

WHEN

GUARDRAIL

Manufacturers Seek Profits Over Safety, Consumers Pay the Price

BY J. Kent Emison & Michael Serra

Roadway safety experts agree that guardrails are intended to protect motorists who inadvertently leave the roadway. The Texas A & M-Texas Transportation Institute ("TTI") put it best when it stated, "The penalty for an inadvertent roadside encroachment should not be death or serious injury". Unfortunately, some guardrails installed on America's roadways are themselves hazardous. In particular, the ever-present ET-Plus guardrail end terminal has a proven track-record of spearing errant vehicles that are unlucky enough to impact the end of the guardrail installation, causing numerous horrible injuries and deaths.

When corporations put profits over the safety of the public, the inevitable results include more money to the corporation and horrible injuries and many deaths to the public.

Trinity chose to exchange corporate profits over safety of the motoring public on at least two occasions which will be discussed below:

Trinity's Unnecessary and Dangerous Redesign of the ET-2000 End Terminal System

Trinity Industries is one of the world's largest manufacturers of roadside safety hardware, including guardrail end terminals. Trinity manufactured the ET-2000 guardrail end terminal from 1990-2000.

A photo of the ET-2000 is below:



ET-2000
(NCHRP 350)

The ET-2000 was designed by engineers over a period of four years. It underwent more than 25 crash tests and was analyzed by Trinity in a comprehensive "in-service" evaluation of real-world crashes. The results of the testing and in-service evaluation established that the ET-2000 was very effective at preventing serious injuries and deaths for motorists who inadvertently left the roadway.

In one of the in-service evaluations, Steve Easton – an employee at Trinity – published, *In-Service Evaluation of the ET-2000*, for the Transportation Research Board. Based on crash data from the State of Texas and Ohio, Mr. Easton determined the "injury severity of the ET-2000 to be at a very low level. In fact, at such a low level as to be able to compare it to the safety of the Supplement Restraint System (SRS) commonly called the air bag." Mr. Easton reported "no performance problems" with the ET-2000 end terminal system. The FHWA also

reported that the ET-2000 had an "excellent history".

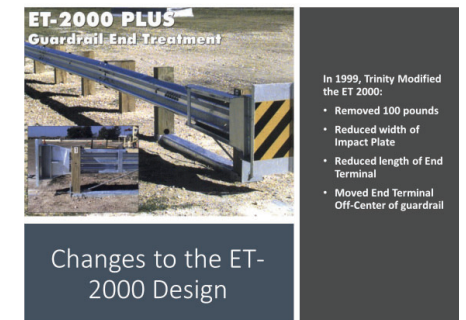
However, in 1999, the patent for the ET-2000 was expiring so a Trinity executive (Steve Brown) and a non-engineer employee of Trinity (Wade Malizia) met with engineers for TTI to discuss a new guardrail end terminal product, which would become the ET-Plus.

It is universally known in the highway safety community that the development of a highway safety device is a long and arduous process. However, in the case of the ET-Plus, Mr. Brown and several TTI engineers redesigned the ET-2000 end terminal during a single meeting, lasting no more than a couple hours. These individuals made ad hoc design changes – without the benefit of any engineering analysis, design calculations, or computer simulations. Trinity's design methodology – what little can be gleaned from it – is so nebulous and lacking in scientific rigor as to cast serious doubt if any engineering judgment was utilized in the design of the ET-Plus. In fact, following the design meeting, Trinity selected Wade Malizia – a plant manager with no engineering experience or background – to construct the prototype ET-Plus end terminal. Mr. Malizia holds a bachelor's degree in Business from Youngstown State University. Mr. Malizia was given no design or fabrication drawings, just Mr. Brown's meeting notes.

The meeting lasted a couple of hours and resulted in the non-engineer employee,

Malizia, being tasked with building the prototype in Ohio with other factory workers, none of whom were engineers. This prototype was subjected to one crash test and was immediately marketed all over the world.

The ET-Plus is below:



Changes to the ET-2000 Design

- In 1999, Trinity Modified the ET 2000:
- Removed 100 pounds
 - Reduced width of Impact Plate
 - Reduced length of End Terminal
 - Moved End Terminal Off-Center of guardrail

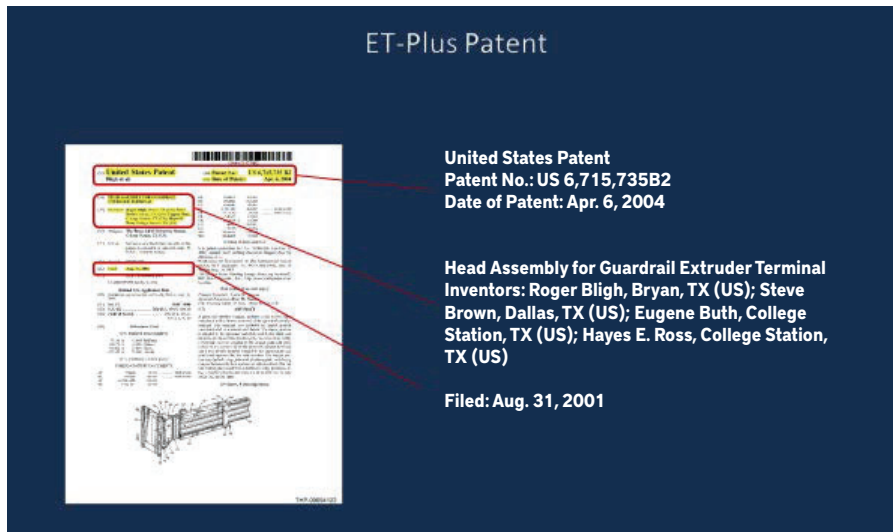
Despite its renowned safety record, Trinity changed the ET-2000 end terminal by making dramatic modifications. Trinity removed approximately 100 lbs. of steel from the end terminal by reducing the number of internal stiffeners and narrowing the impact faceplate. Trinity also reduced the end terminal's overall length and shortened the extruder section of the head. Most importantly, Trinity's

changes resulted in the ET-Plus having an asymmetrical head design. The asymmetry increased rotation during the extrusion process, which substantially increases the potential for lockup and exposing vehicles to the potential to be speared by the guardrail

Why would TTI and Trinity change the design of a proven safety product like the ET-2000? You must look no further than the patent for the ET-2000, which was

going to expire shortly after the year 2000. The new product, the ET-Plus, would be subject to a new patent and provide increased revenues to Trinity.

Further, the inventors of the new ET-Plus continue to receive tens of millions of dollars in royalties for the sale of the ET-Plus. Who were the inventors? They are some of the very people who attended the two-hour meeting where it was decided to build the ET Plus; i.e. Steve Brown, the Trinity executive, and TTI engineers:



Trinity's Undisclosed Modifications to the ET-Plus End Terminal System

A few years after sales of the ET-Plus began, Trinity again looked to make more profits by "secret", but substantial, changes to the ET-Plus.

In November 2004, Trinity Executive Steve Brown emailed Trinity management, advocating modifications to the ET-Plus, which would result in more profits to Trinity. In particular, Mr. Brown suggested the guide channel on the end terminal could be reduced from 5 inches to 4 inches (20 percent) which would save \$2.00 per end terminal. Mr. Brown – a non-engineer – stated that if TTI agreed to these modifications that Trinity could make this change with "no announcement."

Trinity was again pushing design modifications without conducting a proper engineering analysis or in-service evaluation to determine the effect said changes may have on real-world impacts. In fact, Brown testified that the only analysis Trinity conducted before implementing design changes into the system was informal "piece of paper" calculations to determine the difference in weight and cost. Brown speculated that modifying the guide channel would "in some ways offer[] some benefits we thought in some of the crashes." It is indisputable that Brown's justification is pure speculation. These statements, by a non-engineer, are an attempt to justify modifications that will save Trinity \$2.00 per end terminal. Without any input from the engineers at TTI, Trinity assigned Wade Malizia to design and fabricate a prototype 4-inch ET-Plus.

From: Steve Brown
Sent: Tuesday, November 09, 2004 2:38 PM
To: Rodney Boyd; Brian Smith
Cc: Will Burney
Subject: Fw: ET

If Wade's numbers are good, we would save \$2/ET. That's \$50,000/ year and \$250,000 in 5 years by using the 4" channel for the legs.

For this money we ought to be able to consider some pendulum or sled testing, if that's what we need to convince TTI that we should roll this out.

I think we'll could get a better ET:

- * it will be a little lighter for side impacts
- * we'll save a few bucks
- * welding will be stronger at the juncture of the head and legs
- * welding, which hasn't been a problem, will be a bit more mistake proof
- * the fit of the head on the guardrail will be much closer.

If TTI agrees, I'm feeling that we could make this change with no announcement. We did pretty good with the TRACC changes.

Note: Wade's got the weight correct but the channel incorrect.

Trinity again turned to its factory workers to make the changes to the ET-Plus. Trinity shop workers fabricated the prototype 4-inch ET-Plus. They did so without input or guidance from an engineer. They conducted no engineering or failure mode analysis. They changed the end terminal's welds between the guide channel and end terminal from butt welds to fillet welds. This was done without analyzing the weld strength. The reduced guide channel required insertion into the end terminal, which reduced the internal height of the squeeze section and reduced the overall length of the end terminal. Again, none of these design changes were subjected to any engineering analysis or calculations.

On May 27, 2005, Trinity and TTI conducted a single crash test with the 4-inch ET-Plus prototype. The crash test report, prepared by TTI and submitted by Trinity, contained no mention of the above-referenced design modifications. Rather, Trinity referred to the 4-inch ET-Plus as a "standard" end terminal. The submission also lacked any detailed drawings or photographs of the end terminal. The FHWA approval letter highlighted seven design modifications, none of which mentioned the change to 4-inch guide channels.

Conclusion

As a result of ongoing litigation, the dangers of the ET-Plus have come to light. While the number has varied, the map below shows that as of 2014 a majority of states permitted no new ET-Plus end terminals to be placed on its roadways:



Unfortunately, tens of thousands of the dangerous ET-Plus end terminals remain on roadways throughout the United States. States have not chosen to remove the ET-Plus from our roadways, so people will continue to be horribly maimed and killed by the ET-Plus for the foreseeable future.

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