MOBILE BARRIERS FOR HIGH-TRAFFIC WORK:

Safety on the Highway

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Work zones in the U.S. result in a large number of fatalities, injuries, and other accidents each year. The Transportation Equity Act for the 21st Century (TEA-21) specifically addresses this problem and the need to provide positive protection in work zones while providing adequate work space and minimizing traffic delays. A number of jurisdictions in the United States and Canada have implemented Movable Barrier Technology to improve safety, capacity, and efficiency during recent reconstruction projects.

According to the United States Department of Transportation, over 40 percent of interstate highways and approximately 70 percent of arterial roadways will need reconstruction. Inevitably, reconstruction of the nation’s highways, bridges, and tunnels will lead to an increased number of fatalities. The Laborer’s Health & Safety Fund of North America reports that almost two-thirds of fatalities in highway work zones involved non-traffic related causes such as workers being struck by construction vehicles and the overturning of construction equipment. It is logical to conclude that where space is limited, and without a designated path for construction equipment, the probability of equipment striking workers is higher than in cases where adequate space is available. In addition to these safety problems, work zones often cause significant traffic delays to local and through traffic, which includes interstate commerce activities. User delays on many urban freeway reconstruction projects can cost more than $50,000 per project per day.

The Federal Highway Administration states that, "Meeting the Customer’s Needs for Mobility and Safety During Construction and Maintenance Operations," has concluded that "...Successful work zone traffic management is dependent upon reducing the exposure of the road user and the worker. Transportation agencies must focus on the bottom line: reducing the loss of life and limb, the waste of individual’s time, and the drain on our nation’s economy."

Reason tells us that it is necessary to provide positive protection in work zones and to provide adequate work space to make construction work safer. Reason also tells us that construction work must also be more time efficient. When a work zone causes a reduction in the capacity of a roadway, it can lead to significantly increased traffic congestion, particularly during the peak traffic periods. According to TEA-21, traffic delays due to work zones should be within reason. Section 1402(b): Traffic Flow and Safety Applications of Road Barriers, states that the use of positive separation technologies should be considered related to:
- separating workers from traffic flow when work is in progress;
- providing additional safe work space by using adjacent and available traffic lanes during off-peak hours;
- rapid deployment to allow for daily or periodic restoration of lanes for use by traffic during peak hours as needed;
- mitigating congestion caused by construction by: opening all adjacent and available lanes to traffic during peak traffic hours; or using reversible lanes to optimize capacity of the highway by adjusting to directional traffic flow.

In recent construction projects, some jurisdictions in the U.S. and Canada have opted to use Positive Separation Technologies (PST) to help manage their construction work zones.

PST can be defined as technologies that provide positive physical protection between adjoining lanes of traffic flow or between a traffic lane and a work zone. Since traffic volumes vary constantly within any given day, PST is especially efficient when it can respond to these variations in traffic flow. Movable Barrier Technology (MBT) is a type of positive separation technology that has the ability to provide positive protection continuously both to road users and construction workers while responding to traffic flow conditions and construction needs. MBT’s flexibility allows it to be moved quickly and safely to open and close traffic lanes as required by varying work zone activities and traffic volumes.

The movable barrier is constructed of a series of interconnected sections of barriers hinged together to form a continuous chain. The cross section is similar to that of other portable barriers, but with a "T"-shaped top. Each section is just over three feet (39 in.) long and weighs approximately 1,500 lb. Sections of barrier can easily be locked together or unlocked by inserting or withdrawing a steel pin through the hinge components attached to either end of the barrier. A specially designed conveyer system on a self-propelled barrier transfer machine (BTM) is used to shift the barrier laterally across the roadway. The distance of the shift can be varied from 4 to 18 feet. Conveyor wheels on the BTM engage the T-shaped top of the barrier. The barrier can then be lifted several inches off the ground, moved sideward fashion through an elongated “S” curve, and accurately repositioned to form a new lane line. Barriers can be moved at a speed of up to five mph or more.

**ACCOMMODATING TRAFFIC ON ELEVATED ROAD**

In Montreal, Canada, MBT was applied during the Metropolitan Highway (A-40) Reconstruction. It was used to add an additional lane to the work zone during off-peak periods. Critical to the reconstruction of

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this elevated section was minimum disruption of traffic and rapid execution of seven separate contracts, all running concurrently. Because MBT offered both portability and positive protection, it was the traffic control device selected.

The A-40 is a major elevated freeway with limited right-of-way serving downtown Montreal. This six-lane elevated section connects Montreal and Quebec City and is heavily trafficked with average daily traffic (ADT) of about 200,000 vehicles. It consists of six 12-ft lanes, two narrow 1.5-ft buffer zones, and a permanent median barrier. Signalization de Montreal was responsible for maintaining traffic during the reconstruction. To prevent major traffic backups, the Ministry of Transportation required that two lanes in each direction be maintained during peak periods. A $5,000 fine for every five minutes of traffic delay in moving the movable barrier to accommodate traffic was written into the contract. In Stage 1, MBT was deployed closing off both inside lanes next to the permanent median for a distance of 3.5 miles. During off-peak travel times two machines would transfer the movable barrier, closing an additional lane to traffic and enabling the contractor to reconstruct the permanent median barrier and 1.5 lanes. Before the peak periods, the movable barrier would be moved back allowing two lanes for commuters.

In Stage 2, the contractor transferred the movable barrier to the shoulder side of the highway, deploying it to close the outside lane. Again, twice a day, the contractor would transfer the barrier over, closing a lane during the off-peak travel periods, allowing the reconstruction of the remaining 1.5 lanes of this elevated section of the roadway. Using MBT in this way eliminated one complete stage.

Construction time was reduced to 5.5 months, saving the Ministry millions of dollars, and no fines were levied for delays. According to Quebec Ministere des Transport’s regional director of construction Jacques Alepin, “It enabled us to complete the project during one construction period, something that would have been impossible without the movable barrier system.”

MINIMIZING IMPACT OF LANE CLOSURES

In Arlington, Virginia, MBT was applied to add an additional lane to the work zone during off-peak periods. I-66 just outside Washington, DC, is a critical east/west corridor into the District of Columbia, and this six-lane highway has an ADT of about 175,000. When the Virginia Department of Transportation (VDOT) looked to widen I-66 for a distance of almost three miles, the heavy traffic volumes and concerns regarding congestion management and safety resulted in VDOT specifying MBT. The contract required that all construction be carried out behind concrete barrier and that lane closures be restricted to four hours by day and eight hours at night.

Where space is limited, the probability of workers being struck by construction vehicles is higher.

For the project, contractor Lane Construction Company (Meridan, Connecticut) constructed a six-ft asphalt shoulder in the median. The road was then restriped and traffic rerouted four feet toward the center of the road. Approximately 14,000 linear ft of movable barrier was deployed to the inside shoulder, and a full depth concrete widening, 15-ft wide, was initiated.

Using MBT, lane closures in the median were reduced from two hours to about 30 minutes. This time saving made it cost-effective to take advantage of the four-hour work window during mid-day.

VDOT reported that construction time was reduced by 30 percent through the increased speed created by the lane closure, and having a paved surface to access and reconstruct the project allowed the contractor to use larger and more efficient equipment.

MBT also allowed for continuous inspection and easier placement of sub-base materials and transverse load joint baskets. According to Lane Construction, this allowed the contractor to build the road as if it were a new highway without interference from existing traffic.

MBT minimized the impact of the lane closures on the public. So intrigued were local residents by the “commuter friendly” equipment that it was put on display at a county fair. The project was completed about five months ahead of schedule at a savings of hundreds of thousands of taxpayer dollars.

MBT has been applied successfully in numerous other work zones throughout the U.S. Its benefits include:

- mitigating traffic congestion by providing additional traffic lane(s) during peak periods;
- enhancing safety by reducing traffic accidents through continuous positive protection, a shorter construction period, and less traffic congestion. All three of these measures are positively correlated with the number and/or severity of accidents;
- increasing the efficiency and productivity of work zone construction operations because of the additional workspace that MBT can provide.

For follow-up Q&A and Web site addresses visit www.fwmag.com and click on “This Month’s Issue.”

REFERENCES