ENDURANCE · INTENSITY-DURATION

CRITICAL SPEED

ATHLETE	DATE	TEST
SoccerMon TeamA-f20565cc	2021-11-13	276 GNSS sessions at 10 Hz, 2020-2021

01 SUMMARY

2.25 m/s
CS
8.1 km/h · 7:25/km

212 m
D′
SEE 13.3 %

0.575
R^2
8 efforts

READING

Critical speed **CS = 2.25 m/s**, a pace of 7:25 min/km; reserve above it **D′ = 212 m**.

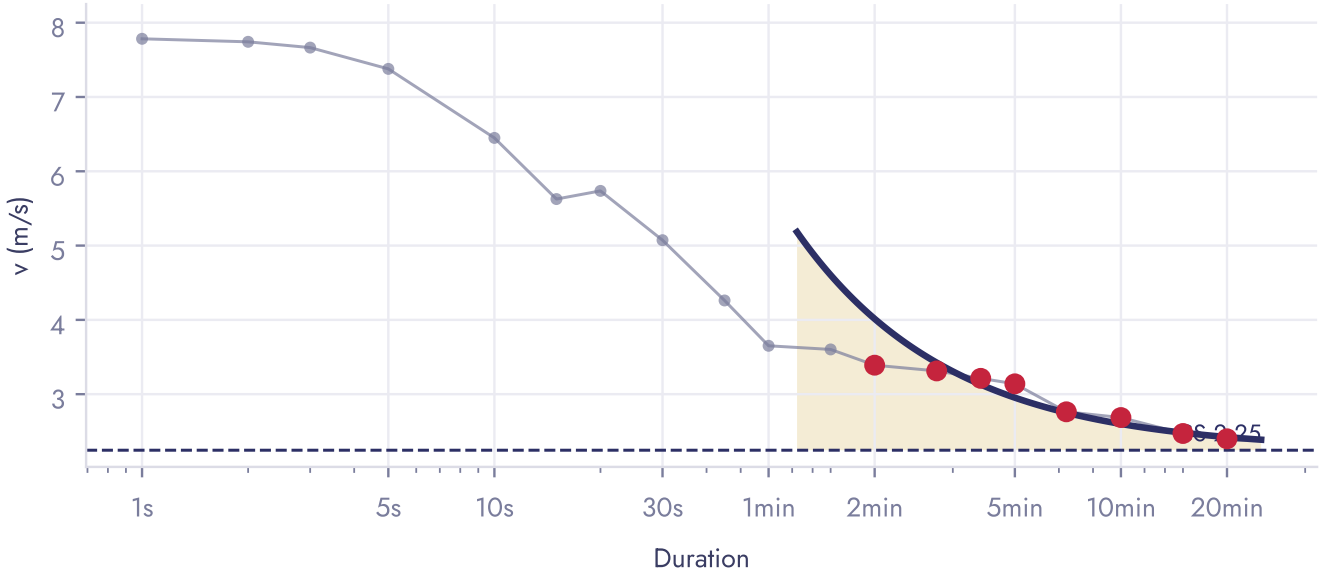
CS separates the intensities that can be stabilised from those that lead to exhaustion: above it, D′ is depleted the faster the further above one goes.

Standard error: 2.1 % on CS, 13.3 % on D′ — estimate **to be confirmed** (indicative guides: ≤ 5 % on CS, ≤ 10 % on D′).

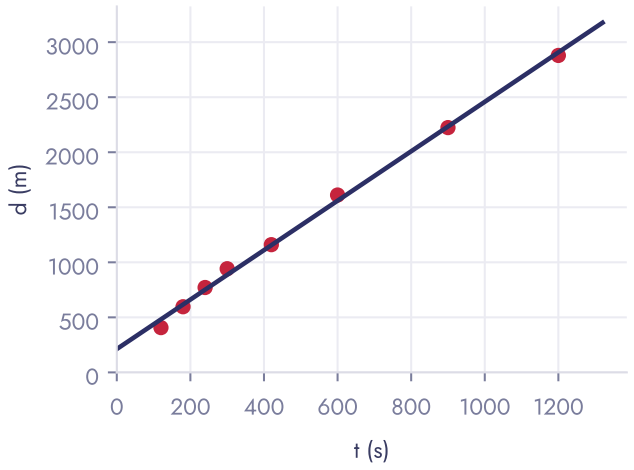
Across models, CS ranges from 2.25 to 2.45 m/s: the spread shows how much the model choice matters.

Field data: best mean values are not always maximal efforts, so the value is a **lower bound** of the true capacity.

02 INTENSITY-DURATION RELATIONSHIP



Best mean values over all sessions (grey); red dots: durations used for the fit.



Work (or distance) against duration: the slope is the critical value, the intercept the reserve.

2.1 Efforts used

DURATION	MEASURED	MODEL	RESIDUAL
2 min 00	3.39	4.01	-0.624
3 min 00	3.31	3.42	-0.112
4 min 00	3.21	3.13	0.083
5 min 00	3.14	2.95	0.186
7 min 00	2.76	2.75	0.012
10 min 00	2.69	2.60	0.086
15 min 00	2.47	2.48	-0.011
20 min 00	2.40	2.42	-0.023

03 ▸ MODEL COMPARISON

MODEL	CS (M/S)	D′ (M)	MAX	SEE CS	SEE D′	R^2
Linear work-time selected	**2.246**	**212**	**—**	**2.1 %**	**13.3 %**	**0.5749**
Linear 1/time	2.447	139	—	4.5 %	18.8 %	0.8244
Hyperbolic (2-param.)	2.447	139	—	4.5 %	18.8 %	0.8244

04 ▸ PREDICTIONS

4.1 Sustainable intensity

DURATION	M/S · MIN/KM
2 min 00	4.01 · 4:09
3 min 00	3.42 · 4:52
5 min 00	2.95 · 5:39
10 min 00	2.60 · 6:25
20 min 00	2.42 · 6:53

4.2 Time limit

TARGET	TIME LIMIT
2.36 m/s (+5 %)	31 min 30
2.47 m/s (+10 %)	15 min 45
2.69 m/s (+20 %)	7 min 52
3.03 m/s (+35 %)	4 min 30

05 METHOD

The relationship between the intensity of a maximal effort and its duration is hyperbolic: P = CP + W′/t (Monod & Scherrer 1965; Hill 1993). The linear forms (work-time, intensity-1/time) give the same parameters by regression; the 3-parameter model (Morton 1996) adds a finite maximal intensity at t → 0. For running, the same relationship links speed to duration: CS (m/s) and D′ (m).

Every parameter comes with its standard error in % (SEE); by default, the selected model is the one minimising the summed SEE of CP and W′, among those keeping at least two degrees of freedom. Protocol and model choices are discussed by Muniz-Pumares et al. (2019); efforts should last between about 2 and 15-20 min for the relationship to hold.

Field data: for each session, the best rolling mean is computed for each duration (cumulative sum on a regular grid); the best values across sessions form the curve, fitted between the chosen durations (Smyth & Muniz-Pumares 2020).

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- Jones A.M. & Vanhatalo A. (2017). The 'critical power' concept: applications to sports performance with a focus on intermittent high-intensity exercise. Sports Med 47 (Suppl 1), 65–78.
- Muniz-Pumares D. et al. (2019). Methodological approaches and related challenges associated with the determination of critical power and curvature constant. J Strength Cond Res 33, 584–596.
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- Vanhatalo A. et al. (2007). Determination of critical power using a 3-min all-out cycling test. Med Sci Sports Exerc 39, 548–555.
- Smyth B. & Muniz-Pumares D. (2020). Calculation of critical speed from raw training data in recreational marathon runners. Med Sci Sports Exerc 52, 2637–2645.

Report generated by critpower 0.1.0. Values depend on the efforts being maximal and on measurement quality; read them with the athlete's context in mind.