IN RE INVESTIGATION OF AN ACCIDENT WHICH OCCURRED ON THE LINE OF THE SOUTHERN PACIFIC COMPANY NEAR CAPITOLA, CALIF., ON OCTOBER 29, 1920.

January 22, 1921.

On October 29, 1920, there was a derailment of a passenger train on the line of the Southern Pacific Company near Capitola, Calif., which resulted in the death of 2 employees, and the injury of 6 passengers and 2 employees. After investigation of this accident the Chief of the Bureau of Safety reports as follows:

This accident occurred on a single-track branch line over which trains are operated by time-table and train orders, no block-signal system being in use. The speed of passenger trains over this branch is restricted by time-table rule to 30 miles an hour. The accident occurred .7 mile west of Capitola. Approaching the point of accident from the west there is a tangent 4,038 feet long, followed by an 8-degree curve to the left about 650 feet in length; the derailment occurred on this curve about 150 feet from its eastern end, at which point the grade is about .8 per cent descending for eastbound trains. The accident occurred in a cut having a maximum depth of twelve feet. The track in this vicinity is laid with 90-pound rails, 33 feet in length, with 18 ties to the rail, tie-plated, double-spiked on both sides of the rails, and ballasted with 8 inches of gravel, the gauge, surface and alignment were maintained in good condition. The weather was clear.

Eastbound passenger train No. 134, consisting of 1 baggage car, 1 smoking car, and 1 coach, all of wooden construction, haul-

ed by engine 2286, was in charge of Conductor Day and Engineman Cushing. It left Santa Cruz, its initial terminal, 4.7 miles west of Capitola, at about 3:36 p.m., 1 minute late, made a brief stop at Seabright, a non-telegraph station, and proceeded eastward, being derailed while traveling at a speed estimated by the employees to have been about 30 miles an hour.

Engine 2286 came to rest on its right side on the outside of the curve, at a point 260 feet east of the first marks of derailment, while the tender was a short distance west of the engine, bottom up, and turned end for end. The baggage car was on its left side on the outside of the curve, nearly clear of the track, and at right angles to it, while the smoking car turned over on its left side on the inside of the curve parallel with the track, the coach was not derailed. The employees killed were the engineman and fireman.

Inspection of the track after the derailment showed that gravel on the outside of the curve beyond the ends of the ties was ploughed up for about 27 feet west of the first mark on the track, which consisted of a bolt having been sheared from an angle bar, the first wheel mark was on the second tie beyond this point, on the outside of the rail, while 21 feet farther east was the first mark on the ties between the rails; this was the point where the tender left the track, and 158 feet east of this point the tender turned over. Between the point where the tender turned over and the point where the engine was derailed there were 12 ties, or about 18 feet of track, not wheel-marked or damaged, indicating that the engine was not derailed until after the tender turned over and that the turning over of the

tender caused the derailment of the engine.

According to a statement made by Engineman Cushing prior to his death, he shut off steam at a point about 1 mile west of Capitola, looked at his watch, and noted that it was about 1½ minutes before the time at which his train was due to leave Capitola, which is 3.48 p.m. His first intimation of anything wrong was a jolt and a jerk, he did not recall anything which happened afterwards. Engineman Cushing did not think that the speed of his train had been in excess of 30 miles an hour at any point. The statements of the conductor, baggagemaster, and two brakemen indicated that their first knowledge of anything wrong was when the accident occurred, Conductor Day saying that the air brakes were applied at the same time. None of the train crew had been paying particular attention to the speed, but they estimated it to have been about 30 miles an hour. Conductor Day thought the accident was due to something giving way on the engine, on account of the marks in the gravel preceding the first flange marks on the ties, but on examination of the wreckage he was unable to find any indication of anything having been dragging. Head Brakeman Stanton thought the tender was the first part of the train to be derailed and that there might have been something dragging, while the baggagemaster, who was injured, and the rear brakeman, expressed no opinion.

Section Foreman Martin was working near by and was observing the approach of train No. 134 as he expected the roadmaster to be on it. The section foreman said he saw gravel fly and the tender seemed to tip over to the right, the tender in turn derailing the engine. He estimated the speed of train No. 134

to have been more than 40 miles an hour and probably close to 50 miles an hour. Section Foreman Martin examined the track immediately afterwards and found it to be in good condition. About two rail-lengths beyond the first marks in the gravel he saw marks on the ends of the ties which indicated that some heavy iron object with a ragged edge had been dragging. Section Foreman Martin thought part of the equipment had dropped, but he also expressed the opinion that excessive speed had something to do with the occurrence of the accident.

Several of the passengers stated that the speed had been very high, some of them saying that they had talked about the rate of speed at which the train was operated after leaving Seabright, which is 1.2 miles from Santa Cruz, and that it had frightened them. Train No. 124 is scheduled to leave Santa Cruz at 3.35 p.m. and Capitola at 3.48 p.m. Conductor Day said the train departed from Santa Cruz on time, but Rear Brakeman Shafer and Head Brakeman Stanton said it was about 1 minute late. The statement of the engineman indicates that the accident occurred at about 3.47 p.m. Conductor Day was the only member of the crew who looked at his watch shortly after the occurrence of the accident, he stated he got out of the rear end of the rear car, and after speaking to the baggagemaster and brakeman, climbed over a fence and reached the engine, while doing this he looked at his watch and it was then 3.46.40, from which he judged the accident occurred at 3.46 p.m. The distance from Santa Cruz to the point of accident is 4 miles, and if the accident actually occurred at 3.46 p.m., as stated by the conductor, the train

travelled the distance of 4 miles in 10 or 11 minutes, including the stop at Seabright.

While none of the members of the crew estimated the speed of train No. 124 to have been in excess of 30 miles an hour, the evidence indicated that the train had lost a little time in leaving Santa Cruz, not only on account of the slight delay in departing from the station but also because of the fact that it is usually operated at a little less than schedule speed between Santa Cruz and Seabright. Under these circumstances the speed of train No. 124 probably averaged at least 30 miles an hour after leaving Seabright, and the section foreman's estimate that the speed of the train at the time of derailment was in excess of 40 miles an hour is partly supported by the condition of the derailed equipment and the position in which it came to rest after the accident.

About 4 months previous to the occurrence to this accident considerable work had been done on the curve, ties being renewed and the track surfaced and gauged. After the accident measurements of the gauge and elevation were taken every 15 feet, extending from the western end of the curve to the point of accident and it was found that the elevation was uniform, while the gauge varied only from 4 feet, $8\frac{1}{2}$ inches to 4 feet, $8\frac{3}{4}$ inches. None of the members of the crew had noticed anything unusual in the motion of the cars, while the engine had been found to be in good condition when inspected prior to starting on this trip, and careful examination of the derailed equipment after the accident failed to disclose any defect which could have contributed to its occurrence.

This accident is believed to have been caused by the train being operated at an excessive rate of speed.

The elevation on the 8-degree curve on which this accident occurred was 4 inches at the point of derailment, which according to the recommended practice of the American Railway Engineers' Association is sufficient for the safe operation of trains at the maximum rate of speed prescribed for this branch, 30 miles an hour; a speed of 35 miles an hour on an 8-degree curve requires an elevation of 6½ inches, while a speed of 40 miles an hour requires an elevation of 8 3/8 inches. It will thus be seen that if the speed of train No. 124 was 10 miles an hour in excess of the maximum speed prescribed for this branch, the speed would have been entirely too great for the elevation of this curve, the accident was probably due to failure to observe this speed restriction.

All of the employees involved were experienced men, at the time of the accident they had been on duty less than 1 hour after more than 24 hours off duty.