



Sheetlines

The journal of
THE CHARLES CLOSE SOCIETY
for the Study of Ordnance Survey Maps

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enough?”

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Sheetlines, 87 (April 2010), pp.11-18

Stable URL: <http://www.charlescloseociety.org/files/Issue87page11.pdf>

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Published by
THE CHARLES CLOSE SOCIETY
for the Study of Ordnance Survey Maps
www.CharlesCloseSociety.org

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Arnhem 1944 – were the maps good enough?

Rob Wheeler

Operation Market Garden was a bold attempt to gain a bridgehead across the Rhine in September 1944. If it worked, it offered the potential to skirt the northern end of the Siegfried Line, giving a quick route to the Ruhr and ultimately Berlin. It was expected to make it easier to open up Antwerp, easing the Allies' huge logistic problems, and, conveniently, it would cut off the last V2 launch sites within reach of London. On Sunday 17 September the Allied front line stood at the Belgian-Dutch frontier, more precisely at the canal joining the Maas to the Scheldt. The plan was to push XXX Corps up the road through Eindhoven, Veghel, Grave, and Nijmegen to Arnhem. Some sixty miles would take them beyond the last natural obstacle, with no obvious defensive line remaining between them and the Ruhr. There were a number of rivers that needed to be crossed, notably the Maas at Grave, the Waal at Nijmegen, and the Lower Rhine or Lek at Arnhem. All the key crossings would be seized by 1st Airborne Army, who would, they were assured, be relieved by XXX Corps within 48 hours.

¹⁵ Another very well chosen symbol.

As we all know, it didn't work. The 2nd Para Battalion under Lt Col John Frost valiantly held the Arnhem bridge until the evening of Wednesday 20 September, with isolated pockets of resistance holding out until the Thursday, but XXX Corps never arrived. Afterwards, there was a very distasteful search for a scapegoat. Sosabowski and the Polish paras were shamefully blamed without a shred of justification other than political convenience. More recently the RAF has been blamed for not having done things it was never asked to do.

I do not want to set up GSGS or the US Army Map Service as a scapegoat. I don't even intend to argue that, had the maps been better, the outcome *would* have been different. I do intend to argue that the maps ought to have been better and that, with better maps available for one key decision, the outcome *might* have been different.

That key decision took place on the afternoon of Wednesday 20 September. Leading elements of XXX Corps had reached Nijmegen some 36 hours earlier. That afternoon, the US 504 Parachute Infantry Regiment paddled across the Waal under heavy fire. They took significant casualties but pressed on and stormed the north end of the Waal bridge, just as XXX Corps and the US paras managed to fight their way through the town to reach the south end. The German defenders broke and ran, and the first tanks from XXX Corps crossed the bridge. The key decision was whether they should press on to Arnhem. It was not an easy decision. Night was starting to close in and British armour at that date was unaccustomed to fighting at night. They would need supporting infantry; few were available and those who *were* available were not from formations the armour were accustomed to working with – those were stuck in the massive traffic jam snaking back to Belgium. There was a significant risk that the armour might run into a German ambush. So they decided to wait until morning, or, as the US paras who had taken heavy losses in order to capture the bridge viewed it, 'the Brits crossed the Waal and stopped for tea'.

With the advantage of hindsight, we know there were no German blocking positions between Nijmegen and Arnhem that evening. Whether a small number of tanks arriving at the south end of the Arnhem bridge might have been sufficient to enable 2 Para to hold on longer, we do not know. By the following morning the Germans had established a blocking position at Elst, and in any case the Arnhem bridge was effectively under German control again. This decision – whether to press on – was not, or at least should not have been, taken in haste. The Waal crossing had originally been intended to go ahead at dawn, so General Horrocks, commanding XXX Corps, had presumably been considering exploitation plans for some time. What were the topographic issues?

The outstanding one was: how does one get from Nijmegen to Arnhem? The small-scale maps showed a new motorway supplementing, indeed replacing, the old road. However, the standard map for army tactical use in the Netherlands was the 1:25,000, namely GSGS 4427, actually produced by the US Army Map Service as their M831 series. This showed the new autoroute as incomplete (figure 1); the armour would be forced to take the old route through Elst. This village offered excellent potential for a blocking position: a water obstacle to the east preventing outflanking there; to the west a moderately built-up area, well suited for holding by infantry with anti-tank weapons. A mile to the north, the road runs along the top of a dike, the sort of situation the armour particularly hated: completely exposed, no space to get round destroyed vehicles, and with

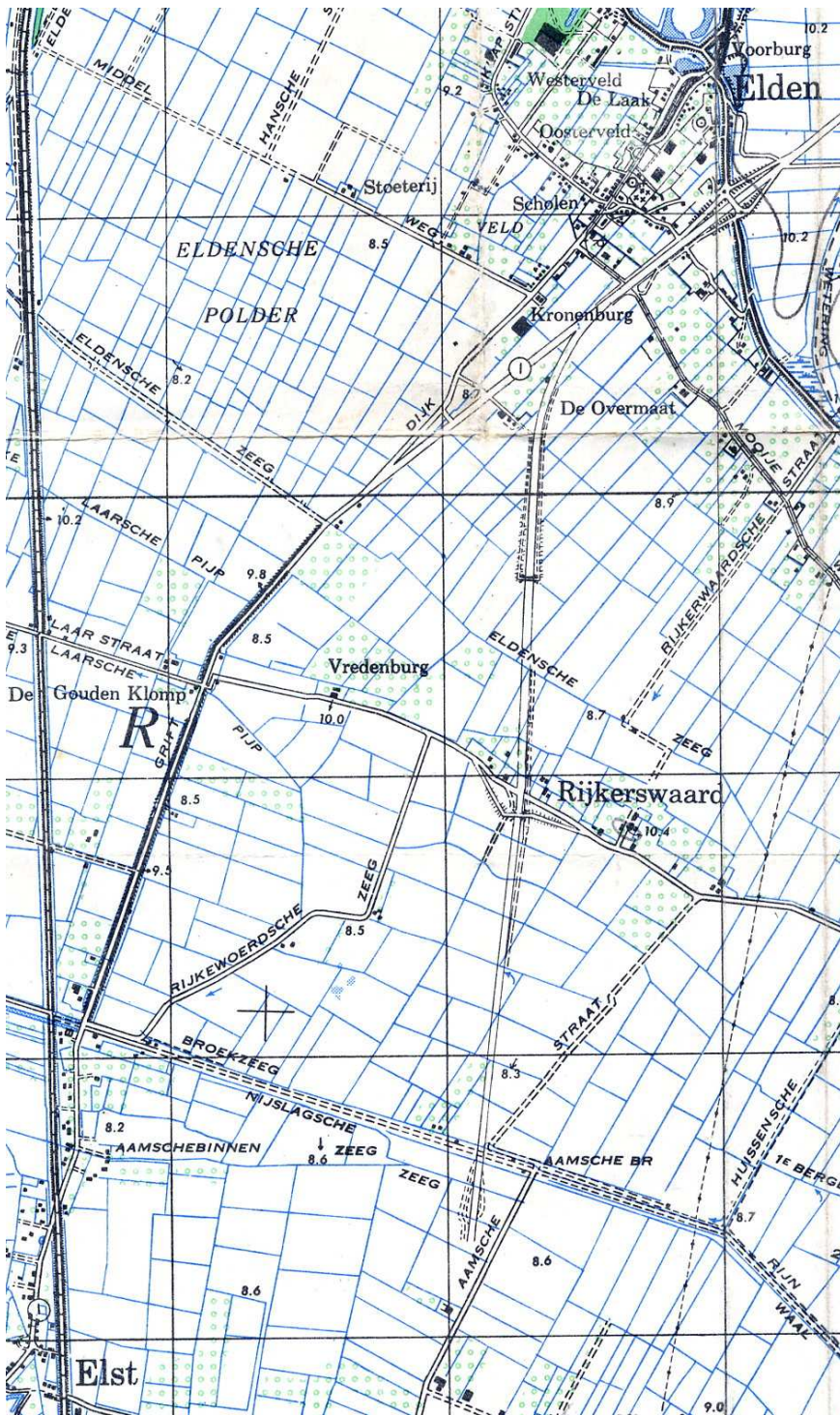


Figure 1 GSGS 4427 1:25,000

is placed against the old road crossing by the pontoon bridge. The Nijmegen sheet shows the new Waal bridge and the start of the motorway, but 'To Arnhem' marks the connection to the old road not far beyond the bridge.

banks too steep even for tanks. The maps also presented differing views about what bridges there were at Arnhem (figure 2). The traditional crossing had been by a pontoon bridge slightly to the west of the centre of the old town; the motorway led at its northern end to a new crossing slightly east of the town centre and leading to the boulevards built on the site of the early-modern town defences. However, the cartographers presented differing views about whether the new bridge (the one that Lt Col Frost was so valiantly holding) was actually passable. The message varied according to the map series

Town plans at 1:7000. This was a product of the Dutch Military Intelligence Department that had been photolithographed by the War Office in May/June 1944 and provided with a key in English to major buildings. It seems to have been used for the planning for Market Garden. The Arnhem sheet shows both bridges, but 'To Nijmegen'

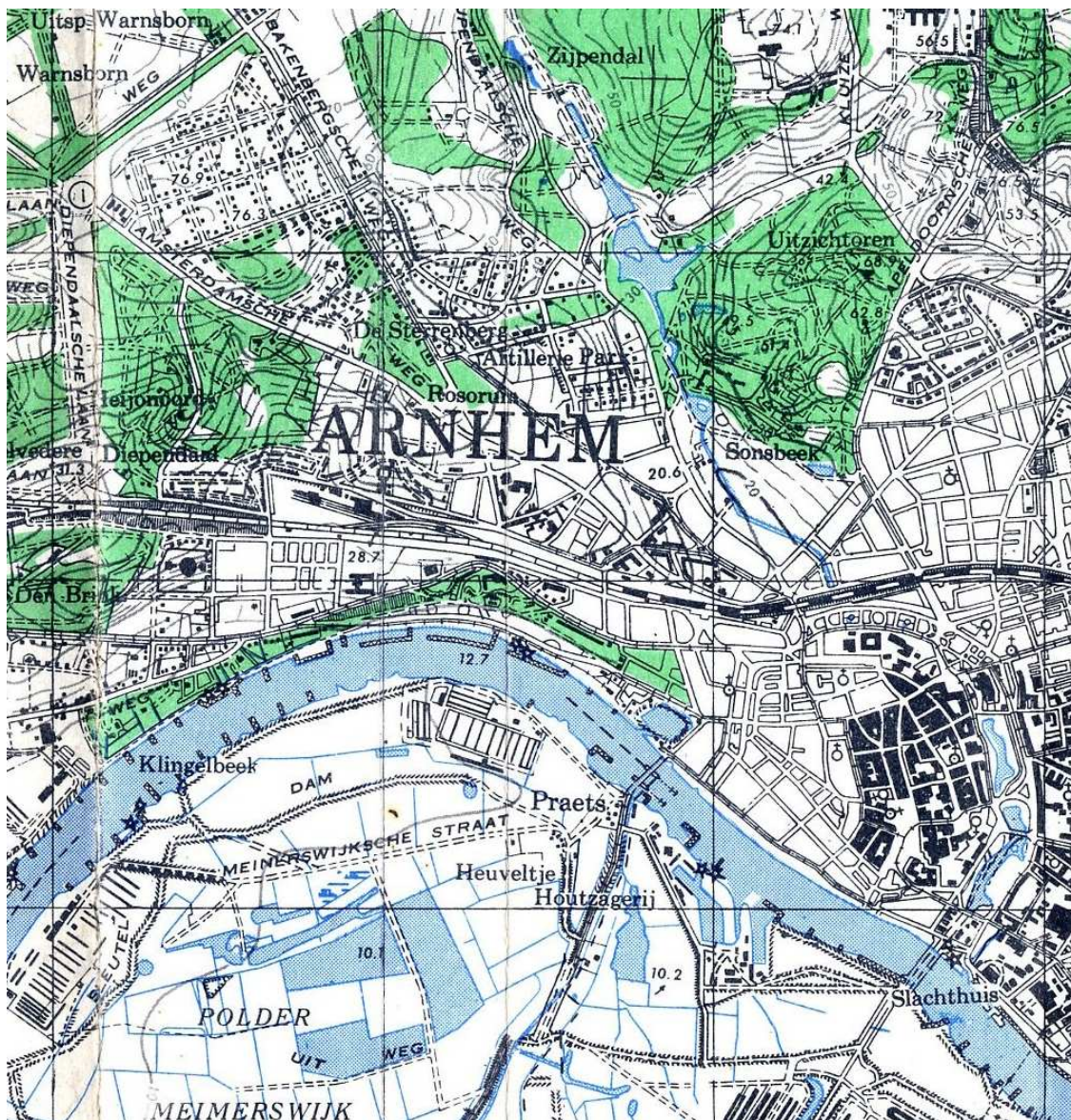


Figure 2 AMS M831: Arnhem



Figure 3 GSGS 4369, Sh 8, 5th edn with motorway complete

1:25,000. This shows the northern part of the motorway, but it is not complete. The First Edition (Jan 44 printing¹) does not show the new Rhine bridge: the motorway just stops at the river; the old road is clearly the route in use. The Nov 44 edition² shows the new bridge in place although the road across it is dashed, which should probably be interpreted as ‘under construction’. The old road now appears to be broken in a couple of places. Overall, the November edition appears to advise that the old road should be used as far as Elst, 3km south of Arnhem, and the new road and new bridge beyond. I have not been able to discover what edition was carried by troops engaged in Market Garden and whether it was closer to the January or the November edition.³

1:100,000. The RGS has a sheet that, from its annotations, appears to have been used by a member of the Glider Pilot Regiment who landed at Arnhem. It shows the motorway complete, with bridges.

1:500,000. GSGS 4369 was the RAF’s standard planning map. The 1944 edition⁴ (figure 3) shows the motorway complete, with bridges.

In defence of the US Army Map Service it must be admitted that, until September 1944 the Gelderland was a strategically unimportant part of Europe whose maps ought not to have been accorded a high priority in the competition for resources. (Indeed, if the US had had its way, it would have remained so.) However, by November, Arnhem was the German front line and had been so for a couple of months, so one might suppose that the November edition of M831 might have justified a somewhat higher priority. It is worth comparing that map’s depiction of the various bridges at Arnhem with the situation on the ground.

<i>Bridge</i>	<i>Map</i>	<i>Ground truth</i>
Railway	Complete	Central span destroyed by Germans, Sep 44.
Pontoon	Complete	Centre portion removed by Germans before September.
New bridge	Road under construction	Scorched but passable.

‘What was going on?’ is the question one has to ask. This is a question that can actually be addressed at three levels. The first is to examine what was happening on the ground.

a. The Rhine bridge at Arnhem was built between 1932 and 1935. It was destroyed by the Dutch in 1940 and was only re-opened in August 1944. (It was destroyed by the Germans in 1945 and replaced by two successive Bailey bridges before the present John Frost Bridge was opened in 1948.)

b. The Waal bridge at Nijmegen was built 1931-36. It too was destroyed in 1940, being re-opened in 1943.

c. The motorway between them was included in the *Rijkswegenplan* of 1932.

¹ At NLS.

² M831 sheet 6(NW) (eastern half) [the field printed sheets were divided to for smaller presses], revised by air photographs to Nov 44. This sheet is the source of the illustrations here.

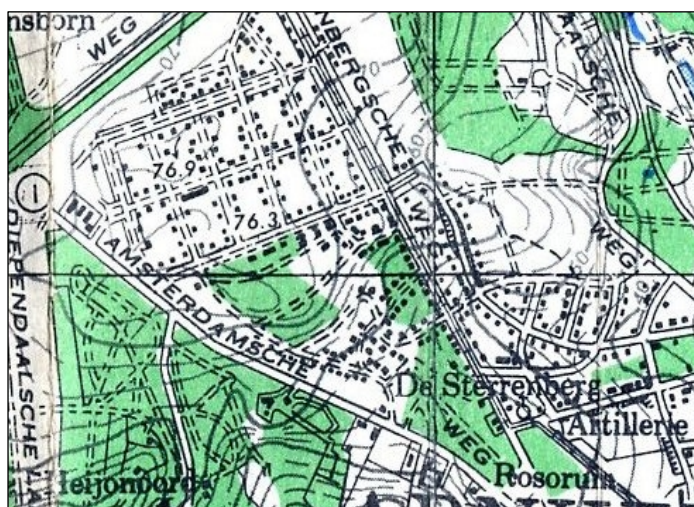
³ I showed a photocopy of the 1:25,000 to one veteran, whose response was that they did not have maps as detailed as that. Of course, the issue here is the maps available to the commanders.

⁴ GSGS 4369, sheet 8, fifth edition, print code 150,000/10/44 Wa.

Construction was certainly underway in 1941 but it was only opened (one carriageway only) in October 1946.⁵

The second level addresses the sources for the maps. Compilation statements do not always appear. For example the field-printed version of M831 dispenses with them. However, the Jan 44 full sheet (well, full quarter-sheet) states that it is derived from 1:25,000 Netherlands Topographische Dienst maps of 1921-30, updated by aerial photographs 1940-43. A diagram shows the year of the latest air photograph for each portion of the sheet: the Arnhem area was covered in 1943 but a large proportion of the map depended on earlier coverage. Clearly photographic coverage was fairly sparse. In contrast, the 1:100,000 was 'Partially revised from Dutch maps of 1936-9. Communications revised from GSGS 4183 and 2185 and Autokaart van Nederland. Intelligence reports to 1942'. Was this Autokaart van Nederland a commercial product? Commercial map makers are often tempted to insert roads that are merely projected, and they do not always resist temptation. That the military compilers believed their source is unsurprising. That their intelligence reports did not include the dropping of the Rhine and Waal bridges is a little more surprising. GSGS 4369 tells us that it was compiled from the Map of the Netherlands at 1:200 000, and updated by air photographs to 11/41. So the simple answer to 'what was going on' might be that the maps 'do what it says on the tin': the larger scales are based on 1920s Dutch maps, with patchy updating from air photographs; the smaller scales make use of a commercial map which had jumped the gun on new motorways.

Unfortunately, the position is more complicated than this. Compared to the Dutch original, AMS M831 has been redrawn. Instead of distinguishing tree-lined roads, it now distinguishes metalled roads. Quite unimportant tracks have been updated, even in woods, where air photography will have scarcely provided reliable evidence for the disappearance of a track.⁶ Suburban development west of Arnhem has been added; even individual houses being shown⁷ (figure 4a, 4b).⁸



Left: Figure 4a New housing on AMS M831
Above: Figure 4b Dutch original (as reproduced
by German forces)

⁵ *www.autosnelwegen.nl* as at 2009.

⁶ Note for example the deletion of tracks west of Boschveld (Nord de Guerre grid reference 713796).

⁷ Nord de Guerre 732789, 701790.

⁸Thanks to Francis Herbert for permission to reproduce fig 4b from the map in his possession.

The additional detail is hardly characteristic of revision from air photographs. Nor can this detail have come from an unidentified later state of the Dutch 1:25,000: even when this was re-issued in 1951, detail of this nature was still as surveyed in 1927. In contrast, the Dutch 1:50,000 was revised more regularly and shows an increase in suburban development at each new revision. On the basis of these maps, it appears that M831 depicts a state of suburban development existing after 1932 and before 1940.⁹ In fact, an intermediate state of the 1:50,000, not yet seen, seems a possible source for the updating of housing development. The 1940 revision of the 1:50,000 includes the motorway from the new bridge up to where it joined the old road south of Elden. It is noticeable that this section as drawn on M831 does indeed look complete, with embankments on the approaches to the Elden overbridge. In contrast, the section running south is without earthworks and the associated link roads are dashed and sometimes end in the middle of nowhere. This seems consistent with this southern part having been drawn from an air photograph showing mere earthworks. The motorway peters out at the point where the Reliability Diagram on the Nov 44 edition notes detail as being less complete.¹⁰

The third level at which the question can be posed concerns policy on topographical intelligence. ‘The main object of a military map must be to enable a General to move his troops to desired points by the most direct or advantageous lines, and for this a good road map is essential’. That was Farquharson’s view in 1892.¹¹ It was also the view taken in the earliest German Mil-Geo publication I have encountered,¹² which devotes nearly a hundred pages to the potential of the roads into neighbouring states, a very short description of frontier fortifications, and 145 pages to descriptions of frontier bridges, with exact dimensions. But after the First World War, where (at least on the Western Front) the requirement for indirect fire by artillery was paramount, emphasis shifted to the provision of gridded maps and away from the collection of road information. This change is certainly apparent in the products of the German General Staff: the 1940 *Militär-geographische Angaben über England* is dominated by the portfolios of maps, the accompanying text being a mixture of generalities with statistical data selected more for its availability than for its immediate relevance to military decisions.¹³

Rather than the 145 pages of bridge descriptions seen as requisite in 1908, we have ‘The strength of English road bridges is high. There are load regulations for individual cases but they are very complicated and of little value when it comes to practical use’.

Likewise, in the UK the *Topographical Section of the General Staff* became the *Geographical Section of the General Staff* and concentrated on producing maps. Within that organisation, geodesy occupied an honoured place. The official history dwells at length on the business

⁹ Based on sheets with those revision dates (the later one being a German copy) at Bod Maps C29(23).

¹⁰ It happens that this point is also a sheet boundary on the *post-war* Dutch 1:25,000. Is this merely a coincidence? Some sheets had already been issued on the new sheet lines, but not, it would seem, 40A and 40C which abut at this point.

¹¹ Quoted in Roger Hellyer & Richard Oliver, *One-inch engraved maps*, CCS, 2009, 98

¹² *Militär-geographische Beschreibung von Nordost Frankreich, Luxemburg, Belgien, und dem südlichen Teil der Schweiz, bearbeitet vom Grossen Generalstabe*, Berlin, 1908. BL ML.bbb9.

¹³ For a modern translation of the most relevant parts, see *German invasion plans for the British Isles, 1940*, Bodleian Library, Oxford, 2007.

of accurately relating different grids (especially enemy grids) to enable indirect artillery fire across grid boundaries. And the 1:25,000 series of Europe were seen pre-eminently as artillery maps, to enable the accurate determination of the grid references of targets. In part this stems from the 1931 policy recorded in *Maps and survey*¹⁴ that the 1:50,000 scale should be used for the general tactical map, while the 1:25,000 should serve 'for deliberate battle and especially for use by the Royal Artillery'. In the Netherlands, the 1:50,000 produced from the Dutch series was considered too cluttered for issue to troops, so the 1:25,000 served both purposes.

So the question can be summarised as: How did the view that 'a good road map is essential' drop out of sight? Perhaps the business of establishing which motorways were open was considered too trivial for an ambitious officer to give much attention to. And the customers were in no position to complain prior to the break-out in Normandy that summer.

By way of a postscript, it may be worth saying more about the redrawing of M831 noted above. This included re-lettering all the names. The fonts generally matched those used in the original, but names were made larger and hair-lines were eliminated; two new fonts were introduced for polder names and for road names. To avoid clutter, all administrative detail was removed together with many minor descriptive names, such as the *Steenfabriek* (brick works) on the south of the river from Arnhem and the two *Overlaatbruggen* on the old road south from there. These last appear to consist of a light bridge over flood channels for trams and light traffic, with a ford (normally dry) for heavy traffic.

Undoubtedly the redrawn map looks better. However, its military utility was actually reduced by the work. Those brickworks opposite Arnhem played an important tactical role in the land battle. The Germans, who were working with a straight copy of the 1927 Dutch map provided with German grids, knew what they were doing when they sent troops to that position; to the Allies they were merely nondescript industrial buildings. Again, those *Overlaatbruggen* appear to have confused the photo-interpreters and perhaps led to the Oct 44 edition of M831 showing the old road as broken. Were the photographs taken when the area was flooded? It would be difficult to work out what was going on, but the Dutch term, even if not understood, might have caused them to enquire further. Finally, some redrawn names have drifted, which can be dangerous. The AMS expended considerable labour in turning a Dutch original that was 'difficult to read' into an inferior Allied product, and declined to issue the Dutch 1:50,000.¹⁵ The Germans perhaps had better cameras: certainly they produced quite serviceable direct reproductions at both scales.

As a final postscript, I must acknowledge my debt to the map librarians at Cambridge, at Oxford and the NLS. Dutch maps of the 1930s cannot be much in demand, and various sheets were fetched from distant storage for me.

¹⁴ *Maps and survey*, War Office, London, 1952, 18.

¹⁵ *Maps and survey* p383. It must be admitted that the GSGS copy of the 1:50,000 sheet 40W in the BL is indeed horrible.