



Lessons Learned – EV Project: Accessibility at Public EV Charging Locations

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1 Introduction

ECOtality, Inc. (NASDAQ: ECTY), headquartered in San Francisco, California, is a leader in clean electric transportation and storage technologies. Its subsidiary Electric Transportation Engineering Corporation (eTec), dba ECOtality North America, (ECOtality), is the leading installer and provider of charging infrastructure for electric vehicles (EVs). ECOtality has been involved in every major electric vehicle (EV) or plug-in electric vehicle (PHEV) initiative to date in North America and is currently working with major automotive manufacturers, utilities, the U.S. Department of Energy (DOE), state and municipal governments, and international research institutes to implement and expand the presence of this technology for a greener future.

ECOtality designed and currently manages the world's largest EV infrastructure demonstration - The EV Project. With a budget of over \$230 million, The EV Project will deploy and study Level 2 AC electric vehicle supply equipment (EVSE) stations for residential use, Level 2 AC EVSE stations for commercial and DC fast charge stations representing approximately 14,000 field assets, utilized in concert with the deployment of Nissan LEAF™ vehicles and Chevrolet Volt vehicles.

The EV Project is a public – private partnership funded by the U.S. Department of Energy through a federal stimulus grant, made possible by the American Recovery and Reinvestment Act (ARRA) and by private investment of ECOtality and its partners.

The EV Project is an infrastructure study. The Project will deliver to ECOtality, the Government and the general public a wealth of directly-applicable technical and professional experience for jumpstarting regional EV adoption and replicating business models that lead to sustainable, market-based charge infrastructures.

One purpose of the EV Project is to identify potential barriers to the widespread adoption of electric vehicles (EVs) and the deployment of electric vehicle supply equipment (EVSE) to support them. This process identifies topics of national interest in the early deployment of EV charging stations in order to facilitate discussion and resolution. This paper documents the issues associated with, and this EV Project's approach to compliance with the U.S. Americans with Disabilities Act - 28 CFR Part 36 (ADA).

The EV Project is expected to deploy more than 5,000 EVSE in publicly available locations. These EVSE will provide recharge services to all EVs manufactured or sold in the United States utilizing the standard J1772 connector. As these EVSE are publically available, requirements of ADA are applicable. However, current state and federal regulations do not provide design standards that specifically address EV parking and charging. This Lessons Learned report provides background on the issues associated with ADA compliance,

New standards may be developed; therefore, interpretations and recommendations herein constitute the best guidance as of this date.

2 Lessons Learned

This section covers the primary steps involved in developing the final summary. In this task, the project team members performed research, evaluated their findings, and then assessed their results against their expectations before making a final recommendation regarding Accessibility at Public EV Charging Locations.

2.1 Applicability

Federal statutes and National standards that guide accessibility requirements include:

- 2009 International Building Code / 2003 ANSI A117.1 standards (IBC)
- U.S. Americans with Disabilities Act - 28 CFR Part 36 (ADA)

Generally, agencies or companies that build new facilities or alter existing facilities must comply with the ADA Standards for Accessible Design. The ADA also requires that all State and local government programs and services and all goods and services offered to the public by businesses are accessible to people with disabilities.

The federal ADA requirements as well as state and local disability laws require services provided to the public by business and government to be offered equally to persons with disabilities. Because Level 2 commercial charging stations and DC fast charge stations deployed under the EV Project are a service offered to the public, they must be manufactured and installed to meet the accessibility requirements of federal, state and local laws.

The ADA Accessibility Guidelines for Buildings and Facilities (ADAAG) does not specifically address charging station design. However, equal access for persons with disabilities to publicly available EV charging stations is still required even absent ADAAG design guidelines. Accessibility to the EVSE and accessibility to the facility are both important, although separate, considerations.

In the absence of specific accessibility guidelines for EV charging stations, states such as California, Oregon and Washington, are utilizing preliminary guidance documents, past and present, to assist with application of accessibility standards to EVSE deployment efforts¹. Many cities and counties are also developing their own charge station deployment guidelines. Because the EV Project will install charging stations in multiple states and local jurisdictions with the potential for varying interpretations of accessibility requirements, ECOtality conducted an assessment of the application of existing accessibility requirements from Federal Regulations, the 2009 International Building Code (IBC)/2003 ANSI A117.1, and the 2010 California Building Code to charging station design in order to assist the EV Project in developing methodology for compliance with accessibility requirements. Results of this assessment are presented in the following paragraphs of Section 2.

¹ California Department of General Services – Division of the State Architect – Policies, DSA – 2011 California Access Compliance Reference Manual Policies, 97-03 (Revised 6/05/97); State of Oregon Building Codes Division – Local Building Department Newsletter, “Electric Vehicle Charging Stations and ADA” (12/08/10), www.bcd.oregon.gov/bldg_newsletter/index.html; Washington Department of Commerce and Puget Sound Regional Council – “Electric Vehicle Infrastructure – A Guide for Local Governments in Washington State” (07/10)

2.2 General Parking Accessibility Requirements

An accessible space is at least 8-feet wide by 18-feet deep which includes an access aisle of 5 feet on the passenger side. Two accessible spaces can share the common access aisle. A van accessible space is the same size with an 8 foot access aisle on the passenger side.

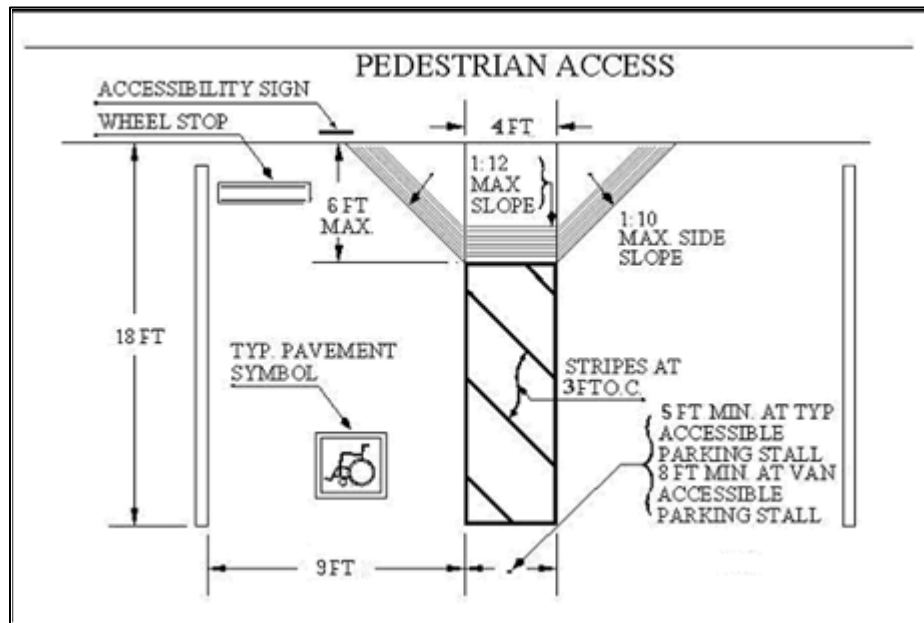


Figure 1 Typical Accessible Parking Space

In general, for every 25 parking spaces, one parking space should be accessible. For every 6 parking spaces that are accessible, one parking space should be van accessible.

Table 1 Accessible and Van Accessible Spaces

Parking Spaces	Accessible Spaces	Van Accessible Spaces
1	1	1
2-25	1	1
26-50	2	1
51 – 75	3	1
76 – 100	4	1

A summary of the elements required for accessibility is found in Table 2.

Table 2 Accessible Requirements

Element	ADA/ABA 2004/ANSI A117.1 2003	CA Building Code 2010
Accessible Route Width	Minimum 36" wide	Minimum 48" wide
Accessible Route Slope/Cross Slope	Maximum 1:20 (5%) running slope	Maximum 1:20 (5%) running

	and 1:48 (2%) cross slope; Accessible vehicle spaces 1:48 (2%) in all directions	slope and 1:50 (2%) cross slope; Accessible vehicle spaces 1:50 (2%) in all directions
Reach Range	48" front and side;	54" side reach range and 48" front reach range;
Accessible Controls	Operable with one hand, and not requiring grasping, pinching, or twisting of the wrist or force more than 5 lbs. Exception: Gas pumps.	SAME
Side Access Aisle	Side access aisle of 60" wide	Side access aisle of 60" wide
Accessible Card Reading Devices		One card reader and two card readers if multiple to be within 54" reach range; Accessible route; 30"x48" clear floor space centered on the reader (+/-9"), with the face of the reader maximum 10" deep.

The general requirements for accessibility can be applied to EV charging stations. A person with disabilities utilizing an accessible EVSE parking space must be able exit their vehicle, enter a side access aisle to access the EVSE, operate the charging station, insert the EVSE connector into the EV and access the services on-site. In addition, the EVSE must comply with the specific ADA requirements noted above.

2.3 Restrictions For EV Charging Only

Establishing an EV charging infrastructure has unique challenges in that the public is not used to seeing EVSEs in public and may be unfamiliar with its purpose and use. Without specific signage to the contrary, internal combustion engine vehicles may park in spaces equipped with an EVSE because they are convenient and vacant. When an EV arrives, the driver finds the space occupied and is unable to connect. For that reason, it is recommended that municipalities adopt specific ordinances to prohibit non-EVs from parking in spaces marked for "EV Charging Only" and require that EVs parked in spaces marked for "EV Charging Only" be connected to the EVSE while parked.



Figure 2 EV Charging Only Sign

Therefore it may not be feasible to install EVSE in existing accessible parking spaces because that space then becomes exclusively designated for an EV and would remove one of the accessible spaces originally required for the facility.

2.4 Facility Accessibility

The introduction of EVSE into an existing parking area brings several challenges. While there is significant interest and incentive to install EVSE to promote range confidence for EVs, there are several practical considerations as well. Without a substantial quantity of EVs in the local market, businesses are wary of investing in the new technology and potential business benefits. The market is still nascent and making the business case is difficult. Consequently, business owners who are interested in providing EV charging are interested in completing the installation for the least cost.

Lowest costs for EVSE installation are typically found closer to the electrical supply where any concrete or asphalt cuts are minimal. These locations are typically not near the business entrance.

It has been found that placing the EV Charging in only the parking spaces in prime locations in a parking lot can be detrimental to the image of EVs in that internal combustion engine drivers feel the preferential treatment given is unfair and especially so if the space is frequently vacant. Thus, EV parking spaces in preferential locations near the entrance are generally discouraged.

For these reasons, providing an accessible path of travel to the business entrance may also be difficult.

2.5 Disproportionality

Subpart D of 28 CFR Part 36 does provide some guidance when considering costs associated with the design and installation of improvements to a parking area.

- (1) Alterations made to provide an accessible path of travel to the altered area will be deemed disproportionate to the overall alteration when the cost exceeds 20% of the cost of the alteration to the primary function area.²

In addition, this section identifies examples of costs that may be considered including “costs associated with providing an accessible entrance and an accessible route to the altered area, for example, the cost of widening doorways or installing ramps;...and costs associated with making restrooms accessible, such as installing grab bars, enlarging toilet stalls...”³

The reference to enlarging toilet stalls as an example would infer costs associated with widening of a parking space could be included. If the cost to widen a parking space and the

² Subpart D of 28 CFR Part 36, § 36.403(f)

³ *ibid*

associated changes to the parking lot exceed 20% of the cost of the alteration to the primary function area, the cost would be disproportional.

2.6 Exclusivity

ADA sets out design requirements for an accessible bathroom. However, an accessible bathroom stall is not reserved exclusively for a person with disabilities. The same is true for accessible hotel rooms. Likewise, an accessible EVSE parking space need not be reserved exclusively for an accessible EV. As noted in the Advisory, “Enforcement of motor vehicle laws, including parking privileges, is a local matter.”⁴

2.7 Card Reading Devices

Requirements for card reading devices are identified above. The ECotality Level 2 Blink EVSE does not contain a card reading device. It does contain an RFID reader which is used to turn on the charging station by placing a RFID card close to the on-board antenna. Placement of accessible EVSE unit shall allow a 48” reach to the RFID antenna as well as the EV connector and cable management system.

2.8 Level 2 EVSE

Level 2 EVSE refer to the EVSE category that is powered by 240 Volt AC current. This is typical of most of the expected EVSE in the workplace and publicly available at destination locations. Level 2 EVSE must be designed for accessibility.

ECotality provides for accessibility in the Level 2 EVSE by adjusting the height of the unit.



Figure 3 ECotality Level 2 EVSE

2.9 DC Fast Charger Connector

⁴ Subpart D of 28 CFR Part 36, § 502.6

The DC Fast Charger (also designated DC Level 2) is designed to return a significant recharge to the EV in a short period of time. Thus it is expected that an EV will remain connected to this DC Fast Charger for a short time, similar to that involved in refueling an internal combustion car. To accomplish this, the equipment is designed to provide the high current necessary. The weight of the DC Fast Charger connector and cable is the biggest impediment to full, unassisted access of to the DC Fast Charging station.



Figure 4 ECOTality DC Fast Charger

The closest comparison of accessibility requirements for DC Fast Charge stations is with retail gasoline stations. The gasoline-dispensing nozzle typically presents impediments to full unassisted access that are similar to those encountered with the DC Fast Charger connector and cable. Access can typically be achieved only by the use of an attendant to assist with fueling. Although ADA requires self-serve gas stations to provide equal access to their customers by the use of an attendant, it provides an exception when the station is operated on a remote control basis with only a single employee. In California, gas stations staffed with two or fewer individuals are exempted from accessibility requirements. Such stations are required to post signage indicating that they provide the refueling service as well as signs alerting customers that they cannot provide the accessible service based on a lawful exemption (California Business and Profession Code § 13660). Other examples that do not provide for any back-up attendant service for disabled users are electronic parking lots and street parking meters, bank ATM machines, drive-up ATM machines, security intercom devices for both pedestrian and vehicular use, and private parking lot ticket machines. Thus the business nature of the DC Fast Charger host and their employee availability, the location of the unit, and costs associated with a local call system will be factors in whether support services can be available. The exceptions noted above suggest that these support services are not required.

2.10 To the maximum extent feasible

Installing an ADA accessible EVSE parking space affects the balance of parking for a facility because of the increased width of the access aisle. In many cases, the access aisle will reduce the total number of parking spaces by at least one. Giving up more parking spaces may be difficult for the business owner when the size of the parking lot is already limited. The following guidance is provided by the 2010 ADA Standards for Accessible Design.

“The phrase “to the maximum extent feasible,” as used in this section, applies to the occasional case where the nature of an existing facility makes it virtually impossible to comply fully with applicable accessibility standards through a planned alteration. In these circumstances, the alteration shall provide the maximum physical accessibility feasible. Any altered features of the facility that can be made accessible shall be made accessible. If providing accessibility in conformance with this section to individuals with certain

disabilities (e.g., those who use wheelchairs) would not be feasible, the facility shall be made accessible to persons with other types of disabilities (e.g., those who use crutches, those who have impaired vision or hearing, or those who have other impairments).”⁵

Creating an accessible EV Van parking space may not be feasible but an accessible EV parking space may be feasible. This requirement will be the primary guidance for EVSE installation.

⁵ Subpart D of 28 CFR Part 36, § 36.402(c)

3 Recommendations

Federal accessibility standards do not specifically address electric vehicle charging stations. Nevertheless, it is required to incorporate ADA accessibility requirements in the design of commercial charging station equipment and installation plans. For the purpose of the EV Project and early market deployment of commercial EVSE, ECotality finds that reasonable efforts to incorporate accessibility requirements during installation of its commercial Level 2 and DC Fast Charge stations can be accomplished.

3.1 Recommendations for Level 2 EVSE

The following recommendations will enable persons with disabilities to have access to a charging station and comply with the ADA and IBC:

- Parking is required in order to use the charging station therefore an accessible space is required to park, exit vehicle and access the charging station. The accessible charging station space should be a 96" space with a 60" access aisle similar to a standard accessible parking space.
- Operable controls within 48" front and side reach range; 30" x 48" clear floor space is required.
- If the accessible charging station is located at a site with other amenities, such as at a convenience store, coffee shop, etc., then the space needs to be connected by a minimum 36" wide accessible route to the entry of the building. Accessible routes must have maximum 1:20 (5%) running slope and 1:48 (2%) cross slope. It is not an accessible route where wheelchair users and others with mobility impairments need to compete with vehicular traffic in the traffic aisles.

Table 3 EV Accessibility Requirements

Element	ADA/ABA 2004/ANSI A117.1 2003	CA Building Code 2010
Accessible Route Width	Minimum 36" wide	Minimum 48" wide
Accessible Route Slope/Cross Slope	Maximum 1:20 (5%) running slope and 1:48 (2%) cross slope; Accessible vehicle spaces 1:48 (2%) in all directions	Maximum 1:20 (5%) running slope and 1:50 (2%) cross slope; Accessible vehicle spaces 1:50 (2%) in all directions
Reach Range	48" front and side;	54" side reach range and 48" front reach range;
Accessible Controls	Operable with one hand, and not requiring grasping, pinching, or twisting of the wrist or force more than 5 lbs. Exception: Gas pumps.	SAME
Side Access Aisle	Side access aisle of 60" wide	Side access aisle of 60" wide
Accessible Card Reading Devices		One card reader and two card readers if multiple to be within 54" reach range; Accessible route; 30"x48" clear floor space centered on the reader (+9"), with the face of the reader maximum 10" deep.

Compliance Recommendations

- 1) When an accessible Level 2 EVSE is added to an existing accessible parking space, the parking space must still meet all of the criteria of an accessible space, including being reserved exclusively for the use of disabled persons. However, since this accessible parking space is part of the original accessible parking design, it cannot be reserved exclusively for EV Charging Only.
- 2) Accessible charging station spaces should have a 60" access aisle and be 96" wide and provided in the ratio of 1 per 25 charging station spaces installed. Accessible EV Van spaces should be provided with a 96" access aisle. The following table illustrates the requirements.

Table 4 EV Parking Space Requirements

EV Parking Spaces	Accessible EV Spaces	Accessible EV Van Spaces
1	1	1
2-25	1	1
26-50	2	1
51-75	3	1
76-100	4	1

In instances where widening an existing parking space or eliminating a parking space is required to establish an accessible space, a project cost analysis may be conducted to identify costs associated with establishing the accessible space. If the alterations required to provide an accessible space exceeds 20% of the unaltered project cost, the alteration costs may be deemed disproportionate to the overall project cost. The alteration shall comply with the requirements of Section 2.8.

- 3) Access aisles must take into consideration use from either side to accommodate differences in location of charging inlets across vehicles. The differences in charging inlets across vehicles and the design of the EVSE may require the EV driver, both able bodied and disabled, to back into the parking space.
- 4) As charging is considered the primary purpose of parking spaces equipped with EV charging equipment, the charge station facility is not a parking facility. Therefore when an accessible EV charger is added to a new accessible parking space, the accessible charging station does not need to be located immediately adjacent to the building entrances. New accessible charging stations should, however, be located in reasonably close proximity to the building or facility entrance (consistent with economical installation of electrical service to the charging equipment).
- 5) If an accessible charging station is located on the site of a building that is required to be accessible, such as at a convenience store, coffee shop, etc., then the charging station must be connected by an accessible route to the entry of the building. Provision of an accessible route through a parking lot may require curb ramps, crosswalks or other alterations. As an alternative, establishing an accessible route may involve moving the proposed charging station

adjacent to an existing accessible parking space that has an existing accessible route. In instances where alterations to an existing site or relocation of the charging station are required to establish an accessible route, a project cost analysis may be conducted to identify costs associated with establishing the accessible route. If the alterations required to provide an accessible route from the charging station to the building entrance exceeds 20% of the unaltered project cost, the alteration costs may be deemed disproportionate to the overall project cost. In this case, the path of travel will be made accessible to the extent that it can be without incurring disproportionate costs; the disabled person will have access to the charging station but may need to move the vehicle to obtain access to the entry of the building.

6) Distinct signage must be utilized at accessible charging station parking spaces indicating that the space is only for electric vehicle charging purposes. It is not necessary that this signage designate the accessible electric vehicle charging station exclusively for the use of disabled persons. When not in use by a disabled person, the accessible charging station can be used by able bodied persons similar to the use of accessible hotel rooms.

3.2 Recommendations for DC Fast Chargers (DC Level 2)

The DC Fast Charger shall be designed for accessibility. In addition, the recommendations above for the Level 2 EVSE apply along with the following recommendations. The ECotality Blink DC Fast Charge does not contain a card reading device.

1) Proposed locations for DC Fast Charge station installations may have an attendant (such as a gas station/convenience store) or not, as in an unattended parking lot or minimally staffed location. Where available, attendants may be used to provide equal access to DC Fast Charge stations. Signs or notification on or near the DC Fast Charge stations will let customers know that individuals with disabilities can obtain charging assistance by honking their horn or otherwise signaling an employee. A call button may be provided.

2) The cable and connector for DC Fast Charge stations weigh approximately 19 lbs. The force required to operate the DC Fast Charge connector lever and insert it into the EV inlet exceeds the 5 lbs maximum operating force for accessible controls. The exemption allowed for gasoline-dispensing nozzles is, however, applicable here.

4 Summary

Federal accessibility standards do not specifically address electric vehicle charging stations. Nevertheless, it is required to incorporate ADA accessibility requirements in the design of commercial charging station equipment and installation plans.

In general, design requirements provided by the 2010 ADA Standards for Accessible Design can be accommodated in the design and installation of publicly available EVSE. In some cases, strict interpretation of these design requirements may increase the project costs disproportionately or create such facility design issues that compliance is not feasible. Public policy and direction is favoring the expansion of the EV charging infrastructure and strict interpretation may impede its development. Consideration for this situation is already provided in the ADA Standards related to “disproportionality” and “maximum extent feasible”.

For the purpose of the EV Project and early market deployment of commercial EVSE, ECOtality finds that reasonable efforts to incorporate accessibility requirements during installation of its commercial Level 2 and DC Fast Charge stations can be accomplished under the above parameters.