# Look to the skies

## Satellite-based tolling is taking over, insists **Norbert Schindler**

It's been three years since I reported on the ITS World Congress that took place in my native city of New York. Ok, I'll confess that I actually grew up in New Jersey, but after living in Europe for more than 20 years, such geographical details are relative, aren't they? The 2011 ITS World Congress was again hosted by the United States, this time in Orlando, Florida. The contrast to New York could hardly be greater. I don't necessarily refer to the obvious differences of climate or culinary choices – the latter of which was quite possibly the most frequently discussed topic among the European participants, at least – but what I am talking about is how the perspectives on tolling technologies have changed over the last three years.

You may not yet be familiar with my personal preferences about tolling technology, about which I have been rather vocal in various articles and presentations in recent years. But to give you a rough idea, some have called me a die-hard GNSS (Global Navigation Satellite System) Tolling advocate. So, given this perspective, it is fair to say that the attention now being given to satellite-based tolling is indeed remarkable, if not dramatic. In the paragraphs that follow, I will try to give you some examples of the new developments being made on the GNSS front, not ignoring some of the painful limitations being felt by the deployment of older technology.

### GNSS TOLLING IS GAINING A US FOOTHOLD

Let's start out in the US, where in Orlando there was a "Road Pricing Village" (a tent, actually), outside the conference center. There, leading American tolling companies presented GNSS-based solutions, pointing out the obvious advantages of being able to toll without having to invest in costly roadside infrastructure. For those of you that might think that this is all still highly theoretical, especially in the North American market, I have some news for you: one of the United States of America is currently preparing to introduce a Vehicle Miles Travelled (VMT) scheme, a real tax scheme, in which GPS tolling technology will play a major role. It will be the first such scheme of its kind in the USA, targeted at first to a small group of vehicles. I feel confident in predicting that this scheme in Oregon will not be just one of a kind, but will grow from a few thousand users to hundreds of thousands users in a short time. It is almost certain that others will follow the example of this very beautiful and highly innovative state.

Most likely by 2014, the Oregon VMT scheme for electric and plug-in hybrid vehicles will become a reality. The use of GNSS On Board Units (OBUs) will be an option, much like "E-Z Pass" tags are optional for drivers on tolled roads in and around New York. The reason "E-Z Pass" caught on so quickly was the fact that it provided a great convenience to its users. There is reason to believe that the same phenomenon will be witnessed with the GNSS OBUs that will be made available in Oregon, since the VMT payments will be much more convenient (ie automated) and surely the service providers which supply GNSS OBUs will offer other convenient services as well (such as real-time traffic information, parking information, etc). In other words, we may be witnessing the dawn of a new era in North America.

In Oregon, GNSS will be optional since an odometer-based mileage-counting device will also be offered for those who

**Skywatching: a tolling scheme that uses the global navigation satellite system enables charging schemes without costly changes to roadside infrastructure**

*"Oregon's VMT scheme will not be just one of a kind, but will grow from a few thousand users to hundreds of thousands in a short time"*

prefer not to have GPS device in there car. As it was explained to me, there are enough people out there who refuse to use GPS, even though this is now a standard feature in every smart phone. Even without GPS, a mobile phone will always be able to reveal your location – as long as you have it turned on. Privacy issues aside, a GNSS-based device in your car is simply extremely convenient, and opens the door for the kind of really neat "apps" based on your location that you may already have seen on an iPhone. The opportunities for improving traffic safety using such a GNSS platform are multifold, many of which are sure to be discussed in future editions of magazines such as this one and its sister title, *Thinking Highways*.

## GNSS IS EXPANDING IN EUROPE

Turning to Europe, there are still only two countries that have implemented nationwide GNSS Tolling so far. Germany started their nationwide truck tolling scheme in 2005 (after considerable delays) and Slovakia has had their GNSS truck tolling scheme successfully operating for two years now. Built in only 11 months, the 2370 km long Slovak toll system reached a toll collection efficiency of 98.99 per cent in its first year, including 1800 km of first class roads – a first in Europe.

Soon France will join this (still exclusive) GNSS club, having awarded a rather contentious contract earlier this year for the implementation of satellite-based truck tolling on all of its 12,000 km of national roads *(see Remi Demerle's interview with Sergio Battiboia on pages 38-43 for more details)*.

From 2013, all trucks above 3.5 tons will be obliged to pay a distance-based "écotaxe" on its national (first-class) road network, in addition to the existing fees for all vehicles on the motorway network. This new scheme should generate more than €1 billion annually, money >>>

**State-of-the-art GLONASS technology is enabling Russia in its efforts to launch the largest electronic toll system in the world**

clearly needed to maintain this road network – which suffers significant damage from the trucks driving on it – as well as to finance new transport infrastructure projects. It is anticipated that over 800,000 GNSS OBUs will be supplied to the trucks using these roads.

France is a country with a very long tradition in tolled motorways, and this new GNSS system will be operated in parallel to the existing tolling (conventional) systems. However, the 11 existing motorway concessionaires can offer their customers (the ones driving heavy vehicles, that is) a replacement of their existing microwave tags with new GNSS OBUs. In turn, the incumbent operators would need to accept the use of third-party GNSS OBUs on the motorways they operate. In other words, the "Hybrid Tolling" approach I wrote about a year ago is already becoming a reality in France (*ETC, etc* Vol. 5 No. 4, pg. 28-32).

## POLAND LAUNCHES ITS OWN NATIONWIDE TRUCK TOLLING SCHEME

In the middle of 2011, Poland joined its neighbors to the West and South, launching a truck tolling scheme of its own. Like France, Poland also already had existing tolled motorways in operation long before a nationwide truck tolling scheme was being considered. Yet in contrast to France, Poland installed microwave-based technology (as their Czech neighbors had done a few years before). This may not seem unusual, but it's worth pointing out that one of the scenarios for the scheme in Poland included over 1000 km of first-class national roads of in an overall network totaling 8000 km by 2018 – a majority of which being expressways having lots of intersections. In other words, like Slovakia to the South, Poland could have been an ideal candidate for the deployment of GNSS-based technology. In fact, an independent study conducted by the Polish Motor Transport Institute[1] in 2010 came to the conclusion that "a tolling system, using GPS satellite positioning and GSM will be the best future solution for each EU Member State, particularly in terms of interoperability and flexibility when toll systems may be usedfor more categories of roads (or all roads) and each category of vehicle."

Poland had a highly ambitious plan, with the intention to have a >>>

*"The use of older tolling technologies is by no means a guarantee that a system can be implemented more quickly"*

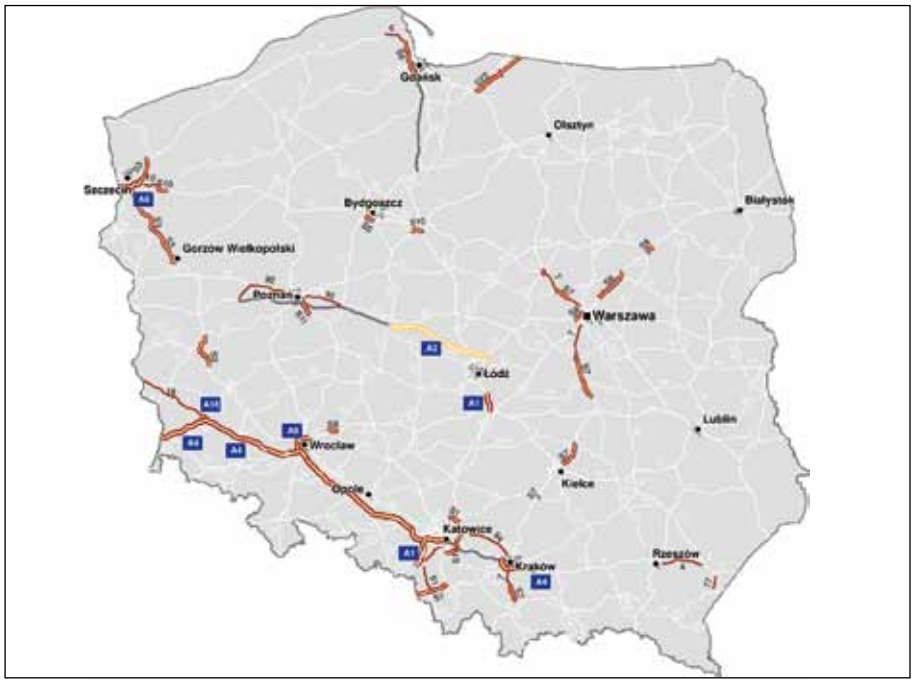
1: "TEST RESULTS OF THE NATCS PILOT PROJECT" Gabriel Nowacki, Grazyna Nowacka TRANSBALTICA 2011, The 7th International Conference, May 5–6, 2011, Vilnius, Lithuania Pages 136-141. ISSN 2029-2376 print/ISSN 2029-2384 online/ISBN 978-9955-28-840-4 http://transbaltica.vgtu.ltt)

*"Russia is planning to launch the largest electronic toll system in the world, using their state-of-the-art GLONASS technology"*

nationwide toll system installed on an initial 1758km of roads, including about 400 km of first-class roads, although the system was launched on 1560 km of roads. Since microwave technology requires beacons to be installed on each toll section, more than 430 gantries needed to be installed in this short period. The toll operator went to great lengths to erect those gantries speedily. According to spokeswoman Dorota Prochowicz, "221 gantries were standing within three weeks after the launch date"[2].

As critical as I might be towards infrastructure-heavy tolling technologies, I must admit that it was an amazing feat, building up to nearly half of the needed gantries within such a short implementation time. Of course, a GNSS-based system would not have been faced with these kinds of issues, but would have other issues to deal with, such as the long lead times required to produce hundreds of thousands of new GNSS OBUs. In any case, it should come as no surprise that a toll system launched so hastily could suffer in terms of accuracy, at least in the beginning. In the months after the system was introduced, the Polish press has reported a number of complaints coming from the Transport sector, in particular regarding over-charging. With a project of this size, one can fairly expect a number of "teething troubles".

Admittedly, short implementation times for such large and complex systems are extremely demanding, independent of the technology you deploy. But as this example demonstrates, the use of more established (infrastructure-heavy) tolling technologies is by no means a guarantee that a system can be implemented more quickly than using a modern GNSS system. A very large country to the East of Poland has come to this realization, as you will see in a moment. However, there's perhaps an even more important lesson to be learned in Poland about the consequences of implementing a tolling technology based on roadside infrastructure.




**The Polish experience showed trucks driving on parallel roads to avoid tolls, but the numbers of trucks on the tolled motorways fell considerably**

In Slovakia, tolling all major roads, including parallel roads to motorways, was a piece of cake with GNSS; consequently, traffic diversion is not an issue. In Poland, however, dramatic changes in the behavior of truck traffic were witnessed. As reported by the *Rzeczpospolita* newspaper the number of trucks on the A1 Motorway (from Konin to New Tomysl) fell about 50 per cent, even though there were signs on the parallel route that prohibited vehicles above 18 tons. On the A4 Motorway (from Katowice to Cracow) about 30 per cent of the trucks drove on the parallel roads to avoid the toll fees, while the number of trucks on the A1 Motorway (from Gdansk to Gruduziadz) reportedly fell by 76 per cent.[3]

As a result, many local roads became jammed with large trucks, residential roads are being damaged and the quality of life and safety in these areas is diminished. Imagine, for example, parents' concern about allowing their kids to ride bicycles among all those trucks driving through their neighborhoods.

## FROM THE COUNTRY THAT LAUNCHED THE WORLD'S FIRST SATELLITE

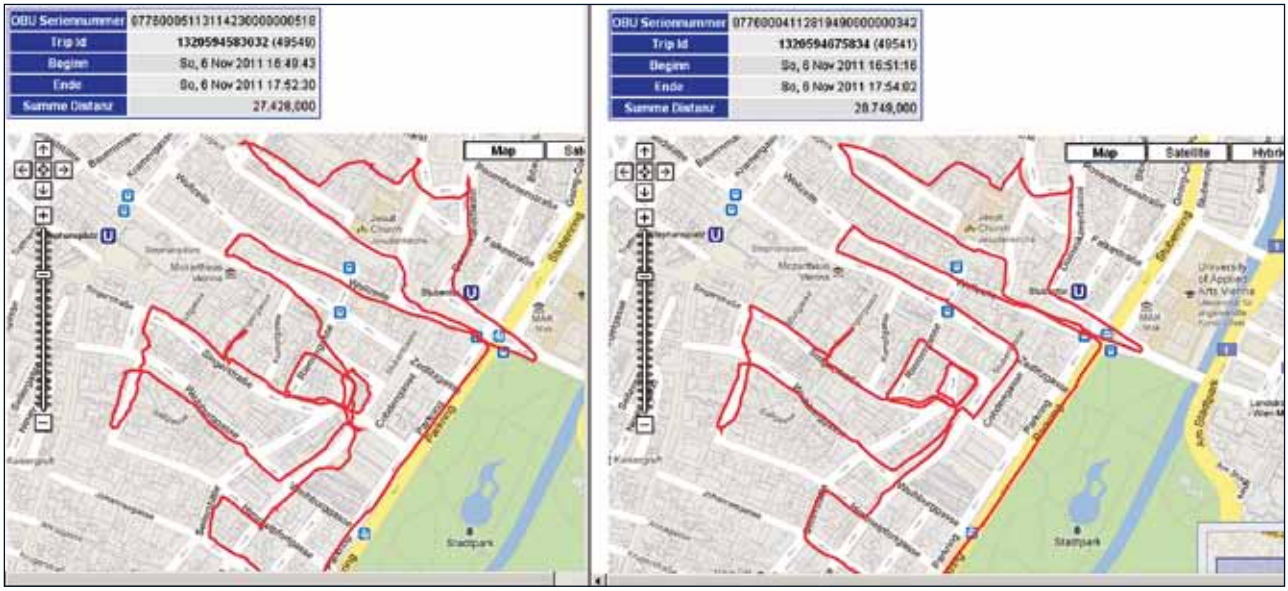
Russia has enjoyed considerable attention in the ITS world lately, and with good reason. I don't just mean the prominently placed cover story in the last issue of *Thinking Highways*. Within the next two years, for example, >>>

2: "Teure Maut-Ausfälle für Kapsch TrafficCom", Wirtschaftsblatt 21.07.2011, Aureliusz M. Pedziwol, http://www.wirtschaftsblatt.at/archiv/teure-maut-ausfaelle-fuer-kapsch-trafficcom-481396/index.do.

3: Rzeczpospolita, E-myto jak za króla Ćwieczka, Piotr Kobalczyk 23-09-2011, http://www.rp.pl/artykul/721343.html?print=tak&p=0.

**FIGURE 2**

**A trip through the center of Vienna's Historical Center with a GPS-only OBU (left) and a GPS/GLONASS OBU (right)**




the Russians will introduce the world's largest emergency breakdown system (called "ERA-GLONASS"). Similar to the European plans for a unified "e-Call", ERA-GLONASS is an Accident Emergency Response System which should save thousands of lives each year on the Russian roads, while at the same time reducing the cost of emergency response and rescue services. By the end of 2013, all new motor vehicles sold in the Russian Federation will be equipped with GLONASS satellite navigation communication devices.

For those of us in the business of tolling, the big news is that Russia also plans to introduce a nationwide truck tolling system by 2013 on all of its 50,000 Federal Roads. Even though a few selected motorways are now being equipped with conventional "Shlagbaum" toll plazas, Russia will be launching a free-flow electronic scheme for trucks, much like the countries in Central Europe mentioned above. You would think that a country of this size – having the largest land area in the world – would be a clear cut case for a GNSS-based system. Indeed, this now appears to be the case, but a year ago there was actually a plan on the table proposing to start with microwave-based DSRC and to migrate to GNSS at a later date. Fortunately, a scientific committee reviewed the proposal favoring microwave technology. Apparently, the revised plan now foresees the use of Russia's state-of-the-art GLONASS (GLObal NAvigation Satellite System) for the tolling system from the very beginning. This will become the largest single electronic tolling system in the world, with about 2 million trucks above 12 tons being tolled on over 50,000 km of roads. In fact, there are yet another half a million kilometer of regional roads which will eventually be considered as becoming part of this GLONASS-based tolling scheme. An extremely ambitious (but also notably realistic) undertaking.

For those of you still unfamiliar with GLONASS, it's worth pointing out that this positioning system is about to take a prominent place alongside GPS and GALILEO (which has yet to finally get off the ground). The latest Apple iPhone 4S now has a combined GPS/GLONASS chipset integrated inside and it's no wonder; the more satellite signals available in your device, the better positioning data you will get. This principle obviously applies to GNSS OBUs as well. Without the use of any special algorithms, an OBU using both GPS and GLONASS signals works remarkably well. Just look at a trip I took on a cold (overcast) November evening through the narrowest streets of Vienna's Altstadt (historic old town). As Figure 2 illustrates, the typical problems of global canyons are clearly visible when using GPS alone (above left). Yet, with a GPS/GLONASS-enabled OBU, a nearly flawless path through those narrow streets can be shown (above right).

So, for a GNSS enthusiast like me, Russia is certainly a very hot place to be for at least these two reasons alone: a landmark satellite-based tolling system and the now commercially available GLONASS technology which can be used for tolling all over the world.

Who knows, maybe this winter I'll indulge in a popular Russian pastime and take a dip in a prorub ("ice-hole"). If I do so, I will take with me the memories of that heavenly (and very warm) swim just before the ITS World Congress in the Atlantic Ocean just south of Cape Canaveral.

**fyi**

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