

## CASE STUDY

# A21 SEVENOAKS AND TONBRIDGE BYPASS M25 INTERCHANGE

This bulletin describes the use of Pulverised Fuel Ash (PFA) as a load bearing fill on the A21 Sevenoaks and Tonbridge bypass in 1966 and also its use as a lightweight fill behind bridge abutments and below bridge seats.



### What is PFA?

PFA is the by-product of the pulverized coal burnt in the furnaces of most modern power stations. It is produced in the form of a very fine glassy powder varying in colour from cream to light grey. PFA has been used successfully for many years in motorway and road construction. Typical applications include load bearing fill, concrete and grouting.

### Site details

Parts of the by-pass were constructed directly adjacent to the base of the Hythe Beds scarp at Hubbards Hill, where Weald and Atherfield Clays outcrop.

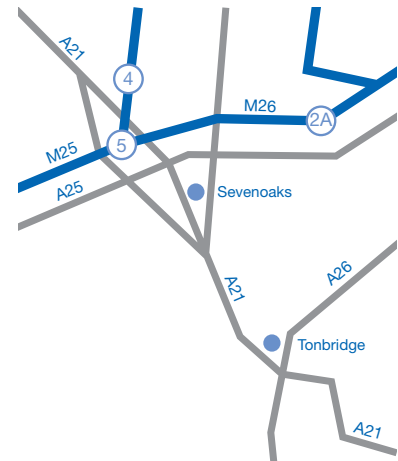
The area has been considerably affected by periglacial activity, landslips and valley bulging and is covered by a widespread solifluction sheet that extends for more than 3/4 mile from the escarpment.

Due to the presence of potential slip planes in the underlying geological discontinuities, a lightweight fill material was required to form the main embankment, which was keyed into the side of the escarpment.

In addition, the subsequent excavations prior to the construction of the embankment led to further site difficulties due to excess moisture in the cut material which prevented access and movement of plant.

### Why PFA?

By overlaying the existing saturated clays with semi-dry PFA, access for wheeled plant was made immediately possible because of PFA's ability to absorb the excess moisture from the surface of the clay. The PFA was laid and compacted in 150mm layers using standard earth moving equipment and vibrating rollers.



Full stability of the new embankment was provided by the high shear strength of the PFA giving adequate safety factors against slip plane failure in the underlying clay soils. In addition, the use of lightweight PFA fill was effective in reducing pore pressure in association with counterfort drains.

In addition, a stabilised PFA fill was used as a seat for the abutments of the Morants Court Road bridge, which crosses the M25 near Chevening. The stabilised PFA was placed on top of conventional PFA fill. Due to PFA's self-hardening properties, and its consequent gain in shear strength, there is negligible settlement when it is properly compacted close to its optimum moisture content. An additional benefit from PFA's self-hardening properties is the reduction in horizontal pressures on structures such as bridge abutments.

Following the delivery of ash to the site, care must be taken during compaction to ensure that the moisture content is in the range of 0.8 to 1.2 of the optimum level as determined by BS 1377. Best results are obtained if compaction is carried out immediately after delivery to achieve at least 95% of the maximum dry density.

A total of approximately 250,000 tonnes of PFA was used on the Sevenoaks project, the ash being supplied from at least 8 power stations.

An average compacted bulk density of 1280g/m<sup>3</sup> was easily achieved, which is less than that of most conventional fill materials. Road embankments built with PFA are relatively light in weight. On compressive, poor quality subsoils this can be important, effectively leading to reduced settlement and reducing the likelihood of shear failure. The Sevenoaks bypass works were carried out in the late 1960s where, in common with many other comparable road schemes before and after, PFA fill was specified and used for technical and economic reasons.

Since construction, the embankment has performed satisfactorily with no settlement occurring within the PFA fill or at embankment structure interfaces.

As a result of the successful use of PFA on the Sevenoaks bypass, a further 400,000 tonnes was used on the Tonbridge bypass in the early 1970s (modern power station ashes will produce higher bulk densities than ashes used at Sevenoaks).



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