

INTERSTATE COMMERCE COMMISSION

REPORT OF THE DIRECTOR OF THE BUREAU OF SAFETY CONCERNING AN
ACCIDENT ON THE RICHMOND, FREDERICKSBURG & POTOMAC RAIL-
ROAD NEAR CHERRY HILL, VA., ON DECEMBER 6, 1933.

January 19, 1934.

To the Commission:

On December 6, 1933, there was a derailment of a freight train on the Richmond, Fredericksburg & Potomac Railroad near Cherry Hill, Va., following which the engine fouled the adjacent main track and was struck by a passenger train traveling in the opposite direction, resulting in the death of 2 employees, and the injury of 8 passengers, 1 Pullman conductor, 2 Pullman porters and 3 employees. This accident was investigated in conjunction with the Virginia State Corporation Commission.

Location and method of operation

This railroad extends between Richmond, Va., and a point near RO Tower, a distance of 110.08 miles; RO Tower is 3.5 miles from the station in Washington, D. C. It is a double-track line over which trains are operated by time table, train orders, an automatic block-signal system, and an automatic train-control system of the two-speed, continuous-inductive type, with three-indication cab signals. The accident occurred in a cut about $\frac{1}{2}$ mile north of the station at Cherry Hill; approaching from the north, there is a compound curve to the left 2,597 feet in length, with a maximum curvature of $2^{\circ} 06'$, followed by 1,612 feet of tangent, the derailment of the freight train occurring on this tangent at a point 1,435 feet from its northern end. Approaching from the south the track is tangent for a distance of 1,554 feet and there is a 2° curve to the left 825 feet in length, on which the derailed freight engine was standing when struck by the passenger train. The grade for south-bound trains at the point of derailment is 0.6 percent descending.

The automatic block signals are of the color-light type; south-bound signal 837 is located 4,853 feet north of the initial point of derailment, while north-bound signal 822 is located 2,845 feet south of that point.

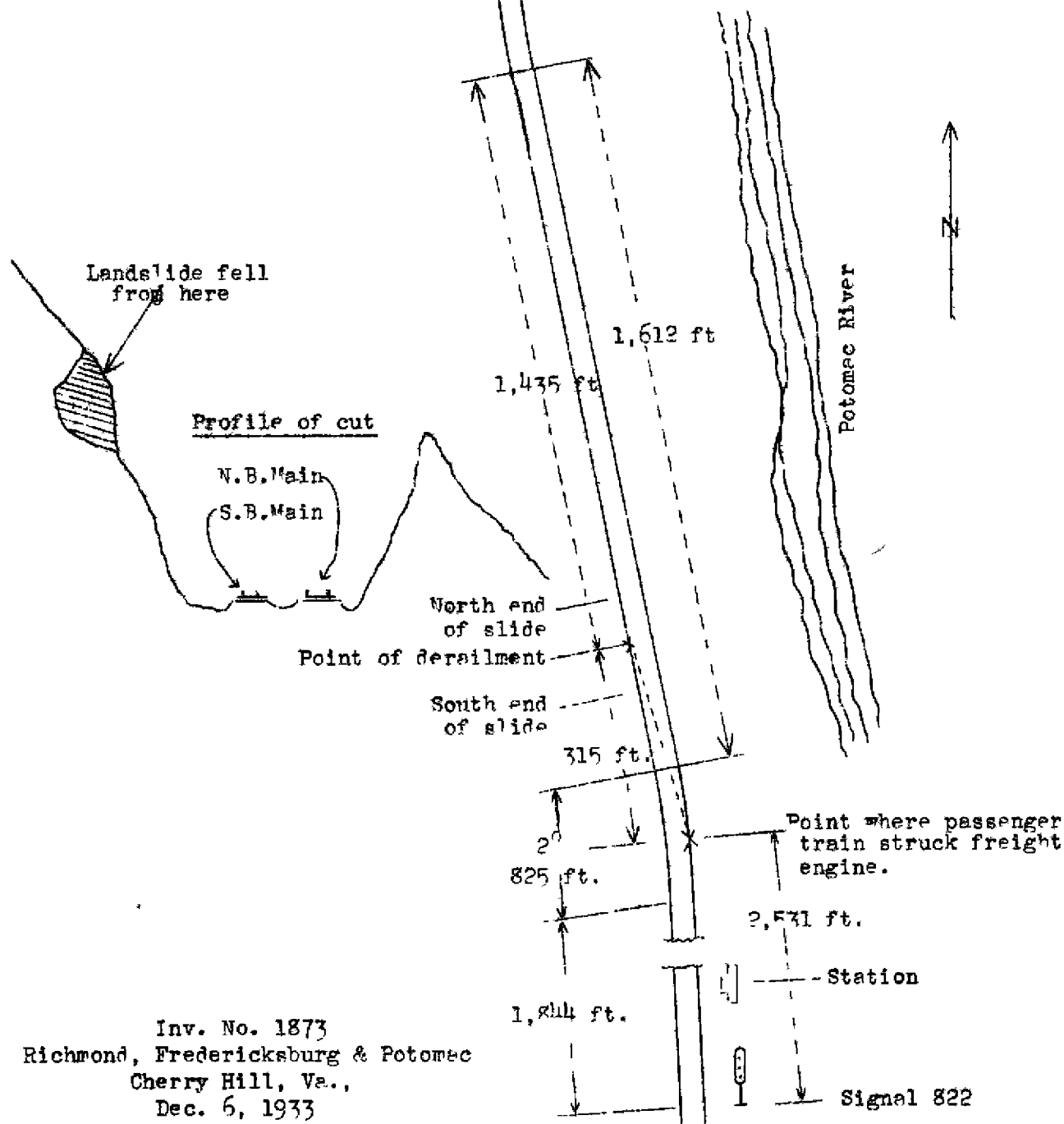
The tracks are laid with 130-pound rails, 39 feet in length, with 20 ties to the rail length, and ballasted with gravel; the track through the cut is well drained and maintained. The cut is 2,290 feet in length and the bank on the west side is about 96 feet above the tracks at its highest point, and approximately 57 feet high at the point where the landslide occurred; the east bank of the cut is about 47 feet above the tracks at its highest point in the cut. The width of the cut, from slope to slope, is from 50 to 60 feet, thus allowing a space of about 15 feet on

o Washington, DC
 31.1 mi.
 X Point of accident
 o Cherry Hill, Va.
 23.0 mi.
 o Fredericksburg, Va.

-2-

Sig. 827

2006'
 2,597 ft.



Inv. No. 1873
 Richmond, Fredericksburg & Potomac
 Cherry Hill, Va.,
 Dec. 6, 1933

each side of the tracks between the ends of the ties and the slopes to accommodate movement of loose material or raveling; the faces of the banks are precipitous.

The weather was cloudy and a light rain was falling at the time of the accident, which occurred about 3:06 a.m.

Description

South-bound freight train extra 403 consisted of 1 water car, 65 freight cars and a caboose, hauled by engine 403, and was in charge of Conductor Gills and Engineman Wilfred. This train passed CW tower, the last open office, 10.9 miles north of Cherry Hill, at 2:50 a.m., according to the train sheet, passed signal 837, which was displaying a proceed indication, and was derailed at a landslide in the cut north of Cherry Hill while traveling at a speed estimated to have been between 35 and 45 miles per hour; the derailed freight engine continued to a point about 315 feet south of the point of derailment and fouled the north-bound main track, where it was struck by the engine of train No. 192.

North-bound passenger train No. 192 consisted of 5 empty express cars, 1 loaded express car, 1 baggage car, 1 coach and 6 Pullman sleeping cars, in the order named, all of steel construction, hauled by engine 306, and was in charge of Conductor Leary and Engineman Kuhn. This train passed Quantico, the last open office, 3.6 miles south of Cherry Hill, at 3 a.m., according to the train sheet, 15 minutes late, passed signal 822, which apparently was displaying a proceed indication, and struck the derailed engine of extra 403 while traveling at a speed estimated to have been between 50 and 55 miles per hour.

Engine 403, together with its tender, the water car, the first 11 freight cars, and the forward truck of the twelfth car were derailed. Engine 403 was leaning to the east with its tender and the water car behind it; the first 10 cars were empty gondolas and 8 of them were piled up behind the engine and tender and completely blocked the cut. When the derailed equipment of extra 403 was struck by train No. 192 the force of the impact apparently drove engine 403 and its tender backward a distance of about 30 feet and tore the boiler from the frame, this engine being very badly damaged. Engine 306 was hurled over the east bank of the cut and stopped on its left side, partly reversed and headed toward the river east of the right of way, while its tender was standing on and leaning against engine 403. Four of the empty express cars were derailed, the first car overriding the wreckage and stopping diagonally across the front end of engine 403, with the forward end of the car alongside the west bank of the cut; the second car followed engine 306 up the east bank, with the next two cars behind it, but in line with the tracks. The landslide which caused the derailment of the freight train consisted of approximately 375 cubic yards of material from near the top of the west bank of the cut, most of it lodging

between the toe of the slope and the ends of the ties of the south-bound track and pushing that track out of line toward the east a maximum of about 12 inches. The employees killed were the engineman and fireman of train No. 192, while the employees injured were the engineman, fireman and head brakeman of extra 403.

Summary of evidence

Engineman Winfree, of extra 403, stated that signal 837 was displaying a proceed indication when he passed it and that he called the indication and the fireman repeated it. His engine was about three car lengths from the landslide when he first observed it, at which time the speed of the train was about 35 or 40 miles per hour, and he immediately applied the air brakes in emergency, reversed the engine, shouted a warning of danger, and then started back over the tender. He was thrown off when his engine was derailed, and on looking around he saw the reflection from the headlight of the engine of train No. 192, only a second or two before it collided with his own engine. Engineman Winfree did not know exactly when the slide occurred, but he did not think it was falling when he first saw it, although just as he applied the brakes he saw a piece of the material, about the size of a trunk, which was moving, about on a line with the headlight. The air brakes had been tested and worked properly en route, and the headlight on his engine was burning brightly.

Fireman Mitchell, of extra 403, stated that he had just gotten back on his seat box when the engineman shouted a warning of danger and applied the brakes in emergency, at which time the speed was about 40 miles per hour. On looking ahead Fireman Mitchell saw dirt on the rails, about 50 or 75 yards away, and tried to get around in position to jump, but was thrown around in the engine before he could do so; apparently Fireman Mitchell got off or was thrown off about the time the engine stopped and then saw the headlight of train No. 192 when it was 100 or 150 yards distant.

Head Brakeman Hall, of extra 403, was riding on the seat box behind the engineman and the first he knew of anything wrong was when the engineman shouted a warning of danger, at which time the speed was about 45 miles per hour; he started to follow the engineman up over the tender but did not get very far when he was thrown down and hit the footboard of the engine, and then he saw train No. 192 about to collide with his engine.

Conductor Gills, of extra 403, who had been riding in the cupola of the caboose estimated that his train had been at a standstill about 10 seconds when he heard a loud noise which he assumed was caused when train No. 192 struck his own engine; the statements of Flagman English were similar to those of Conductor Gills.

Conductor Leary, of train No. 192, was in the ninth car when the accident occurred, at which time he estimated the speed

to have been about 55 miles per hour; he said he did not notice any application of the brakes prior to the lunge of the train at the time of the impact. The estimates as to speed made by Baggage-master Bughan and Flagman Blank were practically the same as that of Conductor Leery. After the accident the flagman went back to protect, going south of signal 822, which he observed was then displaying a stop indication. Neither the baggage-master, in the seventh car, nor the flagman, in the fourteenth car, felt any application of the brakes prior to the accident.

Section Master Pitts stated that there was very little seepage from the banks of the cut, that the drainage ditches were comparatively dry, and that very little rainfall had occurred during the month prior to the accident. No serious trouble had been experienced previously from slides in this cut; there had been some loose material, nothing very large and very little of it coming close to the tracks, and he had been able to handle it without assistance. On examining conditions after the accident the south-bound track had a bad kink in it opposite the landslide; it was out of line about 7 or 8 inches; there was not much dirt over the track, most of it being beside and against the track.

Road Foreman of Engines Lewis expressed the opinion that after engine 403 was derailed as a result of the landslide it ploughed beneath the north-bound track without disturbing the track circuits in any manner, with the result that no warning of danger was given to the engineman of train No. 192 by the automatic train-control and cab-signal system; had the circuits been broken the automatic train-control devices would have applied the brakes 7 seconds after the break occurred.

Assistant Engineer DeJarnette stated that he was the field engineer in charge of construction of the line revision north of Cherry Hill in 1928 and that the cut was completed in November of that year. The excavation consisted of soft sandstone and a blue, sticky marl or hard clay, the marl lying between the upper and lower strata of sandstone, very little ground water was noticeable when the excavation was made, the material being mostly dry except when rainfall occurred. At first the slope stakes were set at $\frac{1}{2}$ to 1, but trouble was experienced during excavation by a large landslide about 200 feet north of the point where the accident under investigation occurred, and it was then decided to make the rate of slope more gradual and the slope stakes were changed to $\frac{3}{4}$ to 1; this was the only difficulty encountered. Explosives were used by the contractor in breaking up the material for removal by steam shovel; most of it broke to horizontal seams; in plane with the subgrade, but there were also vertical seams, although not as many as there were horizontal. Mr. DeJarnette was of the opinion that there was ample slope for the nature of material excavated; he said that the toe of the slope was cut back beyond the regular width in order to allow ample space between the track and the slope for any raveling out or loose material that might come down as a result of action by the elements, rather than in anticipation of anything in the nature

of a slide. Several days after the accident he examined the landslide; some water was coming from the side of the cut, some was also coming down where the slide occurred and there was a spring at a point farther south. He attributed the landslide to this water that seemed to be coming through; he did not know whether it was coming through before the slide occurred, but said it was very evident after the occurrence of the slide. Where the water came from he could not say, but it seemed possible that there might have been an accumulation in the vicinity. No previous trouble due to water had been experienced in the cut since its construction.

Chief Engineer Hastings stated that it was questionable just when the landslide occurred; he did not think that it covered the east rail of the south-bound track. He thought the freight engine was derailed by an abrupt kink in the track, caused by the slide pushing the track out of line, rather than from the engine encountering the landslide. During the progress of construction of the cut he kept in very close touch personally with all of the developments and noted the fact that the cut was dry, practically no water being encountered. The only seepage or dampness of consequence was at the point where the slide occurred during construction, and after the line was placed in operation in 1929 it was necessary to ditch the cut frequently at that point. The standard roadbed section of this railroad for wet cuts is 44 feet, and 42 feet for dry cuts; this particular cut was made from 50 to 60 feet in width, the depth of the cut making it advisable to have a wide berm between the tracks and the slopes, as it was expected there would be some raveling of the banks. On August 23, 1933, an unprecedented rainfall occurred in this vicinity and watchmen were placed in the cut during that storm, but no apparent trouble developed. Mr. Hastings further stated that this cut had been carefully observed since the time it was opened, that no trouble had been previously experienced, and that he considered that the company had gone beyond the limits usually followed by the dictates of prudence in using all precautions for its proper maintenance. While he did not anticipate a recurrence of similar trouble, yet he said that everything possible would be done to prevent it, and in his opinion the best safeguard was the additional width of roadbed which had been provided in order to take care of the sloughing of the slope. As to the cause of the landslide, Mr. Hastings said he did not think that the material broke from the top, but rather that a gradual wetting of the lower seam of marl took place which finally caused it to slip from its base, loosened possibly by the continuous vibration of traffic; he was unable to state definitely, however, just what caused the landslide.

South-bound passenger train No. 191 passed through the cut shortly before 1 a.m., while north-bound freight train extra 402 passed through shortly after that time, and none of the members of either crew noticed anything unusual while passing that point.

In conducting this investigation the cooperation of Dr. George E. Ladd, Economic Geologist of the Bureau of Public Roads,

was secured. His observations are briefly summarized as follows:

The location of this slide was near the south end of the west side of a cut through a bluff near the Potomac River. Both faces of the cut are exceedingly steep, parts of them nearly vertical. The geological formation is sedimentary and was laid down in unquiet waters with many currents and cross currents. All materials deposited were relatively fine. The individual beds vary greatly in thickness; at the site of the slide there are three well-defined beds of fairly uniform thickness.

The slide which caused this accident was relatively small, involving less than 400 cubic yards. What actually happened was the collapse of a small portion of the face of the third stratum above the bottom of the cut; through impact it took with it a portion of the face of the second stratum. This mass pitched forward and outward, and constituted a roughly outlined prism, the outer edge of which lay upon the southward track. Behind it a stream of fine material poured down, fan-like.

The slide was precipitated by structural weaknesses in the side of the cut. In addition to the major bedding planes there are thin, irregular beds of sand and very coarse plates of kaolinite. There are numerous joint planes or fractures, usually occurring in parallel series, and cross-bedding, due to the type of sedimentation, which are indications of weakness. At the time of inspection a few days after the accident, at the right-hand side of the fresh break in the face of the cut there was a vertical joint plane which penetrated the beds at an angle of 30° or 40° , destroying horizontal cohesion and strength along the beds; also there was another set of joint planes near and parallel to the west face of the cut and the break occurred along one of these joints. Near the bottom of the stratum where the break occurred is another area of weakness; it consists of a large amount of very coarse kaolinite flakes mixed with some quartz sand and a great deal of sand made up of feldspar fragments which are covered with kaolinite. The latter material was not deposited as sediment but has originated in its present site through weathering processes acting upon the feldspar sand. The fine, loose material back of and above the main slide-mass was in part a determining factor in the cause of this slide. It is a matter

of interest that water does not appear to have been a present agent in causing this slide; on the contrary shrinkage of the exposed beds because of excessive loss of moisture during a long dry period probably was the deciding factor.

Future slides in this cut can be prevented only by extensive reduction of the slopes, either uniformly or by terracing. Terracing would be better because it would make accessible all parts of the face for detailed inspection, and would make strengthening of weak spots relatively easy.

Conclusions

This accident was caused by a landslide, resulting in the derailment of south-bound freight train extra 403, following which the freight engine fouled the adjacent track and was struck by north-bound passenger train No. 192.

The slide which caused this accident consisted of less than 400 cubic yards of material which fell from the upper portion of the cut into the space between the toe of the slope and the south-bound track, partly covering that track, pushing it out of line, and forming a kink which probably was the immediate cause of the derailment of the freight engine. It is not known just when the slide occurred; the track was intact when the last preceding train passed over it about 2 hours before the accident and the slide may have occurred just as extra 403 was approaching this point. Apparently the damage done by the slide was not sufficient to shunt or break the circuits controlling the automatic block-signal, train-control, and cab-signal devices, and the engine crew of extra 403 had no warning of danger until the headlight shone on the slide when it was only a short distance ahead of them, too late to enable them to stop. It appeared that the brakes on the passenger train were not applied prior to the accident; only a few seconds intervened after the engine of extra 403 was derailed before it was struck by train No. 192, and this fact together with the possibility that engine 403 ploughed under the north-bound track and pushed it to one side without breaking the circuits, makes it evident that the engine crew of train No. 192 had no warning of danger prior to the time their engine collided with the derailed equipment of extra 403.

An examination of conditions in the cut was made by Dr. Ladd, economic geologist of the Bureau of Public Roads; he stated that the slide causing this accident was a dry slide due to structural weaknesses in the side of the cut, and that shrinkage of the exposed beds as a result of excessive loss of moisture during a long dry period probably was the deciding factor. It was the opinion of Dr. Ladd that further slides could be prevented only

by extensive reduction of the slopes, either uniformly or by terracing, and that the latter method would be better because it would make accessible all parts of the face for detailed inspection and would make the strengthening of weak spots relatively easy.

Respectfully submitted,

W. P. BORLAND,

Director.

