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Analysis of the electric vehicle charging station coverage in an Italian alpine region

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Abstract

The transition towards more sustainable transport promotes the adoption of electric vehicles, and the status of the charging infrastructure is a crucial point to achieve this result. This research examines the availability of EV charging stations in the Provincia Autonoma di Trento (PAT), a popular tourist destination in the Italian eastern Alps. The study uses the Open Charge Map dataset, which is representative of the distribution and density of charging stations and is available under the Creative Commons Attribution 4.0 (CC-BY 4.0) International license. The road network and charging stations are combined, and the distance between roads and potential users is evaluated. Custom software has been developed and released under the GNU GPL license for the network analysis for this research, while all the carthographic processing has been carried out in QGIS. The mean distance of any point on the road network to the closest charging point is 4763.4 m, with a standard deviation of 4601.6 m. The maximum distance is 36766.6 m, with a minimum distance of 0 m. The density of charging stations is evaluated by extracting charging points for each municipality. The average number of charging stations per municipality is 1.9, with 42.4% having no charging points and 56.6% having at least one. With respect to resident population, the average number of charging points is 0.84 per 1000 inhabitants, with a standard deviation of 1.39. The results are compatible with with the recent Italian national report MOTUS-E and are useful for future EV charging infrastructure planning. In conclusion, results highlight that in our study area the charging stations reach the maximum density per inhabitant in touristic locations. From the point of view of data availability, the research highlighted that the quality of Open Data sources like Open Charge Map should be improved to obtain more reliable results.

1. Introduction

The transition towards more sustainable transport, together with a worldwide push for decarbonization, promotes the adoption of light-duty electric vehicles (EVs). Nevertheless, for EVs to run on par with or better than internal combustion engine vehicles, they require convenient enough charging infrastructure (Knez et al., 2019).
Another significant factor is the phenomenon called *range anxiety* (Myers et al., 2025), in which EV drivers are concerned about the distance their vehicle can cover within a single charge. This can be alleviated by a charging infrastructure that has the following characteristics (Hanig et al., 2025):

1. high frequency: small coverage gaps in between stations
2. dense: enough stations to provide for the number of vehicles in the corresponding region
3. reliable: it maintains the above characteristics even if some nodes fail

Even if only a small fraction of all car trips are longer than 50 miles (well within the range of today's EVs), long-distance drivers' concerns about charging tend to have a disproportionate effect on their decision to buy this kind of vehicle (Haidar and Aguilar Rojas, 2022). In addition, changing station availability can be critical when choosing a tourist destination.
Current studies investigate the possibility of identifying optimal locations for electric vehicle chargers (Kim and Kim, 2025) (Perera et al., 2020), identifying the relationship between demand and traffic, which in turn highlights the proximity to main roads and highways as a deciding factor for charger locations. The economics of the public electric vehicle has been investigated, in particular with respect to the situation in France (Haidar and Aguilar Rojas, 2022), Korea (Kim et al., 2022), Turkey (Ömer Gönül et al., 2021) and the United States (Yang et al., 2024). The incompatibility of electric vehicle chargers across various car manufacturers, models and world regions is the main topic of (Knez et al., 2019).
In Italy research focused on the dynamics of electric vehicle charging infrastructure management on a highway (Saldarini et al., 2025), charging behavior in urban areas (Conti et al., 2025) and forecasting power demand patterns of public electric vehicle charging (Baronchelli et al., 2025).
Information about EV charge points accessibility and density can be found in reports aimed primarily at a general public and communicating information at a national level with little detail. More than 277,365 battery electric vehicles (BEVs) are circulating in Italy, with 64,391 charge points (+27% vs. Dec 2023), 54,093 (84%) of which are currently active (MOTUS-E, 2025).
This research project analyzes the availability of EV charging stations in the Provincia Autonoma di Trento (PAT), a region in the eastern Italian Alps (Figure 1), a popular tourist destination for Italians and northern Europeans. This region has been extensively studied for both the current landscape (Gobbi et al., 2019a) and the past land use/land cover (Gobbi et al., 2019b, Zatelli et al., 2022, Bozzano et al., 2024). The number of charge points for the Provincia Autonoma di Trento is not indicated in the last MOTUS-E report (MOTUS-E, 2025), where data are recorded for the whole Trentino-Alto Adige–Südtirol region, thus including the province of Bolzano–Bozen: it records 1983 installed charge points (1912, 96%, active) in December 2024.
The availability of EV chargerschargers is evaluated with respect to the distribution of the distance of the charger from any part of the road network, the number of chargers for each municipality and the number of chargers per 1000 inhabitants.

Figure 1. Trentino region in Italy.

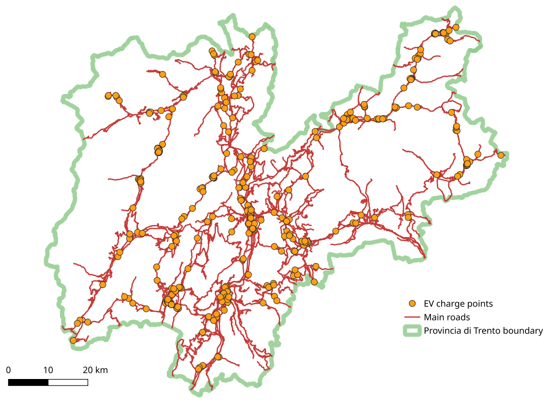

Figure 2. EV charge points and main road network in the Trentino region.

2. Materials and methods

2.1 Materials

An analysis of EV charge point accessibility and density needs three maps: a map of administrative boundaries, the road network, and a map of the EV charge points.
Although an Italian national repository, PUN, "Piattaforma Unica Nazionale dei punti di ricarica per i veicoli elettrici" of the Ministero dell'Ambiente e della Sicurezza Energetica (Single National Platform for Charging Points for Electric Vehicles of the Italian Ministry of Environment and Energy Security) (Ministero dell'Ambiente e della Sicurezza Energetica, 2025) is available for consultation, its dataset cannot be downloaded as a map or a table for processing at the time of writing. Therefore, the Open Charge Map (OCM) dataset (Open Charge Map, 2025), available under the Creative Commons Attribution 4.0 International license (CC-BY 4.0), has been used. Although this charging point database is far from complete, it is fairly representative of the distribution and density of the charging stations. The JSON data set for Italy has been converted to CSV, with two columns containing latitude and longitude for each point in the WGS84 Lat/Long (EPSG 4326) datum. A point map has been created via geocoding and the points have been re-projected in the ETRS89/UTM32N (EPSG 25832) datum. Finally, points inside the Provincia Autonoma di Trento have been extracted.
The road network and the administrative boundaries, for both the Provincia Autonoma di Trento and the municipalities, have been provided by the local government, the Provincia Autonoma di Trento, with a scale of 1: 1000, again under the CC-BY 4.0 license (Provincia Autonoma di Trento, 2025) and with ETRS89/UTM32N (EPSG 25832) datum. Only paved roads have been used.
Information about the number of inhabitants for each municipality for the Provincia Autonoma di Trento in 2024 has been obtained from ISTAT (Istituto nazionale di statistica – Italian National Institute of Statistics) under the Creative Commons Attribution 4.0 International (CC BY 4.0) license (Istituto nazionale di statistica, 2025).

2.2 Methods

Network analysis provides a set of tools to determine the geometric and topological features of a network (De Vito and Grossetti, 2024). Networks are represented as graphs, with nodes corresponding to entities and arcs expressing their connections, which are analyzed using Graph Theory. For road networks nodes represent either starting points/destinations or an intermediate point, arcs correspond to the road sections connecting nodes. This approach is usually employed to optimize travel routes, but its application field is very wide. For example, (Zatelli et al., 2025) applied network analysis to the reconstruction of historical itineraries for literary and responsible tourism.
We have developed a software tool, available under the GPL-3.0 license (Bacilieri, 2025), to perform the network analysis, using python with numpy and geopandas libraries for data processing and igraph for network analysis. The Matplotlib library has been used for data visualization.
The road network and the charging stations have been combined, placing a node in each station, at each road intersection, and at each road extremity. Each edge in the graph has then been assigned a weight proportional to the physical length of the road, to avoid approximating with the euclidean distance between the endpoints, which is strictly smaller than the real value. Once the network is set up, the algorithm analyzes the distance of each node by spreading the information from the charging stations out, breadth-first. Each node is initially assigned a distance, equal to zero for the charging stations and set to infinity for all other nodes. Then the information is iteratively spread from the active nodes to their neighbors: the algorithm calculates the distance that the neighbor would receive by adding the length of the road to the value at the active node; if this value is smaller than the current registered distance, the information is updated and the neighbor is marked to be active for the next iteration.
With this configuration, the distance of each road to the closest charging station, defined as the minimum distance of the starting or ending node of the arc representing the road, has been evaluated: the minimum distance is below 1 km for most of the roads, with only a few roads above 7 km. To provide a better representation of the distance between charging stations and potential users, a set of points along the roads with a distance of 500 m has been created, as seen in Figure 3. The distance from the charging points for these 8975 points has been evaluated. Nodes belonging to roads shorter than 100 m have been removed because they would have too much influence on the distance distribution.
EV charge points have been assigned to each municipality by selecting the corresponding points overlapping the municipality area feature in QGIS (QGIS Development Team, 2025) and

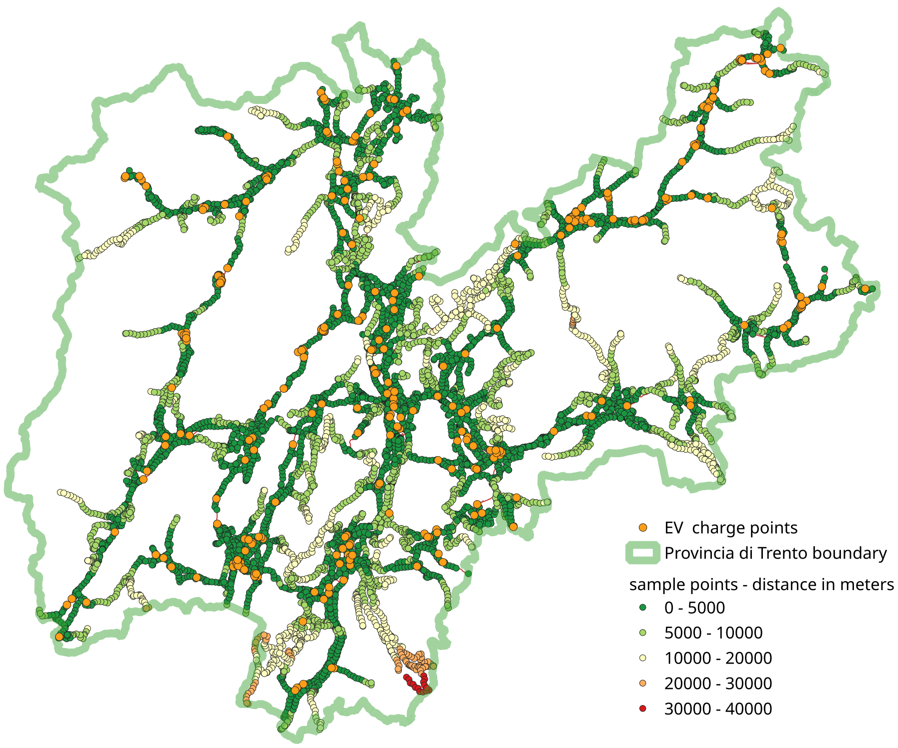

Figure 3. Distance from the nearest charger of points sampled at 500m distance along the roads.

assigning the chargers number to each area in a new field in the associated table.
The resulting map, originally in the GPKG format, has been exported in the CSV format for further processing in a spreadsheet. Basic statistics, such as average and standard deviation of charges per municipality, have been evaluate in LibreOffice Calc. Since almost half of the municipalities have no charge point (see Section 3) and they would heavily skewed the results, the same statistics have been calculated for the subset of the municipalities with at least one charger.
The population table provided by ISTAT has been linked to the area features of the corresponding municipality using a join, with the ISTAT municipality code as join field. This code follows the European Regulation (EC) no. 1059/2003 which established the territorial units for statistics (NUTS – Nomenclature d'Unités Territoriales Statistiques) and their classification. Finally, average and standard deviation values per municipality have been evaluated, both including and excluding municipalities with no chargers.

3. Results

The average distance of any point on the road network from the charging points is 4763.4 m, with a standard deviation of 4601.6 m. The maximum distance is 36766.6 m, and, as expected, the minimum is 0 m. Only 3175 (35.37%) points have a distance above 5 km, of which 1115 (12.42 %) have a distance above 10 km. The distribution of these distances is shown in Figure 4. Distance distribution skewness is 1.85 indicating, as expected, an asymmetric distribution with large majority of points having very low distances. This can also be seen by noticing that the median value is 3337.2 m, significantly lower than the average value. The higher concentration of points in the central portion of the curve is also described by the distribution's kurtosis, valued at 4.986, where the normal distribution has a value of 0.

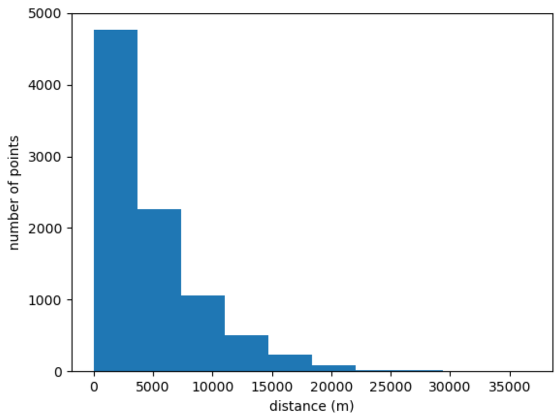

Figure 4. Distribution of distances using points every 500m on the roads.

Figures 5 and 6 show how the minimum and maximum distance for each road are distributed. It is possible to see how the minimum for many roads is 0 or very low, due to many roads having at least one of their endpoints close to a charging station.
To analyze the spatial distribution of the charging stations, their density was evaluated by extracting the charging points for each municipality. The province has 166 municipalities, ranging from relatively large cities in the main valleys to very small municipalities in secondary valleys. The number of charging stations per municipality is quite low, 1.9 on average, but 72

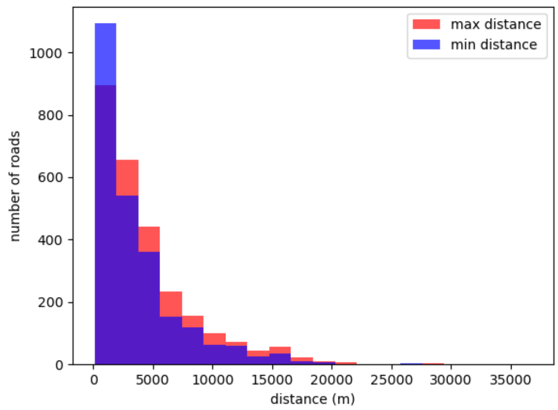

Figure 5. Distribution of minimum and maximum distance on a per-road basis.

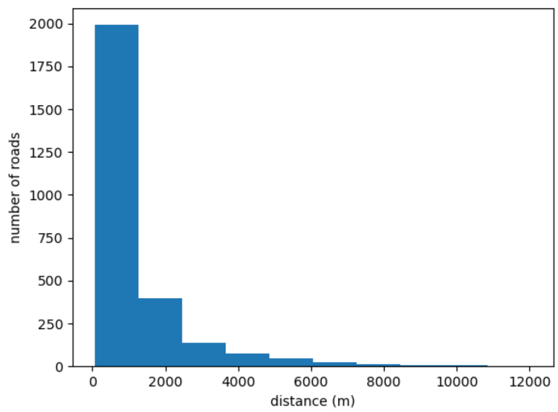

Figure 6. Distribution of the difference between the maximum and minimum distance on a per-road basis.

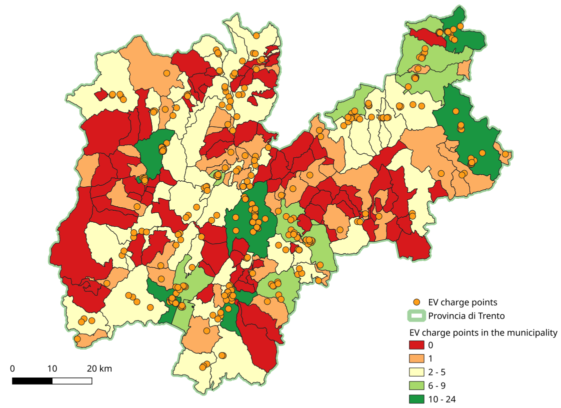

Figure 7. Distribution of EV charge points per municipality.

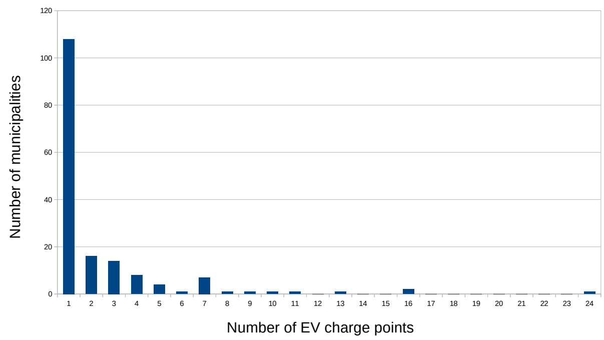

Figure 8. Distribution of municipalities per number of EV charge points.

(43.4%) municipalities have no charging points at all. For the other 94 (56.6%) municipalities which do have at least one charging station, the average number is of 3.32 charging point per municipality, with a standard deviation of 3.79.
The distribution of charge points across municipality is shown in Figures 7 and 8, its main statistics are in Table 1. Note that some areas are detached parts of a municipality (“isole amministrative” in Italian), therefore they are classed as having one or more EV charge points even if they do not contain any charge point.

	Av.	Std	Av. non 0	Std non 0
Per munincp.	1.95	3.32	3.45	3.79
Per 1000 inhab.	0.84	1.39	1.48	1.58

Table 1. Chargers distribution statistics: number of EV charge points per municipality and per 1000 inhabitants in each municipality. Average and standard deviation values are calculated for all the municipalities and for municipalities with at least one charger (“Av. non 0” and “Std non 0” columns).

Values for each municipality is reported in Table 2 in Appendix A.
Municipalities with a high number of EV charge points (24–10), in dark green on the map in Figure 7, correspond either to the largest cities (Trento and Rovereto) or to the most popular touristic destinations (Pinzolo, Riva del Garda, San Martino di Castrozza and Canazei–Cianacei).
The second group, in light green in Figure 7 with a number of charge points between 9 and 6, contains a large town, Pergine Valsugana, and 12 touristic destinations (Andalo, Arco, Campitello Di Fassa-Ciampedel, Cavalese, Comano Terme, Folgaria, Levico Terme, Moena, Nago-Torbole, Pergine Valsugana, Predazzo, San Giovanni Di Fassa–Sèn Jan, Ville Di Fiemme).
The third class, in light yellow in Figure 7 with a number of charge points between 5 and 2, correspond to 42 smaller towns or municipalities close the largest ones, where it is therefore possible to use the charge points from the adjacent towns. For example, the municipality of Lavis, with 4 charge points, borders the municipality of Trento, where some of its 24 charge points are quite close to the border.
Municipalities with 0 (in red in Figure 7) or 1 (in orange) charge point are 108 peripheral areas with low tourists numbers, with some exceptions. For example, the village of Mazzin–Mazin, in the north eastern part of the region, which have no EV charge points, is close to Canazei–Cianacei, which is one of the best served municipalities with 10 EV charge points.
The density of EV chargers with respect to the population in 2024 is shown in Figures 9 and 10 as number of chargers per 1000 inhabitants. The range is 0–10 and has been divided in 7 classes (0–0.13, 0.13–0.44, 0.44–1.42, 1.42–3.13, 3.13–5.89 and 5.89–10) using Jenks’ natural breaks classification method

(Brewer and Pickle, 2002).

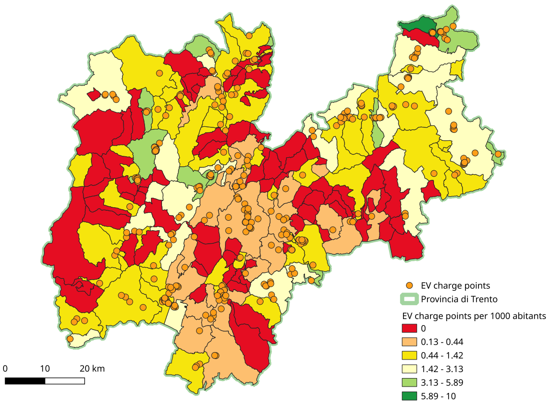

Figure 9. Distribution of EV charge points per 1000 inhabitants per municipality.

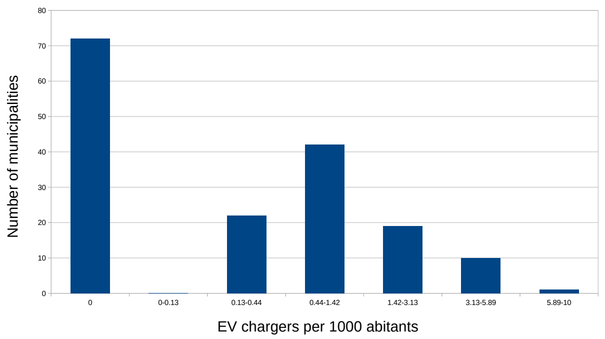

Figure 10. Distribution of municipalities per number of EV charge points per 1000 inhabitants.

While nothing obviously changes for municipality with no charger, in red in Figure 9, the spatial distribution of the other classes is modified because EV chargers are usually concentrated where the population is larger. Therefore, municipalities with a large number of chargers fall in an intermediate class with respect to chargers density. The average number of charger points for 1000 inhabitants is 0.84, with a standard deviation of 1.39. The average value increases to 1.48, with a standard deviation of 1.58, if only municipalities with at least one charger are considered.

Interestingly, municipalities with the higher chargers density per inhabitants correspond to popular touristic destinations, such as Campitello Di Fassa-Ciampedel and Canazei–Cianacei, in the north–east extremity of the region, and Pinzolo and Mezzana, which includes the Marilleva ski area, in the eastern part. This is mainly due to the fact that the resident population is small with respect to the number of tourists, for which the charging network is sized. For example, Campitello Di Fassa-Ciampedel has 7 EV charging points and only 700 residents.

4. Conclusions

Results are compatible with the recent Italian national report MOTUS-E (MOTUS-E, 2025) indicating that more than 40% of the municipalities have no charging stations. Estimated chargers density per 1000 inhabitants of 0.84 for the Provincia Autonoma di Trento is slightly lower than the value of 0.92 reported for northern Italy in the MOTUS-E report, possibly as a consequence of having taken into account only charge points in the Open Charge Map database (Open Charge Map, 2025).

Moreover, around 30% of Italy has a reported distance to the nearest charging station above 5 km, 6% above 10 km. However, results are not really comparable because the national report does not employ network analysis but a coarse raster analysis with 1 km resolution and, more importantly, it takes advantage of the access to a more complete charging stations dataset.

The main limitations of the analysis come not from the processing tools but from the insufficient availability of data, which are often in fragmented, proprietary and inaccessible datasets. In particular, the EV charge points maps, provided by Open Charge Map (Open Charge Map, 2025) is incomplete. A request has been made to the PUN to obtain a more complete map, but its outcome is currently uncertain. At the same time, while with this new dataset the absolute number of charging points would increase, most of the results about their distance from the road network would not change significantly because the missing charges in the Open Charge Map dataset (Open Charge Map, 2025) are usually located near the existing ones. In the same way, charging points distribution per municipality is expected to remain the same in relative terms, therefore results discussed in Section 3 are not expected to change much.

Moreover, for parts of the road network close to the border of the Provincia Autonoma di Trento the presence of EV charge points on the other side of the border has not been taken into account: this means that the higher distance values to chargers are possibly overestimated.

All analyses and statistical and spatial processing were carried out using only FOSS (Ciolli et al., 2017), demonstrating the power and versatility of these software tools. In particular, topological analysis has been implemented using python with numpy and geopandas libraries for data processing and igraph for network analysis. The Matplotlib library has been used for data visualization. QGIS has been used for coordinate conversion, map representation, table processing and geo-processing.

Future developments include the repetition of the network analysis on the urban streets network for the city of Trento, to verify if using a more dense network does not significantly change the results in terms of distance of parts of the network from the EV charge points. The same type of analysis will be carried out for other regions, both in the Alps and in a flat area in the Po Valley (Padan Plain), with the differentiation of the analysis for different types of EV chargers and the use of a more comprehensive charging stations dataset. The availability of traffic data is being investigated since it would make it possible to verify whether the charging stations distribution matches the traffic distribution or if it is possible to optimize its configuration to serve the largest number of vehicles.

Network analysis procedures available in GRASS GIS (GRASS Development Team, 2025) will be applied to the same network. In particular, the net allocation (v.net.alloc) and the cost isolines evaluation (v.netiso) modules will be employed.

References

Bacilieri, D., 2025. Code repository for network analysis of EV charger distribution. https://github.com/davbac/road_chargers (17 April 2025).

Baronchelli, M., Falabretti, D., Gulotta, F., 2025. Power Demand Patterns of Public Electric Vehicle Charging: A 2030 Forecast Based on Real-Life Data. *Sustainability (Switzerland)*, 17(3). https://doi.org/10.3390/su17031028.

Bozzano, M., Sguerso, D., Zatelli, P., Zendri, D., Besana, A., 2024. Accuracy Evaluation for Plan-Reliefs and Historical Maps Created during WWI in Northern Italy. *ISPRS International Journal of Geo-Information*, 13(3). https://doi.org/10.3390/ijgi13030101.

Brewer, C. A., Pickle, L., 2002. Evaluation of methods for classifying epidemiological data on choropleth maps in series. *Annals of the Association of American Geographers*, 92(4), 662 – 681. https://doi.org/10.1111/1467-8306.00310.

Ciolli, M., Federici, B., Ferrando, I., Marzocchi, R., Sguerso, D., Tattoni, C., Vitti, A., Zatelli, P., 2017. FOSS Tools and Applications for Education in Geospatial Sciences. *ISPRS International Journal of Geo-Information*, 6(7). https://doi.org/10.3390/ijgi6070225.

Conti, V., Andrenacci, N., Bruno, F., Valentini, M. P., 2025. Investigating Electric Cars Charging Behaviour in Italian Urban Areas. *Lecture Notes in Intelligent Transportation and Infrastructure*, Part F154, 696 – 709. https://doi.org/10.1007/978-3-031-82818-8_52.

De Vito, A., Grossetti, F., 2024. Network Analysis: A Mathematical Framework. *Tax Avoidance Research: Exploring Networks and Dynamics of Global Academic Collaboration*, 33–49. https://doi.org/10.1007/978-3-031-51765-5_3.

Gobbi, S., Cantiani, M., Rocchini, D., Zatelli, P., Tattoni, C., La Porta, N., Ciolli, M., 2019a. FINE SPATIAL SCALE MODELLING of TRENTINO PAST FOREST LANDSCAPE (TRENTINOLAND): A CASE STUDY of FOSS APPLICATION. *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences - ISPRS Archives*, 42(4/W14), 71 – 78. https://doi.org/10.5194/isprs-archives-XLII-4-W14-71-2019.

Gobbi, S., Ciolli, M., La Porta, N., Rocchini, D., Tattoni, C., Zatelli, P., 2019b. New tools for the classification and filtering of historical maps. *ISPRS International Journal of Geo-Information*, 8(10). https://doi.org/10.3390/ijgi8100455.

GRASS Development Team, 2025. Geographic Resources Analysis Support System (GRASS) Software. Open Source Geospatial Foundation. grass.osgeo.org (10 April 2025).

Haidar, B., Aguilar Rojas, M. T., 2022. The relationship between public charging infrastructure deployment and other socio-economic factors and electric vehicle adoption in France. *Research in Transportation Economics*, 95, 101208. https://doi.org/10.1016/j.retrec.2022.101208.

Hanig, L., Ledna, C., Nock, D., Harper, C. D., Yip, A., Wood, E., Spurlock, C. A., 2025. Finding gaps in the national electric vehicle charging station coverage of the United States. *Nature Communications*, 16(1). https://doi.org/10.1038/s41467-024-55696-8.

Istituto nazionale di statistica, 2025. Popolazione residente per sesso, età e stato civile al 1° gennaio 2024. https://demo.istat.it/data/posas/POSAS_2024_it_022_Trento.zip. 9 March 2025.

Kim, H., Kim, D.-W., Kim, M.-K., 2022. Economics of charging infrastructure for electric vehicles in Korea. *Energy Policy*, 164, 112875. https://doi.org/10.1016/j.enpol.2022.112875.

Kim, H., Kim, G. S., 2025. Factors Influencing Electric Vehicle Charging Station Locations and Policy Implications: Empirical Lessons from Seoul Metropolitan Area in Korea. *Sustainability (Switzerland)*, 17(2). https://doi.org/10.3390/su17020745.

Knez, M., Zevnik, G. K., Obrecht, M., 2019. A review of available chargers for electric vehicles: United States of America, European Union, and Asia. *Renewable and Sustainable Energy Reviews*, 109, 284-293. https://doi.org/10.1016/j.rser.2019.04.013.

Ministero dell'Ambiente e della Sicurezza Energetica, 2025. Piattaforma Unica Nazionale dei punti di ricarica per i veicoli elettrici. https://www.piattaformaunicanazionale.it/. 9 March 2025.

MOTUS-E, 2025. Le infrastrutture di ricarica a uso pubblico in italia. https://www.motus-e.org/studi_e_ricerche/le-infrastrutture-di-ricarica-a-uso-pubblico-in-italiasesta-edizione/. 9 March 2025.

Myers, J., Hanna, R., Garg, T., Kavanagh, J., Kleissl, J., Tebbe, S., Washom, B., Victor, D. G., 2025. Design of workplace and destination-based EV charging networks considering driver behavior, habits, and preferences. *Renewable Energy*, 242. https://doi.org/10.1016/j.renene.2025.122441.

Open Charge Map, 2025. Open Charge Map (OCM) GitHub repository. https://github.com/openchargemap. 9 March 2025.

Perera, P., Hewage, K., Sadiq, R., 2020. Electric vehicle recharging infrastructure planning and management in urban communities. *Journal of Cleaner Production*, 250, 119559. https://doi.org/10.1016/j.jclepro.2019.119559.

Provincia Autonoma di Trento, 2025. Geocatalogo della Provincia Autonoma di Trento. http://www.territorio.provincia.tn.it/portal/server.pt/community/portale_geocartografico_trentino/254. 9 March 2025.

QGIS Development Team, 2025. QGIS Geographic Information System. QGIS Association.

Saldarini, A., Longo, M., Yaici, W., 2025. Smart Charging Strategies for EVs: Insights from Simulation Modeling on Italian Highways. *IEEE Access*. https://doi.org/10.1109/ACCESS.2025.3538094.

Yang, H., Fulton, L., Kendall, A., 2024. A Review of charging infrastructure requirements for US electric light-duty vehicles. *Renewable and Sustainable Energy Reviews*, 200. https://doi.org/10.1016/j.rser.2024.114608.

Zatelli, P., Gabellieri, N., Besana, A., 2022. Digitalization and Classification of Cesare Battisti's Atlas of 1915. *ISPRS International Journal of Geo-Information*, 11(4). https://doi.org/10.3390/ijgi11040238.

Zatelli, P., Gabellieri, N., Besana, A., 2025. In the Footsteps of Grandtourists: Envisioning Itineraries in Inner Areas for Literary and Responsible Tourism. *ISPRS International Journal of Geo-Information*, 14(2). https://doi.org/10.3390/ijgi14020067.

Ömer Gönül, Duman, A. C., Önder Güler, 2021. Electric vehicles and charging infrastructure in Turkey: An overview. *Renewable and Sustainable Energy Reviews*, 143, 110913. https://doi.org/10.1016/j.rser.2021.110913.

A. Tables

ISTAT	Municipality	Charge points	Population	Chargers per 1000 inhab.
22068	Croviana	0	689	0.00
22060	Cis	0	292	0.00
22150	Rabbi	1	1373	0.73
22244	Porte Di Rendena	0	1823	0.00
22118	Moena	7	2580	2.71
22085	Fierozzo-Vlarötz	0	464	0.00
22142	Pieve Tesino	0	653	0.00
22043	Carzano	0	511	0.00
22249	Ville D'Anaunia	4	4682	0.85
22183	Storo	3	4482	0.67
22210	Vallarsa	0	1393	0.00
22050	Cavalese	5	3987	1.25
22147	Predazzo	5	4543	1.10
22135	Ronzo-Chienis	0	1003	0.00
22078	Drena	0	597	0.00
22038	Canal San Bovo	1	1458	0.69
22202	Torcegno	0	692	0.00
22039	Canazei-Cianacei	10	1878	5.32
22235	Altavalle	0	1631	0.00
22013	Besenello	1	2799	0.36
22071	Dambel	0	406	0.00
22190	Tenna	1	1063	0.94
22131	Ossana	0	832	0.00
22241	Cembra Lisignago	0	2352	0.00
22127	Nogaredo	2	2072	0.97
22007	Avio	3	4132	0.73
22216	Vignola-Falesina	0	198	0.00
22029	Caderzone Terme	0	695	0.00
22001	Ala	2	8819	0.23
22037	Campodenno	0	1512	0.00
22081	Fai Della Paganella	2	933	2.14
22098	Isera	1	2804	0.36
22203	Trambileno	0	1474	0.00
22062	Cles	3	7309	0.41
22253	Novella	4	3599	1.11
22102	Lavarone	3	1200	2.50
22017	Bleggio Superiore	0	1505	0.00
22035	Calliano	0	2041	0.00
22064	Commezzadura	1	1010	0.99
22128	Nomi	0	1352	0.00
22184	Strembo	0	583	0.00
22054	Cavizzana	0	234	0.00
22130	Ospedaletto	0	810	0.00
22164	Sagron Mis	1	177	5.65
22095	Grigno	0	2023	0.00
22115	Mezzano	1	1585	0.63
22254	Ville Di Fiemme	6	2651	2.26
22169	Sanzeno	0	920	0.00
22240	Castel Ivano	1	3277	0.31
22165	Samone	0	543	0.00
22245	Primiero San Martino Di Castrozza	16	5113	3.13
22236	Altopiano Della Vigolana	2	5110	0.39
22033	Caldes	0	1112	0.00
22167	San Michele All'Adige	3	4103	0.73
22188	Telve	1	1912	0.52
22195	Terzolas	0	643	0.00
22112	Massimeno	0	138	0.00
22049	Castelnuovo	0	1081	0.00
22089	Fornace	1	1341	0.75
22177	Sover	0	782	0.00
22196	Tesero	4	2996	1.34
22237	Amblar-Don	0	549	0.00
22114	Mezzana	3	875	3.43
22074	Denno	1	1249	0.80
22242	Contà	1	1403	0.71
22025	Brentonico	1	4121	0.24
22234	Pieve Di Bono-Prezzo	1	1450	0.69
22238	Borgo Chiese	0	1934	0.00
22022	Borgo Valsugana	2	7067	0.28
22097	Imer	1	1178	0.85
22109	Luserna-Lusérn	1	267	3.75
22155	Romeno	0	1496	0.00
22171	Scurelle	0	1361	0.00
22117	Mezzolombardo	1	7647	0.13
22018	Bocenago	0	397	0.00
22032	Calceranica Al Lago	0	1395	0.00
22157	Ronchi Valsugana	0	451	0.00
22123	Mori	2	10208	0.20
22116	Mezzocorona	1	5505	0.18
22156	Roncegno Terme	1	2944	0.34
22176	Soraga Di Fassa	1	717	1.39
22059	Cinte Tesino	0	350	0.00
22222	Villa Lagarina	2	3881	0.52
22160	Roverè Della Luna	0	1637	0.00
22052	Cavedago	1	578	1.73
22015	Bieno	0	462	0.00
22003	Aldeno	2	3278	0.61
22058	Cimone	0	728	0.00
22172	Segonzano	0	1356	0.00
22232	Valdaone	0	1148	0.00
22079	Dro	2	5064	0.39
22233	Dimaro Folgarida	2	2116	0.95
22193	Terragnolo	1	705	1.42
22252	Borgo D'Anaunia	3	2557	1.17
22093	Giustino	0	740	0.00
22179	Spiazzo	1	1259	0.79
22230	Predaia	4	6927	0.58
22113	Mazzin-Mazin	0	601	0.00
22243	Madruzzo	0	2991	0.00
22159	Ronzone	2	485	4.12
22246	Sella Giudicarie	2	2943	0.68
22083	Fiavè	1	1055	0.95
22011	Bedollo	1	1491	0.67
22213	Vermiglio	0	1789	0.00
22061	Civezzano	1	4209	0.24
22110	Malè	3	2260	1.33
22040	Capriana	1	594	1.68
22143	Pinzolo	16	3078	5.20
22139	Pergine Valsugana	8	21672	0.37
22205	Trento	24	118504	0.20
22180	Spormaggiore	1	1258	0.79
22209	Valfloriana	1	470	2.13
22108	Lona-Lases	0	865	0.00
22191	Tenno	1	2031	0.49
22173	Sfruz	0	363	0.00
22144	Pomarolo	0	2451	0.00
22239	Borgo Lares	0	726	0.00
22045	Castel Condino	0	225	0.00
22199	Tione Di Trento	3	3654	0.82
22168	Sant'Orsola Terme	0	1117	0.00
22124	Nago-Torbole	7	2768	2.53
22228	Comano Terme	5	2958	1.69
22170	Sarnonico	0	790	0.00
22247	Tre Ville	4	1386	2.89
22053	Cavedine	0	3070	0.00
22005	Andalo	7	1189	5.89
22120	Molveno	4	1132	3.53
22026	Bresimo	0	244	0.00
22189	Telve Di Sopra	0	620	0.00
22034	Caldonazzo	3	3964	0.76
22226	Ziano Di Fiemme	3	1784	1.68
22002	Albiano	0	1512	0.00
22021	Bondone	1	645	1.55
22250	San Giovanni Di Fassa-Sèn Jan	7	3632	1.93
22133	Palù Del Fersina-Palai En Bersntol	0	158	0.00
22106	Livo	2	769	2.60
22181	Sporminore	0	718	0.00
22092	Giovo	0	2512	0.00
22048	Castello Tesino	2	1156	1.73
22090	Frassilongo-Garait	0	352	0.00
22136	Peio	5	1800	2.78
22042	Carisolo	1	923	1.08
22251	Terre D'Adige	1	3099	0.32
22161	Rovereto	11	40077	0.27
22051	Cavareno	1	1121	0.89
22129	Novaledo	0	1162	0.00
22163	Rumo	3	786	3.82
22162	Ruffrè - Mendola	0	416	0.00
22153	Riva Del Garda	13	17857	0.73
22231	San Lorenzo Dorsino	3	1570	1.91
22182	Stenico	0	1176	0.00
22006	Arco	7	17754	0.39
22009	Baselga Di Pinè	1	5215	0.19
22248	Vallelaghi	2	5256	0.38
22087	Folgaria	7	3165	2.21
22200	Ton	0	1281	0.00
22138	Pelugo	0	397	0.00
22103	Lavis	4	9152	0.44
22091	Garniga Terme	0	408	0.00
22104	Levico Terme	9	8253	1.09
22224	Volano	0	3118	0.00
22134	Panchià	3	815	3.68
22047	Castello-Molina Di Fiemme	2	2320	0.86
22229	Ledro	4	5387	0.74
22036	Campitello Di Fassa-Ciampedel	7	700	10.00
22137	Pellizzano	0	798	0.00

Table 2. Number of charge points and charge points density for the municipalities of the Provincia Autonoma di Trento. The "ISTAT" column indicates the ISTAT identifier for the municipality