



Research and Technology Review

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Jim Gibbons, Governor

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POTENTIAL ALTERNATIVE ENERGY APPLICATIONS FOR NDOT FACILITIES

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The objective of this research project sponsored by Nevada Department of Transportation (NDOT) is to assess the prospects of significant renewable energy development and energy conservation methodologies at NDOT facilities (i.e., office buildings, roadway systems, parking areas, remote stations, etc.) The study focused on three areas: 1) viability, cost-effectiveness, and efficiency of potential applications of alternative sources of electrical power; 2) savings and benefits of integrating alternative sources of electrical power generation; and 3) solutions and recommendations for co-generation units integrated with NDOT facilities and roadway systems.

Recent incentives in renewable energy at state and federal levels urged NV Energy to adopt a "Renewable Portfolio Standard" (RPS) along with other utilities and system operators throughout the Country. NV Energy adopted an RPS standard that 20% of their energy must come from a combination of renewable and conservation programs by 2015. Currently electrical power is generated primarily through coal and natural gas plants. Other resources include geothermal, solar, and wind farms.

The study researched an extensive list of renewable energy sources and applications, existing federal and state incentive programs and other states' alternative energy programs. For instance, California DOT's (Caltrans) RPS goal is 33% by 2020. Their energy conservation program focused on four energy

load categories: 24-hour fixed loads, nighttime only loads, weekday loads, and variable loads for an energy savings in 2003 of \$16.2 million. Technical details of electrical energy conversion and economical aspects of each renewable energy source for initial investment (operational and production) costs were reviewed and documented.

Federal Grant Program, production incentives, rules, regulations and policies were reviewed, along with NV Renewable-Generations Rebate program, utility rebate program, property tax assessment program, and exemption program. Potential incentive programs that can benefit Nevada were identified.

Potential applications at NDOT facilities and roadway systems were investigated for wind, solar, and geothermal sources. NDOT facilities included office buildings, maintenance stations, facility parking lots, highway rest areas, highway lighting, overhead highway signs, traffic signals, charge stations, bridges and tunnels.

Due to the lack of specific energy consumption data for different seasons, generic formulas were used to capture costs for potential alternative energy applications.

NDOT can develop an "Energy Conservation Program" incorporating conclusions from this project.



An Offshore Wind Farm in Belgium

A summary of the recommendations is put together as follows:

1. There are potential applications for wind and solar based power generation. These applications may serve as independent power sources as alternative to utility connection or they can be used for reducing utility usage.
2. There are potential applications for geothermal based heating systems, however, the electric power production using geothermal might not be the most cost-efficient solution.
3. An "Energy Consumption Map" of NDOT should be developed to identify the potential applications for alternative energy systems. The answers to questions such as "What, Where, When" are essential to creating a consumption map (Example: What is the electrical energy consumption due to heating, ventilation and AC (or lighting etc.) of a specific facility during summer?). Without this map, the economic analysis cannot be sufficiently accurate. Economic analysis including the capital costs, operation and maintenance costs of alternative energy systems should be more comprehensive.
4. Realistic short-term and long-term plans can be proposed if data from NDOT facilities become available. In addition to potential applications of alternative energy systems, we strongly recommend NDOT to initiate an extensive "Energy Conservation Program" for its facilities. This program will aim at reducing the energy consumption through efficient use in all its facilities.

The recommendations generated through the assessment of alternative energy applications at NDOT facilities will assist NV Energy in meeting their RSA objectives, provide more cost-effective solutions for energy usage, and help NDOT do their part in responsibly allocating their energy resources.

Acknowledgements: Authors thank Dr. Mehdi Etezadi and Dr. Theodore Batchman for providing valuable suggestions and insights throughout the project.

New Research Coordinator

The Research Section is happy to welcome and introduce Manju Kumar, the new Research Coordinator at NDOT. Manju has been working on tackling transportation issues through innovation, research and implementation for about a decade. Prior to joining NDOT Research, he worked as a Research Engineer for University of California, Berkeley. His work at Berkeley largely focused on accelerating implementation of research results. Manju was also a Research Engineer with Western Transportation Institute (WTI) at Montana State University-Bozeman between 2002 and 2006 with a focus on rural safety and mobility.



Manju has experience in the private sector as a transportation consultant with Lee Engineering LLC in Phoenix, AZ. He is a licensed professional engineer in Montana and Arizona and has a Masters degree in Civil Engineering from Virginia Tech with a Bachelors degree in Civil Engineering from Indian Institute of Technology, Madras (IIT M).

Manju will be focusing on streamlining the annual research solicitation process for FY 2011 and will be developing a plan for encouraging multidisciplinary innovative research that has potential to transform the transportation system. His work will also include incorporating elements in the research solicitation process that will accelerate the implementation of innovative research results.

Manju and his wife Rajee, a physician in post graduate training at University of Nevada Reno, enjoy their time with their two-year old son Siddhran, aka Sid. They also love traveling to Lake Tahoe and watching Hollywood, International including Bollywood and Kollywood movies whenever they find time!

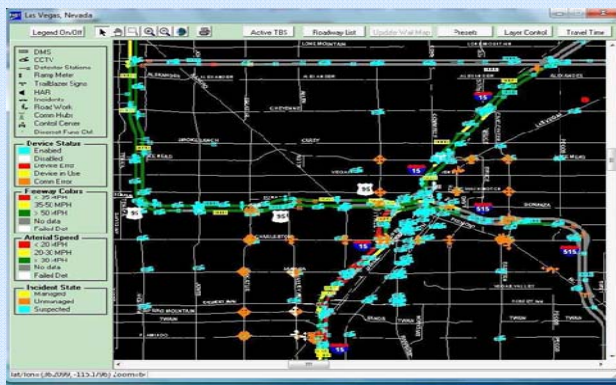
Nevada University Transportation Center (UTC)

Compiled by Manju Kumar

U.S. Transportation Secretary Ray LaHood recently announced \$463,400 grant to the Nevada Transportation Research Center (UTC) at the University of Nevada, Las Vegas. The awards were made by the U.S. Department of Transportation's (DOT) Research and Innovative Technology Administration (RITA). The Nevada Transportation Research Center (UTC) will use its \$463,400 grant to continue developing cutting edge research tools and products especially relevant to the unique Nevada environment. The funds are matched by the Nevada Department of Transportation and also support research performed at the University of Nevada, Reno. The grant also supports graduate, undergraduate and high school students, and has been attracting additional sources of research funds, which would not have been possible without the UTC grant.

NUTC Research Capabilities and Facilities

FAST Real Time Traffic Control System



Nevada UTC has recently initiated a link with Freeway and Arterial System of Transportation (FAST) which enables the Nevada UTC to receive live traffic data. The FAST workstation (software installed at the Nevada UTC with the help of FAST) enables Nevada UTC to detect 'incidents' and the status of incident management. The Nevada UTC can also access the data feed from various individual monitoring devices setup by FAST. Another interesting tool that the Nevada UTC has acquired with the cooperation of FAST is the I2 workbench which is used to monitor many intersection and traffic signals across the area. The Nevada UTC is developing online processing tools for this real-time data which can help our traffic operations and planning.

Driving Simulator



The recently acquired Driving Simulator at the Nevada UTC, is equipped with the latest advanced motion simulation technology. The whole simulation setup is mounted on a platform with 3-D roll, pitch, and yaw capabilities, which accurately monitor a driver's real-time behavior. We are also adding a physiological monitoring system that in real-time would enable the recording of the physiological state of the driver while performing various driving tasks.

The driving simulator can be programmed to simulate multiple events like driver distraction while texting, drunk driving scenarios, effect of drugs on drivers, etc. Moreover, it can also be programmed to train younger drivers, elderly drivers and snow plow operators. Apart from these applications, the driving simulator can also be used to evaluate alternate designs for the traffic infrastructure. For instance, an evaluator can drive two competing road designs before one is selected and built.

Nevada UTC Geographical Information System (GIS) Applications

The Nevada UTC is developing modern tools for integrating traffic data systems with on-line GIS capabilities. In particular, an on-line system has been developed that uses Google Earth for data visualization, and is integrated with hand-held data collection devices with synchronized databases. Different sources of data such as seatbelt usage, crash data, Freeway Management System (FMS) data, trauma data, and Vehicle Miles Traveled (VMT) data is being currently integrated into this tool. The Nevada UTC is also developing software tools that will enable people to use smart phones to collect geo-located transportation data such as data for incident management.

Humor corner: On the I-5 North freeway in San Diego, the California Department of Transportation has kindly erected a sign for the nautically challenged: "Cruise Ships Use Airport Exit" - JJ Markham

Highlights of the Nevada UTC Research Focus Areas: (More Info at <http://nutc.unlv.edu/>)

The Nevada UTC's research focus is on the following topics:

1. Performance measures for transportation systems (traffic flow, incident management, traffic safety measures, etc.)
2. Incident management (analysis and tools)
3. Analysis of design build projects (traffic impact, analysis, tools)
4. GIS based online visualization and analysis tools.
5. Hand-held devices, smart phones for data collection, analysis.
6. Transportation network simulations, calibration, and analysis, microscopic, mesoscopic, and macroscopic. (Vissim, Corsim, Dynust, and others)
7. Traffic safety (seat belt usage, crash and trauma data, user-behavior, traffic data, VMT, data collection, databases, online systems and data integration)
8. Human factors studies (driving simulator, driver training, distracted drivers, design evaluations, 3-D animations and simulations, physiological data collection and analysis)
9. Traffic control strategies

PRODUCT EVALUATION UPDATES

Written by Roma Clewell, Product Evaluation Coordinator

PRODUCT EVALUATION COMMITTEE (PEC) SEPTEMBER 7, 2010 MEETING SUMMARY

The pavement reinforcing fabric category on the Qualified Products List (QPL) #731.03.01 has been eliminated. The specifications are addressed each time in the special provisions so the evaluation of the product becomes redundant. The Fly Ash (Type F) category on the Qualified Products List (QPL) #702.03.05 changed its name to Pozzolan. The name change recognizes the addition of other Pozzolan products, not just the fly ash (type F).

A pull-sheet change has been made to the Standard Specifications for Road and Bridge Construction, Section 606, regarding structural plate culverts.

Clark County and City of Las Vegas are making tougher laws regarding graffiti crimes. One requirement is for merchants to lock and secure any product having to do with graffiti. Another measure uses inmates to remove graffiti throughout the community. More than 37,000 hours of labor were conducted last year representing approximately \$305,525.00 in labor.

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Student Planning Organization

The Northern Nevada Student Planning Organization is comprised of University of Nevada, Reno graduate students studying Land Use Planning Policy. The NNSPO is a student chapter of the American Planning Association. Each year our club solicits planning oriented projects from agencies, organizations and private companies within Washoe County to gain professional experience and exposure within the community. More importantly, we are establishing professional relationships within the state Nevada. Please visit our website for further information: <http://planningclub.blogs.unr.edu/>.

SIGN SHEETING SPECIFICATIONS AND EVALUATION CRITERIA CHANGES

Written by Roma Clewell, Product Evaluation Coordinator

The basic requirements of a highway sign is that the sign is legible and understandable in time to permit a proper driver response. This includes attributes such as high visibility both day and night; high legibility, defined as adequately sized letters or symbols; and a short legend for quick comprehension by a road user approaching a sign. Retroreflectivity or illumination of signs should show the same shape and similar color by both day and night.

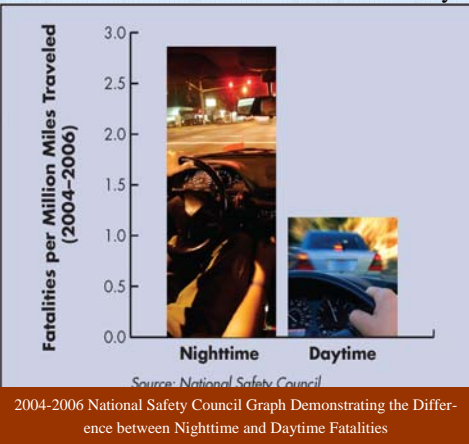


Example of 3M's Reflective Sheeting and intensities.

Industry standards for the use of sign sheeting have changed. Lighting on overhead signs is being removed in some instances. Increased illumination is desired to enhance motorists' nighttime visibility. This precision of the angularity is important as the reflectivity changes depending on the distance between the lights from the vehicle and that of the sign (i.e. sight distance). These are just a few of the reasons for the changes to industry standards.

Overhead sign lighting energy costs can be greatly reduced by removing the lighting system under the sign and replacing the system with signs comprised of reflective sheeting lettering. The reflectivity from the sign sheeting serves to illuminate the sign. The photograph to the right demonstrates various degrees of reflectivity. Not only is NDOT decreasing energy costs and realizing financial savings, but the maintenance is reduced because durability of the signs is increased from approximately 8 years to 15 years.

NHTSA summarized 1997 highway statistics for older drivers in "Traffic Safety Facts 1997: Older Population" (DOT HS 808 769) publication and reported, "In 1997, older people made up 9 percent of the resident population but accounted for 14 percent of all traffic fatalities." This is further underscored when reviewing the 2004-2006 National Safety Council graph shown below demonstrating the difference between nighttime and daytime fatalities. Research at the University of South Dakota



shows that the time needed by older drivers to detect signs in complex backgrounds can be reduced significantly by using super-high-intensity sheeting materials. Research also shows that the detection distance for fluorescent signs is significantly greater

than non-fluorescent signs for both younger and older observers, though the older drivers reaped the most benefit. Older drivers also experience restricted physical movement and reaction time so increased distance visibility provides additional reaction time.



Brighter sheeting material make signs more noticeable, especially in areas with a high level of visual "noise." (see above signage). The reflective lettering increases the illumination when the refraction from car lights hits the sign at certain angles and especially at nighttime.

Thus the observation angle (the optimum angle for measuring the light source) and the entrance angle (the optimum angle from which the sign orientation is measured from the light source) are very important to determining the reflectivity angle for the greatest driver visibility. Care has to be taken, as signs lighted at the wrong refraction or too close to the roadway can be too bright and blind drivers.

NDOT has spent a lot of research with other states in determining the correct angularities and distances. The sign sheeting types NDOT uses are determined based on angularity, reflectivity, and distances.

The American Society for Testing and Materials (ASTM) recognized these changes and revised the sign sheeting standards. The Nevada Department of Transportation (NDOT), Traffic and Safety Section, responded to ASTM's revised standards by reviewing NDOT's policy. As a result, the following categories were established and updated on the Qualified Products List: Type IV, V, VI, IX, and XI. The table below provides a guide as to how NDOT will select sign sheeting on projects.

Guide for Selection of Sign Sheeting

Category	Application	Fluorescent Color	ASTM Sheeting Type	
			Background	Legend & Border
Regulatory	All		IV, IX, XI	
Warning	All	Yellow	IX, XI	
	School	Yellow-Green	IX, XI	
Temporary	Rigid	Orange	IX, XI	
	Rollup	Orange	VI	
Guide	Overhead		IV	IX, XI
	Ground Mounted *		IV, IX, XI	IV, IX, XI
	Route markers *		IV, IX, XI	IV, IX, XI
Other	Special signs *		IV, IX, XI	IV, IX, XI

* - Use same "Type" sheeting for legend and background on the same sign.

Library Corner:

ASCE Journal Publications Electronic Access

After giving Sena Loyd, NDOT Librarian, your input, Research decided to try online access for all ASCE Publications. This library of journals is accessible at each of your workstations authenticated by an IP Address (NDOT employees only). This means that by accessing this URL, (<http://www.ascelibrary.org/>), you will have access to approximately 73,000 papers. If you have any trouble accessing or finding the specific information you are seeking, feel free to contact Sena Loyd, NDOT Librarian, at 775-888-7895 or sloyd@dot.state.nv.us.

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About NDOT's R&T Review

The NDOT Research Section administers the NDOT's research, development and technology transfer program and serves as the "clearing-house" for product evaluations.

Research and Technology Review is published quarterly by the NDOT Research Section. Its purpose is to provide the latest information on the NDOT research activities including product information and other pertinent research topics.

If you have comments or need additional information regarding any of the topics discussed in this issue, please contact the Research Division.

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