business street at the returns for the cross streets, run the pavement surface at the gutter line to the curb corner at a depth of about 4 to 6 in. below the top of the curb; thence around the curb corner to the catchbasin inlet, located about 70 ft., more or less (depending on the grade) from the curb corner, at a depth of about 8 to 10 in. below the top of the curb. This eliminates any step for the main lines of pedestrian traffic along the business street, but does present a 6-in. step to those crossing the business or car line street. This tends to cause pedestrians to hesitate before crossing a busy street, and affords a smooth, full width of roadway for the vehicle traffic along the direction of the busy street.

Fundamentals of Construction.—The construction of roads can be divided into five principal parts, as shown in Table IV., which gives the comparative costs and life of the various components.

Table IV.

	Cost per cent.	Life in years.
1. System of drainage (sewers, inlets, ditches, culverts)	10-20	20-100
2. The earth subgrade	10-30	20-100
3. The foundation	20-40	10-50
4. The wearing surface	20-50	2-30
5. *Maintenance	5-50	

*Maintenance ought to be included as an element of cost, and, while chargeable almost entirely to the wearing surface, may operate to reduce the average cost of such wearing surface because of prolonging its life.

There are but two approved forms of foundation construction; namely, macadam (including telford) and concrete. The thickness and quality of the foundation must be based on the maximum loads to be supported, and the amount of pressure which the subgrade will bear, together with the inherent structural resistance of the material composing the foundation. If it is assumed that 30 per cent. of the total weight of a vehicle is transmitted by each rear wheel, and a 30-ton auto truck is to be provided for, then we can expect a pressure of nine tons across the area of contact of tire of approximately 9 x 6 in., or 54 sq. in.

In the case of macadam, the lines of pressure fall within lines making an angle of about 45° with the surface, due to the interlocking of the stones. The area distributing pressure on the subgrade varies directly as the square of the depth or thickness of the foundation plus part of the thickness of the wearing surface. Hence a thickness of 12 in. would support on a given subgrade about four times as much as a thickness of 6 in. Since a dry, well rolled subgrade will support more than a wet subgrade, the question of adequate drainage, as opposed to increased thickness of foundation, must be considered. Design can be based on rational principles, and, if not, then it should be based on direct investigation at the site in question.

In the case of a concrete base, the failure is more likely to be due to shear than to tensile failure under beam action. The strength of a concrete base varies directly as the square of its depth. Definite information is needed as to the strength of concrete under the daily stress of use. A coefficient could be determined by experiment, by laying, say, a 2-in. and a 4-in. base and subjecting them to various loads at known speeds. With such knowledge we could design more intelligently. Is a 6-in. concrete base of 1:3:6 mix on an undrained clay soil strong enough to resist the trucks; if so, with what factor of safety? If not, what is the economical thickness? It is commonly assumed that a 6-in. concrete base is equal to a 12-in. macadam base, but is this true?

Conclusion.—The engineer often has too little experience to decide as to the more desirable type of pavement, as well as to the elements of its construction. In this case he should be advised by competent specialists. Often, though able, he is not consulted, and the public, with its opinion crystallized by the happy assurances of the elusive promoter, adopts a kind of pavement not suitable to the conditions.

It is often necessary to vary the kinds and types of pavement to suit various conditions on the single job. Standards and uniformity, while easy to specify, must be modified to suit definite conditions. A specification, which is successful in one locality, may be a failure in another; due to climate, traffic, grades, poor subgrade, and inadequate experience and equipment of the inspector and contractor.

An engineer, in recommending an improvement, should give the reasons for the type of design adopted and for the kind of construction deemed best for the stated conditions. When the authorities welcome, or rather demand, this of us, then we can furnish, or secure, competent counsel which will in time be appreciated by the public. As the public reposes more confidence in the engineer, which the engineer in turn will merit by rational study, popularly explained, it will be possible to build pavements in a fair, intelligent and economic way. Then the present alleged safeguards usually present in the typical specification, such as contractors' guarantee, irresponsibility of the specifications to secure the desired product, uncertainty of quantities and ignored contingencies, will disappear. Where the contractor must shoulder all these omissions or commissions of the so-called "standard specification," let it be known that the public pays dearly for their relief of responsibility.

Since the engineer is the agent of the public he should be given the power to specify the best suitable construction and be afforded the support and means of securing it. The specification should be definite and if the contractor executes his work in strict accordance with the specifications he should be relieved of any responsibility or guarantee. Since the contractor is not consulted in the drawing up of the specification he cannot logically be held to account for their insufficiency. The engineer's position and duty is a peculiar one—he must protect the public by requiring good work, and must aid the contractor in securing it. To this end he should know definitely what he is doing, and how it should be done, although he has no right, under conditions where the contractor guarantees the work, to insist on his method being followed. The engineer's responsibility is vague under prevailing conditions, which places him continually in an awkward position, exposed to criticism from both parties—the unthinking public and the unsympathetic contractor.

Between 50 and 60 tons of tailings are being treated daily at the cyanide plant of the Porcupine (Ont.). Crown Mine. These tailings have an average gold value of $3.15 per ton, which gives a net return of $2. The company is enabled to go on with the treatment of 15,000 tons of these tailings. The cyanide plant is capable of treating 150 tons, but at present the output of new ore has been cut down to 75 tons each day. With the tailings this keeps the cyanide plant going at its full capacity.