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Public Works DEPARTMENT.

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*Proceedings of the Madras Government, Public Works Department,
16th October 1869.*

No. 316. Read the following Circular from the Officiating Secretary to the Government of India, Public Works Department, (Railway,) to the Secretaries to the Governments of Madras, Bengal, the North-Western Provinces and the Punjab; the Chief Commissioner of Oudh, and the Resident at Hyderabad, dated Simla, 2nd September 1869, No. 23 :—

I AM directed to forward, for information and careful consideration by both Government and Railway Officers, copy of the papers noted in the margin regarding the successful results which have attended the use of cast-iron bowl-sleepers on the Railways in Bombay.

Letter from Under Secretary to Government of Bombay, to the Oudh Administration, No. 1,157, dated 12th June 1869.
Memorandum by Captain White, Deputy Consulting Engineer.
Opinion of Chief Engineer, Bombay, Baroda and Central India Railway.
Opinion of District Engineer, Great Indian Peninsula Railway.
Opinion of Chief Engineer, North-East Division, Great Indian Peninsula Railway.
Opinion of Chief Engineer, Great Indian Peninsula Railway.
Replies to queries put by the Chief Commissioner, Oudh.

No. 317. ORDER THEREON, 16th October 1869, No. 3,335.

RAILWAY, No. 42.

COMMUNICATED to the Consulting Engineer for Railways.

(True Extract.)

Captain, R.E.,

Acting Under Secretary to Government.

To the Consulting Engineer for Railways.

Exd. S. T. Augustin.

Enclosure to Circular No. 23 Railway.

No. 1157, dated 12th June, 1869.

From—*Lieut. Col. J. S. Trevor, R. E., Under Secy. to the Govt. of Bombay, in the P. W. Dept., Railway Branch.*

To—*Joint Secretary to the Chief Commissioner of Oudh, Railway Dept.*

In reply to your letter No. 2002 R of the 10th November 1868, I beg to forward papers as per margin on the subject of pot sleepers. The

- 1.—Memo. by Captain White, R. E.
- 2.—Opinion of Railway Engineers.
- 3.—Replies to the queries put by the Chief Commissioner of Oudh.

general experience on this side of India is favourable to the use of the oval pot sleeper with wooden-cushion—Muir and McIlwain's patent—and it is probable that these sleepers will be largely used in

all future extensions of the Railways of this Presidency.

Memo. by CAPTAIN J. H. WHITE, R. E., Deputy Consulting Engineer for Railways, Bombay.

There are two descriptions of pot sleepers, Greaves' and Muir and McIlwain's. The former is circular, and the diameter varies from 2 to 2 1/4 inches, and the weight from 82 to 88 lbs; the latter is oblong, the longer axis being 2 feet 1 1/2 inches, and the shorter 1 foot 6 1/2 inches, whilst the weight varies from 90 to 95 lbs. The oblong sleepers are provided with two hard wood-rests, which give a considerable bearing to the rail, and make this pattern decidedly superior to the Greaves' and other bowl-sleepers.

The pots are placed at 3 feet apart from centre to centre on the Bombay, Baroda and Central India, which distance will be increased to 4 feet 3 inches and 4 feet 6 inches in all newly laid road. On the Great Indian Peninsula Railway they are 3 feet 6 inches from centre to centre, and there is 1 foot 6 inches from joint to the centre of end chair.

In the circular pot, the length of the rail seat is 2 1/4 inches; in the oblong 16 to 19 inches, the wood rests giving about 1 foot of bearing, and the iron seat in centre of sleeper being 7 inches.

The Greaves' pattern have thick edges, some are with, and some without, radial ribs; the oblong pot has a thick edge with extra thickness across the centre, but has no ribs; the lip is 3/4" thick, but the metal at outer-edge is only 1/2 inch.

The pot sleepers are keyed on the outside.

They are delivered to the works in good order, packed loose in traffic wagons, and are unloaded by manual power.

The pots are rung by a hammer to ascertain their soundness; they are not rejected for trifling flaw or chip.

River sand, gravel, or small broken-stone should be used for ballast.

The trains pass at the same speed over the iron as over the wooden-sleeper road, no difference is made, but opinion is in favour of a limit of 40 to 45 miles an hour.

The breakage may be put down at 1 per cent. per annum, but there is not accurate information yet on this point. The pots are not removed unless cracked near the centre, or in such a manner as to give unequal bearing.

Opinions of the Chief Engineers are attached; there is a general concurrence in favour of the oval pot sleeper on account of the low cost of maintenance.

The cost of the oblong pot sleeper road close to Bombay, not including cost of rails, fish-plates, bolts or keys, is as follows:—

	Rs.	Rs. PER TON.	Rs. A. P.
2 Oval pots, @	90	83 4 6	7 1 0
1 Tie-bar 2 x 1/2	25	162 6 5	1 13 0
2 Gibs		164 2 7	0 0 5
2 Cotter's		217 2 6	0 1 0
2 Oak-rests		0 0 11	0 1 10
Pair of pots complete ...			9 1 3
Pairs, 1,320 per mile ...			11,983 12 0
Laying, 10 annas per yard ...			1,100 0 0
			13,083 12 0

Opinion of Mr. F. MATHEW, Chief Engineer, Bombay, Baroda and Central India Railway.

On the Northern Division, where suitable sand ballast is obtainable, the road has during the last two years been re-laid for long lengths with pot sleepers; the results have been satisfactory, and in similar positions in this country, the road is perhaps the least costly which can be used.

On this line pot sleepers have not heretofore been laid on hard ballast, but Adams' No. 1 patent iron-way was so laid down some years ago, and whilst the road has at all time been hard, the rails have been so damaged that even without counting the corresponding injury to rolling-stock, it is quite certain that the road would be most expensive to maintain, the extra durability of the sleepers being much more than counterbalanced by the more rapid deterioration of the rails.

Opinion of Mr. T. J. DEWAR, District Engineer, Great Indian Peninsula Railway.

These pots were laid under unfavourable circumstances, *e. g.* :—

1st.—Nearly all in rock-cuttings.

2nd.—All in soft moorum ballast.

3rd.—Every second pair only having a tie-bar.

The traffic on this District is necessarily the heaviest on the Great Indian Peninsula Railway, yet the annual breakage is only about half per cent. per annum.

The result has been that these pots have been largely used in preference to teak sleepers, and they have been used exclusively for the doubling of the line. There are now 109 miles on my District laid with them out of a total mileage, including sidings, of 285. Out of this length, 30 miles are laid with new oval pots with two bearings on wooden-cushions, every pair of pots tied and gravel ballast exclusively used.

Our experience is totally at variance with that on the East Indian Railway. The Engineer in reporting the breakage to be 33 per cent. per annum, does not state the nature of the ballast.

An unfounded prejudice exists against them, but I am certain that they are far more economical than sleepers.

I regret to report that account of the breakage has not been properly kept for some years owing to repeated changes in the Staff, but careful record will be kept from 1st January next.

Opinion of Mr. R. M. BRERETON, Chief Engineer, North Eastern Division, Great Indian Peninsula Railway.

I beg to state, so far as I have been able to ascertain, that the failure and breakage of the old-fashioned bowl pots on this Division has been very small, and that, on the whole, the road laid with them has been well maintained.

Mr. Dangerfield states that on the Nagpoor Branch, where we have used the spherical pots, Greaves' patent, more extensively between the 477 and 492 miles, 284 single pots which were laid in 1865 have been broken and removed since 5th November 1867, and that a great portion of this road has lately been opened, and but 50 fractured pots discovered. The road between 491 and 492 is in a rock-cutting with hard ballast, and here 120 of the above-mentioned 284 fractured pots were found.

We have had some loss, however, from the engines, &c., getting off the road: for instance, at Jullum, on 7th March last, Mr. Dangerfield reports that six wagons of a goods train left the rails, and broke 240 single pots; and on another occasion, a brake leaving the rails broke 392 single pots.

We have lately largely used the new oval pot sleepers, and have found it make an excellent road. The loss from breakage has been next to nothing, and any such has arisen from carelessness on the part of the beaters when packing, and from uneven pressure owing to the want of oak rest pieces.

So far as the present and limited experience goes, they can be most favourably reported on. Only sand, shingle and moorum ballast, however, has been used, and it is on the Concan line where broken stone is so largely employed that these sleepers have been severely tested, and the results, good or bad, be determined.

I should be inclined to question the quality of the castings on the East Indian Railway, as the facts recorded are astounding.

Opinion of Mr. H. P. LEMESURIER, Chief Engineer, Great Indian Peninsula Railway Company.

The information furnished by Mr. Dewar together with that gleaned from the other Engineers, and my own recent experience, convince me of the great advantages of good oval iron-bowls over any class of wooden-sleeper, save under rare and very exceptional conditions, assuming always that the iron-bowls are of the best pattern, made from good iron, that they meet with ordinary good treatment in all preliminary handling, and finally that they are laid and packed in the road with reasonable care.

The first cost of sleepers for laying a mile of road at a mean distance on Great Indian Peninsula Railway from Bombay (say at Bhosawl) would appear to be as follows, inclusive of all charges for the carriage of materials by Railway, but exclusive of all loss from breakage between shipment and actual delivery to Engineer :—

	Rs.
For an oval pot road, each complete pair of pots costing in Bombay Rs. 7-2-8, there being in each mile 1,320 pairs, each pair complete weighing 1 cwt. 2 qrs. 14 lbs.	10,312
For a rectangular teak sleeper road, each sleeper costing in Bombay Rs. 8, there being in each mile 1,604 sleepers, each sleeper weighing 2 cwt. 2 qrs. 3 lbs.	14,442
For a rectangular creosoted sleeper road, each sleeper costing in Bombay Rs. 3-8, there being in each mile 1,604 sleepers, each sleeper weighing 1 cwt. 1 qr. 23 lbs.	6,541

With the new oval pot sleeper, six pairs to a 24-feet rail, the rail resting on two oak cushions, the greatest length of rail between any two bearing points is 2 feet 11 inches. A similar maximum distance between bearings would be attained by placing creosoted or teak sleeper at a distance of 3 feet 3½ inches from centre to centre, or 1,604 to a mile, but this arrangement of wooden-sleepers, with the ordinary chairs, only gives 6,817 running inches of rail bearing per mile, against 15,840 running inches per mile on the oak cushions.

The bearing of the oval bowls upon the ballast being in the case of each pair of bowls 880 square inches, and per mile 1,161,600 square inches, as compared with 800 square inches for each timber sleeper, allowing two-thirds of the entire length of the sleeper to do efficient duty, or per mile of timber sleeper road 1,283,200 square inches of bearing.

The life of an iron-sleeper, if once fairly laid in suitable ballast, is many times greater than that of any wooden-sleeper. The iron-pot sleepers suffer from the following amongst many causes of damage or deterioration, *viz.* :—

Extreme carelessness in shipping, stowage, lading, loading on to wagons, and unloading. They are in fact comparatively tender under rough usage.

During the process of packing with ballast, whether through the holes or under the runs, they are liable to injury from the blows of the packing tools. They crack if the ballast is either too large, or if it cakes into solid mass, and they suffer more damage than do wooden-sleepers from accidents with vehicles off the road.

Both teak-wood and creosoted sleepers are said to last on the Great Indian Peninsula Railway about ten years under the most favourable circumstances, and beyond a certain point they do not suffer direct injury from climatic influences, or the attacks of insects, but from hard wear the ends split so that the spikes wont hold, the chairs, too, bed themselves to the depth of nearly, or quite, half an inch in the road. I consider, however, that the greater portion of the condemned sleepers I have seen on this line have been retained as serviceable for a long time after they ought to have been removed in the process of maintaining a safe road.

The iron-pots do not offer such inducements for theft as do the wooden-sleepers, but the smaller parts, the tie-rods, &c., are easily secreted, so that it is questionable if there is any great difference on this score in favour of either class of sleeper.

The cost of laying a mile of iron-bowls is apparently less than that of laying a mile of timber sleepers, but my only guide hitherto has been the rate at which the contractor's tender, which I do not wish finally to accept is correct.

In and about station yards, at points and crossings, and in places where much stowing of road is likely to be needed, it is of course preferable to use wooden-sleepers. Moorum ballast that cakes hard is perhaps the worst ballast for pot-sleepers.

The breakages on the Great Indian Peninsula Railway fall so very far short of those on the East Indian Railway, that the failure of the pot-sleepers on that line as reported by Mr. Cockburn, and the general objection to their use, must be attributed to other causes than the "description of ballast."

There was always some doubt as to the quality of the iron from which the first batches at least of the East Indian Railway sleepers were cast, but Mr. Rendel has stated that he has good evidence in favour of the soundness of the material. There must, therefore, have been some defect in pattern, or deficiency in weight.

GREAT INDIAN PENINSULA RAILWAY.

QUESTIONS.

Questions.	Mr. Sletor, Resident Engineer.	Mr. Whyte, Resident Engineer.	Mr. Warren, Resident Engineer.	Nasipoor Branch.		North East Line.	CONCAN AND DECCAN.
11 Nature and size of ballast used and whether carefully filled?	Sand and gravel packed as well as they can be from beneath.	Chiefly on river gravel ballast which admits of careful packing.	Rough sand or gravel ballast. Constant care is required to keep the pots filled by packing.	Mr. Dungenfield, Resident Engineer.	Mr. Ramsden, Resident Engineer.	Mr. Breton, Chief Engineer.	CONCAN AND DECCAN. Mr. Dewar.
12 Percentage of renewals per annum? Speed at which fast trains run? Speed for goods trains?	71 to date. Fast trains 40 miles an hour. Goods trains 30 miles per hour.	I have renewed none as yet. Fast trains go sometimes as fast as 40 miles an hour. Goods about 20.	During the last two years about 80,000 pots sleepers have been renewed on District No. 3, and I have only known of two having been renewed, except on two occasions when an engine got off the rails. Experience on this Railway is as yet limited on this head. The speed of fast trains averages 25 miles, and their maximum speed is about 30 per hour. Goods trains frequently run between 20 and 25 miles an hour, especially on descending gradients.	The delivery of oval pot sleepers commenced 13 months ago, since which time scarcely any have had to be renewed. I consider 25 miles an hour a safe speed to be run over them, though of course a speed of 30 miles an hour is not unsafe.	No renewals of pot sleepers as yet in my District.		Gravel or small broken stone carefully filled. Soft moorum is the worst and breaks the pots, the contents becoming as hard as concrete after each monsoon from the constant concussion of passing traffic. There are no reliable data in this Office since Mr. West handed over charge to Mr. Manning. The last report I can find gives half per cent. breakage per annum, but I should say allow 1 per cent. per annum. Speed of fast trains 45 miles an hour; maximum speed for goods trains about 30.

13. Extent of injury/See reply to question 10.
held to necessitate removal?

Any symptoms of a crack in the direction of its radius, or a horizontal crack that would be likely to cause a fracture on the edge of more than 2 inches square.

11 Detailed expenditure of pot sleepers on road, including all charges, laid ready for traffic.

have not laid any continuous length with pot sleepers. My operations in this respect have been merely renewing the inferior jungle wood sleepers by

Rs. 12-1-0 per head and calculated for 1/4th of sleepers to a pair of rails	1844 6 2
TOTAL	1844 6 2

fracture to such an extent as to give rise to unequal hearing or when split to such a degree as to threaten fracture.

No continuous length. Cost of permanent wire fence has been said on this per mile laid with District at any one iron post sleepers.

This information can be best afforded by Mr. Dewar, for the Concan Line.

1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2423	2424	2425	2426	2427	2428	2429	2430	2431	2432	2433	2434	2435	2436	2437	2438	2439	2440	2441	2442	2443	2444	2445	2446	2447	2448	2449	2450	2451	2452	2453	2454	2455	2456	2457	2458	2459	2460	2461	2462	2463	2464	2465	2466	2467	2468	2469	2470	2471	2472	2473	2474	2475	2476	2477	2478	2479	2480	2481	2482	2483	2484	2485	2486	2487	2488	2489	2490	2491	2492	2493	2494	2495	2496	2497	2498	2499	2500	2501	2502	2503	2504	2505	2506	2507	2508	2509	2510	2511	2512	2513	2514	2515	2516	2517	2518	2519	2520	2521	2522	2523	2524	2525	2526	2527	2528	2529	2530	2531	2532	2533	2534	2535	2536	2537	2538	2539	2540	2541	2542	2543	2544	2545	2546	2547	2548	2549	2550	2551	2552	2553	2554	2555	2556	2557	2558	2559	2560	2561	2562	2563	2564	2565	2566	2567	2568	2569	2570	2571	2572	2573	2574	2575	2576	2577	2578	2579	2580	2581	2582	2583	2584	2585	2586	2587	2588	2589	2590	2591	2592	2593	2594	2595	2596	2597	2598	2599	2600	2601	2602	2603	2604	2605	2606	2607	2608	2609	2610	2611	2612	2613	2614	2615	2616	2617	2618	2619	2620	2621	2622	2623	2624	2625	2626	2627	2628	2629	2630	2631	2632	2633	2634	2635	2636	2637	2638	2639	2640	2641	2642	2643	2644	2645	2646	2647	2648	2649	2650	2651	2652	2653	2654	2655	2656	2657	2658	2659	2660	2661	2662	2663	2664	2665	2666	2667	2668	2669	2670	2671	2672	2673	2674	2675	2676	2677	2678	2679	2680	2681	2682	2683	2684	2685	2686	2687	2688	2689	2690	2691	2692	2693	2694	2695	2696	2697	2698	2699	2700	2701	2702	2703	2704	2705	2706	2707	2708	2709	2710	2711	2712	2713	2714	2715	2716	2717	2718	2719	2720	2721	2722	2723	2724	2725	2726	2727	2728	2729	2730	2731	2732	2733	2734	2735	2736	2737	2738	2739	2740	2741	2742	2743	2744	2745	2746	2747	2748	2749	2750	2751	2752	2753	2754	2755	2756	2757	2758	2759	2760	2761	2762	2763	2764	2765	2766	2767	2768	2769	2770	2771	2772	2773	2774	2775	2776	2777	2778	2779	2780	2781	2782	2783	2784	2785	2786	2787	2788	2789	2790	2791	2792	2793	2794	2795	2796	2797	2798	2799	2800	2801	2802	2803	2804	2805	2806	2807	2808	2809	2810	2811	2812	2813	2814	2815	2816	2817	2818	2819	2820	2821	2822	2823	2824	2825	2826	2827	2828	2829	2830	2831	2832	2833	2834	2835	2836	2837	2838	2839	2840	2841	2842	2843	2844	2845	2846	2847	2848	2849	2850	2851	2852	2853	2854	2855	2856	2857	2858	2859	2860	2861	2862	2863	2864	2865	2866	2867	2868	2869	2870	2871	2872	2873	2874	2875	2876	2877	2878	2879	2880	2881	2882	2883	2884	2885	2886	2887	2888	2889	2890	2891	2892	2893	2894	2895	2896	2897	2898	2899	2900	2901	2902	2903	2904	2905	2906	2907	2908	2909	2910	2911	2912	2913	2914	2915	2916	2917	2918	2919	2920	2921	2922	2923	2924	2925	2926	2927	2928	2929	2930	2931	2932	2933	2934	2935	2936	2937	2938	2939	2940	2941	2942	2943	2944	2945	2946	2947	2948	2949	2950	2951	2952	2953	2954	2955	2956	2957	2958	2959	2960	2961	2962	2963	2964	2965	2966	2967	2968	2969	2970	2971	2972	2973	2974	2975	2976	2977	2978	2979	2980	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BOMBAY, BARODA AND CENTRAL INDIA RAILWAY.

GREAT INDIAN PENINSULA RAILWAY.

QUESTIONS.	NAGPORE BRANCH.			
	Mr. Sletor, <i>Resident Engineer.</i>	Mr. Whyte, <i>Resident Engineer.</i>	Mr. Warren, <i>Resident Engineer.</i>	Mr. Dangerfield, <i>Resident Engineer.</i>
15 Where the road is laid partly with pot sleepers, partly with transverse sleepers, comparative cost in detail of all labour and material in renewal and up-keep of each class of road for the years 1867-68?	No replies can yet be given to queries 14 and 15, as pot sleepers have only recently been delivered on the Division, and were being laid. They are used in intermediate or where required between ordinary sleepers.	As I am merely reviewing, this question, I am hardly as yet in a position to reply. I have not had to increase my permanent way gauge for these renewals. I believe the expenses are nearly the same when the value of interest and spikes received are allowed for. There has been no additional cost in up-keep as yet.	To answer this question requires an experience of two roads under similar conditions, one laid with pots, the other with transverse timber sleepers. The cost of labour in up-keep would probably be from 10 to 20 per cent. more on a pot sleeper road than on one well laid with transverse timber sleepers, but the cost of labour is a very small item in the cost of maintenance.	The whole of the road was originally laid with wood sleepers. The oval pots have been used for new-als indiscriminately; no detailed information can therefore be given to this question.
16 Opinion of the Chief Engineer: opinion of the Locomotive Superintendent, as to each class of road?		The transverse sleeper road is the best, the safest, and gives the least vibration, and is certainly to be preferred in every country where good timber is to be had at a moderate price. In this part of India however, as teak sleepers,	I think a good squared timber sleeper with 10-inch bed makes a smoother and better road than the pot sleeper, and is less trouble to keep up, but for this country I should prefer a good pattern pot (such as that we now have) to timber, owing to the rapid decay of the latter and the diffi-	Only a short length of pot sleepers has as yet been laid on my District.
				Mr. Ramsden, <i>Resident Engineer.</i>
				Mr. Breton, <i>Chief Engineer.</i>
				Mr. Devan.
				CONCAN AND DECCAN.

(8)

which (every thing being taken in consideration) are the cheapest to be laid, and are extra gaily dead; a substitute must be found in the iron sleeper where practicable. This sleeper has been found to answer well where the road is good and well supplied with consolidated gravel ballast. They cannot however be used for points, crossings, level crossings, &c., and are not suitable for sharp curves, but on the whole I would recommend their adoption in Guzerat or any similar country. One circumstance may be mentioned connected with them:—they are not likely to be stolen.

act independently of the other as is the case with a pot sleeper road in case of accident by engine or vehicle damaging the rails, a pot road is damaged to a most serious extent, whereas a wooden-road retains but little injury. There is also a greater chance of accident from scour during heavy rains on a pot road than on a wooden-road.

culty of procuring suitable ballast except at increased cost.

The Greaves' pot sleeper hitherto so largely in use on this Railway. It can be used with sand, gravel, moorum, stone, or small broken stone ballast, and is packed as easily almost as the timber sleeper. It can be laid with great ease and rapidity. The breakages have hitherto been very small even where broken-stone ballast of too large dimensions have been employed. For the first year or two the rectangular timber road is with broken-stone ballast an admirable road. Its elasticity and resistance under the rolling loads is almost perfect, but with the extremes of atmospheric action decay is sure and more or less rapid, and it is most difficult to ensure perfect picking of the timber. Most of the crested pine sleepers we have had showing a depth varying from 1 inch to 1 inch only of creosote, whereas the picking should extend to the full depth of the spike holes.

(9)

(10)

BOMBAY, BARODA AND CENTRAL INDIA RAILWAY.				GREAT INDIAN PENINSULA RAILWAY.			
QUESTIONS.	NAGPOOR BRANCH.			NORTH-EAST LINE.			CONCAN AND DECCAN.
	Mr. Sletor, Resident Engineer.	Mr. Whyte, Resident Engineer.	Mr. Warren Resident Engineer.	Mr. Dargenfield, Resident Engineer.	Mr. Ramsden, Resident Engineer.	Mr. Breton, Chief Engineer.	Mr. Dewar.
1. Limit of speed found requisite on the iron road to prevent injurious wear to the rolling-stock from vibration, &c., &c.	As trains can travel at 50 miles an hour over Adams No. 1 Road, I assume that the same if not a higher speed could be attained on a pot sleeper road without extraordinary or injurious wear, &c.	I consider trains ought not to exceed 30 miles an hour, particularly with the heavy engines in use.	The speed of trains has not been reduced since the partial introduction of pot sleepers on this Railway.	I have not known any necessity for making any difference in the speed whether running on a pot or wood sleeper road.	No information.	The life of a teak, sal, or pine wood sleeper is therefore collectively more or less restricted, whereas the life of an oval pot sleeper above alluded to is unaffected by the action of the weather, and though breakages will occur from the vehicles leaving the rails by accident, such contingency is neither of frequent occurrence, nor a heavy item of cost. An iron pot road can be lifted with ease for the purpose of packing the road during maintenance; whereas, where the timber road has begun to decay, the spikes are apt to draw under the leverage employed. The old fashioned Greaves' pot road is not a satisfactory one. It does not give so good or true a bearing, and it is wanting in the hard wood cushion under the rail which is absolute.	The vibration is not greater than on a sleeper road.

CIRCULAR No. 23 RAILWAY.
GOVERNMENT OF INDIA.
PUBLIC WORKS DEPARTMENT.
RAILWAY

To

THE SECRETARIES TO THE GOVERNMENTS OF MADRAS, BENGAL, THE NORTH WESTERN PROVINCES AND THE PUNJAB; THE CHIEF COMMISSIONER OF OUDH, AND THE RESIDENT AT HYDERABAD.

SIMLA, SEPTEMBER 2, 1869.

SIR,

I am directed to forward, for information and careful consideration by both Government and Railway Officers, copy of the papers noted in the margin regarding the successful results which have attended the use of cast-iron bowl-sleepers on the Railways in Bombay.

(Signed) R. STRACHEY, Colonel, R. E.,
Offg. Secy. to the Govt. of India.
C. E.,
Asst. Secy. to the Govt. of India.

To the Secretary to Govt. of Madras
Railway Department.

1007. 1069 Dept.

GOVERNMENT OF INDIA.
PUBLIC WORKS DEPARTMENT.
RAILWAY.

77. 1075.

To

THE SECRETARIES TO THE GOVERNMENTS OF
MADRAS, BENGAL, THE NORTH WESTERN
PROVINCES, AND THE PUNJAB; THE CHIEF
COMMISSIONER OF OUDH, AND THE RES-
IDENT AT HYDERABAD.

CIRCULAR No. 23 RAILWAY.

Dated SIMLA, September 2, 1869.

Received *" 27 "*

Howe

No 3335 995

No 3335-16th Oct^r 1869.

Forwards, for information and careful consider-
ation, copy of papers regarding the successful
results which have attended the use of cast-iron
bow-sleepers on the Railways in Bombay.

P. W. D. Press—14-9-69—137.

With an order

*to
Com. Engrs for
Railways
for
16th Oct 1869
Start at 10 AM
16th Oct 1869
Commenced to the
Cantonment Engineer*

2294 Sept 14. A. G. C. S.

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Cart of 1869, Madras.

PUBLIC WORKS.

The Consulting Engrs.
for Railways.



16th Oct, 1869. 3335.

Nos. 316-317

Cart. from the Hon. C. S. S. (Ry) Co.
Circular from the Hon. C. S. S. (Ry) Co.
a copy of certain papers regarding
the successful results which have
attended the use of Cast-iron
Pond. Sleepers on the Railways
in Bombay. And also the
Circular.