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University of Ottawa, 1984

THE FIELD ENGINEERS OF THE 1ST CANADIAN INFANTRY DIVISION
IN THE SECOND WORLD WAR 1939-1945

By

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PREFACE

In the late seventies I found myself becoming interested in technology in two different ways. At the University of Ottawa I took a course in the history of North-American technology taught by Professor Donald Davis. The relationship between machines and society fascinated and I decided to examine the relationship between technology and society to some greater depth. Simultaneously, I spent many evenings, weekends and summers working as a reservist for 3 Field Engineer Squadron, a unit which had been carrying out engineer work since 1902. Not unnaturally then, when it came time to prepare a thesis for a Master's degree in History, I combined my two major interests and set out to study the relationship between military engineers and the technology they used to carry out their work.

My starting point was to look at the official histories of the United States and Canada. This gave me a feel for the problems formations had carrying out engineer work. From these I gleaned the kind of jobs the engineers were expected to carry out in wartime. It was then a short hop to discussing the issue with veterans of the Second World War who gave me an idea of the problems and eventual solutions that went hand-in-hand with being the army's jacks-of-all-trades, problems I myself had often dealt with as a member of a Militia Engineer unit.

To research the thesis itself, I turned to the company war diaries of the division that interested me, the 1st Canadian Infantry Division, to try to determine the relationship between the sappers, those who did all the work, and the equipment they

had to use. Did the new technology to the battlefield make life easier or more difficult for the engineers? Was it possible to see in advance the kind of problems the new equipment would solve as well as cause? In the end I took up the problem of the engineers preparedness. Were they able to carry out their missions, or did they require retraining and experience before becoming adept at their trade? These are questions I wanted to answer.

In the course of preparing this work, invaluable assistance was given me by many too numerable to name. Two in particular I should mention. The first is Lieutenant-Colonel S.N. White, honorary colonel for 3 Field Engineer Squadron, who related his experiences as an officer in the Second World War in Italy and who also helped me decipher some of the army's abbreviations and technical terms. Second, but far from least, Sergeant Gary Lindsay of 3 F.E.S. provided me with books and knowledge on the organization of the British and Canadian Armies in the Second World War as well as the moral support an academic needs to slugging it out in the university trenches.

INTRODUCTION

The Second World War saw the introduction of new technology and tactics designed to speed up the movement of troops and equipment over land. Blitzkrieg, or Lightning War, required the quick movement and deployment of the implements of war in order to destroy the enemy's ability to fight. Though designed and first used effectively by the German Army, the importance of speed was emphasized by British and thus Commonwealth forces as well. A training pamphlet prepared by the British War Office in 1939 for use by all Commonwealth Armed Forces stated that "In war, the necessity of speed, often combined with lightness and portability, overrides technical perfection, and (within limits) cost."¹ This doctrine was to put a heavy strain on the soldiers most responsible for ensuring the mobility of friendly troops while hindering that of enemy troops, the military engineers.

To carry out these tasks in the Second World War, Canadian engineers were organized into companies of about two hundred men under the leadership of a major. The role of these units was to execute the engineering work required to allow armoured and infantry divisions to live, move and fight.² Each division in the Canadian Army had under its command three engineer companies as well as a Field Park company of about twenty men, whose

responsibility was to ensure that the division's tools and equipment were in good working order.³ This meant that four companies of engineers totalling a little over six hundred men had to fulfill a two-fold assignment. First, they had to ensure that the eighteen thousand troops of the division could move quickly through rough terrain. Second, the engineers prepared the bunkers, wire and trench positions the division would occupy should it have to defend itself against superior forces.

How were these sappers of the 1st Canadian Infantry Division prepared for their role? Each sapper's training had to cover all aspects of the engineer in war, as there was no specialization among the division's engineers. Each man had to be prepared to carry out the gamut of engineering tasks in any phase of war and under a variety of climatic conditions. Whether the training the engineers of the 1st Canadian Infantry Division underwent was sufficient to prepare them for their combat role will be the topic of this thesis. It will be argued that when engineers of the 1st Canadian Division saw the enemy for the first time in Italy in July 1943, they were not fully prepared to carry out their tasks, despite the fact that they had been in training since their September 1939 mobilization. To support this view, the author will concentrate on the company war diaries and training pamphlets. The former were prepared on a daily basis by a junior officer chosen for the job. Their value as a source of

information on the successes and frustrations of engineers in training and in combat are therefore limited by the amount of time the officer-designate spent on preparing the diaries at the end of each day. This does not seem to have been a problem. Rather, the reverse is true. Every single event of the day, including the menu for lunch and the title of the evening's film, were often included in the diaries. The fact that these documents were typed and organized by clerks in the course of the war is very helpful, as is the thoroughness with which appendices were prepared. Training reports, routine orders, battle plans, lists of men and equipment as well as efficiency studies and state-of-equipment forms and a variety of other reports and returns were appended to the war diaries, expanding their value as a source of information. Interestingly, only one month's worth of diaries, that for June 1943 for 1 Field Company, were ever lost. The remainder survived the war intact in spite of ship sinkings and artillery attacks on headquarters.

One problem with war diaries that arose in the First World War did not appear in the second. On the battlefields of the Somme and Paschendaele junior officers chosen to keep the diaries up to date did not have the information necessary to do so. Detachments sent over the top often went missing for months, their bodies discovered when the Canadians finally reached their objectives. To make matters worse, the diarist sitting in the

trench could not see what was going on across no man's land, where the fighting took place. Radios were a thing of the future and the telephone cables very rarely survived the shelling and machine gun fire that raked the area between the opposing forces. Therefore the diaries were inaccurate at best and far from useful. This was fortunately not the case for the Canadian engineers in the Second World War. Diarists in company headquarters were in touch with the units in the field, if they themselves did not accompany them. Communications were far better and the scale of battle was different. Units went from job to job rather than rush through smoke and gas to disappear for a time on the other side of no man's land. Though operations often lasted several days they did not approach the weeks of confusion common to First World War battles. Thus the diaries are a reasonably accurate source for studying the activities of engineer units in garrison and in combat.

In order to understand the goals of engineer training the author studied the training pamphlets listed or cited in the war diaries. Diarists often included the guidelines used when the units carried out training. One can thus get an accurate list of the pamphlets the engineers relied on to teach their men. There is no certainty, however, that training was indeed carried out exactly in accordance with the pamphlets, and so such statements in the diaries must be taken on faith. This is not so much a

problem as it may seem, for the main purpose in studying the books was to determine the goals the engineers were supposed to reach in their training. Studying the diaries then shed light on whether such goals were indeed within the sappers' reach.

The use of war diaries is not original, as any perusal of an official history will attest. The author's approach, however, is different than that of official histories. In this case the focus is on the smallest possible unit, the company or platoon, in order to determine the relationship between engineers and the equipment they must use to carry out their assignments. Previously, the war diaries were used to trace the units' involvement in the battles and campaigns of the war, at times in great detail. This thesis will concentrate not on the strategic questions of the war but on the training and logistical problems the engineers had to solve as technicians and soldiers as reported by junior officers in the war diaries. The work to follow will deal with men who knew nothing of the discussions in cabinet, the negotiations with the allied powers or the global problems of war and diplomacy, but who had to train, repair, build and fight. In relying on war diaries then, it becomes impossible to deal with the larger problems of strategy, supply and war policy. It is necessary to bring in other sources, namely the official histories of the Canadian Army and the Royal

Canadian Engineers, to provide the background necessary to greater understanding of the subject in question.

This thesis, then, is a case study. The 1st Canadian Infantry Division, one of eight divisions formed in the course of the war, was chosen because of its breadth of experience. The first to mobilize, it was the only division-sized formation to engage in the campaigns in Sicily, Southern Italy, Northern Italy and Northwest Europe. It was the first formation to send troops on tactical operations in the unopposed raid on Spitzbergen and spent the most time in England, being heavily involved in the defense plans for the island during and after the Battle Of Britain. The engineers of the division were part of a corps that included mechanical equipment companies, road construction companies, tunneling companies, construction companies, stores sections, topographical sections, map photo sections, drawing sections, general survey sections, railway operating companies, railway workshop companies, bridge platoons and modelling teams, all attached to corps or army formations. The field engineers were chosen because of their proximity to the battlefield - where engineer operations are the most difficult and crucial. Thus the relationship between technicians and their equipment in time of crisis can be studied in depth. The problems the engineers faced and solved were those reflected in the war diaries, which as a

written source comes closest to relating the experiences of sappers in war.

The four engineer companies of the Division, namely 1, 3 and 4 Field Companies and 2 Field Park Company, faced a series of material and strategic obstacles to training which made it extremely difficult to prepare the sappers for their combat role in Italy and Western Europe. These obstacles differed greatly. The very role set out for the engineers in combat made it almost impossible to train them adequately. It was so vague and varied that no amount of teaching could prepare the sappers for all eventualities of war. Linked to this was the problem in scheduling training. Because the engineers were expected to help set up and maintain the division's training camps and defence installations in England from 1940 to 1943, putting their electrical, plumbing and carpentry abilities to work, there was little time available for training. When they had time to train, the sappers often did not have the necessary equipment. Their trade was oriented towards the manipulation of resources and thus required much hands-on practice if the sappers were to become proficient. But the necessary training resources were rarely available. The problems the engineers faced in attempting to conduct any type of training prevented them from preparing adequately for all the tasks they were expected to perform once the division began operations against the Axis. The engineers'

war can thus be separated into two distinct periods. From September 1939 to July 1943 the engineers of the 1st Canadian Infantry Division remained in England, constructed camps, gave aid to bombed villages and towns, learned the basics of their trade and gained experience in defensive operations. From July 1943 to May 1945 they learnt mobile warfare on the battlefields of Sicily, Italy and the Netherlands. Eventually and at some cost they became proficient in maintaining the forward momentum of the division under the new technological conditions of the Second World War. The learning process required by evolving technology did not end until after the German surrender.

To date, this important problem has not been studied at the company level. The official history of the Canadian Army in the Second World War does no more than mention certain engineer operations. It does not deal with the sappers or their problems in any detail. The multi-volume History of the Corps of Royal Canadian Engineers (RCE), sponsored by the Military Engineers Association of Canada and written by Colonel A.J. Kerry and Major W.A. McDill, is an excellent survey of the background history and development of the RCE from the formation of the Royal Engineers in the seventeenth century to the end of the Second World War. But it does not analyse the relationship between the engineers, their training and the technology they had to deal with at the company level. Rather, the official history concentrates on the

corps as a whole, which includes the various engineer units mentioned above. It is thus most useful in tracing the development and experiences of the Royal Canadian Engineers in the course of the war.

The official histories of the Royal Engineers and the United States Army Corps of Engineers discuss many of the issues that will be dealt with in this thesis. As with the Canadian official history, they concentrate on their respective corps as a whole, covering in great depth the problems with supply and training that arose with mobilization and persisted throughout the war. The difficulties dealt with at higher levels of command have thus been studied in the official histories and lie outside the scope of this thesis. Suffice it to say that the enormous complexities involved in mobilizing and maintaining huge military organizations in the field in the face of a strong and determined enemy made it almost impossible to avoid bottlenecks in supplying engineer troops and giving them proper guidance in carrying out their training. The nature of war allowed the Americans and British, and by extension the Canadians, to foresee only the general mobile nature of the war they were fighting, which accounts for the vagueness of engineer doctrine.

Before entering into the main body of this thesis it will be helpful to explain in some detail the role and organization of the engineers within the Canadian Army in the Second World War.

It was partly because of this role, which was so vague and all-encompassing, that the officers and men of the 1st Division's engineer units who faced the Italian and German Armies in July 1943 were so ill-prepared. An engineering officer was expected to assist his commander, in the case of the 1st Canadian Division an infantry general, by advising him on technical matters relating to his plan and ensuring through his own planning and leadership that the work required by the division was executed. He thus had to have leadership ability, as did all Army officers, but he also had to have a technical aptitude. His areas of expertise included the design and construction of bridges, culverts, diversions, minefields, road blocks, anti-tank obstacles, roads, airfields, permanent buildings, and a host of other projects.⁴ He had to carry out any of these with minimum preparation and often without the proper materials. The engineer officer's role in the division was very broad and required a wealth of knowledge and resources. The role of the other ranks, which included privates, corporals, sergeants and warrants, was as broad. They were required to undergo full military training, to achieve proficiency in general field engineering and to acquire skill at an engineer trade such as plumbing, carpentry or even lithography.⁵ A typical engineer section, of which there were three to a company, would have over fifty men including a great variety of trades; two blacksmiths, three bricklayers, ten carpenters, one clerk, two concretors, one

electrician, four engineer artificers, two fitters, one mason, one miner, two painters, one tinsmith, one waterman, one plumber, one stoker, one driver-batman, nine general service drivers and eighteen pioneers, who specialized in combat operations. Though there could be minor variations the above tended to be the norm. Headquarters also had a draughtsman and a surveyor for mapping and special construction projects such as airfields. No less than sixty-four different trades were represented at the company, division, corps and army levels.⁶ On the one hand a sapper had to be able to fight a battle, build a bridge or repair a water main. On the other hand he had a specific trade which he may have brought with him from civilian life and was put to use only intermittently. Because of the variety of skills the sapper had to learn, the training period for engineers would have had to have been much longer than for any other branch of the army. Therefore the first problem faced by the Royal Canadian Engineers in training was both the breadth and the specificity of material they had to learn.

Military engineers were technicians and tradesmen trained to support the combat arms, that is to say the infantry and armoured units, in the execution of their duties. As there was no guarantee that a specialist in a specific engineer trade would be available in an area at a given time, the engineers had to learn a wide range of subjects dealing with all aspects of the

technology of the day. A War Office engineer training pamphlet prepared at the beginning of the war put it in these terms.

The distinctive features of the organization and technique of military engineering are therefore the comparative absence of specialization and the wide range of general engineering which it embraces; the necessity for speed; and the capacity for improvisation from the slenderest resources."

The term engineer in this sense does not therefore have the same professional meaning it has today. The sapper was both soldier and tradesman, expected to know the basics of fighting in a modern war on top of applying his engineering knowledge, which had to be both accurate and wide-ranging. His role then, was far from specific. "The role of the military engineer in war is to apply engineering knowledge and resources to the furtherance of the commander's plans."⁸ This doctrine may appear simple enough on the surface. It places the engineers in a subordinate position, their task to follow the instructions of the commander to whom they have been assigned. It also made them out to be the all-around technical experts on the battlefield.

Within the 1st Canadian Infantry Division engineers came under the overall command of the Commander Royal Canadian Engineers (CRE), who was responsible to the Divisional Commander for the execution of engineer tasks. Groups of engineers could also operate as independent units or be attached to infantry or armoured units within the division, such as a brigade, to carry out operations in accordance with the division commander's plan.⁹

Close cooperation and coordination between the engineer companies as well as between them and other branches was an absolute necessity. This meant, however, that the engineers had to be prepared to carry out any engineering task required by the overall military plan. Therefore, military engineers required training, in a host of subjects in order to ensure their competence in any situation. At the same time, a growing reliance on technology in order to achieve greater speed of movement created novel emphases within military engineering for all three phases of war - withdrawal, defence and attack.

In the course of a withdrawal, the engineers' task was to impede the enemy's movement in order to hold up his pursuit of friendly forces. This was achieved in a variety of ways. Bridges were destroyed and roads were cratered to slow the enemy's movement along major communications axes. Barbed wire entanglements and minefields were laid down along likely avenues of approach in order to force the enemy either to take less passable routes or waste valuable time breaching the man-made obstacles. In the withdrawal, engineers were also expected to destroy any facilities which may have been of use to the enemy's war effort. These included ports, airfields, power plants and ammunition and fuel dumps. This role required that the sappers learn the intricacies of explosives, land mines, booby traps, barbed wire entanglements and various man-made obstacles. Such

training required special stores for demolitions, and much time for training in mine warfare.

In the defence the engineers' role changed somewhat, although once again their task was essentially to impede the enemy's advance. Minefields and wire obstacles were laid in the path of the enemy's forces to protect vulnerable areas and funnel his troops and tanks towards the strongest sections of friendly defensive positions, which were for the most part dug by the engineers. Though the individual infantryman dug his own slit trench or fox hole, the engineer built command posts, bunkers, communication trenches and other such facilities. While in the withdrawal phase the engineer's task was essentially one of destruction, in the defence stage construction took on primary importance. This meant that sappers had to learn the basics of heavy construction including the use of compressor tools, heavy equipment and basic carpentry skills.

Moving into a defensive posture involved other tasks for engineers. Since the Canadian Corps and Canadian Army spent most of the war to 1943 in England, the engineers belonging to those formations were given another role specific to that country. On the one hand, they built and maintained the division's accommodations. On the other, they gave aid to civilian authorities. This consisted in helping to clear rubble and repair facilities after bombing raids. As all engineer units also



consisted of tradesmen such as carpenters, plumbers and fitters, they were given the job of repairing bombed water mains, buildings and heating plants. In fact, the engineers fulfilled similar tasks throughout the war in Europe, even in combat, often repairing damage to civilian towns and villages that had been inflicted by their own artillery the day before.

Finally, the engineers in the defence also acted as infantry companies. Once the sappers had completed the construction of defensive positions; digging trenches, stringing wire and laying mines they occupied the forward lines like other soldiers in order to ward off enemy attack. To this end they often acted as anti-aircraft troops to defend airfields and headquarters against bombing and parachutist attack. The engineers, then, not only trained in their own trades as plumbers or carpenters but they had to know how to handle infantry weapons such as the rifle, anti-tank rifle and anti-aircraft gun.

In the advance the role of the engineers changed once again. In this phase they were charged with maintaining the mobility of friendly troops advancing against heavy opposition over rugged terrain. Their enemy counterparts, the withdrawing German and Italian engineers, were very adept at destroying roads, bridges, airfields and power facilities. The Canadian engineers accompanying the pursuing forces thus had to put up new bridges, build roads, and fill craters in roads and runways. As when in a

defensive posture, the engineer tradesmen in the course of an advance repaired damaged facilities such as power plants and water supply points. Some of the work was hazardous, such as breaching minefields and wire obstacles, most of which were still under the observation and fire of the enemy. Mines were often booby trapped so that their removal could injure or kill engineers trying to remove them. Engineers' training therefore had to include techniques to defuse and neutralize explosive devices designed to trap unsuspecting soldiers or civilians.

In one way or another then, the sappers had to be competent to deal with modern, rapid mechanized land warfare, most notably heavy trucks and tanks. In order to maintain the mobility of friendly troops, engineers had to be capable of building new types of roads and bridges strong enough to carry the ever larger trucks, artillery pieces and tanks developed in the Second World War. Tanks, for instance, presented them with two major problems. The first was that they were tracked vehicles moving on plated treads which dug into the ground and thus afforded the vehicle mobility even in sod or mud. The engineers' problem was that these same tracks tended to break up pavement and dig up hard packed dirt. Thus maintaining roads became a particularly complicated process. At times it was even necessary to build parallel roads, one for tracked vehicles and another for wheeled vehicles. The introduction of the heavy tank in the Second World

War also created serious problems when it came time to construct bridges. Their immense weight made it necessary to change outdated bridge designs. This was compounded by the fact that tanks in the rear areas were often loaded on huge truck transporters - flat beds - in order to eliminate unnecessary wear and tear on the tank itself. The combined weight of a tank and its massive carrier could exceed eighty tons. Thus new techniques had to be developed to build greatly strengthened roads and new bridging equipment.

Tanks presented different problems when they belonged to the enemy. As the armoured fighting vehicles grew in mobility, size and armament engineers were expected to set up ever-larger and more complicated tank obstacles to slow down or divert the German Panzers. As new assault vehicles were designed for rapid and more effective movement on many types of terrain, this was no easy task. Cratering a road was an effective means of stopping trucks and other wheeled vehicles, but did little to hinder the movement of a fast tank, which could simply leave the road and travel cross-country. It became necessary to develop new ways to block off entire areas of the countryside to prevent the deployment of these tanks. Construction of such massive anti-tank ditches, walls and obstacles required much manpower and improvisation of technique. Experimentation lasted throughout the war.

To ensure the mobility of friendly equipment and hinder the movement of the enemy's, sappers had to maintain and repair a variety of machines of their own. In the Second World War picks and shovels were no longer adequate to carry out the variety of complicated tasks they were assigned in the course of the war. Bulldozers were used for heavy earthwork, compressor tools were needed for construction and survey equipment ensured the proper alignment of the different phases of a project. Engineers had to carry spare parts for all their equipment as well as the equipment itself. This required trucks and flat beds, which themselves had to be maintained in good working order.

The role of the Canadian engineers of the 1st and other divisions in the Second World War was exceedingly varied, stemming from the growing reliance of modern armies on new technology to move and fight. Although by today's standards the armies of the Second World War may appear to have been backward and ill-equipped, the trucks, tanks and other implements of war were numerous and evolved quickly enough to make the job of the engineer more complicated and intense than it had ever been in the past. Much of what the engineers learned about the new technology, as this thesis will show, had to be done on the job in the face of the enemy.

NOTES

1. Directorate of History FN 7, War Office, Engineer Training Part I - Individual and Collective Training, 1 January 1941, p. 4
2. "The role of the Field Company or Field Squadron is to execute the normal engineer work required to allow armoured and infantry divisions, respectively, to live, move and fight."
Ibid., p.1
3. "The role of the Field Park Company is to carry respectively the armoured divisions' an infantry division's reserves of tools, bridging equipment, engineer plant and stores; to organize and man divisional engineer workshops and dumps; to operate the divisional H.Q. lighting set; to provide a reserve of skilled tradesmen, and to serve as the channel for the supply of engineer stores (other than replacements of unit equipment)."
Ibid., p.2
4. Directorate of History, FN 7, War Office, Engineer Training Part I Individual and Collective Training, 1 January 1940, p. 4
5. Ibid., p. 5
6. PAC, RG 24, vol. 14713, 4 Field Company, March 1941, Appendix 10
vol. 14778, 2 Field Park Company, December 1942, Appendix 4
vol. 14709, 3 Field Company, October 1941, Appendix 9
vol. 14713, 4 Field Company, May 1941, Appendix 9
7. Directorate of History, FN 7, War Office, Engineer Training Part I Individual and Collective Training, p. 4
8. Ibid., p.3
9. Ibid., Engineer Training Part II War, p. 30-31

CHAPTER ONE

MOBILIZATION TO THE FALL OF FRANCE: SEPTEMBER 1939 TO JUNE 1940

On 1 September, 1939 German troops and tanks, closely supported by aircraft, crossed the frontier into Poland. Two days later, after the expiry of an angry ultimatum, France and Great Britain declared war on Germany. They were soon followed by Australia, New Zealand, South Africa and Canada. In Canada, mobilization began immediately. The country implemented plans to form a mobile force of two divisions with ancillary troops as well as special forces for local defence and internal security duties. The first formation destined to go overseas, the 1st Canadian Infantry Division, was formed from exsistant militia personnel and volunteers.¹ This formation was to include four engineer companies; 2 Field Park Company and 1, 3 and 4 Field Companies of the Royal Canadian Engineers, which had all been local militia units before the outbreak of war and were to be expanded in numbers and equipment to give close, technical support to the new Canadian division. In the case of the engineers, the mobilization period including training lasted until the fall of France in June, 1940. This mobilization process can be separated into four parts. The first concerns the recruiting and elementary training of new men for the field

companies. The second traces the tasks the engineers had to fulfill since they arrived in England in January 1940 and how these interfered with advanced training. The third element concentrates on the problems with equipment, both quantity and quality, which the engineers had to face in attempting to learn their role. Finally, the fourth element of the mobilization process deals with the training actually carried out in order to determine the level of proficiency the engineers managed to achieve by the fall of France.

During their initial time in Canada the engineers had little opportunity to train. From September to December 1939, when the division left for England, engineer officers and non-commissioned officers concentrated on recruiting and organizing the four companies. Basic kit, even coats and boots, was sorely lacking. There were too few men qualified to teach the recruits the basics of military life or field engineering and there was too little time available for training. After their arrival in England, the engineers had few problems finding the necessary instructors, but constant camp construction and maintenance tasks and fatigues left them again with little or no time to learn their trade. Special engineer stores such as bridging or explosives were not available to the Canadian sappers, and so again training suffered. By the fall of France in June 1940 the engineers had become very proficient at setting up new training camps, but had

had little opportunity to learn much about their combat role in the division.

These training difficulties were not readily apparent when the four field companies were mobilized in early September 1939. The first problem faced by these units was one of personnel. It was the government's intention to form the 1st Division quickly and so recruiting became a top priority.² It was necessary to fill out the ranks of the new division which was to be sent overseas to help Britain and France fight against Nazi Germany. Because of problems with recruiting and kitting out new men, very little training was carried out in Canada during these first few months.

The four engineering units of the 1st Canadian Infantry Division were all originally part of the Canadian militia.³ These men were part-time soldiers who paraded and trained one night a week and perhaps attended a ten-day concentration during the summer. At the time of mobilization there were very few of these reservists. 1 Field Company of Victoriaville, Quebec, totalled only two officers, a Lieutenant-Colonel and a Lieutenant,⁴ twelve Non-Commissioned Officers and thirty-four sappers.⁵ 2 Field Park Company of Toronto was even smaller at the outbreak of hostilities. Its minimal effective strength was made up of only one acting captain and ten other ranks. Beginning with this weak complement the Toronto Park Company had to recruit and train to

its war establishment of 152 all ranks.⁶ Exact figures are not available for 1 Field and 4 Field from Ottawa and Montreal respectively, although they would not have been much different. The militia had been extremely small before the outbreak of war. Bringing these four units up to war strength was to be no easy task.

The engineers' mobilization problem was aggravated by the specialized nature of the assignments the engineers were expected to perform once mobilized. There were very few positions available at the four engineer units for non-tradesmen with the result that the recruiting pool remained very small. The majority of Field Engineers had to be qualified in a civilian trade such as carpentry, plumbing or fitting.⁷ Officers could come from three sources. Some were recruited from within the ranks of their respective units, candidates moving on to an Officer Candidate Training Unit on an emergency commission. Others were brought in from the universities if they had at least six months of post-secondary education and could pass general army officer exams. Finally, civilians over the age of 37 with the required technical qualifications could apply for commissions in the Army Officers Emergency Reserve.⁸

Although the recruiting pool for engineers was much more limited than that of the infantry, the armour or the artillery, these limitations were to some extent alleviated by the dispersed

locations of the units. Each company recruited in its own allocated area. 1 Field Company was ordered to recruit in Halifax, though the unit itself was based in Victoriaville, Quebec.⁹ 2 Field Park Company recruited in its own district around the Fort York Armouries in Toronto,¹⁰ while 3 Field and 4 Field Companies found their new men in their home cities of Ottawa and Montreal respectively.¹¹ This made it somewhat easier for the four companies to recruit the tradesmen they most sorely needed, especially since these specialists were not yet required for domestic war production. The formation of the 1st Canadian Infantry Division predated Canada's shift to a war economy.¹²

Recruiting began well in the first few weeks of September, but failed to meet the demands of the engineer units. By 22 September 4 Field had increased its numbers to 175, but because of lack of kit and accommodation was not given permission to expand to full war establishment of 251 until 9 November.¹³ 1 Field had 164 all ranks in uniform by 24 October when it was ordered to recruit to its full war establishment of 250 by 15 November.¹⁴ It did not achieve this goal until 12 December.¹⁵ 2 Field Park Company and 3 Field Company faced similar problems. There were simply not enough tradesmen volunteering for service who could meet both the educational and physical criteria to become sappers. Many of those recruited had to be released before the units went overseas because it was discovered that they had

too many dependents or were too old. The engineers could not fill out their ranks as quickly as expected by higher headquarters. Each field company remained at about two hundred all-ranks throughout the war.¹⁶

Even though understrength, these units still found it impossible to clothe their recruits with the necessary footwear and uniforms. Though boots and coats began to arrive in the first few days of mobilization, these were not in sufficient numbers. One company reported that "Great difficulty is being found in equipping recruits with clothing. ... No clothing available to issue to recruits except boots, socks and underwear."¹⁷ What did arrive did not necessarily fit the needs of the recruits who had to wear it. One company received a full complement of boots but many of them were much too big or too small. Some were so small that they would have only fit men too tiny to be accepted into the army.¹⁸ These supply problems of course seriously hindered training. So many men fell ill during the cold fall from the lack of warm clothing that it became very difficult to teach them even the rudiments of army life. 3 Field Company offers a good example. Not a day went by between September and November without several soldiers being admitted into hospital with colds or flu.¹⁹ Because of the lack of kit and equipment training of all kinds had to concentrate on basic aspects of soldiering which did not require actual practice with tools or weapons. Physical

training in the form of callisthenics became the mainstay of the engineers' training plan. It was needed to build up the stamina and physique of the recruits but it required no special equipment. It had the added advantage of not requiring boots or field clothing. Very little other training was carried out during this period.²⁰

Some units took advantage of those stores they could acquire easily from the army or other sources to practice some very basic engineering skills. Because it was well supplied with rope, 1 Field Company spent a great part of September training its men to tie knots and lashings. All that was required for this type of training was cordage. Later in September the company added 'lectures' and field works to its programme, making use of the shovels and pick axes it had just received.²¹ On the other hand, training of any kind did not even begin for 4 Field until well into October, at which time the unit concentrated on rifle practice, where men learned to strip, assemble, clean and fire the rifle.²² The other companies did not mention any training at all in their diaries, where they harped at length on the lack of equipment and personnel. 1 Field Company seems to have come off the best in this period: they even managed to carry out some rowing drill in four boats belonging to the Royal Canadian Navy in Halifax. Thus very little military and almost no engineer

training was carried out by the field companies of the 1st Canadian Infantry Division before embarkation.²³

Training was hampered by more than just the lack of equipment. The units mobilized in September, were low in strength and there were simply too few trained military engineers to teach the incoming recruits. Officers were occupied trying to organize training schedules while at the same time attempting to locate much-needed equipment. This left the few non-commissioned officers to instruct the men in the basics of soldiering.²⁴ Sergeants and corporals who before the war had trained only a handful of men at a time found themselves instructing groups of twenty recruits or more who did not have full uniforms and were probably ill. The only source for non-commissioned officers in 1939 was the Non-Permanent Active Militia. Thus engineer units had to rely on those who were qualified as N.C.O.s at the outbreak of war. There were very few of these for several reasons. Manpower was low in all these units to begin with. Many of the N.C.O.s present when war began did not qualify to enter the Active Service Force (which was destined to go overseas) because of age, medical problems or number of dependents. Some chose to remain in Canada to stay with firms that had employed them during the depression. It would take several months or years to train new men to replace these non-commissioned officers. The situation was far from ideal.

Training in Canada was therefore minimal and no one expected to send a fully-prepared division to England. The problems of mobilization would take more than a few months to solve, and so the engineers carried out what training they could in spite of equipment deficiencies and the lack of instructors. Also, by December 1939 the companies had still not filled out their ranks with recruits. The officers and senior N.C.O.s expected to overcome these difficulties in English training camps.

The engineers of the 1st Canadian Infantry Division moved to England by troop-ship between December 1939 and January 1940. There they found that many of the problems encountered in Canada had followed them and that new difficulties were added. Chief among the latter was a series of new construction and custodial tasks the recruits were expected to perform. 1 Field Company quickly discovered that fully one third of its complement of 251 was allocated on a rotational basis merely to help run and maintain the division's camp at Aldershot on Salisbury Plain. These duties were not in any way linked to the general combat role of the engineers in war. Rather, they were required to clean barracks, ensure coal was delivered to the quarters and help in the kitchen. Because of the very rundown state of the old barracks, they were difficult to clean. The inadequate kitchens needed more helpers than would ordinarily be required. Thus in

doing its share of the daily work around the camp each company found its training seriously hampered.²⁵

Because its general role was different from those of the field companies, 2 Field Park found itself doing somewhat different work. It became the workshop for the entire division. It was quickly organized into five sections, each with its own special stores and responsibilities. Headquarters section was formed with the clerks and drivers and ensured the proper despatch and reception of the paperwork that inevitably accompanied any other activity carried out by the company. Field Stores section kept and maintained shovels, pickaxes, sledge hammers, pickets and other small stores except for those held directly by the other units of the division. This included such items as shovels for infantry trench-digging exercises and survey equipment for the artillery to set up ranges. Thus tools were issued only for large-scale projects. The transport section repaired, drove and maintained the division's reserves of trucks. It was also responsible for hauling gravel, coal and any other materials the camp required to ensure the comfort of its inhabitants. The bridging section was responsible for the maintenance and delivery of pre-fabricated bridge equipment, a task complicated by the fact that the bridging in its stocks was incomplete. During this initial period in England, from January to June 1940, workshop section was the busiest, but headquarters,

field stores, transport and the bridging section also had their hands full fulfilling the requirements of the infantry, artillery, signals, and other units of the 1st Canadian Infantry Division.²⁶

The division's various activities sometimes seemed without direction as the formation suffered from the settling down pains resulting from a quick and unexpected mobilization. Decisions made one day were rescinded or countermanded the next. From their arrival in England in December 1939 to the fall of France in June 1940 the troops of the 1st Canadian Infantry Division were often transferred from one command to another as the situation changed. They were involved in a number of expeditions which never left the island, with destinations in Norway, the Netherlands and France.²⁷ The engineers of 1 Field Company actually accompanied the 1st Canadian Infantry Brigade to Brest from 15 to 17 June 1940. The 'forlorn hope' achieved nothing more than the loss of their vehicles when they reembarked without them and returned to England. In between such missions the engineers were sent to training camps to complete their military indoctrination. Each of these changes was accompanied by a road move, keeping the engineers very busy preparing camps or making previously sited camps more comfortable. As the division moved into a new area, which could be as often as once a month, the park company took on carpentry, wiring and plumbing jobs. They could also be required

to construct slit trenches throughout the camp to be used as shelters in case of air raids.²⁸ The field companies found themselves with slightly different tasks. They erected and camouflaged tents and built abution tables and latrines. Like the field park company and everyone else in the division, the sappers of the field companies dug slit trenches - the latter being referred to as Passive Air Defence. Thus training of any kind had to be postponed every time the units moved.²⁹

The situation was worsened by the fact that the units were still not up to strength upon arrival in England. One field company's diarist reported in frustration as late as June 1940 that the unit was still thirty men short of full strength. Since tasks were allocated by unit and not according to the number of personnel available, the training of the engineer units suffered considerably. Combat arms units sent a third of their men on fatigues, but at least put the other two thirds through rudimentary training. The engineers were required to help with camp construction, plumbing, carpentry or other specialized tasks and often had to send half their sappers to work on fatigues with the result that fewer men could be trained at any one time. At times there was absolutely no one available for training.³⁰

Lack of engineer equipment too, continued to plague the engineers. The strategic planners' main concern was to equip the infantry, armoured and artillery units of the division. The

engineers were a lower priority. It must also be remembered that in the pre-war period the army had to compete with the navy and air force for funds, and so very little equipment was available on the first day of war, especially in the engineer units. It had been recognized by the Chief of the General Staff, Major-General T.V. Anderson, that equipment for the division to be sent overseas could not be made available from Canadian production until the country's economy was put on a war footing. The division could be equipped only with rifles and personal kit. Thus immediate supplies of all other equipment would have to come from British sources.³¹ Soon after arrival in England, however, the 1st Division's chief engineering officer, Lieutenant Colonel Hertzberg and his staff found that the engineering stores they had expected to find in the new training camps were not available. The Royal Engineers, whom the Canadians expected would supply these stores, were in turn under the impression that the equipment was to come from Canada. The best example of this dilemma involved the simplest of tools, picks and shovels, which Division Headquarters thought would be supplied by the Royal Engineers. On 11 January, 1940, the CRE's office reported that it could not obtain even the most basic stores from the Royal Engineers. For several weeks headquarters negotiated with their British counterparts for the required tools, but to no avail.³² The problem was not solved until the CRE took matters into his

own hands and arranged to draw five hundred shovels and a thousand picks from an unknown British source. A process that should have been in the hands of a Lieutenant was forced to the attention of the highest ranking engineer in the Canadian army because there were not enough resources to go around. The more sophisticated the tool, the more difficult it was to procure.³³

Even more severe problems arose when it came time to borrow power tools for training. Engineers needed a good supply of compressor tools, which used compressed air from a wheeled trailer unit to run drills, rock bores, circular saws, jack hammers, clay diggers and augers. These were essential for the engineers to construct roads, airfields and culverts quickly but were not familiar to many of the men in the Canadian engineering units. But none could be borrowed from the Royal Engineers and the best the British could do was to arrange a demonstration by the 258th Field Company of the Royal Engineers. This permitted the men no opportunity to practice the skills being demonstrated.³⁴

Those stores that actually were issued to the engineer companies were often deemed to be useless. Basic stores included sandbags, pickets, rolls of wire, hand tools, work gloves, thumpers and a host of other items used for day-to-day work and training. They were, however, of no use to the companies because of their age and bad state of repair.³⁵ Even the steel pickets,

one of the most basic items in engineer stores, were defective. These were usually driven into the ground to act as posts for fencing or to support sandbag walls. Those issued to the Canadian engineers were leftovers from the First World War and had to be screwed into the ground like augers. In cold weather they could not be used at all until the ground had been first broken with picks - which were in short supply.³⁶ Thus the engineers could not even count on getting the basics to carry out their work and training. Even basic personal kit was lacking. On 15 January 1940 it was reported that,

Training commenced more or less according to syllabus. 3 Fd Coy decided to spend first few days on drill and weapon training one reason being that the boots in general were in a bad state of repair and there was snow on the digging site. No second issue of boots had been made...³⁷

This problem persisted for several weeks. When 2 Field Park went out on a trench digging scheme, only about half the company was available to go because of poor footwear.³⁸

Training of any kind was extremely difficult to organize as long as such deficiencies continued to hamper planning. Because of the problems involved in getting stores issued many aspects of engineer training had to be taught through lectures and demonstrations instead of through practical use of the proper equipment. It was not until mid-February that engineering stores, especially tools, became available to the Canadian field companies. 1 Field Company was the first to begin receiving the

equipment, taking delivery of a three-ton truck and promises of further supplies to follow. Other important pieces of mechanical equipment, especially bridging, would however have to wait much longer.³⁹

One of the most complex and time-consuming phases in military engineer training was supposed to be bridging. According to the army's training manual, a full six weeks of sapper indoctrination was put aside to learn the different aspects of erecting pre-fabricated bridges⁴⁰ as opposed to the four weeks spent on all the basics of soldiering put together.⁴¹ This is not surprising when one considers the various kinds of equipment in existence and the different phases of work that went into the construction of each type of bridge. Floating Bridge Equipment, the Folding Boat Bridge, the Great War Inglis, the Small Box Girder Bridge and timber bridges are examples of the different kinds of equipment the engineers had to learn to manipulate. Each of these bridges had its own construction sequence involving a precise series of tasks beginning with a gap measurement and ending with the posting of load restriction signs.

The skills required to build bridges were learned at bridge camps. A typical bridge camp would have run for two to three weeks at a time at the British training camp at Wallingford. It began with lessons stressing the importance of accurately measuring the gap, especially when materials are in short supply.

The following two days were spent building a Small Box Girder Bridge followed by two days of pier construction. Then, the company spend a few days learning the construction sequence for the Large Box Girder Bridge, without actually building it. Bridge camp ended with training in the use of block and tackle as well as shears, or bipods, as construction aids.⁴² The pre-fabricated bridges built at Wallingford were erected by pinning together box girders (and thus the name Large Box Girder Bridge) - much like a child's meccano set. But this camp was deficient in certain key parts of bridging. Decking, which is placed across the girders to form the actual roadway of the bridge was not available in sufficient amounts to complete any of the practice builds.⁴³ Girders were also lacking. The bridge was designed in such a manner that by adding two girders during construction it could be strengthened to accomodate heavier trucks and armoured vehicles. There were, however, only two girders in the camp and so only the weakest version of the bridge could be built.⁴⁴

The construction of floating bridges was practiced at another British camp at Pangbourne. The training programme there lasted about two weeks and stressed not only the use of floating bridge equipment but such skills as rafting, ferrying, rowing as well as the loading and unloading of pontoons.⁴⁵ Bridging was thus not just one job but a variety of tasks. It was practiced by day and night. Unfortunately pontoon bridging equipment was not

readily available. A training progress report prepared on 9 March 1940 by 4 Field Company underlined the problem. It stated quite simply that training was hindered by the fact that there was, "Not enough (Floating Bridge) Equipment to bridge right across the river."⁴⁶ This complaint was voiced often. As well, there were no power units for the boats or pontoons, which forced the sappers to spend a disproportionate amount of time rowing rafts. Normally, powered boats were used to push the parts of a floating bridge into position. Without them training took on an unrealistic air. Part of pontoon bridge training was the loading and unloading of bridge parts, including pontoons, from lorries specially designed to carry them. Practice was necessary to cut down on time spent unloading stores and preparing the bridge site for construction for in operations speed was of the essence. These transport lorries were, however, not available to the Canadian engineers. An officer with 1 Field Company recommended that, "application be made to the R.E.'s at Pangbourne to borrow their lorries."⁴⁷ Equipment of all kinds was lacking.

In spite of the fact that the division's engineers trained in camps specially set up for bridging, there was still not enough opportunity for the sappers to get hands-on experience. Training in pontoon bridging suffered from serious deficiencies in stores. The companies could do no more than practice the preparation of the banks as there were not enough piers to bridge

the 190-foot gap.⁴⁸ These parts deficiencies were often not discovered until training was well under way, underlining the inexperience of the officers and N.C.O.s in charge. On at least one occasion construction of a Floating Bridge was well advanced when it was discovered that there were not enough stores to complete the task.⁴⁹ Such deficiencies could lead to serious hindrances when it came to applying newly acquired knowledge in the field on exercises or manoeuvres. One field company had to cancel a night scheme for a bridge build because there was too little equipment to go around and it had already been drawn by the Royal Engineers.⁵⁰

The troubles encountered in acquiring bridging equipment were paralleled by the problems encountered when the engineers tried to work with explosives. The latter were necessary to allow sappers to practice demolitions, which had applications in withdrawal, defensive and construction operations. Before they could learn how to blow up bridges, destroy roads, remove obstacles and demolish facilities it was necessary for the sappers to be versed in the basics of explosives handling. Training in this area, however, rarely got past the lecture stage, as no material was available for practice. Though some explosives were secured from time to time they were in insufficient quantity to allow adequate training.⁵¹ At one point a company of engineers only had thirty pounds of ammonal, a type

of explosive, to train its two hundred or so men in demolitions. Thus few men received the in-depth training necessary for the safe and accurate use of explosives.⁵²

By the late spring of 1940 the problems in supplying personal kit, at least, were well on their way to being solved. By April there were enough uniforms and boots for all. Special clothing for long marches or exercises could be drawn only for the length of the manoeuvres, but at least it was available.⁵³ This improvement was more evident in mid-May when the new webbing, which with its belt and straps allowed soldiers to carry rations and ammunition with greater comfort, was issued.⁵⁴ The process was complete when new respirators arrived in that same month.⁵⁵ With personal kit becoming more and more accessible in May and June 1940 it became possible to send more men on exercises to practice their skills.

As the situation improved in personal kit, so did the delivery of vehicles. Though special trucks such as the bridging lorries were still very much in short supply, the general purpose 3-ton lorries used for carrying stores, spare parts and troops began to arrive in the spring of 1940.⁵⁶ No less than thirteen motorcycles and thirty-four other vehicles were allocated to each field company by the month of June. Many of the old or borrowed vehicles were replaced by relatively new stock allocated directly to the units who needed them. Finally, after nine months of war

the companies were being given enough vehicles to bring them up to war establishment. Again, it must be stressed that these deliveries did not begin in earnest until a few weeks or days before the fall of France.⁵⁷

The engineers, then, faced two major obstacles to training before the fall of France. The first was the variety of tasks they were expected to perform in support of the Canadian division. The second was the lack of necessary equipment. It is important to note that when training did take place, subjects taught were dictated by the availability of time and materials and not by the need to follow a logical sequence. While doctrine stated that a sapper had to learn to be a soldier, a field engineer and a tradesman, he was not necessarily trained in that order. In fact the distinction between soldiering and field engineering existed only in a very abstract sense. In practical terms, given the problems in acquiring equipment and finding time for training, the two were done together and became indistinguishable. Therefore, several subjects would be taught in the course of the same day, rather than cover one topic one day and another topic the next. Time and equipment had an important impact on the way training was conducted. A brief study of this impact will help understand the low level of proficiency the Canadian engineers achieved before the fall of France.

Given the obstacles the engineers had to face it is not surprising that a rough plan for training the field companies was not submitted by the CRE to the army's Chief Engineer before late December 1939.⁵⁸ The Chief of the Canadian General Staff had already admitted that the division could not train past an elementary stage while in Canada. It was expected that the formation would train for one to three months in England before proceeding to a theatre of war. As it was the division remained in the British Isles for over three years. When the four engineer units of the 1st Canadian Infantry Division arrived in England they were still effectively untrained and tried to make up for lost time. For example, 2 Field Park Company included both basic soldiering and engineer training in its first month in England.⁵⁹ 3 Field Company took a different path. For the first two months of 1940, the company concentrated on training its men in the use of infantry weapons - part of basic training. These included the anti-tank rifle, the Lewis gun or medium machine gun, the light machine gun and of course, the general issue service rifle.⁶⁰

Training did not begin to see any standardization until orders were issued to that effect on 14 January, 1940. These stated that all men would be trained to the same standards of recruit competence.⁶¹ By this time some units, such as 3 Field Company, had already been in the country almost a month.⁶² Along with these orders was issued a list of reference material, which

had been recently published between 1937 and 1938 and so was applicable to the war then being fought. Training was rationalized and taken out of the hands of company commanders and their subordinates and given specific goals.⁶³

Training from mid-January to the end of February followed closely the directives of the Commander Royal Canadian Engineers. Subjects covered included weapons, placement and removal of obstacles, drill and tactics, knots and lashings, field geometry, hand tools, power tools, demolitions, passive air defence, anti-gas and earthworks, thus combining basic military requirements with engineer skills. Each lesson lasted about fifty minutes, but an average company had only about one quarter of its time available for this: about 125 out of a possible 450 hours a month. The rest of the time was spent on various jobs or waiting for equipment to be made available.⁶⁴

On top of normal training to qualify as soldiers and field engineers, some of the men were sent on specialist courses. The first of these was driver training, which was organized by the division and began on 4 March, 1940.⁶⁵ Similar courses would be held from time to time to train certain men in the use of such things as bulldozers or water supply equipment. In turn these men would teach their colleagues back at the units.

The first few months of 1940 were thus used to catch up on lost time. Men were trained on weapons many had never even seen

before. There were problems with supply. The allocation of only six hundred rounds a day for one field company's training on the Lewis Gun is an example. As half the company or a hundred men had never fired the weapon before, this meant that each novice was allowed no more than five rounds a day for training, which is quite inadequate for practice on a machine gun.⁶⁶ When looking at the level of proficiency achieved by the companies during this period, one realizes that it could not have been too high even in such basics as weapons handling.

Many supply problems were partially solved through imaginative scheduling. One unit began taking advantage of the few stores allocated to its training by splitting itself into five groups and teaching them in a 'round-robin' fashion. Thus in March twenty-five men were sent on a motor-transport course to become qualified driver-mechanics while the other four groups performed different training at different times. While one group learned how to fire the anti-tank rifle, another worked with the light machine gun, a third practiced folding boat bridging and the last would concentrate on some other engineer task.⁶⁷ This allowed each soldier more time to practice what was being taught at each 'stand'. This system was adopted by all the field companies in April.⁶⁸

As teaching systems were developed, the engineers of the 1st Canadian Infantry Division carried out whatever training they

could. Mixed in with the days spent on the rifle ranges and parade squares were two main aspects of sapper training, preparation of defensive positions and maintenance of the division's momentum in the advance. These two subjects predominated until the fall of France.

The first part of a defensive position an advancing enemy would meet would be the wire and anti-tank obstacles placed by the engineers who in the spring of 1940 practiced this art. Training in anti-tank obstacles usually began with the screening of a training film showing tank obstacle trials at the testing grounds.⁶⁹ Much time was spent on wire obstacles designed to slow infantry and armour. Such training included rapid wiring exercises, in which sections⁷⁰ competed to see who could put up obstacles the fastest. This would be important in a situation where time to prepare defensive positions was limited.⁷¹

Behind the obstacles the engineers were responsible for the construction of earthworks. The sappers were taught the army's procedures for the preparation of defensive positions. First, tracing parties marked the ground, establishing the shape of the position and the location of each bunker, observation post and trench. All of these were then dug out and 'revetted' or reinforced with timber, sand bags or corrugated iron. Tunnels could also be dug between bunkers and command posts to allow safer movement within the position. All of these skills were

tested on trench digging exercises in which the sappers prepared defensive positions in accordance with the standards that had been set during training. Though these occurred often it was not until well after the fall of France that the engineers became expert at such operations.⁷²

While some days were spent learning how to prepare defensive positions others were filled with road construction and bridge erection, skills necessary to maintain the forward momentum of the division during an advance. This could include training in the construction of both earth and corduroy roads. The former is self-explanatory and consisted in reshaping the soil and tamping it hard so as to form a roadway. The latter was much more complicated. In marshy and swampy areas it was impossible to build roads by simply clearing the land and tamping the ground. A corduroy road was built by spiking logs together and sinking them into the mud. They thus offered a strong, if somewhat treacherous, roadway. All this work, however, was performed by hand without the help of bulldozers as the latter were not yet available.⁷³

Bridging took on a particular importance in early 1940. It was very difficult for the engineers to gain proficiency in bridging because of the serious equipment deficiencies. Some training was carried out in the bridge camps, and eventually projects were timed to determine progress. The first bridge build

to be clocked took place on 27 March 1940 when 1 Field Company managed to construct a 130-foot Large Box Girder Bridge in six and a half hours.⁷⁴ Although this result was fairly good, it had taken the company six months after mobilization to achieve it and there was still much room for improvement.

Though as much as time as possible was spent on engineer tasks such as bridging, earthworks, obstacles belts and road construction, it was not enough. Problems in finding the time between works programmes seriously hindered training. The technology of the day, which the engineers would have to deal with under combat conditions, was not available in sufficient supply to allow them hands-on training. Thus they could not gain proficiency in their trade, though the situation was better than it had been in Canada. By the fall of France training for the engineers of the 1st Canadian Infantry Division had begun to pick up but there were still serious problems to be resolved. The four engineer companies were not ready to fulfill their full role in battle as they had not been able to complete the full range of training necessary to be competent in all combat situations. This became obvious in mid-April when the engineers of the division were inspected by the General Officer Commanding, Major General A.E.L. McNaughton. The purpose of the inspection was to check their dress and deportment and look into the progress they had made in training. The commander was not impressed. The Lewis

gunners were badly trained and the troops in general showed a substandard level of drill. Though they had become somewhat proficient at earthworks, the sappers had had little opportunity to build complete bridges or use heavy machinery and explosives. Many, though not all, of the problems encountered in attempting to train the engineers would be somewhat alleviated in the period to follow from July 1940 to the end of 1942, though even then they would not be wholly prepared for the type of operations they were to carry out against the Axis in Italy.

NOTES

1. Canada's war plans in 1939 did not include a major effort in Europe. Rather, Prime Minister MacKenzie King expected to help in Britain's war effort mainly in the training of air squadrons, which would not require massive reinforcements and thus precipitate a conscription crisis as in the First World War. It was not expected that a force of two divisions (about forty thousand men) would require conscription to maintain it. C.F. Stacey, Six Years of War (Ottawa 1955), p. 33, 42.

2. The decision to begin recruiting was taken on 1 September, 1939, the day Hitler's forces entered Poland, though it was not known at that time that the division would be going overseas. Ibid., 42

3. At the outbreak of war these units belonged to the Non-Permanent Active Militia, which was organized into thirteen Military Districts across the country. Each district had allocated to it infantry, armoured, artillery, cavalry and other units which were located nearby. They totalled 40,540 people, most of whom were expected to remain in Canada in time of conflict to guard facilities and carry out operations in support of civilian authorities.

4. The rank structure in the Canadian Army at that time was as follows:

General
Lieutenant-General
Major General
Brigadier General
Colonel
Lieutenant-Colonel
Major
Captain
Lieutenant
Second Lieutenant
Officer Candidate

For the Other Ranks it was as follows:

Warrant Officer 2
Warrant Officer 1
Staff Sergeant
Sergeant
Lance Sergeant
Corporal
Lance Corporal
Private (referred to as sapper)

5. Public Archives of Canada (PAC), R. 6, 24, Records of the Department of National Defence, vol. 14701, 1 Field Company, 2 September 1939

6. Ibid., vol. 14777, 2 Field Park Company, 2 September 1939

7. Directorate of History, FN 7, War Office, Engineer Training Part I Individual and Collective Training, 1 January 1941, p. 9, 11

8. Ibid., p. 9

9. PAC, RG 24, vol. 14701, 1 Field Company, 3 September 1939

10. Ibid., vol. 14777, 2 Field Park Company, 2 September 1939

11. Ibid., vol. 14709, 3 Field Company, 1 September 1939, vol. 14712, 4 Field Company, 2 September 1939

12. There were very few orders for war material placed in Canada in the first months after mobilization. Those that were are referred to as 'educational orders', such as the request for forty fighter planes. It was not expected that Canadian industry would be on a true war footing for three years, though much could be produced in the meantime. Great Britain did not begin to place large orders in Canada until after Dunkerque.

W.A.B. Douglas and Brereton Greenhous, Out of the Shadows: Canada in the Second World War, (Toronto 1977), 39-40

13. 4 Field was typical. In the month of September it reported its progress exclusively in terms of numbers, as follows.

9 September - 66 all ranks.

10 September - 78 all ranks.

12 September - 91 all ranks.

13 September - 113 all ranks.

14 September - 120 all ranks.

16 September - 140 all ranks.

21 September - 155 all ranks.

22 September - 175 all ranks.

Thus every few days the unit reported its full strength. After 22 September it had to wait for permission to recruit further. The diary mentions nothing about the education, work experience or age of the recruits. None of the engineer companies of the 1st Canadian Infantry Division gathered such statistics until two years later.

PAC, RG 24, vol. 14712, 4 Field Company, 2 September 1939

14. Ibid., vol. 14701, 1 Field Company, 24 October 1939

15. Ibid., 12 December 1939

16. In the course of the war, the four companies often reported their strengths to division headquarters. Rarely were they up to strength. The exception was 1 Field Company which reported on 5 December 1940 and 11 May 1943 that it had its full complement of troops. This same unit, however, also listed deficiencies on several occasions, complaining on 18 June 1942 that the unit had been understrength for several months. Just before operations began in Sicily each company averaged 195 other ranks and seven officers - an average deficiency of over forty men.

Ibid., vol. 14701, 1 Field Company, 5 December 1939

vol. 14703, 1 Field Company, 11 May 1943

17. Ibid., 1 Field Company, 8 October, 15 November 1939

18. Ibid., vol. 14712, 4 Field Company, 13 September 1939

19. Ibid., vol. 14709, 3 Field Company, 20 September, 7 October-10 November 1939

20. Ibid., vol. 14701, 1 Field Company, September 1939.
Appendix 1

21. Ibid.

22. Ibid., vol. 14712, 4 Field Company, October 1939

23. Ibid., vol. 14701, 1 Field Company, 16 October 1939

24. Canada expected much from Great Britain in the first months of the war, especially where the 1st Canadian Infantry Division was concerned. Unfortunately the British were having problems of their own trying to raise and train a large army.
C.P. Stacey, 61-62

25. PAC. RG 24, vol. 14701, 1 Field Company, 20 February 1940

26. Ibid., vol. 14777, 2 Field Park Company, 2 April 1940,
7 February 1941

27. C.P. Stacey, 256-269

Colonel A.J. Kerry and Major W.A. McDill, The History of the Corps of Royal Canadian Engineers, Volume II 1936-1946, Toronto, Thorn Press, 1966, p. 578.

28. PAC. RG 24, vol. 14777, 2 Field Park Company, 1, 28-29 June

1940

29. Ibid., vol. 14709, 3 Field Company, 24 June 1940
30. Ibid., 29 May 1940
31. C.P. Stacey, 61-62.
32. PAC, RG 24, vol. 14689, 1 Canadian Division Headquarters, 27 January 1940
33. Ibid., 11, 29 January 1940
34. Ibid., 29 January 1940
35. Ibid., 27 January 1940
36. Ibid., 15 January 1940
37. Ibid., 15 January 1940
38. Ibid., vol. 14777, 2 Field Park Company, 5 February 1940
39. Ibid., vol. 14701, 1 Field Company, 16 February 1940
40. Directorate of History, FN 7, War Office, Engineer Training Part I Individual and Collective Training, 1 January 1940, p. 56
41. Ibid., p. 50
42. PAC, RG 24, vol. 14701, 1 Field Company, 11 March 1940
43. Ibid., vol. 14709, 3 Field Company, 13 March 1940
44. Ibid., vol. 14709, 3 Field Company, 3 March 1940
45. Ibid., vol. 14701, 1 Field Company, 4, 13, 16 March 1940, vol. 14712, 4 Field Company, 9 March 1940, vol. 14709, 3 Field Company, 18 March 1940
46. Ibid., vol. 14712, 4 Field Company, March 1940, Appendix 2.
47. Ibid., vol. 14701, 1 Field Company, 9 March 1940
48. Ibid., vol. 14701, 1 Field Company, 23 March 1940
49. Ibid., vol. 14709, 3 Field Company, 20 March 1940

50. Ibid., vol. 14701, 1 Field Company, 14 March 1940

51. Ibid., vol. 14689, 1 Canadian Division Headquarters, 13, 31 January 1940

52. Ibid., vol. 14701, 1 Field Company, 11 April 1940

53. For example, Sergeant E.H. Dauphinee of 1 Field Company was sent on exercise with other elements of the division. He reported that each man was issued with five blankets, a sleeping bag, a wool-lined water proof canvass coat, a pull-over sweater, scarves, gloves, rubber boots, a rifle and ammunition. This was for an overnight stay in the field. For longer periods more was available. Webbing was very important to the efficiency of every soldier. It consisted mainly of a belt and shoulder straps from which pouches and pockets could be hung. These would contain ammunition, a respirator, mess tins for eating and a water bottle, all readily at hand. This avoided the problem of having to carry everything in a pack sack which hung from the shoulders and decreased the soldier's mobility and comfort. It must be remembered that troops in the First World War had been cut down in waves as they marched forward with bulky packs on their backs.
Ibid., 19 April 1940

54. Ibid., vol. 14709, 3 Field Company, 14 May 1940

55. Ibid., 12 May 1940

56. Ibid., vol. 14689, 1 Canadian Division Headquarters, 4 February, 14 March 1940

57. Ibid., vol. 14712, 4 Field Company, May 1940, Appendix 3, vol. 14689, 1 Canadian Division Headquarters, May 1940, Appendix 2, vol. 14709, 3 Field Company, 27 May, 11 June 1940

58. Ibid., vol. 14689, 1 Canadian Division Headquarters, 27 December 1940

59. Ibid., vol. 14777, 2 Field Park Company, January 1940

60. Ibid., vol. 14709, 3 Field Company, January, February 1940

61. Ibid., vol. 14689, 1 Canadian Division Headquarters, 14 January 1940

62. Ibid., vol. 14709, 3 Field Company, 15 January 1940

63. Ibid., vol. 14688, 1 Canadian Division Headquarters, January 1940, Appendix 1

64. A typical rundown was that of 4 Field Company, which was as follows:

WEAPON TRAINING	9 LESSONS
MAP READING	4 LESSONS
DRILL AND TACTICS	4 LESSONS
POWER TOOLS	4 LESSONS
GAS AND P.A.D.	13 LESSONS
EARTHWORKS	60 LESSONS
DEMOLITIONS	45 LESSONS
RANGES	14 LESSONS

To be fair it is necessary to group the weapon training and the ranges together, for the latter is but practical application of the former.

Ibid., vol. 14689, 1 Canadian Division Headquarters, February 1940, Appendix 1,

vol. 14709, 3 Field Company, 15 January - 29 February 1940,

vol. 14712, 4 Field Company, 15 January - 29 February 1940

65. Ibid., vol. 14689, 1 Canadian Division Headquarters, 4, 18 March 1940

66. Ibid., vol. 14701, 1 Field Company, 2 February 1940

67. Ibid., vol. 14777, 2 Field Park Company, 18 March, 1 April 1940

68. Ibid., vol. 14709, 3 Field Company, 24 April 1940

69. Ibid., vol. 14689, 1 Canadian Division Headquarters, 24 January 1940

70. Each company was composed of three sections, each with about sixty men if at full strength. A section was commanded by a lieutenant with a sergeant as his second-in-command. Later in the war these sections were called platoons, each platoon being further broken down into three more sections of about eighteen to twenty men.

71. PAC, RG 24, vol. 14701, 1 Field Company, 29 April 1940,
vol. 14709, 3 Field Company, January - February 1940

72. Ibid., vol. 14777, 2 Field Park Company, 1-15 February 1940,
vol. 14712, 4 Field Company, 13 April 1940,
vol. 14701, 1 Field Company, 1 April, 30 April 1940,
vol. 14709, 3 Field Company, 16 January 1940,

- vol. 14689, 1 Canadian Division Headquarters, 19 January 1940
73. Ibid., vol. 14709, 3 Field Company, 18 April 1940
74. Ibid., vol. 14701, 1 Field Company, 23 March 1940
75. Ibid., vol. 14689, 1 Canadian Division Headquarters, 16 April 1940

CHAPTER TWO

THE FALL OF FRANCE TO THE TURN OF THE TIDE

JUNE 1940 TO DECEMBER 1942

In May 1940 German tanks and infantry crashed through the Ardennes and pushed deep into France. Within six weeks they had shattered French and British resistance on the continent, forcing the British Expeditionary Force to evacuate its troops from French ports. Canadian involvement in the events of May and June 1940 was limited to the despatch of the 1st Canadian Infantry Brigade to Brest on 15 June. The formation moved inland only to be recalled for evacuation with German forces over two hundred miles away. In the confusion that followed, the brigade, including 1 Field Company, embarked without its transport. The Canadians returned to England on 17 June.¹

After the French surrender Great Britain remained the only unconquered European nation to face Nazi Germany. Everyone in England expected the Germans to invade as soon as they had completed preparations to do so. At this time the 1st Canadian Infantry Division became an important part of the War Office's calculations to defend the islands. Though one of its brigades had lost its transport in France and the division as a whole could not be said to be well trained, the formation was the

strongest element in a very weak military fabric for the British units had been badly mauled on the Continent. The Canadian division and its engineers thus prepared to defend England against a German onslaught.² This was to require much work on the part of the engineers. The defence of the United Kingdom required the construction of defensive positions all along the southern coast facing the Continent, while airfields, ammunition dumps and fuel depots had to be surrounded by wire and obstacles to help protect them from airborne assault.

As there were not enough troops in the British isles to defend every mile of coastline, it was decided to adopt a policy of mobile defence. Small units positioned themselves at key points along the coast as well as near important facilities inland while the bulk of British, Commonwealth and other allied forces concentrated in the countryside and prepared to counter-attack any German amphibious or airborne landing. British planners expected the Germans to enjoy initial successes, but hoped to push them out of their beachheads into the sea with well-timed counter-attacks.³

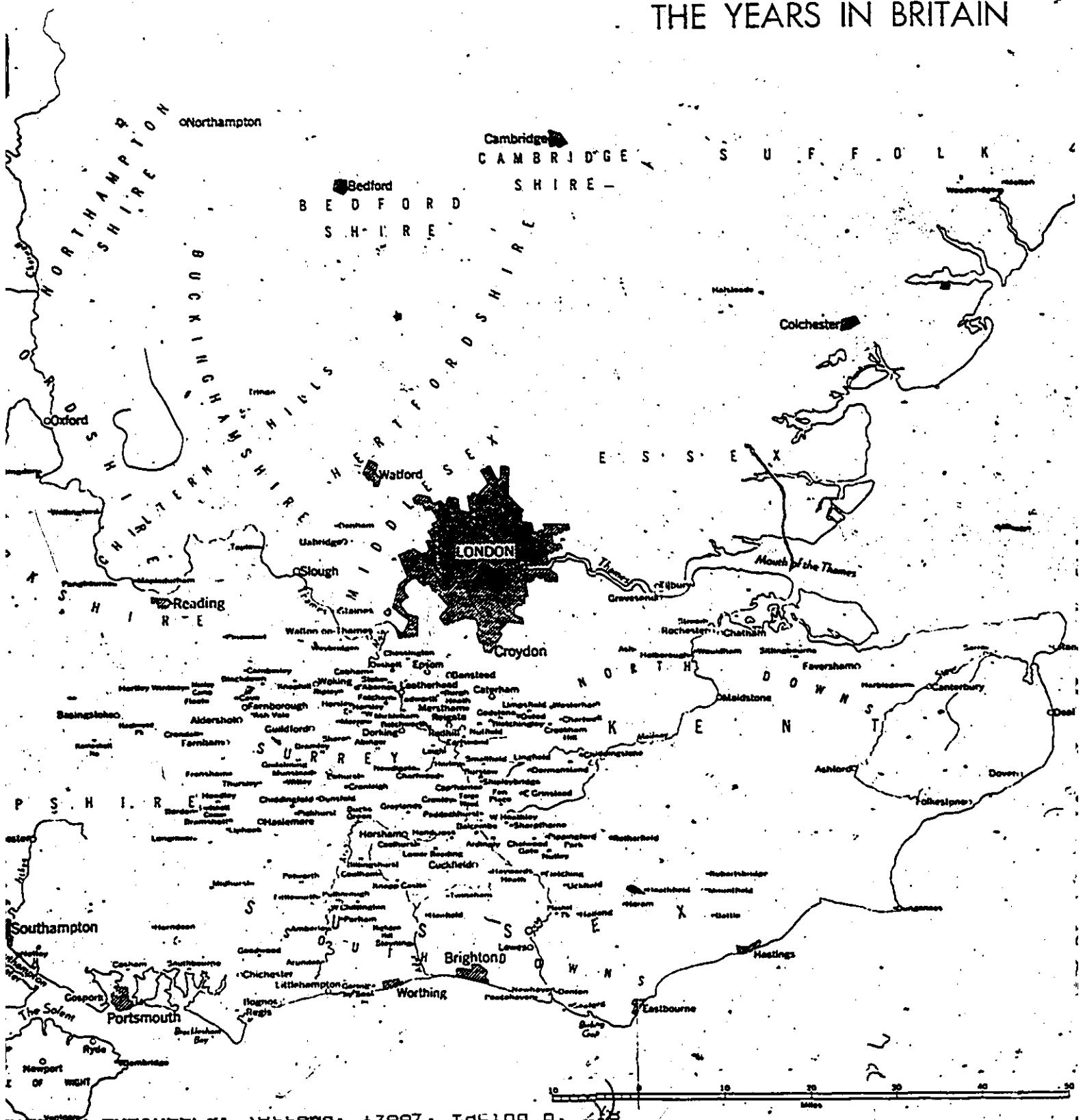
From the fall of France in June 1940 to the allied successes in North Africa in October and November 1942, the engineers of the 1st Canadian Infantry Division found themselves with heavy new tasks to perform added to their old responsibilities. Though they faced the same obstructions of time and equipment as before

they managed to gain great proficiency in defensive operations in preparing the area around Brighton against invasion. There are three aspects of this period which must be studied if the sappers' level of general competence and proficiency is to be judged. First, there were still severe equipment shortages. The British had left the bulk of their military supplies in France, and war production had not yet reached its peak either in England or Canada. Training of all kinds suffered as the engineers still could not carry out adequate hands-on practice on machines, tools, weapons, or explosives. Second, the establishment of a separate Canadian Corps and the expansion of the British Army required the additional construction and maintenance of extensive new camps to house and feed the new troops. The Canadians had to construct winter quarters, for they were originally supposed to have gone to France but were now called upon to help prepare the defence of England. These massive housing jobs seriously limited the time available for training, preventing the engineers from preparing themselves adequately for the role they would be expected to perform in support of the 1st Canadian Infantry Division's advances in Sicily, Italy and the Netherlands after July 1943. Finally, the fall of France added specific new defensive responsibilities to the Canadian engineers' already expanded role in the British Isles. Strong defensive positions along the English southern coastline and around all major

facilities such as harbours and airports in southern England had to be built, maintained and manned. The British developed a new mobile defence which Canadian troops practiced on exercise under the critical eyes of the Chief of Staff. By the end of 1942, the sappers had become very proficient at preparing defensive positions and had learned a great deal about moving with infantry and armour while practicing mobile defensive tactics. But the overwhelming demands of Britain's defence together with the continuing day-to-day maintenance jobs and nagging equipment shortages conspired seriously to hinder the engineers in attempting to learn their full role in support of friendly troops in an advance.

The engineers' technical and combat training continued to be haphazard until the end of 1940, partly from want of any standard training guidelines. Then in January 1941 the War Office finally produced a set of instructions for the training of military engineers. The manual, titled Engineer Training: Individual and Collective Training, became the first modern official military reference for the training of engineer officers and sappers. It outlined in great detail the subjects to be taught and the time to be spent on each. Officers were to undergo 24 rigorous weeks on field engineering, administration and construction.⁴ Privates were to learn basic soldiering, weapons handling and field engineering.⁵ With the publication of this training manual,

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instructors found themselves at last with more sound direction than they had since the beginning of the war and so could better organize training - time and equipment allowing.

Equipment, however, remained a constant, insoluble problem. As has been noted above, too few bridging lorries were available. In July 1941 new bridging vehicles adapted by Ford of Canada were finally issued to the bridging section of 2 Field Park Company. But the unit quickly found twelve major deficiencies in these Canadian trucks including improper emergency brakes, lack of adequate traction and weak clutches. After a thorough inspection by the company's mechanics and some visiting generals, the lorries were disgustingly declared to be totally unsuitable.⁶ As a result, the unit was forced to carry its bridge equipment in standard 3-ton trucks, though these swayed dangerously with that kind of load.⁷ These obstacles with loading and transporting bridge parts made it almost impossible to carry out different kinds of bridge training outside of the special 'bridge camps.' As a result the engineers were forced to return to building their bridges at the same well-known sites as before and rarely were given the opportunity to face the challenge of following the complete bridging procedure for crossing a gap on new river sites. Because the bridge parts in the camp were already piled up at the old crossing sites, the engineers could not practice loading and convoy procedures. Reconnaissance for the best

bridge location also became unnecessary as the same training areas were used again and again. All the information about width of the gap, height of the banks, depth of the water and ground bearing pressure⁸ were already known from previous builds. The engineers could not carry out new and realistic training that simulated different and novel situations they might encounter if they ever began operations against the Axis.

Ammunition was also still in short supply, so that the candidates on an anti-tank course could only fire one round each in practice.⁹ Mine detectors tended to break down regularly.¹⁰ This not only seriously hampered training, but made mine sweeping tasks on the beaches of southern England all the more difficult and time-consuming as the sappers did the work by hand. Radios were not only in very short supply, but those that were available tended not to function properly.¹¹ Other materials necessary for waging a mobile war were also scarce with the result that road moves could not be carried out properly because the trucks were too few and in a state of very poor repair. In summary, important engineer specialties such as mine warfare, bridge erection, road construction and demolitions went unpracticed because the mine-detectors, pre-fabricated bridging, heavy equipment and explosives were either not available or did not work. This meant that engineers could learn to be engineers only in a very limited sense.¹²

Even if the equipment had been available, it is doubtful whether the engineers would have found the time necessary to train for combat. In the period from the fall of France to the end of 1942, the sappers carried out many of the same construction and maintenance jobs they had performed since their arrival in England. These assignments took much time and seriously interfered with combat training. It was not unusual for any one company to go an entire month without carrying out any training whatsoever to increase its proficiency in soldiering or field engineering.¹³

One of the pressing needs after the fall of France was to quickly prepare new billets for the troops of the Commonwealth and those evacuated from occupied countries waiting for the eventual return to the Continent. Then in September 1940 preparations began for the construction of new winter quarters. Each Canadian engineer company supported an infantry brigade. For example, 1 Field Company allocated a section to each of the three battalions of the 1st Infantry Brigade. 1 section built the quarters for the Royal Canadian Regiment and the Toronto Scottish, while 2 section took care of the 48th Highlanders and the Reconnaissance Squadron and 3 section prepared accommodations for the Hastings and Prince Edward Regiment and the Anti-Tank Company.¹⁴ 3 Field Company sent most of its tradesmen to the 2nd Infantry Brigade's billets at Limsfield to carry out repair

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work¹⁵ while 4 Field Company put in plumbing, carpentry work and blackout screens.¹⁶ These works programmes made it impossible for any unit to train as a unit until the spring of 1941 as each was constantly forced to send off many of its tradesmen for special jobs. Headquarters, prisons, canteens and all the amenities of army life had to be put under shelter for the winter of 1940-41.¹⁷

In November 1940 new hutting projects were begun which occupied the engineers intermittently until March 1942. Each hut required wiring, plumbing and the pouring of concrete floors. The plumbing caused special problems as it had to be constantly thawed during the winter, keeping the companies' plumbers very busy.¹⁸ With time this work became more and more ambitious as more troops arrived in England and men moved from under tents to more permanent quarters. By May 1941 these huts were being ordered in groups of hundreds.¹⁹ Though carpentry, concreting, plumbing and fitting skills were exercised in these projects, giving the engineers valuable practice in their own trades, these construction jobs took the sappers away from the combat training they needed to ensure the fighting mobility of the 1st Canadian Infantry Division. There was an unrealized dichotomy of roles demanded of the Canadian sapper; that of construction engineer and that of field engineer. Such time-consuming tasks lasted

until March 1942, with units attempting unsuccessfully to fit training into their works programmes.

Finally, in March 1942 policymakers in the army decided to lighten the heavy engineers' burden. The British took it upon themselves to pool all work orders in the army and then decide who would best carry out the assignments. They hoped in this manner that general construction and maintenance duties would fall to engineer construction companies and leave the field companies to support their own division and carry out combat engineer training.²⁰ Unfortunately, the new organization was not completely successful. As late as October 1942 units were still complaining that, "Training (was) badly thrown out as most men (were) employed."²¹ The only real change was in the nature of the work. Hutting projects were replaced by such field engineer tasks as road construction or footbridge erection. One unit spent the last weeks of 1942 hauling anti-aircraft guns to the tops of buildings.²² Though the British tried to organize all engineer work so the field companies would get time to train, the latter's services were still required by the division and time was very limited.

Following the fall of France, the Canadian engineers were also pressed into service not only for construction projects and day-to-day maintenance tasks around the camps but especially for the defence of England. With continental Europe under German

control it was expected that Hitler's armies would next strike at the British isles. Defensive positions along the coast were required to repulse an amphibious assault and all strategic inland facilities such as airports, headquarters, fuel and ammunition dumps had to be prepared against airborne attacks. The Canadian field companies were engaged to change and revamp huge earthworks to improve the coastal defences. The engineers of the 1st Canadian Division concentrated their efforts in the area of Brighton. The four companies could not clearly schedule any additional training while they worked on and manned these important defences.²³

On the beaches the engineers placed a whole series of obstacles, mainly to stop tanks. One type consisted of driving a pipe into the earth and filling it with explosive. The erection of tubular scaffolding and other non-explosive obstacles such as ditches, concrete boxes and steel spikes were believed to be more practical. Tubular scaffolding was the most popular type of obstacle. No less than six miles of it was erected in the Brighton area.²⁴ But this scaffolding was a source of many continuing problems, as it required constant maintenance for debris floating in the Channel could foul and damage it. A great deal of manpower was required to erect the scaffolding, forcing the companies to request help from nearby artillery units. These inexperienced men had to learn how to erect the scaffolding

before they could begin work, making the job even more time-consuming. By far the worst snag was that the scaffolding could not stop tanks. Trials held in June 1942, two years after the equipment was adopted, showed that a Churchill tank could easily get through the scaffolding regardless of how it was positioned.²⁵ A great deal of time and effort had, in this way, been invested erecting and maintaining an essentially useless series of obstacles. The engineers did gain some skill at working with the scaffolding, which had uses in construction, and so the time was not totally wasted.

It is important to note that in the crisis atmosphere of the time the engineers did not get the opportunity to accurately survey the areas they were expected to defend. The first logical step in setting up defensive positions along the coast of England was to take accurate measurements of the beaches and other likely enemy approaches. It was not until late January 1942, however, that the three field companies began to measure beach slopes at different points along the British coastline facing France. The engineers sought to calculate the various beach gradients, for they knew how steep a hill had to be to stop a tank and how much water a landing craft needed to unload its troops. With these measurements the engineers could determine where the strongest defences were necessary to hold off a German assault. Most of the

defenses had already been completed long before the survey was even begun.²⁶

Obstacle belts had to be built in depth to ensure the enemy's first waves ashore would have no room for their tanks to manoeuver. Roadblocks were built, wire was strung and minefields were laid; all by hand. The engineers received much needed help from the infantry battalions they were supporting, who proved to be especially useful in wiring tasks. There was, however, much doubt as to whether the obstacles were positioned properly. There was also some confusion as to where some obstacles were actually located. It was standard procedure for all barriers to be marked on a map so the brigadier could tell at a glance where the enemy would find it hardest going. Unfortunately, these recordings were often so inaccurate that maintenance crews could not find the obstacles they were supposed to work on. Because of the doubt and confusion, much of the work was done more than once.²⁷

The obstacles were designed only to delay the enemy. They could not have stopped him, as the British well knew. Behind the wire, the mines and the scaffolding, soldiers had to man defensive positions to fight the enemy off. These shelters required heavy digging, camouflaging and construction which were part of the engineer's domain. Companies were rotated through the job, each spending several weeks on site. Arches in viaducts were bricked up to prevent German troops from moving through them.

Minefields were laid with gaps in them to allow friendly troops lanes through which they could counter-attack. Forward sandbag posts were established for artillery observers, from which to track enemy movements and call down artillery fire on his formations. Machine gun pits and posts for anti-aircraft gunners, riflemen, mortarmen and artillerymen were excavated or sandbagged. All exits from the beaches were wired, mined or similarly blocked.²⁸ Excavating defensive positions involved much more than putting holes in the ground. It required much time and engineer knowledge, the latter of which the officers, N.C.O.s and men of the field companies learned on the job. With time and practice they became experts in digging defences, most of which was done by hand.

To help thwart an airborne attack by gliders, open areas in the English countryside around Brighton were laced with sturdy poles and other obstacles designed to deter the Germans from attempting a landing there. No potential landing site could be neglected. For example 4 Field Company spent several pleasant days erecting these aeroplane obstacles on Effingham Golf Course. Using telephone poles intertwined like a Chinese puzzle, such devices would prevent the enemy from landing gliders filled with troops on open areas.²⁹ The work plans failed to mention if club members could continue to play golf after the addition of these new hazards.

Protection also had to be effected against possible airborne attack on airfields and other military targets. Aerodromes were considered to be especially important for if German paratroopers could capture one intact, they could land large formations of follow-on troops in transport aircraft. Many of these airports had been built near London to give that city fighter protection against Axis bombers. A successful airborne attack against one of these would place German formations within striking distance of the British capital.

The engineers of the 1st Canadian Infantry Division were given responsibility for the defence of two major airports in southern England, Biggin Hill and Redhill. At the Biggin Hill Aerodrome over one hundred weapon pits and several splinter proof shelters were prepared. This work required liaison with the West Nova Scotia Regiment, who manned the airfield defenses. This led to some friction over organization, as reported by the unit's diarist,

The work is not progressing as well as it might at the Biggin Hill airport so Major R.J. Cassidy decides that all sections will concentrate on this job for a time. The W.N.S.R. do not seem as yet to have the locality planned thoroughly, so organization of the work is difficult. ³⁰

Later it was decided that the engineers were to build an additional one hundred weapon pits at the aerodrome and put up several thousand more yards of barbed wire obstacles. ³¹ At Redhill Airport liaison with the infantry was much more effective

but the defences still took several months and much effort to complete. In a record day sixty sappers and one hundred infantrymen were able to excavate sixteen weapon pits and reinforce fourteen. The job sometimes required shifts working around the clock.³² Officers and N.C.O.s learned much about organizing defensive work in carrying out such assignments while the men developed skills in preparing defensive positions quickly. At the same time, however, the engineers missed out on the possibility of practicing the mobile skills they would need in Sicily, Italy and the Netherlands.

When the original construction jobs were completed, the engineers still did not have time to begin organized training programmes. Once the mines, the wire, the scaffolding and the pits were completed it was necessary to man them with all available soldiers, including the engineers. Though this meant that training had to be dropped, the duty also took the engineers away from the unpopular works programmes. As a result the men found themselves with much free time.

Horse-shoe pitching has proved a new and popular sport in H.Q. section, and many of the sappers are becoming quite adept in competitive team work, and in the absence of much military activity this and soft-ball keep the men physically alert. There is little to report as the one main duty seems to be standing awaiting the threatened invasion.³³

During this period then, the engineers learned only one phase of war in depth - the defence. The war situation demanded that the British Isles be held secure and the Canadian sappers were part

of the organization put to work to defend them. Through their experiences the engineers became experts, but not in those skills they would need to support their division in an advance.

The engineers could during this period of defence apply much of their basic soldiering knowledge. Because of the almost constant threat of airborne assault, the engineers were positioned in all-around defence, forming pockets along or behind the beaches. There they rehearsed action stations and at the same time kept the earthworks and obstacles in good repair. Once construction was over few engineering projects got past the planning stage. One field company was supposed to build the Brigade Battle Headquarters in its area but no suitable site could be decided upon. "The site has changed so often now, that it is doubtful if there will be one constructed before the war ends." in fact, the headquarters was never built.³⁴

As part of the mobile coastal defence plan, the engineers also had to prepare themselves for a possible withdrawal. As noted above, it was not expected that the coastal defences would be strong enough to stop a determined assault by several divisions of German infantry and panzers. The Canadian engineers at Brighton had to be ready to demolish roads and bridges in the area if a withdrawal were ordered. But this would have been difficult to carry out, for the engineers were positioned as the most forward troops and would have had no one to cover their

demolition activities. The infantry battalions were placed further back from the beach defences to guard against airborne landings and also to act as a mobile counter-attack force.³⁵

There would also have been possible breakdowns in the command and control structure for as late as December 1941 there had been no opportunity to carry out alert drills. It was doubtful whether orders to destroy the allocated targets would be received in time. One of the engineer company officers reported;

Brigade says we are to blow our craters, etc, on receipt of orders from a certain officer, but I'm afraid that when the balloon does go up, nobody is going to have time to issue many such orders, and its going to be pretty much every man for himself, and we will have to carry out the demolitions on our own initiative.³⁶

Liaison with other units still had to be perfected for the engineers had become somewhat isolated from the rest of the division while working at airfields and on the beaches. This problem remained a nuisance throughout the war, whether the engineers were in garrison, in training or in combat.

Demolitions had to be carried out not only near the beaches but further back as well. Airports were wired for destruction, though the Royal Air Force was to fire the actual charges. Destruction of oil installations was also a high priority. As any enemy tank advance required much fuel it was obviously reasonable to deny as much oil as possible to the enemy. In this manner, an engineer unit found itself responsible for several different demolition targets both on the coast and in the

hinterland. Operation Order No. 2, for example, listed the tasks one field company would fulfill in case of enemy landings in the Brighton area as including the destruction of three piers, two aerodromes, two petroleum installations and the Shoreham footbridge.³⁷

There were few opportunities for the engineers to practice a withdrawal. When they did, the results were not promising. Part of a retreat involved cratering roads to slow the enemy's advance. This turned out to be more complicated than expected.

The one and only cratering exercise in January 1942 unearthed a whole series of problems. As each section was very much on its own blowing up parts of the road allocated to it, deliveries of explosive were difficult to work out. Rendez-vous points had to be set up, and some of these were missed. The engineer officers who acted as exercise directors also found that the map reading skills of those who had to find the targets were not up to par. Two of the craters were put in the wrong roads. Finally, the equipment, which included blasters and testers, was sometimes faulty. Training in this area was thus sorely needed.³⁸

In practicing for a possible withdrawal, the engineers also learned reserve demolitions, which consisted in preparing a bridge for destruction but waiting for an order from headquarters before setting off the charges. This was supposed to prevent the premature or unnecessary demolition of bridges which

might be needed for a counter-attack. In practicing reserve demolitions on exercise certain weaknesses were revealed. In order to prepare and place the explosive charges quickly engineer N.C.O.s and officers had to gather certain specific information about the target used to calculate the method of destruction, the time required and the amount of labour and material needed. The commanders possessed too little experience and had trouble gathering this information. So they ordered too much or too little explosive, which was a limited resource, and badly estimated the amount of time and labour required to complete the task.³⁹ Training was faulty at all levels, from platoon commanders down to privates and all aspects of bridge demolition from the issuance of orders to the reconnaissance to the actual act of destruction badly needed practice. Only one bridge was actually destroyed as a part of training.⁴⁰

The Canadian engineers not only constructed and manned Britain's defences and prepared to demolish important facilities but rendered assistance to civil authorities after air raids. The engineers were members of the Air Raid Assistance Force. Following a severe air raid, they were to clear debris, ensure the restoration or maintenance of the water supply, re-establish communications, assist in fire fighting and provide the picks, shovels, crowbars and other tools needed to assist in this work. Orders were very specific as to what each unit would do in such a

situation. The "Plan for Assistance to Brighton Group of Towns in the Event of Severe Air Raids Damage" specified five tasks the engineers were expected to perform in case of severe damage. One, they were to demolish buildings to form firebreaks and thus check the progress of fires. Two, the engineers were to blow up any buildings rendered dangerous by structural failure. Three, they were to clear debris from essential thoroughfares to allow the passage of emergency vehicles. Four, company electricians, plumbers and fitters were to restore public services such as water, electricity and street lights and finally, the sappers were to supervise unskilled labour clearing debris.⁴¹

Because they had to carry out so many duties in England the engineers had very little time for combat training. It is true that they did apply many of their technical skills in the defence of England and so were able to practice some of defensive aspects of their military role. Luckily, however, these defensive skills were never put to the test in England as German forces never completed their preparations for the assault.

The men of 1st Canadian Infantry Division trained for an eventual invasion and hoped they would see action soon. Some of them did become involved in one operation outside of England, however, though it did not involve actually fighting the enemy. This operation demonstrated that the men of the division were ready and able to carry out a small-scale mission. The target of

the operation was Spitzbergen, to the north of Norway. Its purpose was three-fold. First, it was to destroy, or remove all coal mining facilities, stocks of free coal, transit facilities between mines and wharves, harbour facilities, wireless stations and meteorological stations. Second, the expedition was ordered to repatriate the two thousand Russians on the island. Finally, the eight hundred Norwegians on the island were to be removed to the United Kingdom. Code-named Operation Gauntlet, this expedition of 645 men consisted of the Edmonton Regiment, 3 Field Company RCE, the Saskatoon Light Infantry, a detachment of Norwegian infantry as well as support from the British Army, the Royal Navy and medical detachments.⁴²

The operation was a short one, lasting from 25 August to 2 September 1941. As the enemy was nowhere near the islands, the expedition did not take the form of an actual landing and thus no combined operations training was put into practice. The variety of targets to be destroyed tested to the limit the abilities of the engineers to improvise in the face of new situations. One of the major demolition problems encountered was a colossal 150,000 ton coal pile measuring 1000 yards long by 50 yards wide and 10 yards high. The engineers had received no previous training in how to dispose of such an awesome dump. After some lively discussion, they lighted four hundred wood fires around the base of the pile and saturated it with petrol. It burned fiercely for

days.⁴³ Most of the other demolition challenges were within the engineers' sphere of knowledge. They had learned to use explosives in the destruction of trestles, supporting cables and conveyor systems. Some targets, such as heavy machinery, cranes and power generators, were rendered useless without the use of explosives, immobilized simply by removing vital parts and packing them off to England.⁴⁴

The operation was judged to have been a success. The Canadian engineers, who formed practically half the force,⁴⁵ completed the demolition of the coal and coal mining facilities, sometimes having to rework techniques learned in England or even invent their own. As the mission was unopposed, the sappers had sufficient time to calculate the amount of explosives they would need and figure out how they would attack each target without having to worry about enemy fire. This was the only such operation carried out by engineers of the 1st Canadian Infantry Division in the period leading up to the end of 1942. In this way at least one of the engineer companies put some of its training into practice.⁴⁶

Were the skills the engineers learned in England between the fall of France and the end of 1942 of any real use to the sappers in their most important subsequent assault role of maintaining the fighting momentum of the division? Exercises and training schemes, when they were squeezed in, managed to cover the three

phases of war, if in a rudimentary fashion. Defensive operations continued to receive most attention until the Allies were ready to assault Fortress Europe. Interestingly enough, training for the defence of England also included some training for offensive operations. As the defences along the beaches would not be sufficient to stop a German assault the troops were trained to carry out attacks in order to assault an enemy's beachheads. It must be stressed here that for the most part this training did not cover engineering operations in the advance but concentrated instead on developing infantry skills. This type of military exercise was valuable in the sense that the engineers learnt how to move across country in coordination with the infantry units they would be supporting in Italy and Western Europe.⁴⁷

The engineers carried out little training to prepare them for operations against the Axis in Italy and Northwest Europe. Their expertise until the end of 1942 essentially remained rooted in a static war, when mobility turned out to be a decisive factor in Second World War battles. Attack training was very limited in scope, as of course the defence of England was the army's first priority. During a withdrawal engineers were ordered to put craters in roads, during an advance the sappers were expected to fill them in and make the roads passable. Very little actual crater repair was done, and it was practiced on only one exercise in December 1941. Neglect of this particular aspect of training

was to have serious consequences at first when the division moved to Italy, where Axis forces cratered roads with abandon to slow the Allied advance.⁴⁸

The only real aspect of the advance the engineers practiced frequently in England was bridging. But this continued to take the form of stereotyped 'bridge camps' run for a few weeks at a time. Increasing emphasis was placed on speed of construction. "Exercise Endurance," was held in August 1942, in which 1 Field Company constructed a raft, a pontoon bridge and a non-floating bridge in a twenty-four hour period.⁴⁹ In that same month 4 Field Company constructed five bridges in as many days ranging in length from 100 to 120 feet.⁵⁰ Now that the proper bridging equipment was somewhat easier to acquire, the engineers were becoming experts at constructing bridges, if still only on well known sites.

Bridge training included the entire operation needed to construct a bridge during an advance against the enemy. This type of operation was designed to get the division across a defended river in as little time and with the fewest casualties possible. The engineers were responsible for supplying the assault boats to the infantry, the preparation of approaches, clearing of minefields and wire, construction of bridges or rafts and the maintenance of all crossing sites until the division had completed its move to the other side.⁵¹ This type of operation

also combined many of the engineer tasks such as road construction, mine clearing and bridge erection. Engineering skills were practiced on Exercise Robin and consisted in an assault water crossing in boats. After the bridgehead was consolidated the engineers would then be in a position to build the bridge to allow the armour and the rest of the brigade vehicles to get across and thus continue the advance. In this case however, the bridge was not built as there was not enough material available, while of course there was no enemy opposition to hinder the work.⁵²

In June 1942 officers and N.C.O.s from the field companies saw the Extra Widened Bailey Bridge for the first time. This equipment was much more versatile than its predecessors. It could be built either as a pontoon or as a non-floating bridge and could be constructed in many configurations. One could build it either as a light bridge and use the extra parts elsewhere or put one up capable of carrying the heaviest tanks. The companies began to practice construction procedures with the new bridge at the end of June 1942. The Bailey bridge soon became the most important piece of bridging equipment in the 1st Canadian Infantry Division.⁵³

Canadian and British soldiers alike expected the enemy to make much use of minefields to slow the division's advance. To counter this, engineers were trained in a variety of mine

clearing techniques including the use of cordtex mats to blow a lane through a minefield. The mats were made by weaving detonator cord together, which when ignited exploded along its entire length. Mats could then be unrolled into a minefield and detonated, forcing most of the mines to explode. The engineers used bangalore torpedoes in the same manner. Originally designed to blast gaps through barbed wire obstacles, the bangalore was a tube filled with explosive which when detonated would force mines beneath it to explode. This type of mine clearing created a lane wide enough for infantry to move through on foot. In mid-1942 the new tube-snake was demonstrated to the Canadians by the British. This was a flexible tube filled with explosive which could be positioned in the minefield more quickly than the bangalore. It had been especially developed for clearing minefields and could clear a wider path and destroy a higher percentage of mines than the mat or bangalore torpedo. Although the Canadian sappers saw all of this equipment in demonstrations, they never actually used the new techniques on exercise.⁵⁴

In spite of new anti-mine devices, there remained only one sure way to remove all mines silently - to breach a minefield by hand. Sappers were expected to move into the minefield in formation and then proceed to detect the mines with a mine detector or a prodder and then remove them. This dangerous mine breaching work incurred more casualties than the elaborate use of

explosives, especially if the mines had been booby-trapped by subsidiary devices which would explode if anyone attempted to remove them. For this reason this mine removal technique called for 'one man - one mine' so that an exploding booby trap would kill or injure only the man working on it.⁵⁵ An important part of mine warfare training was the mine circus. This consisted of setting up tables with different German, Italian, British and other mines as well as booby trap switches in order to teach sappers and other soldiers the workings of each one. An experienced sapper would then explain the intricacies of each device as well as the means by which it could be neutralized. Training in the removal of such explosive devices had to be thorough to avoid heavy casualties. Mines and booby traps did not forgive error.⁵⁶

The engineers were often called upon to deal with mines placed on the beaches of England by friendly hands giving them practical experience in mine warfare. As coastal defences developed, it sometimes became necessary to remove minefields for Navy or Army units that wanted access to the beach. Also, as minefields began to expand on all of Britain's southern beaches, casualties mounted as unwary soldiers or civilians wandered into them. The engineers often received requests from the police or local units to lift mines they themselves had laid and then

recover the bodies. This work was understandably very unpopular with the sappers.

Assault tasks were applied in combined operations training beginning in August 1941. Though no doctrine outlining the tasks of engineers in a beach assault was published until March 1943 and the division carried out no combined operation until July of that year, assault training was carried out long before in case Canadian troops were sent to conduct raids on the Continent. Most of these exercises took place at Inveraray, Scotland, though much of the preliminary training was covered in the engineers' own camps. Engineers took part in rowing drills, built beach roadways and landing piers for landing craft and practiced raiding techniques. This type of assault required the application of such engineer knowledge as the construction of roads, floating bridges (to be used as piers), demolitions and the handling of boats.⁵⁷

Therefore the engineers did manage to carry out some assault training between the fall of France and the end of 1942. But because the greatest part of their time was spent on works programmes and defensive operations the sappers' expertise remained one-sided, concentrating as it did on the defence of England. The engineers themselves gained little confidence in their own abilities to operate effectively against an enemy. On New Year's Day, 1942, one of the engineer companies' diarists expressed this pessimistic view:

Wonder what the New Year will bring in, in the way of developments. The old year has certainly left the world in a turmoil. What of the so-called "Crack Cdn. Corps"? For the past 2 years we have been living in a peace-time atmosphere, with our time occupied with such things as Court-Marshalls, Courts of Inquiry, Reports and Returns, Inspections, Defence Works; which have all tended to make us forget our real job, that of being prepared to fight a clever enemy... It is very necessary that this winter we pull ourselves together. There has been a mis-guided effort to carry on training and works together resulting in no gain in either one. Something must be done about this soon. We have been over here two years now, and we are almost afraid to ask ourselves what we have accomplished.

This depressive judgement came from the same unit that had carried out the operation at Spitzbergen and was signed by the Company Commanding Officer. Long-term static defence in England without action and inadequate assault training seriously affected the engineers' morale. The diarist was not the only one who wondered if the engineers would ever complete the learning process or see action.

From the fall of France to the end of 1942, the engineers had two-and-a-half years in England during which to train for assault operations. But that time was largely spent carrying out defensive duties that precluded proper assault training. The engineers' area of mastery now lay in the area of defence, which would not be very useful when the advance against the Axis finally began in Italy. Their education was incomplete and the landings in Sicily were only six months away.

NOTES

1. C.P. Stacey, Official History of the Canadian Army in the Second World War; Volume I: Six Years of War (Ottawa 1955), p. 279-284

2. C.P. Stacey, 286-290

3. C.P. Stacey, 285-307

4. Directorate of History, FN 7, War Office, Engineer Training Part I Individual and Collective Training (1 January 1941), Appendix A, Part I.

For example, officer training was layed out as follows:

MILITARY DUTIES AND ELEMENTARY FIELD ENGINEERING	8 WEEKS
MOTOR TRANSPORT AND MECHANICAL EQUIPMENT	3 WEEKS
DEMOLITION, BLOCKS, TACKLES, USE OF SPARS	3 WEEKS
FLOATING BRIDGES, CAMPS AND WATER SUPPLY	3 WEEKS
NON-FLOATING BRIDGES	3 WEEKS
ROADS, LIGHT RAILWAYS, CONCRETE WORK AND MINES	3 WEEKS
SPARE	1 WEEK
TOTAL	24 WKS

5. For the sappers, training was organized into five phases:

Phase I: Military Duties: drill, weapons, anti-gas, map reading and first aid.

Phase II: Elementary Field Engineering: field defences, obstacles, demolitions, water supply, knots and lashings, use of spars.

Phase III: Advanced Field Engineering: mining and bridging.

Phase IV: Chemical Warfare: decontamination of buildings and bridges.

Phase V: Mechanical Transport.

Ibid., p. 10

6. PAC, RG 24, vol. 14777, 2 Field Park Company, 25 July 1941

7. Ibid., vol. 14690, 1 Canadian Division Headquarters, 16 August 1942

8. Ground bearing pressure was a measurement of the amount of weight that could be placed on the ground without sinking into it. Thus, if the ground bearing pressure was too low, the banks would collapse under the bridge and the latter would fall into the gap.

9. PAC, RG 24, vol. 14714, 4 Field Company, 29 October 1942

10. Ibid., vol. 14702, 1 Field Company, 27 August 1942.

11. Ibid., vol. 14710, 3 Field Company, 12 July 1942,
vol. 14709, 3 Field Company, 7 November 1941.

12. Ibid., vol. 14710, 3 Field Company, 14 July 1942.

13. One of the reasons these tasks were so time-consuming was because the units did not always have the proper equipment to carry them out. One of the best examples of this was a water supply job handed to 1 Field Company. There was not enough equipment to carry out the task properly and so the unit had to use its initiative to get the necessary materiel.

The problem of supplying water to some 4000 men in the Bde has been solved by using fire hydrants; we got these from the Water Works and carefully forgot to return them, so that we are able to set up water points in new locations within a few minutes. Who is going to answer for the disappearance of these hydrants no one knows.

Ibid., vol. 14712, 4 Field Company, 2 July 1940.

14. Ibid., vol. 14701, 1 Field Company, 16 September 1940.

15. Ibid., vol. 14709, 3 Field Company, 19 September 1940.

16. Ibid., vol. 14713, 4 Field Company, 2 October 1940.

17. Colonel A.J. Kerry and Major W.A. McDill, The History of the Corps of Royal Canadian Engineers: Volume II 1936-1946 (Ottawa 1966), p. 522-524.

The list of buildings to be constructed in this period was as follows:

Drill Halls, Canteens, Recreation Buildings, Garages, Car Shelters, Car Workshops, Engineer Workshops, Disinfestors, Gas Huts, Regimental Aid Posts, Reception Centres, Physiotherapy Buildings, Personnel Selection Huts, Night Vision Units, Artillery Training Buildings, Dome Trainer Buildings, Chemical Warfare Buildings, Operational Gasoline Storage, Anti-Tank Gun Sheds, Commissariats, Chapels and Ordnance Mechanical Engineering Workshops.

18. Ibid., vol. 14777, 2 Field Park Company, January 1941,
vol. 14713, 4 Field Company, 13 January 1941, February 1941,
vol. 14701, 1 Field Company, 17 February 1941,
vol. 14709, 3 Field Company, 3 March 1941.

19. Ibid., vol. 14713, 4 Field Company, 1 May 1941.

20. Ibid., vol. 14714, 4 Field Company, March 1942,
vol. 14690, 1 Canadian Division Headquarters, 31 March 1942
21. Ibid., vol. 14702, 1 Field Company, 29 October 1942
22. Ibid., vol. 14714, 4 Field Company, 9 November 1942,
vol. 14702, 1 Field Company, 26 March 1942,
vol. 14710, 3 Field Company, 14 November 1942
23. Ibid., vol. 14713, 4 Field Company, 12 September 1940, 22
October 1940, 1 November 1940,
vol. 14701, 1 Field Company, 6-30 December 1940,
vol. 14702, 1 Field Company, 17 September 1941,
vol. 14710, 3 Field Company, December 1941, Appendix 4
24. Ibid., vol. 14710, 1 Canadian Division Headquarters, 15 July
1940,
vol. 14711, 3 Field Company, January 1943, Appendix 22,
vol. 14710, 3 Field Company, 26 February 1942
25. Ibid., vol. 14702, 1 Field Company, 3 March 1942,
vol. 14714, 1 Field Company, 10 March 1942, 15 June 1942
26. Ibid., vol. 14714, 4 Field Company, 29 June 1942,
vol. 14702, 1 Field Company, 25 January 1942,
vol. 14710, 3 Field Company, 24 January 1942
27. Ibid., vol. 14709, 3 Field Company, 15 November 1940, 14
April, 24 November 1941,
vol. 14689, 1 Canadian Division Headquarters, 2 April 1941,
vol. 14714, 1 Field Company, 18 January 42
28. Ibid., vol. 14701, 1 Field Company, December 1940, Appendix H
29. Ibid., vol. 14712, 4 Field Company, 5 July 1940
30. Ibid., vol. 14713, 4 Field Company, 24 June, 27 June, 2 July
1941
31. Ibid., 22 August 1941
32. Ibid., vol. 14702, 1 Field Company, 23 June, 31 July 1941
33. Ibid., vol. 14712, 4 Field Company, 20 July 1940
34. Ibid., vol. 14712, 3 Field Company, January 1943, Appendix 12
vol. 14702, 1 Field Company, 16 January, 2 April 1942,
vol. 14711, 3 Field Company, 16 January 1942

35. Ibid., vol. 14710, 3 Field Company, 9 December 1941
36. Ibid., 12 December 1941
37. Ibid., vol. 14710, 3 Field Company, 31 December 1941,
vol. 14690, 1 Canadian Division Headquarters, 8 January 1942,
vol. 14714, 4 Field Company, February 1942, Appendix 9
38. Ibid., vol. 14702, 1 Field Company, January 1942, Appendix 5,
vol. 14690, 1 Canadian Division Headquarters, 23 January 1942
vol. 14710, 3 Field Company, 21 January 194240.
39. An exercise carried out by 4 Field Company demonstrates the
type of training they were conducting in bridge demolitions. The
timings for the exercise were as follows:
0903: Orders handed to Officer Commanding
0925: Recces begin.
1030: Company arrives at Rendez-Vous.
1115: Two sub-sections leave for Toll Bridge.
1150: Recce returns.
1210: The recce report on Shoreham Bridge comes in.
1 section goes out.
1225: 1 section begins preparing firing charges.
1255: The last recce report comes in.
1330: Toll Bridge blown.
1600: Shoreham Bridge blown.
Ibid., vol. 14702, 1 Field Company, 4 February 1942
40. Ibid., vol. 14713, 4 Field Company, February 1942, Appendix 4
41. Ibid., vol. 14689, 1 Canadian Division Headquarters, December
1940, Appendix B-2,
vol. 14713, 4 Field Company, January 1941, Appendix 3,
vol. 14710, 3 Field Company, December 1941, Appendix 6
42. Ibid., vol. 14709, 3 Field Company, February 1942, Appendix 9
vol. 14710, 3 Field Company, 22 August 1942
43. Ibid., vol. 14709, 3 Field Company, 29 August 1941
44. Ibid., 1-2 September 1941
45. Ibid., vol. 14710, 3 Field Company, February 1942, Appendix 9
46. The infamous Dieppe raid was carried out by the 2nd Canadian
Infantry Division and involved 7 Field Company.
47. PAC, RG 24, vol. 14690, 1 Canadian Division Headquarters,

6-8, 13-14 April 1942

48. Ibid., vol. 14689, 1 Canadian Division Headquarters, 28 December 1941
49. Ibid., vol. 14702, 1 Field Company, August 1942, Appendix 3
50. Ibid., vol. 14714, 4 Field Company, 24 August 1942
51. Ibid., vol. 14778, 2 Field Park Company, 15 January 1942, vol. 14702, 1 Field Company, 21 January 1942
52. Ibid., vol. 14710, 3 Field Company, 12 April 1942
53. Ibid., vol. 14702, 1 Field Company, 17, 29 June 1942
54. Ibid., vol. 14702, 1 Field Company, 29 August, 22 September 1941, vol. 14690, 1 Canadian Division Headquarters, 7 May 1942
55. Ibid., vol. 14689, 1 Canadian Division Headquarters, 18 November 1941
56. Ibid., vol. 14710, 3 Field Company, 4 December 1942
57. Ibid., vol. 14709, 3 Field Company, 8 August 1941, vol. 14702, 1 Field Company, 1 April 1942, vol. 14703, 1 Field Company, 4 December 1942
58. Ibid., vol. 14710, 3 Field Company, 1 January 1942

CHAPTER THREE

SICILY; PREPARATIONS AND CAMPAIGN: APRIL TO AUGUST 1943

By the beginning of 1943 Canadian troops in England had become restless waiting for an opportunity to see action. Officers and N.C.O.s found it more and more difficult to maintain morale and discipline. The situation was similar on the home front in Canada, where newspapers such as the Winnipeg Free Press, the Vancouver Sun and the Montreal Gazette demanded that the government finally send troops into action to take part in the upcoming battles against the Axis. Allied armies in North Africa were pushing the German and Italian forces there into the Mediterranean without Canadian help and there was little doubt that Europe would be invaded soon. Mackenzie King responded to this bellicose pressure by agreeing that a Canadian division and tank brigade take part in operations against Sicily. On 23 April 1943, Lieutenant-General McNaughton, commander of the First Canadian Army, received a formal request from the British to prepare an infantry division and a tank brigade for operations in the Mediterranean. He chose the 1st Canadian Infantry Division and the 1st Canadian Army Tank Brigade as the first Canadian formations to take part in large-scale military operation against Hitler's forces.¹

From January to July 1943 the 1st Canadian Infantry Division prepared itself for its first major military operation of the war,² though it was not until April that the target was confirmed. Eighteen thousand Canadian troops would be involved in the amphibious mission, which aimed at capturing the Italian island of Sicily and using it perhaps as a base for landings on Corsica, the mainland of Italy or the south of France. Capturing the island would secure the Allies' Mediterranean line of communications, divert German strength from the Russian front and intensify pressure on Italy to force it to cease fighting on the side of the Axis. For this attack, the 1st Canadian Infantry Division fell under command of General Leese's British 30th Corps of Montgomery's 8th Army, made famous in the desert war against Rommel.³

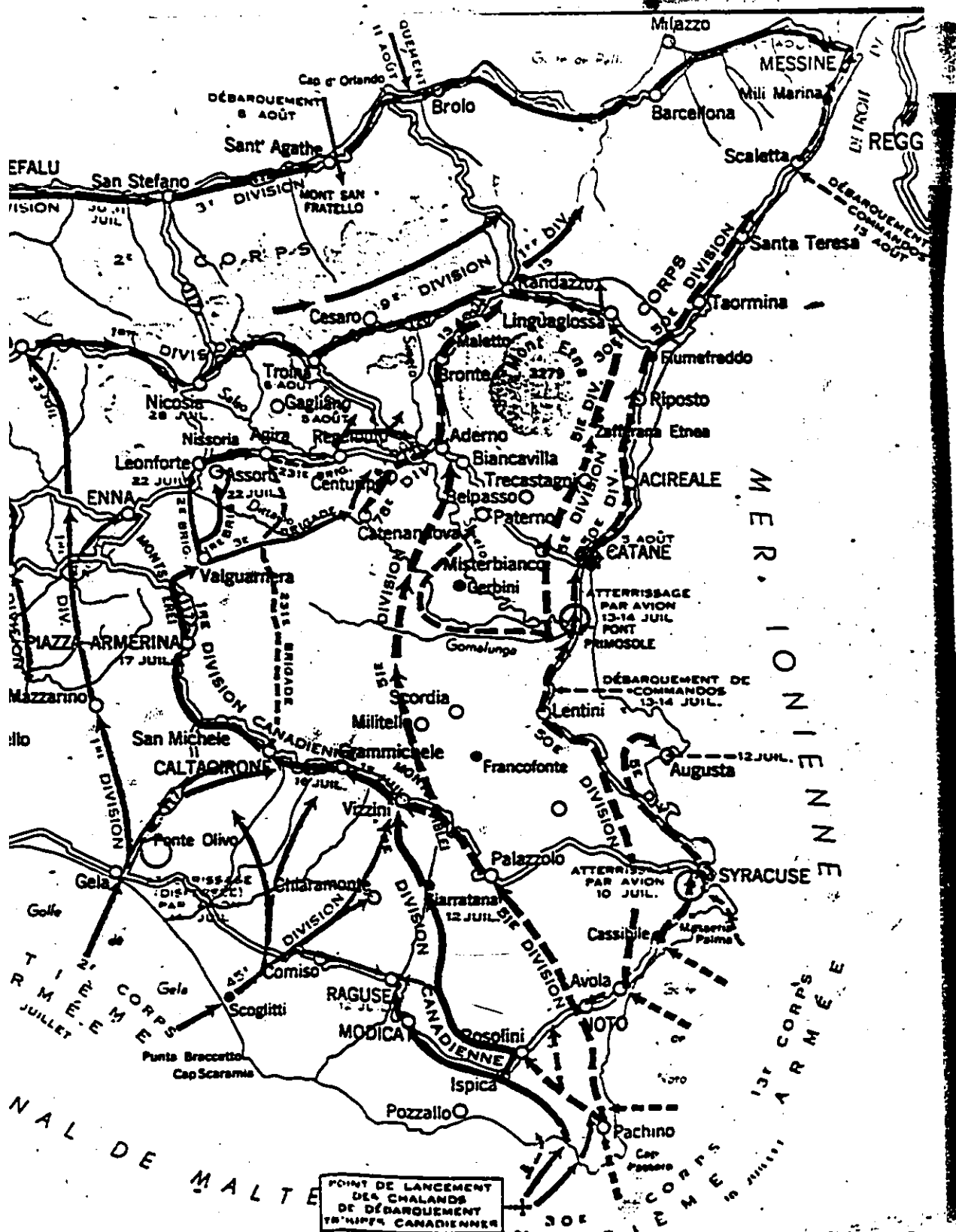
As planned, the campaign would begin with one of the largest amphibious landings of the war and require close coordination of navy, air force and army elements. The engineers of the 1st Canadian Division primed themselves for the battles to come in the months before D-Day, 10 July 1943. Preparations were two-fold. First, the engineers readied themselves for combined operations with intensive training in their own camps and at Inveraray and secondly, they were equipped with the bridges, prodders, tools, mine detectors, bulldozers, trucks and other items the engineers would need to help the division carry battle.

to the Axis forces in Sicily and beyond. All of this gear had to be loaded on the ships that would run the U-Boat gauntlet to the assault beaches.

This groundwork was put to the test when the 1st Canadian Division landed on the beaches of Sicily on 10 July 1943. It was soon found that the engineers, who had become quite proficient at defensive work and bridge construction while in England, faced new problems in active operations which had never come up in training. They had learned their full role in an abstract way, but only experience would make them proficient enough to keep the division moving in the brutal Sicilian terrain. Sappers absolutely needed hands-on experience with the technology of their trade in order to be considered trained and engineer units of the 1st Canadian Infantry Division had to experience actual combat conditions in order to reach any level of real efficiency. Sicily was to be the training ground on which they developed these mobile assault abilities.

In the months prior to the landings in Sicily, the engineers of the 1st Canadian Infantry Division moved into a dramatic new phase of training. Emphasis was finally given to the serious business of learning engineer skills and the engineers began to train in operations to maintain the forward momentum of the division. This new training was carried out in accordance with the War Office's doctrine of combined operations which determined





the timing, order of attack and engineer tasks for assaulting enemy beach defences.⁴ This doctrine was published in the manual, Combined Operations Royal Engineers and was very specific as to the missions the engineers would have to carry out on the beaches. One section of a company was to land on the beach at the same time as the assault battalion to destroy obstacles and put safe lanes through minefields. Fifteen minutes later the remaining sections were to land and assist carriers and trucks through the minefields as well as reconnoitre beach exits. They were to be followed again fifteen minutes later by engineers on bulldozers to prepare proper access routes inland. Finally, an hour after the first wave landed, the company's headquarters would arrive and the entire operation would move inland off the beach. The engineers' variety of responsibilities required tight organization and fine timing.⁵

Beginning in January 1943, the engineers began for the first time to spend much of their time on learning their assault role rather than on construction or defensive assignments. They carried out special bridging and demolitions exercises and combined operations interspersed with establishing water supply and improvising roads.⁶ They concentrated on perfecting assault skills to meet the challenges facing them on the beaches, but spent less time on those liable to be encountered in supporting the Allied advance inland.

To prepare for night operations they instituted 'night into day' training. All engineering work was done at night, including the administration of the unit. This was found to be especially useful in bridging with the Bailey bridge equipment. During combat operations, most bridges had to be built under cover of darkness due to their proximity to the enemy.⁷

The engineers also began to learn to work more closely with the infantry. One section at a time was sent to train with an infantry battalion or tank squadron as the sappers would often be called upon in battle by one of the other branches to help breach minefields for their tanks and their supporting troops. Thus the engineers practiced how to move and fight in close coordination with infantry and armoured units.⁸

To keep up with a mobile mechanized formation like the 1st Canadian Infantry Division or its brigades the engineers needed dependable trucks and capable drivers. But in early 1943 the latter were not available and so courses were run to teach sappers how to drive and maintain company vehicles. Each course lasted a week and taught candidates how to drive, maintain and camouflage a truck and read a map. Orienteering skills were especially important as drivers would often have to drive after dark to pick up supplies or get to a new site. To lose one's way in a mobile war could lead straight to an enemy prison camp.⁹

The non-commissioned officers of each unit learnt to lead their men in mobile warfare and to take the places of their officers in case of death, capture or disappearance. Since officers tended to spend a lot of time reconnoitering, they were often not on site when engineering jobs were carried out. N.C.O.s were given in-depth training especially on assault water crossings. This training usually took the form of a tactical exercise without troops, or T.E.W.T, to expose them to proper reconnaissance procedures. Both the officers and the N.C.O.s felt that these exercises were a valuable teaching aid.¹⁰

New recruits had joined the units and the units themselves had had little opportunity to train properly in attacks during the years prior to this period. The basics of advancing over rugged terrain had to be learned again, and time was set aside to relearn battle drills, which taught individuals and sections how to move and fight in an operational theatre.¹¹ This included basics such as platoon formations, the Geneva Convention's rules in the treatment of prisoners of war and even German words of command. The CRE, after a series of inspections, judged that though the engineer companies were in fact becoming more skillful in carrying out combat missions this progress was not quick enough to prepare them for action. Following one inspection, a diarist wrote despondently,

In the afternoon CRE held a tactical inspection of Coy., (sic) by having us move by march route and take up a

defensive position. Results were not particularly good. But it rather looks as though the engineers must be jacks-of-all-trades.¹²

The diarist was correct. The sappers had to learn not only how to work as engineers to construct bridges or demolish obstacles, but also to develop their skills as soldiers. Much of their engineering work would take them close to German or Italian positions and could require them to defend themselves should the enemy attack.

Bridging took up a good deal of the companies' training time from January to June 1943. There were now several types of bridge equipment available. The sappers had built some of them at least once before, though they might not have seen them again for months or even years. So this sort of training became intense. In January they reviewed the bridges they had built before. Officers and N.C.O.s went on T.E.W.T.s to relearn how to reconnoitre the terrain, plan and construct the approaches and build the bridges. In March, a new wrinkle was added. In order to apply their bridging knowledge to beach landings, the engineers learned how to construct beach jetties and quays, which at this time were still in the experimental stage.¹³

As the engineers became more familiar with bridging equipment, they began to apply their skills towards speedier builds. The sappers were most successful with the Bailey bridge. Though they broke no records, the engineers managed to erect most

types within reasonable time limits, four to six hours. As important at this time was that the engineer companies became skilled enough with the bridging to erect it without serious delays or accidents. The work had to become almost second nature for in operations, one could not afford to stop to solve unforeseen problems as most bridge sites would be within artillery range of the enemy. The engineer units of the division came to find the new Bailey bridges easy to build.¹⁴

It did not always go so well with other bridge equipment. Work on the Floating Bridge Equipment (FBE) tended to be slow. This was unacceptable to the CRE. Though it could not handle tanks or heavy equipment as the Bailey did, it was designed for quick erection to allow the infantry to cross water obstacles in a hurry. The FBE was an assault bridge usually erected under enemy artillery fire and so had to be in place with a minimum of delay. Each minute spent in construction would give the enemy gunners that much more time in which to inflict casualties and destroy the equipment. Timing was poor in practice however because officers and N.C.O.s were either unfamiliar with the equipment or had forgotten what they had learned. They encountered problems organizing the work properly and so the bridges took too much time to build. These were problems which only experience in Sicily would iron out.¹⁵

Successful bridging was hampered not only by lack of experience but by missing personnel. Many men were away on other courses and others were on leave. During the previous years in England there had been little time for leave as pressing construction tasks and the defence of the island as well as day-to-day fatigues allowed little opportunity for sappers to get time off work. In the first months of 1943, on the other hand, they were sent on leave in droves. As many as thirty-five men could be absent from their company at any one time. Not only were there too few sappers to build the bridges in practice but many of them missed this training altogether. Whereas in previous months there had been problems finding the training time for the men because they had works programmes to complete and fatigues to perform, in the early months of 1943 the generosity of senior officers with leave passes caused similar predicaments within the engineer units.¹⁶

In April the division was informed it would soon be involved in combat. As a result, the manpower situation and the attitudes of the men improved. Engineers supported the infantry in exercises with their full complement of personnel. These later exercises gave the engineer units the opportunity to work together to build rafts and ferry men and supplies across rivers. With time and additional drills the engineers managed to cut down

on their construction times. Rafts were constructed in twenty to thirty minutes, which satisfied the CRE.¹⁷

The engineer companies also worked hard on the removal of obstacles hindering rapid forward movement for it was crucial to ensure continued momentum in the division's advance. Time was devoted to experiments with explosives to remove barbed wire entanglements and anti-tank obstacles,¹⁸ but the engineers spent by far the most effort learning to breach minefields. An enemy could delay or even completely stop an advance by skillfully laying mines in the path of an advancing force. Mines and booby traps had proven to be an important element in the mobile warfare of the Middle East. If many minefields are encountered by advancing troops, the men become mine-conscious and hesitant at every step. The Canadian Army relied heavily on dash and initiative, so such hesitation could easily bring an assault to a grinding halt. It was therefore extremely important for the engineers to be capable of locating and removing mines in order to ensure not only the safety but the morale of advancing troops. But the engineers' training in mine warfare faced certain pitfalls by far the most important of which was the lack of realism. In training dummy mines were used to avoid unnecessary death and injury but the sappers quickly got bored with putting in and taking out inert mines. There was no way to tell whether a trainee had made a mistake, which in actual operations could cost

him his life.¹⁹ In spite of this pitfall, training attempted to make the sapper competent in dealing with mines and booby traps. The engineers were taught to breach a three-foot wide gap in a minefield for the infantry to get through followed by a sixteen-foot gap for vehicles. As minefields were usually under the observation and fire of the enemy a good deal of this work had to be done under cover of darkness, which afforded some protection. Practice at night, however, made it even more difficult for instructors to supervise and correct the sappers.²⁰

The mine circus again played an important part in mine warfare training. Engineer instructors were sent to other units to explain the different mines and booby traps available and how to deal with them. This later proved to be of value to all members of the division, for booby traps were not only found in the battle areas but in all likely locations for headquarters and dumps. It was important to ensure that all members of the division knew what to look for.²¹ This experience of teaching others about mine warfare helped to make some sappers expert in the field. The engineers were expected to land on a beach and begin clearing mines and booby traps from an area below the water line all the way to the exits. This training required careful timing as the operation would quite likely take place under enemy fire in daylight.²²

All aspects of training, from battle procedure to general field engineering to bridging and mine warfare were practiced on manoeuvres. These usually lasted a few days and were designed to get the division practice at operating in a theatre of war. For example, on the three-day "Exercise Present," the engineers were broken into their respective companies under the direction of the CRE. They practiced engineer reconnaissance, bridge construction, water supply, mine clearing, camouflage, vehicle maintenance and road move techniques. The exercise was one of many on which the engineers had the opportunity to support the infantry units they would work with in actual operations.²³

The infantry needed armoured support to carry out an attack against a well-trained and determined enemy, so the division practiced ferrying tanks and trucks across the many rivers of England. "Exercise Past" practiced assault water crossings, uncovering several inadequacies that had not come up in everyday training. One of the field companies found itself facing a gap without bridging available. Headquarters had 'denied' its request for equipment; an event that could easily occur in operations where logistics were always a problem. When the necessary material was finally released it had to be moved twenty-seven miles to the bridge site and then could not be unloaded because an artillery unit was blocking the road. Thus the entire operation was held up for a whole night. This kind of activity

was supposed to get the companies used to the problems they would encounter in Sicily and Italy.²⁴

Combined operations exercises were again carried out at the Inveraray training centre in Scotland. Troops practiced landing drills, laying sommerfeld track, assault demolitions, erecting water supply points, constructing quays, clearing mines and building bridges.²⁵ All this training was geared towards the capture of immediate objectives and concentrated little on the jobs that would follow. Assault skills learned at Inveraray were put into practice in other exercises. Such manoeuvres allowed the engineers to practice the skills necessary to land and work on a defended beach and ensured close cooperation between the engineers and the combat arms.²⁶

The engineers also honed up the skills they would need to prepare the beach for subsequent landings after the initial wave had moved inland. This concentrated on the construction of jetties and fish quays. The jetties were built of the same tubular scaffolding that had been used to make anti-tank obstacles. They were supposed to aid in the unloading of personnel and light stores from small craft. The fish quays were built from Bailey bridge parts, were sturdier, could accommodate larger craft and unload vehicles. Both were built after the beachhead had been secured and were supposed to allow the

unloading of war material over an open beach until a port could be captured.²⁷

It was only in mid-March that officials decided on a procedure for the use of engineers in a beach landing. With sappers in the first wave to remove obstacles, in the second wave to prepare exits and in subsequent waves to construct quays and jetties there were simply not enough engineers to go around. Headquarters decided to use infantry pioneers to deal with wire and other such obstacles and have the engineers go in only for reconnaissance work or to remove large-scale obstacles.²⁸ This division of work was supposed to ensure that the sappers would not be given more than they could do in the first few hours of a landing and also made it easier for an engineer platoon commander to keep track of his men, as they would not be spread out amongst several infantry units. The new procedure was applied on Exercise Dalmally on 18 March. Two beaches formed the immediate objective. The first beach was cleared by infantry pioneers of the Royal 22e Regiment while the engineers in support were kept on board ship. When the beach was secured they began to clear routes inland. The second beach was different. The infantry commander thought that heavy obstacles would have to be removed and that a bridge would be required. Thus engineers were included in the first wave of the Carleton and York Regiment to clear the beach and reconnoitre a bridge site further inland.²⁹ The exercise was

a success. It demonstrated that it was best to use engineers only for those assignments, like bridging, that could not be performed by the infantry. The task of cutting barbed wire entanglements and removing mines could be given to the assaulting troops.

Combined operations training seemed to be going well, with the engineers learning their role and the infantry learning how to coordinate their movements. There were, however, still some problems to sort out. The main complication was with assault scales. The latter were a series of lists denoting what men and equipment would be in what vessel. This ensured that the right troops and material would be at the right place at the right time. One of the problems the engineers had with the scales was that they could not seem to get a reasonable group of sappers in the allocated boats. They would thus be short-handed in carrying out their mission until a subsequent wave brought on the balance of their personnel.³⁰

By May the engineers had learned most of the drills and basics of combined operations. There was still however, some confusion as to what specific tasks the sappers would have to carry out. Clearing beaches was a very large and general undertaking and there had been as yet no clear list of priorities to guide the engineers in their work. It was noted by the diarist that, "Poor stabs (are) being made at training. Everybody is more or less in the dark as to what direction to train in."³¹ The

sappers knew the basics of combined operations: how to load their equipment, how to follow the infantry into and across the beaches, how to clear obstacles and prepare beach exits. They had not yet learned everything they needed to know, such as how to move their trucks and equipment off the beaches, where to place stockpiles, when to unload heavy equipment and what to bring with them when they moved inland. These things they would learn with experience on the beaches of Sicily and Italy. A problem faced by all units including the engineers was the shortage of landing craft. Though the procedures for landing were becoming ingrained, it was not possible to carry out the large-scale exercises needed to practice material dumping and traffic control.³² The engineers never saw any real opportunity to support a full-scale operation and so could not be sure how to handle some of the problems that could arise when several units tried to move over the same beach. As with most of their training, the engineers had to wait until operations began before this problem could be solved.

Another aspect of the preparations for war was to gather all the stores and equipment the engineers would need to complete their mission. These would be carried in no less than thirty trucks for each field company. Each of the latter was also allocated, from war stocks, thirteen motorcycles for reconnaissance, a station wagon for the commanding officer,

three compressors and a water tanker. Each of the field companies therefore had a war establishment of forty-eight vehicles. Many of these began to arrive at the units in the first months of 1943.³³

Engineers had to face some rather unique problems in preparing their equipment for combined operations. For example, in April the engineers found that a 3-ton truck loaded with Floating Bridge Equipment could not fit on a landing ship because some of the bridge parts would overhang the bed of the truck. They also discovered that many vehicles were being loaded in excess of the permitted weight. As a result, all items that were to be transported had to be weighed before loading which proved to be a time-consuming and frustrating process. Also, the engineers conducted load trials, loading and unloading trucks to determine the best way to arrange their equipment. The arrival of new trucks alleviated many of these problems though the new vehicles, of course, required maintenance.³⁴

For years the engineers had had to deal with meager supplies. In May 1943 they began to drown in new equipment. In May the amount of stores being delivered became a problem, though that may seem ironic. On the 19th 2 Field Park Company received word that four hundred tons of equipment would be arriving in forty-three railroad cars. This would no doubt have included bridge parts and heavy equipment. The field companies were also

buried in new kit.³⁵ Some of the gear was so new no one in the units had any idea how to operate it. For example, three distillation plants on trailers arrived in May. They were to be used for purifying water if water mains were destroyed, which in a combat zone was very likely. The engineers found, however, that no one was versed in the operation of such equipment. They decided to organize a course to teach the members of the units how to run and maintain the new devices.³⁶

New rifles began to arrive in March to replace those the men had been training with for over two years. In spite of their newness the weapons required frequent repairs. Because of their newness it was necessary to spend much time zeroing them. This was a lengthy process designed to ensure that the sights of the weapon aimed at the same place as the barrel. The man to whom the weapon was issued had to fire several magazines of ammunition on the ranges, adjusting the sights of the weapon after each group of shots. To make matters worse, the magazine spring, which feeds ammunition into the weapon, tended to stick and thus jam the rifle. As in 1940 the engineers were finding snags in their basic kit.³⁷

Also in March, the paperwork that went hand-in-hand with equipment arrivals began to pile up. All stores that had been non-serviceable for six months or more had to be disposed of. Any discrepancies between the equipment establishment and the actual

holdings of the units had to be uncovered. All reports were completed in quintuplicate and had to be sent out by specific deadlines. The latter were barely met.³⁸ Dealing with the new equipment was putting a heavy strain on the administration of the units.

The great kit panic caused more than paper headaches. All stores had to be loaded on vehicles and ready to move by 1 June. The process began on 1 May and was completed a few hours ahead of deadline. The difficulties were immense. The diarist for 1 Field Squadron reported in a daze,

Loading of vehicles still continuing. This is becoming a headache due to continual change in allowable dimensions and such things as tool deficiencies which require complete off-loading of vehicles to straighten out.

Officers and quartermasters struggled with paperwork, non-commissioned officers fought with loading scales and the privates wrestled with the equipment to load it on trucks and ships. Dealing with stores proved to be a frustration that lasted until the end of the war.

By June 1943 preparations were complete. The sappers were versed in the basics of combined operations and had access to most of the equipment they would require to carry out their tasks in the first few days of the upcoming campaign.

The 1st Canadian Infantry Division embarked on 14 June.⁴⁰ The sea voyage to Sicily was not without incident. Some trucks

were lost when three of the ships were torpedoed.⁴¹ The missing items would make the sappers' job in Sicily all the more difficult.

The assault on Sicily was carried out by American and British forces. Patton's U.S. 7th Army was ordered to attack and capture the western part of the island while Montgomery's 8th Army captured the eastern part. The British 30th Corps would advance on the 8th Army's left with Mount Etna as its main objective. All forces were to capture airfields and make them usable by Allied air forces for operations against Italy and the South of France. The role of the 1st Canadian Infantry Division in the assault was to capture the Pachino airfield, destroy a coastal battery and maintain the left flank of the 51st Highland Division. Defences along the beaches, codenamed Bark West, were not formidable, but sandbars eighty yards out from the shoreline could ground out landing craft and leave them sitting ducks to Italian machine guns and artillery. The airfield was heavily defended, though the absence of any formidable land obstacle behind the beaches made the approach to the objective somewhat easy. Heavy casualties were expected.⁴²

The landings in Sicily began on 10 July with little opposition and few casualties, proving planners wrong on that point. 1 Field and 3 Field Companies supported the 1st and 2nd Infantry Brigades respectively in the assault wave while 4 Field

supported the 3rd Infantry Brigade in reserve and 2 Field Park remained offshore. The engineers in the assault wave found themselves in one of the most confusing situations possible in a landing operation; they were landed on the wrong beach. They soon collected themselves, however, and found the units they were supposed to support. By evening the first day the assault companies were in possession of almost all their vehicles and were dug in against a counter-attack by the Italian forces in their area. There was actually not as much for the engineers to do as planners had believed. Defences were weak and the defenders, members of the 206th Italian Coastal Division, were war-weary and unwilling to engage in battle. Some infantry units landed on the beaches with no opposition at all. The engineers, who had been trained to demolish steel and concrete obstacles and clear mines spent a little time sweeping and preparing beach exits and then moved on. The day was somewhat anticlimactic, a good thing when one considers the heavy casualties the operation was supposed to cost.⁴³

That first day the Canadians captured all their major objectives, driving deep into the Italian defences. The engineers earned their pay, removing the few obstacles encountered without delay or confusion. The Pachino airfield was in Canadian hands and operations to push into the interior could begin. At this time the companies of the assault wave broke down into their

respective platoons to give close support to the infantry. Their duties consisted mostly in carrying out reconnaissance patrols. Small groups of men would search forward for potable water, which in the Sicilian July heat was invaluable, and passable routes through the island's rough topography. This reconnaissance was a top priority. As the Canadian division would not meet German forces until 17 July, the engineers did not put their combat skills to use. The Italians were more intent on returning home than on sacrificing themselves to buy time for the German elite.⁴⁴

While the assault wave was moving further and further inland, 4 Field was in support of the 3rd Brigade, preparing an assembly area on the 10th before moving off with the formation the following day, at which time its platoons began to support the infantry battalions.⁴⁵ Headquarters arrived on the 11th while the Park Company landed on the 13th.⁴⁶ At that time all the engineers of the division were ashore.

With successful attacks in most sectors, the engineers in headquarters and the Field Park Company had to move off the beaches. This was no easy task for in the course of the landings, stores had been dumped wherever room could be found on the beach. Divisional Engineer Headquarters decided to leave a sentry on the equipment and move forward with a minimum of bulky stores. An officer was left behind to find a transporter so at least one of

the bulldozers could be moved.⁴⁷ 2 Field Park arrived on the 13th to ensure that the field companies had the equipment necessary to complete their jobs. It thus prepared to issue nails, timber, mine detectors, bulldozers and a host of other items. The unit had attached to it the 15th Light Aid Detachment (L.A.D.), part of the Royal Canadian Electrical and Mechanical Engineers, whose job was to recover vehicles so they could be repaired and the two units would spend several months together attempting to keep the division's equipment in working order.⁴⁸

With the support of the Park Company, the field companies carried on with their respective infantry brigades. Their duties included a lot of reconnaissance work. Normally mounted on motorcycles, N.C.O.s and officers gathered information on enemy activity. The advancing formations hoped that with aggressive reconnaissance bridges could be captured before the Germans or Italians had the time to destroy them. 4 Field Company, using binoculars to stay out of rifle range, made accurate sketches of a bridge showing how the Germans had planned to blow it up, complete with the type of charges they had set.⁴⁹

Sicily's rugged topography made it easy for the German and Italian engineers to cause bottlenecks and delays by destroying bridges and cratering roads. What few routes were left clear were no more than goat tracks. If the division was to take advantage of the armoured formations which gave it mobility, the engineers

would have to clear or rebuild the roads and bridges along its line of advance as quickly as its reconnaissance teams could find them. The sappers thus had to prepare the way through hills and valleys and across rivers. For example, in an attack across the Salso, one field company carried out a series of tasks to make the crossing speedier. As a reconnaissance patrol had stated that a railway bridge was usable, 2 Platoon was ordered to build a ramp up to it. 1 Platoon developed a crossing along the bottom of the dry river bed, removing dozens of huge boulders. Finally 3 Platoon prepared a road cross-country to the next objective, the river Troina, using bulldozers. The railway bridge was ready after two hours while the river bottom was made passable by noon the next day.⁵⁰ Almost all the rivers encountered in Sicily and Italy required some work in order to get the infantry and supporting units across. It must also be remembered that supply routes were indispensable to ensure the forward troops had rations and ammunition.

The engineers found that their main battle in supporting the division's advance was not against the Italian and German armies but against the roads of Sicily. The 'battle of the roads' as it came to be called, took up much time and effort. The expression referred not to the Germans' habit of destroying roads and bridges in the path of the Allied advance but to the decrepit condition of the Sicilian roads in the first place. These routes

tended to dry up and blow away in the summer and wash away in the rain the rest of the year. They had not been maintained in years and could not survive the passage of tanks and trucks. Tanks in particular were a problem. They tended to destroy any track or road they travelled on. A brigade ~~passing~~ down a road had to be followed by engineers repairing potholes, ruts and even broken culverts. The battle of the roads was a full-time job and seemed never-ending to the sappers who waged it.⁵¹

In trying to build and maintain roads the engineers often found themselves desperately short of equipment. For a time in mid-July all work, including the removal of road blocks placed by the enemy, had to be completed by hand as all the heavy equipment was being used to repair an airfield.⁵² On another occasion, a platoon of engineers decided to put a bridge across a crater rather than go through the slow and tedious process of filling it in. Unfortunately, it was found that the bridging equipment was so far back that it was not worth waiting for.⁵³ Because of such incidents the engineers relied more and more on manual labour to maintain the division's supply routes, making the assignment all the more time-consuming and frustrating.

Craters were a constant nuisance. The enemy used huge reserves of explosives to put large holes in the road. These had to be repaired carefully to prevent cave-ins later on. Often it was preferable to bridge such an obstacle, but this created

problems of its own. On more than one occasion the bridge train got lost and precious time was wasted. Also, bulldozers were in short supply and working on priority jobs such as airfields. More often than not craters were repaired by hand, which was time-consuming in the extreme.⁵⁴

At times routes were so badly cratered that new roads had to be built. This sometimes required the resources of all four companies in the division. In constructing one road past Regalbuto the CRE used his companies in echelon. 3 Field conducted the recce of the area and cleared the way for one way traffic. 1 Field followed with two bulldozers and operators from 2 Field Park to make the road fit for two way traffic. Finally, 4 Field followed to finish the road and put up the necessary signs. 2 Field Park supplied tools, bulldozers, signs and labour for the job. Thus six hundred men were involved in the construction of a single stretch of road.⁵⁵

Communications also required the construction and maintenance of bridges. These operations were different in Sicily from what they had been like in training for the enemy had to be contended with. Even after German and Italian troops had been driven away from a bridge site they could still hamper construction with artillery and mortar fire. One of the first bridging operations in Sicily can serve as an example. Conducted by 3 Field it began on 21 July. Lieutenant D.D. Love, a platoon

commander, managed to get close enough to the gap under cover of darkness to estimate the width of the obstacle to be forty feet. At daybreak a reconnaissance party approached, but was driven away by enemy fire. That evening the Loyal Edmonton Regiment captured Leonforte and thus forced the German machine guns away from the bridge site. The bridge was built from 21:30 the 22nd to 02:00 the 23rd. Traffic began to cross at 07:00. Enemy fire could thus stretch out a four-hour operation into several days.⁵⁶

There were signs that the training in England had not prepared the engineers for conditions in Sicily. The day after Regalbuto fell one of the field companies was ordered to build a 70-foot Bailey Bridge. The report on the project stated that construction time was extremely slow and the work was not generally well organized⁵⁷ in spite of the fact that there was no enemy interference. The engineers were beginning to discover that they still had much to learn. No longer would they build their bridges on ideal sites, as they had in England.

Almost every operation the engineers carried out in Sicily required them to clear mines and booby traps. German and Italian soldiers made liberal use of the devices to hinder work. The first encounters with mines and booby traps occurred on the beaches when the units landed and these had to be cleared before the engineers moved off. Axis troops also tended to mine road blocks and craters. At one point a field company bivouacked in

the former camp of the Herman Goering Division found itself surrounded by a minefield. The sappers lifted over a hundred mines before they discovered that the devices were inert and had been used by the Germans for instructional purposes.⁵⁸ The mine circuses had not been completely thorough in teaching the engineers to identify mines. Training in mine warfare could not have prepared the engineers for some of the new mines being found in Sicily. They were essentially wooden boxes filled with explosive with an igniter to set them off if stepped on. Many were gathered as samples for the field companies though some sappers were killed attempting to lift the new mines, as they tended to be booby trapped.⁵⁹

In early August the 1st Canadian Infantry Division ceased operations against Axis forces and went into reserve to prepare for the invasion of the mainland. From 10 July to 6 August the division had advanced from Pachino through Modica, Ragusa, Caltagirone, Armerina, Leonforte, Assoro, Agira and Regalbuto, covering some 120 miles of rugged, heavily-defended territory.⁶⁰

By 17 August the Germans had evacuated the island and the Italians were either gone or had surrendered. The Allied armies in Sicily prepared for the next campaign. These preparations included refresher training, mostly in bridging to cut down on the amount of time and confusion that had accompanied some bridge builds in the Sicilian campaign. On the surface the training was

successful. 3 Platoon of 1 Field Company managed to set a new record in the construction of an 80-foot Bailey Bridge, which they completed in one hour and eight minutes.⁶¹ The division conducted a Bailey Bridge exercise on 27 August, the scheme showing that the units could build the bridges in little time, but that they did not follow the proper tactical procedures. The engineers failed to sweep the bridge site for mines, which in real operations could lead to serious casualties. Also, if mines were discovered part-way through a build it became necessary to halt the project while the area was cleared, delaying completion of the assignment. The engineers also failed to post sentries to warn against enemy activity. Snipers or fighting patrols would thus have had little difficulty moving to within range of the work site and inflicting casualties. Finally, stores layouts were confusing, which could seriously hinder construction at night. A bridge cannot be erected if nuts, bolts and tools cannot be found.⁶²

The refresher training was necessary. Though the engineers had carried out their tasks adequately it was found that training had not kept up with the pace of technical innovation as in the case of box mines, nor had it prepared the engineers adequately for operations against the enemy, as shown in their bridging.

The Sicilian campaign was the first battle experience for the engineers of the 1st Canadian Infantry Division. They had

arrived on the beaches on and after 10 July with only a basic knowledge of their role, but in the month that followed began to accumulate experience that would serve them well in the time to come. They were learning on the job and developing, though slowly, an ability to improvise and innovate. It was this ability that enabled them to perform their tasks better in the operations that led from the beaches at Reggio to the fall of Rome. In the months to follow the sappers would learn the details of their role in the advance while on operations. Experience took the place of formal instruction.

NOTES

1. W.A.B. Douglas and Brereton Greenhous, Out of the Shadows: Canada in the Second World War (Toronto 1977), p.122-123
2. Spitzbergen was a small-scale operation involving only 645 personnel. It must be remembered that a division totalled over eighteen thousand troops.
3. Lt. Col. G.W.L. Nicholson, Official History of the Canadian Army in the Second World War: Volume II: The Canadians in Italy 1943-1945 (Ottawa 1956), p. 50, 175
4. Directorate of History, FN 7, War Office, Combined Operations Royal Engineers, March 1943, p. 2
5. Ibid., p. 32
6. PAC, RG 24, vol. 14703, 1 Field Company, January 1943
7. Ibid., vol. 14714, 4 Field Company, 3 January 1943
8. Ibid., vol. 14703, 1 Field Company, 10-12 January 1943
9. The diarist commented that drivers were of absolute necessity in a company that had to haul so much equipment. There seemed to be some element of frustration in trying to get enough men qualified to drive and maintain the unit's vehicles.
Ibid., vol. 14778, 2 Field Park Company, 12 January 1943,
vol. 14715, 4 Field Company, 13 April 1943
10. This training was successful not in its results, which according to the diarist were not good, but in the fact that much was learnt.
Ibid., vol. 14717, 4 Field Company, 25 January 1943
11. The biggest problem was with new recruits, who were still coming in at this time. The diarist was not at all impressed with their abilities, especially when it came to camouflage - an important part of basic training when one considers the devastation aircraft can inflict on unprotected troops.
Ibid., vol. 14714, 4 Field Company, 23 January 1943
12. Statements similar to the last phrase were common in the war diaries. The diarist seemed amazed at the amount of material everyone was expected to learn.
Ibid., vol. 14703, 1 Field Company, 3, 9 April 1943

13. Ibid., vol. 14703, 1 Field Company, 29 January - 11 February 1943,
vol. 14691, 1 Canadian Division Headquarters, 4 February 1943,
vol. 14715, 4 Field Company, 7 March 1943
14. Ibid., vol. 14711, 3 Field Company, 22 March 1943
15. The diarist reported that the times for the build were poor and the organization was worse. The unit spent the next day trying to get "...FBE drill down to reasonable time limit."
Ibid., vol. 14703, 1 Field Company, 22 March 1943
vol. 14691, 1 Canadian Division Headquarters, 25 March, 7 April 1943,
vol. 14715, 4 Field Company, 8 April 1943,
vol. 14703, 1 Field Company, 14 April 1943
16. Ibid., vol. 14715, 4 Field Company, 14 April 1943
17. Ibid., 15-16 April 1943
18. Ibid., vol. 14691, 1 Canadian Division Headquarters, 25 February 1943,
vol. 14703, 1 Field Company, 25 February 1943
19. Ibid., vol. 14703, 1 Field Company, 11 March 1943
20. In the debrief to a minefield clearance scheme, the diarist noted that the whole thing was very unrealistic. Men were in the minefield searching for mines with the enemy only 150 yards away. The question was raised as to what would the sappers do if they came under fire?
Ibid., 19 April 1943
21. Ibid., vol. 14715, 4 Field Company, May - June 1943
22. Ibid., vol. 14703, 1 Field Company, 17 May 1943
23. Ibid., vol. 14703, 1 Field Company, 19 February 1943,
vol. 14778, 2 Field Park Company, 19 February 1943,
vol. 14691, 1 Canadian Division Headquarters, 19 February 1943,
vol. 14714, 4 Field Company, 20 February 1943
24. Ibid., vol. 14715, 4 Field Company, 1 April 1943
25. Ibid., vol. 14711, 3 Field Company, 19-25 February 1943

26. Ibid., 1 March 1943

27. Ibid., vol. 14715, 4 Field Company, 7 March 1943

28. Ibid., 14 March 1943

29. Ibid., 18 March 1943

30. Ibid., vol. 14703, 1 Field Company, 2 May 1943

31. Ibid., 14 May 1943

32. The shortage of landing craft was acute at this time. It must be remembered that the Americans required most of the craft produced for their operations in the Pacific. The problem was not solved until the eve of the Normandy landings.

Ibid., 4 May 1943

33. Vehicle establishment was listed as follows:

Motorcycles	13
Station Wagon	1
8 cwt Pers.	4
15 cwt General Service Truck	7
Compressor (15 cwt)	3
15 cwt Water Tanker	1
30 cwt General Service Truck	6
30 cwt Office Truck	1
30 cwt Truck with Derrick	1
30 cwt Truck with Winch	11
Total	48

Ibid., vol. 14709, 3 Field Company, 1-31 August 1941

vol. 14703, 1 Field Company, 18 February 1943

34. Ibid., vol. 14703, 1 Field Company, 7 May 1943,

vol. 14715, 4 Field Company, 14-15 May 1943,

Vol. 14691, 1 Canadian Division Headquarters, 19 May 1943.

35. Ibid., vol. 14778, 2 Field Park Company, 19 May 1943,
vol. 14711, 3 Field Company, 20 May 1943

36. Ibid., vol. 14778, 2 Field Park Company, 25 May 1943

37. Ibid., vol. 14703, 1 Field Company, 18 March 1943

38. The diarist was quite surprised at some of the discrepancies that were discovered. He did not, however, give any examples.

Ibid., 23 March 1943

39. Ibid., 10 May 1943

40. For operations in Sicily, Italy and Western Europe the 1st Canadian Infantry Division retained the same organization, as follows.

4th Reconnaissance Regiment (Princess Louise Dragoon Guards)
from Ottawa, Ont.

Saskatoon Light Infantry (Machine Gun Battalion), from
Saskatoon, Sask.

1st Canadian Infantry Brigade

Royal Canadian Regiment, from London, Ont.

Hastings and Prince Edward Regiment, from Trenton, Ont.

48th Highlanders of Canada, from Toronto, Ont.

2nd Canadian Infantry Brigade

Princess Patricia's Canadian Light Infantry, from
Winnipeg, Man.

Seaforth Highlanders of Canada, from Vancouver, B.C.

Loyal Edmonton Regiment, from Edmonton, Ala.

3rd Canadian Infantry Brigade

Royal 22e Regiment, de Quebec, P.Q.

Carleton and York Regiment, from St. Stephen, N.B.

West Nova Scotia Regiment, from Bridgewater, N.S.

Artillery

1st Field Regiment - Royal Canadian Horse Artillery

2nd Field Regiment

3rd Field Regiment

1st Anti-Tank Regiment

2nd Light Anti-Aircraft Regiment

Engineers

1 Field Engineer Company

3 Field Engineer Company

4 Field Engineer Company

2 Field Park Company

Ibid., vol. 14691, 1 Canadian Division Headquarters, 14 June 1943

41. Ibid., vol. 14691, 1 Canadian Division Headquarters, 5 July 1943

42. Lt. Col. G.W.L. Nicholson, 65-67

43. Strangely enough, the diarist did not seem to be the least bit surprised that the engineers had been landed on the wrong beach. This attitude might be attributable to inter-service rivalry.

PAC, RG 24, vol. 14711, 3 Field Company, 10 July 1943

44. Ibid., 11 July 1943

45. Ibid., vol. 14715, 4 Field Company, 10-11 July 1943

46. Ibid., vol. 14778, 2 Field Park Company, 13 July 1943

47. Dumping was done by all the units of the division. The terrain they would be advancing through was so rough that supplies could only catch up when the division halted, which did not occur very often.

Ibid., vol. 14691, 1 Canadian Division Headquarters, 11 July 1943

48. Ibid., vol. 14778, 2 Field Park Company, July 1943

49. Ibid., vol. 14703, 1 Field Company, July 1943, Appendix 7

50. Ibid., vol. 14711, 3 Field Company, 3 August 1943

51. Nothing was to cause such hatred and discontent as the battle of the roads. Diarists throughout the campaigns in Sicily and Italy wrote in frustration of the day-to-day grind of having to build, rebuild, repair, maintain and patrol the Italian roads that turned to quagmires in the rain and blew away during dry spells.

Ibid., vol. 14691, 1 Canadian Division Headquarters, 21 July 1943

52. Ibid., vol. 14703, 1 Field Company, 12 July 1943

53. Ibid., 28 July 1943

54. Ibid., 29 July 1943

55. Ibid., 1 August 1943

56. Ibid., vol. 14711, 3 Field Company, 21 July 1943

57. Ibid., vol. 14703, 1 Field Company, 4 August 1943

58. Ibid., vol. 14703, 1 Field Company, 9-11, 19 July 1943,
vol. 14691, 1 Canadian Division Headquarters, 15 July
1943

59. Ibid., vol. 14691, 1 Canadian Division Headquarters, 23 July
1943

60. Lt-Col. G.W.L. Nicholson, 164, 175, 179

61. In order to fully appreciate the feat, it is necessary to compare it with other, average completion times. On that same day, other builds went as follows:

1 Pl. of 1 Fd: 70 feet in 3 hours.
2 Pl. of 1 Fd: 70 feet in 4 hours.
3 Pl. of 1 Fd: 70 feet in 2 hours, 47 min.
1 Pl. of 3 Fd: 60 feet in 2 hours, 48 min.
2 Pl. of 3 Fd: 60 feet in 2 hours, 57 min.
3 Pl. of 3 Fd: 70 feet in 2 hours, 37 min.
1 Pl. of 4 Fd: 70 feet in 3 hours, 43 min.
2 Pl. of 4 Fd: 70 feet in 2 hours, 57 min.
3 Pl. of 4 Fd: 80 feet in 4 hours, 26 min.
2 Fd Pk - one section only: 70 feet in 3 hours.

PAC, RG 24, vol. 14711, 3 Field Company, 17, 30 August 1943,
vol. 14703, 1 Field Company, 23 August 1943,
vol. 14691, 1 Canadian Division Headquarters, 27 August 1943
vol. 14711, 3 Field Company, 30 August 1943

62. Ibid., vol. 14691, 1 Canadian Division Headquarters, 27
August 1943.

CHAPTER FOUR

FROM REGGIO TO ROME: SEPTEMBER 1943 TO JUNE 1944

After the capture of Sicily British and American policymakers debated heatedly what they should do next. The British, especially Churchill, favoured a full drive through Italy or the Balkans in order to draw German forces from other fronts and knock Italy out of the war. The Americans, led by Marshall and Eisenhower, preferred a build-up in England followed by a full-scale landing on the coast of France; they feared the British plan would delay the end of the war. After much discussion the two partners decided to carry the fight to the Italian mainland and force the Mediterranean Axis power out of the conflict. With this purpose in mind Allied planners prepared "Operation Baytown," the invasion of mainland Italy. The British 8th Army would lead the way with the 13th Corps; the 1st Canadian Infantry Division attacking on the right and the British 5th Division on the left. A week later the Americans were to land at Naples. Though resistance on the British and Canadian front was light, the American landing at Salerno was a near-debacle and German resistance quickly stiffened in the Italian hills. Rome was nine months away.¹

The Canadian objective was the capture of Reggio and its airfield, followed by a push towards the heel of Italy. The learning process that had begun in Sicily continued throughout the Italian campaign. Crater repair, bridging and mine warfare dominated the sappers' battlefield from the landings at Reggio di Calabria to the fall of Rome. After their first experiences in battle the engineers still required practice. The Sicilian campaign had taught the sappers much. In the advance from Reggio to Rome the engineers put what they had learned in Sicily to work, increasing their ability to keep the division moving in the face of enemy resistance. The Italian campaign then, was the practical application of lessons learned in the Sicilian experience.

Three aspects of the period must be closely examined to determine the engineers' progress in dealing with the technology of modern war. Their ability to maintain the division's advance is the first. In examining how the engineers carried out road repair and construction, bridge erection and the removal of obstacles made with mines, booby traps and wire one can determine whether they truly applied the lessons of the Sicilian campaign. The second aspect under study is their skill in dealing with their own technology; in maintaining and replacing the equipment they could not do without. Finally, the training they organized must be studied to determine whether lessons learned on the



battlefield were passed on to new recruits coming into the units and replacements from other theatres. Then one can determine if indeed the engineers managed to become well-trained in their main role - supporting the division's advance.

The engineers' first mission was to aid the division in its assault across the straits of Messina and the capture of Reggio. For the first time since the fall of France Allied troops would land on the continent of Europe. Engineer planning for "Operation Baytown" began in mid-August. An engineer appreciation concluded that the Germans would carry out four types of operation to delay the Allied advance. First, their engineers would mine the beaches and the foreshore. Second, they would use craters and wire to prevent quick development of the beach exits for a breakout. Third, the German engineers would block and damage the roads leading further inland to delay the Allies should they manage to break out of the bridgehead and finally, they would mine and destroy all defiles to force the advancing troops to move on the ridges and thus without adequate cover. Having determined what the enemy was most likely to do, the engineers could plan their activities to counteract it.²

The plan was relatively simple in outline. A field company would assist the infantry in crossing the beach, reconnoitre two exits and clear lanes to them as well as develop routes for follow-on forces. More engineers would then clear the foreshore

of mines, prepare a lateral roadway joining the two exits and prepare a third one. Also, this second wave was to reconnoitre and develop a maintenance area and be prepared to follow the first company to clear and improve routes. The engineers expected that adherence to this plan would maintain the division's forward momentum after it unloaded on the beach.³

Equipment and personnel for the operation were limited by the number of available landing craft. Each company was allowed 59 all ranks in each of its three platoons and twenty men in its headquarters, or almost its full war complement of troops. These men would not enjoy the benefit of going ashore with all their equipment. Each company was allowed to bring eleven trucks, one signals van, one water tanker and a compressor, about thirty percent of their full lift power.⁴ This was barely enough to haul the stores needed to carry out the tasks allotted to the engineers on the beaches. They would be hard-pressed for equipment until subsequent waves brought the bulk of their supplies.

Preparations for the operation began on 31 August. The engineers loaded their vehicles with all the stores they could carry. The platoon officers were briefed on the company plan and then informed their men as to what was expected. Detector parties and other engineers landing in the first wave joined the infantry units they would be supporting. Finally, those officers who would be conducting reconnaissance missions soon after the landings

reported to Brigade headquarters. Everyone was in a high state of readiness for the crossing.⁵

On 3 September 1943, the fourth anniversary of the outbreak of war, the 1st Canadian Infantry Division and its engineers carried out the operation as planned. 4 Field Company, the lead element of the engineers, moved out into the straits of Messina on 2 September and landed on the mainland on the 3rd. There was no opposition as the Axis had not been able to guard every mile of coastline and so was keeping the bulk of its forces further inland. The company cleared routes, improved the beaches and swept the roads for mines, removing obstacles to the division's advance. A reconnaissance party was sent with the 4th Reconnaissance Regiment (Princess Louise Dragoon Guards) to check routes inland. The role of the regiment was to move in advance of the division and search for enemy strongpoints and troop concentrations. The engineers attached to them checked the seriousness of damage done to roads and bridges to determine the amount of engineer work required to keep the division moving. The German and Italian engineers had been hard at work, blowing up all lines of communication leading off the beaches. 4 Field Company itself moved off the beach with all but one of its vehicles. The operation was, as expected, unopposed and therefore a relatively easy landing. The Italians were in total confusion following the replacement of Mussolini by Badoglio in a palace

revolution and the Germans had not completed their occupation of Italy. Reggio was defended by Italian coastal troops whose morale was quickly disintegrating and who did not expect to have to fight; the Axis had not pegged the area as a possible target. Hard fighting would come later.⁶

The engineers expected the move inland to be similar to the post-landing operations that had taken place in Sicily. One of the diarists reported, "As we expect this, is a repetition of Sicily and the division will move only as fast as sappers can fill craters, build bridges and repair roads."⁷ Though everyone expected the Italians to surrender at any moment, commanders warned their troops against complacency; there were still crack German formations to deal with including knowledgeable and experienced field engineers. The American landings in Salerno on 9 September did not compel the Germans to pull out of Southern Italy as expected.⁸

As in Sicily, one of the first orders of business was to keep the roads open. This chore usually began with a reconnaissance team, whose job was to inspect roads and report on their condition. The work had to be quick and accurate. The CRE received one or two reports a day giving precise and up-to-date information on the bad condition of roads, ditches and verges. These reconnaissance patrols were always carried out by engineer

officers or N.C.O.s, giving the companies fair warning of what assignments lay ahead and the stores required to complete them.⁹

Despite the Italian surrender on 8 September, the Canadians encountered severe delays resulting from German demolitions. The most common problem unearthed by the reconnaissance teams was cratering. The Germans in Italy blew up large sections of road, usually at points where bypass was difficult or impossible, in order to delay the advance. The usual solution was to build a diversion around the demolished area, but this could not be done if there was, say, a swamp on one side of the road and a mountain on the other. The Germans could worsen the situation by blowing the craters in series. Such snarls could keep a field company busy for several days or even a solid week.¹⁰ Even when fighting was not intense the constant battle to keep the roads open in spite of German efforts to the contrary began to take a toll of the engineers' morale soon after the landings at Reggio. One diarist reported dejectedly that,

The days are definitely assuming a dreary sameness, as sappers still battle with blown bridges and craters... Recces report roads east of Cittanova simply packed with craters.

To deal with the problem it soon became evident that some system would have to be developed to reconstruct these large stretches of road if the division was to carry out its advance up the boot of Italy without delay. One solution adopted in September was the crater hop. This consisted in leap-frogging units through the

obstacles so fresh sappers would always be available to work on a new job rather than have the same group of engineers work its way through several miles of demolished road and drive itself to exhaustion. The new process could sometimes get very complicated. One company would prepare a diversion around a series of tightly packed craters. When the job neared completion, a second field company would send one of its platoons through the diversion to attack the next set of obstacles. As soon as this first platoon had filled in or bypassed the crater, another would move through to the next one, and so on. It was not unusual for the system to involve two or even three companies. Its main advantage lay in the fact that it was not absolutely necessary to complete one job before engineers could start working on the next. The process worked as long as engineers could somehow get through a set of obstacles to take care of craters further down the road. Two months after they encountered their first crater, the engineers were beginning to develop speedy ways of dealing with such obstacles by using the knowledge they were gaining through experience.¹²

The engineers could often be found moving ahead of the advancing infantry. In this manner they became the lead elements of the division, repairing or developing roads before friendly troops had occupied the area.¹³ This could only be done safely, however, if the enemy was not very active. There were, of course,

hazards involved in moving forward of the advance as engineer patrols were lightly armed and likely to find enemy troop concentrations as well as obstacles. Some engineers, whose numbers cannot be accurately counted,¹⁴ were caught or killed by German patrols while carrying out reconnaissance work ahead of the advancing infantry. On one occasion an officer and a corporal passed two vehicles that were going too slowly and keeping them from their appointed task. Unfortunately, the trucks belonged to the German Army and their occupants opened fire. The reconnaissance team left their unprotected vehicle and ran for the woods. Though the team leader, Lieutenant Rollefson, managed to elude the pursuers his driver Corporal Calnen was captured. Though the circumstances differed, many other engineers became casualties conducting road reconnaissance.¹⁵

Some chores could be hazardous even if the enemy was not present. If time was available, the Germans booby trapped road blocks and craters. Their engineers were also learning with experience and kept finding new ways to place mines and booby traps so as to cause the advancing Canadians maximum delay and casualties. This made the job of restoring the roads all the more time-consuming as greater caution was called for. On occasion a road block became a crater in the process of being removed. The sergeant working on one such site decided that it would be too hazardous to disarm the trap and so proceeded to tie some twine

to it to pull it away from the road block. This procedure was common as it was considered better to damage a road or structure than to have a sapper killed or maimed by a trap. In this case the damage done was considerable. When the dust had cleared the sergeant found himself faced with a 28-foot crater. The poor sergeant discovered that solutions may cause their own problems.¹⁶

Even if there had not been enough time to set booby traps, the Germans could still hamper engineer operations with machine gun and artillery fire. Direct fire, where the Germans could see their targets clearly, was most dangerous as this meant that the machine guns, mortars or artillery could fire directly upon the sappers and cause heavy casualties, as many as twenty or so for a single job. Artillery was often indirect, meaning that observers called down fire on easily recognized targets to gunners several kilometers away. This was less physically dangerous to the sappers themselves as the Germans usually shelled important landmarks such as cross-roads and bridges. Though this type of fire did not always strike the areas in which the sappers were working, it could still make their task more difficult by cutting them off from their stores. Bulldozers were worth their weight in gold in crater repair but could not be brought forward if the road leading to the site was under fire. Many bypasses were built using pick and shovel because of this.¹⁷

Enemy fire could seriously delay road restoration. For example, at 18:00 on 13 October a sergeant of 3 Field Company was sent forward to reconnoitre a crater but was forced back by a German machine gun. The following day, the company commander and a platoon commander managed to get a good look at the site, but were fired upon as they left. The situation was worsened when shelling along the road cut the unit off from its materials. That night 1 Platoon and a bulldozer filled in the crater under cover of darkness. The road was ready for two-way traffic at 09:00 the 15th, a day and a half after the crater was found. Such operations were common and could not be avoided as the Italian countryside favoured the defence.¹⁸

Blows, where the Germans had demolished bridges in their withdrawal, were usually registered by artillery units who could thus accurately shell the sites should the engineers attempt to build new bridges there. It was necessary to develop techniques to allow the task to be carried out with little or no casualties and with minimum delay. The experience of 3 Field Company near Campobasso is an excellent example of work under fire. The company was preparing to build a bailey bridge on the outskirts of Vinchiaturo, just outside Campobasso. The reconnaissance was completed by the company commander and one of the platoon commanders, who had to run for their lives when German mortars accurately shelled the site. That night, 3 Platoon moved into the

area and began to prepare the banks. They were also shelled, but none of the mortar fire was close enough to cause a work stoppage. The bridging was then brought up to be unloaded, but this took several hours as the shelling began to get close, forcing the engineers to make frequent interruptions. The bridge itself was not built until the following evening, a day-and-a-half after the gap was found.¹⁹ Such operations were common throughout the Italian campaign. As the engineers became more skillful at constructing bridges quickly, the German gunners became more accurate with their barrages. After a time the sappers learned to judge the accuracy of falling shells and thus continue with their work with a minimum of interference.

When the roads were finally opened in spite of German efforts to the contrary, it was necessary to maintain them. Supplies had to come to the front through captured ports, which meant that thousands of tracked and wheeled vehicles travelled on a few main arteries. These roads were bad to begin with and after having been destroyed by the Germans and then pounded by Allied trucks and tanks were in sorry shape indeed. They required constant repair. For this purpose road patrols were initiated. These consisted of a section of sappers with a dump truck, picks, shovels and road signs. Their mission was to carry out road repairs such as paving new roads and diversions with gravel, filling potholes and removing debris from ditches as the Allied

armies ground forward. If the road was in such poor repair as to be beyond their limited capabilities the road patrols prepared detailed reports explaining the extent of the defects they had discovered and the manner in which they could be fixed. The engineers carried out these road patrols in all rear areas through which important supply routes ran.²⁰

In maintaining roads, the engineers faced an enemy as formidable as the Germans - Mediterranean autumn weather. The heavy rain in the fall and winter was a constant hindrance for which the Canadians were not at all prepared. Small streams suddenly became raging, flooding torrents; rising by as much as a foot a minute in the worst rainstorms. Flooding rivers could wash away bridges while roads simply disappeared from hillsides or drowned in gullies. It was very difficult for the sappers to keep up. The rain and variety of chores they had to perform combined to make road maintenance very hard on the engineers. Frustration and depression usually accompanied the litany of washed out roads, burst culverts and flooded highways. One diarist reported in frustration,

Weather - Wet and heavy rain. The continual downpour is making the task of road maintenance extremely difficult. The Coy is split on works spread from one end of the area to the other. The problem appears from widespread commitments which do not allow concentration of effort in any one place.²¹

Bridges were also affected, especially when the approaches to them became deep quagmires no vehicle could negotiate. While the

engineers could build bridges in four or five hours without enemy interference the preparation of approaches could take an extra seven or eight hours as the sappers drained water, dredged mud and dumped tons of gravel.²² The weather often threatened to wash away banks or scour piers, thus plunging important bridges into Italy's raging rivers. The battle of the roads lasted throughout the Italian campaign. In the end, the sappers simply left as the advance moved forward and new ports closer to the front were opened, leaving the old roads to fate of the Italian weather.

Many of the challenges the engineers faced in Italy were new to them. The Mediterranean weather, for example, could not possibly have been included in bridge training. In Sicily the engineers had found solutions to many new situations when they had to build bridges under fire. In Italy they began to apply this knowledge, using their own initiative more and the training manuals less. The day the engineers arrived in Italy, on 3 September, one of the field companies was ordered to build a 100-foot bailey bridge so tanks could cross a deep gully. The engineers found themselves facing a situation they had never seen in bridging before. In England they had learned to build bridges in open flat countryside. Now the engineers had to adapt to the narrow and enclosed Italian spaces. The far bank, where the bridge was to land, was a causeway too narrow to accept the wide bridge. Reconnaissance parties could find no cross-country routes

except one that was suitable only for jeeps. After much thought the engineers decided to widen the causeway with parts from the bridge so the latter could be firmly anchored on both banks. It took an entire day to figure out how to do this and hand-carry the transoms to the other side. As a result, the bridge was not built until 4 September. The engineers were discovering that there was no such thing as an ideal bridge site outside of England.²³

In an advance priority went to moving ammunition, food and water to the troops at the front. All else was secondary. The engineers faced a new kind of bridging challenge when the advance outstripped their stores. At times there was not enough bridge equipment available to complete certain assignments and the division could not wait for the necessary parts to be brought up from the rear. On one occasion a field company faced the problem of constructing a fifty-foot bridge with only enough Bailey parts for thirty. The solution eventually adopted was to make two major changes to the construction drills. First, the nose was eliminated. This was formed of the same parts as the rest of the bridge and measured about half the total bridge length. Its purpose was twofold. First, the nose was supposed to land on rollers on the far bank so the entire structure could be pushed into place. Second, it ensured that the bridge's centre of gravity never went past the rollers on the near bank. In essence

it turned the entire bridge into a seesaw. The nose could not be removed until the bridge was in place and so left the engineers with spare parts. The engineers came up with the novel idea of using the parts for the nose in the actual structure of the bridge. The solution was to build the whole bridge on the near bank and then use a huge counterweight (probably a bulldozer) on the rear of the bridge to launch it to the far side. The second part of the solution was to eliminate the Bailey ramp leading from the roadway to the edge of the bridge, which was normally built above ground. These parts could then also be used in the structure, though this required the engineers to dig out the bank in order to make the bridge roadway level with the road. After much pushing, shoving and praying the job was completed. Therefore a complete rethinking of accepted procedures was necessary to allow for the completion of the project.²⁴

Even when equipment was available and allocated to a certain unit there was no guarantee that it would be delivered within a reasonable time limit. The habit of leaving certain materials behind because of the lack of transport could lead to frustration if certain items suddenly became critical. In building two timber bridges west of Lucera one field company found that the lumber it needed had to be hauled from Foggia, eighteen miles away. This delayed the construction of the bridge by a full day.²⁵ The problems in getting the necessary parts for the completion of a

job had followed the engineers to Italy, only now they could not cancel a bridge build on the grounds that material was not available. Improvization became an important part of field engineering.

At times the sheer size of a task could strain the engineers' capacity to plan and improvize. Wide gaps were no problem if pontoon bridging could be used for it was easy enough to simply float more piers into the water to support the bridge. There was, however, no easy solution for the construction of long non-floating bridges, which required piers as deep as the gorge they spanned to guarantee the entire structure did not fall into the gap. In November 1943 a field company was faced with a non-floating bridge site with a 180-foot gap. The gorge was too deep for the engineers to build piers to support the bridge. The longer an unsupported span is, the weaker it is, and 180 feet of unsupported bridge would not be strong enough to carry the loads the division would be putting across it. To meet this challenge, the engineers again had to improvise. The company had to erect steel cribs at each end of the gap to bring the distance down to 140 feet and a bulldozer was needed to stabilize the huge and unwieldy bridge during launching. The process of working out a solution and then building the bridge took three days. The unit had never had to erect such a massive unsupported structure before.²⁶

Bridging jobs could also be huge due to the number of bridges that had to be built in a small area. If rivers were close together, as was often the case in Italy, several bridges would have to be erected in double quick time for the division could not afford to wait as the engineers stopped to organize for each bridge site. The solution adopted was the bridge gallop. This was similar to the crater hop in that engineers waited until a bridge was sufficiently complete to allow them to cross so as to build another one. In November a field company had three bridges to build in quick succession. The plan was to slap them in one after the other with platoons leap-frogging to their sites. 2 Platoon was the first to leave with its bridging equipment, completing its task with 3 Platoon looking on. 3 Platoon then passed over the newly completed bridge to build another with 1 Platoon following closely to erect still another. Before 1 Platoon had finished the structure however, the company was ordered to build two more bridges which it also successfully completed. All five bridges were operating within 24 hours of the order to build having been given.²⁷ The bridge gallop worked very well, allowing each platoon in a company to organize each bridge build separately and consequently quicker than they had in training and thus maintaining a reasonable rate of advance for the division.

As their ability to solve complex bridging problems increased, the sappers' speed in constructing simple bridges did also. No longer was there the confusion in stores layouts that had plagued bridge construction in Sicily. N.C.O.s were more experienced at organizing work and the sappers were more familiar with construction drills. On 27 November 1943 3 Platoon of 1 Field Company put up a ninety-foot bailey bridge in 4 1/2 hours, a record.²⁸ After several months in operations in a theatre of war the engineers were becoming quite skillful at quickly completing bridge tasks that in Sicily had been rife with confusion and delay. On 28 November 1943 Lieutenant General Dempsey, commander of the British 13th Corps in which the 1st Division served, recognized the Canadian engineers' proficiency in a speech given in the Agnone square near the River Sangro. The general congratulated the unit on having gone over 608 miles of rugged Italian terrain from the landing at Reggio di Calabria to the outskirts of Ortona. In that time the engineers had learned much about bridging in the rugged terrain of Italy.²⁹

The bridges that had been built since the landings had to be maintained. This entailed the erection of guardrails that had not been put into place during construction. It also required painting and marking bridges so drivers would be careful in crossing them. This caution was to no avail as trucks continued to slam into the bridges and force the engineers to repair them

time and time again.³⁰ The structures required constant attention and became an important part of the engineers' works programmes when the 1st Canadian Infantry Division was in reserve. There were, however, some opportunities to learn more about the structure of the bailey bridge during maintenance. Such an opportunity arose when, for the first time, a bailey bridge was hit by shellfire on 26 January 1944. It was found that it could easily be repaired by replacing some of the damaged parts. The Canadian engineers, who had always preferred working with the Bailey bridge, were impressed even more by its show of ruggedness.³¹

Whenever the division went into reserve to rest and train, the engineers began to remove bridges in the rear so they could be used at the front. This process began in June, 1944.³² The purpose of the work was to recover bridges that were no longer in use. As the Allied Armies moved up the boot of Italy they captured ports through which their supplies could flow to the front. Each time a new port was put into operation old lines of communication to its predecessor became redundant. Given the scarcity of bridge parts in the Mediterranean theatre because of the planned Anzio landings near Rome and the build-up for D-Day in the summer of 1944, it was considered to recover the bridges the engineers had built in the heat of battle so they could be used again. The bridging cycle was thus complete, from

construction to maintenance to dismantling. It was especially in the first phase that the engineers had to be capable, as the movement of the units they supported depended on the swift construction of strong bridges. The engineers improved greatly in that regard during the advance from Reggio di Calabria to Rome.

When in the advance, the engineers were responsible for the removal of all mines and booby traps. The sappers carried out this chore not only in pitched battles to allow the infantry and armour to close with the enemy but also in rear areas to ensure the safety of soldiers and civilians alike. Whenever an explosive device was found, the engineers were called in. They thus found themselves disarming mines and booby traps on a regular basis. The engineers also found themselves removing unexploded bombs, sea mines that had washed ashore and any suspicious-looking object, including on occasion empty oil drums and hub caps.³³

While a bridge or crater required engineers to concentrate at one site, minefields could be immense. It was not unusual to have a platoon ordered to check thirty or forty miles worth of roads for mines. Such orders did not mean that mines were present. On one occasion a platoon of engineers found only a handful of the explosive devices along a 35 mile stretch of road.³⁴ The opposite could also be true. During one advance, a field company removed a hundred mines in less than a mile.³⁵ The engineers never knew how densely mined were their areas of

responsibility and so could not judge how much time and equipment would be required to sweep a given area. A company could spend hours searching a field without discovering a single mine while a section of men could find themselves clearing a minefield of a hundred mines or more. Such inconsistencies were a drain on morale and did not make the job any easier.

The engineers had a lot of ground to cover and it could not be expected that the sappers would find all the mines the enemy had laid. All craters, bridge sites, prospective headquarters, verges and roads were swept for mines. The fact that the mine detectors worked badly in the rain, and it rained constantly, was no help. There were thus occasions when vehicles were destroyed and their occupants killed or injured by mines after the sappers had passed through the area. This inaccuracy placed some strain on the Park Company, as its diarist reported, "Fd Park are besieged from all angles with requests for sandbags for the flooring of vehicles. This invariably happens if one vehicle chances to run across a Teller mine."³⁶ The engineers never did develop an effective technique for finding all the mines in a given area. The best they could do was to be as thorough as possible and hope they had left none of the dangerous mechanisms in the ground. The mines' illusiveness could have serious consequences on other types of engineer work. Some bulldozers were lost when they ran over deep-buried mines that had gone

undetected by the sappers, even after several sweeps. Fortunately, the operators usually escaped unscathed. Some equipment, never plentiful, became even rarer as vehicle casualties mounted.³⁷

Mine clearing was often made more hazardous by the Germans' use of booby traps. These were attached to buried mines and designed to explode if the device was lifted. If booby traps were thought to be in an area, all mines had to be lifted with the utmost caution. It was very difficult to tell if a mine was booby trapped and so mine clearing operations could be time-consuming in the extreme as sappers became extra cautious. As a result some minefields could tie down an entire field company and take several weeks to clear. This sense of caution did not prevent death and serious injury from taking its toll, as each unit lost over a dozen men to mines. One of the worst mine clearing jobs of the entire campaign took place in what came to be called "Little Stalingrad" - the battle of Ortona. The town was mined and booby trapped from end to end, keeping the sappers hard at work long after the infantry had moved on.³⁸ Training in England could not prepare the sappers for these hazards as it was impossible to make exercises realistic enough without inflicting unnecessary casualties. The engineers learned to deal with mines while on the job.

The engineers, as the experts in the field, taught the other branches in the division how to recognize mines and booby traps. This was essential to prevent casualties from mounting due to ignorance and lack of familiarity with the devices. It must be remembered that there was no known way to find all the mines the Germans had laid and so it was not unusual for people, soldiers and civilians, to find some. By educating the other members of the division it was hoped that such discoveries would not have tragic consequences. This did not mean that the engineers enjoyed teaching mine warfare to others. One diarist reported,

Training continues and we try to supply the infantry with their ever demanded instructors in "Mines and Booby Traps." In static periods these latter become an absolute mania with the infantry.

The sappers thus passed on what they were learning to the other elements of the division. It was hoped that this would take some of the pressure off the sappers as infantrymen or artillerymen learned to deal with mines and booby traps themselves.

The learning process was taken one step further with various experiments in mine-clearing techniques. Explosives figured prominently in these tests. The purpose of the experimentation was to find a quick and safe way to clear lanes through minefields during assaults on enemy fortified positions. One involved firing a rocket which pulled an explosive cord across the minefield and detonated it. The best that could be achieved with this method was a path forty yards long by six feet wide.

Snakes were still in development. These were pushed or pulled into a minefield and detonated. The armoured units requested them on occasion and deliveries began in May 1944.⁴⁰ Such experiments were useful in developing new techniques to force paths through minefields with a minimum of risk and delay. They were used rarely, but their very existence was of some comfort to the engineers who had to crawl into minefields and clear them.

The engineers were put to the test in mine-clearing during the assault on the Hitler Line in May, 1944; the last barrier before Rome. Engineer preparations for the operation began on 20 May. 3 and 4 Field Companies sent detachments out with infantry fighting patrols for three nights to reconnoitre possible tank routes through the minefields. The procedure was simple. The tank officer would decide on a likely approach and the engineers would carry out a reconnaissance of the route. The information was then used in breaching the minefields under cover of darkness. These lanes were to be ready before the assault actually began on the 23rd. Thus the tanks would be able to advance up to the enemy's defences with little danger of being destroyed by mines.⁴¹

Engineers were involved in the actual assault phase of the operation. 3 Field Company was chosen for the mission and so the unit began to allocate men and material to infantry and armoured units on the 22nd. The plan called for two sappers to accompany

each infantry company in the assault wave to clear wire and destroy pill boxes. Each of the three battalions would have under its command a section of engineers equipped for mine clearing. The remaining engineers were held in reserve with their own company headquarters. Planning had to take every detail into account and prepare for any contingency.⁴²

The assault began at dawn on 23 May. All went according to schedule except that some of the tanks found themselves in an unmarked minefield. After some confusion the engineers managed to get the armour moving again. By 19:00 the sappers returned, though five of them had been killed and another thirteen were missing or wounded, or about one in every three who participated.⁴³ The engineers had fulfilled their role well, keeping the armoured and infantry units moving through extensive minefields but their casualties proved that the job was one of the most hazardous of all.

The learning process continued. The engineers learned not only their role in the advance but how to deal with their own material shortages, which never ceased to be a source of frustration and perplexity. The worst of these problems was the scarcity of stores the engineers needed to carry out their missions, such as lumber, gravel and nails. This dilemma was partially solved somewhat when the engineers learned where to find materials locally. Reconnaissance patrols for stores became

common and began soon after the landing at Reggio di Calabria.⁴⁴

The engineers found a variety of the war stocks they needed in furniture factories, lumber yards, tool sheds, gravel pits, machine-tool plants and sundry other places. This ability to scrounge helped to ensure an adequate supply of such material as fill, timber and rubber.

Some spare parts, however, were so specialized that they had to come from the division. Parts for some engines, compressors, water supply equipment, weapons and pre-fabricated bridges are but a few examples of the supplies the engineers could not find in the villages and towns of Italy. When these spares could not be delivered serious complications arose. Transport could not move, bulldozers became useless and compressor tools had to stay in the workshop. Sappers had to resort to picks and shovels in order to complete their work, which seriously delayed some projects. Vehicle break-downs would plague the engineers for the entire campaign.⁴⁵

In order to avoid delays that equipment shortages and breakdowns could cause, the CRE tried to anticipate problems and find their solutions before they could become serious. In this manner he could send out reconnaissance patrols to find material he thought the division would need in the future as well as have men work on devising means to eliminate stumming-blocks to the division's advance. At one point in October he ordered a

lieutenant to design a sleigh and sleigh runners which could be used in the hills during the winter months.⁴⁶ Presumably, the CRE expected heavy snows to slow the advance and hoped the sleighs would avoid unnecessary and frustrating delays. It is never mentioned, however, whether the kit was ever put to use. It does serve to demonstrate the lengths the sappers were willing to go to to ensure their forward momentum at a time when they did not have the equipment to do so.

The kit situation did improve at times as equipment that had been left behind caught up or as the division received new stores from England and the United States. In October 1943 an additional bulldozer was placed under command of the division engineers. That brought the total up to five, three large D-7s and two smaller D-4s. Other heavy equipment began to arrive in December. Dump trucks were especially appreciated as they were a boon to the road patrols.⁴⁷ Equipment shortages thus tended to be temporary, though the engineers never had all the kit they believed they needed.

What stores and spare parts were held by the units had to be kept safe. Rain was a serious danger as unprotected metal quickly began to rust in the Mediterranean dampness. Even such large pieces as bridge parts would not fit together properly if they were attacked by rust. Greasing the joints of Bailey bridge parts could take a dozen men several days. Even when all necessary

precautions were taken to keep equipment dry disaster could still strike. One field company was shocked to find its camp suddenly flooded by a local stream, which rose fourteen feet in fifteen minutes during a heavy rainstorm. It overflowed its banks and damaged much of the unit's equipment. Between the weather and the Germans it was very difficult to keep a company's stores up to par.⁴⁸

Regardless of the equipment situation, the engineers had to keep up with the advance. This often meant that broken down equipment such as trucks or compressor tools were left behind in the hope that they would be repaired and moved up later on. There must have been equipment strewn the length of Italy in this manner, as spare parts were few but road moves were many.⁴⁹

Though the existence of such material was a great help to the engineers, it still had to be maintained, the latter proving to be an almost insurmountable difficulty. It has already been mentioned that bulldozers tended to suffer severe damage from deep-buried mines.⁵⁰ But even when equipment avoided enemy action major overhauls were required on a regular basis. The day to day wear and tear on vehicles and heavy equipment was a serious strain on their endurance. Bad roads, long working hours and a shortage of spare parts made it necessary to go to great lengths to ensure the continued reliability of the engineers' gear. When engineer companies went into reserve, they built their own grease

pits and carried out major overhauls that could easily take a fortnight. Though the vehicles held by the engineers were necessary to their work, they were also a source of extra labour.⁵¹

Material shortages sometimes led the sappers to use extreme means to maintain their mobility. Cannibalizing trucks became an acceptable way of keeping the unit's vehicles up to par. Most of the vehicles destroyed or abandoned in combat had parts which a good mechanic could salvage. The Park Company was very adept at cannibalizing salvaged trucks to repair their own.⁵² At times enemy equipment was put to use, as when a German lorry was brought in and repaired by the Park Company.⁵³ More and more, the engineers were taking advantage of what they could find around them. As they had the necessary trained personnel to repair almost anything, they could often cannibalize what they needed.

While in reserve, time left over after vehicle overhauls, works programmes and scrounge patrols was devoted to training. The engineers were never warned in advance as to when and where they would be put in reserve and so it was very difficult to plan training programmes. Every time a unit found itself with a few hours or days without a mission, it rehearsed the basics of soldiering and field engineering. This review was especially important as there were many recruits joining the companies who had to be indoctrinated in the special problems being encountered

in Italy.⁵⁴ These new men were brought in to replace casualties and those who were transferred to other formations in England and Canada. They had been trained before their arrival in Italy, but had to be broken in to the ways of the units they were joining. Because recruits did not arrive in accordance with any particular schedule and because time for relearning the basics could not be planned in advance training was haphazard.

The only times the engineers had the opportunity to deal with specific tasks in training was when they went on exercise with the infantry. The biggest of these took place in May, just before the advance on Rome. There were some problems with liaison during these manoeuvres and so the engineers rarely benefitted from them. The infantry and armoured units concentrated on their own tactics and had little time to spend on operations with the engineers. For example, one frustrated diarist wrote, "As usual infantry refuse to accept facts and this party is not called upon to do any task."⁵⁵ Another diarist was puzzled by the infantry's attitude, as cooperation between them and the engineers was important in assault operations. He wrote,

Training continues and as usual in such schemes sappers are given little to do. What a different story it is when action starts, how often a bulldozer or a mine sweeping party have led the advance.⁵⁶

The training the sappers managed to carry out, then, was not very meaningful. The learning process continued to take place on the battlefield and not on the exercise ground.

The engineers from the landing at Reggio di Calabria on 3 September 1943 to the fall of Rome on 5 June 1944, had to rethink much of what they had learned in England, apply the lessons of the Sicilian campaign and develop their own techniques for handling certain problems, such as bridging and crater repair. What little training they carried out between operations did little more than bring recruits up to date on engineer developments. Throughout this period, however, the sappers concentrated their efforts in maintaining the forward momentum of the division and learned from their experiences. The battlefield continued to be the sapper's classroom and it was not until after the fall of Rome that the engineers could truly be said to have been applying their knowledge rather than acquiring it.

NOTES

1. Lt. Col. G.W.L. Nicholson, Official History of the Canadian Army in the Second World War; Volume II: The Canadians in Italy 1943-1945 (Ottawa 1956), p. 186-196
2. PAC, RG 24, vol. 14707, 1 Field Company, 19 August 1943
3. Ibid., 19, 30 August 1943
4. Ibid., vol. 14703, 3 Field Company, 31 August 1943, vol. 14711, 4 Field Company, 31 August 1943
5. Ibid., vol. 14715, 4 Field Company, 31 August 1943
6. Ibid., vol. 14715, 4 Field Company, 2 September 1943
G.W.L. Nicholson, 188, 192-193
7. Ibid., vol. 14691, 1 Canadian Division Headquarters, 3 September 1943
8. G.W.L. Nicholson, 217-220
9. PAC, RG 24, vol. 14691, 1 Canadian Division Headquarters, August - September 1943
10. Ibid., vol. 14703, 1 Field Company, 7 September 1943
11. Ibid., vol. 14691, 1 Canadian Division Headquarters, 8 September 1943
12. Ibid., vol. 14711, 3 Field Company, 9 September 1943
13. Ibid., vol. 14703, 1 Field Company, 14 September 1943
14. Casualties lists were prepared at the end of the war. Each entry includes the man's name, the date on which he fell and the type of casualty he was. The lists include those who were injured in training or became ill and had to be hospitalized. It is not possible to determine how many were killed by mines as opposed to snipers, shell fire and firefights with the Germans and Italians. Only when the diaries mention casualties after a specific operation can numbers be determined with any accuracy.
15. PAC, RG 24, vol. 14703, 1 Field Company, 21 September 1943
16. Ibid., 18 September 1943

17. Ibid., 5 October 1943
18. Ibid., vol. 14711, 3 Field Company, 13 October 1943
19. Ibid., 15 October 1943
20. Ibid., vol. 14715, 4 Field Company, November 1943, Appendix 8
21. Ibid., vol. 14704, 1 Field Company, 10 March 1943
22. Ibid., vol. 14715, 4 Field Company, 30 October 1943
23. Ibid., vol. 14703, 1 Field Company, 3 September 1943
24. Ibid., 22 September 1943
25. Ibid., vol. 14711, 3 Field Company, 2 October 1943
26. Ibid., vol. 14691, 1st Division Headquarters, 24 November 1943,
27. Ibid., vol. 14703, 1 Field Company, 9, 23 November 1943
28. Ibid., vol. 14703, 1 Field Company, 27 November 1943
29. Ibid., 28 November 1943
30. Ibid., vol. 14704, 1 Field Company, 22 January 1944,
vol. 14711, 3 Field Company, 26 February, 1944
31. Ibid., vol. 14703, 1 Field Company, 26 January 1944
32. Ibid., vol. 14716, 4 Field Company, June 1944
33. Ibid., vol. 14691, 1 Canadian Division Headquarters, 12 September 1943
34. Ibid., vol. 14711, 3 Field Company, 30 September 1943
35. Ibid., vol. 14703, 1 Field Company, 8 October 1943
36. Ibid., vol. 14691, 1 Canadian Division Headquarters, 9 October 1943
37. Ibid., vol. 14711, 3 Field Company, 11 October 1943
38. Ibid., vol. 14715, 4 Field Company, 5 November 1943,
vol. 14703, 1 Field Company, 3 December 1943,

vol. 14711, 3 Field Company, 17 December 1943,
vol. 14691, 1 Canadian Division Headquarters, 31 December
1943

39. Ibid., vol. 14711, 3 Field Company, 30 April 1944
40. Ibid., vol. 14711, 3 Field Company, 1 May 1944;
vol. 14691, 1 Canadian Division Headquarters, 12, 20 May 1944
41. Ibid., vol. 14691, 1 Canadian Division Headquarters, 20, 22
May 1944
vol. 14704, 1 Field Company, 21 May 1944
42. Ibid., vol. 14711, 3 Field Company, 22 May 1944
43. Ibid., 23 May 1944
44. Ibid., vol. 14703, 1 Field Company, 16 September 1943
45. Ibid., vol. 14711, 3 Field Company, 3 October 1943
46. Ibid., vol. 14691, 1 Canadian Division Headquarters, 26
October 1943
vol. 14703, 1 Field Company, 28 December 1943
47. Ibid., 15 September 1943
46. Ibid., 19 October 1943
47. Ibid., vol. 14691, 1 Canadian Division Headquarters, 30
December 1943
48. Ibid., vol. 14711, 3 Field Company, 3 October 1943
49. Ibid., 15 September 1943
50. Ibid., vol. 14691, 1 Division Headquarters, 30 December 1953
51. Ibid., vol. 14704, 1 Field Company, 5-12 June 1944
52. Ibid., vol. 14779, 2 Field Park Company, 2 February 1944
53. Ibid., 3 June 1944
54. Ibid., vol. 14711, 3 Field Company, 18 October 1943,
vol. 14778, 2 Field Park Company, 19-26 October 1943,
vol. 14703, 1 Field Company, 31 October 1943

55. Ibid., vol. 14711, 3 Field Company, 9 May 1944

56. Ibid., 10 May 1944

CHAPTER FIVE

FROM ROME TO APELDOORN: JUNE 1944 TO MAY 1945

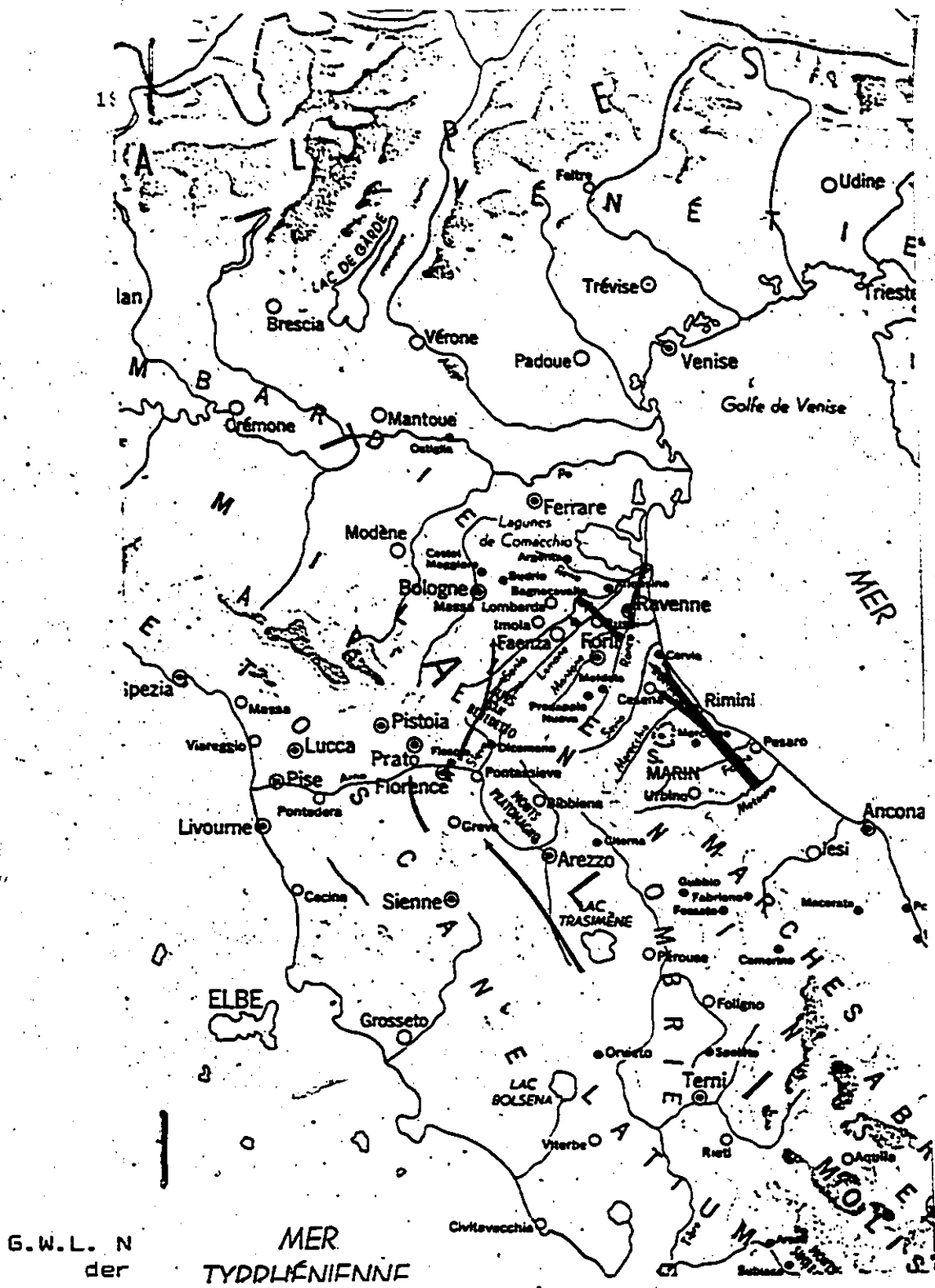
The long-awaited capture of Rome on 5 June 1944 was overshadowed by the largest amphibious assault in history when Allied troops stormed the beaches at Normandy. D-Day was one of the most important events of the war for after the landings on the French coast the Germans faced huge armies on three different fronts - France, Italy and Eastern Europe. In Italy, there remained almost eleven months of hard fighting before the Germans in the Mediterranean theatre surrendered. In the months following the fall of Rome and the D-Day landings Canada, for the first time in the nation's history, completed preparations to field an entire army. Two army corps formed the 1st Canadian Army in France, though the 1st Canadian Infantry Division did not leave Italy to join the new formation until March 1945.¹

From the fall of Rome to the end of the war the engineers' abilities were not in doubt. Their experience in offensive operations served them well in two theatres, Northern Italy and Northwest Europe. In both areas the engineers excelled at maintaining the division's advance. This expertise was the result of specialization, which can be demonstrated in two ways. First, by looking at the engineers' record in carrying out assault

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operations one sees that they completed their jobs smoothly and quickly - a sign of proficiency. In defensive operations, however, the engineers did not do so well, having forgotten some of what they had learned in England. This atrophy was shown when in December 1944 the 1st Canadian Infantry Division went into defensive positions to guard against an attack by German forces in Northern Italy. Finally, the fact that the engineers were experts because they were specialized was demonstrated when they began to meet new types of roadblocks in the Netherlands and proceeded to experiment with new techniques for their removal. A close look at the way the engineers dealt with technology will reveal that experience was indeed the sappers' best teacher.

When the battles in Normandy began the Italian theatre started to play a secondary role in Allied grand strategy. The British and American war leaders hoped the armies in Italy would be able to tie down a great deal of the enemy's resources so they could not be used against the American, British, Canadian and Continental forces in the Normandy campaigns. As long as the Germans continued to send troops and supplies to Italy, the Allied armies would have the advantage in France. The theatre commander in the Mediterranean, Field Marshall Alexander, carried out his part by planning campaigns that would maintain pressure on the Germans. This meant, of course, that the Allied armies in Italy were almost always on the offensive. As it turned out, the



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Germans continued to maintain a presence in Italy until the end of the war.²

In June 1944, the Allied advance in Italy continued to make its way towards the distant Italian-Austrian border. Crucial to the speed of the offensive was the construction and maintenance of roads to ensure the mobility of motorized formations, including the 1st Canadian Infantry Division. As has been seen, this was no easy task and required much time and effort on the part of the engineers. The battle of the roads allowed little time for rest. The terrible condition of Italian communications made the job so much more difficult. The roads were narrow and the shoulders were soft. Blockages were common, and not all of them were caused by the retreating Germans. Broken down vehicles could easily cause traffic jams on the narrow roads. The engineers were quick and efficient when they were ordered to repair major thoroughfares, however, thanks not only to their experience but because of the help they received from the local population. The CRE was authorized to hire Italians to help in all labour-intensive jobs, which almost always meant working on the roads. The Italians were paid in money or in rations for work with the Allies. Spreading gravel, digging ditches and filling potholes were chores that were best done with as many hands as possible. The division road near Rome was built in nine days with the help of a hundred Italian girls spreading several tons of

gravel. This allowed the engineers to work with compressor tools and heavy equipment.³

Reconnaissance and improvement of all major arteries was considered important by division headquarters after the fall of Rome and so were usually allotted to the engineers as their priority task whenever the division was in reserve. Because of their experiences in Sicily and Southern Italy the engineers finished their jobs with a minimum of delay. While the infantry and armoured units in reserve trained for upcoming operations the engineers prepared the supply routes, behind the lines, which would be needed for future advances. Most of the heavy equipment held by the division was used on road maintenance or construction. Time constraints often forced the engineers to use the expedient method of simply bulldozing a temporary route from one point to another. This quick technique avoided putting a lot of work into what might later become an unimportant secondary route. Should the road become a major artery later on, proper road construction techniques could be applied. Using expedient methods, the engineers managed to complete 79 projects in one month in the summer of 1944, including fifteen diversions, six bridges and over 92 series of craters. Only the support the engineers gave to assaulting infantry and armour was more important than the battle of the roads.⁴

The engineers really had their work cut out for them when they built roads in direct support of assaulting troops. These routes would guarantee that ammunition, food and fuel would reach those who needed it most.⁵ It was quite common to have engineers working on a road or diversion a few minutes after the infantry had secured the area. The work was often difficult because the necessary equipment and materials could not be brought up to the front. As Italy had become a secondary theatre of war supplying the formations there was no longer of highest priority. Bulldozers were few and far between and often worked elsewhere on other projects. Gravel could not always be brought up to the engineers supporting the infantry because dump trucks were in short supply while gravel pits could be located dozens of miles from where the engineers were working. So picks and shovels and muscle replaced bulldozers, and rubble from bombed-out villages was used in lieu of gravel. The engineers' ability to make do with almost nothing was a source for much amused diary comment:

Lt. Osborne phoned up on the radio to say that he still hadn't tracked down D-8 (a bulldozer - author), but that work was proceeding by hand and should be finished by 1300 hours for one way traffic. It appears that they have off-loaded the better part of a church into the gap and plugged it that way.

Improvisation remained an important part of many engineer assignments and in repairing and maintaining roads became a very impressive art.

Where there are roads there is also a need for bridges, especially in a country like Italy laced with rivers. As noted above, in Italy it was impossible to move more than a few miles without encountering a river, stream or gorge, especially in the mountainous terrain of the interior. The situation was worsened when the division began to run out of pre-fabricated bridges after the fall of Rome. It became increasingly necessary to leave engineers behind as the division moved on in order to recover bridges they had erected in the advance. By this time the engineers could build and tear down Bailey bridges in their sleep. In June one field company remained in the area of Pofi near Cassino and recovered eleven structures by the end of the month. In this manner, units supporting the advance would have bridging available to them.⁷

The engineers were also called upon to solve other, more complex problems. The infantry and especially the armoured units asked the engineers to figure out quandaries they had never seen before. The officers and N.C.O.s of the field engineer companies had built up a wealth of experience that could be directed toward the development of new techniques for river crossings. On 1 July, 1944 the 4th Princess Louise Dragoon Guards, who were involved in long-range reconnaissance, asked the engineers to design a new type of bridge. The structure was completely new in concept, for the reconnaissance unit wanted it to be portable. The armoured

corps felt that their missions would be easier to carry out if they had a twenty-foot bridge that could be carried in jeep trailers. Such a device would allow them to cross small rivers and streams quickly without having to perform a time-consuming reconnaissance to find a ford, thereby affording them much greater mobility in the Italian terrain. The bridge only had to be strong enough for jeeps, the main vehicle in reconnaissance work. The engineers came up with not one, but several designs which would meet the needs of the Princess Louise. Such challenges served to make the engineers think back to fundamental principles as well as apply their knowledge of Italian terrain and conditions.⁸

All rivers were considered to be obstacles by the Allied commanders. They impeded the advance by forcing troops to stop and regroup to assault the enemy on the far bank. Rivers offered the Germans excellent positions from which to make a stand. After the infantry had completed a successful assault it was essential to get tank support across the river to help the infantry defeat German counter-attacks. While in direct support of the combat arms units the engineers had to be capable and quick in getting armour across on rafts or bridges or an attack could fail. If Allied tanks did not cross a river in time, the infantry could be over-run by German panzers. At the Metauro River on 25 August 1944, to everyone's surprise, the engineers carried out the

unprecedented feat of preparing the crossings, the approaches and the exits in enemy territory before the infantry attack had begun. Good reconnaissance and excellent timing had allowed the engineers to put up their rafts and bridges before the Germans could react. Only one of the crossings caused some delay when it was found to be too deep for wading and a bridge had to be built instead.⁹

By 1944 the officers, N.C.O.s and men of the engineer companies were able to put all their hard-earned knowledge to use in all assault water crossings. What had once been a piecemeal operation rife with delay and confusion became a smooth undertaking characterized by thoughtful planning and bold execution. The Savio River operation of October 1944 involved weeks of preparation and planning. 4 Field Company supported the advancing infantry for the crossing. The first few weeks of October saw the company build, maintain and sweep roads to ensure the necessary forces and equipment had approach routes to assemble and concentrate before the attack. The engineers reconnoitered likely sites for fords, rafts and bridges. The infantry crossed the river in boats on 20 October 1944 and captured the far bank closely followed by 4 Field Company which then prepared crossings so the supporting tanks could follow the infantry. These crossings were maintained while follow-on forces crossed the river to carry on with the advance. The process was

brought around full circle when the engineers built, maintained and swept roads on the far bank behind the advancing troops. The company ended the operation exactly as it had begun, by working on roads. Several skills were applied together and in sequence, eliminating the need to stop, think and prepare between phases.¹⁰

During assaults against fortified positions the engineers were often called upon to breach lanes through minefields, an activity they had come to know much about. These operations were particularly dangerous, as the minefields were under the enemy's observation and fire. One of the largest of these undertakings took place in late August, when the Allies attacked the Gothic line. A field company was ordered to silently breach a lane through the minefield in front of the German position. The engineers put in two gaps while a reconnaissance party located a third that the Germans had put in to allow their patrols to move through the minefield. The sappers had to clear the mines by hand under cover of darkness and were often interrupted by shelling. Only one man was hurt when a member of the infantry covering party set off a mine. The entire operation from the reconnaissance to the breach demonstrated the engineers' hard-gained expertise in mine warfare.¹¹

By June 1944 the engineers had removed so many mines that the assignment had become routine. After the fall of Rome they directed many of their activities towards the development of new

techniques to locate and disarm the explosive devices. Some of the methods they developed were ingenious and made use of concepts the engineers learned not in training, but on the battlefield. In October 1944 a field company was ordered to clear mines off the roads and verges in some of the rear areas. As the enemy was not nearby it was not necessary to perform the operation silently or surreptitiously and so the engineers could use lights for night work. They began to shine powerful search lights on the surface of the road, highlighting the small mounds formed by the mines and making them much easier to detect. It took little time to learn to read the language of the shadows. The engineers were beginning to use all available equipment and knowledge to make their job easier. It was this same spirit of experimentation that had allowed them to develop the bridge gallop and the crater hop.¹²

In the final months in Italy the engineers continued to manage and experiment with a wide range of equipment, using more vigorous techniques to test their own inventions and applying experience to develop new ones. This willingness to apply trial and error techniques to the development of new technology sometimes led to minor disasters. Anti-mine snakes, which had been in the developmental stage for a couple of years, were demonstrated under severe test conditions for the first time on 7 and 8 July 1944 during "Exercise Vulcan," a series of manoeuvres

designed to improve liaison between engineers and the combat arms. Unfortunately, the first one broke while being pushed into the minefield and the second became entangled in tank tracks while being pulled. These experiences set back development of the item by over two years. Other experiments were somewhat more successful. In August, 1944, 2 Field Park Company began to put armour plate on the bulldozers of the division to help protect the operators from German small arms fire and shrapnel. Material for the job was found on burnt-out Bren Carriers and tanks. Each armour project took about two days to complete so that by the end of the month several bulldozers were armoured.¹³ The engineers were applying their growing experience in this manner to improve their equipment and thus had moved a step up from mere scrounging and cannibalizing.

The sappers also began to take a hard look at their small stores, such as tools and other portable equipment. The officer commanding 1 Field Company, Major McConnel, told his platoons in November 1944 to submit suggestions for revising the list of stores carried with them. After a year-and-a-half of combat the engineers judged the usefulness of their equipment in the light of experience. After some careful research the storemen realized that the companies were wasting precious transport carrying equipment they had never used. In the great kit panic of May 1943 the engineers had not known what items would be most useful and

which ones could be discarded. They found that much of the water supply equipment, some of the tools and a few other items they had spent so much time and effort packing, unpacking and lugging were nothing more than dead weight.¹⁴

When the division was in reserve and there was time for training between road maintenance and construction programmes, the companies rarely had the necessary tools, bridging equipment, mine detectors, and bulldozers to do anything meaningful.¹⁵ This was not surprising as there were often shortages where the equipment was needed the most - at the front. The problems with training that had plagued the engineers since mobilization in 1939 proved to be insurmountable. The sappers trained from time to time, however, whenever there were brigade or division exercises that included the engineers. One such was a series of manoeuvres called Vulcan which was supposed to help the armour, infantry and engineers in working together. Each brigade of the division in turn spent two days on exercise with a field company in direct support. The training carried out with 2 Brigade was rather good and the engineers were gratified to see the proper emphasis laid on the sapper angle. The infantry were willing to let the engineers fulfill their proper role, assisting the assault by removing obstacles and preparing water crossings. With the other two brigades, however, the old problems with liaison

came again to the fore. One of the engineer diarists reported a common complaint,

Little attention seems to be paid to the Sapper angle and we suggest our own tasks. What a difference there is in actual battle for then one hears from all sides "Bring up the Sappers!" "Where is the bulldozer!"¹⁶

The infantry were concerned with carrying out their own training in order to hone up the skills they found crucial in operations. The engineers were left out as a result and were rarely able to perfect their own skills. The engineers' expertise after the fall of Rome cannot be attributed to training as the latter was almost non-existent.

The Allied advance in Italy was seriously interrupted only twice. The first time occurred in January - April 1944 when the British, American and Canadian formations halted for the winter. The second time was different for many division and brigade commanders believed that the Germans intended to attack during late December 1944. There had been no such alarm during the first halt. The cause for their concern was Hitler's Ardennes offensive of 16 to 26 December 1944. Three German armies attacked the Americans in Northwest Europe and attempted to inflict another Dunkirk on the Allies. The assault failed, but commanders in Italy began to prepare their areas of responsibility for defence and withdrawal in case the Germans should attack in Italy with the same intensity.¹⁷

The skills the engineers had learned in the defence of England had atrophied somewhat as they concentrated on maintaining the division's advance. Some of the engineers were recent arrivals and had never taken part in the operations in the United Kingdom from 1940 to 1942. The engineers, however, were ordered to begin preparations to slow the enemy's advance should he choose to attack. This assignment involved performing duties, notably reserve demolitions, that the sappers had not practiced since leaving England.¹⁸ The engineers' inexperience in reserve demolitions may explain an incident that occurred on 26 January, 1945. One of the bridges prepared for destruction was in danger of being damaged by debris floating down and colliding with the piers. It was decided to remove the blockage with explosive, with unexpected results.

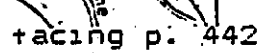
During the removal of debris from the... bridge... a rather weird incident occurred. The bailey (sic) overhead had been prepared for defensive demolition but with all the detonators removed. Beehives (a pre-fabricated demolition charge - author) being used on removal work below must have tossed up a bit of shrapnel to hit a cortex lead or primer above because the Bailey went up for complete demolition job. Casualties: - three minor injuries, a lot of red faces and no end of razzing from other member of the div.¹⁹

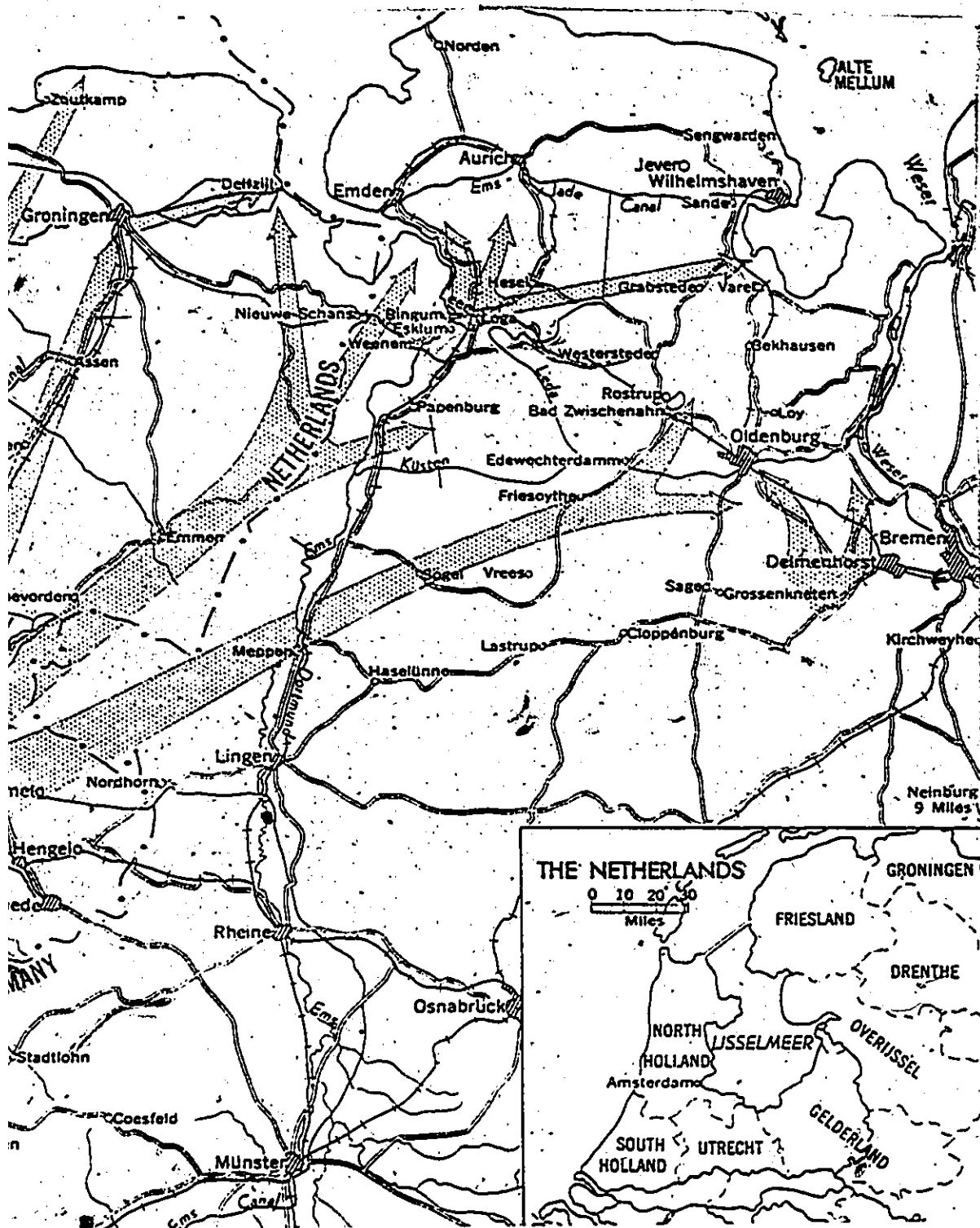
Though the accident may seem to have had causes beyond the sappers' control, it demonstrated that the engineers were no longer totally versed in defensive operations. Clearing debris from bridges to prevent scouring had to be done quickly, during an advance where the engineers had much to do in very little time.

To use explosives to carry out such a task while in defensive positions showed a confusion in priorities. The engineers were using a rapid method of clearing debris when in fact they had all the time they needed to do it by hand or other non-explosive means which would not endanger the bridge. It must be remembered that only the most important routes and bridges would be prepared for reserve demolitions so the division commander could keep them safe until the very last moment. Otherwise the structures were simply destroyed outright. In their unjustified haste the engineers blew up a bridge that should have been kept open at all costs.

The above incident demonstrates that the engineers had become experts in only one area - supporting the division's advance. Training after Sicily had been geared towards this and battle experience had confirmed it. Other aspects of the engineer's role had been neglected, and rightly so. In the battles to follow, in the Netherlands, the sappers worked exclusively towards maintaining the momentum of the advance.

The 1st Canadian Infantry Division was the only Canadian formation in 1945 to serve under a foreign command. Since the beginning of the war McNaughton had insisted that all Canadian troops serve under Canadian commanders and so in March 1945 the engineers of the 1st Canadian Division moved from Italy to Western Europe to participate in the final collapse of the





German Army. The move was done in stages, with each company travelling independently. First the vehicles, equipment and personnel were gathered in ports in Italy, from which they made their way by ship to Southern France. From there they drove to assembly areas in Belgium and the Netherlands. The engineers of the 1st Canadian Infantry Division were to participate in the final phase of the war in Europe.²⁰

The role of the 1st Canadian Army in the Allied grand strategy was a difficult one. The formation, which included not only troops from Canada but from Great Britain and the occupied countries as well, was to move along the left flank of the Allied advance and capture key ports in Belgium and the Netherlands before driving into Germany. The 1st Canadian Infantry Division became part of the 1st Canadian Corps moving through the Lowlands.²¹ The geography was much different than in Italy, which proved for the most part to be to the engineers' advantage. Roads required less maintenance, bridges could be floated on the surface of canals instead of being built over muddy gorges and it was much easier to move cross-country. The nature of the Lowlands' waterways was especially advantageous to the engineers. Because river banks tended to be very low and waterways calm, the sappers could build floating rather than non-floating bridges much more often than they had in Italy. Floating bridge equipment was much easier and quicker to build and could be moved more

easily if it was threatened. Though the topography was different the missions were essentially the same. The engineers had little difficulty adjusting to the new conditions.

Upon arrival in the Netherlands the first order of business was to reconnoitre the area. The situation was less stable in Western Europe than in Italy and the engineers needed information on road conditions, bridge sites and enemy placed obstacles. Because there was no front line to speak of in the fluid campaign it was difficult to tell from one day to the next who was in control of certain areas. To the engineers this meant that a reconnaissance party could very likely run into a superior-armed German fighting patrol. The first incident involving reconnaissance occurred on 8 April, three days after 1 Field Company arrived in its area. The Company Sergeant-Major was gathering information about the area the unit expected to work in when he missed a turning and ran into a German ambush. The reconnaissance party managed to escape by crawling into the woods, but the truck was a complete loss. The engineers were beginning to realize that the Western Front also held its dangers.²²

The advance through the Netherlands was similar to the operations in Italy in many respects. Engineer platoons swept forward, cleared roads, made them passable to two-way traffic and repaired bridges.²³ The general role of the engineers remained

the same, as expected. The subtle differences in sapper tasks did not become evident until a few weeks after their arrival. The engineers spent less time on road maintenance and construction than they had in Italy. Only one company was given the job of working on the division's supply routes at the end of April.²⁴ There were two main reasons for this phenomenon. The first was that the field engineers were needed more desperately at the front, where the Canadians were attempting to liberate the Netherlands before the population starved. The second was that the roads in Western Europe were less likely to wash away or turn into quagmires, in the spring weather. For the engineers of the 1st Canadian Infantry Division the battle of the roads was over.

Bridges were needed to maintain lines of communication. They were also the subject of the only major training carried out during this period. The Germans were destroying dykes to flood wide areas and thus delay the Allied advance, so soon after their arrival in the new theatre, the engineer companies went to a bridge camp to practice their skills. Some of the results were phenomenal. While training on the Waal, 1 Field Company managed to build 480 feet of floating bridge in a little over an hour. Though floating bridges were easier and quicker to build than non-floating equipment the company's speed was unprecedented.²⁵ 4 Field Company took four and a half hours to complete the same length of bridge.²⁶ Training ended on 4 April. Though not all the

units repeated 1 Field Company's incredible build their level of ability was very high.

The floating bridge training was put to the test during "Operation Cannonshot," in which the engineers demonstrated their experience and proficiency. The operation was supposed to get troops across the River IJssel and cut off elements of the 25th German Army. Planning began on 5 April, with reconnaissance patrols beginning on the 7th. Crossing sites were chosen on the following day and the operation began on the 11th. The division's objective was the town of Apeldoorn and all its engineer companies were involved in the crossing. On the face of it the battle looked like a well-conducted exercise.²⁷

The reconnaissance patrols carried out by the engineers reminded them of bridge camp, where there is no enemy force. The division was opposed by a paratroop training battalion with some naval troops. Neither seemed interested in doing harm to the reconnaissance parties. One of the company diarists was pleasantly surprised, "A new type of battle this is - when recce parties can prowl about in the open on a river bank and not be shot at from the far bank."²⁸ The first phase of the operation was similar to most training exercises, where the worst danger was falling into the river.

The actual assault was somewhat more hazardous. In 1 Company's area of responsibility, the infantry crossed in the

amphibious Buffaloes at 16:30 and had captured a bridgehead within ninety minutes. Meanwhile, the engineers worked on the construction of a raft to bring up the tank support. It was not completed until 21:00 because enemy artillery was firing air bursts, which spread hot glowing shrapnel over the entire site. The company also built a mine boom in case the Germans floated mines down the river to sink the heavily laden ferries. The operation was a success and the company crossed to the other side on the afternoon of the 12th.²⁹

The mission given to 3 Field Company was somewhat different. Four sections were to go with the assaulting infantry to prepare exits for the Buffaloes ferrying troops across. The remaining engineers from the company would then cross, sweep a path on the far side and build a road leading from a floating bridge 4 Field Company was supposed to build.³⁰ There was little opposition to the assault and all went according to plan. The diarist described the operation as a 'textbook crossing'. As with 1 Field's operation, 3 Field's was carried out with little difficulty and no fatalities.³¹

Finally, there was 4 Field Company's mission, which was the construction of a 360-foot floating bridge which infantry, armoured elements and 3 Field Company were supposed to cross. The unit worked under heavy fire but sustained only two minor casualties. Beginning at 18:00 they completed construction of the

bridge at 22:30. After the division had moved on 3 Platoon remained behind to maintain the crossing. The operation was completed without serious delays.³²

The engineers of the 1st Canadian Infantry Division had learned long ago how to work under artillery fire while building bridges to span the raging gorges and ragged gullies of Italy. They could judge artillery and determine whether it was truly effective by listening to the fall of shot. If the incoming shells were not a serious threat, the sappers carried on with their work even though incoming artillery fire whistled and exploded seemingly only yards away. Only battle-hardened troops could carry on in this manner.

After the operation the division moved on. Its lines of communication were limited however, to what the engineers had put across the IJssel. This meant that all supplies had to cross either on the floating bridge, which could carry only nine tons, or the raft, which was capable of hauling forty tons on each trip across the river. These crossings were under much pressure as a result and so it was decided to build a Bailey bridge to allow supplies to cross the river more easily. The engineers continued to improve the division's lines of communications long after the infantry, armour and artillery had moved forward. The front had depth.³³

The next assault water crossing operation came as something of a surprise to the engineers but served to demonstrate their ability to prepare for work on very short notice. Captain Bailey, the Acting Officer Commanding of 1 Field, was roused from his sleep at 04:45 on 17 April with the news that the Royal Canadian Regiment was crossing the Apeldoorn canal. On short notice, the company built a first bridge across the canal by 17:40 and a Bailey bridge in the town by 11:00. The unit then crossed and followed the infantry, removing obstacles to the advance. With little or no preparation the engineers of the company had thus managed to carry out a complete bridging task. The engineers were beginning to show an impressive adroitness.³⁴

The engineers were not so expert in the removal of new obstacles the Germans were beginning to put in their path. Route clearance proved to be yet another learning experience for the engineers as they developed means to remove new types of roadblock. In late April experiments began in the destruction of a new kind of obstacle. The Germans had begun blocking the road with reinforced concrete blocks, which soon became a common feature on the Western Front. These blocks were most effective in dense forest for the tanks could not get around them. The Germans also felled trees to form road blocks, called abattis. This process consisted in dropping the trees at an angle toward the advancing Allies so the tops would intertwine. Then the obstacle

was mined and booby trapped to make it even more formidable. Another period of education for the engineers began as they tried to find ways to remove the obstacles with little risk and without wasting valuable time. Within a few weeks the engineers had learned or developed techniques to remove both types of obstacle quickly. Concrete roadblocks were simply blown up with well-calculated and carefully placed explosives. The abattis were hauled out of the way by tanks or bulldozers with engineers moving into the gap to remove mines and booby traps.³⁵

Near the end of the war the engineers found that their problems with equipment were finally being solved. The engineers had found their own solutions to a certain extent by scrounging and cannibalizing what they could find around them. Also, material had improved in quality and quantity since leaving Italy. The period in Western Europe began well with the arrival of all the important equipment that had left Italy. One diarist was actually impressed with the situation, "Since starting our move across Italy we have not lost a vehicle, which in itself is quite a feat."³⁶ A few weeks later, another company was pleasantly surprised to receive its full allotment of Sten guns, pistols and ammunition.³⁷ The equipment situation seemed to be improving, with only one company reporting deficiencies after its arrival in the Netherlands.³⁸ The shortage of vehicles the units had been suffering since the landings in Italy were never made

up, but the engineers, by eliminating stores they had never used and repairing captured enemy trucks were able to carry on with their work. Bridging was plentiful for the first time in the war. While at the gates of Apeldoorn the division had a profusion of bridging lined up for several hundred yards to cross the canal.³⁹ The move from Italy to the Netherlands had placed the engineers in the most important theatre of the war, in the policymakers' view, and so the implements of war were both abundant and in good working order.

On 4 May 1945 German forces in the Netherlands surrendered unconditionally. The engineers built one more bridge to allow supplies to move into unoccupied areas, in the process breaching one of the most complicated obstacles of the war,⁴⁰ and waited for further orders. Though their time in the Netherlands had been brief, the sappers of the 1st Canadian Infantry Division had learned much. Their ability to build bridges under a variety of conditions was laudable and they had dealt with new obstacles with a minimum of fuss and delay. The learning process, however, did not end until the advance came to a stop with the German surrender. Five years and seven months after training had begun the sappers were still developing their skills.

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On 8 May, 1945 all German forces in Europe surrendered. This did not mean that the engineers had no further work to perform. In order to allow the safe and speedy transportation of food, prisoners and civilians mines and obstacles had to be removed, bridges needed to be built and roads required maintenance. The division commander gave the sappers their orders the day the Germans surrendered in Europe.

1 Divisional Engineers' role in the occupation will be as follows: - Main line road and water communications will be opened as soon as possible, German engineer personnel doing most of the work, especially mine-clearing. All possible engineer information will be collected and passed through Corps to Netherlands Military Administration.

It would be some time before the sappers could put their tools away.

The job began immediately. German engineers were put to work clearing minefields they had laid only weeks or even days before. The only chores allotted to the Canadian sappers were those that required the use of heavy equipment, such as the removal of obstacles, and guard duty on the host of German prisoners-of-war that were making their way to the Canadian Army camps. This allocation of tasks allowed many engineers to fill their time with sports, movies and storm boat tours of the Netherlands.⁴² The war was over, and it was only a matter of time before the sappers were sent home. Disbandment began in August, with all of

the engineer units delegated back to reserve status by the end of the year.⁴³

The engineers who returned home in the months following the German surrender had learned much in the previous six years. The lessons had been expensive. The full engineer strength of the 1st Canadian Infantry Division hovered at around 620 men and was usually less than that. From these, over 450 had become casualties, of whom 96 died or were presumed killed, 350 were wounded or injured and 8 spent part of the war in prisoner of war camps.⁴⁴ These figures help to demonstrate that the dangers faced by the officers, N.C.O.s and men of the field engineering units were real and unavoidable. Because proficiency with technology could only be gained through experience casualties were high while the sappers learned their trade on the battlefields of Europe.

The men who were disbanded in 1945 had little to say about the war. Diaries became little more than a countdown to the return home,

Trivial Preparations being cleared up, stores and canvas being loaded and area being cleaned up for the BIG DAY tomorrow. This is the day most of the unit have waited for for 5 long years, and to many it still seems hard to believe. For tomorrow we pull up stakes from Holland and start the long trek back to our beloved but dimly recollected homeland, CANADA.⁴⁵

Some did reflect on the role they had played in the war. Working in teams to build bridges, breach minefields, put up Nissen huts

and carry out all the other engineering jobs of the division, the field units had developed a certain sense of camaraderie. 3 Field Company's diarist wrote on the day the unit arrived in Ottawa,

After a six year venture, we are inclined to regret leaving one another. On the other hand we are glad to be home and to know peace, has been restored - small though our part has been. 48

Understandably, morale was much higher than it had ever been before. The engineers were also much more satisfied with themselves. In the last months of the war they had completed every one of their assigned missions without a hitch. Improvization, experience and hands-on experience were the keys to their success, expensively earned though they were.

NOTES

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3. PAC, RG 24, vol. 14691, 1 Canadian Division Headquarters, 8 June 1944
4. Ibid., vol. 14704, 1 Field Company, 6 August 1944, vol. 14691, 1 Canadian Division Headquarters, 21 August 1944, September 1944 Appendix 21
5. Ibid., vol. 14691, 1 Canadian Division Headquarters, 20 October 1944
6. Ibid., vol. 14705, 1 Field Company, 27 October 1944
7. Ibid., vol. 14711, 3 Field Company, 10 June 1944
8. Ibid., vol. 14691, 1 Canadian Division Headquarters, 1 July 1944
9. Ibid., vol. 14704, 1 Field Company, 26-27 August 1944
10. Ibid., vol. 14716, 4 Field Company, October 1944
11. Ibid., vol. 14691, 1 Canadian Division Headquarters, 31 August 1944, vol. 14716, 4 Field Company, 31 August 1944
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15. Ibid., vol. 14704, 1 Field Company, 1-30 July 1944, vol. 14716, 4 Field Company, 3 July 1944
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C.P. Stacey, 440-444
18. PAC, RG 24, vol. 14717, 4 Field Company, 22 December 1944
19. Ibid., vol. 14692, 1 Canadian Division Headquarters, 26 January 1945
20. Ibid., vol. 14711, 3 Field Company, March 1945,
vol. 14706, 1 Field Company, 10-17 March 1945,
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22. PAC, RG 24, vol. 14706, 1 Field Company, 8 April 1945
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26. Ibid., vol. 14717, 4 Field Company, 29 March 1945
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vol. 14706, 1 Field Company, 6 April 1945
28. Ibid., vol. 14706, 1 Field Company, 10 April 1945
29. Ibid., 11 April 1945
30. Ibid., vol. 14711, 3 Field Company, 10 April 1945
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33. Ibid., vol. 14692, 1 Canadian Division Headquarters, 13 April 1945,
34. Ibid., vol. 14706, 1 Field Company, 17 April 1945
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36. Ibid., vol. 14780, 2 Field Park Company, 19 March 1945
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Forty years later the unit received a letter from one of the men who had joined in 1942. He was interested in establishing that 3 Field Engineer Squadron, located at Lees Avenue, was indeed the unit he had worked with during the Second World War so he relate his experiences. The sense of camaraderie was still strong.

CONCLUSION

By the time the Germans surrendered unconditionally on 8 May, 1945, the engineers of the 1st Canadian Infantry Division had been at war for five years and nine months. They had been involved in the defence of England, the campaign in Sicily, the war in Italy and the fall of Germany. The entire war, from mobilization in September 1939 to Germany's collapse in May 1945 had been a learning process. Because the Second World War was one of mobility, based on the truck and the tank, the engineers found themselves working in an environment where technology dominated the battlefield.

This thesis has attempted to demonstrate that the engineers faced many challenges unprepared. This does not contradict the official engineer histories of Great Britain, the United States and Canada, all of whom deal with training problems at the corps level to some extent. In studying the field engineers of the 1st Canadian Infantry Division one can trace the impact the problems of time and equipment had on the sappers themselves, which in this case confirms the official histories' positions. Training, whether in England or during lulls in battle was not ample enough to anticipate the problems of a modern war, because war itself had reached a completely unmanageable scale with the introduction of weapons of mass destruction of ever greater complexity and the

use of huge armies scattered about the globe. The engineers, far from escaping from these problems, were one of the hardest hit. While the infantry and armour learned tactics that were applicable to the three phases of war and required little modification. They learned how to use and maintain their weapons as well as how to move and fight in the face of the enemy. The skills they acquired were applicable on all battlefields, as were the principles on which they were based. The main armament on a tank had to be pointed at the enemy whether the vehicle was retreating or advancing while an infantryman had to make the best use of the ground around him to observe the enemy without being observed regardless of other circumstances. The engineers, on the other hand, required much more training than the men and women of other branches, for it was necessary to learn new principles for each phase of war. During a withdrawal quick work in destroying facilities and erecting obstacles was the key to success in delaying the enemy's advancing formations. In the defence principles changed somewhat as speed was replaced by thorough design and deliberate execution. The engineers had to site obstacles so they would break up, delay and funnel attacks while preparing trench systems and bunkers that would offer the most protection to the defenders. During an advance speed was essential, as was good planning. The engineers had to think on their feet to ensure that obstacles to the division's advance

were removed or bypassed. Training had to be different for each phase of war and it was difficult to teach the sappers to be prepared for every eventuality. Deep buried mines, concrete road blocks, craters and unusual bridge builds sometimes caught the engineers without ready-made solutions. Eventually most, though not all, of these engineering challenges were solved as the sappers learned from their experiences on the battlefield - the only effective classroom in modern war.

1. Training then, can be separated into two periods. The first was from mobilization to the landings in Sicily, while the second was from Sicily to the German collapse. Each was different and prepared the engineers in different ways. Before the Sicilian campaign the sappers became experts in defensive operations. They spent two years planning and preparing for a German invasion of the British Isles while simultaneously carrying out a variety of construction projects. After the landings in Sicily and Italy the learning process changed course as the engineers began to gain expertise in maintaining the division's advance. Studying them in turn allows some insight into how the sappers learned to fulfill their role in a modern war.

It has already been seen that training in Canada was almost non-existent. This deficiency was due to the lack of any guidance on the one hand and problems in recruiting personnel and acquiring equipment on the other. There was no training syllabus

for the companies to follow; nor was there a list of priorities. It was extremely difficult to teach the sappers everything they needed to know without spending an enormous amount of time doing so, and some direction would thus have been necessary. Even if such guidance had been forthcoming the essential materials were not available in Canada and so the engineers could have done no more than attempt to simulate the jobs they were expected to perform. The division lacked even the basic personal kit necessary to carry out the fundamentals of soldiering. It was thus not until their arrival in England that the sappers had the opportunity to train. Even then the situation was far from ideal.

In England the British faced serious problems of their own and could not afford to give the Canadians the equipment they requested. Bridging was rare, explosives were almost non-existent and even picks and shovels could not be drawn without backroom negotiations. Such equipment was crucial in training engineers, who in their tasks had to know how to use available technology effectively. The only way to teach a man how to use a tool properly was to have him practice with it. Since the equipment was not available, the sappers missed the opportunity for hands-on training so important in developing an engineer's proficiency.

The armies of the Second World War came to rely very heavily on modern technology to achieve their aims and the engineers were

the soldiers who most had to deal with the new implements of war. In training, however, the Canadian engineers did not have enough opportunity to use the technology they would require to carry out their missions. The tank, which quickly became the centre of any army's strategy, tended to destroy roads simply by travelling on them. The quickest solution to this dilemma was to use bulldozers and dump trucks as engineer aids to repair the damaged lines of communication as soon as the tanks had passed. The sappers did not get the opportunity to use such specialized vehicles until after they began to work at the front in Sicily. The same could be said of all engineer equipment, which did not arrive in sufficient numbers until the eve of the Sicilian invasion. As a result, the sappers did not train on the technology that had been designed to help solve problems caused by technology.

There was also a certain lack of forethought in the way the engineers were taught the details of their role. The higher commanders knew that the engineers would be answering challenges arising out of the use of technology whether it was used by friendly or enemy forces, who would both cause damage to lines of communication, lay minefields and put up wire which the Canadian sappers would then have to deal with in one way or another. The role of the engineers was to solve these problems. At the outset, however, no one knew what particular skills the sappers would require to fit the variety of circumstances. It was known that the

enemy would be attempting to delay the Allied advance by destroying or blocking roads. But there was no crystal ball to tell the Allies that the Germans in Italy would rely on mined craters and demolished bridges to delay their enemies while in the Netherlands they would rely on road blocks of various kinds to achieve the same goal. The lack of foresight, then, simply could not be helped. The German and Italian armies had available to them explosives, heavy equipment and engineer knowledge that allowed them unlimited possibilities as to how they could slow the Allied advance. In Italy the mountains and in the Netherlands the dykes favoured the defence and the Axis engineers took full advantage of the opportunities offered to them. Craters, road blocks, mines, destroyed bridges and booby traps could be located in ever more difficult areas and combined for greater effect. By using their imagination the Axis engineers could create new ways to delay their enemies and thus gain time to prepare their own defences, which themselves were made more formidable with the application of engineer knowledge and skill. The role of the Canadian engineers was vague and all-encompassing and it was impossible to determine all of the probable missions this role implied. While in England The sappers could train in bridge construction if the bridging was available, but neglect, for instance, crater repair, which in Italy became one of their priority tasks. The very role the engineers had to fulfill

therefore made it impossible to determine what they would be doing specifically and so allow for proper training. The lack of foresight was then unavoidable. The nature of war itself added to the problems the engineers faced in trying to develop needed skills.

The very technology the engineers had to deal with made the training situation all the more difficult. The first problem was that it tended to change rapidly. The Second World War saw the development of many new implements of war and the modification of many old ones. From the soldier's point of view these technological changes were fast and furious and sometimes outstripped the pace at which people could learn to deal with them. The best example of this process of change was in mine warfare. Different mines had to be disarmed in different ways. Though the engineers had mine circuses to help them learn the various devices then in use; these could obviously not take into account mines and booby traps introduced after the sappers arrived in Italy. It was necessary to gather samples of the new mines in order to study them and determine how best to deal with them. Engineer training could not keep up to the pace of technological development.

The second problem arising from the technology the sappers had to deal with was its increasing complexity. This was especially true when it came to using and maintaining their own

equipment. Trucks, bulldozers, water supply kits and compressors not only had to have spare parts but someone qualified to diagnose the reasons for mechanical breakdowns and repair them. Some of the equipment the engineer units received was so new that no one knew how to use it. The field companies had to organize courses to teach sappers their use and maintenance. Bridging was especially troublesome in this regard. All pre-fabricated bridges were of complex design and could not be built unless all the parts were available. Whoever was constructing the bridge had to place the pieces in position in the proper sequence or the entire project had to be stopped and started again. When bridge parts were available, which was rare, learning to put them together properly took up a great part of the sappers' training time. The trucks, water supply equipment, bridging and other engineer technology was necessary if the engineers were to fulfill their role, but it also brought problems of its own in terms of its maintenance and the time it took to learn how to use it.

Because of the complexity of both the role and technology the engineers had to cope with, the time they spent in training had to be very long; longer than the infantry, armour or artillery. Sappers required training in the maintenance of bulldozers, compressors and trucks so as to keep them in good working order. Because their role included so many diverse elements, the engineers also had to learn how to use and maintain

bridge parts, water supply equipment, sommerfeld track, assault boats and a myriad of other kit. It took months to teach men the use of this equipment in ideal conditions. In England the conditions were far from ideal.

One of the major problems the engineers faced in learning their proper role was lack of time. The sappers possessed skills that were not only required in operations against the enemy but were useful in maintaining the comfort of soldiers while in garrison. Plumbers, fitters, blacksmiths, and carpenters filled the ranks of the engineer companies and were always in great demand to work on old or new buildings in the assembly camps. They were thus responsible to apply their knowledge in setting up camp whenever the division moved, which was often. The engineers prepared defences along the coast around Brighton and were on call to help in case of severe air raid damage. The Canadian sappers were therefore in the awkward position of requiring the most time for training but having the most to do in garrison.

Much of what the engineers did learn while in England had to do with only one aspect of their role. In siting and preparing defensive positions in the area around Brighton and at several airfields the sappers became quite skillful at bolstering the defence of a locality. The erection of barbed wire entanglements, tubular scaffolding and road blocks became familiar jobs for the engineers. Digging and revetting trenches and weapons pits for

riflemen, machine guns, artillery and anti-aircraft guns were routine chores by the end of 1942. The sappers became very proficient as their experience expanded, but it was limited to defensive operations. In Sicily, Italy and the Netherlands, the engineers would be called upon to support the advance and there had been too little training in that area while in England.

The end result was that the engineers were not wholly prepared to meet the challenges of Sicily and Italy. At first, craters took days to fill, bridges washed away and mines went undetected. It was not until the engineers had spent a few months supporting the 1st Canadian Infantry Division that they began to develop a certain expertise in specific areas such as bridge construction, crater repair and mine warfare. This was the result of experience gained in operations. Because they had filled a dozen or so craters before the campaign in Sicily ended or built several bridges by the time they left the area around Reggio or removed a thousand mines before the assault on mainland Italy the sappers became skilled at crater-hopping, bridge gallops and breaching minefields. The learning process lasted until the end of the war.

After they left England the engineers found that there was still little time for formal training and that they would learn their role while on the job. Operations to maintain the forward momentum of the division were of course the engineer units' top

priority. This allocation of work not only meant that the sappers were often engaged in activities at the front but also that they were busy in the rear areas. It was not enough to build roads and bridges. These also had to be maintained until alternate routes were found. When new ports were captured and made useable, lines of communication changed and it became possible to deliver stores by sea closer to the front, making many of the old overland routes useless. It was then necessary for the engineers to remove bridges that had been built during the division's advance so these could be used in operations later. With so much to do there was just too little time to set up training programmes, though the jobs the engineers performed for the division were a form of training in themselves. The sappers were getting the hands-on experience they had missed in England.

When they were not directly or indirectly supporting the advance, the sappers still had chores to perform. As in England the engineers possessed skills that were useful when the division went into reserve. Much of their 'free' time in Sicily was spent clearing minefields from beaches so troops could engage in recreational swimming. Throughout the campaign in Sicily and Italy engineers removed booby traps from prospective headquarters, cleared debris so buildings could be used by civilians and soldiers alike and helped reconstruct airports for use by the Allied air forces. When the engineers were put in

reserve and found time to hone up their skills, which was rare, they found themselves short of equipment. The stores they had used in supporting the division required maintenance and could not be used immediately. Equipment not held by the companies was rarely available for training as it was being used at the front. Operations, naturally enough, had priority for stores. Therefore the engineers tended to learn on the job because that was the only time they had equipment to work with.

Even if both time and equipment were available the engineers could not always take advantage of them. In the course of the war, over 450 engineers of the division became casualties¹ and still others were sent to Canada or England as instructors. These men had to be replaced and their replacements had to be taught. Quite often, training had to be geared to teaching newcomers to the companies the latest developments in field engineering in an operational theatre. Recruits had to be brought up to date on how the engineers were handling the problems they were encountering at or behind the front. Training was thus organized around the new recruits and the more experienced members of the engineer companies continued to develop their skills while on operations.

Therefore experience became a more important teacher than formal, organized training. Since the Canadian engineers practiced the same skills again and again during operations, they became proficient at certain tasks. They could build bridges

quickly, fill craters swiftly and remove mines silently. In the course of supporting the division's advance, they developed some of their own techniques and adapted to local conditions. As time went on their expertise in assault operations expanded. Because equipment was in short supply and time was unavailable for training the Canadian engineers developed a particular inventive attitude that became important to the continuing efficiency of the engineer units. This tendency toward improvisation showed itself in the experimentation with Snakes, cordtex mats or searchlights for clearing minefields. It also showed itself in strange bridge configurations that allowed a launch to a narrow causeway or the construction of fifty feet of bridge with thirty feet of parts. The engineers developed the ability to improvise, going beyond their training and using new techniques.

The sappers also learned the importance of 'scrounging.' Damaged friendly vehicles were stripped for spare parts. Captured enemy trucks were repaired and used to haul equipment. Bulldozers were armoured using salvaged armour plate from tanks and armoured cars. Rubble was substituted for gravel in filling craters and timber from nearby furniture factories and lumber yards could be used to build culverts and bridges. These are but a few examples of how the sappers made use of whatever was at hand to complete their tasks. They learned that resources were often available

outside the usual logistics train. Again improvisation was the key.

Therefore the engineers of the 1st Canadian Infantry Division were able to carry out their duties in the Second World War because these tasks remained relatively constant during long periods of time, allowing them to gain experience. For several years, from June 1940 to June 1943 the sappers concentrated on the defence of England. They had the time to learn the intricacies of defensive positions, all-round defence, wire and anti-tank obstacles. This period was followed by almost two years in the advance against Axis forces in Sicily, Italy and the Netherlands where the engineers became quite proficient at bridge construction, crater repair and mine warfare. In effect, the battlefields of Europe honed the engineers' skills in certain specific areas. Though the sappers were expected to fill different roles in different situations, conditions prevalent in the Second World War allowed them to specialize as they only had to concentrate on one phase of war at a time, and that for several years.

Such were the experiences of the field engineers of the 1st Canadian Infantry Division as reflected in the war diaries of 1 Field Company, 2 Field Park Company, 3 Field Company, 4 Field Company and the engineers of division headquarters. In effect, the goals laid out in the training pamphlets were reached in

certain areas as the sappers learned their trade on the battlefields of Europe. The combination of war diaries and pamphlets can be very useful in studying the training and combat experiences of sappers in the field. In examining the diaries to understand the problems associated with the introduction of sophisticated technology to warfare, the author has focused as much as possible on the sappers themselves and not on their contribution to general strategy. The work is different from official histories mainly in scale, concentrating on engineer companies, platoons and sections and not on the engineer corps or infantry division as a whole. In the process, much has been left out about the organization of the corps of engineers and how it functioned in the course of the war. This strategic aspect has been covered more than adequately in the official history of the Royal Canadian Engineers. It must be noted that a certain knowledge of military doctrine is necessary in using war diaries and pamphlets. In this case the project would have been impossible without a developed background in military engineering. Only then can one understand the problems and solutions the diarists discuss, sometimes in their own jargon. A manual of abbreviations is also essential if the militarese used by the diarists and pamphlet authors is not to drive one to drink. The 1949 manual of abbreviations, which was used for this thesis, is no less than fifty-six pages long, indicating a

certain attitude towards the English language on the part of the Canadian Army. Thus anyone wishing to use war diaries to any great extent must have an in-depth knowledge of the subject matter, such as engineering, gunnery or infantry tactics, as well as some means of translating the ~~military's~~ jargon into something comprehensible to the reader.

In studying the 1st Canadian Infantry Division the work has of course been limited in scope, but this is necessary. Whether the problems the engineers faced and solved were common to all of the field companies of the Canadian Army or even other armies can only be a matter for conjecture. The field squadrons that accompanied the 4th and 5th Canadian Armoured Divisions must be studied especially to determine if the relationship between engineers and technology holds the same for these formations. The author suspects that because of the nature of technology and war the experiences of engineers throughout the Canadian Army were very similar.

Though limited in scope, this work can make a few general statements about the relationship between technicians and technology, especially if one attempts to explain not just the problems the engineers faced, but the reasons behind their ability to find solutions. The explanation for the engineers' success lay in the nature of technology itself. Man has no innate ability to deal with mechanical equipment, apparatus or material.

Technology's use must be learned. This learning process requires practice with the gear in question for one must actually use the equipment before one can be said to know how to operate it. In the case of the engineers of the 1st Canadian Infantry Division, they practiced the manipulation of the same technology for the same goals over an extended period of time. In this way they learned how to cope with technology's challenges in the course of a cruel, demanding mobile war with all its pressures and dangers.

NOTES

1. PAC, RG 24, vol. 14706, 1 Field Company, 8 May 1945,
vol. 14481, 2 Field Park Company, 8 May 1945,
vol. 14711, 3 Field Company, 8 May 1945,
vol. 14717, 4 Field Company, 8 May 1945.

APPENDIX I

A NOTE ON EQUIPMENT USED BY THE ENGINEERS OF THE 1ST CANADIAN INFANTRY DIVISION

The purpose of this appendix is to lay out only the equipment most frequently used by the engineers of the 1st Canadian Infantry Division, from the arms they bore as individuals to the bridge equipment whole platoons or companies worked with.

THE RIFLE:

All Canadian and British soldiers used the .303 inch Short Magazine Lee-Enfield. This weapon had first been produced in the First World War, though modern versions were made available to the Canadians of the division before they embarked for Sicily. The only real objection to the more modern weapon was the sight, which could only be set at 300 and 600 yards, making it difficult to aim at close quarters or at long range. In July 1944 the sights were changed to remedy the problem.

THE LIGHT MACHINE GUN;

For the first few months of the war the Canadians were issued the Lewis gun, which had been used in the First World War.

It was heavy and somewhat awkward to carry if the unit was moving on foot. The obsolescent Lewis was replaced by the Bren soon after the fall of France, when Canadian manufactured versions became available. The Bren gun was much lighter than its older counterpart though both fired the same ammunition as the rifle.

THE SUB-MACHINE GUN OR MACHINE CARBINE;

Until they joined the Canadian Army in Northwest Europe the men of the 1st Canadian Infantry Division used the Thompson .45 calibre machine gun, easily recognizable from its use in Hollywood gangster movies. It was an American weapon which, unlike the Lewis or the Bren, could be fired from the shoulder or the hip. The division replaced it with the Sten gun in March 1945. The new weapon was much more simple and could use captured 9 millimetre ammunition. The Sten was somewhat unpredictable, firing on its own when dropped or jarred.

BULLDOZERS;

There were several types of bulldozers in use during the Second World War, all of them very similar to earth-movers construction companies use today. Those issued to the 1st Canadian Infantry Division engineers ranged in size from the D-4, the smallest but most manoeuvrable, to the D-8, which was much larger but rarely available for the usual field engineer tasks.

All were very slow under their own power, having been designed to push earth and not for quick movement. This limitation meant that they had to be put on flat-beds if they were to travel more than a few miles, unless of course the advance was moving at a snail's pace. No armoured dozers were issued to the Field Park Company, whose responsibility was to maintain all heavy equipment, though as has been seen the engineers took the matter into their own hands and put armour on the vehicles themselves.

The bulldozer had many uses, the most common of which was to push earth with a steel blade mounted on the front. A kind of plow could be attached to the rear of the machine to break up earth or railway ties. There was also a hook on the rear so the dozer could be used for pulling heavy loads, especially when trucks had to be assisted up some of the steep river banks in Italy where the engineers built exits from assault landing sites.

THE COMPRESSOR;

This device was a godsend to the engineers. It has not changed much in the last forty years and many can be seen on most construction sites. It consisted of a motor and chamber for compressed air which could then be released through valves at the rear or side of the machine. The air could then be directed through hoses to run several types of tools; jackhammers (which came in two sizes), clay diggers, rock bores, earth augers,

circular saws, chain saws, sump pumps, spike drivers and winches. Because they used compressed air, they required little maintenance, unless of course they went through artillery barrages. The compressors were mounted on trailers pulled by 3-ton lorries.

BRIDGES;

There were several types of bridges in use by the time the Canadians assaulted the beaches in Sicily. Only those most in use can be mentioned in any detail. They were the Bailey, the Folding Boat and a variety of timber structures.

The Extra-Widened Bailey Bridge (EWBB), in the movie "A Bridge Too Far" referred to as the technical wonder of the Western World, was by far the most versatile and popular of the pre-fabricated bridges used by the Canadian engineers. Designed by the British, it could be built in an almost infinite number of combinations, floating or non-floating, strong or weak. When built as a floating bridge pontoons were launched into the water and formed into piers on which the bridge superstructure was built. If the bridge was non-floating, then a nose was added so the structure would never pass its centre of gravity and fall into the gap. As 'bays' or 10-foot sections were added, the entire structure was pushed out over the gap on rollers, with the nose eventually landing on rollers placed on the other side. The

Bailey's strength was determined by the number of 'panels,' which went the length of the bridge on each side of the roadway, were used in the construction of each bay. The weakest version of the bridge used two, one to each side of the roadway, while the strongest version used eighteen and could handle a train.

The Folding Boat Equipment Bridge, as its name implies, was built much as the Pontoon Bailey was. This equipment, however, was lighter and could only handle nine tons. Though trucks and infantry could cross safely, tanks did so at great risk to the bridge and the tank crew. Its one advantage lay in the speed in which it could be built. It was not unusual for engineers to build two hundred feet or more in an hour and at times four hundred feet of the structure could be in place in ninety minutes. Because of this speed the Floating Boat Equipment was used immediately after an assault to get supplies and reinforcements into the bridgehead.

If pre-fabricated bridging was not available, the engineers could still construct improvised timber bridges. These structures were always non-floating and were designed by the officer or N.C.O. immediately responsible for its construction. To this end engineers carried charts and graphs in pocket book form which enabled them to design the bridges quickly. This, however, resulted in overdesign, meaning that the bridge was much stronger

than it had to be just to make sure it was not built too weak by mistake.

THE MINE DETECTOR:

At the beginning of the war the Canadians used British mine detectors. In fact, they were metal detectors that would pick up anything made of iron, lead, steel or other metallic materials, not just mines. It was operated by a sapper sweeping over the ground with a disk attached to a handle. A needle and gauge near the upper portion of the handle told him if the disk passed over metal. The device could not be used in poor light conditions for the sapper would not see the gauge properly.

By the time the Canadians landed in Sicily the British mine detector had been replaced by a Polish model. This one was different in that the disk communicated its information audibly instead of visually. The sapper wore headphones which squealed slightly if the disk passed over metal. The device could easily be used at night but was unfortunately notorious for not functioning well in the rain. Many nails and tin cans were unearthed using the mine detector..

APPENDIX II

A NOTE ON SOME ENGINEER TECHNIQUES

MINE CLEARING;

There were basically three ways to clear a minefield, either by hand, with the use of explosives or by mechanical means.

Clearing a minefield by hand was the only way to breach lanes or gaps silently. Sappers crawled into the minefield, usually under cover of darkness, and used mine detectors or prodders- (sometimes bayonets were used) to locate the mines, which were then disarmed on the spot or pulled out of the ground with grappling hooks and rope. The latter method was safer but had a much greater chance of setting off mines, which would give the sappers' positions away. If the minefield was a friendly one, laid by the Allies, or if the enemy was out of range, mine clearing was done in broad daylight or with the use of lights at night. It was not necessary to crawl, though many opted to do so for then an exploding mine was less likely to kill the man attempting to disarm it.

For the most part, explosive means to breach minefields remained experimental throughout the war, though some were used on the request of the armoured units attacking the Hitler line. The tube-snake, the bangalore torpedo, cordtex mats and rocket

pulled detonator cord were all tested. All shared certain characteristics. The basic concept was to push, pull, unroll or toss a length of explosive into the minefield and blast a lane through it. None of the techniques tested and used ever achieved 100% results; there was still a chance that an infantryman or tank advancing through the corridor could set off a live mine. The main advantages in using explosive means lay in speed and safety for the engineers.

Mechanical means were not used by the engineers of the 1st Division but are worth mentioning here. The greatest example of using a machine to clear minefields was the flail tank. It consisted in placing a rotating drum from which hung chains on the front of a tank. The drum, in spinning, would beat the ground in front of the tank with the chains and thus force all mines to explode. After a time, of course, it became necessary to replace some of the chains as repeated explosions shortened or destroyed them.

ROAD CONSTRUCTION;

The road construction carried out by the field companies was quick and sometimes somewhat crude. The finished product would, however, have ditches, verges and culverts to ensure that the road did not wash away. The three D's of road construction were Drainage, Drainage and Drainage. Roads were surfaced with gravel

so water could not seep into the roadway itself and turn it into a quagmire. The convex shape of the surface, or camber, forced water to flow into the ditches which then channeled into streams and rivers. Finally, culverts ensured that water flowed under the road through small tunnels rather than over it. At best, the engineers could use bulldozers to remove rocks and trees and dump trucks to haul gravel which the dozers could spread. At worst, the whole project was done by hand, often with the help of a hundred or more Italians to spread gravel and remove stones.

CRATER REPAIR;

Filling in craters was somewhat more complex than most people would believe. First, the hole had to be pumped out so water would not undermine the roadway or landing strip sometime in the future. Then successive layers of gravel or other fill were carefully spread into the bottom of the crater and tamped. This process was supposed to ensure that it did not cave in later on and form a large hole in the road. The work was complete when a surface even with that of the original roadway was spread and tamped using gravel for roads and concrete for landing strips. With luck, the sappers would have a bulldozer to push the successive layers of gravel or rubble into the hole. Otherwise, shovels and muscle were used.

BRIDGE CONSTRUCTION;

Though there were a variety of bridges, which have already been discussed, engineers followed essentially the same basic procedures for the construction of each. First, an officer or an N.C.O. gathered all the relevant data about the gap so the bridge could be designed. If possible, the engineers prepared a diversion, often in the form of a ford, around the bridge site so priority traffic could carry ammunition, food and water to the men at the front. After the bridge had been designed, which with the pre-fabricated bridges took little time, the bridge commander requested the necessary stores. Two columns would then move toward the site. The first was formed of the platoon or company that would actually build the bridge and the other, the bridge column, carried the bridge parts themselves from 2 Field Park Company's storage to the site. Upon arrival, sappers prepared the near-side approach and the near bank. At the same time, the bridge commander usually sent a detachment across the gap by boat, diversion or overhead ropeway to prepare the far bank. The engineers then built the actual structure, finishing with load limit signs and gravel on the approaches and exits.

DEFENSIVE POSITIONS;

Defensive positions were prepared in accordance with priorities, which were always the same. First, the infantry,

sometimes assisted by engineers, dug their own trenches. The first priority was to get everyone below ground level in case of bombing or shelling. In the long-term projects around Brighton this step was carried out by the engineers. The second priority was to build bunkers and communication trenches so commanders would have a safe, relatively roomy place to prepare orders and control the company, battalion or brigade. Next, the engineers began to put up the wire and lay the minefields that were supposed to delay the enemy's advance. All obstacles were built starting with the enemy's side of the belt so engineers would not find themselves stranded in case of a surprise attack. The minefields were laid with lanes through which friendly forces could send out patrols. Wire and anti-tank obstacles had to be far enough from the trenches so German or Italian soldiers could not use them as cover to throw grenades.

RESERVE DEMOLITIONS;

Reserve demolitions were carried out in three phases. The first consisted in reconnoitering the target, usually a bridge, calculating the charges and placing them at strategic locations as determined by the task's commander. No more could be done without explicit orders from higher command, usually a brigade or even the division commander. The second phase, if ordered, consisted in placing the detonators in the charges and preparing

to blow up the bridge. The sappers tested all wires to ensure there would be no snags. Finally, the third phase was the actual destruction of the target, carried out upon the order of higher command or if the bridge was in immediate danger of being captured. At times even capture was preferable to destruction as a counter-attack might quickly retake the bridge, and so the engineers could only blow up the bridge upon the reception of a code word. Throughout the sappers were protected by an infantry guard, whose commander was responsible for the defence and destruction of the bridge.

APPENDIX III

A NOTE ON ENGINEER CASUALTIES

Following is the breakdown by unit of engineer casualties among the field engineers of the 1st Canadian Infantry Division during the Second World War as reported on 8 May 1945.

1 Field Engineer Company

Killed in Combat:	13
Died of Wounds:	6
Wounded:	94
Injured:	6
Prisoner of War:	2
TOTAL -----	121

2 Field Park Company

Killed or Died of Wounds:	3
Wounded:	22
Accidental Death:	1
TOTAL -----	26

3 Field Company

Killed in Combat	29
Wounded:	123
Killed (not in combat):	5
Prisoner of War:	5
Missing, Presumed Dead:	1
TOTAL -----	163

4 Field Company

Killed or Died of Wounds:	24
Wounded or Injured:	105
Died of Other Causes:	10
Missing, Presumed Dead:	4
Prisoner of War:	1
Illness:	3
TOTAL -----	147

TOTAL CASUALTIES ----- 457

Reported strengths of the field units on 14 July 1943 was as follows:

1 Field Company -----	187
2 Field Park Company ---	22
3 Field Company -----	207
4 Field Company -----	197
TOTAL -----	613

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