asphalt mixture will carry practically every kind of traffic. With a cheap local supply of bitumen of fair but somewhat inferior quality, an absorbent limestone will often make a very satisfactory pavement for carrying light traffic. Sands which are lacking in fine or coarse particles can frequently be brought up to the proper standard of grading by the addition of fine or coarse unweathered crusher screenings.

Summary.—Sand should be clean grained, hard and moderately sharp. The grains should be chiefly quartz and should have rough pitted surfaces. If necessary, as will usually be the case, the proper mesh composition or grading must be obtained by the mixing of several sands or possibly by the addition of unweathered crusher screenings. In the ordinary type of sheet asphalt pavement the presence of clay is undesirable, either as a coating to the grains or disseminated throughout the mass. For medium and heavy traffic pavements all particles retained on a 10-mesh screen should be discarded. For light traffic three to five per cent. of 8-mesh particles can be incorporated in the pavement with advantage. Sands containing a large percentage of flinty grains should be avoided.

Gravel should be clean grained, hard and free from adhering clayey particles. It is lacking in stability owing to the roundness of its particles and is usually considerably improved by passing it through a crusher. Gravel with a rough pitted surface is to be preferred and gravel containing a large percentage of flinty particles is to be avoided. Unsuitable for the construction of pavements carrying heavy traffic and inferior in all respects to crushed stone.

Slag. Hard, dense basic slag is to be preferred. Should be stable when exposed to weather and not show any tendency to slack or disintegrate. Only suitable for light traffic and should preferably be coated with a very fluid bitumen.

Broken Stone. Should be freshly crushed, preferably in cubical shaped particles. Size and hardness required depends upon the traffic which the pavement is to carry. Dense, hard limestone will carry medium and light traffic satisfactorily. When the traffic, though light in volume, is composed of heavy iron-tired units, a dense, hard trap is required. Trap is now comonly used for asphalt block manufacture, although in the past a large number of asphalt blocks made from limestone gave excellent service under light traffic. Granite is not usually satisfactory, as it is too coarse and uneven in texture and much of it is friable and it is liable to shatter in crushing. Mesh composition just as important as with sand. Not suitable for use in pavements carrying very heavy traffic.

RAILROAD EARNINGS.

The following is a record of the transcontinental railroads' gross earnings for the first three weeks of January:—

Canadian Pacific Railway.

	1916.	1915.	
January 7	$1,874,000	$1,316,000	+ $558,000
January 14	1,863,000	1,321,000	+ 542,000
January 21	1,910,000	1,391,000	+ 519,000

Grand Trunk Railway.

January 7	$ 880,702	$ 753,522	+ $137,180
January 14	966,301	779,745	+ 186,556
January 21	980,914	795,830	+ 185,084

Canadian Northern Railway.

January 7	$ 541,100	$ 315,700	+ $225,400
January 14	469,300	349,300	+ 120,000
January 21	504,000	322,600	+ 181,400

THE ACTIVATED SLUDGE PROCESS OF SEWAGE TREATMENT.

IN *The Canadian Engineer* for December 2nd, 1915, there appears an abstract of an International Engineering Congress paper on "Disposal of Suspended Matter in Sewage," contributed by Mr. Rudolf Hering, D.Sc., of New York. We are now able to present a very able discussion of this paper, submitted by Dr. Gilbert J. Fowler, of Manchester, who replies to some of Mr. Hering's comments in an interesting way that will be appreciated by many of our readers who have been closely following our articles and references to the activated sludge process of sewage treatment.

Dr. Fowler states that experience at the Withington sewage works of the Manchester corporation bears out much of what Dr. Hering has stated in regard to the operation of the Imhoff tank. The necessity for periodically stirring the scum is a somewhat serious matter; if mechanical agitation is to be used it will introduce complication and cost. The statement that exposure to the air tends to increase putrefaction, appears *a priori* open to question, and he would like rigid scientific evidence on the point. His experience with the Imhoff tank has confirmed him in his belief that the final solution of the sewage problem is not to be found in processes involving anaerobic action but on the lines of aeration, putrefaction being avoided at every point.

The history of the development of what has come to be known as the "activated sludge process" is carefully given in the first paper by Messrs. Ardern and Lockett (Jour. Soc. Chem. Ind., No. 10, Vol. xxxiii., May 30th, 1914.)

The articles which have recently appeared in American technical journals, describing experimental work at various centres, are clear evidence that the work of the English investigators marks an advance on anything previously accomplished.

It is a matter for satisfaction that the interchange of scientific work on both sides of the Atlantic should eventuate in progress for the general good.

The question of priority where so many workers are involved is of small importance in itself. When, however, statements are made by Dr. Hering and others which obscure the scientific understanding of the process, it is important that they should be corrected.

It is quite true that he (Dr. Fowler) was much impressed by Mr. Clark's work at Lawrence, and to the Massachusetts workers is due the idea of building up by prolonged aeration of successive quantities of sewage a growth which would rapidly purify sewage in the presence of air. But the question of expensive surfaces, difficult to construct and handle, still remained and because of this the possibilities of the process were not favorably considered by the Metropolitan Sewerage Commission with whose president the matter was carefully discussed. The writer, therefore, returned from New York considering the problem of how to bring about purification in open tanks with, at any rate, the least possible addition of costly chemical precipitants. The idea of adherent growths was therefore abandoned in favor of some process of bacterial or enzymic activity, a line of thought which had previously been present in the mind through a suggestion by Dr. Maclean Wilson (Jour. Soc. Chem. Ind., No. 23, Vol. xxx., p. 1348, 1911.) From this line of thought was developed what has come to be known as the "M7" process, which was described in a paper by the writer and E. M. Mumford at the Congress of the Royal Sanitary Institute at Exeter in July, 1913.