

Chapter 14

Organisation

Speed of Build-up in the Assault Crossing of the Rhine
(Report No.30)

Speed of Build-up in the Assault Crossing of the Rhine

Summary

1. The build-up went smoothly and very much according to plan. The traffic control organisation worked well, and the system for calling over vehicles out of their priority order was rapid and efficient. However, a study of 12 Corps Build-up records, and observation on the river banks in 12 and 30 Corps sectors made it clear that the Build-up was not going quite so quickly or evenly as it might have done.

2. The unevenness in the flow over the ferries was due partly to the considerable number of vehicles called up out of their turn, which inevitably delayed the rest, and probably also to the failure of the organisation as a whole to seize every possible opportunity of pushing vehicles over the river.

3. The speed over the ferries and bridges was not as great as it might have been, largely because of small difficulties, which it is thought could have been put right on the spot by someone in authority without detailed administrative ties. The actual rates over the river, and the rates which, in our opinion might be achieved given the best of conditions, are given in the following tables.

Ferries				
Type of Ferry	No. of rafts etc. per Corps	Average No. of Vehicles per hr observed		Possible No. of vehicles per hour
		12 Corps	30 Corps	
LVTs (Buffaloes)	2 Regts (96 per Regt)	45	37	192
Class 9 & 12 Rafts	8 Rafts	21	4	24
Class 50/60 Rafts	4 Rafts	4	5	9

During the hours of darkness these rates will inevitably fall to some extent.

Bridges		
Type	Average No. of Vehicle per hr per bridge observed	Possible No. vehicles per hr per bridge
FBE	50	100
Bailey pontoon bridge	200	400

The difference between 12 and 30 Corps sectors was largely that the former was very little shelled and the latter quite a lot. The shelling did not much upset the LVTs, as might be expected, but had a serious effect on the Class 9 rafts. The Class 50/60 rafts on both Corps sectors had more mechanical difficulties than anything else.

4. From our results it would seem that the two LVT regiments per Corps were more than was necessary, and that one regiment per Corps could have managed one and probably two divisional build-ups of the type of this operation. Eight Class 9 rafts and four Class 50/60 rafts should be capable of managing the heavier build-up of one Division and accessory troops on quite a lavish scale, although subject very much to the shelling encountered.

No. 2 Operational Research Section

Speed of Build-up in the Assault Crossing of the Rhine

Introduction

1. During the crossing of the river RHINE, as much information as possible has been collected on the speed of the early Build-up. This, it is hoped, will help in deciding what must be provided for an assault river crossing, should another ever be necessary. The information has been got mainly from Bank Control 12 & 30 Corps, formations and units of 15 (Scottish) and 51 (Highland) Divisions, 11 and 13 AGRE's, units of 79 Armoured Division, and from our own observations on the river bank. Since the assault over the Rhine is being fully described by GSOs1 (Liaison) of 21 Army Group only a minimum of the general background is included.

2. The report is not intended as a criticism of the operation, which was quite conspicuously successful. It is a detailed examination of one aspect of it, put forward so that another time, the build-up can be accomplished even more rapidly and efficiently.

Outline of the Plan

3. In both 12 and 30 Corps the assault was to consist of two Brigades. Two assault Battalions of each Brigade were to be taken over at H-hour in Buffaloes, together with a small quantity of essential preloaded vehicles. The reserve Battalions of the assault Brigade were to be put over somewhat latter in Stormboats. As soon as practicable after the assault wave, essential transport was to be ferried over for the assault Brigades by Buffaloes, and while this was still in progress the reserve Brigade in the case of 12 Corps, and the two reserve Brigades in the case of 30 Corps, were to be taken over in Stormboats, followed in turn by their essential transport in Buffaloes. By this time, Class 9 ferries should have been ready to take over heavier transport belonging to the Brigades, essential Div transport, and in the case of 12 Corps, Airborne transport as well. Class 50/60 rafts were also planned to be ready at an early stage to carry over considerable quantities of armour, SP arty and SPA.Tk guns. DUKWs were to start as soon as exits and entrances were made, carrying over all forms of supplies. The next step in Build-up was to be the opening of Class 9 FBE bridges, which were to be followed by Class 12 and Class 40 Bailey pontoon Bridges. Over these would go all the residues and further Divisions. On both Corps sectors, but especially in 12 Corps, this sequence of events was closely followed.

4. The organisation for feeding vehicles over the river started with Marshalling Areas some way back, which were kept full by Q(Mov) of Corps acting on the information of the Corps Bank Control Organisation. Subsequently Bank Control called serials forward from the Marshalling Areas to Vehicle waiting areas, from which they were called up to the ferries as required. On the far bank vehicles went into Assembly areas and were sent out as traffic allowed. Bank Control worked on a priority list laid down by Corps and Division, but was in constant touch with Divisions and Brigades, and at any time a serial could be called forward from the Marshalling or Waiting areas out of turn. This organisation worked, on the whole, excellently. Brigades said that they could always get over any vehicle they wanted in a very short space of time while dispersal on the far side went rapidly and smoothly.

12 Corps Build-up

5. The rate of the early build-up is shown on the Diagram, made from Bank Control records. Immediately after the assault Battalions of 44 Brigade, essential transport went over in LVTs and the bulk of it, some 160 vehicles, was put over in 8 hours. The essential transport of 227 Brigade however was delayed until the banks could be cleared of enemy, but, once it started, went over at much the same rate, some 180 vehicles in 8 hours. About the same time as 227 Brigade's essential transport, 46 Brigade started to move over, some on the right and some on the left sector. The bulk of their essential vehicles, some 215, were put over in 10 hours. While these movements were still in progress, the Brigade build-ups carried on with heavier stuff on Class 9 rafts and continued through D, D+1 and into D+2. The Divisional troops build-up went on over a similar period. Lastly came the Airborne build-up which did not start until late on D-day and continued until the early hours of D+2.

6. A Class 9 FBE bridge was opened late at night on D-day but was damaged by a carrier and did not take any quantity of traffic till 1400 hrs on D+1. Not long after, the Class 40 Bailey pontoon bridge was opened. A class 12 Bailey pontoon bridge opened on the morning of D+2, and thereafter very little went over by any means other than bridges, except for Class 50/60 rafts which operated until the afternoon of D+2.

7. The rates of ferrying are given below.

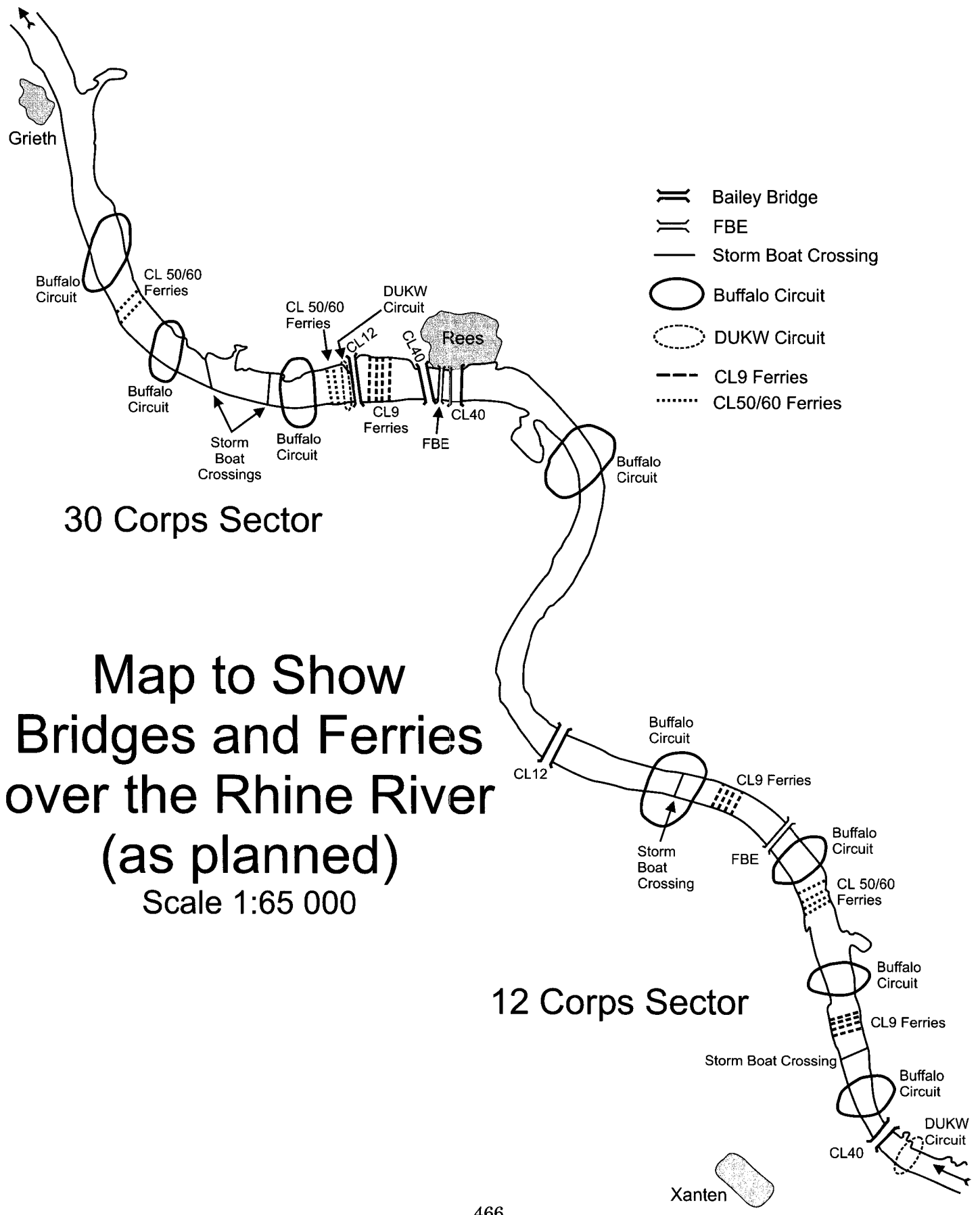
Table I				
Type of ferry	No. of Craft involved in ferrying	Operating for __ hrs	Total vehs carried	Ave. vehs ferried per hour
LVT	2 Regts - approx 180 LVTs	46	2070	45
Class 9	8 rafts	48	1030	21
Class 50/60	4 rafts	46	190	4

N.B. - 1. The total of vehicles carried by LVTs was obtained from the Regiments. It does not include assault wave trips, and is greater than the totals obtained by adding up the build-up diagram, which is evidently not quite complete.

2. The total of vehicles ferried by Class 9 rafts was obtained from 11 AGRE, and is slightly greater than the total obtained from build-up diagram.

3. The total AFVs ferried by 50/60 Rafts does not include some soft vehicles carried on the rafts at the same time as the armour.

8. The most striking feature of the build-up, especially clear from the totals of vehicles ferried by LVTs and Class 9 rafts, is the variation from period to period. This can only mean that the flow of traffic to be taken over was not organised evenly, or that the ferries varied from hour to hour in what they could get over. The first of these difficulties certainly arose, for both Buffaloes and Class 9 rafts complained from time to time that they had no vehicles to take over. The possible causes are mentioned in the next



paragraph. But traffic control was not the only reason for an uneven flow; the actual operation of the ferries was probably more important. This is dealt with in a latter section.

9. Unevenness in supply of vehicles to the ferries may have been due to defects in the mechanism of calling up vehicles; but the whole system was arranged to have a number of 'cushions,' in the Marshalling and Vehicle Waiting areas, and actually by the ferries. The cushions should have overcome this sort of difficulty and, as far as could be judged, in fact did so. It is suspected that the trouble lay in more frequent calling up of vehicles out of their normal turn, which, though it was managed rapidly, tended to result in gaps and delays. It is felt too, that traffic was going over at the speed it chose, rather than being 'forced over' at the greatest possible rate, probably because there were insufficient personnel to supervise all the links in the chain of control.

30 Corps Build-Up

10. Because of stiffer opposition, the build-up on the 30 Corps front did not go entirely according to plan and full records were not kept. In brief Buffaloes did very well and operated much as on 12 Corps front. Class 12 rafts did not work nearly so well, partly because of shelling, while Class 50/60 rafts, in spite of difficulties, were distinctly successful. Again because of shelling, bridges were not put across as rapidly as on the 12 Corps front, and the various types of ferry had therefore to operate for longer. Although in the case of 30 Corps there are not the same detailed two-hourly loads available, observation on the banks showed that the rate of flow was not even, partly of because of traffic control difficulties, but largely because of actual unevenness of operation of the ferries. The first of these difficulties has already been discussed. The second is dealt with in the next section.

11. The rates of the various ferries are given below for comparison with 12 Corps.

Table II				
Type of ferry	No. of Craft involved in ferrying	Operating for __ hrs	Total vehs carried	Ave. vehs ferried per hour
LVT	2 Regts - approx 180 LVTs	61	2240	37
Class 12	8 rafts	about 25	about 100	Operation of rafts was sporadic. Up to 10 per hr but ave. 4 per hr.
Class 50/60	4 rafts	63	320	5

N.B. Total AFVs ferried by 50/60 rafts does not include some 120 soft vehicles taken over at the same time as armour.

The Operation of the Ferries

12. Although the report has so far been concerned with LVTs, Class 9 and Class 50/60 rafts, while watching the operation from the banks of the RHINE, we saw the functioning of storm boats, DUKWs and Bridges, and for the sake of completeness have included them all.

LVTs

13. The actual time spent by LVTs in making a crossing is small. Where the current was favourable it was accomplished in 2.5 minutes, and at the worst in only 5 minutes. These times were only small in comparison with the times spent making circuits on the near and far banks and in maintenance. On the

near banks, the loading areas were, in the first instance, purposely kept well back to be out of observed fire, but when the bridgehead was securely held and this was no longer necessary, the loading areas in several instances were not moved forward. The rate of flow of Buffalo ferries was therefore being largely limited by the length of inland circuit, although the need for frequent maintenance was a contributory cause.

14. One Buffalo circuit, on 12 Corps front, was for a short time on the afternoon of D+1, a most impressive sight. There were never less than 5, and sometimes as many as 10 Buffaloes in the water going east, giving a rate of flow of about 120 an hour. Supposing half of the 96 Buffaloes in a regiment to be actually functioning (the other half being out because of repair, maintenance, crews resting and so on) this represents about 2.5 trips per Buffalo per hour - or a circuit time of about 25 minutes. Nevertheless, this rate was only achieved for a short time by certain Buffaloes, and as can be seen by examining two hourly totals in the build-up diagram, was never achieved by *all* Buffaloes, even at the height of their activity on the afternoon of D+1.

15. The general impression with the Buffaloes was that, given shorter inland circuits, a much higher rate could have been achieved. The capacity of Sappers to make tracks may however limit this, particularly in bad weather. A target figure of a half hour circuit seems reasonable and allowing 48 Buffaloes per regiment actually working, this means 96 trips per hour per Regiment. In fact, the average on 12 Corps front for the whole operation was only 22.5 trips an hour per Regiment, and for the period of maximum activity (Airborne Build-up) about 50.

Class 9 and 12 Ferries

16. The time for a complete circuit of a Class 9 raft varied greatly; on the six visits paid to these ferries circuits were averaging: 13, 16, 19, 23, 26 and 31 minutes (each figure based on about 5 circuits). The trips from shore to shore always took 5-6 minutes, and the variability came in at the loading and unloading of vehicles. The troubles were mostly trivial - fouling of breakwaters, failure of vehicles to run on to the rafts rapidly, delays in pulling on awkward gun and RE loads. The impression was that most of these troubles could be eliminated, and at least a 15 minute turnover reasonably achieved. Allowing further that 25% of rafts will unavoidably be out of action because of breakdowns, crews resting, etc., this would give, for the 8 rafts on a Corps front, a turnover of 24 vehicles per hour. In fact on 12 corps front an average of 21 was achieved.

On 30 Corps front, Class 12 rafts were much less successful, largely because of shellfire. The 8 rafts averaged only 4 vehicles per hour. It is very evident that these rafts cannot successfully be operated in face of much shelling, partly because they involve a lot of men standing about, partly because they are quite liable to damage themselves.

Class 50/60 rafts

18. There was never a shortage of vehicles to go over on Class 50/60 rafts, although there was a certain amount of wasted effort in that ordinary soft vehicles were often sent over alone (particularly on 30 Corps sector before Class 9 rafts started working) when they could have been sent over on the same raft as a tank. The limiting factor was once again the actual operation of the rafts. Here, there were purely mechanical troubles with winches, cables were broken by Buffaloes and there was interference from shellfire. Even so, there was the same variability of turnover as with Class 9 rafts. On various visits, the following average times for individual rafts were noted: 20, 22, 24, 30, 35 minutes. (Each figure based on about 3 circuits). The actual time from one shore to another was only 5 to 6 minutes and, much

* A point arise in connection with the Buffaloes used on 30 Corps front for supplies. These were quite definitely limited by labour for loading and unloading and not by the length of inland circuits.

as with Class 9 rafts, the rest was made up by trivial difficulties - fouling breakwaters, coming in slow, and going aground when the tank got on the raft. Again there was the impression that many of these troubles could have been eliminated and a turnover of 20 minutes made possible. Allowing again that 25% of rafts will be unavoidably out of action. This would give a flow of 9 tanks an hour from the 4 rafts, whereas during the operation an average of only 4 per hour was achieved on 12 Corps and 5 an hour on 30 Corps fronts.

19. The 50/60 rafts on the 30 Corps front were not troubled by quite so much shelling as the Class 9 rafts, and their working was not seriously affected by it. But it must be expected that their turnover would drop seriously if they were heavily shelled, for they and their crews are equally vulnerable as class 9 rafts.

Storm-boats

20. There is little to say on storm-boats. They were very successful, and transported infantry over exceedingly rapidly, taking only about 1.5 minutes to make the crossing. In fact, they had little to do for much of the time, but the number required must be dictated by the number of infantry required simultaneously on the far bank, rather than by the most economical number of boats to perform the job.

DUKWs

21. Only the DUKW crossing on the 12 Corps sector was examined. It was felt that the control left much to be desired. Large numbers of DUKWs were waiting on the other side to go across, but there was only one combined exit and entry on each bank. For this reason only one way traffic was allowed, followed after a time by one way traffic in the other direction. The actual crossing took 3-5 minutes and never more than 3 DUKWs were allowed in the water, since the exits were difficult, and occasionally DUKWs failed to get out, while others piled up behind. Communication with the far bank was by loud hailer which was notably ineffective.

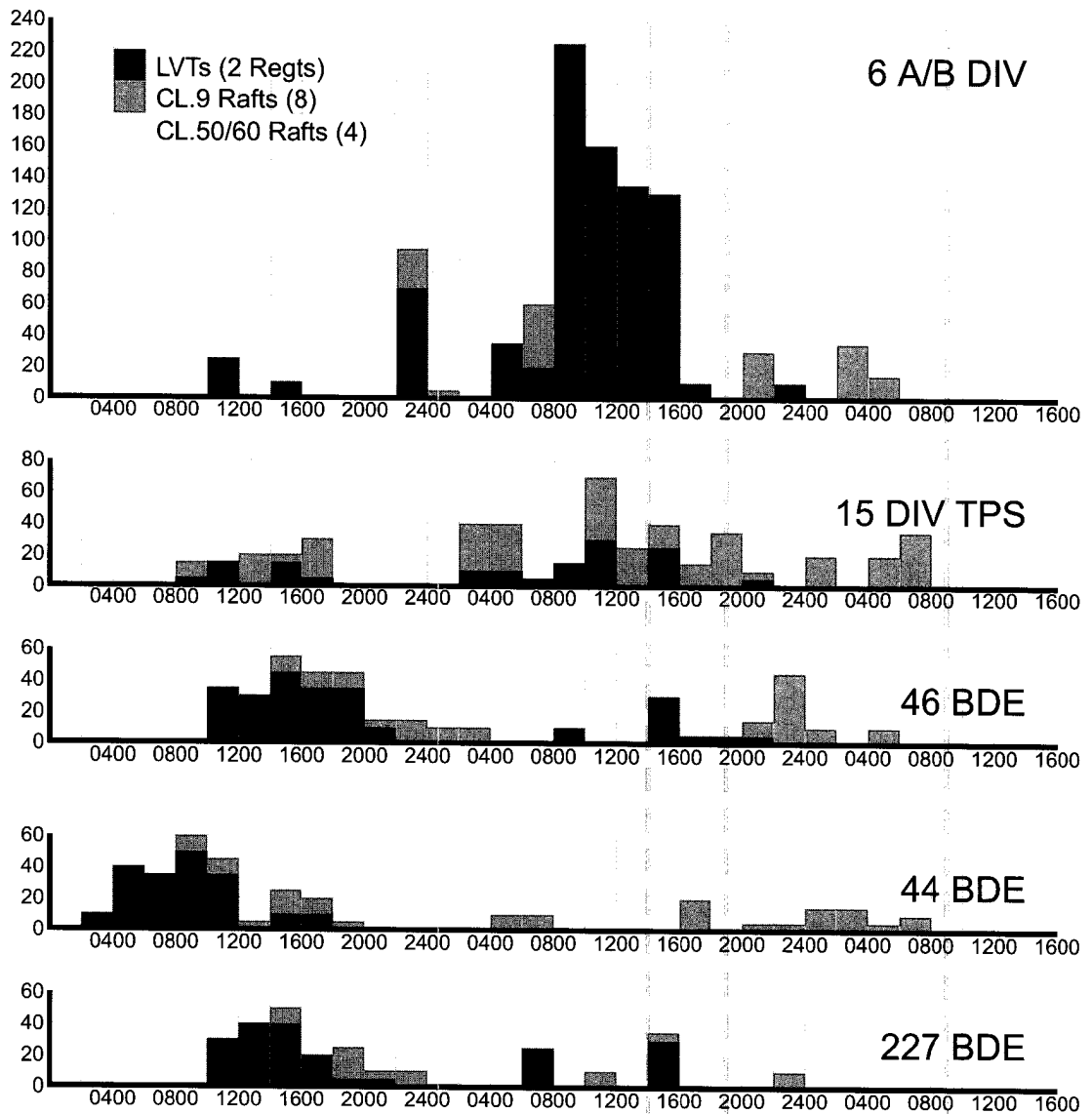
22. As a result, the rate of flow was only 1.5 DUKWs per minute in one direction - giving an average rate of flow over a period of time of 1 in 3 minutes or 20 an hour. At least two passages down to the water on each bank, and preferably 4 should have made it possible to achieve a flow of 40 or 80 an hour, when no doubt the limiting factor would have been loading and unloading.

Bridges

23. The flow of traffic over bridges was not good, as the following figures show:

12 Corps Build-Up

Number of Vehicles and Guns per 2 Hours



Ave. No. of Vehicles and Guns per 2 Hrs.

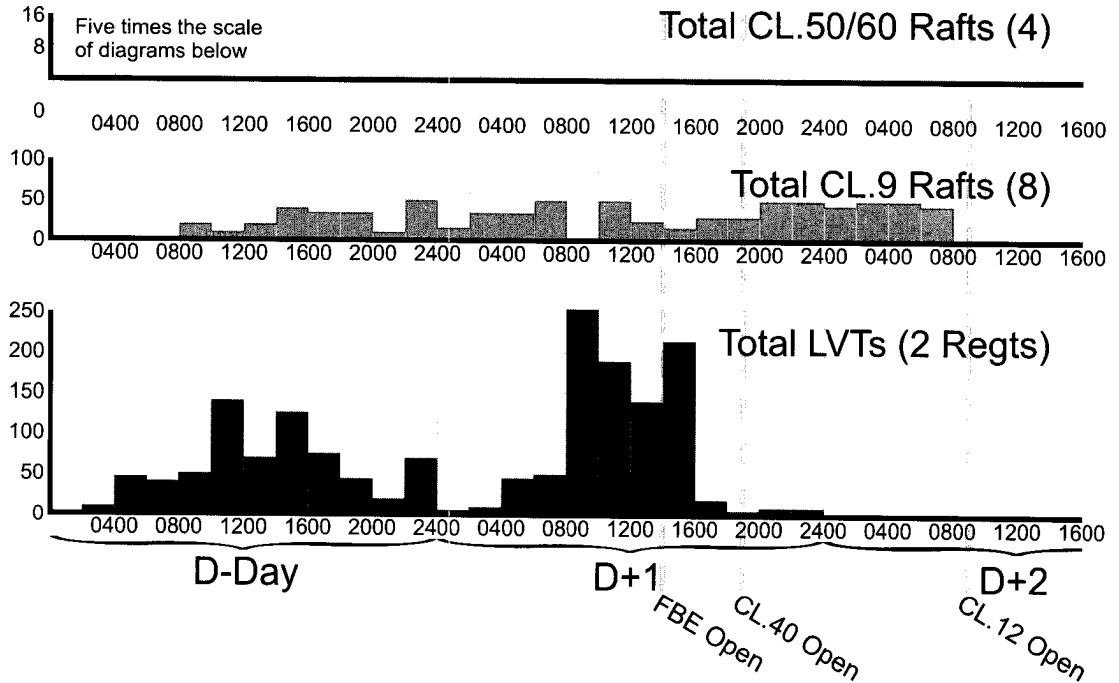


Table III				
Type	Rates of flow observed during uninterrupted periods (about 15 minutes each)	Effective rates of flow (including major delays)	Possible uninterrupted rates of flow	Possible effective rates of flow (including major delays)
Class 9 FBE	48, 57, 75, 75, 80, 88	55	140	105
	Ave. 70			
Class 12 BPB	170, 210, 280	165	540	415
	Ave. 220			
Class 40 BPB	98, 240, 276, 312, 290, 480	210	540 ²	415 ²
	Ave. 280			

The possible rates of flow are arrived at as follows:

Class 9 FBE - Wide spacing and low speeds are essential on these bridges; 30 Corps for instance enforced 200 ft spacing. At 5 mph this represents 140 vehicles an hour, uninterrupted flow. Discounting any major delays due to changing direction of traffic etc. there should be no difficulty in maintaining such a speed and spacing.

Class 12 BPB - 80 ft spacing is necessary on these bridges. Allowing a speed of only 8 mph, which should be maintained, an uninterrupted flow of 540 vehicles an hour should be possible.

~ Class 40 BPB - As for Class 12 BPB, but closer spacing can be tolerated and slightly higher rates of flow should be possible.

In all three cases, the effective rate of flow is taken as 25 % less than the uninterrupted rate; i.e., for 15 mins in every hour the bridge is assumed to be taking no traffic at all because of breakdowns in the approaches, switching of traffic, maintenance to the bridge, etc, etc. During darkness these rates must inevitably fall to some extent.

24. The actual rate of flow was everywhere about half what we estimated as being possible. The causes were several. Occasionally, but not often, it was genuine congestion on the far side of the bridge. Much more often it was poor traffic discipline and a failure to close up to the correct spacing or to "step on it." This was no doubt aided by the apparently widespread but erroneous belief that it is necessary to crawl over pontoon bridges (excluding of course FBE). Here and there were notices announcing no speed restriction on the bridge, but these seem to have little effect. In several cases Traffic Control was solely to blame in instituting their own speed restrictions, and enforcing quite unnecessary spacing. On the Class 12 Bridge on 12 Corps sector, there was actually a notice on the approach to the bridge announcing "5 mph OVER BUND." This was removed several times by the CAGRE only to be replaced by Traffic Control. It is clear that traffic movement on bridges leaves much to be desired. It should be noted that the approaches to the bridges were on the whole well laid out and made up by Sappers, and were not such as to limit the flow of traffic over bridges in any way. It is also, apparently, not generally realised by traffic control, that Class 9 or 12 loads do not need to maintain 80 ft spacing on Class 40 bridges.

Layout along the river

25. On the 12 Corps front:

- 3 Bridges
- 3 Buffalo Circuits
- 4 Class 9 Ferries (8 rafts)
- 2 Class 50/60 Ferries (4 rafts)
- 1 DUKW crossing
- 2 Storm boat crossings

were arranged in 8500 yards (just under 5 miles)

On 30 Corps front:

- 5 Bridges
- 4 Buffalo Circuits
- 4 Class 9 Ferries
- 2 Class 50/60 Ferries
- 1 DUKW crossing
- 2 Storm boat crossings

Were arranged in roughly the same length of river.

This averages out at one bridge or ferry roughly every 500 yards.

26. Although there were occasional troubles of LVTs, DUKWs and Class 9 rafts colliding with Bridges and Class 50/60 rafts, these were due to bad management rather than overcrowding. In fact, the impression was that more could if necessary be operated on a similar stretch of river. A much more serious limiting factor is likely to be the number of approaches to the river that already exist or that can be made up, although in fact this operation was favoured by the weather, and the ground was hard enough to take vehicles almost anywhere. Had this not been so, the crossing would have been made immeasurably more difficult. Such an operation is in fact very largely governed by the road situation.

Conclusions on the operation of the ferries

27. Without entering into details, it is evident that all means of getting across needed attention, mostly in small points. The impression was that the planning at all levels had been excellent, that where changes had to be made, they were made, but where things were running not so badly as to demand immediate changing, no attempt was made to improve matters. It was our opinion that had there been anyone whose sole job was to watch the general functioning of the build-up, he could have made innumerable small changes as the Operation progressed and speeded up the whole process very considerably. It has also been suggested that an officer, preferably RE, on the telephone of each rafting and ferrying site, in communication with the Vehicle Waiting areas, could hasten the feeding over of vehicles.

Discussion

28. The operation, on both Corps fronts, went very successfully, but it is also certain that the various means of ferrying were not working anything like as fast as they might have done and that the early build-up was consequently slowed down. The reasons for this have been pointed out.

29. Occasionally the opinion was heard expressed that more vehicles and troops would only have been an encumbrance, but after the first few hours, the bridgehead was never so cramped, nor the roads so crowded, that they limited the vehicles and troops being fed in. Occasionally of course this may occur,

and in the case of 227 Brigade it did occur for a short while at first light on D-day when they only held a 400 yard deep bridgehead. But excluding such special occurrences, the bridgehead is seldom likely to be too small to accommodate the flow that can be achieved purely on rafts and ferries. The advantage of the fastest possible build-up are too obvious to need mentioning. One of the main problems of any assault crossing is indeed "which side can build up the faster."

30. Referring to Table I it will be seen that LVTs and Class 9 rafts averaged about 65 vehicles an hour on 12 Corps front. Referring to the section on the operation of the Ferries it can be seen that, in our estimation, they might have achieved about 310 vehicles an hour. Table III shows that this was very much what in fact was going over the Bailey pontoon bridges. In other words, the ferrying facilities might have been more or less the equivalent of a Class 12 Bailey bridge, available from the very early stages of the operation.

31. If the rate of 96 vehicles an hour for a Buffalo Regiment can be reached, then two Regiments could put over the 800 or so essential vehicles for a 3 Brigade and Divisional troops build-up of this type in 4 hours. The implication is that the allowance of two regiments to an assault division is unnecessarily lavish and that one regiment could deal with 1 division, and indeed probably two divisions in the period before the opening of bridges.

32. The class 9 rafts, however, cannot achieve the same rapid turnover, and the 800 or so Class 9 vehicles selected for the essential build-up of 15 Div would take at the best about 32 hours. It would seem that an allotment of 8 rafts to a division is certainly not excessive for an ideal build-up.

33. The ferrying over of armour needs rather separate consideration. Excluding DDs, which, while excellent if they succeed as they did in this instance, can only be considered chancy, Class 50/60 rafts are the only means of transport until a class 40 bridge is opened (after 40 hours on 12 Corps front). Under these circumstances, rafts could get over (allowing 12 hours to get into operation) 250 AFVs. Excluding SP A/Tk guns, Bulldozers, etc., etc., this represents 2 regiments, which must be considered very adequate for one division.

34. A last point concerns the safety margin required. It must be recognised that if the river banks are heavily shelled, rafts may become more or less unusable while the shelling is going on. A safety margin in rafts is therefore largely a question of how much shelling is anticipated and to what extent it can be silenced. LVTs, on the other hand, should not be unduly upset by shelling on the banks (since they can unload inland) but they are sensitive to mud, and careful reconnaissance is therefore essential. Whatever safety margin is in the end allotted, if things go well, then the fullest possible use should be made of it to speed up the operations beyond what was originally planned and facilitate the subsequent breakthrough.

