The materials most generally used are Broken Stone, Furnace Slag, Gravel, Burnt Clay, Cinders and Earth.

Definitions.

Broken or Crushed Stone.—Stone broken by mechanical means into small fragments of specified size.

Gravel.-Small worn fragments of rock, coarser than sand, from natural deposits.

Sand.—Any hard granular rock material, finer than gravel or coarser than dust.

Cinders.—The ashes or residue from coal used in locomotives and other furnaces, including the sparks from the front end of locomotives.

Slag.—Waste product. A more or less vitrified form of furnace reduction of ore. This to include the granulated slag formed by dumping hot slag into water or any other product of a blast furnace, iron, copper or lead.

Burnt Clay.-Clay of gumbo, which has been treated with fire.

Mud Ballast.—Any natural material used as ballast, which, when well drained, will not churn under the ties.

Description.

Broken Stone.—This in general is considered the best material for ballast, as it meets the requirements; does not f.e.ze nor heave in cold weather, and can be worked in wet and dry weather alike. Almost any hard building stone may be used, provided it breaks with an angular fracture and not into thin, flat pieces. Granite, trap, limestone and flint are mostly used.

Gravel.—This material is more used than any other and is a varying quality. It may be sandy, dusty or loamy, or else full of large stone, which, unless removed, will make an irregular and rough riding track. The best gravel should be clean and coarse, and as far as possible of uniform size and quality. It does not give as good drainage as stone, tut a fairly coarse and clean gravel generally proves satisfactory, provided plenty of it is used.

Sand.—This, when clean, sharp and granulated, makes fairly good ballast under light traffic, but unless it is very coarse requires constant attention and renewal, involving a great deal of maintenance work, as it runs out from under the ties and is gradually weathered away by the action of the elements. Where gravel or sand ballast is full of dust it should be provided by a top dressing of coarse cinders or coarse stone screenings, so as to avoid dusty track.

Slag.—Furnace slag or cinder is commonly used on roads in the vicinity of blast furnaces and iron works. Coarse slag is about as durable as broken stone and in some ways almost as good, except that the ties decay more rapidly from dry rot than in stone ballast. At the present time slag from blast furnaces and iron works is being furnished in granulated shape. This is done by dumping the slag into water, the product of which, when taken out, is similar to and about the same quality as sand ballast. When first placed in the track it is very dusty, but the repeated rains relieve this condition. Its drainage qualities are much better than that furnished by sand ballast.

Burnt Clay.—This is being used in England and other foreign countries; has extended to this country and is being used extensively in the West. The most suitable is brick clay, or almost any clay that has not too much sand, gumbo, or clayey earth. Burnt clay is very light and is about equal to screened locomotive cinders.

Mud Ballast.—Dirt, earth and mud are used, the ballast being composed of natural soil along the road. This is the cheapest material to be used and generally the most troublesome to maintain. It is of a variable quality, from sandy to clayey. Unless very sandy, cakes in hot weather and when any work is done it becomes intolerably dusty. In the winter it heaves badly by frost and in rainy weather it washes out and in continued wet seasons, or in the spring, when the frost is coming out of the ground, it becomes so soft that it is almost impossible to keep track in safe condition, as the ties churn the saturated roadbed into mud. In other words, good mud ballast is a continuous performance, every day in the year, Sundays included.

SPECIFICATIONS.

Broken Stone,

Broken stone ballast shall be made from stone hard enough to prevent pulverizing under the treatment to which it is subjected, also durable and tough enough to resist the disintegrating action of the elements where it is used, or from other stone, acceptable to the Engineer.

When crushed it shall break into angular pieces and the maximum size shall not exceed pieces which will pass through a revolving screen having two (2) in. holes, and the minimum size shall lie on a revolving screen having three-quarter (34) in. holes.

Stone shall be crushed in suitable crushers; be clean and free from all dust, rubbish, dirt and particles threequarter $(\frac{3}{4})$ in. in diameter and under. If crushed by hand, the stone should be broken in clean places especially selected for the purpose.

BALLAST.

Stone Screenings.

Stone screenings shall be made from the same quality of stone as stone ballast, as it is a by-product of the crusher. The maximum size shall not exceed pieces which will pass through a revolving screen having three-quarter $(\frac{3}{4})$ in. holes and the minimum size shall lie on a revolving screen having one-quarter $(\frac{3}{4})$ in. holes. The product shall be free from all dust, dirt, rubbish and particles that will pass through a one-quarter $(\frac{3}{4})$ in. ring and under.

Cinders.

Cinder ballast shall be free from ashes, dirt and rubbish.

Slag.

Slag ballast shall be free from lime, dirt and rubbish, and the product from the mill, if not quenched in water, should be broken into pieces which will pass through a revolving screen having two (2) in. holes, and the minimum size shall lie on a revolving screen having three-quarter $(\frac{3}{4})$ in. holes. If slag is quenched in water to form granulated slag, this product shall be free from dirt, lime and rubbish, or any material that will not pass through a two (2) in. ring.

Gravel.

The best should be clean and coarse, free from dirt, dust, marl lime, and stone that will disintegrate under the action of the elements, and should range in size from two (2) in. in diameter to coarse sand. Gravel should be screened or washed where prevention of dust is an object, but this need not be done when the traffic is such that it is not objectionable.

Sand.

Fine gravel or sand ballast should be free from dirt, rubbish, marl lime and pebbles that will disintegrate under the action of the elements, and should range in size from two (2) in. in diameter to fine sand, a portion of about 75 to 80 per cent. to 20 and 25 per cent. of coarser material.

Burnt Clay.

This ballast should be made of clay free from sand or silt. The clay should be burnt hard and thoroughly. The fuel used should be fresh and clean enough to burn with a clean fire. Ballast should be allowed to cool before loading.