

# A tale of two worlds

Norbert Schindler examines the case for GPS-based tolling in North America and Europe



**T**his past ITS World Congress was particularly eventful for me, as it took place in my chosen home town of Vienna. For the first time, I did not travel to an interesting new place but simply took the metro on a slightly different route than usual. Admittedly, I was less focused on the Congress itself, since I was rather pre-occupied on being a good host to friends and business partners (with the ambition of showing them some nice places off the beaten track). The positive feedback I heard from guests from around the world was, of course, rather heart-warming. At one point, though, I experienced a special moment (a light bulb moment, one might say), in which I felt myself smack between two continents:

my native North America and Europe, where I have been living since I graduated from college.

During the Special Interest Session “Road charging based on satellite navigation experiences and trends in Europe and US,” several presentations were made on the implementation of GNSS-based charging systems in Europe – a subject all too familiar to me and to many of my business associates. Then, a congenial American took to the stage to talk about the approach towards distance-based road user charging being taken in Minnesota. The contrasts of this presentation to the previous ones were, to put it mildly, eye-opening. To summarize, the Minnesota “Road Fee Test” was conducted to demonstrate the use of GPS

in the implementation of “mileage-based user fees” (MBUF now a commonly used acronym), using a completely different approach than what has been observed in Europe. To paraphrase: “We don’t force any particular solution on users as you do here in Europe; we let people use their smartphones to measure the distance travelled – as an option that brings benefits to the user.”

After this unique presentation, a European associate approached me with a frown: “the Americans make everything sound so easy! Of course smartphones could never substitute an OBU in a European tolling system.” That basically summed up my sentiment as well, I initially thought. Although, admittedly, I didn’t really think about it much, since the

*“When Switzerland introduced its truck-tolling scheme in 2001, the main motivation was not to raise revenues”*



Minnesota approach had virtually nothing in common with the large European schemes other than the use of GPS.

Being rather familiar with both continents, though, I am often able to understand both perspectives – and still find it entertaining when I observe Americans and Europeans viewing each other as though the other one came from Mars. But aren't the similarities greater than the differences? Are there not experiences in GNSS-based road user charging on both sides of the Atlantic that could be inspiring to the other? In the weeks that followed, I looked more deeply into the subject, reading a variety of reports and talking with some “MBUF experts” in the United States. I also went back to some of the presentations and

materials I received while attending this past year's IBTTA Symposium on Mileage-Based User Fees in Jersey City – a short drive away from where I was born.

### **BOTH SIDES NOW**

Clearly, both continents face the same fundamental problem of needing to generate funds for the development and maintenance of their road infrastructure. The traditional resources of fuel taxes, vehicle taxes and general taxes are no longer able to foot the bill for the growing costs of developing and maintaining modern road infrastructure. Although our starting points are quite different, both Americans and Europeans are basically heading down the same inevitable path of charging road users more equitably.

In other words, vehicles should pay according to their actual use of the roads – and relative to the amount wear and tear they are causing to the roads. Somewhere down that path, I would imagine, the deployment of GNSS technology should inevitably play a major role in reaching that goal.

Currently, Europeans are much further down the GNSS tolling road (no pun intended), with two comprehensive nationwide satellite-based truck charging schemes in operation already for a number of years: in Germany and in Slovakia. In mid-2013 France will introduce distance-based fees on 15,000 km of national roads which until now have been free of charge, affecting about 800,000 trucks which will be equipped >>>

# *“Political have shown to be an extremely practical and effective means of filling up empty road fund coffers factors aside, these nationwide road usage schemes in Europe”*

with windshield-mounted GNSS OBUs. This will be the largest nationwide road usage scheme to date. Also Switzerland has more than a decade of experience in collecting distance-based tolls, in which all trucks above 12 tons are charged per kilometer, based on their tachograph (i.e. odometer) readings. For Swiss trucks, a mandatory OBU is installed with a tachograph connection, using GPS to confirm the distance measurements (to avoid cheating).

When Switzerland introduced its truck-tolling scheme in 2001, the main motivation was not to raise revenues. The local population was getting increasingly frustrated at having to bear the burden of the noise and pollution of heavy transit

traffic in their beautiful alpine valleys. With its long history of direct democracy, the Swiss introduced the so-called “Alpen-Initiative” in which several measures were taken to curb the transit traffic. Among these measures was a considerably high fee for trucks using the Swiss roads – any type of road – to the tune of at least 26.3 eurocents per kilometer (for 12 ton trucks meeting strict emissions standards). For a “high emission” 40 ton tractor-trailer, more than €1 per kilometer is charged! Not surprisingly, measures were taken to ensure that cheating the system is virtually impossible.

Thanks to the initiative in Switzerland, nationwide truck tolling schemes soon started popping up all over Central

Europe after the turn of the century. The momentum continues, of course, as Hungary, Belgium, Denmark and others currently plan the introduction of their own road usage charging schemes for trucks. Although sound ecological incentives accompany these schemes, the primary goal, of course, is to raise revenue.

### **TAX DOESN'T NEED TO BE TAXING**

An American might ask: is there not an outrage in those countries, that “another tax” is forced upon those truck companies

**Windscreen-mounted OBUs use GPS to confirm distance measurements**



## *“For the Minnesota test, users got a discount when using a smartphone: they paid only 3 cents per mile, rather than the obligatory 5 cents per mile”*

– especially in these economically troubled times? A European politician might answer: getting the trucks to pay their fair share for the damage they cause to the roads – especially when many of them are coming from foreign countries – is a sure way of improving your popularity among the electorate. After all, why should the general taxpayer foot the bill of heavy transport vehicles that cause most of the road damage (in the neighborhood of 90 per cent, according to some statistics)? Unlike in the United States, Europeans driving passenger cars pay more than their fair share of taxes at the pump (at least two to three times more than their American counterparts).

Political have shown to be an extremely practical and effective means of filling up empty road fund coffers factors aside, these nationwide road usage schemes in Europe. In Germany €4-5 billion (US\$5-6.5 billion) is generated by charging trucks over 12 tons (that’s about 26,500 lbs) on approximately 13,000 km (8000 miles) of Autobahn. Slovakia, which is smaller than the state of West Virginia and has a population similar to, conveniently, Maryland, has a mere 310 miles of motorways and its distance-based toll is charged on all major transit routes, totaling 1,470 miles. Despite its size, Slovakia generates about US\$200m from the tolling system each year, with an operational overhead of only 15 per cent.

### **WHY NOT USE SMARTPHONES FOR TRUCKS IN EUROPE?**

Every now and then, the question is raised: why don’t you simply use smartphones instead of OBUs for the European road usage schemes for trucks? Allow me to explain. The European schemes are designed to secure the revenue streams from the vehicles obliged to pay, with virtually no chance for road users to evade those charges. The distance-based fee is not voluntary, and usually the

technology used to calculate the fees isn’t either. Germany is an exception since self-declaration is also made possible by means of roadside terminals, call centers and the Internet. Such options typically increase operational costs, however. Now that windshield-mounted “plug and play” GNSS OBUs are on the market, deploying a mandatory OBU is logical – and cost-effective.

The central idea behind the European road usage charging systems is that the truck drivers should not be burdened with the issues of declarations, payments, and handling of devices. In Slovakia, and soon also in France, a mandatory OBU is installed within minutes by the driver who attaches the device to the vehicle’s windshield, connects it to the cigarette lighter, sets the vehicle category, and is ready to go. From then on, everything is done automatically: the OBU knows when to turn itself on and off, when to record trip information, and when to send and receive data from the back office server using the cellular (GSM) network.

The OBU cannot be tampered with; you cannot open it up, remove the internal battery, or change the SIM card. An attempt to cut off the power will set off an alarm on the OBU and immediately notify the back office of potential non-compliance. The data being transferred to and from the OBU cannot be tampered with (thanks to encryption and a built-in Security Access Module) nor can any data be “lost.” Most importantly, there are no excuses for an OBU not functioning properly: you don’t need to “boot up” the device, install an application, or make sure the batteries are charged.

Enforcement officers can control user compliance by reading the data directly off of the OBU – even when it is turned off. In short, the truck tolling systems in Europe are closed systems with the sole purpose of ensuring full compliance to the scheme and thus securing the revenue stream. Of

course there is great potential for other value-added services, particularly those that could increase traffic safety and provide real-time traffic information, but these have yet to be realized in any of the European schemes.

A smartphone, on the other hand, could not easily meet such rigid requirements. There would be countless versions of hardware and software out in the field and no guarantees that the correct version of the correct application was operating as it should be. In a world of iPhones and Androids, even the basic operating systems could differ significantly, not to mention the potential of other “apps” operating in parallel that could bring the smartphone to its knees, consequentially causing the road usage charge “app” to crash (along with the entire phone).

An “open platform” software could be potentially manipulated or sabotaged, viruses could be spread and all other kinds of neat tricks could be conjured up to avoid paying the obligatory fees. Where there is a will, there is a way.

### **WEST, LOOKING FURTHER WEST**

Alas, GPS-enabled smartphones are no substitute for a GNSS OBU in the case of mandatory fee collection – in fact, they were never intended to be. What the folks in places like Minnesota are doing is to show the potential for using smartphones that are already out there when millions of ordinary users will be obliged to pay distance-based fees. In the European road usage charge schemes, there are “only” a few hundred of thousands of users. Once you get into the millions, the cost of producing and distributing OBUs to all users is a factor to be considered.

A European OBU might cost a fraction of a smartphone, but the fundamental question being asked (and being explored by various trials) is whether you can realistically offset the capital costs of a system by allowing users to bring their

# *“Drivers would be charged based on the number of miles they drive, regardless of the type of energy source used to propel the vehicle”*

own devices. There are many issues to be solved, of course, and those of us in Europe would be well advised to keep a close eye on the findings being made in the United States. Based on the years of experience made in Europe, though, I would think that a key success factor for the introduction an “open system” (in which the drivers are offered a number of technology choices for tolling) would be to ensure that not only capital investments could be saved, but also that operational costs would not wind up being higher than that of a closed system.

The “bring your own” approach would probably only work if users are truly motivated that their devices work properly. For the Minnesota test, users got a discount when using a smartphone: they paid only 3 cents per mile, rather than the obligatory 5 cents per mile. So, if their smartphone crashed or ran out of power, they would be paying the full price. The default payment would be measured by the odometer readings. One might then logically ask: how do you secure regular and reliable readings from the odometer? Since regular technical vehicle inspections are not mandatory in all US states, this is not a trivial question.

In Oregon, for example, questions like these are being taken seriously and are currently being evaluated in a pilot program launched by the state’s Department of Transportation (ODOT) which is currently drawing up a proposal for legislature which will be voted upon in February of 2013. If the legislature is passed – and there appears to be high probability for this – we will witness the dawn of a new era in road usage charging in America. As opposed to the “big bang” approach of the nationwide truck tolling schemes in Europe, the Oregon MBUF would at first only affect a relatively small number of vehicles. The distressing trend of decreasing fuel tax revenues will be addressed by charging those vehicles



paying little or no fuel taxes at all: plug-in hybrids and electric vehicles. The road usage fees will be mandatory, but owners of these vehicles will be offered a choice technology and non-technology options to count the miles, GPS being one of them.

The ecologically oriented drivers of these vehicles who also reject the use of MBUF technology will be free to “opt out” and pay a flat fee – which would be considerably higher than that of the average driver that allows its distance to be measured precisely.

### **EITHER OR**

The key for the success of an open system is that there should be a motivation for

the users to “opt-in” to the use of the technology. This can be achieved primarily by providing financial incentives, but eventually additional services (such as location-based services and real-time traffic information) will be a key motivator as well. Equally important, at least in the United States, is public acceptance of the scheme in order for it to be launched. Freedom of choice is essential for any scheme to get off the ground, and Oregon is showing the world how this can be done. The world should be watching.

Since motor fuel tax income is on the decline, Minnesota is also preparing itself for the implementation of an MBUF system in which “drivers would be charged

*“Many US states are watching what is happening in Oregon very closely and are sure to launch MBUF systems of their own once the Oregon scheme gets off the ground”*



**Portland, Oregon - the State's DOT is drawing up a proposal for legislature which will be voted on in February**

based on the number of miles they drive, regardless of the type of energy source used to propel the vehicle, and instead of being charged by the gallon for fuel consumed in operating a vehicle.” An MBUF system could furthermore be used as a policy tool to address problems such as traffic pollution and congestion. The Minnesota DOT is also very interested in the added benefit of accurate real-time travel data which an MBUF system would make available, which would allow for the efficient management of “peak period

demand” on the road network.

The MBUF test using 500 volunteers has been completed and has drawn the conclusion that the GPS functionality given in today's smartphones is accurate enough to form the basis of a tolling mechanism. Privacy issues are a major concern among users, and solutions have been demonstrated that adequately address those concerns. Interestingly, there has been no public outcry about the ability of being tracked by a personal mobile phone, even those without built-in GPS – even though the police track down criminals this way all the time. So, by letting people use their own phones, privacy concerns have dwindled. Nevertheless, a non-technology option needs to be made available to those who are still concerned about “being followed”.

Ben Pierce, the research leader from Minnesota who made the presentation in Vienna, made a very good point: “The users have much more of a vested interest in keeping a personal smartphone operational than they do for a dedicated, mandated, black box required by the government to put and keep in their vehicles. The advantage of the smartphone is that it is just another application for a device that they likely have for other purposes, which are much more near and dear to them than collecting and paying a distance-based fee.”

### **A GAP THAT NEEDS BRIDGING**

In the United States, MBUF is being considered as a means to slow down or ideally stop the growing gap between fuel tax revenues and the funds needed to preserve, maintain and expand the road network. Therefore, at least in Oregon, the logic is: start with electric vehicles first since they don't pay any fuel tax. The Europeans, on the other hand, focus on the group of vehicles which are most responsible for the wear and tear on the roads: heavy commercial vehicles. If

Oregon moves forward as planned and introduces road usage charging, a few thousand users will be paying annual fees in the neighborhood of US\$200 to US\$300. This may not sound like much of a business case, especially when compared to the Europeans truck tolling systems which generate anywhere between US\$200m and US\$6 billion each year. However, the potential for growth in the European schemes is limited by the ability to expand from hundreds of thousands of commercial vehicles to millions of passenger vehicles. Not only is this unlikely in the near future, but in light of the colossal fuel taxes (about US\$4 per gallon!) already being paid at the pump, hardly a necessity.

Many US states are watching what is happening in Oregon very closely and are sure to launch MBUF systems of their own once the Oregon scheme gets off the ground. This would make Oregon something like the Switzerland of North America, leading the way for a new approach towards charging vehicles for the use of the roads that will have a dramatic and lasting impact on the way revenues are generated for road infrastructure.

As the United States is soon to commence with the implementation of an MBUF scheme, it may eventually overtake Europe in the actual number of vehicles participating in a comprehensive electronic distance-based road user charging system – at least by the next time Austria will be given another opportunity to host the ITS World Congress. 📍

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-  Norbert Schindler is Global Sales Manager at Siemens Electronic Tolling
-  [norbert.m.schindler@siemens.com](mailto:norbert.m.schindler@siemens.com)
-  [www.siemens.com](http://www.siemens.com)
-  Visit our archives for previous articles by this author