Stabilisation of landslip using pile retaining wall solution

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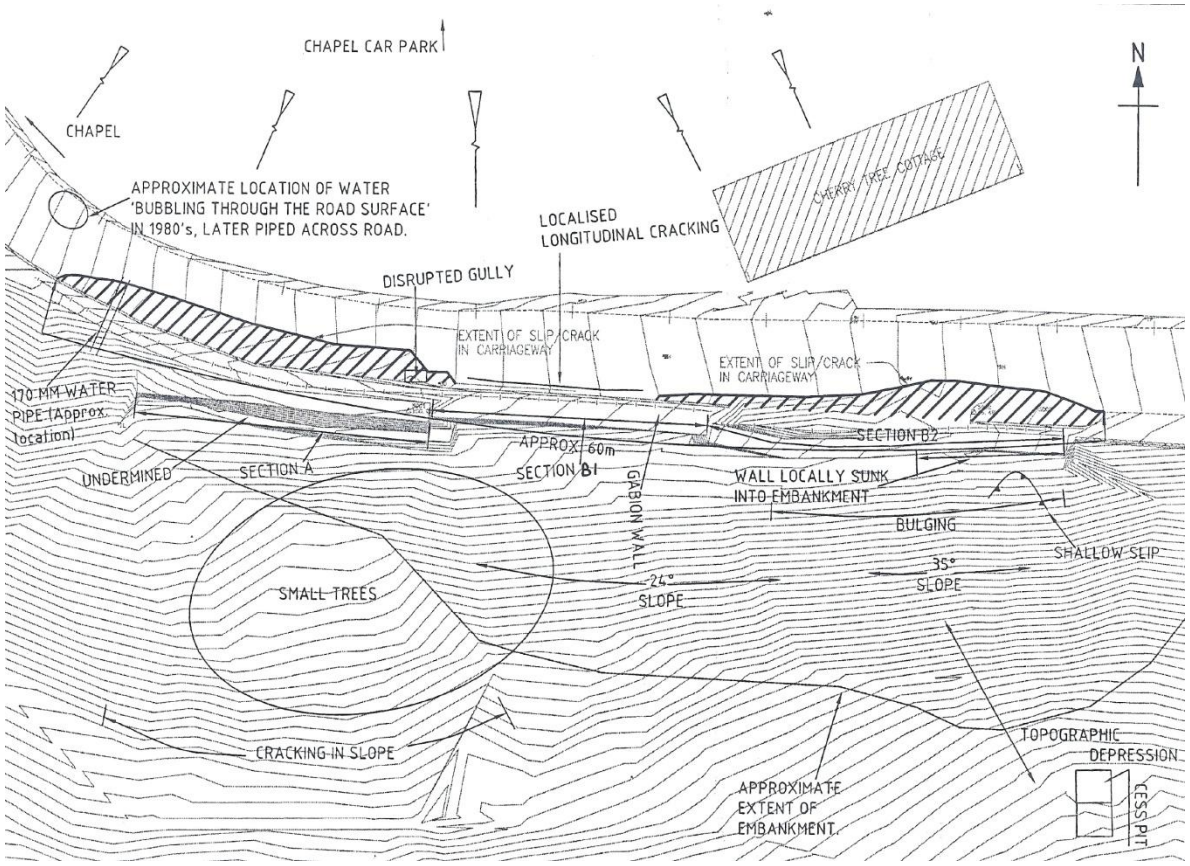
Stanton Lees, Derbyshire, UK

Embankment, 90m in length, slope 35–40^{o}

Longstanding problem of instability, particularly after periods of heavy rainfall

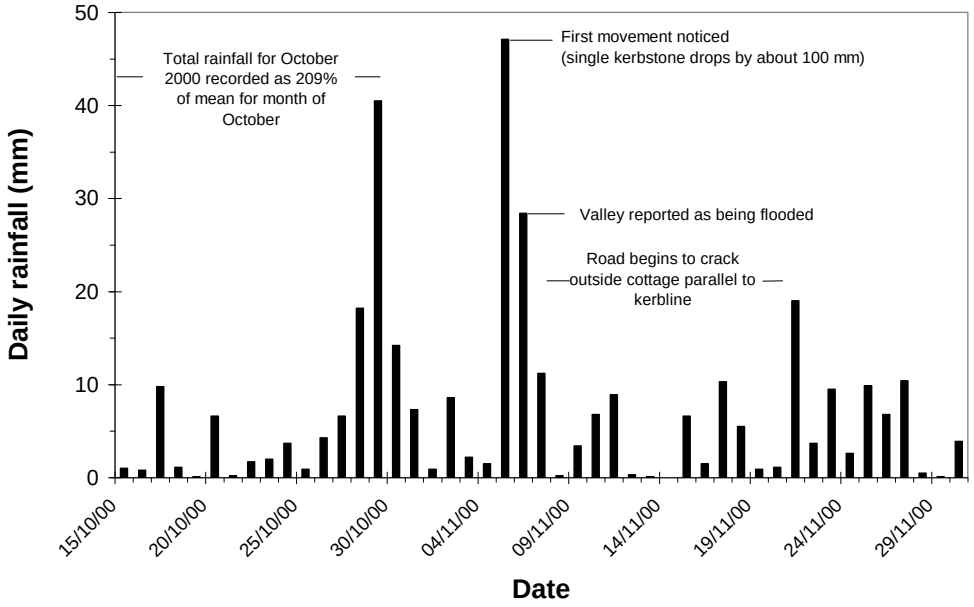
Significant movement

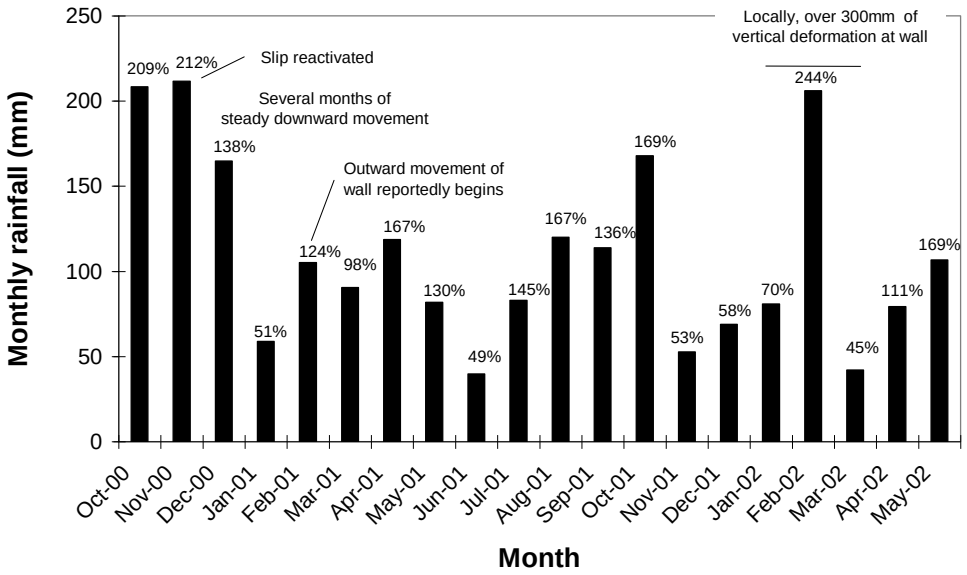
Nov 2000 and Feb 2002



Embankment supporting existing gabion retaining wall slipped 0.5–1.0 m

Rainfall Data





Daily data, Middleton, Derbyshire

Monthly data

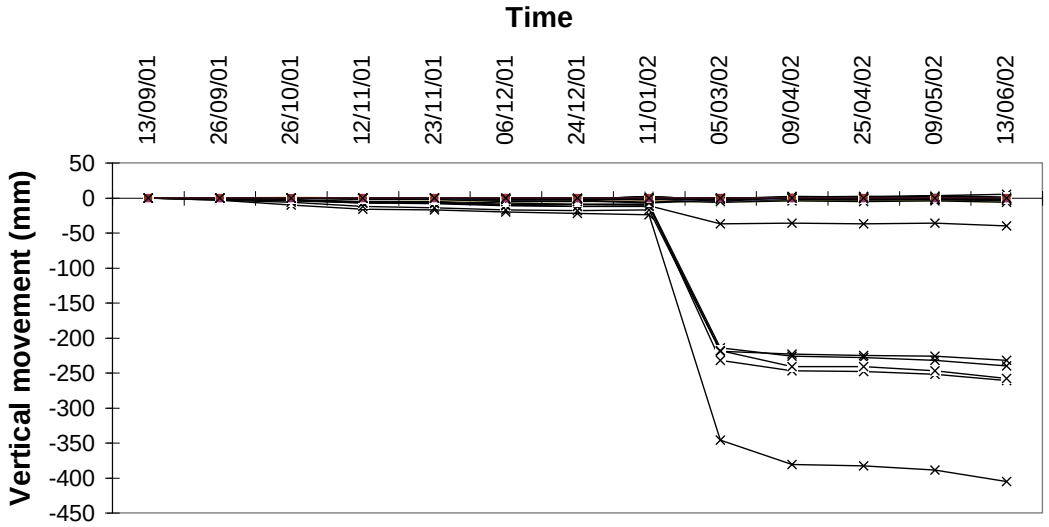
Autumn 2000, wettest season since local records began in 1870

Oct. 2000 yielded 209% mean monthly rainfall for that month, second wettest on record

Survey data

Ground movement and groundwater levels monitored over 14 month period

Hilti nails in road surface and four lines of wooden pegs driven in embankment



Survey points at road level

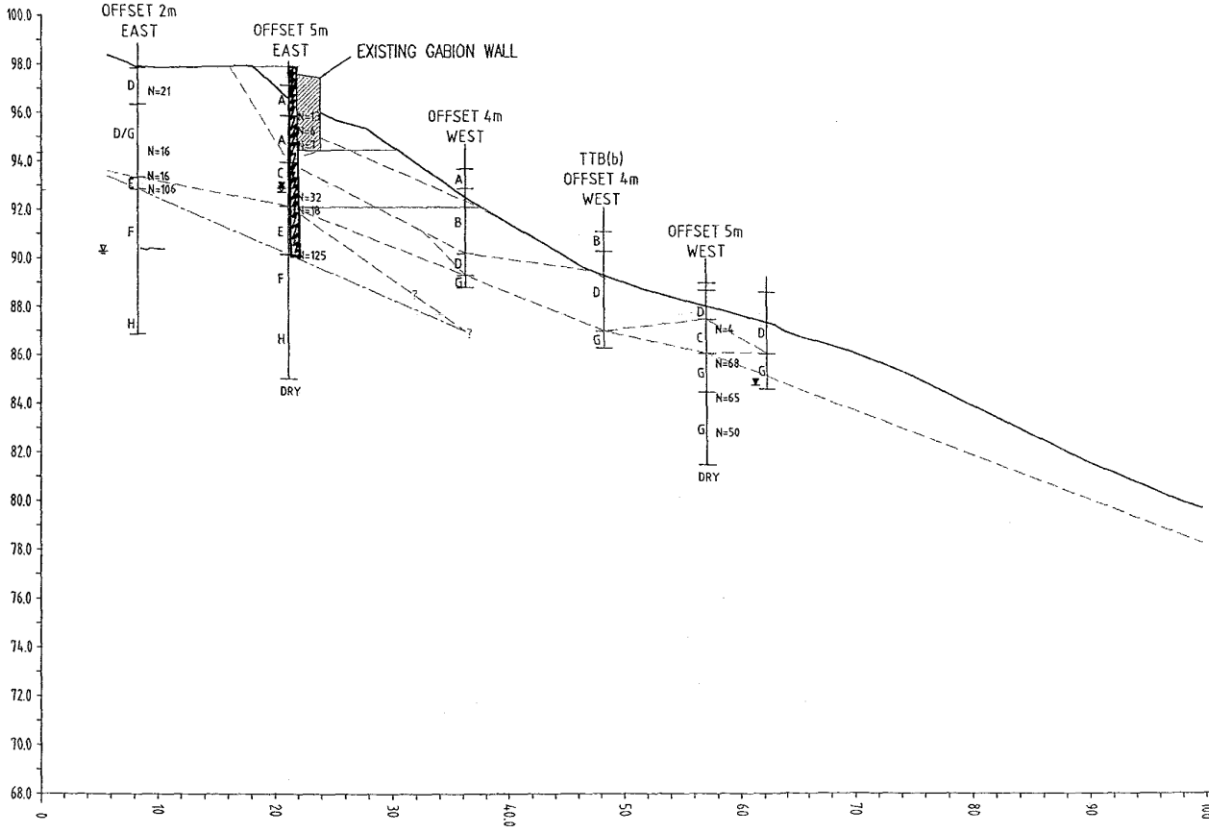
Movement coincides with high total rainfall figures

No distress in northern part of road

Ground investigation

19 boreholes and seven trial pits

Standpipe piezometers, groundwater recorded in all instruments



KEY

A Granular Fill

B Cohesive Fill

C Very soft, soft and soft to firm CLAY/SILT HEAD

D Firm and 'Dry Friable' CLAY HEAD

E Completely to highly weathered SANDSTONE

F Moderately weathered SANDSTONE

G Completely to highly weathered MUDSTONE/SILTSTONE

H Highly to moderately weathered MUDSTONE/SILTSTONE

Stability back-analysis and sensitivity study using *Slope/W* assuming FOS of unity (limiting equilibrium) applies

Soil parameters: preliminary soil parameters from ground investigation and laboratory tests

Stratum	**Bulk unit weight (kN/m^3)**	**Effective stress parameters**	
		c' (kPa)	**∅' (degrees)**
Granular fill	17	0	32
Cohesive fill	18	0	30
Head material (peak)	19	0	30
Completely to highly weathered sandstone	20	0	34
Completely weathered mudstone/ siltstone (peak)	21	5	30
Competent bedrock	23	50	45

Remedial works

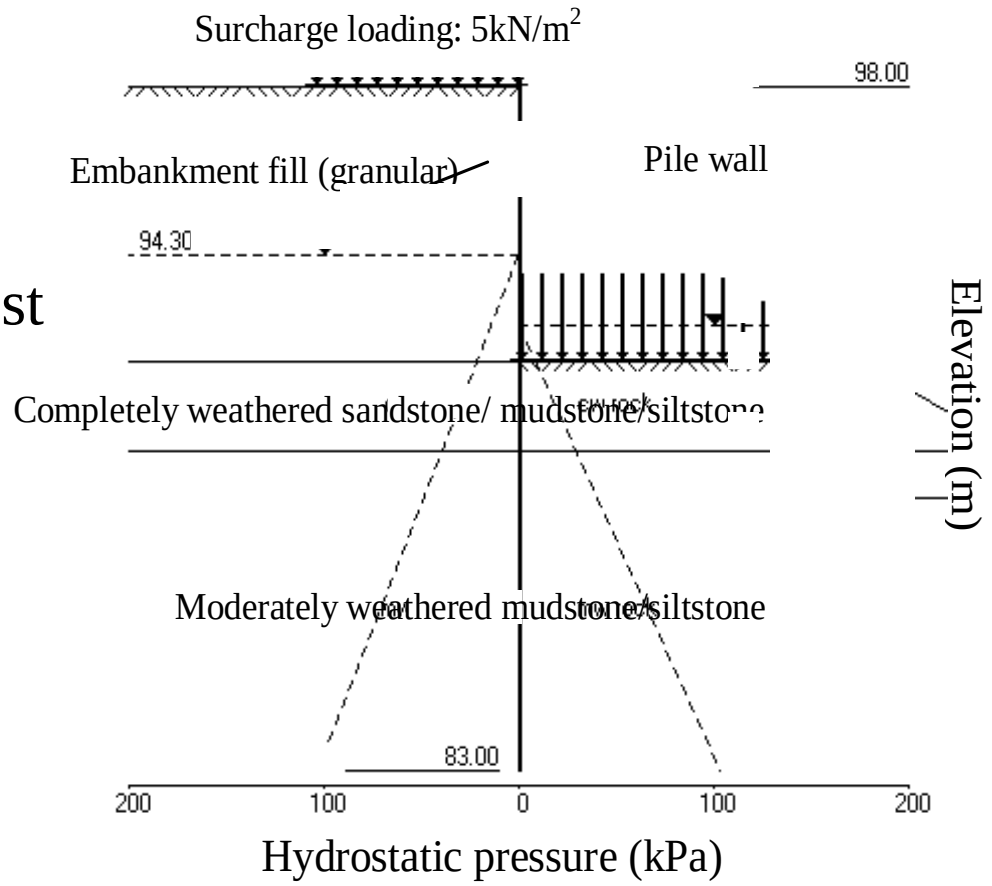
Replace gabion wall with cantilevered bored pile retaining wall

Analyzed using *WALLAP* and Burland-Potts method

Design groundwater levels = highest observed plus 1.5 m head behind wall

Friction δ/Ø = 0.66 considered in deriving full active and net available passive earth pressures

Failed groundmass on passive side provide surcharge only to underlying weathered rock



Two rows, 600-mm dia. bored piles (86 in total) installed along southern road verge

staggered in plan, clear spacing 1.0–1.7 pile diameters, allows free passage of groundwater

8.0–13.5 m in length, founded within underlying mudstone and sandstone bedrock

reinforced-concrete capping beam connecting pile heads

25-tonne compact Bauer rig

Acknowledgements

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THANK YOU