3) Calculating a Land Based, Motorised Mobile Fighting Machine's (MFM's) Overall Combat Power Coefficient (OCPC)

Motorised Mobile Fighting Machines (MFMs) include: tanks, command tanks, flame thrower tanks, assault guns, tank destroyers, all types of self-propelled guns, armoured cars, armoured personnel carriers, all types of reconnaissance and observation vehicles, armoured ammunition carriers, armoured trains, miscellaneous AFVs and transport type vehicles. The latter are usually not armed except for the crew with self-defence small arms, but for this purpose we will consider them as MFMs.

The following factors are considered in calculating all MFM's OCPCs. All vehicle Weapons Combat Power Coefficients (WCPCs) calculated in step 1) above (i.e. as detailed in 'Calculating individual Weapon Combat Power Coefficients (WCPCs)'), Battlefield Mobility Factor (MOF), Range of Action (RA), Protection Factor (PR), Shape and Size Factor (SSF), Open Top Factor (OTF), Rapidity of Fire Effect (RFE), Fire Control Effect (FCE), Ammunition Supply Effect (ASE) and Half Track/Wheeled Effect (WHT).[1]

For MFMs the Overall Combat Power Coefficient (OCPC) is given by,

$$OCPC_{MFM} = \left(\left(\sum_{1}^{MBE} WCPC_{MFM} * MOF * RA \right) + \left(PR * SSF * OTF \right) \right) * RFE * FCE * ASE * WHT$$

where $\sum_{1}^{MBE} WCPC_{MFM}$ is the sum of WCPCs for all LMGs and larger weapons on the Mobile Fighting Machine (MFM), added up using modified Multi Barrel Effect (MBE) rules (refer below).

The reader should note that the factors WCPC, MOF and RA are essentially offensive components while PR, SSF and OTF are essentially defensive components. Factors RFE, FCE, ASE and WHT enhance both the offensive and defensive power of the vehicle. Hence the overall combat power is the enhanced sum of the offensive and defensive elements.

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a. MFM Weapons and Multi Barrelled Effect rules

All the individual weapon WCPCs on MFMs are added together using slightly modified Multi Barrelled Effect (MBE) rules.[2] For MFMs the MBE effect does not apply to the first or principal weapon on the MFM. However it applies to all weapons after the first one.

For example, consider the *Panzerkampfwagen* III Ausf F (Sd Kfz 141). This tank has 1x 3.7cm KwK tank gun and 3x MG34 machine guns. The 3.7cm KwK tank gun has a WCPC value of 29 while the AFV mounted MG34s each have a WCPC value of 2.28. The tank's WCPC is then = 29 + 2.28 + (2.28x0.5) + (2.28x0.33) = 33.

When calculating the MFM's WCPC, the primary weapon is always first, followed by the remaining weapons in order of decreasing WCPC values.

Armoured Personnel Carriers (APCs) require special consideration when calculating the overall vehicle WCPC. The weapons value for the APC includes permanently mounted weapons, plus the small arms in the infantry squad typically carried by that APC.[3] If the infantry squad dismounts from the APC then the squad still functions normally as foot infantry with all its small arms. This effectively means giving double value to all squad small arms carried into battle on APCs.

For example, consider the *Mittlere Gepanzerte Mannschaftskraftwagen* (Sd Kfz 251). This APC carries a full German armoured infantry (*Schutzen*) squad: that is a heavy rifle squad with an additional MG34 LMG. In addition the Sd Kfz 251 usually has a permanently mounted MG34 (usually with a swivel mount and a small gun shield).[4] Thus the total Sd Kfz 251 WCPC includes an AFV mounted 7.92mm MG34, an additional MG34 LMG, and all the weapons in a heavy rifle squad. The heavy rifle squad can fire its weapons from inside the APC, or it can operate outside the APC with all its weapons and the additional MG34 LMG. In the latter case

[1] The QJM model does not consider Shape and Size Factor (SSF) and Open Top Factor (OTF), for mobile fighting machines. In addition the Battlefield Mobility Factor (MOF), Protection Factor (PR) and Fire Control Effect (FCE) are considerably simpler and calculated completely differently.
[2] Refer Volume I, Part II 2. 1) i. – 'Calculating individual Weapon Combat Power Coefficients (WCPCs) - Multi Barrelled Effect (MBE)'.
[3] T.N. Dupuy, Numbers, Predictions and War, Hero Books, Fairfax, Virginia 1985, p. 198. QJM uses the same method to calculate total APC weapons. In addition RFE, FCE and ASE factors for APCs are not included in APC calculations.
[4] Some Sd Kfz 251s also mounted another MG34 (or MG42 later in the war) at the rear, also on a swivel mount. The MGs could also be removed in action if required, or if the vehicle was disabled and the crew wanted to dismount with the MG.

the APC (and its dedicated two man crew) gives supporting fire to the heavy rifle squad operating outside the vehicle.

Interestingly enough this is exactly the tactics employed by German panzer grenadiers in APCs operating with tanks. Armoured infantry operating in APCs and supporting tanks is much more effective and less vulnerable than infantry riding on the tanks themselves. This is because in the latter case the infantry has to immediately dismount when the shooting starts, or face annihilation. This means that 'tank riding' infantry immediately revert to foot infantry, in the tactical sense, once the tanks come under even moderate fire. A common perception (unfortunately promoted by many popular war movies) is that it is save to ride into battle on tanks, or stick close to them in battle using the tank for cover. In reality however, tanks usually draw the most intense fire from all sorts of weapons including artillery, mortars, AT guns, AA guns, aircraft and infantry small arms. A single HE shell exploding on the outside, or next to the tank, will not usually affect the tank crew but will wipe out any infantry squad sitting outside on the tank or standing next to it. Most veteran infantry won't even follow a tank into action, unless it's at a reasonable distance or they have some form of armour protection themselves.

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b. Battlefield Mobility Factor (MOF)

The MOF factor is a measure of how mobile the vehicle is around the battlefield. It is often stated that the most successful AFVs are a good balance of mobility, protection and firepower. Hence mobility is a very important factor in determining any MFM's lethality, particularly its ability to change position on the battlefield, or 'battlefield mobility'.

On first analysis, one might believe that the maximum road speed of the vehicle was an appropriate measure of battlefield mobility. However research shows that using this as the basis for the MOF factor presented severe problems in representing true battlefield mobility.[5] These problems include the following.

i. Some vehicles, particularly fast reconnaissance and transport vehicles (trucks), were designed to be fast under certain conditions. However these same vehicles often had very poor cross-country ability. Many armoured cars and other wheeled vehicles did not perform well crossing even moderate terrain. In effect these vehicles would have an apparently higher MOF factor compared to slower fully or semi-tracked vehicles, while in reality the opposite was the case in many tactical situations. This leads to unrealistic results, and alone severely weakens the case for basing MOF on maximum speed.

ii. A vehicle's top speed bears little relationship with its ability to negotiate obstacles, inclines, ditches or rivers. Technical information on WWII tanks often present a lot of information on their ability to negotiate obstacles, the maximum inclines they can ascend, the depth of water they can ford, etc. All these combat enhancing features are ignored if only using top speed.

iii. A lot of technical information on WWII MFMs present a vehicle's top speed, but do not differentiate between top road speed and top cross-country speed. We are really interested in cross-country speed because battles in WWII were rarely fought from roads and the large majority of tactical situations involve moving cross-country.

iv. When information is provided for cross-country speed there is almost no information on what type of terrain constitutes 'cross-country'. It could be anything from a firm, flat, empty field to a marsh filled with thick forest and streams. For that matter there is also no information on what constitutes a 'road', and the average roads in Europe were very different to the average roads in the western USSR during WWII.

v. Some vehicles had the ability to travel on wheels or tracks. The most well known example in Operation Barbarossa is the BT series of Soviet tanks. These tanks could move rapidly in wheel mode on roads but had normal speeds on tracks, which were almost always used in combat or when operating close to the front lines. If simply top speed is used (using its wheels), these types of vehicle would gain an unrealistic boost to their OCPC values.[6]

So what parameters better represent a MFM's true battlefield mobility than simply top speed? After analyses, the most consistent and realistic results were obtained using the maximum horse power of the engine under normal operation, divided by the combat weight. In almost all cases the MFM's power to weight ratio was directly proportional to the vehicle's top road speed and top cross-country speed, as well as the ability of the vehicle to negotiate obstacles and ascend inclines.

[5] The QJM model uses 0.15 x the square root of the vehicle's road speed as the MOF factor.

[6] This type of vehicle already gets a benefit from the Range of Action (RA) factor, because they have longer road range.

Once the MFM's horse power/combat weight ratio (in hp/metric ton) has been established, the MOF factor is determined by using,

$$MOF_{MFM} = \sqrt{power / combat\ weight_{MFM}} * 0.35$$

It is important to use the weight in combat to calculate MOF, because there is often considerable variation between empty and loaded vehicles. Some AFVs carry more fuel and ammunition, as a proportion of their empty weight, than others. Such vehicles enjoy the benefits of longer range (Range of Action (RA)) and more ammunition (Ammunition Supply Effect (ASE)) which are considered below. They must therefore pay the price in lower MOF factors to produce more realistic OCPC values.

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c. Range of Action (RA)

The combat potential of any MFM is affected by its operational range, which is the distance it can travel without refuelling. This Range of Action (RA) is essentially part of the overall battlefield mobility of the MFM.

The two options available in determining the RA factor for MFMs are to use range on roads or cross-country. On balance using the range on roads seemed to produce more realistic and consistent results for several reasons.

i. The variation in RA factors, calculated for fully or semi-tracked vehicles using road range versus cross-country range, was small. Thus for tracked vehicles there was little or no additional realism in using cross-country range to calculate RA, as opposed to the road range.

ii. The information on AFV's cross-country range varied widely depending on sources used. The same sources produced more consistent information when using road range.

iii. There is almost no information on what type of terrain constitutes cross-country. Also what constitutes a road seems to have less variation.

iv. Many wheeled MFM types have no cross-country range given. This is probably because they couldn't move cross-country without considerable difficulty.

Once the MFM range on roads (in kilometres) has been established, the RA factor is determined using,

$$RA_{MFM} = \sqrt{road\ range_{MFM}} * 0.08$$

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d. Protection Factor (PR)

The PR factor is a direct measure of the armour protection on the MFM. The slope and shape of the armour is not included as part of the PR factor: this is included in the Shape and Size Factor (SSF) considered in the next entry. The MFMs benefiting from high PR factors are usually termed AFVs (Armoured Fighting Vehicles).

To measure PR it is simple and possible to use the weight of the vehicle, as it is reasonable to assume that weight is proportional to the level of armour protection.[7] However this takes no account of the size of the AFV or the distribution of armour, which can lead to very strange and unrealistic results. For example, the *Panzerkamfwagen* II Ausf J weighed 18 tons, but it was a tiny tank with only three crew. The actual armour was 80mm on all front surfaces and 50mm on all side and rear surfaces, considerably more heavily armoured than the much larger 25 ton *Panzerkamfwagen* IV Ausf H, which was a main battle tank.[8] However, based on weight only, the Pz IVH would have a considerably higher PR factor.

To obtain the most realistic PR factor we will use armour thickness on the seven principal surfaces of the AFV. These surfaces are:

- Superstructure Front (SF) (below the turret ring on tanks; sometimes called the driver's plate or glacis plate).
- Superstructure Side (SS) (below the turret ring on tanks).

[7] QJM uses weight to determine the PR factor, referred to as the Punishment Factor. QJM has no factors considering AFV shape and size. Generally this means that the QJM's PR factor is inaccurate. However by using the vehicle weight they avoid the even more inaccurate error of placing too much emphasis on the vehicle's front armour thickness and slope. Refer SSF factor entry for more on this.
[8] The *Panzerkamfwagen* IV Ausf H had 50mm front turret armour and 20-30mm side and rear armour.

- Superstructure Rear (SR) (below the turret ring on tanks).
- Turret Front (TF) (includes the gun mantlet, same as superstructure front on turretless AFVs).
- Turret Side (TS) (same as superstructure side on turretless AFVs).
- Turret Rear (TS) (same as superstructure rear on turretless AFVs).
- Average Top (AT) (average of superstructure and turret roof).

AFV structure in WWII can usually be broken down to the hull, superstructure and main turret. The hull of the vehicle is essentially the armoured floor and sides containing the wheel axels, suspension, transmission and engine structure. This is usually the least well armoured part of the AFV (excluding the roof) and has vertical sides. However the exposed hull is usually low down and often protected by wheels and parts of the superstructure. The superstructure and turret form the most important armoured elements of the AFV. These contain the thickest and most steeply sloped armour on the AFV as the vast majority of hits from all weapon types (except AT mines) are on these surfaces. For our purposes we will consider only armour on the superstructure and turret of the AFV.[9]

On AFVs with no rotating turret, such as turretless assault guns, the fighting compartment is considered the ‘turret’. In these cases the superstructure armour extending over the fighting compartment is considered to be the AFV’s ‘turret’ armour. In addition, on some rare AFVs the hull armour on the front and rear extends upwards to a large degree, blurring the distinction between hull and superstructure. In these cases the armour most exposed to hits is used.

The key question now remains: what weighting do we give each surface to determine the overall protection offered by the armour?

The single biggest cause of incorrect and unrealistic AFV armour values being used, in military simulations, is the assumption that the tank’s frontal armour is by far the single most dominant factor in its protection. The more sophisticated tactical-level simulations do use armour facing rules. However the majority of tactical/operational simulations use one value for an AFV’s armour. This is usually based on the frontal armour thickness and degree of slope, leading to ‘theoretical’ AFVs with much heavier protection than the historical AFVs that are meant to be represented. This practice totally ignores the fact that throughout WWII (and even today) tank designers felt it necessary to provide all round protection. The Soviets in particular never skimped on ensuring all-round protection for their tanks. They correctly concluded that AFVs without all-round protection could not survive long enough in assault conditions to fulfil their primary functions.

The main reason for this ‘preoccupation with frontal armour’ is the idea that the main purpose of any WWII tank was to engage enemy AFVs head on. The assumption is that most tanks were lost in this type of combat and this was how they spent most of their time in action. During WWII the reality was the exact opposite. Tanks spent by far the majority of their time fighting non-armoured and non-mobile weapons with high explosive rounds. When they did engage enemy armour, it was often not head on. In addition the majority of tanks were not lost to enemy tank or tank-destroyer gun fire. The majority were lost to AT guns, artillery, mines, close assaulting infantry, infantry AT weapons, air-attack or simply abandoned/blown up as operational losses. All these causes of loss, except the last, demand all-round protection because the majority of hits from these types of attack were probably non-frontal hits.

One of the most famous and leading panzer aces of WWII stated “to destroy an enemy tank is important but to destroy an anti-tank gun is doubly so”.[10] During WWII almost all tankers feared the concealed AT weapon more than enemy armour (and this state of affairs hasn’t changed much on today’s battlefield). The purpose of the AT gun (or AT infantry squad) is to be carefully concealed and then pick off AFVs before they can get a lock or use artillery. In other words the AT gun will almost always get the first few shots, and if they know what they are doing the gun is concealed on approaches so the tank has to show some side angle. As the primary function of the tank is to break through and exploit such defences (not to destroy enemy tanks as such), and as there are many more AT guns around than tanks, then the tank’s ability to survive heavy dug in AT defences is a much truer measure of its protection than its ability to engage enemy armour. Surviving this type of action requires good overall armour protection. In addition aircraft rarely hit the front of a tank. During WWII they invariably dropped a bomb on it, used heavy rockets, or pumped cannon shells through the top. Thick and

[9] AFVs with heavier superstructure and turret armour generally also have a similar proportional increase in hull armour. Therefore the error introduced in the overall PR factor by not considering hull armour, is usually small because the change in most AFV’s PR factor is relatively proportional. It should also be noted that in the SSF factor calculation below, the AFVs with steeply sloped turret and superstructure armour gain more benefit in their overall PR factor by ignoring hull armour because their armour is considered to be all sloped. However the vulnerable hull armour is almost always flat on the sides.

[10] Michael Wittmann with 138 tanks and 132 guns destroyed to his credit, mainly in a Tiger tank. G. Williamson, Aces of the Reich, Arms and Armour Press, London, 1989, p. 89.

well sloped frontal armour provides no significant benefit against this type of attack. Similar arguments can be made for plunging artillery fire, AT mines and close infantry assaults. The irony is that tanks with thick frontal armour are in fact more vulnerable to all these types of attack because they usually have thinner armour everywhere else in order to keep the overall weight down.

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A good historical example of the importance of all round protection is the experience of the Panther tank on the Western Front during 1944-45. This is a particularly suitable example because the Panther tank had excellent frontal protection but mediocre protection on its other surfaces. The frontal protection on the Panther was even superior to that on the heavier Tiger I tank (due to its slope from the vertical and curved gun mantlet), which has prompted several military simulations to give the Panther a superior all-round armour protection value, and some authors to state that, one for one, the Panther was a superior tank.[11]

In 1944/45 the British Army's Office of Research and Analysis commissioned three studies of captured and/or destroyed Panther tanks to analyse causes of loss. These were an examination of 80 Panthers captured between 6th June and 7th August 1944, 96 Panthers captured from 8th to 31st August 1944, and 47 Panthers captured from 17th December 1944 to 16th January 1945.[12] Of the 223 tanks examined, 63 (28%) were destroyed by AP rounds, 8 (4%) by hollow charge (from bazooka or PIAT infantry weapons), 11 (5%) by HE rounds from artillery, 14 (6%) by aircraft (all weapons), 103 (46%) abandoned or blown up their crews, and 24 (11%) from unknown causes. This means that at most only 28% of the tanks were lost due to direct combat with enemy tanks, tank-destroyers or AT guns. Of these, it is reasonable to assume at least 30% (19 tanks) were lost due to penetrations from AT guns. Therefore, at most 20% of total losses were as a result of direct fire from Allied AFVs, and probably a very large proportion of these were side penetrations. At least 23% of total losses were from probable penetrations of side, rear and top armour (from bazooka or PIAT infantry weapons, artillery, AT guns, aircraft rockets and aircraft cannon), and around 57% of total losses were from other causes which had nothing to do with frontal armour at all. In other words what matters most is the tank's all-round survivability and not simply how thick or slopped its frontal armour is.

There are also several other telling statistics which emerge from the British Army's Office of Research and Analysis' reports. The first is shown below and clearly indicates the Tiger I was a significantly tougher all-round tank than the Panther.[13]

Average Number of Hits to Knock out Each Type of Tank (Western Europe, 1944-45)

Tank Type	Average number of hits to knock out the tank	Average number of penetrations to knock out the tank
Panzer VI (Tiger I)	4.2	2.6
Panzer V (Panther)	2.55	1.9
Panzer IV	1.2	1.2
Sherman M-4	1.63	1.55

The average Panther took only 61% of the AP hits that the average Tiger took before it was knocked out. In addition the Tiger was significantly stronger than any other tank at surviving a penetrating hit: in this case the average Panther took only 73% of the penetrative hits that the average Tiger took before it was knocked out. Note, the kinetic energy left in a round after a penetrative hit is inversely proportional to the thickness of armour it penetrates. In other words, the thicker the armour, the less energy a round has left over after a penetration and the less damage it will do to the tank internally. As the Panther had superior frontal protection, the only realistic explanation for all the above figures is that a much higher proportion of the hits were on non-frontal surfaces

[11] E.g. N. Zetterling, Normandy 1944, J.J. Fedorowicz Publishing Inc, Winnipeg, Canada, 2000, p. 59. Zetterling does point out that the Panther had superior mobility and its main gun had superior armour penetration at normal combat ranges. All other factors are, however, ignored, For example; the fact that the Tiger had a superior gun against all other target types and carried more ammunition, despite the Tiger's 88mm round being considerably bigger than the Panther's 75mm round.
[12] Data from: T.L. Jentz, Germany's Panther Tank: The Quest For Combat Supremacy, Schiffer Publishing Ltd, Atglen, PA, 1995, pp. 147 and 153. Also, the some of this data is presented in different form in P. Moore, Operation Goodwood: July 1944 A Corridor of Death, Helion & Company Ltd, Solihull, UK, 2007, Table IX, p. 176.
[13] P. Moore, Operation Goodwood: July 1944 A Corridor of Death, Helion & Company Ltd, Solihull, UK, 2007, Table XII, p. 177. The figures should be treated with some caution, especially as the type of AT weapons used is not shown. It is however reasonable to assume that, on average, the various German tank types came up against similar weapons.

than is commonly perceived: on these surfaces the Tiger I had much thicker armour as well as superior overall protection.

The second important report to emerge from the same series (of reports) goes even further to demonstrate the importance of all round armour protection. A summary of this report is given below:[14]

Distribution of AP Penetrations and AP Failures on German Panzer V (Panther)						
Weapon	Superstructure Front	Turret Front & Gun Mantlet	Turret Side	Superstructure and Hull Side	Turret rear	Superstructure and Hull Rear
Successful Penetrations						
17 Pounder		1	4	9	1	3
3 inch M-10			1	5		1
75mm			1	4		
6 Pounder APDS*		1	1	3		1
6 Pounder APCBC^	1		3	2		
Total	1	2	10	23	1	5
Failed Penetrations						
17 Pounder	2		1			
3 inch M-10	1	1	1			
75mm	1		1	1		
6 Pounder APDS*	3	1				
6 Pounder APCBC^			1			
Total	7	2	4	1	0	0
Total Hits	**8**	**4**	**14**	**24**	**1**	**5**
Penetration/hits	13%	50%	71%	96%	100%	100%
* Special Armour Piercing Discarding Sabot Ammunition (with solid tungsten core, late war)						
^ Armour Piercing Capped Ballistic Capped Ammunition (standard late war AP ammunition)						

The first and most obvious fact from the above data is that no less than 79% of the total hits were on non-frontal surfaces. In other words the Panther's much vaunted frontal armour and slope did not help at all against the large majority of armour piercing (AP) hits from enemy AFVs and AT guns. By far the largest number of hits was on the side (68%). Note, as we have seen above, the proportion of hits from other weapons (such as infantry HEAT weapons, artillery, AT guns, aircraft rockets and aircraft cannon) on the side and rear was likely considerably higher than even this. As we would expect, the data also demonstrates that the Panther's frontal surfaces were well protected, even against the formidable 17 pounder and 6 pounder firing APDS ammunition. However, the sides of the turret (which received 25% of the total hits) were relatively easily penetrated, and the superstructure and hull sides (which received 43% of the total hits) were easily penetrated by even the weakest Allied AT and tank guns. If even the relatively weakly armed 75mm M4 Sherman or Cromwell could outflank the Panther, it could quickly get a killing shot.

The same tank would have to penetrate 80mm of armour on a Tiger I in the same position, which means it would need to get perilously close as well as achieve a good angle hit (i.e. as close to 90 degrees as possible). At the same time, hidden AT guns facing a Tiger I side on, especially at 1-70 degrees of angle, are going to have a much harder time than if facing a Panther in the same position. This is confirmed by the Tiger I consistently achieving a higher kill/loss ratio during WWII compared to the Panther. This was especially apparent against AT guns, artillery and other weapons. Tiger tanks (including Tiger IIs) destroyed at least 10300 enemy tanks and, equally as important, a staggering 11380 AT guns and artillery pieces during WWII. This was achieved for the loss of 1725 Tigers (including a large number of operational and strategic losses, i.e. abandoned, broken down, etc). [15] When destroyed AFVs, AT guns, artillery, infantry, and other weapons and equipment are

[14] P. Moore, Operation Goodwood: July 1944 A Corridor of Death, Helion & Company Ltd, Solihull, UK, 2007, Table XV, p. 178. The sample used for this table is rather small (56 AP hits), but the trend is clear.

[15] Note, Tiger I production was 1354 and Tiger II production was 489, which leaves a total of 118 Tigers unaccounted for. Data compiled from: W. Schneider, Tigers in Combat I, JJ Fedorowicz Publishing Inc, Canada, 1994, and W. Schneider, Tigers in Combat II, JJ Fedorowicz Publishing Inc, Canada, 1998, and C. W. Wilbeck, Sledgehammers: Strength and Flaws of Tiger Tank Battalions in WWII, The Aberjona Press, Bedford, Pennsylvania, 2004, pp. 182-191.

included, the Tiger I tank almost certainly achieved the highest kill/loss ratio of any tank in history.[16] There is no doubt that the Tiger tank's success was largely due to its all-round protection.

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On balance, any equation attempting to calculate a realistic single armour protection figure for AFVs in WWII, should give the following approximate weighting to the various surfaces: 45% front (turret front and superstructure front), 35% for both sides (17.5% to each turret side and superstructure side), 10% rear (turret rear and superstructure rear) and 10% top (turret top and superstructure top). This will ensure a reasonably realistic figure for 'overall armour protection' against the multitude of anti-tank weapons fielded against AFVs during WWII.

Once the average armour thickness (in mm) has been established on the various AFV surfaces, the PR factor is therefore determined by,

$$PR_{MFM} = ((0.2 * SF) + (0.2 * SS) + (0.05 * SR) + (0.25 * TF) + (0.15 * TS) + (0.05 * TR) + (0.1 * AT)) * 3.5$$

where SF is the Superstructure Front armour thickness in mm, SS is the Superstructure Side, SR is the Superstructure Rear, TF is the Turret Front, TS is the Turret Side, TR is the Turret Rear and AT is the Average Top (superstructure and turret roof).

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[16] Detailed examination shows the Tiger I actually achieved a higher KR than the Tiger II. This was due to the strategic situation in 1945, which resulted in many Tiger IIs being abandoned or destroyed by their crews to prevent capture.