



MASSEY UNIVERSITY
LIBRARY

Massey Research Online

Massey University's Institutional Repository

Harper, Glynn. From Masterpiece to Massacre. The New Zealand Division in 1917 and a tale of three battles, The David Gallaher Memorial Lecture: Rugby World Cup Events, 10 and 11 October 2007, Ieper Belgium.

Massey author: Harper, Glyn

<http://hdl.handle.net/10179/1040>

Copyright is owned by the Author of the paper. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The paper may not be reproduced elsewhere without the permission of the Author.

1917: 90 Years On

Masterpiece to Massacre: the New Zealand Division and three battles

by Glyn Harper

The year 1917 was the worst year of the war for the allies. It was a year of German victories on the Eastern and Italian Fronts, but costly failed allied offensives on the Western Front, the decisive theatre of war.

Operations on the Western Front were severely hampered by the appalling weather conditions that year. Spring arrived late, summer amounted to three weeks of fine weather and 1917 saw the heaviest rainfall in 75 years combined with one of the most severe winters on record. Marshal Ferdinand Foch warned at the beginning of October as the battles of Passchendaele were underway, that it was impossible to wage war against both Germans and mud.¹ This would be just one of the many painful lessons learned at Passchendaele.

For the New Zealand Division 1917 was a crucial year. Brought up to full strength after its severe bleeding on the Somme in September 1916 and after spending many months training the large number of reinforcements, the New Zealand Division was involved in three set piece battles and two minor actions during the year. Prior to the first military engagement of 1917 the New Zealand Division was in the peak of its condition. At the end of the year after suffering its worst ever military disaster the Division was a spent force incapable of further military action. This presentation briefly examines the three battles and offers some comment on the enduring legacy of 1917.

Masterpiece 1: Messines June 1917

As a preliminary to the launch of the BEF's main offensive for 1917 the Messines Ridge was to be captured. This ridgeline ran for nearly ten kilometres from St Yves in the south to just beyond Wytschaete. This would secure the southern flank of the Ypres offensive planned later in the year as well as ejecting the Germans from a vital piece of high ground thus denying them observation over the potential battlefield.

Responsibility for mounting the attack at Messines was assigned to General Herbert Plumer's Second Army which had spent many months planning and preparing it. Plumer, despite his unmilitary appearance, was one of the most able generals in the BEF and this operation involved several innovative features. For a start the objectives were strictly limited in what Plumer's colleague General Henry Rawlinson called a "bite and hold" operation. Capture of the ridgeline was the ultimate prize; there was to be no attempt at breaking through the German lines. Artillery support, upon which success of the operation depended, was to be overwhelming: more than 2,000 guns of which a third were heavy and medium. The American military theorist Stephen Biddle has calculated that the ten-day artillery bombardment that preceded the infantry attack on 7 June was "of literally atomic magnitude" with more explosive power than a US W48 tactical nuclear warhead dumped on every mile of the German frontline trenches.² The infantry from the nine divisions involved in this attack and with three more in reserve, were both well trained and moved into location early so that most commenced the attack well rested. Railways had been constructed right up to the start line to ensure adequate logistical support throughout the operation. All preparations had been made under cover of darkness so as to preserve the element of surprise. Then there was the knockout blow. Twenty-one mine shafts had been sunk deep

under the German lines and filled with more than a million pounds of high explosive. Their detonation would signal the start of the attack. As the Australian official historian, Charles Bean commented on Messines: “Never had a big British operation been prepared in such detail.”³

The New Zealand Division had a key role in this attack. As a result of being involved in only minor actions since leaving the Somme in October 1916 and being able to train those formations not holding the front-line trenches the Division was in fine form for this attack. In April 1917 the various artillery and infantry brigades underwent, in turn, 12 days of intensive training for their roles in forthcoming offensive. The history of the New Zealand Division records of this training:

... nothing was left undone to achieve realism. The ground at the training area happened to conform with the actual position to be assaulted, and replicas of the whole German trenches and our assembly ones were cut out a foot deep to scale. In these, battalions and brigades rehearsed the delicate operations of the assembly and attack, and attained the invaluable certainty of purpose. The final full-dress rehearsals were witnessed and criticized by the Second Army Commander and his Staff.⁴

The training for Messines included testing tactics for open warfare and for obtaining the maximum firepower from the recent reorganization of platoons into specialized sections of riflemen, Lewis gunners, bombers and rifle bombers. As a result the historian Christopher Pugsley believes that the New Zealand Division was “at its peak” for Messines. He writes that “the combination of enthusiasm, esprit de corps and training reached its high point for this battle.”⁵

In II Anzac Corps sector the New Zealand Division was in the centre between the 3rd Australian Division on the right and the British 25th Division on the left. Its role included the capture of the heavily fortified Messines village upon which the whole Army plan depended. Once the village was taken the 4th Australian Division could pass through it on the way to the final objective, a line about a mile beyond the crest.

At 3:10 am on the morning of 7 June the mines went up (only 19 of them exploded) and a colossal barrage over a kilometre deep crashed down on the German defences. The noise from the explosion was distinctly heard as far away as the United Kingdom and an observatory on the Isle of Wight registered it on its seismograph.⁶ The war correspondent Philip Gibbs described it as:

The most diabolical splendour I have ever seen. Out of the dark ridges of Messines and Wytschaete and that ill-famed Hill 60 there gushed out and up enormous volumes of scarlet flame from the exploding mines and of earth and smoke all lighted up by the flame spilling over into mountains of fierce colour, so that the countryside was illuminated by red light.⁷

A German officer on the receiving end of this “diabolical splendour” recorded this vivid account of the event and its effect on his battalion:

In the front line the relief was in full swing: when suddenly, at 4.00 am, there was an almighty roar and the earth began to quake and everything flew off the chairs: explosion! Attack! Both officers and men poured out of the entrance into the open air. An awe-inspiring and appalling sight met their eyes. The hills from Wijtschate to

Messines were enveloped in a great sea of flames. Fourteen fiery volcanoes and masses of earth erupted vertically into the sky colouring it a blood red. Then the great masses of earth crashed back down to the ground and, simultaneously, drum fire of an unprecedented violence crashed down. Time passed worryingly then, at about 5.00 am a runner arrived from the front, with dreadful news: '3rd Battalion Bavarian Infantry Regiment 17 has been blown sky high.'⁸

Many other German battalions on the ridge suffered a similar fate.

Immediately following this eruption the infantry from the nine assault divisions moved off in the semi-darkness and advanced into the smoke and dust-cloud that hung over the ridge. Moving behind a protective artillery barrage they occupied the Messines Ridge almost unopposed. So effective was the British artillery's counter battery fire that it was ten minutes before a feeble German barrage fired on the advancing infantry. By then it was too late.

The New Zealand Division easily captured Messines village by 7:00 am and a New Zealand soldier, Lance Corporal Samuel Frickleton, won a Victoria Cross in the fighting to clear the village's outskirts. That afternoon the New Zealanders repelled a German counterattack which crumpled under heavy machine gun and artillery fire.

The New Zealand infantry remained around (but not in) the village of Messines for the next two days and it was then they experienced the bulk of their casualties. The exposed ridgeline was overcrowded with allied soldiers and the New Zealand position was no exception. Major General

Russell requested but had not been permitted to thin out his defences.⁹ The German artillery, once it had recovered from the shock of the opening attack, pounded the Messines village and its outskirts mercilessly. On 8 June those New Zealanders on the ridge endured a German artillery bombardment that lasted uninterrupted for ten hours. Fortunately though, the survivors were withdrawn into reserve the next morning.

The attack, beginning in the early hours of 7 June 1917 was a complete success, the finest of the war to date according to Field Marshal Sir Douglas Haig. The battle of Messines came to be regarded as a model for offensives on the Western Front. Careful planning, effective preparation, and excellent infantry-artillery cooperation had produced an outstanding success. As Russell later commented:

The battle ... was won through the weight of metal thrown on to the enemy positions and the mettle of the men who advanced to attack. Everything went like clockwork.¹⁰

This success did not come cheap though; it never did on the Western Front. When the New Zealanders were withdrawn from Messines village on the morning of 9 June they had suffered nearly 4,000 casualties of which some 700 were killed in action in just over two days of fighting.¹¹

Masterpiece 2: Broodseinde 4 October 1917

New Zealand's next large-scale military actions were the two attacks made in October 1917 in the Flanders region of Belgium as part of Third Battle of Ypres. They rank as two of the most significant military engagements the country has ever undertaken.

The Third Battle of Ypres was the BEF's main campaign for 1917 and it aimed to clear the Germans from the Belgian Channel Ports as well as relieving pressure on the French Army in the south. If it succeeded it would be a strategic victory seriously damaging Germany's ability to remain in the war. Beginning on 31 July and ending on 10 November 1917, Third Ypres consisted of eight separate battles. The New Zealand Division took part in just two of these. They were the battle of Broodseinde on 4 October and First Passchendaele fought just over a week later on 12 October.

The attack of 4 October aimed to seize the first low ridge in front of Passchendaele as a preliminary to taking the village itself in a subsequent push. Twelve divisions would be taking part along an eight mile front. There was a unique element to this attack. In the centre making the main thrust, for the only time in history, four Anzac Divisions would attack side by side. On the right (south) I Anzac Corps (1st and 2nd Australian Divisions) would attack on a 2000 yard front with the village of Broodseinde and the surrounding ridge as their objective. To their north II Anzac Corps with 3rd Australian Division on the right and the New Zealand Division on the left, would attack on a 3000 yard front with the object of taking the Gravenstafel Spur. The three Australian divisions were to secure the whole of the Broodseinde Ridge including the town of Zonnebeke and Broodseinde village. The New Zealanders, advancing on

a 2000 yard front to a depth of just over 1000 yards, were to concentrate on the Abraham Heights and the Gravenstafel Spur itself.

While the objectives were strictly limited, varying from 1200 to 2000 yards, this was still a formidable task. It involved the four Anzac divisions advancing up open slopes which were chequered with strong defensive positions including many ferro-concrete pillboxes. They would be under full observation of the Germans on the heights throughout the attack. However, the key to success was the overwhelming artillery support provided to the attackers. Second Army had some 796 medium and heavy guns available and 1548 field guns and howitzers. The New Zealand Division was allocated a generous portion of this support: one-hundred and eighty 18 pounders (field guns), sixty 4.5 inch howitzers and sixty-eight machine guns. These would provide four distinct barrages to assist the advancing infantry including a creeping barrage throughout the attack and standing barrages once each objective had been taken. As one New Zealand historian noted the attack was to be “a limited advance with unlimited explosives to blast out a way. If the weather held it must succeed.”¹²

The weather did hold – only just – and the battle of Broodseinde was a stunning success for all those divisions of Second Army taking part. The New Zealand Division easily captured all its objectives advancing the British line by nearly 2,000 yards and taking 1,159 German prisoners. New Zealand casualties were heavy numbering 1,853 of which more than 450 had been killed. One of those killed was a 43 year old sergeant in the 2nd Auckland Battalion named David Gallaher. Gallaher had been the inspirational captain of the 1905 All Blacks – the Originals – and he had enlisted in 1916 after learning that two of his brothers had been killed.

The New Zealand casualty rate was around 25 per cent in a battle where everything had gone according to plan.¹³ As one young soldier wrote of 4 October: “Its marvelous the way these ‘Stunts’ as we call them are got up, everything run like clockwork.”¹⁴

But in the afternoon of 4 October heavy rain started falling turning the Flanders region into a quagmire. Prince Rupprecht, Crown Prince of Bavaria and the German Army commander, reflected after the attack of 12 October that the rain was “our most effective ally”.¹⁵ Many experienced soldiers thought that this break in the weather meant an end to the Third Ypres offensive. It was not to be though, and the BEF’s commander, Field Marshal Sir Douglas Haig, in the most controversial and questioned decision he made during the war ordered that it should continue. The New Zealand Division’s next attack would be far from a textbook or “clockwork” operation.

Massacre: First Passchendaele 12 October 1917

The warning signs were clear to anyone who cared to notice them. Convinced that the Germans were near breaking point Haig ordered a new attack on 9 October which is known as the Battle of Poelcapelle. Poorly planned, lacking adequate artillery support, ignoring weather and terrain conditions the attack was a disaster for the 11 divisions involved. In the Anzac sector two British divisions, the 49th and the 66th of II Anzac Corps and the 2nd Australian Division of I Anzac Corps took part. While their planned advance was a short one, between 600 and 900 yards, not a single objective was taken and the casualties were horrendous. The 49th Division alone suffered more than 2,500 casualties in this attack. Yet still Haig persisted in continuing the offensive writing in his diary that the results of this attack “were very successful”. Then he informed his headquarters:

I am of the opinion that the operations of the 49th and 66th Divisions, carried out today under great difficulties of assembly, will afford the II Anzac Corps a sufficiently good jumping off line for operations on October 12th, on which date I hope that the II Anzac Corps will capture Passchendaele.¹⁶

The New Zealand Division and the 3rd Australian Division were now condemned to make an attack that should never have gone ahead.

Never in its history have New Zealand troops been ordered to carry out an attack in such unfavourable circumstances. Nothing at all was right for it. Here is a brief list:

- the terrain was like glutinous porridge and it was raining heavily. This made a mockery of any attempt at tactical finesse like fire and manoeuvre and outflanking enemy strong points
 - the objectives were very deep, over 3,000 yards. It included those set for 9 October.
 - only two days were allocated to plan and coordinate the attack.
 - artillery support was totally inadequate as the CRA (Napier Johnston) informed General Russell before the attack commenced. Few guns had been moved forward; those that had been did not have stable gun platforms and were short of shells.
 - the troops were exhausted just reaching the start line and their morale was low. This was especially so for the 3rd Rifle Brigade which had just completed a month detached as laborers from the division, one of the disadvantages of maintaining a four brigade division. Since 4 September, the 3rd Rifle Brigade had been in the Ypres salient burying telephone cables and constructing roads. This work had to be done at night, often while wearing gas masks. The Brigade's history candidly admits that in October its soldiers "were almost worn out and [were] certainly unready for immediate combative action".¹⁷
- The New Zealand stretcher bearers started the attack exhausted too having to clear the battlefield of over 200 wounded men left out since the debacle of 9 October.
- the German obstacles ahead of them were formidable. These included the many pill boxes and two belts of barbed wire each about 30 yards thick, all of which was clearly visible from the New Zealand start line. What was not observed though were the many hidden machine gun nests and sniper teams moved into position for this attack.

- the German defenders knew the attack was coming. Not only could they see the preparations being made but a British deserter and three other soldiers captured in raids on the night of 11 October informed their captors of the exact time of the attack.¹⁸

Really the attack was doomed before it even started. This is not the hindsight of an historian either. Those New Zealand soldiers in the line on the morning of 12 October knew that the task ahead of them was formidable and that their prospects of survival were slim.

First Passchendaele on 12 October was an absolute disaster. Nothing went to plan and the fate of this attack is best reflected in its opening artillery barrage. It was universally condemned as “very feeble”.¹⁹ Worse than this it damaged the wrong people. Leonard Hart of 1 Otago Battalion recalled:

Through some blunder our artillery barrage opened up about two hundred yards short of the specified range and thus opened right in the midst of us. It was a truly awful time – our men getting cut to pieces in dozens by our own guns. Immediate disorganization followed.²⁰

Leonard Hart’s infantry company lost 148 of its 180 members on this morning.²¹

The two New Zealand infantry brigades making this attack – 2nd Brigade (the South Island Battalions) and the 3rd New Zealand Rifle Brigade –

suffered devastating losses. Most New Zealand soldiers never saw a German that morning. Here are two brief accounts:

Corporal Harold Green, C Company of the 3rd Rifles:

At 6 am a tremendous bombardment opened and we went over in a sea of mud. The fire from the German pill boxes was hellish and our barrage failed. The emplacements for our guns were not solid enough and the guns tilted causing trouble in our ranks from the shells of our own 18 pounders. The wire entanglements, the mud and the pill boxes prevented any success. C Company lost heavily and the 3rd Battalion lost about half its numbers in casualties. Our Colonel, Winter-Evans, was killed. 150 of C Company went over and casualties numbered 82, including all the sergeants except Goodfellow. The attack was an impossible attempt. The ground was swampy and very muddy and heavy cross fire from the pill boxes did not give us a chance. The Black Watch on our left were in exactly the same position. The stunt should never have been ordered under such conditions. It was absolute murder.²²

Private Ernest Langford of 2 Otago Battalion was more succinct:

Attack a failure on account of wire encountered. Casualties extremely heavy. Hun machine guns and snipers play havoc. Absolute hell. ... Brigade practically wiped out.²³

Not one objective was taken and the cost was massive. Some 846 New Zealanders were killed on this dismal Flanders morning and a further

2,000 soldiers were wounded. Another 138 New Zealanders died of their wounds over the next week.²⁴ More New Zealanders were killed or maimed in these few short hours than on any other day in the nation's history.

Third Ypres finished in November after the Canadians finally captured the red brick stains in the mud that had once been the village of Passchendaele. The offensive advanced the British line by six miles and captured the objectives that had been set for the first two weeks. The BEF suffered some 275,000 casualties of which 70,000 had been killed. The effects of this battle when combined with the dreadful climatic and terrain conditions “brought dire consequences” upon the morale and fighting ability of the BEF.²⁵ Many writers have commented that for the first time in the war, after Third Ypres the BEF lost its confidence and sense of optimism which was replaced by a “deadly depression”.²⁶ This was certainly the case for the New Zealand Division which experienced its nadir at the end of 1917. Every military formation has its breaking point and the New Zealand Division almost reached the limits of endurance at the close of 1917. For the survivors of Passchendaele the war seemed never-ending and ceased to have a purpose. More than this, they now began to doubt whether the allies could ever defeat Germany. Their sense of humour remained intact though and was one of the vital coping mechanisms available to soldiers. While they told newcomers that the war was going to last a lifetime, they reassured them that “The first seven years will be the hardest.”²⁷

But for the New Zealanders the misery of 1917 was not finished. On 3 December the 2nd Brigade carried out another costly attack at Polderhoek which gained some ground but not the objective. The New Zealand Division then wintered in the Ypres salient until relieved in late February and loathed the experience. While here they suffered another 3000 casualties, most through sickness, but a further 500 New Zealand soldiers were killed.²⁸ It really was a winter of discontent.

The Passchendaele experience left an enduring legacy for New Zealand. It was the one great military disaster the New Zealand Division suffered on the Western Front. It is the single event that encapsulates for most New Zealanders the experience of the First World War. A.J.P. Taylor wrote that the Somme battle in 1916 “set the picture by which future generations saw the First World War: brave helpless soldiers; blundering obstinate generals; nothing achieved.”²⁹ But for New Zealand, which did not take part in the early disastrous stages of the Somme battle, it is the 12 October attack that dominates public memory of the Western Front. As Professor Peter Simkins wrote earlier this year: “Passchendaele has never lost its power to shock even the most hardened student of the Great War and, to many people, it remains the quintessential symbol of the horrors of the fighting on the Western Front.”³⁰

Of all New Zealand’s experience of war 12 October 1917 at Passchendaele has had the most significant impact on the nation with the possible exception of Gallipoli. It inflicted the deepest physical and psychological scars upon the New Zealand Division and on New Zealand society as a whole. Nearly every family was directly affected by this battle or knew people who were. Denied the rituals that are usually associated with death, no sense of closure accompanied these losses. The pain of separation and loss still endures.

The bitterness and disenchantment experienced by the New Zealand soldiers who were there was taken back to New Zealand where it took root and grew. As one veteran stated: “the older we get the more bitter we feel about the needless suffering and loss of so many of our friends”.³¹ Still another soldier who lost a brother at Passchendaele reflected more

than 70 years later: “In many respects it makes me so angry when I think of the terrible loss of life and the things we had to put up with in war”.³²

This bitterness is entirely understandable but the notion that it was futile, that this sacrifice was all for nothing is wrong and destructive. To be told and believe that your father, uncle, brother or cousin had died for nothing is the cruelest of legacies. As Hew Strachan, the Chichele Professor of the History of War at Oxford University, concluded in his masterly one volume overview of the war:

In short it [the First World War] shaped not just Europe but the world in the twentieth century. It was emphatically not a war without meaning or purpose.³³

As stated at the beginning of this paper, 1917 was the hardest year of the war for the allies and for the New Zealanders fighting on the Western Front. The New Zealand Division commenced the year in the peak of condition, but ended it close to breaking point. It was down, but definitely not out, as the events of March 1918 revealed. Just weeks after leaving the Ypres salient the New Zealand Division, along with eight other divisions was rushed south to plug huge gaps that had been punched in the line by the German Michael offensive. Here they performed what I consider to be their finest feat of the war playing a decisive role in defeating the Germans on the Somme. But that is a different story and I hope that next year I have a chance like this to tell it.

¹ Foch was in Paris where he made this comment in an interview: “*Boche* is bad, and *Boue* (mud) is bad, but *Boche* and *Boue* together – ah!” and he raised his hands in a warning gesture. Quoted in Leon Wolf, *In Flanders Fields. The 1917 Campaign*, London, 1958, p.199.

² Stephen Biddle, *Military Power. Explaining Victory and Defeat in Modern Battle*, Princeton, 2004, p.30. Biddle points out that the 1,200 tons of explosive applied to each mile of the German frontline line trenches is more than a kiloton in nuclear parlance.

³ C.E.W. Bean, *Anzac to Amiens*, Melbourne, 1993, p.349.

⁴ H. Stewart, *The New Zealand Division 1916-1919*, Wellington, 1921, p.159.

⁵ Christopher Pugsley, *On the Fringe of Hell. New Zealanders and Military Discipline in the First World War*, Auckland, 1991, p.189.

⁶ Holmes, p.159.

⁷ quoted in Richard Holmes, *The Western Front*, London, 1999, p.159.

⁸ Oberleutnant Eugen Reitingger, Adjutant 3rd Battalion Bavarian Infantry Regiment 17, quoted in Jack Sheldon, *The German Army at Passchendaele*, Barnsley, 2007, pp.7-8. German time on the Western Front was an hour ahead of the allies.

⁹ Pugsley, pp.190-91.

¹⁰ Russell to Sir James Allen, letter, 19 June 1917, Allen Papers, Archives of New Zealand (ANZ).

¹¹ Ian McGibbon (ed.), *The Oxford Companion to New Zealand Military History*, Auckland, 2000, p.603.

¹² A.D. Carbery, *The New Zealand Medical Services in the Great War 1914-18*, Auckland, 19124, p.332.

¹³ Casualty figures are from Glyn Harper, *Massacre at Passchendaele. The New Zealand Story*, Auckland, 2000, p.42.

¹⁴ Malcolm Beaven, letter, 7 October 1917, MB 195 Box 83, Macmillan Brown Library, Canterbury University.

¹⁵ Crown Prince Rupprecht of Bavaria, diary entry 12 October 1917, quoted in Sheldon, p.231.

¹⁶ quoted in Harper, p.58.

¹⁷ W.S. Austin, *The Official History of the New Zealand Rifle Brigade*, Wellington, 1924, p.230.

¹⁸ The deserter was from the 9th (Scottish) Division which had returned to the front line on the New Zealand Division's left flank after a two week break. Two of the prisoners of war also came from this division; the other was from the British 48th Division. See Sheldon p.229 and Harper pp.79-80.

¹⁹ Report on Operations 11-14 October 1917, War Diary, 2 Cant Bn, WA 78/1, ANZ.

²⁰ Leonard Hart, letter, 19 October 1917, MS papers 2157, ATL.

²¹ Harper, p.101.

²² Corporal Harold Green, Diary entry, 12 October 1917, 18926 KMARL Waiouru.

²³ Private Ernest H. Langford, Diary entry, 12 October 1917, MS papers 2242, ATL.

²⁴ Summary of Casualties, NZEF, reported 15 August – 14 November 1917.

²⁵ Robin Prior & Trevor Wilson, *Passchendaele the untold story*, Melbourne, 2003, p.200.

²⁶ Harper, p.94.

²⁷ quoted in Harper, p.94.

²⁸ Ian McGibbon (ed.), *The Oxford Companion to New Zealand Military History*, Auckland, 2000, p.605.

²⁹ A.J.P. Taylor, *The First World War. An Illustrated History*, London, 1966, p.140.

³⁰ Peter Simkins, Foreword to Jack Sheldon, *The German Army at Passchendaele*, Barnsley, 2007, p.vi.

³¹ Leonard Leary, Reminiscences, MS Papers 4022, ATL.

³² Gordon Kirkpatrick Neill, oral testimony, OH AB 503-1, Oral History Centre, National Library.

³³ Hew Strachan, *The First World War*, New York, 2003, p.340.

1917: 90 years On - Masterpiece to Massacre: the New Zealand Division and three battles

Harper, Glyn

2009-10-11T22:27:03Z

<http://hdl.handle.net/10179/8783>

14/03/2024 - Downloaded from MASSEY RESEARCH ONLINE