

RAILWAY.

Government {1897} of Madras.
PUBLIC WORKS.

Recd.

Regd.

1897.

Enclosures

Spare copies

G.O., No. 929 R., 6th November 1897.

NOVEMBER.

Accident at Mallur Bridge, Southern Mahratta Railway

23 Ordered that the Government Inspector's report on the — which occurred on the 29th September 1897, with remarks by the Senior Government Inspector of Railways, be forwarded to the Governments of India and Bombay.

3. Considering the character of the river, its rapid velocity, said to be 15 feet per second, and its sandy bed, I am of opinion that much larger spans would have ensured safety from obstruction by trees sticking in the spans.

4. Although the drawing shows the wells as founded on rock, I think that in all probability they were founded considerably short of it. Levels taken after the accident show that the flood when at its highest did not rise higher than springing of arches. I am informed by the Agent of the Railway that every bridge on the line is examined annually by an officer, and that this bridge had never been reported as cracked or unsafe. Rule 206 of the General Rules issued by the Government of India prescribes that each ganger must immediately collect the men of his gang whenever their services may be required. The ganger, having been called off with his gang under this rule to assist in repairing the washaway at mile 236/8, was not in a position to take action as provided in Rule 214. The permanent-way inspector also acted properly in taking all his available staff to repair the washaway at mile 236/8. The driver who lost his life in this accident is reported to have been a very steady man of 9 years' experience, and the guard's evidence goes to show that the train was proceeding at a very moderate speed. Under these circumstances, I consider that no blame can be held to attach to any of the staff of the railway.

5. The Agent of the Railway informs me that no rules have been issued for the Mysore State Railway directing that a system of night patrols should be organised during the monsoon, and the general and subsidiary rules of the Company contain no such rule. It is very probable that had an efficient system of night patrol been in force, the accident might have been avoided; but this cannot be said with certainty, since the bridge may have been standing up to the moment when the train came on to it; and if this were so the patrol, seeing the water no higher than springing, might not have seen cause to show a caution signal to the train. I consider therefore that, while the railway administration cannot be held guilty of neglecting to observe the rules laid down by Government for their guidance, they are to blame in having omitted to take precautions which are in force on neighbouring lines and, I believe, on most railway systems in India. I recommend that an additional rule be inserted by Government after Rule 214 in the General Rules directing that during the monsoon the permanent-way inspector shall be responsible for the line being patrolled from sunset to sunrise. I also recommend that, owing to the uncertainty which exists as to the foundation of the remaining wells, the existing bridge be replaced by a girder bridge with spans of 40 feet.

6. The enclosed statements marked A, B and C have been supplied by the Engineer of the Mysore District, Southern Mahratta Railway.

MADRAS,
8th October 1897.

(Signed) F. D. FOWLER,
Government Inspector of Railways.

ENCLOSURE A.

Approximate cost of damage to the bridge.

1. Damage to present bridge ...	Rs. 11,000
2. Cost of a new bridge ..	50,000
3. Cost of diversions ..	4,000

ENCLOSURE B.

Approximate cost of damage to rolling stock.

1 engine and tender ...	} 35,000
1 accident van ..	
5 third-class carriages.	
1 first-class carriage ...	
1 double second-class }	

ENCLOSURE C.

Number of dead bodies recovered from the river.

		Date.				Number of bodies.
	Rs.	Sept. 23rd	...	...	...	2
		" 24th	...	...	...	3
		" 25th	...	...	...	...
		" 26th	...	...	...	2

REMARKS.—Correct damages cannot be given until river subsides. The upper structures of six were totally destroyed leaving under frames in fair order.

DESCRIPTION, SUMMARY OF EVIDENCE AND FINDING OF JOINT ENQUIRY INTO ACCIDENT TO No. 70 DOWN, AT MALLUR BRIDGE, MILE 246/12, MYSORE STATE RAILWAY, ON 23RD SEPTEMBER 1897.

Report of an enquiry held under the orders of the Agent, Southern Mahratta Railway, at Channapatna on the 12th October 1897; as submitted to the Senior Government Inspector with Agent's, Southern Mahratta Railway, letter No. A. 852/10388, dated the 22nd October 1897.

The Committee was composed of the following officers:—

- Mr. A. H. MACKENZIE, District Engineer.
- " D. HUGH LINTSAY, District Traffic Superintendent.
- " J. F. WILLANS, District Locomotive Superintendent.

Description.

The bridge at mile 246/12 was built 16 years ago. It is an arch bridge of eight spans. The size of spans counting from the north or Bangalore side of stream is 2 spans of 25 feet, four of 27 feet 6 inches and two of 25 feet.

The masonry in superstructure is stone in lime mortar. The piers are built on wells, both round and square. The 2nd and 6th are abutment piers. The 5th pier according to plan is built on 4 wells, 6 feet square (internal *), and is shown as resting upon rock at a depth of 22 feet below river-bed.

* No. External, not internal.

F. J. E. S.

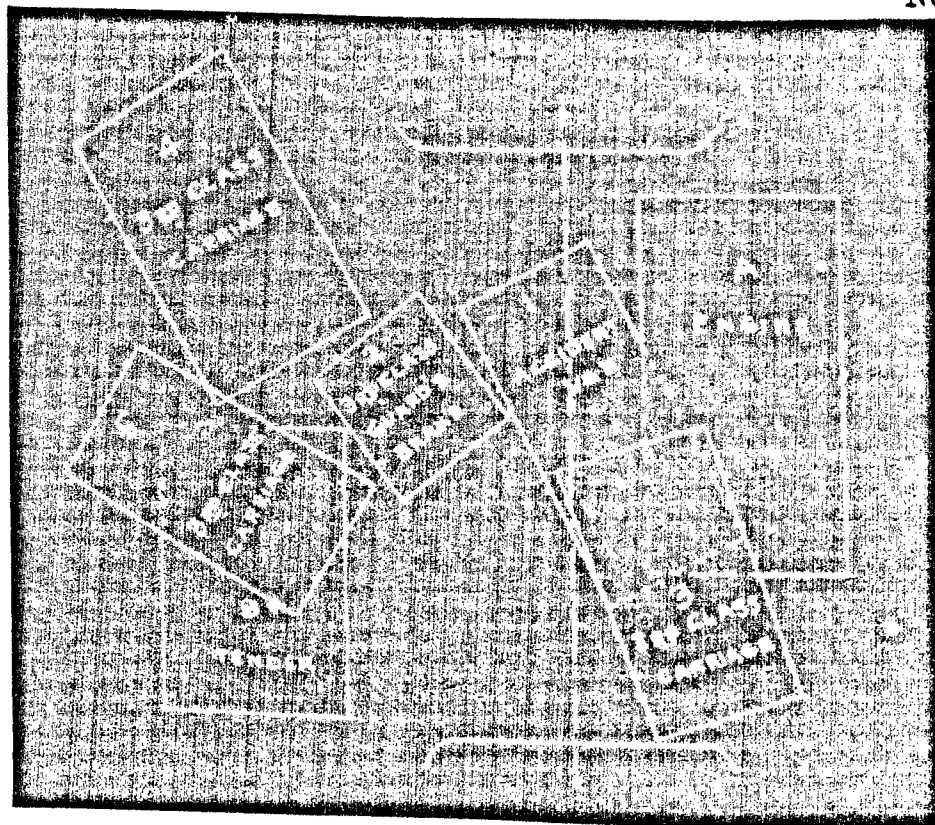
The 6th pier is shown in plan as being built upon 2 circular wells of 11 feet diameter intended to be founded on rock at a depth of 30 feet below bed.

The 5th pier, 5 feet wide, has fallen sideways into the span. Half of the 6th, an abutment pier 8 feet wide, has fallen lengthways upstream, indicating the overturning of wells by a scour in the 6th span.

The bed is sandy, and flood velocity of stream is 15 feet per second.

The fall of the 5th and 6th piers brought down the arches of 5th, 6th and 7th spans.

The engine, tender, accident van, third-class brake and three third-class carriages fell into the gap of the 4th span. While the following second-class carriage hung over the side of pier No. 4, the lower end being partly submerged in the water, the succeeding double first-class hung a little over the gap. The roof and portion of one side of one third-class carriage was found on a sandy island covered with brushwood 1/4 of a mile down stream. A rough sketch of the position of the vehicles in the gap is as follows:—

BROKEN PIER.
No. 5.

PIER No. 4.

- A. Engine, funnel uppermost and tail down.
- B. Tender, on side.
1. Accident van, submerged.
2. Third-class guard's brake, end on.
3. Third-class carriage, on its side on top of No. 1 and A.
4. " " on its wheels with shutters closed on down stream side.
5. " " wheels uppermost and lying on B.

Summary of Evidence.

The evidence of the Permanent-way Inspector proves a system of patrolling by day, and that this was carried out on the date of the accident is amply proved by Boya, cooly of No. 5 gang, who witnesses that he patrolled his length in the morning, going across the bridge and remaining all day trimming banks the other side of it, returning in the evening. Also the gang cooly of the same gang, in charge of gate at mile 246, deposes that he went across the bridge on his way home after dusk.

Both these men are experienced gang men of 12 years' service on this line, and neither of them saw anything in the bridge or the depth of water in the river to cause uneasiness or necessitate a report to the P.W. Inspector or Stationmaster. The state of the bridge and the flood is corroborated by the evidence of driver M. L. Staggs and fireman E. Binnee, both of 76 down of 22nd September which crossed the bridge after 16 o'clock. This is further substantiated by Byramshah, pay clerk of the Bangalore district, who was in 76 down of that date, and by gateman Soorsingh of traffic gate at 247/2-3.

It is clear from Boya's evidence that he understands the rules applying to cases of suspicion, and that, had he any reason to suspect the bridge, it would have been, as he says, a simple matter to have reported it to the Permanent-way Inspector or, in his absence, to the Stationmaster, as he lives at Channapatna.

The Permanent-way Inspector inspected the bridge on the 2nd or 3rd September, and a memorandum put in by the District Engineer shows that he inspected it in February last, and that both arches and piers were perfectly sound; only some old cracks in the parapets were noticeable, these being due to want of proper bond and not affecting the stability of the bridge.

This bridge has been built 16 years ago. It was under no suspicion. The local rainfall, as given in Mr. Karve's evidence, was not of such a nature as to call special attention to the bridge. That the Permanent-way Inspector, who has been 7 years in charge of this section, had no misgivings on this account is proved by the evidence of the Assistant Stationmaster Sadanandam, who was on duty at Channapatna on the night of the 21st, and who states that the Permanent-way Inspector remained in his office the whole of that night, as he was anxious to go by the night train to look at the Shimsha bridge, although there are two watchmen in charge of it. Meanwhile, hearing of the accident at mile 236/8, he was obliged to go there to render assistance and remained there the whole of the 22nd up to midnight, when he got into 70 down and returned to Channapatna. If he had had any misgivings about bridge 246/12, he could easily have taken precautionary measures, as he lives a little more than a mile from it.

Though Mr. Karve's evidence shows that 6.45 inches of rain fell in 4 hours at Closepet* on the night of the 21st, it must be understood this rain would not affect the Mallur river, as Closepet lies in a different valley and its drainage runs into the Arkavatti river over which we have a big bridge, and rises near Hesser gutta. Mr. Karve shows the rainfall at Channapatna to have been only 1.58 inches the same night and 0.80 the following night.

Previous to this there was very little rain. It is clear that the bridge was all right up to dusk on the 22nd, for we have not only the evidence of the patrolling gangmen, but that of the driver and fireman and pay clerk who were in 76 down, the last train that passed over it at the usual speed, several trains having passed over it during the day.

From the statement put in by the District Traffic Superintendent, which is corroborated by the evidence taken, and by the position of the carriages, it is evident that the total loss of life is under † 20.

† I should say about 20.

There were eight third-class carriages on the train capable of holding 250 passengers. But there is convincing evidence to prove that the number of those travelling in the third-class carriage provided with a brake, including brakesman and greasers, was 11, and that no one either got into or left the carriage *en route*. Therefore, the maximum possible number of persons travelling in third-class carriages when the train left Bangalore was $250 - (32 - 11) = 229$. At Kengeri, Bidadi, Closepet and Channapatna 88 passengers alighted and $22\frac{1}{2}$ entered the train, which leaves $163\frac{1}{2}$ as the possible maximum in the train when it crossed the bridge. Enquiry however shows that only 132 third-class tickets were issued to stations beyond Channapatna, and the above remarks prove that there could not have been many if any more than that number, travelling beyond Channapatna. Of the 132 passengers, $101\frac{1}{2}$ can be accounted for, leaving $30\frac{1}{2}$ unaccounted for. But this number can be still further reduced, for 14 passengers were booked to Mudgere and Maddur where, however, searching enquiries seem to prove that no one belonging to these parts is missing. If, as is therefore highly probable, none of these 14 were drowned, the total number of passengers unaccounted for is reduced to $16\frac{1}{2}$, out of which number 7 corpses have been recovered.

In the accident van (No. 1) two traffic cranemen were travelling, and as they are missing, it may be assumed that they were drowned, the whole of the carriage being submerged.

In the up-guards' brake carriage (No. 2) which was found end on, the evidence of the brakesman and peon Abdul Rahim proves that there were altogether 11, including the brakesman, of whom 7 are proved to have been saved.

The next carriage, an ordinary 3rd class—No. 3, lay on its side on top of the accident van and engine. No bodies were found in it, and it is therefore clear that either the carriage must have been empty or its occupants must have escaped, as from its position no bodies could have been washed out. A live parrot was found in this carriage.

The fourth vehicle, female carriage—No. 4, which was found on its wheels and with all shutters on the down stream side closed, contained, according to the statement of Mureem Bee, six adults and three children, all of whom were saved.

The fifth vehicle, an ordinary third class—No. 5, was lying wheels uppermost on the tender, and it is evident that the principal loss of life occurred in this carriage. The Sub-divisional officer, Closepet, took down the evidence of one Manickachary, travelling in this carriage, who is said to have stated that there were nine in his compartment, of whom two were saved. It is evident that he must have referred to the whole carriage, because the brakeman is positive that there were not more than twelve in the carriage, as a considerable number alighted at Channapatna and only two passengers were booked from Channapatna.

It may therefore be safely assumed that the number of passengers killed is under sixteen, to which number may be added four Company's servants.

Query, about 20.

J. B. M.

It is proved that all 1st and 2nd class passengers are safe.

Finding.

We find it proved that rules 200 and 214 of the General and Subsidiary rules, Parts I and II of 1897, have been complied with.

That there was nothing in the local rainfall to induce special precautions.

We are of opinion that the accident is apparently due to some action in the river between dark on the 22nd and 2 o'clock in the morning of the 23rd.

The wells appear to have been undermined by a scour. It would be futile to give reasons for the failure of the bridge till borings are taken (when the river goes down) and the nature and depth of foundations have been decided. At present it can only be a matter of conjecture, hence a full consideration of the subject must be postponed.

(Signed) A. H. MACKENZIE,
District Engineer.

(„) D. HUGH LINDSAY,
District Traffic Supdt.

(„) J. F. WILLANS,
District Loco. Supdt.

Evidence.

Evidence given by Chief Guard Narayan Row, before the Government Inspector, on the 24th September 1897.—My name is Narayan Row, I was Chief Guard of No. 70 down of the 22nd. Fifteen years' service, seven as Chief Guard; my pay is Rs. 27-8-0 per mensem. Staff No. 1895. I was Chief Guard of No. 70-down mixed from Bangalore on the 22nd. I left Bangalore City at 21-25 and arrived at Channapatna at 2-23 on the 23rd, one hour and fifty-two minutes late. I left Channapatna at 2-26 with ordinary line clear ticket. I was riding in the rear brake. On arriving at mile 246/12 I felt a shock. The train was then travelling between 12 and 13 miles an hour. I heard no whistle. I put my brakes on hard. On leaving Channapatna my train consisted of engine, tender, accident van, one third-class brake, three third-class carriages, one double second, one double first, four third-class, one double second and one heavy brake. All my lamps went out from the shock. I lighted my lamp and found the train in the river. The carriages in rear of the double first were on the bridge. I protected the rear of my train according to rules. I sent a memorandum to Stationmaster reporting the accident; I then assisted the passengers.

Evidence of Permanent-way Inspector, Channapatna section Ruthnasawmy Pillay, on the 12th October 1897.—My name is Ruthnasawmy Pillay. My age is 38. Salary Rs. 90. I am Permanent-way Inspector, Channapatna section. My service in the Southern Mahratta Railway is 14 years. I have been Permanent-way Inspector at Channapatna for 7 years. The length of my charge is from 228½ miles to 268 miles. I have ten gangs. I have eight to ten men in each gang including gateman and one mate or ganger in charge. The gangers have four mile lengths to look after. My gangs are numbered one to ten. On the day of the 22nd I was at the site of the other accident at mile 236/8, where No. 70 down of the 21st September was derailed. I was there till midnight of the 22nd. I returned to Channapatna by 70 down of the 22nd. I had with me at mile 236/8 parts of gangs one to six inclusive. I had five men from the 5th gang and three men from the 6th gang. Besides these men I had the gangers of both 5th and 6th gangs. The 6th gang work between 248 and 262 mile. The bridge at mile 246/12 is on the length of the 5th gang. Three men of No. 5 gang were left behind to look after the road and gates. One man to patrol and two men to look

after the gates. There are three gates near the bridge, one at 245/17 and 18, one at 246/4 and 5, and one at 247/1 and 2; at the last gate the gateman stops there night and day being a traffic gate on an important road. The gangmen looking after gates have to work and look after ½ of a mile of line on either side of their gates. I did not give the gangmen left behind any special instructions on the 21st or 22nd.

I have a copy of the General and Subsidiary rules of 1897, parts I and II. I set apart one gangman to patrol his length of 4 miles. He does this regularly every morning returning by 8 or 9. He then works in the gang. If he finds anything wrong or suspicious, he has to report to me as well as to the ganger. If he finds anything likely to endanger trains, he has to protect the train by showing red flags as signals and stopping the train. There is no patrol after 9 o'clock. Some of my coolies of gang No. 5 live at Channapatna Fort, some at Malur opposite bridge. They leave the work at 6 o'clock and have to pass over their length going to, and returning from, work. Consequently they patrol the line and pass over the bridge. There is no night patrolling. I have no instructions to patrol the line at night. I have to submit a bridge report in authorized form every month, after I have personally inspected every bridge in my section. I inspected the bridges last on the 2nd and 3rd of September, and submitted the required reports. I examined the arches of the bridge at mile 246/12 and did not find any cracks in them. There were no cracks in the piers also, but some in the parapet walls on the north-west and north-east side. These were all old cracks existing from the time I took charge of the section seven years ago. The Shimsha bridge is on my section. I have two watchmen at that bridge one on either side. They have been there from the commencement of the line. There is a speed restriction of 5 miles an hour over the bridge. I have no watchmen on other bridges because there are none under suspicion.

Evidence given by Permanent-way Inspector Ruthnasawmy Pillay, before the Government Inspector on the 24th September 1897.—Total service from 1879. Permanent-way Inspector from 1883. Pay Rs. 90. My length extends from 228½ to 268 miles. On 22nd I was attending to matters at the site of the other accident at mile 236/8 when No. 70 down of the 21st was derailed. I was there till midnight of the 22nd. I had five gangs with me, viz., Nos. 1 to 5 gangs, whose lengths are four miles each, viz., 228½ to 248. I took the mate of each gang. I took three to five men of each gang. I returned to Channapatna by 70 down of the 22nd arriving at 2-23. I went to my house in the stationyard. Three men of No. 5 gang got down with me at Channapatna. Three men of No. 6 gang went on by train to the next station. Two of these men from 6th gang within half an hour came to me and reported the accident. They were travelling in the last vehicle of the train. I informed Stationmaster and sent for the men of the 5th gang and went to the accident with Stationmaster, Channapatna. On the day of the 22nd it was drizzling at intervals, but no heavy rain, when I was at 236/8 p.m. The Kanva river rises and falls very rapidly. I have never seen for the last seven years the flood as high as the springing of the arches. I have seen it 2 feet below it. I saw it about four days back, there was then about 1 foot of water in it. I have never heard of the bridge being unsafe or cracked. I do not remember to have received any circular instructing me to have the line patrolled at night during the monsoons. On the night of the 21st I sent two gangmen on either side of the station with lamps to see if the line was safe and I waited at the Telegraph office from 8 till their return at 11. They reported all was right, because I expected floods as it had been raining heavily. I always instructed all the gangs to do this when it rains heavily. I did not give special instruction on the 22nd as I was at the other accident. It seemed to me from the marks on the bank left by flood the water must have been up to the crown of the arch. A keyman goes daily up the line from 6 to 8 over the gang length, he does not go out again that day but works with the gang. The men live in villages along their lengths so that they necessarily travel over the line going and returning from their work. The gang mates have orders to inspect certain bridges which have suffered before from floods at morning and evening, and in the event of a high flood to stop the trains. When I arrived at the scene of the accident the water was up to springing; I particularly noticed it.

Evidence of C. T. Sudhanandam, Assistant Stationmaster, Channapatna, on the 12th October 1897.—My age is 35. My salary, Rs. 25 and service twelve years. Staff No. 232. I was Assistant Stationmaster on duty on the night of the 22nd September 1897. I did not count the number of passengers in the first four third-class carriages in 70 down of the 22nd, but I observed that these carriages were about half full. I remember that there was heavy rain from about 7 P.M. which continued up to the time No. 70 down left my

station for Mudgers. There was rain all the day, but not heavy. I believe the rainfall the whole day was 2 inches, as the next morning I heard from the State local officials that this was the quantity that fell during 24 hours ending in the morning of the 23rd early. No gangmen or any one else came to say that the bridge was out of order or in any way dangerous. I do not know that the Permanent-way Inspector gave orders on the night of the 21st to any of the permanent-way men. He did not speak to any permanent-way men in my presence. He was the only permanent-way employé that I saw that night. He came to my office to enquire where 70 down was; he slept in my office all night. I happened to ask him why he came, and he said he was going to Maddur that night by 70 down to see the Shimsha bridge, as it was raining very heavy. The 70 down was about 2 hours late that night.

Evidence of Ramasawmy Iyah, Stationmaster, Channapatna, before the Government Inspector on 24th September 1897.—I was appointed Stationmaster in 1887. Pay Rs. 45. Train left Closepet at 2-1 and arrived Channapatna on the 23rd. I left Channapatna on the previous day, the 22nd, for mile 36/8, by 69 up mixed, to assist the passengers of the derailed train at that mileage. I returned by 70 down of the same date, arriving at Channapatna 2-23 on the 23rd. Assistant Stationmaster being on duty I told him to start the train and went home. About 15 or 20 minutes after, the Permanent-way Inspector called me and said another accident had happened. I returned to the station and sent the prescribed notices of accident; after that I went to the site of accident with the Permanent-way Inspector and assisted in rescuing the passengers with ropes. We rescued about 20 passengers, and there were about 100 passengers in the other carriages.

Evidence of Fireman F. A. Snell, on the 12th October 1897.—My age is 23. I have four years' service in the Southern Mahratta Railway. One year as second fireman and three years as first fireman. My salary is 12 annas per day. I was first fireman on engine of No. 70 down of the 22nd September 1897. I was looking out ahead, when we approached the bridge at mile 246/12 and while on the bridge, by the head light of the engine, I saw nothing unusual. Then the engine went down suddenly. I fell into the water and came up again but was knocked down once more by a carriage falling near me. I rose to the surface and was carried down by the current about 2 or 3 miles down the river. I can swim. When I got out I could not walk and lay in the paddy fields till morning when some ryots came and carried me up to the broken bridge at mile 246/12. Later on Dr. Benson had me carried round to the Channapatna station from whence I returned to Bangalore and went to hospital. I did not see the driver or second fireman after we fell into the river. I did not notice if any one else floated down the river with me. I did not notice anything, being frightened and confused.

Evidence of M. L. Staggs, Driver of 76 down of the 22nd September.—My age is 25. Salary Rs. 2 a day. Service 7 years. Driver for 2 years past. I was driver of 76 down of the 22nd. I left Channapatna at 15-59 for Mudgers. I passed over the bridge at mile 246/12 at the usual rate of speed and felt no unevenness in passing over. The bridge was all right. The river was in flood. I never saw it high. May have been 6 or 7 feet high.

Evidence of E. Bineer, Fireman of 76 down of 22nd September.—My age is 27. Service 17 months. I was a corporal in the 19th Yorkshire Regiment before joining the Southern Mahratta Railway. My salary is 12 annas a day. I was first fireman on engine of 76 down of the 22nd September. When I passed over the bridge at mile 246/12 which was about 16 o'clock, I felt nothing give under the engine, the road and bridge was just as usual. I did not think the river was in extraordinary flood more than I had seen it at other times.

Evidence of Arogasawmy, Brakeman of 70 Down of 22nd September.—Three years' service. Pay Rs. 10 a month. Age 22. I was brakeman of 70 down of 22nd September. My brake (a third-class carriage) was next to the accident van, second vehicle behind the engine. As the carriage is an open one I could see how many passengers were in it. I saw 4 greasers in my carriage after the train left Channapatna for Mudgers, and there was a Eurasian in the separate compartment. I am quite sure that there were no other passengers in the open compartments. In the third-class carriages behind mine there were about a dozen passengers in each. I saw them at Channapatna. When we fell into the river and three-quarter of my carriage was submerged, I and the 4 greasers crawled out of the window, and climbing up the roof of the other carriage reached the top of the bridge. I and the 4 greasers were slightly bruised. I could not appear at the first enquiry as I had fever. I was not looking out when I approached the bridge.

Re-examined—In my third-class brake, there were two closed or boarded compartments and two open ones, and not as stated in my former evidence. I was travelling in the north or Bangalore end of the carriage in an open compartment. With me there were 4 greasers. The next open compartment was empty. In the end closed compartment there was one Eurasian travelling. I do not know if there was any one in the second closed compartment. The third-class in which the women were travelling was divided into two compartments. At Closepet and Channarayana I noticed a large number of passengers got out at those stations. I observed this as they left the carriages which were immediately behind mine.

Evidence of Scoring, Gateman at mile 247/2 and 3.—Service 3 years. Age about 50. Salary Rs. 6. I am gateman at mile 247/2 and 3. About 6 o'clock in the evening of the 22nd I went to the bridge at mile 246/12, because I wanted to see if any cattle had been trespassing on the line. The bridge was then as usual. There appeared to be water waist deep in the river at the time. I did not hear the bridge fall at night.

Evidence of Boyah, Gang cooly of No. 5 Gang.—Age about 30. Service 10 years. Salary Rs. 6 per mensem. On the day of the 22nd I patrolled the line from 244th mile to 248th mile. I went over the line in the morning and went across the bridge and remained trimming the line on the other side of the bridge. I returned in the evening to Channarayana before sunset. I was on the other side of the bridge when 76 down of the 22nd passed over it to Mudgers. The bridge at mile 246/12 was all right when I returned over it in the evening. The level of the water was below the piers. It was less than the previous day. There was nothing that I need have reported to the Stationmaster, Channarayana, or Permanent-way Inspector, Channarayana. I did not therefore report anything to either of these officials. I was alone. I did not see the gateman doing any work. If I had noticed that the bridge was in danger I should have told the gateman to show the red flag when train approached and have gone myself to report matters to Permanent-way Inspector and in his absence to the Stationmaster, Channarayana. There are gates about half mile each side of the bridge.

Evidence of Rajoo, Gang cooly in charge of gate at mile 246/4 and 5.—Age 30. 12 years' service. Pay Rs. 4. I am in charge of gate at mile 246/4 and 5 in the day time. I have besides to look after the line 4 of a mile either side of the gate. I live at Malur the other side of the bridge. When about to get dark I left work and went across the bridge to my house. The bridge was all right. The water in the river was then about waist high.

Evidence of P. Byramshaw, Pay Clerk of Bangalore district.—My age is 26. Salary Rs. 55. Service 5½ years. I am Pay clerk of the Bangalore district. I was travelling by 76 down of the 22nd September from Bangalore to Mysore. We passed Channarayana after 16 o'clock. I was next to the engine in a third class brake compartment and was looking out when we passed over the bridge at mile 246/12. I felt no jerk on passing over the bridge. We went over it

as usual. I looked at the river and it did not seem to me to be in high flood. I frequently trolly over this bridge making payments to gang coolies and have seen the river before in much the same flood.

Evidence of F. H. Kurve, Esq., Offg. Supdg. Engineer, Eastern Circle, Mysore State.—I took careful levels of the high flood at the bridge at mile 246/12 on the morning of the 25th September and found it to be one foot below the springing of the arches. I took the marks of the high flood left on the bushes and trees on the left bank, and am satisfied that the flood was no higher. I have also found from calculation that the flood velocity was about 16 feet per second. On the night of the 21st I was at Closepet. It rained very heavily on the night of the 21st between 8 and 12. The rainfall as reported to me next day was 6.46 inches, and nearly the whole of it fell during the time stated. I do not know if we have ever had such a high flood before in the river at mile 246/12 as I have not been in charge of the Bangalore division to which Channarayana belongs. The rainfall at Channarayana on the 20th was 1.30 on the 21st 1.58 inches and on the 22nd 0.18.

Evidence of M.R.Ry. A. Krishnaswamy Iyengar, B.A.—I am an Amildar in charge of Channarayana taluk. On the evening of the 22nd no villagers or any owners of gardens either side of the river near the railway bridge came and reported to me that the bridge was in danger of falling or had fallen or that there was extraordinary flood in the river. If the bridge had actually fallen and if there were people near, it is probable they would have told me of it. It is not likely that people would be there as it was raining between three and seven that day.

Evidence of Abdul Rahim, age 45, peon in Military Secretary's office, Mysore State.—I was a passenger in 70 down of the 22nd September. I was travelling in a third-class closed compartment. I do not know the position of the carriage on the train. There were with me in the carriage a Brahman asleep on the seat, I was seated next to him; an old pensioned sepoy was sleeping on the floor of the carriage, while a sepoy of the siladar horse and a hindu boy were on the seat opposite to mine. I and the siladar horse sepoy scrambled on to the roof of a carriage when the water poured into our compartment. The roof, with us on it, got swept away in the stream; we struck on an island. I laid hold of some shrubs in the water and waded with the sepoy on to land. I do not know what became of the other 3 passengers in my compartment. My ticket was lost in the water. No passengers between Bangalore and Channarayana got into my compartment and no one left it.

From the Stationmaster C. Nagaswami, to the District Traffic Supdt., dated 14th October 1897, Memo. No. 344-T.—I had been to the sub-division office. In the compartment of one Mureem Bee, what we meant as Futeem Bee, there were 8 adults and 3 children; all were saved, but in the compartment of one goldsmith, Manickachari, there were 9 passengers, including him, of whom three strangers and 4 of his relatives are missing, and further says that he did not take number of passengers in the carriage occupied by goldsmith.

NOTES MADE AT THE SITE OF THE MALUR BRIDGE ACCIDENT BY THE SENIOR GOVERNMENT INSPECTOR ON THE 27TH OCTOBER 1897.

1. An inspection of the position of the fallen engine which still lies in the river-bed, though it has rolled over now on its side instead of lying straight as shown in the earlier photographs, confirms the opinion which I had arrived at from the photographs that the bridge had already fallen before the engine came upon it. Though how long before the engine came on the bridge the gap had occurred there is, and I think can be, no evidence to show.

2. It seems sufficiently evident that the first effect of the flood was the falling of the upstream well of the "abutment pier" which supported the sixth and seventh arches. The collapse of this well caused the upstream half of the pier to tilt over into the river. This naturally brought both arches down with it. Then although the thrust of the eighth arch was insufficient to overturn the pier supporting it and the seventh arch, yet the thrust of the fifth arch was sufficient to overturn the pier supporting it and the sixth arch. The result was three arches down, one pier overturned sideways, and another pier split and with its upstream portion tilted in the upstream direction.

3. I examined the masonry. That of the arches is excellent, being large slabs of "burnt" granitoid gneiss set in good mortar. That of the piers is not so good, the mortar being of only fair quality, and I found large cavities in the heart of the split pier filled with dry sand. That, however, was not the cause of the collapse.

4. I had hoped to have been able to get at the wells, but that is at present impossible. It appears, however, that under the split pier which once supported the sixth and seventh arches, there are two circular wells, each 7' 8" internal and 11' 0" external diameter, that is, with 1' 8" steining. One of these wells collapsed, but whether by falling to pieces or by being undermined it is at present impossible to say for certain. The wells are apparently built of brick, though why of brick when such excellent burnt stone is available it is difficult to say. I found some of the bricks in the spandril walls beneath the coping. They are very thin bricks and have been moulded radially. The ones that I found were of very poor sandy quality, scarcely fit to be called second-class. Unless the filling of such thin-walled wells, built of such very poor bricks, is a very superior sort of concrete, they must almost certainly, sooner or later, have failed under the vibration of floods and of trains.

5. There are nine foundations, piers and abutments, and the drawing, which was handed to me, as a tracing of the original drawing made over by the Mysore Public Works Department to the Southern Mahratta Railway, shows four of them, which are still standing, as founded on stiff clay; three, including the failed well foundation, as founded on rock; and two, still standing, as founded on sand. The piers, which are 9' 6" high, stand on top of the wells, and the wells of the pier which must first have failed are shown as going down 26' to rock. But there is a suspicious line drawn across the wells at a depth of 16' 6" which may possibly mean that one or both of them were stopped at that depth instead of being carried down to the rock. This line, however, might mean a clay stratum. I consider that the Southern Mahratta Railway authorities, finding a drawing of an arched bridge showing that its wells were satisfactorily founded, were quite justified in failing to view that bridge as being fit to be put under suspicion. From my examination of the quality of the bricks, however, and from finding a pocket of sand in the pier masonry, I am inclined to believe that the up-stream well of the pier in question failed because its masonry, or filling, or both, were bad. It must remain in doubt at present whether it was or was not fully sunk to the rock. I am disposed to believe that it was not sunk to the rock but only to the 16' 9" line; because, though the depths of all the other wells are figured on the drawing, the only depth figured on this particular well is 16' 9", and not the depth 28' 0" to the rock, although the lines representing the wells are drawn down to rock.

6. The visible bed of the river is sand. There was evidently no scour in the 6th span, because the engine is lying on the bed of the river about on the level of the top of the wells. Had the bed been deeper than the tops of the wells in No. 6 span at the time of the accident, the engine would now have undoubtedly been more or less buried in sand if the sand had filled in the hole on the fall of the flood. I see no reason to think that there was excessive scour in the 7th or 8th spans either. There certainly is no sign of it now.

7. All other evidence likely to be useful having already been recorded either at the Government Inspector's enquiry on the 24th September, or at the departmental enquiry of the 12th October, it only remained for me to take the following evidence from the District Engineer:—

Evidence of Mr. A. W. Mackenzie, District Engineer, Southern Mahratta Railway.—Am Resident Engineer on the section containing the Mallur bridge. Have seen the bed of the river dry right across during the dry season. It will probably be dry again in a couple of months. When the bed has been dry I have never seen any sign of scour having occurred round any of the piers: but have never taken soundings during flood. There has never been any loose stone pitching round the piers. The depth of the water at present close up to the failed well is only two or three feet (tested by sending men in, F.J.E.s.). I had no particular reason to suspect the probable failure of an arched bridge shown in its drawing as having its piers satisfactorily founded. I have no particular reason to think that trees or brushwood caused excessive scour. No such obstruction has been found.

From the Senior Government Inspector of Railways, Madras, to the Joint Secretary to the Government of Madras, Public Works Department, Railway Branch, dated Bangalore, 28th October 1897.

In compliance with the orders contained in Government of India Circular, No. VII-R., dated the 19th April 1895, I have the honour to submit a report upon the serious accident which occurred at the Mallur bridge, mile 246/12, Mysore State Railway. The Mysore State Railway is worked by the Southern Mahratta Railway Company. At about half past two o'clock, on the morning of the 23rd of September, part of No. 70 Down Mixed Train, from Bangalore to Mysore, dropped into a gap where three arches of the Mallur bridge had fallen. At about 8 o'clock, on the night of the 23rd, I received, at Ootacamund, a telegram from Mr. F. D. Fowler, one of the Government Inspectors of Railways in my circle, and recently Chief Inspector, informing me of this accident as well as of the previous accident at mile 236/12. I may mention that in this telegram the only mention of any casualties to passengers was that a few passengers had been slightly injured in the earlier accident. Mr. F. D. Fowler's telegram concluded by informing me that he was proceeding to attend the joint enquiry. Later on the same night I received a telegram to say that four deaths and ten injuries were known to have occurred. On the 28th, the Agent, Southern Mahratta Railway, wired that the number killed or drowned might be taken as thirty.

2. Meanwhile the Government Inspector, Mr. F. D. Fowler, had presided at an enquiry, which was held at Chennapatna, after viewing the scene of the accident, on the afternoon of the 24th September. The evidence taken at this enquiry as well as the Inspector's conclusion will be found recorded at page 2. Though Mr. Fowler presided at and directed this enquiry, and made his own notes of the evidence taken, he left the actual editing and copying of the evidence to the Southern Mahratta Railway departmental officers, and the consequence was that he did not receive a full copy of the proceedings until the 7th October, and it was then sent to him not by the Agent but by the District Engineer with his No. 4851, dated the 3rd October 1897. On receipt and consideration of this report I decided to myself go deeper into certain matters which did not seem to have been sufficiently thoroughly enquired into, and wired to that effect to the Agent, Southern Mahratta Railway.

3. But meanwhile the Agent having arrived at a similar opinion, ordered a second, departmental, enquiry to be held at Chennapatna on the 12th October. The evidence taken at this enquiry and the conclusion arrived at by the departmental committee will be found recorded at pages 7, 8 and 9.

4. The Mysore Durbar had also made an independent police enquiry and a magisterial enquiry, and between the two Durbar enquiries and the two railway enquiries a great mass of evidence has been taken, and most of this fitted fairly well together and left little doubt possible about the actual facts of the accident or about the conduct of the railway officials. The question, however, of the actual causes of the failure of the structure itself had been left practically untouched, and it was to this point chiefly that I intended to direct my own enquiries. But, as it turns out, very little further light can be thrown upon this question until the river-bed is dry after the coming monsoon.

5. However, under section 5 of the Railway Act, I called upon the Agent, Southern Mahratta Railway, to meet me with such witnesses and evidence as seemed likely to elucidate this point. We met yesterday, the 27th October, at Bangalore, and proceeded to the site of the bridge. I afterwards had an interview with the Resident of Mysore with reference to certain matters connected with the magisterial enquiry. At this interview I was informed by Colonel Robertson that the Mysore Public Works Department have no information about the details of the construction of the Mysore State Railway on this particular section, all having been made over to the Southern Mahratta Railway Company. The results of my own enquiry on the site of the bridge will be found at pages 9 and 10.

6. In the *Madras Times* of October 26th, I read what purports to be a report of the evidence and finding of the Sub-Divisional officer of Closepett at the enquiry which he held into the causes of this accident. It would not be proper that I should

criticise the Magistrate's finding; but it may not be improper to say that it seems probable that, if he had had the advantage of railway expert advice, he would in certain important details have probably arrived at other conclusions. He, however, makes one very important error in having based a great part of his censure of the Southern Mahratta Railway authorities upon certain evidence tendered to him by casual passengers by a previous day's train in regard to the precautions taken by the railway authorities to slow the trains over a certain bridge, stated to be the Mallur bridge. As a matter of fact the bridge in question was quite another bridge half a mile away. The mistake was a natural one enough for passengers to make, and the conclusion derived therefrom by the Magistrate was natural enough. But he might reasonably have been expected to have taken the evidence on this important point of some of the railway men, any one of whom would have proved, unquestionably, that the evidence referred to was mistaken and valueless.

7. There is no question of fact at issue about the system under which the patrolling of the Southern Mahratta Railway is carried on. The Agent admitted to me that, beyond the locating of watchmen at actually suspected places, there is no system of night patrolling. The system of day patrolling will be found described in the evidence, it is this. At six in the morning one of each gang, the keyman on this particular section, patrols his 4-mile length, returning at 8 or 9, and working with the gang for the rest of the day. As a guarantee that everything is safe for the night reliance is placed on the return of the gangs from their work to their quarters at night. This system, though doubtless good enough for 8 or 9 months of the year, is not, in my opinion, good enough for the 3 or 4 months of the monsoon. The conclusion which I have come to is as follows:—

Conclusion of the Senior Government Inspector.

The Mallur bridge failed as the result of the collapse first of the upstream well of the pier supporting the 6th and 7th arches. It is impossible just yet to say what precisely was the cause of the failure of this well. I am disposed to think that it failed owing to its structure being deficient in strength, and to its therefore yielding at last under the combined vibration of trains and of floods, aggravated, doubtless by a certain amount of scour. It may be that the well, which there is reason to think may not have been sunk to the rock, had got underscoured; but I think this less likely than that it failed from inherent weakness. The Agent has promised to have this point thoroughly investigated by borings as soon as the well can be got at.

2. I do not think that, up to sunset on the evening before the accident occurred, the railway servants had any reason to suspect the bridge. Indeed it was not a sort of bridge which would be likely to be looked on as liable to be suspected, considering the record of its drawing. The flood which, according to the expert evidence of Mr. V. H. Karve, seems only to have reached within a foot of the springings of the arches was not an abnormal one. I consider the permanent-way staff to be free from blame. I also see no reason to blame the engine staff. There is a rising grade of 1 in 100 up to the bridge, and the engine staff would not get a good look over it until they came very nearly on to it; and it would in all probability have been too late, even if the gap had been fully visible on arrival at the bridge on a bright moonlight night, to pull up the train. But the night in question was dark, and the chances were largely against the engine staff being able to see the gap until they were practically into it, even if any one of them should have happened at that particular instant to have his eye on the road in front of the cowcatcher.

3. The chief question to be considered is whether the Southern Mahratta system of patrolling the line is sufficient and suitable for local conditions. Their system is to patrol the whole line during daylight and only suspicious places at night. Certain other railways patrol large sections, or their whole line, at night during the rains. The South Indian Railway patrol system is a very good one. I print their rules as Appendix A. The correspondence which led to the abandonment of a similar system on the Madras Railway will be found printed as Appendix B. I am informed by the Agent, Southern Mahratta Railway, that they have not, and apparently never have had, any system of night patrolling all over the line. I understand them to reason that a night patrol is only a partial insurance against accidents of a sort likely to happen from heavy rain; because an interval of some hours may elapse between the

APPENDIX B.

From the Consulting Engineer for Railways, dated Madras, 15th November 1881, No. 845.

With reference to your letter, No. 553, dated 12th August 1881, on the subject of the gradual discontinuance of line watchmen, I have the honour to observe that I am of opinion that, in the interest of the travelling public, it is desirable that any possible misconception should be prevented by a full explanation of the grounds upon which the officers of the Railway Company, with the approval of the Government, determined to modify the existing system.

2. With this object, I have the honour to request that I may be informed—

- (1) When the system of permanent night watchman was first introduced?
- (2) What were the several duties expected of the men, and what the special objects of those duties?
- (3) Was it found in practice that the results aimed at by the system were fully attained?
- (4) Have the general condition and circumstances of the way and works become, in course of time, so far modified as to warrant a change of system?

3. I ask that these points may be placed on record,—first, because, I gather from the Session Judge's comments, that he was under the impression that one of the main objects of the system was the timely detection of obstacles intentionally laid on the line; a result which I am of opinion could hardly be expected, and was in practice little likely to be realized. Second, because I have understood that it has been found almost impossible to secure in practice from the system all that was expected from it.

4. Adverting to the resolution, dated 27th February 1880, quoted in your letter under reference, also to the Chief Engineer's Circulars No. 374 of 25th May 1880 and No. 5/89 of 3rd October 1880, I request to be informed—

- (1) What bridges continue under the charge of night watchmen?
- (2) Whether the men selected for night duty from the Permanent-way gangs are relieved from day work, or are expected to perform night work in addition to their day work, receiving extra pay on that account.
- (3) Whether the selection of the parts of the line to be watched rests with the subordinate staff, or is made by the Resident Engineers, in communication with the Chief Engineer.
- (4) What is the extent of the economy ultimately expected from the change of system?

5. I shall be glad to learn to what extent the contemplated reduction has been already carried out; and whether the Chief Engineer is still satisfied with the working of the new arrangements.

From the Agent and Manager, Madras Railway Company, to the Consulting Engineer for Railways, dated Madras, 1st December 1881, No. 791.

I have the honour to acknowledge receipt of your No. 845 of the 15th November, and in reply to your second paragraph would offer the following answers to the four questions:—

(1) The system of night watchmen on this railway was introduced simultaneously with the running of night trains, on the South-west line on the 1st February 1864 and on the North-west line on the 1st November 1869.

(2) The main duties of the men consist of a systematic patrol of the portions of the line assigned to them, besides an examination of the line, the exhibition of signals to passing trains, and of danger signals in the event of any damage caused by heavy rains or abnormal floods and the removal of stray cattle or obstructions intentionally placed on the rails.

(3) The results aimed at were satisfactorily attained.

(4) The condition and circumstances of the way and works are so far modified that the development of the vegetable fencing and the introduction of cow-catchers on the engines have minimised the danger arising from the presence of cattle. As to the obstructions intentionally placed on the line the would-be offenders in this respect become so thoroughly conversant with the movements of the night watchmen and the times of the trains, that they are seldom if ever detected in the act of placing such obstructions, although in some cases the watchmen have subsequently discovered and removed and in others the train has come in contact with them before the watchman could return over his length.

2. Referring to your 4th paragraph I have the honour to submit replies to the 4 questions therein contained—

(1) Responsible subordinates resident on the spot or night watchmen or both are retained at the following bridges:—

(2) Gang-men selected for temporary night duty are released from work on the following day but continue to receive the wages for this day.

(3) The selection of the portions of the line to be temporarily watched must of necessity rest with the Inspectors and their subordinates, inasmuch as it is impossible for the Resident Engineer to be, on any one night, aware of all the parts threatened with heavy rainfall over his division averaging 122 miles in length.

(4) The ultimate saving cannot be computed until the whole of the permanent night watchmen have been gradually eliminated by death, resignation, dismissal or absorption into other branches of the service.

3. I may further inform you that the Chief Engineer is still satisfied with the working of the new arrangement.

4.

5. The procedure we now adopt is to make special provision in rainy weather or during the two monsoons, each of which lasts for a period of about two months.

6. I have already placed on record my opinion that the reduction of the night watchmen on this line could be carried out with safety to the public if gradually taken in hand and after an experience of some 18 months' working, I am still of opinion that the measure was a wise one.

From A. M. SAUNDERS, Esq., Agent and Manager, Madras Railway Company, to the Consulting Engineer for Railways, dated Madras, 12th August 1881, No. 553.

With reference to your letter of the 1st of March last, No. 160, with which you enclosed a letter addressed by the Sessions Judge of North Arcot to the Chief Secretary to the Government of Madras, I have the honour to state that the question of the gradual absorption of the line watchmen was very carefully considered before it was decided to take any action in the matter.

2. The matter was considered at the official meeting held on the 27th of February 1880, when you were present, and when the following resolution was passed:—

“Resolved that, in the opinion of this Committee, the services of night watchmen employed in the Engineering Department may safely be gradually dispensed with as vacancies occur, except the men employed on bridges; the safety of the line being provided for by the gang maistries being ordered to put on the most trustworthy men in the gang as watchmen, whenever the weather is threatening and floods may be expected; the men so employed being paid extra for the special service.”

3. The course it was thus proposed to adopt was subsequently approved by the Government.

Note by the Consulting Engineer for Railways, Madras, No. 287, dated 12th December 1881.

2. As stated by Mr. Saunders, the question of the gradual absorption of night watchmen was carefully considered before action was taken. The matter had engaged attention for some years, and had received full discussion on many occasions; and when the proposal was formally brought forward at an official meeting held in February 1880, the resolution quoted by Mr. Saunders was passed.

3. The circumstances of the line have greatly altered since the introduction of the system of night watchmen (simultaneously with the running of night trains) on the South-west Line in 1864, and on the North-west Line in 1869.

4. The irrigation tanks have been made much more secure than they then were; and the extent of the storm water to be passed by the different masonry works is better known. Bridges have been enlarged; others have been added; the embankments have been strengthened and protected, as experience proved necessary; until many portions of the line no longer require patrolling as a precaution against floods.

5. Similarly, as regards cattle trespass. The fences have now grown so as greatly to diminish this risk, which the introduction of cow-catchers on every engine has still further lessened.

6. As regards obstructions intentionally placed on the line. It has long been a question in this office whether the system of night watchmen has afforded any appreciably increased security. In several instances the offences have been traced to domestic quarrels between the watchmen themselves, or between them and the neighbouring villagers; while the length of the beats affords full opportunity to take advantage of the absence of the watchmen at any particular point. It has even been suggested that the system itself provoked this sort of offence by furnishing motives for the act, which would not otherwise exist.

7. The accompanying statement shows the practice followed on the other lines in India; it will be seen that generally where watchmen are employed it is, as is now proposed for the Madras Railway, on specially selected portions of the line where there is known to be increased risk.

8. It cannot of course be denied that a continuous chain of watchmen, each man within sight of another, would afford a greater degree of safety than a system providing only one man to a mile, whatever might be the risk to be guarded against; but in this, as in all other insurances against risk, it is a question of degree; and the system now obtaining on the Madras Railway permits the Chief Engineer full discretionary power to protect the line, wherever and whenever thought necessary, without compelling expenditure on other parts where practically speaking there may be no risk at all.