Electric Vehicle Charging Strategy

Proposed Mooretown Development

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1.0 INTRODUCTION

ENX has been appointed by Glenveagh Homes Ltd. to review the provision of electric vehicle charging stations and infrastructure to off-curtilage surface parking spaces on new development at Mooretown, Swords, Co. Dublin.

This report will review the requirements under Building Regulations (Technical Guidance Document Part L) and Fingal County Council.

The aim of this report is to provide guidance on achieving the minimum requirements under the Building Regulations, while also future proofing the residential developments to meet the likely increased uptake of electric vehicles in the future.

There are 367 no. communal parking spaces.

2.0 EV CHARGING REQUIREMENTS

2-1 BUILDING REGULATIONS (DOMESTIC)

Under current Building Regulations (Technical Guidance Document Part L), there is a requirement for:

- Ducting or cabling for a future electric vehicle charger (EVCH) to be installed in all individual dwellings with on curtilage parking.
- Ducting or cabling for EVCHs to be installed to each parking space on multi-unit buildings (apartments, duplexes, etc.) where parking is provided inside or within the curtilage of the building.

There are no requirements in TGD Part L relating to dwellings with off-curtilage parking.

There is also no specific guidance on the recommended capacity of future EVCHs, diversity of their usage or ducting layouts (e.g. duct sizes, how many EVCHs can be provided on a single system, etc.).

2-2 BUILDING REGULATIONS (NON-DOMESTIC)

Under current Building Regulations (TGD Part L, Conservation of Fuel and Energy – Buildings other than Dwellings), there is a requirement for:

- Buildings with at least 10 car parking spaces should have at least 1 EV charger installed.
- Ducting or cabling for a future electric vehicle charger (EVCH) to be installed in 20% of all parking spaces inside or adjacent to the building.

Similarly to the guidance for dwellings, there is no specific guidance on the recommended capacity of future EVCHs, diversity of their usage or ducting layouts (e.g. duct sizes, how many EVCHs can be provided on a single system, etc.).

2-3 PLANNING STAGE CONSIDERATIONS

Electric vehicle charging needs to be considered early in the design process, as the provision of EV chargers and associated mini pillars, ducting, etc. will impact the site layout.

Important things to consider include:

On curtilage parking:

The majority of houses on the development have on curtilage parking and these houses will be pre-wired to enable EV chargers to be installed easily in the future.

Spatial requirements for Chargers & Ducting:

Locations for ESB mini-pillars and micro pillars, public lighting, substations, etc. need to be considered. These must all be located at least 2 metres apart from each other, so adequate space must be provided to install these, without impinging footpath widths.

Footpaths and off-curtilage parking spaces should be designed with future EV charging in mind. EV chargers must not reduce access routes along footpaths (typically 2.0m wide footpaths are required).

***Ownership/ Management of off-curtilage parking*:**

All off curtilage parking spaces on the development will be managed by the local authority. Therefore, it will be the local authority's responsibility to maintain and run the installed EV chargers on the development and add any additional chargers in the future.

All ductwork, mini pillars, chargers, etc. associated with proposed and future EV chargers must be installed on local authority property and is not allowed to cross public footpaths, road, etc.

EV Charger Locations

The locations of EV charging points being installed initially should also be considered and ideally these should be banked together, within walking distance (3-5 minutes) of any dwellings with off curtilage parking.

EV chargers should be installed in communal parking spaces and not ones specific to individual dwellings.

This strategy of provide charging hubs for users with multiple outlets will also reduce the installation costs and provide a more user-friendly installation for the residents.

3.0 CURRENT EV CAR MARKET

3-1 CURRENT EV USAGE IN IRELAND

Fully electric EVs currently represent 5% of the 2.3 million private cars (approximately 110,000) in Ireland.

The government have stated repeatedly that the adoption of EVs will play a significant role in reducing CO_2 emissions and achieving its various greenhouse gas emission targets. With this in mind, they aim to electrify one-third of the private car fleet by 2030. This would mean approximately 850,000 EVs will be on the Irish roads in 2030.

If these targets are achieved, the number of fully electric EVs in Ireland will increase by 770% in the next 6 years and the charging infrastructure needs to be in place to meet this future demand.

As things stand, there has been a well-publicised downturn in EV sales this year and these targets are highly unlikely to be achieved. It is more likely that there will be a maximum of 400,000 EVs in Ireland in 2030 (still a significant increase).

3-2 POPULAR EV MODELS & BATTERY SIZE

Based on new vehicle registrations between January 2024 and April 2024, the following are the most popular EVs in Ireland[3]:

- VW ID 4 (77kW battery)
- Hyundai Kona (65.4kW battery)
- Tesla Model 3 (82kW battery)
- Skoda Enyaq (77kW battery)
- MG MG4 (64kW battery)

The efficiency of cars above varies slightly and are worse in wintertime, when the external temperatures are lower. For the purposes of this report, we have used an efficiency of 0.21kW/km based on the average real world range in cold weather conditions (mix of city and motorway driving) of the 5 car models above[4].

Car manufacturers recommend that the battery levels are maintained at between 20% and 80% most of the time to prolong the battery life. They also suggest that fast chargers (e.g. 50/ 125kW) are not used all time for the same reason.

Therefore, the average real-world range of the vehicles are[5]:

- VW ID 4 – 375km range (range 300km, when battery charged to 80%)
- Hyundai Kona – 325km range (range 260km, when battery charged to 80%)
- Tesla Model 3 – 345km range (range 276km, when battery charged to 80%)
- Skoda Enyaq – 380km range (range 304km, when battery charged to 80%)
- MG MG4 – 305km range (range 244km, when battery charged to 80%)

3-3 CHARGING PATTERNS & FREQUENCY

The average private car in Ireland travels 16,352km per year[6] (44.8km/day), while the average distance that commuters travel to work is 16.8km[7].

There is no clear data available for average EV usage, therefore for the purposes of this report we have assumed that the average EV driver travels the same distance as the average driver in Ireland.

Based on the national average, the car with the smaller battery above (MG MG4) would need to be charged every 3 or 4 days, while always maintaining their battery between 20% and 80%, in accordance with the manufacturer's guidelines.

Based on the above information and data published by the government[8], the average session will consume between 30 and 40kW of electricity.

3-4 ESTIMATED FUTURE EV CAR USAGE

As referenced above, EV car ownership is likely to increase considerably in the next six years therefore current data on public EV charging stations needs to take this into consideration when making provision for EV chargers in the future.

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[1] Will 41,000 electric cars be sold in Ireland in 2024? (rte.ie)
[2] Will 41,000 electric cars be sold in Ireland in 2024? (rte.ie)
[3] Electric Cars in Ireland - Some Facts and Figures - Money Guide Ireland
[4] Most efficient electric cars - EV Database (ev-database.org)
[5] Most efficient electric cars - EV Database (ev-database.org)
[6] Transport Omnibus 2019 - Central Statistics Office (no data available for 2022 or 2023. 2020 and 2021 data not used due to various Covid-19 restrictions that were in place at the time).
[7] Commuting to Work - CSO - Central Statistics Office
[8] Department of Transport – Electric Vehicle Charging Infrastructure Strategy 2022-2025

As stated above, a typical EV car driver will need to charge their car every 3 or 4 days, with an average charging session requiring between 30 and 40kW of electricity, which is unlikely to change in the future.

4.0 EV CHARGING OPTIONS

There are a range of EVCH available on the Irish market, ranging from slow 7.0kW chargers to super-fast 150kW versions.

The cost of the chargers and the associated infrastructure vary hugely, and the type of charger installed should suit the local requirements (e.g. slower chargers for homes, offices, etc, where the cars are likely to be parked up for a number of hours/ overnight, with faster chargers (e.g. 50kW and 150kW) in motorway service stations, town centre public car parks, etc.).

The future running costs and maintenance of the chargers should also be considered. On this development the management and maintenance of the EV infrastructure will be the responsibility of the local authority.

EV chargers are typically managed by a specialist company, who will be responsible for handling payments and undertaking annual maintenance, repairs, etc. For this service they will charge a handling fee of between 7% and 10% on all transactions and approximately €600 for the annual service. The servicing and any costs relating to repairs, replacements of parts, etc. will be recouped through higher tariffs, therefore a more often a charger is used, the cheaper the tariffs should be.

A number of EV specialists will provide a two-tier payment structure, where residents of a development can avail of cheaper tariffs that non-residents. This will be discussed with and agreed with the EV specialist, prior to going into contract with them.

In the future, when the need arises for additional EV chargers, the local authority will need to engage the services of a specialist to install and manage the new EV chargers. Again, the cost of this work will need to be recouped through higher charging tariffs. Good design, taking into account future EV charging requirements should reduce the civils costs associated with these works and lead to lower tariffs in the future.

Taking into consideration the average battery size of the 5 most popular EV models above (73kW), the average car usage and recharging patterns in Ireland (Sections 3-2 and 3-3) and information from an EV charging specialist (EasyGo), the average charging session will consume between 30 and 40kW. We have used 35kW for the basis of the calculations below.

4-1 7.0KW CHARGER

Based on the average car usage (44.8km/ day), the average car will need to be charged every 3 or 4 days. A 7kW charger will provide an average 35kW charge in 5 hours. Current government guidelines[9] and the ESB[10] advise that a typical 7kW charger will take longer (at least 7 hours) to charge a car on average. As most car charging takes place in the evening time during the week, it is unlikely that more than 1 car will use an EVCH of this type for a full charge on a typical weekday (a person plugging their car in a 5pm is unlikely to move their car after 10pm). At weekends, the charger is more likely to be used a second time in the morning/ afternoon.

Therefore, a 7kW charger is likely to be used a maximum 9 times a week and suitable for up to 4 regular users. A dual charger serving 2 parking spaces could serve a maximum of 8 regular users.

4-2 FAST 22.0 KW CHARGER

Using the same assumptions above a 22kW charger will provide an 35kW charge in 1 hour 36 minutes. This is broadly in line with the ESB, who advise that a typical charger with an output of >7-49kW will take up to 2 hours to charge a car on average[11].

It should be noted however that a number of EV models currently on the market do not accept a 22kW charge and therefore limit the charge to 11kW[12]. This may change in the future, but for the purposes of this report we will work on a basis that all cars will only charge at 11kW, and so the average charge times are likely to be between 2 and 4 hours as per government[13] and ESB[14] advise.

Given the faster charging times, a much higher turnover of cars using is chargers will be possible. Software can be installed on the charger to limit the time a car can be plugged in, with financial penalties to ensure a single user does not monopolise a charger after a set period of time (say 4 hours).

Based on the assumptions above relating to the most common charging times, it is likely that 1 or 2 cars could utilise a single charger every evening. Morning or daytime charging will also be more likely, given the reduced charging times. Taking this into account a single charger could easily be used 2 or 3 times a day during the week and 3 or 4 times a day at weekends.

Therefore, a 22kW charger could be used up to 23 times a week and suitable for up to 11 regular users. A dual charger serving 2 parking spaces could serve up to 22 regular users.

[9] Department of Transport – Electric Vehicle Charging Infrastructure Strategy 2022-2025 – Table B1
[10] ESB Networks Overview of Public On-Street Electric Vehicle (EV) Charging ≤49kVA(71A) – Table 1
[11] ESB Networks Overview of Public On-Street Electric Vehicle (EV) Charging ≤49kVA(71A) – Table 1
[12] Department of Transport – Electric Vehicle Charging Infrastructure Strategy 2022-2025.
[13] Department of Transport – Electric Vehicle Charging Infrastructure Strategy 2022-2025 – Table B1
[14] ESB Networks Overview of Public On-Street Electric Vehicle (EV) Charging ≤49kVA(71A) – Table 1

By installing 22kW chargers only on a development, ducting to all parking spaces is not required and that a smaller number of faster chargers, with ducting for some additional chargers is a more cost-effective solution to meet all the future needs of the development, reduce running costs for the local authority and lead to reduced charging tariffs for the end user.

4-3 RAPID CHARGERS (50-125KW)

Rapid type chargers are unlikely to be commercially viable on residential developments at the moment, however they could be in the future.

In the next few years, EV commercial operators (e.g. EasyGo) may determine that a rapid type charger does become viable on this development and it will be possible to remove existing 22kW chargers and replace them with 50kW type units, without the need to undertake major infrastructure changes.

In the event 50kW chargers are retrofitted, the average charge time would be reduced to 42 minutes, allowing 6 or 7 cars to utilise a single charger every evening. Morning or daytime charging will also be more likely. Taking this into account a single charger could easily be used 9 or 10 times a day during the week and 12 or 13 times a day at weekends.

Therefore, a 50kW charger could be used up to 76 times a week and suitable for 38 regular users. A dual charger serving 2 parking spaces could serve 76 regular users.

This may be a more cost-effective solution to installing additional chargers in the future and avoid any major civils works and furthers the argument of not installing ductwork to all parking spaces.

4-4 ELECTRIC VEHICLE CHARGING INFRASTRUCTURE REPORT 2022-2025

This report sets out the government's targets for the provision of publicly accessible EV charging locations around the country. As part of the report, it references residential/ neighbourhood charge points, recommending that chargers with an output of up to 22kW are installed in these locations.

4-5 ESTIMATED FUTURE EV CAR USAGE

As stated in Section 3-4 above, the EV charging infrastructure needs to be capable of meeting the future EV charging demand in both the short/ medium term (up to 2030) and longer term (100% EV ownership).

5.0 EMBODIED CARBON ASSOCIATED WITH FUTURE EV CHARGING PROVISION

As can be seen from the calculations in Section 4.1, a standard slow 7kW charger will provide adequate charging capacity for up to 4 users, meaning that there will never be a scenario where 100% of parking spaces need to be fitted with EV chargers (i.e. 25% of spaces provided with 7kW chargers would provide sufficient capacity). By installing 22kW chargers as a standard, the number of chargers required to meet 100% EV usage is further reduced (i.e. as few as 9% of parking spaces, with 22kW charger fitted could provide sufficient capacity for 100% of parking spaces).

With this in mind it is worth considering the waste of materials, work and embodied carbon associated with the installation materials in the ground that will never be required.

9no. 22kW chargers would provide adequate charging capacity for up to 198 users (equivalent to 54% EV ownership on the development, which is considerably higher than the government's ambitious 2030 targets). Ducting for an additional 18no. parking spaces would easily meet the demands of higher EV ownership at some point in the future, catering for over 385 EV owners.

Following this strategy would considerably reduce the amount of ducting required in the ground, reducing construction costs and embodied carbon.

To cater for future EV chargers, a concrete mini pillar chamber and ducting is typically installed at construction stage, which will cater for up to 18 parking spaces. Following the typical planning requirements, at least 37no. concrete chambers and associated ducting would be required on this development. By installing 22kW chargers only, 9no. EV charging system/ hub could meet the requirements of the whole development, with capacity for up to 198 users and negate the requirement to install 28 other systems.

The BSRIA Guide, Embodied Carbon – The Inventory of Carbon and Energy (ICE) provides advice on how to calculate the embodied carbon of various building materials (e.g. precast cement, 0.168kgCO_2/kg and uPVC ducting, 2.56kgCo_2/kg) and how to consider other factors (e.g. wastage and transport).

Typically an EV charging system will consist of an ESB mini pillar, concrete chamber, 125mm ducting to each proposed EV charger, EV chargers and 125mm ducting to the nearest ESB mini pillar. Where provision is being made for future charging only, only the concrete chamber and 125mm ducting will be installed initially.

Based on the BSRAI data, a typical concrete chamber weighing 880kg and will have approximately 152kg of embodied carbon, assuming they are manufactured in Ireland. A typical EV installation will consist of approximately 50 metres of 125mm underground ducting. Allowing for 10% wastage, this will have approximately 156kg of embodied carbon. Therefore, over 300kg of embodied carbon is required to provide underground services to a future EV charging hub. Across this development, materials with over 4,200kg of embodied carbon would be installed unnecessarily. This excludes other elements of the installation which are harder to calculate (e.g. carbon emissions associated with digging and back filling the trenches, omission of the 500mm buffer zone between the parking spaces and footpaths, etc.) which significantly increase the carbon emissions connected with the installation.

6.0 FUTURE EV CHARGER INSTALLATION COSTS

The costs associated with the future installation of EV chargers is an important consideration and one that is not covered in detail in the current regulations and guidelines.

Where on curtilage parking is provided to a house, the installation of a new EV charger will be straightforward and can be carried out by a competent electrician, utilising preinstalled cabling, a standard home charger and without an upgrade to the dwellings ESB supply in most cases.

It is not as simple in the case of off curtilage parking spaces. As the off-curtilage parking spaces will not be owned by specific homeowners and will instead be managed by the local authority. To install an EV charger in one of these spaces, the local authority will need to approve the installation and be responsible for the upfront costs associated with the installation or allow an independent EV provider to install and run the EV chargers as a private enterprise.

The most common EV charger installation scenarios will be:

a) 7kW EV charger added to existing EV charger hub, with all ducting and ESB supply in place.
b) 22kW EV charger added to existing EV charger hub, with all ducting and ESB supply in place.
c) 7kW EV charger with existing ducting in place but no ESB connected.
d) 22kW EV charger with existing ducting in place but no ESB connected.
e) Upgrade existing 7kW charger to 22kW type.
f) Upgrade existing 9/22kW charger to 50kW type.

We will now review the installations costs for each of these situations. For the purposes of this cost comparison, we will assume that all ducting and underground chambers are installed correctly, and no major civils works are required.

7kW EV charger added to existing EV charger hub, with all ducting and ESB supply in place.

New ESB 49kV/ 3phase supply	N/A
New ESB mini pillar supply & installation	N/A
New dual 7kW EV charger installation & commissioning	€5,000.00
Total Budget Cost (excluding VAT)	€5,000.00

22kW EV charger added to existing EV charger hub, with all ducting and ESB supply in place.

New ESB 49kV/ 3phase supply	N/A
New ESB mini pillar supply & installation	N/A
New dual 22kW EV charger installation & commissioning	€7,000.00
Total Budget Cost (excluding VAT)	€7,000.00

7kW EV charger with existing ducting in place but no ESB connected.

New ESB 49kV/ 3phase supply	€5,000.00
New ESB mini pillar supply & installation	€2,000.00
New dual 7kW EV charger installation & commissioning	€5,000.00
Total Budget Cost (excluding VAT)	€12,000.00

22kW EV charger with existing ducting in place but no ESB connected.

New ESB 49kV/ 3phase supply	€5,000.00
New ESB mini pillar supply & installation	€2,000.00
New dual 22kW EV charger installation & commissioning	€7,000.00
Total Budget Cost (excluding VAT)	€14,000.00

Upgrade existing 7kW charger to 22kW type.

New ESB 49kV/ 3phase supply	N/A
New ESB mini pillar supply & installation	N/A
New dual 22kW EV charger installation & commissioning	€7,000.00
Total Budget Cost (excluding VAT)	€7,000.00

Upgrade existing 9/22kW charger to 50kW type.

New ESB 49kV/ 3phase supply	N/A
New ESB mini pillar supply & installation	N/A
New 50kW EV charger installation & commissioning	€12,000.00
Total Budget Cost (excluding VAT)	€12,000.00

As can be seen from the budget figures above, there is a significant cost increase associated with installing the first EV charger to a system, compared to adding one to an existing system. These additional costs will need to be paid upfront by the local authority and recouped from the people using the chargers through higher charging tariffs.

Higher charging tariffs will lead to less people using the chargers and discourage people on these developments from switching to EV vehicles.

We propose installing active 22kW chargers at the charging hubs, so that the ESB supplies and mini pillars will be in place initially, thereby reducing the cost of adding additional EV chargers in the future.

Standard Approach to Compliance with EV Charging Requirements

If we consider the typical approach to a development of this nature with 367 no. off-curtilage parking spaces and a planning requirement for EV chargers to be installed in 20% of parking spaces, with ducting to the remaining spaces. The following installation would achieve planning compliance:

- 74 parking spaces, served by 33no. dual chargers EV charging systems.
- 33 no. 7kW chargers installed initially
- Ducting provided to remaining 293 spaces.

Based on the calculations in Section 4-0, the above installation would be suitable to meet the charging demand of up to 18 average EV users. This is in excess of the requirements to meet even the best-case government targets for EV ownership in 2030, meaning that most of the chargers will either not be used at all, or massively underused for the foreseeable future. This could also lead to other problems (e.g. vandalism). Slower 7kW chargers are unlikely to be used by people outside of the developments, due to low recharging times. If/ when an additional charger is required, a new ESB supply, mini pillar, etc. will be required. There is also a risk that by the time the installed chargers are actually required they are 5 to 10 years old and are nearing the end of their expected working life.

Proposed Alternative Solution:

The following installation would meet the actual EV charging requirements of the development:

- 18 parking spaces, served by 9no. EV charging hubs (2no. spaces per system).
- 18no. 22kW chargers installed initially.
- Ducting provided to 18 other parking spaces.

Based on the calculations in Section 4-0, the above installation would be suitable to meet the charging demand of up to 22 average EV users (more than 33no. 7kW chargers). This installation would exceed the requirements for even the best-case government targets for EV ownership in 2030 and provide the residents will a better facility providing faster charging. Faster 22kW chargers are far more likely to be used by people outside of the developments, due to faster recharging times. 9no. charging hubs with 18no. 22kW chargers each would also easily meet the requirements for higher EV ownership at some point in the future.

The information above furthers the argument that a smaller number of suitably positioned EV charging hubs with high output (e.g. 22kW) EV chargers is a better solution to providing chargers in all off-curtilage parking spaces. It will lead to a better facility for the residents, with faster charging times, lower running costs and be easier to maintain by the local authority/ EV specialist.

7.0 PROPOSED EV CHARGING INFRASTRUCTURE

7-1 DWELLINGS WITH ON-CURTILAGE PARKING

There will be 210 no. standard on-curtilage/in-curtilage car parking spaces. These will all be pre-wired to allow for EV charging.

7-2 OFF-PARKING CURTILAGE PARKING

367 off curtilage parking spaces are provided. Public parking spaces, which will be maintained by the local authority will be provided around the development for use by residents and visitors.

As stated earlier, there is no specific requirement in TGD Part L relating to public parking spaces.

Parking spaces will not be designated to individual dwellings/ commercial units, but most parking spaces will become associated with a particular house (e.g. a parking space directly outside a house will predominately be used by the occupants of that house most of the time). By installing EV chargers in these parking spaces in front of houses there is a risk that the occupants of the houses will use the space as their own, regardless of whether they have an EV or not.

Ducting will not be installed to all off curtilage parking spaces but instead provided to 9no. EV charging hub only. Faster, 22kW EV chargers will be installed, which will provide more EV charging capacity initially and adequate future capacity to meet the demands of higher EV ownership.

8.0 CONCLUSION

Current planning conditions typically require that ducting for future EV chargers is installed to all parking spaces on new developments, with active chargers installed to 10% of spaces. As detailed in the report, these requirements are not appropriate and do not take into consideration capacity of different EV chargers on the market, installation and running costs, or how the chargers will be maintained in the future. There will never be a scenario where EV chargers are installed to each off-curtilage parking space, as the cost of installing individual EV chargers to each space, maintaining the chargers and other on-going costs will be not be viable.

Based on the data in this report, an average EV driver needs to charge their car 2 or 3 times a week, meaning that a slow 7kW public charger could cater for up to 4 EV drivers, while a 22kW charger could cater for up 11 EV drivers. With this in mind, there will never be a scenario where 100% of parking spaces on a typical development will require EV chargers, therefore the majority of ducting currently required is unlikely to ever be used.

We propose to move away from the standard requirement of providing ducting to 100% of parking spaces and instead provide a bespoke EV charging solution for the development.

EV chargers should be grouped together in 1no. charging hub, within walking distance of all dwellings with no on curtilage parking. These hubs should have ducting installed for additional chargers to be installed in the future and/ or allow the installed chargers to be replaced with faster versions. The savings made by not installing unnecessary ductwork will be used to upgrade the standard 7kW charger to a 22kW version.

This approach should make servicing easier as the chargers, mini pillars, etc. will be grouped together and also make the developments more appealing to private EV operators in the future to operate and expand the initial EV offering.

Additionally, a discount rate will be agreed with the EV specialist for residents of the developments as part of the long term operational and maintenance contract