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The Division of Research, Innovation and System Information (DRISI) within California's Department of Transportation (Caltrans) provides solutions and knowledge that improves California's transportation system. The Division recently sought to determine whether the data it provides on the agency's website, the way it's organized, and how it's delivered, serve the division's goals and the agency's priorities of sustainability, active transportation, livability, and economic vibrancy. If not, they wanted to know what improvements were needed. The purpose of this study, therefore, was to: (a) discover the variety of practices for structuring, organizing, and presenting such data currently in use by other transportation-related websites; (b) determine "best practices" that offer the greatest potential to engage, illuminate, and provide practical application for the transportation community; and (c) determine which of these reasonably could be implemented on the Caltrans DRISI (research) library website and identify areas for further exploration and discussion.

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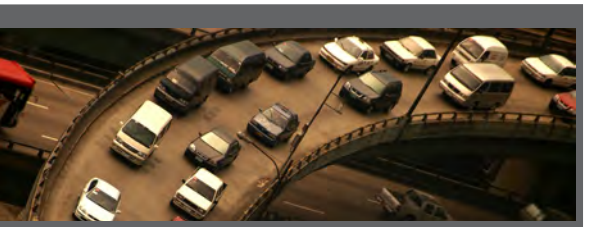
# Data Presentation on Transportation Agency Websites: Trends and Best Practices

MTI Report 12-76



MINETA
TRANSPORTATION INSTITUTE
MTI

# MINETA TRANSPORTATION INSTITUTE
## LEAD UNIVERSITY OF MNTRC

The Mineta Transportation Institute (MTI) was established by Congress in 1991 as part of the Intermodal Surface Transportation Equity Act (ISTEA) and was reauthorized under the Transportation Equity Act for the 21st century (TEA-21). MTI then successfully competed to be named a Tier 1 Center in 2002 and 2006 in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). Most recently, MTI successfully competed in the Surface Transportation Extension Act of 2011 to be named a Tier 1 Transit-Focused University Transportation Center. The Institute is funded by Congress through the United States Department of Transportation's Office of the Assistant Secretary for Research and Technology (OST-R), University Transportation Centers Program, the California Department of Transportation (Caltrans), and by private grants and donations.

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REPORT 12-76

# DATA PRESENTATION ON TRANSPORTATION AGENCY WEBSITES: TRENDS AND BEST PRACTICES

Frances Cherman

May 2017

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# EXECUTIVE SUMMARY

The Division of Research, Innovation and System Information (DRISI) within California's Department of Transportation (Caltrans) provides solutions and knowledge that improves California's transportation system. The Division recently sought to determine whether the data it provides on the agency's website, the way it's organized, and how it's delivered, serve the division's goals and the agency's priorities of sustainability, active transportation, livability, and economic vibrancy. If not, they wanted to know what improvements were needed. The division thought a survey of websites operated by similar agencies, including other state DOTs and other California agencies, might reveal "best practices" regarding specific data topics and their presentation. The purpose of this study, therefore, was to:

a. Discover the variety of practices for structuring, organizing, and presenting such data currently in use by other transportation-related websites;

b. Determine "best practices" that offer the greatest potential to engage, illuminate, and provide practical application for the transportation community; and

c. Determine which of these reasonably could be implemented on the Caltrans DRISI (research) library website and identify areas for further exploration and discussion.

The research involved seven steps:

1. Identify relevant sites for analysis;

2. Identify and review relevant literature, policies, and guidance;

3. Develop criteria for analyzing and comparing data content and presentation;

4. Collect data;

5. Evaluate the collected data;

6. Develop recommendations for Caltrans; and

7. Present the findings and recommendations.

Agency types and specific organizations were based on Caltrans' suggestions, which included state departments of transportation, California metropolitan and regional transportation planning organizations, University Transportation Centers, and an assortment of other transportation-related agencies and organizations. In addition, several sites and many resources were added by the author as they were discovered. In all, 143 websites were examined, 137 in depth.

Concurrently, a rigorous search for relevant literature was undertaken with initially no results. Finally, by broadening the search to encompass the larger concept of *all* government agencies and subject matter – in other words, the concept of "e-government," as it's still known in research circles – literature was discovered; however, most studies

lacked relevance due to their focus on public data with respect to privacy issues. What did have relevance were policies, technological advances, and an entire movement that has emerged over the past five to eight years focused on making data "open" – that is, making it discoverable and freely available for use and reuse by anyone who can make use of it.

The analysis yielded the following findings:

1. **States have been slow to implement open data.** Most state and local transportation agency websites offer little data on their websites, and what they do offer falls far short of the trend toward "open data." Crash data is the most commonly covered topic.

2. **System usage data is more common than system inventory data.** The breadth of data topics on agency sites is small and often incomplete, with gaps or overlaps in timespans and topic areas.

3. **Data discoverability and accessibility vary but are generally poor.** Most state sites provide no obvious path from the home page to data, and no agency provides direct access to, or even lists, all data in a single, central location.

4. **Data structure, presentation, and appearance vary widely.** PDF files, which have serious drawbacks and cannot be considered a "best practice," are the most commonly used data presentation medium on state sites, but this is fortunately starting to change as more agencies embrace open data.

5. **Reusability is standard on federal sites but lacking on state sites.** Data on state DOT sites is generally reusable only by investing considerable time and effort in exporting and reformatting text from PDF files. Federal sites, however, are embracing concepts of reusability.

6. **Agencies that offer open data are valuable resources.** Such websites are both a rich source of ready-to-reuse data on dozens of topics of interest to Caltrans' customers, and a generous source of guidance and support for agencies just getting started with open data.

The study concluded with a host of recommendations for the DRISI Data Library, some of which can be implemented immediately.

# I. INTRODUCTION

The goal of Caltrans' Division of Research, Innovation and System Information (DRISI) is to provide solutions and knowledge that improve California's transportation system. Given the state's and the nation's current and planned transportation priorities of sustainability, active transportation, livability, and economic vibrancy, the Division sought to determine whether the data content, organization, and delivery methods in use on the DRISI website[1] serve Caltrans' goals, and, if not, how they can be improved. Specifically, the agency sought to learn:

- What transportation data and data trends would be most useful to the State's residents, industry, economy, and quality of life?
- How should the website and data be organized for maximum usability?
- What types of presentation methods, graphic techniques, and technology would best enable users to derive meaning from the data and gain insight that drives positive action?
- How does this compare to what is currently offered on the DRISI-HQ Data Library site, specifically the two statistical publications updated annually: *California Quick Facts* and *Travel and Related Factors in California*? Where are the gaps?
- Should different data types and trends be shown? Should the data be grouped or presented differently to make it more understandable or reusable?

It was thought that a survey of other agency's websites might reveal "best practices" regarding specific subject matter and its presentation. Thus, the purpose of this study is to:

- Discover the variety of practices for structuring, organizing, and presenting such data currently in use by other transportation-related websites;
- Determine "best practices" that offer the greatest potential to engage, illuminate, and provide practical application for the transportation community; and
- Determine which of these reasonably could be implemented on the Caltrans DRISI (research) library website and identify areas for further exploration and discussion.

This report is structured as follows. Section II details the methodology used to conduct this project. Section III presents a brief review of the limited existing literature on digital access to data, particularly on transportation agency websites. Section IV reviews some of the guidance, sourced from the federal government, related to open data and best practices for digital government. Section V provides a detailed assessment of the current DRISI Data Library, including an evaluation of the California Quick Facts and Travel and Related Factors in California products. Section VI examines several other State of California and Federal agency websites in order to identify potential best practices that Caltrans could implement on their DRISI site. Findings from this analysis are presented in Section VII and a set of recommendations for Caltrans is discussed in Section VIII.

# II. METHODOLOGY

Research for this project involved seven steps, some of which were performed concurrently for reasons that will be discussed. The steps, in brief were:

1. Identify relevant sites for analysis;
2. Identify and review relevant literature, policies, and guidance;
3. Develop criteria for analyzing and comparing data content and presentation;
4. Collect data;
5. Evaluate the collected data;
6. Develop recommendations for Caltrans; and
7. Present the findings and recommendations.

## SELECTION OF RELEVANT SITES

DRISI suggested several categories of sites, including state departments of transportation, California metropolitan planning organizations and regional transportation planning organizations; University Transportation Centers; and certain transportation-related organizations, such as the Bureau of Transportation Statistics. In all, 143 agency websites were examined, with 137 of these analyzed in depth. A representative handful are discussed here in detail, but all informed the findings and recommendations.

To establish priorities among such a large group, the author considered factors that affect transportation systems and differ from state to state, such as population size, population density, and land area. The population, population density, and land area for all fifty states and Washington DC were obtained from the US Census Bureau.[2]

## IDENTIFICATION OF RELEVANT LITERATURE, POLICIES, AND GUIDANCE

With the understanding that each website is unique in language as well as appearance and structure, the literature review began with an in-depth search of the **Transportation Research Thesaurus**[3] (TRT) on the Transportation Research Board (TRB) website. For this project, the need was twofold: First, it was necessary to identify keywords that would reveal relevant literature. Second, for purposes of locating data on transportation agency websites, to: a) identify the generic terms that might be used to describe a section containing the agency's data (e.g., "system information" or "statistics"); and b) identify any terms that might be used for specific *topics* on which an agency might publish data – that is, any word or phrase (for example, "vehicle miles traveled") that, typed into a site's search field, might turn up data on that topic.

The Transportation Research Thesaurus was unfortunately of little help with either goal; apparently, currently popular terms such as open government, digital data, data visualization, and data reusability have yet to be added. The search for literature continued as agencies were selected and data collected. Dozens of documents and articles were reviewed, but most addressed "information" in general, not data specifically, and even fewer discussed websites. Dozens of keywords and key phrases were tried, many extracted directly from the project task order, along with "transportation agency data," "digital data," "transportation agency statistics," "system information," and dozens of others.

When a relevant article finally was discovered, the journal in which it was published – *Government Information Quarterly* – was mined for more. For future reference, it should be noted that such articles are typically tagged with the keyword: "*e-government."* An additional keyword – digital government – also came to light.

Literature searches were conducted on the following databases, among others:

- **Transport Research International Database** (TRID), the world's largest and most comprehensive bibliographic resource, with more than 1.1 million references to research in all transportation modes;[4]

- **Bureau of Transportation Statistics** (BTS) websites;

- **US DOT Research Hub**, which simultaneously searches the databases of the Federal Aviation Administration (FAA), Maritime Administration (MARAD), Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), Federal Transit Administration (FTA), Pipeline and Hazardous Materials Safety Administration (PHMSA), Office of the Assistant Secretary for Research and Technology (OST-R) under the Secretary of Transportation, National Highway Traffic Safety Administration (NHTSA), and the Federal Motor Carrier Safety Administration (FMCSA).

- **IT Policy Library** on the website of the US Chief Information Officer, which covers laws, executive orders, memos, Office of Management and Budget (OMB) circulars, plans, policy reviews, and strategy/guidance documents pertaining to federal agencies and OMB information technology."[5]

In addition, dozens of open searches were conducted on Google and Google Scholar.

Policy and guidance searches were conducted on the Federal-aid Highway Program Policy & Guidance Center, the "Laws & Regulations" section of the US Environmental Protection Agency website,[6] the Library of Congress, the Federal Register, and OpenData.gov.

## CRITERIA DEVELOPMENT

Initially, the author identified four areas relevant to the agency's purpose. Within each area, various indicators of effectiveness were identified for comparison:

1. **Discoverability/Access:** Ease/difficulty of finding data, navigation menus and search tools, site structure, best practices for discovery by search engine (collectively known as search engine optimization, or SEO).

2. **Content:** Topics addressed, time range, and terminology used.

3. **Presentation:** Delivery methods and media, style, credibility factors, visual appeal, learning tools, and engagement devices.

4. **Reusability:** Data manipulability, exportability, and opportunities for reuse on other platforms and for other purposes.

The four areas were selected for their potential impact on the usefulness of the data to visitors – the agency's internal and external customers – and to the public at large. Each indicator was further deconstructed to identify objectively observable phenomena, or "markers." Ultimately more than 100 markers were identified. These were rigorously applied in the initial stages of the research and would have served well throughout if the sites had been less diverse. Variations in the way each site was structured, how its data was organized, and where it was located were so extreme that merely discovering data – one small chunk at a time – required more time than was allotted to analyzing the entire site. Given the project scope and schedule and the resources available, the author determined that a purely objective analysis would not be possible; however, the criteria informed the author's examination of each site.

Caltrans' goal in conducting this research is ultimately to better serve the needs of its customers. Although outside the scope of this research, an important task for the agency will be to evaluate exactly who those customers are: what organizations, communities, agencies, or constituencies they represent; the nature of their visits to the Caltrans site; the type of information they seek; the tasks that they have come to accomplish; and their values, priorities, preconceptions, and "pain points."

Caltrans' primary interest was in learning which topics other agencies were covering and how the data was organized and presented; therefore, that was the primary focus of the research. However, unlike print media, which has been part of the American landscape for centuries, the content delivered by digital media is only one component that determines its impact. The discoverability of a website as well as its usability are critical to its ability to effectively transfer knowledge and understanding to the populace.

Several assumptions were made for this research:

1. Links to data are not data. If a visitor must leave the agency site to access data, the agency was not credited with providing it.

2. If a visitor on the agency's home page cannot quickly identify a single, clear path to the data (i.e., if none of the links in the main menu or submenus seems promising, or if there are two or more links that seem equally promising), the data is unlikely to be discovered, therefore, the agency is not credited with providing it, or the difficulty

of locating the data is noted. Usability expert Ginny Redish says studies show that Web users don't mind having to drill down into a site to find what they're looking for *as long as they have sense they're on the right track.* [Emphasis added.] The phenomenon is known as "the scent of information."[7]

3. Having to use a site search because the path isn't clear from the home page is a less-than-ideal option and is so noted.

## AGENCY SELECTION

### Caltrans' Preferences

Caltrans identified several categories of agencies and specific examples of those agencies whose websites might be worth analyzing, including:

- Other state departments of transportation, metropolitan planning organizations (MPOs), regional transportation planning agencies (RTPAs), and agencies whose business is transportation;

- Other agencies in California, such as the Department of Motor Vehicles, the Office of Transportation Safety (OTS), the California Air Resources Board (CARB);

- Federal agencies, such as the Bureau of Transportation Statistics (BTS), the American Association of State Highway and Transportation Officials (AASHTO); and

- Scientific institutions, such as universities and university transportation centers.

They requested that, wherever possible, the analysis focus on California agencies rather than national agencies, with the exception of other state DOTs, which were a particular area of interest.

### Additional Choices

Several sites discovered along the way that were noteworthy for their consistency with or departure from the practices of the majority were also included for comparison.

## DATA COLLECTION

Prior to beginning formal analysis, a brief review of the sites revealed surprising disparities in both the topics addressed by each site and the way the information is organized. These disparities most likely reflect differences in the way the agencies themselves are structured. For example, in Rhode Island, crashes resulting in injuries or fatalities are reported by the state's Department of Health rather than the Department of Transportation. The variations may also reflect varying priorities based on the state's geography, climate, economy, and demographics. Regardless of cause, one result is that each site has its own terminology, making the task of locating statistical data roughly comparable to that offered by the DRISI Data Library something akin to searching for buried treasure without knowing what it

is, what it's called, or even if it exists. Thus, it was necessary to first establish a set of terms and phrases most likely to yield results. Doing this efficiently required searching the sites of all agencies. Between the keywords provided by Caltrans, terms used on other agencies' websites, and the author's variations, the selected agencies were searched for 159 key phrases. Initially, these searches were conducted with and without the phrase in quotation marks; the former configuration finds instances of an exact match for the phrase; the latter, for either or both words but not necessarily together. Searches without quotes tended to turn up the maximum number of results (100) in each instance, but they were not necessarily helpful for our purposes, so eventually those results were discarded and searches for only an exact match were completed.

In 2006, Google introduced Google Custom Search Engine, a Web-based tool that allowed anyone to create and save a Google search engine customized to their specifications – for example, one that would search only specified websites, return only specified document types, or include specified keywords in every search. In 2007, an engineer at the Washington State Department of Transportation created a Google Custom Search engine to search the websites of all 50 state departments of transportation simultaneously. The National Transportation Library at the Bureau of Transportation Statistics (BTS) offers an embedded version of the same search engine; however, the same BTS Web page provides a list of links to each of the 50 state agencies, and several URLs are obsolete, returning "page not found" errors.[8] This created concern that perhaps searches conducted with these engines would fail to return accurate results. Disadvantages of the 2007 US State DOT Custom Search include (see Figure 1):

- Only ten search results returned per page; must load page ten times to see the maximum number of results (100).

- Thumbnail images included in results. Thumbnails expand to full size (often very large) when search results are copied and pasted, making it difficult to work with the text.

**Figure 1. A Minor Distraction in Search Results (L), Thumbnail Images Become a Nuisance When Pasted into a Document and They Resume Their Original Size**

## Four New Custom Search Engines Created

- To facilitate efficient collection of data and ensure that searches conducted for this report encompassed all key agencies selected for analysis, four new Google Custom Search Engines were created and are now available for public use (see Table 1). Each engine searches all agencies of a specific type and jurisdiction:

**Table 1. New Google Custom Search Engines for Transportation Agencies**

| Search Engine Name | Scope | Public URL |
|---|---|---|
| All (50) US State & DC Departments of Transportation (DOTs) | Departments of transportation for all 50 states and the District of Columbia | https://cse.google.com/cse/publicurl?cx=008606113859401413051:rh74zwyf7tw |
| California Metropolitan Planning Organizations (MPOs) | California's 18 MPOs as of June 2016[a] | https://cse.google.com/cse/publicurl?cx=008606113859401413051:zjix0j0qury |
| California Regional Transportation Planning Agencies (RTPAs) | California's 28 RTPAs as of June 2016[b] | https://cse.google.com/cse/publicurl?cx=008606113859401413051:izj2i_uwkdi |
| US University Transportation Centers (UTCs) 2013 – 2016 | The 5 national, 10 regional, and 20 Tier 1 University Transportation Centers – 2013 to 2016[c] | https://cse.google.com/cse/publicurl?cx=008606113859401413051:kbmjrdpesjy |

*Sources:*

[a] http://ntl.bts.gov/tools/statedot.html (12 URLs corrected).

[b] *"California Transportation Planning Agencies (XLS)," http:*//www.dot.ca.gov/transplanning/orip/docs/California_Transportation_Planning_Agencies_March2016.xls; "CA MPOs & RTPAs (XLS)" http://www.dot.ca.gov/hq/tpp/offices/orip/index_files/CA_MPOs_RTPAs_Contacts.xls; and "Map of California MPOs and RTPAs (PDF)" at http://www.dot.ca.gov/transplanning/orip/images/MPORTPAMapMarch2016.pdf (2 URLs corrected).

[c] https://www.transportation.gov/utc/2013-utc-grantees

The new search engines afford the following advantages:

- Simultaneous search for all agencies within a given group: State DOTs, UTCs, California MPOs, or California RTPAs.
- URLs updated and verified accurate (as of October 1, 2016).[9]
- Searches return twenty results per page, halving the number of pages (from ten to five) that must be loaded to see all 100 results.
- Thumbnail images are suppressed. The text-only results can be skimmed, pasted, and manipulated more easily.

Sites were examined beginning with the agency's home page. The home page was examined for direct links to agency data, and several site searches were conducted using the terms most common among transportation agencies (see Figure 2 for an example of a site search). Navigation menus were studied to determine whether they offered an obvious path to agency data. Notes and screenshots were taken. Annotations about specific features were added to many screenshots. Notes, screenshots, and comparison data were logged into a database program chosen specifically for its ability to store and display images, plain text notes, and rich text documents, mapped data, and live links.

**Figure 2. New Jersey Department of Transportation Site Search for "Data Library"**

# III. REVIEW OF THE LITERATURE

Ideally, a literature review should take place prior to designing the research. But immediately two challenges became evident:

First, repeated efforts to identify studies addressing the topic of data on transportation agency websites were unsuccessful. Broadening the topic to "government agencies" and trying a variety of terms for "data," including "system information," "system inventory," "performance," "system performance," and "performance data" did not help.

Second, when it comes to the Web and other form of "virtual" (non-physical) media for which new releases require no manufacturing, packaging, or physical distribution, the "state of the art" is a target that moves not by the decade or year but literally by the hour. Practices considered "best" two years ago are unlikely to be considered "best" today. Thus, research performed more than three or four years ago may overlook solutions available today.

Although no studies specifically address the issue of data topics on transportation agency websites, many discuss data on government websites, in general. Typically, such studies pertain to the handling of sensitive (i.e., personally identifiable) information, which is not the type tracked by transportation agencies. A plethora of studies address how data is presented on websites, and these are relevant. Since their findings are similar, they have been referenced where they are most applicable – in the context of the findings and recommendations. A third area of study with respect to data on government websites involves public access, transparency, and accountability.

NCHRP research report 8-92, *Implementing Transportation Data Program Self-Assessment,* suggests agencies ask themselves some of the same questions Caltrans has asked:

- Do we have the data we need to meet federal mandates and manage our core business functions?
- How can our agency make it quicker and easier to access and analyze data so that we can do our jobs more efficiently and effectively?
- Is our data good enough for what it is being used for, or do we need to improve its level of accuracy, precision, or timeliness?
- Are we managing our data to maximize its use and ensure its integrity?[10]

# IV. DIGITAL GOVERNMENT: POLICY, LEGISLATION, AND GUIDANCE

President Barack Obama made the accessibility of government information through digital media a cornerstone of his administration. On May 23, 2012 he issued a directive and strategy document entitled, Digital Government: Building a 21st Century Platform to Better Serve the American People, in which three objectives were outlined:[11]

- Provide the American people and an increasingly mobile workforce with access to high-quality digital government information and services anywhere, anytime, on any device.

- Ensure that government seizes the opportunity to procure and manage devices, applications, and data in smart, secure, and affordable ways.

- Unlock the power of government data to spur innovation and improve the quality of services for the American people.

The strategy rests on four overarching principles:

- **Information-Centric:** Rather than thinking about data in terms of documents, Web pages, applications, or other forms of data *presentation,* agencies must "decouple" data from presentation, so that it "can be tagged, shared, secured, mashed up and presented" in any way the consumer finds useful.

- **Shared Platform:** Agencies can reduce costs, streamline workflow, and achieve more consistent data generation and delivery by sharing platforms and other resources within and across agencies.

- **Customer-Centric:** Data and its delivery methods should be platform-independent so that customers can access, manipulate, and share it in the manner and from the device of their choosing.

- **Security and Privacy:** Digital data and its delivery methods must be safe, and the privacy of individuals must be protected.

As for what constitutes data, the document says, "It can be unstructured content (e.g. press releases, help documents, or how-to guides) or more structured data (e.g., product safety databases, census results, or airline on-time records)."[12] But, "[r]egardless of form, to harness its value to the fullest extent possible, we must adopt an information-centric approach to digital services by securely architecting for interoperability and openness from the start."[13]

For agencies, this means that customers – internal or external – are best served by data that can easily be extracted, manipulated, and shared. Data that fails the test of "openness" includes data "fixed" in a format that makes it difficult or impossible to manipulate and reuse. A practical example is offered by Tim Davies writing in the Commonwealth Governance Handbook:[14]

> *Imagine a national budget that is released in a printed report, made up of hundreds of different tables, each with a slightly different layout. To compare this budget to actual spending, or to see a breakdown of funds by different categories from those the publisher has chosen to present, citizens would have to re-type all the data into a spreadsheet manually. For a budget, this could be weeks upon weeks of laborious work. Even once done, citizens might find that the data is covered by copyright that prohibits their wider use of the information.*

Though Davies was writing for an overseas audience, it's fair to say that the scenario he describes – and the exasperation at its inefficiency – is universally recognized. Documents such as PDFs that prioritize the *appearance* of content over its reusability are one example. Although content can be exported or copied and pasted from properly made PDFs, doing so often causes it to lose its relational structure (tables, for example), and extensive time and effort is often required to reestablish those relationships and remove unwanted artifacts, such as carriage returns in text that should flow. Data and text content presented as images is entirely "closed," in that it cannot be copied as raw data, edited, restructured, or reformatted – it must be inefficiently reconstructed from scratch through manual data entry although in some cases, optical character recognition (OCR) processes can be used to extract text from images. (See the discussion of Rhode Island DOT in Section VI for a more in-depth explanation of the issue, with examples.) Spreadsheets and text documents, while more "open" than PDFs or images, still fall short of optimal "openness" because they require the user to download documents and open them in a separate application, such as a spreadsheet, a word processor or rich text editor, or specialized visualization software, such as GIS-mapping applications. These additional time and technology requirements create a barrier between users and data, making it inaccessible to those who don't have time to download and open each file before knowing if it contains the data they're looking for and for those who do not have access to specialized, often expensive, third-party applications.

Davies then contrasts these constraints with the accountability enabled under a government policy of open data:[15]

> *With open data, these barriers are removed. Original spreadsheets of budget information could be published, and the intellectual property licence applied to the data could allow citizens to use the data as they choose – including for promoting transparency and accountability and even to support commercial enterprises, perhaps based on providing market intelligence to others. Open data advocates argue that, by freeing public data (which has commonly already been paid for by citizens through taxation) for re-use, technically skilled developers could build applications and visualisations that allowed citizens to access it more effectively. In addition, a wide community of innovators could use the data in ways that would bring social and economic value never before imagined.*

On May 9, 2013, President Obama issued Executive Order 13642, *Making "Open" and "Machine-Readable" the New Default for Government Information* [punctuation added for clarity].[16] The same day, the OMB issued a memorandum establishing a framework for implementing the principles outlined in the Order that agencies can apply to all information resources, regardless of whether the data can be made public. The Memorandum requires

federal agencies to collect or create information "in a way that supports downstream information processing and dissemination activities" – in other words, a way that enables the data to be easily shared and reused. The memo goes on to outline the technical requirements for such data.

This includes using machine-readable and open formats, data standards, and common core and extensible metadata for all new information creation and collection efforts. It also includes agencies ensuring information stewardship through open licensing and review of information for privacy, confidentiality, security, or other restrictions to release. Additionally, it involves agencies building or modernizing information systems to maximize interoperability and information accessibility, maintain internal and external data asset inventories, enhance information safeguards, and clarify information management responsibilities.

On, September 28, 2016, the White House hosted its first-ever Open Data Innovation Summit,[17] The event showcased uses of open data.[18] Three special "focus sessions" were offered, including one on Energy, Transportation, and Community Resilience. Under the Obama administration, the federal government has released more than 200,000 datasets, clearing the path for a vast number of collaborative open data projects across the federal government.

## OPEN DATA

"Open data" derives from the concept of "open knowledge," which is defined as "any content, information or data that people are free to use, re-use and redistribute — without any legal, technological or social restriction."[19] The two key criteria that must be met for data or knowledge to be considered "open" are: 1) it must be equally available to all and 2) it must be available for use (and reuse), modification, and sharing, "subject, at most, to measures that preserve provenance and openness."[20] The term "open source," as in open-source software, is based on this definition. The purpose of making data "open" is threefold:

1. To provide citizens with transparency into the activities of its government;

2. To release government-held data to those who can use it to develop innovative businesses and services with social and commercial value; and

3. To facilitate participation and engagement between a government and its constituents, or between a business or organization and its customers or audience.[21]

To see an applied example of open data principles in a government website one need not look far. The **California Open Data Portal** (CODP), launched September 1, 2016, features datasets from eleven State agencies, including two from Caltrans at the time of this publication (see Figure 3).

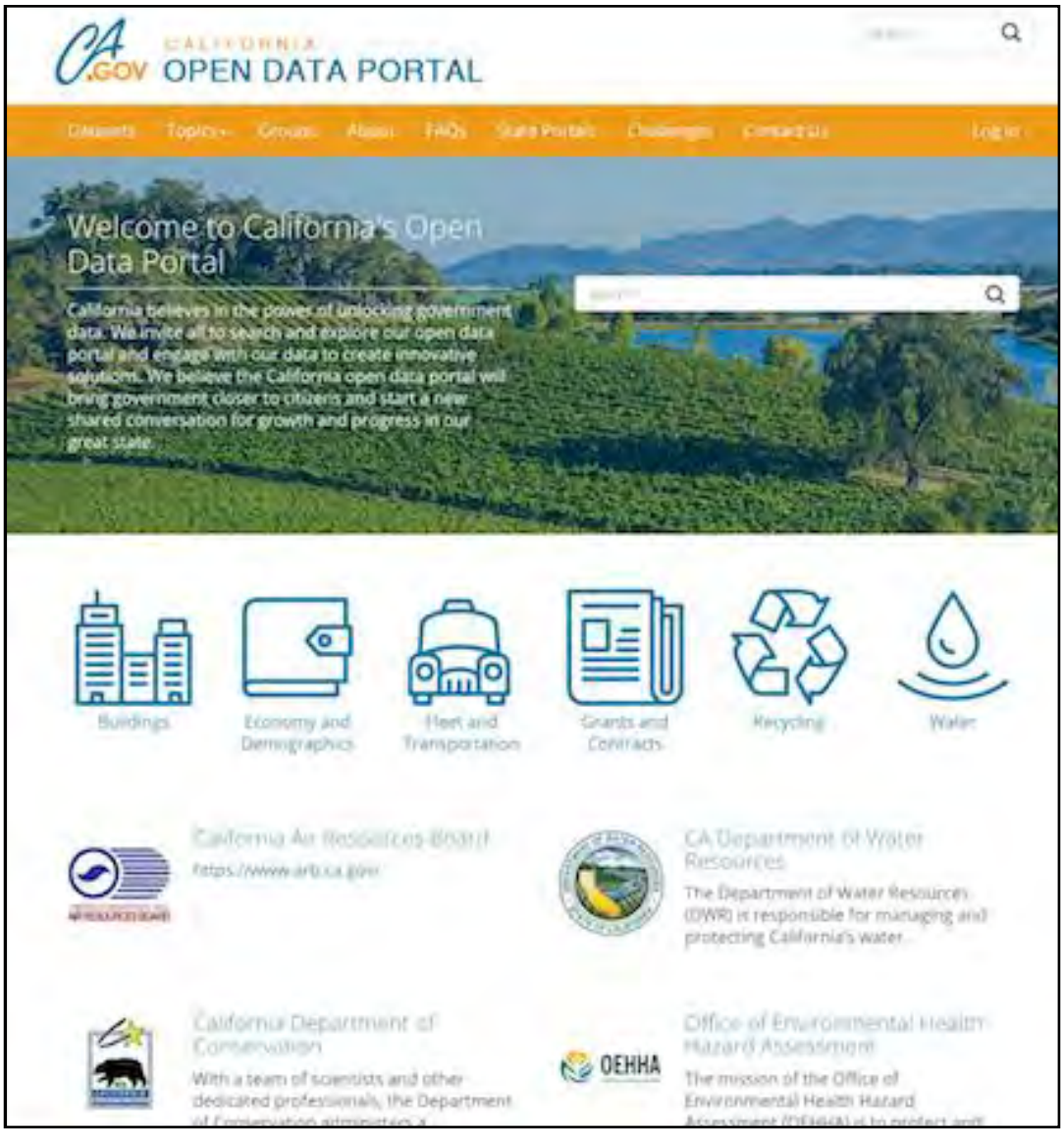



**Figure 3. State of California Open Data Portal**

*Source:* data.ca.gov

A dataset from the State's Air Resources Board as shown in Figure 4 illustrates the ways in which the Portal supports open data principles:

**Figure 4. Open Data Principles Demonstrated by a Dataset from the California Air Resources Board on the California Open Data Portal**

*Source:* https://data.ca.gov/dataset/california-air-resources-board-gis-datasets

Other examples of government websites that have implemented open data principles, some to a greater degree than others, can be found throughout this report, particularly in Section VI beginning on page 29.

It is no coincidence that many open data sites share a markedly similar visual style. Most rely on the same small handful of data hosting platforms. In the case of the California site, the platform is **DKAN**, which describes itself as "a better way to publish open data;" the New York DOT site (see Section VI) and many others use **Socrata**, self-described as "cloud-based democratization for government."[22]

Nascent open data efforts such as California's demonstrate an important point: it is not necessary for an agency to commit "lock, stock, and barrel" to overhauling its Web presence in order to begin implementing open data. Many of the sites studied for this report that initially appeared to have fully implemented open data were later found to have implemented it with only a few data products, and even those, in some cases, were missing most of the metadata that makes open data discoverable. In other cases, although data were offered for downloading, the only format in which they were offered was PDF files. Or datasets were available, but when links to promised visualization tools were followed, the viewer was notified that they were not yet functional. The point is not to find fault with these agencies but to recognize them for their courage in experimenting for the public good – to be among the "early adopters" who will become known as the innovators who led the rest.

# V. EXAMINING THE CURRENT DRISI DATA LIBRARY, INCLUDING CALIFORNIA QUICK FACTS AND THE TRAVEL AND RELATED FACTORS DATA PRODUCTS

In 2007, the State undertook a major redesign of its website portal, unifying State departments under a common "brand." In 2013, the State introduced another major redesign built on a template that automatically adjusts to smaller screens, allowing mobile and tablet users to navigate more easily (known as mobile-optimized). The rollout of the 2013 design did not reach Caltrans until March 2016 – just two months before the State would launch yet another major redesign to be discussed later. Rollout of the 2013 template across the entire agency is expected to take several years. Unfortunately, the first phase updated only top-level pages. In the case of DRISI, much of the site appears to have the new design. Figure 5 shows the new mobile-optimized design for DRISI's homepage, while Figure 6 shows the System Information Data Library – a major source of data products for Caltrans which retains the old design.

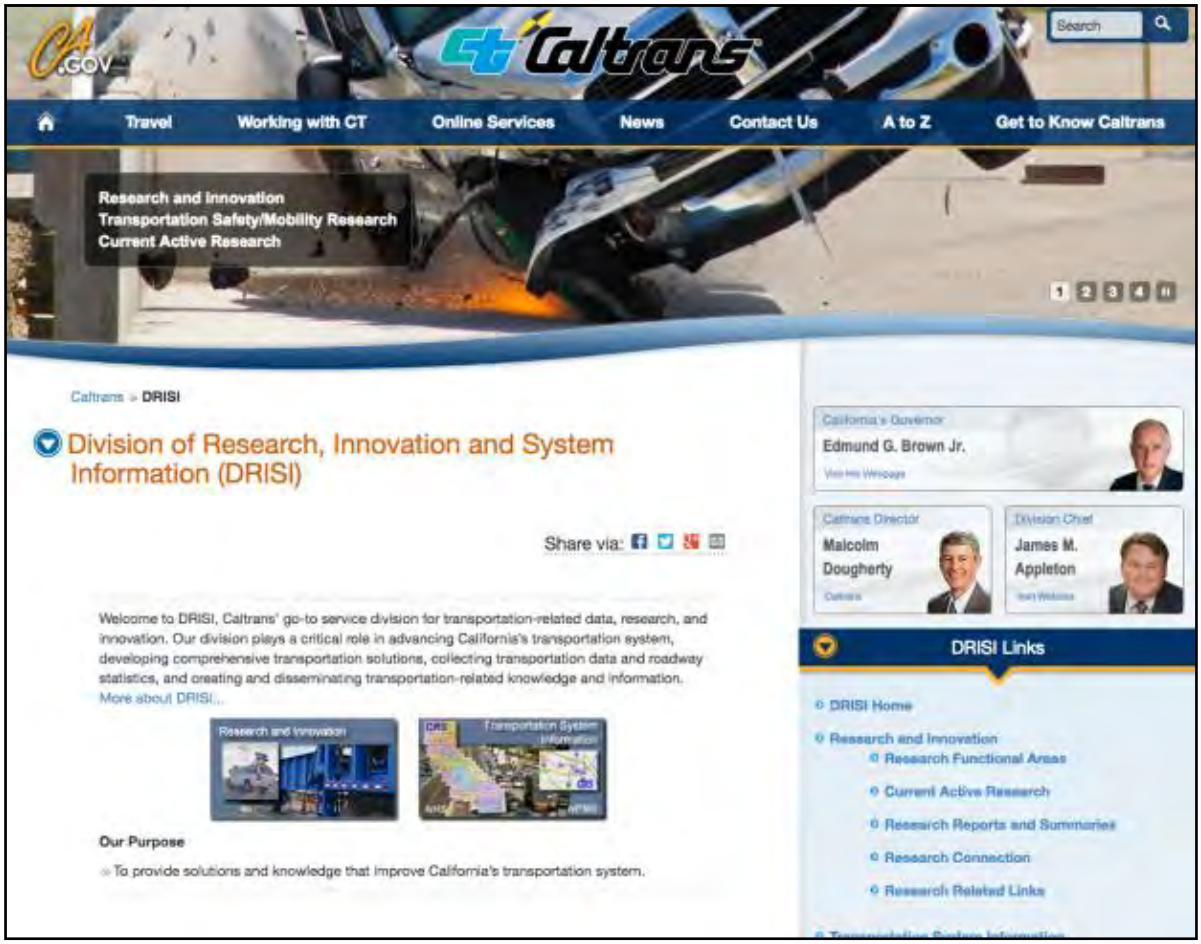



**Figure 5. Caltrans DRISI Home Page**

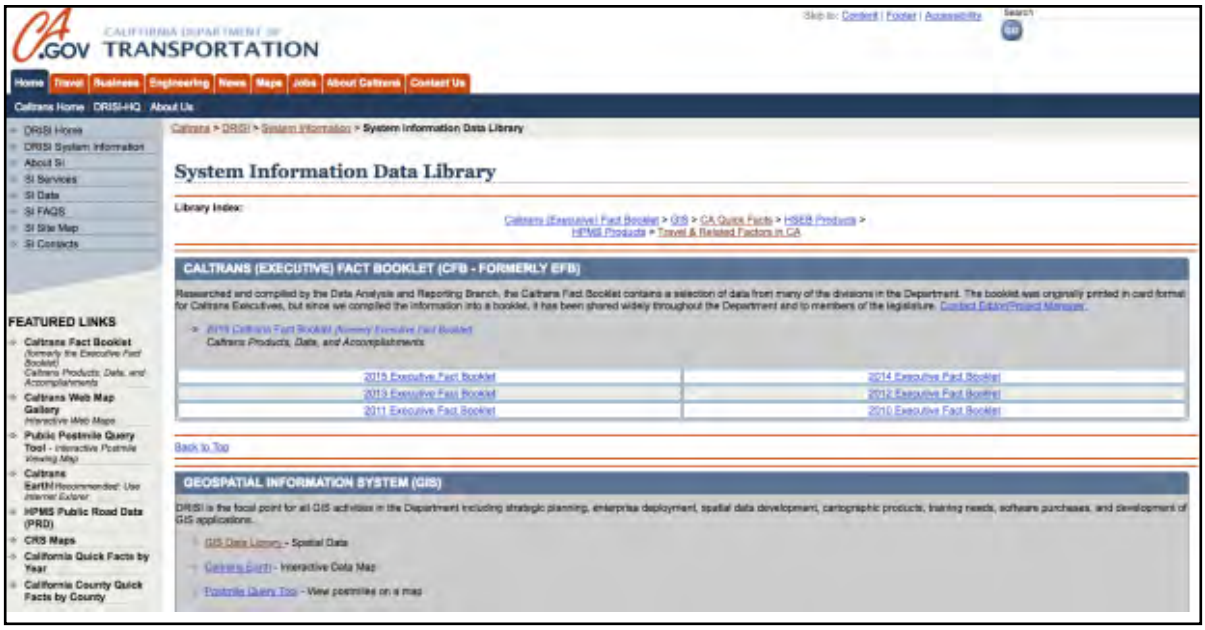



**Figure 6. Caltrans DRISI Data Library**

## ACCESS/DISCOVERABILITY

There is no obvious path from the main agency home page to either the main DRISI page or Data Library itself. If a visitor knows the DRISI division name, of course, they can enter it into the site search, but most visitors will not know the name, nor will they know that the DRISI section of the site houses the Data Library. Breadcrumbs on the system information page (see Figure 7) suggest there is a direct path from the Caltrans home page to the DRISI page, but, unfortunately, that path is not clear to the user when navigating through the site.

**Figure 7. Breadcrumbs on the System Information Page**

If an organization's website must serve both internal and external customers, priority must be given to external customers since occasional visitors can't be expected to know or learn, for example, how the agency is structured, its divisions and their roles, or which group(s) and individuals are responsible for which functions. Thus, everything from the site structure to navigation, pages, interactive tools, documents, and the content within each Web page or document, must be designed so that consumers, with a quick glance at a menu or a list of links, instantly know which of the clear and distinct options will take them in the right direction. Usability expert Ginny Redish says visitors are "on a hunt – a mission" to "get to 'the good stuff' – to whatever they're looking for – as quickly as possible." They don't mind having to click through several "pathway pages" (pages that provide little or no content themselves but act as tables of contents, which includes the DRISI home page, as well as the System Information, SI Services, and System Information Library introductory pages) as

long as each provides what user interface engineer Jared Spool refers to as “the scent of information”[23] – clues that give them confidence they’re on the right track.[24] Figure 8 lists the features services on the DRISI System Information Services page – here is an opportunity where Caltrans may wish to consider how information is presented – what is the logical order? How do each of these items relate to one another as a “Featured Service.”

**Figure 8. Links on the System Information Services Page Lead to Content on the Data Library Page but Order/Structure Could be Improved**

## CONTENT

A major focus of this research for Caltrans' focus for this research was on two key products located in the Data Library: **California Quick Facts (CQF)**, and **Travel and Related Factors in California (TRFC)**. In the following subsections, an analysis of each of these products is provided.

### California Quick Facts (CQF)

The title of the *California Quick Facts* product may not provide adequate guidance to a user regarding what the product contains. In fact, although it is later referred to as the *California Transportation Quick Facts*, the primary link on the Data Library page uses the title *California Quick Facts*. Information consistency is important for site visitors so that as one navigates through the site, one doesn't discover different titles or terms for the same product. While the diversity of information contained in the product may best be summarized as "facts," people almost never go looking for "facts" – they look for specific types of information for specific purposes; thus, it would be best if the product should be accompanied by a description that contains a sampling of these specific information types.

The title is also very similar to the *Caltrans Fact Booklet*, a separate document posted on the same main Data Library page, which could lead to confusion. At first glance, site visitors may not distinguish between the two products and Caltrans may wish to consider a better way to distinguish each product, or event look to see if that information could be combined into a single site, particularly since the *Caltrans Fact Booklet* is a PDF which has limited reusability.

Looking more closely at how the *California Quick Facts* product is presented on the main Data Library page, a user is faced with choosing between two distinct options: "California Quick Facts by Year" or "California County Quick Facts by Year and by County" (see Figure 12). The two versions are treated from the start as if they are qualitatively different – users must choose which version they want before setting eyes on the data. Yet, it turns out the two versions are virtually identical, from the topics they address to their appearance (see Figure 10). It may be useful to implement an interactive data management and visualization tool which could allow for easy switching between how the data is presented and made available to the user.

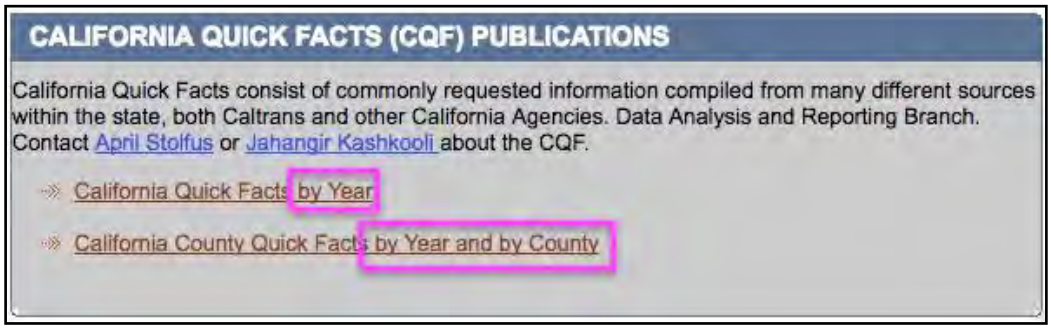



**Figure 9. Two California Quick Facts Subproducts**

According to the 2016 release of a large-scale usability study conducted each year since 1996,[25] "When users can't clearly distinguish between similar navigational categories or links, they struggle to find the right path to content. Category and link names need to make sense on their own, *but also in conjunction with other options on the site* [e.g., the two versions of *Quick Facts and* the *Caltrans Fact Booklet*]. If multiple sections or pages could address a specific information need, users must explore each or make their best guess. Alternatively, they may turn to search or even leave the site."[26] In fact, "competing links and categories" ranked second on their list of the ten most common Web design mistakes.[27]

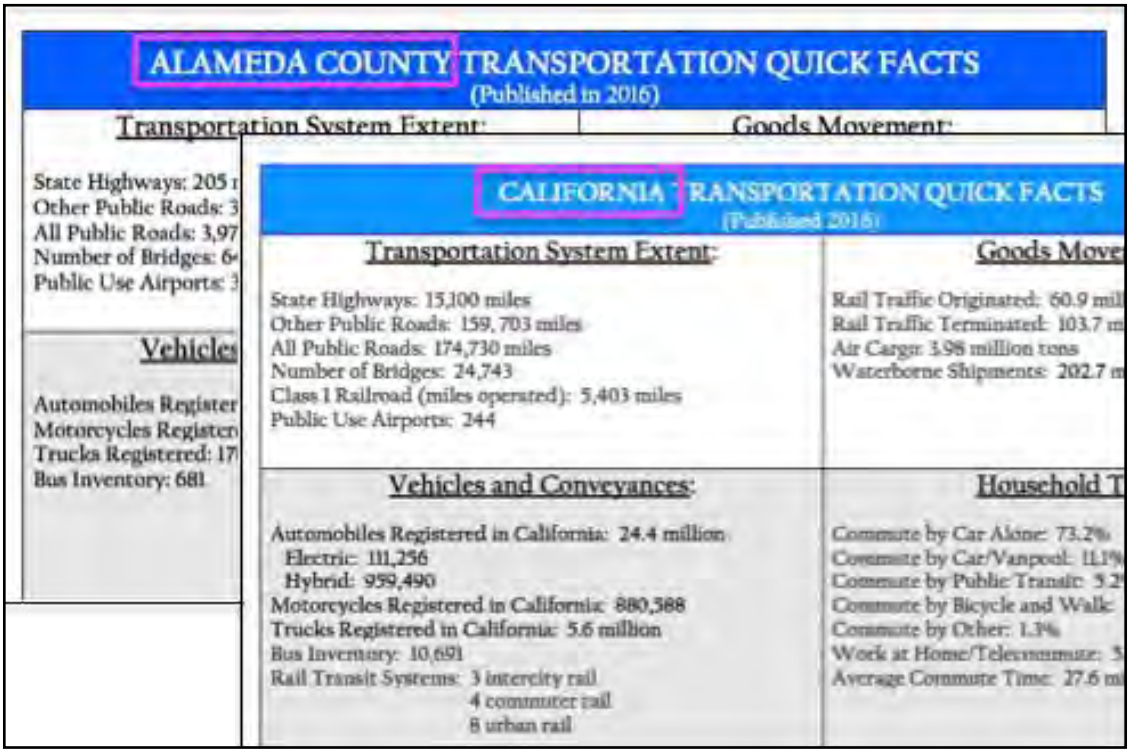



**Figure 10. 2016 California Quick Facts for Alameda County (Back) and the Entire State (Front)**

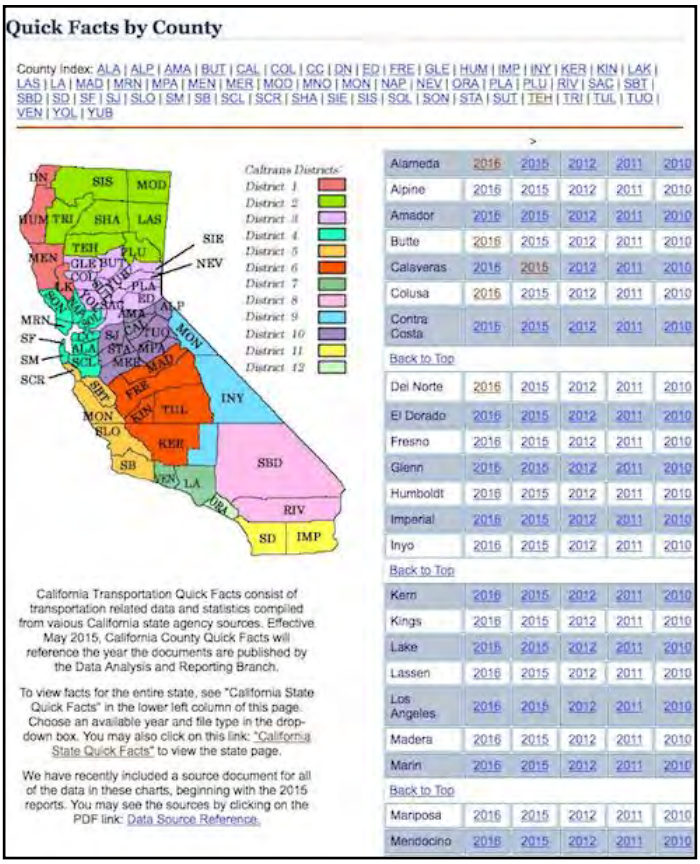



**Figure 11. California Quick Facts by County Could be Simpler**

To keep users oriented, page headings should, to the extent possible, match the text of the link the user followed to get there; neither of the CQF landing pages do so. The link labeled “California Quick Facts by Year” lands on a page with the heading “California Transportation Quick Facts;” the one saying “California County Quick Facts by Year and County” (which mentions “county” twice) lands on a page with the heading *Quick Facts by County*. The *Quick Facts by County* page is also complicated by unnecessary anchor links at the top of the page. The list of counties simply isn’t long enough to require this, and the abbreviations are probably unfamiliar to most visitors. In addition, the page provides a breakdown of the state by district, yet the data isn’t available by district. A paragraph of text explains that, as of May 2015, the documents reference the year they are published. Keeping website information fresh and current (in this context) is helpful for the user so that the assumption of currency is made. The reference to May 2015 information may no longer be needed, or could be removed to a footnote on the page. There is other text instructing users to visit the page offering the State totals. If the data from the two pages were combined this instruction would not be needed.

Tabs can be useful for breaking up long content that would otherwise be visually daunting, but in this case, there is no practical purpose by having them hide the links to the PDF and Word files that comprise *California Quick Facts by Year*. They double the number of clicks required to access the files for each year, and make a very simple product look more complicated than it actually is.

**Figure 12. Tabs Add Unnecessary Visual "Weight" and Require Extra Clicks**

The PDF and Word documents hidden behind each tab would be more accessible from a simple table, such as the one shown in Figure 13.

| *Year* | **Download PDF** | **Download Word Doc** |
|---|---|---|
| *2016* | | |
| *2015* | | |
| *2012* | | |
| *2011* | | |
| *2010* | | |
| *2009* | | |
| *2008* | | |
| *Etc.* | | |

**Figure 13. Eliminating the Tabs Reduces the Clicks Required to Download a Document by Half and Makes Quick Facts Look Lighter and Feel "Quicker"**

"Lighter" still is the form on the County page for downloading the State data as shown in Figure 14:

**Figure 14. Simplest Access to State Totals by Year**

*Source:* http://www.dot.ca.gov/hq/tsip/data_library/QuickFacts/QFCo.php

With a simpler presentation, both datasets could be offered from the same page, perhaps arranged in tables similar to Table 2. Offering them from the same page makes sense given that State version is merely the combined totals for all counties. In fact, an argument could be made for displaying county and state data in a single document for each year.

**Table 2. California Transportation Quick Facts**

| | State Totals | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2016 | 2015 | 2012 | 2011 | 2010 | 2009 | 2008 | 2007 | 2006 | 2005 | 2004 | 2002 |
| State Totals | | | | | | | | | | | | |

| | By County | | | | |
|---|---|---|---|---|---|
| | 2016 | 2015 | 2012 | 2011 | 2010 |
| Alameda | | | | | |
| Alpine | | | | | |
| Amador | | | | | |
| Butte | | | | | |
| Calaveras | | | | | |
| Etc. | | | | | |

## Travel and Related Factors in California (TRFC)

Travel and Related Factors in California (TRFC) is a collection of data products posted on the main Data Library page towards the bottom of the page (see Figure 15). Unlike *California Quick Facts*, TRFC is not gathered on a separate page from the main Data Library page.

**Figure 15. Travel and Related Factors – Not What "Travelers" Have in Mind**

Similar to CQF, it is possible that the title of this product is not intuitive to users outside Caltrans. The product consists of three sets of data: demographics; fuel usage; and multi-modal transit. At first glace, some of the data contained within these three categories may not match user expectations. For example, demographics includes licensed drivers in California, population by County, registered vehicles, and registered electric & hybrid vehicles. A complete list of data for TRFC is provided in Table 3.

**Table 3. Summary of Data Available in the Travel and Related Factors in California Section of the Data Library**

| Feature | Travel and Related Factors in California (TRFC) |
|---|---|
| *Media* | PDF, Excel |
| *Summary* | No description given. Topics include number of registered vehicles, drivers' licenses, and population; fuel sales; and transit ridership |
| *Topics* | **Demographics**<br>• Number of Drivers Licenses Issued in CA 2008 – 2012, 2011 – 2015<br>• Population in CA by County 2009, 2013, 2012-2016<br>• California Estimated Registered Vehicles 2014, 2015<br>• California Registered Electric & Hybrid Vehicles 2011-2015<br>**Fuel Usage**<br>• Fuel Sales Including Aviation Fuel 2005 – 2010, 2011 – 2015<br>• Fuel Sales Excluding Aviation Fuel 2008 – 2012, 2011 – 2015<br>• Fuel Sales - Diesel Fuel 2008 – 2012, 2011 – 2015<br>**Mass/Multimodal Transit**<br>• Commercial Air Passenger Annual Emplanements and Deplanements by Major CA Airport, 2007 – 2011, 2011 – 2015<br>• Combined Bus & Rail Ridership by Fiscal Year FY 2006 – 2011, 2010 – 2015<br>• Bus Ridership by Fiscal Year FY 2006 – 2011, 2010 – 2015<br>• Commuter Rail Ridership by Fiscal Year FY 2006-2011, 2010 – 2-15<br>• Ferry Ridership by Operator and by Fiscal Year, 2006 – 2011, 2010 – 2015<br>• Intercity Rail Ridership by Fiscal Year<br>• Light Rail Ridership by Fiscal Year<br>• Statewide Bus Transit Ridership by County by Fiscal Year 2007 – 2012, 2011 – 2016<br>• Light Rail Ridership by Fiscal Year 2006 – 2011, 2010 – 2015<br>• Statewide Bus Transit Ridership by County by Fiscal Year 2006 – 2011, 2010 – 2015 |

The data is typically available in both PDF and Excel formats, with the latter potentially more useful to users because of the ability to reuse the data for further analysis. At the time of this research (May 2017), several links to the data were broken (e.g. all of the fuel usage data) which highlights another challenge when providing data sourced from other sites. As the information and sites can changed and/or updated, the links can easily become broken and outdated. A Content Management System that includes a module that checks for broken links could alleviate or work with a third-party vendor that provides this service may be an alternative. However, ideally, data generated by any and all California agencies should be available through a consolidated and *comprehensive* open data portal.

## PRESENTATION

Upon arriving at the Data Library page from the Caltrans home page or another high-level page on the Caltrans site, it is very quickly apparent that the site has been going through a transition from the old design to a new design (see Figure 16). This can be problematic for the agency as the credibility of the information may be questioned (e.g. Is this archived, historic information that is no longer updated? Am I still at a legitimate Caltrans site?).

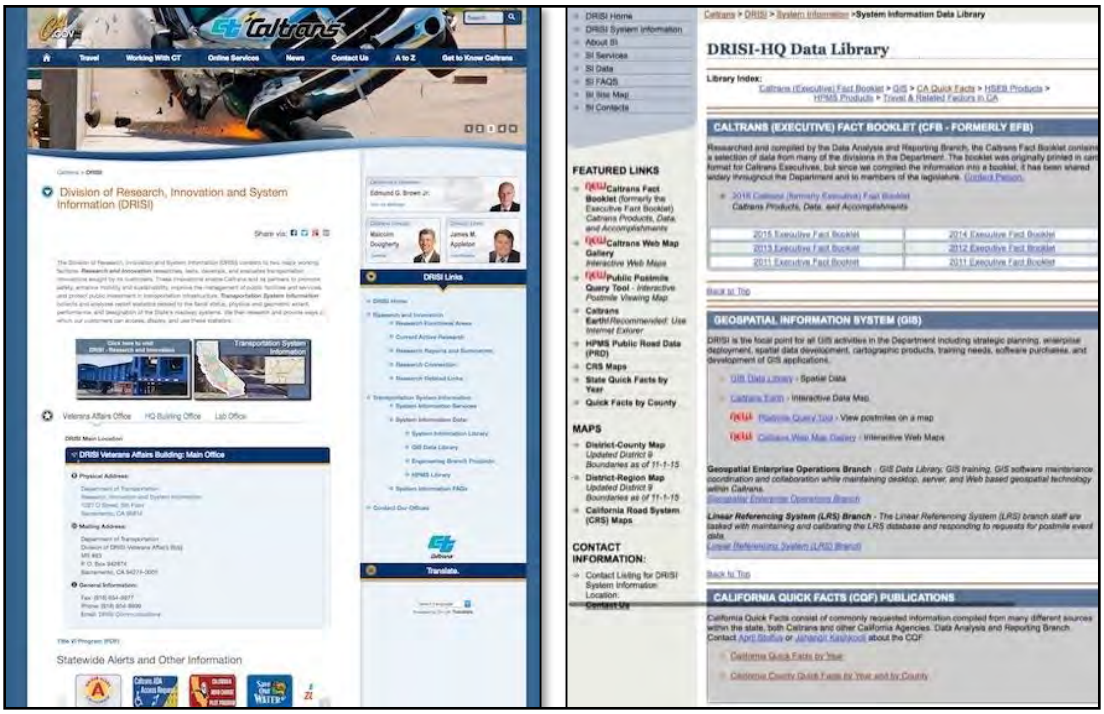



**Figure 16. Current DRISI Division Home Page (L) and Data Library Page (R)**

According to Stanford Web Credibility Research, credibility "doesn't reside in an object, a person, or a piece of information," therefore, when evaluating the credibility of technology products, "one is always discussing the *perception* of credibility [emphasis added]."[28] Studies by Stanford researcher B.J. Fogg and others found that "people quickly evaluate a site by visual design alone."[29] Among the qualities influencing users' perceptions of credibility is the perceived professionalism of a site. Sites thought to be "amateurish" are deemed less credible by users, and three indicators (to them) of "amateurishness" are broken links, typographical errors, and infrequently updated content. The first two of these indicators are found in the DRISI Data Library, and the older template makes it *appear* to have the third. Fogg wrote, "These 'small' glitches seem to have a large impact on Web credibility perceptions. Even one typographical error or a single broken link is damaging."[30] His research also found that "[p]eople assign more credibility to sites that show they have been recently updated or reviewed." But there are other reasons as well to minimize the stark contrasts between the new and old Caltrans templates, and these will be addressed in the recommendations.

# VI. EXAMINING SELECTED CALIFORNIA AND FEDERAL AGENCY WEBSITES

In this chapter, an overview of selected California government websites are discussed. In addition, several other state Department of Transportation websites and data portals are reviewed along with an analysis of a selection of federal government websites.

## STATE OF CALIFORNIA: CA.GOV AND THE OPEN DATA PORTAL

On May 10, 2016, the State of California launched a completely redesigned ca.gov website "to better help its citizens access key state services in one easy-to-use site."[31] The new design (see Figure 17) features a clean, uncluttered home page and long pages with multiple, visually distinct panels. The trend toward longer pages is a direct result of the stunning rise in the share of Web access time now being spent on mobile devices. Since mobile devices load pages more slowly, users prefer longer pages packed with more information.

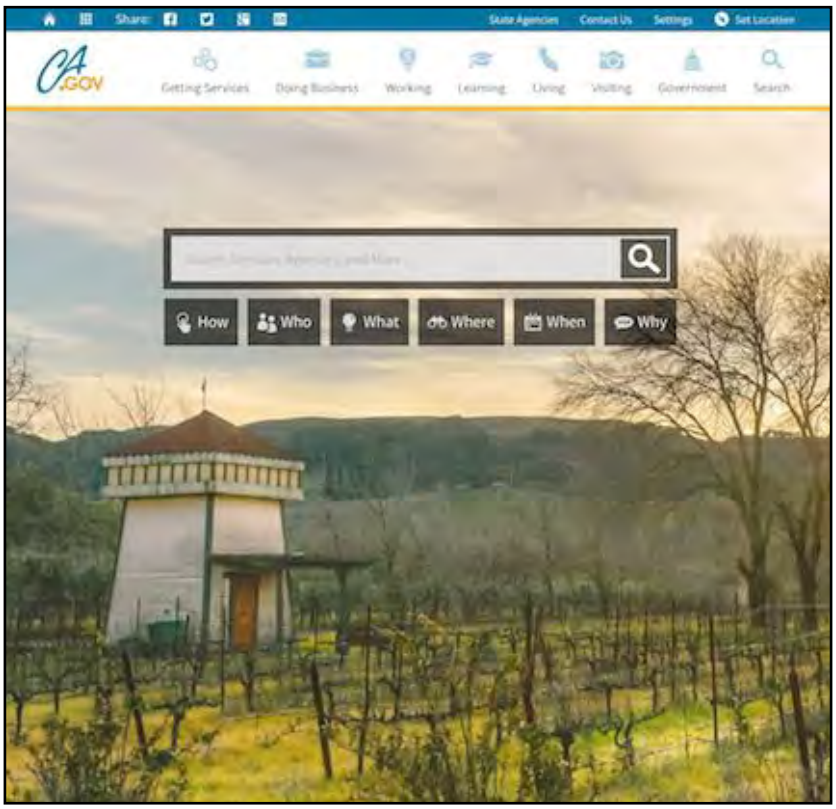



**Figure 17. The State's New Home Page Exemplifies Constituent-Driven Design**

## California Open Data Portal

As mentioned previously, the **California Open Data Portal** features 37 datasets as of May 2017 from eleven State agencies, including:

- Air Resources Board
- CalRecycle
- Caltrans
- Department of Conservation
- Department of Finance
- Department of General Services
- Department of Water Resources
- Environmental Protection Agency (CalEPA)
- Office of Environmental Health Hazard Assessment
- State Water Resources Control Board
- Strategic Growth Council

The site also provides links to seven additional open data portals operated by the State of California, as exemplified by the California Health and Human Services site.

## California Health and Human Services (CHHS) Open Data Portal

The **CHHS Open Data Portal** (see Figure 18) offers excellent examples of open data, with 477 datasets as of May 2017, each described in detail by up to 25 fields of metadata. The site's catalog index is continuously updated. Each record includes a unique identifier for each dataset, the type of object, the name, description, creation date, last update, category, keywords/tags, publisher, contact point, posting frequency, temporal and geographic coverage, limitations/exclusion statements, language presented in, and various other fields that provide information on the source or related resources for the data, and comments on how it might be used.

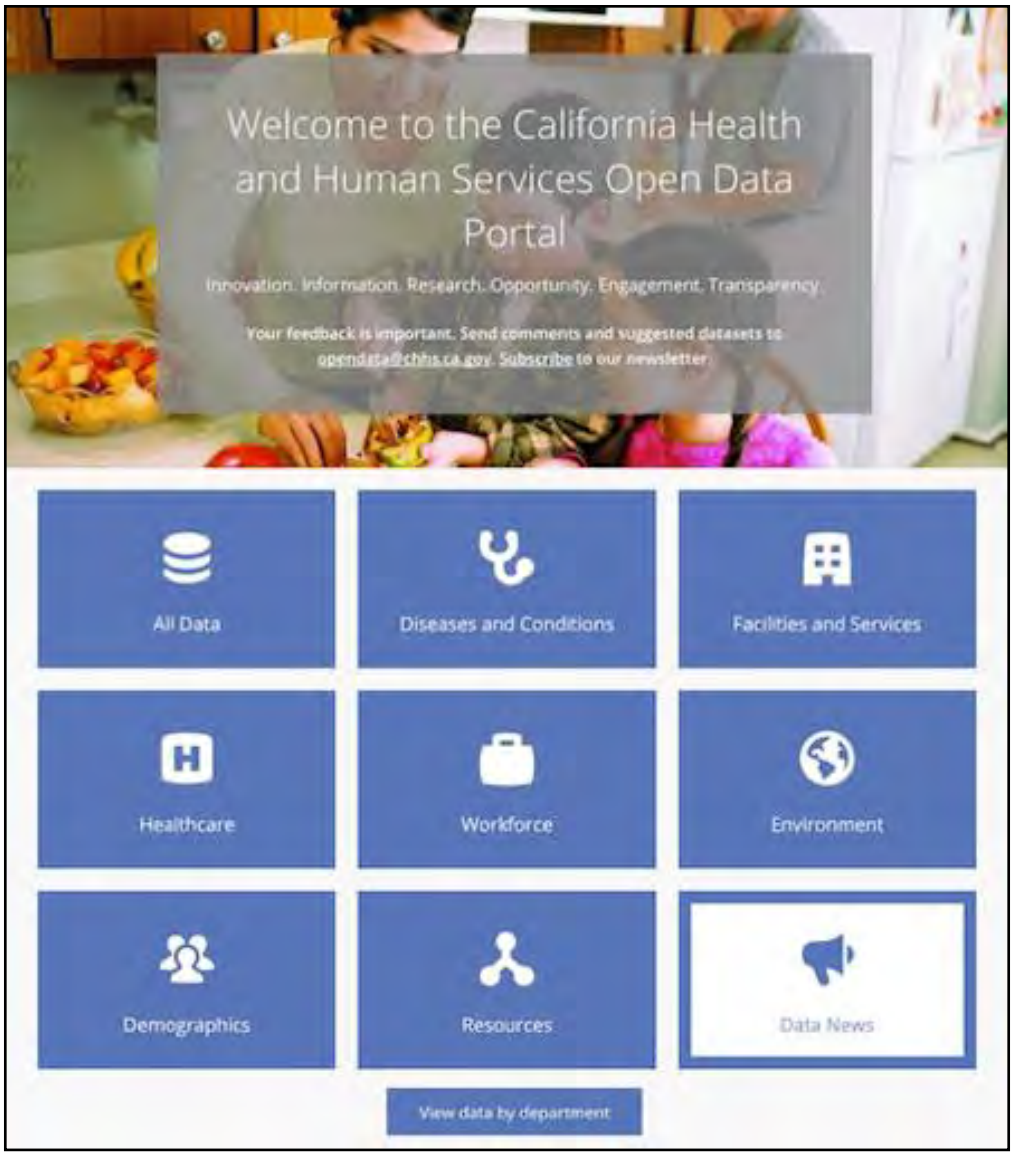



**Figure 18. California Health and Human Services (CHHS) Open Data Portal**

The open data portal includes a number of features to allow users to interact directly with the data through the site. These include tools such a filters, different visualization tools for graphing the data, as well as the ability to download the data in a number of formats which allow users to reuse, combine, and otherwise analyze the data on their own.

Not all the sites offer data in as wide a variety of exportable file formats as the CHHS site, but all are mobile-optimized and have a sleek, modern look consistent with federal open data sites. Also like the federal sites, they are generous in providing helpful resources for other agencies. For example, the California Department of Health and Human Services site offers an HTML version of its *Open Data Handbook*.[32] Meant for internal use but freely offered to the public, the handbook provides guidelines to identify, review, prioritize and prepare publishable CHHS data for public access, with an emphasis on value, quality, data and metadata standards, and governance. In addition to guidelines, the site also provides links to the tools and resources it uses to operationalize its processes.

## CALIFORNIA REGIONAL AND LOCAL TRANSPORTATION AND OTHER AGENCIES

California's metropolitan planning organizations (MPOs), city and local transportation agencies, and agencies tangentially related to transportation are, overall, ahead of Caltrans and other state DOTs with respect to modernizing data and its delivery. The following subsection provides a sampling of regional sampling and state websites.

### Metropolitan: Southern California Association of Governments (SCAG)

The **Southern California Association of Governments** (SCAG) is the largest metropolitan planning organization in the U.S. It also serves as the region's RTPA. SCAG provides a direct link to their data page from the homepage. The data page provides a clear layout with intuitive subheadings and brief descriptions.

**Figure 19. Data and Tools on the SCAG Website**

The data library, accessed from the main "**Data and Tools**" page, provides direct downloads for a number of datasets (see Figure 20). While most of SCAG's data is not available in an interactive format the way CHHS data was, their GIS mapping application does provide some visualization tools for demographic and economic data.

**Figure 20. Detail of SCAG ZIP File Download Showing Metadata**

## California Air Resources Board

The **California Air Resources Board** (CARB) provides an extensive array of data on their site. Suffice it to say that it is likely to satisfy the most demanding environmental data wonk. CARB is one of several agencies examined for this study that, despite its less-than-cutting-edge appearace, has fully embraced and implemented open data principles. This should encourage agencies like Caltrans who may not be able to make sweeping changes to their sites in the near future but are eager to provide customers with the benefits of open data.

Figure 21 provides an example of the type of air quality data statistics available at the CARB website. For each data type, a user can click on the topic, and then filter the data in a number of different ways depending on the specific topic. In some cases, data is available back several decades and in a wide range of geographic areas. A simple, interactive tool allows the user to produce graphs and compare data for many of the topics.

It's worth noting that the old-school design of these pages comes from a template that appears to be from 2009, yet it offers such an abundance of value, it could conceivably be one of the site's most-visited pages. Visitors can see and manipulate the data directly in a browser without having to download and open it in another application, and the simple, onscreen configurability of the output.

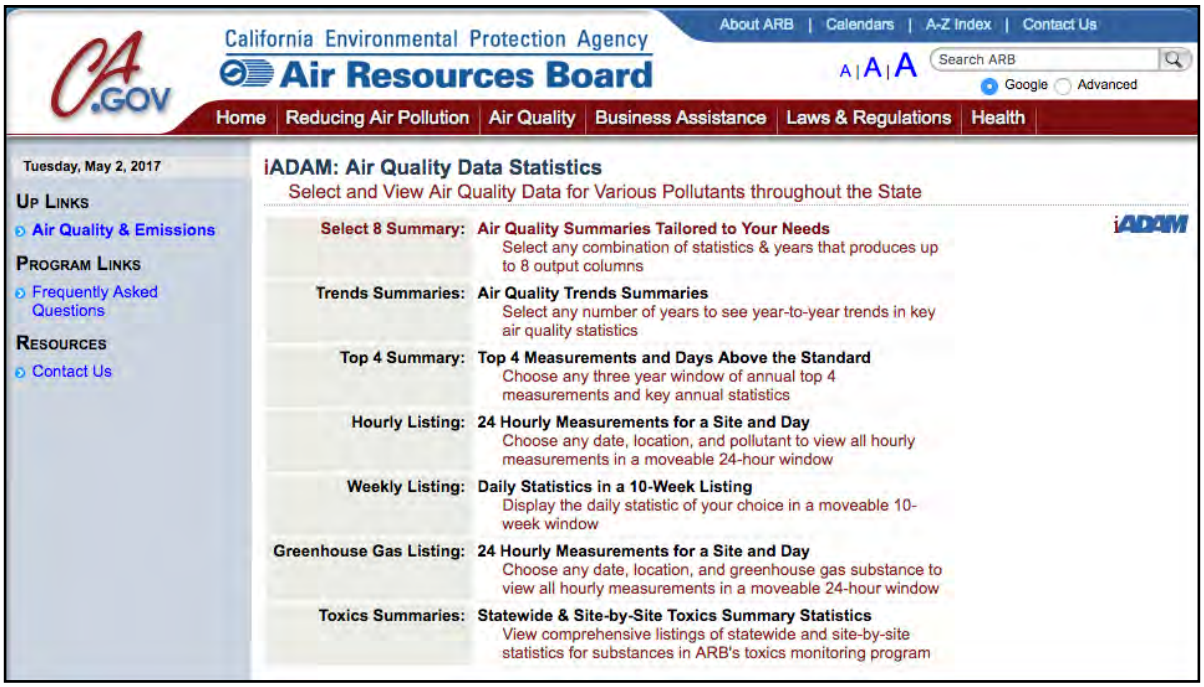



**Figure 21. Example of Air Quality Data Statistics Available on the California Air Resources Board Website**

## DETAILED ANALYSIS OF SELECTED STATE DEPARTMENTS OF TRANSPORTATION WEBSITES

This section examines data on the websites of other state departments of transportation. All fifty state DOT sites were explored; thirteen besides Caltrans were examined in depth. Like Caltrans, these agencies are responsible for transportation systems located in densely populated states or districts – the highest in the nation, in fact – and they were selected for that reason. They are presented in alphabetical order.

### Connecticut Department of Transportation (CDOT)

The website (see Figure 22) of the **Connecticut Department of Transportation** has an older look and feel.

**Figure 22. CDOT Home Page**

Data on the website can be difficult to find. Searching for “statistics” turns up documents (mostly PDFs) spread across different areas of the site. The site contains a page titles “Other Materials and Reports” that did offer links to an assortment of documents containing statistical information, but the offerings seemed somewhat random, and many products appeared to have been abandoned (see Table 4 for a list of documents). For example, a booklet called *Fast Facts* was available only for the years 2008 and 2012.

**Table 4. List of Statistical Documents on the CDOT Site**

| Feature | Other Materials and Reports |
|---|---|
| *Media* | HTML page of links to PDF files |
| *Summary* | An assortment of reports and data, some of which are like Caltrans' (e.g., "Fast Facts Booklet") |
| *Topics* | **Air Quality, Environmental and Cultural**<br>• Congestion Mitigation Air Quality (CMAQ) Program<br>• Call for Applications from RPOs (October 2011)<br>• Program Guide for RPOs (October 2011)<br>**Census Data, Trends and Demographics**<br>• Connecticut Census Review from 1990 - 2000<br>• Transportation in Connecticut: Trends and Planning Data<br>**Existing System and Fast Facts**<br>• Department's 2012 Fast Facts Booklet<br>• Department's 2008 Fast Facts Booklet<br>• Transportation in Connecticut: The Existing System<br>**Performance Measures**<br>• Connecticut DOT Performance Measures<br>• Planning Process<br>• Transportation in Connecticut: The Planning Process<br>**Public Roadway, Crash and Other Related Data**<br>• Highway Log<br>• Limited Access State Numbered Highways<br>• Guidelines for Subdivision Streets - January 1987<br>• State Highway Mileage<br>• Public Road Mileage<br>• 2015 Traffic Log<br>• 2010 High Occupancy Vehicle Lane Report<br>• 2008 Connecticut Traffic Accident Facts Report<br>• 2012 Connecticut Traffic Crash Facts Report<br>• 2014 Connecticut Traffic Crash Facts Report<br>**Rail and Bus Transit**<br>• Connecticut Transit Score Workshop<br>• Connecticut Transit Score Methodology Draft<br>• Transit Score Presentation with Connecticut DOT<br>• Train Station Visual Report<br>**Transportation Research Reports and Products**<br>• Link to Transportation Research Reports and Products Page |

## Florida Department of Transportation (FDOT)

With a dedicated item in its navigation menu saying "Maps & Data," the **Florida Department of Transportation** (FDOT) site initially seems promising (see Figure 23); however, the site offers very little data, and virtually all of it is in PDF format.

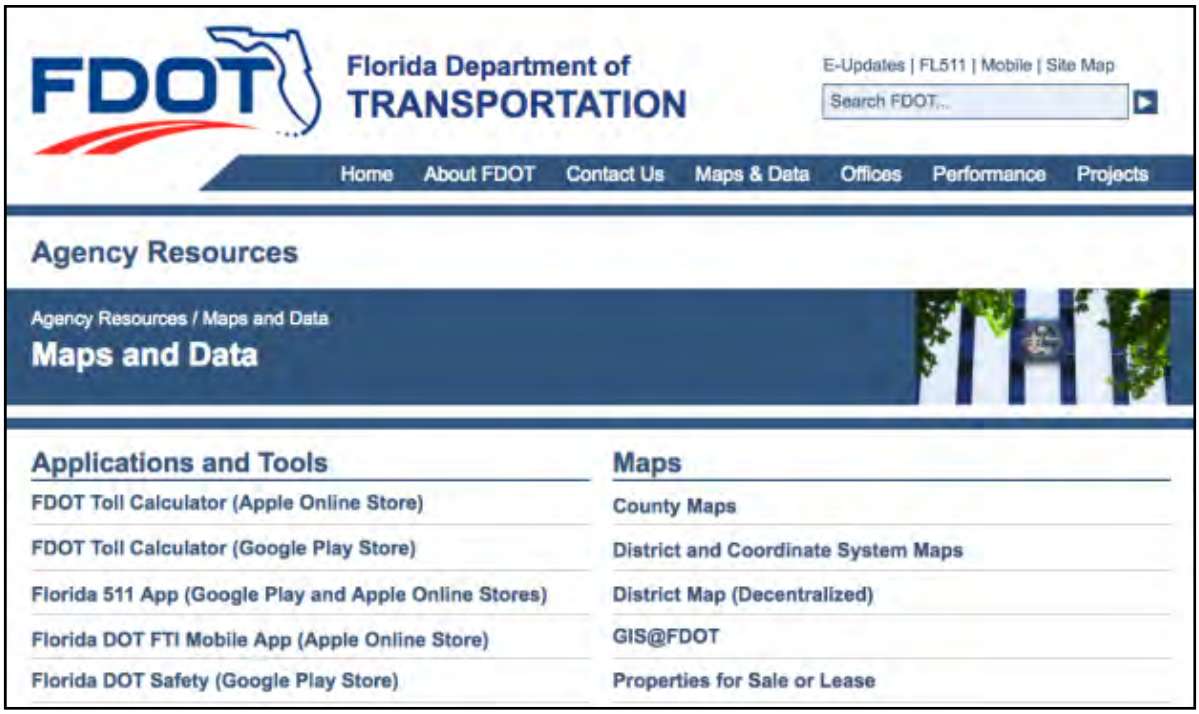



**Figure 23. Screenshot of Florida DOT "Maps and Data" Webpage**

*Traffic Data*

An analysis of the FDOT website revealed a number of potentially useful examples of how traffic data and other data is made available to the public. They include:

- **Florida Traffic Online** - A web-based mapping application that provides traffic count site locations and historical traffic count data. Traffic data is updated annually each April. See Figure 24 for a screenshot of the application.

- **Real-Time Traffic Information** - A web-based mapping application that provides real-time traffic count information (*PLEASE NOTE: This data is only activated during emergencies such as hurricane, wildfire, etc* ).

- **Florida Transportation Information DVD** - Disk with variety of current and historical transportation data. A new DVD is published in June each year.

- **Traffic Data Shapefiles** - GIS shapefiles of AADT, truck AADT, etc.

- **Traffic Monitoring Handbook** - How to perform traffic data collection.

- **Project Traffic Forecasting Handbook** - How to forecast traffic for analysis of future highway projects.

- **SPS Manual** - Survey Processing Software user manual.

- **Daily Vehicle Miles Traveled Reports** - Annual summary of traffic data by county and highway facility.

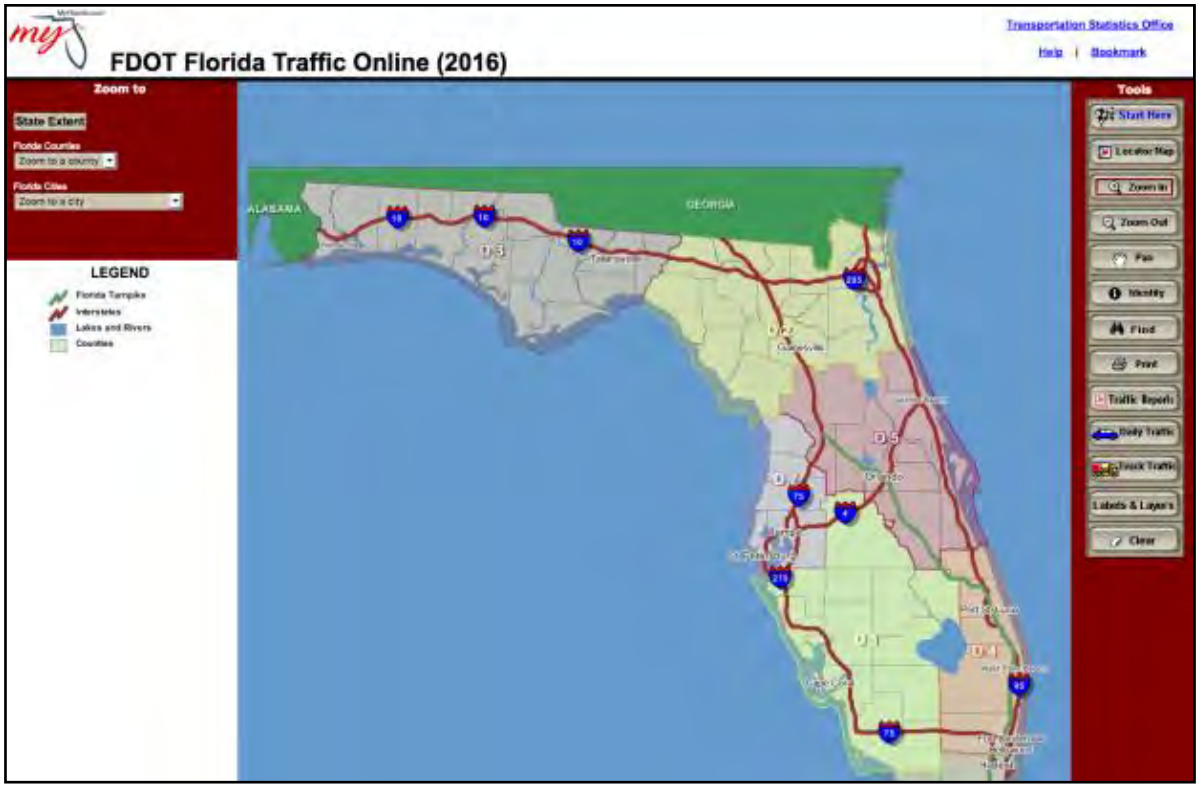



**Figure 24. Screenshot of FDOT "Florida Traffic Online" Website**

## Massachusetts Department of Transport (MassDOT)

The **Massachusetts Department of Transportation** (MassDOT) presents several navigation tools on the agency's Home page (see Figure 25). These include a main menu loosely based on travel mode (see Figure 26); a utility or "eyebrow" menu at the top of the page; a site search feature; and a tabbed section with four headings (see Figure 27): "How do I …?", Quick Links, Projects, and News.

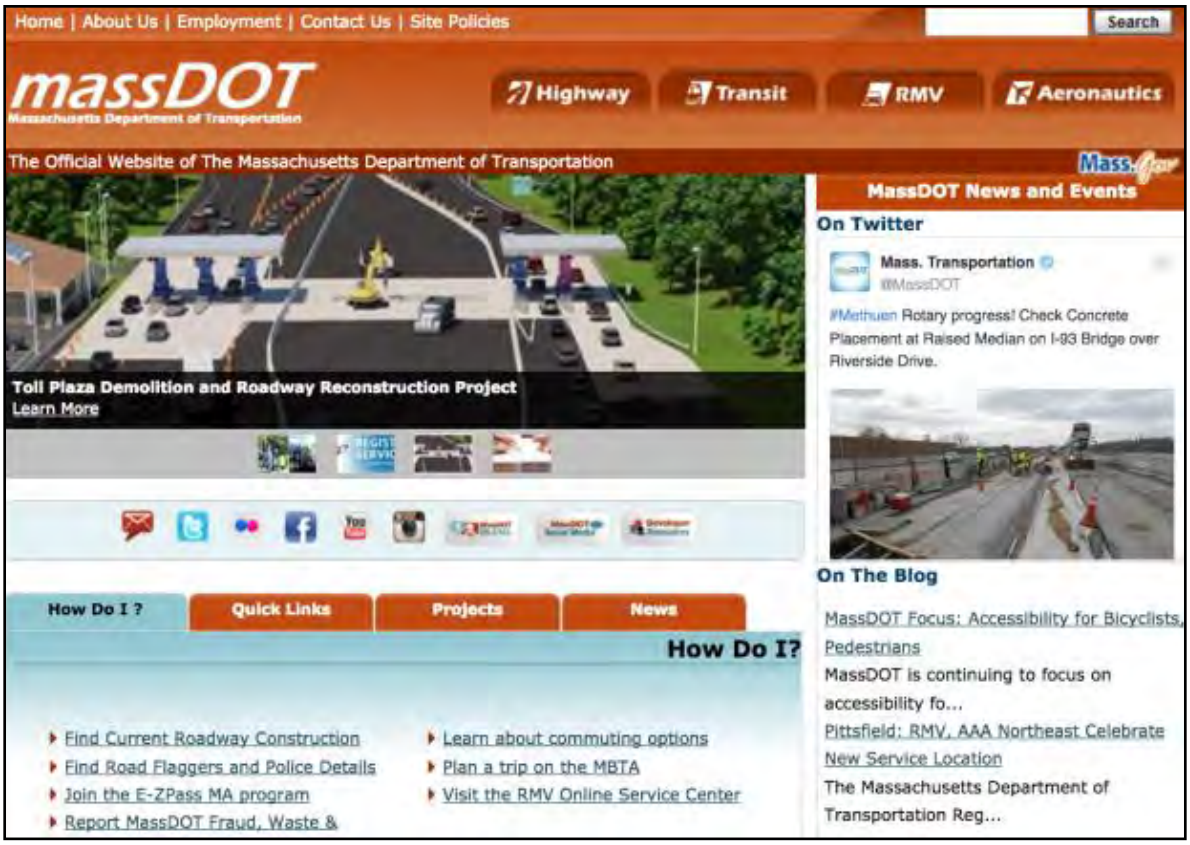



**Figure 25. MassDOT Home Page**

**Figure 26. Main Menu Navigation Based on Travel Mode**

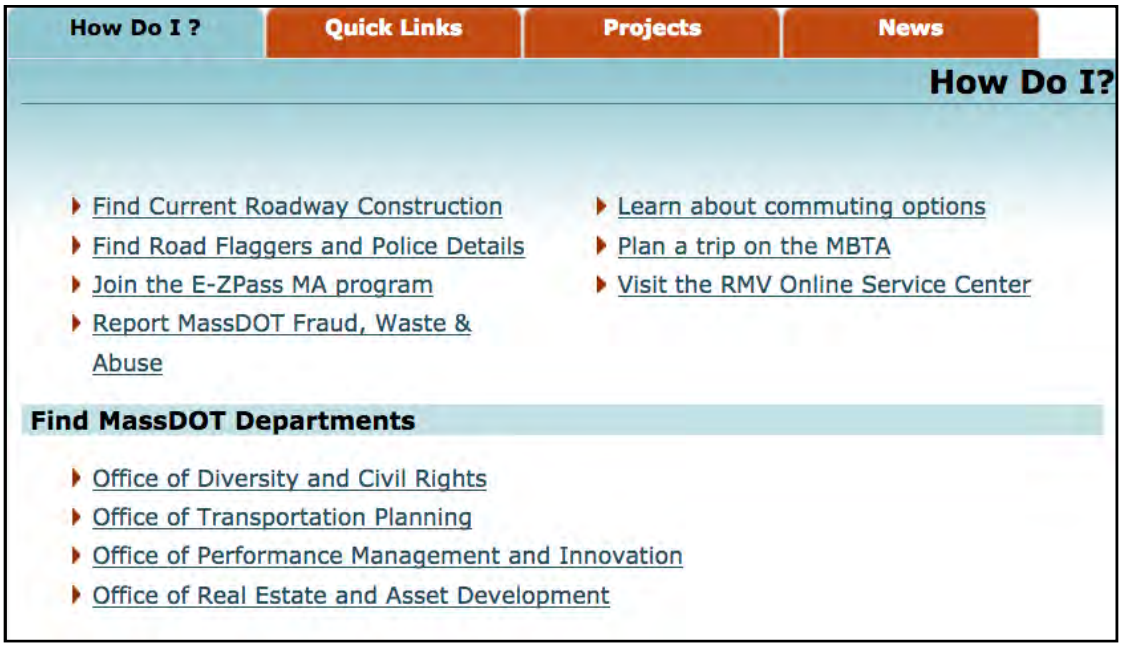



**Figure 27. Tabs Organize the Site Visually and Simplify Long Lists of Links**

The "How do I…?" tab also contains a list of agency departments, though this location seems unintuitive. MassDOT houses most data in two areas of the site: The **Information Center** (also called "Info Center") within the Office of Performance Management and Innovation, which contains performance and financial data, and the "Projects and Services" section of the **Office of Transportation Planning**.

A vertical sidebar (see Figure 28) down the right third of the page provides links to news releases, events, social media posts, and agency initiatives, one of which – the "Info Center" – contains the agency's performance and financial data.

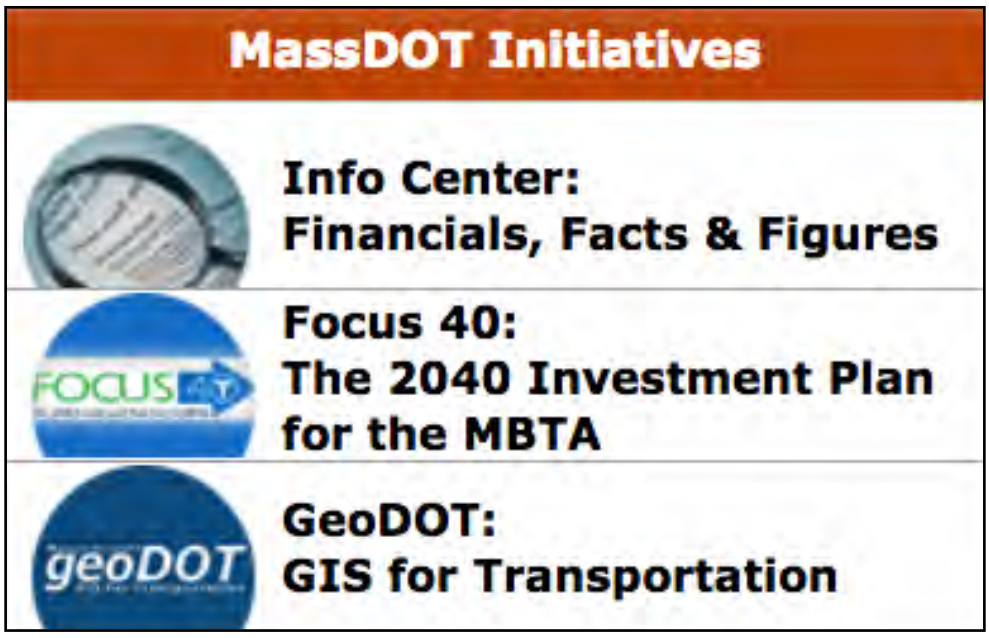



**Figure 28. Direct Link from Home Page to Data ("Info Center")**

The link is in the bottom right corner of the home page – an area that, according to usability studies, is often overlooked.[34] If the direct link is missed, visitors will find no obvious path in the main menu, which organizes the site primarily by mode: Highway, Transit, RMV,[35] and Aeronautics.

The "Information Center" ("Info Center" on the home page – see Figure 29) serves a function like the DRISI Data Library. The page offers a clean design with a short, bulleted introduction.

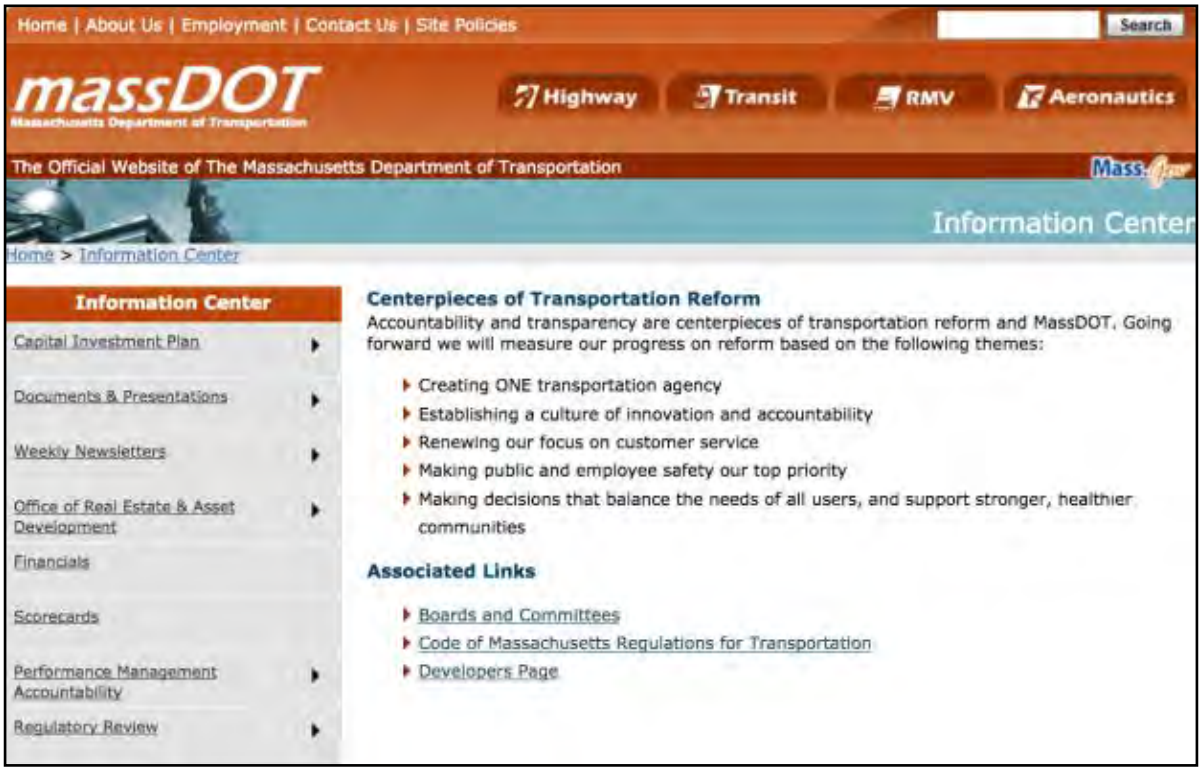



**Figure 29. "Info Center" Offers Data on Agency Performance and Finances**

Other examples of data presentation on the MassDOT website include their "**Open Data Portal**" which enables users to directly download datasets in a wide variety of formats (see Figure 30).

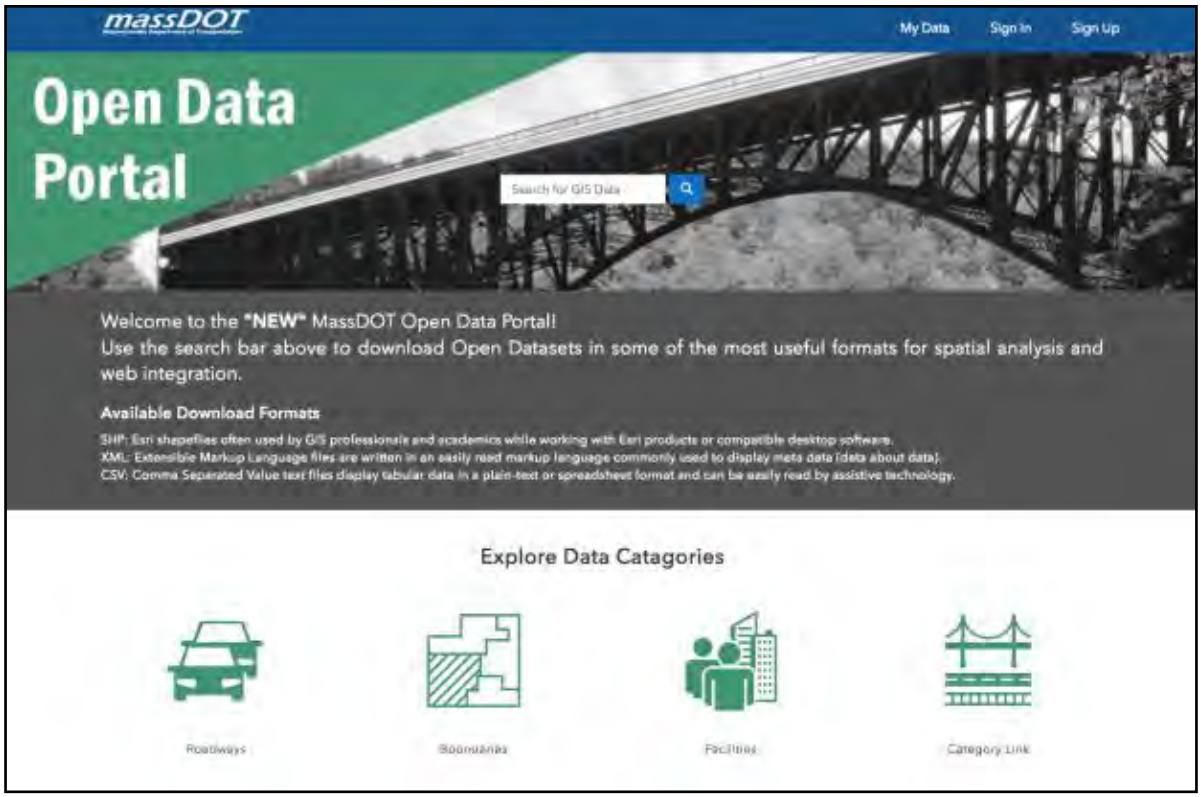



**Figure 30. MA geoDOT – GIS Open Data for Transportation**

## New Jersey Department of Transportation

The **New Jersey DOT** website (Figure 31) offers several similarities to the DRISI Data Library. Both rely on tables-based, non-mobile-optimized templates (the New Jersey templates appear to have been last updated in 2005) and older design trends, such as fixed-width pages; text-heavy pages with few images; smaller fixed-size fonts; blocks of high-contrast color, and frequent use of center-aligned text.

**Figure 31. New Jersey DOT Homepage**

The NJ DOT site does use hierarchical HTML headings, which increases the discoverability of its topics by search engines. A “Reference Data” section of the site appears to perform a function like the DRISI Data Library, offering most of the site’s statistical data, although some links point to resources on other state-managed sites. The section is available directly from the home page, although the link label (“Reference/Links” shown in Figure 32) suggests links rather than data and does not match the section name and does not necessarily suggest data.

**Figure 32. NJ DOT Main Menu**

The dropdown submenu is forbidding. It contains 24 uncategorized items, many of which wrap to two or three lines. In some cases, the second line of text aligns under the first; in others, it wraps to the left margin.

Statistical content is accessed mainly from the Reference Data page, though many of the links point to offsite resources. Topics center around crash data, a sidewalk inventory, GIS maps, safety programs, and roadway information and traffic monitoring data.

## New York Department of Transportation

The **NY DOT** site does not offer an intuitive path to data from the homepage (see Figure 33). The site does offer an "A–Z Index" but it contains nothing under "data," or "statistics" as specific keywords. There is a page titled "**Transportation Trends, Surveys & Statistics**" listed until "Transportation." This would not be considered a best practice as an individual searching for statistical data on a transportation agency website will not look under "transportation" because, presumably, everything on the site pertains to transportation.

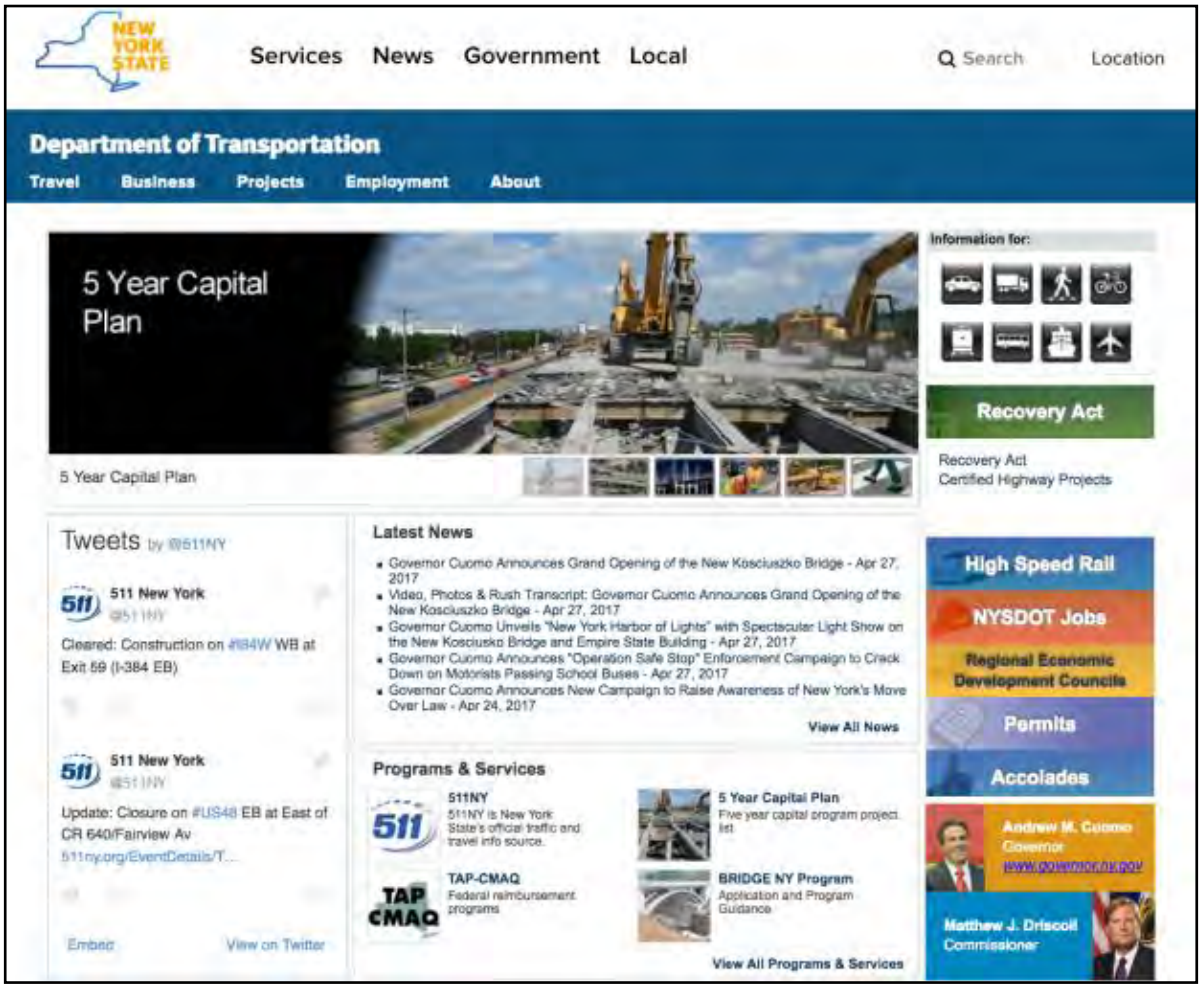



**Figure 33. NY DOT Home Page**

The **Transportation Trends, Surveys & Statistics** page is buried deeply within the Policy & Planning Division, as indicated by its breadcrumb (see Figure 34). Deeply nested pages are not a problem if the path to them is obviously intuitive, but the Policy & Planning home page offers no apparent link to the "Data Analysis/Research Bureau" housed within it. The page initially looks impressive with its lengthy data about the State's transportation system as well as national data from a variety of sources, including the US Census. Not all the

listed items are related to transportation; some are more general, such as population and geographic data. The links point to destination pages both on and off the NY DOT site. Some of these links are obsolete, and the lack of consistency in the landing pages detracts from the initial impression of the page as professional and well curated.

**Figure 34. Breadcrumb Shows Data Deeply Buried Down an Unintuitive Path**

Although not part of the NY DOT website, the state's open data portal (Figure 35) is worth noting since 368 of its 3,129 datasets – more than 10 percent – are in the transportation category. Caltrans may find it a useful reference when the agency is ready to make open data its standard.

The most frequently accessed transportation dataset (with nearly 1 million views views as of May 2017) is New Driver Application Status, which is updated several times daily. Several "view types" are offered, including calendars, charts, files and documents, forms, and maps, among others.

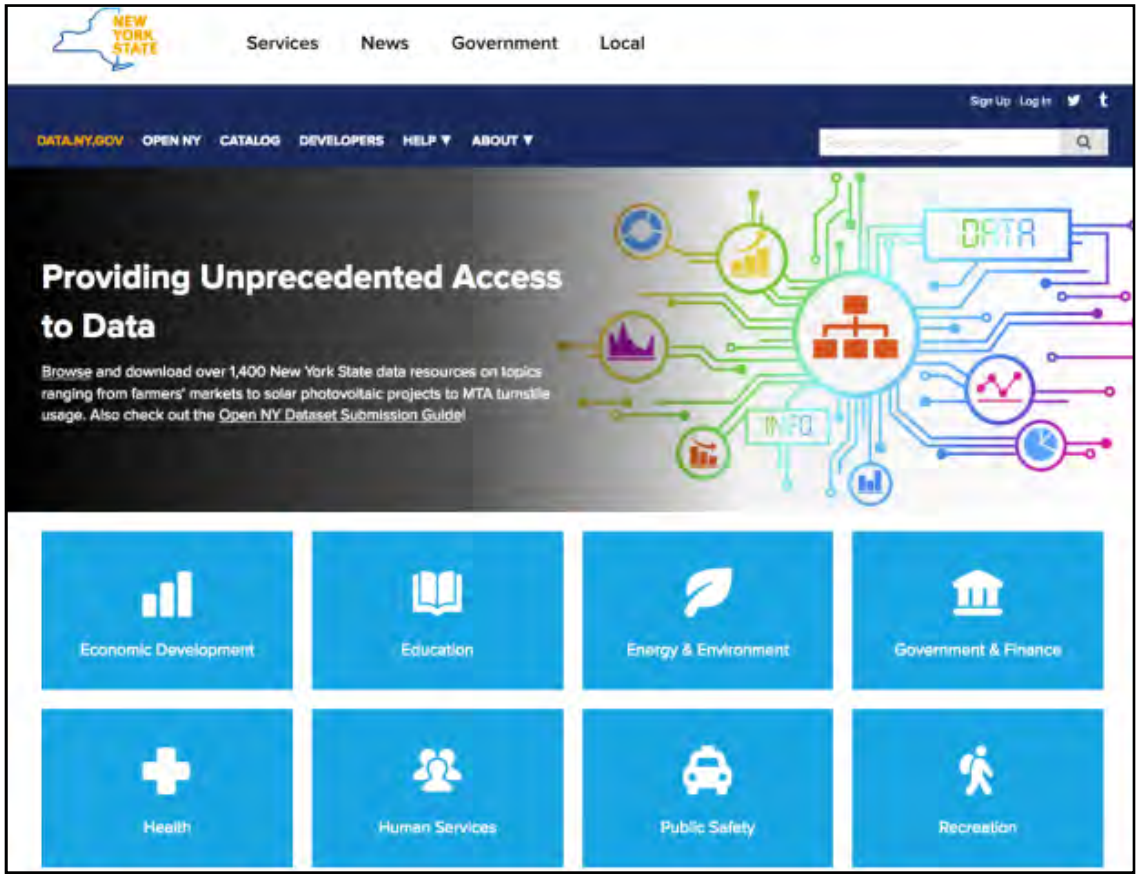



**Figure 35. New York State Open Data Portal**

*Source:* data.ny.gov

## Pennsylvania Department of Transportation

Many state transportation websites are in transition, moving towards mobile-optimized sites and embracing open data. However, even those that appear to be on the cusp of contemporary design contain at least some data in static, old-school documents. The **Pennsylvania Department of Transportation** (PennDOT) site is a good example (see Figure 36). The site is modern-looking, mobile-optimized, and offers an impressive array of open data features, yet there are still documents available only in PDF format, and some of these have a decidedly dated look (see Figure 37).

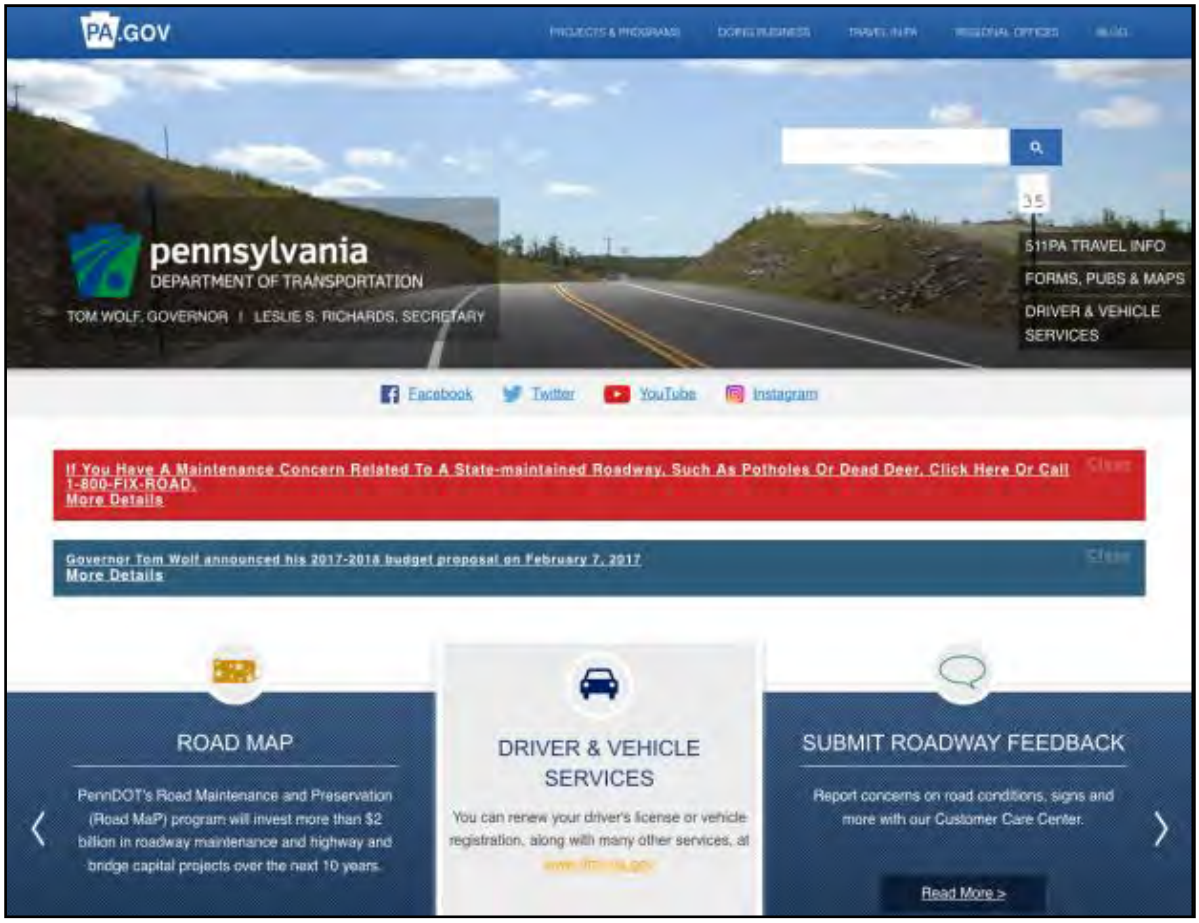



**Figure 36. Pennsylvania Department of Transportation Home Page**

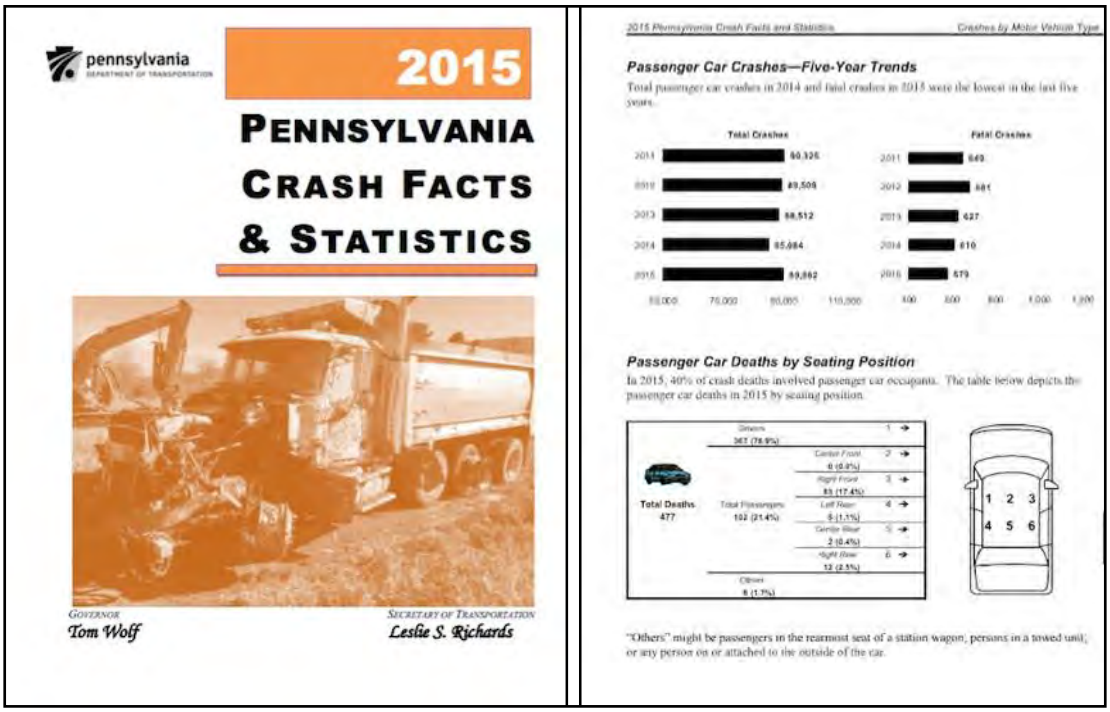



**Figure 37. Old-School, Static Data in PDF Format**

PennDOT is embracing open data through their "**PennDOT GIS Data Portal**" (Figure 38) although the primary emphasis currently is on spatial data and there is an opportunity to broad the available datasets to a wider range.

**Figure 38. PennDOT's GIS Data Portal**

## Rhode Island Department of Transportation

Rhode Island DOT's home page contains two main navigation menus (see Figure 39). The more comprehensive menu on top goes almost unnoticed due to the visual prominence of the other menu, which at first appears to consist of three large buttons: "Doing Business with Us," "Getting Around Rhode Island," and "In Your Community."

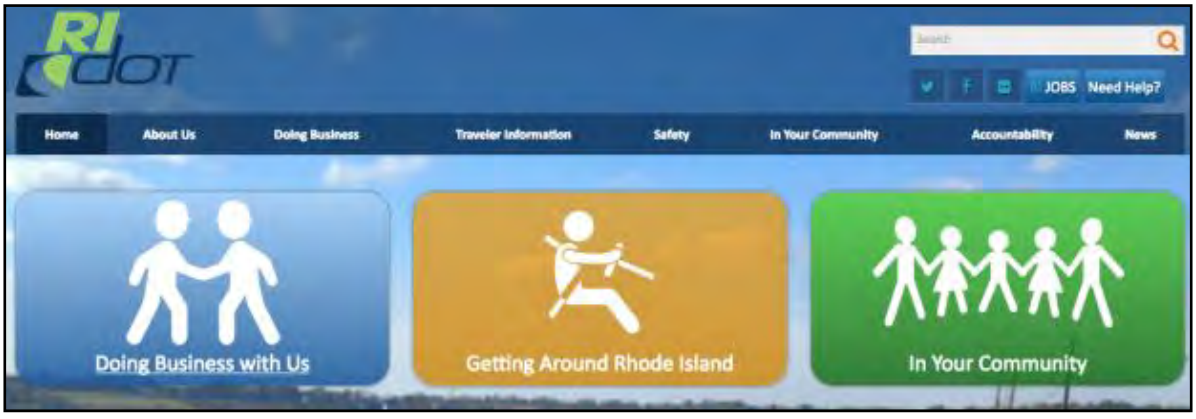



**Figure 39. A More Comprehensive Menu is Located Above the Images, but It's Easily Overlooked**

Clicking any of the buttons, however, yields unexpected results. Rather than taking users to a different page, the buttons produce dropdown menus (see Figure 40). Although this is not likely to deter visitors from using the site, it is behavior users are conditioned to expect from a menu bar, not from images. For purposes of this research, it is a reminder of the importance of consistently fulfilling users' expectations with respect to the way the site functions, leaving the job of breaking new ground to the content.

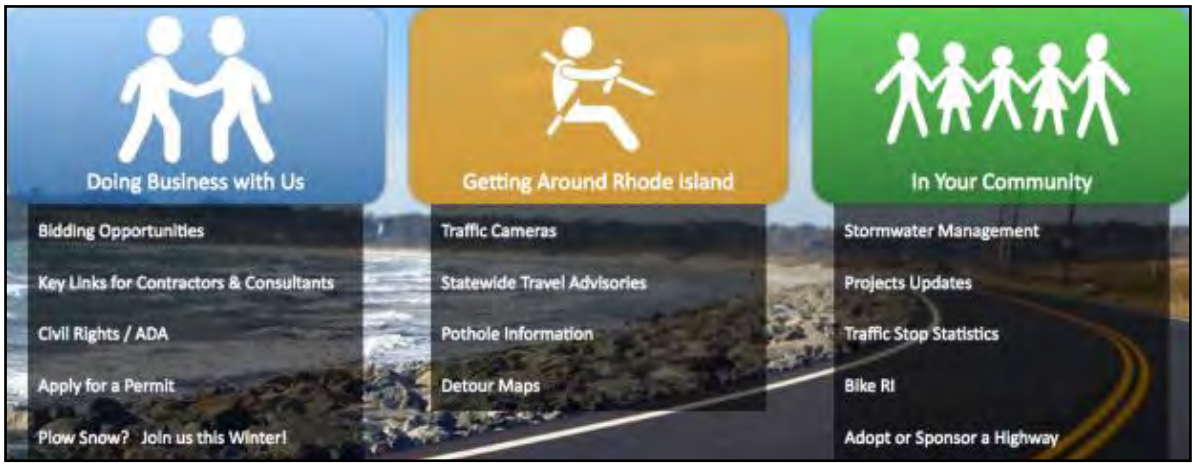



**Figure 40. Clicking on the "Buttons" Reveals Unexpected Dropdown Menus**

The site structure is not particularly intuitive, and data seemed scarce at first. Eventually, reports were found in a section unintuitively titled "In Your Community." Among these are a collection of safety plans, including at least one mandated by NHTSA (see Figure 41). Unfortunately, the visitor must rely on the document titles to distinguish their purpose and content, and the titles are no help at all:

**Figure 41. Got Highway Safety Plans?**

*Note:* Indistinct Choices Become Dead-Ends for Users.
Modify Labels to Distinguish Items by Scope or Purpose.

The search feature on the Rhode Island DOT site searches pages from all State of Rhode Island websites, not just the DOT site. Figure 42 shows the search results initiated at through the DOT search feature for the Caltrans-supplied keyword phrase "alternative fuels." The process yielded dozens of results, but most are on the state's Office of Energy Resources site.

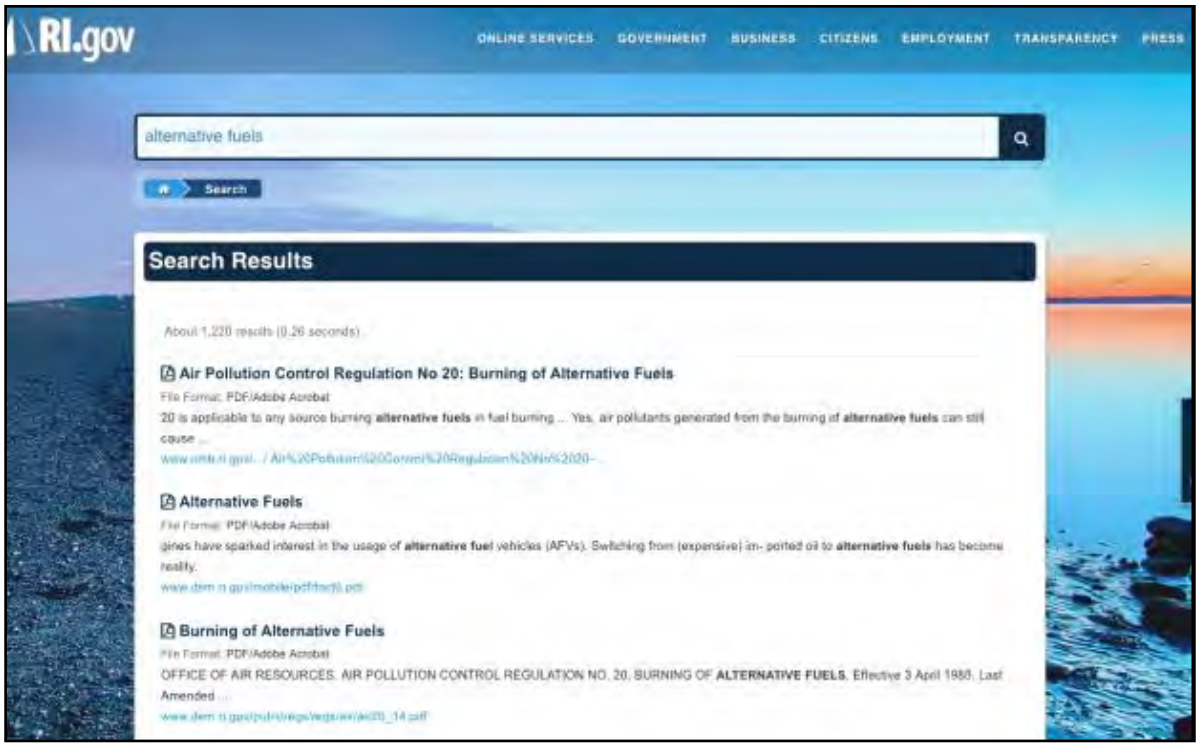
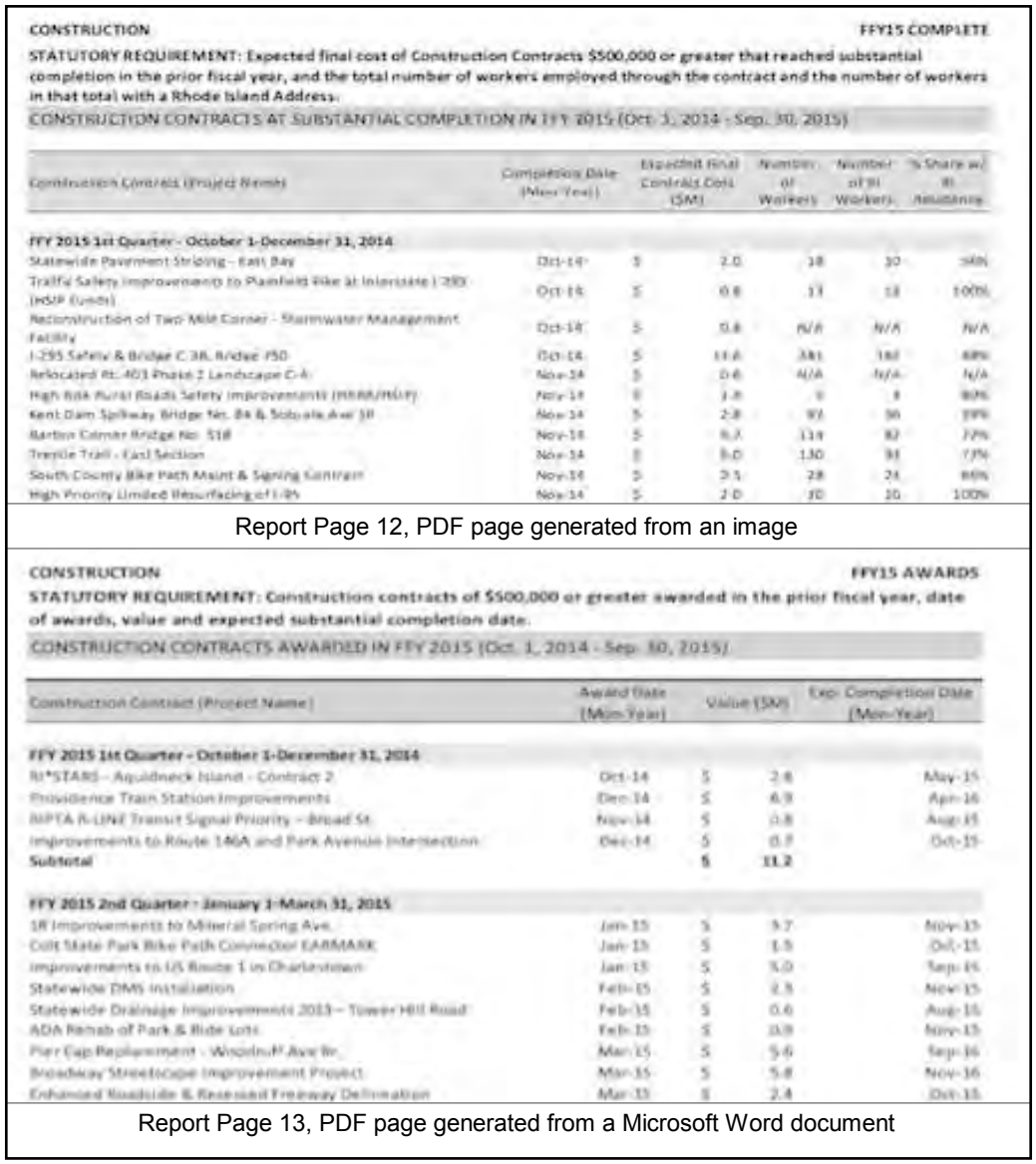



**Figure 42. Search Results for "Alternative Fuels"**

The agency's Quarterly Reports, posted in the site's "**Accountability**" section, provides an excellent demonstration of the difference between data that's "reusable" and data that is not, and why the distinction is important. The screenshots in Figure 43 represent two of the six pages of tables about the agency's construction projects. Style wise, the pages are identical. Both present the data in a format that appears to be tabular. The formatting was most likely applied in the spreadsheet or word processing program used to structure the data, and there is no visual distinction between the data on the PDF page and the data as it may have appeared in either of those programs. Yet, unlike data in a spreadsheet or word processing program, neither page of the PDF presents the data in a form that can be reused easily, if at all. Although the text from page 13 (bottom) can be copied and pasted or even exported into another file format, the results require extensive "cleaning" and reformatting to restore structure for further analysis. The page on the top is even less useful – it is created from an image rather than from actual text; optical character recognition scans can be used to extract text from images, but the results can be far from perfect and even then, additional reformatting would likely be required to effectively access the data for further use.



CONSTRUCTION FFY15 COMPLETE

**STATUTORY REQUIREMENT: Expected final cost of Construction Contracts $500,000 or greater that reached substantial completion in the prior fiscal year, and the total number of workers employed through the contract and the number of workers in that total with a Rhode Island Address.**

CONSTRUCTION CONTRACTS AT SUBSTANTIAL COMPLETION IN FFY 2015 (Oct. 1, 2014 - Sep. 30, 2015)

| Construction Contract (Project Name) | Completion Date (Mon-Year) | | Expected Final Contract Cost ($M) | Number of Workers | Number of RI Workers | % Share w/ RI Residency |
|---|---|---|---|---|---|---|
| **FFY 2015 1st Quarter - October 1-December 31, 2014** | | | | | | |
| Statewide Pavement Striping - East Bay | Oct-14 | $ | 2.0 | 18 | 10 | 56% |
| Traffic Safety Improvements to Plainfield Pike at Interstate I-295 (HSIP Funds) | Oct-14 | $ | 0.8 | 13 | 13 | 100% |
| Reconstruction of Two Mile Corner - Stormwater Management Facility | Oct-14 | $ | 0.8 | N/A | N/A | N/A |
| I-295 Safety & Bridge C-38, Bridge 750 | Oct-14 | $ | 11.6 | 381 | 182 | 48% |
| Relocated Rt. 403 Phase 2 Landscape C-4 | Nov-14 | $ | 0.6 | N/A | N/A | N/A |
| High Risk Rural Roads Safety Improvements (HRRR/HSIP) | Nov-14 | $ | 1.8 | 5 | 4 | 80% |
| Kent Dam Spillway Bridge No. 84 & Sobrale Ave 1R | Nov-14 | $ | 2.8 | 93 | 56 | 59% |
| Barton Corner Bridge No. 518 | Nov-14 | $ | 6.7 | 114 | 82 | 72% |
| Trestle Trail - East Section | Nov-14 | $ | 5.0 | 130 | 93 | 72% |
| South County Bike Path Maint & Signing Contract | Nov-14 | $ | 0.5 | 28 | 24 | 86% |
| High Priority Limited Resurfacing of I-95 | Nov-14 | $ | 2.0 | 30 | 30 | 100% |

Report Page 12, PDF page generated from an image

CONSTRUCTION FFY15 AWARDS

**STATUTORY REQUIREMENT: Construction contracts of $500,000 or greater awarded in the prior fiscal year, date of awards, value and expected substantial completion date.**

CONSTRUCTION CONTRACTS AWARDED IN FFY 2015 (Oct. 1, 2014 - Sep. 30, 2015)

| Construction Contract (Project Name) | Award Date (Mon-Year) | | Value ($M) | Exp. Completion Date (Mon-Year) |
|---|---|---|---|---|
| **FFY 2015 1st Quarter - October 1-December 31, 2014** | | | | |
| RI*STARS - Aquidneck Island - Contract 2 | Oct-14 | $ | 2.8 | May-15 |
| Providence Train Station Improvements | Dec-14 | $ | 6.9 | Apr-16 |
| RIPTA R-LINE Transit Signal Priority - Broad St. | Nov-14 | $ | 0.8 | Aug-15 |
| Improvements to Route 146A and Park Avenue Intersection | Dec-14 | $ | 0.7 | Oct-15 |
| **Subtotal** | | **$** | **11.2** | |
| **FFY 2015 2nd Quarter - January 1-March 31, 2015** | | | | |
| 1R Improvements to Mineral Spring Ave. | Jan-15 | $ | 3.7 | Nov-15 |
| Colt State Park Bike Path Connector EARMARK | Jan-15 | $ | 1.5 | Oct-15 |
| Improvements to US Route 1 in Charlestown | Jan-15 | $ | 5.0 | Sep-15 |
| Statewide DMS Installation | Feb-15 | $ | 2.3 | Nov-15 |
| Statewide Drainage Improvements 2013 - Tower Hill Road | Feb-15 | $ | 0.6 | Aug-15 |
| ADA Rehab of Park & Ride Lots | Feb-15 | $ | 0.9 | Nov-15 |
| Pier Cap Replacement - Woodruff Ave Br. | Mar-15 | $ | 5.6 | Sep-16 |
| Broadway Streetscape Improvement Project | Mar-15 | $ | 5.8 | Nov-16 |
| Enhanced Roadside & Recessed Freeway Delineation | Mar-15 | $ | 2.4 | Oct-15 |

Report Page 13, PDF page generated from a Microsoft Word document

**Figure 43. Text Captured in Images (Top) Looks Like Character-Based Text (Bottom) but It's Not Searchable and Can't be Copied or Edited**

*Source:* Rhode Island Department of Transportation Quarterly Report, July – September 2016.[37]

Since it is impossible to know who might want to use the data Caltrans generates, or what they might do with it, it is in the public interest for the agency to assume it will *all* be used in one way or another, and to make it available in as many reusable formats as is practicable.

## Vermont Agency of Transportation (VTrans)

Although Vermont is not among the higher density states, **Vermont's Agency of Transportation** (also known as VTrans) is included because it offers a uniquely public-friendly approach. The home page contains a direct link to the "**VTransparency Public Data Portal**," a page containing introductions and links to data in four areas: Pavement, Bridges, Projects, and Maintenance (see Figure 44).[38] The page design is airy, clean, modern, and approachable. The language is notably absent of any industry jargon and acronyms. The

introduction to each of the four areas begins with a query from a hypothetical visitor – much like an FAQ – that may well be the very question the current visitor seeks to answer. If not, it nonetheless effectively telegraphs the type of information the visitor will find in that section:

1. Pavement Information: “My road is in bad shape! When are you going to fix it? When did you last work on it?”

2. Bridge Information: “Are you closing a bridge on my commute?”

3. Project Information: “What are you going to do to this road?”

4. Maintenance Information: “What are VTrans crews working on?”

**Figure 44. VTrans Pavement Information Section Home Page**

Each question is followed by brief introduction to the topic written in a colloquial, second-person voice that speaks directly to the visitor – e.g., “You can file a request …” – versus the more formal and commonly found third-person voice – “Those wishing to file a request …”). The second-person voice, in addition to appealing to visitors’ self-interest, creates a sense

of intimacy and trust, as if the agency were in a one-on-one conversation with the visitor, as opposed to the third-person voice, which focuses somewhere “out there” and places the visitor in the role of an onlooker. The agency has clearly sought to engage “plain folk” who know little or nothing about transportation systems and operations. This is a smart and efficient way to cover all bases – i.e., all customer types and needs.

### Washington DC – District Department of Transportation

The **District Department of Transportation’s** (DDOT) website features a minimalist but modern, mobile- and search-engine-optimized (SEO) home page. (see Figure 45).

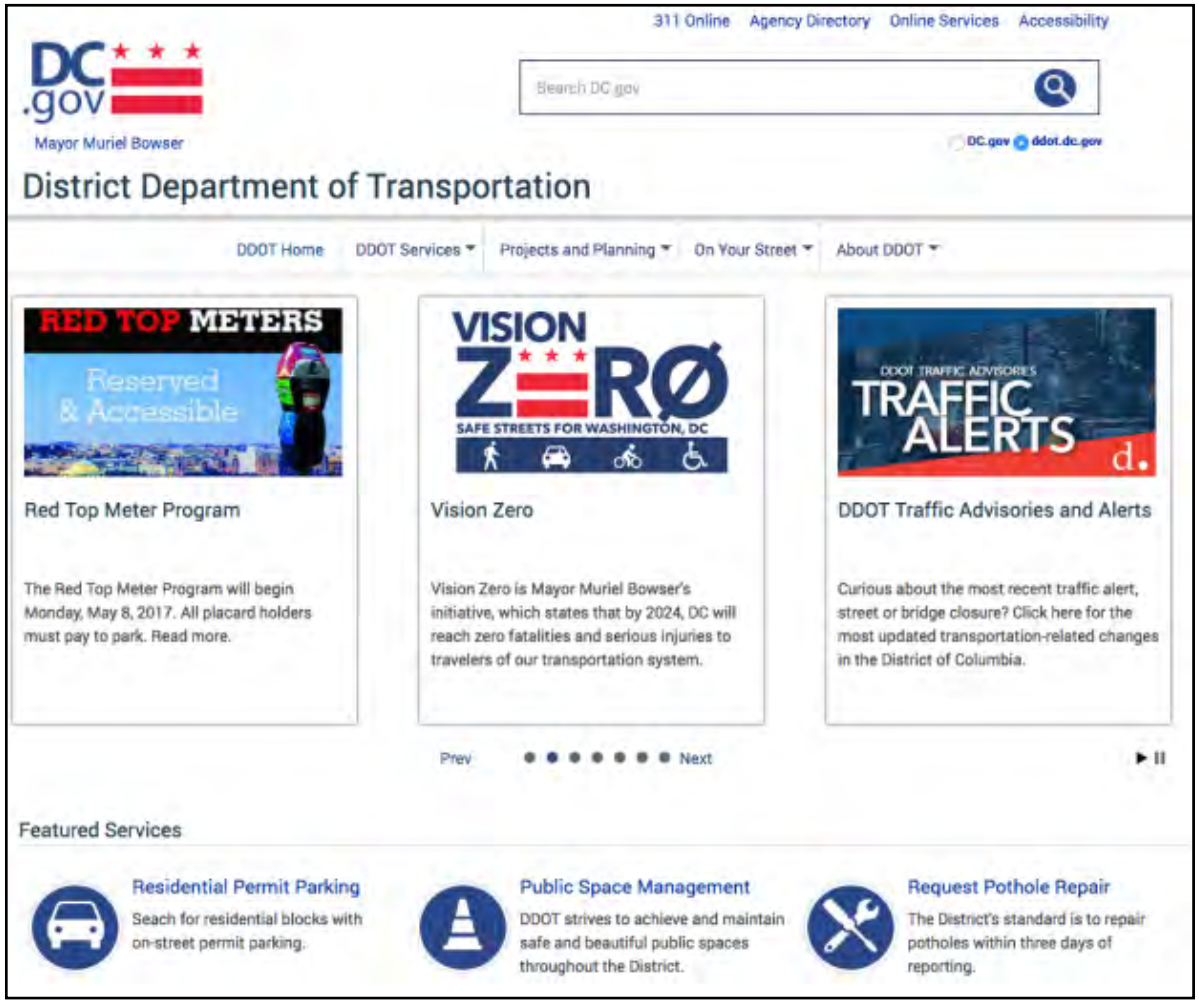



**Figure 45. Minimalist Home Page with “Eyebrow” Menu**

Like many agencies, the DDOT home page has two navigation menus – the main menu located below the logo, and a smaller utility or “eyebrow” menu located unobtrusively at the very top of the page.

## FEDERAL AGENCIES AND RESOURCES

Several federal agencies are resources that emphasize transportation-related data were also examined. A selection is discussed below.

### National Transportation Safety Board

The **National Transportation Safety Board** (NTSB) website provides clear and direct links to their "**Data & Stats**" and "**Aviation Accident Database**" information on the homepage as shown in Figure 46.

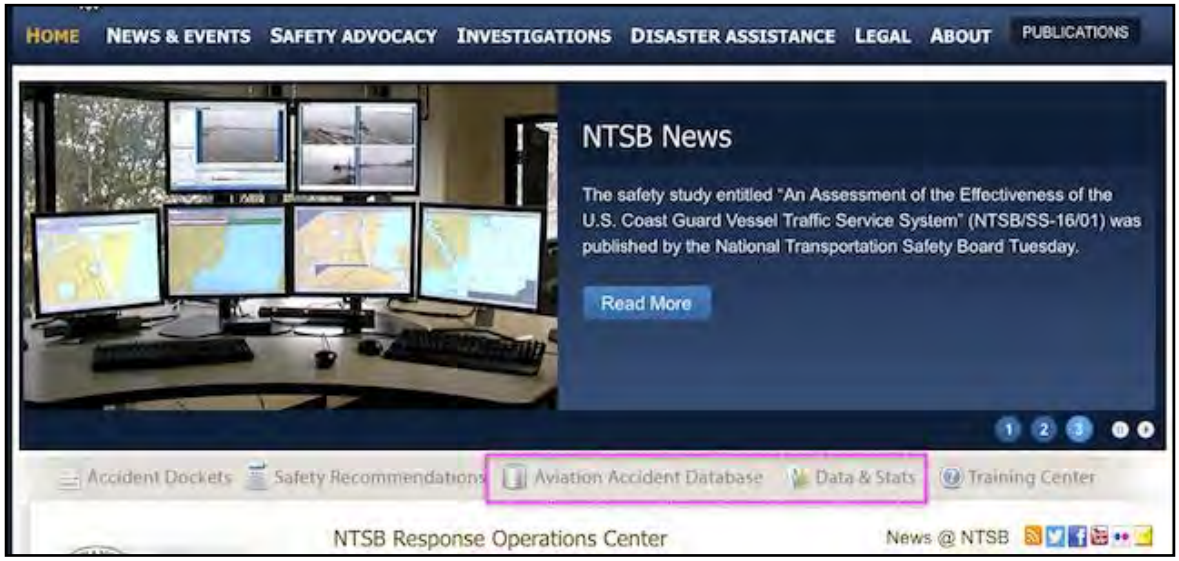



**Figure 46. "Data & Stats" Link Prominently Displayed on the Home Page**

At the "**Aviation Accident Database**" page (see Figure 47), the user is greeted with descriptive information about the available data, an interactive way to select the desired data, and the ability to download the data in different formats, which increases usability.

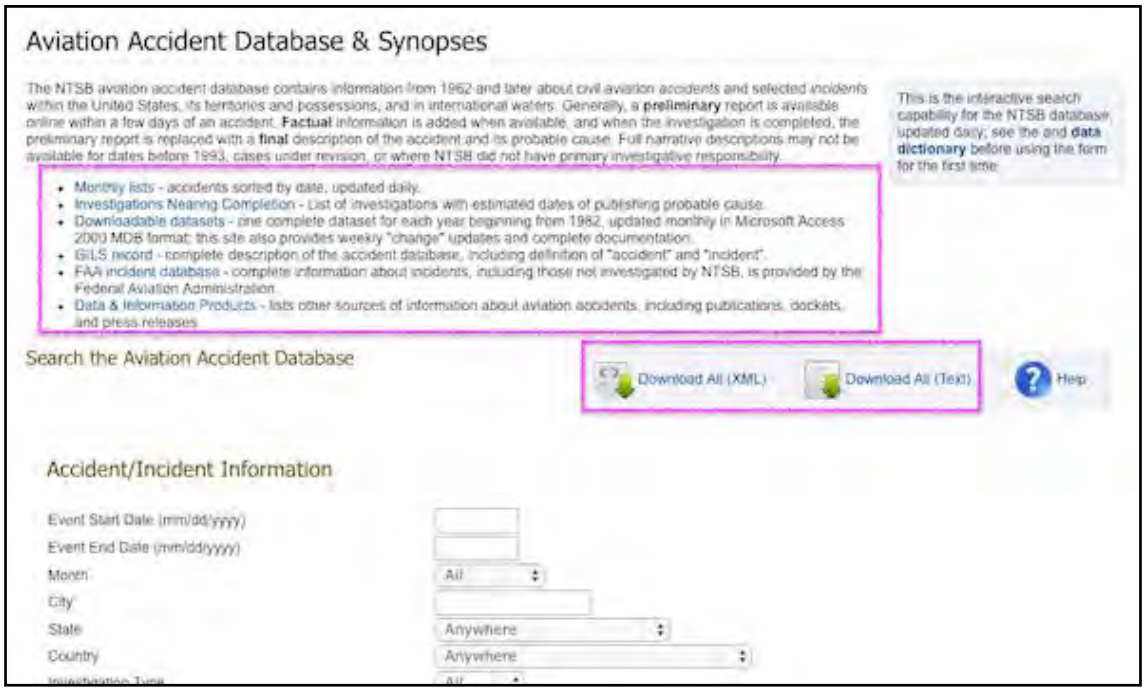



**Figure 47. NTSB Data is Well Described, Making it More Discoverable**

## US Department of Energy, Alternative Fuels Data Center

The US Department of Energy's **Alternative Fuels Data Center** (AFDC) offers over 130 engaging, fun-to-use, environmentally educational maps and data and embeddable widgets related to transportation trends, vehicles, and alternative fuels. Includes tutorials, APIs, and more.

**Figure 48. Alternative Fuels Data Center Homepage; Maps & Data Link Clearly Presented**

The AFDC homepage (see Figure 48) clearly links directly to their maps and data page, which allows uses to both interactively view and manipulate the data, but also to download for future analysis. A user is also able to easily view a graph of different data types and embed directly into their own website, increasing the visibility of the agency's data and information.

## National Highway Traffic Safety Administration

The **National Highway Traffic Safety Administration** (NHTSA) website is an updated, mobile-optimized site that provides access to a wide range of data. The homepage has a direct link to research and data, although it could be easy to initially overlook given the small font size on the right hand menu. However, once a user navigates to the research and data site, they are presented with a wide range of available research and data, including access to testing databases (see Figure 49). While the interface to access and download the data may require a number of steps based on the user query, there is a large array of data available, as well as the ability to display the data directly on the website.

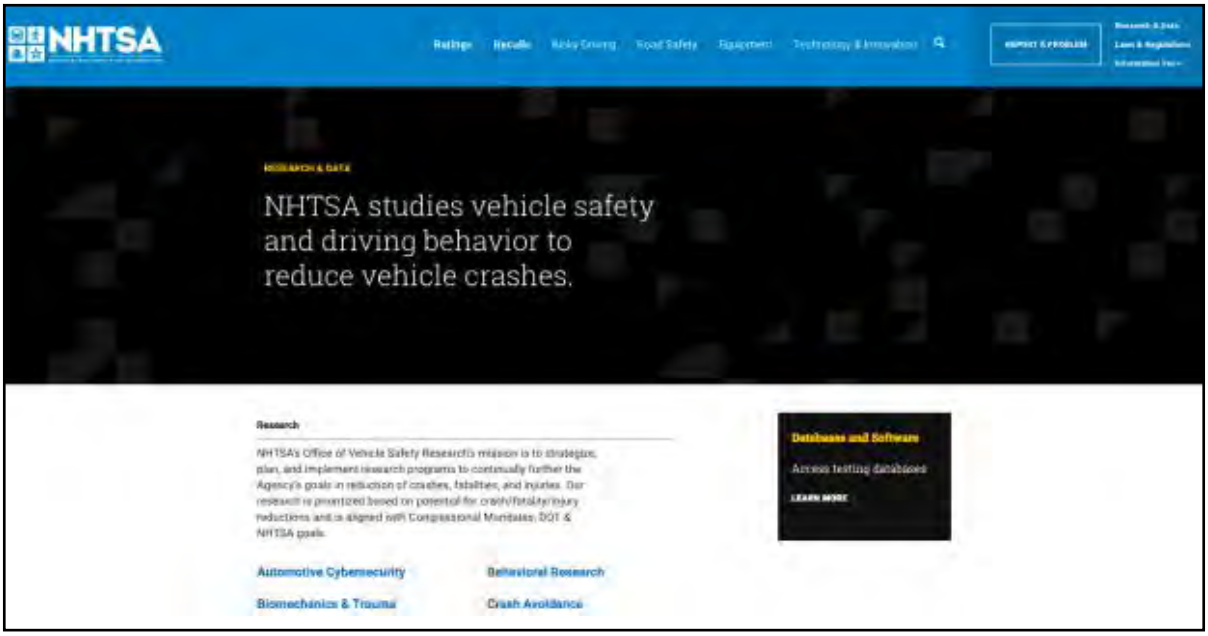



**Figure 49. NHTSA Research & Data Webpage**

## US Census Bureau

The **US Census Bureau** offers a rich, open-source repository of interactive demographic data on a wide range of topics, many of which may be of interest to California residents and travelers.[39] Datasets can be filtered and customized, visualized with onsite tools, and downloaded in a variety of common file formats for reuse (See Figure 50 and Figure 51). The site also offers an array of widgets, tools, and apps, and information on displaying data hosted by the Bureau on your website. Selecting data that's most relevant to the agency's customers and suppliers and providing an easy way for them to manipulate, visualize, and download it directly from the Caltrans site increases the value of the agency and its website and reinforces its "brand" as a credible, contemporary resource that knows the people it serves and is responsive to their needs. Table 5 presents a list of a number of available data tools and applications on the US Census Bureau's site.

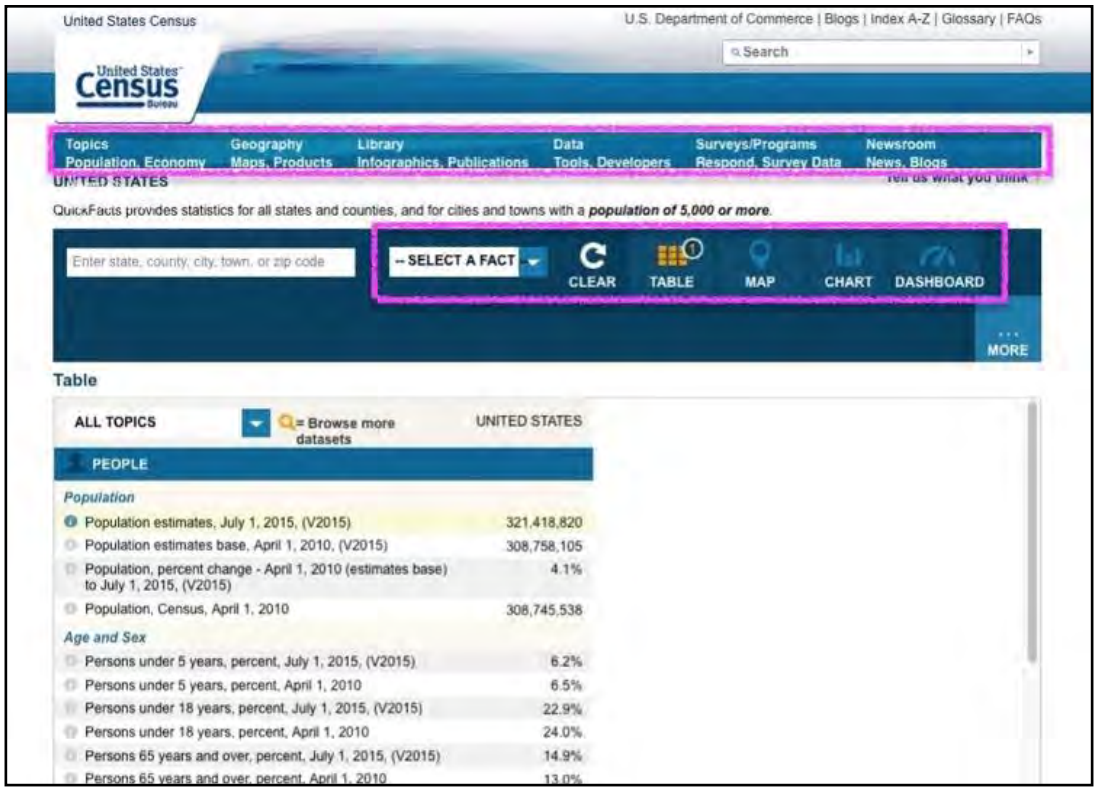



**Figure 50. US Census Bureau QuickFacts: Filter, Manipulate, and Graph Over 150 Census Statistics in 30 Categories**

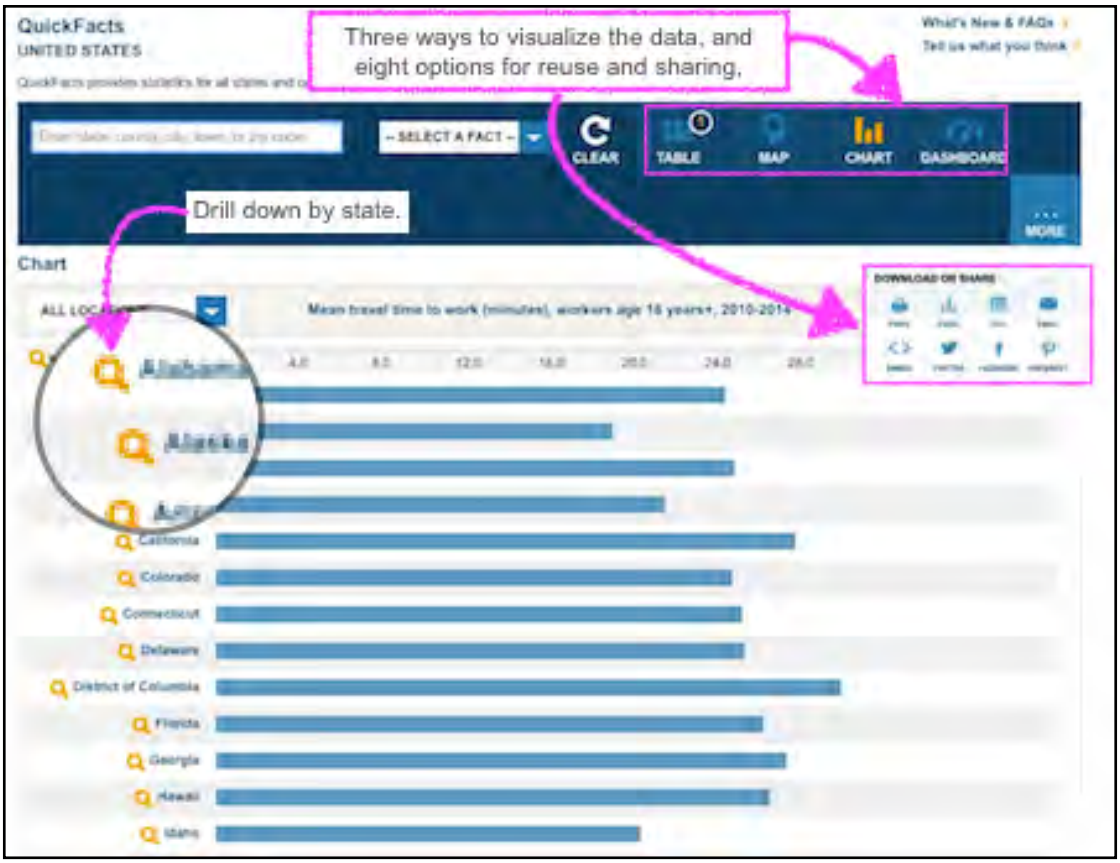



**Figure 51. US Census Bureau "QuickFacts" can be Explored, Mapped, Charted, Tabulated, Downloaded, or Shared on Social Media with One Click**

## Table 5. US Census Bureau Data Tools and Apps

| *Feature* | **US Census Bureau Data Tools and Apps** | |
|---|---|---|
| *Summary* | • Interactive applications that access statistics from multiple surveys. | |
| *Tool/App* | • 2010 Census Interactive Population Map | Use this tool to explore 2010 Census statistics down to the block level, compare your community with others, and embed charts on your web site. |
| | • Access Tools at Other Sites: Integrated Public Use Microdata Series | iPUMS [University of Minnesota]. |
| | • American FactFinder | This interactive application provides statistics from the Economic Census, the American Community Survey, and the 2010 Census, among others. |
| | • American Housing Survey Table Creator | The AHS Table Creator gives you the ability to create customized tables from the American Housing Survey without having to use the Public Use File (microdata). |
| | • Business Dynamics Statistics | This tool shows tabulations on establishments, firms, and employment with unique information on firm age and firm size. |
| | • CPS Table Creator | The CPS Table Creator gives you the ability to create customized tables from the Current Population Survey's Annual Social and Economic Supplement (CPS ASEC). |

| *Feature* | **US Census Bureau Data Tools and Apps** | |
|---|---|---|
| | • Censtats | Applications available include: Census Tract Street Locator, County Business Patterns, Zip Business Patterns, International Trade Data, and more. |
| | • Census 2000 EEO Data Tool | Select levels of geography based on residence or workplace. The estimates present information for various occupation groupings by race and ethnicity and sex. |
| | • Census Business Builder | Census Business Builder offers small business owners selected Census Bureau & other statistics to guide their research for opening or expanding their business. |
| | • Census Explorer | Make new discoveries about your neighborhood through the power of statistics with the US Census Bureau's newest mapping tool. |
| | • Census Flows Mapper | The Census Flows Mapper is a web mapping application intended to provide users with a simple interface to view, save and print migration flows maps. |
| | • DataFerrett | This tool is the analytical interface to TheDataWeb and allows users to create custom tables and data visualizations, such as graphs and thematic maps. |
| | • Direct File Access: Census 2010 datasets | Download datasets. |
| | • Direct File Access: Census OUTGOING File Directory (HTTP) | Pickup files from Census Employees. |
| | • Economic Database Search and Trend Charts | Easy access to Economic Statistics using drop-down menus. Create tables in ASCII text and spreadsheet format. Display customizable dynamic charts. |
| | • Glossary | Simple definitions of key Census Bureau terms. |
| | • HIV/AIDS Surveillance Database | Access data from various sources on HIV/AIDS prevalence and incidence for countries in Africa, Asia, Europe, Latin America and the Caribbean, and Oceania. |
| | • Health Insurance Interactive Data Tool | An interactive application for exploring data from the Small Area Health Insurance Estimates program. |
| | • Income and Poverty Interactive Data Tool | An interactive application for exploring data from the Small Area Income and Poverty Estimates program. |
| | • Industry Snapshots | These interactive pages present key statistics from the Economic Census with per capita ratios using data from Population Estimates for a selected industry. |
| | • International Database | Find demographic indicators, population pyramids, and source information for countries and areas of the world with a population of 5,000 or more. |
| | • International Map Viewer | The International Map Viewer web application offers demographic indicators for the world's countries. Values based on the International Data Base. |
| | • Language Use Mapper | A web-based interactive map application built to display language data from the American Community Survey. |
| | • Local Employment Dynamics | This partnership offers a variety of data tools. |
| | • This partnership offers a variety of data tools. | A web-based interactive map application built to display Demographic data at the Census 2010 tract level. |
| | • Metropolitan/Micropolitan Population Map Viewer | Access selected statistics about your Congressional district collected through the American Community Survey (ACS) and County Business Patterns (CBP). |
| | • My Congressional District | An online mapping & reporting application showing where workers are employed & where they live with companion reports on worker characteristics. |

| *Feature* | **US Census Bureau Data Tools and Apps** | |
|---|---|---|
| | • OnTheMap | A public data tool for accessing US population and workforce statistics, for areas being affected by natural disasters. |
| | • OnTheMap for Emergency Management | Using TIGER and the American FactFinder. |
| | • Online Mapping Tools | Provides detailed demographics; geographic (state, county, and metro/micro areas); ownership information; industry information, and recent and historical data. |
| | • QWI Explorer | QuickFacts provides frequently requested Census Bureau information at the national, state, county, and city level. |
| | • QuickFacts | See US population by date, region, age and sex, and the top 10 areas by people and density. The world view has basic facts, trade, and projections by country. |
| | • US and World Population Clock | Place name, and ZIP code search engine. |
| | • US Gazetteer | USA Trade Online is a free and dynamic online tool, where users can access current and historical US export and import data. |
| | • USA Trade Online | Web widgets that are intended for use on (embedding in) third-party websites. |
| | • Widgets | Use this tool to explore 2010 Census statistics down to the block level, compare your community with others, and embed charts on your web site. |

*Source:* US Census Bureau, http://www.census.gov/data/data-tools.html

# VII. SUMMARY OF FINDINGS

The investigation revealed several themes which are summarized below and then discussed in greater detail:

1. States have been slow to implement open data.

2. System usage data is more common than system inventory data.

3. Data discoverability and accessibility vary but are generally poor.

4. Data structure, presentation, and appearance vary widely.

5. Reusability is standard on federal sites but lacking on state sites.

6. Agencies that offer open data are valuable resources.

## 1. STATE AGENCIES HAVE BEEN SLOW TO IMPLEMENT OPEN DATA

Most state and local transportation agency websites offer very little data on their websites, and what they do offer does not currently meet the “open data” standard. Crash data is the most commonly covered topic.

Data on state agency websites is typically not fully cataloged and/or accessible in a single location. Instead, it is spread across the site and hosted by the department or division responsible for producing it. This can be a challenge for external users who may not know of the internal organizational structure. In some cases, users must exit the DOT site to access referenced data – if, for example, the data is hosted under the State’s primary domain rather than the DOT subdomain.

Often topics and titles of available information on the site lack an obvious structure or order to the information. Descriptions of data products are limited and frequently not described in a user-friendly manner. Titles sometimes offer little clue as to the report content (e.g., “Quick Facts”) or may contain acronyms that are not obvious to the general public (e.g. “HPMS Data,” “Section 500 Reports”). The most popular delivery medium – PDFs – requires users to download documents before they can determine if the content is relevant to their inquiry. Typically, the report title is the only description provided, and it is usually generic, e.g., “2016 Performance Report.” This is a substantial barrier to discovery.

## 2. SYSTEM USAGE DATA IS MORE COMMON THAN INVENTORY DATA

The range of data topics on state and local agency sites topics tends to be small, and sometimes incomplete, with gaps or overlaps in timespans and topic areas. The most frequently found topics relate to system usage – in particular, problem areas, such as crashes, congestion, and potholes. Project data is also common; financial data less so. Neutral data, such as system inventory and vehicle miles traveled are less prevalent.

## 3. DATA DISCOVERABILITY AND ACCESSIBILITY VARY BUT ARE GENERALLY POOR

Like most website home pages, those of transportation agencies offer multiple ways to navigate. All feature a main menu, and almost all offer dropdown menus of one sort or another – some are large "mega-menu" panels similar to the one on the 2013 Caltrans template. All offer a site search feature, although those that share a site with their state government do not always provide a way to limit the search scope to the transportation agency. None have more than a few sentences of narrative text, and all offer numerous links. Some, such as the Massachusetts Department of Transportation (MassDOT), offer task-based "How do I …?" menus or links. Not all offer a direct link to agency data from the home page. Florida Department of Transportation is one of the few that do (see Figure 54).

Most state sites provide no obvious path from the home page to data. Typically, data is spread across the site and offered by the department or division responsible for producing it. In some cases, users must leave the DOT site to access data that seems nearly identical in nature to the data offered onsite. For example, crash and injury data may be on the DOT site but fatality data resides on the state's Department of Public Health site. This precludes use of onsite tools to "mash" and "crunch" the data together and makes at-a-glance comparisons difficult, especially if each site structures the data differently.

Agency websites also vary widely in their data terminology, which can make discovery difficult even when a site search is provided, as it is in nearly all cases. The absence of a standard nomenclature across sites impedes users' ability to find data they're looking for or discover data they weren't seeking but might find interesting. Only a few sites use the word "data" (or a close synonym, such as "statistics") in the main navigation menu. As shown in Figure 54, Florida DOT is one exception.

**Figure 52. Florida DOT Calls Out Data in the Main Menu**

## 4. DATA STRUCTURE, PRESENTATION, AND APPEARANCE VARY WIDELY, EVEN WITHIN THE SAME SITE

PDF files are the most commonly used data presentation medium on state sites, although this is fortunately starting to change. PDFs have limitations and are not considered a "best practice" for data dissemination. PDFs are static documents fixed at a point in time; they can't be updated the way data that resides on Web pages or in Web-based applications can. Data embedded in PDF files is virtually unreusable. It can't be easily exported into another application for reconfiguration. Nor can it be copied and pasted as structured data; unlike tables in a spreadsheet or word processing document.[40] Paragraph text that appears to flow from one line to the next in a PDF may paste with hard returns at the end of each line. Such content must be cleaned and reformatted before it can be reused.

Some state sites offer Excel-formatted files in addition to PDFs, but the availability of this option tends to be inconsistent even within a single website. Few state agencies offer widgets, an Application Programming Interface (API) that provides access to data for integration into mobile, Web or other apps, or other means of accessing live data programmatically.

Agencies that embrace open data continue to use PDFs for many text-based documents. However, the data itself is also made available in a wide variety of downloadable and machine-readable formats, such as XML, JSON, or GIS, in addition to standard formats, such as CSV and Excel.

With respect to organizing, labeling, and styling data, no standards currently exist. Styling and formatting vary across websites as well as often within a single site. Consistency of appearance is not window dressing – it is critical in the virtual realm because it keeps users oriented.

## 5. REUSABILITY IS STANDARD ON FEDERAL SITES, BUT LACKING ON STATE SITES

Data on state DOT sites is, for the most part, reusable only with considerable time and effort. The most common formats are (from most to least common) PDF files, html pages, CSV, Word, or – in the very worst case – images, from which data cannot even be copied). Providing data in a variety of formats that allow it to be used by other applications, such as spreadsheets, GIS software, or data visualization tools, is important for increasing access and usability of the information.

By contrast, Federal agencies, California's regulatory agencies, and even the State's new open data portal, **data.ca.gov**, have embraced and implemented open data.[41] All provide data in a variety of exportable formats. (Most offer programmatic access via APIs and provide onsite interactivity, such as tables that can be sorted and filtered.) Many offer built-in data visualization tools that allow visitors the opportunity to "play" with data, and visualize "what-if" scenarios. Several offer interactive, embeddable "widgets," such as the one shown in Figure 53 from the US Department of Energy (DOE) Alternative Fuels Data Center. Hovering over a node in the live widget shows the details, and users can switch between tabular and graphed views of the data.

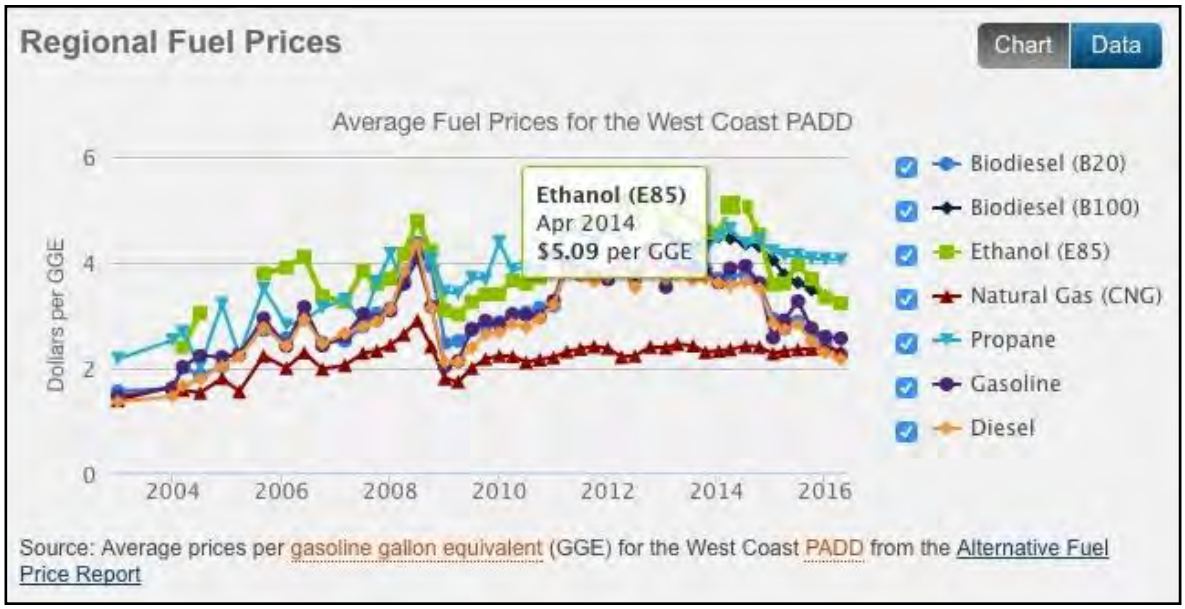



**Figure 53. Colorful Interactive "Widgets" Engage and Educate Customers**

These small, self-contained applications pull data directly from the source database and are often used to perform useful calculations, such as the annual cost of gas by fuel or vehicle make and model. Adding one or more to a Web page is as easy as pasting in a short snippet of code provided by the source website.

Since the data is hosted and managed by the source site, widgets require no maintenance other than viewing the page to ensure they're still working. This is an excellent way to increase the value and appeal of the DRISI Data Library without adding overhead.

## 6. AGENCIES THAT OFFER OPEN DATA ARE VALUABLE RESOURCES FOR CALTRANS

Sharing not just content but knowledge, skills and best practices is a key principle of the "open" concept, and this is reflected in the depth and breadth of resources offered by agencies that have embraced open data. Such websites represent an enormously valuable resource for Caltrans and other agencies struggling to modernize their public-facing data on limited funds. First, they're a rich source of ready-to-reuse data on dozens of topics of interest to Caltrans' customers. In addition, many offer easy-to-use guides, tutorials, and tools that can help cash-strapped agencies get up-to-speed without hiring additional Web staff. Many offer APIs (APIs) allowing the agency data to be integrated into mobile, Web, or other apps. Last, they represent best practices in data dissemination and the state-of-the-art in website design for today's information consumers.

# VIII. RECOMMENDATIONS

"A great customer experience … is primarily about delivering the right knowledge to the right place at the right time."

## LEARN WHO'S USING THE SITE AND WHAT THEY WANT

- **Capture and study Google Analytics data.**

  Google Analytics (GA) is a rich source of information about who's using the site and how they're using it. Among other valuable insights, GA identifies the domain from which each user is accessing the site. This means that in many cases you'll know which specific businesses and government agencies visit the Data Library. You'll learn which pages they entered the site on and which they left from. You'll also learn their location and certain demographic information. Google recently added a feature that visually represents how traffic moves through the site. Viewing this can be a highly enlightening (if sometimes dismaying) experience. For example, if a large number of users are seen moving back and forth between the same two pages or looping through a small number of pages more than once, it usually means the anchor text of a link they're following is misleading and should be rewritten. The number of times they are compelled to try the same path again is an indicator of just how convincing the misleading text is (and how frustrated those users must be).

- **Develop user "personas" to drive content and design decisions.**

  User-centered design embraces the principle that products and services should be designed around people rather than people taught to adapt to products. To design data products and delivery and presentation methods that meet customer needs, it is necessary to understand and empathize with those needs. Personas are hypothetical yet realistically detailed profiles of archetypical users that help product and service providers keep customer needs front and center in every design decision, including the design of data products and presentation media. "Personas concentrate on what a user does, what frustrates the user, and what gives the user satisfaction. A good persona is a narrative that describes a person's typical day and experiences, as well as skills, attitude, background, environment, and goals. Personas identify the person's motivations, expectations, aspirations, and behaviors. Personas bring the "user" to life, providing a specific target to aid developers in designing a final product."[43] Also include background information such as age, gender, behaviors, and occupation.

- **Consider using a survey to elicit feedback and preferences.**

  There's no substitute for direct input from actual site visitors, and nothing satisfies a frustrated customer like feeling heard. Customer feedback mechanisms range from a simple, self-hosted form – such as Google's single-question form at the bottom of every product support page (see Figure 54) – to full-service data collection and analysis solutions offered by third parties, such as **ForeSee**, that specialize in customer analytics (see Figure 55 for an example of how the US DOT

incorporates this feature). Figure 56 shows an example of a customer satisfaction survey that the National Highway Traffic Safety Administration integrates on their site using ForeSee.

**Figure 54. Every Google Support Page Asks, 'Was this Article Helpful?' Clicking 'No' Reveals One More Question: 'How can We Improve It?'**

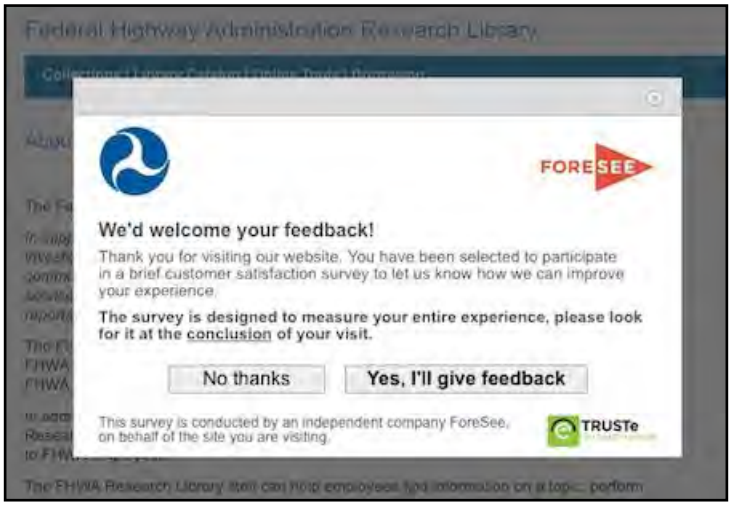



**Figure 55. The ForeSee Overlay Appears Shortly After a User Arrives on Any US DOT Site and Disappears if the User Declines the Feedback Request**

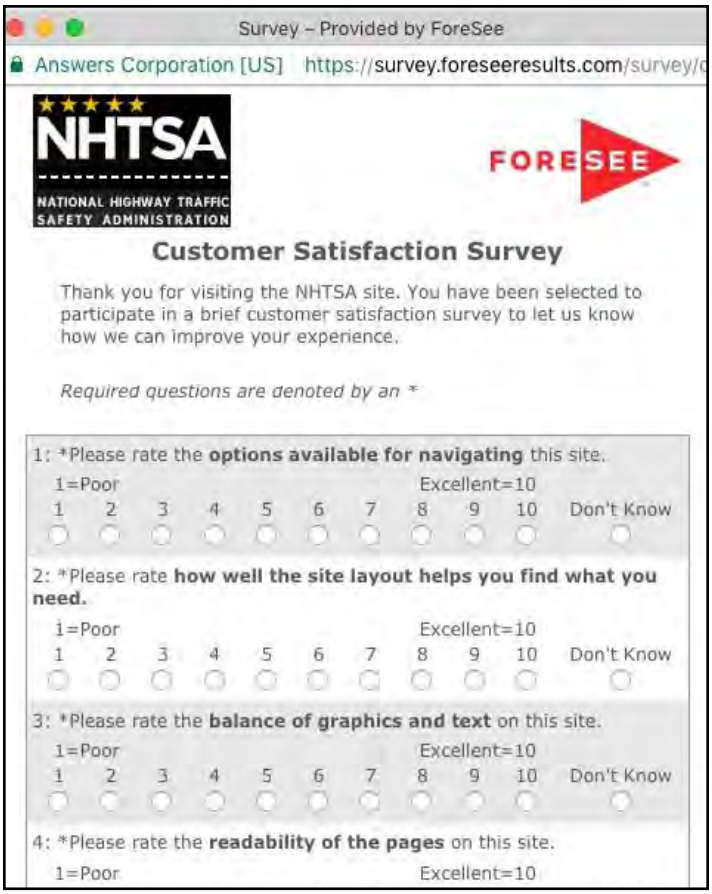



**Figure 56. If the User Consents, the Survey Opens in a Separate Window**

While larger organizations generally prefer the simplicity of end-to-end solutions, for the small number of pages comprising the DRISI Data Library, a form built and hosted in-house, or a link to an offsite survey, such as those offered by SurveyMonkey,[46] may be all that's needed. The Massachusetts Department of Transportation website contains links to several surveys conducted with SurveyMonkey.[47] Google Forms is another offsite forms option. While less elegant than professionally designed surveys, Google Forms can be created and made available for public use quickly. They require no coding or technical knowledge, can be created from any Google account, and they're free.

## EXPAND OFFERINGS TO ADD VALUE AND MEET EXPECTATIONS

- **Increase the breadth of topics and add contextual data.**

  Collect data on a wider range of topics, especially "hot" or controversial topics that engage the general public, such as data on human behavior as it relates to transportation, trends in public opinion on transportation, and environmental issues (alternative fuel options and impacts, a carbon footprint widget, etc.).

Provide context for California data by including national data and data from all 50 states for comparison purposes. Access the data programmatically via APIs to allow comparison with other states and to make the site a one-stop shop for those researching these topics.

Review how other agencies have implemented open data features, such as MassDOT's GIS open data portal, geoDOT (see Figure 30).

- **House all Caltrans data within the Data Library.**

  Libraries are repositories – warehouses, rather than boutiques. When a visitor arrives at the Caltrans "Data Library," they expect to find the entire body of Caltrans data in one place. They expect it to be catalogued in an organized manner that allows them to find relevant items by scrolling, searching, and, ideally, sorting and filtering on a variety of criteria, such as system, mode, region, population served, reporting period, report title(s), owner, update frequency, and so on. At minimum, they expect to find a hierarchically structured list of data products organized by topic, not by producer.

  Users don't care which workgroup produced the data (although they appreciate knowing who to contact about it), and they don't like feeling as though there may be more relevant information hiding in some obscure corner of the site where they would never think to look. While authoring divisions should be free to publish their work on their pages, what customers need to know is that any data produced by Caltrans can be found in the Caltrans Data Library.

  Setting this as a goal would mean a significant expansion of the Library's current scope, and would requires agency-wide cooperation to attain and sustain. The Library should not have to (and probably can't) shoulder the burden of reprocessing all Caltrans data for public access; yet, public access must be provided. Thus, it is incumbent upon Caltrans to address the need for divisions to begin providing data in an open data format. scale; it must either be received in a standardized format or must be formatted by the Division for consistency – a change that would require upper management support, if not authorship.

  Ensuring the library receives all data products would require ongoing, agency-wide participation. This would likely require both a policy change and a relatively painless process that would ensure data products are routed to the library as part of the routine distribution process. Proposing such a process along with the concept would minimize resistance by demonstrating impacts rather than merely claiming they would be trivial.

  Regardless of the presentation medium – onscreen or downloaded file – the policy should signal the expectation that the data and accompanying text to have a consistent appearance and structure, as though it had all been produced by a single entity for use by a single customer. This is user-centered design, and the positive feelings it produces in users toward any institution that provides can't be overstated.

- **Add interactivity features.**

  Providing easy-to-use onsite tools to manipulate and visualize data engages visitors as they browse and increases interest in transportation issues. Adding interactivity can be as easy as pasting the code for one or more self-contained widgets into the html. Time and staff permitting, additional tools tailored to the agency's data and customer needs can be added with basic programming skills.

- **Consider adding an open data GIS mapping tool like the one used by MassDOT.**

- **Raise awareness of open data and its importance throughout the agency.**

  Spread the word that "open data" is here to stay and represents an opportunity for the agency to raise its profile and increase its value to the public. Consider creating a presentation demonstrating its principles and potential using one or more of the sites named in this document.

## INCREASE DISCOVERABILITY OF DRISI DATA

- **Use standard, hierarchical HTML headings (H1, H2, H3, etc.).**

  The tables-based code on which the Data Library was built contains no standard heading elements (h1, h2, etc.). These elements are what search engines look for to identify the content of the page. This is a simple fix.

- **Organize data as visitors expect to find it: by topic rather than by division or document title**

  Most site visitors won't know which division produces the data they're looking for, nor will they know the precise title the agency has assigned to a document containing that data. They know what topic they're looking for, but the terminology they use may not be the terminology the agency uses. Hence, the Data Library should be organized by topic, not by product or producer. If the list of topics is too long to take in at a glance, consider double- or triple-listing items by all the terms a visitor might reasonably use to minimize the chance that relevant data called by a different name will be overlooked. For example, a regulator may look for "HPMS;" a private citizen may have no idea what that stands for yet *may* understand the phrase "highway performance management" … or may not, in which case, another phrasing should be added. To avoid uncertainty, it may be useful to add the alternate phrasing in parentheses. Avoid acronyms unless accompanied by the spelled-out name (se Figure 57).

**Figure 57. Acronyms are Unhelpful to Those Outside the Industry**

More broadly, it's important to tailor the language of the site – particularly the navigation – to those who are *least* familiar with the agency and the industry. How would visitors looking at the division navigation menu shown in the Figure 58 know whether they want DRISI-HQ home page or DRISI-13th/O home page? If they can make sense of it, those with more experience will have no problem.

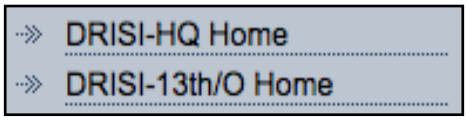



**Figure 58. Help Users Understand Choices**

- **Add "data" and commonly used synonyms to the A to Z site index.**

  Accessible from the site's main menu, the "A to Z" page – a list of links sorted alphabetically – offers the most direct path to the Data Library. Yet, a visitor in search of data will find no entry there for "data" or "data library," nor any other popular synonym, such as statistics, metrics, tracking, trends, measurement, information, or analysis. Nor will they find entries for the topics addressed in the Data Library, such as system inventory, system usage, agency performance, crash (or accident) data, commute times, vehicle types, fuel use, or transit use, to name a few. That's because the page is not a true index of topics as its name suggests – it is an index of page titles, some of which are reasonably descriptive in a very general sense, but many of which are names of divisions, departments, or programs that are unique to the agency and barely hint at the diversity of functions those units perform or the needs they can satisfy. In addition, many of these listings are alphabetized by a word visitors would never associate with the topic. For example, a page titled "Provide Feedback," which, not surprisingly, allows visitors to provide feedback, is listed under "P" (for "provide"), where few would think to look for it, rather than under "F" (for "feedback"). The link that takes visitors closest to the Data Library is under "R" (for "Research, Innovation and System Information, Division of"), which is fine if users already know of the Data Library, what it offers, and where it's kept. And, if they did, they'd probably look in vain under "D" for "DRISI."

  There's no purpose served in listing pages by title rather than by topic, and there's no reason each destination page should be limited to only one entry. Currently, a few pages are listed twice by different words in its title, and one, titled "In Remembrance: Fallen Workers," is listed once for each of its four words (though, ironically, the page is *not* listed where many would intuitively look for it: under "M" for "memorial").

  There's no reason the A to Z index should not be turned into a true index. It can also include divisions by name, but its primary purpose should be to assist visitors in finding pages by topic.

- **Consider adding a direct link from the Caltrans home page.**

- **Add descriptive data to links that point to reports or data.**

Hidden tooltips that appear upon hover can accomplish this unobtrusively with minimal coding and no revision of existing layouts. Tooltip templates and tutorials are widely available on the Web.

- **Find and fix broken links on a regular basis.**

  The Data Library page and linked pages contain several broken links. No-cost tools and browser extensions make finding these a quick, easy task.

## STANDARDIZE STYLES AND FUNCTION ACROSS PRODUCTS

- **Standardize the methods by which data is accessed.**

  Every website is slightly unique in its structure, content, and the methods by which users access its content. Because of this, each presents something of a challenge to first-time visitors. Before they can use it efficiently and comfortably, they must "master" it – learn its conventions. Consistency creates predictability, and this is the key to minimizing the time and effort required for users to accomplish this task. With respect to the Data Library, it means that, regardless of media, users should have to access only one dataset or document to understand how to access all of them. This applies to everything that affects the user experience, from the appearance of the interface through which they request data to what happens after when a request is sent. Obviously, different media will provide somewhat different experiences – manipulating data onscreen is not like downloading a PDF – but the experiences should be close enough in appearance and function that a user who has accessed one DRISI data product knows what to expect from all of them.

- **Develop or adopt style guidelines for presentation of DRISI-published (preferably all Caltrans-published) documents and Web pages, and follow them faithfully.**

  Words, numbers, symbols, and images are critical for conveying information in a document or on a Web page, but equally important are visual elements that provide clues to the content structure and how the parts relate to the whole. These can be graphical elements, such as shapes, icons, or colors, or they can be distinctive graphical styles for text, based on its function. For example, headings of various point sizes, styles, and colors, signal the start of chapters, sections, subsections, and sub-subsections. Unique styles for captions, sidebars, and other elements, set these apart from body text. Without these visual cues, making sense of complex, nested topics would be difficult if not impossible. How would one know if the next paragraph is a second argument for a hypothesis or an entirely new hypothesis? Graphical styles that are used inconsistently can be even more disorienting because they violate the unwritten agreement previously established with the reader as to what each style signifies. In *Developing Quality Technical Information*, Gretchen Hargis et al. writes, "Information presentation that is not uniform is distracting and potentially confusing for readers."[49] Disciplined use of styles can reveal structural deficiencies in the writing that can weaken or cripple its impact. If a publisher

or reader finds it difficult, for example, to determine whether a heading (and its associated text) is meant to function as a sibling or a subordinate of the previous heading, this indicates a structural problem that should be addressed by the author. The most efficient way to ensure uniform application of styles is to provide the authors themselves with the agency's style guide (and a template, if available) and require them to use the approved styles in their writing. Although this can't guarantee pristine manuscripts, it increases the likelihood that structural inconsistencies will be recognized and addressed before the document is submitted for publication. As Hargis et al. says, "Style guidelines help ensure that writers working on related information do not introduce variations that will create inconsistent presentation."

- **Manage User Expectations with Consistent Treatments**

  Websites that look different from others can be enjoyable, but websites that "work different" are not. Predictability and consistency are essential for conveying the organization's stability, keeping visitors oriented, and reassuring them they're exactly where should be. Nowhere is predictability more critical than in navigation. It is disorienting to click a link that looks like any other on the page and land on what appears to be a completely different website. Unfortunately, this is the experience visitors encounter when they move from the DRISI division "home" page, updated earlier in the year to the 2013 template, to the division's internal pages, still using the 2007 template. Staff were informed that the rollout of the 2013 template to the entire site could take years. It is therefore incumbent upon the Division to do whatever it can to minimize the jarring effect of this "hard landing" on users.

  Web users today are wary. They receive emails from scammers daily. They know that even the savviest users have been fooled by sites that mimic well-known, trusted sites. Anything that's slightly "off" – including pages and links that don't work the way they do on other sites or on other pages of the same site – may be enough to induce them to hit the "back" button or close the page. Hence, legitimate websites must continually work to reassure them. Multiple strategies are required to accomplish this. Most important among these is ensuring that every page looks and works in the same predictable manner. Every page must carry the same "branding" – logo, colors, visual styles, and typography. Navigation menus must not change from page to page. A user clicking from one page to the next may not consciously notice that a repeating element, such as a logo or menu, shifts a few pixels to the right or left, but they will be left with the sense that the organization is less reliable than they had thought.

  Users want to know what to expect when they click a link. They expect standard links to take them to another Web page. They're unsettled if instead, they see their browser preparing to download a file. Always provide a visual clue (typically an icon) next to links that lead to anything other than a Web page (such as a document) or lead to a page on an external website (see Figure 59). For downloadable files, it's common to use icons associated with popular document types, which can be downloaded at no charge from many sources.[51] Visitors readily recognize that a link followed by an icon with an outward-facing arrow indicates that clicking will take the user to a different website.

**Figure 59. Links to Offsite Locations or Downloadable Files Should be Marked with Familiar Icons**

- **Use appropriate HTML tags for headings and subheadings, and make headings relevant**

  The Data Library page title (shown in the browser tab) is “System Information,” but the level-1 (h1) heading in the page code is “DRISI-HQ Data Library.” This heading level is what search engines use to determine what a Web page is “about;” however “DRISI-HQ Data Library” isn’t meaningful outside the agency. Change the h1 heading and title tag to “System Information” or “System Information Library.”

- **Minimize inconsistencies within the older pages.**

  Update or remove dated graphics (e.g., “New”), and ensure consistency within older DRISI pages. Change fonts to match the new template (if possible).

- **Present data as HTML pages or from a managed database product, such as Socrata**

  There is no question that the fewer steps involved for people in being able to see and manipulate the actual data, the more individuals you can engage, the more useful they’ll perceive the site, and the more satisfied they’ll be with the experience and the agency. Remember, the website is the only face of the agency most visitors will ever see, and impressions are powerful persuaders. Data that can be sorted, filtered, and otherwise manipulated onscreen is more useful than static data in files that must be downloaded and opened in a separate application before the user knows the data scope and format.

  Where it is not feasible to present data in html, provide a thorough description of the data topics and scope (time periods and depth), as well as a graphical representation of the data’s structure. A thumbnail may suffice, but a thumbnail popup that allows users to see details will increase customer satisfaction.

## REUSABILITY

- **Provide information and data in multiple formats to meet diverse needs.**

  PDFs can be useful for reports that mix narrative and data, but the same content on an HTML page as well will allow visitors to see if it’s the information they’re looking for before downloading, and to access it faster if they want to skim quickly. An HTML page dense with its subject matter will also will boost the site’s ranking in search results more than a PDF.

Establish a policy of consistently providing any statistical data in a variety of file formats for downloading (Excel, csv, and XML, at minimum) to boost reusability.

- Use free, embeddable widgets to take advantage of reusable data of interest to Californians from sites such as the US DOE and California Air Resources Board.

- DRISI **Quick Facts by County** page should tell you which Quick Facts you will find by clicking. See **US Census Bureau QuickFacts**, which are presented in html and are highly configurable.

- Integrate the typography and as many design styles as practicable from the redesigned site to minimize the jarring effect.

- If the link is a downloadable document, *always* indicate the file format, (e.g., DOCX, XLSX, etc.) Otherwise, the user expects a web page. See links under "Additional Information" at **http://www.dot.ca.gov/hq/tsip/opppd/section500.php** for examples of documents that do not have this.

- Provide a direct link to the library from the Caltrans home page. The Massachusetts DOT home page (shown in Figure 25) illustrates one way to do this.

- **Consider adding commenting and social sharing to DRISI pages.**

  Giving users the ability to comment directly on the content of Caltrans Web pages increases their engagement and gives them a personal connection to the organization while providing the agency with insights into certain segments of its customer base. "Share" buttons allow users to easily share Caltrans pages on Facebook or other social media, raising the agency's profile. **Facebook Social Plugins** add commenting and "Like" or "Share" features to any Web page at no cost simply by pasting in a couple of lines of code. Visitors can use them to discuss or ask questions about Data Library page content and products. Caltrans staff can respond directly (if authorized) or through the person(s) charged with managing the agency's Facebook pages. Another plugin can display posts from the Caltrans HQ Facebook page on pages of the Caltrans site. Dedicated conversation tools, such as those offered by Disqus,[52] can be used to add commenting not linked to any social media network.

## Navigability

- Avoid providing unorganized lists of links to varied resources. It makes it challenging for the user to navigate easily to the information they desire.

- When lists of links are necessary, provide a brief description of what the user will find at the destination. Use an "offsite" icon (see Figure 59) to indicate whether the link will take users offsite. *Always* indicate when a link will take a user to a document (and which type) vs. a Web page.

# IX. CONCLUSION

Given the slow start of many state and local transportation agencies in embracing the nation's digital government goals, Caltrans has a singular opportunity to take a leadership role by establishing data policies and practices that will inspire and provide a model for state and local agencies across the country. Preserving California's much-admired natural environment and relieving the congestion of its roadways are just two of the many incentives, and between the state's uniquely creative industries, its obsession with healthful living, its commitment to equal access, and the extraordinary technological and intellectual capabilities of its organizations and universities, the resources available to Caltrans represent almost an embarrassment of riches. By partnering with the state's most forward-thinking organizations whose ability to attract the world's best and brightest depends in no small part on the desirability of the region and its robust economy, Caltrans can serve the needs of its constituents with leading-edge data solutions while simultaneously meeting the organizations' needs for livable communities where people work, play, and prosper. In a state known for the diversity of its causes, innovations that facilitate smarter, faster, and safer movement of people and goods may be the one that unites.

# ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| Breadcrumbs | A list of links, typically in a horizontal sequence, that, like breadcrumbs left on a walking trail, show path to the current page from the home page. Occasionally, breadcrumbs are used to show the path the user followed rather than the most direct path from the home page. |
| CARP | Contrast, alignment, repetition, and proximity – four design principles for improving document readability[53] |
| CDC | Centers for Disease Control and Prevention |
| CDIP | Crash Data Improvement Program |
| CODES | Crash Outcome Data Evaluation System DOT Department of Transportation |
| Data element | Individual fields within each record of a database |
| Data Governance | An established set of procedures to ensure important data assets are formally managed throughout the enterprise |
| Data integration | The discrete linking of databases for analytic purposes |
| DMV | Department of Motor Vehicles |
| EMS | Emergency Medical Service |
| ESRI | Environmental Systems Research Institute (used here to refer to the Institute's data formatting standard) |
| FHWA | Federal Highway Administration |
| FMCSA | Federal Motor Carrier Safety Administration |
| GIS | Geographic Information Systems |
| HPMS | Highway Performance Monitoring System |
| ICTs | Internet and Other Information and Communication Technologies[54] |
| LBRS | Location Based Response System |
| Metadata | Data describing a dataset (literally, "data about data") |
| NHTSA | National Highway Traffic Safety Administration |
| OGD | Open Government Data |
| OMB | Office of Management and Budget |
| SAFETEA-LU | Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (Pulp. 109–59) – a 2005 bill governing US federal surface transportation spending. |
| TRB | Transportation Research Board |
| TRCC | Traffic Records Coordinating Committee |
| TREDS | Traffic Record Electronic Data System |
| TRT | Transportation Research Thesaurus (on the TRB website) |

| | |
|---|---|
| Utility menu (aka “Eyebrow menu”) | Small, unobtrusive menu above the main navigation menu sometimes used for links to areas of the site that are accessed frequently but are ancillary to the main topic. Another popular use is to allow visitors to navigate by role rather than by topic. Example: Customers, Contractors, Researchers, etc. |
| VIN | Vehicle Identification Number |

# APPENDIX

## AGENCIES RESEARCHED FOR THIS STUDY

### Table 6. State Departments of Transportation[55]

| *Agency* | URL |
|---|---|
| *Alabama Department of Transportation* | http://www.dot.state.al.us/ |
| *Alaska Department of Transportation* | http://www.dot.state.ak.us/ |
| *Arizona Department of Transportation* | http://www.azdot.gov/ * |
| *Arkansas Highway and Transportation Department (AHTD)* | http://www.arkansashighways.com/ |
| *California Department of Transportation* | http://www.dot.ca.gov/ |
| *Colorado Department of Transportation* | https://www.codot.gov/ * |
| *Connecticut Department of Transportation* | http://www.ct.gov/dot/ |
| *Delaware Department of Transportation* | http://www.deldot.net/ |
| *District of Columbia Department of Transportation* | http://www.ddot.dc.gov/ * |
| *Florida Department of Transportation* | http://www.dot.state.fl.us/ |
| *Georgia Department of Transportation* | http://www.dot.ga.gov/ * |
| *Hawaii Department of Transportation* | http://hawaii.gov/dot |
| *Idaho Transportation Department* | http://itd.idaho.gov/ |
| *Illinois Department of Transportation* | http://www.idot.illinois.gov/ |
| *Indiana Department of Transportation* | http://www.in.gov/indot/ * |
| *Iowa Department of Transportation* | http://www.dot.state.ia.us/ |
| *Kansas Department of Transportation* | http://www.ksdot.org/ |
| *Kentucky Transportation Cabinet* | http://transportation.ky.gov/ |
| *Louisiana Department of Transportation & Development* | http://www.dotd.state.la.us/ |
| *Maine Department of Transportation* | http://www.maine.gov/mdot/ |
| *Maryland Department of Transportation* | http://www.mdot.state.md.us/ |
| *Massachusetts Department of Transportation* | http://www.massdot.state.ma.us/ |
| *Michigan Department of Transportation* | http://www.michigan.gov/mdot/ |
| *Minnesota Department of Transportation* | http://www.dot.state.mn.us/ |
| *Mississippi Department of Transportation* | http://www.gomdot.com/ * |
| *Missouri Department of Transportation* | http://www.modot.org/ |
| *Montana Department of Transportation* | http://www.mdt.mt.gov/ |
| *Nebraska Department of Roads* | http://www.dor.state.ne.us/ |
| *Nevada Department of Transportation* | http://www.nevadadot.com/ |
| *New Hampshire Department of Transportation* | http://www.nh.gov/dot/ |
| *New Jersey Department of Transportation* | http://www.state.nj.us/transportation/ |
| *New Mexico Highway and Transportation Department* | http://dot.state.nm.us/ * |
| *New York New York State Department of Transportation* | https://www.dot.ny.gov/ * |
| *North Carolina Department of Transportation* | http://www.ncdot.gov/ |
| *North Dakota Department of Transportation* | http://www.dot.nd.gov/ |
| *Ohio Department of Transportation* | http://www.dot.state.oh.us/ |
| *Oklahoma Department of Transportation* | http://www.okladot.state.ok.us/ |
| *Oregon Department of Transportation* | http://www.oregon.gov/odot/ * |
| *Pennsylvania Department of Transportation* | http://www.dot.state.pa.us/ |

| *Agency* | URL |
|---|---|
| *Rhode Island Department of Transportation* | http://www.dot.ri.gov/ * |
| *South Carolina Department of Transportation* | http://www.dot.state.sc.us/ |
| *South Dakota Department of Transportation* | http://www.sddot.com/ |
| *Tennessee Department of Transportation* | http://www.tdot.state.tn.us/ |
| *Texas Department of Transportation* | http://www.dot.state.tx.us/ |
| *Utah Department of Transportation** | http://www.udot.utah.gov/ * |
| *Vermont Agency of Transportation* | http://www.aot.state.vt.us/ |
| *Virginia Department of Transportation* | http://www.virginiadot.org/ |
| *Washington Department of Transportation* | http://www.wsdot.wa.gov/ |
| *West Virginia Department of Transportation** | http://www.transportation.wv.gov/ * |
| *Wisconsin Department of Transportation* | http://www.dot.state.wi.us/ |
| *Wyoming Department of Transportation* | http://www.dot.state.wy.us/ |

*Source:* Office of the Assistant Secretary for Research and Technology. “Search State DOTs.” National Transportation Library (accessed November 30, 2016).

** Asterisked URLs were incorrect on the source site and are corrected here.*

## Table 7. California Metropolitan Planning Organizations

| *Organization* | URL |
|---|---|
| *Association of Monterey Bay Area Governments (Dist. 5)* | http://www.ambag.org |
| *Butte County Association of Governments (Dist. 3)* | http://www.bcag.org |
| *Fresno Council of Governments (Dist. 6)* | http://www.fresnocog.org |
| *Kern Council of Governments (Dist. 6)* | http://www.kerncog.org |
| *Kings County Association of Governments (Dist. 6)* | http://www.kingscog.org |
| *Madera County Transportation Commission (Dist. 6)* | http://www.maderactc.org |
| *Merced County Association of Governments (Dist. 10)* | http://www.mcagov.org/ |
| *Metropolitan Transportation Commission (Dist. 4)* | http://www.mtc.ca.gov/about_mtc/ |
| *Sacramento Area Council of Governments (Dist. 3)* | http://www.sacog.org |
| *San Diego Association of Governments (Dist. 11)* | http://www.sandag.org |
| *San Joaquin Council of Governments (Dist. 10)* | http://www.sjcog.org |
| *San Luis Obispo Council of Governments (Dist. 5)* | http://www.slocog.org |
| *Santa Barbara County Association of Governments (Dist. 5)* | http://www.sbcag.org |
| *Shasta Regional Transportation Agency (Dist. 2)* | http://www.scrtpa.org |
| *Southern California Association of Governments (Dist. 7,8,11,12)* | http://www.scag.ca.gov |
| *Stanislaus Council of Governments (Dist. 10)* | http://www.stancog.org/ |
| *Tahoe Metropolitan Planning Organization (Dist. 3)* | http://www.tahoempo.org |
| *Tulare County Association of Governments (Dist. 6)* | http://www.tularecog.org/ |

## Table 8. California Regional Transportation Planning Agencies

| *Consortium* | URL |
|---|---|
| *Alpine County Local Transportation Commission (Dist. 10)* | http://www.alpinecountyca.gov/ |
| *Amador County Transportation Commission (Dist. 10)* | http://www.actc-amador.org |
| *Calaveras Council of Governments (Dist. 10)* | http://www.calacog.org |
| *Colusa County Transportation Commission (Dist. 3)* | http://www.ccdpw.com/Commission.htm |
| *Council of San Benito County Governments (Dist. 5)* | http://www.sanbenitocog.org |
| *Del Norte Local Transportation Commission (Dist. 1)* | http://www.dnltc.org/ |
| *El Dorado County Transportation Commission (Dist. 3)* | http://www.edctc.org |
| *Glenn County Transportation Commission (Dist. 3)* | http://www.gcppwa.net/ |
| *Humboldt County Association of Governments (Dist. 1)* | www.hcaog.net |
| *Inyo County Local Transportation Commission (Dist. 9)* | http://www.inyoltc.org |
| *Lake County/City Area Planning Council (Dist. 1)* | http://www.lakeapc.org |
| *Lassen County Transportation Commission (Dist. 2)* | http://www.co.lassen.ca.us/govt/dept/transportation/Transportation.asp |
| *Mariposa County Local Transportation Commission (Dist. 10)* | http://www.mariposacounty.org |
| *Mendocino Council of Governments (Dist. 1)* | http://www.mendocinocog.org/ |
| *Modoc County Transportation Commission (Dist. 2)* | http://modoctransportation.com/ |
| *Mono County Local Transportation Commission (Dist. 9)* | http://monocounty.ca.gov/departments.html |
| *Nevada County Transportation Commission (Dist. 3)* | http://www.nctc.ca.gov/ |
| *Placer County Transportation Planning Agency (Dist. 3)* | http://www.pctpa.org |
| *Plumas County Transportation Commission (Dist. 2)* | http://www.countyofplumas.com/public-works/ |
| *Santa Cruz County Regional Transportation Commission (Dist. 5)* | http://www.sccrtc.org |
| *Sierra County Local Transportation Commission (Dist. 3)* | http://www.sierracounty.ca.gov/index.aspx?NID=318 |
| *Siskiyou County Local Transportation Commission (Dist. 2)* | http://www.co.siskiyou.ca.us/content/local-transportation-commission |
| *Tehama County Transportation Commission (Dist. 2)* | http://www.tehamacountypublicworks.ca.gov/Transportation/ |
| *Transportation Agency for Monterey County (Dist. 5)* | http://www.tamcmonterey.org |
| *Trinity County Transportation Commission (Dist. 2)* | http://www.trinitycounty.org/Departments/Planning/transcomm.htm |
| *Tuolumne County Transportation Council (Dist. 10)* | http://www.tuolumnecounty.ca.gov |

## Table 9. University Transportation Centers (2013 – 2016)

| *Type* | Consortium | URL |
|---|---|---|
| *National* | NCST (Davis) National Center for Sustainable Transportation (Strategic Goal: Environmental Sustainability) | http://ncst.ucdavis.edu/ |
| *National* | NTC (U Maryland) National Center for Strategic Transportation Policies, Investments, and Decisions (Strategic Goal: Economic Competitiveness) | http://ntc.umd.edu/ |
| *National* | CAIT (Rutgers) Center for Advanced Infrastructure and Transportation (Strategic Goal: State of Good Repair) | http://cait.rutgers.edu/ |
| *National* | NITC (Portland) National Institute for Transportation and Communities (Strategic Goal: Livable Communities) | http://nitc.trec.pdx.edu/ |
| *National* | TSET (Carnegie Mellon) Technologies for Safe and Efficient Transportation Center (Strategic Goal: Safety) | http://utc.ices.cmu.edu/utc/ |
| *Regional* | UConnect (Berkeley) University of California Center on Economic Competitiveness in Transportation (Strategic Goal: Safety) | http://www.ucconnect.berkeley.edu/ |
| *Regional* | InTrans (Iowa State) Midwest Transportation Center (Strategic Goal: State of Good Repair) | http://www.intrans.iastate.edu/mtc/ |
| *Regional* | UTCMIT (MIT) New England University Transportation Center (Strategic Goal: State of Good Repair) | http://utc.mit.edu/ |
| *Regional* | Roadway Safety (UMn) Roadway Safety Institute (Strategic Goal: Safety) | http://www.roadwaysafety.umn.edu |
| *Regional* | Mountain-Plains (ND State) Mountain-Plains Consortium (Strategic Goal: Economic Competitiveness) | http://www.mountain-plains.org/ |
| *Regional* | UTRC (UNY) University Transportation Research Center (Strategic Goal: Economic Competitiveness) | http://www.utrc2.org/ |
| *Regional* | SPTC (UOK) Southern Plains Transportation Center (Strategic Goal: Safety) | http://www.sptc.org |
| *Regional* | STC (U Tenn) Southeastern Transportation Center (Strategic Goal: Safety) | http://stc.utk.edu/ |
| *Regional* | MATS (UVa) Mid-Atlantic Transportation Sustainability (MATS) Center (Strategic Goal: Environmental Sustainability) | http://www.matsutc.org |
| *Tier 1* | ABC (Florida Intl) Accelerated Bridge Construction University Transportation Center (Strategic Goal: State of Good Repair) | http://www.abc-utc.fiu.edu |
| *Tier 1* | ASAP (Florida State) Center for Safe and Accessible Transportation for an Aging Population (Strategic Goal: Safety) | http://utc.fsu.edu |
| *Tier 1* | METAL (U Maine) Marine Engine Testing and Emissions Laboratory (Strategic Goal: Environmental Sustainability) | http://www.mainemaritime.edu/metel |
| *Tier 1* | CHPP (MI State) University Transportation Center for Highway Pavement Preservation (Strategic Goal: State of Good Repair) | http://www.chpp.egr.msu.edu/ |
| *Tier 1* | RECAST (Mo U of Science) University Transportation Center for Research on Concrete Applications for Sustainable Transportation (Strategic Goal: State of Good Repair) | http://recast.mst.edu/thecenter/ |
| *Tier 1* | SURLC (MT State) Small Urban and Rural Livability Center (Strategic Goal: Livable Communities) | http://www.westerntransportationinstitute.org/centers/small-urban-and-rural-livability-center/default.aspx |
| *Tier 1* | TransInfo (Buffalo) Transportation Informatics University Transportation Center (Strategic Goal: Economic Competitiveness) | http://www.buffalo.edu/transinfo.html |
| *Tier 1* | CrIS (Ohio State) Crash-Imminent Safety University Transportation Center (Strategic Goal: Safety) | http://citr.osu.edu/CrIS/ |
| *Tier 1* | CESTICC (U Alaska) Center for Environmentally Sustainable Transportation in Cold Climates (Strategic Goal: Environmental Sustainability) | http://ine.uaf.edu/cesticc/ |
| *Tier 1* | MarTrec (U Ark) Maritime Transportation Research and Education Center (Strategic Goal: Economic Competitiveness) | http://martrec.uark.edu/ |

| *Type* | Consortium | URL |
|---|---|---|
| *Tier 1* | EVTC (U Central FL) Electric Vehicle Transportation Center (Strategic Goal: Environmental Sustainability) | http://evtc.fsec.ucf.edu/index.htm |
| *Tier 1* | NURAIL (U IL) National University Rail Center (Strategic Goal: Economic Competitiveness) | http://www.nurailcenter.org/ |
| *Tier 1* | SAFERSim (U IA) Safety Research Using Simulation Center (Strategic Goal: Safety) | http://safersim.nads-sc.uiowa.edu/ |
| *Tier 1* | ATLAS (U MI) Center for Advancing Transportation Leadership and Safety (Strategic Goal: Safety) | http://www.atlas-center.org |
| *Tier 1* | SOLARIS (U NV) Institute for Safety and Operations of Large-Area Rural-Urban Intermodal Systems (Strategic Goal: Safety) | http://www.unr.edu/solaris |
| *Tier 1* | NCTR (U So. FL) National Center for Transit Research (Strategic Goal: Livable Communities) | http://www.nctr.usf.edu/ |
| *Tier 1* | METRANS (USC) Metropolitan Transportation University Transportation Center (Strategic Goal: Economic Competitiveness) | http://www.metrans.org/about/ |
| *Tier 1* | UTCRS (U TX Rio) University Transportation Center for Railway Safety (Strategic Goal: Safety) | http://railwaysafety.utrgv.edu/ |
| *Tier 1* | dSTOP (U TX Austin) Data-Supported Transportation Operations and Planning Center (Strategic Goal: Economic Competitiveness) | http://ctr.utexas.edu/research/d-stop/ |
| *Tier 1* | TRCLS (Western Mi.) Transportation Research Center for Livable Communities (Strategic Goal: Livable Communities) | http://www.wmich.edu/transportationcenter |
| *Tier 1* | ABC (Florida Intl) Accelerated Bridge Construction University Transportation Center (Strategic Goal: State of Good Repair) | http://www.abc-utc.fiu.edu |

## Table 10. Federal Agencies

| *Agency/Division (Parent, if applicable)* | URL |
|---|---|
| *Bureau of Transportation Statistics/OST-R (US DOT)* | http://www.rita.dot.gov/bts/home |
| *National Institute of Standards and Technology* | https://www.nist.gov/ |
| *National Transportation Safety Board* | http://www.ntsb.gov/Pages/default.aspx |
| *Data.gov (Under the US General Services Administration)* | http://www.data.gov |
| *FHWA Research Library/FHWA (US DOT)* | http://www.fhwa.dot.gov/ http://www.fhwa.dot.gov/research/library/ |
| *National Highway Traffic Safety Administration (NHTSA) and two of its programs:* | http://www.nhtsa.gov/ |
| I. National Center for Statistics and Analysis (NCSA) | http://www.nhtsa.gov/Data |
| II. NHTSA Fatality Analysis Reporting System (FARS) | http://www.nhtsa.gov/Data/Fatality-Analysis-Reporting-System-(FARS) |
| *Office of Highway Policy Information (OHPI) of the Federal Highway Administration (under US DOT)* | http://www.fhwa.dot.gov/policyinformation/tables/performancenetwork/ |
| *US Data and Statistics (US Census Bureau)* | http://www.census.gov/quickfacts/table/PST045215/00 |
| *US Department of Energy* | http://www.afdc.energy.gov/ |

*Note:* Some federal agencies were studied in greater depth than others based on their relevance to Caltrans' mission.

## RESOURCES

The following are a very small subset of the vast array of data and data presentation resources available for site owners. Many of them are available at no cost.

### Data Hosting and Visualization Platforms

*CKAN*

One of three open-source data catalog tools recommended for agency use by the Project Open Data website, and the one used by the State Open Data Portal. According to the website, "CKAN can provide a robust and feature-rich solution with which to begin maintaining an internal or external catalog." It also helps automate generation of needed metadata.

*DKAN*

One of three open data catalog tools recommended by the Project Open Data website, and the one used to power the State's Open Data Portal.[56] Modeled on CKAN, a stand-alone Drupal distribution that "allows anyone to spin up an open data portal in minutes." It can be can be used to add a data portal to existing Drupal sites, such as the one currently in use by Caltrans.

*Socrata*

One of three open-source data catalog tools recommended for agency use by the Project Open Data website, Socrata is used by the seven California open data portals currently available from the data.ca.gov site. Socrata runs as a Web-deployed service, which means "agencies that have not adapted a data catalog yet can use Socrata without having to install or setup any servers or software." In addition to providing rich visualizations and data management features, Socrata natively supports data.json, so any datasets managed through Socrata will be automatically exposed correctly. Socrata also supports all the extended metadata fields through its extensible metadata features.

# ENDNOTES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33. *Massachusetts Department of Transportation*, http://www.massdot.state.ma.us/ (accessed January 5, 2016).

34. Jakob Nielsen, "F-shaped Pattern for Reading Web Content," *Nielsen Norman Group*, https://www.nngroup.com/articles/f-shaped-pattern-reading-web-content/ (accessed December 15, 2015). Users skim pages quickly in a very distinct pattern roughly like an uppercase letter "F." Starting at the upper left corner of the page, the typical location of a site logo, a user's eyes move horizontally across the top – where the main navigation menu is usually located – then vertically down the left side. Approximately one-third of the way down, their eyes once again move horizontally partway across the width of the page. This is typically the area where the main heading is located. Then they resume their path down the left edge of the page, their eyes briefly taking in the first few words of any subheads.

35. Since the other three menu items are travel modes, the author was unsure what RMV might stand for – Recreational Motor Vehicles? As it happens, it stands for Registry of Motor Vehicles – Massachusetts' equivalent of California's DMV. The abbreviation is probably instantly recognized by Massachusetts residents, but it was not by this Californian, which demonstrates why it's essential to test proposed content, particularly navigation and other critical components, with a wide range of potential customers – not just those outside the agency but those outside the industry and even outside the state, as this example illustrates. Despite having the best of intentions, in-house staff cannot simply "turn off" their understanding of industry and agency jargon and view content as someone having no connection to the transportation industry or the agency.

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51. A Google search for “free document icons” or “free document icon sprites” will turn up dozens of no-cost document icons. For external links, search for (*icon AND (external link) OR (external site*)). For individual icons, a “best practice” to reduce page download times is to collect all the icons into a single image (the collected icons are known as “sprites”) and use the CSS “background-image” and “background position” properties to display the specific icon you want to see in your HTML. There are many free, online sprite generators (search for “online sprite generator”) that will create sprites from images you upload and will even generate the CSS code for positioning each one. Two such generators are at http://spritegen.website-performance.org/ and http://csssprites.com/, but there are many others.

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Frances Cherman has been responsible for the operation and management of the MTI website since 2010. She also applies her InDesign and editing skills to assist in production of MTI publications. A longtime business consultant, specializing in copywriting for the Web, direct marketing, sales collateral and packaging, she has served some of Silicon Valley's most successful companies, including Apple, HP, Intuit, LegalZoom, Netflix, Wells Fargo, and many others. Before starting her copywriting business in 1987, she was copy director at Inmac. She holds a BA in English from California State University, Northridge.

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