

Road User Charging with privacy focus

Ola Martin Lykkja, Q-Free Norway

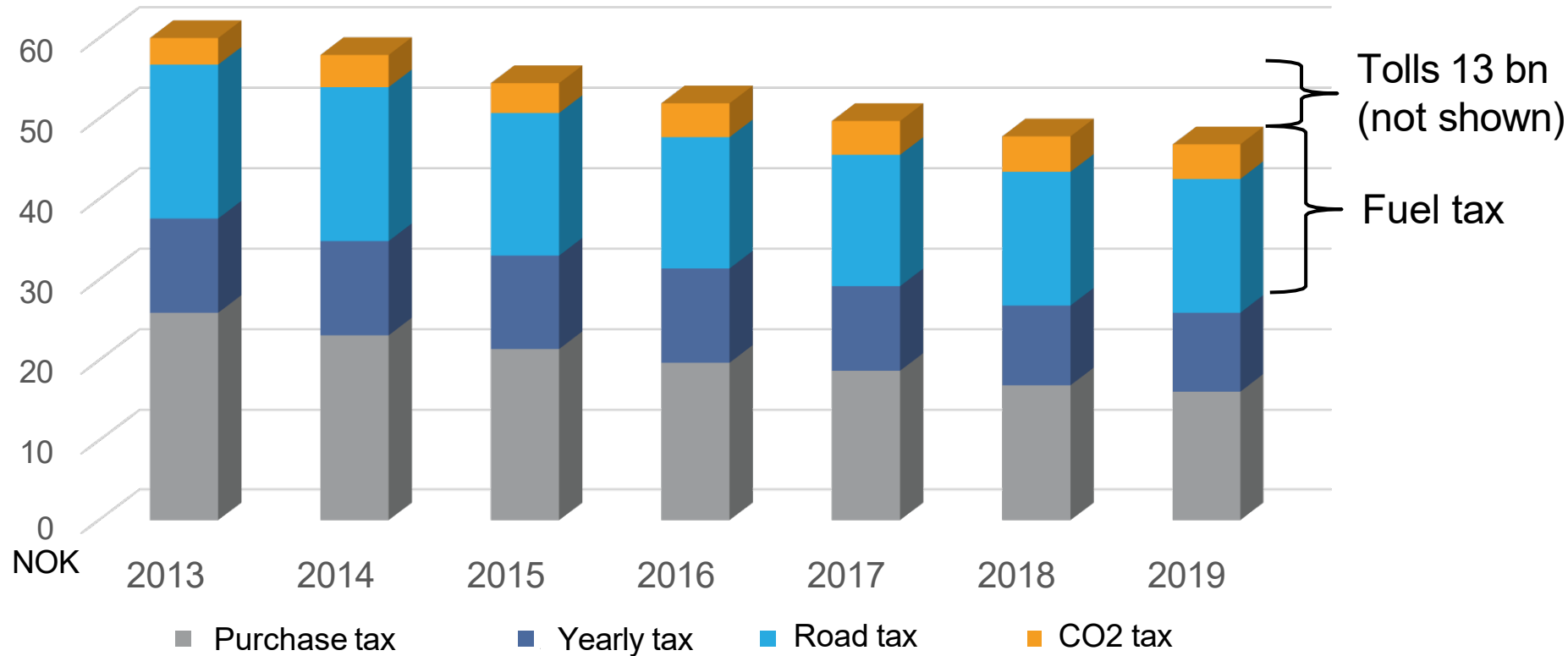


External drivers in Tolling and Road User Charging

- Government revenue loss from fuel tax
 - Transition to electric vehicle: No fuel tax
 - Newer cars have better mileage → Less government income from gasoline tax.
- Fairness
 - Arbitrary placement of payment gantries leads to unfair cost distribution on the individual level
 - When new roads or bridges are tolled, the asset is underutilized when old road is free.
- Polluter pays principle
 - EU commission want to migrate from yearly fees to a per use fee (Eurovignette)
 - Drivers should pay external cost (delays, particulates, CO₂ emissions, road maintenance, noise, accidents, etc)
- Privacy issue
 - Current AutoPASS system collects and stores way too much personal information, each passage are stored for 5 years because it is a financial accounting record.



State finances revenue loss in Norway (NOK)



Down from 72 to 47 billions NOK in 6 years
 2021: 80% of new vehicles are electric (65 % fully electric, 15% hybrid).
 500.000 of 2.8 millions registered passenger vehicles are electric

A photograph of two men standing on a rooftop overlooking a city at dusk. The man on the left has long hair and a beard, wearing a white shirt and blue trousers. The man on the right has short hair and glasses, wearing a striped shirt and dark trousers. He is holding a laptop and looking at the screen. The background shows a dense urban landscape with many skyscrapers and a highway with traffic. The sky is a mix of blue and orange from the setting sun.

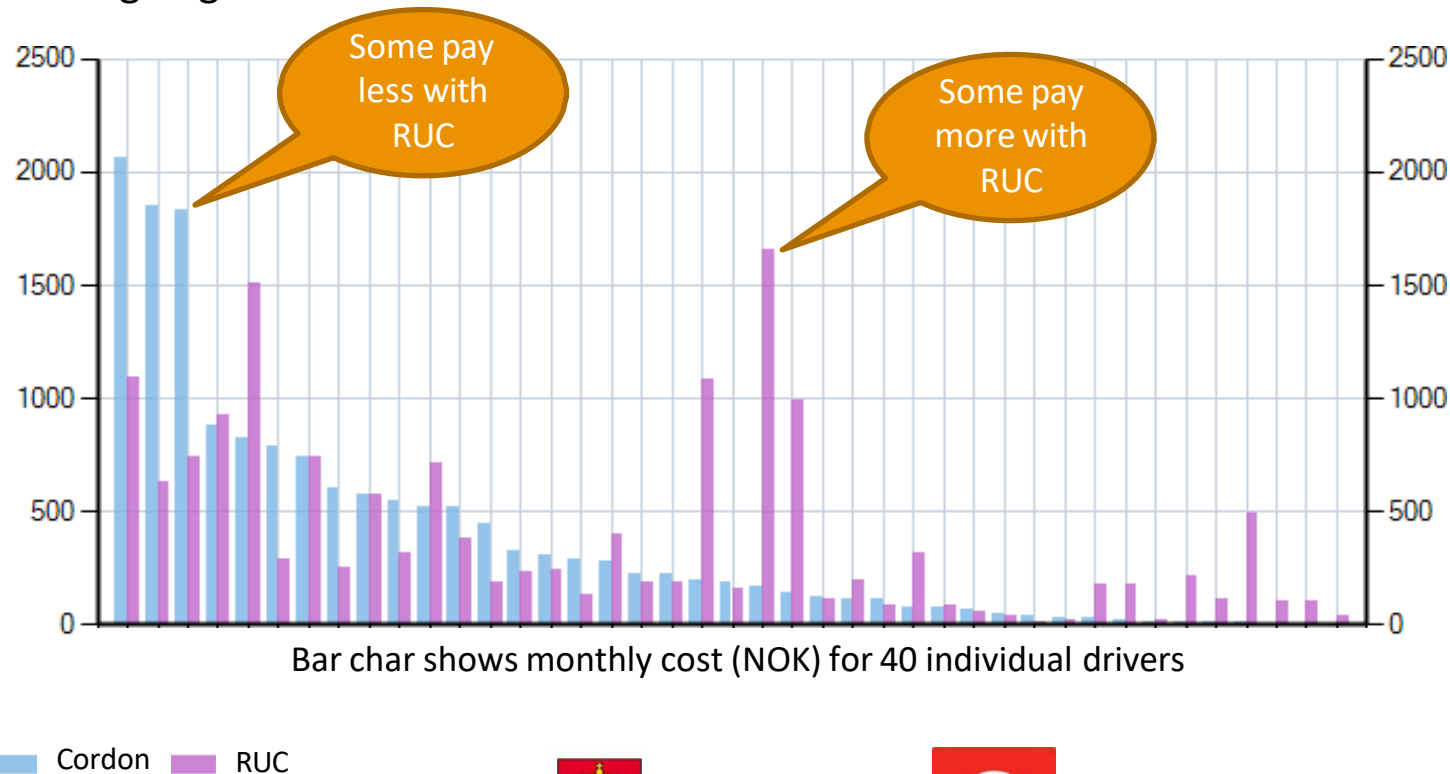
The GeoFlow pilot project



GeoFlow – Fee change for individual users

Participants in the GeoFlow survey are interested in discovering changes in their expenses based on their individual driving patterns.

Some will pay more, especially if they are mainly driving inside our current tolling ring.

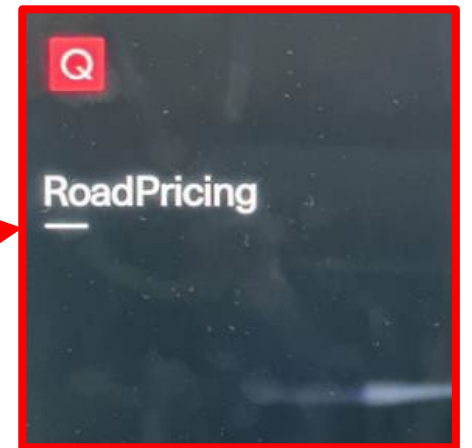


Based on a previous project we analyzed driving patterns for 40 people. The RUC fees are set to 3 NOK per km outside rush hours and 4 NOK per km in the rush hours. This makes it a zero-sum game.

Tag4All – New NFR project (2023-25)



Polestar Android Automotive App

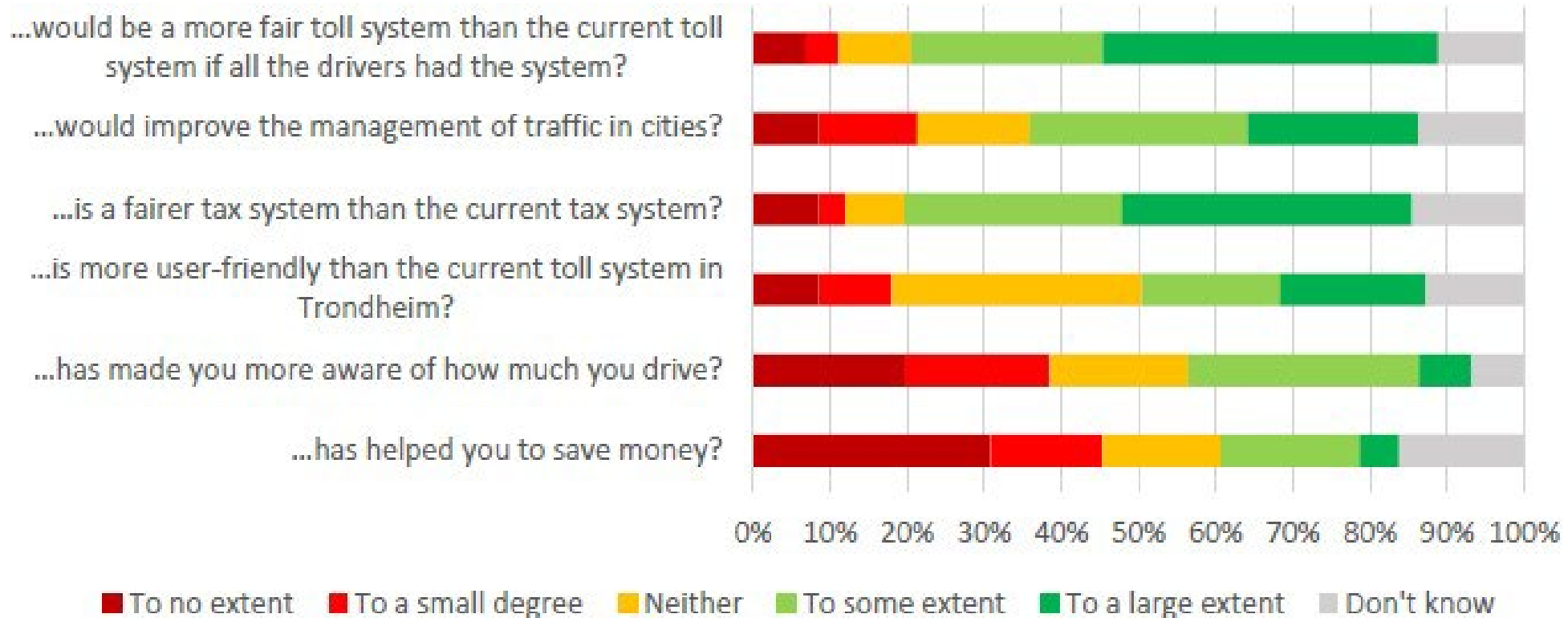


GeoFlow Pilot 2023



GeoFlow User's attitude survey

To what extent can you say that road pricing...



Source: SINTEF

Active enforcement is needed for deployment

- Enforcement is needed to ensure that all vehicles are tolled
 - have a compliant unit mounted
 - unit is powered on and running
 - it is not GNSS spoofed or jammed
 - it is not blocked from communication to back-office
- Recommendation:
 - Enforcement stations with cameras, classification and communication equipment are needed
 - Permanent stations
 - Portable/handheld equipment, just like police speed radar checks at random locations.
- Compare to other well-known enforcement systems:
 - In many cities public transport systems use barrier free train/bus/tram/subway entry
 - Passengers use smartphone apps for payment
 - Enforcement is key to ensure that the cost of cheating exceeds “saved” ticket purchase
 - There is no relationship between the cost of enforcement and the penalty fee revenue from enforcement.



An aerial, high-angle photograph of a city street. The street is filled with cars and trucks, moving in both directions. On the left side, there are several tall construction cranes. The buildings on both sides are modern, multi-story structures with many windows. The overall color palette is a mix of warm tones (red, orange) on the left and cool tones (blue, teal) on the right.

Privacy and cybersecurity

Privacy


I 2023 new systems must be designed with privacy from its inception. Almost every day we read about errors and «mishaps» the leak private information. This make privacy design a key aspect for Road User Charging.

PERSONVERN

Vipps overførte 850.000 kunders navn og e-postadresser ved en feil

Et brudd på interne retningslinjer, ifølge selskapet.

2022-10-28



Dette er Stavanger. Lysene du ser er posisjonene til flere hundre mobiltelefoner.

kl. 06:00

Som vanlig begynte dagen med at han stod opp rundt klokken seks.

Deretter kjørte han til jobb. Vi kan ikke se akkurat når han kjørte, men tidligere hadde vi sett at han pleide å ta denne ruta til jobben.

NRK journalister kjøpte data og identifiserte en person de intervjuet, han besøkte bl.a. sykehuset.

Kundeopplysninger i Santander Bank på avveie

En tidligere ansatt har tatt med seg en fil

6000 norske førerkort lå åpent på nett

Bekreftar at personsensitiv data er lekka etter dataangrep i Østre Toten



The 6 GDPR Principles in EU legislation – article 5

Principle	Relationship to RUC
Lawfulness Fairness Transparency	Lawfulness is outside Q-Free scope. Fairness is the purpose for transition to RUC. GeoFlow lets the user inspect his data. Data collection is 100% transparent to the user.
Purpose limitation	Today, the police (and others) can use AutoPASS data for non-tolling purposes. If this was open, the list of misuse would be endless. Speeding tickets, drunk driving, cheating spouses, ... When transitioning to RUC, much more data (time/place) is traditionally collected (in truck tolling). Can be used to track individuals, calculate average speed on specific roads, driving patterns, infrastructure planning and hundreds other noble purposes.
Data minimisation	In GeoFlow we will very aggressively aggregate data as soon as possible. Raw data are encrypted and stored locally. Time/Place data simply does not exist at any central server.
Accuracy	Yes...
Storage limitation	Connected to data minimalization. But the user can choose to remove personal data at the cost of losing the possibility to make an invoice complaint.
Integrity and confidentiality	Key requirements solved with modern cybersecurity

Q-Free is focused on privacy and cybersecurity in GeoFlow

- AutoPASS: Every toll plaza passage is an accounting record and is stored for 5 years according to financial regulations (including free passages).
- Truck-tolling in Germany, Hungary, Switzerland (and others) collects and transmits detailed position data to back-office systems.
- No country is currently doing distance-based road user charging for private passenger vehicles.
- Norway can be disruptive on km-fees today in the same way as in 1990.
- GeoFlow:
 - All processing executes in the vehicle.
 - Thick Client: The vehicle known all rules, region borders and tariffs.
 - The vehicle creates the invoice e.g. weekly. Only the total amount to be payed is transferred to the toll service provider.
 - Detailed time and location data is stored encrypted in the vehicle such that only the vehicle owner may access it.
 - Modern, powerful cybersecurity.
 - Enforcement is implemented with privacy.



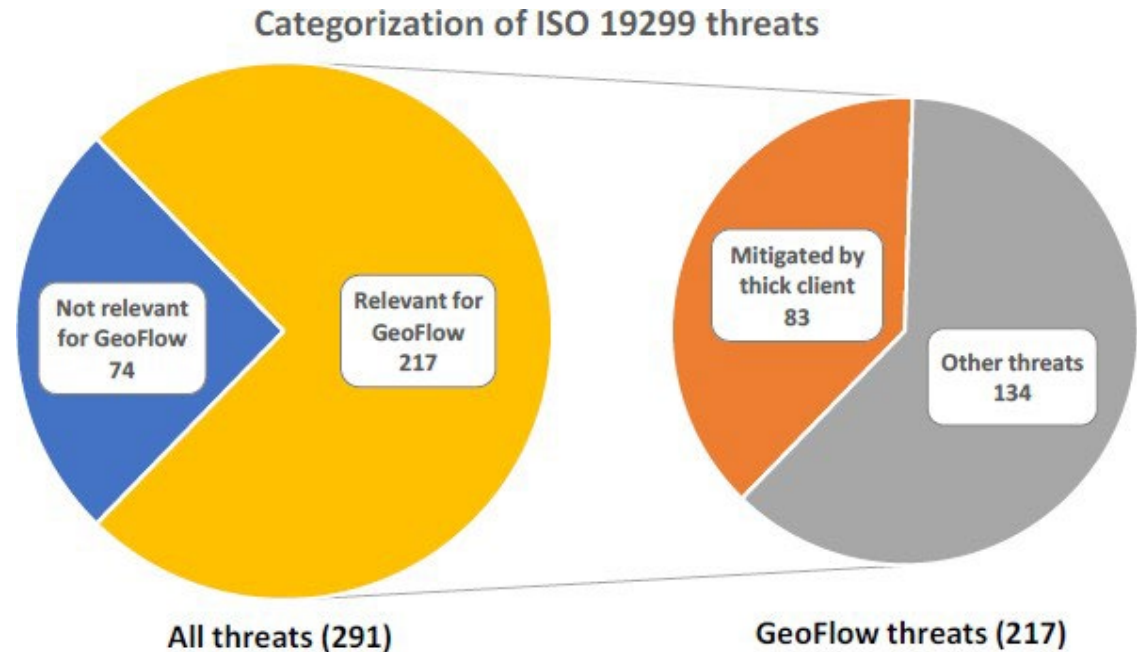
Threat analysis based on ISO 19299 Electronic fee collection — Security framework

ISO 19299 contains an analysis of 291 threats to a tolling/RUC system.

- This considers all kind of threats: hackers, governments, user, etc.
- This has been revisited by SINTEF and they have found that 74 are irrelevant to GNSS tolling (applies only to tag tolling)
- 83 of the remaining 217 are mitigated by the Thick Client approach.

Focus on:

- Device in hands of hostile user.
Can he tamper with own data?
Can others tamper with it?
- Man-in-the middle attacks.
- Non-repudiation
- Privacy



Summary

Why should we implement Road User Charging with privacy?

- Can provide very good privacy, a big step up from AutoPASS
- Driver owns and controls his own data stored in a private vault
- It is within the EETS and is described in international standards
- Eliminates many threats to the system
- User acceptance is higher when privacy is taken care of

Why don't others do it?

- It is cheaper to ignore privacy
- Toll Chargers does not have to trust Toll Service Providers
- Truck tolling sees the drives as employees and tolling data is company data
- Truck tolling was established before GDPR
- Enables secondary use of data



Ola Martin Lykkja
Q-Free Norge AS
ola.lykkja@q-free.com

HEADQUARTERS
Q-FREE ASA

Strindfjordvegen 1
7053 Ranheim
Norway

Postal Address
Pob 3974 Leangen
7443 Trondheim
Norway

Tel.: +47 73 82 65 00
Fax: +47 73 82 65 01

info@q-free.com
www.q-free.com

twitter.com/qfreeasa
[linkedin.com/qfreeasa](https://www.linkedin.com/company/qfreeasa)

Bank: Nordea Bank Abp, filial i Norge
ACC. No.: 6402.05.33518

Register of business
enterprises NO 935 487 242

