

- (7) As they contain no joints, no dirt can collect on the surface and they are therefore easily cleaned.
- (8) All the materials are easily procurable.
- (9) They are durable under ordinary traffic.

Against these qualifications are set the following disadvantages:—

- (1) The noise produced under team traffic.
- (2) The cracking and consequent disintegration due to their expansion and contraction under extremes of temperature.
- (3) Their injurious effects on horses' hoofs.
- (4) The difficulty of maintenance, it being hard to perfectly join up new concrete with old concrete which has been set for some time.
- (5) It is not sufficiently resilient and elastic.
- (6) Its rigidity is not calculated to withstand the constant blows of horses' hoofs or the heavy impact of motor trucks.

When, however, some of the above drawbacks have been overcome or minimized there is no doubt that concrete roads will be a more marked feature in highway construction in the near future. "Hassam" is a patent form of concrete pavement from which it differs principally in that the rock aggregate of the pavement is laid and rolled instead of being mixed along with the cement, etc., and the cement grout poured into the stone until the voids are filled. When confined to streets with light traffic, where there is no vibrating and impounding action of street cars, etc., it appears to give fairly satisfactory results, but unfortunately it has been laid on business streets of which the subgrade is chiefly composed of "made" ground and therefore has been unable to withstand the heavy compressive, as well as tensile, stresses to which it has consequently been subjected.

Dolarway.—As in other matters, so in pavement. Necessity has been the mother of invention. Dolarway was invented or the idea conceived of applying a thin layer of liquid bitumen to a concrete surface, and sprinkling coarse sand thereon. Such a precaution is alleged to reduce the contraction and expansion common in ordinary types of concrete pavement, by protecting it from the alternating influences of temperature. This so-called wearing surface also reduces the noise, presents a better and more beautiful appearance, saves the horses' hoofs and tends to add to the life of the pavement. The effective results of such treatment are, however, very questionable, the bituminous layer being too thin to afford the necessary elastic, resilient and durable surface, particularly on streets with heavy mixed traffic.

Asphaltic Mixture Pavements.—Under this head are included "bitulithic," "asphaltic concrete" and "sheet asphalt." The latter pavement, not being generally adaptable for rural highways, need not be discussed.

Bitulithic and asphaltic concrete pavements can be laid either on a concrete base or a rock base, the typical bitulithic being chiefly laid on the rock base. The composite parts of the wearing surface of both pavements are very similar, being stone, sand and bitumen. But they are dissimilar in that the sizes of the stone used and the grading of the stone vary greatly. In the case of bitulithic the crushed stone is carefully graded in predetermined proportions, scientifically and mechanically mixed in special paving plants, and the mixture spread on the rock or concrete foundation and carefully rolled to afford a compact wearing and waterproof surface. Asphaltic concrete is similarly prepared with different sizes of crushed stone and similarly applied to the foundation. Al-

though the results produced are not quite alike, the objects aimed at in both classes of pavement are closely akin, and while the typical bitulithic pavements have been in longer use than the generality of asphaltic concrete pavements, the latter are becoming more popular and acceptable because they are unpatented and are, therefore, cheaper in first cost. Now that portable or semi-portable paving plants are in vogue, the use of such pavements has been generally extended to the construction of bituminous concrete roads in rural districts. As such pavements approach nearest to the theoretical and practical conception of a first-class pavement and are particularly adapted to country highways, they are destined to be more adopted than brick, concrete or dolarway pavements. Such bituminous pavements appear to meet the urgent demand for special highway construction, not excessive in first cost, of great durability, and of pleasing appearance, made imperative by the general adoption of automobile and motor truck traffic. As they have met with very favorable results when laid on a rock foundation, an existing macadam road which has proved to be no longer serviceable for the traffic it has to withstand can be readily and easily transformed into a fairly permanent paved highway at comparatively less cost than other types of pavement laid on a concrete foundation. The *modus operandi* in converting a macadam road into a paved highway chiefly consists in scarifying the existing roadbed, to reduce the crown and afford a bond for laying of additional medium sized rock. The new foundation thus created is consolidated by careful rolling and coated with bituminous paint, upon which is applied usually a 2-inch wearing surface as mixed in the paving plant. Provided always that the materials, mixing and workmanship are all equally good, asphaltic mixture pavements are claimed to be the best adapted for general city work and for use on rural highways. While the perfect pavement to suit all conditions and circumstances has not yet been devised, bituminous pavements approach nearest to the theoretical and practical type of pavement, inasmuch as all the ingredients used therein are natural mineral products, to the grading and mixing of which all the available skill of the laboratory has been applied. Briefly, such pavements possess the following advantages: Durability, resiliency, elasticity, noiselessness and dustlessness. They have a good appearance, are sanitary and can be easily cleaned. In most circumstances they afford good foothold for horses. As regards cost, they are cheaper than most pavements and, taking the cost of maintenance into account, they are cheaper than almost any type of pavement.

The American Society of Municipal Improvements will assemble in Wilmington, Delaware, October 7-10, 1913. The society has for its purpose the dissemination of information concerning municipal departments and municipal works construction and the promotion of improved methods in management.

The question of the disposal of refuse is dealt with in a vigorous and popular way in an illustrated pamphlet, now in course of publication by the Commission of Conservation. The commission is asking the co-operation of the medical health officers in the various towns and cities throughout the country in distributing this pamphlet, and it is hoped the demand for it will be as large as the importance of the subject merits. Pamphlets may be secured gratis by all bodies or persons interested, by applying to the secretary, Commission of Conservation, Ottawa, Ont.