Formulation of enabling provisions in Urban Design Guidelines to provide for Electric Vehicle Charging Infrastructure.

Town and Country Planning Organisation
Ministry of Housing and Urban Affairs
Government of India

September 2018

Abbreviations:

UNFCC	-	United Nations Framework Convention on Climate Change
IPCC	-	Intergovernmental Panel on Climate Change
GHG	-	Green House Gases
2Ws	-	Two wheelers
3Ws	-	Three wheelers
4Ws	-	Four wheelers / PV(cars)
PVs	-	Passenger Vehicles
CVs	-	Commercial Vehicles
EV	-	Electric Vehicle
EVSE	-	Electric Vehicle Supply Unit
SC	-	Slow Charger / Slow Charging (AC)
FC	-	Fast Charger / Fast Charging (DC and a few AC ones)
BS	-	Battery Swap
Public CI	-	Public Charging Infrastructure
Private CI	-	Private Charging Infrastructure
MBBL	-	Model Building Bye-Laws, 2016
URDPFI	-	Urban and Regional Development Plan Formulation and Implementation Guidelines, 2105

Background:

Rapid urbanization coupled with adoption of mechanized transportation modes has resulted in high emissions of Green House Gases that goes on to impact Global warming. Unless, the global surface temperature rise is restricted to no more than 2°C compared with pre-industrial levels, the IPCC has warned that the world will see irreversible catastrophic climate change.

India being a signatory to the UNFCCC, has pledged for efforts to assess the Greenhouse Gas Emissions (GHG) of anthropogenic origin and removal by sinks. India's per capita emissions are still considered low at 1.9 tonnes (2013), but its total emissions are next only to China and the US and is likely to overtake those of the EU by 2019.

While comparing the Indian cities for their emission scores, Delhi is on top as the biggest emitter at over 38 billion kg (38 million tonnes) of carbon dioxide equivalent overall emissions, followed by Greater Mumbai at 22.7 billion and Chennai at 22.1 billion, Kolkata at 14.8 billion, Bangalore at 19.8 billion, Hyderabad at 13.7 billion and Ahmedabad at 9 billion were the other cities whose emissions for the year were calculated sector wise.

As per the statistics of Transport Department (GNCTD), total number of vehicles in Delhi is more than the combined total vehicles in Mumbai, Chennai and Kolkata. Delhi has 85 private cars per 1000 population against the national average of 8 cars per 1000 population. In terms of figures, Delhi emits about 12.4 billion kg while the city of Bangalore emits about 8.6 billion kg of CO2 equivalent.[1]

Therefore, addressing the quantum of emissions from the "Transport" and "Domestic" sector, emerges to be the high priority subjects under the overarching umbrella of *"Climate change mitigation"* as committed to the UNFCC.

Encouraging "Electric Vehicles" as a viable option for phased transportation in terms of Short and Long distance trips with appropriate "Charging Infrastructure" is therefore, the pre-condition for this paradigm shift / phased migration to sustainable transportation.

The present note is prepared for the required changes in Infrastructure provisions (at Regional and City levels) and the bring necessary changes in Development Control Regulations (in terms of provisions therein) to include the formulations of norms and standards for *"Charging Infrastructure"* in the said Mater Plan Regulations and State Bye-Laws for adoption across the country suiting local conditions.

[1] *Renewable and Sustainable Energy Reviews, April 2015 (Volume 44)*

EV Charging Technology:

Electric Vehicle Supply Unit (EVSE)-

An EVSE is a wall mounted box that - that supplies electric energy for the recharging of electric vehicle batteries. Also EVSE's have a safety lock-out feature that does not allow current to flow from the device until the plug is physically inserted into the car.

EVSE's can be customized with added features like:

- Authentication
- Integrated payment gateways
- Software for remote monitoring.

As electric vehicle charging technology continues to advance, several standards and guidelines have become widely accepted across the industry. This section gives a brief overview of charging infrastructure technology, standards, and terminology.

Different types of EVSE:

Charging speeds- Charging power, which determines the time required to charge a vehicle, can vary by orders of magnitude across charge points, as shown in Table 1. A small household outlet may charge as slowly as 1.2 kW, while the most advanced rapid charging stations can charge at up to 350 kW. Charging infrastructure is broadly broken into three categories based on speed: Level 1, Level 2, and direct current (DC) fast charging (sometimes referred to as Level 3).

Table 1. Characteristics of Level 1, Level 2, and DC fast charging.

Charging level	Voltage (V)	Typical power (kW)	Setting
Level 1	120 V AC	1.2–1.8 kW	Primarily residential
Level 2	200–240 V AC	3.6–22 kW	Home, workplace, and public
DC fast	400 V DC	50 kW or more	Public, primarily intercity

V = volt; AC = alternating current; DC = direct current; kW = kilowatt

(Source: "Emerging Best Practices for Electric Vehicle Charging Infrastructure", Oct' 2017)

Private Charging

Charging batteries of privately owned cars through domestic charging points. Billing is mostly part of home/domestic metering.

AC "Slow" Charging –

The home private chargers are generally used with 230V/15A single phase plug which can deliver a maximum of up to about 2.5KW of power. The EVSE supplies AC current to the vehicle's onboard charger which in turn converts the AC power to DC allowing the battery to be charged.

Public Charging

For charging outside the home premises, electric power needs to be billed and payment needs to be collected. The power drawn by these chargers may need to be managed from time to time.

DC Fast Charging

DC current is sent to the electric car's battery directly via the charge port. Fast charging chargers (usually 50 kiloWatts or more) can supply 100 or more kilometers of range per hour of charging. The fast chargers would generally be used as a top-up for increasing the range, rather than fully charging vehicles. These are important for cab companies and corporate users who have a fleet of electric cars.

Options for EV Charging:

There is an urgent need to offer flexible charging infrastructure for different vehicle segments to drive adoption of EVs. Charging infrastructure is the most crucial enabler in the entire EV value chain. The exploration of different charging models according to the local conditions shall enable faster deployment of electric vehicles in the country.

EV share in all vehicles - It has been broadly projected that by the current rate of adoption of EVs, about 15% of all vehicles in the country would be EVs by the year 2020. Therefore, while assuming percentage composition of all proposed capacities in Public facilities of vehicle holding capacity, the Metropolitan and 'Tier I' cities will be assumed to have a higher percentage share EVs, say ***20% for now***. The charging infrastructure prescriptions in all urban development guidelines shall, therefore, be in consonance with the said percentage.

Power Load sanction to premises – While adding these Charging Infrastructures to the proposed set of Building types of the Indian cities, an ***enhanced Power Load*** *shall have to be sanctioned for each such building type by the Power DISCOMs*, commensurate to the total additional power requirement of simultaneous operation of all the prescribed charging points in the premise. With further advancement of charging technologies and the enhanced capacity of chargers to draw more power, it is advised that the *Load capacity assigned to each premise should be kept with a safety factor of 1.25* with a long-term vision of 30 years.

Both the abovementioned specific arrangements have been arrived at with detailed stakeholders' consultation.[2]

Class of EVs by charging "modes" & "time" with availability in Public Charging Infra:

Vehicle type	Slow Charging	Time reqd	Fast Charging	Time reqd	Public CI
2 Wheelers	Y	1.0-1.5 hr	N	-	Yes/Limited
3 Wheelers	Y	2.0-3.0 hr	N	-	Yes/Limited
PVs (Cars)	Y	6.0 hr	Y	1.5 hr	Yes
PVs (Buses)	N	-	Y	2.0-3.0 hr	Yes

Restricted Options for vehicle types (by ownership) –

Vehicle type	Private CI	Public CI	Predominant place of charging
2 Wheelers	SC/BS	SC	Point of residence / Work
3 Wheelers	SC/BS	Only BS	Residence / Parking stations
PVs (Cars)	SC/BS	FC	Residence / Point of work / else
PVs (Buses)	-	FC/BS	Only at Terminals/Depots

Note:

- *The option of Battery swapping (BS) for privately owned 2Ws and PV (Cars) is limited to Private CI for single handed use of battery and, hence, addressing quality issues.*
- *For 3 Ws the BS is proposed to be made available in Public CI, for faster recharge experience only*
- *For PV (Buses), Fast Chargers can be made available to privately owned Depots/Stations/Garages too.*

Based on the above stated EV charging technologies, their evolution and the preferred and offered choices of charging infrastructures, the proposed amendments in relevant sections of URDPFI Guidelines, 2015 and MBBL, 2016 have been suggested by addenda as follows:

2 Consultations with "Energy Efficiency Services Limited" (EESL), JV of PSUs under Ministry of Power.

Under Chapter 8: Infrastructure Planning
At section 8.4.7 "Distribution Services",
Table 8.57 – "Norms for Distribution Services"

Item no 1. "Fuel Filling Stations" (text addition to columns)

Sl No	Category	Service Density	Land Area requirement		Other controls
			Type of Facility	Area required	
1	Remains same	Remains same	- Battery Swap for EVs	Earmarking an area for "battery fitting station"	Remains same

Note:
- *For long distance travel undertaken by inter-city travel trips and available 24x7.*
- *Has to be organized by a service provider for connection and metering.*
- *Open metering and on-spot payment for all users.*

An additional item "Electric Charging Station" to be included before item no 3.

Sl No	Category	Service Density	Land Area requirement		Other controls
			Type of Facility	Area required	
3	Electric Vehicle Charging Station	Every 40 Kms, along the highways/roads with a provision of 1 FC for every 4 EV 1 SC for every 3 EV	Additional area alongwith Midway Stop Eateries/ Restaurants - AC Chargers - DC Fast Chargers - Battery Swap	As per the number of EV parking provided with the Restaurants /Eateries	Charging Stations to be provided at combined bays closest to the Built up area.

Note:
- *For long distance travel undertaken by inter-city travel trips alongside Midway-stop eateries.*
- *The land allocation is to be contiguous to the Commercial land (Restaurant/ Mid way eatery)*
- *Shall be limited to Passenger vehicles (Cars)*
- *Has to be organized by a service provider for connection and metering.*
- *Open metering and on-spot payment for all users.*

Addendum to Model Building Bye-Laws, 2016:

In Chapter 10: Sustainability and Green Provisions
After section 10.3 "Rating Systems".
A provision of "Electric Charging Infrastructure" to be added at clause 10.4

10.4 Electric Vehicle Charging Infrastructure:

Based on the occupancy pattern and the total parking provisions in the premises of the various building types, charging infrastructures shall be provided only for EVs, which is currently assumed to be 20% of all 'vehicle holding capacity' at the premise. Additionally, the building premises have to be sanctioned an additional power load, equivalent to power of all the charging points operated simultaneously with a factor of- 1.25. The charging infrastructure provision in different building types is as follows:

10.3.1 "Residential Buildings"

Building Type	Plotted House	Group Housing	
Ownership of Station	Private (Owner)	Service provider	
Connection and Metering	Domestic meter	Metering and Payment	
Charging time (avg)	4Ws:6 hrs, 2Ws:1-1.5 hrs SC	SC - 6 hrs: 4Ws, 1-1.5 hrs: 2Ws, FC - 1.5 hrs: 4Ws	
Modes of Charging	AC (Single stn)	AC (SC) + DC (FC)	
Norms of Provisions	only 1 SC	1 FC for each 4 EVs 1 SC for each 3 EVs 4Ws	1 SC for each 2 EVs: 2Ws

Note:
- *The facility in Group Housing is to be organized by a service provider for connection and metering.*
- *The metering and payment may be linked with the House owner's monthly maintenance bills with metered units credited to their smart card that is plugged during charging. Facility available 24x7 to all users.*
- *Open metering and on-spot payment options to be also available for visitors.*
- *Charging bays shall be planned currently at 20% capacity of all vehicles including 2ws and PVs(cars)*

10.3.2 "Institutional Buildings" (as defined in 1.16.c)

Building Type	Office Complex		
Ownership of Station	Service provider		
Connection and Metering	Metering and Payment		
Charging time (avg)	SC - 1-1.5 hrs: 2Ws, FC - 1.5 hrs: 4Ws, 3 hrs: PV (Buses)		
Modes of Charging	AC (SC) + DC (FC)		
Norms of Provisions	1 FC for each 4 EVs: 4Ws	1 SC for each 2 EVs: 2Ws	1 FC for each 4 PVs: Bus

Note:
- *The metering and payment may be linked with the individual's monthly accounts with metered units credited to their smart card that is plugged during charging.*
- *Open metering and on-spot payment options to be also available for visitors*
- *Charging bays shall be planned currently at 20% capacity of all vehicles including 2ws and PVs(cars)*

10.3.3 "Assembly Buildings" (as defined in 1.16.d)

Building Type	Assembly buildings	
Ownership of Station	Service provider	
Connection and Metering	Metering and Payment	
Charging time (avg)	FC - 1.5 hrs: 4Ws, SC - 1-1.5 hrs: 2Ws	
Modes of Charging	AC (SC) + DC (FC)	
Norms of Provisions	1 FC for each 4 EVs: 4Ws	1 SC for each 2 EVs: 2Ws

Note:
- *On-spot metering and payment for all vehicles*
- *Charging bays shall be planned currently at 20% capacity of all vehicles including 2ws and PVs(cars)*

10.3.4 "Multi-level Parking Complex" (as defined in 1.16)

Building Type	MLP Complex	
Ownership of Station	Service provider	
Connection and Metering	Metering and Payment	
Charging time (avg)	FC - 1.5 hrs: 4Ws, SC - 1-1.5 hrs: 2Ws	
Modes of Charging	AC (SC) + DC (FC)	
Norms of Provisions	1 FC for each 4 EVs: 4Ws	1 SC for each 2 EVs: 2Ws

Note:

- *On-spot metering and payment for all vehicles*
- *Charging bays shall be planned currently at 20% capacity of all vehicles including 2ws and PVs(cars)*

10.3.5 "Public Car parking" (alongside BRTS/MRTS)

Building Type	MRTS/BRTS parking		
Ownership of Station	Service provider		
Connection and Metering	Metering and Payment		
Charging time (avg)	FC - 1.5 hrs: 4Ws, SC - 1-1.5 hrs: 2Ws, BS for all EVs		
Modes of Charging	AC (SC) + DC (FC) + Battery Swap		
Norms of Provisions	1 FC for each 4 EVs: 4Ws	1 SC for each 2 EVs: 2Ws	BS only for 3Ws

Note:

- *On-spot metering and payment for all vehicles*
- *Charging bays shall be planned currently at 20% capacity of all vehicles including 2ws and PVs(cars)*

10.3.6 "Bus Terminals/ Depots (Intra City-Services)"

Building Type	Surface Transport terminals	
Ownership of Station	Service provider	
Connection and Metering	Metering and Payment	
Charging time (avg)	FC - 3 hrs: PV (Buses), SC - 2-3 hrs: 3Ws, BS for all EVs	
Modes of Charging	AC (SC) + DC (FC) + Battery Swap	
Norms of Provisions	1 FC for each 3 EVs: PV(Buses)	1 SC for each 3 EVs: 3Ws

Note:

- *On-spot metering and payment for all vehicles. Facility available 24x7 for all users.*
- *Charging bays shall be planned currently at 10% station holding capacity of all busses.*

10.3.7 "Service Stations/ Garages"

Building Type	Service Garages	
Ownership of Station	Service provider	
Connection and Metering	Metering and Payment	
Charging time (avg)	FC - 1.5 hrs: 4Ws, SC - 1-1.5 hrs: 2Ws, 2-3 hrs: 3Ws, BS for all EVs	
Modes of Charging	AC (SC) + DC (FC) + Battery Swap	
Norms of Provisions	1 FC for 4Ws	3 SCs for 2Ws and 3Ws

Note:

- *On-spot metering and payment for all vehicles*
- *Charging bays are provided as per area available with the given minimum provisions*
- *Facilities with variable occupancy and with flow of serviced vehicles, only a fixed level of provision is made based on the average count of vehicles serviced per day.*

---------- x x ----------