THE BARRIER TRANSFER MACHINE: MOVEABLE BARRIER FOR MANAGED LANES

PITT | SWANSON ENGINEERING

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Abstract

Traffic is an issue that negatively affects commuters across the world on a daily basis. One effect on society includes an increase in pollution as fuel burns faster due to the starting and stopping motion of your vehicle in traffic. Additionally, emergency vehicles can experience delays which could ultimately cost someone their life. Fortunately, a recently developed technology has paved the way to increase the flow of travel and alleviate these issues from commuters. This innovation, known as the barrier transfer machine, offers an effective solution to traffic issues and does not require major changes in the structure of the road. The barrier transfer machine uses cutting edge technology to physically move the median of roads, bridges, and tunnels in order adjust to the current traffic. Consider an 8-lane highway leading into a city, 4 lanes in each direction. During prime travel time, there is an abundance of traffic seen in one direction as opposed to another. Because the barrier transfer machine shifts the median, it could allow for 5 lanes coming into the city and 3 coming out. Having more lanes coming in allows for a better flow into the city but doesn't affect the traffic coming out. This technology has provided a solution to traffic in areas across the world such as the Golden Gate Bridge in San Francisco, California and the Auckland Harbour Bridge in Auckland, New Zealand. The barrier transfer machine has begun and will continue to help resolve traffic issues and make travel safer, overall improving the lives of traveler's day in and day out.

Real World

Commuters on I-15 in San-Diego, California, experienced increased delays due to increased travel demand. The table below shows the increase in delay of travel. By 2020 delays were expended to reach 80 minutes if improvements were not made. With the implementation of an express lane delay times have plummeted allowing for a more efficient highway system. Everyday the barrier is moved around 5:30 am then returned following the morning commute around 11:30 am to prepare for the evening commute.

Average Daily Trips

Year	1987	1999	2020
Trips	185k	290k	380k
Delay	45 min	60 min	80 min

What is the Barrier Transfer Machine?

The barrier transfer machine operates by physically moving the median of highways, bridges, and tunnels to allow the flow of traffic be managed in a more dynamic manner. This innovation offers a new strategy for making congested highway systems more efficient and eventually improving the safety of travel.

How it Works

1. One- meter sections of highly reinforced concrete barriers are pinned together at each end to form a continuous wall. The barriers are designed with a "T" shaped top used as the lifting surface for the barrier.

2. The machine lifts the barrier and passes it through a conveyor system. The conveyer consists of small wheels that hook underneath the T-shape on the top of the barrier. This lifts the barrier and moves it laterally across the width of the lane.

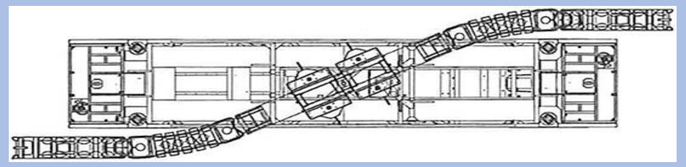
3. In one pass, the barrier is lifted and can be transferred up to 24 feet across the lane. The barrier is then sat down without damaging the road at speeds of approximately 10 mph.

Future

The barrier transfer machine has proved to be an efficient machine, but there are many technological improvements that we believe would better the machine. Improvements such as increasing the speed to allow for more ground to be covered in a shorter period of time. Additionally, implementing renewable energy to run the machine would be a great, ecofriendly, improvement to the machine. Highways would allow for great use of solar power as they are completely exposed to sunlight. Bridges however, could create energy using turbines in the water below. Finally, implementing lane assist technology seen in cars today would allow for the barrier machine to be self propelled. Expect these technological improvements to show up in the near future and the population of barrier transfer machines in the world to increase.

Benefits:

- Budget: According to the FHWA, new freeway construction can cost up to $15.4 million per lane mile. Moveable barrier is a fraction of that cost.
- Reduces Congestion: Moveable barriers give more lanes to the peak traffic direction.
- Increases Safety: Positive barrier protection reduces possibility of crossover, head-on accidents.
- Fast Solution: Construction can take years for planning and construction, moveable barriers can be installed in less than one year.
- Green Benefits: Improved air quality, increased fuel efficiency, reduced atmospheric CO_2.



"S" shaped conveyer design (underneath machine)

Morning Commute: 3 lanes into the city, 2 lanes out of the city

Evening Commute: 3 lanes out of the city, 2 lanes into the city