1. **Definitions –** per CH-01, in addition to the following:

   A. **Strategic Reliance –** The unit forms an important component of an army. It is able to resist damage from opponents, either through its own merits, has the speed to run away from counters, or tends to have a proximity to friendly protective units/buildings. Players formulate and practice build-orders around units of "strategic reliance". NOT A QUESTION OF IF THIS UNIT WILL BE BUILT.

   B. **Effective –** Capable of one or both: 1) able to damage or remove enemy controlled assets, including units, production facilities, economic drop points, defensive buildings, etc. or 2) able to monitor and deny enemy resource collection. May not necessarily be able to perform these activities directly, but can force an investment in counter-play to prevent an enemy from doing damage. This could mean triggering the opponent to create counter units, construct defensive buildings, "quick-wall", garrison react, or economically relocate.

   C. **Ceteris Paribus** – The other things held equal between players: 1) Internet connectivity/lag, 2) Approximate skill of opponents who make the same number of mistakes, at similar points in time throughout the game, 3) Availability of competent civilizations through draft or random selection.

   D. **Investment –** Time and resources spent doing something.

   E. **Counter-Play –** Creation of counter-units, defensive buildings, "quickwalls", and garrison reactions or economic relocation to mitigate or prevent the damage done by offensive units.

   F. Ending Age – The age that at least one of the players will have advanced to by the time the game ends. For example, in a 1v1, if a player in the feudal age defeats a player in the castle age, then the castle age is said to have been the ending age for that game, even if feudal age units ended the game.

2. **Objective –** A competitivity scoring method has been developed as a means of objective custom map evaluation. The competitivity of a map depends on two factors: 1) the strategic variety available on the map in each age, and 2) the amount of time spent in each age to exercise those strategic options.

3. **Option Availability –** Table 1 shows a list of all units/buildings with an attack value (discounting navy), available in each age:

~	**Breakdown of Game Ending Ages**			
	Dark	**Feudal**	**Castle**	**Imperial**
Option List	----------			
	Militia	Man at Arms	Longswordsman	THS/Champion
	Villager	Spearman	Pikeman	Halberdier
	Town Center	Eagle Scout	Eagle Warrior	Elite Eagle Warrior
		Archer	Crossbowman	Arbalest
		Skirmisher	Elite Skirmisher	Elite Skirmisher
		Scout	Cav/Elephant Archer	Heavy Cav/Elephant Archer
		Villager	Light Cavalry	Hand Cannoneer
		Town Center	Knight	Hussar
		Tower	Camelry	Cavalier/Paladin
			Battle Elephant	Heavy Camel
			Steppe Lancer	Elite Battle Elephant
			Ram/Armored Elephant	Elite Steppe Lancer
			Mangonel	Ram/Siege Elephant
			Scorpion	Onager/Siege Onager
			Siege Tower	Heavy Scorpion
			Monk	Siege Tower
			Unique Unit	Bombard Cannon
			Tower	Monk
			Castle	Elite Unique Unit
			Petard	Tower
				Castle
				Petard
				Trebuchet

Option Count	3	9	20	23
Option Percent	**5.45**	**16.36**	**36.36**	**41.82**

Table 1: Summary of Units with Reasonable Attack Value Through Four Ages

With exception of villagers and town centers beyond feudal age, each land unit that can deal damage or remove an enemy unit/building from play is listed in the table above. The assumption is that a more competitive map will be less predictable, with many strategic options that are neither too weak, nor too strong. Therefore, if players are using the above listed units/buildings to win games in equal representation, then the distribution of ending ages for "competitive" maps should be similar to the "Option Percent" distribution of Table 1. According to "jerbot", author of aoestats.io, this is indeed the case, with the actual breakdown for Arabia (the "gold-standard" of competitivity) shown in Figure 1:

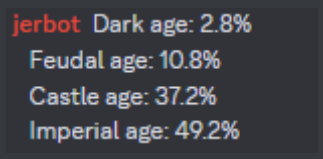

Figure 1: Actual Breakdown of Ending Ages for Arabia

These numbers were calculated 6/20/23 with a sample size of 274,361 1v1 Arabia games, across all

skill levels. With its early-age bias, this simple method likely underestimates the value of siege weapons, but overall supports the following conclusion: the ability for players to end games is proportional to the options they have available.

4. **Option Scoring** – However, it is not simply enough to be theoretically capable of making a unit or building – the quality of these options must be evaluated to score the competitivity of a map. Table 2 shows the ranking system:

Key Word	Score	Description
Impossible	0	The random map is designed with terrains/blocking objects, etc. that make the creation of this unit physically impossible for players even if they wanted to.
Implausible	1	The random map is designed such that strategic reliance on this unit is counterproductive, and there is no conceivable situation in which the unit may be used effectively and attempting to do so would give an advantage to the opponent.
Impractical	2	Strategic reliance on this unit would be effective for less than 15% of map generations, ceteris paribus, assuming equal investment in counter-play from the opponent.
Uncommon	3	Strategic reliance on this unit would be effective in 15% to 35% of map generations, ceteris paribus, assuming equal investment in counter-play from the opponent.
Common	4	Strategic reliance on this unit would be effective in 36% to 64% of map generations, ceteris paribus, assuming equal investment in counter-play from the opponent.
Prevalent	1	Strategic reliance on this unit would be effective in 65% to 85% of map generations, ceteris paribus, assuming equal investment in counter-play from the opponent.
Dominant	-2	Strategic reliance on this unit would be effective for more than 85% of map generations, ceteris paribus, assuming equal investment in counter-play from the opponent.

5. *Table 2: Ranking System for Strategic Options*

Strategies such as “fast-castle” or “booming”, which do not make use of a specific unit/building, are not regarded as direct contributors to competitivity. Instead, their influence manifests in the ability of other units to contest such strategies. For example, on a map lacking feudal aggression, where “fast-castle” is the ideal strategy most of the time, strategic reliance on a typical feudal age unit may be downgraded from “Common”, giving +4, to “Impractical”, giving only +2. As another example, a certain unique unit that would be considered “Dominant” (-2) may only be “Prevalent” (1) if it is slow and the opponent can boom elsewhere on the map. It is assumed that players will select an appropriate timing and economic backing for their desired army volume and composition.

6. **Scoring Worksheet** – per GSRM-04, with representative table below:

Production Building	**Unit Line/Building**	**Age**							
		Dark	**D#**	**Feudal**	**F#**	**Castle**	**C#**	**Imperial**	**I#**
Town Center									
	Villager	Implausible	1	Impossible	0	Impossible	0	Impossible	0
Dock									
	Galley	Impossible	0	Impossible	0	Impossible	0	Impossible	0
	Fireship	Impossible	0	Impossible	0	Impossible	0	Impossible	0
	Demolition Ship	Impossible	0	Impossible	0	Impossible	0	Impossible	0
	Cannon Galleon/Dromon	Impossible	0	Impossible	0	Impossible	0	Impossible	0
	Transport Ship	Impossible	0	Impossible	0	Impossible	0	Impossible	0
Barracks									
	Swordsman	Impossible	0	Impossible	0	Impossible	0	Impossible	0
	Spearman	Impossible	0	Impossible	0	Impossible	0	Impossible	0
	Eagle Warrior	Impossible	0	Impossible	0	Impossible	0	Impossible	0
Archery Range									
	Archer	Impossible	0	Impossible	0	Impossible	0	Impossible	0
	Skirmisher	Impossible	0	Impossible	0	Impossible	0	Impossible	0
	Cavalry/Elephant Archer	Impossible	0	Impossible	0	Impossible	0	Impossible	0
	Hand Cannoneer	Impossible	0	Impossible	0	Impossible	0	Impossible	0
Stable									
	Scout	Impossible	0	Impossible	0	Impossible	0	Impossible	0
	Knight	Impossible	0	Impossible	0	Impossible	0	Impossible	0
	Camel	Impossible	0	Impossible	0	Impossible	0	Impossible	0
	Battle Elephant	Impossible	0	Impossible	0	Impossible	0	Impossible	0
	Steppe Lancer	Impossible	0	Impossible	0	Impossible	0	Impossible	0
Monastery									
	Monk	Impossible	0	Impossible	0	Impossible	0	Impossible	0
Siege Workshop									
	Battering Ram/Siege Elephant	Impossible	0	Impossible	0	Impossible	0	Impossible	0
	Mangonel	Impossible	0	Impossible	0	Impossible	0	Impossible	0
	Scorpion	Impossible	0	Impossible	0	Impossible	0	Impossible	0
	Bombard Cannon	Impossible	0	Impossible	0	Impossible	0	Impossible	0
	Siege Tower	Impossible	0	Impossible	0	Impossible	0	Impossible	0
Castle									
	Unique Unit (UU)	Impossible	0	Impossible	0	Impossible	0	Impossible	0
	Non-Castle UU	Impossible	0	Impossible	0	Impossible	0	Impossible	0
	Trebuchet	Impossible	0	Impossible	0	Impossible	0	Impossible	0
Offensive Building									

Town Center	Town-Center Drop	Impossible	0	Impossible	0	Impossible	0	Impossible	0
Tower	Tower/Donjon Rush	Impossible	0	Impossible	0	Impossible	0	Impossible	0
Castle	Castle Drop	Impossible	0	Impossible	0	Impossible	0	Impossible	0
~		Dark		Feudal		Castle		Imperial	
Estimated Ending Age "Odds"		1		1		1		1	

7. *Table 3: Individual Unit Scorings by Age*

The interactive portions of the worksheet are highlighted in yellow. Each unit/building, is denoted by an individual row, with a column for each age. The term that best describes the viability may be selected as a drop-down menu item. The options for that menu are listed and described in Table 2. After the individual unit evaluations have been completed, an estimate of ending age-breakdown must be provided, similar to the final row of Table 1.

Note that final row "Estimated Ending Age 'Odds'" need not be percentages that add to 100, since the worksheet will auto-correct to the proper sum, but if they are, then the calculations will be more intuitive.

8. **Calculation –** Competitivity is calculated from the worksheet in three steps:

A. Ideal Ending Age Distribution – Calculated by adding all possible strategies (anything not "Impossible") per age and dividing by the all-ages total, in the same manner presented in Table 1. This method can account for the possibility of naval activity on dockable maps, blocking objects that prevent specific building construction, and rarely, rule changes that outright remove the creation of certain units.

B. Age Discrepant Penalty (ADP) – The formula for the age-discrepant penalty is as follows:

$$ADP = 1 - \frac{|A - B|}{A + B}$$

Where A and B are the percentages under comparison, and the vertical lines are "absolute value", to ensure ADP never exceeds 1. For example, if an even distribution of options are available to players across all four ages for a certain map, but the games are all predicted to end in imperial age, then Table 4 summarizes penalties:

~	Dark Age	Feudal Age	Castle Age	Imperial Age
Units from Tech Tree Available	25%	25%	25%	25%
Predicted Ending Age	0%	0%	0%	100%
Age Discrepant Penalty (ADP)	0	0	0	0.4

Table 4: Sample ADP Calculation

For this example, in Dark, Feudal, and Castle Ages, the ADP value is zero because none of the available options in those ages (of which they constitute a total of 75% of the total options) are expected to be capable of ending the game. The ADP value for imperial age is poor, but non-zero.

In the case where A = B, |A-B| = 0 and ADP = 1, therefore no penalty is applied.

C. Strategic Variety Scores (SVS) & Adjustment – The values of each unit for a given age are added together to produce the Strategic Variety Score (SVS) in that age. For example, if man-at-arms are common, and scouts are implausible, with all other units impossible, then the SVS for feudal age is +4 (MAA) +1 (scouts) +0 (everything else) = +5.

The SVS is then multiplied by the Age-Discrepant Penalty (ADP) to account for non-ideal timings spent in each age. The four adjusted scores (one per age) are totaled to produce the final competitivity.

9. **Sample Evaluations** – Additional tabs of GSRM-04 contain quick access to definitions, as well as sample evaluations performed on three diverse common maps: Arabia, Arena, and Nomad, each of which achieves a score above 100 for different reasons.

Revision	Description	Change Document	Date
Original Issue	----------	N/A	2024/02/10