

INTERSTATE COMMERCE COMMISSION
WASHINGTON

INVESTIGATION NO. 2475
THE ATCHISON, TOPEKA & SANTA FE RAILWAY COMPANY
REPORT IN RE ACCIDENT
AT DEL MAR, CALIF., ON
DECEMBER 31, 1940

SUMMARY

Railroad: Atchison, Topeka & Santa Fe
Date: December 31, 1940
Location: Del Mar, Calif.
Kind of accident: Derailment
Train involved: Freight
Train number: Extra 1676
Engine number: 1676
Consist: 39 cars, caboose
Speed: 50 m. p. h.
Operation: Timetable, train orders and
automatic block-signal system
Track: Single; tangent; level
Weather: Cloudy
Time: 8:45 p. m.
Casualties: 3 killed
Cause: Accident caused by landslide

INTERSTATE COMMERCE COMMISSION

INVESTIGATION NO. 2475

IN THE MATTER OF MAKING ACCIDENT INVESTIGATION REPORTS
UNDER THE ACCIDENT REPORTS ACT OF MAY 6, 1910.

THE ATCHISON, TOPEKA & SANTA FE RAILWAY COMPANY

February 21, 1941

Accident at Del Mar, Calif., on December 31, 1940, caused
by landslide.

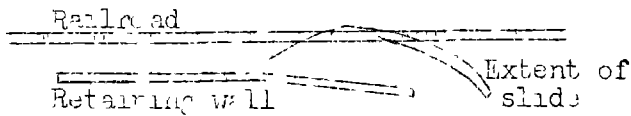
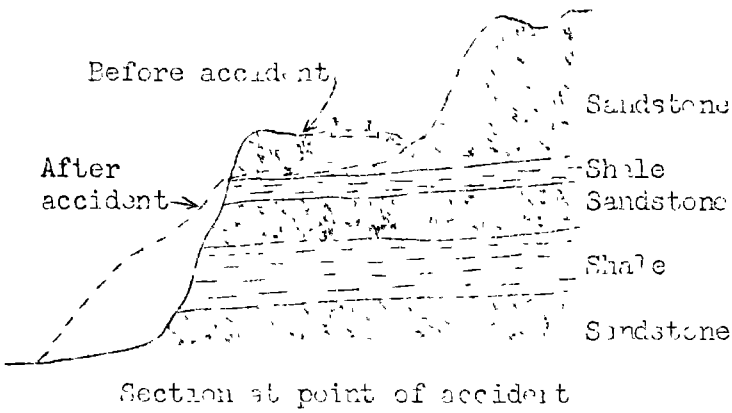
REPORT OF THE COMMISSION¹

PATTERSON, Commissioner:

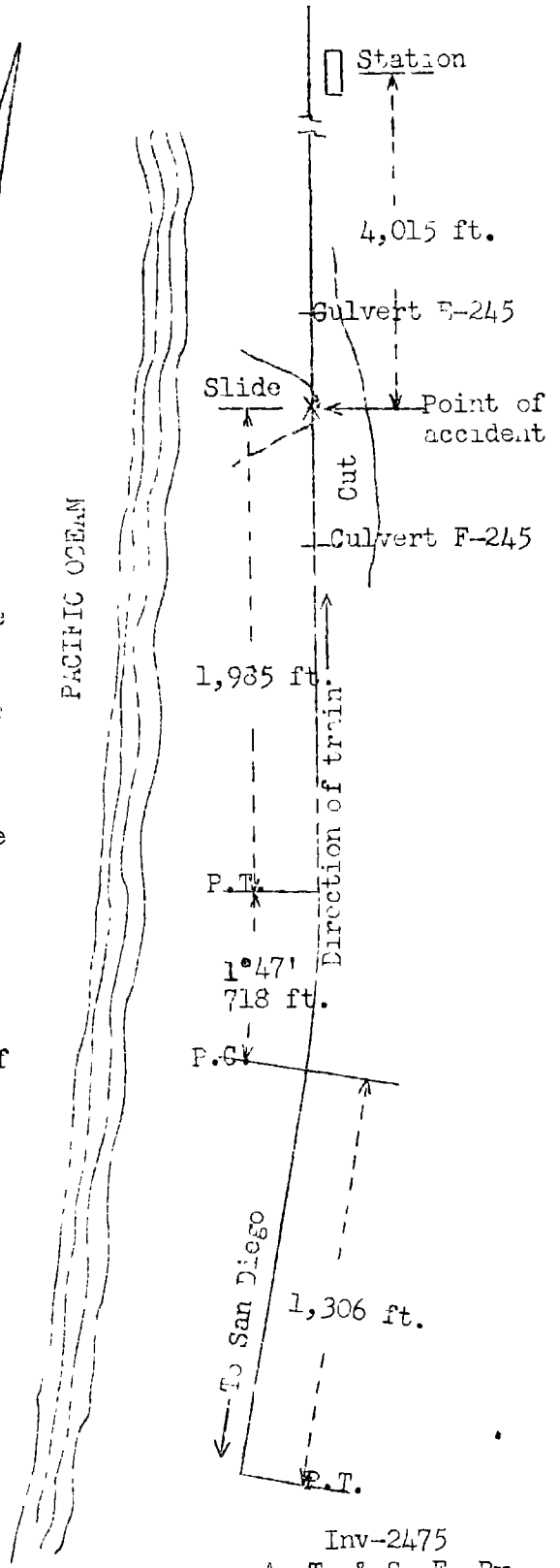
On December 31, 1940, there was a derailment of a freight train on the Atchison, Topeka & Santa Fe Railway at Del Mar, Calif., which resulted in the death of three employees. This investigation was made in conjunction with a representative of the Railroad Commission of California.

¹ Under authority of section 17 (2) of the Interstate Commerce Act the above-entitled proceeding was referred by the Commission to Commissioner Patterson for consideration and disposition.

° Fullerton, Calif. 79 mi.
 ° Del Mar 23.5 mi.
 X point of accident 5.6 mi.
 ° San Diego
 ° National City, Calif.



PACIFIC OCEAN



Inv-2475
 A. T. & S. F. Ry.
 Del Mar, Calif.
 Dec. 31, 1940

Location and Method of Operation

This accident occurred on that part of the Los Angeles Division designated as the Fourth District which extends between National City and Fullerton, Calif., a distance of 108.1 miles. In the vicinity of the point of accident this is a single-track line over which trains are operated by timetable, train orders and an automatic block-signal system. The accident occurred at a point 4,015 feet south of the station at Del Mar. As the point of accident is approached from the south there are, in succession, a tangent 1,306 feet in length, a 1047' curve to the left 718 feet in length, and a tangent 1,985 feet to the point of accident and 1,160 feet beyond. The grade for north-bound trains is, successively, 1.00 percent ascending a distance of 1,837 feet, and level 2,214 feet to the point of accident and 1,508 feet beyond.

In the vicinity of the point of accident the track is laid on a hillside cut; it is about 60 feet above the level of the shoreline of the Pacific Ocean and about 60 feet, horizontal distance, from it. On the east side of the track a vertical wall from 15 to 40 feet in height extends northward approximately 450 feet and slopes gradually downward to a height of 3 feet. At a point about 3/4 mile east of the track the ground rises to an elevation of 400 feet and is under cultivation nearly to the right-of-way fence. Just outside the fence at the top of the cut there is a ditch 840 feet in length, which conveys water to culvert E-245, located 417 feet north of the point of derailment; this ditch extends southward 423 feet to the highest point of the cut. Another ditch conveys water to culvert F-245, which is located 640 feet south of the point of derailment. These culverts are constructed of 48-inch cast-iron pipe with concrete ends. Spillways are provided to carry the water down the bank to the culverts. The area drained to culvert E-245 is approximately 0.126 square mile. Track ditches are provided between the track and the wall of the cut. The wall east of the track is composed of sandstone, on top of which is a 2-foot layer of top soil. Under the track there are alternate layers of sandstone and shale varying in thickness. The sandstone near the beach is of greenish color; also, there is a layer of a mixture of yellow and blue clay.

West of the track there was a concrete retaining wall 129 feet in length, built in 1910; its southern end was 68 feet north of the point of derailment. It consisted of a concrete footing 2-1/2 feet in depth and from 5-1/2 to 6-1/2 feet in width, surmounted by neat work from 5 to 10 feet in height and about 2 feet in width at the top; the outside face was vertical and the inside face was on a batter of approximately 3 inches to the foot. The outside face of the southern end of the wall

was 20-1/2 feet from the center-line of the track, and throughout a distance of 61 feet it diverged inward until the outside face was 10 feet from the center-line of the track; from the latter point throughout a distance of 68 feet northward the wall paralleled the track. At its southern end the top of the wall was 4-1/2 feet below the level of the sub-grade, but throughout a distance of 49 feet it sloped upward to the level of the sub-grade and was level with the sub-grade throughout the remainder of its length.

The track structure consists of 90-pound rail, 33 feet in length, laid new in 1923 on 22 ties to the rail length, treated Douglas fir ties on tangents and oak ties on curves; it is single-spiked, fully tieplated, provided with from 4 to 6 rail anchors per rail length, ballasted with 10 inches of gravel, and is well maintained.

The maximum authorized speed for the train involved was 1 mile in 1 minute 43 seconds, or 35 miles per hour.

It was dark and the weather was cloudy at the time of the accident, which occurred at 8:45 p. m.

Description

Extra 1676, a west-bound freight train according to timetable direction but north-bound by compass direction, with Conductor Light and Engineman Dunham in charge, consisted of engine 1676, of the 2-10-2 type, 3 loaded and 36 empty cars and a caboosc. This train departed from San Diego, 23.5 miles south of Del Mar, at 8:45 p. m., according to the train sheet, left Sorrento, 5.1 miles south of Del Mar, at 8:51 p. m., according to the statement of the conductor, and was derailed as it approached Del Mar moving at a speed estimated to have been 30 miles per hour.

The engine stopped on its left side down the embankment, partially buried in the dirt, with the front end 20 feet and the rear end 5 feet from the center of the track; the top of the boiler was about 4 feet below the level of the track. The engine struck the concrete wall, and broke about 55 feet of it into three pieces, which slid about halfway down the bank. The tender stopped on its side to the rear of the engine with its front end 5 feet and its rear end 16 feet from the center of the track. The engine and tender were badly damaged. The first car was catapulted over the engine, stopped near the shoreline and 40 feet northwest of the engine; this car was demolished. The second car stopped on the roadbed above the engine and leaned at a slight angle toward the east and was practically demolished. The third car stopped with one end on the track and

the other end on the tender and the engine cab; it was badly damaged. The fourth car was on its left side behind the tender, with its front end on the track and the rear end down the embankment. The fifth car was parallel to the fourth car and stopped across the track. The front end of the sixth car was down the embankment and its rear end across the track. The front truck of the seventh car was derailed to the east.

The employees killed were the engineman, the fireman, and the front brakeman.

Summary of Evidence

Conductor Light stated that at San Diego an air-brake test was made and the brakes functioned properly en route. The train was handled as usual. The last stop was made at Sorrento and the train left that point at 8:31 p. m. It had been moving at a speed of about 30 miles per hour and was stopped suddenly. He did not think the brakes were applied before the accident occurred. His crew did not have a train order restricting the speed at the point where the derailment occurred. The conductor proceeded to the front end of the train and found that the engine and a portion of the track were down the embankment and the ground was sunken at the point of derailment. The body of the engineman was on his seatbox. South of the point of derailment the track appeared to be in good condition and there was no evidence of dragging equipment. It had rained during several days prior to the day of the accident but not on that day. Previous to this accident he had not experienced trouble with track conditions at the point involved.

Flagman Miklavic stated that he did not feel a brake application immediately prior to the derailment. He estimated the speed of his train at 25 or 30 miles per hour at the time of accident. He did not see any evidence of soft track or any water along the track.

Section Foreman Robinson, in charge of the section on which the accident occurred, stated that on the afternoon of the day of the accident he worked on the track at the point where the accident later occurred. He found the east rail about 7/8 inch low and the west rail about 3/4 inch low; this condition extended a distance of 34 or 36 feet. He surfaced and tamped the track and lined it about 1/16 inch toward the west. When he left that point about 4:28 p. m. the track was in good condition. He inspected the cliff east of the track and the embankment west of the track, and there was no indication that a slide might occur. The drainage channels were not clogged and there was no indication that the ditch near the fence had overflowed. Water was standing along the track; however, as a result of rainfall during

the latter part of the month of December, sand had been washed from the top of the hill to the ditch along the track. At intervals throughout a distance of 50 feet there were pools of water 3 to 6 inches deep and 3-1/2 or 4 feet wide. The nature of this sand is such that a small amount of water will carry it down the hill; it accumulates rapidly. Loose sand eroding from the face of the cliff prevents the water from draining. Silt that water will not penetrate is deposited; as a result of this condition he had experienced trouble with the track throughout a distance of 1-1/2 miles in that vicinity. There were 8 or 9 soft spots within that distance and at one point the track had to be raised on six different occasions from 3/4 inch to 1-1/4 inches at a time. The section foreman stated that after heavy storms it takes from 20 to 30 days for the water to drain from the cut. To take care of this situation, mud is sometimes thrown across the track toward the ocean. He did not consider that the condition of the track warranted protection by slow order. Subsequent to the accident he found that a slide had occurred at the point involved. The indications were that the ground under the track had dropped vertically several feet and then moved westward, and that the engine had fallen into the depression and then struck the retaining wall.

Track Supervisor Bell stated that when he was making his daily trip over the track on the morning of the day before the accident he found a soft spot in the track in the vicinity of the point where the accident occurred; the track for a distance of 40 to 50 feet was about 1 inch low. He instructed a section gang, which was working about 3 miles south of that point, to repair it. Supervisor Bell traversed this track again about 2:20 p. m. on the day of the accident; it still appeared to be rough, and he instructed the section foreman at Del Mar to repair it. The supervisor stated that because of rains during the past month there was a soft spot in the track north of the tangent on which the accident occurred and another south of it. Sometimes the track at these points was from 1/2 to 1 inch low and it had been raised probably four or five times during the month.

Assistant Extra Gang Foreman Dyer stated that on the day prior to the accident he repaired the track where the accident later occurred. He found the west rail about 3/4 inch low throughout a distance of 40 to 50 feet. There was no water in the ditch at that point and the ground under the track was not wet.

Engineman Morrison, of a work train, stated that at 4:10 p. m., when his train passed over the point where the accident occurred, he did not notice any irregularity in the track; at that time the section men were working on the track involved. He had passed over this track from four to five times daily

since September and had never noticed any unusual condition.

Engineman Massey, of No. 70, the last train to pass over the track prior to the accident, stated that as his train passed that point at 8:07 p. m. at a speed of about 45 miles per hour he felt no irregularity in the surface of the track. He had never received a slow order covering that section of track and had never found a soft spot at that particular point.

Roadmaster Conway stated that within a distance of 1/2 mile south of the station at Del Mar there are several points where soft spots in the track occur in rainy weather, but he did not recall any soft spot at the location where the accident occurred. He thought the soft spots were caused by water pockets in the sub-grade. There had never been enough settling at these spots to require additional drainage. He had inspected the cliff at the point where the accident occurred several times from the beach and had observed small cracks near the bottom of the bank. His last inspection from the beach was made after the rainy season in April. The last time he inspected the retaining wall was about 6 weeks prior to the accident. He was of the opinion that the slide occurred under the weight of the engine.

General Foreman Martens, of the Bridges and Buildings and Water Service Department, stated that he thought the dirt slipped from under the engine and then the engine knocked down the concrete retaining wall. Examination of the broken pieces of the wall showed them to be dry at the base and there was no indication that the wall had slipped prior to its being struck by the engine. These pieces bore marks indicating that the engine had struck it. He stated that possibly the slide may have been caused by a crevice below the track structure, resulting from seepage, which could have originated 1/4 mile or more distant and existed over a period of many years. He did not think the recent rains had any influence on the sub-grade, as it is of sandstone and blue shale formation and impervious to water.

Transitman Haffly stated that the rains which fell prior to the accident were slow and penetrating, and extended over a period of a week; however, the capacity of the ditches was sufficient to carry off the surface water. The slide was semi-circular in shape and it extended along the bluff from 60 to 70 feet in length, eastward about 5 feet beyond the center-line of the track, and about 200 feet along the beach.

Division Engineer Clark stated that he examined practically all the ties that remained on the roadbed at the point of accident as well as many of those that were salvaged from the wreckage. He could not find any mark on the ties and he found only one small mark on the outside of the west rail; however, from its position this mark could not have been made by the engine.

Inspection of the slide disclosed a distinct indication of breakage in a southwesterly direction from the point where the rear end of the tender stopped; this indicated that the slide started a short distance south of the south end of the retaining wall. He thought the slippage occurred immediately prior to the derailment and the breakage of the ground extended underneath the track sufficiently to permit the track to turn over. The retaining wall was broken into three sections. The middle section measured 19 feet in length and bore a mark indicating that the pilot of the engine had struck it; this is substantiated by the fact that the push-pole pocket on the left end of the pilot beam was filled with concrete. All the breaks were new. He also found evidence that the cylinder and the valve-chamber casting had struck the same section of the wall; this indicated that the engine was partially overturned when it struck the wall. The wall was laid on low-grade sandstone. Subsequent to the accident the sandstone appeared to be hard and dry and it retained marks of the base and the back of the wall. Never before during 30 years of operation of this railroad had any trouble at that point been experienced. For the past 2 or 3 years the ocean had been acting in an unusual manner, and for some time prior to the accident geologists had discussed this matter. On the day prior to the accident he observed when waves were breaking against the shore that the water was muddy; this condition extended some distance into the sea; he thought possibly some action at sea was partially responsible.

District Engineer Kinnie arrived at the scene of accident at 3 a. m. and as soon as it was daylight he made an inspection of the drainage structures. He found that the surface ditch along the top of the cliff was clean and there was no evidence of water having overflowed at any time. The east track-ditch held some water because of erosion of the east bank. The material stopped the flow of water as the grade was level, but there was no evidence of overflow from the ditch to the track. He examined conditions from the beach, and there was no evidence of undercutting by the tides; he attributed this to the fact that the lower stratum is hard shale, which is resistant to tidal action. At various locations there was slight seepage between the sandstone and the clay strata. He had observed this same condition numerous times and in all seasons. There appeared to be a certain amount of red siliceous material that came from the top of the hill; this material was cast over during the original construction. At the point of derailment the track was so torn up he could not determine whether the ground dropped from under the track before the engine reached it or after the engine arrived there; however, he thought the ground gave way a short distance south of the south end of the retaining wall and settled sufficiently for the engine to drop and to stop within its length. The ground dropped 3 or 4 feet from its original plane and moved westward. He concluded that during heavy rains water filtered

through the top soil and found its way through crevices in the underlying sandstone until it reached the impervious blue clay immediately underneath; the water then followed the blue clay in a westerly direction toward the ocean until the clay became slippery. The heavily saturated soil may have started the movement or possibly the vibration of some previous train may have started the movement. It was his opinion that the retaining wall was intact before it was dislodged by the impact of the engine.

Chief Engineer Blanchard stated that he found conditions as described by District Engineer Kinnie.

Master Mechanic Tuck stated that he inspected the engine after it was rerailed and found nothing that could have contributed to the cause of the derailment. The brake valve and the throttle were damaged as a result of the accident, and it was impossible to determine their positions at the time of accident.

Geological data taken from a report of the United States Geological Survey, Water Supply Paper 446, Geology and Ground Waters of the western part of San Diego County, dated 1919, states that at a point 1 mile south of Del Mar at the east side of the railroad near the mouth of Soledad Canyon, the beds dip toward the ocean at an angle of $6^{\circ}30'$ N 30° W. The railroad at the point of accident is $N17^{\circ}53'$ W.

Records of the San Diego Gas and Electric Company at Del Mar show the rainfall for a 10-day period beginning at 8 a. m., December 21, 1940, as follows:

	24 hours rainfall <u>inches</u>	Season rainfall <u>inches</u>
Dec. 21, 1940 - 8 a. m. to Dec. 22 - 8 a. m.	0.00	2.32
Dec. 22, 1940 - 8 a. m. to Dec. 23 - 8 a. m.	0.05	2.37
Dec. 23, 1940 - 8 a. m. to Dec. 24 - 8 a. m.	2.44	4.81
Dec. 24, 1940 - 8 a. m. to Dec. 25 - 8 a. m.	0.19	5.00
Dec. 25, 1940 - 8 a. m. to Dec. 26 - 8 a. m.	0.00	5.00
Dec. 26, 1940 - 8 a. m. to Dec. 27 - 8 a. m.	0.00	5.00
Dec. 27, 1940 - 8 a. m. to Dec. 28 - 8 a. m.	0.00	5.00
Dec. 28, 1940 - 8 a. m. to Dec. 29 - 8 a. m.	0.29	5.29
Dec. 29, 1940 - 8 a. m. to Dec. 30 - 8 a. m.	0.06	5.35
Dec. 30, 1940 - 8 a. m. to Dec. 31 - 8 a. m.	0.00	5.35

In addition, yearly rainfall records are as follows:

1931-1932	July to July	14.21 inches
1932-1933	July to July	11.59 inches
1933-1934	July to July	5.09 inches
1935-1936	July to July	7.96 inches
1936-1937	July to July	23.13 inches
1937-1938	July to July	9.86 inches
1938-1939	July to July	8.78 inches
1939-1940	July to July	12.02 inches
1940-1941	July to Jan. 11, 1941.	5.14 inches

According to data furnished by the carrier, engine 1676 is of the 2-10-2 type, and has a total weight of 304,570 pounds. The weight of the tender loaded is 135,400 pounds, and the total weight of the engine and tender loaded and in working order is 489,970 pounds. The rigid wheel-base is 19 feet 4 inches, and the overall wheel-base from engine truck to trailer truck is 35 feet 10 inches. The total wheel-base of engine and tender is 66 feet 6-1/8 inches.

Observations of the Commission's Inspectors

The Commission's inspectors found the slide to be of crescent shape; it extended southeasterly from the middle of the retaining wall a distance of about 30 feet to a point beyond the east rail, then southwesterly to a point about 30 feet beyond; within this distance there was a vertical drop of the earth in the vicinity of the point where the engine stopped. A fissure on top of the slide extended southwesterly toward the ocean a distance of 70 feet. The fissure was 5 feet in width at its northern end and 3 feet at its southern end. The approximate length of the slide along the cliff was about 240 feet and it extended down to the beach. About 165 feet of the north rail and 198 feet of the south rail were carried down with the wreckage and one rail lay close to the beach. Inspection of the bluff from the beach disclosed it to be composed of strata of semi-sandstone, greenish sandstone, blue shale, blue and veiled clay, yellow sandstone and silt. There was evidence of seepage between the various layers of either blue shale or blue clay and the sandstone. The seepage reduced the clays, disintegrated sandstone and silt into a plastic, slippery, spongy mass.

Inspection of the embankment east of the track at a point about 3/4 mile south of the point of derailment disclosed the same composition as that near the point of derailment. About 7 feet above the track, an anticlinal saddle of blue shale or blue clay, with semi-sandstone superimposed, was observed.

This stratum of blue clay had a well-defined dip. At a point several hundred feet north of the saddle, the declining angle of this dip and ascending grade on the railroad caused the disappearance of this stratum below the surface. A similar stratum, probably the same one, appeared below the retaining wall at the point of derailment.

Inspection of the track a distance of 3/4 mile south of the point of accident was made and it was found to be in good alinement and surface. The ditches were observed to be as previously described. Examination of the engine disclosed nothing that might have contributed to the cause of the derailment.

Discussion

According to the evidence, Extra 1676 was moving at a speed of about 30 miles per hour when the derailment occurred. In the vicinity of the point of accident the maximum authorized speed for this train was 35 miles per hour. The crew did not have an order concerning the track involved and no one knew that a dangerous condition existed. Evidently, to those on the engine the track appeared to be in normal alinement and surface, since the conductor and the flagman did not feel an application of the brakes for some time prior to the time of the derailment. South of the point of derailment there was no indication of equipment having been dragged and there was no condition of the engine that might have contributed to the cause of the accident.

Subsequent to the accident, a crescent-shape slide, about 240 feet long and extending about 5 feet east of the center-line of the track and about 60 or 70 feet along the bluff east of the track, was found. Throughout a distance of 50 feet the ground had dropped vertically 4 or 5 feet. A fissure 5 feet wide at one end and 3 feet at the other extended southwesterly a distance of 70 feet. Apparently the engine dropped into the sunken place and then struck the retaining wall. Several theories were advanced as to the cause of the slide. One was that a disturbance in the ocean might have caused it; another, that over a period of years surface water from higher ground east of the track had filtered to some stratum and made a subterranean passage or crevice, which caved in under the weight of the train; a third theory was that water filtered through upper strata but when it reached a stratum of impervious clay, the clay became slippery, and, since the stratum declined toward the ocean at an angle of 6°30', the mass above it, being heavier than normal because of recent rains and being disturbed by passing trains, slipped downward and westward toward the ocean. Apparently the mass had been settling for some time

prior to the occurrence of the accident, as the track at this point was raised from 3/4 to 1 inch on both December 30 and 31; however, the conditions appeared to be the same as at other soft spots in the track near by. During the 10-day period immediately preceding the day of the accident, the total rainfall in this vicinity was slightly more than 3 inches.

At the time of the accident, this railroad had been in operation for 30 years, during which period no similar trouble had been experienced with the track at this point.

Cause

It is found that this accident was caused by a landslide.

Dated at Washington, D. C., this twenty-first day of February, 1941.

By the Commission, Commissioner Patterson.

(SEAL)

W. P. BARTELL,

Secretary.