largest observed asbestos fiber in the test filter (0.13 μm in diameter and over 1.2 μm long) was about the same size as was found on the background sample. The similar, low fiber content of both background and test filters precluded a fiber size distribution estimate. However, it appeared that the quantity of the larger asbestos fibers on the test filter was no greater than that of the background filter.

This supports the observation from the lining wear visualization tests that normal brake wear degrades most of the asbestos fibers. A brake lining grade of asbestos appears on the TEM as in Fig. 4. The fiber bundles are composed of strong, but weakly adhering fibrils of about 0.03 μm (roughly 1 μin) diameter. Mechanical action causes the larger fibers to "open" into smaller fibers or even fibrils, as illustrated in Fig. 5. Contrast these "raw material" fibers with one of the larger fibers (Fig. 6) and one of the more typical fibrils (Fig. 7) from the "normal use" test filter.

The similar, low fiber content of both background and test filters required clarification to permit an asbestos fiber count, thus providing more accurate fiber mass determination, but obscuring the actual fiber size distribution. Therefore, the calculations of fiber concentration (Table 1) were expressed as asbestos mass per unit mass of lining wear dust and asbestos mass per unit mass of lining worn. Asbestos fiber concentration in the ambient air (background) and in the brake exhaust air (test) was calculated in units of nanograms (ng = 10^{-9} grams) per cubic meter of air. However, the actual asbestos emissions from brake usage would be diluted substantially through mixing. The asbestos concentration in urban air due to brake usage was estimated based upon existing automotive exhaust lead dilution data. These calculations appear in Appendix C.

All the test results in Table 1 have been reported as ten times the calculated test values to allow for possible losses in

Fig. 4 - TEM image of chrysotile asbestos fibers

Fig. 5 - TEM image of partially opened fiber bundles

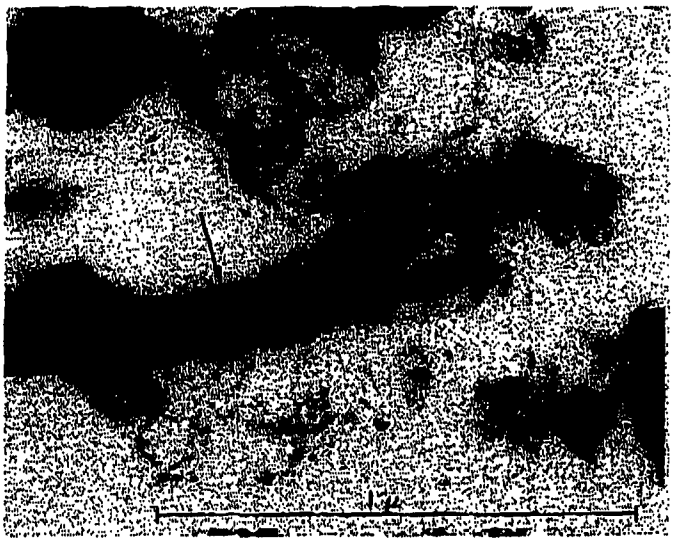

Fig. 6 - TEM image of fiber bundle on "normal use" filter

Fig. 7 - TEM image of fibril on "normal use" filter