How to estimate carbon emissions for road mobility of O-event participants

Mobility represents, by far, the most significant impact factor of orienteering events on climate change. For an otherwise very ecosystem-friendly sport, addressing mobility is extremely important for orienteering, in order to justify its claim of being a sport "at one with nature".

The issue is extremely tricky, as orienteering events, at least those carried out in the forest, typically take place "in the middle of nowhere", out of reach of low-impact transportation means, such as bicycles, railways and, to a lesser extent, buses. The most suitable and common vehicle is therefore the car or a team van.

There may be several organisational criteria to improve the situation and diminish the impact. However, the first approach to any initiative is to develop an appropriate measurement system. As the saying goes "what you can measure, you can manage". A measurement provides you with a baseline on which to evaluate improvements and make comparisons possible.

Measuring carbon emissions of transport can be very precise if you know exactly how much gasoline or diesel fuel or gas each car/van has used for the trip; or you can estimate it by the average mileage/litre provided by the car manufacturer multiplied by the number of km. But collecting data in such detail would be an overwhelming effort, prone to missing data and incorrect reporting.

We therefore here propose a rather simple and straightforward method that is based on a number of reasonable assumptions and will provide a fairly reliable estimate of the overall carbon emissions of orienteering competitions. In its current development, the method considers only road transport and is therefore best suited for regional or national events.

Step 1 – Count the total number of cars/vans in the parking lots.

This is easily done by a volunteer(s) if the parking area has one (or a limited number of) way in.

For a few euros one can buy a mechanical or digital counter. One just has to press a button for each incoming vehicle. An alternative is walking through the parking lots once the competition has started; most likely, all participants have arrived and no one has left, yet.

Step 2 – Sample of car types

Establish a "sample" of the cars, if a census is too time-consuming. One here assumes that the distribution of car types in the parking lot is random, which it usually is, with the possible exception of team vans. Some "educated guess" adjustment may be needed in this case.

Step 3 - Count the cars of the sample that fall in four different classes

Go through the part of the parking lot that you treat as a sample and count the cars that fall in each of the following classes:

Small car	Petrol or Hybrid up to 1.4 l; Diesel up to 1.7 l; segments A and B

Medium car	Petrol or Hybrid 1.4-2.0 l; Diesel 1.7-2.0 l; segment C
Large car	Petrol, Hybrid and Diesel over 2.0 l; segments D and above
Van	Average 9-seats van or camper van

One could be much more detailed, but these classes are enough for the application of emission tables published and regularly updated by the UK Government, Department for Business, Energy & Industrial Strategy[1]. Segments make references to the classes used by car rental companies.

Average emissions per km in each class weighted against the number of vehicles in the sample will provide the average emission per km of the cars in the parking lot.

Step 4 – Get the list of clubs and runners and calculate the distance

For each club get the distance from the seat of the club to the event (e.g. by Google Drive) and multiply the double (two way!) by the number of runners. This gives you the total km that the runners have travelled, either alone or sharing the car/van with other runners.

This is also a simplification because runners may compete for a team that has a legal seat in a different town, but errors are probably both in excess and in default and thus round up eventually.

Step 5 – Calculate the car-sharing factor and the actual car-km

The total number of runners divided by the total number of cars provides the average number of people sharing each vehicle. Again, a simplification, given that participants from far away are more likely to share cars than participants from round the corner.

The total distance travelled by all the runners divided by the car-sharing index will provide an estimate of the total number of km the vehicles have driven.

Step 6 – Calculate the emissions (total and per runner)

The total km multiplied by the average emission/km provides the actual emissions due to road vehicles for the event.

If you want to estimate the average emissions per runner, divide that figure by the number of runners.

Step 7 – Emission offsetting (optional)

Offsetting emissions is a controversial issue. In principle, it means investing in initiatives that will capture as much carbon from the atmosphere as was emitted during the event (e.g. afforestation); or initiatives that will reduce emissions (e.g. photovoltaic electricity plants) by the same amount; or in emission-reduction projects aimed at developing countries.

The emission trading system is criticised by many environmental organisations for allowing the industry to "wash up their conscience" by paying some money, instead of investing in climate-friendly operations themselves and for the excessively low "price" to be paid for many "certified emission reductions" within the "Clean Development Mechanism"[2] managed by the UNFCCC[3]. Some project value the ton of carbon emission at 1 €; according to most ENGOs a reasonably effective "price" per ton, encouraging real change in production systems and lifestyles should be at least 100 € per ton.

As of May 2021 the price per ton of carbon in the EU Emission Trading System[4], the largest carbon market in the world, is 56 €.

[1] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2021

[2] https://cdm.unfccc.int/about/index.html

[3] https://unfccc.int/

[4] https://ec.europa.eu/clima/policies/ets_en

Therefore, you may apply any of these figures to calculate how much it would cost to offset the emissions of an orienteering event; the higher the price, the more environmentally concerned you appear.

The cost could be calculated on a per-participant basis.

What to do with these data?

Estimating emissions is a first necessary step towards improvement. Then you can devise initiatives to diminish emissions and implement them in future events, such as:

- Encouraging car-sharing by imposing a parking fee decreasing with the occupancy rate (e.g. 3 € for driver only, 2 € for two persons, 1 € for three, free for four or more).
- Providing bus transport from the nearest railways station, thus encouraging long distance travel by train and local by bus.
- You can ask a local sponsor to pay for CERs offsetting the event emissions (good for the sponsor's image)
- You can measure (and advertise) improvements by using the "emission per runner" and the "car-sharing index".

You can then compare the efficacy of different initiatives with real data instead of applying a "thumb rule". As W. Edwards Deming once said: "In God we trust, all others must bring data."

Appendix

An Excel file has been produced to simplify calculations. Figures in red on a yellow background are required inputs; the rest are calculated.