active participant in planning. Similarly, Damon Estate sold its Salt Lake lands, seemingly without much concern as to how they might be developed. The resulting product can charitably be described as something less than a well-planned community.

In terms of outcomes for the people of Hawaii, it does not appear to make much difference whether the large landowner is an estate or a corporation. Does it make a difference whether the land is owned in fee or in leasehold in ease of future redevelopment? *(Continued)*

The number of residential leaseholds is decreasing at such a fast rate in Hawaii that the redevelopment argument has little applicability to residential lands. It will, however, continue to be relevant for commercial properties including resorts, as witness the transformation of Lanai from a pineapple plantation to a resort community by Castle and Cooke/Dole Corporation.

Ravages or Rewards?

The high price of real estate and lack of affordable housing in Hawaii (recent reductions in real estate prices notwithstanding) and the significant political influence of large landowners would suggest that some of the arguments of the opponents of concentrated land ownership may have credence in Hawaii. Proponents might point to the presence of several well-designed, environmentally-sound, economically successful, integrated developments in Hawaii as instances in which community has reaped the rewards of concentrated land ownership. They might also note that the likelihood of such large-scale developments occurring in the absence of entities owning large tracts of land would be slim. Kihei might be replicated more frequently and Wailea less often.

Concentrated land ownership offers the opportunity for large-scale developments that meet the needs of the larger community, but it in no sense assures those needs will be met. Protection of the environment, provision of affordable housing, preservation of cultural heritage, participation in underwriting the costs development imposes on the larger community and, perhaps most importantly, building in a way that facilitates the multiple and intricate relationships that make a community function successfully are all matters in the public interest. They are also matters that landowners should perceive as being in their interest as well, but whether or not that occurs, there is a need for the community to assure that those who control the major land resources act in a way that benefits the entire community.

While the proponents and opponents of concentrated land ownerhsip continue to put forth their positions, it is critical for Hawaii to structure its land use planning system so as to bring together: (1) the vision, entrepreneurial drive and commitment of its major landowners to further the well-being of the community; and (2) soundly conceived legal guidelines, including incentives and disincentives established by civil society through government, to assure that the public interest is well served.

Tom Dinell is a planning consultant in Hawaii and on the mainland and Emeritus Professor of Urban and Regional Planning at the University of Hawaii.

July 1997
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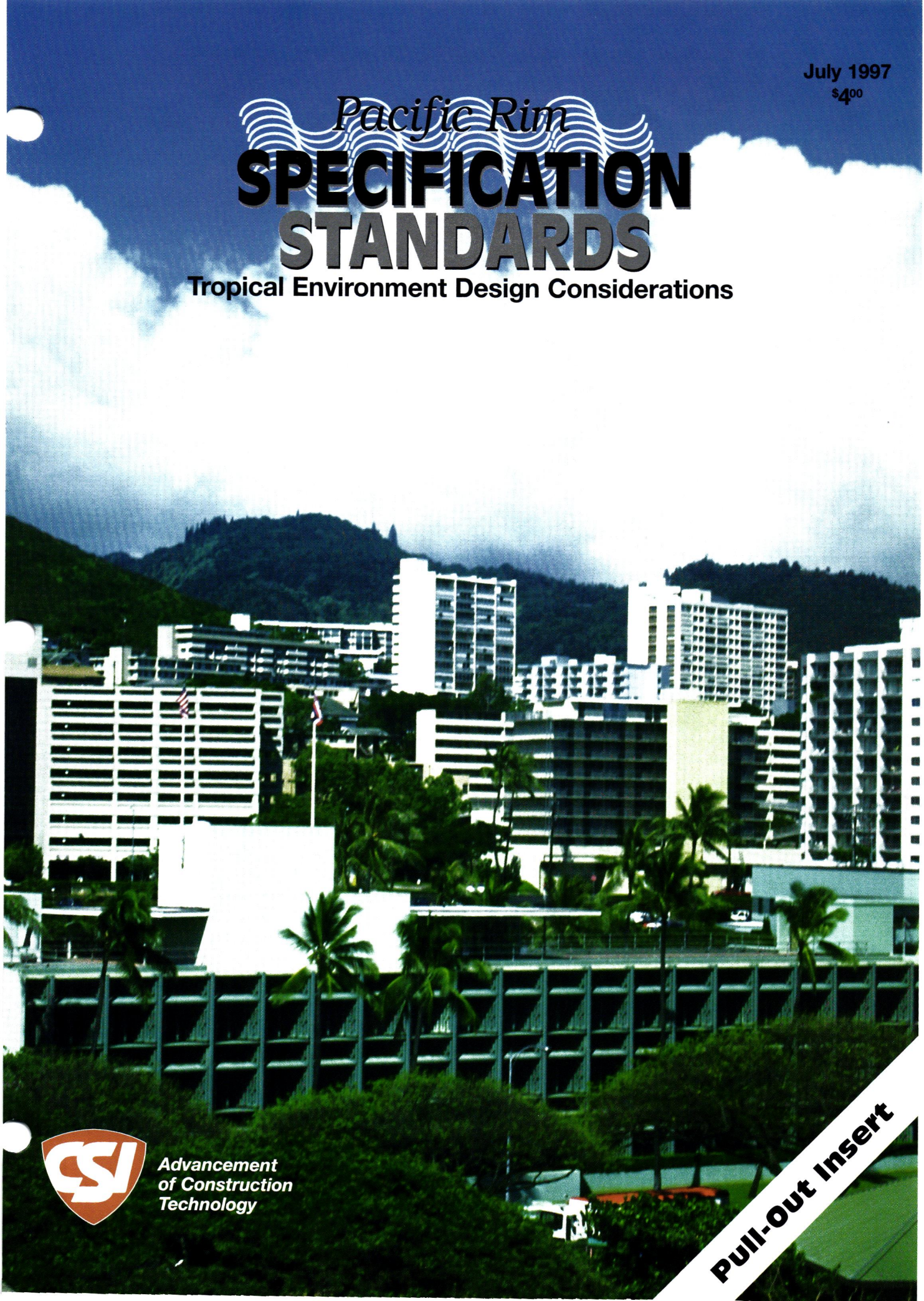
Pacific Rim SPECIFICATION STANDARDS

Tropical Environment Design Considerations



Advancement of Construction Technology

Pull-Out Insert

Pacific Rim SPECIFICATION STANDARDS

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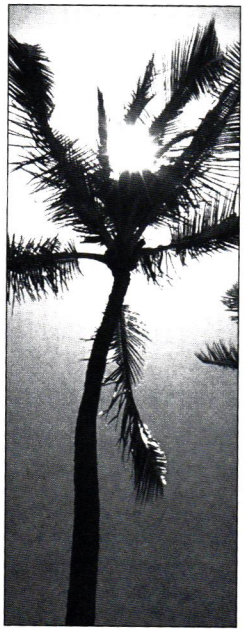

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BUILDING IN TROPICAL AND COASTAL ENVIRONMENTS

By Alice Shelly, CSI, CCS – Independent Specifications Consultant

Note: The information contained in this article is observations and opinions of the author as a specifier in Honolulu for a number of years. This is a written version of a seminar she gave several years ago at a National CSI Convention. The opinions in this article are those of the author and not the Honolulu Chapter CSI, the Construction Specifications Institute or its members.

The obvious topics to consider in building in tropical and coastal environments are high annual rainfall, high temperature range, high humidity, high salinity (both direct in marine structures and indirect by evaporation of water containing salt from the ocean and carried by wind and rain), high water table, high ultraviolet light (loss of plasticizers, materials degradation), insects (termites, wood borers, carpenter ants, and borer bees), microorganisms (mildew, mold, fungus), and rapidly growing vegetation. These general areas will be covered in relation to design and specification requirements by the various divisions as follows:

DIVISION 1 - GENERAL

Note special water/wind-resistant protection during storage. Specify in the applicable individual sections requirements for protecting humidity and temperature-sensitive materials during storage, handling and installation.

DIVISION 2 - SITE WORK

Save all healthy trees where practical; even large tropical trees can be transplanted. Plant shade trees to reduce heat, but avoid dense growth types that can block out cooling breezes. The invasiveness of the root system and mature height of the tree must be considered, as well as the type and moisture retention of the soil and area climate. Locate trees far enough away from buildings to prevent insect and vermin problems, coconuts "bombing" the roof, and leaves and other tree debris clogging drains and gutters.

For other landscaping, keep irrigation and plantings at least 2 feet from buildings to prevent providing a nurturing environment for termites and other insects. Select plants suitable for the climate that do not attract pests. Termites love Panax hedges and cockroaches hold conventions in Junipers. Don't use wood chip mulch; use shells, cinders, stones or gravel.

Grade with ample swales to allow for fast heavy rains in applicable areas. For excavations below water table or sea level, specify early pouring and quick waterproofing of concrete walls below grade.

Ground treatment for prevention of termites is essential, and the various types currently available in Hawaii are covered elsewhere in this edition.

Chain link fencing: Standard Class 1 galvanized isn't sufficient in coastal areas. Use galvanized/PVC coated or Class 2 galvanized.

DIVISION 3 - CONCRETE

Galvanized steel reinforcement is commonly used in foundations and slabs on grade, and sometimes above grade. Epoxy coated rebars are sometimes used in critical areas such as exposed slab edges and in marine structures.

Make sure concrete aggregates are washed salt-free and high range water reducing admixtures are used. Tropical heat sets off concrete rapidly and superplasticizers make it go off even faster. Acceptable mixing times may be as low as one hour.

Concrete coverage is critical; increase coverage over ACI requirements to 2 inches over column spirals and ties and at exposed slab edges. Use non-corrosive chairs or spacers to keep rebars well within slabs and walls.

DIVISION 4 - MASONRY

Exterior joints in concrete masonry require compressing to a slick, water-tight surface. The three recommended tooled joints are concave, V, and inclined weathered. Raked and other types crack in critical areas, allowing easy water intrusion. Concrete masonry units are made locally in a variety of configurations and are widely used. Brick and glazed CMU are rarely used, as they must be imported.

Granite cladding over structural steel structures is a fairly recent system on local commercial buildings. Anchors must be at least galvanized, and stainless steel may be required depending on proximity to the ocean.

DIVISION 5 - METALS

Structural steel should be shop primed before shipping to protect during ocean transport. Some contractors claim it

isn't necessary, and some spray-on fireproofing manufacturers may prohibit it.

Metal fabrications should be hot dip galvanized, preferably after fabrication, with at least G60 zinc coating. Increase coating to G90 in critical areas. Galvanized steel pipe railings should be limited to interiors, if possible. Touch up welds and bare areas on galvanized work with zinc rich coating.

Aluminum railings are most common; specify a minimum .7 mils anodizing or 2 mils polyvinylidene fluoride (PVDF or PVF) AAMA 605.2 (70% Kynar 500 or Hylar 5000). Stainless steel and vinyl-clad railings work well on ocean fronts.

Check details of lanai-edge posts set in concrete to assure proper clearance of rebars and coverage of concrete. Poorly constructed post settings allow water intrusion (often saline), causing rebar rusting and concrete spalling. When using hollow metal poles or posts embedded in concrete, provide proper drainage for trapped condensation and seal post interiors.

Use non-metallic non-shrinking grout that does not contain gypsum.

DIVISION 6 - WOOD AND PLASTICS

In addition to Koa, there are several other attractive local woods in limited supply. There are a number of mahoganies in the South Pacific, as well as attractive Australian and New Zealand woods. Get the latest information on locally available supply.

Termites are voracious; untreated redwood is appetizing to them as well as to borer bees. Second and third growth redwood and cedar do not have the termite resistance of earlier virgin woods, so treat them both, along with all other wood. Don't eliminate termite treatment on a project just because termites aren't known to be in the immediate area; they are prolific and spread. It only takes one clump of contaminated imported fill or one piece of infested lumber to start a colony in a new location. (Currently available termite treatments are covered elsewhere in this edition.)

In Hawaii and South Pacific islands, specify all wood to be dried to a maximum of 19 percent moisture before installation. The standard mainland 12 percent to 15 percent is practically unobtainable in the tropics. Annual rainfalls in Hawaii range from over 200 inches per year to less than 20 inches, so wood should also be tempered to the area. Adjust the moisture percent specification to the project site.

Fasteners should be carefully coordinated with termite treatment specified. Some treatments are corrosive to steel (including stainless), others to copper and brass. This is particularly critical in specifying roofing nails for tile roofs and mansards. A tile freed by its corroded nail to slide off the roof could prove fatal to a pedestrian below.

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

The water table level is critical in determining properly designed below grade waterproofing system. Salinity may also affect choice of materials and system. Bentonite clay waterproofing has a special saline-resistant type material and special installation procedures.

Tropical roofs are generally susceptible to frequent showers. Schedule your roofing work to take into account the local weather patterns. *(Continued)*

Due to the complex nature of thermal and moisture products, there are several previous *Pacific Rim Specification Standards* covering, in detail, the subject matter contained in this Division. For "Waterproofing, Sealants & Traffic Toppings" see the February 1996 edition. For "Low-Slope Roofing, First Revision" see the August 1996 edition. "Steep Roofing – First Revision" will be published again in September 1997. Copies of either of the first two publications are available for $4 each through the Honolulu Chapter CSI. Call the answering machine at 808-847-1862 and leave a message. Copies are limited.

DIVISION 8 - DOORS AND WINDOWS

Metal doors and windows should be galvanized (G60 interior & G90 exterior), bonderized and factory primed.

Isolate aluminum doors, windows and curtainwalls from wood framing by back painting or using polyethylene film. Use aluminum (minor) or stainless steel (structural) fasteners; cadmium plated screws don't last. Operators: stainless steel or bronze. Wheels: stainless steel, delrin, or nylon (not aluminum). Check windloads and maps to determine window and curtainwall design, glass thickness, and edge clearance. Exterior finish: minimum .7 mils anodizing (A41 or A42) or 2 mils polyvinylidene fluoride (PVDF or PVF) AAMA 605.2 (70% Kynar 500 or Hylar 5000); interior in air conditioned areas may be A 31 or PVDF 1 mil.

Use 18 x 18 (if available) or 18 x 16 mesh plastic screens; gnat-sized bugs and wingless termites can wiggle through 16 x 16 mesh. We don't specify screens above the fifth story, unless the building backs up against a mountain or within three floors above an elevated park or recreation deck with trees.

Wood doors and windows need waterproof glue and termite treatment.

Roll-up doors and grilles, anodized or PVDF coated aluminum hold up pretty well, but in industrial areas or where fire doors are required, steel doors may be necessary. All steel should be G90 galvanized, primed and finished with alkyd or modified epoxy enamel. This includes hood and other steel parts of aluminum doors and grilles.

Hardware: Use marine grade locks and bronze butts in severe coastal areas, and bronze/non-ferrous locksets throughout (beware of steel internal parts). Bronze butts are preferred; galvanized PC steel butts can be used in interior air conditioned areas. Use bronze, stainless steel c anodized aluminum for miscellaneous hardware. Avoid polished brass on exteriors in coastal areas. Again, watch out for corrosive fasteners.

DIVISION 9 - FINISHES

Make sure sand is salt free and no lime is used in cement plaster. We spec only PVC trim on exteriors and prefer it on interiors, both for plaster and gypsum board. Zinc and galvanized steel trim with extra zinc chromate primer coats are acceptable on less than monumental buildings.

Use galvanized hangers, wires and grids, and PVC moldings for acoustical ceilings. Consider humidity and wind factors in choosing materials; beware of bold and heavy textures in open areas, which catch wind-driven dirt.

Tile and marble: use salt-free sand and latex modifier in mortars. Check for color stability of grout. Provide adequate expansion joints.

Pressure treat the wood carpet strips. Avoid wood in non-air conditioned areas.

Check dryness of substrates before applying paints or coatings. Use organic zinc rich primers on steel. Add mildewcides/fungicides to exterior paints and stains, and to interior enamel in humid areas (bathrooms, kitchen, laundry, etc.) that are not air conditioned. There is also at least one EPA registered insecticide paint additive which is reported to kill spiders, flies, mosquitos, ants, fleas, and many other flying and crawling insects for the life of the paint. Check drying time and cured-surface tackiness of elastomeric coatings to avoid wind-blown dirt attraction. Check permeability of coatings; they need to breath.

Check for UV resistance, salt-resistance and yellowing of clear coatings.

Use moisture-resistant adhesive with mildewcide for wallcoverings in areas without air conditioning.

DIVISION 10 - SPECIALTIES

Toilet Compartments: Beware of ferrous metal in non-air conditioned areas. Galvanized steel with baked enamel finish may be used in some cases, but never for urinal screens. Laminated plastic with waterproof adhesive, solid plastic, marble and stainless steel all work well. Use only chrome-plated brass or stainless steel fasteners. Lockers: Galvanized steel with baked enamel finish is acceptable in most areas. Laminated plastic with waterproof adhesive, termite treated wood, or stainless steel and plastic lockers may be better choices. Louvers: Anodized or PVDF coated are preferable; galvanized steel with PVDF are acceptable in some areas. High wind areas may require extra depth weatherproof louvers to prevent water infiltration. Also make sure they are installed correctly.

Toilet accessories: use chrome-plated brass or stainless steel. Pot metal (Zamak) with chrome

plating pits, and the metal oxidizes. Wood, porcelain and acrylic plastic are acceptable for residential usage.

Mailboxes and chutes: Exterior should be all aluminum (anodized) or bronze. Interior non-air conditioned areas: stainless steel or as above, air conditioned areas may have galvanized chutes.

DIVISION 11 - EQUIPMENT

Check for protection against corrosion and termites as previously mentioned.

Check finish guarantee for appliances in non-air conditioned areas. Refrigerators are especially susceptible, as are washers and dryers in exterior or open locations.

DIVISION 12 - FURNISHINGS

Termite-treat wood. Check UV resistance of fabric in rooms with sun exposure. Check metals and their finishes for suitability. Specify non-corrosive fasteners.

DIVISION 13 - SPECIAL CONSTRUCTION

You may need to specify special treatment of components for rust protection in high humidity/high salinity areas, termite treatment of wood components, UV resistant coatings, special finishes on exterior surfaces subject to sand abrasion and non-corrosive fasteners.

DIVISION 14 - CONVEYING SYSTEMS

Same as above. Hydraulic elevators: Use PVC pipe for jack hole liners.

DIVISION 15 - MECHANICAL

Use copper, PVC or ABS piping if possible. Use fittings of brass, bronze or stainless steel base metal.

If you can't avoid monstrous water valves and other mechanical appliances in exposed exterior locations, at least shield them visually by plantings.

Corrosion-protect chillers and other air conditioning equipment mounted on the roof or in other exterior locations.

Make sure filters and screens are readily accessible for periodic cleaning.

Heat pumps and solar panels are efficient; don't forget to design for the release water.

DIVISION 16 - ELECTRICAL

Use rust resistant materials for exterior transformers; HECO uses stainless steel.

PVC conduit is most common, but some galvanized steel is used for embedment in suspended concrete slabs in air conditioned spaces.

Bronze or cast aluminum, either anodized or PVF coated, are best for lighting fixtures. Brass may be used in interior air conditioned areas. Acrylic globes hold up better to UV light and don't yellow like polystyrene.

Seal electrical panels against cockroaches and geckos. They've caused many power outages as a result of their "electrocution."

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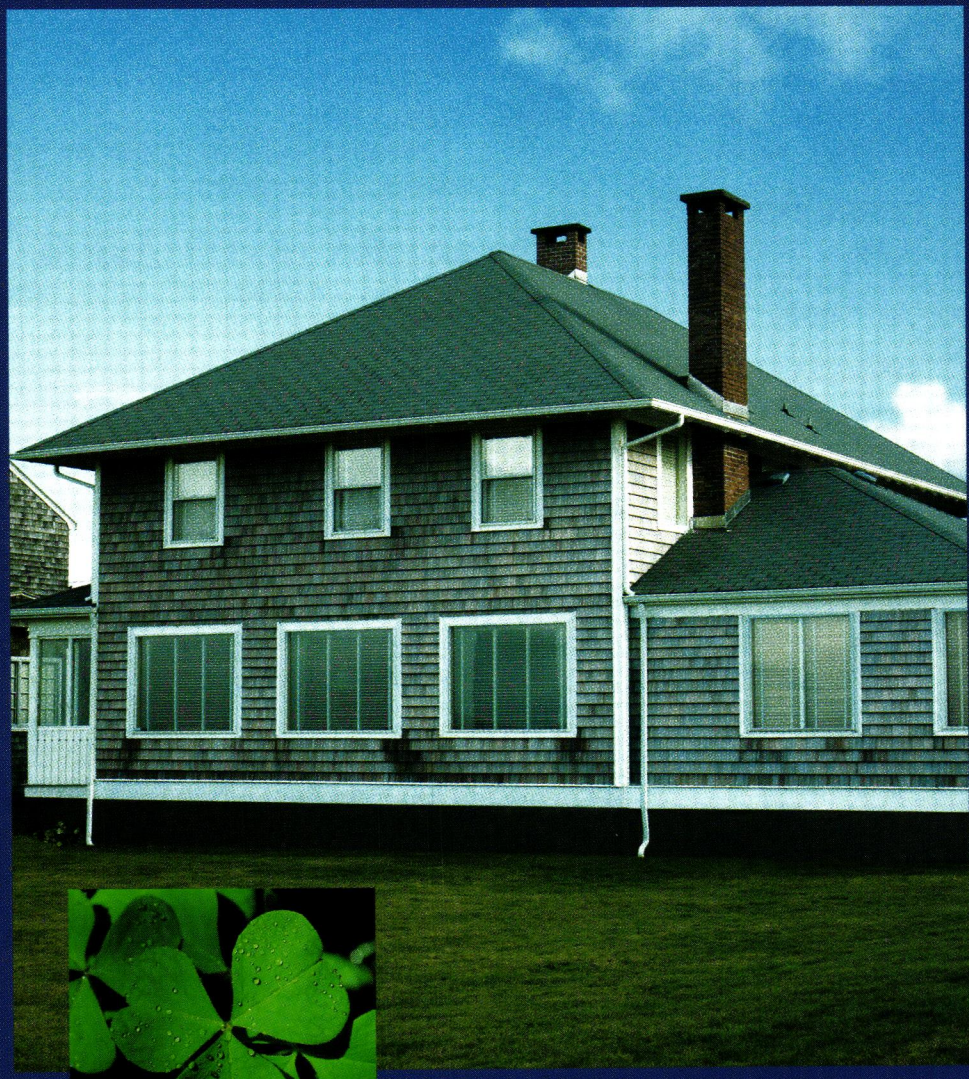

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METAL PROTECTION IN THE TROPICS

By Tino Jacob, CSI
KTA - Tator, Inc. - Pacific Regional Manager

Metals are extremely important in our everyday life, especially in the buildings we use and the infrastructure that supports our existence. Metals in the construction industry are manufactured to separate desired products from undesired products. It is through the manufacturing process that a relatively "pure" substance is extracted, however, the "pure" form of the metal is more chemically unstable than its natural state. The manufactured metals have a tendency to return to their natural state. This tendency is apparent as corrosion takes place. In other words, most metal corrosion on metal is the chemical change from an unstable state to its more natural state.

To prevent this tendency, metals require protection, except in general ambient cases involving stainless steel, cast iron and ductile iron. The appropriate protection of manufactured metals assures maximum service life. It is important to note that almost all metals used in construction are not chemically pure but are alloys, or compounds of two or more metals.

Most Employed Metals in Construction

The metals most frequently employed in construction are: steel, aluminum, copper, stainless steel, zinc, and to a lesser extent chromium, brass and bronze. Each metal has advantages and disadvantages, and it's common to find most or all of the above metals present in one building. For example, the structure may consist of steel, the railings and door/window frames made of aluminum, the water lines and roof flashing made of copper, the elevator doors and jambs made of stainless steel, the air conditioning equipment and duct work made of zinc-coated steel sheet metal and the bath fixtures made of chrome and brass/bronze hardware.

As mentioned earlier, because metals are manufactured, they are usually chemically unstable and have a tendency to return to their natural state. For example, iron oxides found in nature are the raw materials used in the manufacture of steel. Cast iron and ductile iron are used often and manufactured to resist corrosion when exposed to atmospheric conditions. By their nature, cast iron and ductile iron are for the most part resistant to corrosion caused by natural ambient environments and are used in items such as manhole covers and sewer pipelines. However, sewer pipelines are usually lined and coated.

The Aggressive Pacific Rim Environment

Pacific environments are known to be "aggressive" because the prevailing tropical climate contributes greatly to relative increases in corrosion rates. The rain, humidity, winds, salt spray, UV light, coastal marine exposures and relatively high temperature year round all play a part to accelerate corrosion of metals. In the Pacific Rim most corrosion is caused by the climate, which increases moisture contact on the metal producing "corrosion cells." The corrosion cell is basically the completion of a little circuit or battery on the surface of a metal once moisture is allowed onto it. The corrosion cell initiates and exacerbates the reaction of the environment with the metals.

Higher temperatures increase corrosion rates. Rain, humidity and condensation prolong and continue moisture contact. Salt (usually chlorides) increases the conductivity of the moisture which increases the corrosive rate. Salt also tends to "hold" the moisture to the metal surface. The most common causes of corrosion can be alleviated by preventing moisture and the atmosphere from contacting the reactive parts of the metal.

Methods of Metal Protection: Steel:

Steel (carbon steel) is widely used in structures as steel members or as rebar in concrete. Like most metals in construction steel can be corroded by acids. However, steel is passivated by high alkaline environments; such is the case when rebar in embedded in concrete (pH of 9+). Moisture provides a corrosion cell and also the medium for galvanic corrosion (dissimilar metals) to take place. Steel can be protected in four ways, including:

1. MILL SCALE (PARTIAL)

Steel as it is milled has a natural protective coating called mill scale. Mill scale forms from the cooling of the steel in the atmosphere after its exposure to high temperature during the milling process. The mill scale is hard, brittle and black. During the interim period of construction mill scale protects or "passivates" (the act of making inert or unreactive) the steel surface, although not always uniformly or entirely across the surface.

Mill scale is sometimes partially or totally removed by abrasive blast cleaning prior to the application of a protective coating. However, some surface protection standards such as the Steel Structures Painting Council (SSPC) surface preparation specifications SSPC SP-1 "Solvent Cleaning," SSPC SP-2 "Hand Tool Cleaning" and SSPC SP-3 "Power Tool Cleaning," allow tightly adhered mill scale to remain on the steel surface prior to the application of a protective coating. Some specifications involving steel for ser-

vice in interior air conditioned areas do not call for removal of mill scale, major surface preparation or protective coatings (although in tropical environments it is advisable to have some form of protective coating such as a primer).

Mill scale and rust are both forms of iron oxide. Both mill scale and rust can passivate a steel surface and protect the steel. The mill scale is more stable than rust and therefore remains intact. On the other hand, rust when uniform across a surface will continue to some extent at a slow rate of corrosion. This is why specific rust-protected steel products are sold in the industry. The drawback to using this type of rust-protective steel in the Pacific Rim areas is the climate. The wet/dry cycles, high temperatures, humidity, condensation, rainfall and salt in the air exacerbate the rate of corrosion. The serious structural concern is "pitting" corrosion where accelerated corrosion rates can cause large metal loss and affect structural integrity in concentrated areas.

As mentioned earlier, steel when used as rebar in concrete is passivated and therefore protected from corrosion. However, when cracks in the concrete occur and moisture infiltrates to the steel, corrosion begins. As corrosion advances, volumetric expansion of the rusting creates stresses and spalling occurs. The condition exacerbates further. Continual moisture flowing in concrete also lowers the concrete pH.

Sometimes indirect protection of the steel is required. For example, if the concrete that encases the rebar isn't protected and moisture is allowed to reach the steel, corrosion normally occurs and the rust cycle in concrete begins. This is a good reason to coat or seal steel reinforced concrete.

2. PROTECTIVE COATING

Protective coatings are commonly used on steel. There are several groups or classifications of protective coatings. The most important principle to remember when specifying a protective coating is the service condition under which it must protect the steel. A summarized generic discussion of the mechanisms of protection follows. An excellent detailed reference for specific paint systems is found in the Steel Structures Painting Councils (SSPC) "Steel Structures Painting Manual - Volume 2."

There are four factors to consider to ensure performance of a protective coating, including:

1) Design and specification are important to ensure the product is appropriate to function under all conditions to which it is exposed from the beginning of the project to the completion of the installation. This includes the continual integrity of the underlying substrate.
2) Integrity of the product is important to ensure the coating material consists of the components specified by the manufacturer and must also perform as specified by the manufacturer.
3) Surface preparation and cleanliness ensure the substrate is cleaned and prepared to allow the product to adhere well and perform as designed.
4) Application of the product must be properly performed to ensure the correct placement of the coating on the substrate. The requirements of a protective coating are good continuous coverage, uniformity of thickness, adherence, and freedom from gross defects.

In many cases, protective coatings are the first line of defense against the environment and are sometimes the foundation of subsequent applications. Protective coatings must be continuous to protect the substrate from the environment. The long term success of protective coatings rests on the ability to remain continuous and adequately adhered under the service conditions. Every factor as stated above must be met; otherwise, premature failure often will occur.

There are several types of protective coatings, classified generically by their binder type. The coatings basically consist of pigments (particles that offer color, substance and hide), binder (to hold the coating together), and solvents (to give the coating its fluid nature for application).

The major advantage of protective coatings is economy versus other forms of protection. The disadvantage is that it may not last as long as other forms of metal protection, for example, galvanizing. There are often cases where a combination of metal protection mechanisms is employed along with a protective coating for a longer period of protection.

a) Barrier Type

A barrier type coating is what the name implies. The barrier is the most common protective coating employed to protect the steel surface from the exterior environment. Moisture and other deleterious contaminates are not allowed to come in contact with the steel surface. Numerous protective coatings or paints are frequently used on steel, for example, alkyd primers, latex and epoxies. Barrier coatings are applied by various means such as brush, roller or spray. The amount applied is a relatively thin film, for example, 2 to 5 mils (mil = 1,000 of an inch). Barrier coatings, as with most coatings, basically contain a pigment (mass) and a binder (glue) and are for most cases applied as a liquid.

b) Sacrificial

Metallic coatings, for example zinc-rich paints, protect steel from the environment by sacrificing themselves and corroding instead of the steel substrate. Metals have a certain level of

potential to corrode at different rates relative to each other, a tendency known as the "Galvanic Series." For example, under the same conditions, zinc will have a tendency to corrode before steel, however it does so at a much slower rate. This is also the same principle employed in galvanizing (an alloying process), although in that process, the zinc and the steel are metallurgically joined. However, with zinc-rich paints there is a difference. Zinc-rich paints basically contain zinc dust pigment contained in paint.

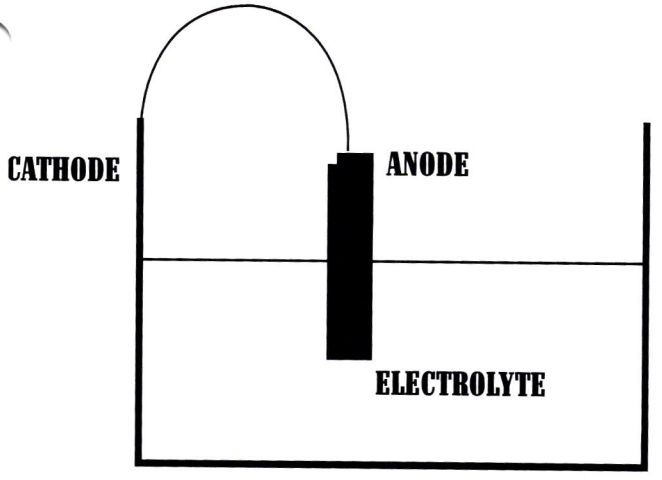
c) Both Barrier and Sacrificial

Some specifications call for more than one type of protective coating. An example is a zinc-rich primer followed by an epoxy intermediate coat followed by a polyurethane top coat. Although zinc-rich coatings are classified as sacrificial coatings, they also have characteristics of a barrier coating.

3. CATHODIC PROTECTION

a) Sacrificial

A simplified explanation of how sacrificial cathodic protection occurs is to imagine a wet cell battery. The battery consists of an anode pole and a cathode pole connected by a wire immersed in a liquid solution, or electrolyte. The anode is a material that will corrode before the cathode because of the different corrosion rates of the different types of metals. The diagram below illustrates the set up for a tank situation. In this case the tank wall becomes the cathode and is protected. The anode, having been chosen as a metal that will corrode before the cathode, i.e., the tank metal, will

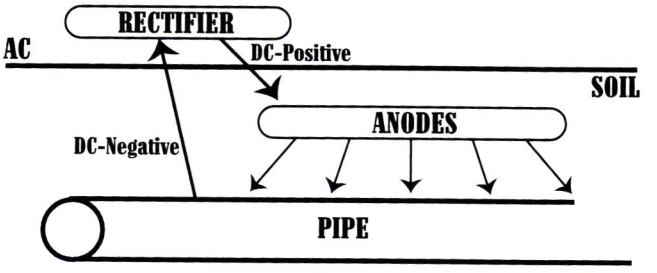


sacrifice itself and protect the cathode.

Obviously, this is applicable only when there is an electrolyte present. For steel tanks, the anodes are usually magnesium zinc, aluminum and sometimes magnesium. Other examples of sacrificial cathodic protection application are on submarines where zinc anodes are placed and for pipelines below grade. Sacrificial cathodic protection is used where soil is conductive, anodes and cathodes are relatively close to each other, a power source for induced current protection is not available, long term protection for more than 20 years is not required, and stray electrical currents in the area aren't a factor.

b) Impressed Current

The principle basically remains the same as sacrificial cathodic protection; however, an external direct current power source is required and there are no sacrificial anodes used. The anodes employed are as corrosion resistant as possible. The protected structure is connected to the negative pole of the DC current. The diagram below of an underground pipeline illustrates the above mechanism. The current passes through the anodes primarily and then through



the protected structure making it the protected metal. The anode sacrifices to corrosion before the cathode does.

The advantages of the impressed current method are: various current voltages can be used, it is effective in low conductive\high resistivity soils, the system can be monitored by the current meter and defective anodes can be found at the power source. The disadvantages are that it requires a power source and it can cause stray currents and interference to nearby structures. The common applications for this method in construction are steel in buildings, tanks and underground pipelines.

4. GALVANIZING

Galvanizing is a term most often associated with "hot dip" galvanizing. There are other uses of the term galvanizing; however, these are either mechanically induced, electrically deposited or are a form of a protective coating application. This article will address hot dip galvanizing.

Hot dip galvanizing is an alloying process. Alloys are mixtures of metals that are usually joined because they are soluble in a liquid state.

As the name implies hot dip galvanizing is accomplished when a piece of steel is emerged in a bath of molten zinc. The amount of protection increases directly with the thickness of the coat of zinc. Studies have shown steel will corrode 17 times faster than zinc in a desert climate and 80 times faster in a marine climate. Under normal environmental conditions and appropriate zinc thickness, hot dip galvanizing can protect steel for 25 years or more. However, this duration can be significantly less in Pacific area environments, especially along coastal marine areas.

The basic process is cleaning the steel, removing mill scale with an acid treatment or abrasive, then immersing it into the molten zinc. Thickness of the zinc is related to its temperature, time of immersion, viscosity and the rate the steel is removed from the molten zinc. Usually four layers containing zinc are formed over the steel surface. From the layer closest to the steel they are: 75 percent zinc/25 percent iron, 90 percent zinc/10 percent iron, 94 percent zinc/6 percent iron, and 100 percent zinc.

The zinc layer sacrifices itself before the steel and protects the steel from corrosion. White deposits or "white rusting" on the zinc surface is evidence of the corrosion taking place. When properly alloyed the zinc protects the steel until it has converted to zinc oxide, then steel (red rusting) will

corrode. If there is damage or deficient alloying of the zinc to steel, those areas are left exposed and red rusting of the steel becomes evident.

Advantages are the duration of protection given to the steel and the protection around edges, rivets and welds. Its disadvantage over protective coatings is that it is more expensive. Protective coatings can be and often are applied over a galvanized surface to provide additional protection. The galvanized surface is usually properly prepared before the application of a protective coating. These are called duplex coatings.

Aluminum:

Aluminum is about one-third the weight of steel. This light weight is one of its advantages over steel. Aluminum has an aesthetically pleasing silver appearance and is resistant to the normal ambient environment by its own thin oxide film called alumina. The disadvantages of aluminum are a thermal expansion coefficient twice that of steel and a stiffness about one-third of steel. As previously stated, metals in construction are generally alloys. Pure aluminum is soft and has little strength relative to steel; however aluminum alloys can be stronger than steel.

Aluminum can be corroded by acid and alkaline environments. Oftentimes aluminum is embedded in concrete or plaster and corrosion can occur. Galvanic corrosion or dissimilar metals such as hardware for the attachments to aluminum should be given consideration especially where moisture is present. Therefore, the same metal should be employed as attachments and fasteners or a dielectric insulator used to separate dissimilar metals.

The most common form of corrosion protection for aluminum is anodizing. Anodizing is also employed for architectural appearances, for example coloring. Aluminum can also be protected with a protective coating usually with an initial surface treatment such as a zinc chromate; however, the use of zinc chromates as an initial treatment has lessened recently because of the heavy metal chromium content and EPA concerns.

Anodizing is a process where aluminum is placed in an acid bath. The acid induces corrosion to take place at a faster rate than what would occur in the environment. The natural corrosion of aluminum in the environment is alumina or aluminum oxide. The acid bath virtually forces a protective layer of aluminum oxide which protects the aluminum substrate below. For thin layers of alumina, boric acid is used. For thick layers of protection and when coloring is required, sulfuric, chromic or oxalic acids are used. These acids produce a thicker alumina layer with pores where dyes can be added for color. The pores are sealed in boiling, deionized water. Oils and waxes as protective coatings are employed to improve seal and appearance.

Aluminum is not often recommended for service under acid or alkaline environments, i.e., pH under 4 and over 9. Tests in seawater over four years indicate that aluminum corrodes at a rate 50 times less than steel. Aluminum can be coated with a protective coating; however, the alumina should be removed for adequate adhesion by either a caustic solution, an acid solution or a light abrasive blast. An appropriate primer and topcoat can then be applied. The type of coating would depend on the service condition and compatibility to aluminum.

Copper:

Copper has a greater thermal expansion than steel and by its nature is resistant to atmospheric corrosion. Under normal environments copper left unprotected can oxidize and change from clear to a dark brown color, to a green color or "patina" or "verdigris." This color change occurs over approximately five years. The oxidized copper surface protects the underlying copper. Copper should use the same attachments and fasteners to avoid galvanic corrosion. As a caution, copper can react with aluminum by dissolving the aluminum especially where moisture is present, for example, copper roofs with aluminum gutters or drains.

Copper is usually used in construction "as is." In fact, the patina is often the desired architectural effect. When used in juxtaposition with compatible materials, its relatively slow rate of corrosion allows it to last many years by itself. However, if the shiny copper color or brown color is required, lacquers are usually used to protect it from further corrosion. Copper can be coated with a protective coating; however, the surface should be physically roughened for adequate adhesion. No inhibitors should be used because of potential reaction to the copper. An appropriate primer and topcoat can then be applied. Usually clear lacquers (thermoplastic coatings) are employed to coat copper.

Stainless Steel:

As opposed to steel (carbon steel) mentioned previously, stainless steels as the name implies are designed and manufactured to be resistant to corrosion and are therefore self-protecting. They are not normally covered with a protective coating. However, they can be corroded. Corrosion has been known to occur on stainless steel prematurely, usually because it has been exposed to an environment or conditions for which it has not been designed to resist. For example, acid cleaning of kitchen quarry tiles causes splatter and fumes to contact the stainless steel surface, causing corrosion. The most important protection of this metal begins with the selection of the stainless steel itself.

Stainless steels essentially have a very low carbon content and a minimum chromium content of 10 percent. Usually the chromium content is approximately 12 percent. As stainless steel is manufactured, the chromium combines with the steel to form a passive chromium oxide film on the surface of the steel. Chromium by itself is not affected by the normal environment and water; however, once temperatures rise above 200 F, oxidation occurs and chromium oxides are formed. Stainless steels when selected properly for the service conditions have excellent corrosion resistance. However, they are relatively expensive (about nine times or more the cost of carbon steels).

Brass:

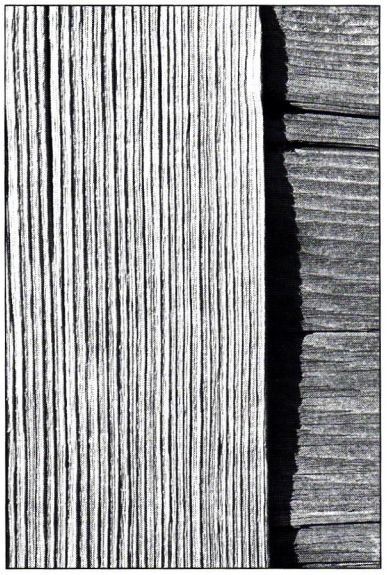
An alloy of zinc and copper is called a brass. Brass is mainly used as an architectural metal and in hardware. When brass corrodes it turns to dark brown and green. Brass corrosion is called dezincification. As the zinc separates at the surface, the characteristics of copper corrosion appear. Brass offers an aesthetically appealing yellow-gold color and is usually protected by a clear lacquer finish or by removing any corrosion by polishing. Brasses can become a maintenance routine if not properly sealed and protected. Therefore, they usually come coated from the manufacturer. Care must be employed to avoid mechanical damage to the coating or localized corrosion may occur.

Bronze:

Alloys of copper with metals other than zinc are called bronzes. Bronze, unlike brass, has relative resistance to atmospheric corrosion. Usually these metals are tin, phosphorous, aluminum, silicon and manganese. Bronzes are stronger than brasses and are usually employed as ornamental items and hardware. Corrosion protection is generally the same as for brass.

Summary:

The protection of metals is vital to their continued function. Corrosion repair is expensive and prevention is the best and most economical answer. Along with the obvious economic decisions, proper design and selection of the type of metal are crucial. The service environment from the manufacturing process to its use must be taken into account. Once the appropriate design is specified, then the proper manufacture of the metal and the application of its protection are required to ensure corrosion will not take place for a long period of time and most certainly, not prematurely.



TERMITE CONTROL IN WOOD-FRAME CONSTRUCTION

by Jim Reinhardt, AIA, CSI, CDT, Architectural Diagnostics and
Julian Yates, Ph.D., University of Hawaii Department of Entomology

Note: The information contained in this article is derived from observations and opinions of the authors. The opinions are those of the authors and not the Honolulu Chapter CSI, the Construction Specifications Institute or its members.

Hawaii is experiencing an epidemic of termite activity and the worst termite problems in the United States. We believe the three main reasons for the increase of termite problems are: 1) the relative ineffectiveness of some new soil termiticides; 2) the increased amount of light-frame (double-wall) wood construction, particularly on slab-on-grade foundations; and 3) failure to modify old construction details and practices. We recommend that the designers of wood-frame structures follow a four-level plan to minimize the risk of termite infestation.

Level One

The first level of protection is to create a barrier in the soil under and around the structure to keep termites away from the building. This barrier can take one or a combination of three forms: soil poisoning, colony elimination baits and/or subslab physical barriers.

Pretreatment of the soil beneath the slab with termiticides must be done before the slab is poured. It is well established that the termiticides now available do not have the longevity of chlordane or heptachlor and that protection provided is limited. Because the longevity of the termiticides is significantly influenced by exposure to rainfall, by soil moisture levels, pH, grain size and chemical composition, some soil termiticides perform better in Hawaii's soil and moisture conditions than others. Our observations, and those of the experts and pest control operators with whom we work are that Permethrin and Cypermethrin based treatment chemicals are the most effective in Hawaii's soils.

It is very important to specify that the chemical be applied "at the maximum allowable label rate for the condition of use." The "label" is the instructions provided by the manufacturer describing EPA's authorized application procedures including the dilution ratios. The best protection will be provided by the maximum amount of chemical in the soil, i.e., the minimum dilution.

The specification should also be very clear that both subslab and perimeter treatments are required. The subslab treatment must be done after all plumbing, electrical, and miscellaneous excavation and backfill have been completed, and the perimeter treatment must be done after all backfill, topsoil placement and landscaping have been completed.

The current ACI recommendations for on-grade slabs call for a 4-inch compacted base course, then a vapor barrier, then a 2-inch sand layer. If your design follows those recommendations, it is necessary to treat both the base course and the sand layer. However, the best assembly in our opinion is to apply termiticide to the base course, place the vapor barrier, and then use 2 inches of BTB instead of sand. The BTB absorbs excess water like the sand but does not require treatment. If you are using the "old style" slab construction, with the concrete poured directly over the vapor barrier, the termiticide should be applied to the base course. It should be noted, however, that more slab cracking is likely to occur with the old style slab construction, providing entry pathways for termites.

An alternative to subslab soil poisoning is the installation of BTB beneath the slab. Installation of BTB is tricky, requiring a knowledge of the proper techniques and details and close attention to workmanship. (AMERON, the manufacturer of BTB, has recently published a new pamphlet which expands and updates installation details and procedures.) The most significant concern in working with BTB is that it tends to move around after it is placed. BTB has a very low angle of repose, so it won't stay in place on a steep cut, and if the workers who place the concrete aren't careful they can displace it, creating voids and potential termite entry points. Properly detailed and placed, however, BTB is very effective and permanent.

Another technique has become available and is becoming accepted: colony elimination bait systems. The SentriCon by Dow Elanco is the only such system now available, but more are under way. The idea is to provide a slow acting "poison" the termites eat and carry back to the nest, which will then kill the colony. SentriCon, which is Hexaflumuron, interferes with the ability of termites to form their outer skin; other chemicals work in other ways, but the idea is to affect the nest.

Our experience is that the SentriCon works well in relatively dry areas with normal suburban levels of vegetation. The few unsuccessful installations of which we are aware were in very wet areas adjacent to heavily wooded forests.

Our greatest concern is that because the system is new, the understanding of the conditions where it will likely work and where it may not hasn't been refined. New and improved versions also will become available, offering other chemicals for use with different strengths and limitations. In our experience, SentriCon is a valuable step toward reducing the likelihood of infestation.

Level Two

The second level of protection is to keep termites that get past the first level away from the wood portions of the structure. With slab-on-grade foundations, this means elimination of all openings in the slabs. We commonly see termite pathways at 1) bathtub and shower drain blockouts, 2) slab penetrations by pipes and electrical cables, where plastic sleeves are routinely used, and 3) slab joints, expansion joints and cracks.

The Australian construction industry has developed methods to eliminate slab cracking as a major step in minimizing termite infestations. The Australians require better subslab soil preparation and compaction, somewhat more reinforcing, and a lower water/cement ratio. As a result, they have nearly eliminated slab cracking at a very moderate increase in the cost of the slabs.

In our own practice, we have found that the addition of fiber reinforcing also helps to reduce slab cracking. Contrary to rumors, termites cannot eat through concrete slabs, so if the cracks are eliminated along with all other openings, such as bathtub, shower and water pipe penetrations, the termites cannot get to the structure's interior.

The plastic sleeves commonly used around copper water pipes where they penetrate the slab are a common termite entry pathway.

We recommend that the sleeves be eliminated and replaced with a tight wrap of plastic electrical tape, limited to only that part of the pipe which is in contact with the concrete. The wrap should extend no more than 1 inch below the bottom of the concrete, be cut off flush with the top of the slab, and tightly adhered to the pipe. The same problem occurs where pipe insulation penetrates the slab. (TermiMesh offers instructions to effectively seal pipe penetrations and pipe and insulation penetrations.)

TermiMesh offers a unique approach to blocking the movement of termites through a slab or from a foundation upward into the wood parts of the structure. TermiMesh is a fine screen woven of 316 stainless steel. Contrary to some people's expectations, the normal TermiMesh installation is not to place the screening under the entire slab. Installers will do so at the customer's request, however, doing so is very expensive. The normal installation is to identify the common problem points: pipe and drain penetrations, slab cracks, cold joints and expansion joints, and to provide barriers at those points. TermiMesh can be installed by only trained, licensed applicators. While that may be seen as limiting competition, TermiMesh believes it is necessary in maintaining tight control over quality standards. There are many conditions in existing structures where TermiMesh

offers a highly reliable solution to termite entry problems, such as at the intersection of a slab-on-grade with an internal retaining wall.

For raised floor construction with continuous perimeter foundations, termites can best be kept away from the wood structure by using well reinforced, poured-in-place concrete foundation walls rather than CMU. Retaining walls supporting wood-framed walls should also be of poured-in-place concrete. If CMU must be used for foundation or retaining walls, termite barriers on top of the CMU can be made of TermiMesh.

Sheet metal "termite shields" placed on top of foundation walls are not normally very effective in stopping the movement of termites. In order for sheet metal to be effective, the sheet to sheet laps, corner joints and anchor-bolt penetrations must be sealed with epoxy or solder. The soil in the crawlspace under a joisted floor should be treated with a termiticide and retreated according to the warranty requirements.

Providing more than the code-required minimum space between the bottom of the beams and joists and the soil will make inspection and retreatment easier and more reliable.

For post and pier foundations, the key is to provide good separation between the soil and the bottom of the posts. Post support brackets which provide clearance between the top of the footing and the bottom of the posts, such as the Simpson EPB or CB series, are also helpful.

Level Three

The third level of protection is to deny food to termites that get past the first two levels of protection. One method which is currently gaining a rapidly expanding share of the market is the use of steel framing and structure. A second method is to use effectively pressure-treated wood framing. The initial penetration of all preservative treatments into Douglas fir and the heartwood of hemlock is improved by incising. Chemonite (ACZA), because of its ammonia carrier, provides the best initial penetration and is our first choice. Wolman or Osmose salts (CCA) provide effective protection of the wood which is penetrated by the preservative, but penetration into Douglas fir lumber, is very limited. The initial retention levels necessary to provide good protection with HiBor (Borate) is the subject of ongoing investigation. It appears that if treated to a retention of 0.4 pcf, borate is effective.

With all wood treatments, adequate penetration and retention of the treating chemicals are critical. Wood treated to the old Hawaii-Use-Only standard is not nearly as well protected as that treated to the more widely used AWPA C-2 standard (the old AWPB LP-2/LP-22) but those levels of penetration and retention may not be consistently achievable in Douglas fir or the heartwood of other construction species.

Treating glulam beams, micro-lam beams, oriented strand board and other engineered wood products remains a tricky problem. Currently most manufacturers of these products will not allow treatment with water-borne chemicals. The Honolulu Building Code, however, requires all structural members to be treated with ACZA, CCA, or Borate – all of which are water-borne preservatives – or "other preservative as approved by the building official." While Tribucide 2 has been used to treat glulams, in our experience, it is not as effective as the water-borne treatment and is much more expensive. It is important to remember that no dip or brush treatments are approved, only pressure treatments. Not only is this a technical problem, it is a "real world" problem. We are seeing extensive termite damage to glulam beams and because they are normally primary structural members, the damage is very expensive to repair.

Level Four

The final level of protection is to force any termites that make their way past the first three levels out into the open where their mud tunnels can be seen during inspections. This involves creating barriers that will block the termites' movement into the wood structure and eliminating obstacles that will limit inspection. Properly detailed and constructed slabs, foundation and retaining walls will accomplish the first part of this. Properly detailed termite shields can help, but the detailing is tricky. Stucco wall surfaces must terminate 4 inches above the soil line or 2 inches above paved surfaces as required by the UBC, providing an inspectable concrete border. We often see plaster extending down the face of the wall into the soil. Termites can then travel into the wood structure, unseen behind the plaster.

Once the blockout openings at bathtub drain penetrations through the slab have been sealed or filled with BTB, the risk of termite entry at those points is diminished. However, a risk still exists for potential termite entry at the cold joint between the old slab and the new patch or at the interface between the BTB and rough slab edge. It is a good idea to provide an access hatch to enable periodic inspection. We like the concealed access door made by Milcor (#3203- 010) but a 12-inch by 12-inch removable piece of gypboard will do as well. We suggest treating the blockout with a soil termiticide after the BTB has been placed.

Once the proper construction has been achieved, it is necessary to obtain proper installation of landscaping. We frequently see the topsoil built up against the bottom of the siding or other wood elements. Specify the required 6-inch clearance between any wood elements and the topsoil, not just the underlying soil. In addition, keep planting away from the foundations so that the edge of the concrete foundation can be inspected. Expansion, control and cold joints should be placed where they can be seen and inspected, not under partitions or concealed inside of cabinets. Panels should be provided so that shower and bathtub blockouts and pipe penetrations can be inspected.

Prevention of termite infestation is a complicated and prolonged process. It requires attention from the beginning of design through the completion of the landscaping and throughout the life of the structure. Until methods have been developed to the point at which Coptotermes formosanus Shiraki (the Formosan subterranean termite) is placed on the endangered species list and the picketers are out marching to "Save the Termite," we'll have to be vigilant.

The products mentioned in this article do not reflect endorsement by the Honolulu Chapter, CSI or representatives of this publication.

SUGGESTED STANDARD SPECIFICATION SECTIONS

The following are several suggested specifications developed by specifiers in the Pacific Rim area. These specifications follow the *1995 MasterFormat* developed by the Construction Specifications Institute, Inc. They are also set up to follow the *SectionFormat* of CSI, but do not follow the *PageFormat* due to space limitations of this publication. These specifications are set-up to be edited for content and for insertion of other special information. Special notes to specifiers are indicated where special care or information is required. Follow these notes closely. A basic knowledge of the subject matter is required before attempting to specify any products. It is recommended that all specification be done under the guidance of a Certified Construction Specifier (CCS) or with the help of a Certified Construction Product Representative (CCPR). These people have very specialized education in the preparation of Specifications and have been tested for this knowledge.

These suggested specification sections follow the CSI *Manual of Practice* as closely as possible. When using with other specification sections be sure they all conform in numbering, section and page format, and appearance.

SECTION 05040
HOT DIP GALVANIZING

PART 1 - GENERAL

Specifier Note: This specification covers iron and steel materials to be hot dip galvanized after manufacture or fabrication.

1.1 WORK INCLUDED

A. Hot dip galvanizing of iron and steel materials including, but not limited to:
   1. General steel articles.
   2. Structural steel members.
   3. Fabricated steel assemblies.
   4. Wire work fabricated from uncoated wire.
   5. Steel forgings.
   6. Iron castings.
   7. Iron and steel pipe.
   8. Fasteners and miscellaneous hardware.
   9. Fencing materials.
   10. Ornamental iron.

1.2 RELATED SECTIONS

Specifier Note: Edit this paragraph carefully to only include those Sections required for this project.

A. Section 02831 - Chain Link Fences and Gates
B. Section 02851 - Steel Guardrails
C. Section 05120 - Structural Steel
D. Section 05210 - Steel Joists
E. Section 05311 - Steel Roof Deck
F. Section 05313 - Steel Floor Deck
G. Section 05500 - Metal Fabrications
H. Section 05510 - Metal Stairs
I. Section 05520 - Handrails and Railings
J. Section 07611 - Custom Sheet Metal Roofing
K. Section 10605 - Wire Mesh Partitions

1.3 REFERENCES

Specifier Note: Select only references and standards which may apply to the particular applications listed in paragraph 1.1 - Work Included.

A. American Galvanizers Association (AGA):
   1. Inspection of Products Hot Dip Galvanized After Fabrication.
   2. The Design of Products to be Hot Dip Galvanized After Fabrication.
   3. Recommended Details of Galvanized Structures.

B. Research Council on Structural Connections of the Engineering Foundation:
   1. Specifications for Structural Joints Using ASTM A325 or A490 bolts.

C. American Society for Testing and Materials (ASTM):
   1. A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
   2. A90 Standard Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron and Steel Articles.
   3. A123 Zinc (Hot-Dip) Galvanized) Coatings on Iron and Steel Products.
   4. A143 Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedures for Detecting Embrittlement.
   5. A153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   6. A307 Standard Specification for Carbon Steel Externally Threaded Standard Fasteners.
   7. A325 Standard Specification for High-Strength Bolts for Structural Steel Joints.
   8. A384 Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Articles.
   9. A385 Providing High-Quality Zinc Coatings (Hot-Dip).
   10. A390 Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
   11. A392 Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
   12. A394 Standard Specification for Galvanized Steel Transmission Tower Bolts.

13. A449 Standard Specification for Quenched and Tempered Steel Bolts and Studs.
14. A563 Standard Specification for Carbon and Alloy Steel Nuts.
15. A595 Standard Specification for Steel Tubes, Low-Carbon, Tapered for Structural Use.
16. A702 Standard Specification for Steel Fence Posts and Assemblies.
17. A740 Standard Specification for Hardware Cloth (Woven or Welded Galvanized Steel Wire Fabric).
18. A741 Standard Specification for Zinc-Coated Steel Wire Rope and Fittings for Highway Guardrail.
19. A767 Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
20. A780 Repair of Damaged Hot-Dip Galvanized Coatings.
21. A896 Practice for Conducting Case Studies of Galvanized Structures.
22. B6 Standard Specification for Zinc (Slab Zinc).
23. E376 Standard Recommended Practice for Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Test Methods.
24. F573 Standard Specification for Residential Zinc-Coated Steel Chain-Link Fence Fabric.
25. F626 Standard Specification for Fence Fittings.

D. American Welding Society (AWS):
1. Welding Zinc-Coated Steel.

E. Federal Specifications:
1. DOD-P-21035 Paint, High Zinc Dust Content, Galvanizing Repair.
2. MIL-P-26915 Primer Coating, Zinc Dust Pigmented.

1.4 QUALITY ASSURANCE

A. Coating Applicator: Company specializing in hot dip galvanizing after fabrication and following the procedures of the Quality Assurance Manual of the American Galvanizers Association.

1.5 SUBMITTALS

A. In accordance with provisions of Section 01300.

B. Submit an original and two copies of the coating applicator's notarized Certificate of Compliance that the hot dip galvanized coating meets or exceeds the specified requirements of ASTM A123, A767, or A153 (as applicable).

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store and protect products under the provisions of Section 01600.

B. Load and store galvanized articles in accordance with accepted industry standards.

PART 2 - PRODUCTS

2.1 ACCEPTABLE COATING APPLICATORS

A. Any member of the American Galvanizers Association or equal approved by the Architect.

Specifier Note: A list of American Galvanizers Association members is available upon request by calling (1-800-468-7732).

2.2 STEEL MATERIALS

A. Material for galvanizing to be geometrically suitable for galvanizing as described in ASTM A384 and A385. Steel materials suitable for galvanizing include structural shapes, pipe, sheet, fabrications and assemblies.

B. Material to be chemically suitable for galvanizing.

Specifier Note: Steels containing carbon below 0.25 percent, phosphorus below 0.04 percent and manganese below 1.35 percent, either individually or in combination, and providing the silicon content is 0.05 percent or less, will normally develop a typical coating when conventional galvanizing techniques are applied.

Specifier Note: In cases where a steel is selected for considerations other than galvanizing and the chemistry of the elements (C,Mn,P, and Si) exceeds the limits indicated above, the steel may be galvanizable. The galvanizer must be advised of the variation in advance so that he can determine if the material is galvanizable and whether or not special processing techniques will be required.

Specifier Note: Experience has shown that silicon in the ranges of 0 to 0.04 percent and 0.15 to 0.25 percent produce coatings of normal integrity and performance. Steels with silicon contents significantly below 0.04 percent may not achieve the desired minimum coating thicknesses.

Specifier Note: Avoid use of steel with an ultimate tensile strength greater than 150 ksi because these steels have been shown to have a potential for hydrogen embrittlement due to pickling prior to galvanizing.

C. Recommended steel materials for hot dip galvanizing include, but are not limited to:
1. Structural shapes and plates: ASTM A36, A242 type 2, A283, A441, A500, A501, A529, A572, and A588.
2. Steel for fasteners:

General Category	Bolt Material	Nut Material
Carbon Steel	A307 Gr A or B	A563 Gr A
High Strength	A325 Type 1	A563 Gr DH or
Tower Bolts	A394	A563 Gr A

Quenched & Tempered Carbon Steel Bolts	A449	A563 Gr C
Quenched & Tempered Alloy Steel Bolts	A354 Gr BC	A563 Gr DH

3. Steel for sheet metal articles: ASTM A569 or A570.
4. Steel for pipe or tubing: ASTM A53, A120, or A595 Gr A or B.

2.3 FABRICATION REQUIREMENTS

A. Fabricate structural steel in accordance with Class [I] [II] [III] guidelines as described in AGA's Recommended Details for Galvanized Structures.
B. Fabrication practices for products to be in accordance with the applicable portions of ASTM A143, A384, and A385, except as specified herein. Avoid fabrication techniques which could cause distortion or embrittlement of steel.
C. Fabricator shall consult with Architect and hot dip galvanizer regarding potential problems or potential handling problems during the galvanizing process which may require modification of design before fabrication proceeds.
D. Remove welding slag, splatter, anti-splatter compounds and burrs prior to delivery for galvanizing.
E. Provide holes and/or lifting lugs to facilitate handling during the galvanizing.
F. Avoid unsuitable marking paints. Consult with galvanizer about removal of grease, oil paint and other deleterious material prior to fabrication.
G. Remove by blast cleaning or other methods surface contaminants and coatings which would not be removable by normal chemical cleaning process in the galvanizing operation.
H. When possible, slip joints should be used to minimize field welding of material.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Pre-clean steel work in accordance with accepted methods to produce an acceptable surface for quality hot dip galvanizing.

3.2 APPLICATION OF COATING

A. Galvanize steel members, fabrications, and assemblies after fabrication by the hot dip process in accordance with ASTM A123.
B. Galvanize bolts, nuts and washers and iron and steel hardware components in accordance with ASTM A153.
C. Safeguard products against steel embrittlement in conformance with ASTM A143.
D. Galvanize reinforcing steel in accordance with ASTM A767.
E. Handle articles to be galvanized in such a manner as to avoid any mechanical damage and to minimize distortion.

3.3 COATING REQUIREMENTS

A. Coating Weight: Conform with paragraph 5.1 of ASTM A123, Table 1 of A767, or Table 1 of ASTM A153, as appropriate.

Specifier Note: Special thickness requirements should refer to ASTM A123 3.1.7. and be specified as the minimum average mils of thickness. Extra thick coatings are not always obtainable.

B. Surface Finish: Continuous, adherent, as smooth and evenly distributed as possible and free from any defect detrimental to the stated end use of the coated article.
C. Adhesion: Withstand normal handling consistent with the nature and thickness of the coating and normal use of the article.

3.4 TESTS

A. Inspection and testing of hot dip galvanized coatings shall be done under the guidelines provided in the AGA publication "Inspection of Products Hot Dip Galvanized After Fabrication".
B. Include visual examination and tests in accordance with ASTM A123, A767 or A153 as applicable to determine the thickness of the zinc coating on the metal surface.
C. Furnish Notarized Certificate of Compliance with ASTM Standards and Specifications herein listed. The Certificate must be signed by the galvanizer and contain a detailed description of the material processed. The Certificate shall include information as to the ASTM standard used for the coating.

3.5 REPAIR OF DAMAGED COATING

A. The maximum area to be repaired is defined in accordance with ASTM A123 Section 4.6 current edition.
   1. The maximum area to be repaired in the field shall be determined in advance by mutual agreement between parties.
B. Repair areas damaged by welding, flame cutting or during handling, transport or erection by one of the approved methods in accordance with ASTM A780 whenever damage exceeds 3/16 inch in width. Minimum thickness requirements for the repair are those described in ASTM A123 section 4.6 current edition.

END OF SECTION

SECTION 06070
WOOD TREATMENT

PART 1 GENERAL

1.1 SUMMARY

Specifier Note: This specification covers both preservative treatment for moisture and insect control and treatment for fire retardants. Be careful to edit all sections for the type of treatment you require.

Specifier Note: Referenced in this specification is the State of Hawaii, for other locations in the Pacific Rim, edit as appropriate.

A. Section Includes
   1. Preservative pressure treatment for lumber, millwork and plywood.
   2. Fire retardant for indicated lumber, millwork and plywood.

B. Products Specified in This Section/Installation Specified in Other Section
   1. Install topical treatment materials for installation under other Division 6 sections.

C. Related Sections

Specifier Note: Edit this paragraph carefully to only include those Sections required for this project. (Consider such items as baseboards, carpet tack strips, etc. that are often overlooked and should be included by reference here and in their appropriate Sections.)

   1. Section 06100 - Rough Carpentry: Framing and sheathing.
   2. Section 06200 - Finish Carpentry.
   3. Section 08210 - Wood Doors.
   4. Section 09900 - Painting: Painting and finishing of finish carpentry items.

Specifier Note: Use the following paragraphs only when appropriate, edit as applicable.

D. Allowances: Allowances described in Section 01020 affect the scope of this work.
   1. Cash Allowances: (Simple Statement-Section 01021).
   2. Quality Allowances: (Simple Statement-Section 01024).

E. Unit Prices: Unit prices described in Section 01025 affect the scope of this work.

F. Alternates: Alternates described in Section 01030 affect the scope of this work.

1.2 REFERENCES

Specifier Note: Select only references and standards which may apply to the particular applications listed in paragraph 1.1. Remember to refer to the proper dated edition of all references or indicate that all references refer to the latest published edition.

A. American Wood Preservers Association (AWPA) Publications.
   1. C1: "All Timber Products, Pressure Treated" (general requirements)
   2. C2: "Lumber, Timber, Bridge Ties and Mine Ties, Pressure Treated".
   3. C9: "Plywood, Preservative Treatment".
   4. C15: "Wood for Commercial - Residential Construction, Preservative Treatment".
   5. C20: "Structural Lumber, Fire-Retardant Pressure Treatment".
   6. C25: "Plywood, Fire-Retardant Pressure Treatment".
   7. C31: "Lumber Used out of Contact with the Ground and Continuously Protected from Liquid Water".
   8. M2: "Inspection of Treated Timber Products".
   9. M4: "Care of Pressure Treated Wood Products".
   10. P5: "Water-Borne Preservatives".
   11. P8: "Oil-Borne Preservatives".
   12. P9: "Standards for Solvents for Organic Preservative Systems".

B. National Wood Window & Door Association (NWWDA).

Specifier Note: Be very careful in the use of the above reference standard, it has other requirements for treatment than the others listed. It may not give adequate protection in Tropical environments.

C. American Wood Preservers Bureau (AWPB) Publication: LP-2, Standard for Softwood Lumber, Timber and Plywood Pressure Treated with Water-Borne Preservatives for Above-Ground Use.
   1. AWPA APPROVED - AWPA C2, above ground use for Douglas Fir, Western Hemlock, and Hemfir dimensional lumber pressure treated with Water Borne Preservative Systems.
   2. AWPA LP-2, for above grade use of Lumber and Plywood other than Douglas Fir, Western Hemlock, and Hemfir, pressure treated with Water Borne Preservative Systems.

Specifier Note: Although the American Wood Preservers Bureau is no longer in existence, many Specifiers still refer to this standard. Use it with care. Be sure you have read the standard and understand it, be aware that there is no method in place for testing or inspecting for compliance.

1.3 DEFINITIONS

A. Treatment Manufacturer: Entities who market specific chemical formulations and methods of treatment under specific proprietary names.

B. Treatment Plant: Entities that possess the physical facilities to treat wood products in accordance with the Treatment Manufacturer's requirements and is a certified Applicator of the Treatment Manufacturer.

1.4 SUBMITTALS

Specifier Note: Do not require submittals when they are not needed, such as, if

specific products are specified and no substitutions are allowed. Submittals require extra time and increase the liability for a project.

A. Meet the applicable requirements of Section 01300 - Submittals.
B. Product Data: Submit treatment data, including chemical formulations, MSDS sheets, treatment methods, and expected penetration and retention rates for each wood species required to be treated in Project.
C. Quality Assurance Submittals: Refer to "Quality Assurance" paragraphs.
D. Contract Closeout Submittals: Meet the applicable requirements of Section 01700 - Contract Closeout.
   1. Project Record Documents
   2. Warranties.

1.5 QUALITY ASSURANCE

A. Meet the applicable requirements of Section 01400.
B. Treatment Intent: All types of treatment to be types effective in Hawaii against wood decaying fungi growth and against wood destroying insects. Insecticide treatments to be specifically effective against dry wood termite species and subterranean termite species, including coptotermes formosanus. Fire retardant treatments to be types meeting fire performances required by Authorities.
C. Pressure Treatment:
   1. Standards: American Wood Preservers' Association (AWPA): "Standards" publication.
   2. Treatment Certification: Submit Treatment Plant's written certification that Project products have been treated in conformance with Treatment Manufacturer's and Contract requirements. Certificates to indicate each treated specie and related standards, treatment process, penetration, and retention rates.
   3. Identification Indicating Treatment Quality: Comply with following:
      a. Insecticide Pressure Treatment:
         1) WT-1: Provide certificate from treatment plant. Provide "AWPA C2" designation wherever possible.
         2) WT-2: Color dye used will be acceptable visual representation of treatment of wood products, but shall not relieve Treatment Plant for providing proper penetration and retention rates.
         3) WT-3: Imprint wood products with Treatment Manufacturer's quality stamp.
      b. Fire Retardant Pressure Treatment:
         1) WT-4: Imprint products with UL's FR-S marks.
   4. Incised Material: Do not incise material which can be provided with "Hawaii Standard" designation and for work that is scheduled to be exposed to view, unless otherwise acceptable to the Architect.
D. Products Scheduled for Transparent Finishes: Do not begin wood treatment of products scheduled for transparent finishes, until samples of treated and finished wood has been successfully reviewed by the Architect.
E. Identification Marks: Any imprinted marks such as those which identify the treatment products, company, or certify compliance, shall be applied to any product which is concealed in the Work or where such products are scheduled to receive opaque coatings. Those products in which identification marks would otherwise be exposed to view in the work, such as those to receive transparent coatings, are to be left off the product, unless otherwise acceptable to Architect.
F. Use adequate numbers of skilled mechanics, who are thoroughly trained, experienced, and licensed in the necessary crafts.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Meet the applicable requirements of Section 01600.
B. Meet the requirements of AWPA Standard M4.
C. Storage: Store treated products off ground, protect from moisture and provide ventilation.
D. Keep treated lumber dry through delivery, fabrication, and erection.

1.7 WARRANTY - PRESERVATIVE TREATED PRODUCTS

Specifier Note: Each manufactuter and system of treatment provides different warranties, some will cover materials only, others will cover materials and labor. Be sure you have read and understand any warranty prior to specifying.

A. Furnish a written [___]-year Warranty Bond on pressure treated lumber and plywood when used in residential construction. The treating company shall be notified of this requirement prior to construction.

PART 2 PRODUCTS

2.1 PRESSURE TREATMENT MATERIALS

Specifier Note: Do not specify products that you are not thoroughly familiar with. Be sure all products that are specified are approved by the American Wood Preserver's Association for the type of wood, the location, and all other factors involved in proper selection.

Specifier Note: The following are only some of the products available for use, these are only listed because they are commonly available in the State of Hawaii. Be sure to do proper research of any product being specified, including those listed below.

A. Insecticide:
   1. One of the following:
      a. WT-1: Ammoniacal Copper Zinc Arsenate (ACZA): J.H. Baxter's "Chemonite."
      b. WT-1: Chromated Copper Arsenate (CCA): Osmose Wood Preserving Company of America or Wolman/Hickson Corp.
      c. WT-2: Borate Oxide (SBX): United States Borax & Chemical Corporation "Hi-Bor PTW" or comparable product acceptable to Architect.
   2. WT-3: Chlorpyrifos/IPBC: KOP-Coat "Tribucide II" or comparable product acceptable to Architect.

B. Fire Retardant:
   1. WT-4: "Dricon" by the Koppers Company, Inc., or comparable products acceptable to Architect; without mono-ammonium phosphate or other materials causing premature heat degradation of treated wood products.

2.2 TOPICAL TREATMENT MATERIALS
A. Insecticide:
   1. WT-5: Chemicals complying with AWPA M4, designed for topical application of wood products; which is the same or functionally similar in chemical properties and compatible with the primary pressure treatment materials. Work treated with clear products to also be clear.

2.3 PRESSURE TREATMENT METHODS
A. Insecticide Treatment:
   1. WT-1:
      a. Above Ground Use, Lumber, AWPA C2 and AWPB LP-2.
      b. Ground Contact Use, Lumber: If any, AWPA C2 and AWPB LP-22.
   2. WT-2: Above Ground Use Only: Treatment Manufacturer's process resulting in 0.42pcf retention rate and 0.4" penetration.
   3. WT-3: Above Ground Use: Same Treatment Manufacturer's process used for Coastal Douglas Fir; resulting in 0.052 pcf retention rate and penetration as occurs for scheduled wood specie.
B. Fire Retardant Treatment:
   1. WT-4:
      a. Solid Lumber Materials: AWPA C 20.
      b. Plywood: AWPA C 27.
C. Topical Treatment:
   1. WT-5: Treatment by Division 6 - Rough Carpentry and Division 6 - Finish Carpentry Installers.

Specifier Note: Moisture treatment is of primary importance in how the wood will perform after installation, field verification is very important, and testing should be considered.

D. Moisture Content of Treated Products: Achieve moisture content levels in wood products as follows:
   1. WT-1, WT-3, WT-4:
      a. Prior to Treatment: 28% maximum or lesser percentage if required by Treatment Plant for solid lumber or plywood.
      b. After Treatment: 19% maximum for solid lumber and 15% maximum for plywood.
   2. WT-2: In accordance with Treatment Manufacturer's Project specific requirements.
   3. Methods:
      a. Reduction in Moisture Content: Reduce moisture content by air or kiln drying.
      b. Increasing Moisture Content: Notify Architect, prior to any treatment where such conditions exist.
E. Defective Material: Inspect each piece of treated material for defects resulting from treatment process. Replace defective materials with treated materials without defects.

2.4 REQUIRED TREATMENT IDENTIFICATION
A. All pressure treated wood is required to be identified by the mark of an approved independent inspection agency operating under ALSC (American Lumber Standards Committee) overview.
B. Quality mark to state "Above Ground" or "Ground Contact" use as applicable. Mark may include the LP reference formerly used to indicate the CCA or ACZA waterborne treatment, for "Above Ground" LP2 or "Ground Contact" LP22 use.
C. Quality mark to indicate the correct retention level specified in AWPA Standards.

PART 3 EXECUTION

3.1 EXAMINATION
A. Verification of Conditions: Examine the substrates and conditions under which work of this section will be performed. Do not proceed until unsatisfactory conditions detrimental to timely and proper completion of the work have been corrected.

3.2 PREPARATION

Specifier Note: Moisture treatment is of primary importance in how the wood will perform after installation, field verification is very important, and testing should be considered.

A. Dry each piece of lumber or plywood less than 2 inches thick to 19 percent moisture content.
B. Finish Lumber: Mill to finish size and shape prior to treating so it can be treated before assembly. Plywood may be treated in regular panel sizes. Framing lumber for rough carpentry work does not require milling to size prior to treatment.

3.3 APPLICATION OF PRESERVATIVE TREATMENT
A. Comply with the AWPA referenced standards for the species of wood materials involved.
B. Water-Borne Preservative Treatment: Pressure treat concealed framing lumber, blocking, furring strips, nailers, roof cant strips, sills, plates, and other general use lumber and plywood that will be concealed in the finished work with water borne preservative in accordance with applicable AWPA APPROVED - HAWAII USE ONLY or AWPA LP2 standards.
C. Pressure Treatment with Oil-Borne Preservatives: Exposed lumber 2-inch nominal thickness and over, door and window casing, structural lumber, glu-lam beams, hardwood flooring, and similar lumber that will be exposed to view in the finished work, shall be unincised and pressure treated with oil borne preservatives. Treat in accordance with AWPA C2 or manufacturer's standards.

3.4 FIRE RETARDANT TREATMENT
A. Comply with the referenced AWPA C-20 for pressure impregnation with fire-retardant chemicals to achieve a flamespread rating of not more than 25 when tested in accordance with UL Test 723, ASTM E 84 or NFPA Test 355. Use a fire-retardant

treatment which will minimize bleeding through or adversely affect bond of the final stained finish.

1. Provide UL Label on each piece of fire-retardant lumber and plywood.
2. Identify each piece of lumber or plywood with the treatment brand.
3. Local mill-made millwork and casework: Comply with the proper section of the referenced woodwork standards.
4. Kiln dry fire treated lumber.

B. Fire retardant treat exposed wood wall and ceiling surfaces to meet U.B.C. Flame-Spread Classifications in the following areas:
   1. Class I - Public spaces and enclosed vertical exitways.
   2. Class II - Other exitways.
   3. Class III - No treatment required.

3.5 FIRE RETARDANT TREATMENT

A. Exterior and Interior: Meet UL FR-S rating.

B. Interior: Meet UL FR-S rating. Kiln dry lumber to maximum moisture contact of 19 percent, and plywood to 15 percent. Maintain treated wood dry, below fiber saturation, in relative humidity exposures up to 95 percent.

3.6 PLANT TREATMENT

A. Treat items after fabrication wherever possible. If cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment.

B. Plastic Laminate Faced Doors: Treat doors after manufacture but before application of plastic laminate.

Specifier Note: Moisture treatment is of primary importance in how the wood will perform after installation, field verification is very important, and testing should be considered.

C. Subsequent to treating, dry at the plant all treated lumber and plywood to an average moisture count not to exceed 19 percent for framing lumber, 18 percent for plywood, and 15 percent for finish lumber.

D. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

3.7 FIELD APPLICATION

A. Thoroughly treat all cuts, holes, notches, splits, etc. made during construction with the concentrated preservative used in the treating plant treatment in compliance with the referenced AWPA M-4.

3.8 CLEANING

A. Upon completion of entire work or when instructed by proper authority, all rubbish, waste, debris, and unused material shall be removed from the premises.

B. Dispose of treated wood in a sanitary land fill or other authorized disposal area. Do NOT burn treated wood. Do NOT bury wood of any type on the job site.

3.9 SCHEDULES

Specifier Note: This is a sample only of a type of schedule that can be used for this specification section.

A. Pressure Treatment: Unless otherwise indicated, For Division 6 - Rough Carpentry products as follows:
   1. Insecticide Treatment:
      a. WT-1 or WT-2: For Division 6 - Rough Carpentry Section, "Dimension Lumber", except where fire retardant treatment required.
      b. WT-3: For exterior WD-1 products. Significant penetration is not expected, but retention is required in accordance with Treatment Manufacturer's Project specific requirements.
   2. Fire Retardant Treatment:
      a. WT-4: For Division 6 - Rough Carpentry Section, "Miscellaneous, Dimension Lumber" required by Authorities to be fire retardant treated.
      b. WT-4: For Division 6 - Rough Carpentry Section, "Construction Panels".

END OF SECTION

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Standards Assure Successful Design

by Andrew C. Yanoviak, AIA, APA, CSI

Windows and doors continue to be essential design elements in modern architecture for all code-required *types of construction* and *occupancy classifications*. Design philosophies can present challenges for building, fire and life safety code officials and building contractors. This is especially true in Hawaii, with the tendency toward "open space" floor plans and interpenetration of interior and exterior spaces.

In addition to codes and other regulations, the architect has the duty to incorporate prevailing design standards into his built works. These include standards in design reference manuals, trade journals, technical literature, and those found in the appendix portion of the code prior to enactment. As professional practitioners, architects must be aware of upcoming changes in code provisions and their design standard precedents.

The American Architectural Manufacturers Association (AAMA) has recently published a technical bulletin claiming to be the "ultimate door and window standard." As with the International Building Code (IBC) and International Fire Code (IFC), it is non-prescriptive and performance-oriented. It is also intended to be material-neutral with regard to aluminum, steel, wood, vinyl clad wood, polyvinyl chloride (PVC) or other plastics.

This standard has evolved over many years with the assistance of the National Wood Window and Door Association (NWWDA). It supersedes ANSI (American National Standards Institute)/AAMA 101-93 and NWWDA I.S.2-93. It incorporates fabrication and installation provisions for structural resistance for fire and wind loads, air and water infiltration, thermal transmission and evaporative condensation, acoustical and security factors for casements, hoppers, sliders, double hung, pivoted, awning, hinged, projected, or fixed windows and doors with designated performance classes and grades based on laboratory and field test reports. It establishes new performance criteria for structural test pressure, water test pressure and design pressure and their interdependent proportional relationships for variable story heights and building orientations. Copies are available from AAMA.

Andrew C. Yanoviak, AIA, APA, CSI is a member of the AIA Honolulu Codes Committee and a voting member of several American Society for Testing and Materials (ASTM) committees.

Does estate building design reflect Hawaiian values?

Architecture and the Big Estates

by Daniel Chun, AIA

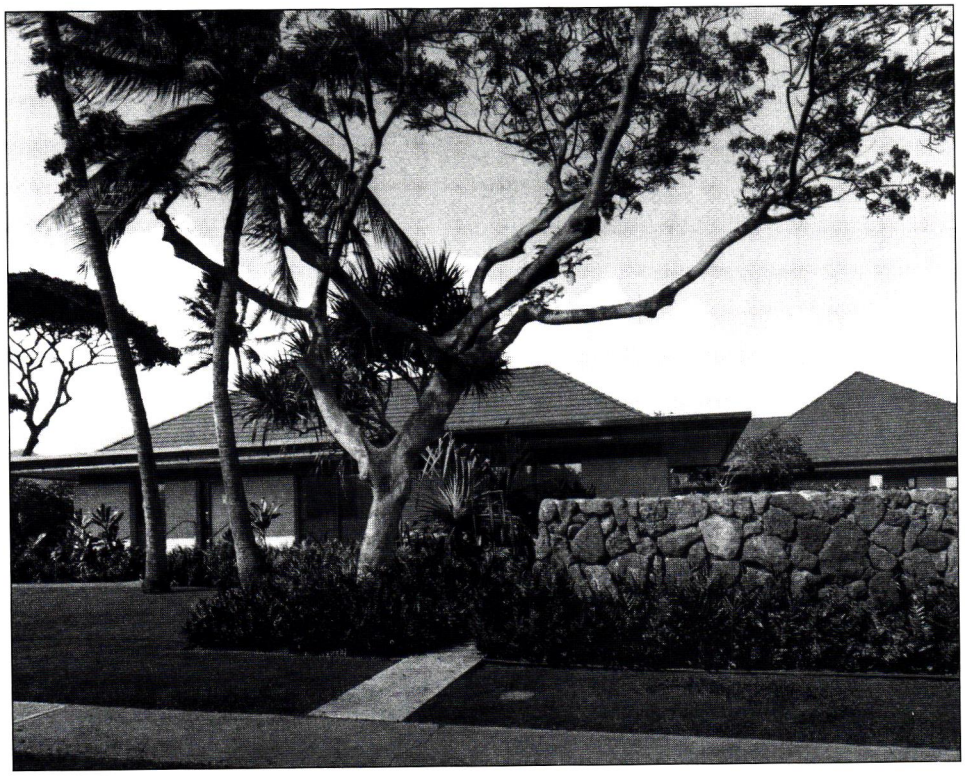
Common to most ancient societies were kings, rulers and other powerful people who used architecture to express their influence over society. The pyramids of Egypt and royal palaces such as Versailles are among famous examples. While a poor person might do with a cheap structure it was considered essential for powerful people and institutions to commission substantial buildings. Because these works were required to convey religious and political messages they qualified as architecture, as compared to mere buildings only concerned with keeping out the rain.

Hawaii is a small land with far fewer resources than those of the continents. However, Hawaii also has a tradition of architecture as advertisement for social influence. The *heiau* of ancient times required great amounts of stone and manpower. The number and weight of stones that had to be hauled and placed remains a strong indicator of the power of a ruling chief. The completion of Pu'ukohola Heiau and the two Iolani Palaces represented the high social position of the kings of Hawaii.

Today Hawaii has no kings but big landed estates remain, with many tracing their roots to royal origins. Do these estates continue to use architecture as an expression of power?

To the casual observer, modern estate architecture does not rival the size and height of most of Hawaii's modern buildings. Instead, modern estate architecture shows its high status in more subtle ways. For example, many estate buildings are low-rises sitting comfortably on very large plots of precious real estate.

The late Bishop Estate trustee Richard Lyman Jr. believed that Hawaiian institutions should express Hawaiian values. The original Kamehameha Schools Kapalama Heights campus is a landmark of Hawaiian regional architecture, although its latest buildings display mixed results. The best estate architecture expresses



One-story buildings topped by high pitched roofs and lava fieldstone walls at Liliuokalani Trust's Honolulu Unit exemplify enduring qualities of Hawaiian regional architecture by Frank Slavsky, FAIA.

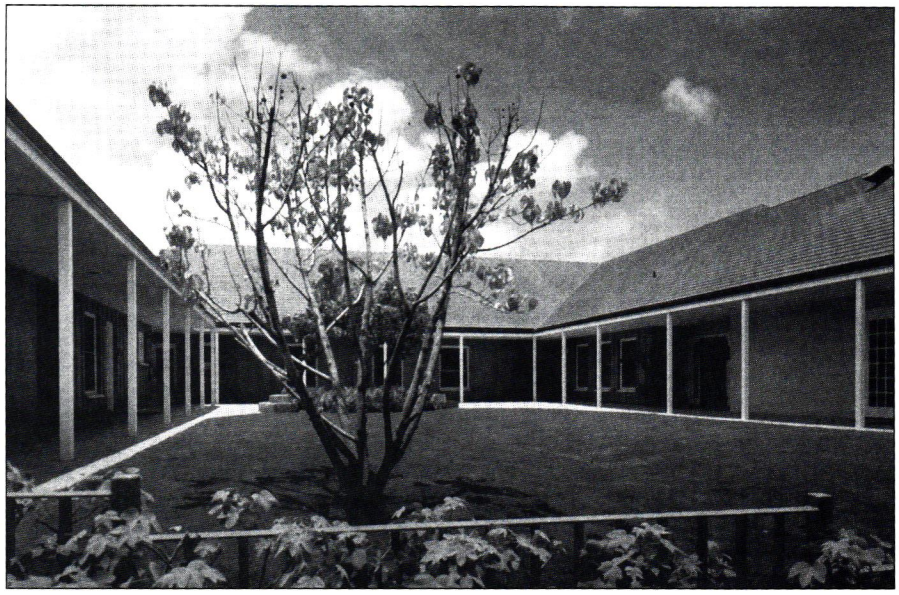
Photos by Augie Salbosa

a strong relationship to Hawaii's cultural and physical world. Are the big estates living up to this ideal?

The Liliuokalani Estate

The Liliuokalani Trust was established in 1909 by Hawaii's last ruling monarch for the benefit of Hawaiian orphans. This perpetual land-based trust is one of Hawaii's smaller royal estates comprising about 9,000 acres. These lands are located mostly in the Kona district of Hawaii Island and the southern end of Waikiki.

Today the estate's social services are dispensed by small teams of counselors stationed within the communities they serve. The Trust does not believe that delivering social services from a single large headquarters is as effective. Last year over 4,000 children received social services from the Trust.



The Liliuokalani Trust Kauai Unit uses traditional wood siding as a veneer over a hurricane-resistant masonry structure. Steel posts prevent hurricane winds from lifting the roof. The central courtyard is landscaped with indigenous Hawaiian plants.

The Honolulu Unit, located in the Kalihi district of Honolulu, was a 1970 AIA Design Award winner. It was designed by the late Frank Slavsky, FAIA, who also designed several buildings at the University of Hawaii-Manoa. The building is also the administrative headquarters of the Trust.

Slavsky's design represents a milestone in Hawaiian regional architecture because it was the first in almost 200 years to use a raised stone platform as an integral design feature. Slavsky also used classic features of regional architecture such as high pitched roofs arranged around intimate courtyards. Durable and non-glossy materials such as tile roofing, rough concrete and stone masonry and copper fascias create architecture that has weathered well over three decades.

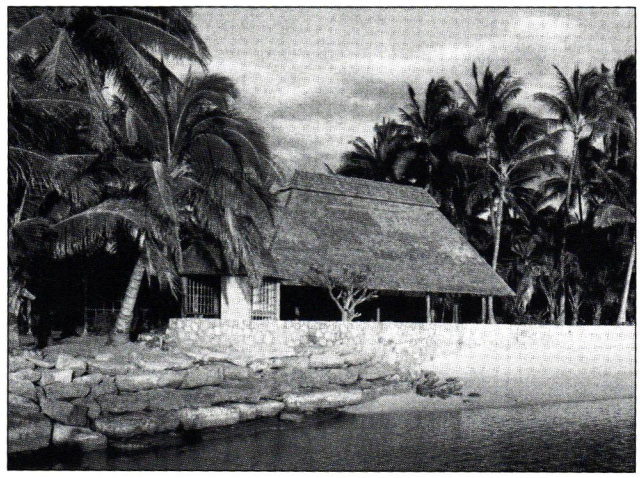
Taking a clue from its broad, 6-foot wide eaves, the Honolulu Unit interior has broad low ceilings. This design device provides a domestic character to the relatively large building. Interior materials are simple but substantial.

The Lihue Kauai Unit is the newest building to be completed for the Trust. Designed by Kauahikaua & Chun/Architects in a vernacular style common to Kauai, it relies on high roofs surrounding a courtyard. While not "cutting edge" design, the architects' reference to historic architecture reflects public sadness at the destruction by Hurricane Iniki of so many older familiar buildings. *(Continued on next page)*

Building ceilings are purposely low to acknowledge children as the focus of the Trust's social work. The design projects an image of domestic tranquility to those who may not enjoy this in their own family situations. While generally falling within the category of Hawaiian regional architecture, each of the Liliuokalani Trust buildings differs in design due to its location. The newest building commissioned by the Trust is presently under design for Kalama'ula, Molokai.

The Estate of James Campbell

The Campbell Estate traces its Hawaiian connections to the marriage of James Campbell to Abigail Maipinepine, the family matriarch, and their eldest daughter's marriage to Prince



The lanai of the Lanikuhonua Hawaiian Cultural Institute replaces one destroyed by a hurricane. Cedar shingles, *ohia* posts and a Waianae sandstone foundation and seawall reflect Hawaiian design. Design by Kauahikaua & Chun/Architects.

David Kawananakoa. The Campbells' second daughter, Alice Kamokila, was particularly knowledgeable concerning Hawaii's ancient culture. Upon her death the trustees set aside her portion of the Ewa estate as a Hawaiian cultural institute.

The 17-acre palm-shaded estate had many older wooden buildings that had to be demolished due to their poor condition. The new buildings were required to have a much stronger Hawaiian character. Within the idyllic landscape refurbished by PBR Hawaii, architecture is very much subordinated to landscape architecture.

The new buildings display all the classic elements of Hawaiian regional architecture. A high roof is the dominant design element as compared to wall surfaces that here are non-existent. The foundation is a long Waianae sandstone wall matching the rocks and sand of the natural shoreline.

Buildings at the Lanikuhonua Hawaiian Cultural Institute display a more pre-contact Hawaiian roof silhouette than do the Campbell Estate headquarters at the City of Kapolei, which reflects Hawaiian design preferences of the early 20th century. However, there is no ques-

tion that Campbell Estate prefers to commission architecture which reflects its Hawaiian setting.

Common Ground

So are there common threads running through estate architecture in Hawaii? In the 19th century Hawaii's architecture displayed the most current fashions prevailing in the United States and Europe. The estates had not yet been created as their founders, many of royal descent, were still alive.

In the 20th century more regional Hawaiian styles have been favored in what some local activists would call the decolonization of style. Hawaii's big estates are now covered in profit-generating buildings in all kinds of styles. But those buildings that are closer to the soul of the estates employ Hawaiian design from the perspective and expectations of the general public.

Daniel Chun, AIA, is president of the Honolulu Chapter of the American Institute of Architects and a partner of Kauahikaua & Chun / Architects.

The Bishop Estate opens new Neighbor Island schools

A Commitment to Hawaiian Children

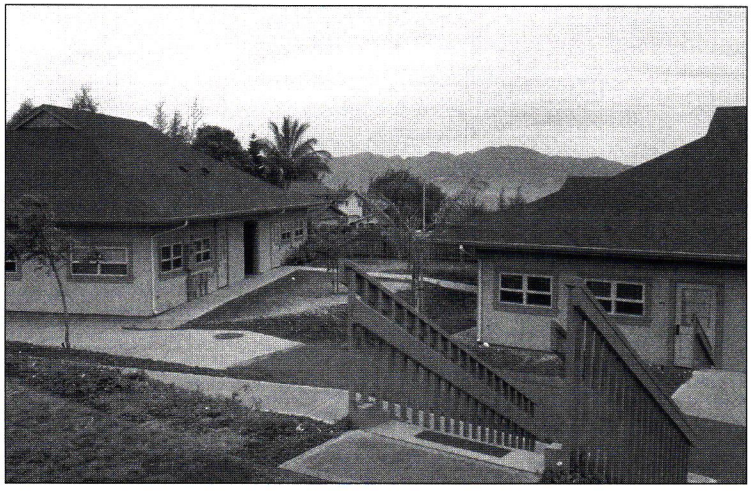
by Dennis Walsh

Last fall, the Kamehameha Schools Bernice Pauahi Bishop Estate greeted the first students at its new schools on Maui and the Big Island. The event marked the beginning of a long-hoped-for expansion of the estate's educational operations to the Neighbor Islands. The campuses, at Keaukaha in East Hawaii and at Pukalani on Maui, each opened with 80 students in grades K-3. A grade will be added each year until the schools reach grades K-8.

The Bishop Estate's trustees set September 1996 as the opening date for the new schools. That aggressive schedule meant temporary quarters would be needed until permanent facilities are completed.

In Keaukaha, a temporary site proved easy to find, with the Department of Hawaiian Home Lands offering property outside Hilo. A site for the permanent school, though, has proven elusive. Alternative locations are still being studied.

The situation on Maui was just the opposite. Land for the permanent school was found above Pukalani, an area slated for development by Dowling Company. However, locating suitable temporary quarters was a problem.



Above: Students truly enjoy a "home-like" atmosphere at their school.

Right: Campus buildings will convert to private homes once the permanent school is constructed.

A Win-Win Solution

The solution came from Dowling Company. The company proposed a package deal in which Bishop Estate would purchase the permanent site from Dowling while Dowling would provide temporary quarters in a residential neighborhood, leasing the quarters to the Bishop Estate for one dollar a year. When the permanent site is ready, Dowling will own the temporary buildings, which will be retrofit and sold as private homes.

Five buildings make up the temporary campus, four of which are now in use. Two classroom buildings and a multi-purpose

building were constructed, while the fifth building, a two-classroom unit, is scheduled to be ready by August. Administrative offices are housed in a home that was taken off the market to become part of the campus.

Greg Bayless of Bayless Architects AIA, designed the structures. "It was a challenge because of the very different initial and final uses of the buildings," he said. "We started by designing the structures as a school, because that is what they will be used for first. Then we worked backwards to see how those buildings would function as homes, which will be their final form. And then we looked at what would be involved in retrofitting the buildings to their residential use. This is the kind of task architects will be facing more and more in the future – designing for long-term use and re-use in buildings, and accommodating new uses in existing structures."

The structures were designed as shells with temporary interiors and future residential plumbing roughed-in beneath pull-out plugs in the floor. Garages are enclosed to provide extra classroom space but will be reopened when the structures are converted back to homes.

The buildings are slightly larger than other homes in the area, averaging 2,000 square feet. Ceilings are higher, and the lack of permanent interior walls meant that roof and wall construction had to meet higher structural standards than would otherwise be required.

"We included some signature details, too," said Bayless, "echoing the buildings at the Kapalama campus. This is Kamehameha Schools Bishop Estate's first architectural statement on Maui, so we wanted it to be special. The detailing on columns, the gable end roof work and the railing designs are inspired by details on the main campus." Many of the buildings at Kapalama were designed by famed architect C.W. Dickey. The permanent school on Maui is being designed by Kajioka Okada Yamachi Architects Inc.

The Kamehameha Schools Bishop Estate was established by Princess Bernice Pauahi Bishop, the last direct descendant of King Kamehameha the Great. In her will, she directed that her estate be used to create and support the Kamehameha Schools. Since 1894, the estate has pursued that mission. Today, Kamehameha Schools is one of the largest private schools in the United States, with more than 3,000 students in attendance and another 1,000 in preschools. Student tuition covers less than 10 percent of the costs of operating the schools. Other costs are underwritten through revenues generated by the management of estate assets.

Dennis Walsh is special projects officer with the Administration Group of Kamehameha Schools Bernice Pauahi Bishop Estate.

Award of Merit

Historic Preservation/Adaptive Reuse

Spencer Mason Architects

Waimea Foreign Church

The Waimea Foreign Church is one of the oldest Christian churches in Hawaii.

This project entailed the successful restoration of the historic Waimea Foreign Church after nearly being destroyed by Hurricane Iniki in 1992. Listed on the National Register of Historic Places, the 150-year-old masonry structure was the first permanent Christian church on Kauai. After Iniki, the structure was deemed a total loss and insurance adjusters recommended completely replacing the historic building with a new structure. Spencer Mason Architects not only restored the church to its original design and appearance but at a cost less than total replacement.

Restoration efforts began in late 1993 with a stabilization and salvage contract and continued with the repair of a missing roof, back walls, and weather-worn finishes.

Lime mortar, similar to that used by the original masons in the 1840s, was used for the restoration. Over time, the lime mortar of the building's exterior will stain with red clay dust to match the 150-year-old material. The surface of the blocks was filled to match the technique originally used over a century ago.

The weakened limestone walls were re-engineered for stability and to ensure that they could carry the reconstructed roof framing. The walls' tops were reinforced with steel box beams, welded to 6-foot long steel straps which were plastered over to remain out of sight.

The congregation deemed the restoration a success since the building is virtually indistinguishable from the structure they used before Iniki.

An old cemetery graces the surrounding landscape.

Credits

Owner/client
Trustees of the Waimea Foreign Church; Council of the Waimea United Church of Christ

Architect
Spencer Mason Architects

Contractor
Randall S. Weir Construction

Consultants
Structural: Clayton Hayes
Electrical: Yuki Matsumoto

Jury's Comments:

"The project represents an important restoration of a significant, historical monument that is a focal point of the local community. It appears to be a well executed restoration."

The original Victorian-era pulpit was splintered by the collapsing walls and roof. All of the intact pieces were reincorporated in the new pulpit and used to recreate the missing pieces.

New Products

Coastal Reinvents the Jalousie Window

Coastal Windows is introducing its new "Security Jalousie." This latest window design incorporates the strength and security of steel with the durability and low maintenance of solid vinyl. The design prevents the jalousie slats from being removed even when the window is open, which allows cool breezes to flow in while keeping intruders out.

Insulate Windows Introduces 700 Series

Insulate Windows has introduced its new 700 Series, a line of strong and stable vinyl casement and awning windows that offer full radius casements, gable top casements and operating octagon awnings in a greatly extended range of sizes. The color in the frame will not fade or peel and never needs painting. The frame is impervious to damage from the sun, humidity or salt.

Pella Windows Extends Color Range

For windows as a design element, Pella Windows and Doors offers Windowscaping Colors. In addition to Coconut White, Boulder Tan and Pella Brown, designers now can choose from 14 colors to aesthetically complement building design. Hunter Green, Renegade Blue and Hemlock are among the colors available at a modest charge.

Stanley Home Decor Names Representative

Stanley Home Decor, the mirrored closet door division of Stanley Hardware Company, has announced the appointment of Jess Freeby of Uni-Sales Inc., to represent the company in Hawaii. Uni-Sales Inc. will be responsible for new construction only, calling on architects and contractors. For more information, call 847-2706.

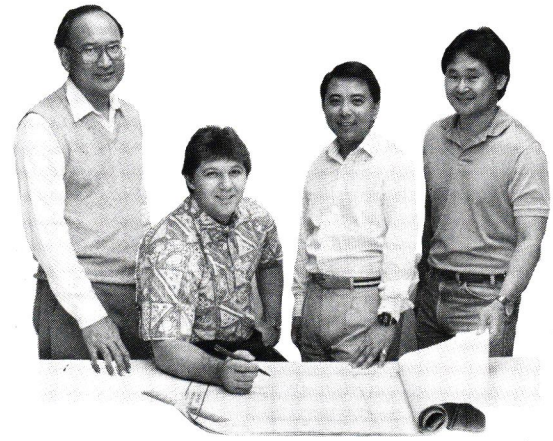
Market Place

When you can't halt hospitality... Allied comes through

Major improvements in scattered areas at the Princess Kaiulani Hotel called for a supremely accommodating contractor. Even as beautifully redesigned lobbies emerged, envisioned by the Gulstrom Kosko Group, and the popular Ainahau Showroom expanded with the overview of Ted Garduque, AIA, the hotelier continued to serve.

"We were on a tight timeline facing a holiday opening," observed Garduque. "Allied's crews were always responsive and concerned with quality execution. Even when the normal problems in renovation occurred, they stayed on top of things."

Adds GKG's David Chung, AIA: "Allied reacts well to the design professional. Beyond this, they know that change at hotels cannot interfere with visitor pleasure. They worked odd hours and with diplomacy when hotel guests were around."



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Architect David Chung, Hotel Food and Beverage Manager Chip Bahouth,
Architect Ted Garduque, ABS Project Manager Ed Sakai