



Ni'ihau

Kaua'i

O'ahu

Molokai

Maui

Lanai

Kaho'olawe

Hawai'i Statewide Sustainable Landscape Masterplan

Hawai'i



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Outline

- Hawaii overview
- Hawaii examples
 - Sustainable Landscape Master Plan
 - Sustainable Landscape Maintenance Manual
- Lessons learned
- Opportunities for Landscape Architects



Most Isolated Islands in the World - Kamehameha Highway, O'ahu

My Islands, My Context



Great Diversity of Landscapes - Route 130, Big Island

My Islands, My Context



Natural Wonders - Interstate H-3, O'ahu

My Islands, My Context



Cultural Landscapes - Paia, Maui

My Islands, My Context

13,796 feet



Diverse Ecosystems - Mauna Kea Observatory Road

My Islands, My Context



Historic Bridge - Hanalei, Kaua'i





Agricultural Landscapes - Highway 801, O'ahu



Iconic Highways - Hana Highway, Maui

My Islands, My Context



Ancient Paths - Kamehameha Highway, O'ahu

My Islands, My Context



Proud Host Culture - Hawaiians

My Islands, My Context



Proud Cultural Traditions

My Islands, My Context



Incredible Ethnic Diversity

My Islands, My Context



One thing the turnpike dramatically does is to teach Americans some lessons in aesthetics. First, that beauty is not an extra; it is a necessity. And second, that if form follows function, beauty does not inevitably result.

LOOKING FOR AMERICA ON THE NEW JERSEY TURNPIKE

Disappearing Contexts

My Islands, My Context

Hawaii Sustainability

- 95% of Hawaii's energy is imported fossil fuels
- 85% of goods are imported
- 90% of food is imported
- 14 day supply of food
- 1/3 of all endangered species in the USA
- 90 year decrease in the recharge of Hawaii's aquifers
- 64% of Hawaii streams are considered 'impaired' by pollutants

HDOT Stewardship Challenges

- No landscape programmatic documents
- Same landscape approach for 60 years
- Design consideration of maintenance funds
- Aesthetic continuity
- Context or 'Sense-of-Place'
- Invasive species vector
- 2 LA : 1,029 Highway Employees

Hawaii DOT Strategy

An Integrated Plug n' Play' set of landscape standards and guidelines for a sustainable and a Hawaii sense of place.

Statewide Sustainable Landscape Master Plan

Provide a holistic and systematic approach for sustainability and context.

Sustainable Roadside Design Guide

Design guidelines for common roadside elements and sustainability guidelines

Sustainable Landscape Maintenance Manual

Integrated roadside vegetative approach to roadside maintenance.

Research & Planning

Design

Construction

Maintenance

Sustainable Landscape Research

- Native Grass Hydroseed
- Native Dry Grassland Forest Hydroseed
 - Native Fern Mechanical Distribution
 - Erosion Vetiver Pilot Project
- Tropical Roadside Bioswale Research
 - Albizia Biocontrol Research

Statewide Noxious Invasive Pest Program

Guidelines for maintaining and controlling noxious and invasive plant species at a manageable level along Hawaii's state roads, protect conservation, scenic and native habitat areas and early detection of high priority invasive species

Texas DOT



Figure 1-2. The visual definition of road corridors is determined by landscape changes, vegetation, and future uses.



Figure 1-3. Urban corridors tend to be linear and are visually defined by the surrounding architecture and alignment of the roadway.

As individual users along corridors, their perceptions change as the character of roadside and the

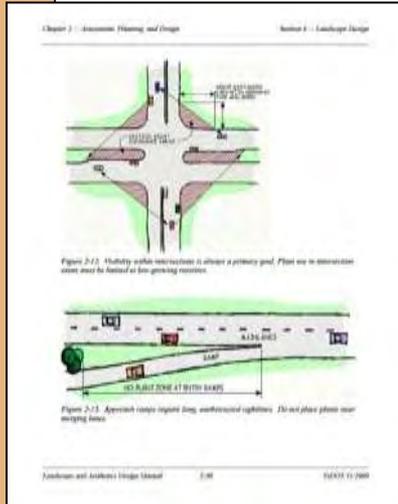


Figure 2-13. Stability within intersections is often a primary goal. Plant use in intersection areas must be limited to low-growing varieties.



Figure 2-13. Approach ramps require long, uninterrupted sightlines. Do not place plants near sightline.



Figure 4-13. Glass bricks (see page 40) are replacements to concrete slabs and compatible in rural situations.

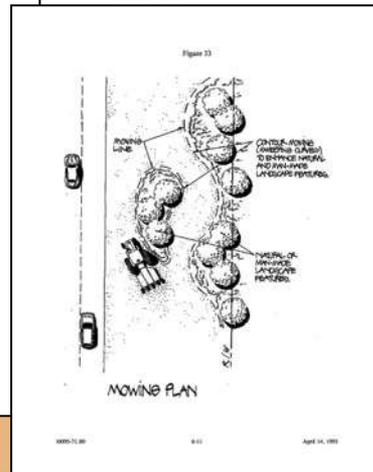
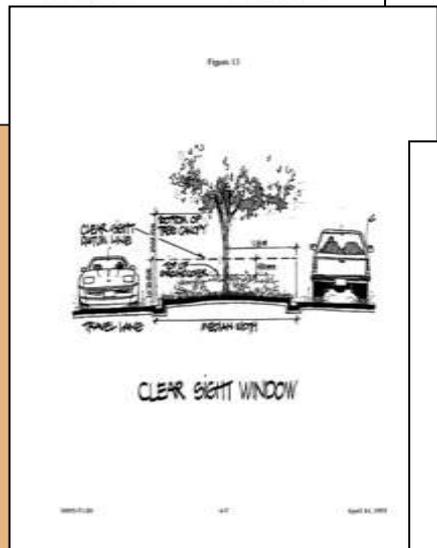
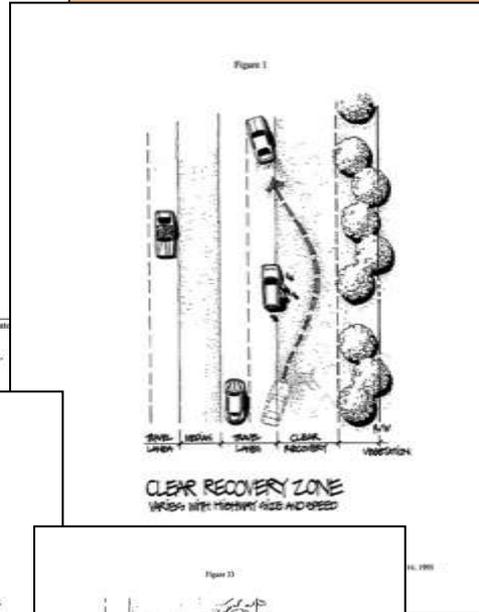
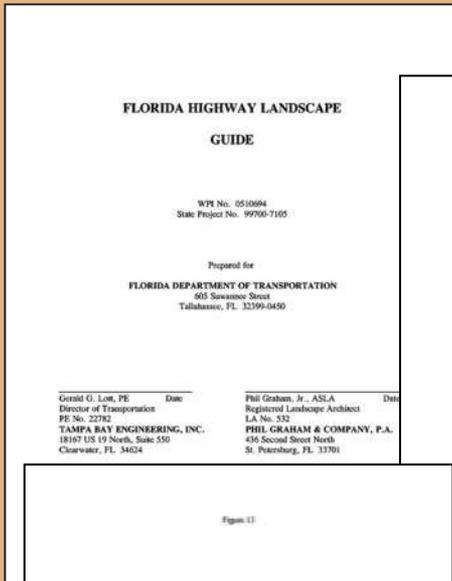


Figure 4-14. Patterned concrete and other art options to add visual appeal without guard posts.

- Guiding principles
- Landscape Architect role
- Highway principles
- Project delivery process
- Landscape and aesthetic guidelines for common elements

Florida DOT

- Organized by project phase
- Planning & Design
 - Landscape Architect role
 - Highway principles
 - Project delivery process
 - Landscape and aesthetic guidelines for common elements
 - Plant palette
- Construction
- Maintenance

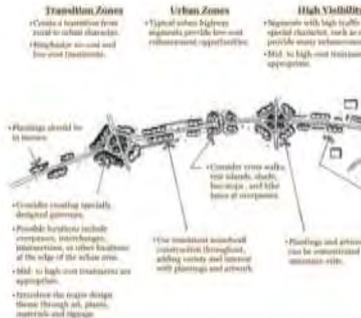


Nevada DOT

Pattern and Palette of Place: A Landscape and Aesthetics Master Plan for the Nevada State Highway System

July 3, 2002

URBAN FREEWAYS



Urban Freeway Guidelines: Slope Treatments



Wedges at the edges of highways, at interchanges, and at overpasses provide many opportunities for landscape and aesthetic treatments. These treatments also serve to protect slopes from erosion and to reduce sedimentation. Plantings and soil control are two methods most commonly used to landscape and stabilize embankments or slopes.

Aesthetic Guidelines

- Slopes should not be treated to not considered a landscape treatment, the smaller, denser, and more varied the plantings, the better.
- Select colors that harmonize with the adjacent terrain and are consistent with the overall palette for the corridor.
- Use a variety of soil types, sizes, and textures to create visual interest.
- Within land graphic design to best pattern, texture, and color.
- The best single design that can be used at highway slopes is to consider the slope and distance from which the slope will be viewed.
- Landscape water plants that need little or no irrigation offer a low-cost, low-maintenance option.

SLOPE TREATMENT OPTIONS

The following table provides information on the various options available for slope treatments. The information is organized by type of treatment, including erosion control, permanent grass, and ground treatment. The information and photographs within the specific options table may be used to select a treatment option.

EROSION CONTROL OPTIONS

Erosion control options include the use of geotextiles, erosion control blankets, and other treatments. These treatments are used to stabilize slopes and prevent erosion. The information and photographs within the specific options table may be used to select a treatment option.



PERMANENT GRASS OPTIONS

Permanent grass options include the use of grass seed, sod, and other treatments. These treatments are used to stabilize slopes and prevent erosion. The information and photographs within the specific options table may be used to select a treatment option.



- 1968 Aesthetics Manual
- Guiding principles
- Project delivery process
- Landscape and aesthetic guidelines for common elements
- 11 Corridor Master Plans

Masterplan & RDG Goals

- Roads that reflect local place and stories.
- Integrated sustainability and context.
- Prescriptive approach.
- Implementation by project managers.
- Consultants:

JONES  JONES

 KI CONCEPTS

SITE PLANNING | LANDSCAPE ARCHITECTURE | URBAN DESIGN

Statewide Sustainable Landscape Masterplan & Roadside Design Guide

Holistic and systematic approach for
sustainability and context.

Introduction

Vision & Guiding Principles



Mālama Pono i ka 'Āina **(To Righteously Care for the Land)**

With limited natural resources and an isolated setting, Hawai'i faces mounting pressure to conserve energy and resources, reduce and recycle waste, and restore and maintain healthy natural systems to ensure people's quality of life. All aspects of highway design, construction, operation and maintenance must consider this island context and utilize renewable and local resources, reduce consumption of imported energy, and preserve and enhance ecological systems and function. The environmental harm often associated with highways can be reduced or eliminated by employing certain practices and techniques in the design, construction, and operation of a road. These methods can protect and restore aquatic and marine resources, wildlife populations, native plants, soils, scenery, and recreational resources near highways.

State of Hawaii Motto

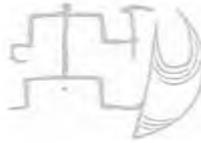
Ua Mau Ke Ea O Ka Aina I Ka Pono

The Life of the Land is Perpetuated in Righteousness



Nā Mea Ma'amau a Mau **(Perpetuation of Culture and Traditions)**

Hawai'i has a rich history of human activity and enterprise shaped by diverse landscapes. Highway design and use must protect the cultural, historic and archaeological resources representing this history. Moreover, highways and highway elements should reflect local culture and history in a way that informs and heightens people's appreciation of place and culture.



He Kuleana kō Kākou **(We Have a Shared Responsibility)**

The Highways are everyone's *kūleana*. So many issues—social, environmental, economic—are associated with highways. It is important to involve a broad spectrum of interests and parties in highway planning, design and maintenance. This coordination and cooperation needs to occur among local, state, and federal agencies, community and business associations, environmental and recreational organizations, and other groups.

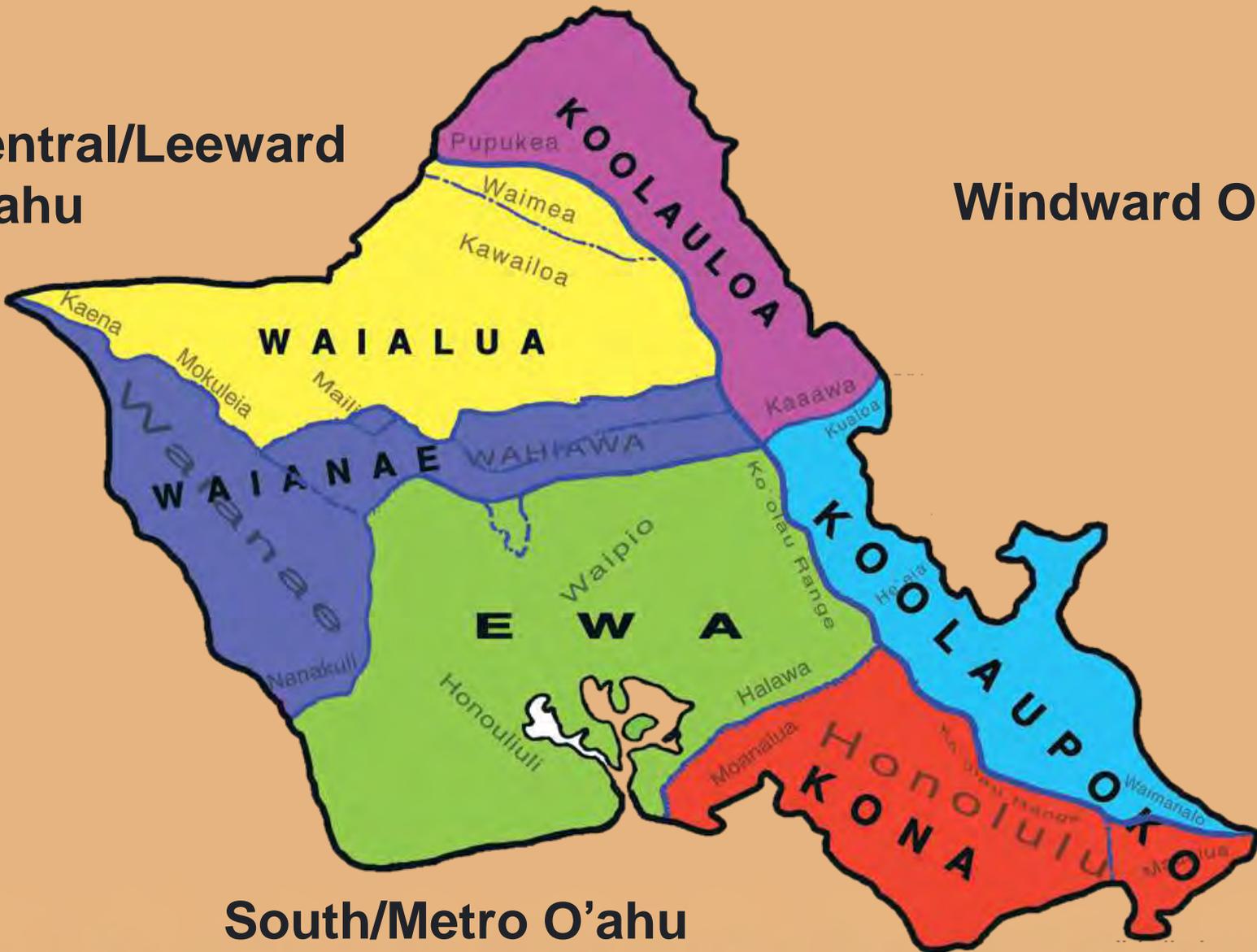
Pehea lā, ua pono 'aneī **(Is it right or excellent?)**

Process and results-based planning requires effective measurement tools to adequately forecast and assess desired outcomes. Methods must be employed or developed for measuring the monetary and non-monetary value and benefits of strategies and recommendations. Also, methods for determining the success of strategies should include ways that strategies can be adapted or managed to meet targeted goals and objectives.

Landscape Context

Central/Leeward
O'ahu

Windward O'ahu



South/Metro O'ahu



Ko'olaupoko Landscape Character

Ko'olaupoko Moku is relatively long and narrow and stretches for 15 miles along the windward (east) side of O'ahu, from Makapu'u Point northward to Kualoa Point. The irregular, scalloped coastline of this moku is defined by shallow bays, small islands and white sand beaches protected by off-shore reefs. A fairly broad coastal plain over the moku's southern half gradually transitions to a narrower coastal plain over its northern half.



Kāne'ohe Bay

The high jagged Ko'olaui Mountains form this moku's inland boundary. The mountains are visible from the coastal lowlands and create a dramatic backdrop to westward views. Fed by ample rainfall, numerous streams flow from the mountains out across the coastal plain, feeding wetlands and estuaries and supplying coastal bays with nutrients which help support healthy fish populations. Abundant rainfall also contributes to lush vegetation cover on steep mountain slopes and verdant landscapes throughout the lowlands and coastal plains.

The natural resources of this moku historically supported large populations of native Hawaiians who inhabited several villages on the coastline and coastal plains prior to western contact. Numerous sacred sites (*wahi pana*), shoreline fishponds, agricultural terraces, and traditional place-stories (*mō'olelo*) bear witness to the once thriving and rich culture of the *Kanaka Maoli* who once occupied this moku.

Perhaps one of the most notable features of Ko'olaupoko are the blue waters of Kāne'ohe Bay. The Bay contains scattered small islets, each with its own name—*Ahu a Laka*, *Kikepa*, *Moku o Lo'e*, and *Moku Manu*—alluding to times past. The peninsula enclosing the east side of the Bay is known as *Mōkapu* which is said to be the birth place of the first Hawaiian man and woman.

With increased western contact in the mid-1800's, the coastal plains were eventually parceled into farms, ranches and plantations and put into intensive agricultural production made possible by the area's fertile soils and abundant water. Initially, most of what is now Kāne'ohe and Kailua were purchased from the estate of Queen Kalama (wife of Kamehameha III) by the Harris and Castle families who developed ranching interests. Later, rice paddies and sugar plantations were established. Fields of pineapple were also scattered over the coastal plain between He'eia (Ko'olaupoko) and Punalu'u (Ko'olaupoko).

Ko'olaupoko's setting and water resources have contributed to this moku's community appeal and high quality of life.

In the late 1920s, the flat lands fronting Pu'u Hawai'i'loa were developed as the first planned real estate subdivision in the islands—a so-called "fisherman's paradise," where businessmen of Honolulu retreated with their families to relax and play. With the advent of World War II, the United States Navy took an interest in Mōkapu and usurped lands for development of a Naval Air Station. Large sections of reef in Kāne'ohe Bay were cut and dredged to allow entry of small ships and to create fill for air station runways.

From the 1950's onward, much of the agricultural land of Ko'olaupoko was converted to residential and commercial development. The suburban communities of Kāne'ohe and Kailua now occupy large areas of the coastal plain, and two military bases (Bellows and Kane'ohe) are located on the coast. Small parcels of agricultural land remain dispersed throughout this moku, as do several streams, freshwater wetlands and marine estuaries. Parks, recreation areas, and nature/forest preserves comprise other open land areas.

Residents here value the area's neighborhood character and strong sense of community, its fresh water and marine resources, its Hawaiian heritage and cultural resources, and an overall quality of life which they believe is tied to good resource management, environmental protection and education.

Summary

The area making up Ko'olaupoko is now generally recognized for its newer suburban communities which provide a less urban but conveniently located alternative to the more built-up environment of Honolulu. The spectacular mountain escarpment along the moku's west edge is often in view from the lowlands and coastline, and an extensive network of streams, wetlands and estuaries still occupy the coastal plains and lowlands. Numerous parks and lovely sand beaches contribute to the district's notoriety and appeal.

The size and importance of the historic Hawaiian community that once occupied this moku is evidenced by numerous sacred places and sites (*wahi pana*), historic fish ponds, and rich collection of associated stories. The area's former agricultural productivity and importance is still represented by a few small farms and truck gardens scattered throughout the district.



View north to Kāne'ohe in Ko'olaupoko



Ko'olauloa Landscape Character

Ko'olauloa Moku is relatively long and narrow, extending from Makahonu Point to Kahuku Point. Because this moku is on the windward side of O'ahu, precipitation levels are moderate to high. The moku's coastline consists of a series of beautiful crescent shaped beaches and shallow bays. The steep Ko'olau Mountains and deep mountain valleys that define the moku's west edge reach nearly to the shoreline over the southern portion of this moku. Over the moku's northern half, the mountains and valleys recede inland creating a broad, relatively flat coastal plain. Numerous streams flowing from the mountains supply wetlands in the valley bottoms and coastal lowlands. Several endemic aquatic species use these streams to migrate between freshwater and marine habitats during their life cycle. Rainfall also supports lush vegetation throughout this moku, with tropical rainforests on mountain slopes transitioning to non-native plants and grasses that have been introduced through agriculture and development in the valley bottoms and coastal plains.



The rich natural resources of this moku, combined with traditional land management practices, sustained a large native Hawaiian population prior to western contact. The historic political and cultural significance of the district is reflected in traditional Hawaiian stories that portray the area as the home of gods (akua), ruling chiefs (ali'i), and royal families. By the late 1800's, the ownership of much land had transferred to U.S. interests and arable land was utilized for ranching and sugarcane. Although cane production has all but disappeared today, significant land area still remains in pasture and small-scale farming throughout the valley bottoms and coastal plain.

Residential and commercial development of this moku is largely concentrated in a series of coastal communities that vary in size and character, with perhaps the largest and most prominent being Lāie which hosts the Polynesian Cultural Center. The small coastal towns of Waimea and Sunset Beach are heavily dependent on seasonal tourism. Numerous scenic beach parks dot the coastline, and popular state parks (Kahana, Sacred Falls) and forest preserves provide public access into some of the deep, lush mountain valleys.

Ko'olauloa retains considerable farming activity, recalling a time when this moku supported a thriving native Hawaiian population who associated the dramatic landscape with their gods.

Residents value the rural character and "country" lifestyle of this moku, and are strongly supportive of protecting agricultural land, parks, natural areas, water resources, and the eclectic laid-back vernacular quality of neighborhoods and commercial areas.



Major Attractions and Places of Interest

Cultural Sites: Kaliuwa'a (Sacred) Falls, Lanakila Church, Polynesian Cultural Center, Hawaii Mormon Temple, Brigham Young University, Kahuku Sugar Mill, Kahikilani (Washington Statue), Pu'uomahuka Heiau State Monument

State Parks and Preserves: Kahana Valley State Park, Sacred Falls State Park, Malaekahana Bay State Rec Area, Hau'ula Forest Reserve, Kaipapa'u Forest Reserve, Pupukea-Paumala Forest Reserve, James Campbell/Punamano National Wildlife Refuge, several island seabird sanctuaries

Public Beach Parks: Kalae'o'lo, Swanzey, Punalu'u, Aukai, Hau'ula, Kokoioio, La'ie, Turtle Bay, Waiale'e, Sunset Point, Ehukai, Banzai Pipeline, Pupukea, Waimea Bay

Summary

Among the more memorable aspects of this moku are the steep rugged mountain ridges and deep lush valleys that push right up to the coastline in the district's southern section. A series of beautiful crescent-shaped public beaches (including "The Magic Seven" north of the town of Waimea) line the coast. The broad coastal plain across the moku's northern end hosts large wetland areas (including the James Campbell/Punamano National Wildlife Refuge) as well as considerable agriculture and aqua-culture activity.

Traditional stories and numerous culturally significant places associated with Hawaiian deities and royalty reflect the historic importance of this moku in Hawaiian culture. The moku's combination of resources and agricultural productivity supported first a large Hawaiian population followed by white-owned plantations and farms. The district retains an astonishing amount of active agricultural land and small-scale farming operations on the coastal plains and in the mountain valleys.

An interesting variety of coastal communities (resort, Mormon, agricultural) continue to exemplify different ways of life and cultural perspectives.

WINDWARD O'AHU

Corridor Types



Photo of Coastal Farmland Corridor



Photo of Shoreline Residential Corridor



Photo of Natural Shoreline Corridor

Highway Corridor Contexts



Photo of Village Center Corridor



Photo of Community Parkway Corridor



Photo of Trans-Mountain Highway Corridor





Shoreline Residential



View of Iconic Corridor Segment

State Route 83 south of Kīā'āwa

Because of O'ahu's rugged terrain, the two-lane highway frequently hugs the shoreline in many areas, and homes line one or both sides of the road for long stretches. Residential character is typically suburban, with homes arrayed only one to three deep and closely spaced along the highway. In places, the highway follows or lies directly on top of the ancient Hawaiian Ale Hele (trail). Beautiful beaches, incredible vistas, and important cultural and historical sites are only a stone's throw from the road.

Iconic Elements



A **Asphalt Shoulders**
Asphalt shoulders provide safety/emergency pull-off zone and informal bike lane.



B **Grass Roadsides**
Roadsides are often used for intermittent parking for beach access and residences.



C **Roadside Shrubs and Trees**
Dense plants within and outside R.O.W. visually obscure homes and yard clutter from highway.



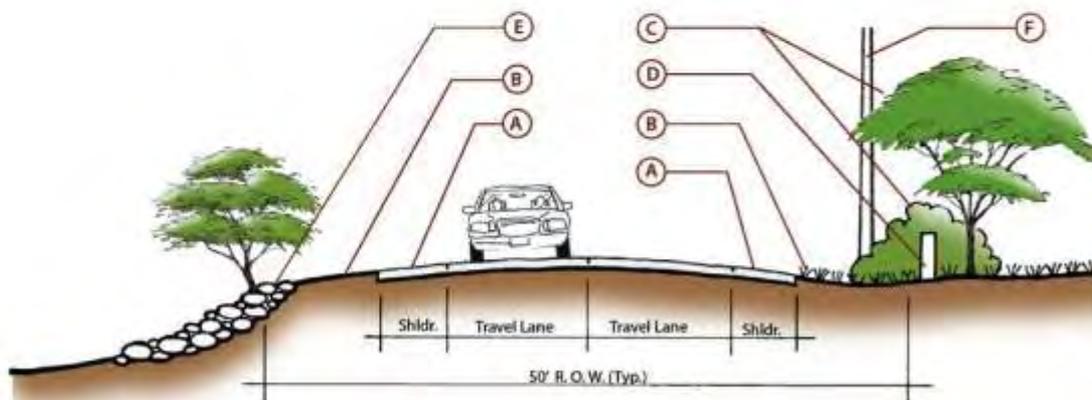
D Adjacent Walls
Just outside the R.O.W., low walls define residential properties and parks.



E Shoreline Protection
Large basalt boulders and deep-rooted plants stabilize shoreline at high tide zone.



F Utility Poles and Lines
On one or both sides of the highway, overhead utilities detract from the corridor's scenic quality.



Cross-Section of Iconic Corridor Segment

A – F Landscape elements that contribute to or detract from iconic character

Shoreline Residential Highway Objectives

Improve community cohesion, appearance & safety

- Develop roadway scale and structures to fit setting, visually unifying highway elements with each other and with setting.
- Screen objectionable views.
- Establish a consistent roadside treatment with plants & drainage
- Bury or consolidate overhead utilities when feasible.
- Integrate elements that reflect local culture.
- Provide cross-walks where required (such as at signalized intersections).
- Provide bike lanes, sidewalks, trails and transit stops when possible.
- Implement traffic calming measures if necessary.
- Use hardy native and non-native species consistent with setting.

Protect & restore natural resources & wildlife habitat

- Manage storm water run-off.
- Maintain or restore natural channel banks and stream bottoms at bridge crossings.
- Replace constrictive culverts with larger structures.
- Protect and repair wetlands, estuaries and marshes.
- Provide wildlife crossing structures at appropriate locations.
- Protect and restore wildlife habitat.
- Replace invasive plants with appropriate vegetation.

Improve highway travelers' experience

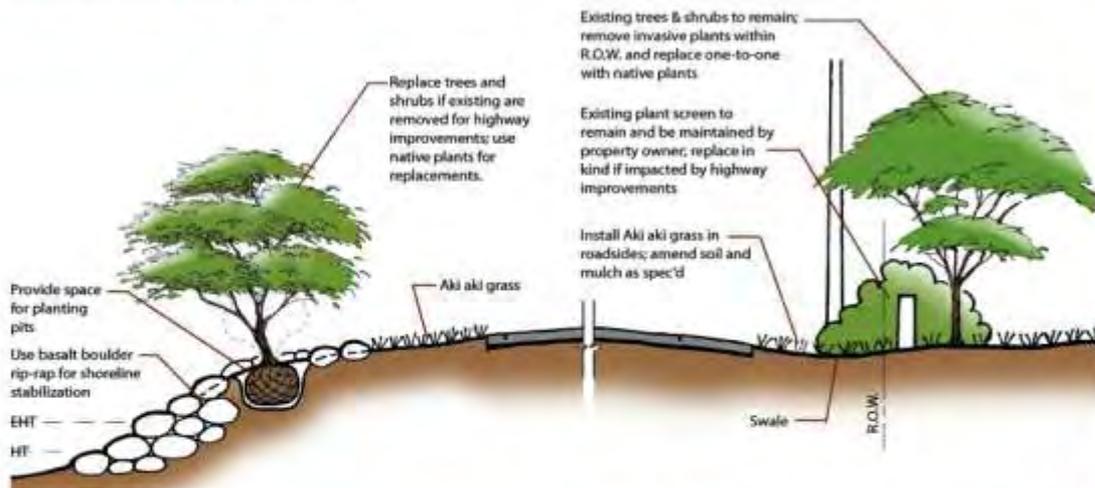
- Identify nearby attractions and points of interest.
- Safely accommodate posted travel speeds and safe movement onto and off of the highway.
- Preserve mountain and ocean views.
- Establish consistent roadway geometry and visual character.
- Provide separated bike/ped trail (optimal), or shoulder bike lanes.

Tell the stories of the diverse Hawaiian cultures

- Mark the boundaries of the traditional Ahupua'a with markers.
- Provide or improve roadside pull-offs/parks (with interpretation) at appropriate locations.
- Tell traditional stories in the landscape through interpretive methods.

Corridor Design Considerations & Recommendations

Iconic Elements to be Preserved



Shoreline Stabilization

Stabilize eroding shoreline with basalt boulders interplanted with native trees & shrubs so roots bind rock and soil together.

See Roadside Design Guidelines: XX-2, Shoreline Stabilization

Benefits

- Prevents erosion of highway edge
- Strengthens and hardens shoreline with "living" infrastructure
- Maintains or improves scenic quality



Aki aki grass thrives along the shoreline in sandy soil conditions with little maintenance.

Roadside Plants

Where highway improvement impact plants, replace invasive plant species with native plants.

See Roadside Design Guidelines: XX-2, Roadside Plants

Benefits

- Screens road from nearby residences (and vice-versa)
- Controls erosion
- Maintains or enhances the corridor aesthetic with native plants



Milo (*Thespesia populnea*) makes an excellent plant screen with its green foliage, acclimation to the coast and attractive flowers.

Elements to be Improved



Roadside Parking for Public Access

Provide stable parking surface at roadside parking areas for beaches, parks, & public areas. Replace haphazard roadside barriers with a consistent barrier type; coordinate barrier work with State Parks or adjacent property owner.

See Roadside Design Guidelines: XX-2, Roadside Pull-offs

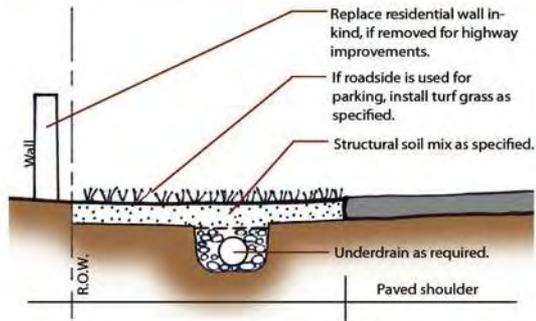


Bridges and Stream Crossings

When upgrading or replacing bridges over streams, restore the natural stream channel to protect riparian plants, enable migration of aquatic and terrestrial organisms, and create a better, more natural appearance for the channel in contrast to a straightened, armored channel section.

Roadside Design Guidelines: XX-2, Bridge structures and stream crossings

Elements to be Improved



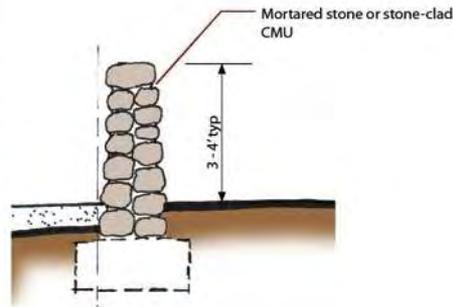
Grass Roadside Parking at Residential Areas

Where informal parking occurs along the roadside and adequate right-of-way is available, reinforce the grass roadside with structural soils for parking.

See Roadside Design Guidelines: XX-2, Structural Soil; XX-2, Roadside Plants

Benefits

- Provides parking for residents and visitors
- Establishes durable grass in high-impact areas
- Preserves informal aesthetic of coastal O'ahu



Roadside Residential Walls

If existing wall is removed for highway improvements, replace with new wall, preferably stone. Coordinate wall construction with adjacent property owner.

See Roadside Design Guidelines: XX-2, Walls

Materials and Finishes Palette



Iconic Roadside Trees

Hala	<i>Pandanus tectorius</i>
Hau	<i>Rauvolfia sandwicensis</i>
Kamani	<i>Calophyllum inophyllum</i>
Milo	<i>Thespesia populnea</i>
Niu	<i>Cocosnucifera</i>

Roadside Shrubs

Naupaka kahakaj	<i>Scaevola sericea</i>
Kalo	<i>Colocasia esculenta</i>
'Akoko	<i>Chamaesyce celastroides</i>
'Ilima	<i>Sida fallax</i>
Makaloa	<i>Cyperus laevigatus</i>



Walls and Barriers

Walls: mortared lava rock, preferred

Barriers: stone-clad concrete



Guardrail

W-beam guardrail with brown finish (such as Natina)



Coastal Farmland



View of Iconic Corridor Segment

State Route 83 opposite the Turtle Bay Resort

Certain coastal areas possess a strong agricultural heritage, having transitioned from ancient Hawaiian taro fields (loi kalo) and crop lands to large plantations and ranches, and then now to small-scale farms, truck gardens, and plant nurseries. When passing through these agricultural landscapes, the highway is sometimes near the shore, sometimes a mile or two inland, and occasionally along the same route travelled by the ancient Hawaiian Ala Hele, or foot-trail, that linked native coastal villages. Views from the highway can be contained by roadside vegetation and hedgerows, or they can be open and expansive across pastures and fields to mountains and ocean.

Iconic Elements



(A) Asphalt Shoulder

Four to five foot shoulder can be used as an informal bike lane.



(B) Stormwater Drainage

Stormwater treatment occurs on an informal basis as water filters and infiltrates through grass roadsides.



(C) Roadside Plants

Native and ornamental plants and healthy grass in roadsides integrate and unify the road with the larger landscape.



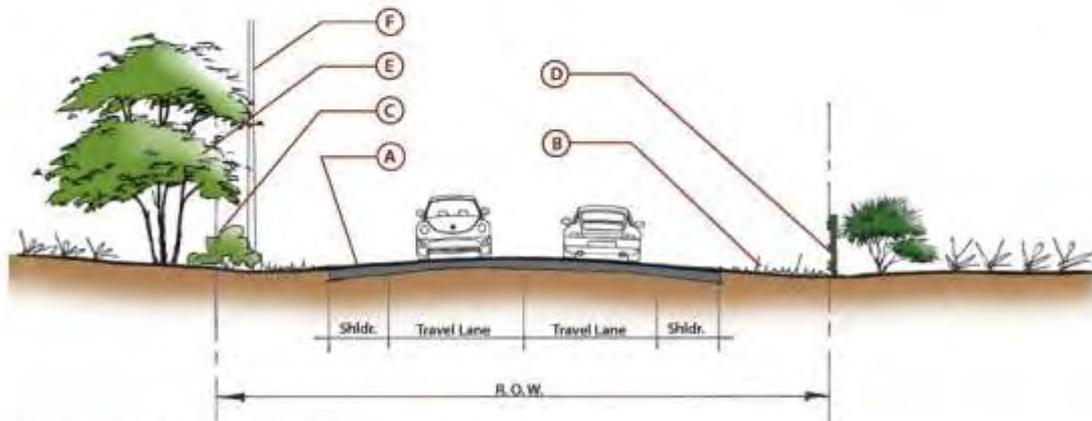
D Fencing
Farm fencing at edge of right-of-way is often board fencing or wood posts with welded-wire mesh.



E Roadside Hedgerows
Dense hedgerows (with trees) in roadides provide visual interest, screening, and habitat.



F Utility Poles and Lines
On one or both sides of the highway, overhead utilities detract from the corridor's scenic quality. (detracts)



Cross-Section of Iconic Corridor Segment

A – F Landscape elements that contribute to or detract from iconic character

Coastal Farmland Highway Objectives

When planning and designing highway improvements in Coastal Farmland settings, it's important to protect and maintain the agricultural activities, natural resources (upon which farming depends) and rich scenery of these corridors. The following objectives should be addressed:

Support farming & agricultural activity

- Accommodate commercial farm vehicles (slow vehicle turn-outs).
- Provide interpretation about agricultural operations and history.
- Ensure safe access to roadside vendors of farm products.
- Support coherent land use and farmland preservation.

Protect & restore water resources & wildlife habitat

- Manage storm water run-off.
- Restore channel banks and creek bottoms at bridge crossings.
- Replace constrictive culverts with larger structures.
- Repair wetlands and estuaries.
- Protect or re-establish wildlife habitat.
- Provide wildlife crossing structures if necessary.
- Provide adequate setbacks from shorelines and stabilize shoreline.

Preserve & improve scenic quality

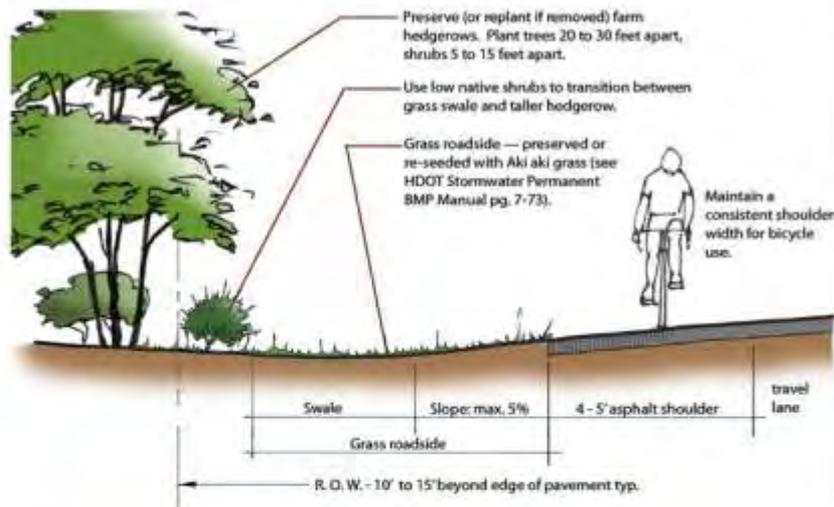
- Screen objectionable views from highway, and expose or frame scenic vistas.
- Establish consistent roadside treatment and visually unify highway elements.
- Integrate highway with terrain features.
- Utilize curvilinear alignment in response to terrain.
- Create gradual cut/fill slope transitions.

Improve highway travelers' experience

- Identify attractions and points of interest.
- Provide or improve roadside pull-offs/parks with interpretive elements.
- Safely accommodate higher travel speeds and safe movements onto and off the highway.
- Establish consistent roadway geometry and visual character.
- Provide separated bike/ped trail (optimal), or shoulder bike lanes.

Corridor Design Considerations & Recommendations

Iconic Elements to be Preserved



Roadside Hedgerows

If highway improvements impact hedgerow plants, replace removed plants with native plants.

See Roadside Design Guidelines: XX-2, Roadside Plants

Benefits

- Screens road from adjacent property (and vice-versa)
- Controls erosion
- Maintains or improves scenic quality
- Provides bird habitat

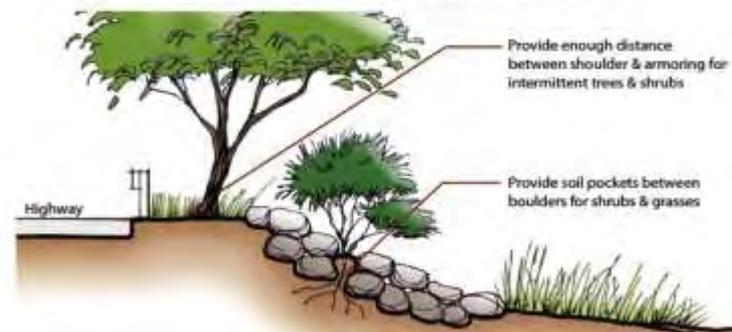


The iconic landscape of the coastal farm corridor arises from views of crops and ranchlands. Intermittent views into surrounding agricultural areas should be preserved or provided.

Elements to be Improved



Existing shoreline erosion adjacent to Highway 83



Proposed shoreline stabilization with native plants

Shoreline Stabilization

Where highway abuts the beach, stabilize the shoreline with basalt boulders interplanted with native trees and shrubs so roots bind rock and sand/soils together.

See Roadside Design Guidelines: XX-2, Shoreline Stabilization

Benefits

- Prevents erosion of highway edge
- Strengthens and hardens shoreline with "living" infrastructure
- Maintains or improves scenic quality

Elements to be Improved



Existing "shrimp shack" with open parking adjacent to Hwy 83



Defined driveway opening in front of produce stand or shrimp shack.

Place bollards, stones or other upright barrier at back of planter strip. No curbs.

Install planter strip in right-of-way on either side of driveway. (see detail to right)

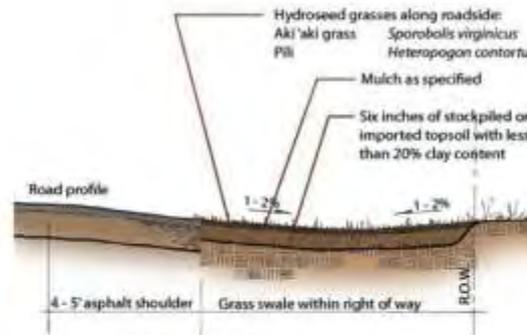
Roadside Produce Stands Access

Control and define access to roadside businesses to improve safety and visibility.

Roadside Design Guidelines: XX-2, Access and Driveways

Benefits

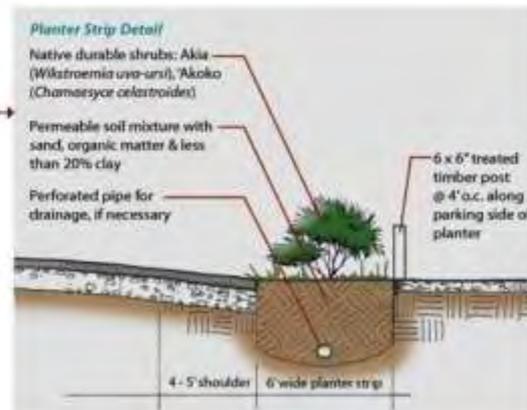
- Maintains access to direct sales of produce and other commodities
- Enhances safety by reducing the size of driveway access
- Planter strip filters stormwater runoff from roadway



Stormwater Management

Provide filtration of stormwater run-off with roadside grass bioswales

Roadside Design Guidelines: XX-2, Stormwater



Materials and Finishes Palette

Hedgerow Trees:

Avocado	<i>Persea americana</i>
Hau	<i>Rauvolfia sandwicensis</i>
Kukul	<i>Alseodora maluccana</i>
'Ohi'a	<i>Metrosideros polymorpha</i>
'Ulu	<i>Artocarpus altilis</i>

Native Roadside Shrubs:

Kalo	<i>Colocasia esculenta</i>
Koki'o kea	<i>Hibiscus waimeae</i>
Ko	<i>Saccharum officinarum</i>
Akia	<i>Wikstroemia uva-ursi</i>
'Akoko	<i>Chamaesyce celestroides</i>
'Ilima	<i>Sida fallax</i>
Makaloa	<i>Cyperus laevigatus</i>

Fencing

Wood can be painted white or dark brown or left to weather.

Wire mesh fencing can be used to replace same, if removed.



Bridge Railings

Concrete bridge railings with decorative, rectangular openings - white or beige paint



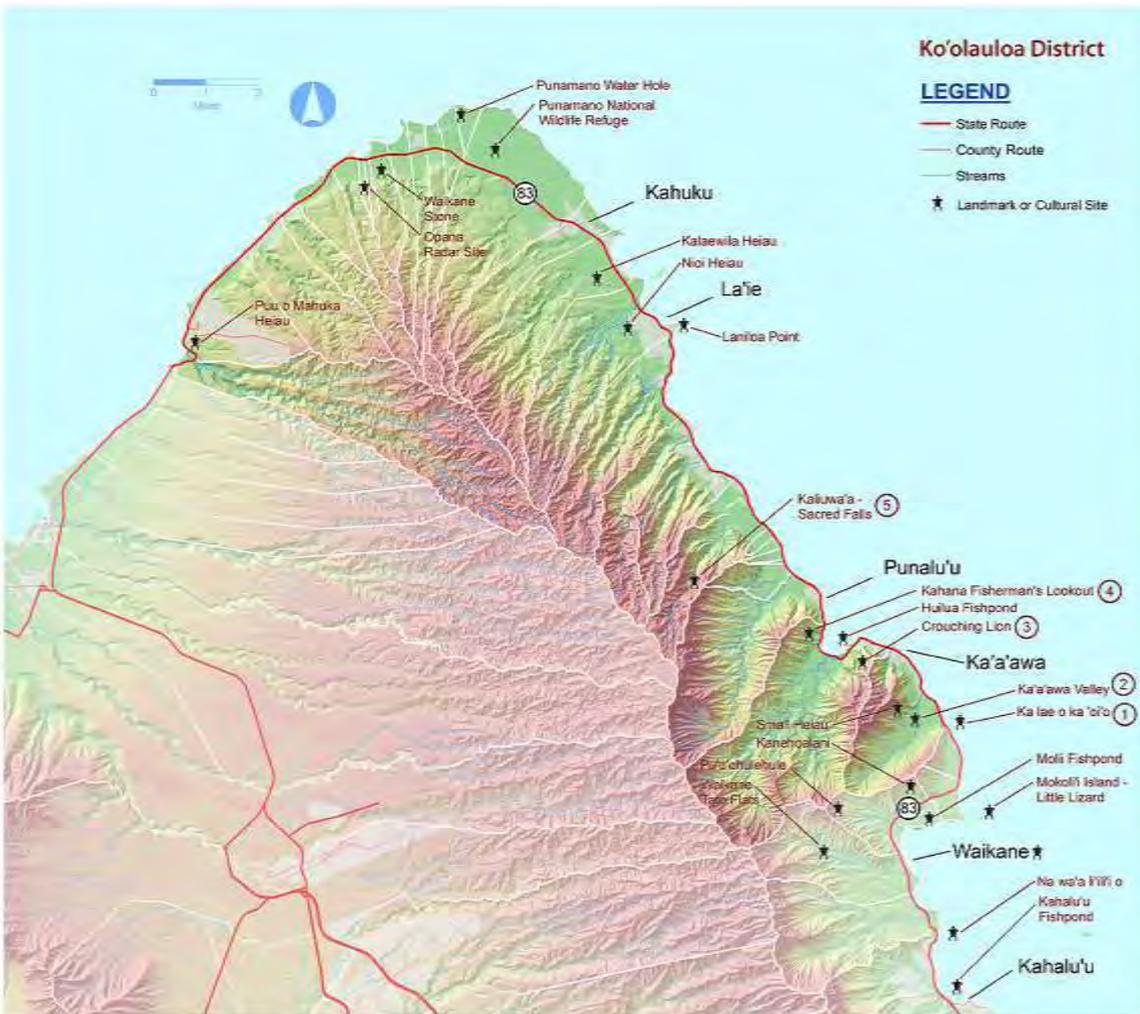
Guardrail

W-beam guardrail with brown finish (such as Natna)



WINDWARD O'AHU

Story Places



Storied Places in Ko'olauloa



① **Ka lae o ka 'oi'o**
 The famed point where the two Ko'olau districts meet is called Ka lae o ka 'oi'o (Point of the night marchers), and commemorates the gathering of the spirits of old on certain nights of the moon.

- a Provide a moku boundary marker of stone at the point (see Boundary Markers and Gateways).

② **Ka'a'awa Valley**
 Ka'a'awa is named for a choice fish which was caught in its waters. The great valley of Ka'a'awa was used in support of dryland agricultural practices in ancient times. The deep valley of Ka'a'awa continues to be part of the ranching operations of the Kualoa Ranch. The valley has provided a panoramic backdrop for big budget film productions, such as Jurassic Park.

- b Locate a place name sign along the road (see Place Name Signs).



③ **Crouching Lion**
 The natural geological formation called Crouching Lion is a storied place associated with the journeys of the goddesses Pele and Hi'iaka along the O'ahu coast. The ancient name of this stone formation is Kauhikeimakaakalani (Kauhi the watcher of the heavens), named for an elder relative of the goddess Pele who was left at this spot to watch for the arrival of Pele's enemy, the goddess Nāmakaokāhā'i. After a long wait he began to rise up in an effort to accompany Hi'iaka on her journey. Hi'iaka called out to him in chant, causing him to turn to stone.

Story Places

WINDWARD O'AHU

Crouching Lion (continued)

in his crouching dog (now referred to as crouching lion) form. It is said that the formation is that of a dual-formed being, who possesses the body of both a human and a dog.

- b Locate a place name sign along the road (see Place Name Signs).
- c Explore a partnership with local development to install an interpretive sign at the Crouching Lion Hotel.



4 Kahana Valley and Bay

Kahana Valley is rich with water resources, once supporting a large Hawaiian population. Kahana Bay is noted as an important fishery. On the northern side of the bay, where the cliffs rise to Pu'u Plei, there was a famous fisherman's lookout where the leader of the fishermen would stand to direct the canoes and fishing boats where to lay the nets to capture the schools of fish.

- c Explore a partnership with State Parks to improve the existing pull out and install an interpretive sign.



5 Kaluanui

The demigod, Kamapua'a, is storied to have been reared here. The chief 'Olopana attempted to attack Kamapua'a and his family; Kamapua'a transformed himself into a great boar and dug out Kaliuwa'a (Sacred Falls) as he transported his family to safety on the leeward side of O'ahu.

- b Locate a place name sign along the road (see Place Name Signs).

a. Boundary Markers and Gateways

Mark the points at which the state highway crosses a traditional boundary with signs or markers to signal to drivers they are passing into the next place of significance. These markers can take two forms:

- Ahu pua'a marker program: identifying the community-defined boundaries of the traditional Ahu pua'a, a small landscape unit important to native Hawaii that is similar to watersheds (see HDOT Ahu Program).
- Moku boundaries: where culturally significant divides occur (i.e. at Ka lae o ka 'oi'o), mark them with a stone wall perpendicular to the road.



Sign graphic from HDOT's Ahu Boundary Marker Program



Traditional construction of a rock boundary marker is similar to the walls of this fish pond

b. Place Name Signs

Place signs that name significant cultural elements or stories along state highways. The signs should have the traditional name for the place (whether in the Hawaiian language or in the language of one of the many people groups) and the English word for the place.



Place name sign along U.S. 93 in Montana with Polish and English words for the place



Oahu's existing place name signs connote the rural agricultural heritage of plantation towns

c. Interpretive Signs and Pull-outs

Interpretive signs provide a more literal method of telling the stories of a place. Residents and visitors alike can learn what makes the landscape unique, what important cultural events occurred at that location, and the natural processes that have shaped the landscape. Signs can be free-standing, mounted to walls, or made integral with the highway infrastructure.

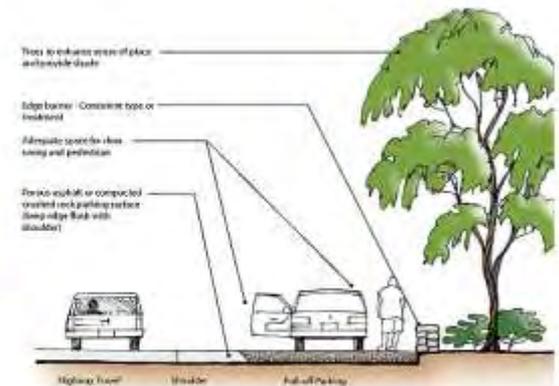


An interpretive sign integrated into the wall describing the old Pali Highway.



An interpretive sign mounted to a stone wall at Makapa Point

Interpretive signs cannot be read from a moving vehicle. HDOT will need to partner with other state agencies to use existing pull-offs and parking lots for interpretive signs. Access to pull-offs should not interfere with the flow of traffic. They can be pleasant, restful places that capture important views of the landscape.



Master Plan & Roadside Design Guide Emphasis

- Water Quality Protection & Improvement
- Soil Conservation – Erosion Control
- Native Plant Preservation & Restoration
- Multi-Modal (ped/bike) Travel
- Scenic Quality & Aesthetics

Alignment & Profile

Various aspects of road design affect the roadside. A roadway's horizontal alignment and vertical profile in particular will have a significant effect on roadside grades, drainage, vegetation and structures. Moreover, the alignment often affects conditions, features and resources beyond the right-of-way, such as visual quality and noise.

The guidelines in this section do not cover the multitude of considerations in alignment and profile development. Instead, these guidelines discuss certain alignment issues that can significantly influence roadside grading and drainage as well as highway construction costs, driveability, aesthetics, environmental quality and maintenance. The guidelines apply both to new highways and to reconstructed roads requiring alignment and profile changes.

AP - 1

Avoid (straight) alignments that produce deep cuts

Through hilly or rolling terrain, try to curve or meander the road through the landscape to:

- Avoid creating a successive series of high steep cuts and erosion problems
- Go around ridges and hills rather than through them, or at least cross through at points where ridges are lower, thus reducing earthwork and cost.
- Create a highway course or path that appears more natural, like the course that a creek or river might etch through the terrain.



POOR



BETTER



Avoid alignments that produce deep cuts if possible

MS - 3 Visually screen or soften roadside retaining walls with plants

Instead of leaving a high wall exposed, or applying decorative patterns and motifs to it, try providing enough ground area in front of the wall for plants. Plants along the face of the wall will:

- Create a better looking condition in any setting where walls are required
- Reduce construction costs by avoiding the decorative patterns and textures often applied to concrete and MSE walls.
- Provide environmental benefits in the way of shade and improved air quality
- Make the wall surface less prone to graffiti



High, exposed walls create a canyon effect.



Plants can reduce the visual harshness of high walls.



Title of Illustration To Come Here



Plants along base of wall improve appearance and deter graffiti.

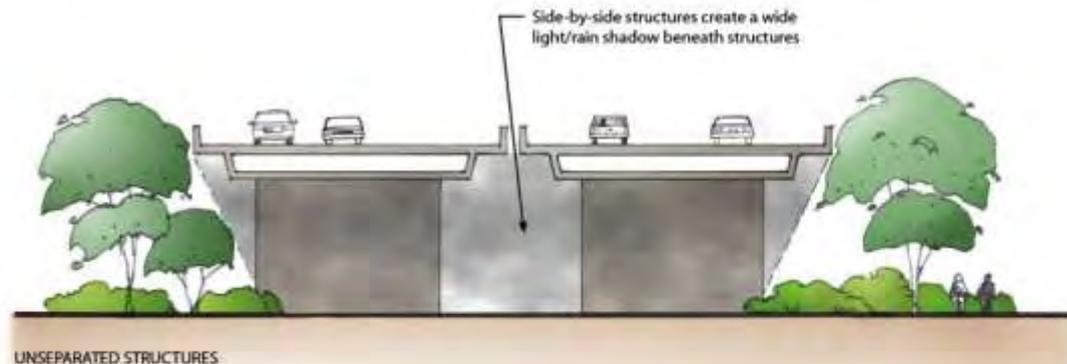
MS - 6 Avoid side-by-side bridges and viaducts

Unseparated or side-by-side wide bridges and viaducts restrict air, light, plant diversity, wildlife and aquatic life, and human activity and travel beneath them. If there is sufficient right-of-way, wide bridge structures should be separated to:

- Permit more light and rain to reach the ground
- Allow a greater diversity of plant species and size at ground level.
- Permit better movement of wildlife in habitat areas.
- Reduce mass and scale, and create a more comfortable condition for people walking (or driving) beneath the structures.



Example of separated viaduct structures: Nimitz Highway, Honolulu



UNSEPARATED STRUCTURES



SEPARATED STRUCTURES

Provide a Moderate Gap or Separation Between Long, Wide Bridges & Viaducts

Stream Bridges & Culverts

Lovely streams and waterways course through the landscapes of the Hawaiian Islands. Streams are of immense cultural, economic and environmental importance. They embody ancient stories, provide irrigation, enhance scenery, and provide critical habitat among other benefits. Unfortunately, highway bridge crossings can damage the beauty and complex ecology of streams. The following guidelines are intended to foster a more respectful and sustainable treatment of streams at highway bridge and culvert crossings.

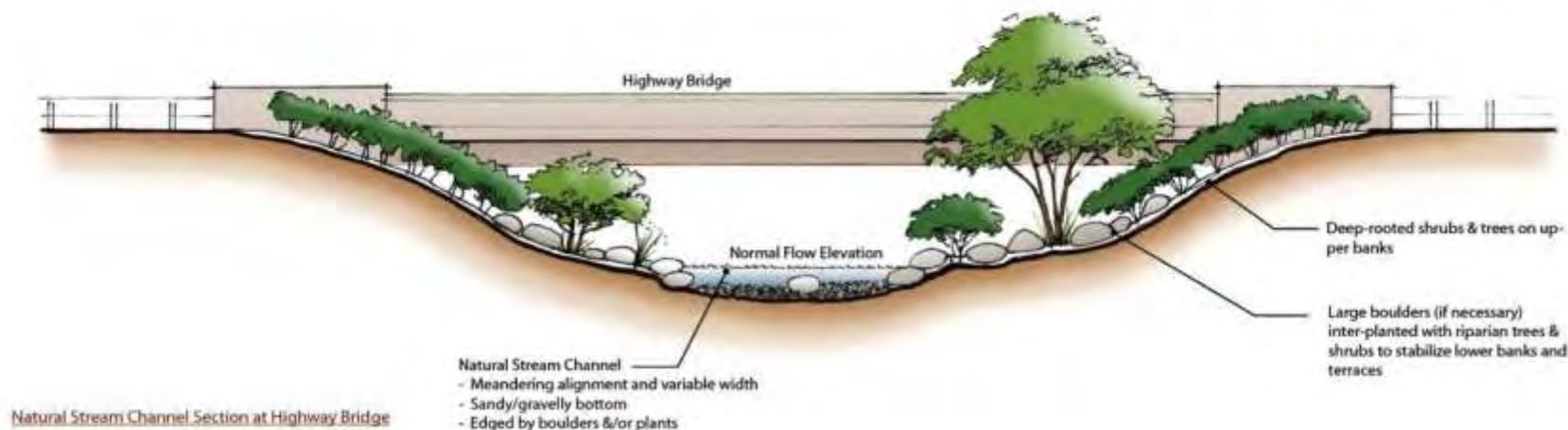
BC - 1 Maintain or restore natural stream beds and banks at highway bridges and culverts

When upgrading or replacing highway bridges and culverts over streams, restore or maintain the natural stream channel at and near the bridge. This will:

- Enable better passage and migration of aquatic and terrestrial organisms moving up and down stream
- Keep hydrologic conditions at the bridge consistent with (natural) conditions farther up and down stream
- Create a better visual appearance for the channel, as compared to a straightened, uniform and armored channel section.



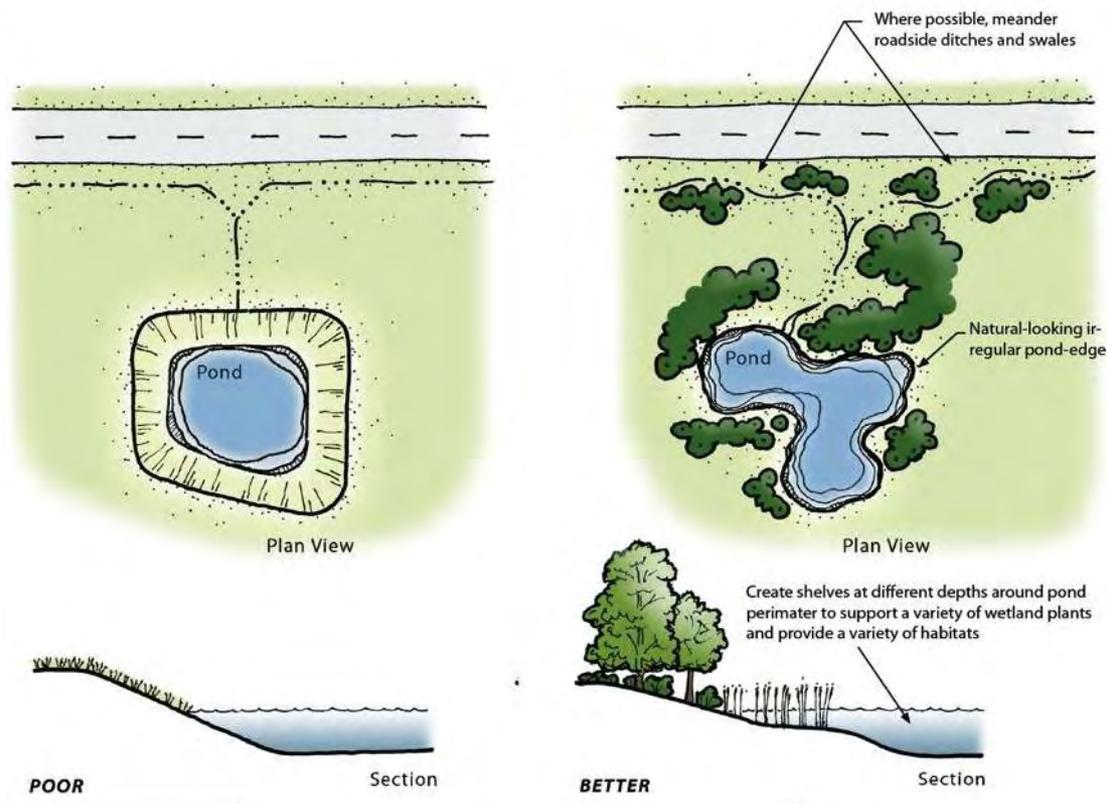
Bridges should not be an impediment to stream out-flow or tidal in-flow at stream mouths.



GD - 2 Create natural-looking stormwater treatment and storage facilities

Design stormwater detention/retention basins and swales to look like natural ponds, wetlands and drainage-ways, incorporating irregular shaped edges, gradually sloped banks, and slopes stabilized with native riparian plants. This will:

- Create basins and swales that look better and are more visually integrated with the larger landscape,
- Improve the quality of stormwater run-off through bio-remediation, and
- Provide potential wildlife habitat.



Topsoil Guidelines

Topsoil is a living, breathing organism, not unlike the plants growing in and upon it. It contains an incredible variety of life forms as well as complex chemical and symbiotic processes that give it its unique qualities and attributes. With sunlight and water, topsoil is a critical component of the life support system for plants. Soil health and quality affect the health and vigor of plants which in turn prevent erosion and flooding, provide air and water quality improvement, wildlife habitat, food and other benefits. Clearly, topsoil's services and functions contribute to economic, social and ecological sustainability. Topsoil is thus an important and finite resource that deserves protection and preservation.

As an organism, topsoil can be easily damaged or destroyed by neglect and poor treatment. During construction of buildings, roads, utilities, etc. topsoil is vulnerable to compaction by heavy equipment, contamination by toxic substances, suffocation by over-topping, drowning by altered drainage patterns, or just outright removal and wasting. Once damaged, the ability of topsoil to support plants and provide good drainage is severely compromised, and its health and viability as a growing medium for plants may take decades to recover, if ever.

Highway projects often involve displacing or impacting tremendous amounts of topsoil. Topsoil work can become highly contentious during highway construction due to disputes over material quality and quantity, loss and contamination, and procedures for handling, salvaging, and protection. Difficulties with topsoil can become magnified into a broad range of serious problems including poor plant establishment and vigor, soil erosion, stream sedimentation, poor drainage, and the spread of noxious weeds.



Topsoil work during highway construction generally consists of the four S's – *stripping* (or salvaging), *stockpiling*, *supplying* (or sourcing), and *spreading*. These activities are not as simple and straightforward as they might appear. Plus, a fifth "S" needs to be added for *surveying* and testing of on-site topsoil. To provide direction and guidance on the complexities of topsoil work, HDOT's Standard Specifications and HDOT's Construction BMP Field Manual both contain good information on topsoil management and construction practices. Similar and additional information on topsoil work can be obtained in guides and manuals developed by state and federal agencies.

In-situ native topsoil that will be affected by highway construction should almost always be stripped and held for re-application over re-graded ground areas. If stripped soil is insufficient or unsuitable for re-spreading, then imported or sourced topsoil should be obtained per fairly rigorous standards. Every step in the five S process of moving and handling topsoil must be carefully done in prescribed ways that limit damage and loss to this important resource. The guidelines outlined below are intended to reinforce and supplement the data in HDOT's standard specs and field manual on topsoil work. These guidelines should be initiated during project design, incorporated into the project construction documents, and implemented during project construction.

For every project, a project-specific Topsoil Management Plan should be developed to include:

- Results of a topsoil survey and testing (Topsoils Reports)
- Plan(s) showing topsoil areas, types and depths to be stripped.
- Recommended techniques for stripping, stockpiling, and spreading topsoils.
- Locations and requirements for topsoil stockpiles.
- Identification of areas to be re-spread or dressed with topsoil.
- Estimated quantities of stripped soils and estimated quantities for re-spread soil.
- Criteria for topsoil amendments and conditioners, and for imported soils.
- Identification of areas to be protected from construction activity.
- Entity charged with overseeing the Management Plan.

SMALL CREATURES
Small animals stir up the soil and make holes where air and water can enter the soil. They chew up dead plants into tiny pieces so fungi and bacteria can break them down more easily. They also feed on bacteria, fungi, and protozoa, and help release the nutrients in them for plants to use.

PROTOZOA
Protozoa are tiny organisms that can only be seen with the aid of a microscope. When they feed on bacteria, fungi, and other protozoa, they release nutrients that plants can use.

BACTERIA
One teaspoon of topsoil may contain 50 million one-celled bacteria! They help to break down dead plants and animal matter. In doing so, they release the nutrients for use by other microbes, small animals, and plants.

Soil Nitrogen
Nitrogen-fixing bacteria can take nitrogen gas from the air and convert it into a form that plants can use. Some of these bacteria live in nodules on the roots of beans, peas, and other plants called "legumes."

Topsoil contains an amazing number of life forms



Barriers & Guardrails

BG -1 Limit the Use of Standard Galvanized W-Beam Guardrail

Galvanized steel w-beam is a common guardrail along highways because it is relatively inexpensive to install and repair and it provides good protection while meeting crash test standards. From an appearance standpoint however, galvanized w-beam is considered unattractive and even a visual blight in certain situations. The following suggestions are offered regarding the use of galvanized w-beam guardrail:

- Whenever possible, limit the use of w-beam guardrail by reducing or eliminating roadside conditions that require guardrail protection.
- Specify a dull (vs. shiny) finish if standard galvanized w-beam guardrail must be used.
- Use galvanized w-beam to make in-kind repairs to long stretches of existing galvanized guardrail.
- If possible, use one of the alternative barriers or guardrail types discussed in this section.



Weathered steel W-Beam guardrail on Oahu

BG -2 Employ Galvanized W-Beam Guardrail with a Brown Finish if W-Beam is Required

Weathering (Cor-ten) steel w-beam has been installed extensively in national parks and along scenic roads because the brown finish fits better with its surroundings than ordinary galvanized w-beam. However, because recent studies show weathering steel may deteriorate faster than galvanized w-beam, the FHWA and some state DOT's have become cautious about using weathering steel guardrail. Fortunately, there are various finishes (such as Natina*) that can be applied to galvanized w-beam to achieve a brown finish without causing the steel to degrade. Steel w-beam with a brown finish is strongly recommended over plain galvanized w-beam in the following situations:

- In rural natural areas and agricultural settings (i.e. Coastal Farmland Corridors) where visual integration of the guardrail with the surrounding landscape is desired.
- Along segments of scenic highway where ordinary galvanized w-beam would diminish scenic quality.
- In lightly to moderately populated areas (i.e. Shoreline Residential Corridor) where a visually unobtrusive guardrail is preferred.

*Natina Steel Finish is manufactured by Natina Products, LLC; Coachella, CA



W-Beam guardrails with a brown finish fit better with the surroundings.

BG -3 Use Cable Barrier System as Alternative to W-Beam Guardrail

While w-beam guardrail offers effective and inexpensive protection, cable barrier systems are often less expensive and may look better. Where roadside conditions require guardrail, consider using cable barrier where deflection distances are adequate. Cable barrier offers the following advantages:

- Typically less expensive to install and easier to repair than steel w-beam
- Visually unobtrusive, especially when backdropped by vegetation
- Better visual integration in rural areas where post and wire fences surround fields and pasture



Cable barrier guardrails are less obtrusive visually than other barriers.

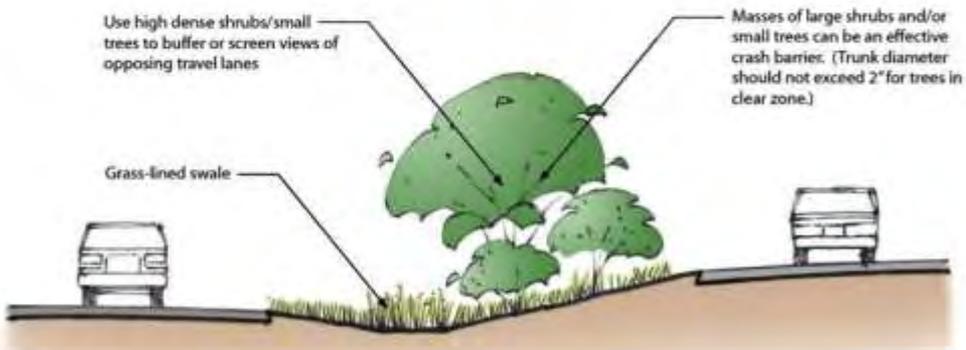
ME-4 Enhance highway operation and safety with median plants

The operational and safety value of medians can be enhanced by plants. The use of appropriately shaped and massed plants in the median can achieve the following benefits:

- Screen the visual distraction and headlight glare of on-coming traffic in opposing travel lanes
- Foster visual continuity and consistency along the highway, improving driver guidance and navigation
- Create a passive crash barrier between opposing travel lanes
- Provide traffic calming by visually narrowing the travelway and bringing elements (plants) close to the road by which drivers calibrate their speed.



A narrow line of small trees and shrubs can reduce the distraction of on-coming traffic



Median Plants Can Improve Driver Guidance

ME-5 Keep median elements consistent with roadside elements

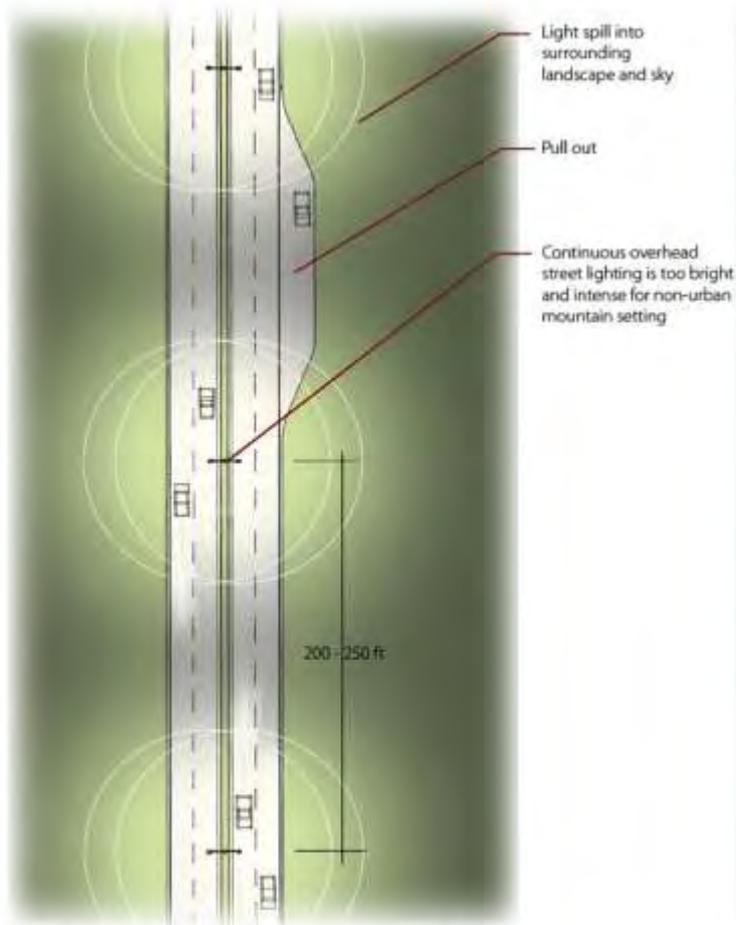
Medians contain barriers, retaining walls, lights, plants and other elements that may also occur in the roadides. Median and roadside elements should be designed or improved to be consistent across the roadway cross-section. This will:

- Create greater visual cohesion and consistency throughout the travelway
- Reduce costs for maintenance and repair by not having to stock, supply and fix two different systems for lights, guardrail, concrete barrier, etc.



A consistent use of concrete barriers in median and roadides on the Lunalilo Freeway

Lighting

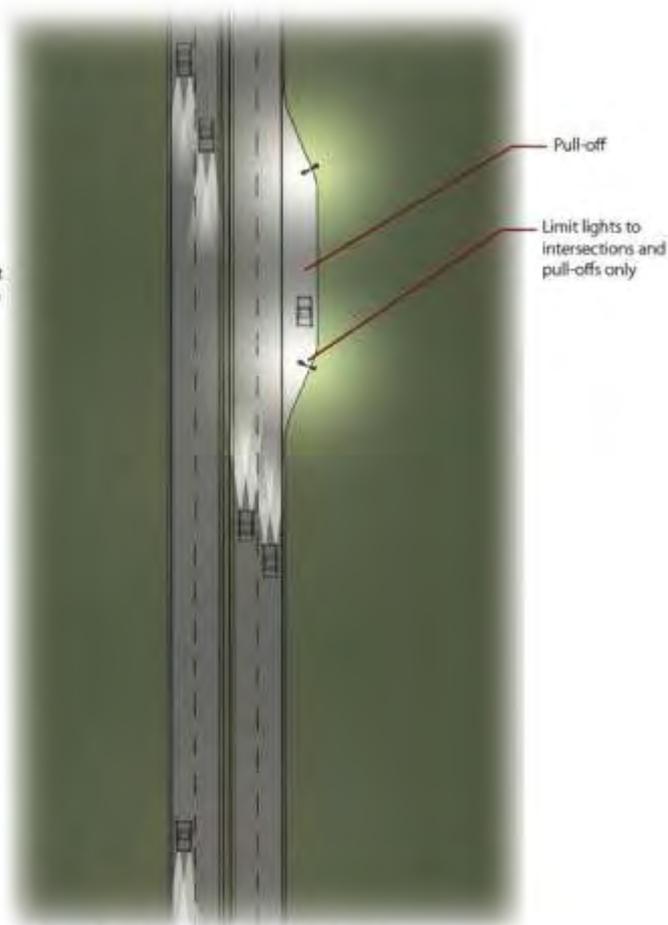


Poor: Existing Continuous Median Lighting on Pali Highway

Highway Lighting

Use limited lighting along the highway to preserve the wonderful dark sky quality of the mountain setting.

See Roadside Design Guidelines: **XX-2**, Utilities and Lighting



Preferred: Partial Lighting on Pali Highway

Benefits

- Significantly reduces energy consumption & maintenance
- Eliminates highway "glow" seen from distant areas
- Avoids light spill into adjacent natural areas and impacts on nocturnal wildlife

Roadside Pull-offs & Interpretive Elements

Roadside pull-offs are as ubiquitous along Hawaii's highways as the spectacular island scenery. Pull-offs are especially common along coast-line highways where access and parking for beaches, parks and scenic vistas seem to occur every half mile or so. Unfortunately, many pull-offs suffer from poor surfacing, inconsistent edge treatment, neglected landscaping, and inadequate visitor amenities.

As important as they are to both visitors and local residents, pull-offs need to compliment their setting and reflect a measure of environmental stewardship and care. Various facilities ranging from trash receptacles to interpretive exhibits should be considered at pull-offs. HDOT should coordinate with other agencies (particularly State Parks) to provide or improve pull-offs at recreation and scenic areas. The following guidelines provide direction for pull-off development and improvements.



Roadside pull-offs are frequently rutted and have inconsistent edge barriers.

RP-1

Improve or develop safe and attractive roadside pull-offs to access parks, trails, benches, and points of interest

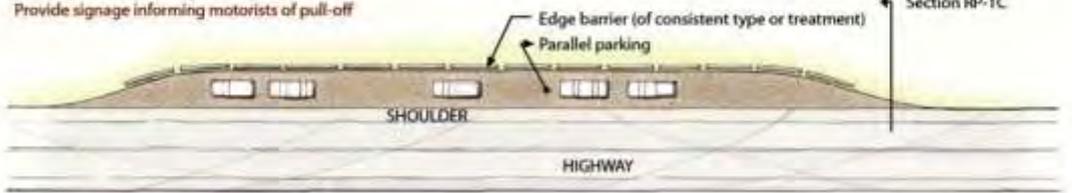
Because they will remain in the roadside cross-section in many places, pull-offs should adhere to the following basic guidelines:

- Provide a consistent edge barrier or treatment for the entire length of the pull-off
- Provide a stable, compacted and uniform parking surface, flush with the edge of the shoulder



RP - 1A: Roadside Pull-Off (Buffered)

- Provide enough distance or width for safely opening car doors and pedestrian movement (see RP-1C)
- Provide signage informing motorists of pull-off



RP - 1B: Roadside Pull-Off (Unbuffered)

Lessons Learned

- Mission: safety, capacity, accessibility
- Increasing regulations & compliance
- Goal – on time & under budget
- 250 engineers : 1 landscape architect
- Engineering firm prime consultant
- Patience is a virtue

Lessons Learned

- Silo style project management
- Setting precedence
- Federal match construction & State maintenance funds
- Increasingly reliant on consultants
- DOT champion
- Progress is hard to change

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 *Live Aloha*

We do not inherit the earth from our
ancestors; we borrow it from our children.
Chief Seattle

The End

