UNITED KINGDOM QUALITY ASH ASSOCIATION

CASE STUDY

The use of Fly Ash Bound Mixture at Ratcliffe Power Station

Introduction

Like many coal fired power stations Ratcliffe Power Station owned by E.ON in Nottinghamshire is in the process of refurbishment and over the next few years will have new, more efficient boilers constructed and fitted. These will be produced in a purpose built factory area adjacent to the power station known as the Construction Laydown Area (CLA). In order to construct this, fly ash has been treated with lime and cement and then compacted to produce a large area of solid stable ground. Part of this area will be used by a large mobile crane, requiring a depth of 1m of treated fly ash in order to withstand the loadings expected.

Construction of the base

Fly ash was initially supplied direct from the power station and later from ash stockpiles to the CLA site using eight wheeled rigid vehicles. The fly ash was placed, then bladed to level and then treated with lime and cement. Lime was spread at 2% by weight on to the surface of the fly ash and the two materials mixed together to the predetermined depth. The resulting fly ash/lime mixture was compacted. The lime/fly ash was allowed to mellow for a period of ~48hours to ensure the lime had fully hydrated. Thereafter 6% cement was also rotovated into the fly ash and again compacted. This dual pass process lead to a solid hydraulically bound material known as FABM 5 achieving a 28 day compressive strength of 4MPa that is to be used for the base on which the various activities that will occur as the boilers are replaced. This enhanced material was then surfaced with a 100mm MOT Type 1 stone layer on which boiler operations will take place.

Figure 1 shows a view of the whole site, when the fly ash is being laid and bladed out to level. At this stage no lime or cement has been added. The only requirement is to keep the surface moist to prevent dust blow.

Figure 1 – Panoramic view of the Construction Laydown Area

Figure 2 shows the site before treatment, when only the topsoil had been stripped and the ground was being prepared for the fly ash lime operation. As will be seen it was a rather wet time of the year. Figure 3 shows fly ash being levelled after lime has been spread and rotovated into the fly ash. This is then trimmed to level.

Figure 2 - The site prior to any treatment, when only the topsoil had been stripped and the ground was being prepared for the fly ash lime operation. As will be seen it was a rather wet time of the year

Figure 3 - Shows the fly ash being levelled after lime has been spread and rotovated into the fly ash. This is then trimmed to level

Figure 4 - shows an area of fly ash being treated with lime immediately prior to rotovation

Figure 5 - Rotovating the cement into the fly ash/lime mixture

Figure 4 shows an area of fly ash being treated with lime immediately prior to rotovation.

Figure 5 shows the rotovator in action, mixing the cement with the ash, which is carried out after the lime and fly ash have had sufficient time to mellow. Finally Figure 6 shows the rotovated mixture being compacted. Thereafter subsequent layers of fly ash/lime/cement mixture are placed until the desired thickness is achieved.

Initially the fly ash supplied was freshly conditioned ash, which is water added to ash straight from the power station. However, due to the close proximity of the station to the site this material would arrive rather on the warm side and therefore prone to moisture variations. The correct moisture content is critical in getting full compaction and providing sufficient water to hydrate the lime and/or cement.

Figure 6 - Compacting the FABM 5

In order to alleviate these problems material was subsequently taken from the stockpiles, which had cooled and the moisture content stabilised. Thereafter no problems in placing and treating the area were found. In order to prevent dust blow problems, a water bowser was used in dry weather conditions to keep the fly ash moist at all times. The hydration processes with lime and cement both require the presence of water, so maintaining the fly ash in a moist state is important for the stiffness and strength gain properties.

Conclusion

Fly ash stabilized with lime and/or cement forms an excellent base material. Fly ash is readily available material and reacts pozzolanically with both lime and cement to form stable hydration products, enhancing stiffness and strength. It can be used in a wide range of Fly Ash Bound Mixtures as enhanced sub-grade sub-base and base with and without coarse aggregates, as described in UKQAA series of Technical Datasheets No.6. They are accepted for use in the Highways Agency's design documents and the Specification for Highway Works and covered within European Standards BS EN14227, specifically within Part 3. The specification for the fly ash is covered within BS EN14227 Part 4.

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In general usage the term 'fly ash' is used for pulverized coal ash but it can also cover ash from burning other materials. Such 'fly ash' may have significantly differing properties and may not offer the same advantages as ash from burning pulverized coal. UKQAA datasheets only refer to PFA / fly ash produced from the burning of predominantly coal in power stations.