

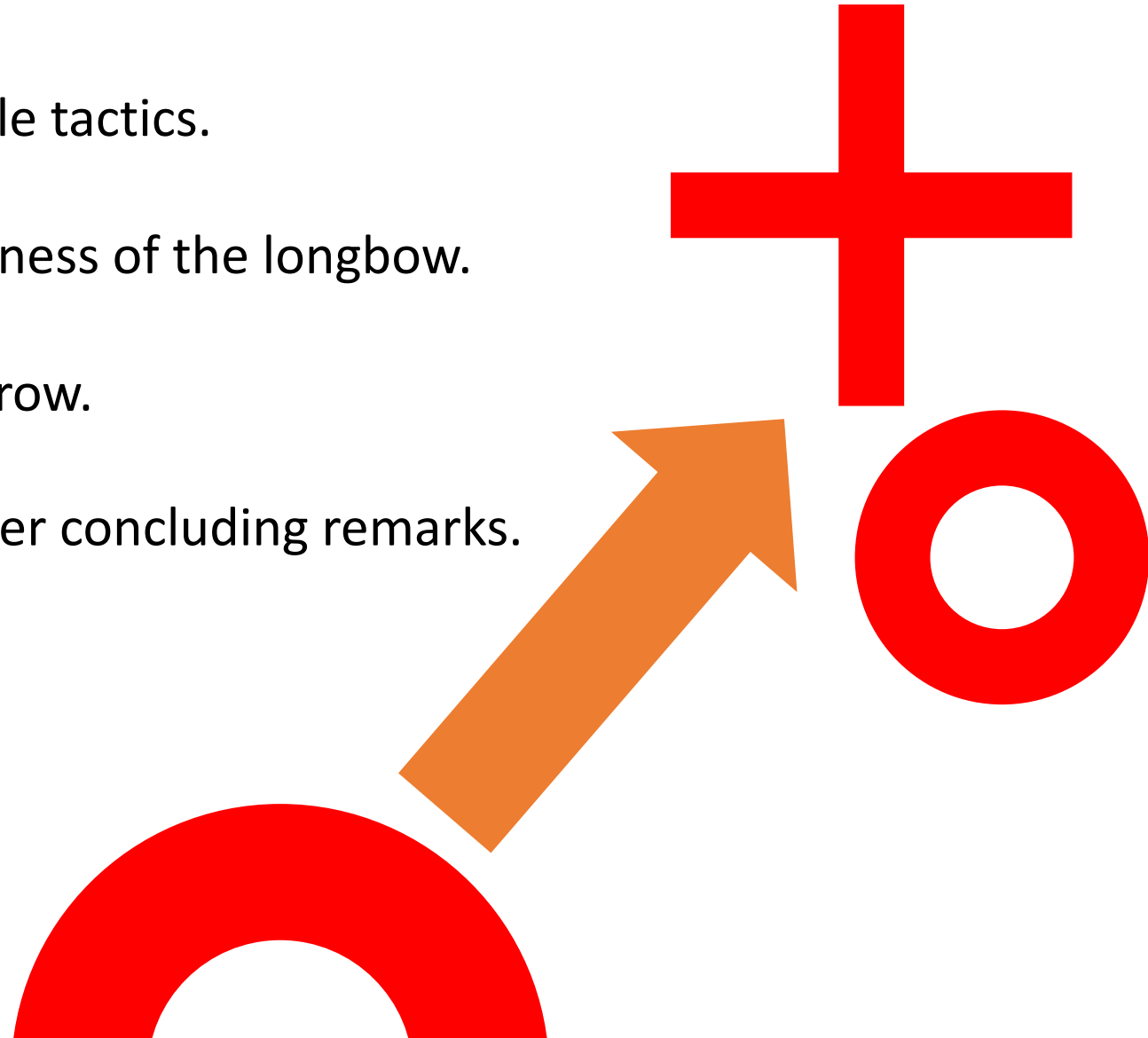
*“Was the
longbow the
most decisive
factor at the
Battle of
Agincourt?”*

By Frazer Graham (1907690)



Content

1. Discuss chronological events and battle tactics.
2. Identify factors affecting the effectiveness of the longbow.
3. Penetration mechanics of a bodkin arrow.
4. Return back to the question and deliver concluding remarks.



The Belligerents

Kingdom of England Led by King Henry V

	English Men-at-arms	- 1000 men
	English Bowmen	- 5000 Men

Kingdom of France Led by a coalition of nobles and dukes

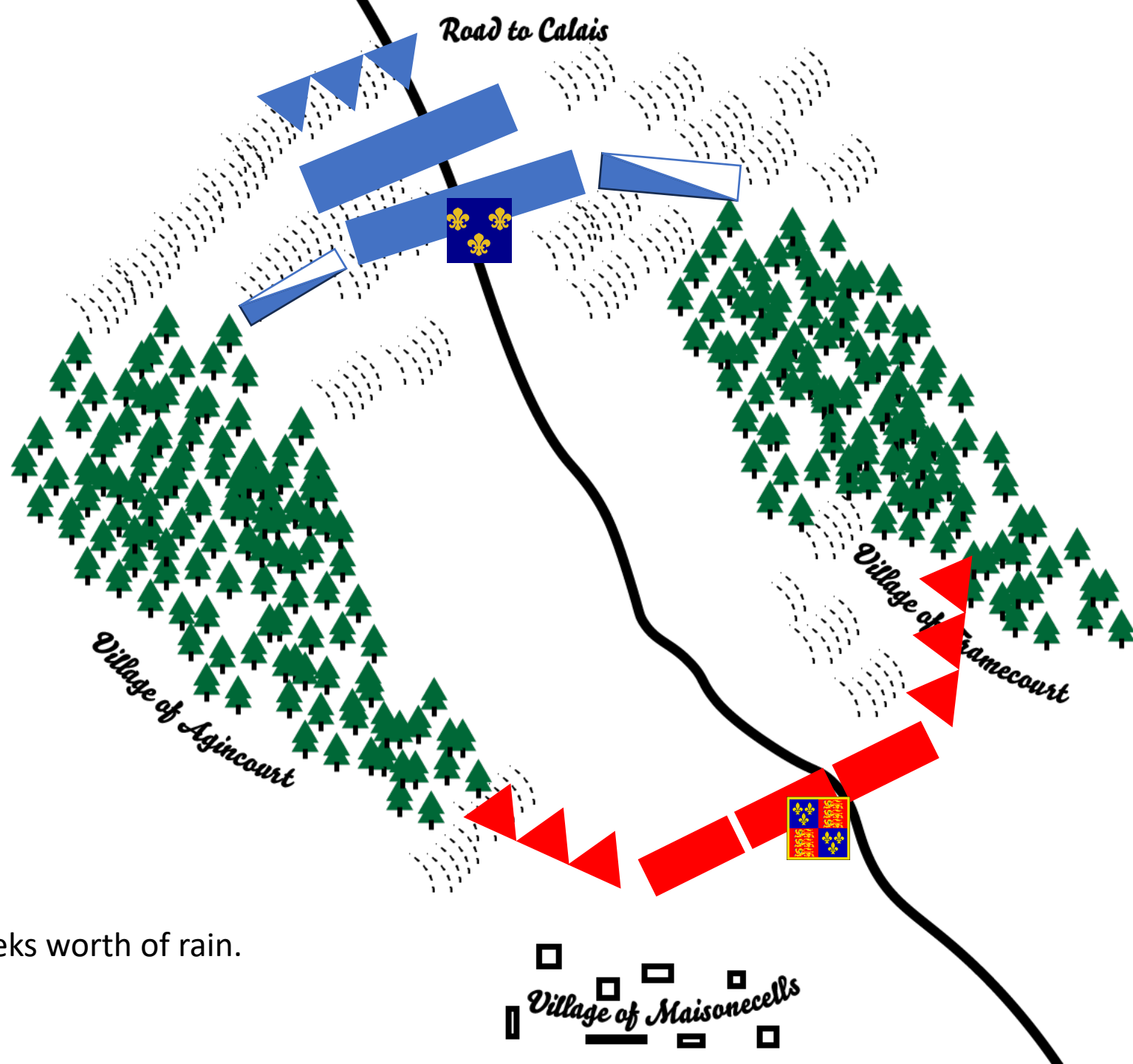
	French Cavalry	- 1200 Men
	French Men-at-arms	- 10000 Men
	French Crossbowmen	- 4000 Men



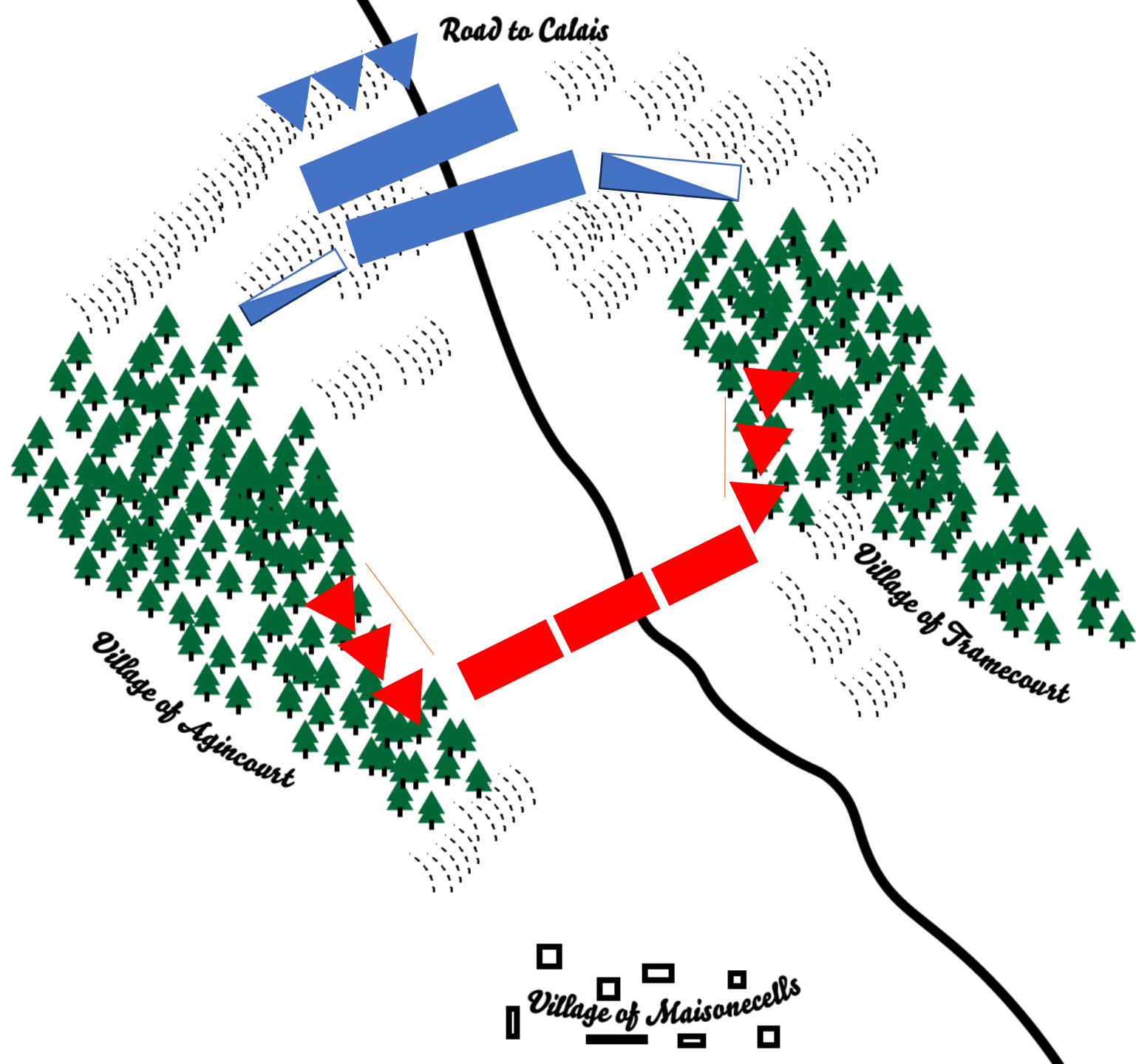
-  French Cavalry
-  French Men-at-arms
-  French Crossbowmen
-  English Men-at-arms
-  English Bowmen

Terrain:

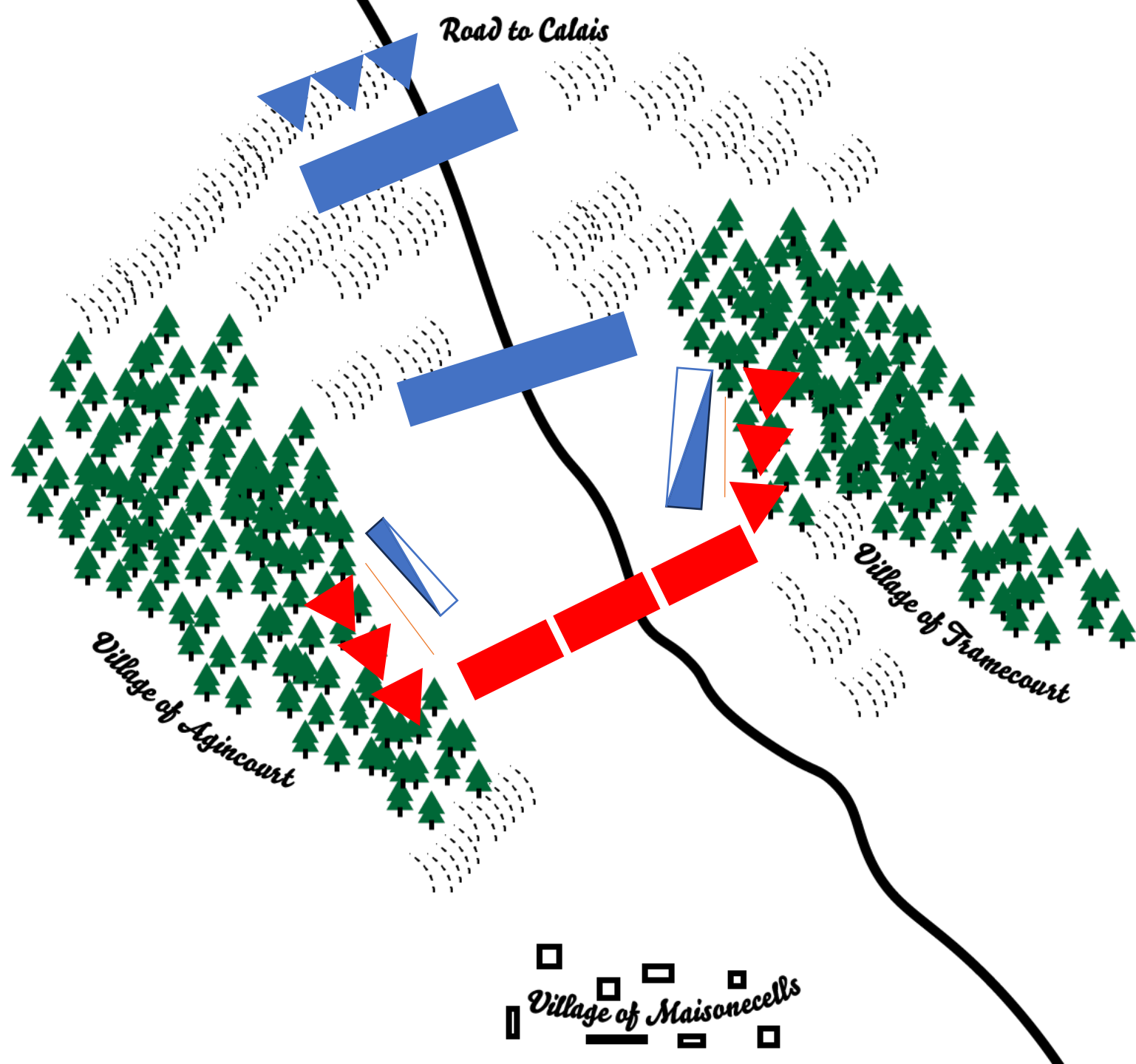
A ploughed field, affected by a weeks worth of rain.



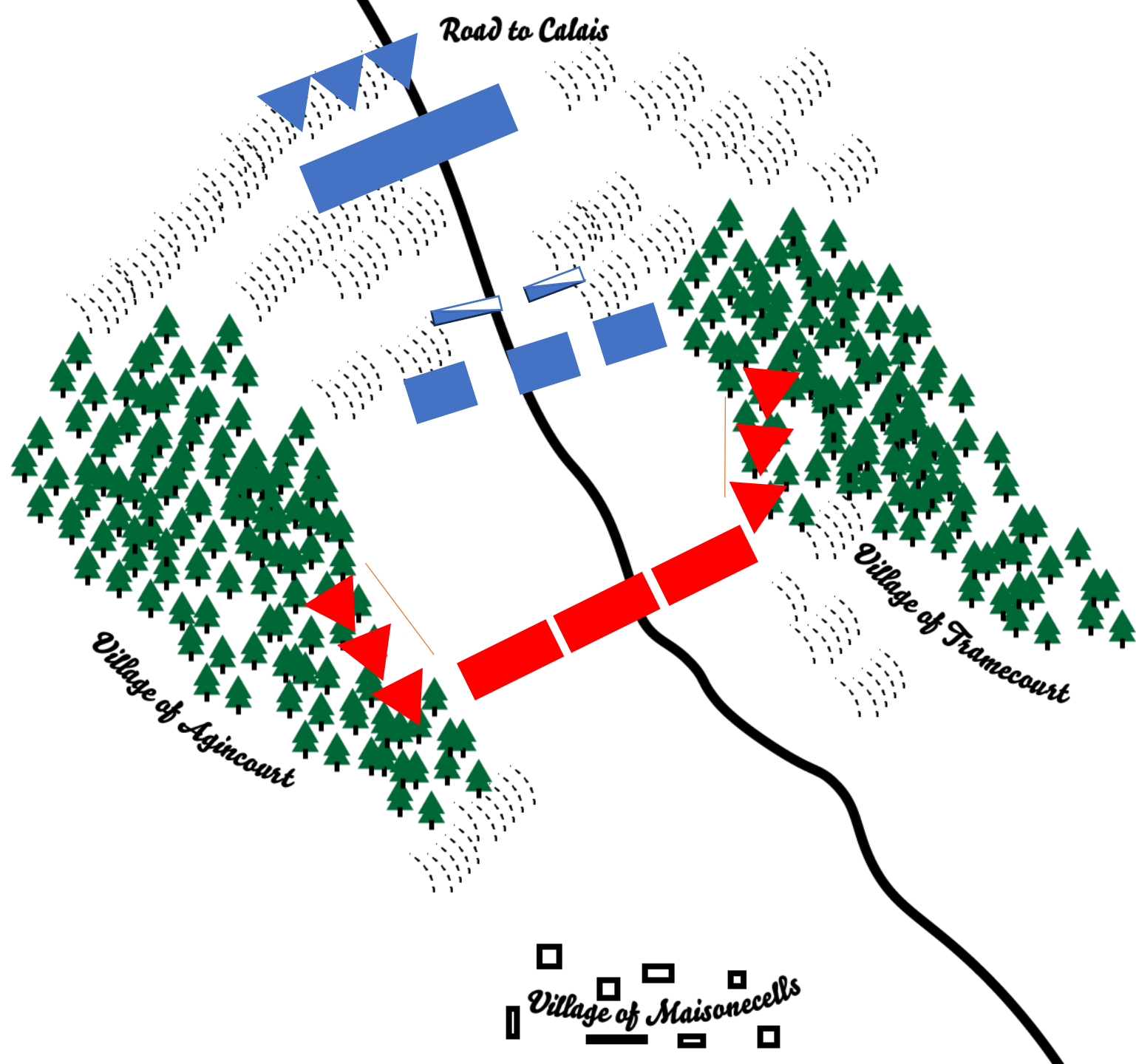
-  French Cavalry
-  French Men-at-arms
-  French Crossbowmen
-  English Men-at-arms
-  English Bowmen



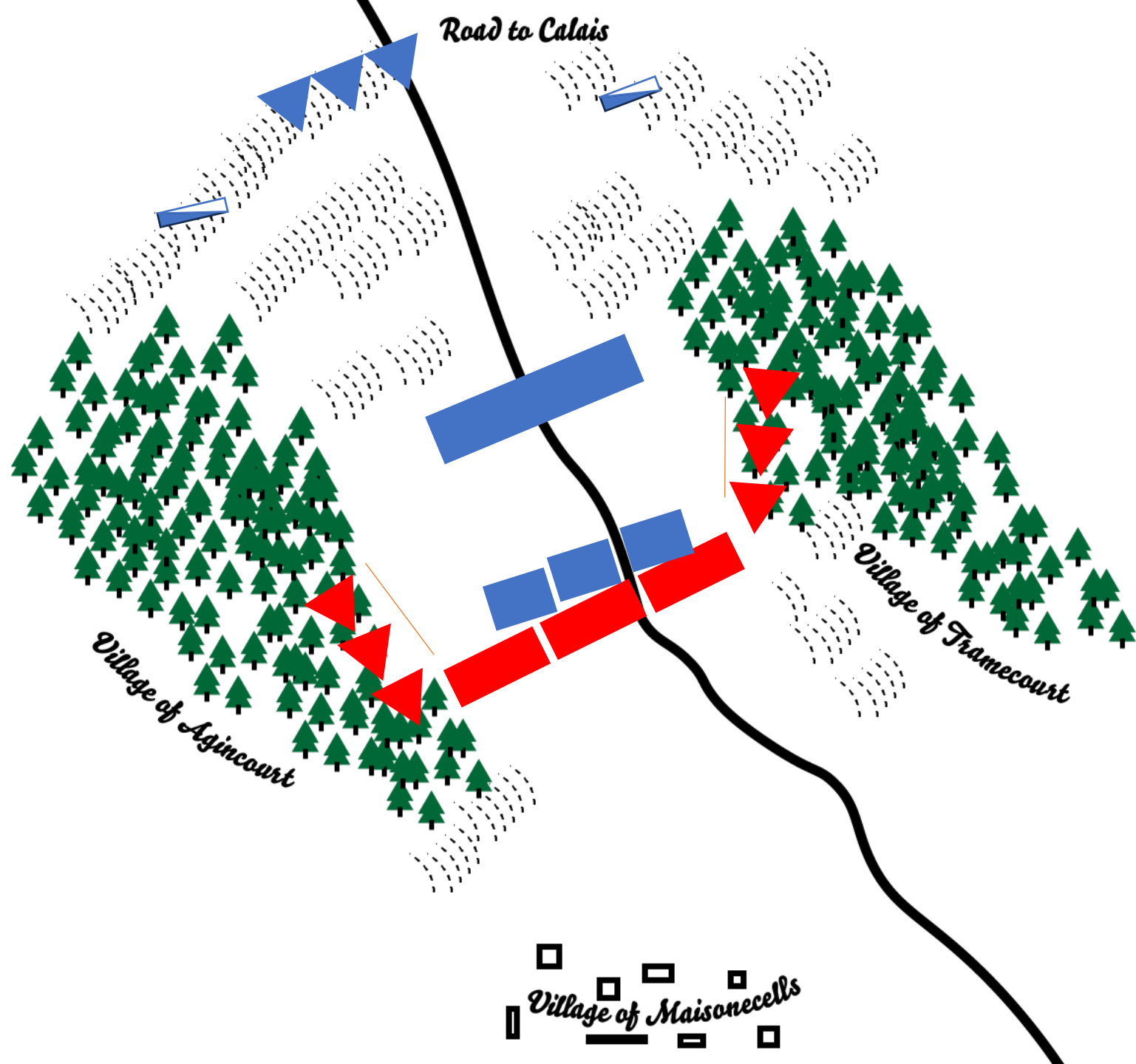
-  French Cavalry
-  French Men-at-arms
-  French Crossbowmen
-  English Men-at-arms
-  English Bowmen



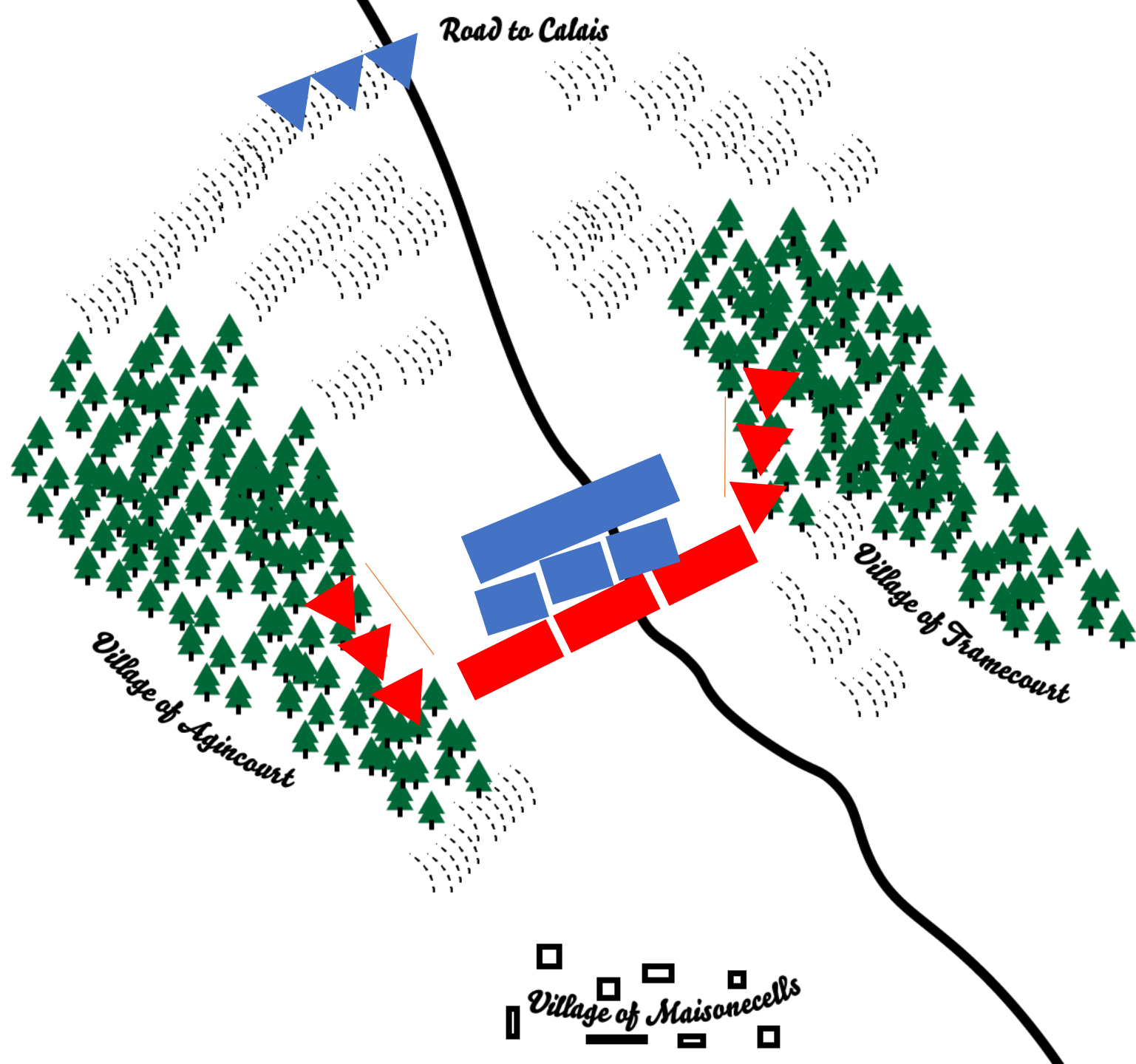
-  French Cavalry
-  French Men-at-arms
-  French Crossbowmen
-  English Men-at-arms
-  English Bowmen



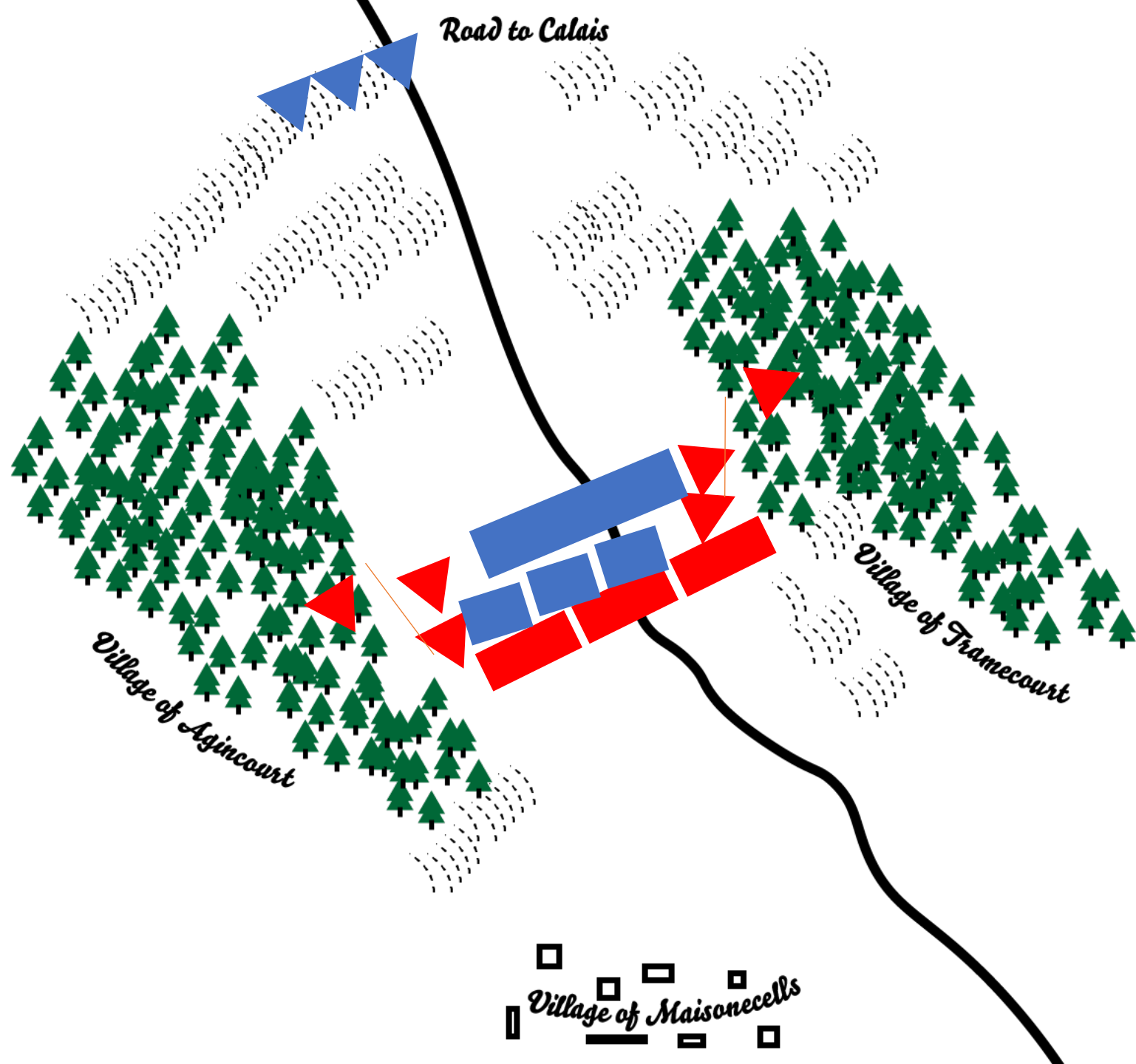
-  French Cavalry
-  French Men-at-arms
-  French Crossbowmen
-  English Men-at-arms
-  English Bowmen



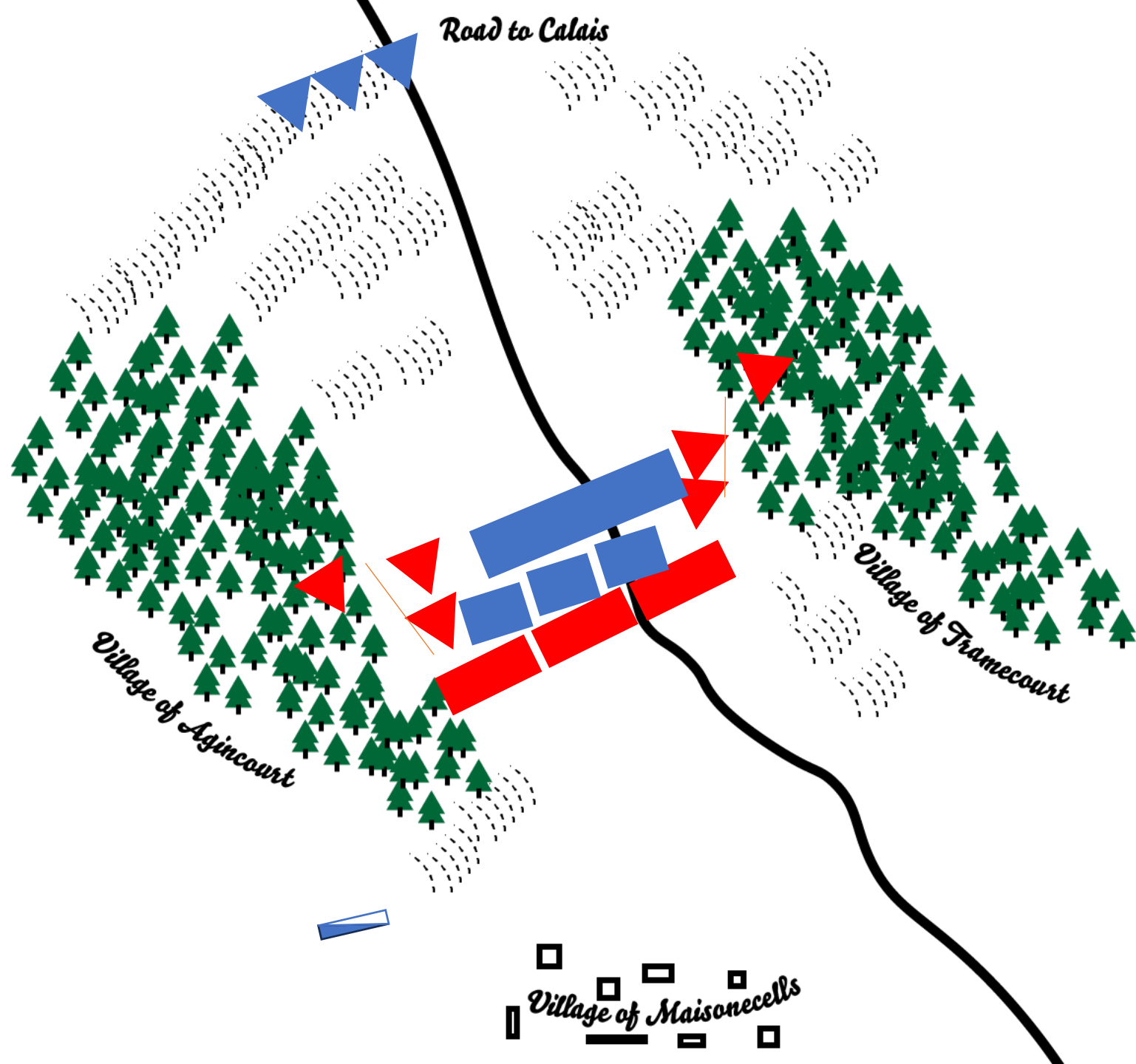
-  French Cavalry
-  French Men-at-arms
-  French Crossbowmen
-  English Men-at-arms
-  English Bowmen



-  French Cavalry
-  French Men-at-arms
-  French Crossbowmen
-  English Men-at-arms
-  English Bowmen

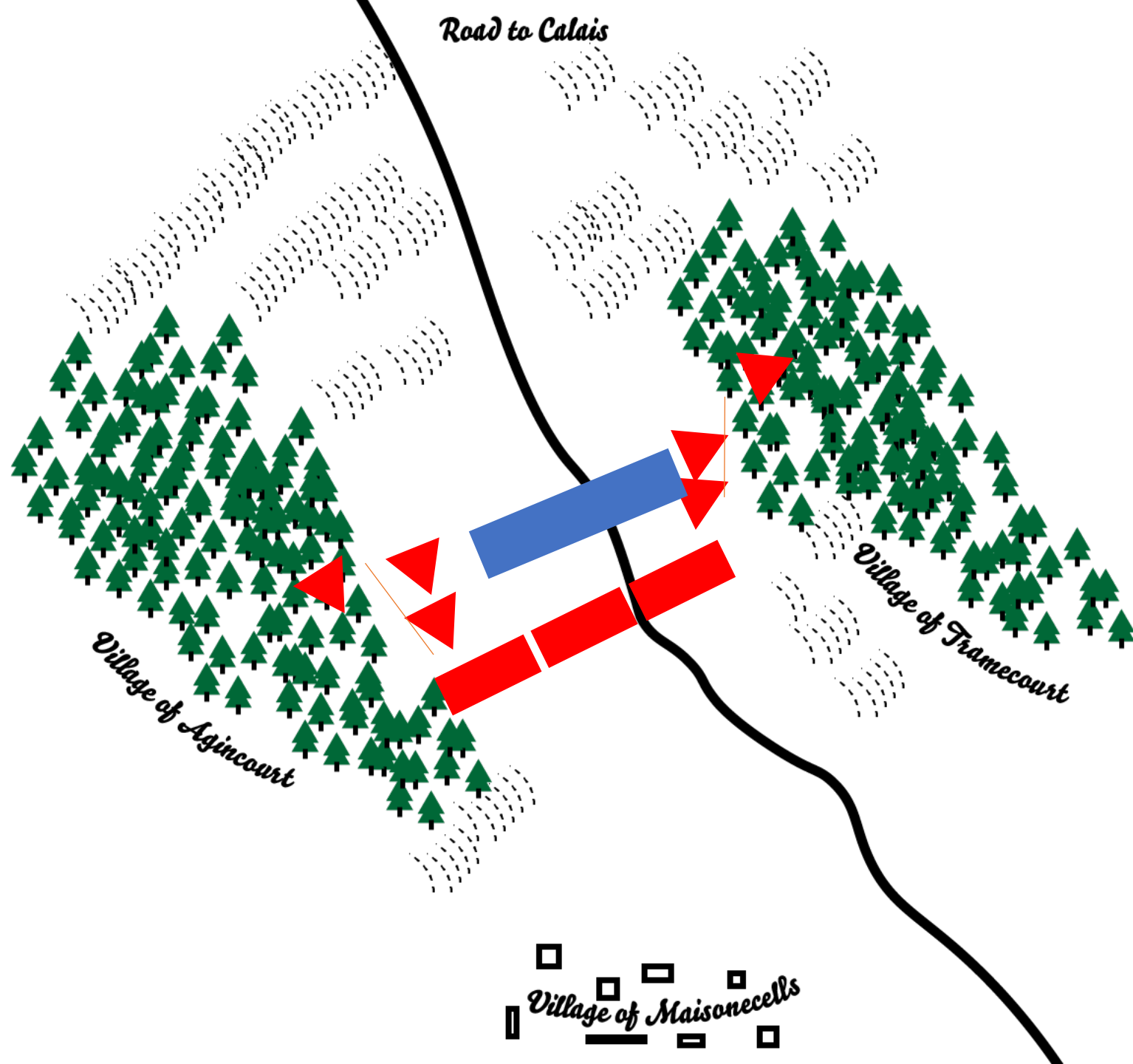


-  French Cavalry
-  French Men-at-arms
-  French Crossbowmen
-  English Men-at-arms
-  English Bowmen

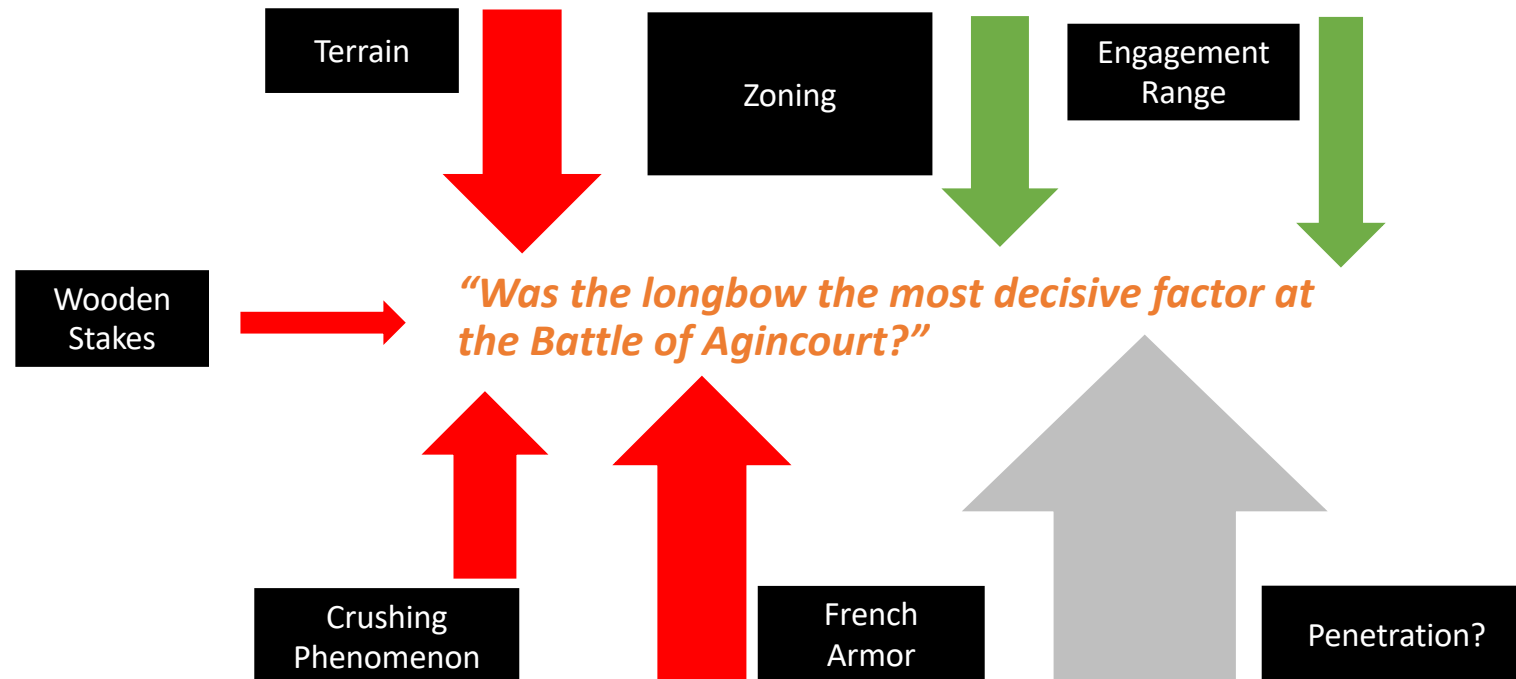


-  French Cavalry
-  French Men-at-arms
-  French Crossbowmen
-  English Men-at-arms
-  English Bowmen

Estimated Casualties:
5000 – 10,000 French
500 – 1000 English



POSITIVE AND NEGATIVE FACTORS

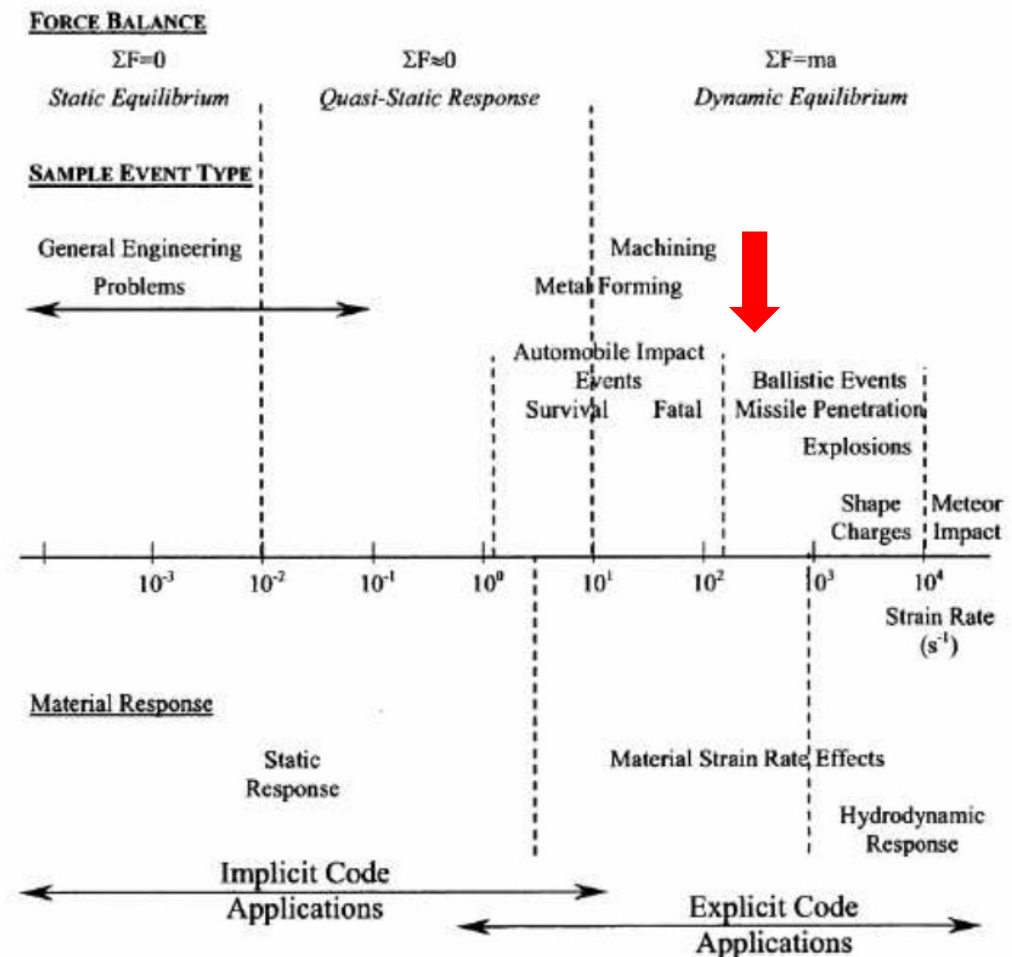


PENETRATION MECHANICS

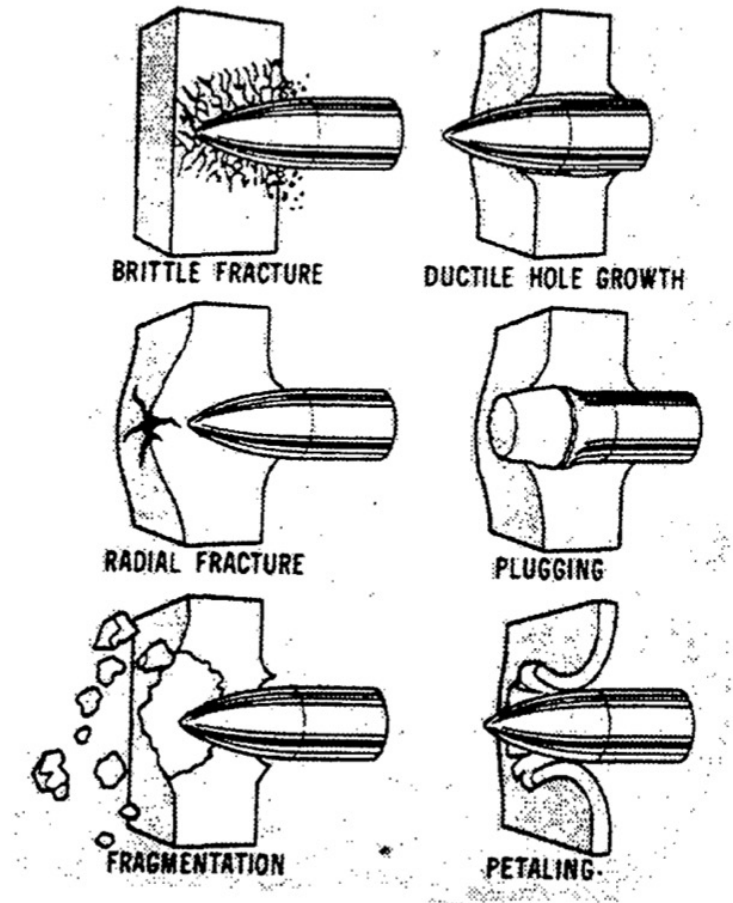
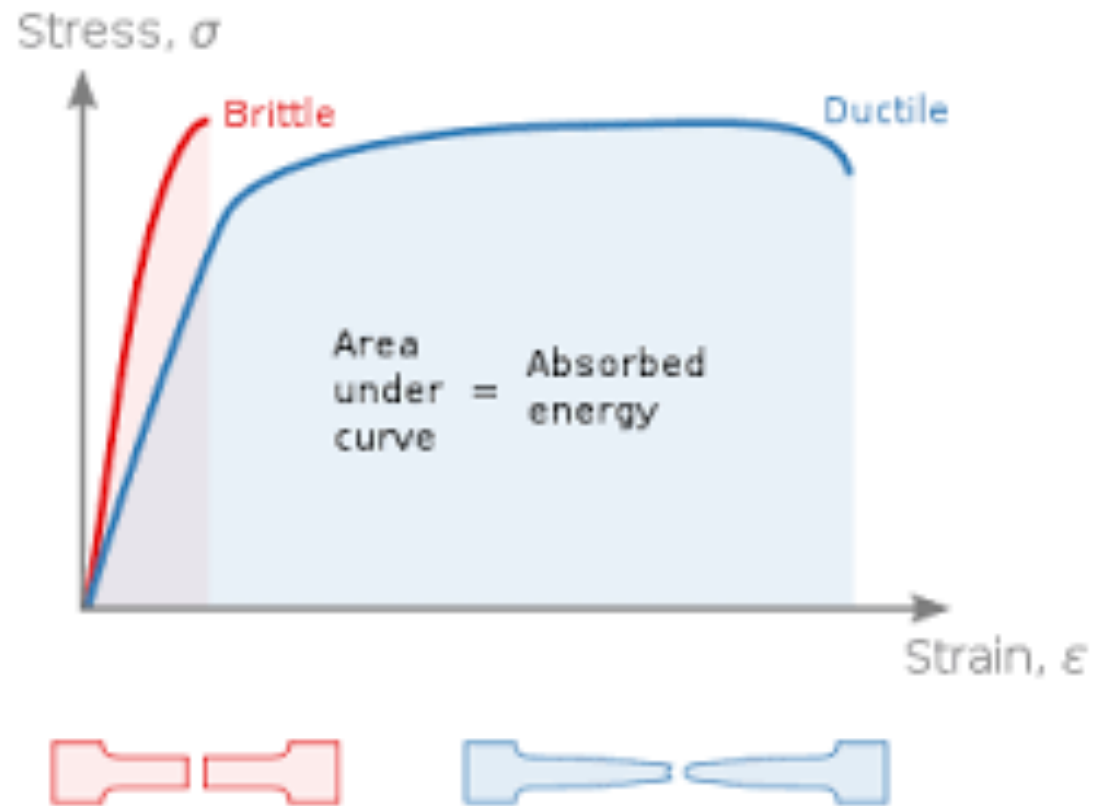
At 100m the velocity on the penetrator is roughly 54 – 63m/s. Weighing 0.116Kg.

$$K_e = \frac{1}{2}MV^2 = \sim 170 - 230J$$

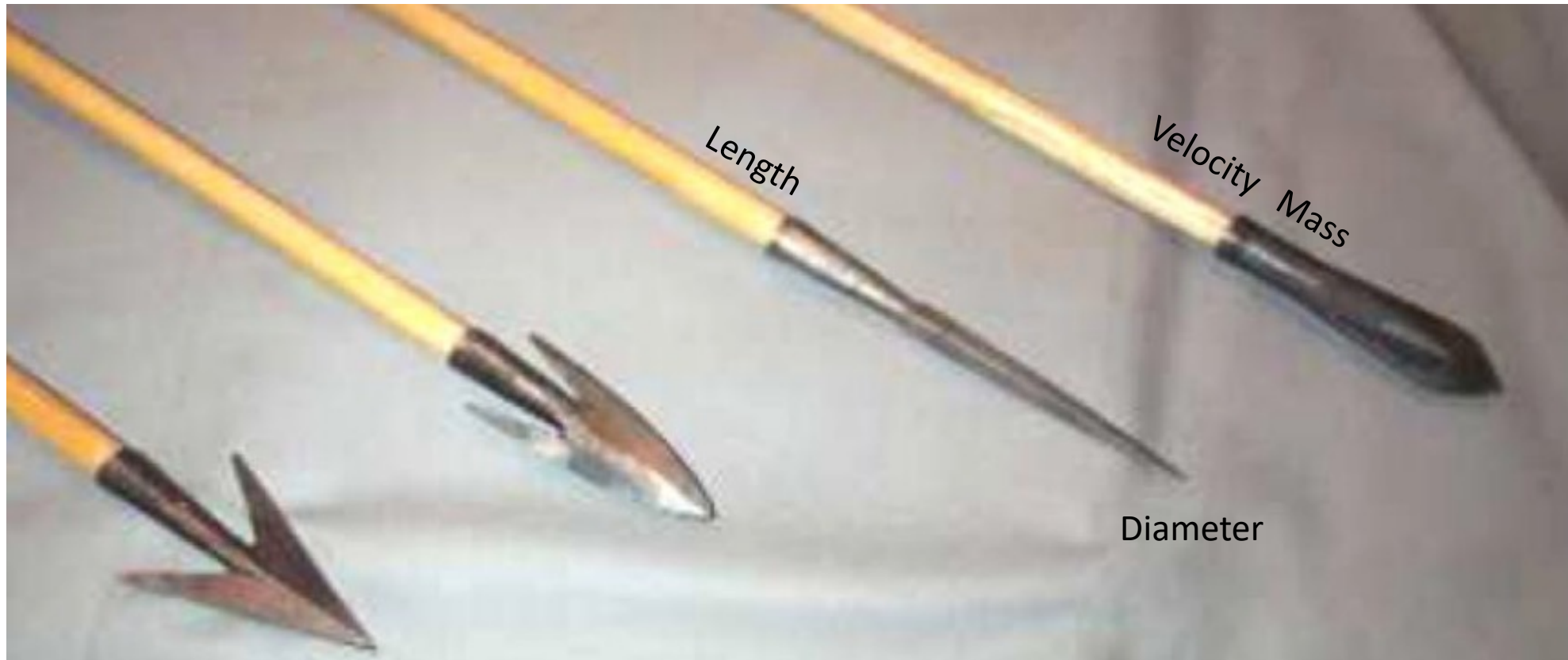
No taking into account angle of contact.



The armor



The Penetrators



Penetration Equations

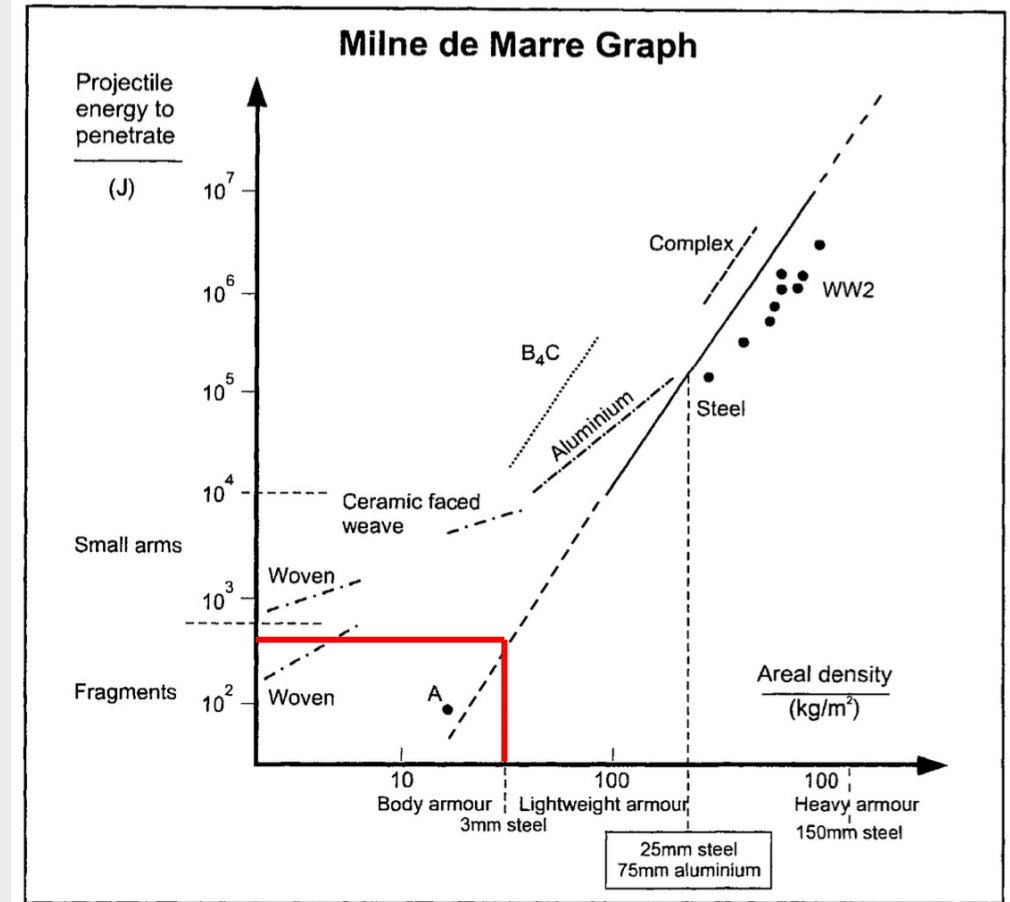
Milne and De Marre Formula

$$E_c = aD^{1.5}h_o^{1.5}$$

Jowett Equation (1986)

$$\frac{E_c}{\sigma_u D^3} = 0.38 \left(\frac{h_o}{D} \right)^{0.84} \left(\frac{W}{D} \right)^{0.61}$$

THE MILNE DE MARRE GRAPH



At 100m the velocity on the penetrator is roughly 54 – 63m/s.
Weighing 0.116Kg.

$$K_e = \frac{1}{2}MV^2 = \sim 170 - 230J$$

No taking into account angle of contact.

Jowett Equation (1986)

$$\frac{E_c}{\sigma_u D^3} = 0.38 \left(\frac{h_o}{D} \right)^{0.84} \left(\frac{W}{D} \right)^{0.61}$$

$$\left(0.38 \left(\frac{0.003}{0.011} \right)^{0.84} \left(\frac{0.116}{0.011} \right)^{0.61} \right) (500 * 10^6 * 0.011^3) = 361 J$$

Milne and De Marre Formula

$$E_c = aD^{1.5}h_o^{1.5} \quad \frac{500}{0.011^{1.5} * 0.003^{1.5}} = 2.64 * 10^9$$

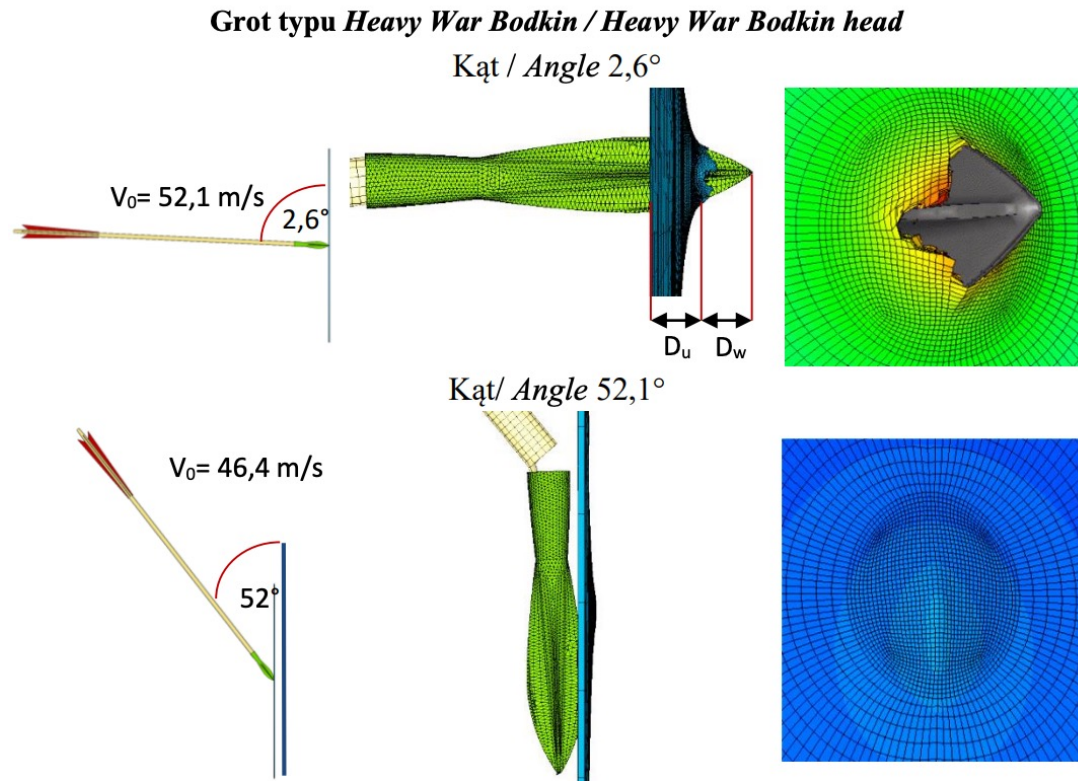
$$E_c = f(W, L, D, \sigma_u, h_o)$$

$$\frac{E_c}{\sigma_u D^3} = \frac{a}{\sigma_u h_o^{-0.1}} \left(\frac{h_o}{D} \right)^{1.5}$$

$$\left(\frac{2.64 * 10^9}{500 * 10^6 * 0.003^{-0.1}} \left(\frac{0.003}{0.011} \right)^{1.5} \right) (500 * 10^6 * 0.011^3) = 279 J$$

$$\begin{aligned} \sigma_u &= 500 * 10^6 Pa \\ D &= 0.011 m \\ W &= 0.116 Kg \\ h_o &= 0.003m \end{aligned}$$

Alternative Findings



Numerical Analysis of English bows used in Battle of Crecy – Military Institute of Armament Technology - Poland



Tod's Workshop – Supported by Dr Tobias Capwell, most detailed practical work completed

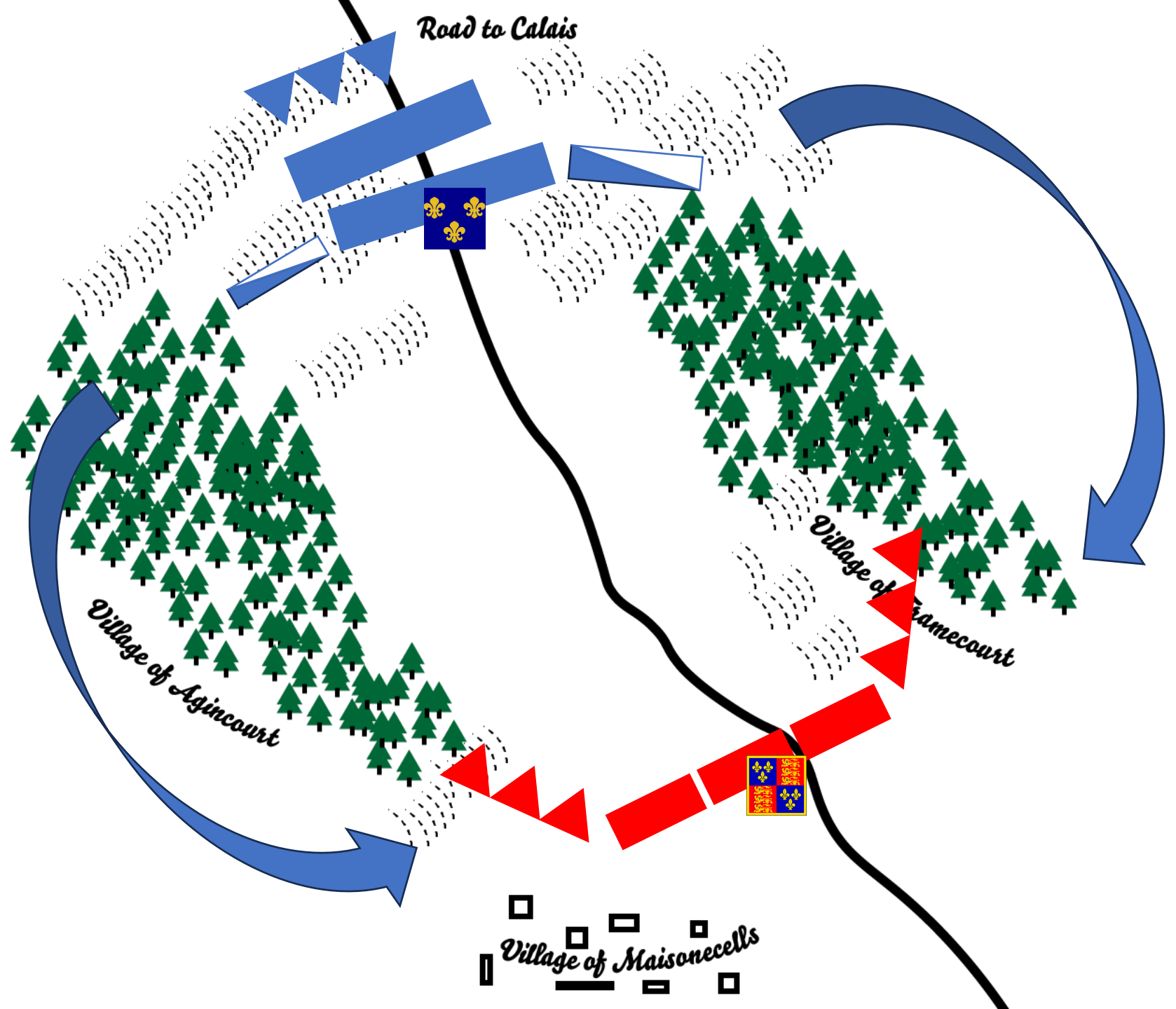
Conclusion

“Was the longbow the most decisive factor at the Battle of Agincourt?”

- The bodkin arrow could not penetrate 3mm plate armor. However, it could penetrate lighter plates (Shoulder, gauntlets, horse barding).
- The sheer volume of arrows played an effective part in wounding, slowing, and **zoning** the enemy.

The combination of terrain, stakes, and tactics prevented the archers from being over-run.

-  French Cavalry
-  French Men-at-arms
-  French Crossbowmen
-  English Men-at-arms
-  English Bowmen





Any questions?

References

- [1] A.Currey, The Battle of Agincourt, Boydell Press, 2000.
- [2] C.J.Rogers, "The battle of Agincourt," in The hundred Years War (PART II) , Brill, 2008, pp. 35-132.
- [3] T.Deniz, "Ballistic Penetration of Hardened Steel Plates," Middle East Technical University, 2010.
- [4] J.Awerbuch, "A mechanis approach to Pojectile Penetration," Israel Institute of Technology, Haifa, 1970.
- [5] A. Doig, Military Metallurgy, London: UK MoD, 2002.
- [6] S.y.Aly and Q.M.Li, "Critical impact energy for the perforation of metallic plates," Nuclear Engineering and Design, vol. 238, no. 10, pp. 2521-2528, 2008.
- [7] M.Magier and A.Nowak, "Numerical Analysis of English Bowes used in Battle of Crecy," Problemy Techniki Uzbrojenia, vol. 142, pp. 66-85, 2017.
- [8] D.Jones, "Arrows against Mail Armour," Socety of Archer-Antiquaries, vol. 57, pp. 62-70, 2014.
- [9] Tod's Workshop, "Medieval Armour Tested! - Arrows vs Armour 2," Tod's Workshop, 22 Nov 2022. [Online]. Available: https://www.youtube.com/watch?v=ds-Ev5msyzo&ab_channel=Tod%27sWorkshop. [Accessed 10 Nov 2023].