Hawai‘i Statewide Sustainable Landscape Masterplan

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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
My Islands, My Context

Cultural Landscapes - Paia, Maui
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.
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

The Quest for Context & Sustainability
Texas DOT

- 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

The Quest for Context & Sustainability
Nevada DOT

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

The Quest for Context & Sustainability
Masterplan & RDG Goals

- Roads that reflect local place and stories.
- Integrated sustainability and context.
- Prescriptive approach.
- Implementation by project managers.
- Consultants:
Statewide Sustainable Landscape Masterplan & Roadside Design Guide

Holistic and systematic approach for sustainability and context.
State of Hawaii Motto

Ua Mau Ke Ea O Ka Aina I Ka Pono
The Life of the Land is Perpetuated in Righteousness
Statewide Sustainable Landscape Masterplan

Landscape Context

Central/Leeward O‘ahu

Windward O‘ahu

South/Metro O‘ahu
Landscape Context

Statewide Sustainable Landscape Masterplan

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 offshore reefs. A fairly broad coastal plain over the moku's southern half gradually transitions to a narrower coastal plain over its northern half.

With increased western contact in the mid-1800s, the coastal plains were eventually parcelled 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 Kāneōhe and Kailua were purchased from the estate of Queen Kalamā (wife of Kamehameha III) by the Harris and Castle families who developed ranching interests. Later, rice paddies and sugarcane plantations were established. Fields of pineapple were also scattered over the coastal plain between He'eia (Ko'olaupoko) and Punahou (Ko'olauloa).

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'ila 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 Mākāpū and usurped lands for development of a Naval Air Station. Large sections of reef in Kāneōhe 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 Kāneōhe and Kailua now occupy large areas of the coastal plain, and two military bases (Bellows and Kaneohe) 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 natural 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.
Landscape Context

Koʻolauloa Landscape Character

Koʻolauloa Moku is relatively long and narrow, extending from Makaholu Point to Kahuku Point. Because this moku is on the windward side of Oʻahu, precipitation levels are moderate to high. The moku's coastline consists of a series of beautiful crescent-shaped beaches and shallow bays. The steep Koʻolaulo 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.

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 Lāʻie 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.

Koʻolauloa 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 protective of supporting agricultural land, parks, natural areas, water resources, and the eclectic, laid-back vernacular quality of neighborhoods and commercial areas.

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 (aliʻi), 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.

Major Attractions and Places of interest

Cultural Sites: Kaliu‘ua (Sacred) Falls, Lanakila Church, Polynesian Cultural Center, Hawaii Mormon Temple, Brigham Young University, Kahuku Sugar Mill, Kahikilani (Washington Statue), Puʻuomahana Heiau State Monument

State Parks and Preserves: Kahana Valley State Park, Sacred Falls State Park, Malaekahana Bay State Rec Area, Hāʻula Forest Reserve, Kaipapaū Forest Reserve, Pupukea-Pamala Forest Reserve, James Campbell/ Punamano National Wildlife Refuge, several island seabird sanctuaries

Public Beach Parks: Kaaawa, Swanzey, Punahou, Aukai, Hāʻula, Koko'olau, Lāʻie, Turtle Bay, Waialae, 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 aquaculture 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.
Highway Corridor Contexts

WINDWARD O’AHU

Ko’olauloa Corridors

LEGEND
Corridor Type
- Town Main Street
- Village Center
- Shoreline Residential
- Coastal Farmland
- Natural Shoreline Trail
- State Route
- County Route
- Streams

Corridor Types

Photo of Coastal Farmland Corridor

Photo of Shoreline Residential Corridor

Photo of Natural Shoreline Corridor
Highway Corridor Contexts

Statewide Sustainable Landscape Masterplan
Defining Corridor Characteristics

Shoreline Residential

View of Iconic Corridor Segment
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.
Defining Corridor Characteristics

Statewide Sustainable Landscape Masterplan

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 (optional), 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.

Cross-Section of Iconic Corridor Segment

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

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

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

Utility Poles and Lines
On one or both sides of the highway, overhead utilities detract from the corridor’s scenic quality.
Corridor Design Considerations & Recommendations

Iconic Elements to be Preserved

- Replace trees and shrubs if existing are removed for highway improvements; use native plants for replacements.
- Existing trees & shrubs to remain; remove invasive plants within R.O.W. and replace one-to-one with native plants.
- Existing plant screen to remain and be maintained by property owner; replace in kind if impacted by highway improvements.
- Install Aki aki grass in roadsides; amend soil and mulch as specified.

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.

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

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

- 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.

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.

Milo (Thespesia populnea) makes an excellent plant screen with its green foliage, acclimation to the coast and attractive flowers.
Corridor Design Considerations & Recommendations

Statewide Sustainable Landscape Masterplan

Elements to be Improved

- Replace residential wall in-kind, if removed for highway improvements.
- If roadside is used for parking, install turf grass as specified.
- Structural soil mix as specified.

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: Pandanus tectorius
- Hau: Rauvolfia sandwicensis
- Kahanu: Calophyllum inophyllum
- Māhoe: Thespesia populnea
- Nīnī: Cocos nucifera

Roadside Shrubs
- Naupaka: Hardenbergia speciosa
- Kalo: Colocasia esculenta
- ‘Alaka‘i: Chamaesyce celsitoides
- ‘Ilia‘ī: Sida fallax
- Makaloa: Cyperus laevigatus

Walls and Barriers
- Walls: mortared lava rock, preferred
- Barriers: stone-clad concrete

Guardrail
- W-beam guardrail with brown finish (such as Nātina)
Corridor Defining Characteristics

Coastal Farmland

Certain coastal areas possess a strong agricultural heritage, having transitioned from ancient Hawaiian taro fields (lo‘i 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.
Corridor Defining Characteristics

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.

Cross-Section of Iconic Corridor Segment
A – F: Landscape elements that contribute to or detract from iconic character
Corridor Design Considerations & Recommendations

Iconic Elements to be Preserved

- Preserve (or replant if removed) farm hedgerows. Plant trees 20 to 30 feet apart, shrubs 5 to 15 feet apart.
- Use low native shrubs to transition between grass swale and taller hedgerow.
- Grass roadside — preserved or re-seeded with Aki aki grass (see HDOOT Stormwater Permanent BMP Manual pg. 7-73).
- Maintain a consistent shoulder width for bicycle use.

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

Elements to be Improved

- Provide enough distance between shoulder & armoring for intermittent trees & shrubs
- Provide soil pockets between boulders for shrubs & grasses

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
Corridor Design Considerations & Recommendations

Elements to be Improved

Stormwater Management

Roadside Produce Stands Access

Roadside Design Guidelines: XX-2, Stormwater

Planting Strip Details

Native drought-resistant shrubs: Akia (Wrightiania leve-squamosa), 'Akoko (Chamaesyce celtoides)

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

Materials and Finishes Palette

Hedge Trees:
- Pennsia americana
- Hau (Hoya sandwicensis)
- Kukui (Alenaea moluccana)
- Ohia (Metrosideros polymorpha)
- Ulua (Arctopus altius)

Native Roadside Shrubs:
- Kalo (Colocasia esculenta)
- Kaniha (Hibiscus waimoe)
- Ko (Saccharum officinarum)
- Akia (Wrightiania leve-squamosa)
- Akoko (Chamaesyce celtoides)
- Tulea (Slade-follis)
- Makalua (Cyperus laxigatus)

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 Natina)
Places to tell local stories

WINDWARD O‘AHU

Ko‘olau’ula District

LEGEND
- State Route
- County Route
- Hiking Trails
- Landmark or Cultural Site

Story Places

Storied Places in Ko‘olau’ula

1. Ka‘i‘ae o ka‘o‘i‘o
The famed point where the two Ko‘olau districts meet is called Ka‘i‘ae o ka‘o‘i‘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 Ko‘olau 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‘aka along the O‘ahu coast. The ancient name of this stone formation is Kauhikoa‘ao‘o‘alo‘i (Kaohi‘i, 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 Namaka‘alo‘a‘nani. After a long wait he began to rise up in an effort to accompany Hi‘aka on her journey. Hi‘aka called out to him in chant, causing him to turn to stone.
Places to tell local stories

**Story Places**

**Crouching Places (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.

**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 Poi, 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.

**Kaluanui**

The demigod, Kamapua‘a, is said 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’s 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).

**WINDWARD O‘AHU**

**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 Hawaiians that is similar to watersheds (see HDOT Ahu Program).
- **Moku boundaries:** Where culturally significant divides occur (i.e. at Ka lea o ka ‘o‘o), mark them with a stone wall perpendicular to the road.

**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 the language of one of the many people groups) and the English word for the place.

**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.

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.

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.
Plants along base of wall improve appearance and deter graffiti.

Columnar Trees or large shrubs (See list ___)
Planter width: 5' min for trees, 2' for shrubs and/or climbing plants
Concrete Barrier Wall

Plant vines and climbers that cascade over top and/or ascend from base of wall
Retaining Wall

Soil Mix 18" - 24" deep
Drain rock w/ perf. pipe

Travel Lane Shoulder

Title of Illustration To Come Here
Major Structures

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

Side-by-side structures create a wide light/rain shadow beneath structures.

UNSEPARATED STRUCTURES

A moderate gap between structures can reduce the light/rain shadow by up to 40%

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.

Natural Stream Channel Section at Highway Bridge

- Meandering alignment and variable width
- Sandy/gravelly bottom
- Edged by boulders &/or plants

Deep-rooted shrubs & trees on upper banks

Large boulders (if necessary) inter-planted with riparian trees & shrubs to stabilize lower banks and terraces.
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, HDOTr’s Standard Specifications and HDOTr’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 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 HDOTr’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)
- Plans showing topsoil areas, types and depths to be stripped.
- Recommended techniques for stripping, stockpiling, and spreading topsoil.
- 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.

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.

**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

**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
**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.

![Image of a narrow line of small trees and shrubs reducing the distraction of on-coming traffic.](image)

**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.

![Image of a consistent use of concrete barriers in median and roadides on the Lunalilo Freeway.](image)
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.

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

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

**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)**

- Edge barrier (of consistent type or treatment) See RP-3.
- Parallel parking slots.
- Drive aisle.
- Planter strip as buffer.

Roadside pull-offs are frequently rutted and have inconsistent edge barriers.
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
We do not inherit the earth from our ancestors; we borrow it from our children.

*Chief Seattle*