INSIDE

Minimizing Moisture Damage in Asphalt Pavements
The Technology Transfer Program is a unit of the Institute of Transportation Studies at the University of California, Berkeley. We provide low-cost professional training, workshops, and free technical assistance and information resources. Topic areas cover motorized and non-motorized roadway traffic, aviation, and rail, and include:

- Transportation engineering, operations, and safety
- Traffic signals
- Infrastructure design
- Project development, management, and compliance
- Pavement design and maintenance
- Planning, funding, and the environment
- Work zone safety

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The Technology Transfer Program newsletter is published quarterly and mailed to 19,500 readers in California and the United States with funds from the California Local Technical Assistance Program (LTAP).

The Technology Transfer Program, California’s LTAP Center, is part of a nationwide network of centers established by the Federal Highway Administration (FHWA) in cooperation with state transportation agencies. California’s LTAP Center is funded with additional support from the California Department of Transportation and is administered by the University of California, Institute of Transportation Studies, Technology Transfer Program.

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New Research Syntheses on Transportation Topics

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PHOTO CREDIT: Bottom Right: A prefabricated bridge system project at Pioneer Crossing in Utah. Claude Napier, Federal Highway Administration.
NEW RESEARCH SYNTHESES ON TRANSPORTATION TOPICS

Each year, the California Department of Transportation (Caltrans) Division of Research and Innovation (DRI) receives numerous problem statements from researchers applying for state funding for transportation-related research projects. To determine the scope of the proposed research and to prioritize the research agenda, Caltrans initiates an evaluation process known as a Preliminary Investigation.

Beyond helping Caltrans make funding decisions, the research reports produced as part of the Preliminary Investigation process are a valuable resource for California cities and counties because they cover topics that are broadly applicable to transportation agencies.

Each Preliminary Investigation is an exceptionally in-depth, concise synthesis report that describes the state of the practice regarding a specific topic. The reports generally include surveys of practice at state departments of transportation (DOTs), interviews with agencies involved with research on the topic, citations for guidance documents, summaries of research reports, and links to websites.

Topics include paving technologies, environmental concerns, human factors, Intelligent Transportation Systems, pedestrian facility design, road design, roadside landscaping, and more. A few recent reports include:

**Best Practices for Rural Smart Growth**

Smart Growth is a development strategy that endeavors to manage community growth through land use and transportation integration. While the topic is well-researched in urban and suburban studies, there is little understanding of how Smart Growth strategies can be used in rural areas. This report describes the resources and strategies that have been developed to aid in the implementation of smart growth strategies, in rural California and elsewhere.

**Roadside Management Strategies to Reduce Greenhouse Gases**

AB 32 and SB 375 require California agencies to reduce greenhouse gas (GHG) emissions, primarily those associated with the transportation system. This report focuses on literature that describes the value of carbon sequestration by vegetation (namely, trees) along roadside Right-of-Ways in terms of environmental and economic impact. It also covers practices used by state DOTs and federal agencies to manage vegetation for carbon sequestration.

**Practices and Guidelines for Temporary Transverse Hot Mix Asphalt (HMA) Tapers**

Roads constructed or rehabilitated with HMA are typically opened to traffic when work is not being performed, which results in transverse drop-offs at the point where pavements of different heights meet. This report describes practices used across the country for constructing transverse tapers to ease the transition between pavements. These practices vary on factors such as taper slope, HMA mix design, drop-off height, and speed limit requirements.

**Green Technologies for Reducing Slope Erosion**

This report describes innovative strategies for reducing the risk of roadside slope erosion. It includes a review of recent research, national guidance, and state DOT practice focusing on Low Impact Development (LID) techniques, biotechnical guidance related to slope design, soil engineering, and vegetation selection and management.

**Measuring and Improving Performance in Incident Management**

Traffic collisions cause traffic congestion on roadways. Clearing incidents rapidly can minimize congestion, reducing secondary crashes and improving safety for roadway users and emergency personnel. This report provides an overview of practices DOTs and other transportation agencies use to reduce the amount of time required to respond to and clear major traffic incidents, including data collection techniques, interagency coordination methods, and other measures.

**ADDITIONAL REPORTS**

Preliminary Investigation reports are posted on DRI’s website at [www.dot.ca.gov/research/research_reports/preliminary_investigations](http://www.dot.ca.gov/research/research_reports/preliminary_investigations).
Prefabricated Bridge Elements and Systems (PBES)

With PBES, an old bridge can be demolished while new bridge elements are built simultaneously offsite, then brought to the project location to be erected. Because PBES are usually fabricated under controlled climate conditions, weather has less impact on the quality, safety, and duration of the project. The use of PBES also offers cost savings in both small and large projects. This technology is described on page 10.

Geosynthetic Reinforced Soil (GRS)

GRS Integrated Bridge System (IBS) technology uses alternating layers of compacted granular fill material and fabric sheets of geotextile reinforcement to support the bridge. GRS also provides a smooth transition from the bridge onto the roadway, and alleviates the “bump at the bridge” problem caused by uneven settlement between the bridge and the approaching roadway. The technology offers a flexible design that is easy to modify in the field, uses common equipment and materials, and reduces construction time and costs. The article on page 11 introduces this technology.

SHORTENING PROJECT DELIVERY TOOLKIT

FHWA put together a toolkit with methods for improving project delivery times, which includes tools to eliminate duplication of effort and tools that encourage the use of existing regulatory flexibilities.

Planning and Environmental Linkages
This initiative represents an approach to transportation decisionmaking that takes environmental, community, and economic information collected early in the planning stage and carries it through project development, design, and construction.

Legal Sufficiency Enhancements Initiative (LSEI)
LSEI encourages Federal-Aid and Federal Lands Highway Division Offices to use early legal involvement as a tool to help expedite the environmental review process, saving time and costs.

Expanding Use of Programmatic Agreements (PAs)
This initiative aims to identify and assist in the expansion of new and existing PAs to a regional or national level. When PAs exist for avoiding, minimizing, and mitigating impacts, projects are reviewed quicker and trust is developed that results in improved relationships between departments of transportation and regulatory agencies.

Use of In–Lieu Fee and Mitigation Banking
In projects that will impact waters of the United States (wetlands, for example), the permitting process under Section 404 of the Clean Water Act currently constitutes a major component of the project development and delivery process. This initiative proposes expanded use of in–lieu fees and mitigation banking currently allowed under existing statute, FHWA regulations, state law, and court decisions.

Clarifying the Scope of Preliminary Design
This initiative identifies the amount of design work allowable under current law prior to NEPA completion regardless of contracting mechanism, and develops guidance to allow this work to be done consistently.

Flexibilities in Right-of-Way (ROW)
This initiative underlines opportunities for improved coordination of ROW activities with other key project development actions in preliminary design; land acquisition for utilities accommodation and relocation project activities; NEPA mitigation land needs; and a number of other areas where streamlined approaches may prove beneficial.

Flexibilities in Utility Accommodation and Relocation
This initiative spotlights existing flexibilities currently in place under federal law and regulations and describes techniques that foster effective utility coordination during project development.

Enhanced Technical Assistance on Ongoing Environmental Impact Statement (EISs)
This initiative provides additional FHWA technical assistance to identify major challenges on ongoing EIS projects and implements solutions to resolve project delays where feasible. FHWA teams will focus on facilitating interagency coordination and collaboration to resolve outstanding issues and provide peer-to-peer activities, workshops, training, or specialized on-site assistance.

ACCELERATED PROJECT DELIVERY METHODS

FHWA also recommends two innovative contracting practices for the construction phase of projects.

Design Build (DB)
DB is an alternate method of project delivery in which the design and construction phases are combined into one contract, eliminating the separate bid phase and allowing certain aspects of design and construction to take place at the same time. This can provide significant time and cost savings compared with the design–bid–build approach.

Construction Manager/General Contractor (CM/GC)
CM/GC occupies the middle ground between the traditional design–bid–build and design–build scenarios. CM/GC allows state DOTs to remain active in the design process while assigning risks to the parties most able to mitigate them.
Outdated fixed interval signal timing contributes to traffic congestion. Adaptive signal control technologies can use real-time traffic information to reduce congestion by determining which lights should be red and which should be green.

**IMPROVING TRAFFIC FLOW**

Wait, go, stop, wait, wait some more; most drivers have spent time fuming at red lights. Maybe the intersection was empty, yet the light stayed red for a maddening amount of time. Or perhaps the road is so congested that you have to wait three or more full light cycles before you can make a left turn. Why don’t traffic lights adjust to actual conditions?

Adaptive Signal Control Technology (ASCT), in conjunction with well-engineered signal timing, can do just that. ASCT refers to technologies that capture current traffic demand data to adjust traffic signal timing to optimize traffic flow in coordinated traffic signal systems. By receiving and processing data from strategically placed sensors, ASCT can determine which lights should be red and which should be green. ASCT helps improve the quality of service that travelers experience on local roads and highways.

The process is simple. First, traffic sensors collect data. Next, traffic data is evaluated and signal timing improvements are developed. Finally, ASCT implements signal timing updates. The process is repeated every few minutes to keep traffic flowing smoothly. On average, ASCT improves travel time by more than 10%. In areas with particularly outdated signal timing, improvements can be 50% or more.

**FASTER RESPONSES TO TRAFFIC CONDITIONS**

The traditional signal timing process is time consuming and requires substantial amounts of manually collected traffic data. Traditional time-of-day signal timing plans do not accommodate variable and unpredictable traffic demands. This produces customer complaints, frustrates drivers, and degrades safety. In the absence of complaints, months or years might pass before inefficient traffic signal timing settings are updated. With ASCT, information is collected and signal timing is updated continuously.

Special events, construction, or traffic incidents typically wreak havoc on traffic conditions. While large-scale construction projects and regular events can be anticipated, determining their impact on traffic conditions can be extremely difficult. Time-of-day signal timing cannot accommodate other disruptions, such as crashes.

**ASCT TOOLS**

Full-scale ASCT technologies are appropriate for large-scale systems of 100 or more traffic signals and on grid systems. These technologies are fully integrated into central systems that operate on a second-by-second basis and have substantial communications and detection systems overhead. They require a high level of operations and maintenance capability and often entail a traffic management center with 24-hour staffing.

A variety of choices are available from many vendors, with more in development. Available adaptive signal control technologies include the Split Cycle Offset Optimization Technique (SCOOT), Sydney Coordinated Adaptive Traffic System (SCATS), Real Time Hierarchical Optimized Distributed Effective System (RHODES), and Optimized Policies for Adaptive Control (OPAC) “Virtual Fixed Cycle.”
USE OF ASCT IN CALIFORNIA

Transportation agencies in California are actively using ASCT tools, including SCOOT and SCATS. According to FHWA, Santa Barbara and Anaheim use SCOOT; Santa Rosa, Menlo Park, Sunnyvale, and Chula Vista use SCATS; Los Angeles uses its own custom system; and several additional cities use other technologies.

The City of Los Angeles uses an Automated Traffic Surveillance and Control (ATSAC) system that was developed in-house to meet the specific needs of the city. The system includes more than 17,000 detectors and is in use on 3,200 of the city's 4,400 traffic signals. The system was initiated to accommodate the increased traffic demands of the 1984 Olympics and has grown ever since. A study conducted in 2001 analyzed the effectiveness of the system, finding it improved travel time by 13%, decreased stops by 31%, and reduced delay by 21%. For more information about ATSAC, visit: trafficinfo.lacity.org/html/atsac_1.html and www.streetfilms.org/atsac-behind-the-scenes-at-la-traffic-control.

ACS LITE

Because full-scale ASCT is expensive, FHWA has developed a cost-effective alternative: ACS Lite. ACS Lite is a specific ASCT—developed by FHWA through a public-private partnership—that shatters many of the barriers to wide deployment of ASCT by reducing the cost, complexity, management, and operations burden typically associated with adaptive control. Significantly, ACS Lite can be used to retrofit existing traffic signals using conventional control equipment, communications, and traffic sensors. Also, ACS Lite does not require a centralized management system.

ACS Lite provides adaptive control for small-scale systems of 30 or fewer traffic signals on linear arterials. It cannot be used to coordinate grid systems. It is signal management software that runs on a computer located either in an office or in the field. The software adapts traffic signals to current conditions every few minutes, and within agency operator constraints, by:

- Measuring and balancing the use of green periods displayed to motorists moving through the intersection.
- Measuring, predicting, and maximizing vehicle arrivals on green signals by adjusting the onset of main-street green time.

For use in closed-loop systems, which represent 90 percent of the traffic signal systems in the United States, ACS Lite is effective.

USE OF ACS LITE IN CALIFORNIA

The City of Anaheim has initiated implementation of a complete ACS Lite adaptive traffic control system at five signalized intersections in the vicinity of Disneyland. The project will provide enhanced signal control and timing coordination within a small area consisting of five signalized intersections along the approach to the theme park.

Also, several field tests are being conducted across the country to integrate and test the ACS Lite software with traffic signal controllers manufactured by four companies. A site in El Cajon, CA was chosen as one of the test sites.

CONCLUSION

At this time, real-time management systems have been deployed on less than 1% of existing traffic signals nationwide. FHWA is now working to expand the use of these technologies in California and across the country through the development and continued evaluation of the low-cost ACS Lite technology and by providing training and technical assistance on the technologies to public agencies.

TO LEARN MORE

Visit FHWA's ASCT website at www.fhwa.dot.gov/everydaycounts/technology/adsc.

The website includes detailed information about the technology, as well as resources, presentations, FAQs, and more.
PAVEMENT EDGE DROP-OFFS

Drop-offs occur when there are height differences between a paved road and the adjacent graded material. Conventional paving techniques result in vertical or nearly vertical pavement edges, which can cause safety concerns when they are exposed.

Roadway departures account for 53% of fatal crashes. There is no national crash data specifically focusing on edge drop-off issues, but some states have researched the issue. Researchers in Iowa found that pavement edges may have contributed to up to 18% of rural run-off road crashes between 2002 and 2004. A similar Missouri study found that pavement edges might have been a factor in up to 25% of crashes of that type.

WHY VEHICLES LEAVE THE ROAD

Drivers leave the paved road for many reasons. Some may need to avoid a drunk driver or a roadway obstruction. Others are drowsy or distracted by a phone call, a text message, a GPS device, or a passenger. It is particularly easy to leave the paved road when visibility is low.

Once a tire drops off a paved surface, a driver may have trouble returning to the paved roadway if the edge is vertical—especially if the height difference is more than two inches. A driver who doesn’t slow down before attempting to steer back onto the pavement can easily lose control of the vehicle. “Tire scrubbing” may also occur when the errant driver attempts to steer back onto a roadway with a vertical edge. This condition may result in over-steering, which is likely to result in loss of control of the vehicle.

THE SAFETY EDGE SOLUTION

The Safety Edge is an uncomplicated and effective solution to mitigate pavement edge-related crashes. When done correctly, simply shaping the edge of the pavement to 30 degrees can eliminate the problem of vertical drop-off. Figure 1 depicts a pavement edge that was shaped using the Safety Edge. Research has shown this shape is considered conservative in that the transition from on-roadway surface to shoulder and back is so smooth it defies assignment of any degree of severity, except when the elevation change from pavement to shoulder causes a noticeable tilt in the vehicle.

Avoiding Tire Scrubbing

On roads with vertical edges, attempts to return to the road can create “tire scrubbing” as the tire rubs intensely against the vertical edge, causing friction between the wheel and the pavement.

If the driver overcompensates by steering too hard, the vehicle can fishtail, swerve into another lane, or go off the road entirely. The vehicle may roll over or be thrown into oncoming traffic. Inexperienced drivers are not the only victims of tire scrubbing. Smaller, lighter vehicles have a harder time climbing a steep pavement edge. At high speeds, the climb is particularly dangerous.

Whereas a vertical drop-off of 2.5 inches or greater has been found to be problematic at speeds of 55-60 mph, drop-offs of up to 5 inches with the Safety Edge are traversable at these speeds.

PHOTO CREDITS:

Bottom Left, p. 8 and both photos on p. 9: A Plumas County Department of Public Works resurfacing project using the Safety Edge. Ken Kochevar, Federal Highway Administration.
ADDED BENEFITS OF THE SAFETY EDGE

The Safety Edge also improves density at the pavement edge, which makes the pavement more durable. Edge raveling is reduced, which means road segments that use the Safety Edge may need maintenance less frequently.

INSTALLATION

The Safety Edge is also easy to install. A commercially available shoe can be mounted on asphalt resurfacing equipment. An attachment acts as a screed extension. As the asphalt is extruded, it confines the asphalt into the desired 30 degree shape.

Although generic devices that provide a 30-degree angled shape can also be used, they typically only cut the pavement into the correct angle, but do not consolidate the asphalt. This leaves the edge more open to breaking off.

The Safety Edge is inexpensive to install. Projects typically require less than 1% of additional asphalt, since the Safety Edge technology compacts the loose asphalt that would otherwise crumble.

The Safety Edge is also recommended for concrete pavements where the edge is adjacent to an unpaved surface. This may call for other considerations, including increases in materials.

THE SAFETY EDGE IN CALIFORNIA

In addition to FHWA’s advocacy of the technology, the California Department of Transportation (Caltrans) is also promoting the use of the Safety Edge technology. The Caltrans Office of Engineering and Specifications Development has listed the development of plans and specifications for the Safety Edge as one of its seven key goals for the 2010-2011 Fiscal Year, and the Innovation Team at the Caltrans Division of Research and Innovation is working to deploy the technology.

In recent years, local agencies in California have started using the Safety Edge as well. In the Fall of 2010, Plumas County used the Safety Edge as part of a road resurfacing project on Grizzly Road in Quincy, CA.

SAFETY EDGE RESOURCES

- California Department of Transportation – Division of Research and Innovation
  www.dot.ca.gov/research/innovation/safetyedge_ver6_final.pdf

- Federal Highway Administration Every Day Counts
  www.fhwa.dot.gov/everydaycounts/technology/safetyedge

- Pavement Safety
  safety.fhwa.dot.gov/roadway_dept/pavement/safedge

- Safety Impacts of Pavement Edge Drop-offs
  www.aaafoundation.org/pdf/PEDO_report.pdf

- Sample Specifications: Iowa Department of Transportation
  www.iowadot.gov/design/dmanual/03C-06.pdf

- TransTech Shoulder Wedge Maker Library
  www.transtechsys.com/products/pro_products_main.htm

Figure 1. Pavement wedge sample with a Safety Edge (Federal Highway Administration)
EVERY DAY COUNTS
PREFABRICATED BRIDGE ELEMENTS AND SYSTEMS

In traditional bridge construction, foundations for piers and abutments are built first, followed by pier column and cap construction, and then placement of beams and decks. Using Prefabricated Bridge Elements and Systems (PBES), many time-consuming construction tasks no longer need to be done sequentially in the work zone. For example, a foundation can be built or an old bridge demolished while the new bridge elements are built off-site. The prefabricated elements can then be brought to the site and erected quickly.

PBES is effective in large and small projects. Applications range from deck replacements, superstructure and substructure elements, to total superstructure replacements, to complete bridge replacements. Use of PBES has many advantages over traditional bridge construction. PBES offers major time savings, cost savings, safety advantages, and convenience. The use of PBES can also improve quality, solve constructability challenges and reduce the environmental impact from construction.

**BENEFITS**

In addition to the time savings gained by being able to work on the construction site and the structure simultaneously instead of sequentially, weather will also cause fewer construction delays. Prefabricated elements are typically constructed in a climate-controlled environment, so weather only affects the portion of the work done onsite. In addition, since PBES uses consistent materials and methods, the process leads to uniform quality in bridge components.

Using standardized components can shorten onsite construction time and increase cost savings. In some cases, using a standardized element in multiple locations will result in more economical construction. Further savings can be achieved through mass production and stockpiling of standardized prefabricated components in regional locations.

In traditional bridge construction, workers are often exposed to hazards such as moving traffic, working over water, or working near power lines. PBES reduces worker exposure to hazards. Construction time is reduced, so exposure to hazards is reduced. Since prefabrication allows many stages of bridge construction to occur in a safe, controlled environment, workers spend less time working in dangerous settings.

Using PBES minimizes construction-related traffic disruptions, since overall construction time is shorter and fewer lanes need to be closed. During construction, traffic delays can be reduced by scheduling transport of the PBES during non-peak times.

Many job sites impose difficult constraints on construction, such as heavy traffic, high elevations, steep slopes, and limited or constrained working space. The use of PBES can solve many constructability challenges as less construction needs to occur on-site.

Because PBES shortens the duration and footprint of construction activities, the environmental impact of construction is reduced. In addition, much of the heavy equipment needed for bridge construction can be located in factories rather than on the construction site. This limits disruptions to sensitive ecosystems, such as wetlands or urban areas in which air and water quality and noise pollution are issues. PBES construction can also be scheduled around crucial times for plant growth or animal life.


The website includes detailed information about PBES, including case studies and a matrix of questions agencies can use to determine whether prefabricated bridge elements are appropriate for use in specific projects.

**PHOTO CREDITS:**

Bottom Left: Forming deck for modular steel unit, Route 262 Bridge over I-80 in Nebraska. Dr. Atorod Azizinamini, University of Nebraska, Lincoln.

Bottom Right: West span for north bridge being moved into position on abutment and pier at Pioneer Crossing, Utah. Claude Napier, Federal Highway Administration.
EVERY DAY COUNTS
GEOSYNTHETIC REINFORCED SOIL INTEGRATED BRIDGE SYSTEM

The Geosynthetic Reinforced Soil (GRS) Integrated Bridge System (IBS) is a simple bridge construction method that uses readily available, inexpensive materials and basic earthwork techniques to build bridges better, faster and cheaper.

METHOD

Rather than drilling a deep foundation, the reinforced soil method builds up the substructure in a faster, simpler way. Imagine building a layer cake:

➤ Step 1. Lay a row of facing blocks.
➤ Step 2. Place a layer of compacted fill (soil, etc.) behind the facing blocks.
➤ Step 3. Top with a sheet of geosynthetic fabric.
➤ Repeat from Step 1 until the desired height is achieved.

This low-tech approach continues until the abutment reaches the desired height and the bridge is placed directly on top of the GRS abutment mass. A GRS approach way is then built behind the bridge beams to transition the bridge to the approaching roadway. No joint or cast-in-place concrete is needed.

Since the bridge extends naturally out of the roadway, there is no “bump at the end of the bridge” caused by differential settlement between the bridge abutment and the approaching roadway.

BENEFITS

This simplified process radically reduces construction time. A GRS IBS is built in days or weeks, not months. There is no need to wait for cast-in-place concrete to dry; the substructure is immediately ready for the bridge. In addition, on-site changes are easy to accommodate and weather is rarely a problem, since this type of construction can occur in variable conditions.

GRS IBS is strong and durable. Bridges built with GRS IBS are stronger, more durable and generally more ductile and flexible than bridges built using traditional methods. A GRS bridge performs well in earthquakes if constructed properly, with closely spaced reinforcement. Full-scale shake table testing showed that a GRS abutment structure can withstand a 1.0 g earthquake acceleration.

GRS IBS bridges are also less expensive to build. Bridges constructed with the GRS IBS cost 25 to 60 percent less than bridges built with traditional methods, depending on the standard of construction and the method of contracting (local forces versus a private contractor).

Shortened construction time means fewer labor hours. In Defiance County, Ohio, one bridge abutment was built in just 3 days. Using traditional techniques such as cast-in-place construction, that same abutment would have required 2 to 3 weeks.

This lower-tech option also reduces material costs. Inexpensive, common materials and equipment are used.

Construction is much simpler with GRS IBS since it has fewer parts. There is no need for highly skilled labor since the method only requires basic earthwork methods and practice. Simpler construction also means simpler maintenance.

TO LEARN MORE


The website includes detailed information about GRS, including a case study of the Defiance County project.

PHOTO CREDITS (ALL PHOTOS): Federal Highway Administration

All photos are examples of FHWA GRS IBS bridges constructed in Defiance County, Ohio.
By Kendra Levine
Reference and Outreach Librarian, Institute of Transportation Studies Library

RESOURCES FROM THE TRANSPORTATION LIBRARY
WILDLIFE MANAGEMENT

**CALTRANS RESOURCES**

In California, the Caltrans Division of Environmental Analysis conducts research and provides resources on issues related to biological resources. Their two primary resources are:

- **Wildlife Crossings Guidance Manual**
  March 2009
  www.dot.ca.gov/hq/env/bio/wildlife_crossings
  (Free login required)

  ➔ This interactive website allows agencies, stakeholders, and interested groups to participate in a community concerned with wildlife crossing. Users can contribute information about their own practices or make suggestions.

- **California Essential Habitat Connectivity Project**
  February 2010
  www.dfg.ca.gov/habcon/connectivity

  ➔ Commissioned in conjunction with the California Department of Fish and Game, the project aims to make transportation planning more efficient and to minimize potential wildlife-vehicle collisions. The report includes the statewide Essential Habitat Connectivity map, data from different areas of the map, and guidance for mitigation.

**FHWA RESOURCES**

  M. P. Huijser, et al., FHWA-HEP-09-022, June 2008
  www.fhwa.dot.gov/environment/hconnect/wvc/index.htm

  ➔ Provides the results of a study mandated by SAFETEA-LU. Offers a deeper understanding of the causes of wildlife-vehicle collisions and solutions to this safety issue. Includes suggestions for types of fencing, design of overpasses and underpasses, and animal detection systems.

- **Wildlife Protection: Keeping It Simple**
  www.fhwa.dot.gov/environment/wildlifeprotection/index.cfm

  ➔ This comprehensive website provides many practical and simple solutions and examples of how agencies can minimize the effects of highways on wildlife.

- **Critter Crossings: Linking Habitats and Reducing Roadkill**
  FHWA-EP-004, 2000
  www.fhwa.dot.gov/environment/wildlifecrossings/overview.htm

  ➔ Describes the impact of transportation on a number of different wildlife habitats, and provides information and methodology to minimize transportation's impact on wildlife.

**WILDLIFE CROSSING DESIGN**

- **ARC: The International Wildlife Crossing Infrastructure Design Competition**
  www.arc-competition.com

  ➔ This competition challenged interdisciplinary design groups to create next-generation wildlife crossing structures for roadways. The website includes thought-provoking entry designs from the finalists, detailed technical appendices, and links to additional references.

- **Handbook for Design and Evaluation of Wildlife Crossing Structures in North America**
  A.P. Clevenger and M.P. Huijser, Western Transportation Institute, Montana State University, 2009

  ➔ Commissioned by FHWA, this handbook provides a detailed overview and technical details for the planning, design, and construction of wildlife crossing structures. Containing an extensive synthesis of the current literature, the handbook also offers practical advice and guidance for implementation and evaluation of wildlife crossing projects.
ARTICLES AND REPORTS

Evaluation of the Use and Effectiveness of Wildlife Crossings
http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_615.pdf

- A comprehensive study of the state of the practice of wildlife crossings nationwide, with attention focused on safety, data modeling, the influence of roads on ecosystems, and possible restoration of wildlife crossings.

Advances in Wildlife Crossing Technologies
M. Gray, Public Roads, v.73, n. 2, September/October 2009, pp. 14-21
https://international.fhwa.dot.gov/publications/publicroads/09septoct/03.cfm

- Provides an overview of animal detection systems, including the benefits and costs. Features a useful matrix to show the different characteristics and capabilities of the systems described in the article. It concludes with suggestions and a checklist for implementation of an animal detection program.

Best Practices for Preventing Wildlife–Vehicle Collisions

- Contains an overview of characteristics and threats for wildlife-vehicle collisions and identifies threatened and endangered species that are particularly vulnerable to road mortality.

Relating Vehicle-Wildlife Crashes to Road Reconstruction

- This paper uses GIS tools to examine crash rates in Wyoming. The GIS data was used to study the effectiveness of seven reconstruction projects in the reduction of animal-vehicle collisions in the state, though design-speed was determined to have the only real impact on crash rates.

Developing an Asset Management Tool to Collect and Track Commitments on Environmental Mitigation Features

- Examines the state of wildlife mitigation projects from the Wisconsin DOT, and their need to track certain features through different projects around the state. This paper describes the development of a tracking tool to help coordinate projects statewide, as well as a survey of other states’ practices.

Relationships between Lighting and Animal-Vehicle Collisions
http://deepblue.lib.umich.edu/bitstream/2027.42/64281/1/102396.pdf

- This report examines the impact of roadway lighting and driver visibility on animal-vehicle collisions. It concludes with suggestions on ways to mitigate poor lighting, such as detection systems and posting speed limits.

UDOT Wildlife and Domestic Animal Accident Toolkit
Utah DOT, UT-08.07, April 2008

- This toolkit contains data about the locations and characteristics of wildlife and domestic animal accident hotspots. There is also information for planners, project managers, and engineers, to help keep animals off Right-of-Ways and roadways.

Mitigating Wildlife Mortality and Habitat Fragmentation Due to Transportation Infrastructure
A.P. Cleverenger, Western Transportation Institute, Montana State University, January 2004

- An extension of the Banff Research and evaluation, this report describes methods used to monitor wildlife crossings, partnership and outreach efforts, and recommendations for implementation.

ABOUT THE INSTITUTE OF TRANSPORTATION STUDIES LIBRARY

Employees of California public sector transportation agencies at the local, state, and regional levels, including federal agencies located in California, are eligible to request anything in the transportation library’s catalog for free. The library will even provide up to 50 pages of photocopies of articles from journals, trade magazines, or conference reports, or scan and e-mail the requested material.

We encourage public agency employees to contact the Library for reference services and loans. Specialized services are provided free to public agency employees with funding from the California Local Technical Assistance Program (LTAP). See library.its.berkeley.edu for details, or contact:

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All requests must include your name, job title, agency name, mailing address, and, if requesting material, the title and call number.
STREAMING VIDEO EXTRAVAGANZA!

Thanks to Public.resource.org, we now offer more than 350 streaming training videos on transportation-related topics, which can be accessed at www.techtransfer.berkeley.edu/videos/streaming.

Public.resource.org digitized all of the non-copyrighted, government-produced videos in our multimedia training library at no charge to us. The organization provides this service to support their mission of making government-produced information accessible to everyone.

The streaming videos now available include:

- Highway Noise Barrier Design (FHWA)
- Bike Safe, Bike Smart (NHTSA)
- Executive Overview of Metropolitan Transportation Planning (FHWA, FTA)
- Driving Modern Roundabouts (WA DOT)
- Barrier Delineation in Work Zones: The Well Defined Path (FHWA, ATSSA)
- Getting Across: Aquatic Organisms and Road-Stream Crossings (USDA Forest Service, San Dimas Technology and Development Center)
- Utility Safety in Work Zones (IA DOT)
- Loading, Transporting, and Unloading Heavy Equipment (IA DOT)
- Acoustics and Your Environment: The Basis of Sound and Highway Traffic Noise (US DOT)
- Professional Flagging: Basic Principles, Procedures, and Applications (IA DOT)
- And many more!

Search our collection at www.techtransfer.berkeley.edu/videos/streaming.

RESIDENT ENGINEER’S ACADEMY

The Resident Engineer’s Academy provides 32 hours of practical, hands-on training, which includes presentations by Caltrans program managers, subject matter experts, and district Construction Oversight Engineers; group discussion sessions; and ample time for questions and answers.

Workshop sessions will provide a unique and instructive opportunity for you to interact with resident engineers from other agencies, Caltrans local assistance representatives, and experts, so be sure to bring your work challenges to the Academy for discussion.

Topics Include:

- Resident Engineer roles and responsibilities
- Pre-construction preparation, conferencing, and process reviews
- Public relations
- Reporting, subcontracting, recording, and accounting
- Staffing and supervision
- Control of materials
- Deficiencies and sanctions; claims and claim avoidance
- Liability
- Labor compliance

Upcoming Dates and Locations:

- February 14-18, 2011
  Sacramento

- March 21-25, 2011
  Moreno Valley

- March 28-April 1, 2011
  Oxnard

Fee:

- $295 for California public agency employees
- $495 for all others

Registration:

Registration opens on January 3, 2011.
Register at www.techtransfer.berkeley.edu/reacademy.
NEW IN GOING...GOING...GONE

We have loads of free* items waiting for you in our Going...going...gone warehouse. Browse our database at www.techtransfer.berkeley.edu/g3 to order useful handbooks, training material, and books you want to add to your collection. The material is free and the shipping is on us.

➜ WATCH: Work Area Traffic Control Handbook

➜ Snow and Ice Control Handbook
   UTAH LTAP and Technology Transfer Program, 2005.

➜ Inspector's Job Guide and Highway Maintenance Tables
   Technology Transfer Program, 2009.

➜ Long-Term Pavement Performance Program (LTPP) Program’s Distress Identification Manual, Fourth Revised Edition

➜ Sign Retroreflectivity Handbook
   Federal Highway Administration, 2009.

➜ Vegetation Control for Safety
   Federal Highway Administration, 2008.

➜ W-Beam Guardrail Repair
   Federal Highway Administration, 2008.

➜ Bridge Rail Guide
   Federal Highway Administration, 2005.

➜ Field Inspection of Rebar
   Concrete Reinforcing Steel Institute, 1998.

*Going...going...gone is a free service available to employees of public agencies in California.

FOLLOW US ON

We are now posting “tweets” with videos, transportation news, and fun tidbits on Twitter at www.twitter.com/TechTransferCA. Recent tweets include a radio interview with UC Berkeley professor and pavement researcher Carl Monismith, a case study about a Utah road safety program that’s reducing fatalities in a big way, and a notice about a free maintenance training course.

Twitter is a real-time information network that can connect you to the latest information about any topics you think are interesting. Many transportation organizations are using Twitter, including the Federal Highway Administration, Transportation Research Board, and the Institute of Transportation Studies Library.

There are several ways to experience Twitter:

➜ Read a Twitter page. Follow this link to read our Twitter page: www.twitter.com/TechTransferCA.

➜ Start a Twitter account. You will need an account if you want to create your own Twitter page where you can post tweets, network with other Twitter users, or “follow” users whose updates you want to see when you login to the site. Accounts are free at www.twitter.com.

➜ Set up an RSS feed. You can subscribe to an RSS feed of your favorite Twitter pages without registering for a Twitter account. From our Twitter page, click on the link that says “RSS feed of TechTransferCA’s tweets” to receive updates at the Feed Reader site of your choice.

Technical tips are posted at http://support.twitter.com.

We hope you’ll start following us on Twitter! www.twitter.com/TechTransferCA
Fees for most courses are two-tiered: the lower rate is for California public agencies and is subsidized by the Cooperative Training Assistance Program (CTAP); the higher rate is for all others.

Additional course and registration information: www.techtransfer.berkeley.edu/training
Course content related questions: training_info@techtransfer.berkeley.edu or 510.665.3410
Registration related questions: registrar@techtransfer.berkeley.edu or 510.665.3466
Mailing list changes: www.techtransfer.berkeley.edu/subscribe or 510.665.3466