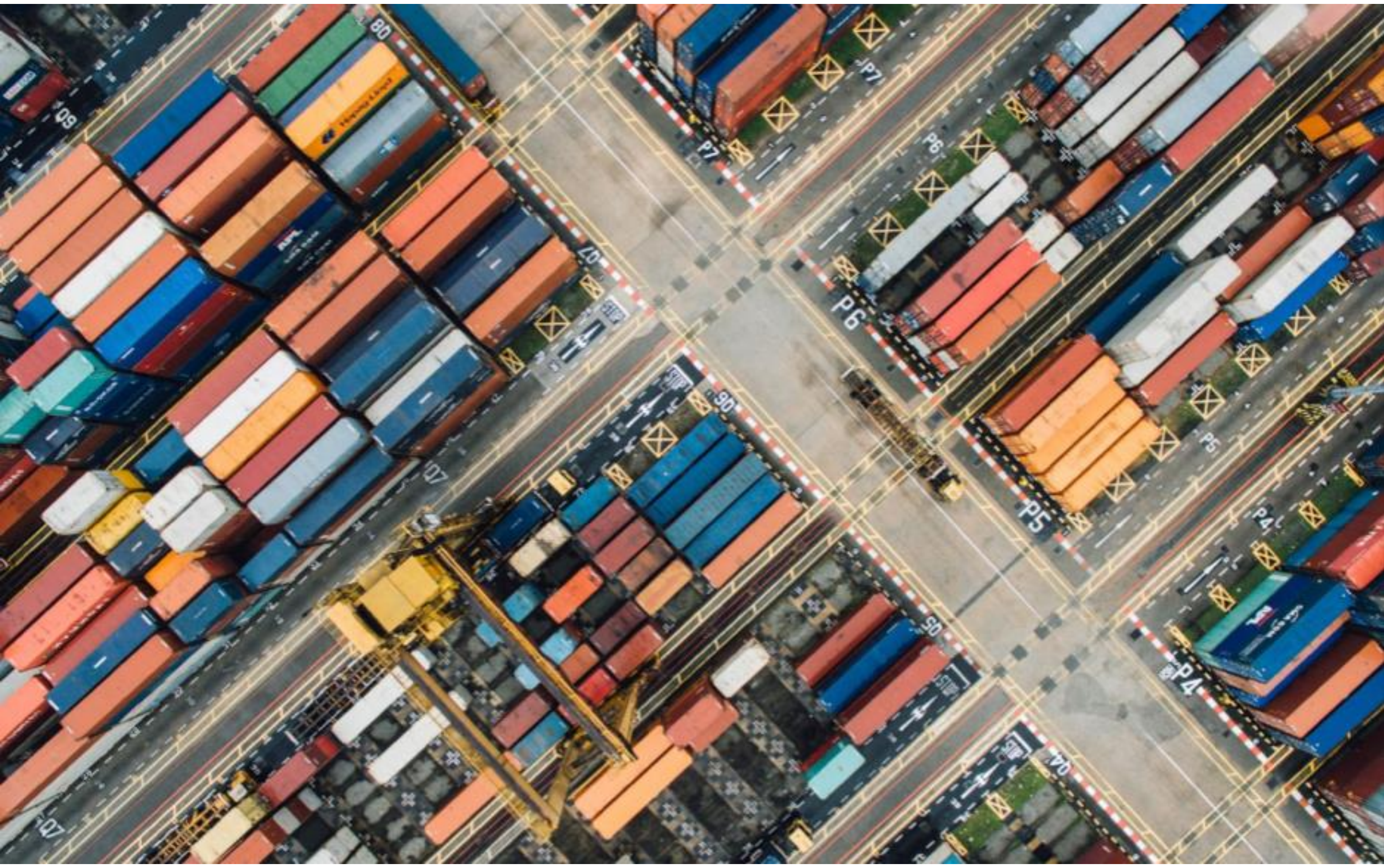
Smart Freight Centre

Accelerating Public Charging

Determining Near-Term Medium and Heavy-Duty Public Truck Charging Locations

April 2025



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Disclaimer

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This report was written by Samuel Barendregt of Smart Freight Centre.

About Smart Freight Centre

Smart Freight Centre is an international non-profit organization focused on reducing greenhouse gas emissions from freight transportation. Smart Freight Centre's vision is an efficient and zero emission global logistics sector. Smart Freight Centre's mission is to collaborate with the organization's global partners to quantify impacts, identify solutions, and propagate logistics decarbonization strategies. Smart Freight Centre's goal is to guide the global logistics industry in tracking and reducing the industry's greenhouse gas emissions by one billion tonnes by 2030 and to reach zero emissions by 2050 or earlier, consistent with a 1.5°C future.

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Executive Summary

The objective for the Accelerating Public Charging (APC) project was to determine where public charging infrastructure should be located to support as many battery-electric truck (BET) deployments as possible based on freight demand from leading shippers. Although previous studies have highlighted the number of stations and power required, they have been largely based on modeled data. The APC project is the first study that integrated data from companies at the forefront of logistics sustainability, and would be among the first adopters of BETs, thus indicating where the near-term charging stations should be built to fulfill this early demand. The final output includes country-level maps of Germany and Poland containing optimal charging infrastructure locations, process learnings, and next steps for stakeholder involvement and coalition building. These maps were used to further cooperation between the logistics industry and Charge Point Operators (CPOs), motorway operators and government entities for the implementation of charging infrastructure at optimal locations. In addition, the focus of APC on Poland has led to the launch of the Smart Freight Centre's (SFC) Poland Corridor project, which has convened leading international shippers to decarbonize road freight in one of the largest freight markets in Europe. Central to SFC's theory of change is the power of aggerated demand, channeled into collaborative projects and partnerships. The APC project illustrates one such way this can be realized, and builds upon the momentum evidenced here through the ambitious expansion of decarbonization projects across the globe.

1 Introduction

Heavy-duty vehicles account for over 25% of European road freight emissions and represent around 6% of the bloc's total CO_2 emissions (EEA, 2020). Therefore, the transition to zero-emission (ZE) freight transportation is a key focus in long-term climate planning, as the EU targets a 55% reduction in greenhouse gasses by 2030. Amongst the numerous ZE alternatives to internal combustion engines, BETs are leading the way, accounting for over 90% of ZE medium and heavy-duty truck sales in the first half of 2024 (BloombergNEF, 2024).

Currently, it is estimated that long-haul BETs will require about 20% of their charging to take place in public charging stations, but a slow rollout of such networks has given logistics professionals reason for pause, with 36% of companies interviewed citing low range and inadequate charging infrastructure as a reason not to invest in BETs (Siddiqi, 2024).

To spur the development of public charging and the transition to BETs, the EU announced the Alternative Fuels Infrastructure Regulation (AFIR). AFIR went live in April 2024 and requires member countries to install heavy-duty charging stations every 60 km along the TEN-T core network, and every 100 km along the comprehensive road network, providing trucks with a minimum of 350 kW for fast and efficient on-the-go public charging by 2030 (ICCT, 2023).

In September 2023, Amazon published the open-source Charging Location for Electric Trucks (CHALET) tool, to support data-driven placement of public charging locations. The CHALET tool is built to ingest detailed data about logistics flows and suggest optimal public charging locations based on fleet characteristics. While applicable to data for individual companies, the application of the CHALET framework to aggregate data allows for increased utilization of the public charging points, and greater confidence that the resulting locations will support the decarbonization of the road freight industry as a whole.

Smart Freight Centre (SFC) is a globally active non-profit which aims to decarbonize freight through emissions accounting and reporting, coalition building, research and advocacy. SFC aims to support BET deployment through demand aggregation, charging infrastructure development, and innovative financing solutions. As SFC is uniquely positioned as a neutral and trusted third party platform focused on collaborative sustainability projects, Amazon and SFC launched a project in early 2024 to integrate the CHALET tool in an industry-wide demand aggregation project, with the shared goal of stimulating public charging infrastructure deployment.

2 Methodology

There have been several research papers which have also investigated the deployment of public charging stations for battery electric trucks including Menter et al. (2023) which demonstrated an optimal network of charging locations based on publicly available traffic simulation data. Similarly, Lange et al. (2024) constructed a long-term megawatt charging network in Europe in the year 2030, using a modified version of the CHALET tool. This study, based on modeled data, concluded that 1,000 optimally placed megawatt charging stations could enable about 91% of electric long-haul trucking in Europe by 2030. And finally, Shoman et al. (2023) used a trip chain approach to identify charging events and simulate a realistic scenario. The authors' main finding was a need for four to five times more overnight chargers than megawatt chargers to support a 15% BET share in Europe. Additionally, this paper highlighted the importance of Germany and Poland in the European road freight market, as the countries together account for nearly a third of truck registrations in the EU.

The Accelerating Public Charging project was a unique bottom-up analysis carried out by SFC over the course of 2024. In this approach, insights were derived by analyzing detailed data from first-mover companies and then aggregating these insights to form broader country level charging maps. Rather than working with modeled data, advantages in this case were marked by an ability to highlight near term infrastructure development priorities, with a granularity that is difficult to achieve with top-down, industry wide modeling approaches. Central to SFC's theory of change is the concept of demand aggregation across first-mover decarbonization stakeholders, and the APC project was an application of this theory to charging infrastructure development. In the project, we received detailed origin-destination data from five international organizations with a focus on their operations in Germany and Poland, to advance charging infrastructure priorities.

Over the course of this project, the following steps were taken:

1. **Engagement**: First, SFC members were encouraged to participate in the project in a variety of ways. The project was proposed at Smart Freight Week, in online webinar announcements, individual conversations, and during workshops. Out of the more than 60 companies approached in one-on-one and group conversations, a total of five committed to providing data for the next step of data processing.
2. **Processing**: This stage included data collection, pre-processing due to the various formats of data collected, and finally the CHALET optimization process was applied. Then the results were presented in the format of charger locations with associated latitudes and longitudes and "demand" based on the volume of traffic each location was expected to accommodate given the route volumes.

The data collection requested participants to provide detailed information on fleet movements in the form of Origin-Destination (OD) pairs, and associated route volumes. Additional CHALET inputs included "Candidate locations" data which was provided in the form of viable truck charging locations, furnished by the European wide truck parking locations dataset, narrowed to Poland and Germany (Link and Plotz, 2023). Finally, the "Additional Parameters" relate to BET specifications, and were determined based on industry averages electric trucks in 2024. A table of these parameters and their values can be found below:

Additional Parameters:

PARAMETER	DESCRIPTION	VALUE ASCRIBED

TRUCK RANGE	Truck range with full battery	270 km
SAFETY MARGIN	Range withheld from truck range was safety margin	20%
CHARGER POWER	Maximum charger power	350 kW
BATTERY CAPACITY	Battery capacity	311 kWh
MAXIMUM FUEL TIME	Maximum charging break time	60 min

Table 1. Additional Parameters

Once the requisite data was collected, the participant input was aggregated and processed by the CHALET tool. The figure below illustrates the APC process as a simple schematic:

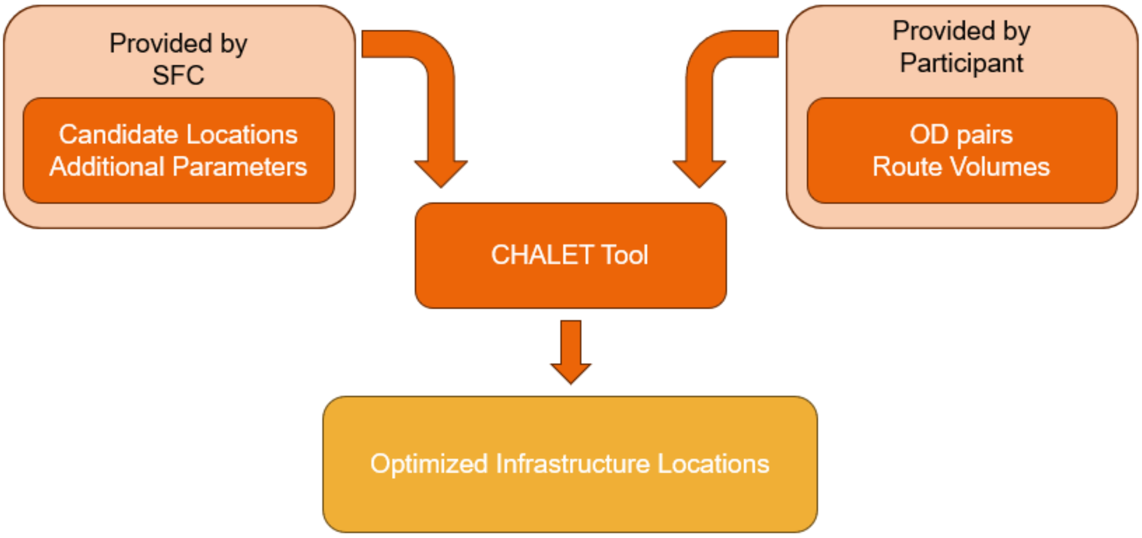

Figure 1. APC Process schematic

The outreach and processing wrapped up at the end of 2024, and the initial results were then sent to the participating companies – both the aggregate map and individual maps of optimal charging locations for their submitted data.

3 Results

The aggregate map based on the five companies' data is included below.

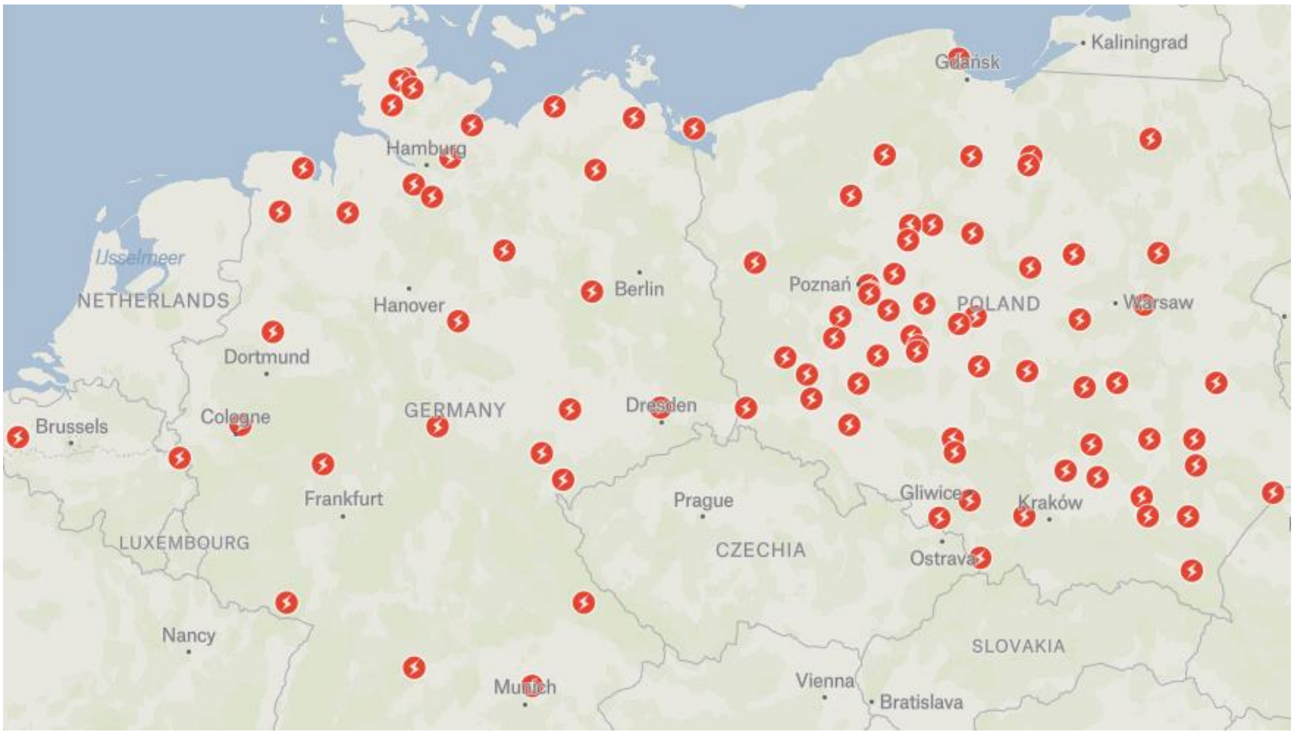

Figure 2. Aggregate Results

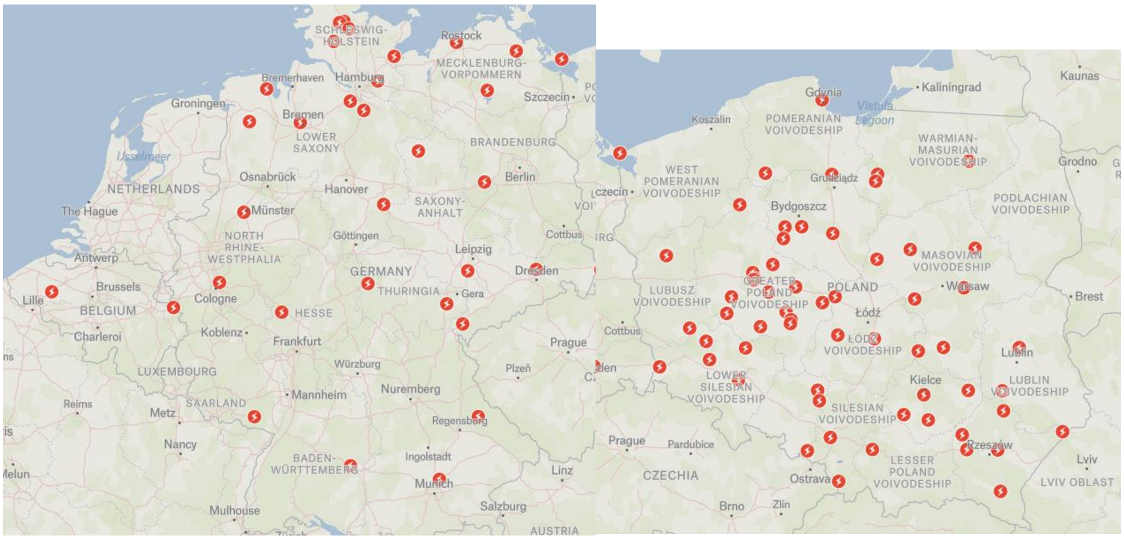

Figure 3. Detail Maps of Germany (left) and Poland (right)

These results show the two countries we focused on, with an additional two charging stops in Belgium as well. It is also important to note that we received more data from companies operating in Poland than in Germany as participants were keen to explore opportunities here in conjunction with strong government support programs. In addition, the charging locations are based on the aggregate truck movements and were not constricted by the AFIR requirement of being on TEN-T network roads. For further transparency, the appendix of this document contains a table of the latitude and longitude of every location shown above as well as their demand characteristics which indicates the number of stops made at each location. The results, while limited in both sample size and scope, clearly illustrate the applicability of such framework to charging location modeling at greater scale or in different geography.

3.1 Lessons Learned

The key learning from this project was in the applicability of APC framework to determine near term and intermediate charging needs for first-mover companies. In a landscape marked by pre and post AFIR compliance, these middle stages of infrastructure deployment can support infrastructure providers with increased utilization certainty, fleet owners with right-sized charging, accelerate the decarbonization of road freight by spurring BET adoption in priority regions.

The APC project differentiated itself from similar research as the inputs were based not on modeled data, but on real-world aggregate data provided to SFC by first-mover companies, and therefore the resulting map of charging priorities indicates an excellent starting point for stakeholders who wish to accelerate the adoption of battery electric heavy-duty vehicles.

This project was developed to demonstrate the feasibility of not only the CHALET optimization tool, but also to provide insight to planning optimal charging infrastructure for near-term rollout. Future steps for the application of this project framework should center around drawing stronger aggregation numbers to provide more weight to the charging locations produced by CHALET optimization. For example, working with a consortium of shippers, carriers, and fleet owners to tailor maps with higher demand, would make the optimal locations more attractive to potential infrastructure providers. In addition, combining APC style analysis with tangible opportunities such as corridor projects should be expected to increase the level of aggregation possible.

3.2 Next Steps

The APC project also brought to our attention our members' appetite to launch a corridor project in Poland, and as of November 2024, SFC has partnered with the Polish organization PSNM to make ZE freight in Poland a reality. Our Poland corridor project is now well underway, and subsidies have been released to support charging infrastructure development, grid upgrades, and BET purchases.

In addition to our corridor project in Poland, SFC is eager to hear from leading shippers, cargo owners, carriers and solution providers as to where their priorities are for the next high-impact corridor project. Our goal is to launch an additional two to three industry consortiums by the end of 2025. To facilitate this, SFC has partnered with Milence and launched a survey to gather these priorities. We call upon our members and industry stakeholders to participate in this collaborative opportunity.

In the United States, FEC and CALSTART have launched the ZET SCALE campaign. The ZET SCALE campaign is designed to disrupt and break through the zero-emission truck (ZET) price barriers holding back wider ZET adoption. Price is the fundamental constraint to scaling up adoption and higher infrastructure asset utilization. It will achieve this by fielding, securing and implementing a significant near-term purchase order for Class 8 battery-electric trucks.

If your organization is interested in participating in either of these coalition driven opportunities, please reach out to Samuel.barendregt@smartfreightcentre.org for more information.

4 Sources Cited

1. *Electric Vehicle Outlook 2024*. BloombergNEF. (2024, June 12). https://assets.bbhub.io/professional/sites/24/BNEF-2021-Executive-Factbook.pdf
2. *European Union Alternative Fuel Infrastructure Regulation (AFIR)*. International Council on Clean Transportation. (2023, April 26). https://theicct.org/publication/afir-eu-april2023/
3. Lange, J.-H., Speth, D., & Plötz, P. (2024). Optimized demand-based charging networks for long-haul trucking in Europe. *Environmental Research: Infrastructure and Sustainability*, *4*(4), 045004. https://doi.org/10.1088/2634-4505/ad889e
4. Link, S., & Plötz, P. (2024, July 10). *European truck parking locations*. Zenodo. https://doi.org/10.5281/zenodo.10231359
5. Menter, J., Fay, T.-A., Grahle, A., & Göhlich, D. (2023). Long-distance electric truck traffic: Analysis, modeling and designing a demand-oriented charging network for Germany. *World Electric Vehicle Journal*, *14*(8), 205. https://doi.org/10.3390/wevj14080205
6. Shoman, W., Yeh, S., Sprei, F., Plötz, P., & Speth, D. (2023). Battery electric long-haul trucks in Europe: Public charging, energy, and Power Requirements. *Transportation Research Part D: Transport and Environment*, *121*, 103825. https://doi.org/10.1016/j.trd.2023.103825
7. Siddiqi, S. (2024, January 12). *Electric truck milestones in 2023 and outlook*. IDTechEx. https://www.idtechex.com/en/research-article/electric-truck-milestones-in-2023-and-outlook/30413#:~:text=Electric%20trucks%20now

5 Appendix

LATITUDE	LONGITUDE	DEMAND	LATITUDE	LONGITUDE	DEMAND	LATITUDE	LONGITUDE	DEMAND
51.9458	7.5481	917	52.1567	17.3812	86	51.4408	22.6181	26
51.0069	10.1762	1287	51.5231	16.0775	16	50.3348	23.5222	76
51.0216	7.031	1258	50.08	18.1933	223	52.508	17.4715	57
49.2029	12.5143	322	50.0981	19.5514	51	52.901	18.7224	237
48.3283	11.69	885	51.5561	19.5916	110	50.091	22.1665	13
48.5206	9.8074	31	52.0229	18.5065	23	53.8977	14.2786	33
50.7373	11.8449	90	51.8019	17.8538	33	53.6369	18.7048	886
50.6256	8.3488	1268	51.6031	18.8269	180	52.9815	17.7272	209
52.0481	10.5083	1624	51.6931	15.7348	35	52.6196	15.2489	22
49.2016	7.77	31	52.0974	18.7724	83	52.5746	19.6461	62
51.1945	13.7405	71	51.4351	16.9013	87	50.6119	22.2896	43
51.1763	12.2915	1567	51.903	17.748	3	49.535	22.2243	40
50.4667	12.1852	59	51.8835	16.511	162	50.0967	21.5213	53
52.0942	16.6096	86	51.0197	16.7532	48	52.6987	20.3407	20
51.7521	17.8381	19	50.7442	18.4431	30	52.3284	17.0922	283
51.7109	17.2117	133	50.2585	18.6751	136	51.4452	21.0356	126
50.883	18.4068	52	53.638	19.6592	3	50.8232	20.623	581
51.2839	16.1502	1529	53.261	16.7821	24	50.2945	21.425	210
49.6687	18.8467	88	52.9858	18.0765	305	52.3143	17.0722	78
51.1896	15.1087	205	52.7137	21.6939	125	52.2113	21.4606	67

LATITUDE	LONGITUDE	DEMAND	LATITUDE	LONGITUDE	DEMAND
52.067	20.435	11	54.1173	9.4492	6883
51.4417	21.0333	23	53.6252	10.3843	9842
50.8803	21.5514	7	53.1115	7.6653	10
52.8353	17.6929	142	52.7371	11.2441	8
53.6508	17.3179	3	54.2753	9.776	41
51.3955	20.5089	556	53.37	9.8018	25096
50.5602	20.2068	116	53.5234	8.0322	1
50.4911	20.7186	397	53.5065	12.7024	8
54.5482	18.5016	1190	53.1009	8.7437	1225
53.8	21.5658	29	54.3646	9.6715	3532
53.5524	19.6183	51	52.338	12.6455	70

52.2226	17.9492	90	53.9314	10.7307	1003
52.4034	17.0542	5			
50.8758	22.2644	292			
50.897	3.4764	32			
50.6876	6.0563	173			
54.1058	12.0485	909			
53.2531	10.0882	1626			
53.9977	13.3176	5			
54.3496	9.5751	1422			

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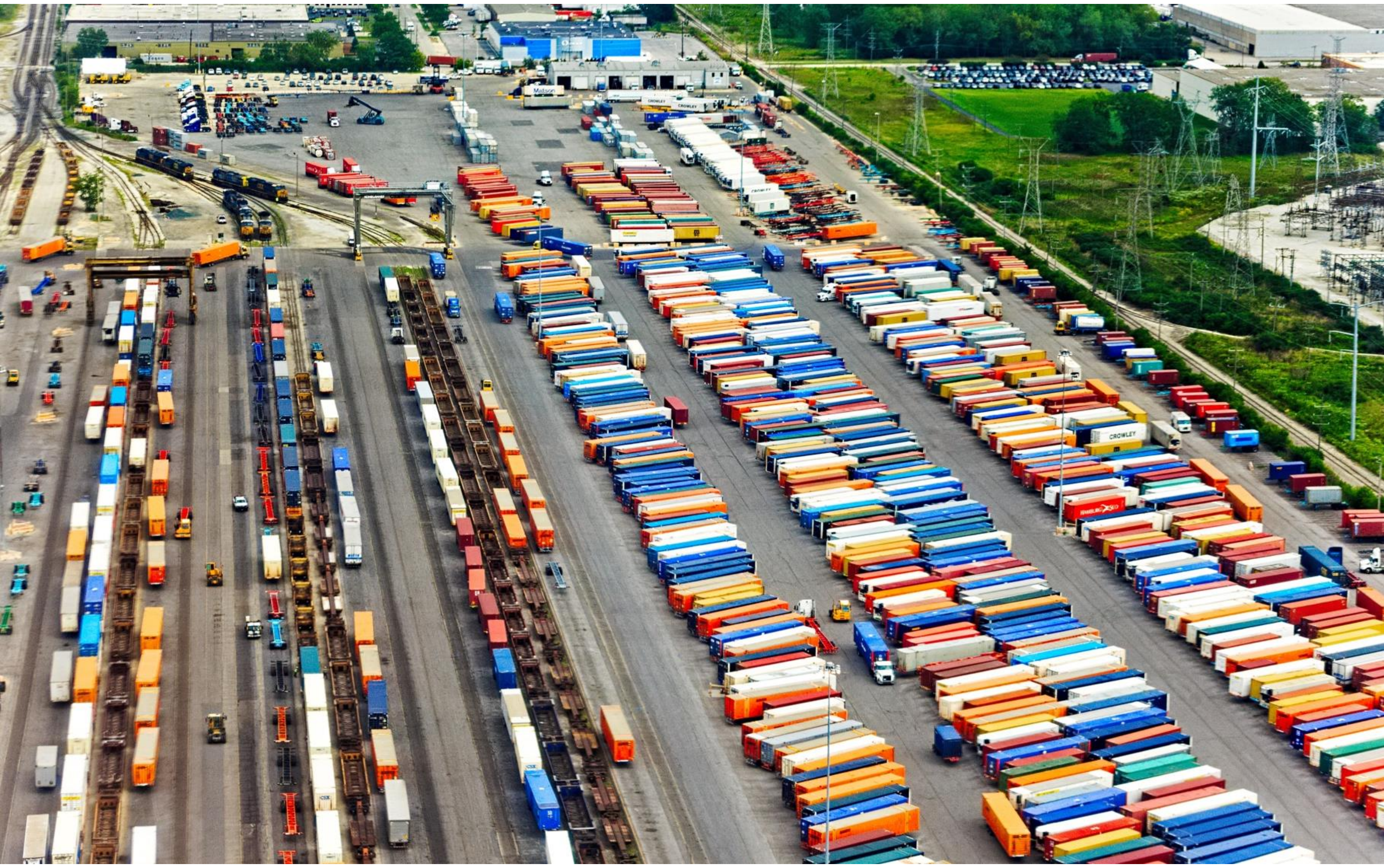

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