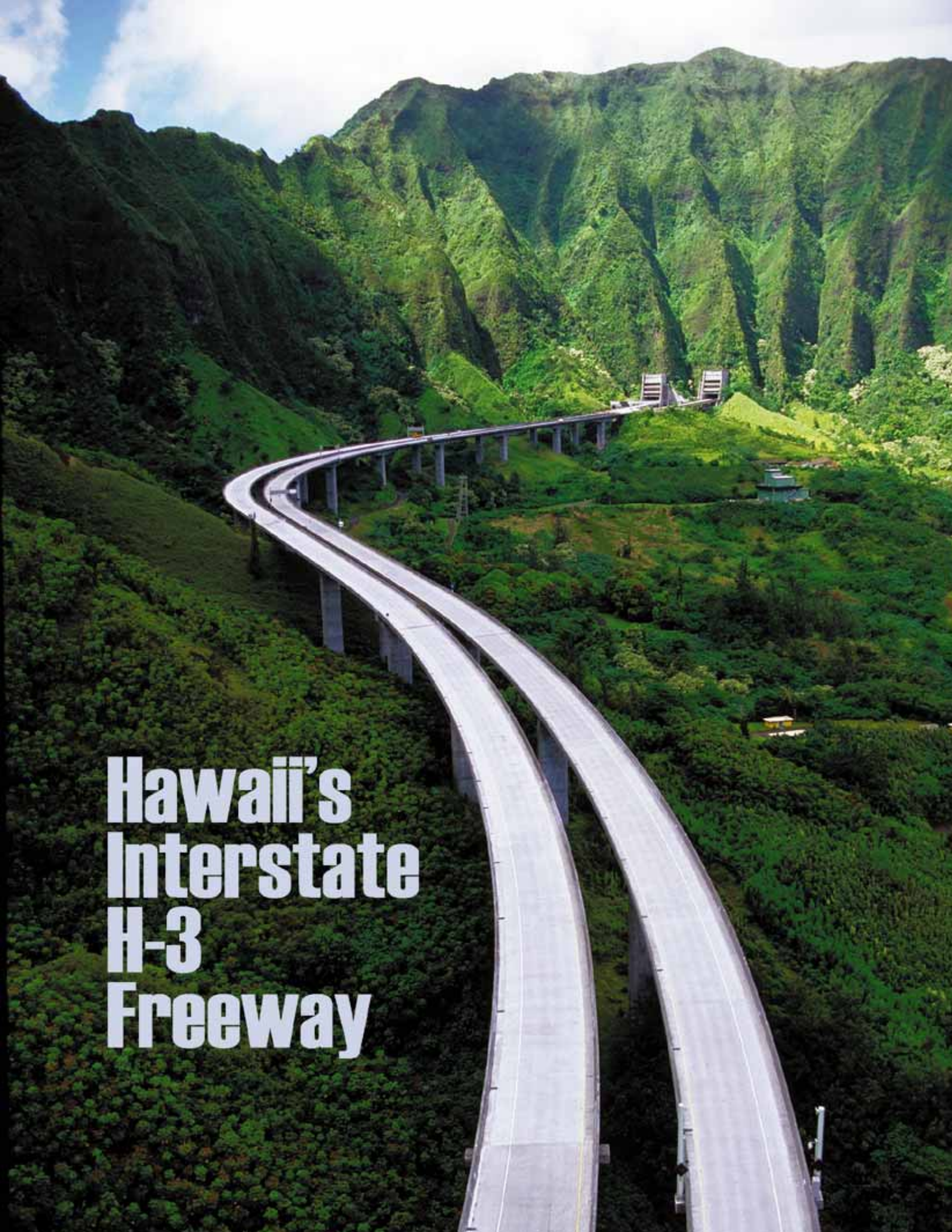


Hawaii's Interstate H-3 Freeway

Message from Governor Benjamin J. Cayetano

I am pleased to extend my congratulations to our state Department of Transportation and our construction industry on the completion of the Interstate H-3 Freeway.

Hawaii became part of the Eisenhower Interstate and Defense Highway System in 1960. Construction of 51.2 miles of freeways for the H-1, H-2 and the H-3 has been underway ever since. Their construction has been the biggest public works project in Hawaii's history. Motorists will have a direct connection from the Windward side of Oahu to Halawa, Pearl Harbor, Aloha Stadium, Honolulu International Airport, and Leeward and Central Oahu.

The H-3 is one of the most complex projects ever built in Hawaii. It was the first state project to require a Federal Environmental Impact Statement. Using detailed environmental studies, extensive mitigation measures, and the latest construction materials and technology, the H-3 was planned and engineered to preserve and protect the environment through which it passes.

We salute those who looked into the future, perceived our state's transportation needs, and labored to make them a reality. May the citizens of Hawaii and our many visitors enjoy the convenience and safety of our newest interstate highway–H-3.

Aloha,

Benjamin Cayetano

Message from the Director

I would like to extend my greatest appreciation to the hundreds of Department of Transportation employees in the Highways Division who have worked on the H-3 during the past 30 years. This has been one of the toughest jobs the Department has ever undertaken, and we've all learned a lot from our experience.

There were a lot of lessons learned on H-3, and those lessons were not lost. We will involve the community more in all phases of our projects, pay more attention to aesthetics, be more sensitive to environmental and cultural issues and try to balance these needs with our need to insure the best transportation system we can for the people of our state.

I also want to thank the seven Directors of Transportation who worked on this project before me. Without their strong leadership, much through unchartered territory, we would not be driving on H-3 today.

Many people believe that when we put a construction job out to bid, that's it. The contractor builds the road. On H-3 it took more than a day's work to get the job done. It took a true partnership between our engineers, inspectors and staff, our consultants and the many general contractors, hundreds of subs, and thousands of construction workers who built the H-3. They worked with us through rain and changing conditions, and we salute them for their courage and fortitude.

My thanks to all who helped in the construction of H-3.

Good Driving.

Kazu Hayashida
Director of Transportation

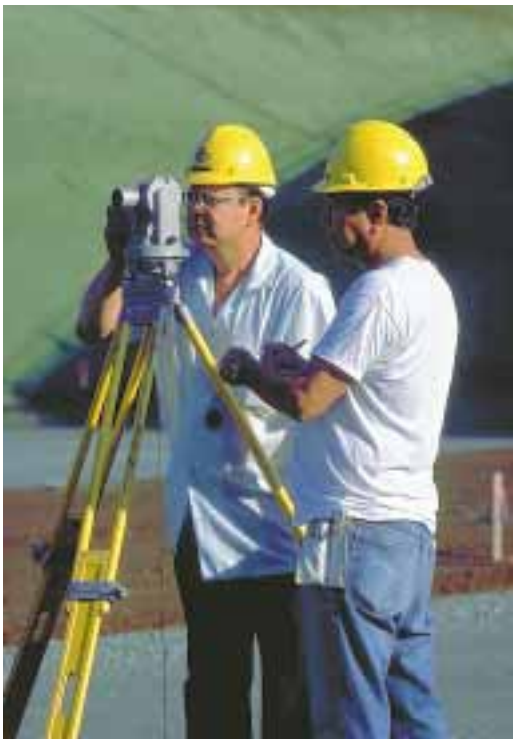
H-3 Began With Statehood in 1960

H-3 will provide a new Trans-Koolau route and relieve traffic congestion on Pali and Likelike Highways.

The H-3 Freeway, the largest public works project in the history of Hawaii, has also been the most controversial, the most studied and the most expensive highway in the state's history.

H-3 was authorized as part of the Statehood Act of 1960, one of three Interstate and Defense Highways in Hawaii to be funded by the U.S. Department of Transportation's Federal Highway Administration.

Surveyors set alignment for H-3.



Although the Interstate generally connects states, Hawaii was able to receive Interstate funds because of its designation as a defense highway. H-1 connects the Hawaii National Guard at Diamond Head to Barbers Point Naval Air Station, with off ramps to Pearl Harbor and Hickam Air Force Bases. H-2 connects the Hickam/Pearl Harbor area with Schofield Barracks. H-3 provides the final link between Pearl Harbor/Hickam and Marine Base Hawaii at Kaneohe.

During the 37 years since the project began, H-3 has survived corridor changes; legal challenges; lengthy delays due to court injunctions; construction challenges including a mile-long tunnel through volcanic mountains; proximity to the Coast Guard's Omega Station; and lots of rain.

H-3 was the first project in Hawaii to require an Environmental Impact Statement following the passage of the National Environmental Policy Act by Congress. The environmental studies conducted for H-3 spanned 20 years, and reach a height of four feet if stacked one on top of the other.

The freeway was rerouted several times, the first from Moanalua Valley to Halawa Valley. On the Windward side, H-3 was rerouted four times. The first to accomodate a flood control project, twice for the expansion of Ho'omaluhia Park and finally, the Kaneohe Interchange was moved to encircle historic agricultural

H-3 Chronology

1960 Interstate-Defense Highway System for Oahu was approved in principle as part of the Statehood Act, consisting of the H-1, H-2 and H-3 Freeways.

1963-1967 The need for a third trans-Koolau corridor was recognized during the Oahu Transportation Study which was a cooperative system planning effort of federal, state and local agencies. The Federal Interstate Highway Network, H-1, H-2 and H-3, was included in this plan. As a result of corridor studies and public hearings, it was agreed that the H-3 corridor would go through Moanalua Valley.

1970 Design public hearings on the H-3 were held.
The National Environmental Policy Act established the requirement for an Environmental Impact Statement (EIS) for projects of this type.

1972 As a result of a suit, the Federal District Court imposed an injunction stopping design and construction of the H-3 section between Halekou Interchange and Halawa Interchange. Work was permitted to continue on the Halawa Interchange and the section between Kaneohe Marine Corps Air Station and Pali Golf Course.

terraces. In Halawa Valley, the route was altered twice to avoid sites considered culturally significant by some Hawaiians.

H-3 was originally envisioned as a six-lane highway through Moanalua Valley at a cost of $250 million. Thirty-seven years later, the highway is through Halawa Valley at a cost of $1.3 billion.

However, throughout the long history of the project, as can be seen in the chronology, there were a dedicated group of DOT engineers and administrators, consultants, contractors, labor leaders and community leaders, who have provided the leadership and expertise to bring the project to reality.

Top left: Community leaders rallied behind H-3 and petitioned Congress to complete construction.

Left: Groundbreaking was held on November 2, 1987 for the first construction package, the North Halawa Valley Access Road.

Relief Map by Manoa Mapworks, Inc.

1973 Moanalua Gardens Foundation submitted an application to the U.S. Department of the Interior and the Hawaii State Historic Preservation Officer to have Moanalua Valley declared a National Historic Landmark. The Advisory Board to the U.S. Secretary of the Interior recommended the preservation of Moanalua Valley and its historic, cultural and natural values.

The City Planning Commission held public hearings on placing a third trans–Koolau corridor on the Oahu General Plan.

1974 The Council placed H-3 on the Oahu General Plan.

The U.S. Secretary of Transportation approved the State's EIS.

The Advisory Council on Historic Preservation unanimously recommended that H-3 not be routed through Moanalua Valley.

The Federal District Court lifted the injunction and design work commenced. It ruled that the EIS was adequate since the required reports and evaluations had been made. The ruling did not cover the substantive merit of the EIS.

1975 Court challenges continued, and the State awarded a construction contract for the Red Hill Tunnel.

Archaeologists surveyed North Halawa Valley.

H-3 Turned Dreams Into Reality

The H-3 Freeway has one of the most spectacular mountainous drives in the nation as it connects Leeward and Windward Oahu through a mile-long Trans-Koolau Tunnel.

The new Interstate freeway begins in North Halawa Valley, climbs to the portal of the Trans-Koolau Tunnel, tunnels through ancient lava rock, emerges into the scenic Haiku Valley, soars on a graceful viaduct, hugs Ho'omaluhia Park, and ends 16.1 miles later at the entrance to Marine Base Hawaii at Kaneohe.

Drilled shafts for cast in place concrete piers were used instead of pile driving for piers.

The H-3 was built in 27 separate construction packages by seven different contractors and four joint ventures at a cost of $1.3 billion. It has two sets of tunnels, two long viaducts and 26 bridges.

The roadway width of H-3 is 38 feet in each direction which consists of two 12-foot lanes, a 10-foot right shoulder, and a four-foot left shoulder.

Due to its sensitive location, a number of innovative construction techniques were used to construct H-3.

Instead of pile driving for piers, the DOT chose drilled shafts and cast in place concrete piers. This method reduced noise during construction, was suitable in a wide range of soil conditions, and was capable of carrying very large loads. The extensive use of drilled shafts for H-3 bridge foundations has advanced the knowledge and experience of engineers and contractors and has made the use of shafts a common practice in the islands.

H-3 was the focus of one of the most extensive environmental controversies in the history of the Interstate Highway program. As a consequence, engineers conducted unusually detailed studies of air and water quality, ecological pacts and historical and archaeological preservation.

They worked closely with federal agency staff that developed some of the regulations affecting H-3 and with numerous specialists in a variety of fields including archaeology, botany, ornithology, malacology, meteorology, history, folklore, native Hawaiian culture, air/noise, bioelectromagnetics, water resources and hydrology. These studies have added an enormous amount of information about Hawaiian history that would otherwise not have been available.

The concrete segmental viaducts on either side of the H-3 tunnel have long spans to reduce the number of piers, minimizing disruption of the land below. A color additive was used in the concrete mix to make the tunnel portals blend in with the mountainsides.

Geotextiles were used extensively during clearing operations to prevent erosion.

1976 The 9th Circuit Court reversed the District Court's decision and reinstated the injunction on construction. The Court ruled that the Secretary of Transportation should have required a 4(f) statement for the project. The purpose of a 4(f) statement is to determine whether any "prudent or feasible" alternatives to a project exist if the proposed project will use recreation land or historic sites. The 9th Circuit Court denied the State's petition for a rehearing.

The State DOT prepared a preliminary 4(f) statement for comment by appropriate Federal agencies.

1977 In view of the ruling of the 9th Circuit Court of Appeals protecting Moanalua Valley as an historical landmark, the U.S. Secretary of Transportation ruled out Moanalua Valley for the H-3 Freeway and suggested consideration of alternative routes through Halawa Valley or Nuuanu Valley.

The State held a series of forums to obtain public response to nine alternative routes for H-3, including a "no build" alternative. Following the meetings, the State announced selection of the North Halawa Valley alignment for H-3.

The Draft Supplement to the approved H-3 Final EIS was circulated and the State DOT held public hearings on the draft supplemental EIS.

To maintain stream water quality, silt fences were installed along the stream alignment during construction to filter transported sediment.

Silt fences

Using a light-weight fill of expanded polystyrene blocks, which are 80 times lighter than soil, for constructing a 70 foot high embankment for the runaway truck ramp on soft ground, avoided construction delays, reduced ground settlement and increased the stability of the embankment.

Erosion control matting and hydro mulching were used extensively to prevent erosion and to encourage quick regrowth of native vegetation.

One of the most cost effective efforts was the construction of a mile-long Exploratory Tunnel through the Koolau range. This 13-foot diameter tunnel was located beneath and between the main tunnels.

Construction of the Exploratory Tunnel allowed engineers to determine the least expensive tunneling methods, water table and other data necessary to design the final tunnels. This data saved millions of dollars in construction costs by eliminating the need to budget for geological uncertainties. The exploratory tunnel also allowed the testing of various types of rock and ground support, including shotcrete and specially designed rock bolts. It now provides easy and safe access between the Windward and Leeward portals and to the main tunnels for maintenance.

Another challenge for engineers, was building the Windward Viaduct through an electromagnetic field. Because of the electromagnetic output of the Coast Guard's Haiku Omega station, special work procedures were implemented to protect construction workers against possible electrical shock.

The Haiku portion of the H-3 near the tunnel entrance is located below the Coast Guard's Omega Station antenna. Since the Omega station was decommissioned on September 30, 1997, the State didn't have to build the proposed Faraday Shield to protect users from the low frequency radio signals used in navigation. The antenna was removed prior to the opening of the H-3.

Top right: Geotextiles helped stabilize soil.

Right: The Exploratory Tunnel saved the State millions by eliminating geological uncertainties.

1978 The Stop H-3 Association was granted a motion by the Federal District Court to amend its 1972 lawsuit.

1980 The supplemental EIS for the North Halawa Valley route was approved by State and Federal officials.

1981 On February 5, 1981, the Federal Highway Administration granted location and design approval for the H-3 route from Halawa to Halekou through North Halawa Valley.

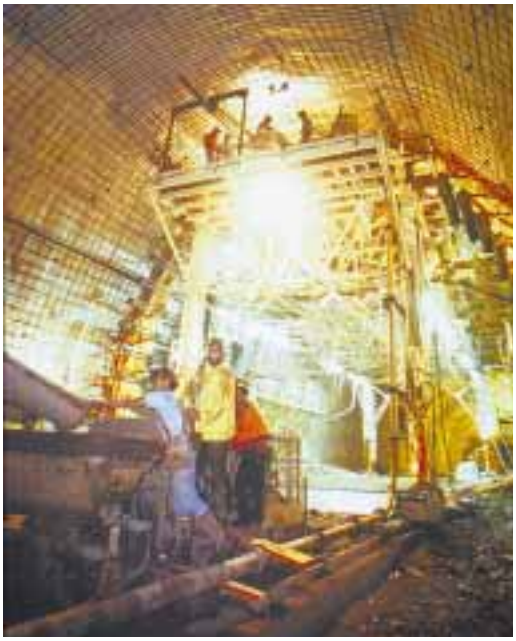
The Federal District Court ruled in March that the court order stopping construction and design work for H-3 through Moanalua Valley, also covered the North Halawa Valley alignment. Trial began in October in Federal District Court on the merits.

1982 In April, the Federal District Court issued its Findings of Fact and Conclusions of Law, dissolving all injunctions on H-3 and requiring recirculation of certain studies involving the preparation of the second Supplemental EIS. Public hearings on the Second Supplemental EIS were held in July. The FHWA approved the Second Supplemental EIS on September 28.

The DOT went to bid for construction of Halekou Interchange.

1983 Construction of Halekou Interchange began in February.

Constructing H-3's Trans-Koolau Tunnels



Top: Haiku Portal.

Above: Constructing the tunnel lining.

The H-3's Trans-Koolau Tunnels are the longest tunnels in Hawaii. The Halawa bound tunnel is 5,165 feet long and the Kaneohe bound tunnel is 4,890 feet. The tunnels were constructed in six separate construction packages totaling more than $300 million.

Excavation

The H-3 Trans-Koolau Tunnels were driven through both sides of the Koolaus through soil and volcanic rock using the latest tunneling techniques. Holes were drilled in the rock and explosives were set in place and later blasted. The tunnels were blasted approximately 10 feet at a time from each side. When the two bores met, the laser survey techniques were so accurate that the two bores were only a fraction of an inch off in dimensions.

Lining

When the excavation was complete, the tunnel was lined with a temporary layer of welded wire fabric and sprayed on cement mortar. A plastic waterproof membrane was also placed at certain locations. Using tunnel lining forms, concrete was pumped into the forms in 50-foot sections to create the walls and ceiling of the tunnel. The concrete lining is a minimum of 14 inches thick throughout the tunnel. A false ceiling was poured to create air plenums above it for the tunnel ventilation.

The tunnel walls are finished with 3.3 million specially made ceramic tiles in three different shades of blue. The darker tiles at the bottom will mask road grime between cleaning cycles and the lighter tiles at the top will aid in light reflectance.

Manufactured in Germany, the tile is non-porous and won't absorb dirt and water. As a result, they will be easier to clean. The tiles were all set in place by hand. The tiles have a pattern that repeats every 12 tiles. A special tunnel cleaning machine will clean the tunnel ceiling and walls using water and brushes. It will be possible to wash both tunnels in less than two weeks.

Portal Buildings

The multi-story portal buildings located at Haiku and Halawa house the ventilation, mechanical, electrical and control systems. Each portal building houses 4 supply and 4 exhaust fans. Each fan is seven feet in diameter. Each fan is approximately 200 horsepower and capable of moving 210,000 cubic feet of air per minute when operated at high speed.

Ventilation

Supply air is delivered through a plenum above the tunnel ceiling and forced down to

Tunnelers set dynamite for Exploratory Tunnel.

1984 The U.S. Ninth Circuit Court of Appeals issued a decision reinstating the injunction on H-3 on the issue of 4(f). The U.S. District Court issued an injunction on October 10. The Court denied the State's motion of modification of the injunction in December.

1985 In May, the U.S. Supreme Court denied the State's writ of certiorari.

The Subcommittee on Transportation of the U.S. Committee on Environment & Public Works of the U.S. Senate conducted a hearing on November 6 on H-3 to consider the 4(f) exemption.

1986 On September 23, the U.S. Senate voted in favor of the 4(f) exemption for the H-3 project. On October 15, 1986, the conference report on the 4(f) exemption for the H-3 project was published in the Federal Register. The President signed PL 99-591 into law granting the 4(f) exemption for the H-3 project in October.

1987 On January 22, the Draft Third Supplemental EIS was issued for public review and comment. Informational meetings and public hearings followed.

On May 11, The Federal District Court dismissed Stop H-3 and Office of Hawaiian Affairs lawsuits and lifted all injunctions effective June 15.

Construction of Halekou Interchange recommenced.

just above roadway level through precast wall panels. The air is discharged into the tunnels through air ports spaced every five feet along the right shoulder of each tunnel. Fresh air is swept across the roadway then pulled up into the exhaust ports located in the ceiling above the left traffic lane. The carbon monoxide levels will be monitored at 1,000 foot intervals and continually analyzed by sophisticated computers.

The tunnels are named the Tetsuo Harano Tunnels in recognition of the former DOT's Highways Chief's 52 years of dedicated public service.

Tunnel Stats	H-3	Pali	Likelike
Halawa Bound	5,165	1,500	2,775 ft
Kaneohe Bound	4,890	1,577	2,813 ft
Roadway Width	38	24	24 ft
Max Inside Dimension	45	29	29 ft

Tunnel Height
Vertical Clearance—16 ft 6 inches
Center—19 ft

Tunnel Elevation
Haiku Portal—845 ft
Crown—1,044 ft
Halawa Portal—1,037 ft

Tunnel excavation.
Far left: North Halawa Valley viaduct groundbreaking.

1987 In August, a Memorandum of Agreement on archaeological resources on the H-3 project was executed by FHWA, the State Historic Preservation Office and Advisory Council on Historic Preservation, with OHA and DOT as concurring parties.

On August 6, the Ninth Circuit Court of Appeals denied a motion for a preliminary injunction against the project.

On October 8, the FHWA approved the Third Supplemental EIS.

Construction of North Halawa Valley Access Road commenced in November.

1988 Tunneling for the Exploratory Tunnel began.

1989-1997 Construction of the H-3 continued through 27 separate construction packages by seven different contractors and four joint ventures.

1997 H-3 Freeway opened on December 12.

It poured during groundbreaking for the Halawa Tunnel.

Traffic Operations Center Makes Driving Safer

The Traffic Operations Center is located between the Halawa portals of the H-3 tunnels. The TOC will control all tunnel operations and an array of computerized traffic management systems.

Traffic Operations Center

The traffic control system will monitor traffic conditions, electronically detect stalled vehicles and provide information to motorists through changeable and variable message signs, radio broadcasts, lane control displays and emergency exit signs.

The TOC will operate 24 hours a day, 365 days a year. It is staffed by highly trained tunnel operators and maintenance personnel.

Systems installed in the tunnels will monitor for incidents such as vehicular fires, crashes and disabled vehicles. The primary monitoring is through the use of standard traffic loops spaced about 500 feet apart.

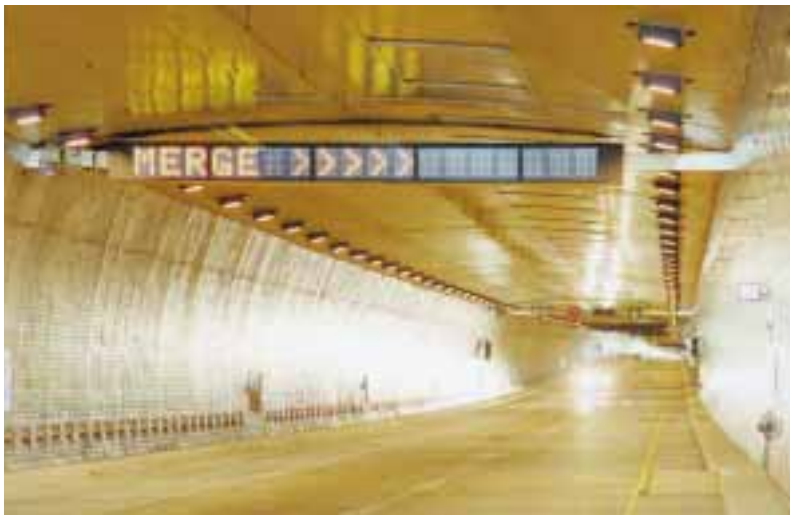
Each vehicle is sensed, its size and speed are calculated, and its time to the next set of loops is projected. As long as the vehicle reaches the next set of loops within an allowable margin of the projected time, nothing happens. If the vehicle changes speed, stops or changes lanes, an alarm will be sent to the traffic control operator. The operator verifies the occurrence through closed circuit television system, then responds accordingly.

Emergency communications

Changeable and variable message signs, lane use signals and traffic signals are all available to the operator. In addition to signage, the operator also has the ability to override all AM, FM and two-way radio frequencies, and send voice messages to any vehicle with an operative radio.

All primary equipment communication is conducted through fiber optic cable to maximize the speed of communication while minimizing the cost of conduit and cable. Nearly 25 miles of 48 fiber cable and almost five miles of multi-mode fiber have been installed.

The tunnel has complex electrical systems including separate power feeds from both Haiku and Halawa, and back up systems.



State of the art tunnel features include transitional tunnel lighting, exhaust fans, emergency call boxes, cross passages, rebroadcast antennas, linear heat detectors, highway message signs, lane control devices, fresh air vents, runoff drains, fire boxes, magnetic loop detectors, CO detectors, smoke detectors, traffic signals, video cameras, sidewalks, and weather stations.

Photo by Irwin Malzman

Windward Viaduct Facts

The Windward Viaduct is the section of H-3 which starts at the Haiku Portal of the Trans-Koolau Tunnel and continues for more than one mile to the smaller Hospital Rock Tunnel.

- ❏ The viaduct consists of two bridges, each approximately 6,600 feet long.
- ❏ There are 24 spans for each bridge.
- ❏ The maximum span is 300 feet (about the length of a football field).
- ❏ The foundations use 5-foot diameter shafts drilled into the ground to depths in excess of 100-feet.
- ❏ The pier typically is supported by six shafts.
- ❏ The columns vary in height from 12 to 160-feet above ground.
- ❏ The individual segments were built at Kapaa Quarry precast yard, about five miles away.
- ❏ The segments were delivered to site with low level trailers.
- ❏ There are 1,338 individual segments.
- ❏ The segments are connected to each other by steel cables.
- ❏ Trusses 384 feet long were used to construct both viaduct structures at the same time.
- ❏ The segments were lifted and moved into place by large gantry cranes that straddled each viaduct.
- ❏ A maximum of 16 segments were placed in one day.
- ❏ The individual segments vary in length from 8 to 10 feet.
- ❏ The Viaduct cost approximately $140 million.
- ❏ The concrete in the Viaduct was colored so that it would blend into the Koolau mountains.
- ❏ The Viaduct took three years to build.

Partners in H-3 Construction

Federal Highway Administration

State of Hawaii Department of Transportation

Primary Design Consultant

Parsons Brinckerhoff Hirota Associates

Design Consultants

Akinaka & Associates, Ltd.
Albert Chong & Associates, Inc.
Alan Murakami Architects
Alvin Zane & Associates, Inc.
Austin, Tsutsumi & Associates, Inc.
Calvin Kim & Associates, Inc.
Dames & Moore
Douglas V. MacMahon, Ltd.
DRC Consultants, Inc.
Dr. Arthur Guy
Engineers Surveyors Hawaii, Inc.
Ernest K. Hirata & Associates, Inc.
Fewell Geotechnical Engineering, Ltd.
Geolabs Hawaii
Harry T. Miyachi, A.I.A.
Hawaii Design Associates
Hawaii Geotechnical Group, Inc.
Harold T. Miyamoto & Associates, Inc.
Ho & Akita, Inc.
Kershner, Wright & Hagaman
KSF Inc
Mechanical Engineers of Hawaii Corporation
Melvin Lau & Associates
Miyabara Associates
MK Engineers, Ltd.
Nakamura & Tyau, Inc.
Nakamura, Oyama & Associates, Inc.
Nishimura, Katayama, Oki & Santo, Ltd.
ParEn, Inc.
PBR Hawaii
PSC Associates, Inc.
Richard M. Sato & Associates
R. M. Towill Corporation
Ronald N. S. Ho & Associates, Inc.
SSFM Engineers, Inc.
Syntech, Ltd.
Thomas Lum & Associates
T. Y. Lin International
Walters, Kimura, Motoda, Inc.
Wilson Okamoto & Associates, Inc.

General Contractors

Coluccio Construction Company
H3 Tunnelers Joint Venture
Hawaiian Dredging Construction Company
JWP Controls
Kiewit Pacific Company
Morrison Knudsen
Oahu Construction Co. Ltd
SCI Construction
Trans-Koolau Joint Venture
Transdyn Controls, Inc.

Subcontractors

Aloha Steel Corp.
American Electric
Apply-A-Line
Associated Steel Workers
AVAR
Big Island Topsoil
B&C Trucking
Board of Water Supply
City & County-Department of Wastewater
Commercial Electric
Concrete Coring Company of Hawaii
Close Electric
DY Mikami
Foundation International
Geolabs Hawaii
Grace Pacific
Green Thumb
Gunite Hawaii
Hawaiian Bitumulls
Hawaiian Electric Co.
Hawaiian Telephone Co.
Henry's Equipment
Honolulu Painting Co.
Hygrade Electric Company Ltd.
Industrial Mechanical
Jensen Drilling
L&F Masons
Maintenance Concrete Services
Malcolm Drilling
Marmolejo
Masons of Hawaii
Oceanic Cable
Pacific Fence Co.
Pacific Preferred Contracting
Pineridge
R & C Concrete Specialist
RHS Lee Inc.
RPM Steel
South Pacific Steel Corp.
Structural Systems Inc.
Sun Industries
Tanscend Inc.
TLT Babcock Inc.
Tokunaga Masonry
Wasa Electric
Wong's Striping