LONG TERM, FREEWAY WORK ZONE DELINEATION ISSUES AND INNOVATIONS

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INTRODUCTION

Since wooden barricades and other crude devices in long term construction zones were challenged as hazards to motorists, a number of safer devices such as concrete safety barriers, breakaway barricades, and plastic drums were developed and put into use. Flashing lights and steady burn lights have been used more extensively along with reflective sheeting for better nighttime delineation. Pavement markings that performed better than paint were sought since residual paint in construction zones can be confusing to motorists and grinding marks can be misleading in the rain at night.

CONCRETE BARRIER DELINEATION

Concrete safety barriers were quite an improvement over wooden barricades, offering better protection to motorists, work crews, and equipment. But often, concrete barriers are placed right at the very edge of a lane with little to no shoulder for traffic. Barriers are sometimes difficult to see and drive next to when edge lines are covered by the barrier or covered by dirt close to it. The barrier is especially difficult to see on a wet night under low volume traffic conditions. As a solution to this problem, steady burn lights were mounted on the top of the barrier to help the driver locate the barrier in a construction zone. An issue then developed as to whether reflective sheeting would do just as good a job at lower cost[1].

Five by ten inch reflective sheeting, placed every 90 feet, and steady burn lights, placed at the standard 180 feet, were compared at an actual construction site on the Garden State Parkway and the following was concluded about using sheeting instead of lights:

1. Reflective sheeting mounts have a lower initial, operational, and maintenance cost.

2. They can be spaced much more closely and still have a much lower cost.
3. They are more reliable since without lights or batteries they are less likely to fail.
4. They are still sufficiently visible after months of service.
5. They have a lower loss value and are less likely to suffer from vandalism and theft.
6. Reflective mounts can be made visibile from either one direction or two when mounted on the top of the barrier.
7. At the 95 percent confidence level, reflective sheeting mounts when compared to steady burn lights caused no decrease in the proportion of the vehicles using the lane adjacent to the construction barrier and no change in mean speed or variance in speed.

Using these conclusions, and some common sense, reflective sheeting mounts appear to be a practical substitute for steady burn lights on concrete safety barriers, at least where barriers are adjacent and parallel to the travelled lane. However, transition zones may still require other traffic control devices.

TRANSITION ZONE DELINEATION

Transition zones often present a troublesome area for motorists, who are confronted with temporary alignment changes due to lane drops or diversions. In some states, PVC Type III breakaway barricades are used in transitions to delineate a gradual lane closure. A question arises: Is a series of barricades the best form of delineation at a construction zone transition for approaching motorists? In a study by McGee, Pain, and Knapp[2], vertical panels were found to provide better delineation than horizontal panels. The barricade design comes from the old concept of blocking off closed sections of road with horizontal boards. Breakaway barricades are basically the same device made safer to hit.

Breakaway barricades at five feet tall are difficult to see in many transitions beyond lead vehicles without extending the lead distance, dramatically. In order to address these probems, three foot high barrels were mounted by four foot high, eight inch wide reflective panels and a comparison was made between these extended barrels and Type III breakaway barricades with flashing lights at a construction zone transition on US Route 46 in northern New Jersey[1] and the following was concluded:

1. The extended barrels could be better seen over the tops of lead vehicles, providing more effective channelization of traffic.
2. They occupy less space, thus are less intrusive at the beginning of transitions where there is little clearance to median barriers. The wider barricades use up more shoulder and work area and restrict the view of curves, adjacent merges, and other downstream barricades in many situations.
3. Barrels are stackable and tall panels are easily removed from supporting barrels.
4. Extended barrels offer no more of a hazard than breakaway barricades, except when lights are mounted high on barricades they can be more of a hazard when hit. A barricade can be shattered into sharp, flying pieces, while a drum gets propelled or pushed on impact with less chance of injury and more often could be assembled again for reuse without new parts.
5. At the 95 percent confidence level, it was found that, with extended barrels, during dry days and nights, there was a 50 percent decrease in the lane encroachment rate, and, on wet days and nights, there was a 50 percent decrease in the lane changing rate.

6. A drum with panel should cost $60 against a cost of about $200 per Type III barricade.

Extended vertical panels appear to offer an improvement in delineation, traffic performance, and cost over Type III barricades.

TEMPORARY PAVEMENT MARKING

One of the toughest problems to overcome in construction zones has been the development of substitutes for temporary painted lines. Paint is not very visible on wet nights and it is difficult to remove without leaving confusing traces. Chemical removal is slow and expensive, burning requires special equipment, black paint wears off, and grinding leaves marks which can be deceiving on wet nights.

Although removable tape is relatively expensive, it was found to be easy and fast to install on New Jersey Interstate Route 78, and it was easy and fast to remove, leaving no lasting trace[1]. Removable tape is similar to paint in appearance, and, like paint, it is difficult to see on wet nights.

Raised reflective pavement markers as a supplement to fresh paint increased visibility on both dry and wet nights on US Route 46 and decreased daytime speed variance by over 50 percent and decreased the rate of lane changes and lane encroachments, at the 95 percent confidence level[1]. They were easy and fast to install and remove and were inexpensive, leaving insignificant traces after removal. But these markers had low visibility during the day and thus were not meant to be a total replacement of paint or substitution for tape.

As an answer to this need, an entire construction zone was marked by white and yellow ceramic reflective raised pavement markers[1]. This provided the strongest form of delineation, especially at the lane transitions where they were spaced every six feet and totally replaced the use of paint. At the 95

percent confidence level, the lane change rate was decreased by almost 50 percent during the day, and, at night, the lane encroachment rate was decreased by 75 percent.

It was felt that the durability of the installation at the transition could be improved and the cost could be lower, since only nine months would be the longest time raised markers would be needed at a temporary diversion in New Jersey.

Installations of improved temporary raised pavement markers for day/night/wet night visibility are currently being evaluated since a number of new materials and adhesives have become available that look promising.

FUTURE ISSUES

Extended barrels were found to be effective and practical at transition zones because they are vertical and visible above most lead vehicles. There are other circumstances at transition zones where plastic barrels cannot be used or are inappropriate, and if there is a temporary alignment change or a temporary physical division of lanes, motorists would still need to see above lead cars in their approach and tall, extended delineation would be needed. Other forms of extended delineation should be developed for this purpose.

There are still a number of unresolved issues regarding pavement marking at transition zones. Can a temporary wet night tape be developed for construction zones? Could it be made to compete with the price of a temporary raised reflective marker installation? Can temporary marking be installed faster and at lower overall cost? These are important issues, especially where there is high speed, high volume traffic and it is desirable to keep traffic moving at normal speeds and regularity.

REFERENCES

1. Davis, T. D., Construction Zone Safety and Delineation Study, New Jersey Department of Transportation, February 1983.
2. McGee, H. W., Pain, R. F. and Knapp, B. G., Evaluation of Traffic Controls for Highway Work Zones, Biotechnology, Inc., Falls Church, VA, February 1979.