

Your Best Defense In The War Against Potholes

The minimum 4" pavement thickness design

Through collaboration and observations shared with other pavement engineers an interesting and significant performance observation came up. Once a pavement is 3½" to 4" in thickness it cannot pothole (in the strict classical sense of the bowl-shaped pothole that loses pavement and is deepened and enlarged by traffic as the granular base is eroded).

In accordance with the information and test results reported by Martin Ekse, Volume 29, AAPT, 1960; W. Phang, Volume 50, AAPT, 1981; and WASHO Test Road Report, Part 2, Test Data, Analyses, and Findings; nine aspects of the 4" pavement design exist:

(1) 4" minimum pavement has more strength than AASHTO or other criteria indicated by straightline coefficient usage.

(2) Distress cracking in a pavement expands and multiplies rapidly when pavements are thinner. The cracking breaks the pavement into many small pieces. However, there is less fragmentation with 4" plus pavements. Also, rutting and waviness which reflect base material stress and freeze/thaw effects are virtually eliminated on 4" plus pavements.

(3) There is often a great deal of strain with a 2½" design due to construction traffic in site-work or subdivisions. In these situations it is common for the design to have a 1½" thickness carrying all of the construction traffic for several years. This initial layer gets easily overstressed and even cracked on the underside before it is topped with only an additional 1" wearing surface. On the other hand, with a 4" design a 2½" layer carries construction traffic adequately. A final 1½" layer provides a wearing and exceptionally strong strengthening course, providing much more strength and longevity to the pavement.

(4) With a 4" design pavement strength adjacent to utility cuts and castings is more substantial.

(5) Added strength acquired through the use of the minimum 4" design, provides a safety factor for traffic growth and occasional overload situations. This is particularly helpful when an owner may not have control of the traffic volume or the funds available to strengthen the pavement.

(6) A minimum 4" design provides a pavement that will require surface maintenance only. Pavement treatments can be limited to individual crack sealing, liquid seals, and very thin overlays — thicker overlays are required only when traffic growth calls for it.

(7) The 4" minimum provides sufficient thickness for recycling by milling. When milling 1" from a 2½" surface to a 1½" in depth, little stock is left for construction traffic to travel on.

(8) Better overall pavement quality and density can be achieved by using more compactible layer thicknesses. This leads to less embrittlement and greater retention of flexibility with time.

(9) Although 2½" designs have been shown in tests to be sufficient, it should be kept in mind that test road data always reflects better performance than actual practice.

When a 4" pavement is overloaded by traffic and cracks, the pavement is thick enough to resist disintegration into small pieces and to resist the type of flaking out at the crack that occurs on thinner pavements. This is why you will rarely see overnight potholing occur on a pavement greater than 4" thick. If distress is occurring, it will be evident for several years while remaining safe and serviceable. Only total neglect and lack of maintenance over many years will cause it to eventually break down into surface raveling. However, this surface raveling or delimitation only affects rideability and appearance. It is tolerable from a safety and auto damage point of view.

Once weakened, pavement thicknesses less than 3 to 4 inches can break into pieces and pothole very easily. This is because the pieces are small enough to be turned out by tire traffic. On thicker pavements (about 3½"+) the thick broken pieces act like big paving blocks and are virtually impossible to be rotated out of the hole by traffic. In other words, it fails but remains safe for traffic.

Thin pavements are sometimes best restricted to liquid asphalt surface treatments that require frequent maintenance treatments every few years. These asphalt surface treatments are only recommended

for very low volume roads, particularly those that do not have significant truck traffic. Such thin pavements must have excellent drainage designed into them and be diligently maintained throughout their service life.

Potholes in thin pavements rapidly get deeper and larger as traffic and water work them. They are the type that most seriously affect safety and cause more damage to autos. An additional problem is the need to overcome the use of poor minimum standards in subdivision control work and new work submitted by consultants. Some of these standards still call for thin surface treatments and pavement thicknesses less than minimums recommended for permanent pavements. The *lack of permanence* built into these new pavements means the municipality is accepting *greater annual maintenance*. This problem is compounded when some consultants use the same minimum standards on other municipal projects within the community and, worse yet, simply copy them to use in other towns as proper standards.

If standards are used, they must be reasonably conservative to cover the weaker conditions and unforeseen circumstances such as variance in soil conditions, construction quality, utility settlement and lack of maintenance when budgets are cut regardless of the pavement's condition.

For a low maintenance permanent pavement, the thickness used by most all agencies is at least 3 inches. The Asphalt Institute has a firm policy of recommending a minimum pavement thickness of 4 inches even for low volume roads.

According to The Asphalt Institute, the minimum permanent pavement thickness when using asphalt hot mix is 4 inches. The slab strength of a 4 inch thick pavement is substantially greater than that of a 2", 2½" or 3" pavement by many times: the load to produce a ¼-inch deformation on the base is only 400 pounds on a 2 inch pavement; 3,900 pounds on a 4" pavement.

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