Surface Haulage Accidents...

...Ways to Prevent Them

MSHA's investigations of surface haulage accidents reveals two key points:

I. ***Certain types of accidents occur over and over.***

II. ***There is a "fine line" between fatal and non-fatal accidents.***

We can use this information to help target safety measures that will prevent future accidents.

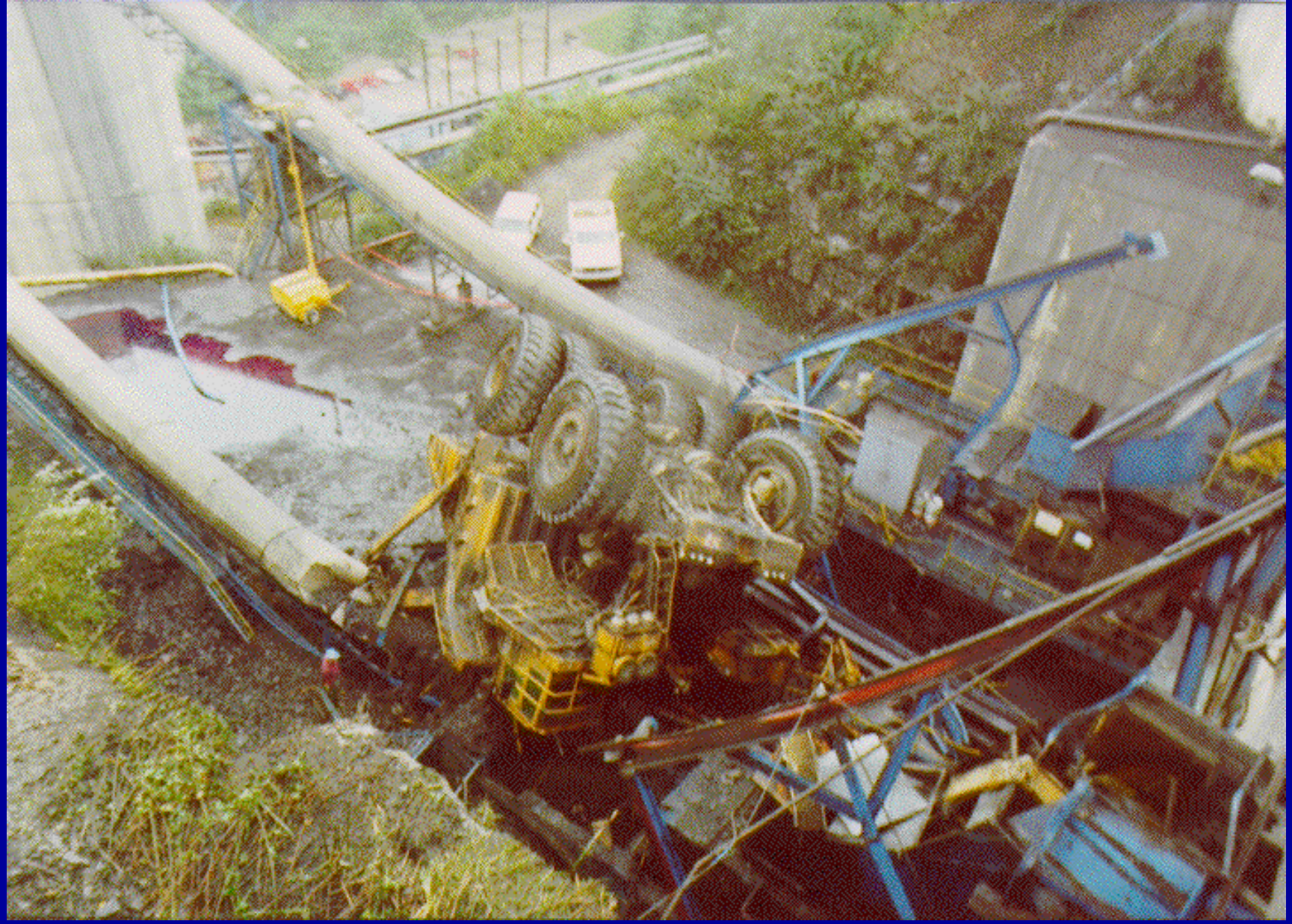
I. Certain types of surface haulage accidents occur over and over.

- Trucks going over dump points;
- Vehicles /persons being run over by large trucks;
- Miners getting caught in conveyors; and
- Haulage trucks going out-of-control...

This presentation focuses on truck accidents.

Common factors in accidents where trucks go out-of-control include:

- **Steep Grades...**
- **Defective Brakes…**
- **Overloading…**
- **Driver Error…**



Example of a fatal haul-truck accident: The operator of this 170-ton capacity haul truck was killed when his truck went out of control as he descended an 8-percent grade.

The contract truck driver had 22 years of experience. At the end of a 4-mile long haul, he was descending this grade to the dump point just around the curve. It was his fifth haul of the shift.

A witness reported that as the truck was descending the grade it appeared to be going at an excessive rate of speed and flames were coming out of the rear wheels. The truck failed to make the curve to the right and left the road at the point where the white truck is parked facing the camera.

This is a close-up view of the area where the truck left the haul road...

The truck went over the wall and ended up here. The victim was not wearing a seatbelt. The accident investigation revealed that the electrical retarder had failed to operate because of a problem with the contacts between the brushes and the commutator.

The accident investigation also revealed that there was no braking effort available from the front service brakes because of a leaking seal. The rear service brakes were found to be capable of providing 78 % of their design braking capacity.

In summary, this fatal accident occurred because the truck's retarder system was defective and the inadequately maintained service brakes could not provide enough braking force to stop the truck.

This is the site of another fatal truck accident. The truck was hauling mine waste on a haul road with six switchbacks. The grade of the road varied from 9 to 19 percent.

The accident occurred at a point where the grade was near 19%. The road was wet and the victim had reporting “spinning his wheels” on the way up. On the return trip the empty truck skidded off the road, as shown above.

The accident investigation revealed that the front brakes were inoperative and there was no braking force from the right rear brake.

The conclusion on this accident was that the deficient and uneven braking, combined with speed too fast for the wet and steep-road conditions, resulted in the truck leaving the haul road. The victim was not wearing a seatbelt and was thrown through the windshield.

This fatal accident occurred on an 11% downgrade. The accident investigation found that there were problems with the brakes and the truck was overloaded.

- **Three of the six service brakes were found to be providing no braking force - grease was found on the brake linings. The other three service brakes had brake drums which exceeded their allowable diameter.**
- **The truck was loaded to the point where it <u>exceeded</u> the truck manufacturer's maximum recommended gross vehicle weight by over 30,000 pounds.**

A fatal accident occurred at this mine when a scraper was hauling overburden up this ramp. The ramp was 320 feet long at a grade of 17%. The ramp runs along the top of a highwall.

The mine uses a left-hand traffic pattern in this area.

As the scraper neared the top of the ramp it stalled and rolled backwards.

The scraper went over the highwall at a point where there was virtually no berm for a distance of about 65 feet.

The scraper operator was 38 years old and had 4 years of experience. He was wearing the seatbelt.

The accident investigation revealed problems with the scraper's brakes. The braking capacity was diminished because the pushrods were out of adjustment and there was no lining-to-drum contact on two of the wheels.

II. Fine Line ...

- The investigation of mining accidents repeatedly demonstrates that there is a "fine line" between fatal and non-fatal accidents…
- Consider the following examples...

In this case a water truck went out of control while descending a 1000-foot long section of haul road on a 10% grade. The truck missed a curve at the bottom of the grade and ran across this field. This could have been a fortunate circumstance, but unfortunately...

…the water truck crashed into a ravine that ran through the field.

The truck driver was 37 years old with one year of driving experience. He was not wearing a seatbelt.

The accident investigation revealed that the truck's front brakes had been removed and the rear brakes were defective. Rear brake problems included a severe air leak, oversized brake drums, and excessive pushrod stroke...

The point here is that if the truck hadn't run into the ravine - if the truck had lost its momentum rolling through the field or otherwise been brought to a controlled stop - the operator may have survived this accident unharmed.

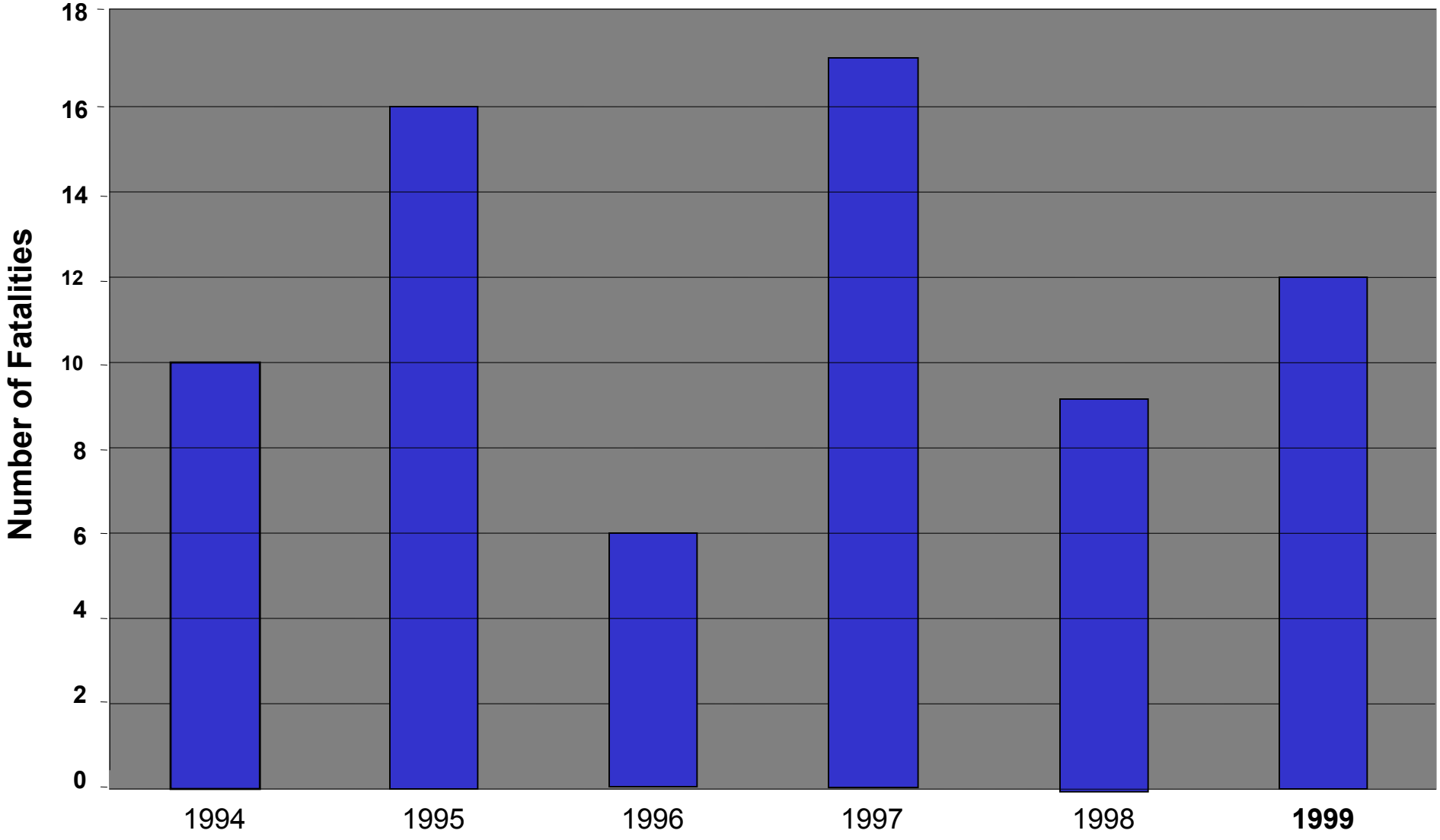
When a fatal accident occurred at this site, it was only the second time that the victim had driven down this haul road and the first time in the particular model truck. The road had an 18 % grade.

Three runaway-truck escape ramps had been constructed on the steep grade as a safety measure.

The victim apparently had jumped from the truck and was found about 200 feet below the second escape ramp. The truck went into a ditch and ended up on its side near the third escape ramp, which can be seen to the right of the truck. This ramp was 350 feet below the second ramp.

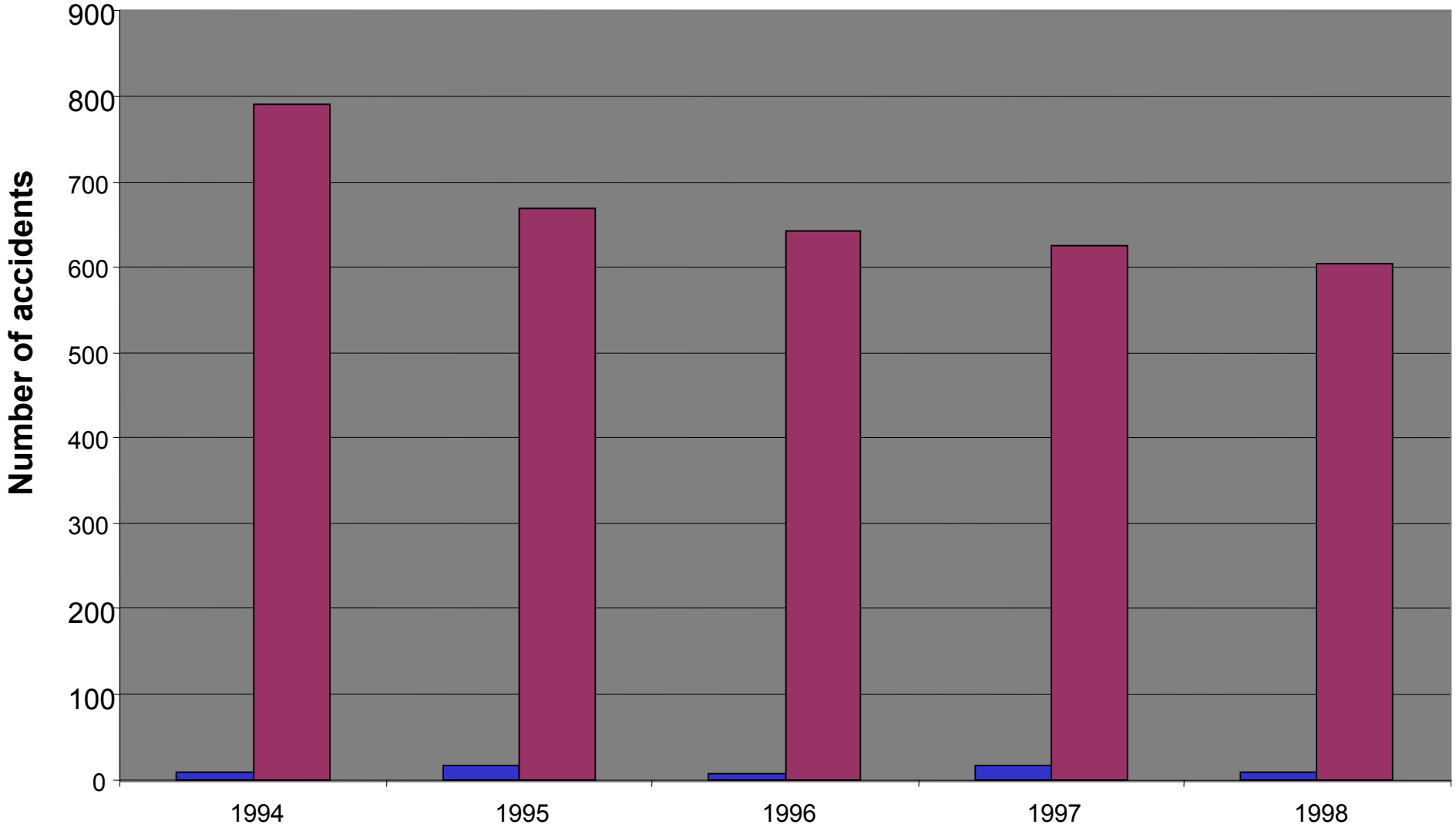
The 20-ton capacity truck was found to have been loaded to about 45 tons. In addition, the driver apparently was not adequately trained on the operation of the truck and the escape-ramp safety features.

Number of "Truck Driver" Fatalities by Year



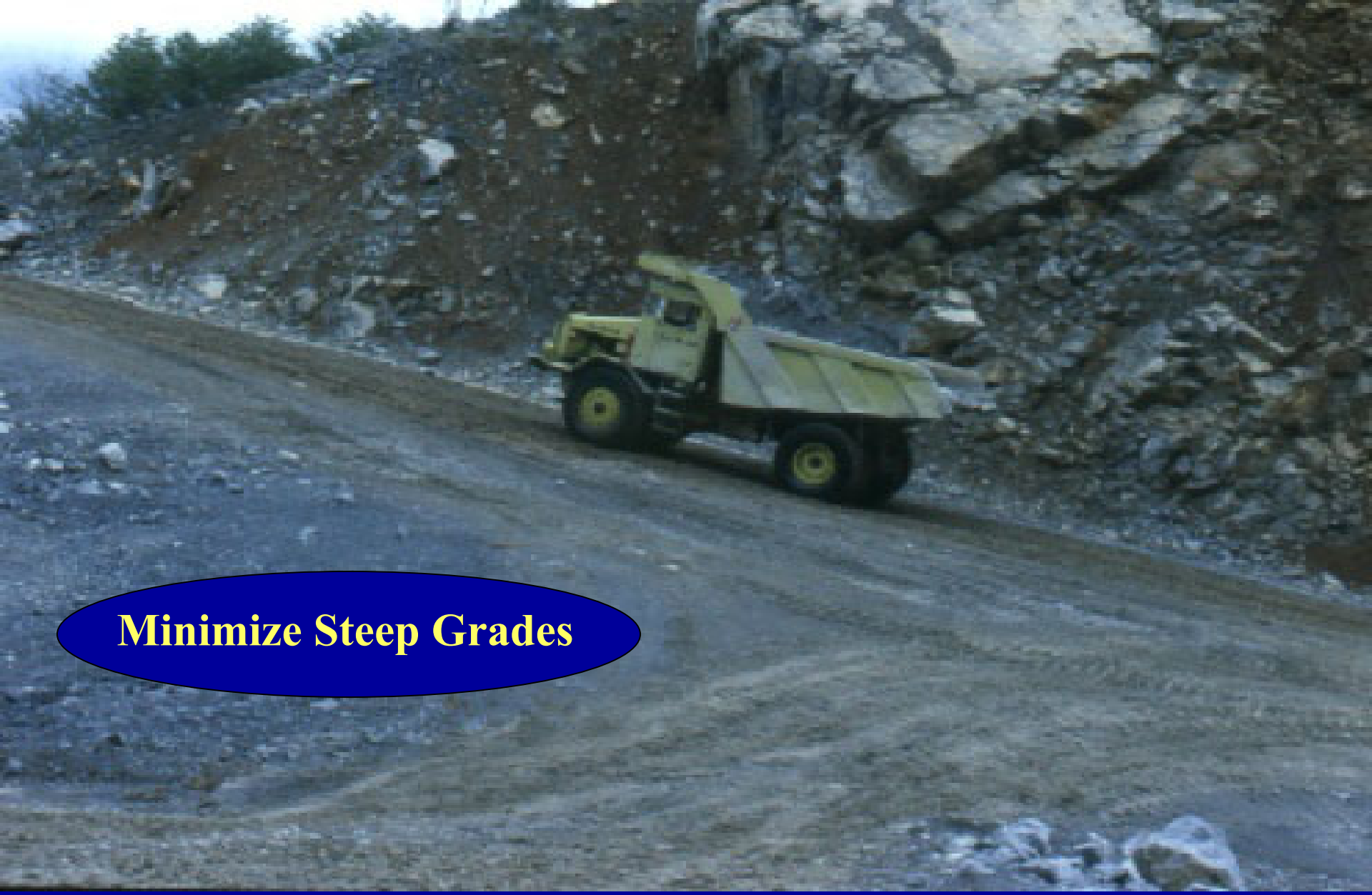
This graph shows the number of truck driver fatalities each year. The fluctuation likely reflects the increased emphasis on surface haulage safety that occurs when the number of truck accidents rise. But these variations also result from the fact that sometimes - even with very similar sets of accident circumstances - in one case a miner is seriously or fatally injured, while in another the miner may receive only minor injuries. Safety measures - as shown in this presentation - can be taken to prevent accidents and to increase the likelihood that when an accident does occur the consequences will not be as serious.

No. of “Truck Driver” Fatal Accidents (blue) vs. Lost-Time Accidents (red)



A goal of surface haulage safety must be to continue the trend of decreasing the number of lost-time accidents and to incorporate measures to reduce the seriousness of any accidents that do occur.

Design Features to Improve Surface Haulage Safety



Steep grades can reduce or eliminate a driver's margin for error, especially if there is a lapse in equipment maintenance or if a truck is overloaded.

Where grades are steep, provide measures to control a runaway truck - such as berms that a truck can plow into, or escape ramps. Such features don't take the place of good maintenance, proper truck loading, and a sound driver training program, but they provide a form of safety insurance.

Here's an example of an escape ramp. The ramp is still under construction in this picture, but in the first year after it was completed, a runaway truck was saved on the ramp.

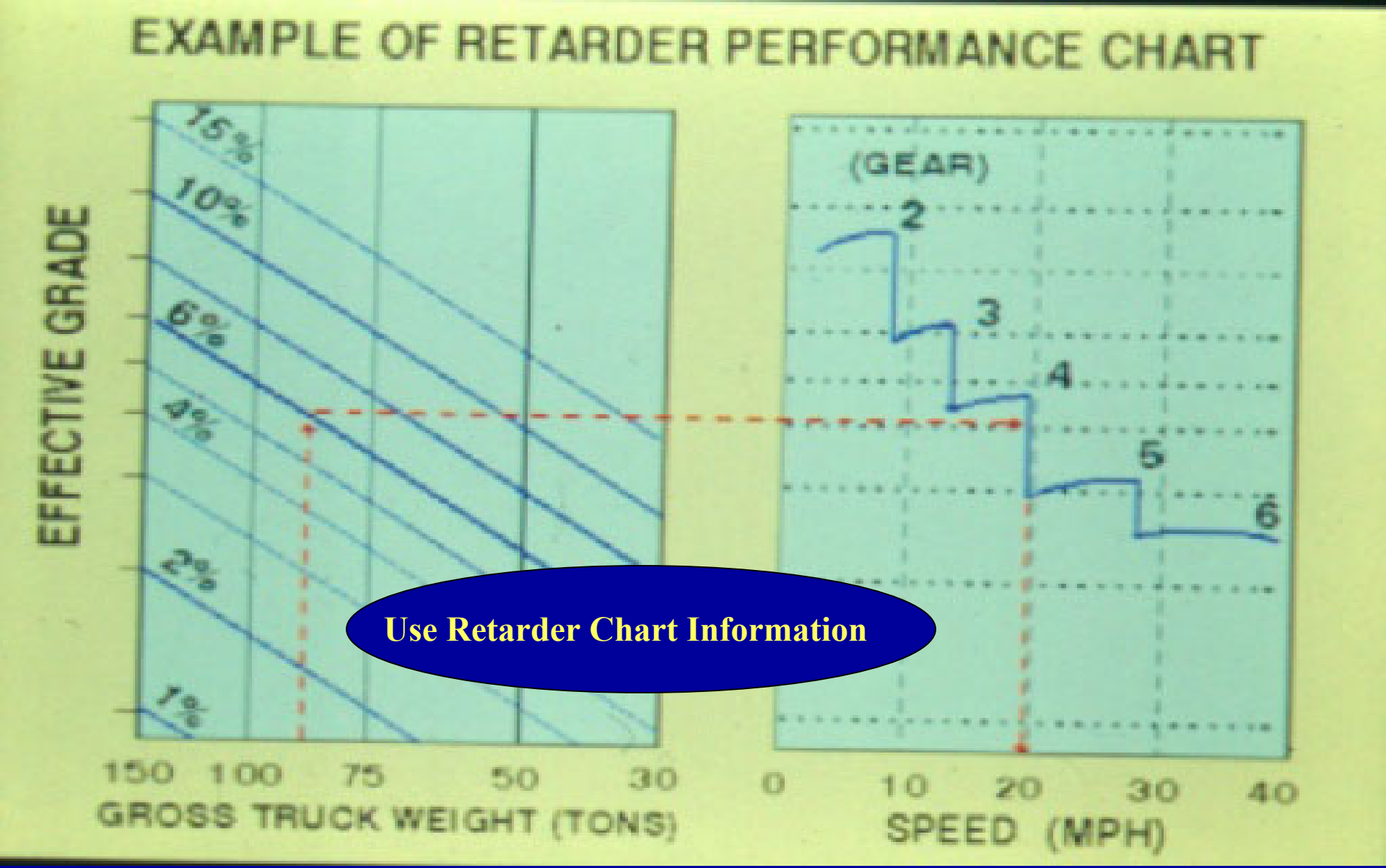
An example of a runaway escape ramp at a copper mine in Utah. A bed of loose gravel is used on the ramp to help bring a runaway truck to a controlled stop.

This was a save of a runaway truck at a mine in West Virginia. Where it may not be practical to construct a ramp, some mines have had success placing berms of loose material along the sides of the roads. As shown above and in the next picture, this driver brought his runaway truck to a stop by plowing into the loose berm material.

The driver stayed in the truck and was not injured.

Here, loose material is placed in a “sawtooth” pattern to provide the driver with the opportunity to straddle the berm. Since the stopping power is limited, the driver must get into the berm as soon as he or she realizes there is a problem and before the truck picks up too much momentum.

These are other examples where “straddle” berms of loose material have been placed in various locations where a truck driver may be able to use them to help bring an out-of-control truck to a stop.



Make sure that trucks are operated within the manufacturer's recommendations. Retarder charts, for example, indicate the combinations of loads, grades and speeds that should not be exceeded if the truck's retarder is to work properly. Use retarder chart information to set speed limits for downgrades and to train drivers on proper operation of the truck.

WARNING

(Example only)

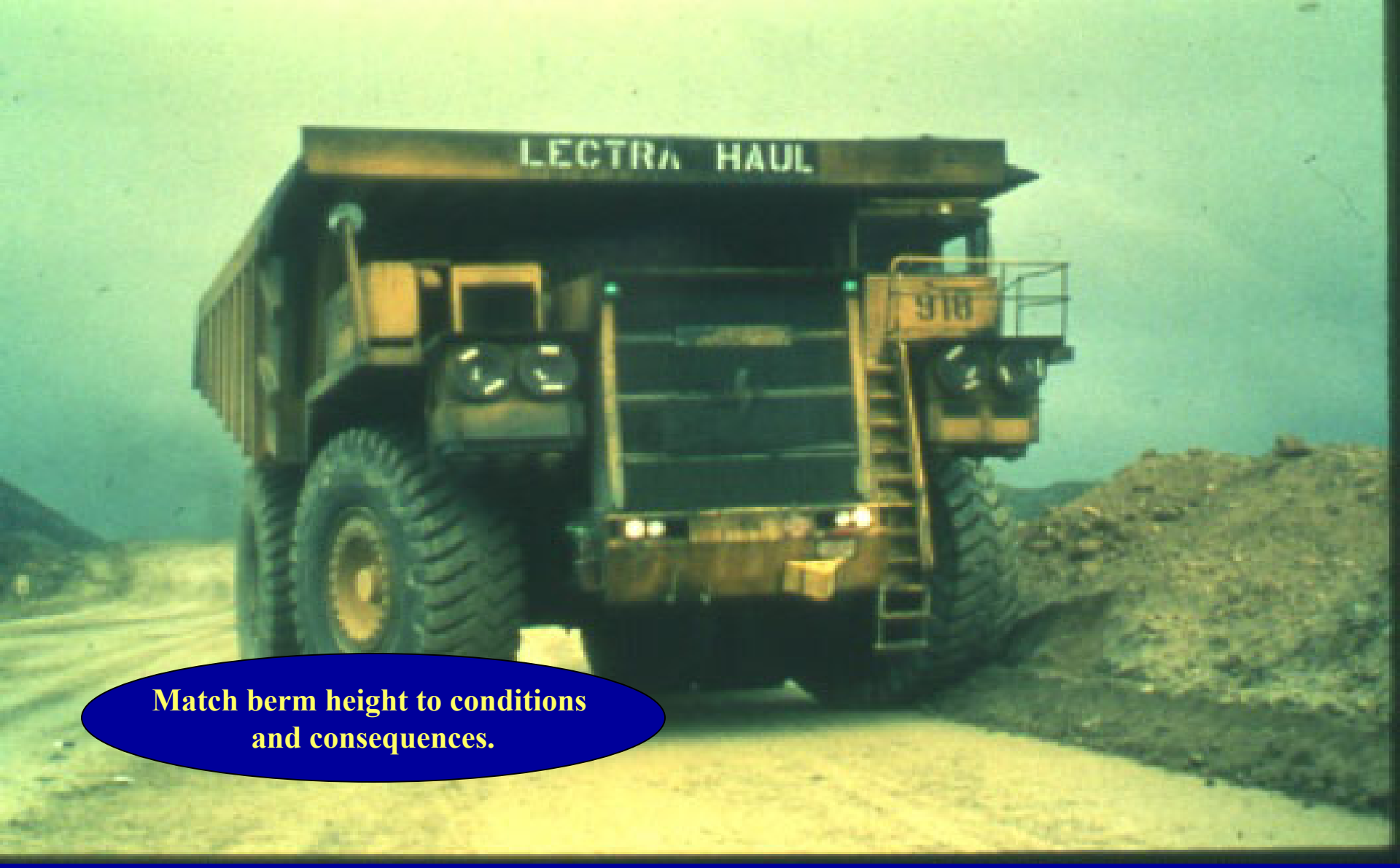
DO NOT DESCEND GRADE AT SPEEDS GREATER THAN LISTED, WHEN VEHICLE IS LOADED AT MAXIMUM GVW.

GRADE %	SPEED MPH
12	0
10	16
8	23
6	28
4	34

Install decals in truck cabs with simplified retarder chart information. This reminds the driver - at a glance - of the retarder performance characteristics of that particular truck.

Provide signs on steep sections of haul road indicating the actual grade of the road in percent.

Combined with the retarder information decal in the cab, these signs help provide the truck driver with the information needed to operate the truck safely.



Where the chances or the consequences of a truck leaving the haul road are more severe, use larger berms. For example, the chances of a truck leaving the haul road may be greater if you have a curve at the bottom of a grade; the consequences may be greater where a road runs near a pond. Construct larger than axle-height berms in the more critical areas.

A fatal accident occurred at this mine when a truck failed to make a 90-degree right turn. The road was narrow and there was little or no berm. The trucks normally took two attempts to make the sharp turn. When the driver attempted to make the turn on one try, he ended up going into a small pond. Even though the water was only 10 deep, the truck ended up on its side and the operator drowned. The lessons here were that roads should be adequately widened on curves and substantial berms should be provided where equipment travels near ponds.

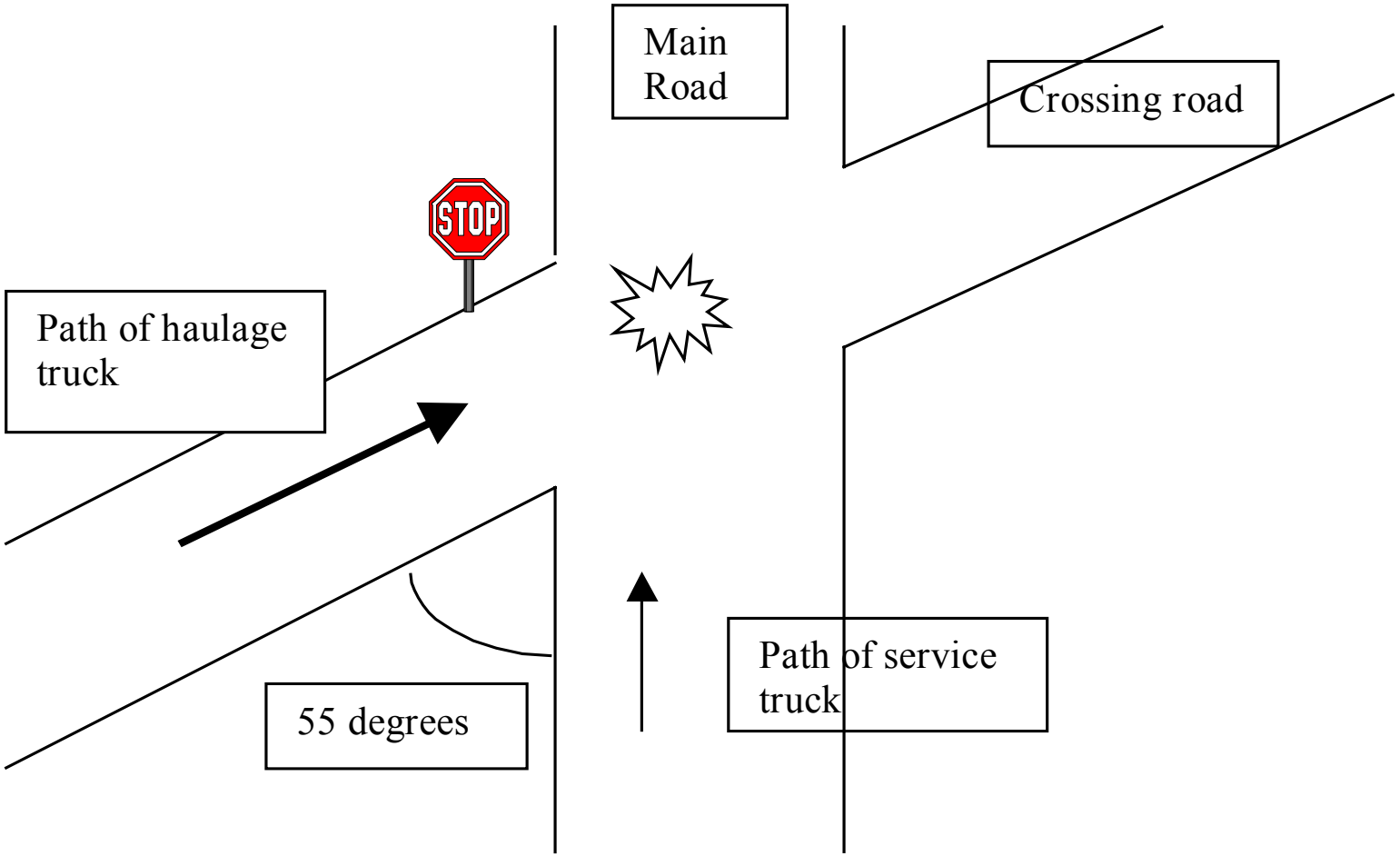
Here's another example. In this accident a 40-ton capacity truck was returning empty to the pit. The truck was descending this 10 percent grade and negotiating the curve when a mechanical problem with the truck caused it to continue turning to the right where it plunged into a pond.

The accident investigation revealed a defective gear selector control cable, which apparently caused the truck to be shifted into reverse instead of 1st gear. Apparently the truck stalled and the emergency steering became depleted. The pond was 42 feet from the road and was not bermed.

In this fatal accident the truck was backing up past this pond when the rear wheels got too close to the edge. No berm had been provided. A berm should serve the three functions of providing a good visual indicator of the edge of a drop off; impeding equipment from going over the edge; and keeping the weight of the equipment back a safe distance from the potentially unstable edge of a drop off.

As larger trucks are used, haul roads need to be widened to provide the drivers with a reasonable margin for error. A good safety rule is to provide clearance of at least half the truck width on each side of each truck. This means that for two lanes, the haul road should be at least 3.5 times the width of the largest trucks.

In this fatal accident a haul truck pulled out to cross an intersection and ran over the utility truck.



Intersection conditions where haulage truck ran over service truck.

This was the layout of the intersection. A "drive left" traffic pattern was used. Note that this intersection layout - with the crossing road intersecting at an angle of about 55 degrees - would have made it more difficult for the haulage truck driver to see traffic approach the intersection from his right side.

Here's the actual intersection. The main road runs from left to right across the front of the picture. The haul truck would have approached and stopped near the right side of the picture.

This shows a haul truck stopped at the intersection.

Notice in the insets below how the driver has a difficult time seeing to the right side.

Intersections should be laid out keeping this right side blind spot in mind. Avoid intersections at angles of less than 90 degrees to the truck's right side. Layout intersections to provide the drivers with as much sight distance as possible.

Several accidents have occurred in recent years where haul trucks were struck by trains.

At this crossing, a 44 year old driver was killed when her truck was struck by a train. She had 15 weeks of experience.

The accident occurred at 1:40 p.m. Other workers heard the train whistle, but the victim did not stop her truck at the crossing.

Drivers should keep these points in mind concerning railroad crossings:

- **It can take a train a half mile to come to a stop from 30 mph;**
- **Trains can come at any time.**
- **Never attempt to beat a train to the crossing - it's easy to underestimate the train's speed.**
- **Always stop, look and listen at railroad crossings.**

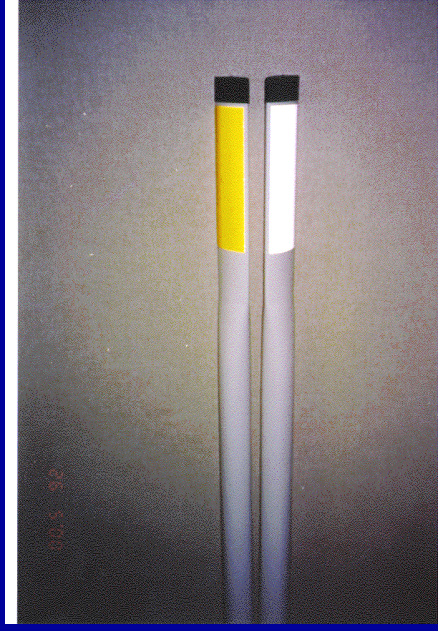
Another concern at railroad crossings - like at any type of intersection - is to ensure that the drivers have adequate sight distance down the tracks. Also avoid situations where trucks leaving mine property and waiting to enter a highway may become backed up and be sitting on the tracks. If this situation can't be avoided, train the drivers about the dangers and provide warning signs.

A fatal accident occurred in at this site involving a 10-ton welding truck. The welding contractor was leaving mine property around midnight. He came down this 10 percent grade to a "T" intersection. Note the skid marks coming across the intersection.

The skid marks were 125 feet long and led through this berm and over a highwall.

The truck fell 160 feet to a bench. Although the rear brakes were found to be defective, a factor in this accident may have been the victims unfamiliarity with the mine roads while driving after dark. The use of road side reflectors may help in this type of situation.

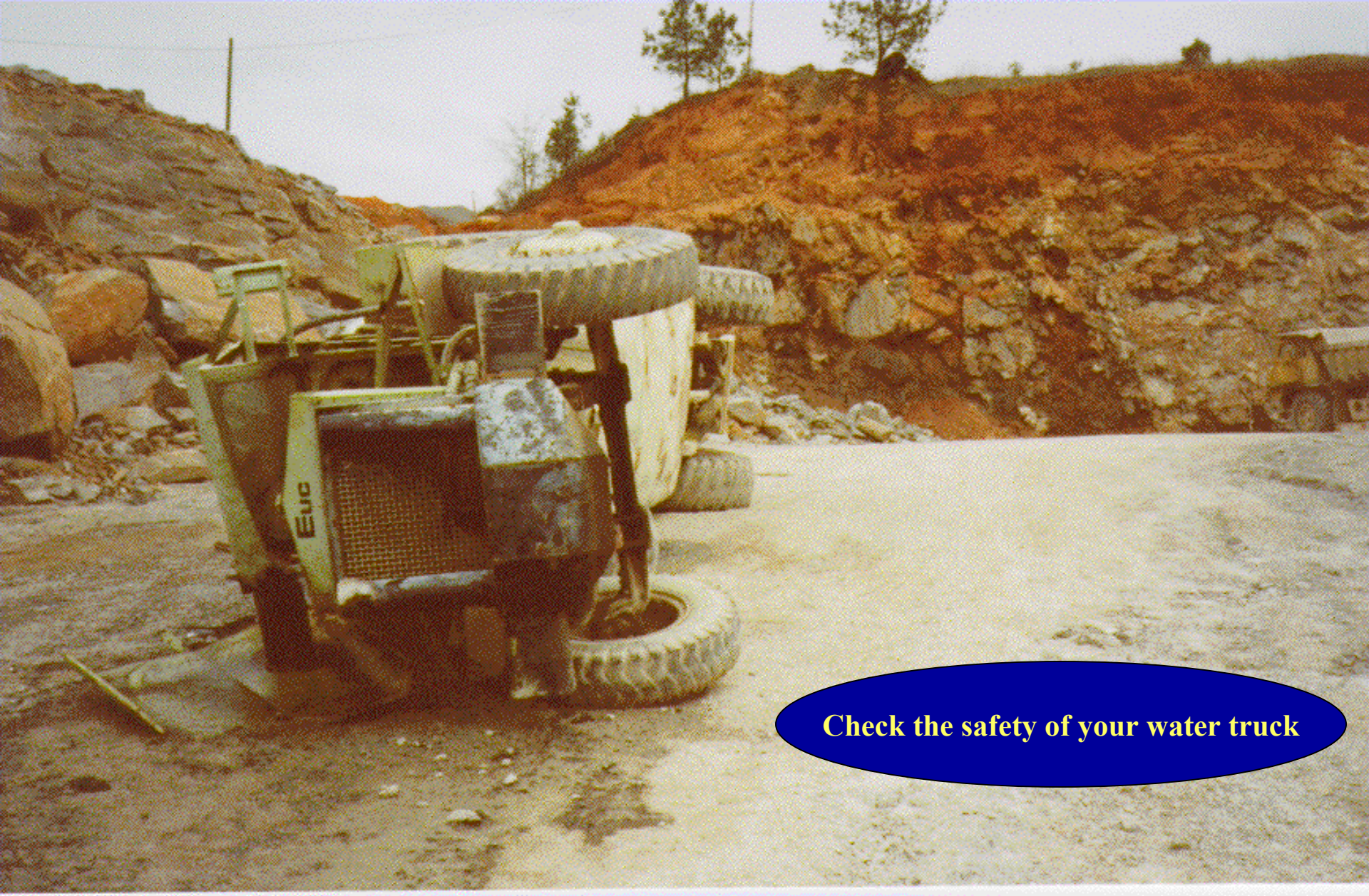
As shown to the left, road side reflectors are a common safety feature on public highways.



- Road side reflectors can provide similar safety benefits on mine roads. They would be helpful for new employees and visitors on the property. And they would benefit older drivers since our ability to see at night diminishes as we age.

- Different colored reflectors could also be used on each side of the road to act as a reminder on “drive-left” properties.

Suppose a tire salesman sees this sign as he enters mine property and drives on the left side as he makes his way to the maintenance shop. As he gets back in his truck after spending a couple of hours at the shop will that salesman remember to drive left as he leaves the property? Make sure there are sufficient signs for this type of circumstance - especially when unusual right-of-way rules are used on the property.



Several fatal accidents have occurred in recent years involving water trucks. This one occurred as the water truck rounded a curve while descending a 7 to 9 % grade. The victim's regular job was in quality control and he only occasionally drove the water truck.

The water truck was about half full at the time of the accident and the tank was baffled from front to back.

A witness reported that the truck appeared to be “going too fast” as it rounded the curve.

The victim was not wearing the seatbelt and the rear brakes were found to be defective.

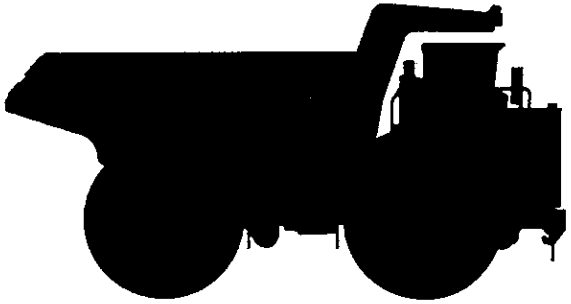
Avoid water-truck accidents by ensuring that: water trucks receive preventive maintenance just like production equipment; water tanks are baffled to control the effects of the water movement in the tank; and water-truck drivers are properly trained on operating the truck.

The Importance of Driver Training...

- In **29 %** of the surface haulage fatal accidents from 1994 to 1998, the victim had less than one year of mining experience.

- In **40 %** of these accidents, the victim had less than one year of experience at the mine where the accident occurred.

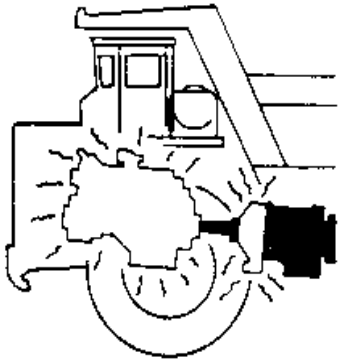
OPERATOR HANDBOOK



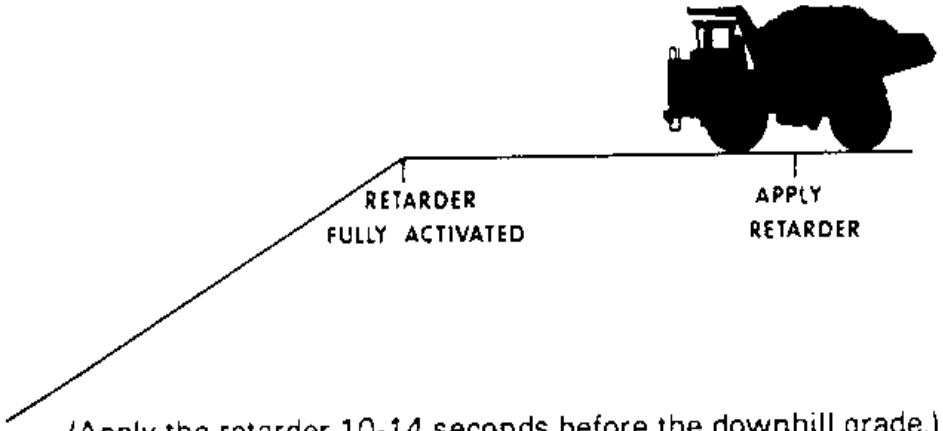
300 SERIES HD REAR DUMP

As part of the training program, it is important that drivers become familiar with the operator's manual for their truck. The excerpts shown here, for example, illustrate an important safety feature of the braking system of this truck.

In order to use the retarder effectively and efficiently, before the grade is descended, the transmission must be in the proper gear range and the converter in direct drive (lockup). The retarder pedal should be depressed 10-14 seconds before the grade is descended to allow enough time for the retarder to become fully activated. The retarder is most effective when fully activated just before the grade is descended. Also, it might be necessary to accelerate



Disengage Retarder When Going Upgrade or When Stopped for Long Intervals



(Apply the retarder 10-14 seconds before the downhill grade.)

Keys to preventing truck accidents:

- Systematic preventive maintenance on equipment;
- Effective driver training and supervision;
- Good haul road layout and road maintenance.