



TECHNICAL NOTE

DATE:	27 June 2022	CONFIDENTIALITY:	Public
SUBJECT:	Coal Mining Risk Assessment P01		
PROJECT:	70057126 Windy Arbor Road Playing Fields Car Park	AUTHOR:	C Cooper
CHECKED:	B Thompson	APPROVED:	A Hallas

INTRODUCTION

Knowsley Metropolitan Borough Council (KMBC) requested WSP to update the Coal Mining Risk Assessment (CMRA) presented within WSP's Phase 1 Geo-Environmental Assessment [1] for the Windy Arbor Road Playing Fields Car Park scheme. The update is required to reflect project decisions made regarding mitigation of the coal mining risks identified and the proposed redevelopment works.

The redevelopment works comprise resurfacing of the existing car park, to include more formalised parking bays, designated disabled parking bays and soft landscaping

It has also been decided that no further ground investigation is to be undertaken to further assess the coal mining risks, as such works is considered to be prohibitively costly to a scheme of this size and nature.

On that basis, this Technical Note provides an update to the CMRA and should be read in conjunction with that assessment. In general, the data presented within the CMRA has not been reproduced here to avoid duplication.

SITE DESCRIPTION

The car park is located at the edge of Whiston Cross, at the junction of Windy Arbor Road and Lickers Lane, Knowsley, approximately 1.2km northeast of the M62/M57 motorway junction. The approximate NGR at the centre of the car park is E346880 N390510.

The site lies within a Coal Authority (CA) defined 'Development High Risk Area'. This is in relation to 'coal outcrops' and 'probable shallow coal mine workings' recorded within the site boundaries. The site is underlain by Made Ground over Glacial Till over Pennine Middle Coal Measures.

PREVIOUS WORKS

This section provides a summary of the CMRA undertaken as part of the Phase 1 Geo-Environmental Assessment [1], which includes a review of ground investigation information undertaken by others in 2020.

Based on the information reviewed as part of the previous works, significant mining activity has occurred within the surrounding area, although no firm evidence of mining activity within the site boundaries was identified. No evidence of below ground coal workings is recorded from the limited previous ground investigation.

Error! Reference source not found. within the Phase 1 Geo-Environmental Assessment provides a summary of the identified coal mining risks to the site, which are related to unrecorded *underground coal mining (probable at shallow depths)*.

The ground investigation undertaken in 2020 records shallow coal seams beneath the site. No evidence of shallow mining is recorded. However, the depth and number of deeper exploratory holes is limited (max. depth 10m bgl). Therefore, it was considered that the 2020 ground investigation provides only limited data on which to base an interpretation of the risk of shallow mine workings being present beneath the site and the risk cannot be definitively ruled out.

It was interpreted that there are likely to be areas of the site where there is insufficient rock cover above the seams to mitigate against the risk of surface movement if the seams have been worked and there is a future collapse. As a result, further consideration of the mining risk was identified and the following options were presented:

- Additional ground investigation to greater depths than those scheduled in the 2020 investigation (and covering a larger area of the site) to confirm the thickness of the coal seams and to provide further evidence as to whether they have been worked; and/or,
- The inclusion of a “soft cap” (i.e. incorporating high strength geogrid layer/s into the new pavement build up across the site) as part of the car park reconstruction works to limit the effects of any potential future subsidence beneath the site.

Subsequent to the CMRA being prepared, a project decision has been made to not undertake further ground investigation to assess the coal mining risks, and therefore the second recommendation (incorporation of a “soft cap”) has been progressed.

PROPOSED MITIGATION

The proposed mitigation measure to reduce the impact of potential future subsidence is to incorporate reinforcement in the form of geogrid within the subbase of the resurfacing works to form a “soft cap” beneath the car park. The design/specification of the geogrid within the “soft cap” is to be undertaken by a specialist supplier, based on the criteria presented in Table 1 and in accordance with the Scheme’s Specification and BS 8006-1 *Code of practice for strengthened/reinforced soils and other fills* [2].

It should be noted that this option is intended to prevent catastrophic failure of the car park surfacing (i.e. to prevent an open hole from forming at the surface) in the event that a collapse of shallow mine workings beneath the site occurs. It is not intended to prevent a collapse from occurring or prevent any expression of a collapse from reaching the surface (i.e. settlement of the surface above a collapse may occur). The proposed mitigation measure would not have an associated ‘*design life*’, as in the event of a failure occurring, remediation would be required. However, the products used should have a minimum 60-year design life.

Given the limited information available and the anticipated failure mechanism from the collapse of shallow mine workings, a maximum design void diameter of 1.0m has been adopted, based on engineering judgement and experience (although the possibility of larger voids cannot be ruled out).

A maximum allowable surface deformation of 100mm has been adopted for the specification of the geogrid to allow the car park to remain serviceable in the immediate aftermath whilst providing KMBC with sufficient time to safeguard the area and undertake further investigation/remedial works.

The geogrid will require anchoring at its extents. Given the full car park area is considered to potentially be at risk and the space constraints around the car park, it is considered likely that such anchorages are to be achieved by wrapping the geogrid back on itself rather than extending beyond the car park perimeter.

Table 1 Summary of design criteria for “soft cap” reinforcement design (to be undertaken by others)

Criteria	Value
Scheme end use	Surfaced car park
Area	Whole car park ~1600m ²
Fill depth above geogrid	Min 0.24m (i.e. pavement construction and taking into account below ground services, structures and the like)
Variable/live loading	Traffic - 10kPa
Design void diameter to be spanned	Max. 1.0m
Allowable surface deformation as a result of design void	Max. 100mm
Design life	Min. 60 years

CONCLUSION

Additional ground investigation works have been identified as being prohibitively costly to a scheme of this size and nature. Also, even with additional ground investigation data, the same mitigation measures may still be proposed.

According to historical mapping [1], the car park has been in its current form since at least 1947, with no known instances of subsidence/settlement issues. Given the proposed resurfacing/landscaping works do not alter the site’s current land use, the incorporation of a “soft cap” within the works is considered to be a pragmatic approach to managing the historical coal mining risks. This approach would not remove the potential for a future collapse occurring beneath the car park but should minimise its impact at the surface. Any collapse would likely require treatment and there may be an ongoing maintenance cost with this approach.

REFERENCES

- [1] WSP, “Windy Arbor Road Playing Fields Car Park Phase 1 Geo-Environmental Assessment,” WSP, 2021.
- [2] BSi, BS 8006-1:2010+A1:2016 Code of practice for strengthened/reinforced soils and other fills, 2016.
- [3] CIRIA, “C758D Abandoned mine workings manual,” 2019.