



Monmouthshire County Council

Pwll Ddu

Inspection Report





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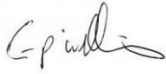
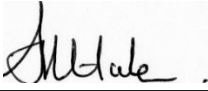
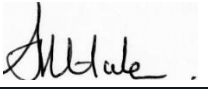
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1 Introduction

Geotechnical Engineers from WSP were asked by Monmouthshire County Council (MCC) to attend and inspect a site at Pwll Du Road, Gilwern on the 7th of November 2022. The inspection comprised the assessment along a section of carriageway showing failures along its verge width, to look at the current condition of the site and compare the section with previous assessments undertaken during 2020 /2021.

MCC closed this section of the highway due to risks identified such as the failing Vehicle Road Restraint system and close proximity to regressive slips reaching into the carriageway edge.

1.1 Site location

The site is located on the northwest face of Gilwern Hill, access from the south is via the B4246 and from the north off Heol Bedd-Dyn-Hir. The road in this section is located along the crest of a historic limestone quarry.

The area of interest (highest risk) is approximately 260m in length between Ordnance Survey Grid Reference SO (3)23505 (2)13061 and SO (3)23493 (2)12869.

1.2 Areas of Interest

The photographs taken during the site walkover are referenced in the text as ^[1] and are included in Appendix A.

A chainage line was established on the site with chainage 0.0m set outside the area of immediate concern on a concrete fence post ^[1] at the southern (uphill) end of the section.

Features of interest were identified along the edge of the carriageway and their condition monitored over time for any changes. These are described and discussed in Section 2 of this report.

1.3 Quarry Face Inspection

A visual inspection of the rockface was undertaken by geotechnical engineers from WSP from ground level (below the quarry face).

2 Monitoring

2.1 Monitoring Methodology

A chainage line and points of interest (high risk sections) were established on the initial visit undertaken on the 10th of September 2020. During this current inspection the same chainage system was utilised to allow comparison of the site with previous inspections. Where possible along the highway section, photos approximately matching the previous report have been taken to allow comparison.

2.2 Monitoring Results – Site Inspections

The results of the inspection are described below related to their relative chainage.

It was noted that the gate at the southern end was locked and secure. However, the concrete barriers set across the road above the quarry face uphill of chainage 0.0m had been pushed aside and no longer block the road.

The road closure measures at the northern end were not checked during this inspection.

Chainage 6.0m (outside risk area)

A small grip ^[2] (informal shallow drainage channel) was identified at this location, generally to the south of the main area of concern where the quarry face and road interact.

No change was noted in this area during the inspection.

Chainage 32.0m (outside risk area)

A local low point ^[3] is present at this location and a series of grips ^[4] were present leading surface water from the road and down towards the quarry face (located away from the road edge).

No change was noted during the inspection.

Chainage 64.0m

The rock face / crest of slope moves closer to the carriageway edge at this point and an old failing vehicle restraint system (VRS) starts. The VRS comprises horizontal metal “Armco” barrier mounted to wooden posts ^[5]. No change was noted during the inspection.

The existing barrier is sub-standard and supported by rotting wooden posts. Visually the VRS condition is so poor it is unlikely to provide any resistance to a vehicle impact.

Chainage 69.0m to 79.0m

The rock face / crest of slope moves within 0.5m of the back of the VRS ^[6&7]. The slope below has recently and historically failed with minor slipping of shallow surface debris since the previous monitoring visit ^[7 & 8].

This section of VRS is visibly leaning towards the road, the supporting posts are in poor condition. Stockproof fencing in this area is suspended in fresh air with no posts present ^[8] (No change).

Chainage 74.5m

Drainage grip through narrow verge over edge of the slope. Slope crest is present within 400mm of the edge of the highway ^[9].

Chainage 79.0m

End of VRS section. Slope crest moves away from the road edge ^[10].

Chainage 90.0m

VRS section starts and is in poor condition throughout comprising a horizontal metal "Armco" barrier mounted to wooden posts, these are in poor condition allowing the barrier to rotate forwards towards the road.^[11]

Chainage 97.0m to 112.0m

Crest of slope moves very close to the edge of the road at between chainage 97.0 and 104.0m (within 0.5m). A shallow slip is present on the slope in this vicinity. The VRS has also failed and rotated forwards towards the road, the slip has taken the footings downslope.

A concrete post and wire fence is present behind the VRS ^[12 & 13]. During the inspection two fence post foundations (previously 1 No) were found to have failed and was being supported by the fence wire ^[14].

Chainage 104.0m to 112.0m

Crest of slope moves away from road, VRS remains tilted over ^[15].

Chainage 135.0m to 143.5m

Surface slip on slope below road ^[16 & 17].

Chainage 139.0m

Low point in road, water draining off the road onto the failed slope below via a grip ^[18].

Chainage 141.0m

VRS is leaning forward into the road with failing (slipped) slope downhill ^[17].



Chainage 150.0m to 160.0m

Crest failure 1.5m from edge of carriageway ^[19]. VRS remains leaning forwards ^[20] and returns to vertical at CH 160.0m.

Chainage 179.0m to 183.0m

Edge of rockface with local crest failure approximately 0.5m from back of VRS ^[21].

The VRS ends at CH183.

Chainage 199.0 to 250.0m

In this section the vertical quarry face is very close to the edge of the carriageway separated only by a narrow verge and a dilapidated fence ^[22]. High risk section.

Chainage 202.0 to 204.0m

Fence down (fence post failed over crest) no fall protection to edge ^[23 & 24].

Chainage 215.0m

Fence hanging with no post to support due to crest failure ^[24].

Chainage 228.0 to 250.0m

Fence hanging with no post to support due to crest failure ^[25 & 30].

Drainage grip is present at 243.0m.

Chainage 250.0 to 258.0m

Fence back in verge, end of crest failures close to road.

3 Quarry Face Inspection

The quarry face can generally be split into three sections which are generally traceable across the quarry face with an apparent dip towards the south, these are indicated on Plate 27.

Weathered upper soil slope

This section of the face represents the in-situ weathering zone of the sequence and is formed of fine material with cobbles (lithorelics).

Upper jointed zone

Comprising heavily jointed limestone beds, this has a blocky appearance.

Three (sometimes four beds) are distinguishable and form a distinct layer traceable across the face, this zone forms a generally competent layer.

Weaker more weathered zone

A distinct ledge is present across the site between the “three beds” and the “Massive limestone” where a weaker horizon is present in the sequence. This material has weathered, and vegetation has established on this ledge, there are generally loose cobble size debris sitting on this ledge.

Main massive limestone

Making up the lower section of the quarry, the limestone rock is massive with limited bedding visible although there are a number of joint surfaces present. A number of “bolts” for climbing were noted on the face of this strata.

The inspection located a number of areas where the differences in weathering and staining of the rock face suggests fresh rockfalls and erosion of surface soil from the “Weaker more weathered zone” have occurred since the last inspection ^[28 to 30].

4 Discussion

During the monitoring inspection limited changes were noted on the highway verge mostly affecting the fence line at the crest of the slope. Some changes were noted to the slips in the superficial deposits immediately below the road as they attempt to regress to a stable angle.

The recommendations of this inspection remain generally unchanged and are repeated below, two additional recommendations are added:

2022 recommendations

1. The concrete barriers are replaced to prevent vehicle access are replaced.
2. Warning signs highlighting the steep unguarded drop are placed to alert the public using the area.

2021 report recommendations:

The existing VRS at the site has failed throughout the full section, leaving the significant drop unguarded. The boundary fence has also failed in a number of places and is not effective in preventing access to the steep ground beyond the highway edge.

It is likely that the slope crest at the edge of the carriageway will regress further over time. However, the timescale of the regression is not predictable as it is not a liner sequence and is dependent on several factors including water ingress (rainfall or surface flows), weathering rates of the soil, freeze thaw action and removal of support by failures of the rock face. These failures are generally rapid events with no warning prior to their occurrence.

It is recommended that the road remains closed, and a fence installed to prevent access to the road edge (with a safety zone between the fence and the crest of the slope) this would reduce the road width and prevent passage of motor vehicles.

Should the road need to be reopened then a suitable VRS would be required, this would need an assessment and appropriately designed by a suitably qualified person. However, there is very limited verge at the edge of the already narrow carriageway which is likely to be insufficient to install the VRS with a suitable working width and clearance to the front of the VRS from the running lane to meet current day standards.

To provide suitable working room for a VRS it is likely that significant civil engineering works would be required to move the road away from the crest by cutting into the uphill side of the carriageway. This would require a ground investigation to allow the design of the revised road layout. The scheme design and construction are likely to be very prohibitively expensive due to the limited access, which will restrict the size of plant that can access the site to undertake any excavation. Additionally, earthworks will involve the removal of a proportion of strong rock materials that may potentially require hard ripping or blasting to remove. The vibration from the excavation works, particularly shock waves from any



blasting has the potential to cause blocks to fall from the existing quarry face, potentially destabilising the existing road edge further. There is a high volume of quarry waste above the road level that will need to be assessed for overall stability if the road was to be moved in this direction.

To allow the construction works to take place, additional land would need to be purchased for the formation of the new cut slope. The heavy equipment accessing the site area is likely to cause damage to the existing road network leading to further costs to repair, following completion.

Appendix A

Photographs

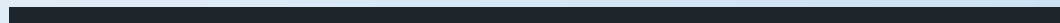




Plate 1: Chainage 0.0m at fence post.



Plate 2: Chainage 6m. Grip in verge



Plate 3 Chainage 32m. Local low point in carriageway - shallow grips in verge



Plate 4 Chainage 32m. Local low point in carriageway - shallow grips in verge



Plate 5: Chainage 64m Start of VRS



Plate 6: Chainage 69m The rock face / crest of slope moves within 0.5m of the back of the VRS



Plate 7: Chainage 69 to 79, The rock face / crest of slope moves within 0.5m of the back of the highway with surface slips on slope.



Plate 8: Chainage 69 to 79, The rock face / crest of slope moves within 0.5m of the back of the highway with surface slips on slope, leaning VRS, and stock fence with no supporting posts.



Plate 9: Chainage 74.5m Grip in verge.



Plate 10: Chainage 79.0m. End of VRS section (historic photo)



Plate 11: Chainage 90m, VRS section starts.



Plate 12: Chainage 97.0m to 112.0m, crest of slope close to road edge, slip in slope below, rotated VRS and fence post.



Plate 13: Chainage 97m, slip bowl below the road above quarry face with unsupported post



Plate 14: Chainage 100, failed fence post foundation.



Plate 15: Chainage 104 to 112m, failed tilting VRS.

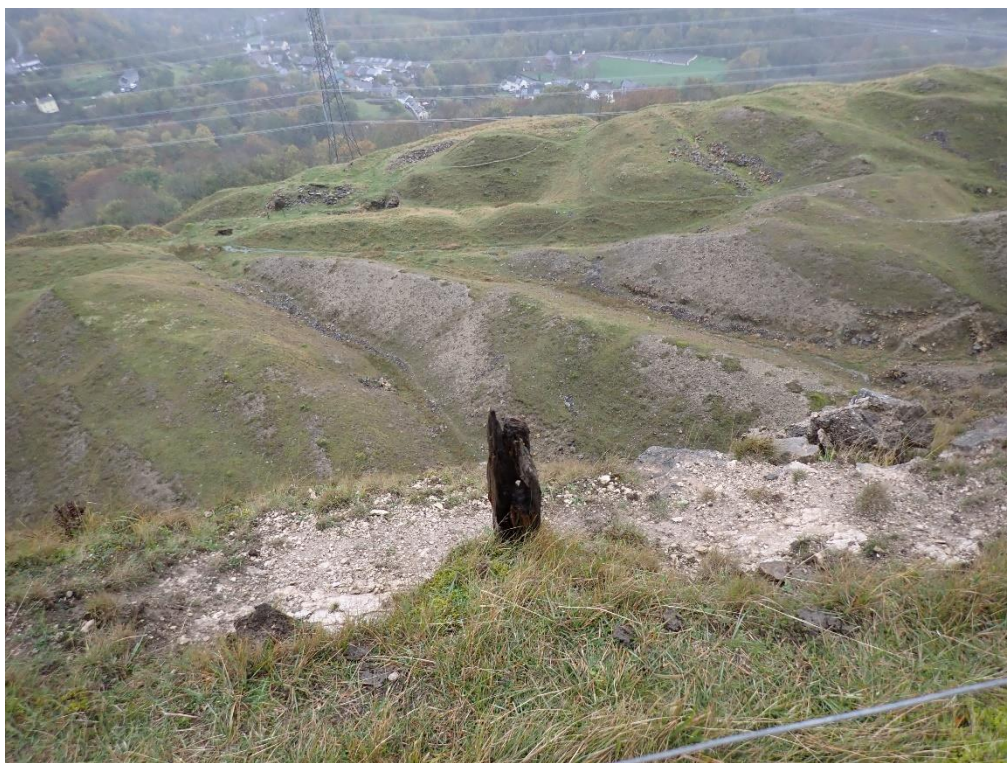


Plate 16: Chainage 135m, slip on slope below road close to carriageway.



Plate 17: Chainage 141m, slip on slope below road close to carriageway. Note VRS leaning forwards



Plate 18: Chainage 139m, Low point in road, water draining off the road onto the failed slope below via a grip.



Plate 19: Chainage 150m, slip on slope 1.5m off highway



Plate 20: Chainage 150m, leaning VRS



Plate 21: Chainage 179m, crest of slope / rock face close to edge of road. Note the end of the VRS at CH183.



Plate 22: Chainage 199m, crest of slope / rock face close to edge of road. Note the poor quality of the fence.



Plate 23: Chainage 202.0m, Failed section of fence



Plate 24: Chainage 215.0m, Section of fence with no support due to crest failure



Plate 25: Chainage 228.0m to 250, Section of fence with no support due to crest failure



Plate 26: Chainage 243, Section of fence with no support due to crest failure with grip through verge.

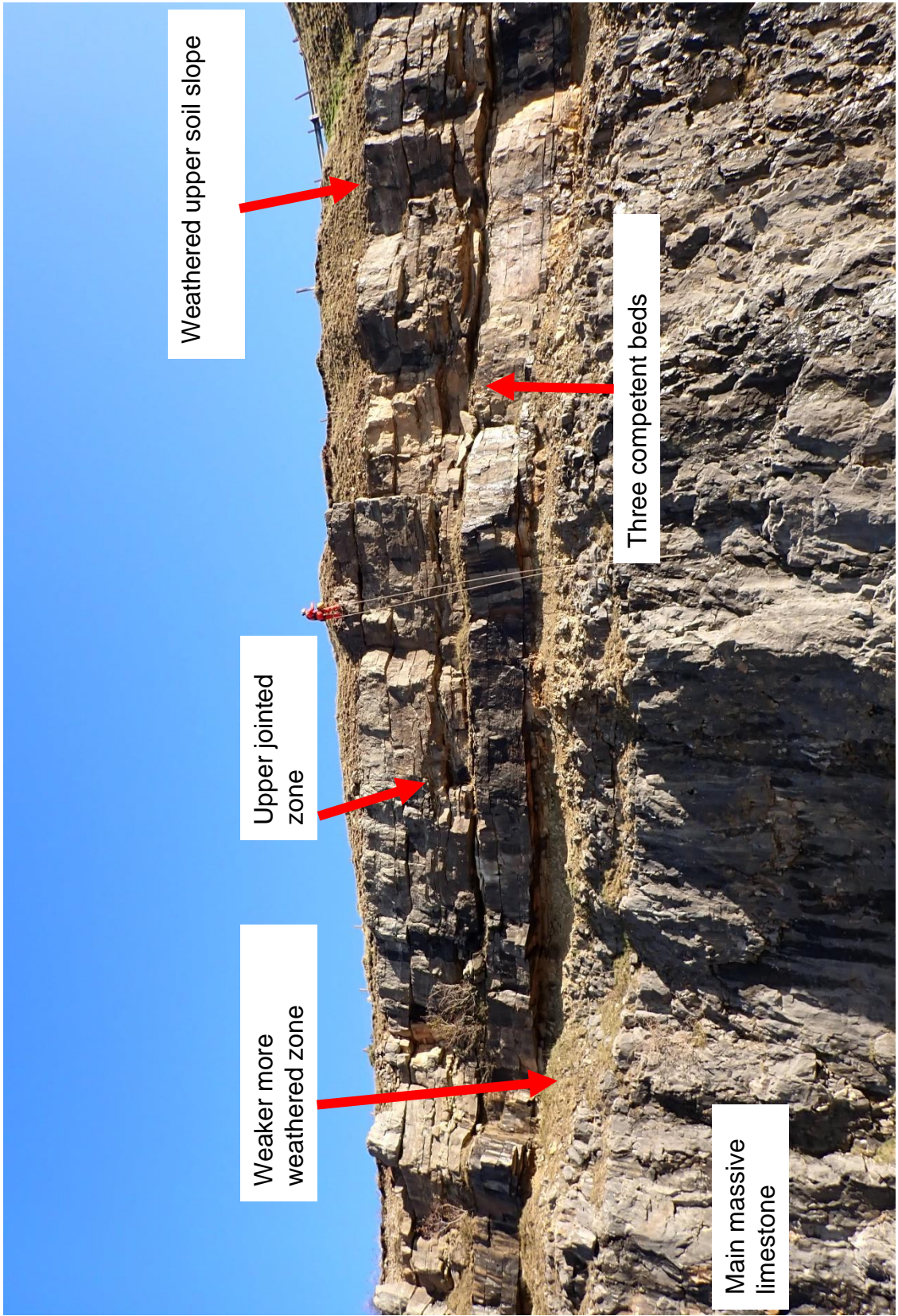


Plate 27: Main strata present in quarry face..



Plate 28: General view of quarry face.



Plate 29: Weathering / erosion of the weaker material undercutting the upper section of the face.



Plate 30: upper rock section with rockfall debris on ledge of weaker materials (recent rockfall).



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