

## Chester Step Test 2 - An Online Submaximal Test for the Assessment of Aerobic Capacity ( $VO_2$ Max)

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### What does it do?

The Chester Step Test (CST) is a submaximal, multistage aerobic capacity test. First devised over 20 years ago [1] and with subsequent revisions [2] CST has been used globally in a wide variety of community, workplace, clinical and research settings.

The latest version (CST2) is software-based and can be downloaded from the webpage [www.chesterstep.com/register](http://www.chesterstep.com/register). The software comprises test instructions, an audio track with metronome beats depicting stepping frequencies, data entry points for exercise heart rates (HR) and Rating of Perceived Exertion (RPE), aerobic capacity calculation and a Results page with graphical output, aerobic capacity score, norm tables with Fitness Rating and a print facility.

CST2 can therefore now be conducted using a desktop, laptop, tablet or smart phone without need for external CD or audio device.

The Test requires a low step (10 - 30 cms depending on the subject's age and physical/clinical capabilities), HR monitor and RPE Chart (downloadable).

Providing there are no medical contraindications to moderately vigorous exercise or stair-stepping, the subject is required to step onto and off a low step at a rate set by the audio beat. Every minute an audio instruction is given asking the tester to record the subject's exercise heart rate and RPE - and the stepping rate is then increased slightly. The Test continues in this progressive manner until the subject reaches 80%HRMax and/or reports a moderately vigorous level of exertion (RPE = 14). Aerobic capacity ( $VO_2$ Max) is then calculated by entering the exercise heart rates into the appropriate boxes. The Test lasts for a maximum of 10 minutes. The Results page then gives an informative summary display of results which can be printed and/or stored as required.

**Technical note:** CST utilises the well-established linear relationship between oxygen cost, heart rate and workload together with ACSM's metabolic cost of stepping equation, thus enabling aerobic capacity to be predicted from a statistical line of best fit [3-5].

### What should you use it for?

Many workplaces now have recommended aerobic capacity standards for certain groups of workers and CST is a highly suitable assessment tool for 'fitness to work' examinations. Whilst a number of industries test all subjects on a standard step height (e.g. 30 cms for UK Fire Service and Commercial Divers), CST can also be administered using different step heights (10, 15, 20, 25 or 30 cms), thereby accommodating a wide range of ages and abilities with no gender bias. Guidelines for selecting step height are given in hyperlinks. CST2 has bespoke Workplace Editions for UK Fire [6], Police and Commercial Divers [7], together with Editions for Personal Trainers and Home Fitness Assessment.

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Chester Step Test is also widely used in a variety clinical and rehabilitation settings - to monitor patient aerobic fitness, functional capacity, recovery levels, tolerance to specific levels of exercise stress, risk stratification and physical activity/exercise prescription [8]. The bespoke Cardiac Rehabilitation Edition is designed specifically for use in CR settings [9].

### Ease of use

CST is straightforward to use. It is inexpensive, highly portable, easy to standardise and is a safely controlled submaximal test where heart rates and perceived exertion are monitored throughout. It is also highly repeatable, therefore ideal for test-retest scenarios.

### Time to master

CST is uncomplicated to setup and conduct. Nevertheless, as with any test with which the practitioner is unfamiliar, time should be taken to rehearse, fully understand the physiological principles of the prediction of aerobic capacity from submaximal heart rates and practice the Test to achieve best and most meaningful interpretation of results. The downloadable CST2 Manual is therefore a highly recommended reference read.

For organisations who request in-house staff training, a One-Day CPD Seminar delivered on-site by Professor Sykes is available. This ensures that all test administrators are fully confident and consistent in their approach, understanding and interpretation of results. Alternatively, an online learning course is available ([www.chesterstep.com/register](http://www.chesterstep.com/register)).

### Pros and Cons

CST is a simple, inexpensive test designed basically to assess aerobic capacity and overall Fitness Rating. However, as with all other submaximal fitness tests based on heart rate responses, the error margin is around 10 - 15%. Sources of error may include: variability in predicted HRMax, nerves and anxiety elevating exercise heart rates and inability to maintain correct stepping rhythm. CST is therefore best used in situations where a good estimate of aerobic capacity is required. However, it is not suited to scenarios where a precise measurement is essential. As the CST is highly reliable on a test-retest basis it is well suited to monitoring changes.

### Cost and where it can be obtained

CST2 details and costs can be downloaded from the webpage: [www.chesterstep.com/register](http://www.chesterstep.com/register).

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