**Advance Rates in Combat**

**based upon Outcome**

By Christopher A. Lawrence

*The Dupuy Institute*

24 April 2023

**Advance Rates in Combat:**

 Units maneuver before and during a battle to achieve a more favorable position. This maneuver is often unopposed and is not the subject of this discussion. Unopposed movement before combat is often quite fast, although often not as fast as people would like to assume. Once engaged with an opposing force, the front line between them also moves, usually moving forwards if the attacker is winning and moving backwards for the defender if he is losing or choosing to withdraw. These are opposed advance rates. This section is focused on discussing opposed advance rates or “advance rates in combat.”

 The operations research and combat modeling community have often taken a short-hand step of predicting advance rates in combat based upon force ratios, so that a force with a three-to-one force ratio advances faster than a force with a two-to-one force ratio. But, there is not a direct relationship between force ratios and advance rates. There is an indirect relationship between them, in that higher forces ratios increased the chances of winning, and winning the combat and the degree of victory helps increase advance rates. There is little analytical work that has been done on this subject.[[1]](#footnote-1)

 Opposed advance rates are very much influenced by 1) terrain, 2) weather and 3) the degree of mechanization and mobilization, in addition to 4) the degree of enemy opposition. These four factors all influence what the rates will be.

 In a study *The Dupuy Institute* did on enemy prisoner of war capture rates, we ended up coding a series of engagements by outcome. This has proven to a useful coding for the examination of advance rates. Engagements codes as outcomes I and II (limited action and limited attack) are not of concern for this discussion. The engagement coded as attack fails (outcome III) is significant, as these are cases where the attacker is determined to have failed. As such they often do not advance at all, sometimes have a very limited advance and sometimes are even pushed back (have a negative advance). For example, in our work on the subject, of our 271 division-level engagements from Western Europe 1943-45 the average advance rate was 1.81 kilometers per day. For Eastern Europe in 1943 the average advance rate was 4.54 kilometers per day based upon 173 division-level engagements.[[2]](#footnote-2) These advance rates are irrespective of what the force ratios are for an engagement.

 In contrast, in those engagements where the attacker is determined to have won and is coded as attacker advances (outcome IV) the attacker advances an average of 2.00 kilometers in the 142 engagements from Western Europe 1943-45. The average force ratio of these engagements was 2.17. In the case of Eastern Europe in 1943, the average advance rate was 5.80 kilometers based upon 73 engagements. The average force ratio of these engagements was 1.62.

 We also coded engagements where the defender was penetrated (outcome V). These are those cases where the attacker penetrated the main defensive line of the defending unit, forcing them to either withdraw, reposition or counterattack. This penetration is achieved by either overwhelming combat power, the end result of an extended operation that finally pushes through the defenses, or a gap in the defensive line usually as a result of a mistake. Superior mechanization or mobility for the attacker can also make a difference. In those engagements where the defender was determined to have been penetrated the attacker advanced an average of 4.12 kilometers in 34 engagements from Western Europe 1943-45. The average force ratio of these engagements was 2.31. In the case of Eastern Europe in 1943, the average advance rates was 11.28 kilometers based upon 19 engagements. The average force ratio of these engagements was 1.99.

 This clearly shows the difference in advance rate based upon outcome. It is only related to force ratios to the extant the force ratios are related to producing these different outcomes.

 Also of significance is terrain and weather. Needless to say, significant blocking obstacles like bodies of water, can halt an advance and various rivers and creeks often considerably slow them, even with engineering and bridging support. Rugged terrain is more difficult to advance through and easier to defend and delay then smoother terrain. Closed or wooded terrain is more difficult to advance through and easier to defend and delay then open terrain. Urban terrain tends to also slow down advance rates, being effectively “closed terrain.” If it is raining then advance rates are slower than in clear weather. Sometimes considerably slower in heavy rain. The season it is, which does influence the amount of daylight, also affects the advance rate. Units move faster in daylight than in darkness. This is all heavily influenced by the road network and the number of roads in the area of advance.

 No systematic study of advance rates has been done by the operations research community. Probably the most developed discussion of the subject was the material assembled for the combat models developed by Trevor Dupuy. This included addressing the effects of terrain and weather and road network on the advance rates. A combat model is an imperfect theory of combat.

 Even though this combat modeling effort is far from perfect and fundamentally based upon quantifying factors derived by professional judgment, tables derived from this modeling effort have become standard presentations in a couple of U.S. Army and USMC planning and reference manuals. This includes U.S. Army Staff Reference Guide and the Marine Corps’ MAGTF Planner’s Reference Manual.[[3]](#footnote-3)

The original table, from *Numbers, Predictions and War*, is here:[[4]](#footnote-4)

STANDARD (UNMODIFIED) ADVANCE RATES

 Rates in km/day

 Armored Mechzd. Infantry Horse Cavalry

 Division Division Division Division or

 or Force Force

Against Intense Resistance

 (P/P: 1.0-1.1O)

Hasty defense/delay 4.0 4.0 4.0 3.0

Prepared defense 2.0 2.0 2.0 1.6

Fortified defense 1.0 1.0 1.0 0.6

 Against Strong/Intense Resistance

 (P/P: 1-11-125)

Hasty defense/delay 5.0 4.5 4.5 3.5

Prepared defense 2.25 2.25 2.25 1.5

Fortified defense 1.25 1.25 1.25 0.7

Against Strong Defense

 (P/P: 1.26-1.45)

Hasty defense/delay 6.0 5.0 5.0 4.0

Prepared defense 2.5 2.5 2.5 2.0

Fortified defense 1.5 1.5 1.5 0.8

Against Moderate/Strong Resistance

 (P/P: 1.46-1.75)

Hasty defense 9.0 7.5 6.5 6.0

Prepared defense 4.0 3.5 3.0 2.5

Fortified defense 2.0 2.0 1.75 0.9

Against Moderate Resistance

 (P/P: 1.76-225)

Hasty defense/delay 12.0 10.0 8.0 8.0

Prepared defense 6.0 5.0 4.0 3.0

Fortified defense 3.0 2.5 2.0 1.0

Against Slight/Moderate Resistance

 (P/P:2.26-3.0)

Hasty defense/delay 16.0 13.0 10.0 12.0

Prepared defense 8.0 7.0 5.0 6.0

Fortified defense 4.0 3.0 2.5 2.0

Against Slight Resistance

 (P/P: 3.01-4.25)

Hasty defense/delay 20.0 16.0 12.0 15.0

Prepared defense 10.0 8.0 6.0 7.0

Fortified defense 5.0 4.0 3.0 4.0

Against Negligible/Slight Resistance

 (P/P:4.26-6.00)

Hasty defense/delay 40.0 30.0 18.0 28.0

Prepared defense 20.0 16.0 10.0 14.0

Fortified defense 10.0 8.0 6.0 7.0

Against Negligible Resistance

 (P/P: 6.00 plus)

Hasty defense /delay 60.0 48.0 24.0 40.0

Prepared/fortified defense 30.0 24.0 12.0 12.0

\*Based on HERO studies: ORALFORE, Barrier Effectiveness, and Combat Data Subscription Service.

\*\* For armored and mechanized infantry divisions, these rates can be sustained for 10 days only; for the next 20 days standard rates for armored and mechanized infantry forces cannot exceed half these rates.

 This is a modeling construct built from historical data. These are “unmodified” rates. The modifications include: 1) General Terrain Factors (ranging from 0.4 to 1.05 for Infantry (combined arms) Force and from 0.2 to 1.0 for Cavalry or Armored Force, 2) Road Quality Factors (addressing Road Quality from 0.6 to 1.0 and Road Density from 0.6 to 1.0), 3) Obstacles Factors (ranging from 0.5 to 0.9 for both a River or steam and for Minefields), 4) Day/Night with night advance rate one-half of daytime advance rate and 5) Main Effort Factor (ranging from 1.0 to 1.2). These last five sets of tables are not shown here, but can be found in his writings.[[5]](#footnote-5)

1. The most significant works we are aware of is Trevor Dupuy’s ORALFORE study in 1972: Opposed Rates of Advance in Large Forces in Europe (ORALFORE), (TNDA, for DCSOPS, 1972); Trevor Dupuy’s 1979 book *Numbers, Predictions and War*; and a series of three papers by Robert Helmbold (Center for Army Analysis): “Rates of Advance in Land Combat Operations, June 1990,” “Survey of Past Work on Rates of Advance, and “A Compilation of Data on Rates of Advance.” [↑](#footnote-ref-1)
2. See paper on the subject by Christopher A. Lawrence, “Advance Rates in Combat based upon Outcome,” posted on the blog *Mystics & Statistic*, April 2023. In the databases, there were 282 Western Europe engagements from September 1943 to January 1945. There were 256 Eastern Front engagements from February, March, July and August of 1943. [↑](#footnote-ref-2)
3. See U.S. Army Staff Reference Guide, Volume I: Unclassified Resources, December 2020, ATP 5-0.2-1, pages xi and 220; and MAGTF Planner’s Reference Manual, MSTF pamphlet 5-0.3, October 2010, page 79. Both manuals include a table for division-level advances which is derived from Trevor Dupuy’s work, and both manuals contain a table for brigade-level and below advances which are calculated per hour that appear to also be derived from Trevor Dupuy’s division-level table. The U.S. Army manual gives the “brigade and below” advance rates in km/hr while the USMC manual, which appears to be the same table, gives the “brigade and below” advance rates in km/day. This appears to be a typo. [↑](#footnote-ref-3)
4. *Numbers, Predictions and War*, pages 213-214. The sixth line of numbers, three numbers were changes from 1.85 to 1.25 as this was obviously a typo in the original. [↑](#footnote-ref-4)
5. See *Numbers, Predictions and War*, pages 214-216. [↑](#footnote-ref-5)