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The Importance of Research…

to the Local Traffic Engineer…

by Paul Luedtke

What the local traffic engineer needs from the research community – three things. First, tools for the most basic everyday problems; second, materials that last longer; and third, truly advanced signal system hardware and software that makes it less labor intensive to maintain good equipment and good timing. The primary thing for researchers to remember is to stay in constant communication with local traffic engineers and always be mindful of the practical implications of what they are recommending.

Basic Tools: There is a need for a continuous compilation of a sort of toolbox of "how to's" and "why should I's" that address such questions as: What are the long term effects of installing speed humps in a city? What are the resulting implications of various speed hump policies? Where is a guardrail appropriate along a curb and gutter roadway? How do you design a grade separation in an urban environment? Which are better – loops or cameras? How do I set speed limits in an urban environment and still keep my job?

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to the Consulting Traffic Engineer…

Everything we do as consulting engineers is based on someone's research, and if we are really lucky, some of the work we are doing will be the basis for the work of future generations in traffic and transportation engineering. Research is the basis for the Manual on Uniform Traffic Control Devices, the ITE Manual, TRB and the underpinning of all the safety protocols that we observe.

Ted Abrahamson, Abrahamson & Associates, tells us that research is what he relies on to do his work whether it is in designing a project, writing a report or giving a deposition. He says, *"My library shelves contain over 400 lineal feet of textbooks, magazines, reports and other literature I use to not only find out about particular subject matter, but also to find out who is in agreement with whom . . . I have worked in most every state in the United States and five foreign countries so it is necessary for me to know who says what about certain subjects no matter where they actually work."*

When asked about research in his work, **Federico Mendoza, PE**, Brown & Gay Engineers, said the following: *"Research is probably at the heart of everything we do in terms of the tools we use as a result of research, whether*

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Check it out!

This edition of the TexITE Newsletter is a Research Digest featuring Texas-based research efforts and other transportation-related resources. We hope that it will serve as a valuable resource for you! But, we need your feedback – What can we do to make the Research Digest edition even better for next year? Send your comments and feedback to dena.jackson@rsandh.com.

Video Detection
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location is one that provides a stable, unobstructed view of each traffic lane on the intersection approach. Moreover, the view must include the stop line and extend back along the approach for a distance equal to that needed for the desired detection layout.

The VIVDS product manuals indicate that detection accuracy will improve as camera height increases within the range of 20 to 40 ft. This height improves the camera's view of each approach traffic lane by minimizing the adverse effects of occlusion.

Calibration of the camera field of view is based on a one-time adjustment to the camera pitch angle and the lens focal length. According to several VIVDS product manuals, an optimal field of view is one that has the stop line parallel to the bottom edge of the view and in the bottom one-half of this view. The optimal view also includes all approach traffic lanes. The focal length would be adjusted such that the approach width, as measured at the stop line, equates to 90 to 100 percent of the horizontal width of the view. Finally, the view must exclude the horizon.

Operation Issues

Detection zone layout is an important factor influencing the performance of the intersection. Guidance provided by several VIVDS product manuals indicates that there are several factors to consider, including:

- location relative to the stop line, zone location relative to the stop line,
- the number of VIVDS detectors used to constitute the detection zone,
- whether to link the detectors using Boolean logic functions,
- whether to have the detector monitor travel only in a specified direction, and
- whether the detector's call is delayed.

The actual detectors provided by the VIVDS product would be placed in the zones such that the area is fully monitored.

Unlike that of inductive loops, the performance of a VIVDS is adversely affected by camera motion, daily changes in light level, and seasonal changes in the sun's position. In recognition of these factors, at least one VIVDS manual encourages an initial check of the detector layout and operation during the morning, evening, and at night to verify the operation is as intended. Periodic checks at specified time intervals (e.g., every six months) are beneficial.

The Researchers Recommend . . .

A life-cycle cost analysis comparing a four-camera VIVDS and an inductive loop system indicated that a VIVDS is more cost-effective than a loop system under certain conditions. These conditions relate to the number of inductive loops needed at the intersection and the expected life of these loops.

In general, a four-camera VIVDS is cost-effective at intersections requiring 12 or more stopline loop detectors, regardless of loop life. However, in areas where the average loop life is only four years, a VIVDS is found to be cost-effective when only five loops are needed. Researchers developed minimum camera height guidelines to reduce occlusion. The minimum heights vary from 20 to 50 ft, depending on the width of the approach and camera offset. The minimum height for a camera mounted in the center of the approach is 20 ft. Larger minimums are needed as the camera is moved left or right from this central position. Field measurements of detection accuracy indicate that intersection approaches served by cameras that exceed the minimum height have significantly fewer unneeded or missed calls.

Researchers also developed minimum camera height guidelines to maintain acceptable detection accuracy. This minimum height is required when the VIVDS is used to monitor sections of the approach that are well in advance of the stop line. The minimum height needed for advance detection ranges from 24 to 36 ft, depending on the distance between the camera and stop line and on the approach speed limit. The higher distances are needed for higher speeds or greater distances.

Field measurements indicate that increasing camera height tends to improve accuracy, provided that there is no camera motion. However, camera heights of 34 ft or more may be associated with an above-average detection error rate unless the camera is mounted on a stable pole.

Researchers developed guidelines for designing stop-line-only detection and stop-line plus advance detection using VIVDSs. These guidelines describe the recommended number of detection zones as well as their location and length. The guidelines for stopline-only detection are based on the use of a long detection zone and a 0.0-s controller passage time. The guidelines for stop-line plus advance detection are based on a 1.0-s passage time and two advance detectors. Both simulation and field data indicate that the use of these guidelines can reduce delay and improve intersection operation.

Note: This research is documented in TTI Report 4285-1, *Video Detection for Intersection and Interchange Control*. Related reports include: TTI Report 4285-2, *Intersection Video Detection Manual*, and TTI Report 4285-3, *Intersection Video Detection Field Handbook*. To obtain copies, visit the on-line catalog at http://tti.tamu.edu or contact Dolores Hott at (979) 845-4853 or d-hott@tamu.edu.

Newsletter Articles

To submit a research article or project summary for future newsletter publication, please send information to dena.jackson@rsandh.com.

Research Information Sources
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including monographs, journal articles, conference papers, technical reports, theses, web sites, and selected media coverage. The Database currently contains over 28,500 records with abstracts. Full bibliographic information is provided, and URLs are included are included for those documents which are available full-text.

Access ***PATH*** *at*: http://www.dcdata.com/path/path.htm

Managed Lanes
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communicating with people interested in managed lanes projects. For more information on the emerging research results on this project or to join the distribution list, contact Beverly Kuhn (979-862-3558, b-kuhn@tamu.edu) or Ginger Goodin (512-467-0946, g-goodin@tamu.edu) or visit the project website at http://managed-lanes.tamu.edu.

This Highway Will Crack
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The key to CRCP is that concrete is poured in a continuous ribbon over networks of reinforcing steel. Instead of inserting joints in the pavement, engineers design the structure to crack on its own at strategic intervals so as to absorb the inevitable shrinkage and expansion that pavements experience. This method not only reduces the cost of construction, but improves road surface smoothness, as well, and has become standard procedure throughout the U.S.

Not all cracks are created equal, however. If a crack is too narrow, it won't relieve enough stress and anchor cracks will form; too wide, and moisture will penetrate to rust the steel. If cracks are too close together, a "punchout" may result—the concrete pavement version of the familiar pothole.

Intentional cracking of CRCP can be managed by modifying certain variables such as the percentage of steel to concrete, the thickness of the pavement, and by designing the mix of materials that make up the pavement. "We want to be able to control these variables under various conditions to optimize the placement and size of pavement cracks," says Dossey.

While few drivers develop a fondness of cracked concrete, Texas drivers at least can feel reassured that some hairline fractures are helping researchers create better roads for the future.

Saving Money for Texas *(Continued from page 13)*

loss, but have not been able to adequately monitor them. The Thermochron (temperature) and Hygrochron probes (moisture) developed under this study provide engineers a cost effective way to extensively monitor the pavement during construction, potentially saving millions of dollars over the years as well as keeping the goodwill of the traveling public.

The Thermochron buttons are $8 each, which allows economical monitoring of temperature in new construction, possibly replacing the conventional maturity meter at lower cost and with higher security (buttons are embedded in pavement and store data internally). In addition, the researchers have used Thermochrons to measure minimum temperatures at various depths over two winters. This data indicates that mid depth temperatures in thick pavements are not as low as expected, which means steel designs can be optimized by region at considerable savings.

In a similar manner, the Hygrochron buttons store humidity readings, which can be used in fresh concrete to indicate how effective the curing is under any condition. If contractors had ready access to information of this sort, additional measures could be taken during high evaporation periods to avoid strength loss or differential shrinkage conditions that lead to spalling.

As a rough estimate of possible statewide savings, the Texas Rigid Pavement Database was examined to determine what percentage of concrete roads fail due to poor temperature or moisture control during construction. The analysis determined that roughly 8.7% fail to reach design life due to close cracking (possible temperature problems) and 7.2% from spalling (possible uncontrolled moisture loss), with some overlap between the two (i.e. some pavements experience both problems). Since 2.5 million cubic yards of paving concrete are used in Texas annually at an estimated cost of $137 million, the failure rates account for about $20 million in replacement cost, allowing for the overlap. If these pavements average a 20% reduction in design life, then the savings from correcting the problem might be as much as $4 million/yr.