Institute of Transport Economics
Norwegian Centre for Transport Research

ENGLISH

Summary

Marginal external costs of transport in Norway

Updated estimates 2026

TØI Report 2187/2026 • Authors: Paal Brevik Wangsness, Kenneth Løvold Rødseth, Knut Veisten, Alena Katharina Høye, Lana Krehic, Gøril Andreassen, Gunn Marit Aasvang, Pham Minh Nhat, Johnny Johansen • Oslo 2026 • 126 pages

Transport generates substantial social benefits but it also external costs that are not fully borne by transport users. This report presents updated estimates of marginal external costs for road, rail, maritime and air transport in Norway in 2026. The estimates cover local air pollution, noise, accidents, congestion and infrastructure wear. Emissions to water and soil are discussed but not monetized, and further work is needed before these impacts can be included. Building on previous work, particularly Rødseth et al. (2019), the report incorporates updated data, recent research and methodological improvements, with particular emphasis on road transport. Marginal external costs vary considerably by transport mode, vehicle type, location, time and traffic conditions. Euro standards and electrification reduce costs from exhaust emissions, but do not eliminate other external effects. The estimates are primarily intended for analysing small (marginal) changes in transport activity and should not be used directly to calculate total social costs. The report provides a more up-to-date and consistent evidence base for cost-benefit analyses and transport policy. Uncertainty varies across cost components, and the results should therefore be used with care in decision-making and supplemented with sensitivity analyses.

Background

Transport generates substantial social benefits, but it also creates costs that are not necessarily borne in full by the actor undertaking the transport. These include local air pollution, noise, accidents, congestion, infrastructure wear, and emissions to water and soil. Such effects are commonly referred to as damage costs; when transport users do not take them into account, they are referred to as external costs. Information on the magnitude of these costs is important for cost-benefit analysis and as a basis for designing and assessing transport-policy instruments. To achieve economic efficiency, transport users should take account of the costs they impose on others. This is known as internalising external costs. One way of doing so is, for example, to levy a charge equal to the marginal damage cost.

This report presents updated estimates of marginal external costs from transport in Norway in 2026. Marginal external costs describe how costs to society change as a result of a small increase in transport activity, for example one additional vehicle-kilometre, train-kilometre or

vessel-kilometre. The report covers road, rail, maritime and air transport, including both passenger and freight transport. This is the first broad review of marginal external costs across transport modes since TØI Report 1704/2019. The report focuses explicitly on marginal external costs, irrespective of whether taxes, charges or regulations currently contribute to internalising some of these costs for transport users.

An updated and more consistent evidence base

The report largely retains the structure and calculation framework of the 2019 report, while incorporating more recent research, updated data and selected methodological improvements. Findings from more recent work on road and maritime freight transport and on rail transport have been incorporated, and the estimates have been harmonised to 2026 prices. The aim has been to establish a consistent and practically applicable estimate base that enables external costs to be compared across transport modes and cost components.

The work has placed particular emphasis on road transport. Among other things, the data used to estimate local emissions have been updated to reflect changes in the vehicle fleet and vehicle technology. New calculations have also been made for emissions from brakes, tyres and road dust, while the valuation of health effects from local air pollution draws on updated evidence from the Norwegian Institute of Public Health. The estimates of marginal accident costs are based on more recent accidents and exposure data, while the evidence base for noise has been updated, including with regard to the health effects of noise.

For rail transport, the report largely draws on the calculations in TØI Report 2126/2025, in which the data and methodology for emissions, accidents, noise and infrastructure wear were updated. For maritime and air transport, the calculations are to a greater extent updates of earlier estimates, harmonised to 2026 prices. A new element in this report is a literature review of external costs associated with emissions to water and soil, with particular attention to microplastics from road traffic. At present, however, the evidence base is not sufficient to establish robust marginal external costs for these environmental impacts.

Main conclusions

External costs vary considerably by where and when transport takes place

A key finding across the analyses is that marginal external costs are not a single fixed cost per kilometre. They may vary substantially by mode and vehicle type, but also by where and when the transport activity takes place. This applies particularly to local air pollution, noise and congestion.

Transport in densely populated areas generally entails higher costs from local air pollution and noise because more people are exposed. Congestion costs depend particularly on traffic conditions and may rise sharply as traffic approaches the capacity limit of the road. Noise costs vary with traffic volume, the number of people exposed and the time of day. For some cost components, the relationship between traffic volume and external costs is also non-linear. Where the data allows, the report therefore presents results differentiated by area type, vehicle type and traffic conditions.

Changes in technology also affect the composition of external costs. The introduction of newer vehicles with low exhaust emissions, together with a growing share of zero-emission vehicles, reduces costs associated with local exhaust emissions. Other external costs do not, however, change with electrification. Electric vehicles contribute to noise, accidents, congestion, infrastructure wear and particulate emissions from tyres, brakes and the road surface to both air, soil and water.

Uncertainty and use of the results

The quality of the evidence base varies considerably across cost components. In some areas, updated data and methods provide a basis for new central estimates, while other parts of the report are primarily updates of earlier calculations. Some results are more uncertain and should preferably be supplemented by additional or sensitivity analyses. The report therefore documents key assumptions and uncertainties for each calculation.

The results are primarily intended for analyses of small (marginal) changes in transport activity. They should *not* automatically be multiplied by total traffic volumes in order to calculate the total social costs of transport. For several cost components, the marginal cost depends on the existing level of traffic or exposure. Calculating total social costs in this way may therefore produce misleading results.

Results

The detailed estimates are presented in the report's individual technical chapters and in the accompanying spreadsheet tables. These provide an updated basis for use in cost-benefit analyses, transport-model calculations, and assessments of taxes and other policy instruments in the transport sector.

This summary presents marginal external costs for all transport sectors and describes the changes made compared with TØI Report 1704/2019. Where estimates have changed substantially since the previous study, the changes are discussed and explained. All costs refer to the year 2026 and are measured in 2026 Norwegian kroner.

Road transport

For road freight transport, the report includes external costs associated with CO_2 emissions, local air pollution, noise, congestion, accident risk and road wear, as in TØI Report 1704/2019 and TØI Report 1953/2023. In the latter, new calculations were carried out only for air emissions and road wear. Figure S.1 provides an overview of the external cost components calculated for road transport and the changes made compared with TØI Report 1704/2019.

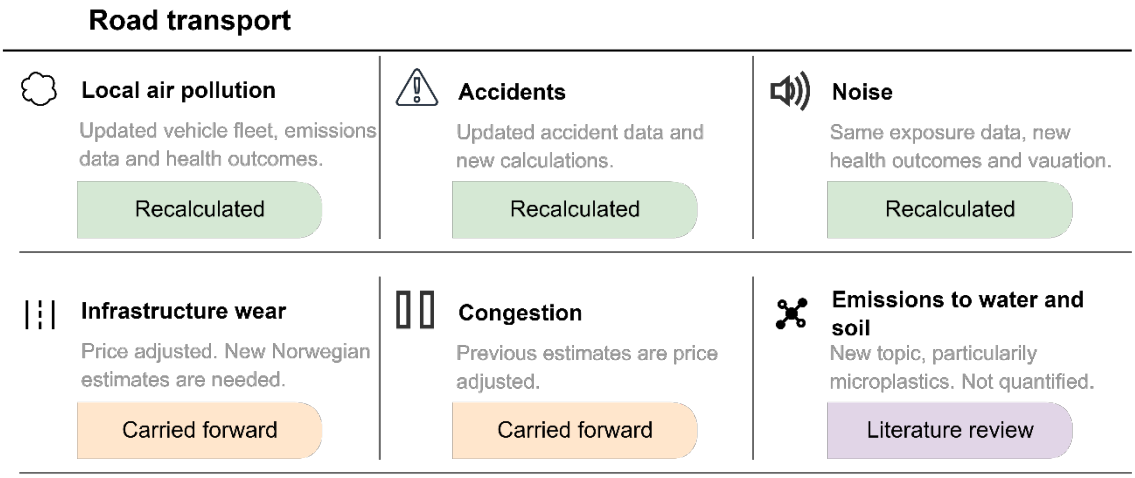

Figure 1.1: Overview of how this report updates the evidence base across external-cost categories for road transport.

Both the calculation methods and the underlying data have been updated in this report, although the extent of the update varies across cost components. External costs of **local air pollution** have been recalculated using newer data on the vehicle fleet, affecting estimates of

emissions from exhausts, brakes, tyres and road dust. In addition, the valuation of health outcomes is based on updated evidence from the Norwegian Institute of Public Health (FHI). The new valuation generally produces a lower cost per kilogram of emissions than a simple real-price adjustment of the 2019 values. Newer Euro emission classes in the vehicle fleet also result in lower exhaust emissions. The calculated quantities of emissions from brakes, tyres and road dust are higher than previously, but the lower valuation means that the resulting external costs are nevertheless lower.

The **accident calculations** are based on a new and expanded dataset on personal injuries in road-transport accidents. Some vehicle classifications have been changed, and e-scooters and all-terrain vehicles (ATVs) are now included. The 2026 estimates have been adjusted for a downward trend in risk, using the same trend factor as in the 2019 report. The new calculations are nevertheless affected by the expanded personal-injury dataset and by new estimates of under-reporting of serious and minor injuries. The new adjustment for under-reporting explains most of the change in estimated marginal external costs associated with personal injuries in accidents, including for passenger cars, compared with the estimates in the 2019 report.

Two new health outcomes are included in the calculations of **external costs from noise** in this report: stroke and diabetes. At the same time, mild noise annoyance has been excluded in order to harmonise the calculations with the method used by the Norwegian Institute of Public Health. The new estimates are on average approximately 30 per cent higher than the 2019 estimates after adjustment for real price changes. The main explanation is the inclusion of stroke and diabetes. Excluding mild noise annoyance in order to reduce overlap between health outcomes has only a small effect.

The impact of road transport on **infrastructure wear** is largely carried forward from the 2019 report. At the same time, the 2019 method has been reviewed in depth, and the report outlines how new estimates that are more representative of Norwegian conditions could be developed in the future. The central estimates have therefore only been adjusted for price changes. The **congestion-cost calculations** have likewise mainly been price-adjusted.

A new topic has been added to this report: emissions to **soil and water**, especially microplastics. This is covered through a literature review, which concludes that although these emissions represent significant environmental pressures, the current evidence base is not sufficient to calculate marginal external costs.

The tables below present estimates of marginal external costs for passenger cars, heavy goods vehicles, vans, motorcycles and buses. Congestion costs and the associated emission costs of congested driving vary substantially by time of day. We therefore distinguish between marginal external costs representing an 'average' situation across the day as a whole and a situation in which the analyst knows, or wishes to analyse, that the traffic change occurs during peak periods in large and medium-sized urban areas. Tables 0.1 to 0.3 present estimated external costs per kilometre for the day as a whole. Tables 0.4 to 0.6 present estimated external costs per kilometre where the analyst assumes that driving takes place in urban areas during peak periods. External costs per tonne-kilometre are reported in the final column of the tables for heavy goods vehicles. This is simply the external cost per vehicle-kilometre divided by the average number of tonnes of freight carried, and thus measures external costs per kilometre per tonne transported. In some cases, trucks with a higher permitted gross vehicle weight achieve lower external costs per tonne-kilometre because they carry more freight on average over which the external costs can be distributed. Separate tables for zero-emission trucks are provided in the Excel files delivered to the commissioning body. Tables with estimated average payloads are provided in Appendix B.

Table S.1: Marginal external costs (NOK 2026 per vehicle-kilometre) for heavy goods vehicles (diesel engine), day as a whole. The final column reports external costs in NOK per tonne-kilometre. The area categories 'Medium-sized urban area' and 'Large urban area' refer to settlements with 15,000-100,000 and more than 100,000 inhabitants, respectively.

Weight class	Area type	CO_2	Local emissions	Noise	Congestion	Accidents	Wear	TOTAL	TOTAL (excl. CO_2)	TOTAL per tkm (excl. CO_2)
<=7,5t	Sparsely populated area	0,54	0,05	0,72	0,00	0,51	0,01	1,83	1,29	1,10
<=7,5t	Medium-sized urban area	0,52	0,18	1,60	0,30	0,51	0,01	3,12	2,60	2,23
<=7,5t	Large urban area	0,52	0,86	3,68	2,08	0,51	0,01	7,66	7,14	6,12
7,5–14t	Sparsely populated area	0,78	0,06	0,72	0,00	0,51	0,10	2,16	1,39	0,82
7,5–14t	Medium-sized urban area	0,79	0,21	1,60	0,30	0,51	0,10	3,52	2,72	1,61
7,5–14t	Large urban area	0,79	1,04	3,68	2,08	0,51	0,10	8,21	7,42	4,39
14–20t	Sparsely populated area	0,94	0,05	0,72	0,00	0,51	0,27	2,48	1,54	0,58
14–20t	Medium-sized urban area	0,99	0,19	1,60	0,30	0,51	0,27	3,86	2,87	1,08
14–20t	Large urban area	0,99	0,95	3,68	2,08	0,51	0,27	8,48	7,49	2,83
20–28t	Sparsely populated area	1,24	0,04	0,72	0,00	0,51	0,39	2,90	1,66	0,39
20–28t	Medium-sized urban area	1,34	0,16	1,60	0,30	0,51	0,39	4,30	2,96	0,69
20–28t	Large urban area	1,34	0,75	3,68	2,08	0,51	0,39	8,75	7,41	1,74
28–40t	Sparsely populated area	1,49	0,04	0,72	0,00	0,51	0,16	2,91	1,43	0,25
28–40t	Medium-sized urban area	1,60	0,14	1,60	0,30	0,51	0,16	4,32	2,71	0,48
28–40t	Large urban area	1,60	0,67	3,68	2,08	0,51	0,16	8,70	7,10	1,26
40–50t	Sparsely populated area	1,60	0,03	0,72	0,00	0,51	0,69	3,55	1,95	0,15
40–50t	Medium-sized urban area	1,74	0,13	1,60	0,30	0,51	0,69	4,97	3,23	0,25
40–50t	Large urban area	1,74	0,58	3,68	2,08	0,51	0,69	9,28	7,54	0,59
50–60t	Sparsely populated area	1,94	0,05	0,72	0,00	0,51	0,47	3,69	1,75	0,13
50–60t	Medium-sized urban area	2,11	0,22	1,60	0,30	0,51	0,47	5,21	3,10	0,23
50–60t	Large urban area	2,11	1,11	3,68	2,08	0,51	0,47	9,95	7,85	0,57

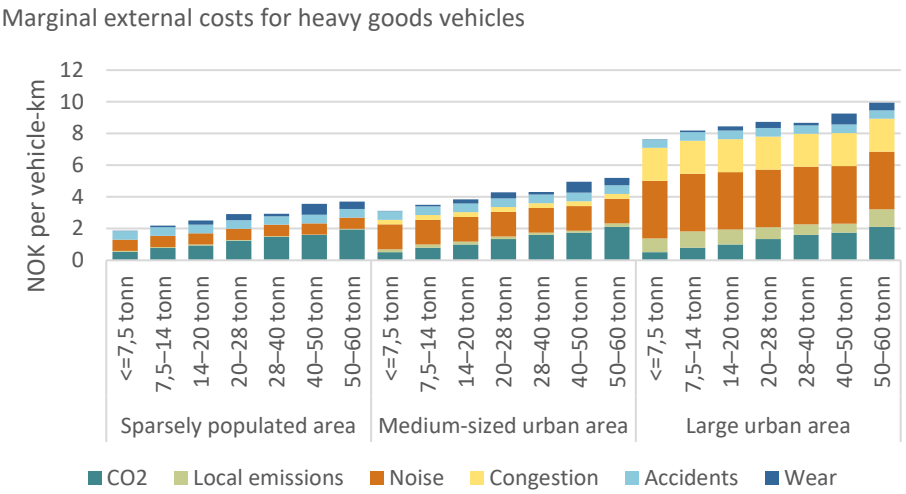

Figure S.2: Marginal external costs for selected weight classes of heavy goods vehicles, average throughout the day.

Figure S.2 shows that the marginal external costs of heavy goods vehicles vary considerably with both vehicle weight and the location of transport activity. Costs are consistently highest in large urban areas, lower in medium-sized urban areas and lowest in sparsely populated areas.

The differences between area types are driven particularly by higher costs related to noise, congestion and local emissions in densely populated areas. At the same time, CO_2 costs generally increase with vehicle size, while accidents and wear costs vary less. The figure therefore illustrates that location has a major impact on marginal external costs, while heavier vehicles generally impose higher costs than lighter goods vehicles.

A similar pattern is observed for zero-emission trucks. The difference from the table above is that these trucks have no external costs associated with CO_2 emissions or local air pollution from exhausts; their local particulate emissions arise from tyres, brakes and road dust.

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Table 1.2: Marginal external costs (NOK 2026 per vehicle-kilometre) for heavy goods vehicles (zero-emission technology), day as a whole. The final column reports external costs in NOK per tonne-kilometre. The area categories 'Medium-sized urban area' and 'Large urban area' refer to settlements with 15,000-100,000 and more than 100,000 inhabitants, respectively.

Weight class	Area type	CO_2	Local emissions	Noise	Congestion	Accidents	Wear	TOTAL	TOTAL (excl. CO_2)	TOTAL per tkm (excl. CO_2)
<=7,5t	Sparsely populated area	0,00	0,02	0,72	0,00	0,51	0,01	1,26	1,26	1,08
<=7,5t	Medium-sized urban area	0,00	0,06	1,60	0,30	0,51	0,01	2,48	2,48	2,13
<=7,5t	Large urban area	0,00	0,21	3,68	2,08	0,51	0,01	6,49	6,49	5,56
7,5–14t	Sparsely populated area	0,00	0,02	0,72	0,00	0,51	0,10	1,35	1,35	0,80
7,5–14t	Medium-sized urban area	0,00	0,06	1,60	0,30	0,51	0,10	2,58	2,58	1,52
7,5–14t	Large urban area	0,00	0,21	3,68	2,08	0,51	0,10	6,58	6,58	3,89
14–20t	Sparsely populated area	0,00	0,02	0,72	0,00	0,51	0,27	1,52	1,52	0,57
14–20t	Medium-sized urban area	0,00	0,06	1,60	0,30	0,51	0,27	2,74	2,74	1,03
14–20t	Large urban area	0,00	0,21	3,68	2,08	0,51	0,27	6,75	6,75	2,55
20–28t	Sparsely populated area	0,00	0,02	0,72	0,00	0,51	0,39	1,64	1,64	0,38
20–28t	Medium-sized urban area	0,00	0,06	1,60	0,30	0,51	0,39	2,87	2,87	0,67
20–28t	Large urban area	0,00	0,21	3,68	2,08	0,51	0,39	6,87	6,87	1,61
28–40t	Sparsely populated area	0,00	0,02	0,72	0,00	0,51	0,16	1,41	1,41	0,25
28–40t	Medium-sized urban area	0,00	0,06	1,60	0,30	0,51	0,16	2,63	2,63	0,47
28–40t	Large urban area	0,00	0,21	3,68	2,08	0,51	0,16	6,64	6,64	1,18
40–50t	Sparsely populated area	0,00	0,02	0,72	0,00	0,51	0,69	1,94	1,94	0,15
40–50t	Medium-sized urban area	0,00	0,06	1,60	0,30	0,51	0,69	3,17	3,17	0,25
40–50t	Large urban area	0,00	0,21	3,68	2,08	0,51	0,69	7,17	7,17	0,56
50–60t	Sparsely populated area	0,00	0,02	0,72	0,00	0,51	0,47	1,72	1,72	0,12
50–60t	Medium-sized urban area	0,00	0,06	1,60	0,30	0,51	0,47	2,94	2,94	0,21
50–60t	Large urban area	0,00	0,21	3,68	2,08	0,51	0,47	6,95	6,95	0,50

Table S.3 summarises the estimates of marginal external costs for passenger cars for the day as a whole. Figure S.3 visualises these estimates together with marginal external costs per kilometre for passenger cars driven during peak periods.

Table S.3: Marginal external costs (NOK 2026 per vehicle-kilometre) for passenger cars, day as a whole. The area categories 'Medium-sized urban area' and 'Large urban area' refer to settlements with 15,000-100,000 and more than 100,000 inhabitants, respectively.

Fuel / traction	Area type	CO_2	Local emissions	Noise	Congestion	Accidents	Wear	TOTAL	TOTAL (excl. CO_2)
Diesel	Sparsely populated area	0,20	0,02	0,12	0,00	0,30	0,01	0,64	0,45
Diesel	Medium-sized urban area	0,23	0,07	0,29	0,30	0,30	0,01	1,19	0,96
Diesel	Large urban area	0,23	0,36	0,53	2,08	0,30	0,01	3,50	3,27
Plug-in hybrid	Sparsely populated area	0,14	0,00	0,12	0,00	0,30	0,01	0,57	0,43
Plug-in hybrid	Medium-sized urban area	0,16	0,01	0,29	0,30	0,30	0,01	1,07	0,91
Plug-in hybrid	Large urban area	0,16	0,05	0,53	2,08	0,30	0,01	3,13	2,97
Petrol	Sparsely populated area	0,22	0,01	0,12	0,00	0,30	0,01	0,65	0,43
Petrol	Medium-sized urban area	0,24	0,02	0,29	0,30	0,30	0,01	1,16	0,92
Petrol	Large urban area	0,24	0,08	0,53	2,08	0,30	0,01	3,24	3,00
Zero-emission cars	Sparsely populated area	0,00	0,00	0,12	0,00	0,30	0,01	0,43	0,43
Zero-emission cars	Medium-sized urban area	0,00	0,01	0,29	0,30	0,30	0,01	0,91	0,91
Zero-emission cars	Large urban area	0,00	0,04	0,53	2,08	0,30	0,01	2,96	2,96

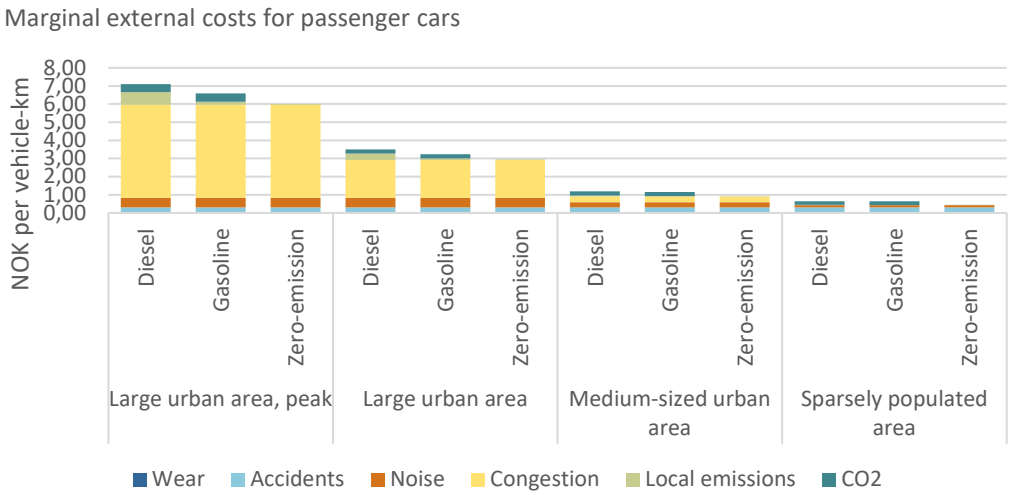

Figure S.3: Marginal external costs for passenger cars, both for the day as a whole and during peak periods in large urban areas.

Figure S.3 shows that marginal external costs for passenger cars increase clearly with the degree of urbanisation. Costs are lowest in sparsely populated areas, higher in medium-sized urban areas and clearly highest in large urban areas. The increase is driven particularly by higher congestion, noise and local-emission costs as more people and road users are affected.

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Differences between powertrains are smaller than differences between area types. Zero-emission cars generally have lower external costs than petrol and diesel cars, primarily because they have no CO_2 emissions and lower local emissions. At the same time, the figure shows that zero-emission cars also entail substantial external costs through noise, congestion, accidents and infrastructure wear.

Table S.4: Marginal external costs (NOK 2026 per vehicle-kilometre) for vans, motorcycles and buses, day as a whole. The area categories 'Medium-sized urban area' and 'Large urban area' refer to settlements with 15,000-100,000 and more than 100,000 inhabitants, respectively.

Vehicle	Fuel / traction	Area type	CO_2	Local emissions	Noise	Congestion	Accidents	Wear	TOTAL	TOTAL (excl. CO2)
Vans	Diesel	Sparsely populated area	0,29	0,02	0,12	0,00	0,17	0,01	0,61	0,31
Vans	Diesel	Medium-sized urban area	0,31	0,05	0,29	0,30	0,17	0,01	1,12	0,81
Vans	Diesel	Large urban area	0,31	0,24	0,53	2,08	0,17	0,01	3,33	3,02
Vans	Petrol	Sparsely populated area	0,25	0,01	0,12	0,00	0,17	0,01	0,56	0,31
Vans	Petrol	Medium-sized urban area	0,29	0,03	0,29	0,30	0,17	0,01	1,09	0,80
Vans	Petrol	Large urban area	0,29	0,16	0,53	2,08	0,17	0,01	3,24	2,95
Vans	Electric	Sparsely populated area	0,00	0,00	0,12	0,00	0,17	0,01	0,30	0,30
Vans	Electric	Medium-sized urban area	0,00	0,01	0,29	0,30	0,17	0,01	0,78	0,78
Vans	Electric	Large urban area	0,00	0,04	0,53	2,08	0,17	0,01	2,83	2,83
Motorcycle	Petrol	Sparsely populated area	0,16	0,00	0,12	0,00	0,78	0,00	1,07	0,90
Motorcycle	Petrol	Medium-sized urban area	0,18	0,01	0,29	0,30	0,78	0,00	1,56	1,38
Motorcycle	Petrol	Large urban area	0,18	0,06	0,53	2,08	0,78	0,00	3,63	3,45
Coach	Diesel	Sparsely populated area	1,31	0,04	0,72	0,00	0,57	0,10	2,74	1,43
Coach	Diesel	Medium-sized urban area	1,53	0,15	1,60	0,30	0,57	0,10	4,26	2,72
Coach	Diesel	Large urban area	1,53	0,72	3,68	2,08	0,57	0,10	8,68	7,15
Coach	Electric	Sparsely populated area	0,00	0,02	0,72	0,00	0,57	0,10	1,41	1,41
Coach	Electric	Medium-sized urban area	0,00	0,06	1,60	0,30	0,57	0,10	2,64	2,64
Coach	Electric	Large urban area	0,00	0,21	3,68	2,08	0,57	0,10	6,64	6,64
Urban bus	CNG	Medium-sized urban area	1,71	0,32	1,60	0,30	0,57	0,10	4,60	2,90
Urban bus	CNG	Large urban area	1,71	1,73	3,68	2,08	0,57	0,10	9,87	8,16
Urban bus	Diesel	Medium-sized urban area	1,40	0,13	1,60	0,30	0,57	0,10	4,10	2,70
Urban bus	Diesel	Large urban area	1,40	0,58	3,68	2,08	0,57	0,10	8,41	7,01
Urban bus	Electric	Medium-sized urban area	0,00	0,06	1,60	0,30	0,57	0,10	2,64	2,64
Urban bus	Electric	Large urban area	0,00	0,21	3,68	2,08	0,57	0,10	6,64	6,64

The following three tables present estimates of marginal external costs for driving during peak periods, when congested driving is more common on average (although congestion is not constant) in large and medium-sized urban areas. This also results in higher fuel consumption and air emissions per kilometre than for the day as a whole. The marginal noise cost of an individual vehicle-kilometre may, however, be lower than the daily average because speeds are lower and the overall background noise level is higher. We do not have sufficient data to adjust the average daily noise cost per kilometre for this effect.

Table S.5: Marginal external costs (NOK 2026 per vehicle-kilometre) for heavy goods vehicles (diesel engine), where the analyst assumes that driving takes place in urban areas during peak periods. The final column reports external costs in NOK per tonne-kilometre.

Weight class	Area type	CO_2	Local emissions	Noise	Congestion	Accidents	Wear	TOTAL	TOTAL (excl. CO_2)	TOTAL per tkm (excl. CO_2)
<=7,5t	Sparsely populated area	0,54	0,05	0,72	0,00	0,51	0,01	1,83	1,29	1,10
<=7,5t	Medium-sized urban area	0,59	0,20	1,60	0,74	0,51	0,01	3,66	3,07	2,63
<=7,5t	Large urban area	1,00	1,67	3,68	5,13	0,51	0,01	12,00	11,00	9,43
7,5–14t	Sparsely populated area	0,78	0,06	0,72	0,00	0,51	0,10	2,16	1,39	0,82
7,5–14t	Medium-sized urban area	0,90	0,24	1,60	0,74	0,51	0,10	4,10	3,20	1,89
7,5–14t	Large urban area	1,53	2,02	3,68	5,13	0,51	0,10	12,98	11,44	6,77
14–20t	Sparsely populated area	0,94	0,05	0,72	0,00	0,51	0,27	2,48	1,54	0,58
14–20t	Medium-sized urban area	1,12	0,22	1,60	0,74	0,51	0,27	4,46	3,34	1,26
14–20t	Large urban area	1,91	1,84	3,68	5,13	0,51	0,27	13,34	11,43	4,31
20–28t	Sparsely populated area	1,24	0,04	0,72	0,00	0,51	0,39	2,90	1,66	0,39
20–28t	Medium-sized urban area	1,52	0,18	1,60	0,74	0,51	0,39	4,95	3,42	0,80
20–28t	Large urban area	2,59	1,45	3,68	5,13	0,51	0,39	13,76	11,16	2,62
28–40t	Sparsely populated area	1,49	0,04	0,72	0,00	0,51	0,16	2,91	1,43	0,25
28–40t	Medium-sized urban area	1,82	0,16	1,60	0,74	0,51	0,16	5,00	3,18	0,56
28–40t	Large urban area	3,10	1,29	3,68	5,13	0,51	0,16	13,87	10,77	1,91
40–50t	Sparsely populated area	1,60	0,03	0,72	0,00	0,51	0,69	3,55	1,95	0,15
40–50t	Medium-sized urban area	1,97	0,14	1,60	0,74	0,51	0,69	5,66	3,69	0,29
40–50t	Large urban area	3,36	1,12	3,68	5,13	0,51	0,69	14,49	11,13	0,88
50–60t	Sparsely populated area	1,94	0,05	0,72	0,00	0,51	0,47	3,69	1,75	0,13
50–60t	Medium-sized urban area	2,39	0,25	1,60	0,74	0,51	0,47	5,97	3,57	0,26
50–60t	Large urban area	4,08	2,14	3,68	5,13	0,51	0,47	16,01	11,93	0,87

Table S.6: Marginal external costs (NOK 2026 per vehicle-kilometre) for passenger cars, where the analyst assumes that driving takes place in urban areas during peak periods. The area categories 'Medium-sized urban area' and 'Large urban area' refer to settlements with 15,000-100,000 and more than 100,000 inhabitants, respectively.

Fuel / traction	Area type	CO_2	Local emissions	Noise	Congestion	Accidents	Wear	TOTAL	TOTAL (excl. CO_2)
Diesel	Sparsely populated area	0,20	0,02	0,12	0,00	0,30	0,01	0,64	0,45
Diesel	Medium-sized urban area	0,26	0,08	0,29	0,74	0,30	0,01	1,68	1,42
Diesel	Large urban area	0,44	0,69	0,53	5,13	0,30	0,01	7,10	6,66
Plug-in hybrid	Sparsely populated area	0,14	0,00	0,12	0,00	0,30	0,01	0,57	0,43
Plug-in hybrid	Medium-sized urban area	0,18	0,02	0,29	0,74	0,30	0,01	1,54	1,36
Plug-in hybrid	Large urban area	0,31	0,10	0,53	5,13	0,30	0,01	6,38	6,07
Petrol	Sparsely populated area	0,22	0,01	0,12	0,00	0,30	0,01	0,65	0,43
Petrol	Medium-sized urban area	0,28	0,02	0,29	0,74	0,30	0,01	1,64	1,36
Petrol	Large urban area	0,47	0,16	0,53	5,13	0,30	0,01	6,60	6,13
Zero-emission cars	Sparsely populated area	0,00	0,00	0,12	0,00	0,30	0,01	0,43	0,43
Zero-emission cars	Medium-sized urban area	0,00	0,01	0,29	0,74	0,30	0,01	1,35	1,35
Zero-emission cars	Large urban area	0,00	0,04	0,53	5,13	0,30	0,01	6,01	6,01

Table S.7: Marginal external costs (NOK 2026 per vehicle-kilometre) for vans, motorcycles and buses, where the analyst assumes that driving takes place in urban areas during peak periods. The area categories 'Medium-sized urban area' and 'Large urban area' refer to settlements with 15,000-100,000 and more than 100,000 inhabitants, respectively.

Vehicle	Fuel / traction	Area type	CO_2	Local emissions	Noise	Congestion	Accidents	Wear	TOTAL	TOTAL (excl. CO_2)
Vans	Diesel	Sparsely populated area	0,29	0,02	0,12	0,00	0,17	0,00	0,60	0,31
Vans	Diesel	Medium-sized urban area	0,35	0,05	0,29	0,74	0,17	0,00	1,60	1,26
Vans	Diesel	Large urban area	0,59	0,46	0,53	5,13	0,17	0,00	6,88	6,29
Vans	Petrol	Sparsely populated area	0,25	0,01	0,12	0,00	0,17	0,00	0,55	0,30
Vans	Petrol	Medium-sized urban area	0,33	0,04	0,29	0,74	0,17	0,00	1,57	1,24
Vans	Petrol	Large urban area	0,56	0,31	0,53	5,13	0,17	0,00	6,70	6,15
Vans	Electric	Sparsely populated area	0,00	0,00	0,12	0,00	0,17	0,01	0,30	0,30
Vans	Electric	Medium-sized urban area	0,00	0,01	0,29	0,74	0,17	0,01	0,78	1,22
Vans	Electric	Large urban area	0,00	0,04	0,53	5,13	0,17	0,01	2,83	5,88
Motorcycle	Petrol	Sparsely populated area	0,16	0,00	0,12	0,00	0,78	0,00	1,07	0,90
Motorcycle	Petrol	Medium-sized urban area	0,20	0,01	0,29	0,74	0,78	0,00	2,03	1,83
Motorcycle	Petrol	Large urban area	0,35	0,11	0,53	5,13	0,78	0,00	6,90	6,55
Coach	Diesel	Sparsely populated area	1,31	0,04	0,72	0,00	0,57	0,00	2,63	1,33

Vehicle	Fuel / traction	Area type	CO_2	Local emissions	Noise	Congestion	Accidents	Wear	TOTAL	TOTAL (excl. CO_2)
Coach	Diesel	Medium-sized urban area	1,74	0,17	1,60	0,74	0,57	0,00	4,83	3,09
Coach	Diesel	Large urban area	2,97	1,39	3,68	5,13	0,57	0,00	13,74	10,77
Coach	Electric	Sparsely populated area	0,00	0,02	0,72	0,00	0,57	0,10	1,41	1,41
Coach	Electric	Medium-sized urban area	0,00	0,06	1,60	0,74	0,57	0,10	2,64	3,08
Coach	Electric	Large urban area	0,00	0,21	3,68	5,13	0,57	0,10	6,64	9,69
Urban bus	CNG	Medium-sized urban area	1,94	0,37	1,60	0,74	0,57	0,00	5,22	3,28
Urban bus	CNG	Large urban area	3,30	3,35	3,68	5,13	0,57	0,00	16,03	12,73
Urban bus	Diesel	Medium-sized urban area	1,59	0,14	1,60	0,74	0,57	0,00	4,65	3,06
Urban bus	Diesel	Large urban area	2,71	1,11	3,68	5,13	0,57	0,00	13,21	10,50
Urban bus	Electric	Medium-sized urban area	0,00	0,06	1,60	0,74	0,57	0,10	2,64	3,08
Urban bus	Electric	Large urban area	0,00	0,21	3,68	5,13	0,57	0,10	6,64	9,69

Rail transport

For rail transport, this report includes external costs associated with CO_2 emissions, local air pollution, noise, accident risk, maintenance-related wear and renewal-related wear, as in TØI Report 1704/2019 and TØI Report 2126/2025. The latter applied updated data and made some methodological changes. Figure S.4provides an overview of the external components calculated for rail transport and the changes made compared with TØI Report 1704/2019.

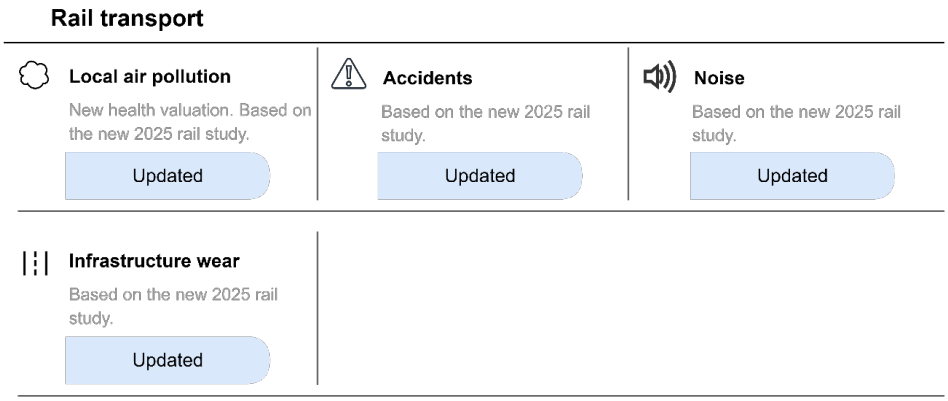

Figure S.4: Overview of how this report updates the evidence base across external-cost categories for rail transport.

The calculations are based primarily on the new rail study documented in TØI Report 2126/2025. For the external costs of **local air pollution**, newer data on diesel use, NOx emissions and train types have been used. In addition, the valuation per unit of emissions has been updated using new calculations from the Norwegian Institute of Public Health. In general, local-emission costs for diesel trains are low in sparsely populated areas but higher in densely populated areas, often surpassing the marginal costs of CO_2-emissions in the latter.

For **accident risk**, the calculations draw on more recent data than the 2019 report, while the data for collisions involving road vehicles as the counterpart have been expanded compared with the 2025 report. We have also specified 'other train' as a separate class, in addition to passenger and freight trains, which also affects the estimates compared with the 2019 and 2025 reports. For **noise costs**, the calculations distinguish between train type and daytime, evening and night-time, as well as between three area types. This has a substantial impact on the estimates, which are generally lower than in 2019. At the same time, the calculations show considerable variation, including very high costs for freight trains at night in densely populated areas.

For the marginal external costs of **infrastructure wear**, this report distinguishes more clearly between maintenance costs and renewal costs. Maintenance costs are estimated directly from Norwegian data, while renewal costs continue to be based on Swedish elasticities. The calculations show substantial variation between regions and rail sections.

Because noise-related external costs depend on whether noise occurs during the daytime (07:00-19:00), evening (19:00-23:00) or night-time (23:00-07:00), separate tables are presented for different times of day.

In the comparison tables, we use an 'average' passenger train and an 'average' freight train (intermodal train) and distinguish between electric and diesel traction. There will naturally be variation within these groups, which can be taken into account if the analyst has more detailed information. For example, lighter and shorter trains will generally cause less wear than longer and heavier trains; for diesel trains, lighter and shorter trains will also have lower diesel consumption and emissions. We also use average estimates of marginal external costs from wear associated with both maintenance and renewal. As shown in TØI Report 2126/2025, there is substantial variation between different regions and rail sections. Where relevant, analysts can use region-specific estimates. These are also included in the Excel files delivered to the commissioning body.

Table S.8: Marginal external costs for rail transport (NOK per train-kilometre), daytime (07:00-19:00 as a whole). The area categories 'Medium-sized urban area' and 'Large urban area' refer to settlements with 15,000-100,000 and more than 100,000 inhabitants, respectively.

Train type	Fuel / traction	Area type	CO_2	Local emissions	Noise	Accidents	Wear (maintenance)	Wear (renewal)	TOTAL (excl. CO_2)
Passenger train	Electric	Sparsely populated area	0,00	0,00	0,00	1,25	23,90	30,86	56,00
Passenger train	Electric	Medium-sized urban area	0,00	0,00	0,00	1,25	23,90	30,86	56,00
Passenger train	Electric	Large urban area	0,00	0,00	0,00	1,25	23,90	30,86	56,00
Average intermodal freight train	Electric	Sparsely populated area	0,00	0,00	0,51	0,43	23,90	30,86	55,69
Average intermodal freight train	Electric	Medium-sized urban area	0,00	0,00	1,31	0,43	23,90	30,86	56,50
Average intermodal freight train	Electric	Large urban area	0,00	0,00	1,82	0,43	23,90	30,86	57,00
Passenger train	Diesel	Sparsely populated area	7,49	1,09	0,00	1,25	23,90	30,86	57,09
Passenger train	Diesel	Medium-sized urban area	7,49	6,28	0,00	1,25	23,90	30,86	62,28
Passenger train	Diesel	Large urban area	7,49	31,18	0,00	1,25	23,90	30,86	87,18
Average intermodal freight train	Diesel	Sparsely populated area	22,34	3,24	0,51	0,43	23,90	30,86	58,93
Average intermodal freight train	Diesel	Medium-sized urban area	22,34	18,74	1,31	0,43	23,90	30,86	75,24
Average intermodal freight train	Diesel	Large urban area	22,34	93,05	1,82	0,43	23,90	30,86	150,05

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Table S.9: Marginal external costs for rail transport (NOK per train-kilometre), evening (19:00-23:00). The area categories 'Medium-sized urban area' and 'Large urban area' refer to settlements with 15,000-100,000 and more than 100,000 inhabitants, respectively.

Train type	Fuel / traction	Area type	CO_2	Local emissions	Noise	Accidents	Wear (maintenance)	Wear (renewal)	TOTAL (excl. CO_2)
Passenger train	Electric	Sparsely populated area	0,00	0,00	0,00	1,25	23,90	30,86	56,00
Passenger train	Electric	Medium-sized urban area	0,00	0,00	0,10	1,25	23,90	30,86	56,11
Passenger train	Electric	Large urban area	0,00	0,00	0,10	1,25	23,90	30,86	56,11
Average intermodal freight train	Electric	Sparsely populated area	0,00	0,00	1,41	0,43	23,90	30,86	56,60
Average intermodal freight train	Electric	Medium-sized urban area	0,00	0,00	4,24	0,43	23,90	30,86	59,43
Average intermodal freight train	Electric	Large urban area	0,00	0,00	8,08	0,43	23,90	30,86	63,26
Passenger train	Diesel	Sparsely populated area	7,49	1,09	0,00	1,25	23,90	30,86	57,09
Passenger train	Diesel	Medium-sized urban area	7,49	6,28	0,10	1,25	23,90	30,86	62,39
Passenger train	Diesel	Large urban area	7,49	31,18	0,10	1,25	23,90	30,86	87,29
Average intermodal freight train	Diesel	Sparsely populated area	22,34	3,24	1,41	0,43	23,90	30,86	59,84
Average intermodal freight train	Diesel	Medium-sized urban area	22,34	18,74	4,24	0,43	23,90	30,86	78,17
Average intermodal freight train	Diesel	Large urban area	22,34	93,05	8,08	0,43	23,90	30,86	156,31

Table S.10: Marginal external costs for rail transport (NOK per train-kilometre), night-time (23:00-07:00). The area categories 'Medium-sized urban area' and 'Large urban area' refer to settlements with 15,000-100,000 and more than 100,000 inhabitants, respectively.

Train type	Fuel / traction	Area type	CO_2	Local emissions	Noise	Accidents	Wear (maintenance)	Wear (renewal)	TOTAL (excl. CO_2)
Passenger train	Electric	Sparsely populated area	0,00	0,00	1,62	1,25	23,90	30,86	57,62
Passenger train	Electric	Medium-sized urban area	0,00	0,00	1,01	1,25	23,90	30,86	57,01
Passenger train	Electric	Large urban area	0,00	0,00	2,73	1,25	23,90	30,86	58,73
Average intermodal freight train	Electric	Sparsely populated area	0,00	0,00	21,41	0,43	23,90	30,86	76,60
Average intermodal freight train	Electric	Medium-sized urban area	0,00	0,00	69,49	0,43	23,90	30,86	124,67
Average intermodal freight train	Electric	Large urban area	0,00	0,00	121,00	0,43	23,90	30,86	176,19
Passenger train	Diesel	Sparsely populated area	7,49	1,09	1,62	1,25	23,90	30,86	58,71
Passenger train	Diesel	Medium-sized urban area	7,49	6,28	1,01	1,25	23,90	30,86	63,29
Passenger train	Diesel	Large urban area	7,49	31,18	2,73	1,25	23,90	30,86	89,91
Average intermodal freight train	Diesel	Sparsely populated area	22,34	3,24	21,41	0,43	23,90	30,86	79,84
Average intermodal freight train	Diesel	Medium-sized urban area	22,34	18,74	69,49	0,43	23,90	30,86	143,42
Average intermodal freight train	Diesel	Large urban area	22,34	93,05	121,00	0,43	23,90	30,86	269,23

To summarise costs per tonne-kilometre for an average freight train, the daytime, evening and night-time calculations are combined in Table S.11. A gross train weight of 1,010 tonnes and a payload weight (excluding load carriers) of 313 tonnes are explicitly assumed.

Table S.11: Marginal external costs (NOK per train-kilometre and tonne-kilometre) for an average freight train (intermodal train), by area type and time of day. The area categories 'Medium-sized urban area' and 'Large urban area' refer to settlements with 15,000-100,000 and more than 100,000 inhabitants, respectively.

Fuel / traction	Area type	Time of day	SUM per kjøretøykm (eks. CO_2)	SUM per tonnkm (eks. CO_2)
Electric	Sparsely populated area	Daytime	55,69	0,18
Electric	Medium-sized urban area	Daytime	56,50	0,18
Electric	Large urban area	Daytime	57,00	0,18
Diesel	Sparsely populated area	Daytime	58,93	0,19
Diesel	Medium-sized urban area	Daytime	75,24	0,24
Diesel	Large urban area	Daytime	150,05	0,48
Electric	Sparsely populated area	Evening	56,60	0,18
Electric	Medium-sized urban area	Evening	59,43	0,19
Electric	Large urban area	Evening	63,26	0,20
Diesel	Sparsely populated area	Evening	59,84	0,19
Diesel	Medium-sized urban area	Evening	78,17	0,25
Diesel	Large urban area	Evening	156,31	0,50
Electric	Sparsely populated area	Night	76,60	0,24
Electric	Medium-sized urban area	Night	124,67	0,40
Electric	Large urban area	Night	176,19	0,56
Diesel	Sparsely populated area	Night	79,84	0,26
Diesel	Medium-sized urban area	Night	143,42	0,46
Diesel	Large urban area	Night	269,23	0,86

Maritime transport

For maritime freight transport, this report includes external costs associated with air emissions, accident risk and acute discharges, as in TØI Report 1704/2019 and TØI Report 1953/2023. In the latter, new calculations were carried out only for air emissions. Figure 0.6 provides an overview of the external components calculated for maritime transport and the changes made compared with TØI Report 1704/2019.

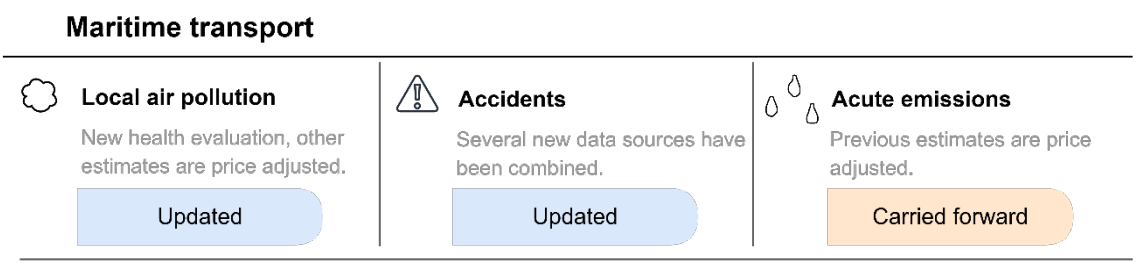

Figure S.5: Overview of how this report updates the evidence base across external-cost categories for maritime transport.

The calculations for local air pollution are based on TØI Report 1953/2023, with results differentiated by vessel type, size and area type. The valuation of local emissions has been updated using new calculations from the Norwegian Institute of Public Health. Accident costs have been updated by combining several data sources. Data from the Norwegian Maritime Authority are now supplemented by data from Statistics Norway (SSB), Nævestad et al. (2014) and more recent sources on recreational craft. The calculations now also distinguish between accidents with and without another party involved. The new accident calculations produce substantial changes, but not in the same direction for all vessel types. Costs increase for, among others, cargo ships and recreational crafts, but decrease for passenger ships. We emphasise that the marginal external cost estimates for personal injuries in maritime-transport accidents should be regarded as highly uncertain. Calculations of the costs of acute discharges to water are carried forward from the 2019 report and updated to the current price level.

The commissioning body has received a larger set of tables with marginal external costs in Excel format for use in further analysis. In this report, we limit the presentation to the size category 5,000-15,000 deadweight tonnes (DWT), for eight different vessel types. The summary table for marginal external costs from maritime freight transport is presented in Table S.12. Marginal external costs per tonne-kilometre are given in the final column. Tables with estimated average payloads are provided in Appendix B.

Table S.12: Marginal external costs (NOK 2026 per vessel-kilometre and tonne-kilometre) for vessels in the size category 5,000-15,000 deadweight tonnes, for eight vessel types and different area types. The area categories 'Medium-sized urban area' and 'Large urban area' refer to settlements with 15,000-100,000 and more than 100,000 inhabitants, respectively.

Vessel type	Area type	CO_2	Local air pollution	Accidents	Acute discharges to water	TOTAL	SUM eks CO_2	External cost per tkm (excl. CO_2)
Breakbulk	Sparsely populated area	130,4	43,2	1,7	47,2	222,6	92,2	0,02
Breakbulk	Medium-sized urban area	130,4	120,1	1,7	47,2	299,4	169,0	0,04
Breakbulk	Large urban area	130,4	650,8	1,7	47,2	830,1	699,8	0,17
Container Lo/Lo	Sparsely populated area	212,3	76,5	1,7	49,5	340,1	127,8	0,03
Container Lo/Lo	Medium-sized urban area	212,3	207,9	1,7	49,5	471,6	259,2	0,06
Container Lo/Lo	Large urban area	212,3	1118,5	1,7	49,5	1382,1	1169,8	0,27
Chemical/product tanker	Sparsely populated area	148,1	63,3	1,7	84,5	297,7	149,5	0,03
Chemical/product tanker	Medium-sized urban area	148,1	165,6	1,7	84,5	400,0	251,9	0,06
Chemical/product tanker	Large urban area	148,1	878,6	1,7	84,5	1113,0	964,9	0,21
LPG/LNG	Sparsely populated area	223,6	84,4	1,7	49,5	359,3	135,7	0,05
LPG/LNG	Medium-sized urban area	223,6	220,4	1,7	49,5	495,3	271,6	0,10
LPG/LNG	Large urban area	223,6	1161,3	1,7	49,5	1436,2	1212,6	0,45
Ro-Ro cargo	Sparsely populated area	276,2	150,5	1,7	50,3	478,8	202,6	0,06
Ro-Ro cargo	Medium-sized urban area	276,2	376,1	1,7	50,3	704,4	428,2	0,13
Ro-Ro cargo	Large urban area	276,2	1961,0	1,7	50,3	2289,3	2013,1	0,59
Ro-Ro vehicles	Sparsely populated area	224,7	124,4	1,7	50,3	401,2	176,5	0,11
Ro-Ro vehicles	Medium-sized urban area	224,7	307,3	1,7	50,3	584,1	359,4	0,22
Ro-Ro vehicles	Large urban area	224,7	1591,6	1,7	50,3	1868,4	1643,7	1,02
Tanker	Sparsely populated area	158,4	49,8	1,7	111,2	321,1	162,7	0,03
Tanker	Medium-sized urban area	158,4	137,3	1,7	111,2	408,7	250,3	0,05
Tanker	Large urban area	158,4	739,7	1,7	111,2	1011,1	852,7	0,17
Dry bulk	Sparsely populated area	159,7	52,9	1,7	49,5	264,0	104,2	0,02
Dry bulk	Medium-sized urban area	159,7	146,9	1,7	49,5	357,9	198,2	0,05
Dry bulk	Large urban area	159,7	795,7	1,7	49,5	1006,7	847,0	0,19

Air transport

For air transport, this report includes external costs associated with air emissions and noise, as in the appendix to TØI Report 1704/2019. We divide the external costs into the CCD phase (climb, cruise, descent), for which only external costs associated with air emissions are included, and the LTO phase (landing and take-off), for which both air-emission and noise external costs are included. Figure S.6 provides an overview of the external components calculated for aviation and the changes made compared with TØI Report 1704/2019.

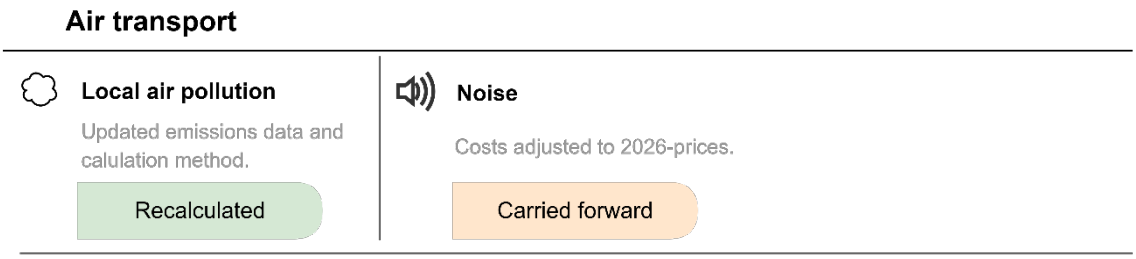

Figure S.6: Overview of how this report updates the evidence base across external -cost categories for air transport.

For air transport, the emission calculations for local air pollution have been recalculated and are based on the European Environment Agency's 2023 emissions calculator. A clear distinction is made between the landing and take-off (LTO) and climb, cruise, descent (CCD) phases and between several types of turboprops, narrow-body and wide-body aircraft. The results show that the LTO phase accounts for a large share of emissions. The noise calculations use the same exposure data as before. All estimates have been converted to 2026 prices.

Estimated marginal external costs are shown in Table S.13 and Table S.14.

Table S.13: External costs per aircraft-kilometre (NOK 2026) associated with air emissions from the climb, cruise, descent phase (CCD), differentiated by aircraft type. The final column converts these to external costs per seat-kilometre.

Aircraft type	Seats/aircraft	CO_2	Other climate effects	NOX	TOTAL per aircraft-km	TOTAL per seat-km
Small regional turboprop	39	5,90	0,00	0,33	6,24	0,16
Medium regional turboprop	50	6,07	0,00	0,41	6,48	0,13
Large regional turboprop	78	10,18	0,00	0,77	10,95	0,14
Small narrow-body jet	120	14,60	10,22	1,02	25,85	0,22
Medium narrow-body jet	141	14,94	10,46	1,15	26,56	0,19
Large narrow-body jet	181	16,89	11,82	1,35	30,06	0,17
Medium wide-body aircraft	264	33,92	23,74	2,72	60,38	0,23
Large wide-body aircraft	269	38,74	27,12	4,58	70,43	0,26

Table S.14: External costs per landing and take-off (LTO) cycle (NOK 2026), differentiated by aircraft type.

Aircraft type	Seats/aircraft	CO_2	NOX	Noise	TOTAL per LTO (landing and take-off)	Total per LTO per seat
Small regional turboprop	39	774	32	2	808	20,71
Medium regional turboprop	50	861	42	2	905	18,09
Large regional turboprop	78	1 222	64	2	1 288	16,51
Small narrow-body jet	120	3 403	199	8	3 610	30,09
Medium narrow-body jet	141	3 909	269	8	4 186	29,69
Large narrow-body jet	181	3 909	269	8	4 186	23,13
Medium wide-body aircraft	264	10 329	931	8	11 268	42,68
Large wide-body aircraft	269	10 328	1 234	8	11 570	43,01

Concluding remarks

This report documents and presents updated 2026 estimates of marginal external costs for road, rail, maritime and air transport. Both passenger and freight transport are included. **This is the first broad review of external costs across transport modes since TØI Report 1704/2019** (Rødseth et al., 2019).

As with TØI Report 1704/2019, this report is **primarily a documentation report and reference work for a large set of external cost estimates that can be used in cost-benefit analyses** in Norway. Key assumptions, data sources and uncertainties are documented to make the results transparent and reproducible. The intention is that the report and the accompanying Excel tables delivered to the commissioning body can be used directly in cost-benefit analyses, studies and assessments of transport-policy instruments.

We emphasise that several of the marginal external-cost estimates are subject to **substantial uncertainty**. This uncertainty concerns both the magnitude of the physical damage effects and their monetary valuation. In addition, many estimates are specified for relatively broad categories of area type, vehicle and time period. The results should therefore be understood as representative marginal external costs within the stated categories, rather than precise estimates for a particular route or situation. For several impacts, actual marginal costs may vary substantially with local conditions, traffic volumes and time of day. Sensitivity analyses are therefore recommended in analyses where external costs may materially affect the results. Where more specific uncertainty intervals are not available, one possible approach is to illustrate uncertainty by varying the rates by +/- 50 per cent.

Some factors considered in isolation, suggest that the calculated external costs may be underestimated. Certain types of impacts are omitted because the current evidence base is not sufficient to establish robust marginal costs. For local air pollution, this applies, among other things, to some pollutants and health outcomes. The valuation of health effects, including the value of a statistical life (VSL), is also an important source of uncertainty.

The **evidence base can be improved for all external-cost components**, but some areas appear particularly important. This applies first and foremost to infrastructure wear on roads and railways, where updated data and methods are needed. A closely related question is the economic trade-off between traffic volumes, maintenance and infrastructure lifetime. For congestion costs, an important further development would be to calculate marginal costs for a larger part of the road network and for different times of day. Another area where the evidence base remains particularly limited is transport emissions to soil and water. More

knowledge is needed on emission quantities, dispersion and economic valuation of, among other things, microplastics, heavy metals and PAHs from tyre, brake and road wear. There is also a need to establish a more representative data basis for road-traffic noise.

Overall, the report provides a more up-to-date and consistent basis for including the externalities of transport in cost-benefit analysis. The most important application is to provide the analyst with a set of differentiated calculation values that can be adapted to the specific transport change being analysed.