HAWAII

INTELLIGENT TRANSPORTATION SYSTEMS

ARCHITECTURE

GOVERNOR'S MESSAGE

Aloha,

The State of Hawaii is taking steps to vastly enhance the efficiency and productivity of our current transportation resources. Our goal is to ensure a transportation system that reduces congestion and enhances safety for our drivers by both preventing incidents and improving incident response effectiveness. This focus on system preservation and safety is supported by the Fixing America's Surface Transportation (FAST) Act, a federal law enacted in 2015 that provides long-term funding for surface transportation infrastructure planning and investment.

Now that we have Intelligent Transportation Systems (ITS) Architectures in place for each county as well as the State of Hawaii, the Department of Transportation is looking to implement preservation and safety projects that will repair and renew the aging infrastructure and improve the dependability of the system. Investments in advanced communication technology and data gathering applications will result in a direct positive impact on daily commutes, minimize environmental impact and promote upgrades that can be completed within the next few years.

These intelligent planning tools, when deployed statewide in partnership with county agencies, will ensure that our transportation network remains highly functional and becomes as efficient as possible.

Mahalo,

David Y. Ige
Governor of the State of Hawaii

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DIRECTOR'S MESSAGE

Aloha,

The Hawaii Department of Transportation (HDOT) has completed the development of regional Intelligent Transportation System (ITS) Architectures that not only give collaborating agencies a program for deploying ITS throughout the State of Hawaii, but also meet the requirement for obtaining and leveraging federal funds for future ITS projects.

On a daily basis, Hawaii's traveling public deals with recurring congestion and large-scale traffic incidents that compromise the efficiency of our transportation network. These inefficiencies have a direct impact to our residents and businesses in the form of time and money.

Unfortunately, new construction, or building ourselves out of congestion, is unrealistic and cost prohibitive. Alternatively, HDOT is looking at various ITS solutions to significantly reduce roadway clearance times, expand traveler information and improve interagency incident management.

Our goal is to utilize future ITS projects to help enhance the efficiency of our transportation network and improve the experience for everyone on the road. Hawaii's traveling public deserves the benefit of the best possible performance from our existing infrastructure.

"Hawaii's traveling public deserves the benefit of the best possible performance from our existing infrastructure."

Mahalo,

Ford N. Fuchigami
Director, Hawaii Department of Transportation

ITS OVERVIEW

Intelligent Transportation Systems (ITS) are a collection of technologies and systems that HDOT can leverage to maximize the performance of its existing transportation infrastructure. The systems integrate advanced communication technology and data gathering applications to create a symbiotic, connected network of traffic operations and management. ITS field devices communicate information to a traffic management center for optimal transportation management.

ITS helps lessen the impact of transportation on communities while enhancing the quality of travel in commuters' daily lives by:

- Improving transportation safety and mobility and enhancing productivity through the integration of advanced communications technologies into the transportation infrastructure and in vehicles.

- Providing reliable congestion data.

- Incorporating sustainable principles into the transportation system.

- Promoting economic growth and adding high-tech jobs in ITS management.

- Improving the productivity of commercial, transit and public safety fleets by using automated tracking, dispatch and weigh-in-motion systems that speed vehicles through much of the red tape associated with commerce.

With the Oahu Regional ITS Architecture in place since 2003, and Hawaii's statewide and regional architectures now completed, the counties can add ITS technologies to their toolboxes for both county- and state-owned roads in Hawaii.

ITS technologies engaged include:

- Traffic cameras
- Computerized traffic signals and detectors
- Electronic freeway signs
- Traffic management centers (TMC)
- Freeway service patrol (FSP)
- Real-time traffic condition information via electronic message signs, websites and mobile apps

ITS services offering the most impactful and measurable results to Hawaii drivers and the State include:

- Traffic Management
- Incident Management
- Traveler Information
- Emergency Response
- Disaster and Evacuation Management
- Connected Vehicles

In 2010, the New York State DOT Traffic Management Center and local partners collaborated in the I-95 Corridor Coalition's Vehicle Probe Project (VPP). By gathering and disseminating probe data in a seamless traffic monitoring system, agencies were able to communicate travel times to drivers via 511 travel information services and electronic message signs, effectively reducing traffic queues by 50%.[1]

ITS ARCHITECTURES

An ITS architecture is a comprehensive planning tool that details how Intelligent Transportation Systems will be integrated into an existing transportation network. Advanced technologies are applied as Service Packages (i.e., portions of the architecture that provide a specific ITS service) to meet the system's unique needs. With the completion of the Maui, Kauai and Statewide Architectures in 2016, all Hawaii-based ITS projects described in the architectures are eligible for federal funds. Typically, federal-aid highway funding is provided to states at a ratio of 80% federal funds with a 20% local match.

ITS architectures are designed to fit the transportation environment of each region (including the State) by establishing a framework to integrate technologies that improve traffic operations, mobility, security and safety; engage data gathered for transportation operations and safety; improve inter-regional coordination and information sharing; and leverage existing and new investments.

ITS ARCHITECTURE TOOLS

Architecture tools are applied to outline existing and potential future computerized systems, define data flows among systems and identify information sources (i.e., traffic detectors).

- **Turbo Architecture™** is a software application that supports the development of regional and project ITS architectures using the National ITS Architecture as a starting point, and ensures compatibility among local and national ITS: *iteris.com/itsarch/html/turbo/turbomain.htm*

- **Service Package Diagrams** highlight specific services and combine several different subsystems, equipment packages, terminators and architecture flows that provide the desired service: *iteris.com/itsarch/html/mp/mpindex.htm*

- **ITS Architecture Websites** for the Hawaii Statewide ITS Architecture, Maui (including Lanai and Molokai) and Kauai: *hawaii.itsarchitecture.org*

ITS ARCHITECTURE PROCESS

Stakeholder interaction guided the development of each architecture to ensure transportation enhancements meet the needs of the community.

Step 1: Identify need through stakeholder interviews.

Step 2: Gather and organize stakeholder data (inventory systems, determine needs/services, develop operational concept, define functional requirements).

Step 3: Define interfaces (identify interconnections and define information flows).

Step 4: Implementation (define project sequencing, develop agency agreements, identify ITS standards).

Step 5: Use Regional Architecture.

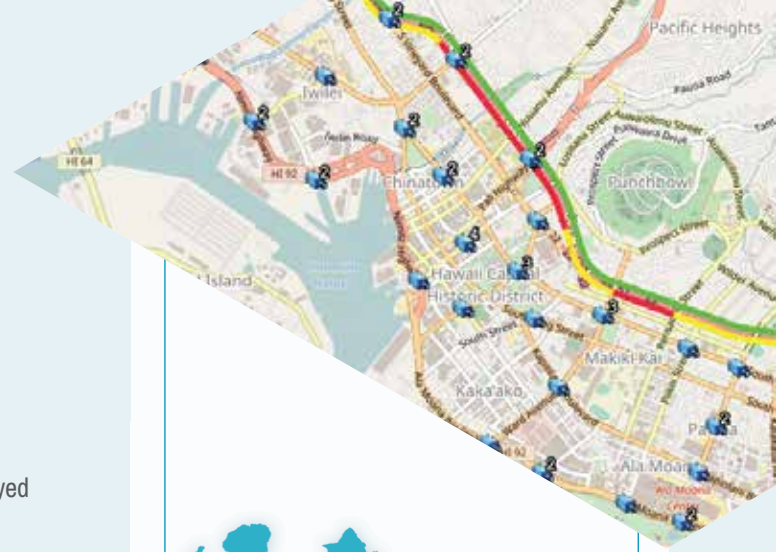**Step 6:** Maintain Regional Architecture.

HAWAII STATEWIDE ITS ARCHITECTURE

The Hawaii Statewide ITS Architecture is aligned with the National ITS Architecture and details ITS devices and systems that are likely to be deployed over the next 10 years, starting with Oahu's freeway system.

Key ITS Services include:

- Traffic Management

- Disaster and Evacuation Management

- Traveler Information

- Connected Vehicles

- Commercial Vehicle Operations

Because ITS on Oahu is mature, the deployment will now focus on filling in the gaps with new technologies to make ITS more robust and effective. The GoAkamai Traveler Information system will allow Hawaii to meet its goal of enhancing infrastructure to produce safer, less congested roads and better incident response. Efforts to expand GoAkamai will focus on adding technologies to increase the efficiency and reach of the traveler information.

In an incident management enhancement project, the New Jersey Department of Transportation applied the I-95 Corridor Coalition's Vehicle Probe Project to vastly improve efficiency, resulting in an estimated savings of $100,000 per incident in user delay costs.[2]

SERVICE HIGHLIGHT:
GOAKAMAI TRAVELER INFORMATION

GoAkamai is an Advanced Traveler Information Systems (ATIS) Service Package that consolidates the region's transportation information into a one-stop resource—accessible through GoAkamai.org or mobile application. Travelers who access GoAkamai receive real-time information about traffic conditions, drive times, weather, emergencies, incidents, construction and planned events that many Oahu motorists find invaluable in commute planning. Drivers may adjust travel times, change travel modes or avoid getting on the roads. As ITS devices are implemented in the counties, HDOT wants to ensure the program expands statewide.

Benefit: informed motorists

HAWAII STATEWIDE ITS ARCHITECTURE STAKEHOLDERS

The following agencies participated in the development of the Hawaii Statewide ITS Architecture.

State Agencies

- Hawaii Department of Transportation (HDOT)
- Hawaii Emergency Management Agency
- Hawaii Tourism Authority
- Hawaii Visitors and Convention Bureau

County Agencies

- City and County of Honolulu Department of Transportation Services (DTS)
- City and County of Honolulu Department of Information Technology

- County of Hawaii Civil Defense Agency
- County of Hawaii Department of Public Works
- County of Kauai Civil Defense Agency
- County of Kauai Department of Finance, Information Technology
- County of Kauai Department of Public Works
- County of Kauai Transportation Agency
- County of Maui Department of Public Works
- County of Maui Civil Defense
- County of Maui Department of Transportation
- Honolulu Authority for Rapid Transportation

MAUI COUNTY REGIONAL ITS ARCHITECTURE

The Maui Regional ITS Architecture expands on the benefits of electronic message signs to streamline efficient evacuation and inform motorists of road closures. The architecture also includes the application of ITS technology to connect, synchronize and remotely time existing traffic lights. This could be managed from a future traffic management center (to be implemented when funding becomes available) to improve traffic flow.

Key ITS Service Packages

- Regional Traffic Management

- Incident Management

- Emergency Management and Disaster/Evacuation

- Traveler Information

Emergency Management and Disaster/Evacuation is highlighted here as the focus of Maui's transportation enhancement through ITS.
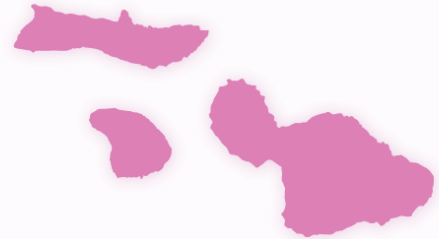
Maui Architecture Stakeholders

State Agency
- Hawaii Department of Transportation (HDOT), Highways, Airports and Harbors Divisions

Maui County Agencies
- Department of Public Works

- Department of Transportation

- Police Department

- Fire Department

- Civil Defense

- Department of Management

- American Medical Services (contractor)

In 2009, a Japan pilot program applied traffic management principles that allowed participants to monitor, assess and adjust their travel behavior, effectively resulting in a carbon footprint reduction of 20%.[3]

MEASURES TO OPTIMIZE SITUATIONAL AWARENESS AND RESOURCE COORDINATION

- Maui County Emergency Operations Center (EOC) offers wide area alerts and disaster traveler information to the public electronically through its website, social media and subscription notifications.

- Maui Police Department provides external access at the EOC to its 911 computer aided dispatch (CAD) system. Maui Bus assists in evacuation as needed.

- HDOT Harbors Division will soon finish construction of a statewide monopole system that promotes communications between state harbors and the counties to improve operations during a disaster.

Emergency Management and Disaster/Evacuation is highlighted here as the focus of Maui's transportation enhancement through ITS.

SERVICE HIGHLIGHT: EMERGENCY MANAGEMENT AND DISASTER/ EVACUATION

Disaster Response and Recovery is an ITS Service Package that will greatly enhance efficiency and effectiveness of the surface transportation system's disaster response protocol. Technological and man-made disasters, as well as natural disasters like hurricanes, earthquakes and tsunamis, can be proactively addressed. In response, protocols can be implemented sooner via the Maui County EOC, which will also facilitate collaboration with multiple agencies and entities in the event of emergency. Specific roles are assigned to public safety, human services, infrastructure agencies and private utilities based on the emergency type.

Benefit: *enhanced disaster response efficiency*

COUNTY OF HAWAII REGIONAL ITS ARCHITECTURE

Created in 2012, the County of Hawaii Regional ITS Architecture focuses on collaborative ITS projects spearheaded by the County of Hawaii Department of Public Works (DPW). Projects to enhance the island's 1,393 miles of public roads include integrating computerized traffic signals, traffic detectors and cameras for data gathering; public traffic information websites and phone systems; and transit bus location systems.

Key ITS Services include:

- Surface Street Control
- Work Zone Management
- Broadcast Traveler Information
- Incident Management
- Transit Operations

A University of Missouri evaluation of the deployments of electronic message signs and traffic cameras in a Missouri Department of Transportation rural safety improvement program showed vehicle speeds decreased significantly (by 1.25 mph and 3.64 mph) in work zones where electronic message signs were used to inform drivers.[4]

SERVICE HIGHLIGHT:
WORK ZONE MANAGEMENT

A major component of Hawaii County ITS Architecture is Work Zone Management, a Service Package that uses temporary, portable systems to support emergencies due to natural disasters, major crashes, construction or special events. In 2014, the COH DPW was successful in quickly deploying PunaTraffic.com, a traffic management and traveler information system, to monitor their transportation network. In the wake of the June 27, 2014, Puu Oo Vent Lava Flow from the Kilauea Volcano, DPW re-deployed the cameras and traffic sensors to monitor construction of a roundabout, thereby improving Work Zone Management and providing motorists with real-time traffic information.

Working collaboratively with HDOT's Hawaii District, DPW provides traffic control on roadways where maintenance, construction and utility work activities are underway. The COH DPW gathers information on traffic conditions and communicates data on events, detours, congestion and other traveler information to the public. Both agencies hope to be able to monitor traffic conditions at work zones using portable and truck-mounted field equipment including traffic cameras, portable electronic message signs and speed sensors to gather data and transmit it to the DPW Traffic Management Center.

Benefits: enhanced traffic flow and improved public awareness of maintenance-related traffic conditions

WORK ZONE ITS

ITS devices will provide work zone management in the form of:

- Remote operations and maintenance achieved through traffic cameras and portable electronic message signs.

- Portable devices that may be used to support longer-term closures due to natural disaster, major events, construction and other incidents.

OAHU REGIONAL ITS ARCHITECTURE

The Oahu Regional ITS Architecture created in 2003 provides a framework for institutional coordination and technical integration of ITS systems for the most populous island in Hawaii.

Key ITS Services include:

- Broadcast Traveler Information

- Regional Traffic Control

- Incident Management

- Emergency Response and Routing

Various ITS programs are in operation and thriving, including:

- Hawaii Freeway Service Patrol program, which provides an average of 8,500 motorist assists on the H-1, H-2 and H201 Freeways annually.

- City & County of Honolulu systems that monitor and manage highways and arterials through the use of more than 300 traffic cameras.

- HDOT system of almost 100 speed sensors on H-1, H-2 and H201 Freeways that feeds the GoAkamai congestion map and provides traveler information to motorists.

In support of Oahu's expected growth, ITS systems that make multi-modal transportation facilities and services more efficient will help meet demand at a lower cost to taxpayers, create efficiency with existing roadway capacity and transit services, and reduce the burden placed on the island's regional transportation network. One key ITS project is the Joint Traffic Management Center.

In 2008, the assessment of a new traffic management system in Espanola, New Mexico, showed a 27.5% decrease in total crashes and an 87.5% reduction in vehicle delay.[5]

JOINT TRAFFIC MANAGEMENT CENTER

When the Honolulu Joint Traffic Management Center (JTMC) is fully operational, it will enhance the day-to-day operation of Oahu's transportation network, coordination and response to traffic incidents, information dissemination among responders and traffic information communication to the public.

Benefits: *enhanced safety and mobility, faster incident resolution and the reduction of secondary accidents*

ACTIVE TRAFFIC MANAGEMENT

The JTMC provides a proactive tool for ensuring efficient traffic operations through strategic information gathering and timely, coordinated response to congestion, incidents and events. DTS (Department of Transportation Services) and HDOT, working alongside Police, Fire and EMS dispatch centers, will manage traffic while the JTMC provides a central headquarters to supervise transportation conditions and address issues to maintain optimal traffic flow.

JTMC traffic operators will monitor over 300 traffic cameras, remotely adjust signal timing for more than 750 signals, control electronic message signs, coordinate Freeway Service Patrol response and examine traffic detection systems. The JTMC is also expected to reduce secondary incidents by minimizing the duration of traffic incidents and alerting motorists via electronic message signs and GoAkamai.

KAUAI REGIONAL ITS ARCHITECTURE

The Kauai Regional ITS Architecture incorporates a number of transportation services that leverage ITS to elevate productivity and and minimize the impacts due to incidents. Some of these services are handled by a single agency, but for others it makes sense to engage multiple agencies in support of a consolidated service.

Key ITS Services include:

- Regional Traffic Management
- Incident Management
- Emergency Management
- Traveler Information

An important component of the Kauai Architecture is the regional Traffic Signal Control Service Package. Consolidating traffic signal functions for the State and County will ensure that HDOT can effectively monitor its roadway network and quickly adapt and respond to unexpected incidents and events.

Kauai Architecture Stakeholders

State Agency
- Hawaii Department of Transportation (HDOT), Highways, Airports and Harbors Divisions

County Agencies
- Department of Public Works
- Police Department
- Fire Department
- Civil Defense
- Department of Finance
- Kauai County Transportation Agency
- American Medical Services (contractor)

In 2008 in Little Rock, Arkansas, the FHA's Work Zone Mobility and Delay Reporting Assessment used traffic volume data and driver surveys to track the tangible benefits of ITS to enhance mobility and safety. Of surveyed drivers, 82% said the Automated Work Zone Information System improved their ability to react to slow or stopped traffic, and 49% said they felt safer traveling through the work zone because of electronic messages.[6]

TRAFFIC SIGNAL CONTROL

Today Kauai has a handful of traffic signals that collect data, and most signals are operated independently by HDOT. The ITS plan includes regional traffic management from a single TMC that will be able to monitor the traffic cameras, electronic message signs and other ITS field equipment to promote better traffic operations and provide real-time traffic information to the public.

Benefit: *improved roadway monitoring and communication*

Next Steps

With completion of the Statewide and Regional architectures, stakeholder agencies are positioned to incorporate the identified projects in the Statewide Transportation Improvement Plan (STIP) planning process and complete supporting institutional agreements as these projects proceed. Finalization of the architectures also positions the agencies for federal ITS funding if they choose to pursue.

The architectures are not static and will change as plans change, ITS projects are implemented, and ITS needs and services evolve in each region. Each architecture has a defined maintenance program to periodically update the plans, engage existing and new stakeholders, and continue the cycle of ITS development and implementation.

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Note: The Hawaiian language uses two diacritical markings. The 'okina is a glottal stop; and the kahako is a macron. The State of Hawaii strongly encourages the use of Hawaiian diacritical markings. The National ITS Architecture tool, Turbo Architecture, does not allow for the Hawaiian diacritical markings to be input and as such, customized service package diagrams, operational concepts and other outputs from Turbo are unable to reflect the diacritical markings. To ensure consistency in the ITS Architecture, no Hawaiian diacritical markings will be used.

Prepared by

ICX
TRANSPORTATION

References:

1. "Traffic queue reduction in New York," U.S. Department of Transportation Intelligent Transportation Systems Joint Program Office - Benefits Database, August 10, 2010

2. "I-95 Corridor Coalition – Vehicle Probe Project General Benefits White Paper," U.S. Department of Transportation Intelligent Transportation Systems Joint Program Office - Benefits Database, Aug 12, 2010

3. "Intelligent Transportation Systems Benefits, Costs, and Deployments Lessons Learned Desk Reference - Final Report September 2011," Intelligent Transportation Systems Joint Program Office

4. "Results of two case studies on rural interstates in southeast Missouri," U.S. Department of Transportation Intelligent Transportations Systems Program Office - Benefits Database, December 2011

5. "NM 68, Riverside Drive City of Espanola, New Mexico ITS Project Final Evaluation Report," U.S. Department of Transportation Intelligent Transportations Systems Program Office - Benefits Database, September 2008

6. "Intelligent Transportation Systems Benefits, Costs, and Deployments Lessons Learned Desk Reference - Final Report September 2011," Intelligent Transportation Systems Joint Program Office