

where the material is of the proper consistency. Provided that the distillation has been properly conducted, he then retains in his product substantially all of the heavy oils originally present in his crude, and all of the various hydrocarbons will be in complete solution. If he desires to reduce the susceptibility of the asphalt cement to temperature changes, he can do this by oxidizing the product (usually by means of air) during the distillation process. Such oxidation is, however, always accompanied by loss in cementing value, and must be very carefully regulated. On the other hand, he may, if he desires, carry the distillation further and produce a harder asphalt and flux this, preferably while still hot, with a suitable flux prepared in a separate operation in another still. By using a flux prepared from a different crude, or by special treatment of a flux prepared from the same crude, it is possible for him to produce an asphalt cement having different properties from that which it would be possible for him to produce from a single crude in a single distillation.

The cost of the asphalt cement prepared from the hard asphalt fluxed back would usually be somewhat higher than that of an asphalt cement prepared from a single distilling operation. Depending upon the characteristics of the crude used, and the purpose for which the asphalt cement was intended, one product or the other might be the more desirable.

The refiner who sells asphalt cement made from a hard native asphalt is, of course, obliged to flux his product. He may either produce or buy his flux, and vary the character of the flux used in accordance with the use to which the asphalt cement is to be put. Assuming that his crude hard asphalt is of constant composition, he must depend upon varying the character of his fluxes in order to produce asphalt cements having different characteristics. If he uses various kinds of crude asphalts, he can, of course, vary his product in this way also.

Both classes of refiners will be affected in the same way by the cost of packages. If it is to be shipped in barrels, these will cost less for a hard asphalt than for a ready fluxed asphalt cement.

Tank cars would not be advisable for use in shipping hard refined asphalts, as they would require too long a period of steaming before the asphalt would be sufficiently softened to permit of being pumped out. They are very useful for shipping asphalt cements, but are quite expensive. Once acquired, however, the necessity for a barrel-making equipment is eliminated, and the freight charges on shipments are considerably reduced by their use. Careful track must be kept of them to insure their prompt return.

From the standpoint of the contractor, much will depend upon local conditions. Some specifications call for certain hard asphalts to be used. If it is necessary for him to procure these from a great distance, and there is available a cheap local supply of suitable flux, it will obviously be much cheaper for him to obtain his flux and asphalt separately. Even where the specifications give him the option of purchasing any of the standard asphalts or asphalt cements, conditions similar to those above described will usually make it to his advantage to buy flux and asphalt separately. Under competitive conditions, the municipality will practically always reap the advantage of cheap buying of raw materials by the contractor.

Where the contractor's plant is small, and the work to be done is limited in area, the cost of paying demurrage on a tank car until he had used up its contents would be a considerable item for him which might more than offset the reduced price of the asphalt in tank cars as compared with the price in barrels. Where the plant is situated at a distance from a railroad, tank car shipments are

obviously in many cases impracticable. Under these conditions the frequent advantage in price of buying ready fluxed asphalt cement in tank cars is lost. When municipalities buy their asphalt from refiners situated at a considerable distance, and where cheap local supplies of a suitable flux are available, a ready fluxed asphalt cement will almost always cost them more than if they bought their asphalt and flux separately. Cost of plant operation is also an important factor. Under certain plant conditions a higher priced, ready fluxed asphalt cement might result in an increased output at a lower cost than if hard asphalt and flux were used. This would not apply, however, to a well-equipped stationary plant operating under normal conditions.

From the standpoint of the public and the life of the pavements, there is probably little to choose either way. As already shown, the majority of asphalt pavements have been laid with an asphalt cement made by the contractor at his paving plant by fluxing a hard asphalt. No evidence exists to show that better pavements are laid by obtaining the asphalt cement direct from the refinery.

It may be argued that refiners generally are better equipped, have a more competent staff and do their fluxing on a large scale. Fluxing, however, is not a difficult operation and does not require any high degree of skill, and the handling of the kettles during the fluxing operation is not markedly different from the procedure employed when a ready fluxed asphalt cement is used. With an incompetent contractor, having no supervision, it would perhaps be better to call for a ready fluxed asphalt cement, but this would be only a partial safeguard, as he would be very likely to injure it by overheating. Assuming that the contractor and his workmen are skilled (and unless this is the case it is folly to award him a contract for asphalt paving work), there is no reason why just as good results should not be obtained by permitting him to flux a good hard asphalt at his plant with as suitable a flux as would be obtained if he purchased a ready fluxed asphalt cement from the refiner.

All ready fluxed asphalt cements are not good any more than are all hard asphalts good. Modern specifications describe the fluxing methods to be used, and limit the kinds of flux and asphalt and asphalt cement which may be employed, and if work is properly and intelligently carried out under them, the question of whether the asphalt is to be fluxed at the plant or at the refinery, or to be made into an asphalt cement by a single distillation process, is largely an economic one.

Where the contractor does his own fluxing, the flux used and the method of using it are usually much more under the supervision of the engineer than when fluxing is conducted at the refinery. In all cases the flux used must be of such a character as to completely dissolve the bitumen of the hard asphalt, and the heating must be continued with proper regulation of temperature for a sufficiently long time to effect this result, and sufficient agitation must be used to thoroughly mix together the two ingredients.

Before using, the contents of each kettle or still at the paving plant or refinery must be tested to see that it is of the proper consistency. If too hard, more flux must be added; if too soft, more hard asphalt. It is, of course, assumed that exhaustive previous tests have been made to determine the quality of the asphalt cement produced by the combination of the hard asphalt and flux being used.

The procedure for regulating the quality and consistency is exactly the same whether the asphalt cement is prepared by fluxing a hard asphalt at the paving plant or at the refinery, excepting that at the refinery the operation is usually conducted on a larger scale.