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Impact Assessment
Annex IV-part 1

Accompanying the document

Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

on measures to reduce the cost of deploying high-speed electronic communications networks

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analysys mason

Final report for
the DG Information Society and Media, European Commission

Support for the preparation of an impact assessment to accompany an EU initiative on reducing the costs of high-speed broadband infrastructure deployment (SMART 2012/0013)

27 September 2012

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1 Executive summary

This document is the Final Report of a project carried out by Analysys Mason Limited ('Analysys Mason') on behalf of the European Commission (DG Information Society and Media) to assess the potential impact of the following five regulatory measures on reducing the cost of deploying high-speed broadband infrastructure across Europe:

- a centralised atlas of passive infrastructure
- mandated access to passive infrastructure
- a one-stop shop on rights of way and administrative procedures
- a database where all planned civil works must be published
- an obligation to equip all new buildings with high-speed Internet (100Mbit/s) as well as mandated open access to the terminating segment.

Background to the project

In its *Digital Agenda for Europe*,[1] the European Commission stated the target that "*Europe needs download rates of 30 Mbps for all of its citizens and at least 50% of European households subscribing to internet connections above 100 Mbps by 2020*."

The costs of deploying high-speed broadband infrastructure can be prohibitive, especially in rural areas, and the Commission is committed to addressing this issue. In the Commission's September 2010 communication, *European Broadband: investing in digitally driven growth*,[2] it announced plans to complete a review of cost reduction practices by 2012. As part of these plans, there is currently an open consultation with a closing date of 20 July 2012, entitled *Public Consultation on an EU Initiative to Reduce the Cost of Rolling Out High Speed Communication Infrastructure in Europe*.[3]

Civil works have been identified as the dominant cost (up to 80%) in infrastructure provision, and three main areas have subsequently been identified for cost reduction, namely: sharing of existing infrastructure, co-deployment of new infrastructure, and planning for infrastructure in new developments. Under these broad areas, the Commission wishes to evaluate the above five categories of measure that can be taken to reduce costs.

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[1] See http://ec.europa.eu/information_society/digital-agenda/index_en.htm

[2] See http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0472:FIN:EN:HTML

[3] See http://ec.europa.eu/information_society/policy/ecomm/library/public_consult/cost_reduction_hsi/index_en.htm

Our approach to the study

To assess the implementation costs and potential savings of each measure, we have considered two European case studies for each measure. In order to compile these case studies and collect the required data for a cost-benefit analysis, we have carried out exhaustive desk research and interviewed national regulatory authorities (NRAs) from ten different European Member States.

Summary of findings

The main findings from our impact assessment of each of these five regulatory measures are:

- **A centralised atlas of passive infrastructure** – Such an atlas could range from being a database that contains information on which infrastructure operators are active in what region (examples of such databases cost less than EUR10 million to implement), to a map that details the exact route of infrastructure as well as details of ownership and capacity for infrastructure sharing (which can cost many tens or hundreds of millions of euros). We believe that this measure could be an enabler of broadband deployment using shared ducts, and potential cost savings would be largely due to a reduction in the initial required investment for deployment; we note that currently duct sharing often takes place without such an atlas. An additional benefit would be the reduction in damage to existing infrastructure during excavation work, which could be between EUR10 million and EUR50 million per annum in some Member States. For this measure, we have considered Infrastrukturatlas in Germany and the mapping projects by the Agentscahp voor Geografische Informatie Vlaanderen (AGIV) in the Flanders region of Belgium as case studies.
- **Mandated access to passive infrastructure** – In many Member States, the incumbent operator is obliged to offer access to its ducts, and in some Member States a further universal access obligation has been placed on all other infrastructure owners. Clearly, the initial cost to the state or national regulatory authority (NRA) of implementing this measure is low. The ongoing cost of maintaining the measure depends on the amount of regulation required and the number of disputes that need to be resolved, though our case studies of Lithuania and Portugal suggest that this cost is low. Estimates of the savings made by sharing ducts range from 29% for a mixture of sharing and self-digging, to 75% if no self-digging is required.
- **A one-stop shop on rights of way and administrative procedures** – This measure is currently rare Europe; however, some Member States have taken steps to simplify the rights of way and administrative procedures process. Our case studies consider the Netherlands and Poland; in both states the NRA has obliged land owners to tolerate telecoms cables being deployed on their land. Again, the cost to the state of implementing this measure is thought to be low, with ongoing costs depending on the number of disputes, which itself is likely to be dependent on the clarity of the legislation. Implementing a one-stop shop is likely to require a centralised database and therefore some investment in IT. We believe that this measure is an enabler of self-deployment (i.e. without the use of shared ducts), and so it is difficult to

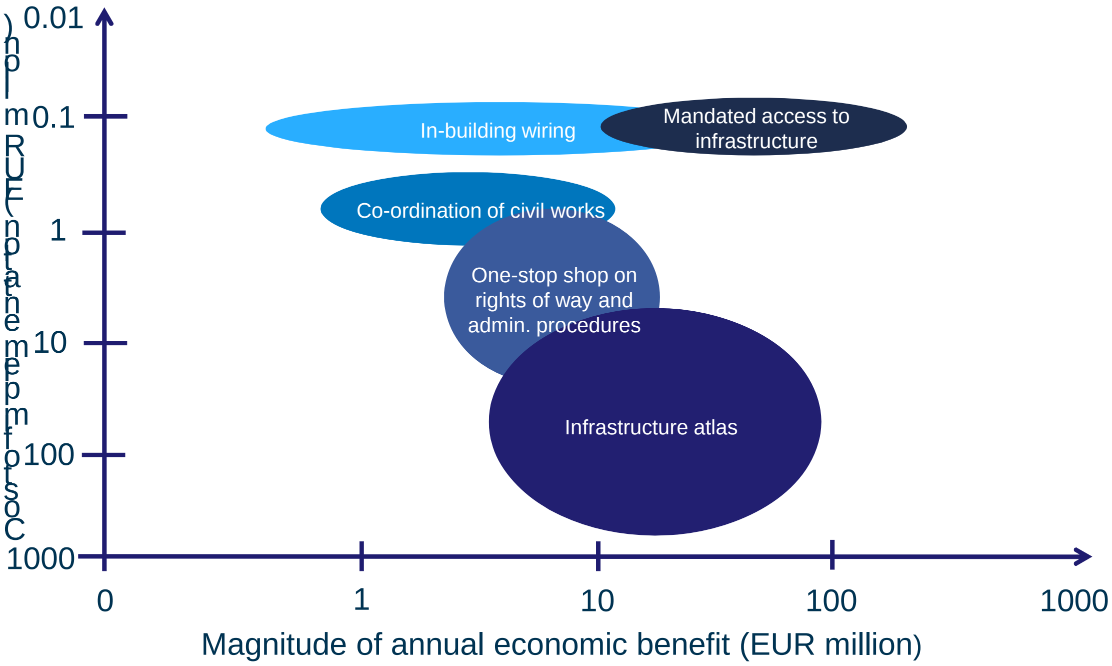
quantify the potential benefits. However, if implemented well, this measure could reduce the administrative burden on operators during the planning phase of network deployment, and could ultimately lead to greater coverage. Time savings accrued in the planning phase could also enable operators to realise revenues more quickly.

- **A database where all planned civil works must be published** – The aim of such a database is to reduce the cost of deployment by sharing the cost of excavation between operators and utility companies. Such costs can constitute as much as 80% of total deployment costs. Our case studies for this measure are Finland, which has implemented a simple web portal to encourage co-deployment, and Sweden, which is currently piloting and investigating a number of possible solutions. Evidence from our cases studies suggests that the cost of implementing these systems can range from a few hundred thousand euros, to the low millions. Estimates of cost savings vary from 15% up to a theoretical high of 60% if four operators are co-deploying. However, implementing such a system creates a number of challenges for operators, and we have examples where co-ordination of civil works could cost the operator more than if it were to deploy it alone.

- **An obligation to equip all new buildings with high-speed Internet (100Mbit/s) as well as mandated open access to the terminating segment** – This measure has been implemented in Spain and France for all new and refurbished buildings. The cost to the CMT (Spain) and ARCEP (France) of implementing this measure has been low, as the costs are principally incurred by the construction sector. Estimates of the cost of installing this wiring in a building during construction vary significantly (up to EUR20 000 for a Western European building containing 20 apartments), although this cost is thought to be small in comparison with the cost of providing utilities, such as water or gas. Additionally, the cost savings of pre-wiring a building during construction compared with fitting wiring retrospectively are thought to be significant (up to 60%). Regulations are also in place in France regarding the shared connection point to the operators' network. The French and Spanish NRAs claim that this measure has led to increased coverage, although the overall benefits may take time to be realised as this measure only applies to new or refurbished buildings.

The cost and overall benefits to an NRA of implementing each of these five regulatory measures is shown in Figure 1.1.

Figure 1.1: Estimate of the cost and overall benefits to an NRA of implementing each of the five regulatory measures [Source: Analysys Mason, 2012]



Conclusions

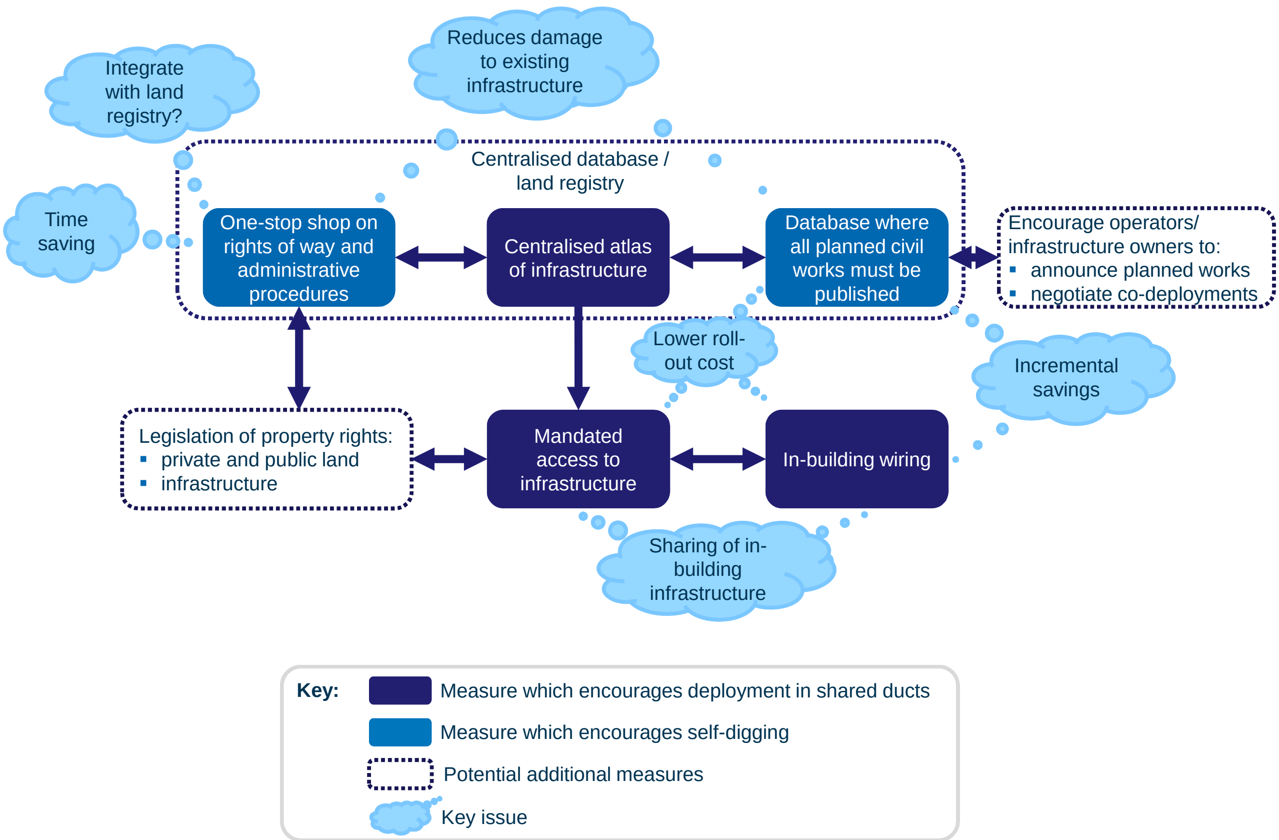
Overall, we estimate that **mandated access to passive infrastructure** is the measure that performs most strongly in a cost–benefit analysis, although experience has shown that it is mainly the ducts owned by incumbent telecoms operators that are the most utilised in next-generation access (NGA) deployments and that EU-level regulation is already in place to enable this. **Co-ordination of civil works** also has the potential to offer significant benefits due to the low costs of implementing this measure.

The cost to an NRA of implementing **in-building wiring** is low, but it may take some time for the benefits to materialise. Implementing a **one-stop shop for rights of way and administrative procedures** is primarily a time-saving measure, and so the economic benefits could be achieved from more rapid NGA deployments, which would in turn enable operators to generate revenues sooner.

A **centralised atlas of passive infrastructure** is an enabler of mandated access to passive infrastructure, but depending on the detail of the mapping, the land area covered and the amount of prior infrastructure knowledge, the costs of implementing such a measure could be extremely high. However, if the additional social and economic benefits of reduced damage to existing infrastructure are taken into account, such a mapping project could be worthwhile.

Furthermore, **these measures are interlinked**, in particular the centralised atlas of passive infrastructure, the one-stop shop on rights of way and administrative procedures, and the database of planned civil works, as shown in Figure 1.2. These measures all require a similar database which could be based around a map-based portal. If implemented in parallel, it is likely that much of the IT implementation costs would overlap between these measures, and the resulting system would enable the implementation of mandated access to passive infrastructure, and thus encourage both deployment in shared ducts and self-deployment.

Figure 1.2: Summary of the effects of the five measures studied [Source: Analysys Mason, 2012]



2 Introduction

The European Commission, DG Information Society and Media ('the EC' or 'the Commission') has commissioned Analysys Mason Limited ('Analysys Mason') to undertake the study *Support for the preparation of an impact assessment to accompany an EU initiative on reducing the costs of high-speed broadband infrastructure deployment* (SMART 2012/0013). The study has assessed the potential impact of the following five regulatory measures on reducing the cost of deploying high-speed broadband infrastructure across Europe:

- a centralised atlas of passive infrastructure
- mandated access to passive infrastructure
- a one-stop shop on rights of way and administrative procedures
- a database where all planned civil works must be published
- an obligation to equip all new and refurbished buildings with high-speed infrastructure.

The EC's Digital Agenda for Europe (DAE) targets aim to achieve 100% coverage at speeds of at least 30Mbit/s and 50% household take-up of at least 100Mbit/s by 2020. In order to achieve these targets**,** Member States are investing heavily to accelerate the deployment of next-generation access (NGA) networks across Europe. Some Member States have a significant challenge ahead in achieving the required coverage, and thus there is significant interest in schemes that have the potential to reduce the cost of NGA roll-out. In those Member States that already have good coverage, lower deployment costs could increase infrastructure competition, which in turn could lead to an increased quality of service and lower retail prices.

It is widely documented[4] that civil works (i.e. digging or trenching) often makes up around 80% of the total deployment costs. Reducing this cost could have a significant and positive impact on the economic viability of some network deployments. In parallel with the Commission's recent consultation on how to reduce the cost of rolling out high-speed communication infrastructure in Europe,[5] this report considers five measures that could potentially reduce the costs associated with civil works. For each measure, we consider two case studies of Member States that have implemented these, or similar, measures. The case studies have been compiled from secondary research based on publicly available information and from interviews with key stakeholders, such as the NRAs in each of the case-study countries.

We have studied each of the proposed regulatory measures in detail, carrying out exhaustive desk research and considering two case studies for each measure. We have interviewed national regulatory authorities (NRAs) in ten different Member States in order to inform our case studies, and to benchmark the implementation costs and ongoing costs of each measure, as well as the potential benefits that they can bring. Based on this information, we have considered which

4 For example, see: http://ec.europa.eu/information_society/activities/broadband/investment/index_en.htm.

5 http://ec.europa.eu/information_society/policy/ecomm/library/public_consult/cost_reduction_hsi/index_en.htm.

measures are the most effective from a cost-benefit perspective, and thus have arrived at a number of conclusions with regards to reducing the cost of NGA deployment in Europe.

The remainder of this report is laid out as follows:

- **Section 3** presents the results of our impact assessment of a centralised atlas of passive infrastructure
- **Section 4** presents the results of our impact assessment of mandated access to passive infrastructure
- **Section 5** presents the results of our impact assessment of a one-stop shop on rights of way and administrative procedures
- **Section** Error! Reference source not found. presents the results of our impact assessment of a database where all planned civil works must be published
- **Section** Error! Reference source not found. presents the results of our impact assessment of high-speed infrastructure for new and refurbished buildings
- **Section** Error! Reference source not found. presents our conclusions

In addition, the following supplementary materials are appended to this report as annexes:

- **Annex A** gives a glossary of terms used in the report
- **Annex B** includes the notes from our interviews with stakeholders.

3 A centralised atlas of passive infrastructure

Definition: A centralised atlas of passive infrastructure is a database to which telecoms operators and other utilities send relevant information on their passive infrastructure, including ducts (e.g. actual availability, conditions for access), to the NRAs (or other responsible bodies). Those bodies would manage such information in a database and provide it only upon request to interested parties (thereby responding to security concerns).

3.1 Background

In many countries, the location and state of current infrastructure, such as underground electricity cables and water pipes, must be requested from the relevant authority or utility company as and when it is required. A number of different bodies may need to be contacted to collate this information, and it may not always be clear which authority is ultimately responsible for recording the data.

There are two principal advantages to a centralised atlas of this passive infrastructure:

- The first advantage is that operators and utility companies that are due to carry out civil works are more likely to be informed about where existing infrastructure is located, and hence are less likely to cause damage to that infrastructure when carrying out their own excavation works for new deployments. The continuous civil disruption because of damage caused in this way was an incentive to implement the measure in the Flanders region of Belgium (see Section 3.3).

- The second advantage is that such an atlas would be an enabler of passive infrastructure sharing, which could significantly reduce the cost of NGA deployment. Operators would be able to find out exactly where existing ducts lie, and may be able to place new cables and fibres within these, rather than carrying out their own excavation works and installing their own ducts, thus saving time, money and reducing unnecessary civil disruption.

Knowing only the location of ducts may not always be sufficient. It is also important to know who owns the duct, the administrative procedures for granting rights of way to the existing infrastructure, and, most significantly, whether the ducts are suitable for the deployment of additional infrastructure (e.g. whether there is sufficient space in a duct for more fibre). Such a detailed system exists in Portugal, with the incumbent telecoms operator’s ducts marked with red, amber or green lights to denote available space.

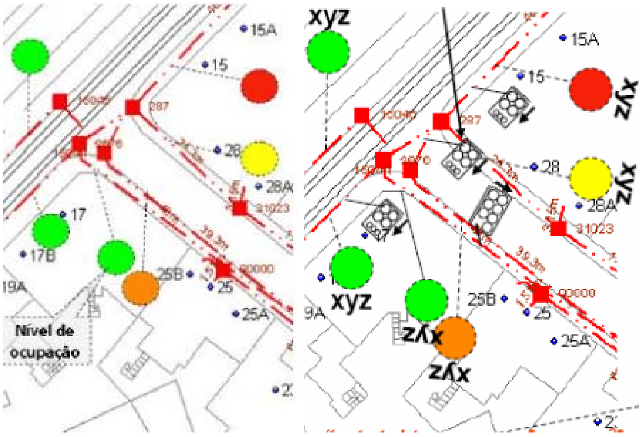


Figure 3.1: Example of Portugal's electronic map of duct locations (CIS), showing available duct capacity with red, amber and green lights [Source: ANACOM][6]

For example, a 2007 study of France Telecom's duct infrastructure conducted by the French NRA ARCEP found that in the sample areas, the proportion of duct segments suitable for installing multiple fibre networks was between 50% and 75%. Similarly, an Analysys Mason study[7] carried out on behalf of Ofcom, the UK's NRA, found that even in ducts where space is theoretically available, it may be unusable due to duct collapse, existing cable cross-over or duct engineering rules (such as regulations to prevent interference issues).

These detailed duct surveys take a considerable amount of time and money to carry out and may cause damage to the ducts. Moreover, it is not always possible to conduct such detailed surveys: a 2009 study by Analysys Mason[8] found that only 42% of planned manhole surveys were successfully carried out, due to complications such as health and safety concerns and flooding.

Whilst telecoms operators may have a good knowledge about the state and capacity of ducts closer to the core network, information about the ducts that are closer to the home is likely to be more limited. Due to the tree-like nature of telecoms networks, the total duct length will increase exponentially as the distance from the core network increases, and thus the survey costs will ramp up accordingly as the survey extends outwards in the network. As part of a study carried out on behalf of the Broadband Stakeholder Group[9] in the UK, Analysys Mason found that the total length of the lines between the cabinet and the distribution point was ten times that of the total length of lines joining the cabinets to the local exchange. (Please refer to Section 3.4.1 for greater detail on the factors that drive the cost of telecoms duct survey programmes.)

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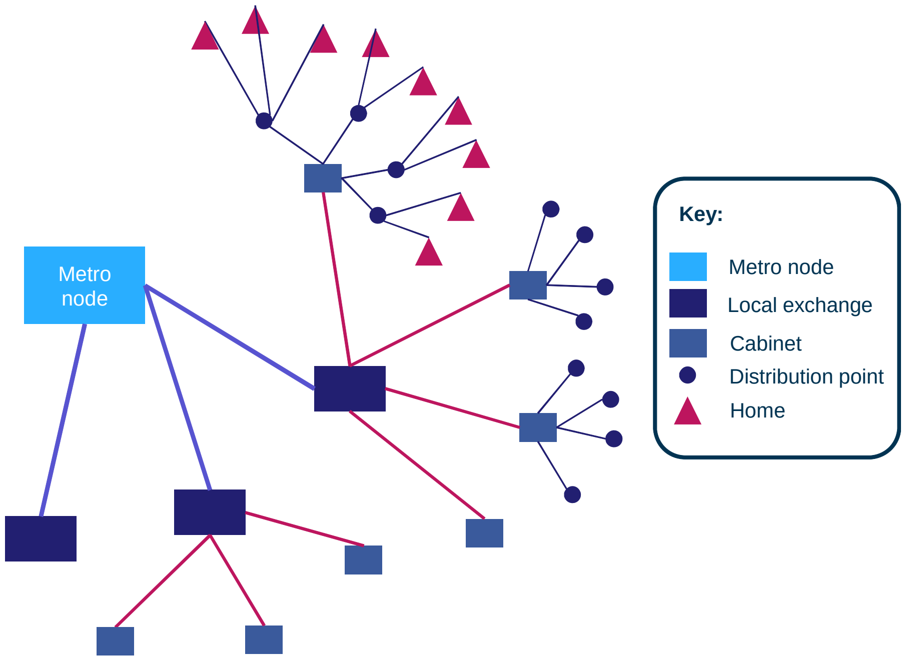
6 http://www.anacom.pt/streaming/RelatorioORAC28outubro2010.pdf?contentId=1057615&field=ATTACHED_FILE.http://www.bipt.be/GetDocument.aspx?forObjectID=3083&lang=en

7 Analysys Mason final report for Ofcom (15 January 2010), *Sample survey of ducts and poles in the UK access network*. Available at http://stakeholders.ofcom.org.uk/binaries/consultations/wla/annexes/duct_pole.pdf.

8 Analysys Mason final report for Ofcom (3 March 2009), *Telecoms infrastructure access – sample survey of duct access.* Available at http://stakeholders.ofcom.org.uk/binaries/telecoms/policy/ductreport.pdf.

9 Analysys Mason final report for the Broadband Stakeholder Group (8 September 2008), *The costs of deploying fibre-based next-generation broadband infrastructure*. Available at http://www.broadbanduk.org/component/option,com_docman/task,doc_view/gid,1036/).

Figure 3.2: Illustration of a tree-like structure of a telecoms network [Source: Analysys Mason, 2012]



Utility companies may have more detailed and accurate knowledge of their deployments than telecoms operators, as the former are more likely to be bound by regulations governing the installation and record-keeping of such infrastructure due to safety concerns (particularly for the gas and electricity sectors). It may therefore be more straightforward to collect geographical deployment information from utility companies, especially if information is already kept in electronic form. An infrastructure atlas could also have the additional benefit of reducing the damage caused to existing infrastructure during excavations works; in fact, this was the key reason for the introduction of such a system in Belgium (see Section 3.3.2).

There are a number of further issues related to this measure, and potential challenges in implementing it:

- How is the information acquired? Possible options include carrying out ground surveys and mandating infrastructure owners to provide the information. Note that in Lithuania, the incumbent operator, TEO, had told the NRA, RRT, that mapping out its entire network would be prohibitively expensive.
- Who is allowed to request information from the atlas? Network data is often treated as commercially sensitive, particularly by telecoms operators, and some companies may not wish to contribute to the atlas voluntarily.
- In Finland, concerns were expressed about the accuracy and detail of current data concerning underground infrastructure locations; for example, there was rarely any information about how deep in the ground the infrastructure is buried.

- Are ducts widely used? In Belgium, historically telecoms cables have often been buried directly in the ground rather than using ducts. Direct burial may be more common in the outer parts of the network, closer to the home, as the operators try to reduce costs when making the final connection between the home and the network. This is commonly seen in the cable networks when connecting between the network buried in the street and the home.

- How much information is already known? Are there other mapping projects in place, such as those addressing the Commission's INSPIRE initiative.[10] If so, do these projects overlap in terms of costs?

In order to consider the different ways in which these issues can be tackled, we have looked for examples in Europe, where attempts have been made to implement such an atlas. These examples are summarised in the table below. Two of these examples – Germany and Belgium – have been selected as detailed case studies for this measure, which are presented in Section 3.2 and Section 3.3, respectively.

Figure 3.3: Examples of countries that have attempted to implement a centralised atlas of passive infrastructure [Source: Analysys Mason, 2012]

Country	Description
Germany	**Case study** – see Section 3.2.
Belgium (Flanders region)	**Case study** – see Section 3.3.
The Netherlands	The Kadaster (Land Registry) is responsible for maintaining the register of cables and infrastructure in the Netherlands, using the KLIC portal. Although not a map as such, this database contains the locations of active infrastructure. Any organisation that wishes to undertake excavation work is mandated by law to check the system to see which operators are active in the area in question. The law and the system are primarily in place to avoid accidents. However, it is envisaged that the system will be further developed into a complete centralised information system to meet the EC's INSPIRE directive over the next few years.
Portugal	ANACOM, the Portuguese NRA, decided in 2009 to implement the Centralised Information System (CIS), a central infrastructure atlas aimed at reducing the cost of deploying new electronic communications equipment. Providing and regularly updating information is mandatory for all organisations that own or operate infrastructure suitable for accommodating electronic communication infrastructure (including roads, railways, water and gas infrastructure). This requirement applies to local authorities, state-owned companies, utility companies, electronic communications companies, and any other bodies that may own relevant infrastructure. It extends further to the incumbent, Portugal Telecom, which must provide information on available space within its ducts.
Poland	Polish operators are mandated to provide information on new deployments annually to the NRA, UKE. However, rather than detailed maps, they are required only to submit the location of nodes and the approximate location of connections between them. According to UKE, many Polish operators have their detailed network

10 Infrastructure for Spatial Information in the European Community – "*an EU initiative to establish an infrastructure for spatial information in Europe that will help to make spatial or geographical information more accessible and interoperable for a wide range of purposes supporting sustainable development*"

Country	Description
	information stored as paper maps rather than in electronic form.
Sweden	There are three separate map-based projects in Sweden. The first is an annual broadband survey in Sweden that maps out which services are available to each home. The second project is inspired by the Infrastrukturatlas and aims to develop a map that shows both existing and planned network deployments, thus to encourage infrastructure sharing and to attract players to deploy in new areas. Finally, there is the dig alert system, Ledningskollen, which is designed to reduce damage to existing infrastructure during construction works. This splits the country into 1km-sided grid squares and provides information to those intending to carry out civil works regarding which infrastructure owners are active in which areas.
UK	The National Joint Utilities Group (NJUG) is a UK organisation that aims to promote best practice for public street civil works. Members include a number of UK water supply and energy companies, as well as Openreach, the local access network provider, and Virgin Media, the UK's largest cable operator. One initiative of the NJUG is to map existing underground assets to create an infrastructure atlas for the UK. In addition to the estimated 1 million kilometres of gas and water mains and sewers, and 500 000 kilometres of electricity cables, NJUG believes there are 2 million kilometres of telecoms cabling, all of which it wishes to map.

3.2 Case study: Germany

3.2.1 Market context

The German broadband market is largely DSL-based. The incumbent operator, Telekom Deutschland, was reported to have 44.7% of total broadband subscribers as of March 2012.

Cable is the most widely available form of NGA, with an estimated footprint of 76% of homes at the end of 2011, whilst DOCSIS3.0 coverage is estimated at 48%. Fibre-to-the-home (FTTH) coverage is thought to be low, although a number of cabinets have been upgraded to fibre, whilst fibre-to-the-cabinet (FTTC) coverage is estimated at around 28% at the end of 2011.

Fixed broadband penetration is just below the average for Western Europe, at 69% of households at the end of 2011, with DSL accounting for the vast majority (84%) of broadband connections. The Commission reports that, at the beginning of 2012, 7.8% of total broadband connections were of between 30Mbit/s and 100Mbit/s, and 0.4% were of 100Mbit/s or higher.

3.2.2 Measure implemented

In 2009, Bundesnetzagentur, the German Federal Network Agency, introduced the Infrastrukturatlas programme to map existing infrastructure that could be used for the deployment of NGA networks. Infrastructure covered includes:

- wired telecoms infrastructure (line profiles of fibre, including cable core networks and last-mile fibre; nodes such as main distribution frames (MDFs) and cabinets; empty telecoms ducts)
- wireless telecoms infrastructure (transceiver sites; fixed links; backhaul to transceiver sites)

- other infrastructure (utilities such as electricity, gas, water and sewers; utility poles, including antenna masts; potential antenna sites on tall buildings; windmills; church towers)
- transport networks (conduits on roads, highways, waterways and railways).

The Infrastrukturatlas framework[11] states that expanding NGA networks is important for the continued growth of the German economy, and that the cost of building fibre networks or radio links can sometimes make expansion economically unviable. The aim of Infrastrukturatlas is thus to reduce both the cost and construction timescale of NGA deployment by exploiting pre-existing infrastructure.

Infrastrukturatlas is being launched in three phases:

- **Phase 1** – In this phase, which was launched in December 2009, only Bundesnetzagentur had direct access to the database, acting as an intermediary between the database, the parties requesting data and those parties providing data. Those parties that wished to request information from the database were required to submit an application to Bundesnetzagentur. Bundesnetzagentur offered information, applications and contracts in PDF form on its website, as well as running an information hotline to cater for interested parties in Infrastrukturatlas.

- **Phase 2** – In this phase, which was launched in October 2011, Infrastrukturatlas has moved towards a system where authorised users are able to access it themselves to some extent, with Bundesnetzagentur releasing excerpts of the database to users as PDF maps, in a maximum resolution of 1:30 000. Infrastructure designated as commercially sensitive is not included in this, and access to the actual database is still reserved for Bundesnetzagentur only.

- **Phase 3** – this phase will be launched in late 2012 and will consist of a web application that will allow authorised users to view mapping information online. Bundesnetzagentur currently has no legal basis to charge a fee for requesting data from Infrastrukturatlas, and this is likely to remain the case for Phase 3.

A drawback of the system is that it does not include information on the suitability of sharing existing infrastructure. Bundesnetzagentur did want to include this information, but due to the lack of standards on duct capacity and the rapid development of infrastructure roll-out, it was decided that the project would have to go ahead without such provisions in place.

Currently, information on infrastructure location is provided to Bundesnetzagentur in electronic form, using the file formats set out in the framework. All data is collected from the infrastructure owners themselves, rather than from new ground surveys, although it is currently voluntary for infrastructure owners to take part. It is envisaged that in the future, infrastructure owners will be mandated to provide location information of their relevant infrastructure via the web application.

11 See: http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/BNetzA/Sachgebiete/Telekommunikation/Infrastruktu ratlas/Phase2/ISA_Rahmenbedingungenpdf.pdf?__blob=publicationFile.

This is because although some bodies have embraced the scheme, some have shown no interest in sharing their infrastructure and thus do not want to provide information as to its whereabouts.

Notwithstanding these challenges, the scheme has been popular, and, as of May 2012:[12]

- 501 infrastructure owners were participating in the scheme
- 91 parties had requested to use the database
- 71 497km^2 of area had been mapped, covering a population of 3.5 million (see Figure 3.4).

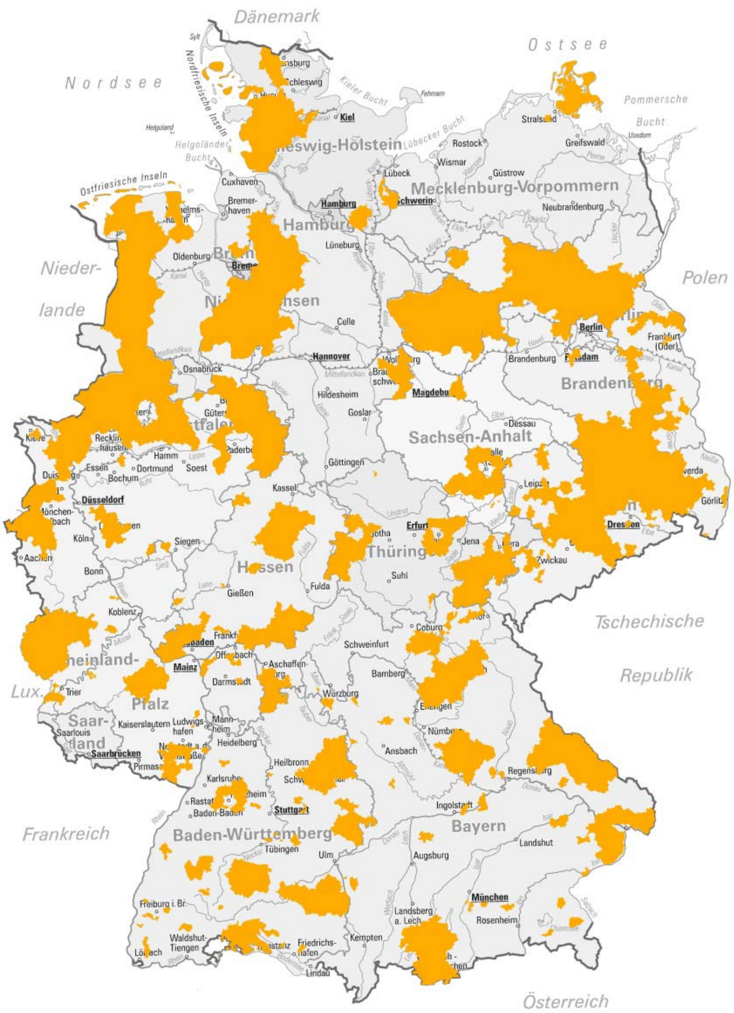


Figure 3.4: Progress of mapping Phase 1 (from December 2009 to September 2011) [Source: Bundesnetzagentur, 2012]

Note: Mapped areas are highlighted in yellow

It is noted that some users waited for Phase 2 of the project to be implemented before registering with the service.

12 Source: http://www.bundesnetzagentur.de/DE/Sachgebiete/Telekommunikation/Infrastrukturatlas/Statistik_ISA_Phase2_Basepage.html.

The project aims to cover the entire Federal Republic of Germany, but no deadline has been given for its completion. With the potential introduction of mandatory reporting in Phase 3, it is possible that the mapping progress will soon become more rapid.

3.2.3 Strengths and weaknesses

Strengths ↑	Weaknesses ↓
• Reduction in administrative/human effort in users requesting data • Potentially a key enabler of duct sharing • No ground surveys are required, which means that costs are kept relatively low for both the NRA and the operators	• High administration effort by the NRA required for collection and processing of data (i.e. the mapping process) • Operators are currently not mandated to provide the locations of their infrastructure, and so the database may be incomplete • Issues related to insurance laws concerning liability in cases of misuse of data • No information on total capacity or available capacity in ducts • May take many years to map the entire country

3.3 Case study: Belgium

3.3.1 Market context

Belgium was one of the first European countries to invest in high-speed broadband, and is one of the pioneers of copper-based NGA. The incumbent operator, Belgacom, has been deploying FTTC/VDSL for many years, and this network was reported to cover at least 81% of households by the end of 2011. Belgacom has also been trialling and deploying vectored VDSL in some areas, which is capable of delivering speeds of up to 100Mbit/s over shorter lines.

Belgium has nearly universal cable coverage (around 89%), and the vast majority of connections have been upgraded to DOCSIS3.0. Partly due to this high-speed availability, at the start of 2012, 28.5% of connections were providing speeds of between 30Mbit/s and 100Mbit/s (although just 1.5% of connections were of 100Mbit/s or higher).

As a result, Belgium has the second-highest broadband penetration in Europe, at an estimated 89% of households at the end of 2011, just behind the Netherlands.

3.3.2 Measure implemented

In 1995, the Flanders region of Belgium implemented a Geographic Information System (GIS) decree, which aimed to create a geographical database of environmental and human factors covering the region. The agency in charge of the project is known as Agentscahp voor Geografische Informatie Vlaanderen (AGIV). In 2009, GIS framework was updated with the Spatial Data Infrastructure (SDI) programme, to bring the project in-line with the Commission's

INSPIRE initiative. This consisted of three decrees, one of which is the Kabel-en Leiding Informatie Portaal (KLIP) decree, which is specifically with regards to cables and conduits.

KLIP was implemented after the Gellingen disaster, which was a large gas explosion in 2009, just one of the estimated 90 daily incidents of cable or infrastructure damage that were occurring in Belgium at the time. As of September of that year, all bodies that own or operate underground cables and pipes are obligated to register with KLIP and provide information on the areas in which they operate within 50 days of the decree being published. Furthermore, any organisations wishing to carry out excavations must submit a planning application electronically using the KLIP interface no more than 40 days in advance of commencement of works, and no fewer than 20. Those companies that do not comply are liable to a fine of between EUR50 and EUR100 000, in addition to those that do not co-operate with the new planning regulations. A small administrative fee is charged for submitting a planning application using the KLIP – in the past, planning applications were slow and complex, requiring often incomplete geographical data to be shared in paper format.

According to AGIV, the KLIP has improved the speed and simplicity of the process. Now, the company that wishes to carry out excavation work logs on to the KLIP. KLIP then contacts the operators of the infrastructure in that area, which then can check if they are affected by the planning application, and, if they are, provide the exact location of their infrastructure.

However, the database is not detailed, and the exact position of the underground wires and cables is not given, nor does it contain any information on dark fibre or empty ducts, as its focus is primarily on preventing accidents caused by excavations rather than for the ease of broadband deployment. A similar system exists in the Walloon and Brussels region (KLIM-CICC), which is linked to the KLIP database, although the KLIP is the more complete of the two.

In addition to, and currently separate from, the KLIP, AGIV has been producing the Large-scale Reference Database (GRB) since 2004, a long-term project that aims to produce an accurate map of underground cables, pipelines and surface features (such as roads and property numbers) of the whole of the Flanders region[13]. This is focused on mapping the locations of passive infrastructure, rather than being a full survey of potential duct capacity. The project is funded by the Flemish Regional Government and the utility companies, which agreed on the need to produce such a map. The project is divided up by region, and stakeholders are able to register their interest in the preliminary phase, before the mapping begins. The database is available online and access is unrestricted to most services.

13 http://www.agiv.be/gis/projecten/?artid=202

Figure 3.5: Illustration of the GRB online portal [Source: AGIV, 2012]

AGIV is currently planning a second phase of the KLIP: Informatie Model Kabels en Leidingen (IMKL). The aim of the project is to completely automate the excavation planning process, using a mapping system; this should have the effect of easing the deployment of NGA infrastructure in third-party owned ducts, as well as encouraging the co-ordination of civil works (see Section **Error! Reference source not found.**). IMKL cannot be implemented until the exact location of underground infrastructure is known, and the GRB database is complete. Thus, it is envisaged that at some point in the future, the GRB project and the KLIP database will be combined, which has the potential to create a complete map-based atlas of passive infrastructure which complies with the EC's INSPIRE directive, as well as providing a one-stop shop on rights of way and administrative procedures.

3.3.3 Strengths and weaknesses

Strengths ↑	Weaknesses ↓
• Gives those operators deploying infrastructure an idea of which other operators are in the area, and therefore an indication of any potential sharing opportunities • There are plans to upgrade the system to a full map-based database • Reduces the likelihood of accidents during construction works, thus reducing the risk of civil disruption	• The database is not currently detailed enough to be a standalone solution in reducing the cost of broadband deployment • The system was expensive to roll out and the costs of running it are high (see Section 3.4.1) • In the past, the incumbent operator, Belgacom, often buried copper cables directly rather than installing ducts, and so there is likely to be limited duct space of interest to operators in the region

3.4 Financial implications

3.4.1 Costs of the measure

Mapping projects are often expensive, with the cost being heavily dependent on the detail and scale of the mapping project implemented, as well as the amount of prior knowledge regarding the location of infrastructure.

Cost to the NRA or government

According to the European Competitive Telecommunications Association (ECTA), the initial budget for the Flanders GIS mapping project ten years ago (i.e. what is now known as the GRB database) was EUR77 million for implementation, in addition to EUR80million spread over 12 years for maintenance. The KLIP database alone cost EUR500 000 to implement and receives funding of EUR250 000 per annum.[14]

Considering the small area and population of the Flanders region, and the fact that the database is not yet detailed enough to be of significant benefit to broadband deployment, the costs of such a project in many areas might be likely to outweigh the benefits. For example, a surface mapping project in Poland which takes a similar approach (GBDOT) is costing ~EUR75 million.

However, in some cases, where there is adequate data on the location and state of infrastructure, such a map could make sense. For example, the Infrastrukturatlas in Germany has cost the NRA an estimated EUR1 million (excluding staff costs and some IT costs). Thus far in 2012, an average of 6.6 members of staff at Bundesnetzagentur have been dedicated to the project, up from 2.2 at the start of the project in 2009. The relatively low costs of implementing the Infrastrukturatlas compared to the AGIV project are because the authorities have simply collected location data from infrastructure owners, rather than undertaking a complete mapping operation. Furthermore, the incremental cost of adding newly constructed infrastructure to the database is likely to be negligible.

In Portugal, the IT systems required for the CIS database implemented by the NRA, ANACOM, have cost in the region of EUR2 million. Here, most operators have adequate data on the geographical routes of their networks and are able to upload this information to the system, and so expensive ground surveys are rarely required.

There are three separate map-based projects in Sweden. The first is an annual broadband survey in Sweden that maps out which services are available to each home. This costs ~EUR60 000 per annum to run, as well as ~300 hours of staff time to carry out tasks such as quality checking. The second project is inspired by the Infrastrukturatlas and aims to develop a map that shows both existing and planned network deployments. This is to encourage infrastructure sharing and also to

[14] http://www.corve.be/docs/english/parlementaire_vraag_egovernment-eng.pdf.

attract players to deploy in new areas. So far, ~EUR75 000 has been spent on software developers over one year to implement the required IT platform. Finally, there is the dig alert system, Ledningskollen (see Section **Error! Reference source not found.**), which is designed to prevent damage to existing infrastructure during construction works; this cost ~EUR1.8 million to implement between 2007 and 2010, and costs EUR600 000 to EUR800 000 per annum to run.

In the Netherlands, the software for the KLIC database costs the Kadaster (land registry) EUR76 000 to procure.[15] This consists of a large-scale map onto which all infrastructure owners are required to upload the location of their assets to (see Section 5.2.2). If errors are found, or unexpected cables are discovered during civil works, the excavator is able to update the database with more accurate information.

However, many of the example projects examined have multiple purposes, for example providing a portal for announcing planned civil works (see Section **Error! Reference source not found.**), or reducing the administrative burden associated with the planning or permit application process (see Section 5). Thus, it is highly likely that some implementation costs would overlap across these different measures, in particular IT costs (which have typically been found to be in the EUR several millions range), and the collection and processing of data, which could amount to many hundreds of staff hours each year.

Cost to the operators

In Germany, the operators are likely to have incurred some administrative costs from gathering and providing information to the NRA, though the exact details of this are unknown. Bundesnetzagentur has tried to minimise this cost by accepting data in a range of electronic formats. Moreover, Bundesnetzagentur does not charge operators for requesting information from the database as it is a non-for-profit organisation and has no legal basis to charge for the service.

In contrast, in the Netherlands, each request to the KLIC database costs EUR21.50, generating annual revenues of around EUR10 million. As with Bundesnetzagentur, the Kadaster is a non-for-profit organisation and thus uses this income to cover costs and reinvest in the system.

In Portugal, the incumbent operator, Portugal Telecom, is required to provide information on the available capacity of a duct using a red-amber-green system. To determine this availability, duct surveys are carried out when another operator has expressed an interest, this other operator must pay a one-off survey fee for this service, thus minimising the cost incurred by Portugal Telecom, or indeed ANACOM. These survey costs are set by Portugal Telecom's regulated duct reference offer, and amount to EUR69 per application, in addition to any additional costs incurred, such as construction costs.[16]

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15 However, due to complications with the tendering process, the Kadaster had to pay out EUR10 million in compensation to other software procurement firms (see http://www.binnenlandsbestuur.nl/digitaal-besturen/nieuws/foute-aanbesteding-kost-kadaster-10-miljoen.3519485.lynkx)

16 http://ptwholesale.telecom.pt/GSW/PT/Canais/ProdutosServicos/OfertasReferencia/ORAC/ORAC.htm

Cost of surveys

As the cost of implementing an infrastructure atlas is largely dependent on the detail of the data included in the database, it might make sense in some Member States to implement such a measure using a two-phase approach. The first phase could contain geographical information of existing passive infrastructure, populated by requesting the information from the operators and utility companies; this could be similar to Infrastrukturatlas, and may cost EUR several million to implement. The second phase may provide more detailed information about the (likely) shareability of each duct, from the results of a ground survey; this could be similar to projects in Poland and cost EUR hundreds of millions to implement, depending on the geographical extent of the infrastructure mapped and the number of different types of infrastructure covered.

The advantage of this approach is that it might be possible to implement the first phase fairly quickly and at a reasonable cost to the NRA, assuming the information is readily available from operators and utility companies and no surveys are required. This might allow telecoms operators to identify expansion opportunities that they did not originally believe to be economically viable. It would also have the advantage of reducing damage to existing infrastructure during civil works, as previously mentioned, as well as increasing the opportunity for the co-ordination of civil works (see Section **Error! Reference source not found.**).

However, operators are likely to favour the wait-and-see approach if they are aware that a more detailed database is being developed. Commencing a deployment with the knowledge of duct locations but no knowledge of duct shareability would be extremely risky to operators, and they are likely to be reluctant to do so. Also, as previously mentioned, the amount of information available on existing telecoms ducts is likely to decrease as the distance from the exchange increases. The majority of the cost of deployment is likely to lie in this area, as the total length of lines increases due to the tree-like structure of a telecoms network. If little information is known, this first phase may do little to reduce the risk of operators considering new deployments. If the second phase were to be implemented, it would be very costly to survey these areas, as the total length of the network could increase by ten-fold at each stage outward (see Section 3.1).

To put this into perspective, we have estimated the cost of undertaking duct surveys of BT's network in the UK, based on Analysys Mason's experience in this area. Our calculations suggest that carrying out a nationwide inspection survey of the ducts joining local exchanges to cabinets would cost around EUR7.9 million. This would rise dramatically to ~EUR495 million if the survey were to be extended to cover the rest of the network between the cabinet and the home. The results of our calculations for different coverage areas are shown in the table below.

Figure 3.6: Estimate of costs for performing detailed duct surveys of BT's infrastructure in the UK [Source: Analysys Mason, 2012]

Coverage area (percentage of homes, in order of density)	Cost of surveying between the local exchange and the cabinets	Cost of surveying the complete access network
25%	~EUR5 million	~EUR95 million
50%	~EUR7 million	~EUR160 million
75%	~EUR11 million	~EUR250 million
100%	~EUR33 million	~EUR495 million

The results show that the majority of the cost is incurred in surveying the most rural 25% of ducts, which are furthest away from the exchange. In terms of coverage expansion, in most Member States, it may only be necessary to map out certain areas on the edge of economic viability, so a universal survey programme could be an unnecessary expense. Our calculations are based on the following assumptions:

- There are 145 000 manholes between the exchange and the cabinet, and 4.2 million footway boxes between the cabinet and the customers' premises in the UK.
- It costs EUR225 to survey a manhole and EUR110 to survey a footway box.
- The cost estimates are based on our experience of completing surveys in the UK of infrastructure from the exchange to the cabinet[17] and from the cabinet to the customers' premises.[18] However, the sample sizes in our surveys were relatively small (0.02% of chambers and 0.013% of total chambers / 0.008% of total poles respectively). It is likely that unit costs can be reduced if surveys are carried out on a larger scale.
- However, it should be noted that, in some case, it is likely that additional certified personnel may be required to remove residual gas from manholes, which would significantly increase the cost of an inspection.

Only the cost of inspecting the incumbent operator's telecoms duct network is considered; including multiple types of infrastructure would increase the costs considerably, as additional surveys would be required. However, as illustrated with the case of the UK shown in the table below, telecoms equipment is often the furthest deployed type of infrastructure.

Type of infrastructure	Length
BT / other telecoms	2 000 000
Electrical cables	482 000
Water mains	396 000
Sewers	353 000

Figure 3.7: Amount of underground infrastructure deployed in the UK [Source: The Off-highway Plant and

17 "Telecoms infrastructure access – sample survey of duct access" (Analysys Mason, March 2009).

18 "Sample survey of ducts and poles in the UK" (Analysys Mason, January 2010).

Gas mains	275 000	*Equipment, 2012]*

A number of factors determine the cost and implementation time of these surveys, and in some cases the problems encountered will make it impossible to even conduct the survey:

Restrictions by authorities

- **Traffic-sensitive areas** – it may be difficult to obtain the correct permits to access chambers located in traffic-sensitive areas. In some cases, authorities require significant notice in order to grant permission, prolonging the survey programme and increasing the cost of the project.
- **Special event restrictions**– some chambers may be located in areas restricted by the council due to special events, such as Christmas parking embargos, religious festivals and street parties, preventing access to whole areas of the network.

Health and safety issues

- **Sewage** – Analysys Mason has experience of some chambers being inaccessible for health and safety reasons due to the presence of sewage. This was because the chambers had been completely flooded, and the sewage network had spilled into the telecoms infrastructure network. It is difficult to mitigate this risk, as it cannot be predicted.
- **Deep manholes** – some access chambers may be very deep, requiring a surveyor to take extra safety precautions, causing time delays and potential disruption to the programme.
- **Residual gas** – some access chambers may contain a high level of residual gas, causing the chamber to be an unsafe place of work and making a survey difficult or impossible. It is difficult to mitigate this risk as it cannot be predicted.
- **Accuracy of infrastructure drawings** – it is possible that some operators' drawings may be out of date, and hence may not be accurate. These inaccuracies can lead to time delays, programme disruption and possibly inaccurate surveys.

Access issues

- **Hazardous objects placed on the top of chambers** – it is possible that manhole covers could be blocked by objects such as scaffolding and parked cars, making the chambers inaccessible.
- **Overgrown vegetation** – particularly in rural areas, chambers may be overgrown, leading to time delays, and programme disruption.
- **Chambers located in dense pedestrian areas** – working in chambers that are located under busy pavements, for example at pedestrian crossings, may cause an unacceptable level of congestion, as well as the potential for injury to pedestrians.
- **High cable density in chambers** – in heavily loaded chambers, the

survey of ducts and cables can be challenging, and less accurate, due to the general congestion and complexity of cable and duct arrangements.

Other issues

- **Climatic conditions** – heavy rain during a survey may result in the need for extensive pumping of chambers and manholes, leading to significant delays, and programme disruption. Analysys Mason has experience of chambers being completely flooded, making it impractical to drain the water out of them.
- **Issues relating to the surveying of poles** – these issues may include trees obstructing poles; access to the pole itself; fragile roofs; nearby overhead power lines; lower parts of poles being subject to vandalism.

Summary of costs

(EUR millions)	Implementation cost		Ongoing costs	
Member State	NRA	Operator	NRA	Operator
Belgium	77 (0.5 for KLIP)	Unknown	~7 (0.25 for KLIP)	Unknown
Germany	1	Low	Unknown	Low
Netherlands	0.076	Low	Unknown	Unknown
Portugal	2	Low	Unknown	Unknown
Poland	75	Unknown	Unknown	Unknown
Sweden	0.075 – 1.8	Unknown	0.006 – 0.08	Unknown

3.4.2 Savings from implementing the measure

A centralised atlas of passive infrastructure is an enabler of passive infrastructure sharing, and thus the cost savings associated with this measure relate to the reduced civil works required to deploy NGA networks due to duct sharing. This is quantified in Section 4.4.2.

Moreover, such a measure may have the potential to allow more infrastructure sharing than would normally be realised, and thus have the additional benefit of driving out coverage to areas that would otherwise be economically unviable.

AGIV's KLIP database has also had the benefit of significantly reducing the administrative burden related to the planning process prior to civil works taking place (this is considered in greater detail in Section 5). AGIV estimates that the system saves the authorities and the operators a combined EUR29.5 million per annum[19] in administrative and planning expenses alone.

A further benefit of such an infrastructure map would be the reduction in damage to existing cables and infrastructure during civil works; in some cases this was the main reason for implementation of

19 http://www.agiv.be/gis/organisatie/?artid=587.

such a system. In Flanders, for instance, there were around 30 000 incidents per annum of existing infrastructure being damaged. This figure was even higher in the Netherlands, at around 40 000 incidents per annum, which equates to EUR40 million and EUR80 million in direct and indirect losses, respectively. In Sweden, one infrastructure owner has reported that incidents involving its network have reduced from 8–12 occurrences per annum to around 2 since the introduction of the Swedish dig alert system Ledningskollen (see Section **Error! Reference source not found.**). Sweden's NRA plans to collect more extensive data regarding the impact on damage to infrastructure in the near future.

It is therefore possible that the cost savings from damage to existing infrastructure alone could equate the cost of implementing an infrastructure atlas in perhaps two to three years. According to the Kadaster, in the initial years of the KLIC database in the Netherlands, overall damage to existing infrastructure was down by around 10% per annum, but this trend was broken in 2011 with a slight increase in incidents, possibly due to excavators showing less care as they attempt to cut costs. In Belgium, insurers have reported an annual decline of 3– 5% in damages to cables and pipes since the introduction of KLIP in 2007.

3.5 Summary

- In Germany, a database is being developed that aims to map out all passive infrastructure deployments in the country, and eventually make an atlas available via an online portal for registered users (such as telecoms operators and utility companies). In the Flanders region of Belgium, a less detailed database exists that provides information about which infrastructure owners are active in what area, and a more detailed mapping project is also currently underway.

- The main benefit of implementing a centralised atlas of passive infrastructure is that such a measure is an enabler of passive infrastructure sharing, which could lead to significantly lower deployment costs and also increased NGA coverage (see Section 4).

- As well as this, experience suggests that such an atlas can lead to a reduction in the amount of damage caused to existing cables and pipelines when new civil works are carried out. Although quantitative data is fairly limited regarding how much these savings can amount to, it is conceivable that it could be as much as tens of millions of Euros in some Member States, in addition to the related potential improvements in health and safety.

- In many cases, the cost of these mapping projects is high, and in some cases could be prohibitive. For the system to be complete, it would also need to include information on the available capacity within ducts – which is sometimes unknown – and ground surveys. However, to investigate these properties would add further cost. Additionally, there are issues with the information on infrastructure locations being commercially sensitive, and in Germany there have been legal concerns about the misuse of the system.

- In some cases, however, the cost to the NRA is relatively low in Member States where operators have kept electronic records of infrastructure locations, and can easily provide that data to the NRA for a central database. Additionally, implementing a system that only adds information on the potential duct capacity for sharing when a detailed survey has been requested and paid-for by an interested party could also help to minimise costs.

4 Mandated access to passive infrastructure

Definition: Mandated access to passive infrastructure involves telecoms operators and other utility companies being obliged to open up their passive infrastructure for access by interested operators, where technically feasible, and under reasonable and non-discriminatory conditions. In addition, a dispute settlement mechanism could be foreseen.

4.1 Background

As discussed in Section 3.1, allowing telecoms operators to deploy new NGA infrastructure such as fibre and cables in existing ducts owned by third parties reduces the amount of excavation work required, and results in initial time and cost savings, as well as reduced civil disruption. It may also allow some deployments that would normally have a challenging business case to become economically viable, due to the associated cost savings; this is normally of particular importance in areas of low population density.

Historically, the majority of infrastructure sharing has been based on private agreements between companies, or the use of infrastructure made available by public organisations. However, there has been a growing trend across Europe of mandating infrastructure owners to allow access to telecoms operators for the purpose of broadband deployment.

Examples include European NRAs mandating telecoms operators that are deemed to have significant market power (SMP) to open up their ducts to smaller, competing alternative telecoms operators (altnets), resulting in asymmetric regulation. Examples of this include, but are not limited to, Telefónica (Spain), Portugal Telecom (Portugal), Telekom Slovenije (Slovenia), Deutsche Telekom (Germany), BT (UK) and France Telecom (France). It is much rarer for altnets or cable operators being mandated to share their ducts as well (symmetric regulations) – in the Netherlands, for example, alternative operators have so far been unsuccessful in their lobbying to gain access to the extensive cable infrastructure of UPC and Ziggo.

Regulating prices and dealing with anti-competitive behaviour is a potential challenge for this measure; sharing must be made attractive without putting the infrastructure owner at a disadvantage. In many cases, cost-oriented or benchmarked prices are imposed by the NRA. In Italy, for example, the incumbent operator, Telecom Italia, must provide wholesale access to its ducts at cost-oriented prices, which are monitored by the NRA, AGCOM.

It is typically much more difficult to oblige non-telecoms operators to open up their ducts to telecoms operators, as in most countries the NRA will not have the authority to do this, and thus new government legislation may have to be drafted to implement such measures. In addition, it may also be inappropriate for the NRA to regulate the access, as this is likely to be outside the NRA’s area of expertise (for example, attempting to impose cost-oriented prices on a gas utility provider).

There are a number of further issues related to this measure, and potential challenges in implementing it:

- What business interest is created for utility companies? For utility companies that do not currently share their infrastructure, are the potential revenues from duct sharing adequate compensation for the effort associated with opening up their ducts to telecoms operators? For those utility companies that currently allow sharing, would a change in legislation affect the business case for sharing (e.g. if they were obliged to move from charging retail prices for duct rental to cost-oriented prices)?

- Is it possible that one operator or infrastructure provider has the most sought-after ducts? If so, is there a risk of the duct becoming full? When does the duct become so full that it causes inconvenience for the duct owner? Are there potential safety implications?

- How much scope is there for increasing the footprint of the NGA network using shared ducts? Or is it more likely to be a driver for creating infrastructure competition in areas which are already covered?

- Is much information known about the location and shareability of existing infrastructure? If not, will this make sharing difficult? Will a programme of duct surveys therefore be necessary? If so, these costs could be significant and should not be overlooked (see Section 3.4.1).

In order to consider the different ways in which these issues can be tackled, we have looked for examples in Europe, where attempts have been made to implement such a measure. These examples are summarised in the table below. Two of these examples – Lithuania and Portugal – have been selected as detailed case studies for this measure, which are presented in Section 4.2 and Section 4.3, respectively.

Figure 4.1: Examples of countries that have attempted to implement mandated access to passive infrastructure [Source: Analysys Mason, 2012]

Country	Description
Lithuania	**Case study** – see Section 4.2.
Portugal	**Case study** – see Section 4.3.
Germany	Legislation is currently being put in place that obliges public utility companies to provide access to their infrastructure upon request. Steps are also being taken to apply similar measures to all owners of relevant infrastructure, including private utility companies. It is envisaged that an arbitration process will be put in place to settle any disputes that arise.
The Netherlands	Third parties in the Netherlands are mandated to share their networks with telecoms operators when requested, provided this is technically feasible.

4.2 Case study: Lithuania

4.2.1 Market context

In Lithuania, FTTH coverage reaches an estimated 60% of households, and cable coverage was greater than 76% at the end of 2011. The incumbent, TEO, dominates the broadband market, with a 50.1% market share. TEO operates both a copper-based ADSL network as well as an FTTH network, with an estimated coverage of 57% of households in 50 towns and cities[20] at the end of 2011.

According to the Lithuanian NRA, the Communications Regulatory Authority (RRT), overall, broadband penetration stood at 30.9% of households at the end of 2011. FTTH accounted for 50% of all broadband connections. As a result, Lithuania has one of the highest levels of high-speed broadband take-up in Europe – according to the Commission, at the start of 2012, 30.6% of connections were between 30Mbit/s and 100Mbit/s, and 9.4% were faster than 100Mbit/s.

For historical reasons, there are more than 100 Internet service providers in Lithuania, and according to RRT, a distinguishing feature that almost all of these providers have their own networks. This has resulted in both intense service-based and infrastructure-based competition amongst the ISPs, especially in the larger cities.

4.2.2 Measure implemented

Lithuania has been successful in promoting infrastructure-based competition, and RRT, claims that this is largely due to mandated duct sharing between operators as well as other non-telecoms infrastructure operators. Compulsory sharing of all passive infrastructure was introduced in 2004, and detailed regulation on the construction of network infrastructure and infrastructure sharing was introduced in 2005.

In 2009 two complaints were registered with the RRT regarding TEO making the technical inspections of its ducts difficult, failing to provide adequate information to other operators, and attempting to raise duct rentals. Also in 2009, the RRT commenced a market analysis exercise of wholesale physical network infrastructure access, taking into account these complaints. As a result of this market analysis, a second level of regulation was introduced in November 2011 that places a more asymmetric obligation on TEO, as an operator deemed to have SMP. These additional measures allow RRT to regulate the operational problems that the previous complaints had referred to, as well as allowing it to regulate other infrastructure sharing issues such as access pricing (see Figure 4.2).

20 According to TeleGeography.

Figure 4.2: Standard prices for access to TEO's ducts [Source: TEO, RRT, 2010]

Cost item	Standard prices (excl. VAT, as of April 2010)
The one-off charge for investigating technical conditions of space in ducts and providing information, where the length of the ducts is up to 1km	LTL560 (~EUR160)
The one-off charge for investigating technical conditions for the lease of space in ducts and providing information, where the length of the ducts is more than 1km	LTL0.56 per metre (~EUR0.16)
The monthly charge for the leasing of space in 1km of ducts (when renting over 50 km discounts scheme applies)	LTL100 (~EUR30)

The prices charged by other operators and by non-telecoms infrastructure companies are not strictly regulated and so parties are free to negotiate a suitable price on a case-by-case basis. However, if two telecoms companies fail to reach an agreement and a dispute ensues, RRT has the competence to decide on a suitable price in the context of the dispute; this could be a cost-oriented price, for example. As RRT is not responsible for regulating non-telecoms companies, if another infrastructure company becomes involved in a dispute, the case will be escalated to the courts. However, in such a case, RRT can still participate in the process and provide its conclusions to the court. It claims that it is willing to attend these court hearings with the aim of ensuring the development of consistent judicial practice; it also publishes the final decisions on its website, in order to make clear any rulings and discourage any potential future disputes.

Whilst the direct regulation of non-telecoms infrastructure companies does not fall within the competence of RRT, its role is to provide clarifications on the common infrastructure sharing framework to these companies – for example, if an infrastructure provider has doubts about whether it has to provide access to a telecoms operator, it may contact RRT, which will clarify the situation.

There are a number of key areas of legislation which, from its experience thus far, RRT believes are key to ensuring that the obligations to share infrastructure are explicit, and thus keep disputes to a minimum:

- With regards to sharing of existing ducts, the key considerations are:
  - a clear methodology for the calculation of free space within a duct
  - a clear and exhaustive list of acceptable reasons for a duct owner being allowed to refuse access to its ducts
  - a precise administrative procedure for how ducts can be surveyed/ investigated, and deciding whether access should be granted or not
  - a procedure/methodology in place regarding how prices should be set in the case of a dispute.
- With regards to the construction of new ducts, the key considerations are:
  - a clear definition of the required size of inlets installed at the connection point to apartment blocks
  - a clear definition of the size of the technical distribution room within apartment blocks

– an obligation to install ducts of a minimum diameter leading into apartment blocks.

The second set of regulations overlap to some extent with the measures regarding high-speed infrastructure for new and refurbished buildings. As explained in Section **Error! Reference source not found.**, having pre-installed ducts that are suitable for sharing can significantly reduce the cost of covering an apartment block with NGA.

When deploying new telecoms networks, existing telecoms ducts (normally belonging to TEO) are considered as a priority as the reference offers and the procedures are already in place. According to RTT's 2010 report,[21] of the 655 098km of ducts on the market, 97.8% was owned by TEO, implying that alternative operators have not had the need to build their own ducts. In addition, by 1Q 2009, 78 of the 160 electronic network and service providers in Lithuania were using the duct access scheme, with TEO being the main provider of duct access, in addition to ISPs, cable TV operators, dark fibre providers and utility companies.[22]

With mandated access to passive infrastructure having been in place since 2004, historically Lithuanian alternative operators had the option of either adopting a business model based on local loop unbundling (LLU), or deploying its own fibre in existing ducts. The latter option was perceived as simpler, as it would limit the ultimate dependence on the incumbent operator, and may have been slightly cheaper to implement. Mandated access to passive infrastructure therefore allowed alternative operators to plan and deploy their networks extremely quickly, with these altnets being responsible for nearly all of the FTTx build initially. Three to five years later, the incumbent became under pressure from this competition and was forced to before deploy its own NGA infrastructure; this is illustrated in Figure 4.3. This is a characteristic of the market that is less commonly seen in Western European countries, where often it is the incumbent that is generally more advanced than the alternative operators.

21 Source: http://www.rrt.lt/en/reviews-and-reports/lithuanian-communications-sector.html.

22 Source: http://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CE4QFjAA&url=http%3A%2F%2Fwww.rrt.lt%2Frrt%2Fdownload%2F11247%2F4_shared_use_natalija.ppt%3D&ei=l44GUKnQK6On4gSg-JGbCQ&usg=AFQjCNEmuvqBeK3iXxOHBN5fHgeY_4U7Ww

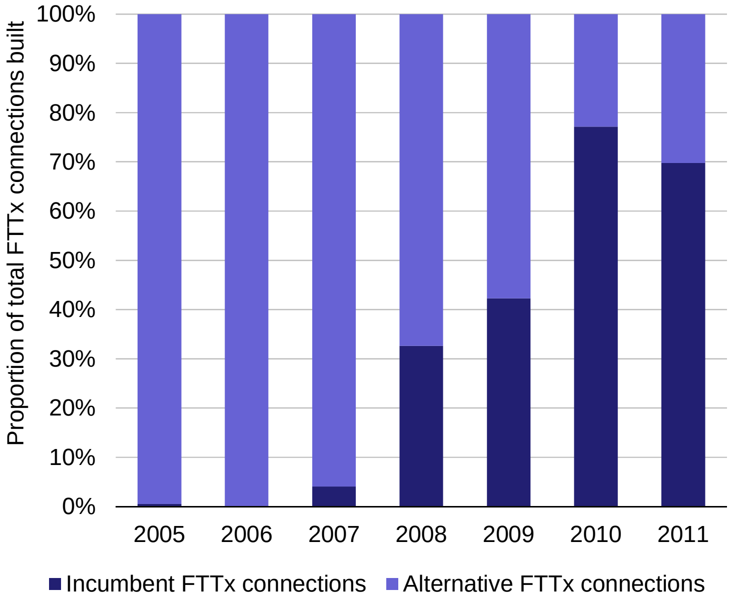


Figure 4.3: Evolution of breakdown of FTTx deployment by operator type in Lithuania [Source: RRT[23], 2012]

It is, however, accepted that space in incumbent-owned telecoms ducts is limited, and there is likely to be more demand for space within other infrastructure deployments such as electricity ducts (where regulations for the technical specifications for fibre deployment already exist) and heating pipes (which are normally deployed in large, manhole-like ducts, and so there is plenty of room for fibre deployments).

A further regulation was introduced in 2009, following a consultation in that year, to address the problem of each operator carrying out excavation work in order to lay cables, often to connect an MDU to its NGA network. To save money, operators often directly buried fibre into the ground, rather than deploying ducts, which led to increased costs and civil disruption due to unnecessary excavation work. The consultation resulted in a more detailed regulation on the construction of network infrastructure, with all new deployments that connect to MDUs being located within a duct, of a minimum diameter of 90mm, in order to accommodate other operators. The operators embraced the new regulations, as the cost of the continual digging was onerous.

One challenge that the system has faced is the difficulty in generating business interest from utility companies. RRT says that duct rental prices are relatively low, and so duct rental revenues are relatively small in comparison with the revenues that infrastructure operators receive from their core business. It is therefore of little interest to these companies in focusing much business attention on renting ducts out to operators. This has not been a significant problem in Lithuania, due to the universal access obligation. On this basis, RRT recommends that if this were to be extended throughout Europe, access would need to be mandatory for public utility companies, and private companies should be made aware of other potential benefits, such as the possibility of telecoms operators agreeing to clean and maintain their rented ducts.

23 Presentation to the Digital Agenda Assembly by RRT, 21-22 June 2012.

4.2.3 Strengths and weaknesses

Strengths ↑	Weaknesses ↓
• Low cost of implementation to the government, the NRA or the operator • Has made many NGA deployments economically viable, which has led to Lithuania having some of the highest NGA coverage in Europe • Mandated duct access has led to good infrastructure-based competition, which has led to the NRA being able to regulate the market more lightly than in some other European countries	• Disputes do still occur, which result in time being spent by the NRA and the operator • Little business interest on behalf of non-telecoms infrastructure companies; they often do not see the benefits • Costs could be incurred by the operator seeking use of the shared duct, for example if it needs to pay for a duct survey

4.3 Case study: Portugal

4.3.1 Market context

Historically, the Portuguese broadband market has been underdeveloped compared to other Western European countries, particularly in terms of penetration. This led the Portuguese government in 2008 to create a EUR800 million credit facility for the roll-out of NGA infrastructure[24]. This was supplemented with funding provided by the leading telecoms players to bring the total investment to just under EUR2 billion. Partially as a result of this, at the end of 2011, Portugal had extensive NGA coverage due to a large cable footprint (covering an estimated 87% of households) and an expansive FTTH network (covering an estimated 58% of households). The majority of FTTH roll-out is by the incumbent, Portugal Telecom (PT), which had a market share of 50% as of March 2012.

Overall, broadband penetration in Portugal stood at 60% of households at the end of 2011, which is still one of the lowest in Western Europe: 35% of broadband connections were cable, and 10% were FTTC. Furthermore, the Commission reports that, at the start of 2012, 12.3% of connections were between 30Mbit/s and 100Mbit/s, and 1.3% were 100Mbit/s or higher.

The pay-TV market in Portugal is well developed. PT and the two main cable operators (which together account for 89.8% of the broadband market) offer a comprehensive portfolio of IPTV and/or cable TV services, often as part of a double or triple-play option.

4.3.2 Measure implemented

The history of duct sharing in Portugal dates back to 1991, when PT was obliged to allow one of its rivals, a cable company, to deploy its network in PT's ducts. Since then, PT has been obliged to allow access to its duct and pole network, and, in 2009, the NRA, ANACOM, extended this ruling

24 Source: Telegeography

on duct access to all operators and public utility companies. These rulings were passed as Decree-Law 123/2009[25] and Law 32/2009.[26]

The laws state that all existing ducts that are suitable for the provision of electronic communications networks must be made available to operators. This includes:

- infrastructure owned by the state, local authorities and Autonomous Regions
- infrastructure owned by entities under the supervision of the state, local authorities and Autonomous Regions
- public infrastructure and utility companies such as water, gas, transport and sewerage companies, as well as roads, railways and ports.

Access to these ducts is defined as the owner making available physical infrastructures such as buildings, ducts, masts, inspection chambers, manholes and cabinets for the purpose of the accommodation, setting up and removal, and maintenance of electronic communications transmission systems, equipment and resources. The cost of access varies depending on who owns the infrastructure. For example, ANACOM, the Portuguese NRA, sets the prices for access to local authority-owned infrastructure, whilst electronic communication companies must charge each other cost-oriented prices. This is to take into account the cost incurred by operators for setting up sharable infrastructure, whilst maintaining transparent and non-discriminatory prices. Infrastructure owners must justify to ANACOM that their prices are reasonable, although this has caused some difficulty in the regulation of smaller players and non-telecoms operators, as it can sometimes be difficult for ANACOM to confirm if the prices are reasonable or not.

PT has a comprehensive and regulated reference offer in place; some of the access prices included in its reference offer are shown in the table below.

Figure 4.4: Extract from PT's duct reference offer [Source: PT, 2012]

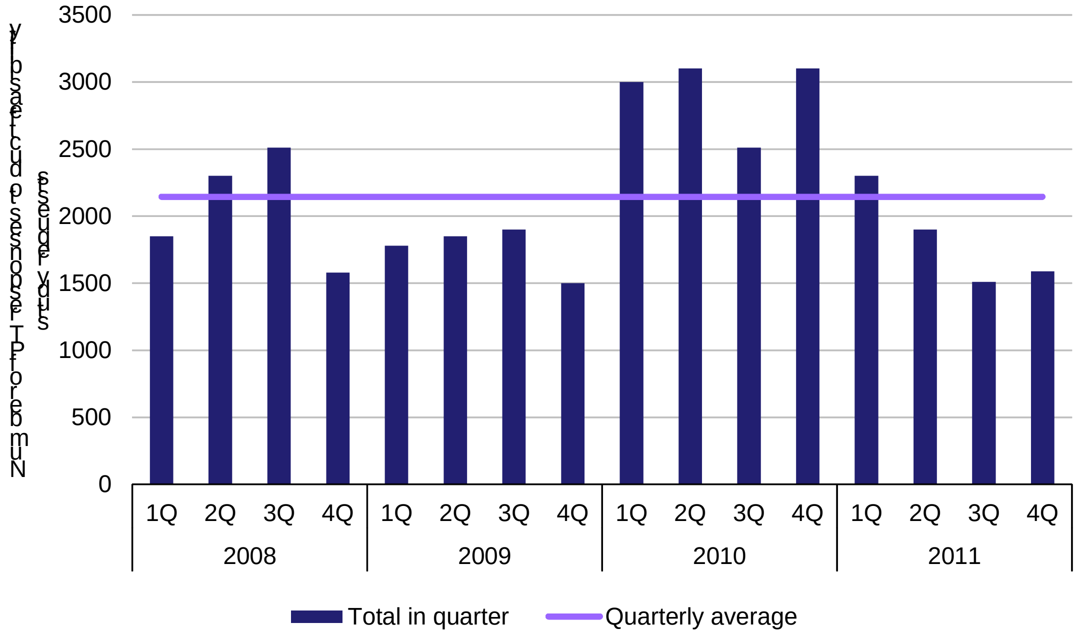
	Lisbon and Porto	Other areas
Monthly price for sub-duct sharing per km per sq. cm	EUR10.60	EUR8.30
Monthly price for duct sharing per km per sq. cm	EUR9.80	EUR7.50
Price of application for duct survey (feasibility study)	EUR69.00	

ANACOM has also monitored the number of responses to requests for feasibility studies from other operators seeking access to PT's ducts, as shown below in Figure 4.5. This has averaged at around 2100 responses per quarter over the last four years.

Figure 4.5: Number of responses to PT's duct feasibility study requests per quarter [Source: ANACOM, 2012]

25 http://www.anacom.pt/render.jsp?contentId=976699.

26 http://www.anacom.pt/render.jsp?contentId=991784.



Infrastructure owners that have the obligation to give access to their infrastructure are permitted to refuse access to their ducts if they can prove:

- the infrastructure is unsuitable for accommodating electronic communications equipment
- accommodating electronic communications equipment would compromise the primary use of the infrastructure, or present a safety risk
- that an additional occupant would lead to lack of space for the primary occupant.

The vast majority of duct access is to PT's ducts, and so ANACOM claims that disputes are rare. This is because the asymmetric regulation on PT has been in place for some time, and the reference offers are clear and well regulated. There have been cases of PT's ducts running out of space; however, due to the universal regulation on other operators, there is normally an alternative route, and so this is rarely a problem. As a result of PT's extensive duct network, there has been little interest in using non-telecoms ducts, with the exception of historical deployments: the main example is Oni Communications (Onitelecom), which in the past was owned by utility companies, and thus has deployments in electricity ducts due to the previous company structure.

No specifications are imposed on operators deploying new ducts. Instead, the deploying operator is obliged to consult with other operators in order to determine if any other operator is interested in deploying along that route. If they are, the deploying operator must install ducts that are suitable for sharing; if they are not, then the duct operator is free to choose which type of duct is deployed.

4.3.3 Strengths and weaknesses

Strengths ↑	Weaknesses ↓
• Negligible cost of implementation to the government or the NRA	• Interest is mainly in PT's ducts, and unclear as to whether non-telecoms ducts will be

• Has made many NGA deployments economically viable, which has led to increased infrastructure competition • As most interest is in PT's ducts and PT's reference offer has been in place for some time, disputes are rare	useful if PT's ducts become full • Little business interest on behalf of non-telecoms infrastructure companies; they often do not see the benefits • Universal sharing regulation applies to all duct owners, but prices are difficult to regulate for small and non-telecoms operators

4.4 Financial implications

4.4.1 Costs of the measure

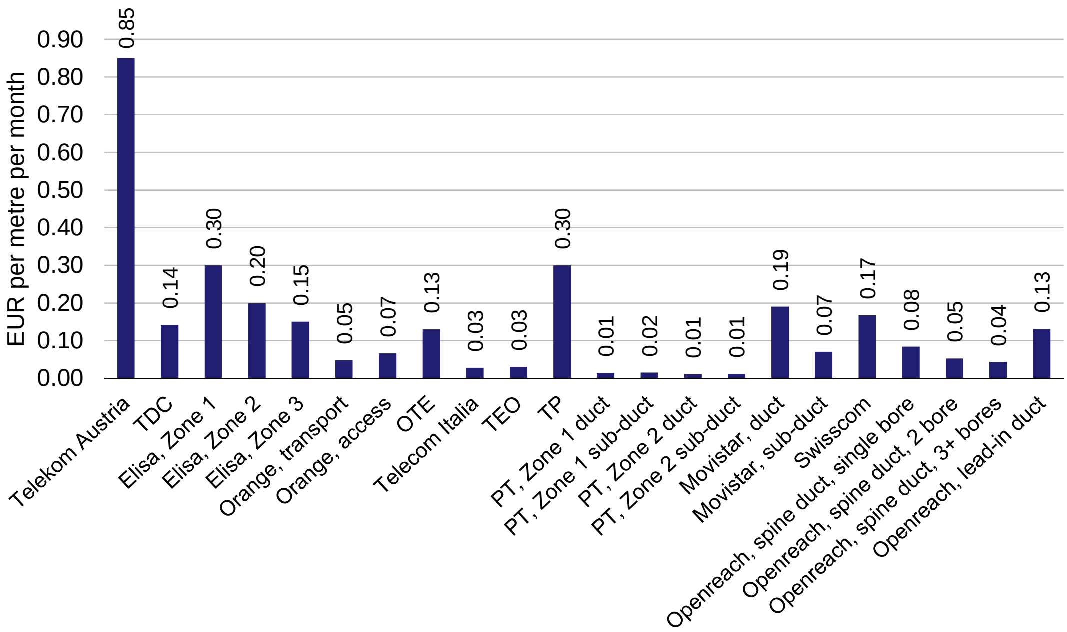
Cost to the NRA or government

In both Lithuania and Portugal, the cost of implementing and maintaining the schemes has been negligible (with the exception of drafting the legislation). However, where information on the location and shareability of ducts is limited, the cost of conducting a survey should not be overlooked (see Section 3.4.1), although in many Member States, this cost is normally incurred by the access-seeking operator.

Cost to the operators

For operators, despite the initial capex saving on deployment, it is important to consider the cost of duct rental, which can be significant over longer periods. According to a recent study by Analysys Mason Research,[27] after 10 years, the cost of duct rental for a shared deployment in the UK is 9–16% of the initial deployment cost (7–12% of total 10-year cost, including initial deployment and ongoing maintenance). This rises to 24–42% of the deployment cost after 25 years. As shown in Figure 4.6 below, access prices vary widely across Europe.

Figure 4.6: Monthly charges for access to incumbent-owned ducts in Europe [Source: Analysys Mason, 2011]

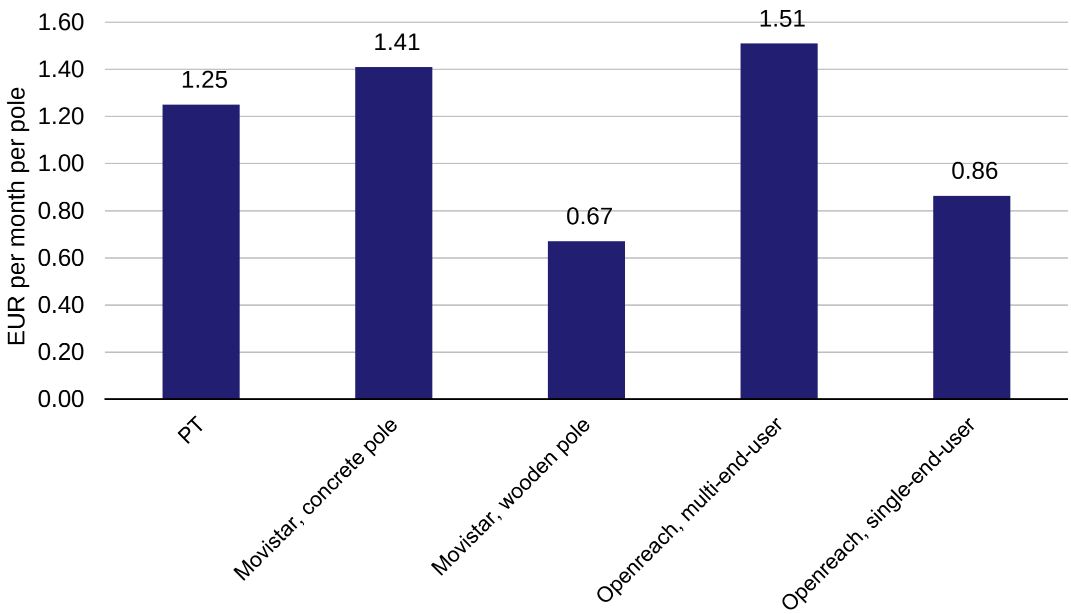


[27] Analysys Mason Research (2012), *PIA versus self-build in the final third: digging into the costs*. See http://www.analysysmason.com/Research/Content/Reports/PIA-self-build-fibre-Aug2012-RDTW0/.

In many Member States, cost-oriented prices are imposed on the incumbent operator, and so these access prices are able to give an indication of the cost incurred by the operator which is granting access to the infrastructure. Typically, this cost appears to be less than EUR0.30 per metre per month.

Some incumbent operators have also been mandated to provide access to poles; the monthly access pricing is shown in Figure 4.7 below. The link between the home and the final distribution is often more likely to be deployed aerially in more rural areas, and so this is an important factor to consider in deployments at the edge of economic viability, such to extend the footprint of NGA networks.

Figure 4.7: Monthly charges for access to incumbent-owned poles in Europe [Source: Analysys Mason, 2011]



Sharers are also liable to unpredictable costs associated with surveys and duct improvement or replacement, such as those detailed in Lithuania and Portugal in Figure 4.2 and Figure 4.4 respectively.

4.4.2 Savings from implementing the measure

The cost savings of implementing access to passive infrastructure in both Lithuania and Portugal are unknown, though RRT believes that if this measure were not in place, NGA deployment would have been more limited in Lithuania. It claims that even in 2004, when RRT launched the first consultations on mandated access to passive infrastructure, operators made it clear that allowing access to ducts would ensure that it would become economically viable to deploy in areas where the business case would not otherwise make sense. It could therefore be argued that a major benefit brought by the implementation of this regulatory measure in both countries have been the socio-economic benefits that arise from bringing NGA to communities that would not normally be covered by the service.

In Portugal, the implementation of this measure has led to infrastructure competition, which has in turn brought benefits to end users, such as potentially increased quality of service and lower retail prices. However, the broadband markets in both Lithuania and Portugal were relatively underdeveloped around the time the measure was implemented. In particular, in Lithuania, opening up TEO’s ducts to other telecoms operators allowed the alternative operators to beat the incumbent operator to deploying NGA infrastructure, with the incumbent having only caught up in the last two years. In most Western European countries, however, the situation is very different as NGA deployment is often led by the incumbent operator, and so the impact that such a measure would have on NGA coverage is likely to be more limited.

According to the partners of the Enhancing Next Generation Access Growth in Europe (ENGAGE) group,[28] the initial cost of network deployment in Western Europe using existing ducts ranges from EUR20 to EUR25 per metre, rather than an average of EUR80–100 per metre for deployments that require digging, thus resulting in a 75% cost saving. This is the ideal case where it is assumed that an entire deployment can be located in existing ducts, and so it is in line with the assumption that civil works accounts for up to 80% of the initial deployment cost.

In contrast, a study by Analysys Mason Research[29] makes clear that coverage cannot be achieved with shared infrastructure alone, and some excavation will be required in areas where no suitable infrastructure is available. The study examined the cost savings that may be achieved by using passive infrastructure sharing in the UK for reaching areas where the business case for NGA deployment is less clear (e.g. in rural areas). As well as traditional trenching, the study also considers a faster and cheaper excavation technique, slot cutting, which is suitable for hard surfaces such as roads and footpaths. The paper concludes that savings on the initial deployment costs range from 29% for relatively densely populated areas using a combination of infrastructure sharing and traditional trenching, to 58% in areas that are located further away from the exchanges (i.e. very sparsely populated areas) and using the cheaper slot-cutting trenching approach. However, due to the duct rental incurred by the deploying operator (as described in Section 4.4.1), the payback period may only be reduced by two to five years.

Figure 4.8 below shows the estimated range of initial cost (i.e. capex) savings that can be achieved from deploying a network using existing passive infrastructure rather than self-digging.

28 A group consisting of12 partners from 10 European countries.

29 Analysys Mason Research (2012), *PIA versus self-build in the final third: digging into the costs*. See http://www.analysysmason.com/Research/Content/Reports/PIA-self-build-fibre-Aug2012-RDTW0/.

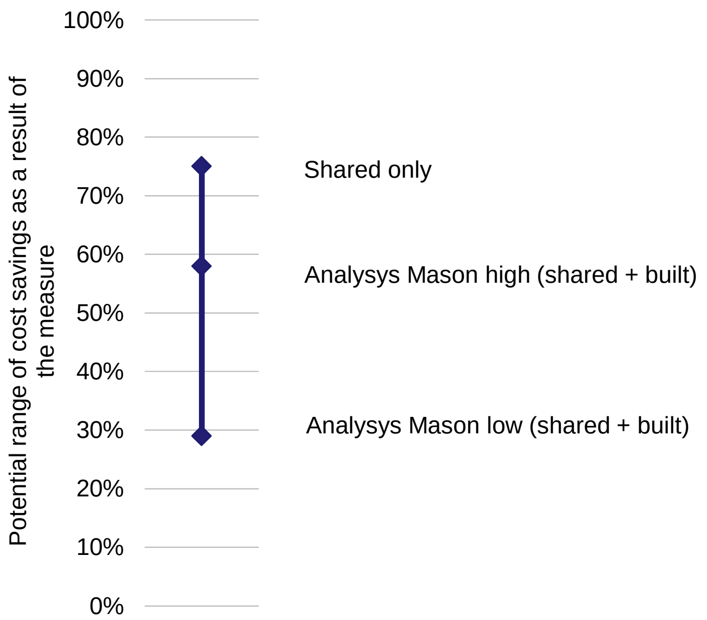


Figure 4.8: Range of potential cost savings from mandated access to passive infrastructure [Source: Analysys Mason, 2012]

4.5 Business interest on behalf of utility companies

Although we have noted that there is little interest from utility companies in opening their networks to third parties, it is possible that there are synergies which can be exploited which have not been fully considered. For example, the Commission is pushing for the installation of Europe-wide smart grids, and so electricity companies may allow an operator to use space in electricity ducts into a home, in return for the operator providing the backhaul from the smart meter, thus reducing costs and increasing the speed of deployment on both sides. A potential issue with this approach is in the maintenance procedure in the case of faults occurring. For example, in a similar scheme in New Zealand, any maintenance visits required the attendance of both a power expert and a telecoms expert, regardless of which type of infrastructure the fault was with; this would be likely to lead to increased operating expenses for both networks.

Another example of collaboration is Jelcer Networks in the Netherlands, which is currently deploying an FTTH network through the sewer system. The company claims that 98% of Dutch households are connected to the sewer network, and is currently deploying in rural areas. It claims that deploying in these sewers rather than digging can lead to a significant cost saving, and as the fibres are within a protected environment six meters underground, they are far more unlikely to be uncovered or damaged than conventional deployments. Jelcer Networks has developed a system of inserting fibres into its own sleeves within the sewer network, which are likely to be very small in comparison with the diameter of the sewer, and thus could constitute a new revenue stream for the sewer owner whilst only incurring a relatively minor hassle; Jelcer Networks claims that the deployment system does not affect the operation of the sewers. The company also claims that its work has helped to improve the geographical knowledge of the sewer system, as it has been necessary for the operator to map the system out in detail in areas of deployment. Other examples include Scottish Water in the UK – which has allowed fibre deployment in some of its sewer network – and Swiss company *KA-TE System AG* – which has also developed a system called fibre access by sewer tube (FAST) that uses sewer maintenance robots to deploy fibre along sewer systems.

Analysys Mason has found in the past that sewer networks may be the most ideal type of infrastructure for the deployment of NGA networks, rather than water pipes for example, which are often limited in terms of available space and may present health and safety hazards such as the risk of contaminating the water supply. However, Analysys Mason has also found that some sewer owners have been unwilling to allow deployment within their infrastructure due to worries about damage occurring to the system, or the lack of compensation. An example of this is the Fibrecity project in Bournemouth in the UK, where fibre operator i3 ran a pilot scheme of deploying through Wessex Water's sewer network; the deal collapsed due to 'contractual problems', with Wessex Water citing issues with the technology employed and the limited compensation offered by i3. However, it is likely that as technology continues to advance, the issue of damage being caused to existing infrastructure is likely to be mitigated over time. One additional problem is that in many Member States, rural areas are unlikely to be connected to the mains sewer network – the Netherlands is an exception as it is generally densely populated throughout the country.

4.6 Summary

- Mandated access to passive infrastructure has been in place in both Lithuania and Portugal for many years. This measure consists primarily of a universal regulation applied to all public and private bodies (such as telecoms operators, gas and electricity companies) in addition to asymmetric regulation on the incumbent telecoms operator (TEO in Lithuania and PT).

- In both countries, the majority of deployments have used the incumbent operator's ducts because they are the most suitable for broadband deployment (in terms of both location and capacity for sharing), and because the asymmetric regulations typically mean that the procedures and reference offers are in place, thus making access simpler.

- The direct benefit from this measure is a potentially significant reduction in the cost of deployment. In both Portugal and Lithuania, the implementation of this measure has led to NGA being deployed to areas where it would not normally be economically viable. An additional benefit of this measure has been strong infrastructure competition, which could in turn benefit consumers in terms of increased quality of service and lower retail prices.

- The main drawback of this measure is that duct owners do not always see the advantages of sharing their infrastructure – for example, the income they receive from duct rental may not justify the inconvenience incurred by allowing access. For this reason, the NRAs claim that the universal obligation is entirely necessary.

- The cost to the NRA or government of implementing this measure is low (except for the cost of drafting the legislation to implement such a measure), and as the case of Lithuania has shown, no special systems need to be in place to allow sharing to take place. Ongoing costs to the state are mainly due to administration and dispute resolution, although this cost is also likely to be low, assuming that the legislation is clear and disputes are relatively rare. Operators that make use of shared access will face the cost of duct rental; although rental is often regulated, it can become a significant operating expense, especially over long periods.

- The cost savings from this measure to operators can be very significant, which are estimated to be up to 75% per meter of the cost of deploying existing infrastructure rather than excavating afresh.
- Although historically most deployments have used incumbent operators' ducts, in some Western European countries these ducts alone may not be sufficient to increase the footprint of NGA networks. There are a number of examples of operators deploying infrastructure in sewer networks, which are ideal as there is often plenty of available space and they are buried deep underground and thus are unlikely to be damaged. However, in many Member States most rural areas may not be connected to the mains sewer network.

5 A one-stop shop on rights of way and administrative procedures

Definition: A one-stop shop on rights of way and administrative procedures would be an organisation that managed information and permits on rights of way. Relevant authorities, including local authorities, would provide information on necessary permits, applicable rules and conditions, and so on to this central organisation (possibly the NRA). That organisation would not only provide information to interested parties, but could also act as an intermediary by receiving and forwarding permit requests to the relevant authorities, and monitor that existing deadlines are adhered to.

5.1 Background

When an operator wishes to deploy new infrastructure, it is normally required to negotiate rights of way directly with the owner of the land on which it wishes to carry out work. For public land, such as roads and footpaths, applications must usually be made with the relevant local authority or municipality, whereas access to private land is subject to wayleaves negotiated with the land owner. In addition, if the planned work might affect any existing infrastructure, the operator must negotiate rights of way with the concerned owner. The process of obtaining rights of way can therefore be long and complex. Moreover, there can be difficulties in determining the land or infrastructure owners, and the operator must negotiate rights of way with each individually. Thus, a relatively small deployment could result in a significant administration effort to co-ordinate wayleaves.

Additionally, operators must often apply for permits before they are able to commence civil works. This is often a complex process which often requires operators to apply for different permits from municipalities and local authorities. Although in many cases this may only incur a small administrative fee for the operator, as with rights of way and administrative procedures, this application process could constitute a significant time and administrative burden. Operators across Europe have reported delays in the permit issuance process of between two weeks and nine months; for a permit to install wireless equipment, this can rise to a number of years.

If a central body existed to manage rights of way and administrative procedures, this could have a positive impact on the administrative burden faced by telecoms operators, and indeed any infrastructure provider that is planning civil works. This could consist of, for example, an organisation that keeps a record of what land is owned by whom, and could forward wayleave applications from the operator to the landowner and act as an intermediary for wayleave negotiations, as well as being responsible for the distribution of building permits. This could be either an existing body which has been given the additional responsibility of co-ordinating such measures, or a new body specifically set up for that purpose. This is, however, not a process that has been widely adopted in Europe. Instead, some Member States have passed legislation granting greater wayleave rights to telecoms operators, thus simplifying the administrative effort required prior to carrying out civil works. This measure is likely to be an enabler of operators deploying their own infrastructure, and is a simple way of encouraging operators to deploy more NGA infrastructure.

There are a number of further issues related to this measure, and potential challenges in implementing it:

- Have infrastructure owners/municipalities/private land owners been mandated to provide access if a telecoms operator wishes to deploy telecoms infrastructure on its property? If so, will they be compensated for the disruption?
- How much centralisation is envisaged? Is it truly a one-stop shop, or will operators still have to negotiate with land owners individually?
- Has this been implemented on a municipality or local authority level? If so, are there different procedures depending on the regions? Do different authorities charge different fees?
- Which organisation becomes ultimately responsible for co-ordinating rights of way and administrative procedures? Is this within the scope of the telecoms NRA or should this be undertaken by another organisation that has the power to intervene across multiple industries?

In order to consider the different ways in which these issues can be tackled, we have looked for examples in Europe, where attempts have been made to implement such a measure. These examples are summarised in the table below. Two of these examples – the Netherlands and Poland – have been selected as detailed case studies for this measure, which are presented in Section 5.2 and Section 5.3.

Figure 5.1: Examples of countries that have implemented measures to simplify rights of way and administrative procedures [Source: Analysys Mason, 2012]

Country	Description
The Netherlands	**Case study** – see Section 5.2.
Poland	**Case study** – see Section 5.3.
Austria	The 2003 Austrian Telecommunication Act grants wayleave rights to telecoms companies, for public property such as streets and pavements, and grants conditional rights for wayleaves on private land, subject to compensation for the land owner. Municipalities cannot refuse rights of way, but have some powers to impose conditions regarding issues such as the timing of any street works.
Greece	Delays in the issuance of antenna licences have ranged from 24 to 36 months, leading to 80% of antennas being deployed without a licence. A single point of contact is being established instead of the current 18 different authorities. Exemptions have also been made for small antennas and low emission sites, which provide time benefits and legal certainty, and electronic submission of applications is being introduced.

Country	Description
Ireland	According to the Irish Department of Communications, Energy and Natural Resources (DCENR), existing public infrastructure is being used to facilitate the deployment of NGA networks, with fibre being deployed along existing rail, electricity, road and gas infrastructure. The DCENR already publishes maps of existing public infrastructure, and has also been considering the implementation of a one-stop shop for access to state infrastructure, which would simplify any issues surrounding rights of way and administrative procedures for service providers.
Portugal	ANACOM has stated that the CIS should contain procedures and conditions governing the allocation of rights of way over infrastructure suitable for the accommodation of electronic communication networks.
UK	In the UK, operators must pay landowners either an annual or a one-off fee to bury cables in their ground. This has arguably been a roadblock to the deployment of broadband in rural areas, and recently the National Farmers' Union (NFU) and the Country Land and Business Association (CLA) have agreed to either charge lower wayleave prices or to provide free access to land in exchange for free broadband access. Additionally, in September 2012, the Department for Culture, Media and Sport announced that it would reduce the administrative burdens associated with broadband deployment. This would be done by allowing broadband providers to install street cabinets in any location without prior approval from local authorities,[30] curtailing wayleave negotiations, relaxing restrictions on aerial deployment, and negotiating a new policy such to reduce the hindrance of traffic regulations on deployment.

5.2 Case study: the Netherlands

5.2.1 Market context

The cable network in the Netherlands is operated by two cable operators – Ziggo and UPC – and covered an estimated 95% of households as of 4Q 2011. Incumbent operator KPN is rolling out both FTTC/VDSL to its copper network and a new FTTH network, which were estimated to cover 53% and 15% of households, respectively, at the end of 2011.

The Netherlands has the highest fixed broadband penetration in Europe, at an estimated 90% of households at the end of 2011 and of these, 44% subscribe to cable, FTTC or FTTH technologies. The Commission reports that, at the start of 2012, 19.3% of broadband connections in the Netherlands provided downstream speeds of between 30Mbit/s and 100Mbit/s, and 2.1% of connections provided downstream speeds of 100Mbit/s or higher.

30 Apart from in exceptional circumstances, such as in areas designated as Sites of Special Scientific Interest.

5.2.2 Measure implemented

The legacy of reformed rights of way for telecoms operators in the Netherlands dates back to the nineteenth century, with wayleave rights granted to the state telecoms operator in the Dutch Telegraph Act. In 1998, this legislation was updated to give rights to all providers of electronic communications networks. In 2007, the legislation was further updated with the Telecommunications Act to remove the power of public bodies such as municipalities to deny rights of way for licensed companies wishing to install electronic communications networks. The aim of this specific provision is to encourage the success of fibre deployment in the Netherlands. According to Article 5:

- Public bodies must tolerate access to their grounds for operators to install or maintain cables.
- This obligation is also extended to uninhabited privately owned land, although rights of way are automatically granted to inhabited privately owned land for the case of connecting a building to a telecoms network, and in this case the operator is also permitted to carry out any required maintenance or the removal of existing wiring where necessary.
- If a body is constructing overhead wires for a non-telecoms use, such as power distribution, that body is obliged to allow telecoms operators to co-locate and subsequently maintain wiring along the infrastructure, assuming that there will be no major overall change in the appearance of the infrastructure, or impediment to the original body that is constructing the infrastructure.

Digging on public land requires a permit from the concerned municipality prior to digging. Written notice must be made to both the Mayor’s office and the city council about the work, detailing the proposed time, place, and how substantial the proposed works are. In order to ensure public safety and reduce civil disturbances, the Mayor’s office may impose requirements on the place of work, the timing of works (which must be within 12 months of the request). Municipalities must promote sharing, and thus also co-ordinate upcoming civil works or duct sharing where possible, in order to minimise civil disruption. Automated or electronic systems are therefore likely to exist in some municipalities, as the system is broadly standardised. The NRA, OPTA, notes that the existing system works well as the municipalities understand the regulations and employ professionals to deal with the process.

When wishing to work on private land, operators must send a letter to the land owner detailing the proposed plans, and undertake an individual negotiation. If no response is received after four weeks, a second letter is sent. The land owner can either then allow the operator to carry out the works, or raise a dispute with OPTA. If no dispute is raised within two weeks of the second letter, the operator is allowed to carry out its planned works. Automated or electronic systems might therefore be inappropriate for the case of private land owners, as each case is negotiated individually and some land owners may not have access to a computer.

A key detail in the regulations is that there is no compensation for access for either private or public land owners. Operators are obliged to ensure that excavated ground is replaced and brought back to its original condition. Municipalities normally charge an administration fee for the required permit, but this is generally small, and is not compensation for digging. This has advantages for OPTA as it has no need to regulate prices, and advantages for operators, as it makes deployment relatively cheap (in addition, the ground in the Netherlands is generally soft, so digging is cheap).

However, operators are obligated to move cables should a land owner decide to carry out ground works, such as digging foundations for a new building, building a swimming pool or landscaping on the site where cables have been previously laid.

According to OPTA, disputes are generally rare, occurring once or twice per year, thus the process is not particularly time consuming or costly to oversee (before the Telecommunications Act in 2007 clarified some of the details on rights of way, disputes were far more common and dispute resolution became a significant administrative and cost burden on OPTA). Most disputes occur around the issue of relocation cables; in order to have cables removed or relocated free of charge, the ground owner must follow specific procedures, and operators are careful to look for breaches in these procedures so they will not have to pay. Relocating cables is expensive, and typically operators will wish to avoid paying for this whenever they can. OPTA normally attempts to deal with most disputes by mediating the negotiation process rather than making a formal decision, in order to save time and administration effort. The civil courts are also deemed competent to handle disputes, although operators have praised OPTA in the past for its expertise in dispute resolution, and so is normally the preferred body (according to OPTA, in 2007, when the Telecommunications Act was being reformed, operators lobbied to keep the resolution process with OPTA rather than the civil courts). There have also been examples of cases going to both OPTA and the civil courts, with the processes going on in parallel and OPTA and the courts reaching different decisions.

OPTA does not keep a register of location of ownership; this is the responsibility of a body called the Kadaster. The Kadaster runs a service called KLIC (Dig Alert). Dutch legislation states that any party that wishes to carry out excavation works must inform the Kadaster of any cables or pipes that are already in the ground, to avoid damage. They do this by consulting the KLIC database, which states which operators are present in that particular area. The party that wishes to carry out work logs onto the KLIC system and draws a polygon on the map interface detailing the area of proposed work. KLIC then automatically contacts infrastructure owners which are active in that area, which must subsequently provide details of their deployments in that area. The Kadaster then updates KLIC with the new information, and sends an electronic map of the area in question to the party that originally requested the information. As mentioned in Section 3.4.1, the party requesting information must pay the Kadaster an administration fee of EUR21.50. The primary purpose of KLIC is thus to reduce damage to existing infrastructure during construction works, rather than for simplifying procedures for rights of way and administration.

As with AGIV's infrastructure atlas project in Belgium (see Section 3.3.2), KLIC is another example of a system potentially having more than one purpose, as the Kadaster is gradually using KLIC to build up a centralised atlas of passive infrastructure, and it is envisaged that it will be developed into a full atlas conforming to the INSPIRE directive. This will be able to facilitate access to existing passive infrastructure, as well as the co-ordination of civil works. This therefore further suggests that some of the implementation costs of the five different measures considered may overlap.

5.2.3 Strengths and weaknesses

Strengths ↑	Weaknesses ↓
• The long history of simplified rights of way legislation in the Netherlands has made deployment more straightforward and has reduced administrative burdens. This is likely to be a strong contributory factor to the strong infrastructure competition and coverage seen in the Netherlands today[31] • As all land owners must tolerate telecoms cables being installed, the measures have simplified the network planning process	• Still requires operators to negotiate individually with land owners and to apply to municipalities for permits • Disputes over the removal and relocation of cables can be complex

5.3 Case study: Poland

5.3.1 Market context

Broadband coverage has historically been low in Poland. DSL and cable coverage is estimated to be the lowest in Europe (with the exception of Greece and Italy, which do not have a cable operator), at 77% and 37% of households at the end of 2010 and at the end of 2011, respectively.

In terms of fibre coverage, FTTH and FTTC/VDSL covered an estimated 3% and 5% of households respectively as of the end of 2011.

Overall, broadband penetration of households in Poland was the second lowest in Europe at the end of 2011, at 36%: around a third of broadband connections were cable connections, whilst the remaining were DSL connections; only 3.5% of connections delivered speeds of 30Mbit/s or higher at the beginning of 2012.

[31] This is in addition to other important factors such as the Netherlands having a high population density and soft ground, which makes digging relatively easy.

5.3.2 Measures implemented

In May 2010, the Polish government passed an amendment to the Telecommunications Act,[32] which included a number of measures designed to encourage to deployment of broadband networks across the country. The Act is long and complex, encompassing a number of different areas that aim to encourage NGA deployment, and refers specifically to fibre deployment a number of times.

The Act has taken away the rights of way from private land owners in most cases, in an effort to encourage more buildings to be connected to NGA networks:

- Building owners are obliged to provide access to their building, and in particular the wiring distribution point/room within the building. If there is a duct system within the private land that is suitable for the deployment of telecoms equipment, and no alternative duct network exists, the owner of that duct is obliged to provide access to the operator seeking access to the duct. These access agreements must be resolved within 30 days of an initial access request.

- If an end user living in an unconnected building requests a connection, the building owner is obliged to allow an operator to carry out installation and maintenance works within the building. All works are paid for by the operator.

A private property owner is obliged to allow operators or local self-governments to deploy telecoms infrastructure to buildings on or above its land, providing that this does not lead to a ‘significant decrease’ in value of the property. The property owner must also allow access to its land for any maintenance of installed infrastructure. This sort of access will require the infrastructure owner to pay the building owner a fee, except in cases where the infrastructure is being used to connect the building to the network. The fee is to be negotiated between the two parties.

For rights of access to public utility infrastructure, the procedures are slightly different. The body in charge of the public utility infrastructure is obliged to engage in negotiations with telecoms operators wishing to access the infrastructure. The president of the Office of Electronic Communications (UKE) may intervene in negotiations in case a dispute may arise, in order to resolve the negations within 90 days of the access request.

However, the disadvantage of the scheme is that power is handed over to local self-governments to develop, use or acquire the rights to telecoms infrastructure and networks. In addition, the local self-governments must keep a record of infrastructure acquisition rights and must take responsibility for granting rights to the construction and maintenance of telecoms infrastructure, as well as supervising and regulating the works. This has made deployment relatively expensive as operators must pay an annual tax for deployments that are over public land, and additionally must pay an ongoing fee for any deployments along roads. As the self-governments are free to set these prices, there have been a number of complaints to UKE from smaller operators claiming that they

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32 http://www.itu.int/ITU-D/eur/NLP-BBI/CaseStudy/CaseStudy_POL_New_Act.html.

struggle to compete with large ones. As a result, UKE is looking to draft new legislation to ensure that operators are not overcharged for deployments.

In addition to taking responsibility for co-ordinating access requests to third-party infrastructure, local self-governments must also respond to requests to access publically owned infrastructure, in which case the self-government is treated as a party with SMP and thus must respond to access requests within 30 days of receipt. Currently, there is no formal procedure in place for dealing with disputes between local self-governments and operators. Disputes are normally raised with UKE, but often resolving them requires drafting new legislation, which is a difficult, complex and time-consuming process.

5.3.3 Strengths and weaknesses

Strengths ↑	Weaknesses ↓
• Has implied the rights-of-way process, and so, in principle, operators should be able to deploy wherever they need to	• The prices charged by landowners can be high, which discourages deployment, especially from smaller operators • Power has been handed over to local self-governments, so not a one-stop shop as such, and there are major differences in procedures and pricing across regions. Additionally, these local self-governments charge an annual tax on buried infrastructure, which can be a significant cost burden on operators • Still requires operators to negotiate individually with ground owners and to apply to municipalities for permits • A fairly new piece of legislation, so there are still problem areas such as the dispute resolution process

5.4 Financial implications

5.4.1 Costs of the measure

Cost to the NRA or government

We are not able to quantify the costs of setting up a one-stop shop on rights of way and administrative procedures as we are not aware of any Member State setting up such a system. The cost to the NRA or government of implementing the measures described for the Netherlands and Poland is low, and is principally due to the drafting of legislation. We believe that the majority of the cost of setting up a dedicated one-stop shop would be incurred in setting up a centralised database and therefore there may be significant IT expenses. This could be similar to the IT costs incurred for the mapping project in Portugal (see Section 3.4.1), or the Ledningskollen project in Sweden (see Section 5.4.1), which cost EUR2 million and EUR1.8 million to implement, respectively. It is likely that some of the IT costs associated with setting up a one-stop shop would overlap with those of an infrastructure atlas and a database of planned civil works, if the three measures were to be implemented in parallel.

The largest cost to the NRA is that associated with managing disputes. Ongoing costs in the Netherlands have been low since the clarification of the Telecommunications Law in 2007, which has significantly reduced the number of disputes. Primarily, these 2007 updates to the Law consisted of making it absolutely clear who has right of way, where and when. Additionally, OPTA adopted the process of allowing the ground owner and access seeker to reach an agreement first, before OPTA steps in to mediate the discussions if necessary. This is normally successful, and so disputes rarely escalate to the point where OPTA is forced to step in and make a formal decision.

Ongoing costs may be higher in Poland, as the system has not been in place for as long as the one in the Netherlands. Ground owners are therefore less likely to be aware of the laws, the dispute resolution process is not as clear, and regulation and procedures vary across regions as it is the local self-governments that have the responsibility for overseeing these procedures.

Cost to the operators

In Poland, the majority of the cost is incurred by the operator, which must pay for access to the ground, pay an annual tax for having assets in the ground once deployment is complete, and pay a further fee in the case of deployments being along a road. These costs vary significantly from region to region (as access prices to public ground is imposed by local self-governments), but can range from a lower end of EUR1–2 per metre up to EUR250 per metre.

In the Netherlands, operators are not required to compensate land owners for access, although as previously mentioned must move cables if ground owners wish to carry out their own excavation work (e.g. building a swimming pool). This can be costly to operators.

Summary of costs

(EUR millions)	Implementation cost		Ongoing costs	
Member State	**NRA**	**Operator**	**NRA**	**Operator**
Netherlands	0.076	Low	Unknown	Unknown
Portugal	2	Low	Unknown	Unknown
Sweden	0.075		0.06	Unknown

5.4.2 Savings from implementing the measure

This measure is an enabler of self-deployment. The main area of cost saving is to the operator in the form of time and administrative savings during the planning and deployment process. Additionally, one could argue that this time saving could lead to earlier service revenues, also benefiting the operator. These savings are therefore likely to vary widely, and are difficult to quantify. However, as mentioned in Section 3.4.2, AGIV's KLIP system in Belgium is in part designed to simplify the planning and permit process, and AGIV estimates that the system saves operators and authorities a combined EUR29.5 million per annum.[33]

Another benefit of simplifying rights of way and administrative procedures could be that smaller players are less disadvantaged by having few staff dedicated to the permit application process and potentially less understanding of a complex system than larger players; this could result in lower barriers to entry.

5.5 Summary

- Neither the Netherlands nor Poland has implemented a true one-stop shop on rights of way and administrative procedures, but both countries have reformed this process significantly, taking power away from land owners. The Netherlands is the most centralised of the two examples, where, although operators must write individually to each ground owner, one body (OPTA) is in charge of overseeing the dispute process. Poland has given most of the power to the local self-governments, so the measures vary widely across the country.

- Giving automatic rights of way to operators allows them to deploy wherever they need to, and is likely to result in greater coverage and infrastructure competition, as in the Netherlands. Another feature of this case study is that operators do not have to compensate land owners, making deployment more straightforward with low rights of way costs and administrative burdens.

- In Poland, land access prices and taxes apply to operators; these can constitute significant costs to operators. Additionally, operators in both countries are still required to negotiate individually with each ground owner, and so there is still likely to be some administrative burden on the operators.

- The cost of implementing these measures is very low to the NRA or government, and only requires little more than the passing of legislation. Ongoing costs consist of regulation and dispute resolution, and so depend on how clear the legislation is. In the Netherlands, legislation has been in place for some time, so the ongoing costs to the NRA are low. In contrast, laws have been introduced more recently in Poland, so the costs could be higher.

- The savings from these measures are mainly in time and administration during the planning and deployment process. It could be argued that the time saving leads to the potential of earlier revenues from services, but these savings are difficult to quantify. Additionally, it is possible that simplifying rights of way and administrative procedures would make market entry easier for smaller players as they would be more likely to benefit from simpler processes and the quicker generation of revenues.

[33] http://www.agiv.be/gis/organisatie/?artid=587.