

Charging Times

To inform the enforcement of maximum dwell times at each EVCP site in Surrey, it is important to understand the average charging times of electric vehicles (EVs) and therefore how a desired dwell time for an EV user may differ from an internal combustion engine (ICE) vehicle driver.

Charging times for a battery are dependent on:

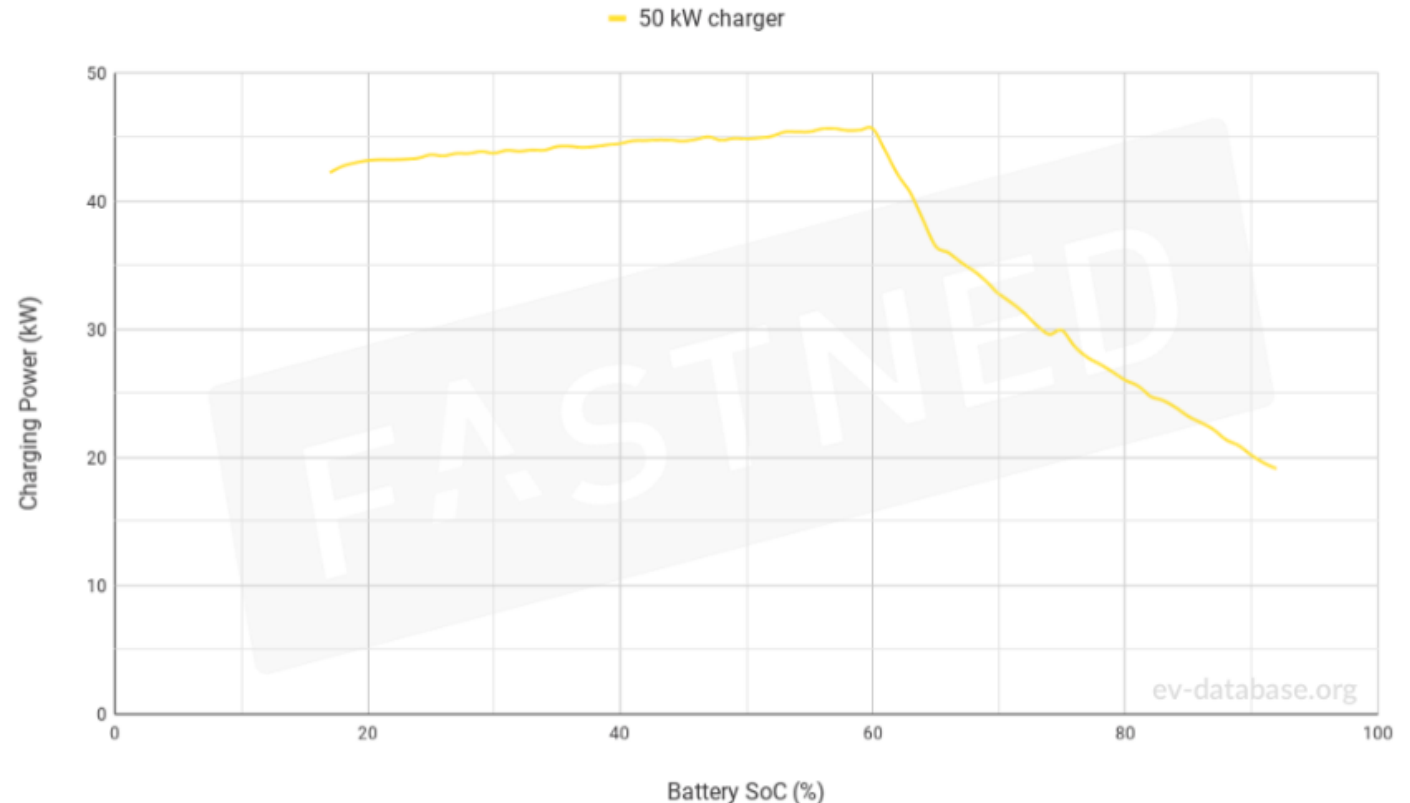
1. **The maximum speed of the charger (kW)** - the power rating or charging speed (kW) is dependent on the supply to the charger (AC, DC, 16A, 32A, single/three phase etc). The higher the power rating (kW), the faster the charging time.
2. **The maximum charging speed of the vehicle (kW)** - vehicles have onboard chargers which limit the speed at which they can receive power. The higher the speed at which a vehicle can receive charge (kW), the faster the charging time.

NOTE: the limiting factor between 1 and 2 is whichever is value is lower.

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3. The battery capacity of the vehicle (kWh) - the larger the battery capacity, the greater the range (miles), but also the longer it takes to fully charge.

4. The battery state of charge (SoC) - the battery of an electric vehicle will draw power at different rates depending on time in the charging cycle. As shown in the figure (right) for a 50kW charger, after 60% SoC the charging power begins to drop and is at half the potential charging speed after 80% SoC. This is why rapid chargers (>43kW) tend to cut off charging when a battery reaches 80% SoC.



Parking Restrictions

Many of the current parking restrictions are:

- Maximum 4 hours
- Maximum 3 hours
- Maximum 2 hours
- Maximum 1 hour

Key	
hours, minutes	Charge < 2 hours
hours, minutes	2 hours > Charge > 4 hours
hours, minutes	Charge > 4 hours

Charging Times - 7kW

Battery Capacity (kWh)	10	40	60	75	100
Approx Battery Range (miles)	24	150	240	300	350
Time for 80%* charge (hours)	1 hours, 25 minutes	4 hours, 42 minutes	6 hours, 34 minutes	8 hours, 42 minutes	11 hours, 17 minutes
Time for 60%* charge (hours)	0 hours, 51 minutes	3 hours, 17 minutes	5 hours, 25 minutes	6 hours, 17 minutes	8 hours, 42 minutes
Time for 40%* charge (hours)	0 hours, 42 minutes	2 hours, 51 minutes	3 hours, 17 minutes	4 hours, 51 minutes	5 hours, 8 minutes
Time for 20%* charge (hours)	0 hours, 34 minutes	1 hours, 25 minutes	1 hours, 8 minutes	2 hours, 25 minutes	2 hours, 34 minutes

**these charging times are assuming a linear charging profile from a 7kW single phase AC charger*

Source: Zap Map Public Charging Calculator, Pod point, <https://ev-database.uk/car/1104/BMW-i3>

Charging Times - 22kW

Battery Capacity (kWh)	10	40	60	75	100
Approx Battery Range (miles)	24	150	240	300	350
Time for 80%* charge (hours)	0 hours, 43 minutes	1 hours, 54 minutes	2 hours, 21 minutes	2 hours, 27 minutes	3 hours, 16 minutes
Time for 60%* charge (hours)	0 hours, 32 minutes	1 hours, 10 minutes	1 hours, 16 minutes	2 hours, 5 minutes	2 hours, 27 minutes
Time for 40%* charge (hours)	0 hours, 21 minutes	0 hours, 27 minutes	1 hours, 10 minutes	1 hours, 43 minutes	1 hours, 38 minutes
Time for 20%* charge (hours)	0 hours, 10 minutes	0 hours, 43 minutes	0 hours, 5 minutes	0 hours, 21 minutes	0 hours, 49 minutes

**these charging times are assuming a linear charging profile from a 22kW three phase AC charger*

Source: Zap Map Public Charging Calculator, Pod point, <https://ev-database.uk/car/1104/BMW-i3>

Charging Times - Vehicle Examples

Vehicle Make and Model	Mitsubishi Outlander PHEV (2018)	Nissan Leaf (2018)	BMW i3 (2018)	Tesla Model S (2019)
Battery Capacity (kWh)	13.8	40	42	100
Battery Range (miles)	24	150	193	350
Max charging speed from a 22kW charger	3.7	7	11	17
Time for 80% charge	3.7 hours	4.6 hours	3.1 hours	4.7 hours
Time for 60% charge	2.8 hours	3.4 hours	2.3 hours	3.5 hours
Time for 40% charge	1.8 hours	2.3 hours	1.5 hours	2.4 hours
Time for 20% charge	0.92 hours	1.1 hours	0.8 hours	1.2 hours

Source: Zap Map Public Charging Calculator, Pod point, <https://ev-database.uk/car/1104/BMW-i3>

Recommendations

1. In town centres where parking is limited to 1 hour or less:
 - ▶ TRO for EVCP bays to allow for 2 hour parking to give EVs time for a significant range top-up
2. In residential areas where there are currently no dwell time limitations:
 - ▶ Introduce a Max 4 hour parking restriction during the day to increase vehicle turnover
 - ▶ Allow overnight charging to facilitate longer chargers
3. Where parking is currently permit only:
 - ▶ Allow for non-permit holders to charge during the day to improve public network coverage
 - ▶ Permit holders only at night to facilitate local resident charging
4. Enforcements for charging while parking in an EVCP bay:
 - ▶ Would need to encourage good behaviour from the start
 - ▶ An option is to explore to have the parking charge included as part of the charging tariff to minimise having to pay separately for parking and charge.

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