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Eurovignette for Ukraine:

Truck tolling to save Ukrainian roads and environment

T&E

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Author: Anastasiia Nahorna
Expert group: Thomas Earl, Max Molliere
Reviewers: Benedikt Hey, Tiziana Frongia
Visualisation assistance: Cristina Pita

Editeur responsable: William Todts, Executive Director

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Further information

Name: Anastasiia Nahorna
Title: Infrastructure and mobility analyst
T&E
anastasiia.nahorna@transportenvironment.org
Mobile: +32 471 57 89 80
www.transportenvironment.org | BlueSky | LinkedIn

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Executive summary

Tolling trucks is a technical solution to implement the **"user" and "polluter pays"** principles. Toll revenue could help ease **budgetary** pressures Ukraine faces and optimise EU funds allocation. If Ukraine decides to implement the tolling system, it is crucial to align it with the Directive (EU) 2022/362 for the sake of the **EU accession** and **sustainable development** of the country.

- **Ukraine is losing control over the state of its road infrastructure.**

Since 2024, the State Road Fund has been used for the military with not much left for road maintenance. Road recovery happens largely through EU and international funding. Three new **"mega-projects"** for road reconstruction (M-07, M-30, M-15) were announced under the DREAM system in 2025. They total over €12 billion, **15 times** the allocation to roads than in 2024. The share of roads in poor condition has increased by 225% from 2011-2016. In 2025, we project 38% of the road kilometers to be in poor condition in a linear optimistic scenario. Bridges are also crumbling. Due to Russian aggression **25,000 km of road** and 344 bridges and crossings were damaged. Truck operating costs may rise up to 35% depending on the road surface quality. This leads to an increase in the logistics costs and lack of strategic autonomy of Ukraine to manage its roads.

- **Older, more polluting and overloaded trucks detrimental to road surface and urban pollution.**

We analysed in the Ukrainian Unified State Vehicle Register and found an increased demand for semi-trailers and heavier Western truck brands. The share of new trucks - below 5 years old - remains stable at only 10% of registrations per year. The average truck age is 16.2 years, 2 years older than the EU average of 14.2. The make year of 88% of all trucks registered in 2024 is before 2019. This puts them all in the least energy efficient CO_2 class I. Weigh-in-Motion (WIM) systems registered 6,000 overloaded trucks per day in 2021. **Older, less energy efficient** and **heavier** trucks on the roads are detrimental for (sub)urban air pollution and road surface condition.

- **Ukraine could raise more than €1 billion of revenue in tolling.**

We model the revenue Ukraine could raise from tolling trucks under different scenarios. At a minimum, tolling trucks over 12t could generate €215 million in annual revenue on three (M-06, M-07, M-05) routes, without external air, noise

pollution and CO_2 charges. However that would not be in line with the **Directive (EU) 2022/362** on road charging. If Ukraine were to adopt the current German Maut, it could generate **over €1 billion** in annual revenue, **66% of which is from CO_2, air and noise pollution** surcharges. Tolling also accelerates the cost recovery on road repairs, incentivises less polluting trucks, could contribute to **modal shift** and avoid deaths from ambient air pollution.

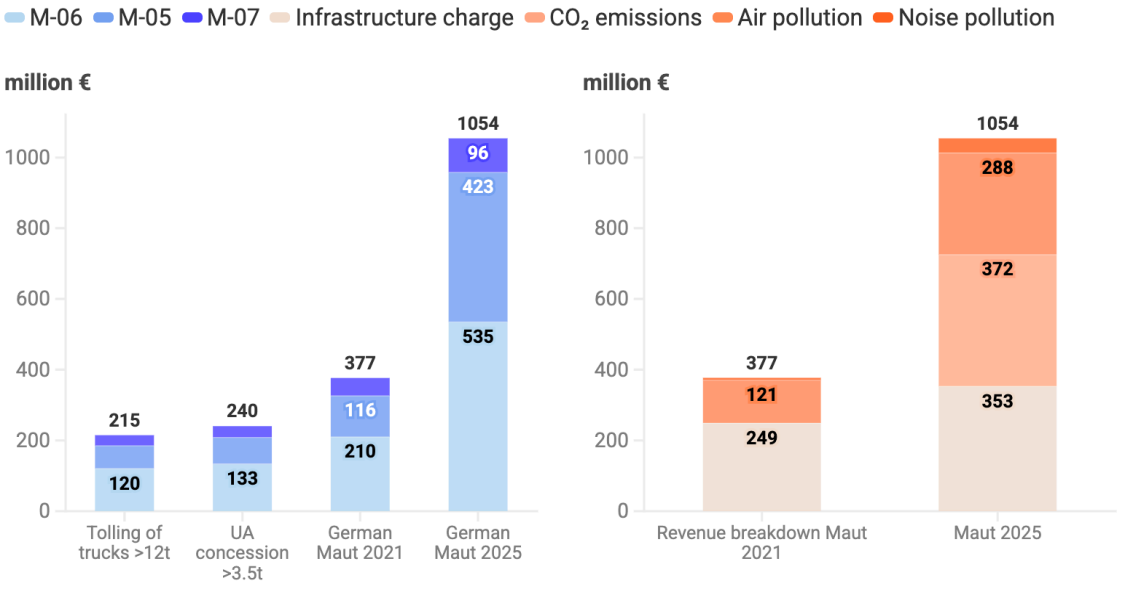
- **Fear has big eyes: ambitious tolling ≠ big price spikes.**

We model the price of the beer bottle transported from Lviv to Kyiv. Under the high-ambition German toll it **might cost 0.84 eurocent or 38 kopyikas more**, a relative increase of 0.49%. Transporting it over the road with a poor surface quality might also have an equivalent cost increase of 0.84 cents (38 kopyikas) for the same beer bottle. **76%** of surveyed Ukrainian businesses support the introduction of tolling provided the improvement in the road surface quality.

Ambitious tolling contributes to Ukraine's fiscal and climate resilience with minimal impact on consumers.

Unlocking €1 Billion: Scenarios for Tolling Ukraine's Major Highways

CO_2 emissions from trucks are largest source of potential toll revenue



Source: T&E, WIM 2021 report, HGV toll Germany, Berechnung der Wegekosten 2021 • Resolution № 1312 of Cabinet of Ministers on UA concession toll rates. German Maut are toll rates for HDVs in Germany depending on the introduction year

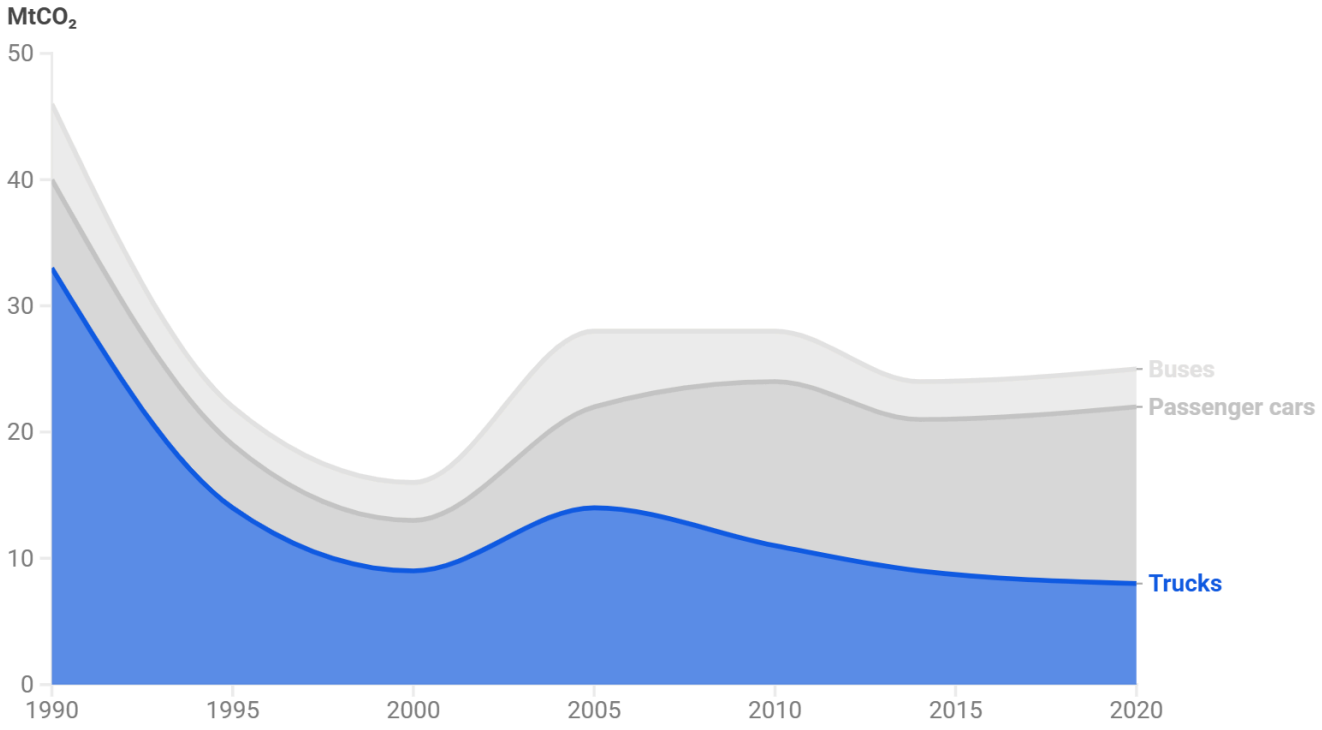
Section 1

1. Road recovery: projects and funding

1.1 Trucks are big polluters on Ukrainian roads

Evolution of CO_2 emissions from Ukrainian trucks:

After sharp reduction in the 90s, 30% of all road transport CO_2 are attributed to HDVs



Source: T&E, UNFCCC, ClimaEast modelling

In 2020 out of 25.9 $MtCO_2$ emitted from road transport, which corresponds to more than 70% of all transport emissions, 8.6 $MtCO_2$ or 33% came from trucks. The National Transport Strategy until 2030 has set the target for GHG emissions reduction in transport at 33% of 1990 level or 23 $MtCO_2$. Law No. 3991-IX on the State Climate Policy aiming to implement climate neutrality in Ukraine by 2050 introduced the **"polluter pays" principle**. This principle is enshrined in EU acquis, e.g. Sustainable and Smart Mobility Strategy and Green Deal files. In transport it is implemented through:

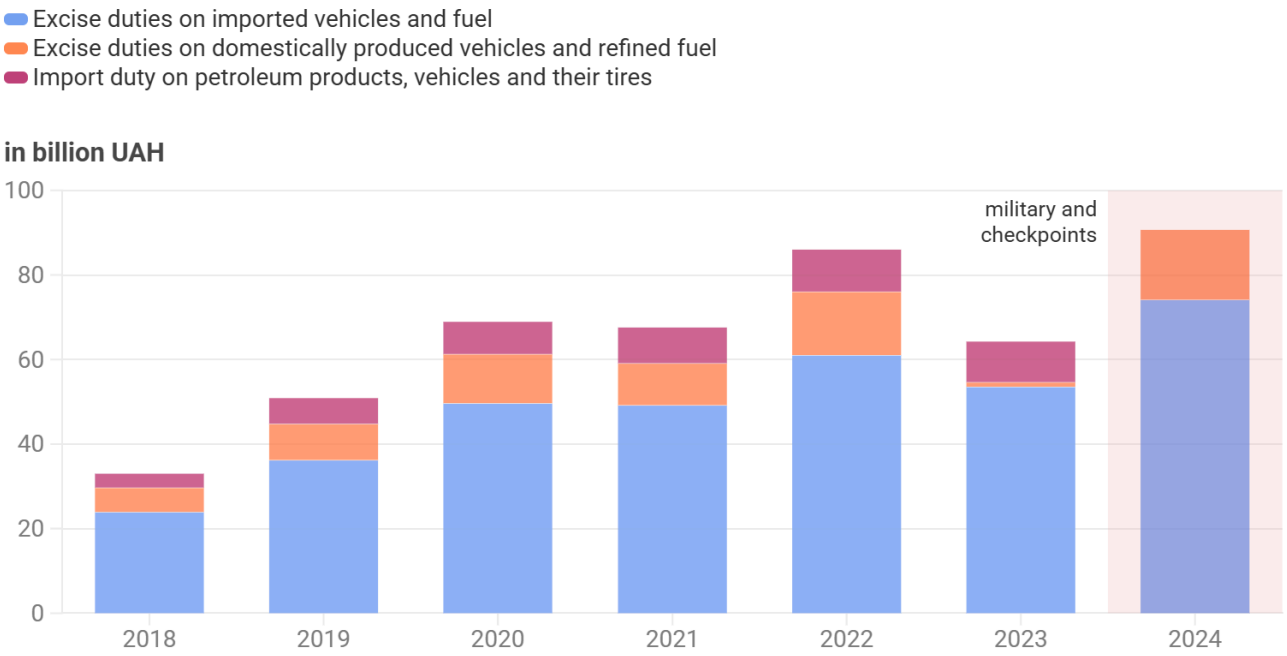
- excise duties on diesel and petrol with minimum rates per Energy Taxation Directive
- one-off registration or ownership tax on the vehicle depending on CO_2 emissions
- infrastructure charges or tolls differentiated by weight, number of axles, CO_2 and air pollution.

This report looks into how Ukraine could pilot infrastructure charges, or tolls for trucks based on their impact on the road surface and environment.

1.2 Ukraine lacks national funds to recover and maintain roads

Annual revenue allocated to the Road Fund faces an uncertain future

From 2024 the Road Fund has been effectively used to finance military



Source: T&E analysis, based on the annual budget revenue estimates of UA government (2018-2024). Amounts are taken from the Special Fund and do not equal the actual excise duty revenue recorded by Tax Authorities.

The State Road Fund was established in 2018 as a special fund of the state budget of Ukraine. It funds road (re)construction, maintenance and repair of local and state roads as well as measures on road safety. Its main domestic revenue sources are excise taxes on domestically produced or imported fuel and vehicles and import duties on petroleum products, vehicles and tyres. They usually come from customs clearance. The typical customs clearance of the vehicle mostly consists of paying the:

- import duty of the 10% of the customs value of the car
- excise tax depending on the type of fuel, engine size and age of the car and
- Value-Added Tax (VAT) on the vehicle.

Around 60% of the Road fund is destined for state roads, 35% - local roads, 4% - for road safety and 1% - for establishment of the State fund for inland waterways. The total declared domestic revenue for it totaled 460 billion UAH or using the average monthly exchange rates €13.3 billion based on the governmental Budget Declarations from 2018 until 2024. This is equivalent to an average of 3.5% of the total public expenditure annually, excluding the international money going into roads from credit institutions and banks.

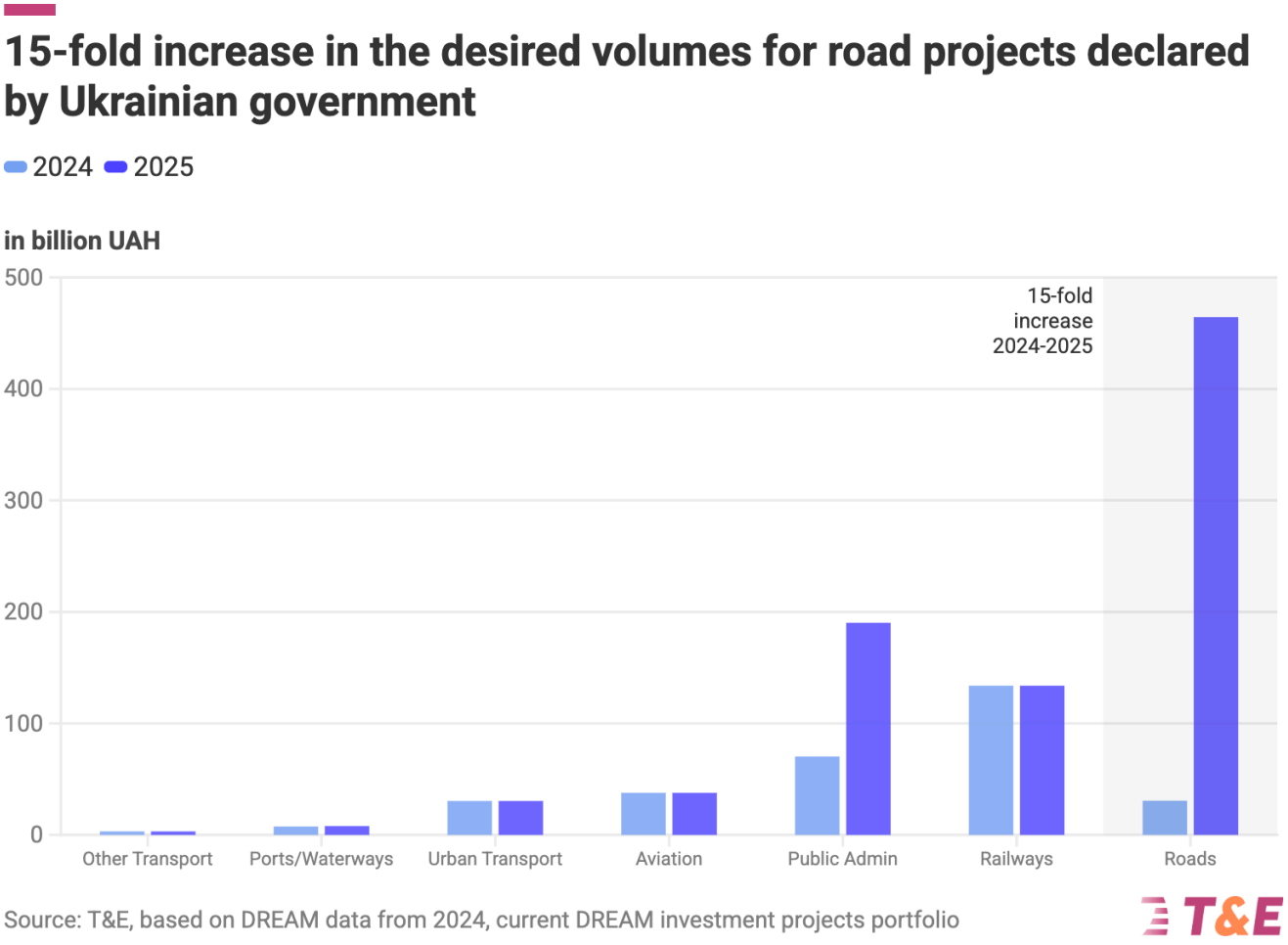
- **2022:** the Cabinet of Ministers amended the Procedure for allocating funds from the State Road Fund to divert 40% of the funds into road safety measures, 30% for the

development of tolling for vehicles above 12t; 20% - into ensuring the operational and safe condition of shipping locks; and 10% - for passenger rail modernisation.

- **2024:** the fund's revenues have been diverted for security and defence. This means that roads upkeep and maintenance is done with funding from elsewhere, e.g. international and EU money, reserve funds and based on the urgency of repairs with priority for winter repairs. So funding for roads will also become even more intransparent and unclear in the absence of the dedicated funding instrument and prioritisation mechanism.
- **2025**: 17.6 billion UAH were again reallocated for roads, almost 60% - for road repairs. This is however still roughly half of what the Road fund domestic revenue was in 2018.

1.3 EU funds are used for road development (again)

In our previous report we show that more than half of EU regional transport funds in 2007-2020 were disbursed to build or reconstruct roads in CEE states. History is about to repeat itself.



The Ukraine Facility is a €50-billion financial instrument created by the EU to support Ukraine's recovery over the period of 2024-2027. It has a dedicated Pillar II, or Ukraine Investment Framework (UIF), to sponsor open projects in different sectors: energy which in 2024 took 53% of total declared necessary funding volumes, transport at 11%, education - 8.3%, industry - 7.4%, healthcare - 7.1% etc.

In 2024 the total volume of transport projects under DREAM, as of 2024 totaled 313.6 billion UAH, or almost €7 billion and a bit less - 248 billion UAH under the Single Project Pipeline of the Ministry of Finance. Road funding needs were at 30.7 billion UAH, or €675 million in 2024. The most expensive of all projects of almost 23 billion UAH, or €503.3 million, was the TEN-T development project. Despite being essentially a massive road reconstruction undertaking, it is put under the category "public administration" and aims to recover in total more than 235 km of M-06 and some kilometers for M-09. If it were included in the road category, it would have driven up the total road funding by 75%. For this project, over 83% in financing comes from the European bank for Reconstruction and Development (EBRD). In the new SPP, the value of the project already rose to almost 28 billion UAH.

Over 2025 at least three new "**mega-projects**" with a total value of 554 billion UAH, or over €12 billion have been introduced in the DREAM. They are not yet included in the Single Project Pipeline as of October 2025, but this might change:

- M-07 reconstruction at 120 billion UAH
- M-30 road reconstruction with an additional lane at 300 billion UAH
- M-15 reconstruction at 134 billion UAH

This allowed the desired funding for road infrastructure to grow more than 15-fold compared with December 2024 following our first analysis. The share of the road relevant investment needs has soared from 9.8% of the transport total to 53.2%. We will come back to these mega-projects in the section on tolling to calculate the total potential revenue collected on trucks from these roads. Until 2028, according to the newly announced investment plans, Ukrainian government has two priorities for road infrastructure:

1. Construct 271 km, repair 2323 km and reconstruct 672 km of roads making it 3266 km in total with a budget envelope of 613 billion UAH, or almost €14 billion
2. Develop and introduce the **tolling system** for vehicles over 12t for which it needs 6.3 billion UAH, or €139 million. With the scope of 3112 km to be tolled by 2027, the revenue expected is 300 million UAH. Assuming 2000 daily average truck activity on those road kilometers will give us a very low charge of around 0.13 UAH. In the tolling section we show you how Ukraine could gain €1 billion on its tolling network limited to 3 main routes.

Each new year brings another road recovery project that in the absence of domestic revenue streams will have to be sponsored from international financial institutions and partners. Without a proper and timely development of the road tolling system for trucks Ukraine is slowly but steadily losing strategic autonomy in managing its road infrastructure.

Public-private partnerships for road projects

In 2020 the Ministry of Infrastructure of Ukraine together with World Bank and IFC presented the first public-private partnership programme for the 1400 km of roads and total volume of 1.8 billion US dollars. Public-Private Partnerships (PPPs) are long-term agreements where private entities fund and deliver public services, such as road projects, sharing risks with the government. Payments can come from the government or directly from users (tolls). Total value of EU PPP transport projects 1990-2020 stands at €224 billion, or 55% of total PPP volumes. Most PPPs in transport were in the UK - €56.1 billion, Spain - €27.3 billion, France - €23.3 billion and Germany with a total value of €13.7 billion.

In Ukraine, the discussion about PPPs for road recovery was revived in 2025 with a new law. This law aims to facilitate PPPs by exempting smaller projects from feasibility studies, allowing state companies and international donors to participate and settling road ownership transfers between government levels. PPPs offer advantages like raising funds for infrastructure, ensuring maintenance, if payments are conditional on it, and potentially faster, higher-quality project delivery. They were attractive in the EU for their off-balance sheet treatment of government debt.

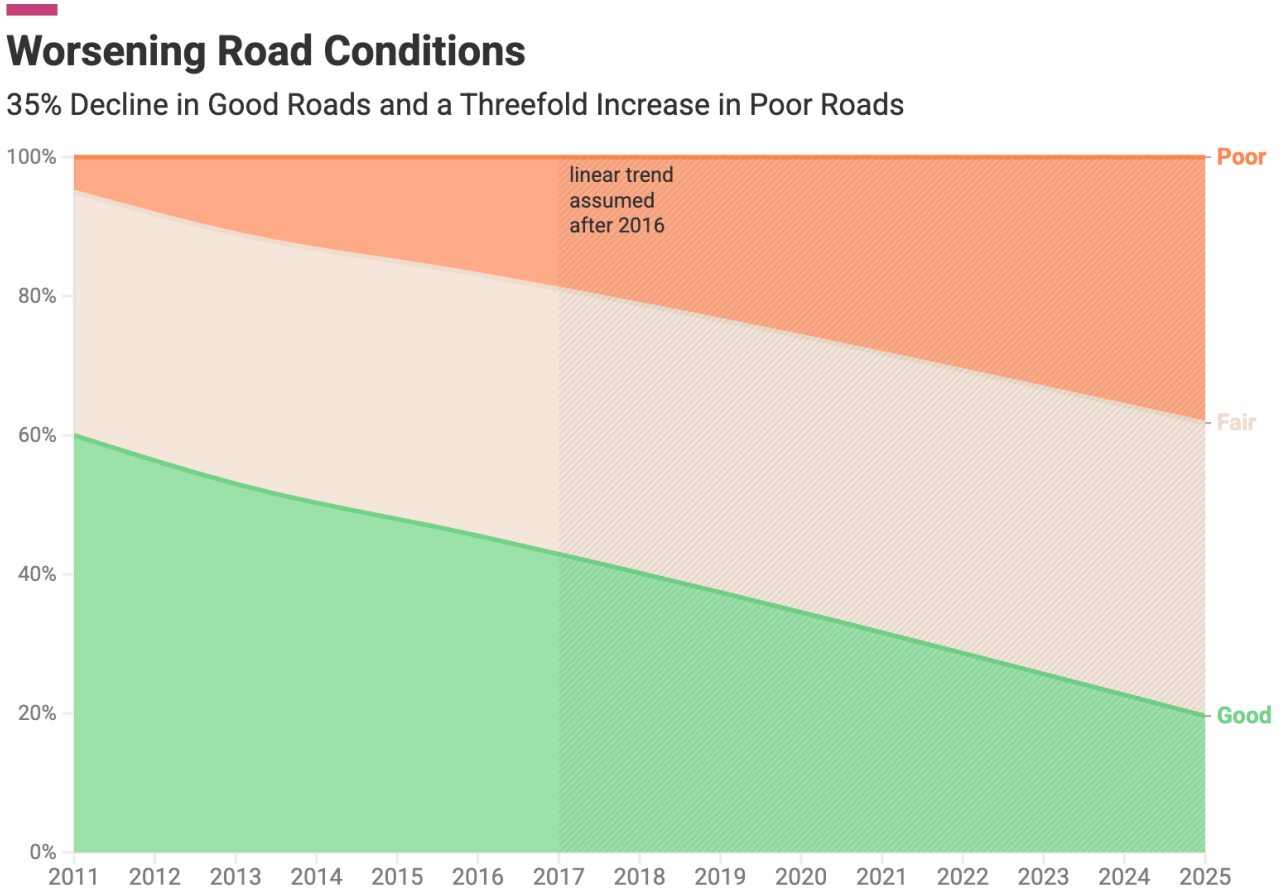
However, PPPs are not without issues:

- **Affordability bias and social discount rates:** States may overestimate what they can afford due to not paying immediately. The net present value is sensitive to discount rates, which environmental groups criticize for devaluing future generations.
- **Delays and cost overruns**: Projects often face delays, cost overruns, and overoptimistic traffic projections, leading to states having to bail out private partners during crises. Greece's traffic decline due to the severe financial crisis led to €1.2 billion in additional costs for the government and delays of up to 52 months. For the N17/18 motorway in Ireland there was a delay of 3 years because of the private partner's difficulty to fund the project.
- **Missing out on tolling revenue**: In concessions, the state loses tolling revenue, missing opportunities to invest in sustainable transport initiatives. Netherlands, for instance, uses some of the tolling revenue on development of the charging infrastructure and purchase subsidies for electric trucks. The country could use some of its tolling revenue from CO_2 or air pollution on other sustainable transport initiatives according to Art. 9 of the Directive (EU) 2022/362. The Ukraine's State Decarbonisation Fund funded by environmental taxes and state borrowings could absorb some of the revenue that is not destined for road maintenance and repairs.
- **Contract renegotiation**: with changing laws and regulations, this can be difficult. France's CO_2-based tolling may only be possible after 2031 due to existing concession contracts.

Our recommendation is to weigh alternatives between the traditional procurement and PPP option, assume realistic traffic demand using the National Transport Model of Ukraine and include the Directive (EU) 2022/362 provisions early on in the contracts.

1.4 Road surface is deteriorating

Over the period 2011-2016, the road condition in Ukraine, measured by the International Roughness Index (IRI), has been deteriorating according to the World Bank. The share of roads in poor condition has increased by 225%. Assuming the very optimistic linear trend, in 2025 38% of the road kilometers are expected to be in poor condition. Meanwhile, the share of roads in good condition dropped in total from 2011 until 2025 by 67%. The share of inoperable bridges increased 4.5 times in the 2019-2023 period. Due to Russian aggression 25,400 km of roads and 344 bridges and bridge crossings were damaged on top of the annual wear and tear.



Source: T&E, based on World Bank study 2018 on prioritising road investments • Road quality is expressed in terms of international roughness index (IRI). Poor condition of the road is with the IRI > 6.

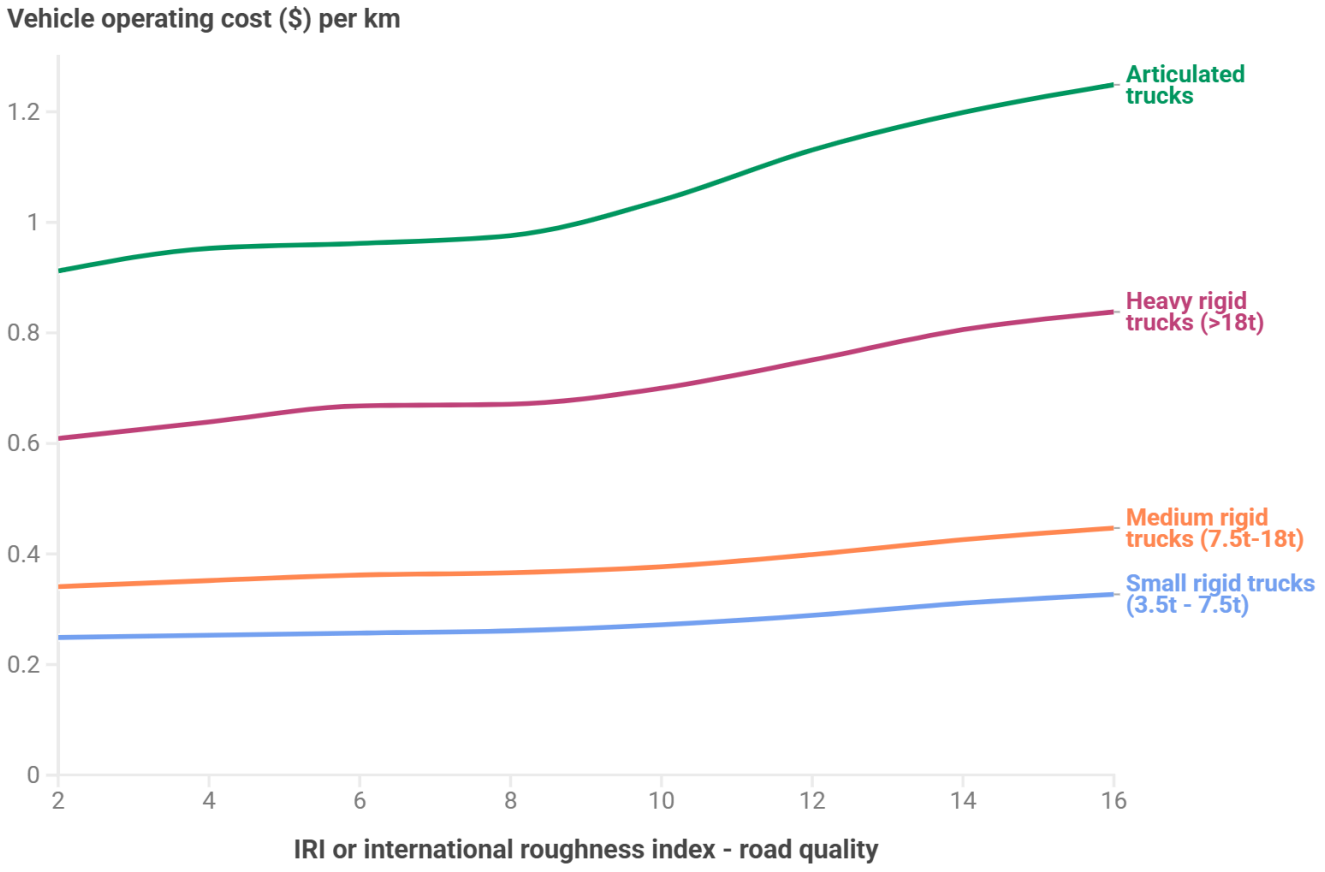
The reasons behind the deterioration of road assets are mainly:

- Russian aggression and use of tanks leading to road damages
- failure to implement an appropriate strategy to maintain and recover road infrastructure,
- intransparency and also lack of road maintenance funding
- absence of the systematised data collection on the network condition, e.g. IRI indices and vehicle activity
- dual-use of infrastructure for civilian and military purposes

Focusing on road recovery in the bad cases and regular road maintenance also impacts the fuel consumption and corresponding CO_2 emissions of the active vehicles. IRI is the international roughness index that evaluates the smoothness of the road. By some estimates, an increase in IRI of 1 meters/km leads to an increased fuel consumption for heavy trucks of 1% at normal highway speed (96 km/h) and 2% at low speed (56 km/h). For repair and maintenance, an increase in IRI up to 4 m/km is associated with the increase in repair and maintenance cost of the heavy trucks by 10%. Vehicle operating costs for vehicles are, in short, higher on the roads with poor road surface compared with the roads with better pavement due to rolling losses. Per World Bank, the average increase in vehicle operating costs on the best and worst road quality for all trucks - small, medium, heavy and articulated - is on average around 35%. Repairing the road and putting the toll on it to recover the cost will lower the vehicle operating costs of the truckers while raising marginally the logistics costs. We explore the potential price increase of the beer bottle in this section. Increased road roughness leads to more dynamic vehicle load on the road surface. This creates a vicious loop which further deteriorates the road surface.

Poor Road Conditions Drive Up Trucking Costs

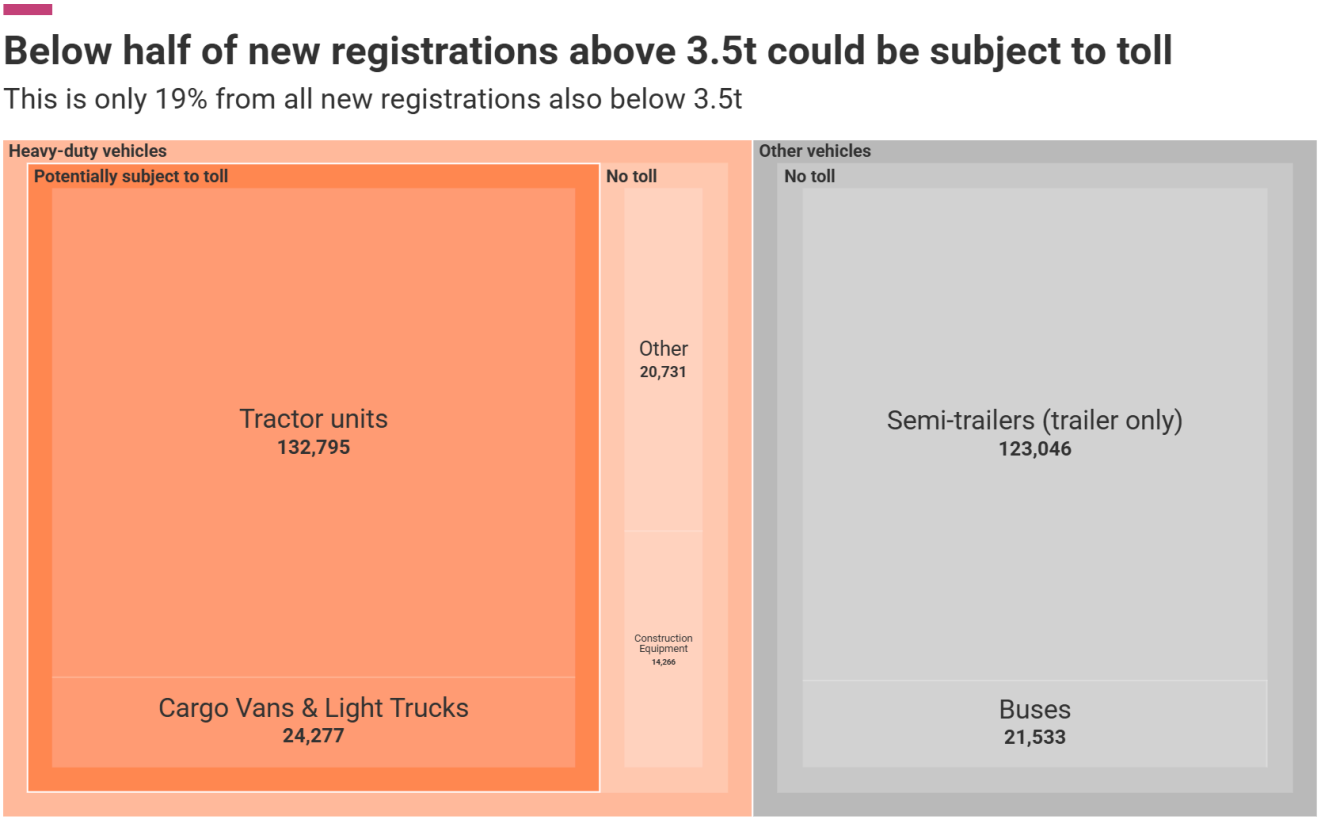
Heavy trucks face almost 38% higher operating costs on poor roads



Source: T&E, HDM-4 EGIS study for World Bank, IRI of 2 = best road quality, 16 = worst.

2. Big trucks: number, age and emissions

2.1 Ukrainian trucks are getting Westernised but still overloaded



Our analysis of the Ukrainian heavy-duty vehicle fleet, using the Unified Vehicle Register from 2013 and 2024, identified 833,479 new registrations out of 3,877,152 total vehicle operations. We approximate that only around 19% of the newly registered vehicles after excluding trailers or buses and those below 3.5 could be subject to the toll. Of those over 3.5t, 192,069 or 57% were heavy-duty vehicles, 123,046 or 37% - semi-trailers, 6% or 21,533 - buses. Semi-trailers are trailers without the front axle that together with the tractor unit make the semi-trailer trucks. The heavy-duty vehicles category mostly consisted of the tractor units, cargo vans and construction equipment. By gross vehicle weight, 41% of all vehicles belonged in the 18t-25t bracket and 40% - 25-40t. See methodology for definitions and data processing details.

Registrations dropped significantly in 2014 due to Russia's invasion and the depreciation of the UAH, leading to a decline in EU imports. New registrations fell by 45% and all operations by 26% between 2013 and 2015.

The interest in semi-trailers has been steadily growing. Their number of new registrations more than doubled in 2024 compared with 2013. This is partly due to reorientation of imports from the East to the West. EU brands like DAF, MAN and VOLVO start appearing in the Register under the new registrations from 2019. 85% of all registered DAF trucks are in the 18-25t gross vehicle weight (GVW) category. Only 49% of the MAZ trucks, old and ecologically dubious Soviet Union

heritage, are 18-25t and 32% are lighter - 12-18t. While increased loading capacity benefits business, it negatively impacts Ukraine's road infrastructure. Especially if the vehicles are overweight and not well controlled. For instance, in 2021, more than 6,000 vehicles per day were registered as being over 12t per axle on all roads where Weigh-in-Motion (WIM) systems were installed. An average of 108 vehicles - 1-2% - per WIM were qualified as overloaded per day. More than 66% of those were four-axle rigid trucks followed by 16% of 3-axle trucks. Those categories of trucks also have the highest road surface damage coefficient. According to the fourth power law, even a modest increase in axle load results in a dramatic rise in road damage—roughly proportional to the fourth power of the load.

2.3 Ukrainian trucks are also older and less energy efficient

In this section we look at the age, euro standards and CO_2 emissions from Ukrainian trucks. We calculate the mean vehicle age as the difference between registration and make year of all trucks above 3.5t under the Register. It oscillated between the mean of 13.3 years old in 2013 and 16.4 in 2024. So vehicles registered became on average 31% older. Buses have gotten older by 57% compared to 2013. The mean age of the semi-trailer truck was 10.5 in 2013 and 12.6 in 2024. The share of the young trucks, those in the age range of 0-5 years is on average 10% annually. Trucks older than 20 years compose one third of all vehicles in the Register in 2024. In the EU, the trucks were on average 14.2 years old in 2023. This is more than 2 years younger than Ukrainian mean age of 16.2. Around 40% of the total road freight performance in tonne-kilometres was done by goods vehicles aged between 2 and 5 years old.

There was no big improvement in fuel efficiency of heavy duty trucks from 2002 to 2014. The fuel consumption was stably at around 35 l/100km.This is changing with the recently adopted Regulation (EU) 2019/1242 on the CO_2 emission standards for new heavy duty vehicles. It sets a 15% reduction target until 2025, 45% by 2030, 65% by 2035 and 90% by 2040. So now the age of the registered vehicle is gaining more importance for its energy performance. The latter has an impact on the cost of tolling. Now, the subgroup of 5-LH or long-haul trucks with the largest share of registrations in the EU recorded a total reduction of 1.94% in CO_2 emissions. It was a drop from 56.6 gCO_2/tkm in 2019 to 55.5 gCO_2/tkm in 2021.

All the vehicles first registered in the EU before 1 July 2019 are automatically assigned to the CO_2 emission class 1, the least energy efficient. See the table with CO_2 emission classes below. They are also tolled on average more than those that demonstrate better energy performance. In the Ukrainian Register, the make year of 88% of all vehicles registered in 2024 is before 2019.

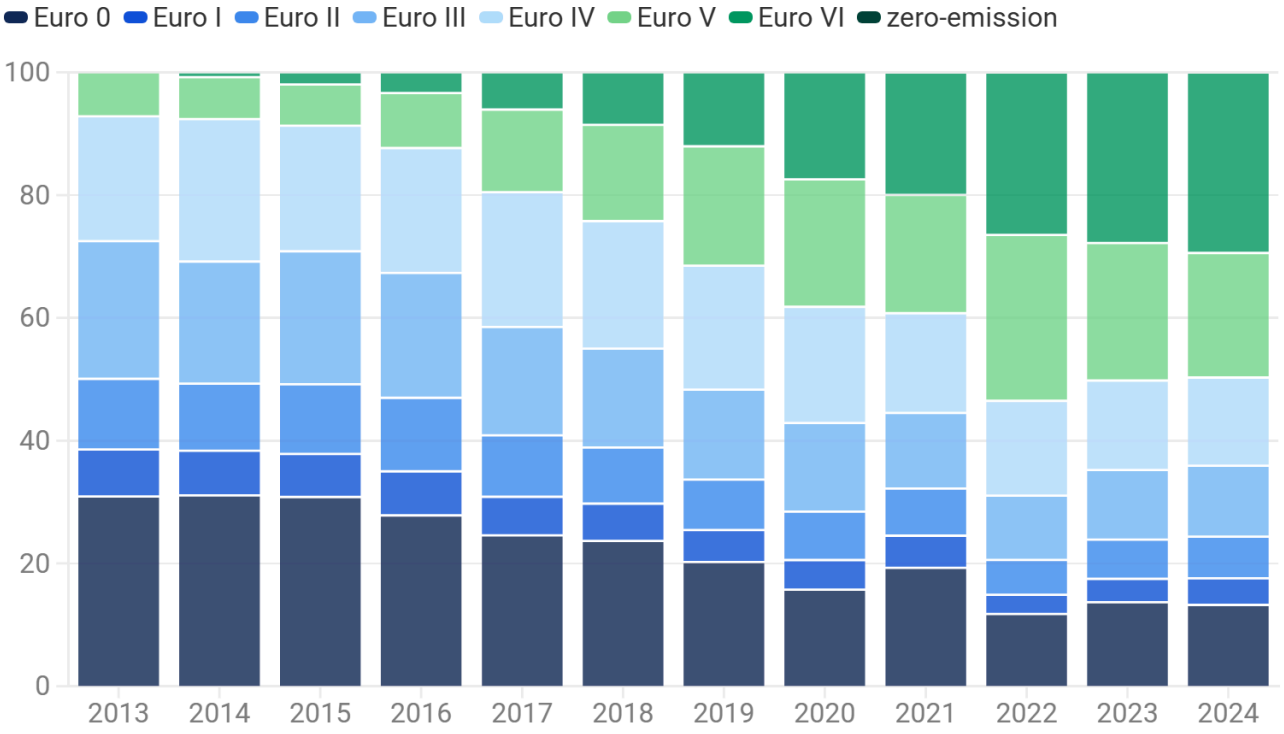
CO_2 emission class	CO_2 emissions range	Reference values for external CO_2 charge
CO_2 emission class 1	The least energy efficient vehicles, or the ones that do not belong to the class 2, 3, 4, or 5	Baseline rate per km varied by Euro standard, urban and suburban setting
CO_2 emission class 2	> 5% below the emission reduction trajectory for the reporting period of the year Y and the vehicle sub-group sg	5% to 15% reduction compared to the charge applicable for CO_2 emission class 1
CO_2 emission class 3	> 8 % below the emission reduction trajectory for the reporting period of the year Y and the vehicle sub-group sg	15% to 30% reduction ~
CO_2 emission class 4	low-emission heavy-duty vehicles, < 50 % of the reference CO_2 emissions of its vehicle group	30% to 50% reduction ~
CO_2 emission class 5	Zero-emission vehicles	50% to 75% reduction ~

Table of CO_2 emission classes according to the Directive (EU) 2022/362 and reference values for CO_2 reduction

In total in the Register, more than 70% of all trucks over the period of 2013-2024 are Euro IV and below. In 2024, the share of less emitting trucks increased in the number of registrations of Euro V and Euro VI. Euro VI truck compared to Euro I emits on average 3 times less CO, 20 times less NOx and more than 60 times less particulate matter PM. The external cost of the air pollution is usually higher in the urban setting compared to regional or long-haul delivery. For Euro III trucks we estimate roughly from 22% to 16% cost increase. This makes zero emission vehicles especially relevant for urban logistics. It also serves as a reason why Directive (EU) 2022/362 also suggests to differentiate the external cost charge by suburban and interurban settings. For instance, in Belgium the toll is differentiated by highway and urban area roads. On average across the euro standards the urban toll is higher than highway toll in the range from 28.7% for lighter vehicles to 45.6% for heavier vehicles.

Shift in Fleet Standards: Euro VI Up, Euro 0 Down

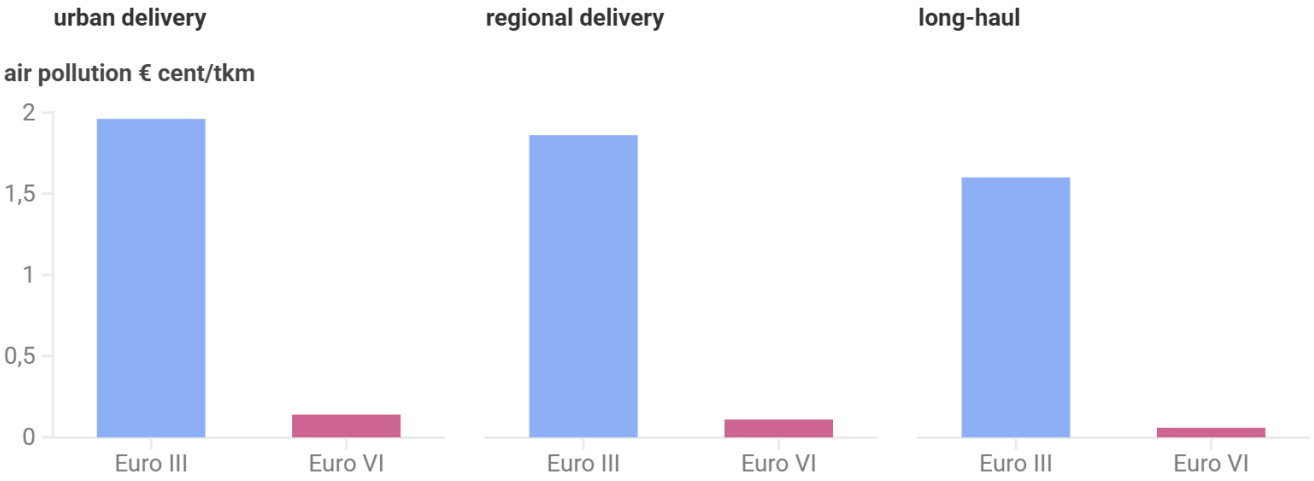
The share of Euro V and VI, less polluting trucks, registered in 2024 is inching to 50%



Source: T&E, Ukraine Unified Vehicle Register, >3.5t, no trailers and buses • See methodology for the matching table

One Euro III Truck Pollutes Like Eighteen Euro VI Trucks

Air pollution in the urban delivery stands out



Source: T&E, Eurostat, Handbook on external cost of transport 2019 • 14t payload and 70% utilisation assumed for 4x2 rigid truck >16t, regional delivery - 70% metropolitan and 30% rural

Due to the lack of details on vehicle subgroups, mission profiles and other technical characteristics in the Register, we could not derive the specific CO_2 emissions of all vehicles. Instead, we filtered the Register to identify the most popular truck brands and models. Those were MAN TGX 18.440 with more than 20,000 mentions, DAF XF 105.460 - > 35,000 and ГАЗ

3307- > 17,000 mentions. We matched MAN TGX 18.440 (2023) and the closest in series to DAF XF - DAF XF 480 FT (2019) with EEA data to identify the range of the specific CO_2 emissions depending on the mission profiles, payloads and vehicle characteristics.

Brand	Model	Vehicle subgroup	Axle Configuration	**Specific CO2 range (min-max) in g/km**	Mean GVWR (t)
DAF	XF 480 FT	5-LH	4x2	**739.36-937.3**	20.04
DAF	XF 480 FT	10-LH	6x2	**773.78-934.11**	26.64
MAN	TGX 18.440	4-LH	4x2	**669.53-673.95**	18.00
MAN	TGX 18.440	5-LH	4x2	**665.22-757.46**	19.36

Table of specific truck CO_2 emissions based on the matched with EEA data from 2019-2023

The CO_2 specific ranges for DAF model registered in 2019 are 13-31% higher on average than those of MAN from 2023. This again shows the connection between the CO_2 emissions and vehicle age.

In terms of low and zero-emission powertrains, we spotted at least two electric trucks registered in the Ukrainian Register: Qingling Patriot EVK100 in Kharkiv in 2024 with a gross vehicle weight of 7.3t and Mitsubishi Fuso Ecanter in 2021 in Poltava weighing 7.5t. The rest of ZEVs were either vans, buses and pickups, including a Tesla Cybertruck registered in 2024 in Kyiv.

In July 2025, the market share of the electric vans in the EU reached 9.5% and electric trucks now take 3.6% of the new registrations. The sales of e-vans and trucks have been increasing by 46%-50% year-to-year. With policy measures such as the purchase subsidies, tolling exemptions for ZEVs and progressive roll-out of technology and the charging infrastructure - the number of zero-emission vehicles in the EU is expected to rise. Some responsible businesses in Ukraine like Nova Poshta or New Post have introduced electric vans for urban delivery. With more fast charging infrastructure, showcasing good examples and introducing state incentives - more could follow. Raised tolling revenue could be also used to fund such incentives as well. We will discuss the freight activity and tolling scenarios in the next section.

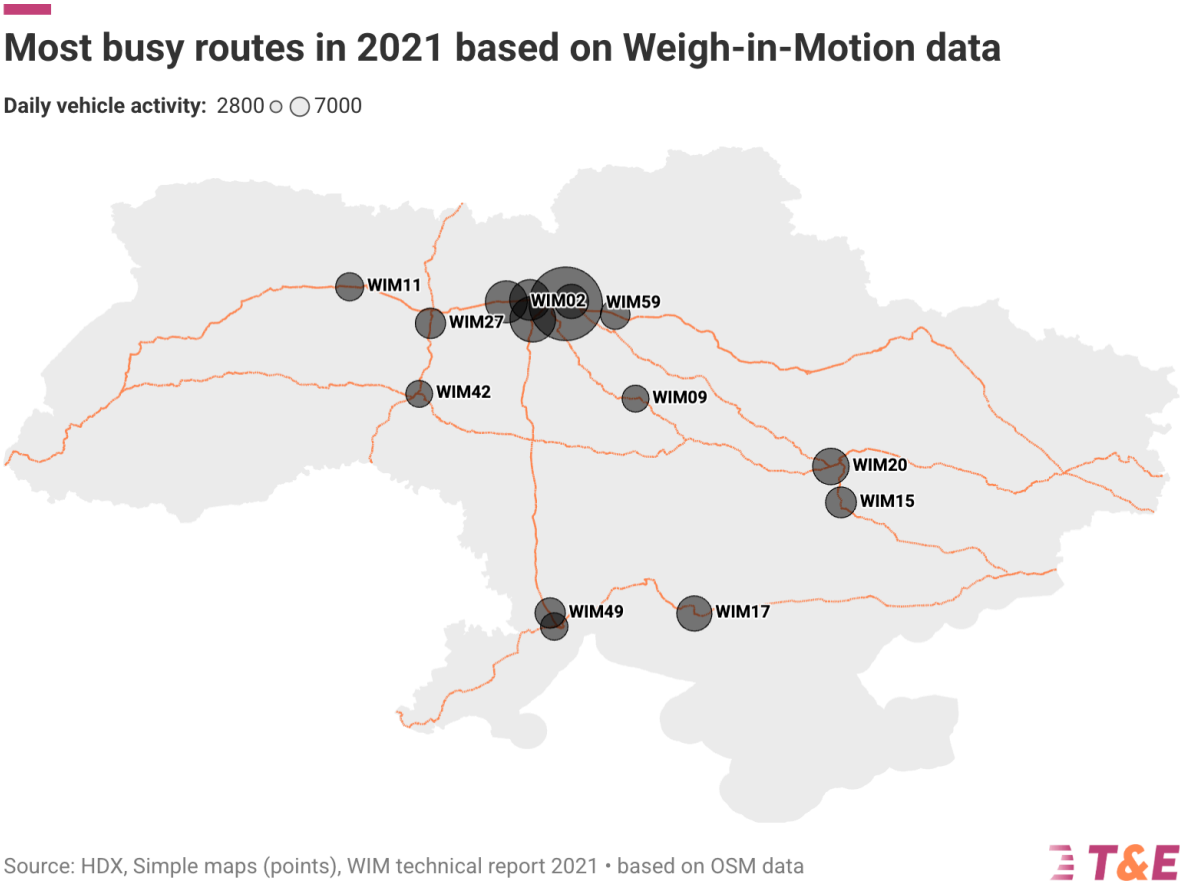
Section 2

1. Freight on Ukrainian roads

1.1 Weigh-in-Motion insights on vehicle activity

There is no up-to-date data on passenger or freight activity. Based on the entirety of Weigh-in-Motion (WIM) data from 2021, we identified 10 most busy routes. In 2024 following

the Russian full-scale aggression the routes M-03, M-05, M-06, M-30, M-14 and H-01 are still in the top 10. In 2024 we were lacking a lot of data points per WIM as a main reason why we focused on 2021 data. Ukrainian road network comprises 26,056 km of main roads, of which 9,348 km international roads (M-roads); 7,205.1 km national roads (H-roads); 9,503 km regional roads (P-roads) and 21,362 km territorial roads. The most busy route in 2021 was M-03 road stretching from Kyiv through Kharkiv to the eastern border road with over 53,000 vehicles per day on average. In 2024 there was on average just over half of 2021 - over 23,100 vehicles passing. It is followed by M-05 with over 25,300 vehicles connecting Kyiv and the port of Odesa and over 15,000 in 2024. At least a single WIM system was installed on 74% of international road kilometers. Only 55% of national, or H-type road kilometers, had a WIM installation. So on average every 1,000 kilometers there were 4 WIMs. The highest number of WIMs - 7 in total - was on the road M-30 spanning over 1440 kilometers from the West, the city of Stryi to the East, the Russian border. Compared to 2021, in 2024 there has been an average 27% decrease in the activity on the routes covered by WIMs. Activity naturally shifted to the West of the country. Consult methodology for the WIM 2024 map and detailed tables.



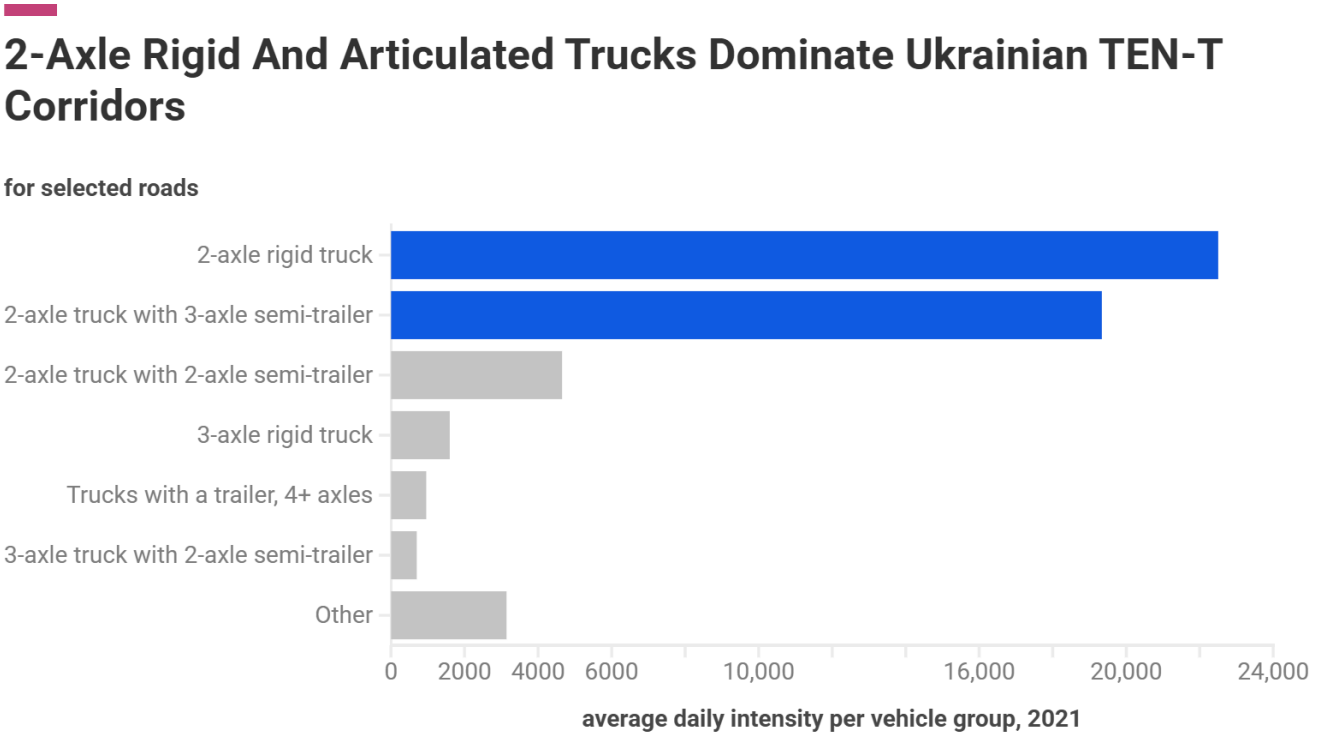
1.2 Most active truck profiles on TEN-T routes

We examined vehicle activity on the TEN-T corridor extensions in Ukraine and also M-05 highway, part of the comprehensive TEN-T, from Kyiv to Odesa based on WIM 2021 data. Here is what we found:

- On average, heavy-duty vehicles did around 35% of all vehicle activity averaged per day, ranging from 14 to 47% depending on the WIM system data.

- The most active truck category was 2-axle rigid trucks. The average weight of the 2-axle rigid truck was at 9.4t with a maximum registered of 22.5t. Over 36.4% of all trucks in this category weighed under 5.5t. Commonly they are represented by 4x2 axles, or 4x4 models for more traction and grip.
- Second most popular - 2-axle trucks with 3-axle semi-trailer. A 2-axle truck with 3-axle semi-trailer was on average weighed at 39.5t and a maximum of 72.7t. Over 72% of all trucks in this category weighed in the 35-45t range.

In 2024 in the EU more than 60% of road freight tonne-kilometers was done by road tractors with a semi-trailer. Around 52% of vehicle-kilometers in EU25 were done by 2-axle road tractors with a 3-axle semi-trailer and around 13% by 2-axle rigid trucks.



Source: T&E, WIM report 2021 • Average daily intensity per vehicle group was averaged across available months of the year. WIMs or Weigh-in-motion systems are located along routes M-06, M-07, M-03 and M-05.

2. Pilot tolling scenarios

2.1 Implementing “polluter pays” is profitable

We looked at three main routes - M-07, M-06 and M-05. M-07 and M-06 are part of extensions of the North Sea Baltic TEN-T corridor. M-05 is part of the comprehensive TEN-T network. The reasons why we chose those routes are primarily their logistical and strategic importance, connection with the EU and at least two WIMs installed and active that allows us to track the vehicle activity over the route. The TEN-T extension to the east of Kyiv was not considered due

to the lack of WIM data. In total it totals to over **1,700 km**.

Source: T&E, based on HDX, Simple maps (points), TENtec ArcGIS • *Part of North Sea Baltic and Rhine Danube corridors go through M-06 and M-07. roads that we selected for tolling. WIM technical report 2021; WIM stands for Weigh-in-Motion system

We calculate **four tolling scenarios**:

- Using toll rates specified in the Resolution of Cabinet of Ministers of Ukraine № 1312 from 2020 for trucks above 3.5t gross vehicle weight (GVW),
- Tolling trucks only >12t GVW at 0.133 €/vkm - under consideration of Ukrainian government currently,
- Applying the German Maut tolls for trucks >7.5t GVW as per the Report 2021 on calculation of the infrastructure and external costs for the federal highway network, depending on the weight, axle number, Euro standard and day or night trucking,
- Using updated German Maut toll rates for trucks >3.5t GVW with substantial charges for CO_2 emissions and depending on the CO_2 emission class.

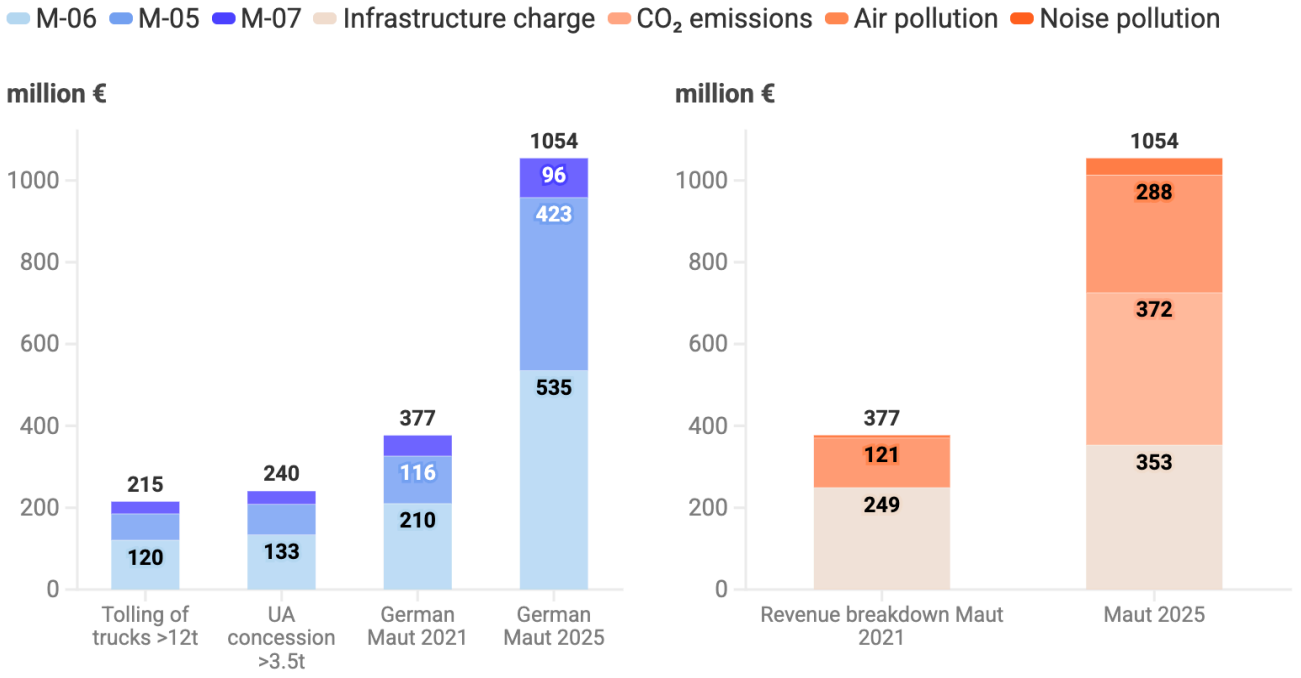
The Ukrainian concession case does not have a CO_2, air or noise pollution toll components. Those constitute 66% of all the revenue in 2025 as part of German Maut revision, double the share of 2021. The concession scenario is 77% lower in revenue compared to the German Maut 2025. Limiting tolling to vehicles only above 12t will bring 11% less to the budget compared to concession case.This is almost €26 million less and 80% or €839 million less than the German tolling scheme.

Over €1 billion annually could be generated on those routes applying the revised German Maut. This revenue will be composed of roughly four parts - infrastructure charge (34%), charge for CO_2 emissions (35%), air pollution charge (27%) and noise pollution (4%). The total toll cost per kilometre under the Maut ranges from 15.1 cent/km for Euro 6 vehicle weighing 3.5t-7.5t to 51.6 cent/km for Euro 0 truck with a gross weight of over 18t and more than 5 axles. We approximate that a bit over € 1 billion was the tolling revenue in Germany for 1 month of July 2025 - with over 3 billion kilometers driven subject to toll. 97% of the revenue in Germany came from the emissions class category A or basically Euro 6 and 95% - from vehicles over 18t. An average toll amount per kilometer paid was around 29 cents per kilometer. In Ukraine, around 55% of vehicles on the routes under inspection were over 18t. More than 60% of the activity we assume was done by Euro 0, Euro III and Euro IV trucks based on the Register data. They are expected to contribute the most to the toll revenue.

We used the 2024 WIM data to compare the tolling revenue on M-06, M-05 and M-07 based on the truck daily activity in 2024. The average decline in truck activity was ranging from 8% to 19% per road. We find on average around **10% decrease** per scenario in potential gross revenue generated. Under German Maut 2025 around €946.5 million could be generated. Interestingly enough, WIM49 located not far from the port of Odesa saw a substantial increase in truck count per day in 2024 unlike all other WIMs. Consult the results in the Annex. The roll-out of WIM systems and publication of detailed statistics on the weight of vehicles per WIM could serve as an efficient enforcement and data-collection tool on vehicle activity and weight profiles.

Unlocking €1 Billion: Scenarios for Tolling Ukraine's Major Highways

CO_2 emissions from trucks are largest source of potential toll revenue



Source: T&E, WIM 2021 report, HGV toll Germany, Berechnung der Wegekosten 2021 • Resolution № 1312 of Cabinet of Ministers on UA concession toll rates. German Maut are toll rates for HDVs in Germany depending on the introduction year

Positive externalities from tolling

1. Incentivising less polluting vehicles through tolling

Due to the EURO class differentiation in the beginning of Maut toll, Germany has managed to boost its truck fleet renewal much faster. Over a 5 year period the combined share of EURO V and EEV or enhanced environmentally friendly vehicles increased from under 1% to more than 60%. The share of EURO II or lower was dropped from 34% to 2.3%. Hence, differentiated tolls incentivise the use of less polluting vehicles. For instance, in Germany a truck >18t with 4 axles of EURO 0 or I will pay €51.2 for 100 vehicle-kilometers (vkm). The same truck but with EURO VI will pay €32.4 which is 37% less.

The ageing and less energy efficient truck fleet in Ukraine could benefit from a "toll booster". Especially, if smaller and medium enterprises (SMEs) could be financially supported for their purchases of more energy efficient vehicles. Only ½ of new truck registrations in Ukraine were of EURO V and VI in 2024.

With the Regulation (EU) 2019/1242 on the CO_2 emission standards for new heavy duty vehicles, EURO standards are ***not the only factor*** that should be taken into account. The long-haul truck with EURO VI manufactured in 2024 or in 2028 will have different CO_2 emissions. The latter truck is expected to have lower CO_2 emissions in g/tkm. This is because the Regulation sets a 15% CO_2 reduction target until 2025, 45% by 2030, 65% by 2035 and 90% by 2040. Over time, it is important to incorporate the toll differentiation by CO_2 emission class as well.

Zero-emission trucks do not have CO_2 emissions at the tailpipe due to the absence of combustion. They should be exempt from tolling to ensure the growth in their uptake. In 2025 the EU has extended the exemption period for ZEV HDVs until 2031.

2. Tolling to support the modal shift

It is difficult to establish the direct causality between levying the road toll and increase in the rail freight, maritime or short-sea shipping. But there are ways to do that. The proceeds of the toll mark-up on Brenner motorway in Austria, or around 25% on top of the base vkm, are earmarked to contribute to the construction of Brenner Base Tunnel, the TEN-T priority rail project. The shift to rail in this mountainous region should unload one of the busiest mountain crossings used for freight transport with more than 2.5 million trucks annually. Thereby it aims to decrease noise and air pollution levels in the Alpine region from road freight and passenger vehicles.

Switzerland, although not part of the EU, also has similar legislation aimed at putting road freight on equal footing with rail. It is mainly due to the logistically important location of the country, Alpine landscapes and the aim of shifting freight transport through the Alps from road to rail. Two thirds of the proceeds of the heavy goods vehicle charge for vehicles above 3.5t goes into rail development and the rest to the cantons for the compensation of the costs born from road transport. Since the introduction of the charge in 2001, the

number of heavy goods vehicle crossings through Alps dropped from 1.3 million to around 860 thousand in 2020.

In Ukraine, similar mark-ups could be applied to sponsor rail transportation alternatives. It might inspire transport operators to choose rail instead of road delivery. It would be more effective if coupled with a general strategy to make the rail transport tariffs predictable for businesses without spontaneous price spikes.

3. **Avoiding health losses from the polluting road transport**

The total external cost of transport in the EU reaches 1000 billion annually. The main contributors are environment (carbon, noise and pollution), accidents and congestion. Most of it comes from road and particularly road freight. In the EU in 2022, 239,000 people died from exposure to fine particulate matter ($PM_{2.5}$), 48,000 - nitrogen oxide and 70,000 - from ozone exposure. On-road diesel vehicles contribute the most to the pollution and associated deaths. Excess NO_x, or nitrogen emissions under real driving conditions, were linked to 38,000 premature deaths worldwide in 2015. Heavy-duty vehicles were by far the largest contributor accounting to 76% of total excess emissions. Long-term exposure to nitrogen is linked to a range of adverse health outcomes, including heart, lung diseases and strokes.

Ukraine in 2021 counted more than 130 deaths per 100,000 from ambient particulate air pollution, similar to China's estimate in 2021 and almost 2.5 times more than the EU average. Prior to the full scale invasion, 67% of all registered deaths were due to cardiovascular diseases. So reducing the health burden by incentivising less polluting road transport, e.g. heavy duty vehicles with high EURO and CO_2 emission standards, is beneficial and highly relevant in Ukrainian realities.

2.2 Recovering road repair cost through tolling

The revised Single Project Pipeline (SPP) under EU's Ukraine Facility includes new road mega-projects with road repairs that require more than 554 billion UAH or more than €12 billion in finance. We calculate the tolling revenue from those roads under UA concession and simplified German Maut 2025 scenarios. See methodology for more details on calculation. Under the UA concession, more than 52 years of tolling will cover the road repair cost. German Maut with its more ambitious CO_2 tolling mechanism will recover it in 17.5 years. Road repair

needs declared in 2024 of €674 million could be recovered in a year under German toll.

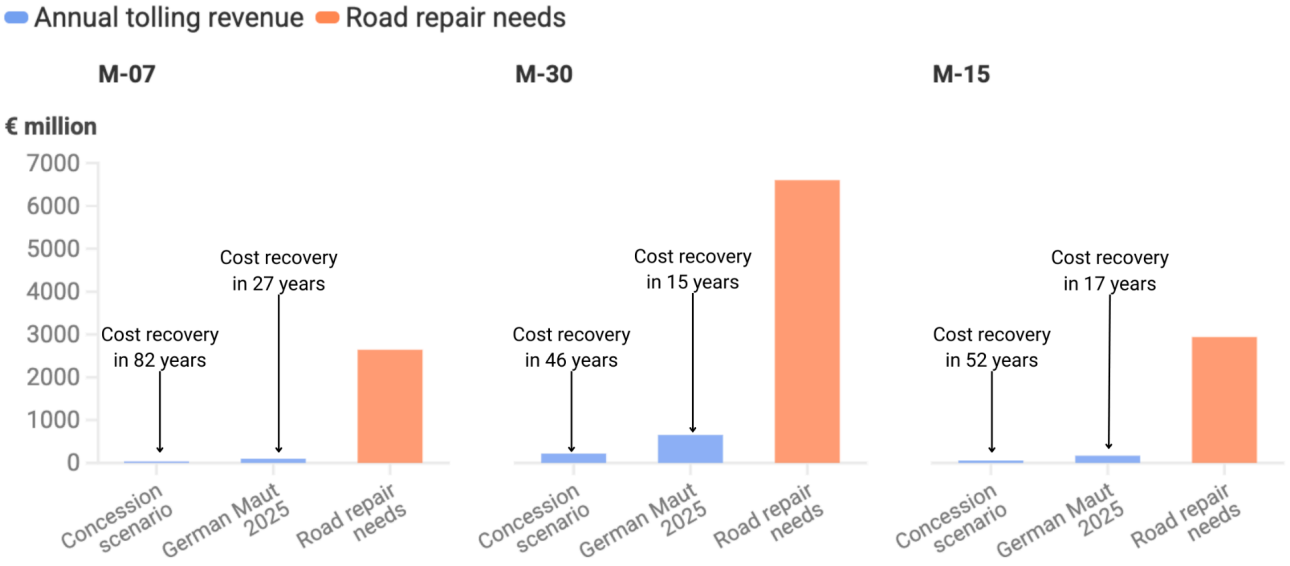
Source: T&E, routes M-07, M-15, M-30, DREAM SPP, WIM report 2021 • Unified Vehicle Register 2013-2024, HGV toll Germany; Resolution of Cabinet of Ministers on UA concession toll rates 2020. 1€ = 45.4553 UAH

Let's calculate how much tolling revenue could be raised on the new road mega-projects:.

- M-07 Kyiv-Yagodyn: WIMs registered on average around 4,000 vehicles in 2021 with 40% - heavy-duty. In 2017 activity estimates on the road reached 36,000 vehicles. Yagodyn-Dorohusk border crossing point on M-07 was the busiest in 2022-2025 for trucks. The average cost of the road repairs per kilometer is around €5.6 million. We calculate that the most ambitious tolling will cover this cost in 27 years. Without additional road upgrades, the cost recovery will be faster.
- M-30 Stryi-Izvarino: The M-30 is the so-called "Road of Unity" stretching from the East to the West. Its repair needs are a whooping €6.6 billion and €6.6 million per kilometer. The vehicle activity on the road ranges from 2,500 vehicles in Kirovograd region and 22,500 in Dnipro region. It requires 10 years of CO_2-based German Maut tolling to recover the cost.
- M-15 Odesa-Reni: The reconstruction of the M-15 road has been long overdue. So far it has been done only to some extent. It is part of the E87 international route, has 49 bridges and provides connections to 5 ports in Odesa region. The current reconstruction project is part of the pilot with the World Bank. The road repair expenses per kilometer are the highest among the three - almost €10 million. German style tolling will be able to recover these costs in around 17 years.

Starting early and ambitious pays off

Up to €700 million from tolling road mega-projects in the pipeline



Source: T&E, WIM report 2021, HGV toll Germany, DREAM SPP • Resolution of Cabinet of Ministers on UA concession toll rates 2020. Years to recovery = total road repair cost / annual tolling revenue.

2.3 Beer cost modelling

From tolling to your beer: a beer price modelling

The beer bottles show potential price variations under different tolling ambition

Source: T&E modelling based on the price of Lviv "Beer Pravda" 0.33l bottle transported on M-06 route for 530 km from Lviv to Kyiv. Low ambition - based on the UA concession rates, Cabinet of Ministers Resolution №1312. High ambition - based on average German Maut 2025. €1 = 45.4553 UAH.

When talk is about tolling, there is a fearmongering about the price increases for goods. In Germany, the increase of the toll per kilometer from 16 cent/km to almost 32 cent/km was modeled to result in an 0.6% the cost increase of the half a liter beer bottle transported from Hamburg to Munich. Simply put, double the toll - and the beer bottle will cost you 0.8 cents more.

We modeled the potential increase under low ambition or UA concession scenario and high ambition or German Maut 2025 for Ukraine. Take a 0.33l beer bottle of Pravda beer manufactured in Lviv. Its cost at the producer is roughly 78 UAH or €1.72. Its transport from Lviv to Kyiv (530 km) on a semi-trailer truck of 40t with 7.5 tonnes payload, relatively good road surface and lowest ambition tolling scheme would result in a **0.3 eurocent or 14 kopyikas mark-up**. This represents an increase of 0.17% compared to the original beer bottle price. Under a more ambitious tolling scheme, the beer bottle would cost **0.84 eurocent or 38 kopyikas more**, a relative increase of 0.49%. Note that it does not necessarily mean that the price increase will happen. It only means that there is a marginally higher transportation cost for goods.

The higher transport costs are now not due to the toll but poor road surface which brings up logistics costs. For example, the same beer bottle transported over the same distance over the road with the IRI of 6 which is still considered to be a “fair road quality” will have a mark-up of 0.12 cents or 6 kopyikas. The road with the worst IRI of 16 will give a cost increase of 0.84 cents or 38 kopyikas. Ironically enough, this is equivalent to the toll mark-up as well in the high ambition scenario. This goes to say that even if the cost increases might occur, the actual impact of those is rather limited.

In a recent infrastructure poll 2024, 76% of surveyed Ukrainian businesses support the introduction of tolling provided the improvement in the road surface quality. Due to the unsatisfactory quality of motorways, road carriers spend more time and money - both on fuel and vehicle repairs. This situation leads to an increase in the cost of logistics companies' services. Although the companies contribute to the Road Fund by paying an excise on fuel at the gas station, they still have to deal with the roads of worse quality. In these circumstances, gradual implementation of user pays and polluter pays seems like a reasonable alternative to crumbling infrastructure and rising logistics costs.

Conclusion

Tolling is time-demanding and could be fear-inducing for truckers, people and policy-makers. So starting early and ambitious tolling is key for cost recovery, optimisation of EU and international funding and alignment with EU acquis. To dissipate the fear around tolling, it should be evidence-based. This requires data collection on the current road roughness, activity levels and general state of road infrastructure. Try tolling the existing roads in the pipeline or strategic TEN-T network as we demonstrate as pilots to demonstrate feasibility. Finally, implementing the polluter pays principle under the Directive (EU) 2022/362 is crucial for EU obligations and will raise revenue for sustainable transport initiatives.

Recommendations

Truck tolling system:

- **Phase-in of distance-based tolling**
  Implement a gradual, distance-based tolling system for heavy-duty vehicles (HDVs), in line with Directive (EU) 2022/362:
  - **Before 2027** - apply tolls to HDVs over 12t in gross vehicle weight.
  - **After 2027** - expand to HDVs over 7.5t.
  - **After 2030** - expand to HDVs over 3.5t.
- **CO_2 differentiation**
  - **Before 2027** vary the infrastructure part of the toll by Euro standard: a more polluting Euro II vehicle pays more than a less polluting Euro VI.
  - **After 2027** - based on the CO_2 emission class.
  - Exempt **buses** and **zero-emission vehicles** from the toll.
- **Gradual incorporation of air and noise charges after initial pilot phase**
  - **Air pollution charges**: vary by road types (suburban / interurban roads). The charge should reflect the level of exposure of the roads and their vicinity to pollution such as population density, annual mean air pollution.
  - Exempt **zero-emission vehicles** from air pollution charges.
  - **Noise charges**: differentiate between night and day with higher night-time rates. This will raise necessary funds for noise protection barriers in the most vulnerable communities.
- **Pilot implementation**
  Pilot tolling on the key **TEN-T routes** of logistic importance with the gradual scope expansion:
  - Those include international roads such as **M-07, M-06 and M-05,** or the roads for which the capital repairs are planned - **M-07, M-30 and M-15**.

Implementation and enforcement:

- **Alignment with EU type-approval framework**
  - Align the Ukrainian type-approval system with Regulation (EU) 2018/858 on the approval and market surveillance of motor vehicles and Regulation (EC) No 595/2009 on type-approval of motor vehicles.
  - Ukrainian type approval certificate should contain all the necessary information on the vehicle, e.g. its specific CO_2 emissions (as per the Certificate of Conformity and determined with the help of VECTO simulation tool).
- **Integration into the Unified State Vehicles Register**
  - Record key vehicle data (Euro standard, CO_2 emissions, emission class) in the Unified State Vehicle Register.
  - Enable toll operators to access this data for compliance checks, consistent with Directive (EU) 2019/520 on electronic toll interoperability.
- **Determination of fair toll rates**

    - Base toll rates on vehicle activity, infrastructure wear, and associated repair costs.
    - Adopt the methodology used in Germany's Wegekostengutachten for cost-based toll setting.
    - Collect supporting data on:
        - Road condition (e.g. IRI index)
        - Vehicle activity by type, associated emissions
        - Noise and air pollution
        - Population density.
- **Use of revenues**
    - Direct toll revenues toward road maintenance and repair ensuring revenue neutrality as per Directive.
    - Allocate additional revenue from pollution and CO_2 charges to sustainable transport projects (e.g. through the State Decarbonisation Fund to sponsor charging stations, public transport improvements) and/or support SMEs in their truck fleet renewal.
    - Publish annual financial report on toll revenues, expenditures, vehicle profiles for public transparency.
- **Weigh-in-Motion systems**
    - Continue rolling out of WIMs to monitor vehicle activity, truck profiles and prevent overweight vehicles.
- **Concessions and PPPs**
    - Integrate Directive (EU) 2022/362 provisions into concession and PPP contracts from the outset to avoid future compliance issues during EU accession.

Benefits for transport operators:

- **Prevent excessive financial burden**
    - Consider dropping the single fee for vehicles collected at border crossing points to avoid double vehicle taxation and ensure fairness between resident and non-resident transport operators.
    - Introduce a targeted financial incentive scheme for SME transport operators to support truck fleet renewal, e.g. leveraging funds allocated under Ukraine Facility for tolling development or using the funding from the air pollution toll charges as mentioned above.

Support from EU partners:

- **Technical and financial assistance**
  The European Commission, EIB, EBRD should provide technical assistance and financial support in helping the Ukrainian stakeholders to align the tolling project with the Directive 2022/362 and EU type approval requirements.

Annex I. SWOT analysis: tolling from 3.5t?

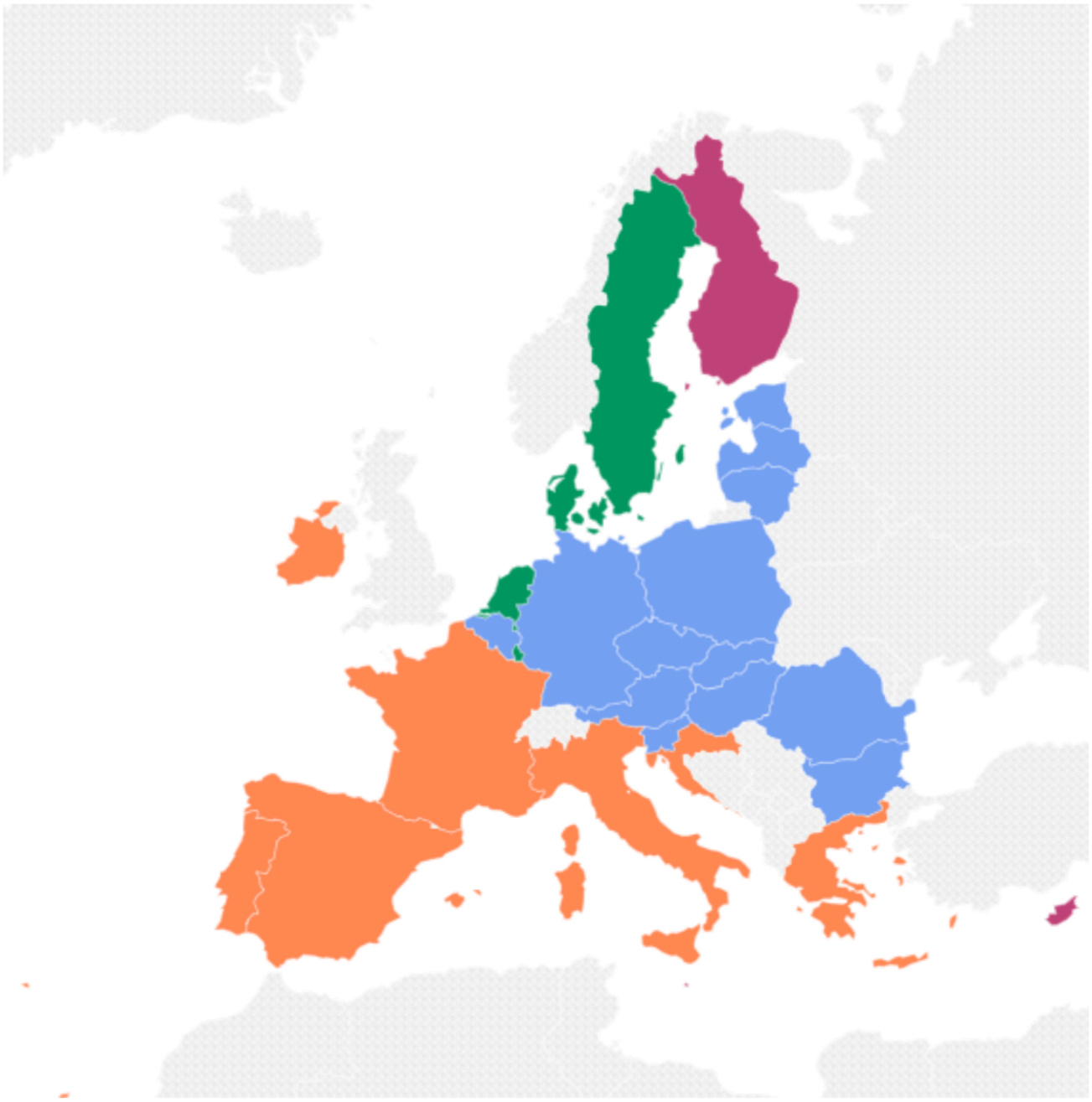
	Helpful	Harmful
Internal	**Strengths:** ● Full and early alignment with the Directive: ○ good signal for EU accession process and internal EU market ○ support for future road freight agreements with regards to environmental provisions ○ **The legal required date to toll vehicles starting from 3.5t as per Directive is March 2027** ○ Since tolling development as such will take some time to implement in Ukraine - thinking in legally required EU terms will be beneficial. ● +€814 million to the road fund using the German Maut 2025 starting from 3.5t compared with UA concession scenario: ○ **faster cost of recovery for road repair and maintenance costs** ○ Potential for using the funding for sustainable transport initiatives, e.g. public transport, charging infrastructure development	**Weaknesses:** ● Political declarations of tolling vehicles starting 3.5t might shake the tolling development and its credibility in principle: ○ Mitigation here - awareness-raising about the polluter and user pays, damage of the heavier vehicles on the infrastructure ● **Diversion of truck traffic** on the parallel untolled roads: ○ In the 12t+ scenario this risk also exists and could be mitigated by a meticulous choice of the pilot projects, e.g. TEN-T core network, where it is not economically beneficial for the truck to use the other longer and less direct route for transport
External	**Opportunities: (from logistics companies):** ● **Poor road surface quality raises the cost of logistics and business** and businesses end up paying for it anyways: ○ Some companies have contributed to road reconstruction near plants, effectively launching PPPs on ad hoc basis and paying for the roads ○ Majority of surveyed businesses by the European Business Association voted for the tolling if the road quality gets better ● Based on the from the Vehicle Register, there are more Euro 0 trucks in the 3.5-12t range than in >12t, so the **smaller vehicles are less energy-efficient:** ○ Tolling more energy efficient 12t+ trucks and omitting the rigid below 12t polluters is unfair	**Threats:** ● Starting tolling immediately from 3.5t could provoke the **backlash from the trucking companies** that would need to adjust quickly by incorporating tolling in their operational and business models: ○ Could hit smaller trucking companies working on the margin harder than bigger ones ○ Mitigation here - **phasing in the truck profiles until 2027** ○ Implementing tolling only from 12t however risks **incentivising more smaller (under 12t) and overloaded trucks on the roads**

Annex II. Map of EU MS: 3.5t or 12t, yay or nay?

Majority EU MS tolls trucks >3.5t:

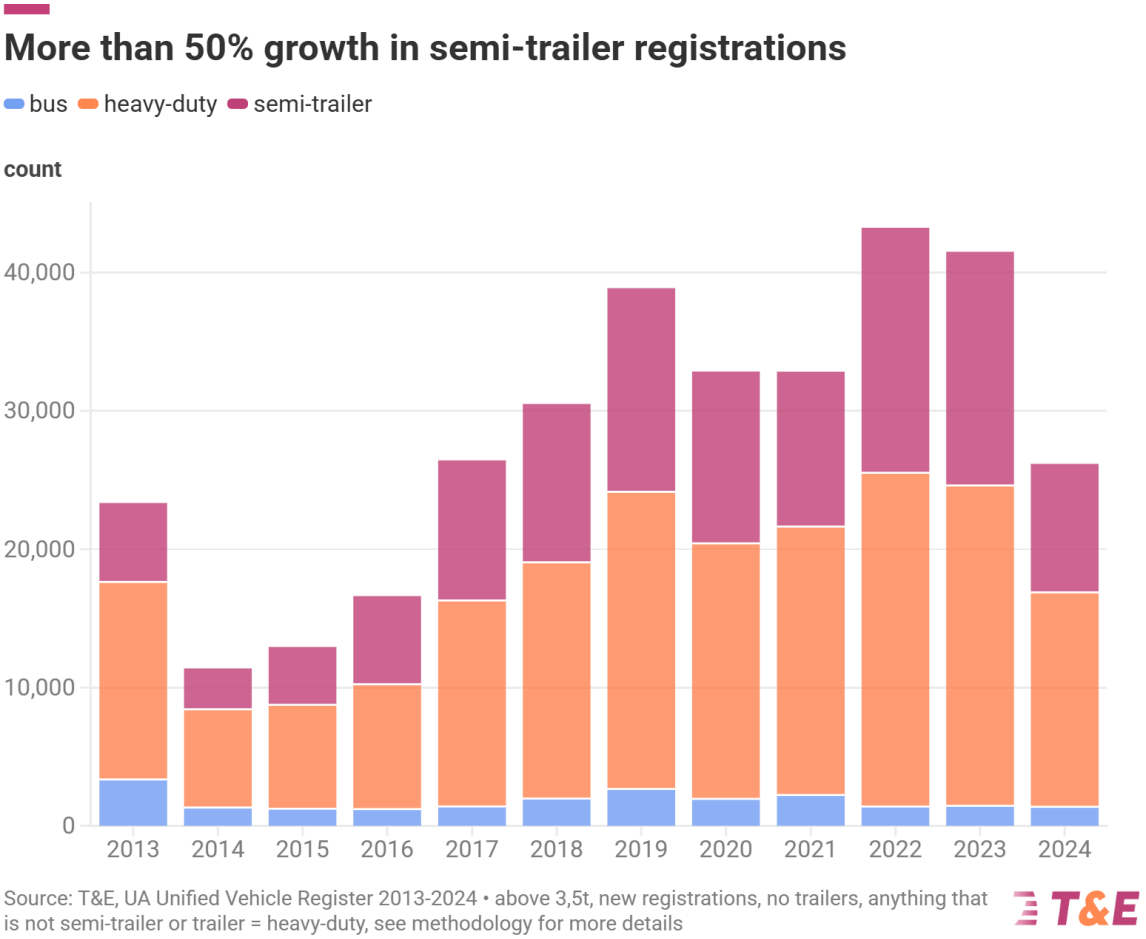
Denmark, Netherlands, Luxembourg and Sweden toll trucks >12t with plans to lower the threshold to 3.5t until 2027

>3.5t all vehicles on tolled motorways, mostly concession contracts
no toll >12t



Source: T&E, World Bank (boundaries), Simple maps (points), See bibliography for the list of sources.

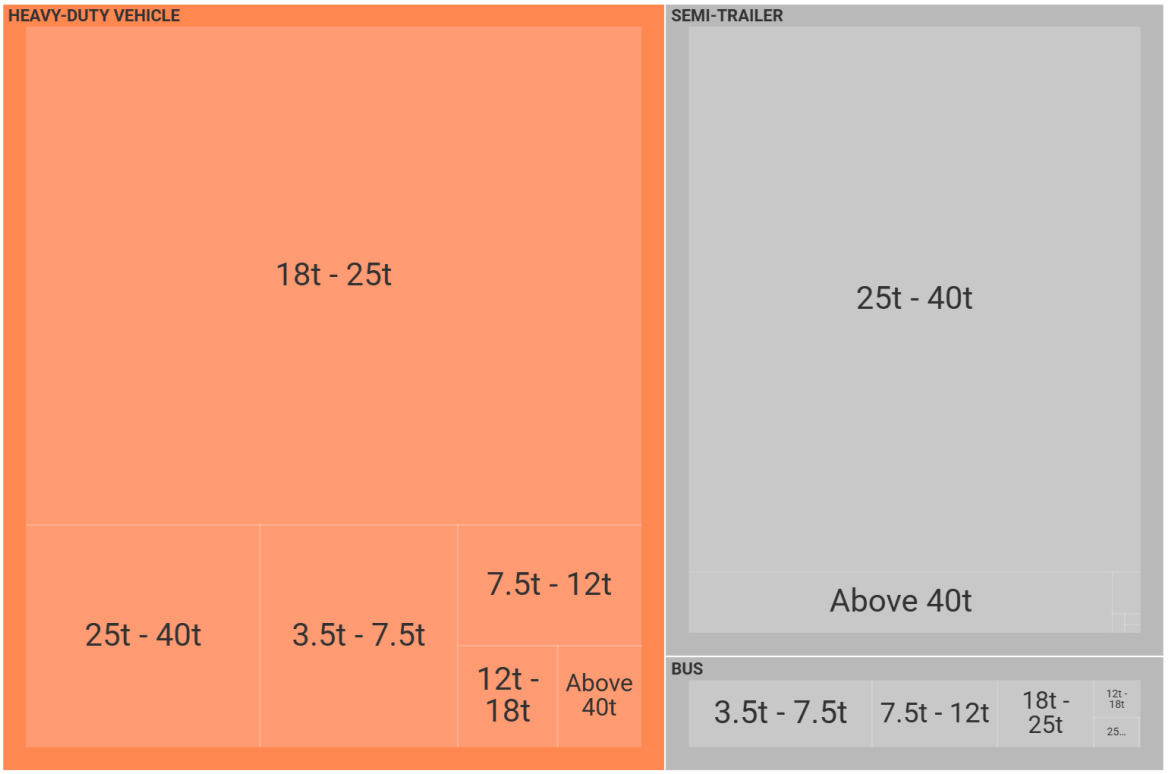
Annex III. Growth in semi-trailer registrations.



Source: T&E, UA Unified Vehicle Register 2013-2024 • above 3,5t, new registrations, no trailers, anything that is not semi-trailer or trailer = heavy-duty, see methodology for more details

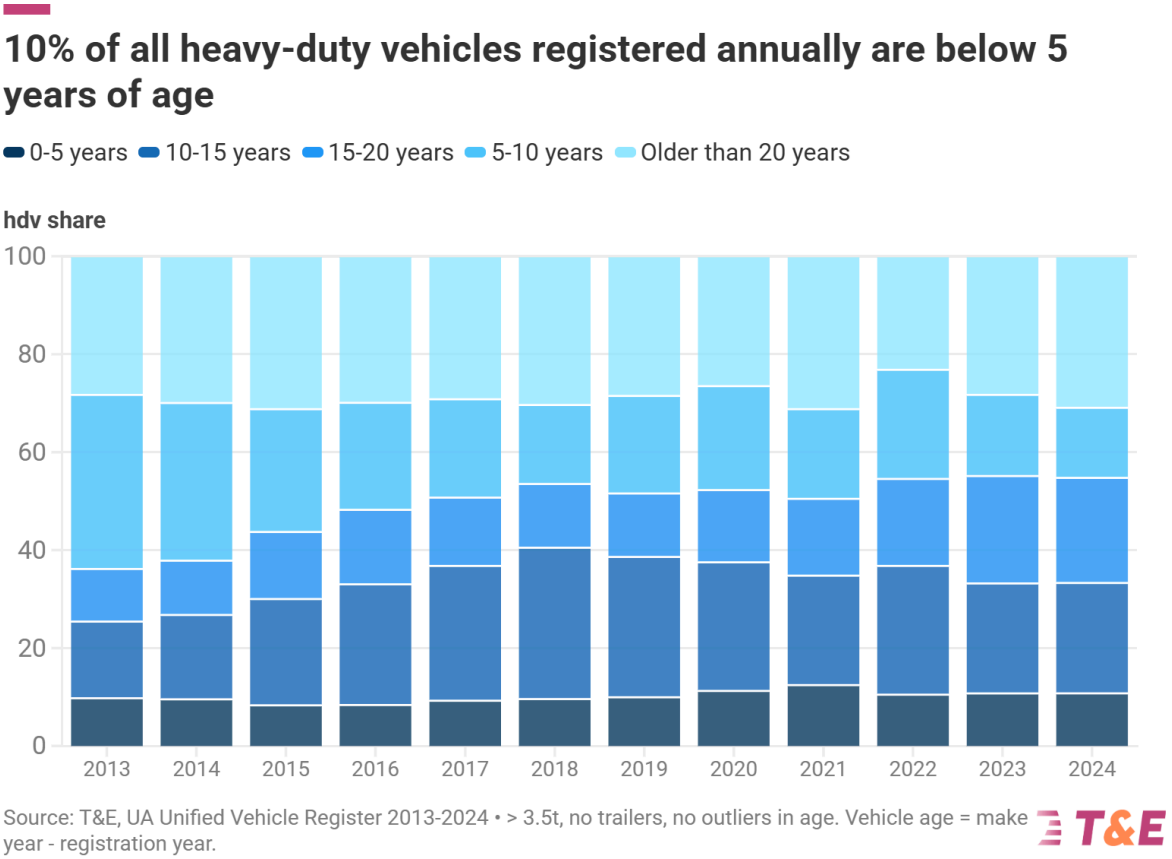
Annex IV. Snapshot of the Register by weight and categories of HDVs.

Snapshot of the Register of Heavy-Duty Vehicles in Ukraine



Source: T&E, Unified Vehicle Register 2013-2024 • New registrations above 3.5t. Semi-trailer - trailer without the front axle (tractor). HDV category: semi-trailer trucks, cargo vans, construction trucks. See methodology.

Annex V. Age brackets of the registered vehicles.



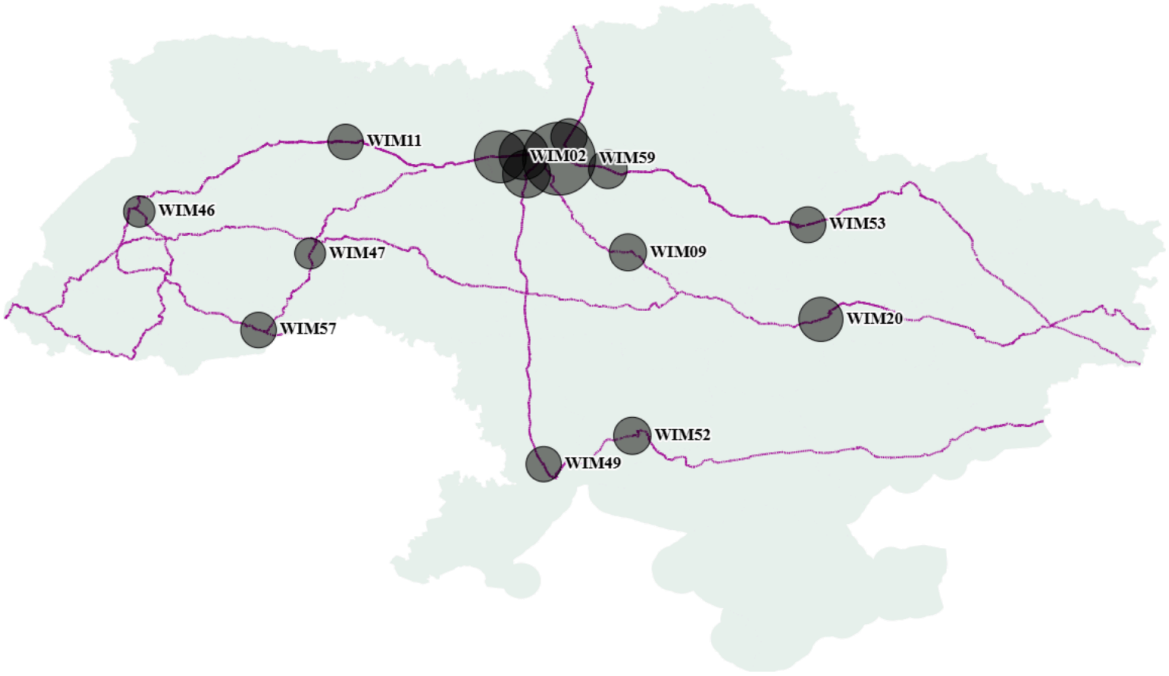
Source: T&E, UA Unified Vehicle Register 2013-2024 • > 3.5t, no trailers, no outliers in age. Vehicle age = make year - registration year.

Annex VI: The map of busy routes based on WIM 2024 data

Most busy routes in 2024 based on Weigh-in-Motion data

More activity in the West compared to 2021

Daily vehicle activity: 1200 ○ ◯ 3000

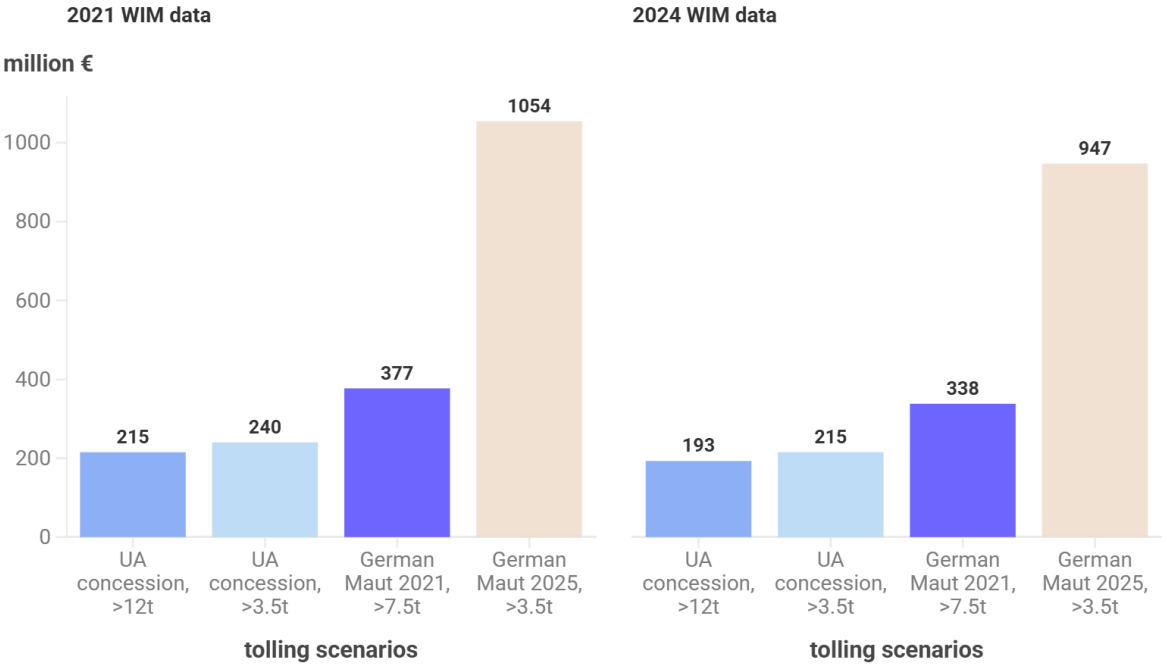


Source: HDX, Simple maps (points), WIM technical report 2024 • based on OSM data

T&E

Annex VII: Gross toll revenue based on the WIM 2024 and 2021 activity data

Post-invasion 10% less toll revenue could be generated based on 2024 truck activity data



Source: T&E modeling WIM 2024 and 2021 technical reports, HGV toll Germany, Berechnung der Wegekosten 2021 • Resolution № 1312 of Cabinet of Ministers on UA concession toll rates. German Maut are toll rates for HDVs in Germany depending on the introduction year

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Methodology

CO_2 road transport modelling

We relied on the modelling per vehicle type: passenger car, truck, bus done by the ClimaEast in the study "*Development of national policy on regulation of road transport CO2 emissions and energy consumption in Ukraine*" (2016).
UNFCCC does not have data per vehicle type for Ukraine. We used the road transportation total 2020 from UNFCCC to choose the most fitting scenario from the ClimaEast study (scenario 2020, I scenario).
This scenario I: Scenario of stagnation

1. Econ activity very slow and transportation activity - slow growth after 2015-2017 decline.
2. Gasoline and diesel consumption in 2020 will reach the levels of 2014.
3. LPG consumption will be increased by 25% compared with 2014 as a result of gasoline substitution.
4. CNG consumption in 2020 will decrease 2.6 times compared with 2014.
5. Slow renewal of fleet - 50% of average 2010-2014
6. Low actual requirements for newly registered vehicles.
7. Gradual implementation of euro standards as per national legislation.

State Road Fund revenue graph

We used the historical UA-EU exchange rates averaged over 12 months per year. No inflation adjustment on figures as those are annual revenue estimates from the State budget.

Monthly averages per year	Equivalent of €1 in UAH
2018	32.06
2019	28.73
2020	31.25
2021	32.18
2022	34.73
2023	39.87
2024	43.37
2025	46.69

The category codes for revenue sources, e.g. excise duties on transport vehicles, fuel, that we looked at from the Budget Declarations 2018-2024 are:

Code	**Revenue category**
14020800	Excise duties from produced in Ukraine goods (under Special fund) for transport vehicles

14021900	~ for fuel
14030800	Excise duties from imported goods (under Special fund) for transport vehicles (with exceptions)*
14031200	~ for transport vehicles (without exceptions)
14031900	~ for fuel
15010000	Import / customs duty (under Special Fund)

*with exceptions - transport vehicles except the transport vehicles that were imported to Ukraine and put on the transit period or temporary import from 1st of January 2015 until 8th of November 2018 during the Law of Ukraine on the "amendments to the Tax Code for excise duties on LDVs".

Sources: Annual estimates on revenue from the Ukrainian State Budget:
2018: https://zakon.rada.gov.ua/laws/show/2246-19#Text
2019: https://zakon.rada.gov.ua/laws/show/2629-19#Text
2020: https://zakon.rada.gov.ua/laws/show/294-20#Text
2021: https://zakon.rada.gov.ua/laws/show/1082-20#Text
2022: https://zakon.rada.gov.ua/laws/show/1928-20#Text
2023: https://zakon.rada.gov.ua/laws/show/2710-20#Text
2024: https://zakon.rada.gov.ua/laws/show/3460-20#Text

Road recovery projects under Ukraine Facility

We looked at the road recovery needs filed by the Ukrainian government on the DREAM portal on 29.07.2025.
We used the exchange rate EUR-UAH averaged from January to June 2025: €1 = 45.4553 UAH. Exchange rate data taken from NBU: https://bank.gov.ua/en/markets/exchangerates
The data on the 2024 Single Project Pipeline projects was taken from the report we coauthored with CEE Bankwatch and Ecoaction.

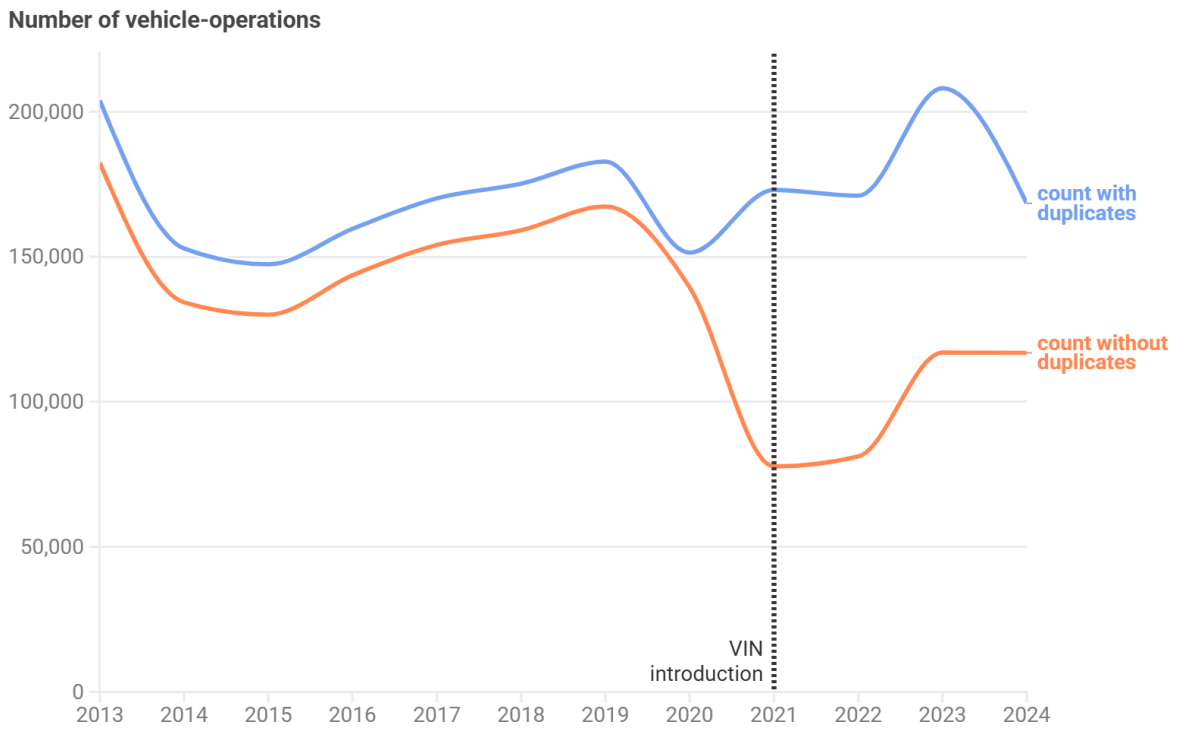
Road surface roughness

We consider 2 scenarios of the road roughness, or number of road kilometers in the good range (IRI = 0-4 m/km), fair range (IRI = 4-6 m/km) and poor range (IRI>6 m/km).
First scenario: road surface condition in 2025 = 2018. It is a low deterioration scenario.
Second scenario: road surface condition in 2025 assuming linear deterioration trend. It is a more ambitious scenario.
Source for initial data: World Bank Group (2018). *Strategy for Prioritisation of Investments, Funding and Modernisation of Ukraine's Road Sector.*

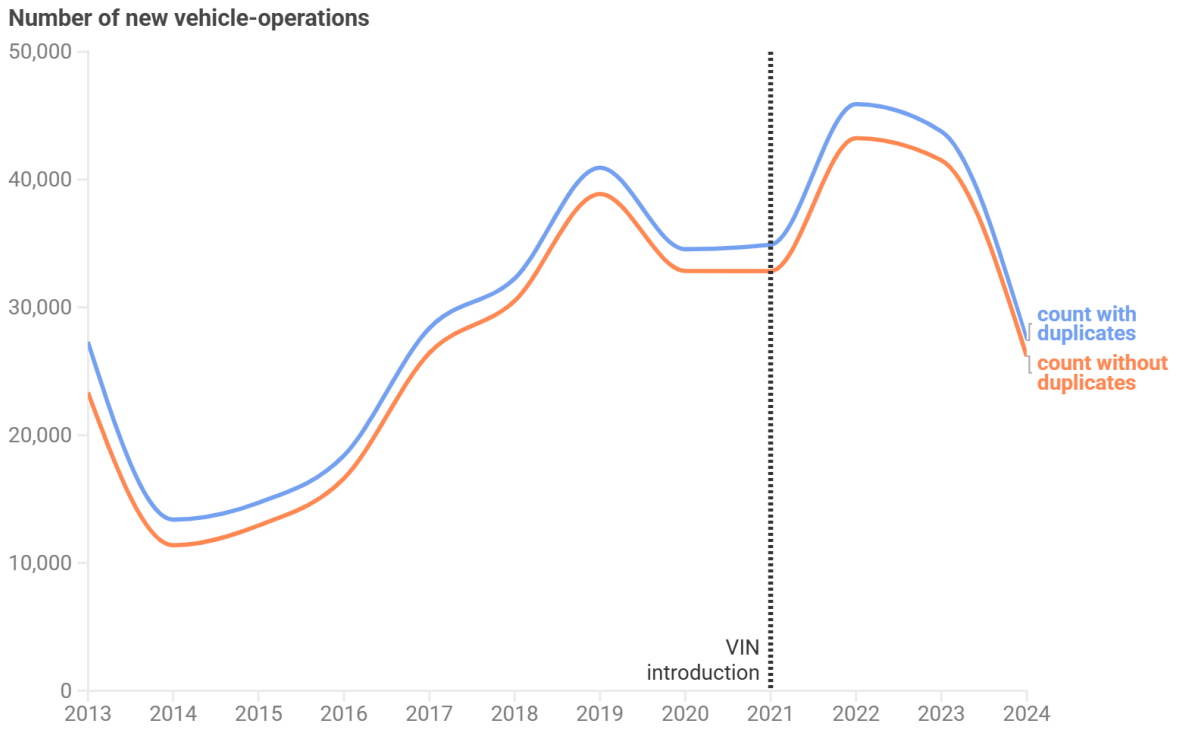
Unified State Vehicle Register dataset: cleaning

Dataset cleaning involved getting rid of duplicate vehicles with multiple operations on them. Starting from 2021, the Register contains VIN information on the vehicles. Here is the comparison in terms of number of vehicle-operations once we dropped vehicles with identical VINs. The graph shows the sudden decrease in vehicle-operations due to

methodology and not an external event. Some vehicles registered before 2020 that we could not identify as duplicates were thus included in the calculations.



Source: T&E methodology based on the Ukrainian Unified Vehicle Register



Source: T&E methodology based on the Ukrainian Unified Vehicle Register

Additional cleaning operations done on all registrations and new registrations:

- No outliers for age, weight
- No trailers
- Vehicles below 3.5t are excluded

Both databases more than halved after the cleaning and dropping of non-relevant vehicles.
All registrations: 3,877,144 → 1,602,848
New registrations: 833,479 → 336,651

Operations under the Register that we map as "new registrations"

Operational code	Ukrainian name	English translation
10	первинна реєстрація тз для держбюдж. орг.	primary registration of a vehicle for a state budget organization
11	первинна реєстрація тз для інших орг. держ.власності	primary registration of a vehicle for other state-owned organizations
20	первинна реєстрація тз для недерж. організації	primary registration of a vehicle for a non-governmental organization
30	первинна реєстрація тз для індив. власника	primary registration of a vehicle purchased from a trade organization, institution
70	реєстрація тз привезеного з-за кордону; реєстрація тз привезеного з-за кордону по вмд	registration of a vehicle brought from abroad; registration of a vehicle brought from abroad under the customs declaration
71	реєстрація тз привезеного з-за кордону по посвідченню митниці	registration of a vehicle brought from abroad under a customs certificate
72	реєстрація нового тз, привезеного з-за кордону по вмд	registration of a new vehicle brought from abroad under the customs declaration for heavy-duty
74	реєстрація нового тз привезеного з-за кордону по декларації про перелік товарів, що визнаються гуманітарною допомогою	registration of a new vehicle brought from abroad under the declaration on the list of goods recognized as humanitarian aid
75	реєстрація нового тз привезеного з-за кордону, як гуманітарна допомога по декларації та по акту приймання-передачі тз	registration of a new vehicle brought from abroad as humanitarian aid under the declaration and the act of acceptance and transfer of the vehicle
76	реєстрація б/в тз привезеного з-за кордону по декларації про перелік товарів, що визнаються гуманітарної допомогою	registration of a used vehicle brought from abroad under the declaration on the list of goods recognized as humanitarian aid

77	реєстрація б/в тз привезеного з-за кордону як гуманітарна допомога по декларації та по акту приймання-передачі тз	registration of a used vehicle brought from abroad as humanitarian aid under the declaration and the act of acceptance and transfer of the vehicle
90	реєстрація тз придбаного з фондів мін. оборони	registration of a vehicle purchased from the funds of the ministry of defense. defense ministry funds
99	первинна реєстрація тз придбаного в торгівельній організації, який виготовлено в україні	initial registration of a vehicle purchased from a trade organization that is manufactured in ukraine
100	первинна реєстрація тз придбаного в торгівельній організації, установи; первинна реєстрація тз придбаного в торгівельній організації, який ввезено з-за кордону	primary registration of a vehicle purchased from a trade organization, institution; initial registration of a vehicle purchased from a trade organization and imported from abroad;
105	первинна реєстрація нового тз придбаного в торгівельній організації, який ввезено з-за кордону	primary registration of a new vehicle purchased from a trade organization that was imported from abroad
172	первинна реєстрація легкових тз, які ввезено з-за кордону	primary registration of passenger vehicles imported from abroad
1000	первинна реєстрація відомчого тз	primary registration of a departmental vehicle

Operations that we exclude under all registrations:

Operational code	**Ukrainian name**	**English translation**
500	зняття з обліку у зв'язку зі скасуванням реєстрації	deregistration due to cancellation of registration
520	зняття з обліку при виїзді за кордон на пост. місце прожив. зняття з обліку при вивезенні за кордон	deregistration when moving abroad to a permanent place of residence deregistration when taken abroad
540	зняття з обліку у зв`язку з вибраковкою	deregistration due to scrapping
542	зняття з обліку у зв'язку з утілізацією	deregistration due to disposal
555	зняття з обліку тз за рішенням суду	deregistration of a vehicle by court decision

Definitions of truck categories under the Register

Semi-trailer category
The semi-trailer category consists primarily of trailers that get attached to the tractor units.

Heavy-duty vehicle category
This is a broad category. We subcategorised newly registered vehicles into the following subcategories:

Category	Count	Share
Tractor Units	132795	69%
Construction Equipment	14266	7%
Cargo Vans & Light Trucks	24277	13%
Special Purpose / Other	5249	3%
Tanker Trucks	1875	1%
Utility & Maintenance	2980	2%
Passenger / Mixed Use	317	0%
Emergency / Rescue / Fire	33	0%
Trailer only	10277	5%
Total	**192069**	**100%**

Euro standards matching map (for vehicles with a gross vehicle mass > 3.5t)

On average around a year is between the standards adoption and the type approval of the first vehicle. The dates listed below roughly correspond to the dates of new registrations. We use the make year as the benchmark to match euro standards. Registration dates in Ukraine might be lagged in time after the first EU registrations of the newly type approved vehicles happened. So it is best to match based on the make year of the vehicle. Otherwise, we risk overestimating the number of less polluting vehicles.

Matching we used for all types of engines and for vehicles > 3.5t:

Make year period	Euro standard matched
0-1992	Euro 0
1993-1996	Euro I
1997-2000	Euro II
2001-2005	Euro III

2006-2008	Euro IV
2009-2013	Euro V
2014-9999	Euro VI

EEVs or enhanced environmentally friendly vehicles' standards are voluntary, so we do not account for them in the table.

WIM systems activity, 2021 and an update from 2024

Methodology to calculate the tolling revenue

1 step

We picked the TEN-T corridor extensions in Ukraine

- road M-06 Kyiv to Chop, part of the North Sea - Baltic and Rhine Danube Corridor;
    - WIMs: WIM01, WIM02, WIM11, WIM34.
- M-07 Kyiv to Yagodyn, part of the North Sea - Baltic corridor;
    - WIMs: WIM06, WIM38, WIM54.
- M-05 Kyiv to Odesa, TEN-T comprehensive, an important road from Kyiv to port of Odesa with a strategic logistic importance
    - WIMs: WIM05, WIM49.

2 step

We took the averages of the daily heavy-duty vehicle activity per month (2021, latest available) for each Weigh-in-Motion (WIM) system and type of vehicle: 2-axle truck, 3-axle semi-trailer truck etc. Here is the table with averages per WIM per truck type except agricultural vehicles, unclassified and light-duty vehicles / minivans. WIMs 03 and 59 are located on the road M-03 Kyiv to Dovzhansky. Under the “Other” category we included the less frequent LDV/ minivan with trailer, 4-axle rigid truck, truck with semi-trailer 6+ axles, truck with semi-trailer 3 axles and 5+ axle truck.
*Update: The last row presents aggregated data per WIM according to the **WIM 2024** data that we obtained in November 2025. Activity on selected WIMs in 2024 has decreased by in total 16%. Only WIM49 near Odesa has seen the traffic grow more than 5-fold.*

Type	WIM01	WIM02	WIM11	WIM34	WIM03	WIM59	WIM06	WIM38	WIM54	WIM05	WIM49	Total
2-axle rigid truck	3366	3946	2081	964	2073	3719	510	529	426	4493	396	22501

2-axle truck with 3-axle semi-trailer	1698	3100	2391	1023	2324	4013	707	881	711	2163	326	19335
2-axle truck with 2-axle semi-trailer	375	642	516	229	529	828	78	410	229	661	156	4651
3-axle rigid truck	141	179	80	96	107	349	23	29	20	554	18	1597
Bus	70	164	139	77	111	248	37	20	9	154	2	1029
Trucks with a trailer, 4+ axles	75	178	77	20	70	324	19	14	17	128	35	956
3-axle truck with 2-axle semi-trailer	66	131	82	44	87	21	15	14	140	98	4	699
Other	245	377	155	83	186	199	114	56	62	616	19	2111
Total, 2021	6036	8717	5521	2534	5486	9700	1503	1951	1613	8866	955	**52880**
Total, 2024	5275	8407	5103	na	4854	7556	917	na	1471	5505	5548	**44636**

Share of trucks from total vehicle activity

WIM01	WIM02	WIM11	WIM34	WIM03	WIM59	WIM06	WIM38	WIM54	WIM05	WIM49
23%	32%	44%	39%	39%	14%	37%	45%	47%	27%	36%

3 step

We used average characteristics per truck type from the WIM 2021 report to calculate how many trucks were registered in each of the weight brackets.
For example, here are the average characteristics of the 2-axle truck gathered across all WIMs.

2-axle truck
Maximum weight - 22,5t
Average weight - 9t

cat_per_t	%	Tolling scenarios	cat_per_t_transformed	%
under_5.499t	36.34%	UA concession	under_3,5t	23,1%
5.5-7.499t	16.32%	→	3,5t-12t	46,9%
7.5t-9.499t	10.60%	→	over_12t	30,0%
9.5t-11.499t	6.76%	German Maut 2025	>3.5t-7.5t	29,53%
11.5t-13.499t	4.64%	→	7,5t-12t GVW	17,36%
13.5t-15.499t	3.47%	→	12t-18t incl	14,01%
15.5t-17.499t	5.90%	→	>18t and up to 3 axles	15,97%
17.5t-19.499t	10.39%	→	>18t and with 4 axles	0,00%
over_19.5t	5.58%	→	>18t with 5+ axles	0,00%
		German Maut 2021	7,5t-12t GVW	17,36%
		→	12t-18t incl	14,01%
		→	>18t and up to 3 axles	15,97%
		→	>18t and with 4+ axles	0,00%

For toll estimation, we need the following weight brackets, e.g.

- For Ukrainian concession scenario: under 3.5t, 3.5t-12t, over 12t;

- For German toll / Maut 2021 scenario: 7.5-12t, 12-18t, >18t and up to 3 axles, >18t and with 4+ axles;
- For German toll / Maut 2025 scenario: 3.5t-7.5t, 7.5t-12t, 12-18t, >18t and up to 3 axles, >18t and with 4 axles, >18t and with 5+ axles

We approximate them by mapping per tonne in each weight category, assuming that In the weight bracket under 5.499t with 36.34% of all vehicles registered, we assume that under 3.5t vehicles will constitute (36.34%/5.499t) * 3.499t = 23.1% of all registered by WIM vehicles under the 2-axle truck category. We do this for all weight brackets that we require for tolling and under the available to us truck profiles:

- 2-axle truck
- 3-axle truck
- 4-axle truck
- 2-axle truck with 2-axle trailer
- 3-axle truck with 2-axle trailer
- 3-axle truck with 3 axle-trailer
- 2-axle truck with 2-axle semi-trailer
- 2-axle truck with 3-axle semi-trailer
- 3-axle truck with 2-axle semi-trailer
- 3-axle truck with 3-axle semi-trailer

Additional assumptions made:

1. If there is a difference of less than 1 tonne between the cutoff points, I prefer to refer to either of the categories instead of calculating share per tonne.
2. To approximate the weight brackets for those categories of trucks for which there were no average weight characteristics specified, we assumed:
    a. For Ukrainian concession scenario:
        i. Truck with 5 axles or more - belong to the category above 12t
        ii. Truck with 5 axles (2-axle truck with 3-axle trailer) echoes the distribution of the 3-axle truck with 2-axle trailer.
        iii. Truck with 3-axles (2-axle truck with 1-axle semi-trailer) is roughly equivalent to the 2-axle truck with 2-axle semi-trailer
        iv. LDV / minivan with a trailer belongs to the category between 3.5t and 12t because just the trailer will be on average around 3.5t
        v. Buses, LDVs / minivans are excluded
    b. For German Maut 2021 scenario:
        i. Truck with 5 axles or more - belong to the category >18t with 4+ axles
        ii. Truck with 5 axles (2-axle truck with 3-axle trailer) similar vehicle distribution as the 3-axle truck with 2-axle trailer
        iii. Truck with 3 axles (2-axle truck with 1-axle semi-trailer) is roughly equivalent to the 2-axle truck with 2-axle smi-trailer except for the percentages assigned in the latter to the >18t with 4+ axles will be >18 with 3 category
        iv. Truck with more than 6 axles will belong to the category >18t with 4+ axles
        v. LDV / minivan will be under the category 7.5t-12t GVW, the lowest one

c. For German Maut 2025:
    i. LDVs / minivan with a trailer category is in 3.5t-7.5t
    ii. Truck with 3 axles (2-axle truck with 1-axle semi-trailer) is roughly equivalent to the 2-axle truck with 2-axle semi-trailer except for the percentages assigned in the latter to the >18t with 4+ axles will be >18 with 3 axles category
    iii. 3-axle truck with 2-axle trailer and 2-axle truck with 3-axle trailer percentages are equivalent
    iv. Truck with 5 axles or more is in the >18t with 5+ axles category

As a result, here are the resulting percentages per each weight bracket are as follows:

Weight brackets	% of total selected WIM activity
Under 3.5t	10%
3.5-12t	23%
Above 12t	67%

Weight brackets	% of total selected WIM activity
7,5t-12t GVW	14%
12t-18t incl	15%
>18t and up to 3 axles	13%
>18t and with 4+ axles	59%

Weight brackets	% of total selected WIM activity
>3.5t-7.5t	16%
7,5t-12t GVW	10%
12t-18t incl	13%
>18t and up to 3 axles	11%
>18t and with 4 axles	6%
>18t with 5+ axles	44%

4 step
General formula we use for toll calculation:

1 General formula: Revenue per road

$$\text{Revenue} = 365 \cdot \sum_{\text{WIM}(i,i+1)} \frac{N_i + N_{(i+1)}}{2} d_{i,i+1} T \tag{1}$$

where $N_i, N_{i+1} =$ number of trucks daily at WIM i and $i+1$, (2)

$d_{i,i+1} =$ distance (km) between WIM i and $i+1$, (3)

$T =$ toll rate per km. (4)

Calculation of tolling scenarios:

1. Scenario I - trucks above 12t pay a toll of 0.133 €/vkm. The value is taken from the CMU Resolution №1312 of 23.12.2020 applied for vehicles over 12t.
   We exclude the buses from the tolling.
   We average the number of trucks between two nearest WIMs to smoothen the effect of the ramp-on and ramp-off roads.
2. Scenario II - Ukrainian concession case
   The values are taken from the CMU Resolution №1312 of 23.12.2020, weight brackets - 3.5t-12t, above 12t.
3. Scenario III - German Maut 2021
   Infrastructure charge was calculated based on the following values and weight brackets according to the formula:

2 Formula: Revenue German Maut 2021

$$\text{Revenue}_{\text{road}} = 365 \cdot \sum_{\text{WIM } (i,i+1)} \sum_{y} \frac{N_{i,y} + N_{i+1,y}}{2} d_{i,i+1} T, \tag{5}$$

where $N_{i,y}, N_{i+1,y} =$ average number of trucks daily at WIM i and $i+1$ of weight bracket y, (6)

$d_{i,i+1} =$ distance (km) between WIM i and $i+1$, (7)

$T =$ toll rate per km. (8)

Truck group	€/vkm
7,5t-12t GVW	0.067
12t-18t incl	0.109
>18t and up to 3 axles	0.143
>18t and with 4+ axles	0.155

The air pollution revenue has been calculated assuming the Euro standard distribution of trucks from the Register and the corresponding highway charges.

Euro standards	Avg % share of vehicles in the register (irrespective of weight)	Highways (Maut, €/vkm)
Euro 0	18.81%	0.133
Euro I	4.88%	0.089
Euro II	9.13%	0.078
Euro III	21.85%	0.067
Euro IV	19.62%	0.034
Euro V	11.03%	0.023
Euro VI	14.68%	0.012
Better than Euro VI	0.00%	0

Noise pollution charges have been calculated based on the following charge table:

Area	Day (€/vkm)	Night (€/vkm)
Suburban	0.0122	0.0222
Highways	0.0023	0.0034

The average night to day ratio of passing trucks according to the WIM reports was assumed to be around 15% at night and 85% during the day in Ukraine due to the curfew.

3 Formula: Air pollution revenue, German Maut 2021

$$\text{Air pollution revenue Maut } 2021_{\text{road}} = 365 \cdot \sum_{\text{WIM } (i,i+1)} \sum_{e} \frac{N_{i,e} + N_{i+1,e}}{2} A_e \, d_{i,i+1}, \tag{9}$$

$$\text{where} \quad N_i, N_{i+1} = \text{average number of trucks daily at WIM } i \text{ and } i+1, \tag{10}$$

$$A_e = \text{air pollution charge depending on Euro } e, \tag{11}$$

$$d_{i,i+1} = \text{distance (km) between WIM } i \text{ and } i+1, \tag{12}$$

(13)

4 Formula: Noise pollution revenue, German Maut 2021

$$\text{Noise pollution revenue Maut } 2021_{\text{road}} = 365 \cdot \sum_{\text{WIM } (i,i+1)} \sum_{nd} \frac{N_i + N_{i+1}}{2} R_{nd} C_{nd} d_{i,i+1}, \tag{14}$$

where $N_i, N_{i+1} =$ average number of trucks daily at WIM i and $i+1$, (15)

$R_{nd} =$ share of trucks during the night 0.15 and during the day 0.85, (16)

$C_{nd} =$ noise pollution charge depending on night-day nd, (17)

$d_{i,i+1} =$ distance (km) between WIM i and $i+1$, (18)

(19)

4. Scenario IV - German maut 2025

Infrastructure charge was calculated as per the previous formula from Scenario III using the following charges:

Weight category	**Infrastructure cost (€/vkm)**
>3.5t – 7.5t	0.052
7.5t – 11.99t	0.066
12 – 18t	0.107
>18t with up to 3 axles	0.141
>18t with 4 axles	0.155
>18t with 5+ axles	0.155

Then, based on the euro standard distribution from the Register per each weight profile:

Weight	Euro 0	Euro I	Euro II	Euro III	Euro IV	Euro V	Euro VI	ZEV
3.5-7.5t	29%	9.1%	12%	16.8%	15.5%	7.9%	9.7%	0%
7.5-12t	50.9%	8.9%	5.2%	12.4%	12.1%	6.2%	4.3%	0%
12-18t	56%	11.1%	9%	10.4%	5.6%	4%	4%	0%
>18t	8.2%	3.4%	9.8%	19%	24.6%	20.6%	14.4%	0%

We calculated the CO_2 emissions revenue from trucks using the following formula:

5 Formula: Revenue CO2 emissions, German Maut 2025

$$\text{Revenue}_{\text{road}} = 365 \cdot \sum_{\text{WIM } i} \sum_{y} \sum_{e} N_{iye}\, P_{ye}\, d_{i,i+1}, \tag{20}$$

where N_{iye} = average number of trucks daily at WIM i with weight y and Euro standard e, (21)

P_{ye} = CO2 pollution charge depending on weight y and Euro standard e, (22)

$d_{i,i+1}$ = distance (km) between WIM i and $i+1$, (23)

(24)

Note, that due to the absence of information on the shares of trucks with certain euro standards and their axle number, the euro standard distribution for trucks over 18t was applied regardless of the number of axles.
The formula to calculate the revenue from air pollution is identical to the one above by using the charges in the column "*External cost of air pollution*" below.
The formula to calculate the revenue from noise pollution using the charges values from table below. Here, noise pollution cost does not vary by day or night as in the previous scenario.

6 Formula: Revenue, noise pollution German Maut 2025

$$\text{Revenue}_{\text{road}} = 365 \cdot \sum_{\text{WIM } i} \sum_{y} N_{i,y}\, C_y\, d_{i,i+1}, \tag{25}$$

$$\text{where} \quad N_{i,y} = \text{average number of trucks daily at WIM } i \text{ with weight } y, \tag{26}$$

$$C_y = \text{noise pollution charge depending on weight } y, \tag{27}$$

$$d_{i,i+1} = \text{distance (km) between WIM } i \text{ and } i+1, \tag{28}$$

$$\tag{29}$$

Euro standard	Weight	External cost of air pollution (€/vkm)	External cost of noise pollution (€/vkm)	CO_2-Emissions (€/vkm)
Euro 6	>3,5t-7,5t	0.011	0.014	0.074
	7,5t-11,99t	0.015	0.016	0.08
	12-18t	0.015	0.016	0.1
	>18t with up to 3 axles	0.022	0.016	0.124
	>18t with 4 axles	0.023	0.012	0.134
	>18t with 5+ axles	0.023	0.012	0.158
Euro 5, EEV1	>3,5t-7,5t	0.043	0.014	0.08
	7,5t-11,99t	0.043	0.016	0.08
	12-18t	0.052	0.016	0.1
	>18t with up to 3 axles	0.062	0.016	0.134
	>18t with 4 axles	0.062	0.012	0.134
	>18t with 5+ axles	0.062	0.012	0.16

Euro 4	>3,5t-7,5t	0.055	0.014	0.08
	7,5t-11,99t	0.059	0.016	0.08
	12-18t	0.063	0.016	0.1
	>18t with up to 3 axles	0.08	0.016	0.134
	>18t with 4 axles	0.087	0.012	0.134
	>18t with 5+ axles	0.087	0.012	0.16
Euro 3	>3,5t-7,5t	0.079	0.014	0.08
	7,5t-11,99t	0.088	0.016	0.08
	12-18t	0.101	0.016	0.104
	>18t with up to 3 axles	0.134	0.016	0.138
	>18t with 4 axles	0.149	0.012	0.138
	>18t with 5+ axles	0.149	0.012	0.162
Euro 2	>3,5t-7,5t	0.098	0.014	0.08
	7,5t-11,99t	0.113	0.016	0.08
	12-18t	0.121	0.016	0.104
	>18t with up to 3 axles	0.164	0.016	0.138
	>18t with 4 axles	0.182	0.012	0.138
	>18t with 5+ axles	0.182	0.012	0.162
Euro 1, 0	>3,5t-7,5t	0.102	0.014	0.08
	7,5t-11,99t	0.114	0.016	0.08
	12-18t	0.123	0.016	0.104

	>18t with up to 3 axles	0.169	0.016	0.158
	>18t with 4 axles	0.187	0.012	0.158
	>18t with 5+ axles	0.187	0.012	0.162

The charges correspond to the CO_2 emission class 1.

Toll revenue calculation based on WIM 2024 data

To make a simplified calculation of the revenue from tolling based on the WIM 2024 data available to us since November 2025:

1. Calculate the total number of trucks registered by all WIMs on the selected road in 2024
2. Compare it with the numbers from 2021 and if there is no data per WIM 2024 use the 2021 data (WIM34, WIM38). Calculate the total difference in the number of trucks registered.
3. Use it as an adjustment factor to calculate the resulting revenue per WIM based on 2024 data.

With these calculation steps and an average of 13% decline in activity on the selected roads we come to the conclusion that the revenue might be decreased by 10%.

Methodology to calculate the years to recover road repair costs through tolling for 3 roads

Main assumptions:

1. Trucks are assumed to perform 35% of all vehicle activity, averaged across WIMs on each road
2. For M-30 road Stryi-Izvaryne the following WIM systems were consulted: WIM12, 20, 23, 41, 42, 50, 55. For M-15 Odesa-Reni road - WIM33.
3. How much each truck pays for the tolling was approximated from road M-07:
    a. Concession - 0.12 €/vkm
    b. German Maut 2025 - 0.35 €/vkm
        i. Normally Maut varies on average between 40 and 25.7 €/vkm depending on the weight and euro standard
4. Years for cost recovery of road repairs = total toll revenue / road repair needs declared

Most busy routes per WIMs 2021 data

Road	**WIMs**	**Averaged over WIMs activity 2021 per road**

M-03	WIM03 WIM53 WIM59	35358
M-05	WIM05 WIM49	25373
P-03	WIM04	19807
M-06	WIM01 WIM02 WIM11 WIM34	19071
M-21	WIM13 WIM27	12679
M-14	WIM17 WIM19	11620
H-08	WIM15 WIM16	10856
H-01	WIM09 WIM10	10157
M-30	WIM12 WIM20 WIM23 WIM41 WIM42 WIM50 WIM55 WIM58	8957
M-15	WIM33 WIM39	8648

WIM most busy routes as per 2024 data

Road	**WIMs**	**Averaged over WIMs activity 2021 per road**
M-03	WIM03 WIM53 WIM59	23113

M-05	WIM05 WIM49	15051
M-06	WIM01 WIM02 WIM11 WIM34	13702
M-14	WIM52	11897
M-01	WIM21	11212
H-01	WIM09 WIM10	9072
H-10	WIM56 WIM57	8796
H-03	WIM14 WIM47	7617
M-30	WIM12 WIM20 WIM23 WIM41 WIM42 WIM50 WIM55 WIM58	4820
H-09	WIM36 WIM46	4180

Methodology to calculate truck air pollution

We took the example of the 4x2 rigid truck heavier than 16t. We calculate the external cost of pollution (cent per tonne-kilometer) depending on the Euro standard - Euro III or Euro VI - and delivery mission - urban, regional or long-haul.

- Urban delivery is calculated by averaging the motorway and urban road values for rigid trucks over 14t.
- Regional delivery is calculated by averaging the cost per different road types in the metropolitan and rural categories with weighting of 70% metropolitan and 30% - rural.
- Long-haul is calculated by averaging values from the motorways in the urban and metropolitan areas.

The external cost values are taken from the Handbook on the external costs of transport, Version 2019 1.1 prepared by CE Delft for European Commission.
Values were used without local calibration for Ukraine; thus, absolute results may differ from national conditions.

Assumptions to calculate the beer bottle price increase

Parameter	Value	Unit	Notes
Beer 1 bottle price	1.716	€	78 UAH at an exchange rate, UAH to EU 1 = 45.4553
Beer 1 bottle weight	0.35	kg	0.33 liter + 0.023g for the bottle
Payload of the truck	7.5	t	Averaged between the estimated actual payloads in EU from TRACCS study 2005-2010 for articulated truck 40-50t GVW
Number of kilometers	530	km	Taking M-06 route from Kyiv to Lviv
Price per km premium for bad road (min)	0.05	€/vkm	Difference between VOC for an articulated truck with IRI = 2 and IRI =6, see the table on the right from the World Bank report, roughly assuming €1 = 1 USD
Price per km premium for bad road (max)	0.337	€/vkm	Difference between VOC for an articulated truck with IRI = 2 and IRI =16, see the table on the right from the World Bank reportre
Toll price (min)	0.12	€/vkm	From the CMU Resolution №1312 of 23.12.2020 for HDVs over 12t
Toll price (max)	0.32	€/vkm	From the average toll rate for German trucks over 18t taken from here

The calculation of the quantity of beer bottles per truck was based on the payload of the truck and the weight of a single bottle.
We then calculate the following scenarios:

1. Without the toll
    a. Cost of a beer bottle on good road
    b. Cost of a beer bottle on bad road min
    c. Cost of a beer bottle on bad road max
2. With a toll
    a. Cost of a beer bottle on good road with a min toll
    b. Cost of a beer bottle on good road with a max toll
    c. Cost of a beer bottle on bad road min with a min toll
    d. Cost of a beer bottle on bad road min with a max toll
    e. Cost of a beer bottle on bad road max with a min toll
    f. Cost of a beer bottle on bad road max with a max toll