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COVER NOTE

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Delegations will find attached Commission document SWD(2013) 73 final - Part 4

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Part 4

COMMISSION STAFF WORKING DOCUMENT

Impact Assessment
Annex IV - Part 2

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

{COM(2013) 147 final}
{SWD(2013) 74 final}

A database of planned civil works

Definition: A database of planned civil works provides an opportunity for third parties to express interest in specific works. Such a database could be managed by the NRA or another body.

Background

The lack of co-ordination of civil works in many Member States can lead to wasteful duplication of costs, when multiple companies need to perform street works in the same location. By creating a communications process whereby all planned civil works are published to interested parties, costs can be shared and thus reduced for all stakeholders, as well as minimising disruption from street works. For example, if excavations are taking place in order to lay new water pipes, a fibre operator that is interested in deploying infrastructure in that location may be able to take part in the project, such that it can deploy its network whilst the excavation work is taking place. In this case, the cost of the civil works are reduced for each operator (subject to the negotiation that they have agreed to), and costs would decrease further if more infrastructure operators were to become involved. The database could be used to register interest from different utilities, so that they are notified when civil works are planned in any locations of interest. This measure is therefore an enabler that is designed to encourage NGA operators to deploy their own infrastructure by reducing civil works costs.

In the most densely populated areas, a street may have six different types of utility deployed along it (water supply, sewer, gas, electricity, cable and telephony), and so it is possible that maintenance to at least one of these services may be required fairly regularly. The number of parallel utility deployment reduces in more rural areas, which may not be covered by the mains gas, cable or sewer network. Very rural areas may have no mains services, although it is possible that co-deployment could increase the economic case for deploying infrastructure to these areas, particularly in the case of new developments.

Some co-ordination of civil works is usually performed by the public sector, but at a local rather than national level. There are some calls for the mandated co-ordination between public companies, as it is in every government's interest to save public money wherever possible, especially given the current financial climate. Including the private sector would pose further challenges due to the increased communication and co-ordination required. Indeed, a Finnish study (see Section 0) found that this was one of the most significant areas of difficulty. In addition, problems were encountered over the issues of funding and scheduling: due to careful budgetary procedures, it may take infrastructure operators up to two years before funding can be allocated to a particular project, and so there is not always enough warning before another infrastructure operator undertakes the planned civil works, and hence schedules do not align.

Therefore, such a database could raise questions about the commercial relationships between stakeholders that make use of the database, particularly in relation to price setting, costing methodologies and how to cater for the different kinds of business model in play. For example, telecoms operators and utilities often differ in terms of their weighted average cost of capital (WACC), investment horizons and attitudes to risk.

For telecoms operators, there is a trade-off in terms of the risks and benefits of complying with this measure: by announcing roll-out plans with enough notice to allow others to co-ordinate, operators could save money in a potential co-ordination agreement, but they are also giving away their NGA strategy to competitors, which could act more quickly given this information. It is therefore conceivable that an operator might prefer to stick to its own roll-out strategy and bear the full cost of roll-out rather than exposing itself to the risk of disclosing its strategy. A shorter-term announcement might protect the operator's plans, but then would not allow other operators sufficient time to co-ordinate; this approach, however, could have the additional benefit of other infrastructure owners being able to contact the operator in the case that they have existing infrastructure in the deployment area which is prone to damage. This is therefore another area where there is potential for the purpose of a measure, and therefore the implementation cost, to overlap.

The scope for co-ordination might therefore be limited to telecoms operators working with other utility companies where there is no competitive threat. It therefore seems unlikely that mandating operators to announce roll-out plans in good time would not be beneficial to the market. A study by the Swedish NRA (see Section 0) suggests some innovative procedures that are designed to deal with these issues.

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

Is co-operation imposed or encouraged? If it is encouraged, how is this implemented?

What would any measures actually mandate? Would it be an obligation to announce plans, an obligation to negotiate or an obligation to grant access?

Have these measured given rise to disputes? If so, how are these resolved? Is the NRA able to deal with disputes if a non-telecoms infrastructure company is involved?

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 – Finland and Sweden – were selected as detailed case studies, and are presented in Section 0 and Section 0.

Figure.1: Examples of countries that have attempted to implement a database of planned civil works [Source: Analysys Mason, 2012]

Country	Description
Finland	**Case study** – see Section 0
Sweden	**Case study** – see Section 0
Denmark	The Telecommunications Industry Association in Denmark co-ordinates intended rights of way and civil works to encourage collaboration between infrastructure providers. This scheme is based on voluntary participation.
France	Infrastructure owners who are about to carry out installation or maintenance projects of 'significant length' (~150m in urban areas and ~1km in rural areas) are obliged to announce their plans for surface works (such as stripping and replacing surfaces/façades), works on overhead lines, and any works which require excavations to the local authorities. These infrastructure owners are also obliged to allow operators to install electronic communications equipment in any trenches that are created during the work. The operator must compensate the infrastructure owner for any extra costs that are incurred during the process, and the operator subsequently becomes the owner of the electronic communication equipment that has been installed, and thus is ultimately responsible for maintaining it.
Lithuania	According to the NRA, the Lithuanian government is looking to draft legislation that mandates public infrastructure companies to co-ordinate civil work, with help from the NRA. It is accepted that it is more difficult to enforce this on private companies from a practical point of view, and a softer 'best recommendations guide' approach is being considered instead.
Luxembourg	A national construction works register is currently being developed to provide an online directory of all future civil works to be carried out. In addition, guide prices will be listed for telecoms operators that are interested in participating in the civil works in order to deploy their own infrastructure.
Portugal and Belgium	Bodies intending to carry out civil works in Portugal and Belgium are now obliged to publish prior notice of this, so that other interested parties (including telecoms operators) are able to participate in them should they wish.
UK	One of the NJUG's working groups, the Advanced Co-ordination Group, hopes to reduce disruption to the public by co-ordinating necessary civil works in the UK. In 2007, a statement of understanding with regard to advance co-ordination was signed by four utility companies, although neither Openreach nor Virgin Media appears to have taken part to date.

Case study: Finland

Market context

Finland has a cable network with an estimated coverage of 86% of households. At the end of 2011, FTTH coverage was estimated to be the third-highest is Europe, at 36%. Overall take-up, however, was low for Western Europe, at 57%, with 76% of broadband connections being DSL. The incumbent operator, TeliaSonera, has a 30.2% of the market, and is the main provider of FTTH services.

The Commission reports that, at the beginning of 2012, only 3.6% of connections delivered speeds of between 30Mbit/s and 100Mbit/s, and 5.6% of connections delivered speeds of 100Mbit/s or higher.

Measure implemented

Finland has one of the most ambitious national broadband plans in Europe, aiming to have at least 99% population coverage of 100+Mbit/s services by 2015. Although 95% of this is expected to be achieved by market forces,[1] the Finnish government has been considering ways to reduce the cost of NGA deployment.

Finland's Ministry of Transport and Communications (LVM) claims that in some cases, excavation work can account for 80% of the cost of deployment of telecoms infrastructure, and so significant overall cost savings can be achieved by co-ordinating construction work. In addition, it claims that if construction work were to be co-ordinated for four deployments that would normally be made separately (e.g. water pipes, gas pipes, electricity cables and fibre), the overall construction time could be halved, thus further reducing cost and reducing civil disruption.

A portal has therefore been set up by the state-owned company, Johtotieto Oy (Co-digging). This is an electronic platform where operators and infrastructure owners are able to advertise work that they intend to carry out, or conversely find out whether other bodies are carrying out work in areas of interest. The portal is not currently based on a detailed geographical platform; instead, projects are categorised by town or city. Interest in the portal has been widespread, and it was developed with the co-operation of a number of key players including TeliaSonera and the state-owned power company Vattenfall. Rather than mandating parties to use the system, announce plans and co-ordinate works, the strategy has been to encourage operators and infrastructure owners to do so. To this effect, the government has embarked on a programme of marketing and advertising, with the advertisements developed such as the one shown below in Figure 2.

1 http://ec.europa.eu/information_society/digital-agenda/scoreboard/countries_2012/country_fi.html.

Figure 2: Example of a government advertisement encouraging co-operation over civil works in Finland [Source: LVM presentation[2], 2011]

Prior to the launch of the portal, in December 2010, LVM published a guide to best practice for jointly constructing infrastructure.[3] This was produced after interviewing a number of operators, and listed a number of challenges faced by such a scheme:

Lack of co-operation between parties – Operators are not used to sharing roll-out plans with rivals, and although it is normal for utility companies to have multi-year project plans, the utility companies rarely co-ordinate with one another. In addition, it has been found that many water company projects are not in areas that are of commercial interest to telecoms operators. A potential solution to this would be to hold regular meetings between the concerned parties regarding future construction plans.

Issues with lack of scheduling compatibility – Construction projects generally require two years' notice due to the slow process of reserving funding. Thus schedules would need to be shared at least two years in advance of works commencing.

Lack of funding. In addition to the above point, there may be no funding available at all for the construction of a fibre network in the area that civil works is being carried out. It is then up to the main contractor to decide whether or not it wishes to install empty fibre ducts for future use. All transport infrastructure built by municipalities with state funding is designed with the provision of telecoms infrastructure in mind.

Concerns that simultaneous construction works could add complexity to the project. However this has been resolved by careful project planning, and only awarding contracts to construction firms with a strong track record.

2 http://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=5&ved=0CFsQFjAE&url=http%3A%2F%2Fec.europa.eu%2Finformation_society%2Fevents%2Fcf%2Fdaa11%2Fdocument.cfm%3Fdoc_id%3D18153&ei=-OMHUL7kMdOk0AWN1PmJBQ&usg=AFQjCNHFX3novYXZNKvyIpb0WJWdFo23_g.

3 http://www.localfinland.fi/en/authorities/information-society/broadband/Documents/2010%20LVM%20Kuntaliitto%20Best%20Finnish%20Practices%20on%20Joint%20Construction%20of%20Infrastructure%20Networks.pdf.

The location and routes of existing underground infrastructure is poorly documented according to the Finnish operators, especially in areas of low population density, for example, there is rarely any information about how deep infrastructure is buried.

It is these challenges that the launch of the portal aims to overcome. An example of a success story provided by the LVM is Vattenfall (which, as previously mentioned, co-operated with setting up the scheme), which has decided to deploy its new cabling underground rather than overhead and has embraced the scheme. When undertaking new projects, as the principal client, Vattenfall arranges planning meetings, prepares planning documents and draws up joint contracts. It is up to the individual parties, however, to draw up the plans and specifications for the infrastructure they require. Only contractors that meet experience requirements are invited to tender, and the cheapest is then selected. According to the LVM, joint construction projects led by Vattenfall have been successful, have kept to schedule, have an improved safety record and have a reduced number of warranty claims in a set period. LVM claims that the most important success factors are:

availability of information at an early stage
good co-operation between parties
a principal client, which co-ordinates the works
joint tendering for contractors, and one successful principal contractor (sometimes with subsidiary contractors, which may be responsible for areas such as site safety
a principal supervisor, whose roles will include ensuring that that the project is delivered on time and on budget.

The portal is, however, in its early stages, and there are likely to be further challenges to overcome. Currently, there is no dispute resolution process in place, and is thought that in the case of a dispute, parties are left to negotiate freely between themselves. Clearly, this is a weakness that could potentially lead to delays in construction. There is also still the challenge that interest from some players can be limited, and the service may not be suited to the needs of some players, perhaps having limited information about an area of interest for deployment. An additional challenge is that some local authorities or infrastructure owners may believe they have a good knowledge of all planned works in their area; this is likely to be a barrier to adoption of the system, and results in the information available on the system being incomplete, thus affecting other users of the system.

Strengths and weaknesses

Strengths ↑	Weaknesses ↓
• The system is User ID and password protected to protect confidential information, but out is still open enough about project plans for users • The system is very cheap to implement and run, compared to the potential cost savings to operators	• Portal is not of interest to some players • Still in early stages and development still may be required (e.g. no dispute resolution process in place currently). Additionally, alignment of implementation plans across different organisation is likely to be a major barrier to implementation

Case study: Sweden

Market context

At the end of 2011, Sweden had the second-highest level of FTTH coverage in Western Europe, at 41% of households, and cable coverage was roughly average for Europe at 60%. Broadband penetration was the eighth-highest in Europe, at 71%: 30% of total connections were FTTH, and 18% were cable.

Broadband take-up is therefore high, with the Commission reporting that 16.4% of connections were providing speeds of 100Mbit/s or higher at the start of 2012. As with Finland, the incumbent operator is TeliaSonera, which enjoys a relatively modest market share of 36%, followed by Com Hem (a cable operator), Telenor and Tele2, each of which has a similar market share of between 15.7% and 18%. TeliaSonera, Telenor and Tele2 are all involved with FTTH deployment.

Measures implemented

According to the Swedish Post and Telecom Authority (PTS), in recent years there has been rising demand for high-speed broadband in rural areas of Sweden, and many of these areas have seen a lack of supply. In part, this is because the pay-back time of network deployments in areas with low population density is typically much longer than in urban areas, and so operators can be unwilling to deploy infrastructure in those areas.

The proposal for the Swedish Broadband Strategy[4] was published in February 2007, and recommended that the viability of co-ordinating civil works should be investigated by the government as a priority, in order to reduce the cost of, and speed up, the deployment of NGA services. The reduced costs would also result in a decreased pay-back time of investment, increasing the commercial viability of network roll-out. Further to this, in December 2011, PTS published a document that detailed its decisions and recommendations for broadband duct protocols.[5] The document suggests that excavation accounts for 60% to 80% of total deployment

4 http://www.pts.se/upload/documents/en/proposed_broadband_strategy_eng.pdf.

5 http://www.pts.se/upload/Rapporter/Internet/2011/2011-26-kannalisation.pdf.

costs, and thus total costs could be significantly reduced by the co-ordination of civil works. However, PTS accepts there are a number of obstacles to the adoption of such a scheme, namely:

differing plans between telecoms companies and utility companies in terms of both timing and location of deployment
concerns over the payback period in deployment areas
lack of information regarding the deployment plans of other parties
concerns over other costs, including unforeseen technical costs
concerns over payment for access to land, as well as other legal concerns.

PTS therefore suggests a number of different solutions that aim to capitalise on the cost saving of co-ordinating civil works, whilst addressing the above concerns:

A utility company installing new infrastructure installs co-located empty ducts suitable for fibre deployment – An Infrastructure Clearing House (ICH) then reimburses the utility company for the cost incurred in installing the ducts. When an operator wishes to lay fibre within the ducts, it pays both the ICH and the utility company, thus the company that installed the duct sees a profit and is incentivised for installing the infrastructure. The business model is designed such that the ICH will see a profit on ducts that are used by operators, although those that are not used will obviously incur a loss.

Developing a commercial platform for the co-ordination and management of excavation activities – PTS considers a number of possible solutions such as creating a platform that has the purpose of monitoring applications for and upcoming civil works and a platform for recording the location of cabling.

Developing existing IT platforms to create a duct co-ordination system – PTS's Ledningskollen system (which provides location information of existing cables, primarily to prevent cables being accidentally dug up) and the Swedish Urban Network Association's (SSNf) Centralt system för Accesser CESAR (an information directory for purchasing access to fibre) could be developed to identify co-location possibilities for ducting. According to PTS, the number of requests for information from CESAR has recently increased, and work is in progress to further improve the system.

Of these options, it appears that Ledningskollen is the most likely to advance. The system works by splitting the entire country into 1km square grid cells; infrastructure owners then provide data on which cells they have deployments within (hence although spatial resolution is relatively high, Ledningskollen is not a true map-based system and was not conceived with the INSPIRE directive in mind). Ledningskollen will send these infrastructure owners automated messages if another party is planning on digging within this cell, thus the capabilities of the system have some overlap with the infrastructure atlas and the one-stop shop for rights of way. Now, ~EUR600 000 of extra funding has been made available for a pilot scheme between PTS and a municipality in the south of Sweden, which aims to investigate what the cost and time savings of civil works co-ordination are, whether the Ledningskollen platform is sufficient to facilitate such a scheme, and how much further development would be required. The funding is being spent on consultants and web developers who have been tasked to create an online portal to facilitate co-deployment. Additionally, the proposal for ICH is currently under consideration in Sweden by the relevant stakeholders. The CESAR system is currently only available to members of SSNf, and thus SSNf would have to consider modifying its business model if CESAR was to be modified into a portal for the co-ordination of civil works. Any development would also require funding.

PTS places much of the responsibility with the municipalities, in part because it is estimated that around 81% of Swedish ducts are owned by municipalities. PTS also believes that the day-to-day running of any co-ordination should be in the hands of the lowest possible level, so it makes sense for the municipalities to take responsibility for this. Finally, in Sweden, municipalities are broadly independent, and so PTS may not have the authority to intervene in some cases.

Unlike the measures implemented in France (see Section 0), it is not envisaged that there will be an obligation to announce or co-ordinate works. This is in part due to a debate within government about the national security concerns of any national infrastructure database 'getting into the wrong hands'. However, there has been some government intervention in the form of agencies responsible for the construction of roads and power networks being obliged to consider broadband deployments when building new infrastructure. Overall, it is hoped that players will see the benefits of the measures and will actively seek to co-operate.

The most significant of these benefits is that where the measures are in place, broadband deployments should go further for the same investment, resulting in better coverage. Additionally, PTS claims that it is important for utility companies to take into account broadband deployment into their business plans, as broadband is becoming a more important part of life, and thus different industries depend more and more on broadband infrastructure being in place. Finally, from a public funding point of view, it is important for all governments to lower costs where they can.

However, a non-mandated scheme would need to overcome a number of challenges. Firstly, co-ordination would disrupt the core business of utility companies, many of which are not interested in broadband deployment, which may lead to longer lead times between planning and construction, and additional costs. Furthermore, there is an issue with greed, as some companies may be willing to allow co-deployment, but only at a high cost to the company wishing to co-operate.

Strengths and weaknesses

Strengths ↑	Weaknesses ↓
• Could lead to reduced deployment costs of broadband, and better coverage • PTS is carrying out a thorough consultation and pilot process, with many innovative ideas being considered, which is likely to lead to a strong solution being implemented • By handing responsibility over to municipalities, it allows the day-to-day running of the measures at a low level • The introduction of an ICH, including utilities	• Cost and time savings currently unknown, which is causing difficulty in convincing policymakers and stakeholders to take an interest in the measures • Many utility companies are not interested in broadband as it is not part of their core business; they may therefore see co-ordination as an inconvenience • Particularly for the case if ICH, cost savings are limited to areas where new infrastructure

implementing fibre compatible ducts, addresses the issue of the co-ordination of projects across different sectors	is being deployed, so impact could be quite limited in the context of the overall NGA roll out. • The Government is concerned about national security implications of a national infrastructure database being accessible.

Financial implications

Costs of the measure

Cost to the NRA or government

The costs incurred by the NRA or Government are mainly due to the cost of setting up the IT systems and the ongoing administration effort. As previously mentioned, the IT costs could overlap with other measures such as the infrastructure atlas and the one-stop shop on rights of way and permits, if implemented in parallel.

In Finland, the portal was rolled out in two phases, with a total implementation cost of around EUR200 000. The ongoing cost is thought to be less than EUR100 000 per annum in operations and maintenance. This is funded by the state, and thus operators and infrastructure owners do not incur costs. These costs are likely to be very low compared with the potential savings from the measures.

In Sweden, Ledningskollen cost ~EUR1.8 million to implement between 2007 and 2010, and costs between EUR600 000 and EUR800 000 per annum to run. As previously mentioned, a further ~EUR600 000 of funding has been allocated for a pilot project to investigate the feasibility and benefits of using the system for the co-ordination of civil works. PTS' business projections suggest that ICH would at least break even within five years of implementation, and be quite profitable after ten years, however, this would require an estimated EUR25–35 million of initial funding. Due to the projected long-term profitability, it is hoped that pension funds may be interested in investing in such a system. As well as this, the possibility of European funding (from the Connection Europe Fund) has been briefly considered. These costs are separate from those incurred from the broadband survey project and infrastructure atlas project discussed in Section **Error! Reference source not found.**. PTS does not intend to attempt to consolidate these systems as it has found that they all act as useful planning tools, but each serve a different purpose and thus each add value as standalone products.

Cost to the operators

As mentioned in Section 0, the main cost to the operator is exposing itself to the risk of announcing its rollout plan to competitors which may be able to move more quickly. In addition, there is likely to be an administrative burden of announcing roll-out incurred by the operators.

Summary of costs

(EUR millions)	Implementation cost		Ongoing costs	
Member State	NRA	Operator	NRA	Operator
Finland	0.2	-	0.1	-
Sweden	1.8	Low	0.6 - 0.8	-

Savings from implementing the measure

As mentioned in Section 0, this measure is an enabler of self-deployment. Therefore, the overall economic savings are achieved by operators, and this is the difference between the cost of deploying alone or deploying in a co-ordinated project. On this basis, if a project is shared between two parties, it is possible that a 50% saving on excavation could be achieved by each party. Assuming there are two players involved, and the cost of excavation forms 80% of the deployment cost, then the cost saving achieved by each operator could be 40% of total deployment costs. Furthermore, if more than two operators were to be involved, the excavation costs per operator decreases further, saving around 53% for three players.

It is worth noting that savings will only be achieved in areas where deployments overlap, and as previously mentioned, although the most densely populated areas may have several different types of utilities deployed in a parallel fashion, this is no longer the case in less densely populated areas, which may only be connected to one or two services. It is therefore unlikely that the co-ordination of civil works will be possible in all areas of a fibre deployment project, except when utility access is being provided to new developments. This issue also means that the benefit is also likely to be incremental, with benefits not seen in a wider context for some time. Companies such as Inexus in the UK already provide multiple utility access including fibre deployment.

It is likely that more players becoming involved would increase the complexity of the project, and thus the excavation cost. For example, there may be special regulations for the installation of power cables or gas pipes, which the project will have to conform to if these utility companies became involved. Gas pipes may require a trench of up to 100cm in width, costing around EUR50 per metre, whereas a micro-trench may cost under EUR10 per metre, thus it would not be worth an operator co-ordinating with the gas company unless the gas company were to pay for the majority of the works. Nevertheless, it has also been found that joint tendering for construction work has resulted in lower prices from contractors, so it seems possible that in some cases the cost savings could be greater than 50% to each operator.

Interest could be generated on behalf of the utility companies by considering the different investment time horizons. Utility companies, generally have a longer accepted payback time on investment than telecoms companies. In Sweden telecoms operators have expected 50-70% of the initial investment per home to be recouped within 2 – 5 years, and shareholders are strongly averse to these companies making what they see as speculative investments. This is in contrast with the utility companies (many of which are former state monopolies) and may wait 10 – 20 years for payback on the initial investment. By considering innovative co-deploying strategies, such as utility companies installing empty ducts alongside new infrastructure, they may be able to see a short-term benefit from operators renting ducts, as well as the long term benefit of providing their normal utility service.

According to LVM, the savings to operators in using co-ordinating civil works for deployment is thought to be 'tens of per cent'. Depending on the size of the operator, this could be EUR tens of millions or even EUR hundreds of millions. A more conservative estimate was reached in a 2011 study[6], which concluded that overall savings can be between 15% and 30%. In Sweden, PTS does not have an idea of the time or cost savings that could be achieved from the measures; it is carrying out a pilot project to investigate this.

6 *Möglichkeiten des effizienten Einsatzes vorhandener geeigneter öffentlicher und privater Infrastrukturen für den Ausbau von Hochleistungsnetzen*, Dr H. Giger et al, 2011

Figure 3 shows the estimated range of cost savings that can be achieved from the co-ordination of civil works.

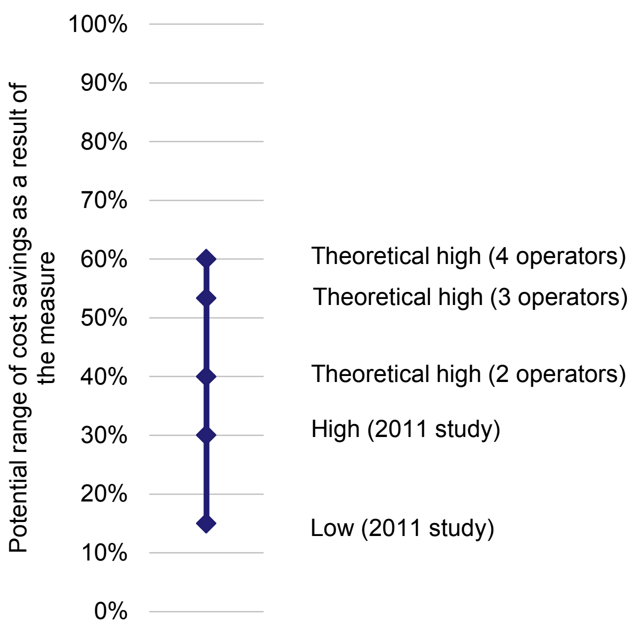

Figure 3: Range of potential cost savings from co-ordinating civil works [Source: Analysys Mason, 2012]

Summary

The implementation of co-ordination of civil works is in its very early stages in Europe. Finland has implemented a basic web portal that allows companies who are excavating to advertise where they are carrying out work, and to search for other parties that are planning work in the same place. In Sweden, a number of different options are currently being considered, with a pilot scheme in progress at the moment. 70% of Swedish municipalities have taken some steps to implementing co-ordinating civil works.

The main benefits are the potential time and cost savings in infrastructure deployment, perhaps leading to increased coverage. In addition, there will be reduced civil disruption. There is also the possibility of economic and social advantages of companies from different industries working together (as broadband is becoming more important to all industries).

However, there are a number of challenges faced by this scheme, for example it is likely to disrupt the core business of utility companies, who may not be interested in broadband deployment. Furthermore, utility companies may not be building in areas of interest to operators, and regulation regarding utility deployment has the potential of making deployments more expensive. The Swedish Government has also expressed concerns about a national database of planned infrastructure construction having national security implications.

The costs of such a scheme vary, although the IT cost of setting up a web portal such as the one in Finland appears to be EUR hundreds of thousands, which is low compared with the potential benefits. PTS estimates for the cost of a portal are fairly similar, although the cost of setting up an Infrastructure Clearing House is much higher and in the EUR tens of millions. However, the business case of such a project is designed to be profitable in the long term.

There is little data on the savings achieved in the past from such a scheme. In theory, the combined cost saving from two operators rolling out should be around 40%, but studies have shown it could be lower at between 15% and 30%.

The mandating of the deployment of fibre compatible duct by utility companies alongside new infrastructure deployments could lead to significant cost savings, but could also lead to unnecessary costs being incurred if it is deployed in areas where sufficient duct space is already available or where there is unlikely to be market demand for deploying fibre. Therefore, some analysis to determine this prior to deployment would be desirable. From a wider perspective however, it is likely that savings would be incremental and take some time to be seen.

High-speed infrastructure for new and refurbished buildings

Definition: This measure would see the provision of in-building infrastructure such as vertical wiring and a shared connection point in new and refurbished buildings. This would aim to facilitate the connection of an end user in an apartment to a high-speed broadband network.

Background

Installing infrastructure to enable high-speed Internet access is much more cost effective at the time of building than retrospectively. This is particularly the case in MDUs, which may have a complicated layout, limited space, and where retrospective installation may result in significant redecoration costs; these issues could represent a significant barrier to NGA adoption.

If, however, property developers are mandated to make provision for high-speed Internet access (in terms of in-building wiring and appropriate ducting on any land under development), this can be controlled as part of the planning permission process for new developments. Ensuring open access to this infrastructure serves to maximise competition and the supply of services to end users. Two wiring solutions are shown below in Figure *4*.

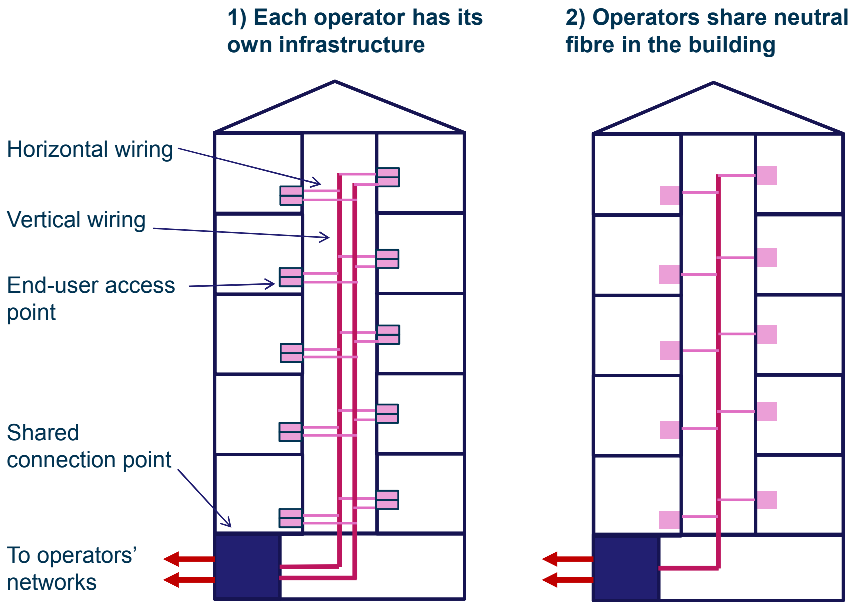

Figure 4: Illustration of in-building wiring in an MDU [Source: Analysys Mason, 2012]

There are potential issues regarding responsibilities for the ongoing ownership and maintenance of infrastructure, which is why such measures are usually limited to passive infrastructure. It is important to define appropriate levels of responsibility for property developers, in order to avoid any adverse effects such as making rural development unviable. The UK government considered making in-building wiring requirements part of building regulations. However, the inherent complications meant that these new laws did not come to fruition. Other Member States, such as Spain and France, have introduced this measure (see Section 0 and Section 0), but care is needed to ensure that the specified technical requirements are compatible with that specified by the operators. Indeed, if it is implemented successfully, the measures could encourage FTTH take-up, which is low in many countries, in part due to many buildings not being wired for fibre.

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

Do the measures apply to refurbished buildings as well as new buildings? This is a key issue, as the impact on NGA take-up is likely to be slow if only new buildings are included. This could be of particular interest in some Eastern European Member States, where there have recently been initiatives to refurbish aging MDUs.

Do measures go beyond vertical wiring and go as far as the horizontal wiring of individual apartments? Connecting each individual apartment directly to the NGA network would simplify the adoption process and remove a barrier to take-up.

Despite these challenges, some Member States have implemented this measure successfully. These examples are summarised in the table below. Two of these examples – Finland and Sweden – were selected as detailed case studies, and are presented in Section 0 and Section 0.

Figure 5: Examples of countries that have implemented an obligation to equip all new buildings with high-speed Internet (100Mbit/s) as well as mandated open access to the terminating segment [Source: Analysys Mason, 2012]

Country	Description
France	**Case study** – see Section 0.
Spain	**Case study** – see Section 0.
Ireland	In 2011, the DCENR launched a public consultation[7] regarding NGA-ready buildings in Ireland. The paper sets out proposed detailed technical regulations for an open-access interface for connecting new residential buildings to FTTH networks, along with recommended standards for in-building wiring. The recommendations are only for new buildings, as the DCENR acknowledges that retrofitting buildings is often difficult and costly.
Lithuania	Measures were introduced in 2009 following a consultation launched by RRT, which resulted in telecoms operators being mandated to connect MDUs to their fibre network using ducts with a diameter greater than 90mm. This came about as operators had previously been directly burying cables, which resulted in the same ground being dug up numerous times as each operator would connect to the MDU separately. In addition, equipment installed by operators for the distribution of vertical and horizontal wiring must leave enough space to accommodate other operators.
Portugal	A number of provisions are in place in Portugal regarding the specification and use of ducts installed in newly erected buildings, to facilitate the deployment of fibre in-house wiring.
Republic of Korea	South Korea, which has the highest take-up of fibre worldwide (20.4% of total households as of June 2011), has had a scheme in place since 1999 in which owners of buildings that contain at least 20 residential units are encouraged to deploy high-quality vertical wiring throughout their premises. Although the scheme is voluntary, around 6500 buildings have been certified to date, equivalent to 3.3 million households. There are four grades of

7 *Recommendations For Open Access Fibre Ducting and Interior Cabling for New Residential Buildings – Making Homes Fibre Ready* (See: http://www.dcenr.gov.ie/NR/rdonlyres/31113BCF-785A-42EC-99D1-99460E017520/0/Consultation_Paper_Recs_For_Open_Access_Fibre_Ducting_and_Interior_Cabling_for_New_Residential_Buildings.pdf)

Country	Description
	certification, based on the speed of service that the in-building networks are able to provide, ranging from 'Third' (up to 10Mbit/s) to 'Special' (over 1Gbit/s).

Case study: Spain

Market context

Cable coverage in Spain stood at 60% of households at the end of 2011, which is in the mid-range of European countries, and two thirds of this network is estimated to have been upgraded to DOCSIS3.0. Thus far, fibre deployment has been slow, with just 6% of households covered at the end of 2011. It is thought that the cabinets in Spain are unsuitable for the deployment of FTTC, and so, in the long term, the main driver of NGA infrastructure competition is likely to be FTTH.

Overall, broadband penetration in Spain stood at 62% of households at the end of 2011, which is around the median for Europe, although DSL accounts for the vast majority of broadband connections. The Commission reports that, at the start of 2012, just 6.3% of connections were between 30Mbit/s and 100Mbit/s, and only 0.1% were 100Mbit/s or higher.

Measure implemented

The legacy of in-building wiring in Spain dates back to the 1960s, when the sharing of in-building wiring for analogue TV was mandated. This was important in the Spanish context, as much of the population lived (and indeed still lives) in MDUs. Telecoms equipment, however, was not covered, so in these buildings, any telecoms infrastructure belongs to the operator that installed it, which in most cases is the incumbent, Telefónica.

In 1998, an obligation was introduced to equip all new buildings and buildings undergoing refurbishment with *common infrastructure* for telephone lines, TV connections (analogue and satellite) and broadband. At the time, these broadband measures consisted of installing either wiring or empty ducts that joined each apartment to a central in-building chamber (which was often located in the basement), which was designed for the location of equipment for broadband switching and distribution. The legislation included detailed technical regulations regarding the installation of the infrastructure, such as detailing the requirements for twisted copper pairs and TV coaxial cables. The infrastructure is owned and maintained by the building owner, not a particular operator; this was in response to disputes arising over the operator-owned telecoms equipment in pre-1998 buildings. In addition, a symmetric regulation was put in place that mandated any operator that installed NGA infrastructure within any building to share it with other operators. A further update in 2003 added digital terrestrial television (DTT) distribution to the list of required common infrastructures.

The legislation was significantly overhauled in March 2011, in light of DAE targets. Royal Decree 346/2011 (March 2011)[8] approved the regulations governing common infrastructure for access to telecoms services inside new buildings. In addition, Order ITC 1644/2011 (June 2011)[9] set out the regulations for installing the infrastructure. Constructors of new buildings (and buildings being refurbished) must now install passive NGA infrastructure such as fibre or coaxial cables that connect each apartment to the central distribution chamber. The regulations apply to all buildings that have 'horizontal properties' – that is, where there are multiple owners – and so includes office blocks and businesses as well as MDUs.

Before new construction projects are approved, a consultation must take place between the construction firm and the broadband operators in the local area, and this is supervised by the Ministry of Industry, Trade and Tourism. The consultation must assess which NGA deployments are in the local region, and thus determine what type of infrastructure will be suitable for deployment within that building. If there is infrastructure competition in the area (e.g. both cable and FTTH), then more than one type of technology must be deployed in the building. Deploying multiple infrastructures is more expensive than just one, but the Ministry believes this is necessary from a competition perspective. However, a key aim of the consultation is to avoid that inappropriate in-building deployments will never be used, and thus would waste money.

It is optional for telecoms operators to take part in the consultation process, and if they wish to must commit to exchanging information and responding to requests from network designers when requests are made. However, as one of the key objectives of the Decree is to increase the supply of NGA services to end users and to promote competition, it would appear to be within the operators' interest to take part in the scheme. Service competition is also encouraged by the requirement for fibre operators to share the in-building fibre network.

As these measures have been put into place with DAE targets in mind, specifications for twisted pair installations are carefully set out in the Decree, which stipulated the maximum length and cable type for different sizes of building, in order to ensure a minimum quality of service. In addition, the capacity of the fibre network installed must be over specified to take into account growing demand and the possibility of fibres becoming damaged. The specific technical regulations are set out in the annexes of the Royal Decree 346/2011.

With the exception of DTT, where amplifiers are installed, normally only passive infrastructure is installed. However, regulations also extend into individual dwellings, with a minimum number of sockets per apartment specified for new construction projects.

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8 See: https://sede.minetur.gob.es/es-ES/procedimientoselectronicos/Documents/SE%20Telecomunicaciones/ICT2011/RealDecreto_346_2011.pdf.

9 See: https://sede.minetur.gob.es/es-ES/procedimientoselectronicos/Documents/SE%20Telecomunicaciones/ICT2011/OrdenITC_1644_2011.pdf.

The Ministry cannot recall any examples of disputes between contractors and operators; it claims that the procedures that have been put in place are designed to deal with issues before disputes occur. Firstly, the person in charge of the common infrastructure deployment must be a certified telecoms engineer, and the applications are independently checked by one of several accredited bodies, before the project is permitted to go ahead. In addition, the Ministry may elect to survey the project. However, conflicts have arisen in the past in projects that have tried to reduce costs, for example by construction firms not considering all the necessary requirements that are necessary to comply with the regulations. Most of the process is carried out using electronic procedures, so despite sounding complex, the measures have not resulted in significant administration or staff costs.

Overall, the Ministry claims that there has been a positive impact on coverage; cable operators in Spain often consider the deployment case on a building-by-building basis (e.g. buildings close to the beach might only be occupied during the holiday season, so the business case is weaker than buildings in the city, which are likely to be occupied all year round). The Ministry has found that cable operators are prepared to deploy in a building that has fewer end users wishing to take the service in buildings with common infrastructure than that in older buildings, due to the ease and reduced expense of deployment. Therefore, regulation has made it economically viable to cover some buildings that normally would not be in the interest of the operator to cover.

Strengths and weaknesses

Strengths ↑	Weaknesses ↓
• Internationally recognised as a strong scheme (considered 'excellent' by the OECD)[10] • Particularly important for Spain, as a large proportion of the population live in MDUs • Measures have encouraged coverage expansion, as cable operators cover buildings that would not normally be economically viable to cover	• As the regulations only apply to new and upgraded buildings, the impact is slow to take effect (~20% of buildings now have common infrastructure) • The scheme is heavily dependent on the Spanish construction sector, which has been in decline over the past few years • The scheme does not include a labelling scheme to promote fibre-ready buildings (such as the one seen in South Korea, for example)

10 See: http://www.oecd.org/dataoecd/53/35/50488898.pdf.

Case study: France

Market context

Over the last decade, the French have embraced broadband, and at the end of 2011 broadband penetration in France was estimated at 83% of households, which is the fifth-highest in Europe. However, take-up of NGA services has been slow, with 93% of all broadband connections being DSL at the end of 2011, and only 2.9% of lines were 30Mbit/s or faster. In part, this is because NGA coverage is relatively low, with cable and FTTH covering an estimated 38% and 8% of homes, respectively, at the end of 2011. However, all of the main operators – France Telecom, Iliad (Free) and SFR – (which had a broadband market share of 41.9%, 21.8% and 21.6%, respectively) have extensive fibre deployment plans currently in progress, and fibre coverage is therefore expected to grow significantly by 2020 – a significant investment driver for FTTH roll-out is thought to be the popularity of pay-TV in France.

Measure implemented

In order to encourage operators to invest in NGA deployments, ARCEP has implemented three main measures since 2009. The first two relate to the shared point at which the MDU is connected to the operators' fibre networks (the shared connection point), and applies to all MDUs in densely populated areas. The third and most recent measure is concerning the installation of in-building wiring in all new buildings.

The first measure is described in Resolution No. 2009–1106,[11] which was passed in December 2009. At this time, FTTH deployments had already begun in Paris, although difficulties were encountered when attempting to connect the fibre network to buildings. The law originally dictated that fibre networks could be shared at the connection point to a building, in order to minimise disruption and damage to private property, and also to enable end users to select their preferred supplier. However, this second point was not economically favourable to the operators, and additionally there were found to be technical compatibility issues with the different FTTH technologies used.

Following a consultation earlier in that year, ARCEP clarified these rules for very densely populated areas as defined by ARCEP. These are 148 areas in the 20 main French cities encompassing around 3.5 million households where the regulator deems it commercially viable for a number of FTTH providers to operate. ARCEP's 2009 decisions are as follows:

[11] See: http://www.arcep.fr/uploads/tx_gsavis/09-1106.pdf.

The equipment installed must be compatible with the different FTTH technologies, i.e. passive optical network (PON) and point-to-point (PtP). As well as ensuring competition, this measure also has the aim to encourage technology neutrality. In addition, a number of solutions are permitted:

a dedicated fibre is installed between the access point and the end user's premises for each operator

a shared fibre is installed, which is only used by the operator selected by the end user

a passive splitter device allows the end user to change service providers as and when required.

If an operator connects a building to its FTTH network, that operator is obliged to allow other operators to provide services through the equipment that the first operator has installed should an end user request services from another operator.

Access to shared connections must be granted in a non-discriminatory and transparent manner. Prices are not regulated as such by ARCEP; instead, each operator is required to submit a reference offer, detailing the technical and financial conditions of access. The three main operators' reference offers are fairly aligned in terms of pricing. Refusal of access is prohibited.

The first operator that connects the building to its FTTH network becomes the building operator and thus is responsible for managing the associated infrastructure. If there is no obvious building operator (for example on a newly built property), the owner of the building is able to designate a building operator. The building operator does not necessarily provide the end-user service, and may choose to be a neutral manager, providing passive access to the network.

Although the guidelines helped to clarify the rules of deployment, there were a number of disputes between operators regarding this regulation. France Telecom and SFR have filed complaints with ARCEP against Free, which was allegedly making it difficult for its rivals to gain access to buildings it connected. According to TeleGeography, French newspaper *Les Echos* quoted an unconfirmed source that claimed that Free's infrastructure had been badly built, making it difficult for its rivals to provide their services to those buildings that Free had connected.

As a result, a second measure was introduced, with clarifications made to the ruling in 2010. Article 2010–1312 was primarily used to create the rules of fibre deployment in less densely populated areas, encouraging collaboration between the main operators in places where the business case for deploying fixed NGA is less clear. However, the Article was also used to update Article 2009–1106, by stating that the preferred location of the building's access point was to be within the private premises of the building. ARCEP has explained that at the time of the decision, this was the best option as it encouraged building owners to consider more carefully which operator they would prefer to be the neutral manager, and thus promote competition and responsibility amongst the operators. This is in contrast to less densely populated areas, where access points must be located in the public domain, with the result that access to FTTH networks on the operator's side works in a similar way to LLU. ARCEP has said that, in retrospect, even though all of the operators were in agreement with ARCEP that Article 2010-1312 was the best way forward, this ruling has resulted in two main complications:

In each building, every landlord must be in agreement as to whom the neutral manager will be, which will install and maintain the access point and vertical network. This is often a lengthy and tedious process.

It is often difficult for operators other than the neutral manager to access the premises, as they will need permission from the building owners, thus in some cases it has been difficult for end users to change operators.

Disputes about how pricing is determined have continued to emerge, for example how the weighting of access pricing is split between the vertical link and the 'last metre' that connects the vertical wiring to the end user's fibre terminal.

The third measure is slightly different and related to all areas of France. It was passed at the end of 2011 (Article R. 111-14, from the Ministry of Housing) and obliges all those applying for a construction permit from April 2012 to equip the associated building with vertical fibre, connecting all residential units to a central fibre access point. The measures are new, and the technical details have not been finalised as yet; this has been causing some compatibility concerns for operators and construction firms. In addition, it is unclear as to whether the measures are confined to new buildings or also include refurbishment projects, as the specific wording of the Article simply refers to the application for a building permit.

Strengths and weaknesses

Strengths ↑	Weaknesses ↓
• The FTTH access point measures have encouraged investment in NGA as the rules of the game have been clearly stated and stability has been created from an investor's point of view • Ideally, the measures should mean that end users are able to choose and switch operators easily, which should encourage competition • The new in-building wiring measures could facilitate NGA take-up, seeing as no further intervention will be needed when end users in these connected buildings wish to take the service (currently most buildings have a copper distribution network, but fewer have a fibre network) • The issues encountered by operators in retro-fitting existing premises highlight the advantage of mandating deployment in new infrastructure	• Although deployment has been encouraged, take-up of NGA continues to be low (according to the latest figures by ARCEP, ~1.7 million households were connected to an FTTH network, but only ~0.25 million had taken the service as of mid-2012) • Having the access point located within the private property means that choosing the neutral manager is a long and difficult process, and other operators have found accessing properties difficult, which could hamper competition • The in-building wiring measures are still in their early stages of development, and the technical guidelines are yet to be finalised, which could result in some incompatibility issues and disputes between construction firms and operators

Financial implications

Costs of the measure

Cost to the NRA or government

An advantage of these measures is that the cost to the government and/or the NRA is negligible (with the obvious exception of the initial consultation and drafting of the legislation). In the case of Spain, a 2007 legislation obliged all government services (such as electronic signatures and registers) to be made available electronically by 2010, and so the platform for introducing these measures was largely already in place. As a result, the cost is incremental and thought to be low.

Cost to the operators

In the examples considered, operators have not incurred any costs when new laws oblige new and refurbished buildings to be fitted with common NGA infrastructure. However, in France, it is up to the operator to build this terminal segment in such a way that it can be shared by other operators, which may incur some addition cost.

Cost to other sectors

For installing the in-building wiring in new buildings, it is the construction firm that must cover these costs, although these are relatively low (much lower than the cost of in-building water and gas distribution, for example). As access to NGA services becomes more and more important to consumers, it is possible that these construction firms may see a future benefit from the measures, with pre-wired buildings being sought-after by property purchasers. Therefore the construction sector could become more willing to deploy NGA infrastructure as consumer demand grows for NGA services.

The table below shows the costs of installing infrastructure in a building containing 20 units.

Figure 6: Costs of installing in-building wiring in a MDU containing 20 units [Source: Analysys Mason, 2012]

Member State	Vertical cost (EUR)	Horizontal cost (EUR)	Total cost (EUR)
France (**existing** building)	Unknown	6000 (300 per premise)	Unknown
Spain (**new** building)	Unknown	Unknown	15 000 – 20 000[12]
UK (**new** building)	2500	2500 (125 per premise)	5000

12 The EUR15 000 figure includes the installation of ducts only, and not the required wiring, which would then need to be installed when an individual apartment decided to subscribe to an NGA service. The EUR20 000 includes all the necessary cabling.

In France, the cost to an operator of installing an FTTH connection box in the end user's apartment (in an existing building) and connecting it to the in-building vertical wiring is estimated by ARCEP to be around EUR300.

Our Spanish benchmarks suggest that the complete cost of wiring a new building containing around 20 units for telecoms, TV and ducts for broadband is thought to be around EUR15 000, rising up to EUR20 000 if the actual fibre/NGA cabling is installed (as per the 2011 measures).

It should be noted that these figures are likely to be heavily dependent on labour rates, which vary significantly across Europe. As an example, Analysys Mason's benchmark for in-building wiring in India, where labour rates are extremely low is EUR55 per apartment.

Savings from implementing the measure

In France, an estimated average of saving 20% can be achieved from pre-wiring new buildings with NGA services as opposed to retrofitting existing buildings with the required infrastructure. That is, placing an FTTH connection point in the end user's apartment and connecting it to the in-building vertical wiring would cost ~EUR240. This saving comes from being able to carry out all of the work in one step, and not having to negotiate with, and approach, individual tenants and landlords.

In Spain, our benchmarks suggests that the cost saved by pre-wiring new buildings (or installing wires in ducts in post-1998 buildings) instead of retrospectively installing wiring is thought to be around 60%. These cost savings largely come from knowing where wires can be installed and not having to survey the roof, facades, internal ducts, etc. All buildings are different, and retro-fitting each one is normally difficult and expensive.

Figure 7 shows the range of potential savings per building from pre-wiring a building during the construction phase as opposed to retrospectively wiring it.

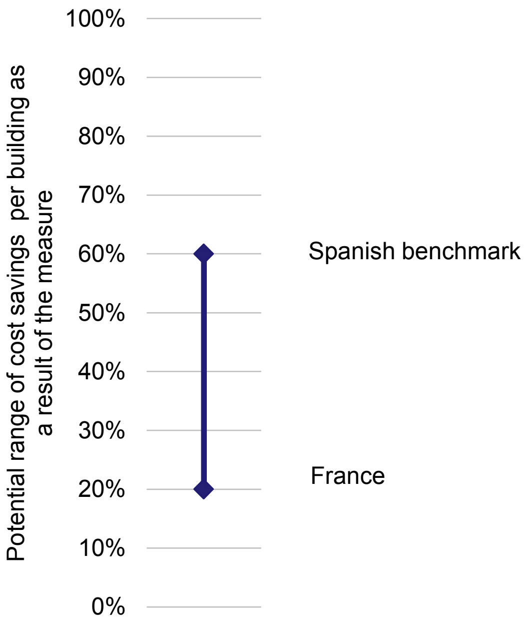


Figure 7: Range of potential cost savings per building from in-building wiring [Source: Analysys Mason, 2012]

Additionally, in the case of France, the savings to the government come from placing the connection obligations in the hands of the operators. ARCEP claims that these regulations have clearly set out the 'rules of the game' from an investor's point of view and so has encouraged NGA deployment, which has been a key benefit. The economic benefits would therefore come from earning revenue from NGA services sooner than expected. However, as previously stated, NGA take-up in France has been disappointing thus far, and so these significant NGA revenues are unlikely to have materialised yet.

Overall, operators are likely to see significant financial benefits when connecting end users in MDUs which have in-building NGA infrastructure already in place. As mentioned in Section 0, it is possible that the measures may make some buildings economically viable to cover, when they would not be without the measures in place, from the point of view of the operator.

Summary

Regulations mandating the installation of in-building wiring in new MDUs are in place in Spain and France. In addition, regulations exist regarding the inter-operating sharing of in-building infrastructure that has been installed by operators.

This measure is of particular importance in countries such as Spain, where a high proportion of the population live in MDUs. The regulations have helped operators to increase coverage, as the existence of in-building wiring may make an MDU commercially viable to cover. In addition, having neutrally owned infrastructure promotes competition and allows end users more choice over their operator.

The main identified weakness is that the measures only apply to new buildings, or buildings undergoing renovation, therefore the benefits are incremental and slow. Additionally, it is doubtful as to whether the measures have significantly increased take-up.

The cost to the government or NRA is generally low, consisting of drafting the legislation and carrying out ongoing regulatory work. Most of the cost is incurred by the construction industry, which must install the wiring in the first place. Cost estimates vary greatly, but overall, these are low, especially when compared with installation of other services such as water or gas.

However, the savings that come from installing the wiring during the construction phase in comparison with retrofitting wiring can be huge. The extra cost of retro-fitting wiring comes from the additional survey work required in order to determine where wiring can be run, and having to negotiate with every tenant and landlord, as well as the building owner; this is also a highly time-consuming process, as highlighted by the experience in France.

Conclusions

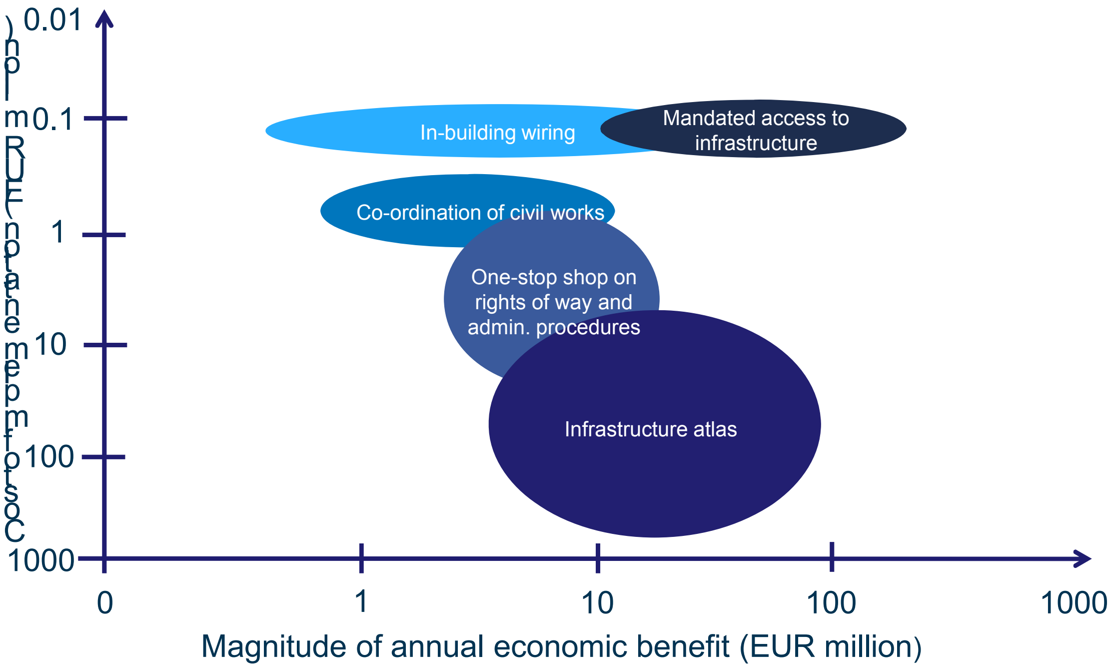
Having carried out exhaustive research and interviewed stakeholders around Europe, we believe that the five measures are all interlinked and should not be considered separately:

We believe that a **one-stop shop on rights of way and administrative procedures** and the **database where all civil works must be published** are enabler of operators self-deploying infrastructure, and not relying on shared ducts. The former can lead to savings in time and administration costs associated with digging; the latter can lead to significant cost savings associated with the digging process itself.

A **centralised atlas of passive infrastructure** will aid the implementation of **mandated access to passive infrastructure**, which will lead to deployment in shared ducts due to lower initial investment costs compared with self-digging. However, we do not believe that a centralised atlas of passive infrastructure is necessary to implement mandated access to passive infrastructure**.** A centralised atlas of passive infrastructure will have the additional benefit of reducing damage to existing infrastructure during civil works due to better knowledge of the location of existing pipes and cables; this could constitute a significant social and economic benefit in some Member States.

The cost and overall benefits to an NRA of implementing each of these five regulatory measures is shown in Figure 8.

Figure 8: Estimate of the cost and overall benefits to an NRA of implementing each of the five regulatory measures [Source: Analysys Mason, 2012]



Overall, we estimate that mandated access to passive infrastructure is the measure that performs most strongly in a cost–benefit analysis. However, experience has shown that it is mainly the ducts owned by the incumbent operator that are the most utilised in NGA deployments. Co-ordination of civil works also has the potential to offer significant benefits due to the lower costs of implementing this measure.

The cost to an NRA of implementing and regulating an obligation to install in-building wiring for new and refurbished MDUs is also low. It is the construction industry that will incur the majority of the cost, but this sector could see future financial benefits as NGA access becomes more important to property purchasers. However, the benefits from this measure will be incremental and so it may take some time for the benefits to materialise.

A one-stop shop on rights of way and administrative procedures is primarily a time-saving measure, and so the economic benefits could be achieved from more rapid NGA deployment, which would in turn enable operators to generate revenues sooner.

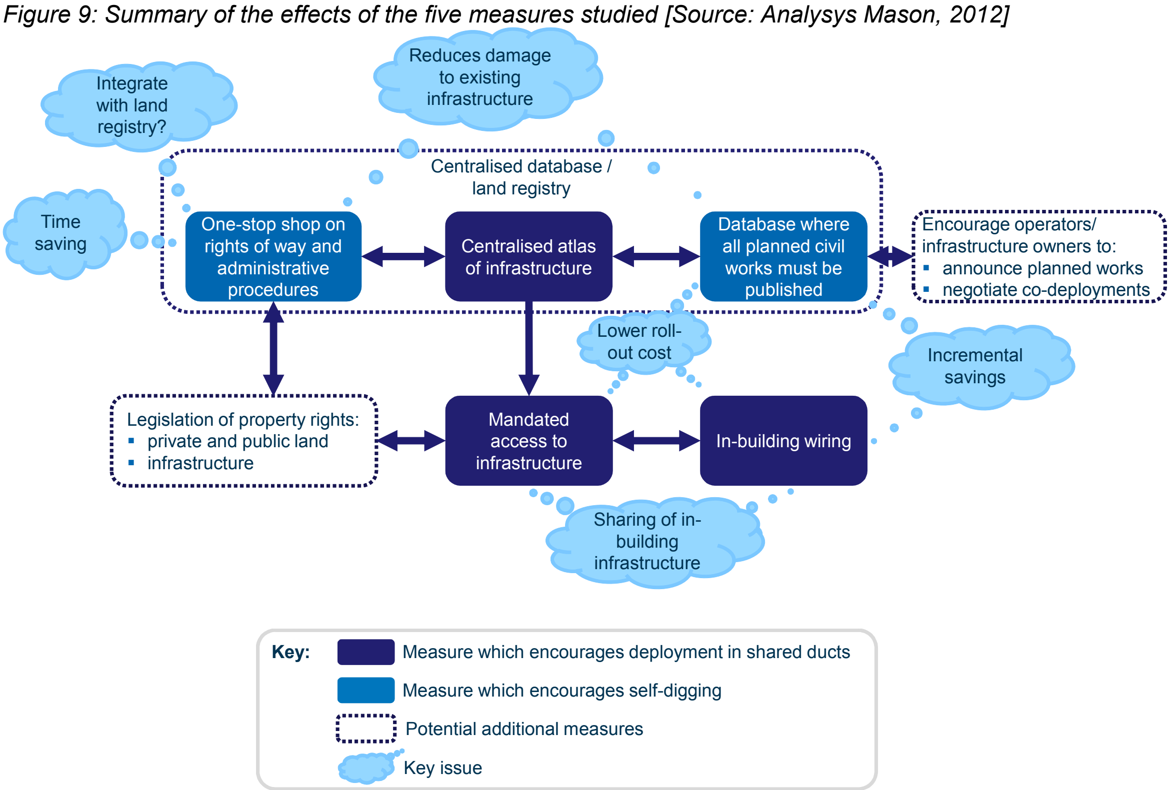
A centralised atlas of passive infrastructure is an enabler of mandated access to passive infrastructure, but depending on the detail of the mapping, the land area covered, the amount of prior infrastructure knowledge, and the likelihood of new NGA deployments in the atlas coverage area, the costs of implementing such a measure could be extremely high. It is possible that a phased approach could be taken to implement such an atlas, where data on the locations of existing infrastructure is requested from operators and utility companies first, with a more detailed second stage survey following where the shareability of ducts is considered. This would allow some information to be available to operators quickly, perhaps encouraging roll-out, although it may lead to a 'wait and see' approach if operators believe that there will be even more detailed information available in the future, as a result of the much more cost-intensive second stage. However, if the additional socio-economic benefits of reduced damage to existing infrastructure are taken into account, such a mapping project could be worthwhile.

It should be noted, however, that mandated access to passive infrastructure was brought into effect in Lithuania when the broadband market was poorly developed, and so the success of the measures there may not transfer well to Member States with more developed broadband markets, such as those in Western Europe. Indeed, both RRT in Lithuania and ANACOM in Portugal have made clear that by far the most useful and utilised ducts belong to the incumbent operators, and so the interest in other operators' ducts has been lower, and very limited in the case of non-telecoms ducts. Notwithstanding this, in some cases incumbents ducts will become full, or ducted access may not be available, particularly in the last drop to the customer premises, so the availability of ducts from other utilities could become attractive. This approach goes beyond the telecoms domain and will require cross-sector co-ordination at national and EC levels. In addition, the suitability of alternative ducts will vary from state to state and will therefore need to be examined on a state-by-state basis.

Finally, in-building wiring can simplify the investment situation for all operators, and is likely to lead to increased roll-out, either through self-deployment or shared deployment. However, as it only affects new and possibly refurbished buildings, the benefit of implementing such as measure will only be realised slowly over time.

Our research shows that these measures are all interlinked, as shown in Figure 9, 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. It is therefore likely that in some Member States, existing systems could be further developed to add the functionality required for the other measures. Whilst it is likely that significant development would still be required, so it is that some of the costs would be shared across the measures, and a combined solution could lead to significant overall benefits.

Figure 9: Summary of the effects of the five measures studied [Source: Analysys Mason, 2012]



This integrated solution could lead to the following annual economic benefits in a typical Member State:

Centralised atlas of passive infrastructure	Between EUR10 million and EUR100 million in reduced damage to existing infrastructure during civil works. Further capex savings seen by operators from passive infrastructure sharing.[13]
One-stop shop on rights of way and administrative procedures	Up to EUR50 million across all parties in reduced administration.[14]
A database where all civil works should be published	Incremental and unknown capex savings seen by operators from passive infrastructure sharing; perhaps up to EUR tens of millions per annum.

To give an example, if we assume that:

25% of the deployment is in existing ducts, saving 75% in capex for this part
10% of the deployment connects the network to new housing developments, and co-deployment with other operators/utility companies is used, saving 15–60%
5% of the deployment connects the network to pre-wired MDUs, saving 20–60%.

Then, the potential capex savings to the operator are in the range of ~20–30%. There will also be the additional social and economic benefits of reduced damage to existing pipes and cables, and the economic benefit from the reduced administrative burden to both the operators and the authorities, as described above.

Many of the implementation costs, however, are either difficult to quantify or vary greatly. In order to provide some insight into the key variables behind these costs, the table below summarises the main cost drivers of implementing each measure.

13 Assuming an obligation to share passive infrastructure was also introduced.

14 Based on savings seen from KLIP in the Flanders region of Belgium (see Section **Error! Reference source not found.**).

Figure 10: Summary of main cost items [Source: Analysys Mason, 2012]

	Measure	Main cost drivers	Other cost drivers	Main benefits
1	Infrastructure atlas	Detail of database, area covered, prior knowledge of deployments	IT costs, inspecting ducts	Could lead to more duct sharing, reduces damage to existing infrastructure during civil works
2	Mandated access to infrastructure	Amount of regulation required, amount of disputes		Reduced deployment capex
3	One-stop shop on rights of way and administrative procedures	Setting up a centralised body, ease of obtaining information on land ownership and rights of way and administrative procedures	IT costs (on-line database)	Time and admin saving during planning and deployment
4	Co-ordination of civil works	Setting up a body to co-ordinate planning, advertising & marketing, co-ordinating the works	IT costs (on-line portal)	Reduced deployment capex
5	In-building wiring	Ensuring that regulations mean that only useful infrastructure will be deployed	Installation costs incurred by construction company	Incentivises operators to increase coverage

Glossary of terms

Abbreviation	Definition
ADSL	Asymmetric digital subscriber line
AGCOM	Autorità per le Garanzie nelle Comunicazioni (Italian NRA)
AGIV	Agentscahp voor Geografische Informatie Vlaanderen
ANACOM	Autoridade Nacional de Comunicações (Portuguese NRA)
ARCEP	L'Autorité de régulation des communications électroniques et des postes (French NRA)
BIPT	Belgisch Instituut voor postdiensten en telecommunicatie (Belgian NRA)
CESAR	Centralt system för Accesser (Sweden)
CIS	Centralised Information System (Portuguese Infrastructure Atlas)
CLA	Country Land and Business Association (UK)
DAE	Digital Agenda for Europe
DCENR	Irish Department of Communications, Energy and Natural Resources
DOCSIS3.0	Data Over Cable Service Interface Specification Version 3.0
DSL	Digital Subscriber Line (refers to all forms of ADSL, but not VDSL)
DTT	Digital terrestrial television
EC	European Commission
EU	European Union
FTTC	Fibre-to-the-cabinet
FTTH	Fibre-to-the-home
FTTx	Fibre-to-the-home/premises/cabinet
GBDOT	Georeferencyjna Baza Danych Obiektów Topograficznych (Poland)
GIS	Geographic information system
GRB	Large-scale Reference Database (Belgium)
ICH	Infrastructure Clearing House (Sweden)
IMKL	Informatie Model Kabels en Leidingen (Belgium)
INSPIRE	Infrastructure for Spatial Information in the European Community
IT	Information Technology
KLIC	Information model for cables and pipelines (Netherlands)
KLIM-CICC	Federaal Kabels en Leidingen Informatie Meldpunt / Contact fédéral Informations Câbles et Conduites (Belgium)
KLIP	Kabel en Leiding Informatie Portaal (Belgium)
LLU	Local loop unbundling
LVM	Liikenne- ja viestintäministeriö (Finnish NRA)
MDF	Main distribution frame

Abbreviation	Definition
MDU	Multi-dwelling Unit
NFU	National Farmers' Union (UK)
NGA	Next Generation Access
NJUG	The National Joint Utilities Group (UK)
NRA	National Regulatory Authority
OFCOM	Independent regulator and competition authority for the UK communications industries (UK NRA)
OPTA	Onafhankelijke Post en Telecommunicatie Autoriteit (Dutch NRA)
PDF	Portable Document Format
PON	Passive Optical Network (FTTH standard)
PtP	Point-to-point (FTTH standard)
PTS	Post- och telestyrelsen (Swedish NRA)
RRT	Ryšių Reguliavimo Rarnyba (Lithuanian NRA)
SDI	Spatial Data Infrastructure (Belgium)
SMP	Significant market power
SSNf	Swedish Urban Network Association
TV	Television
UKE	Urząd Komunikacji Elektronicznej (Polish NRA)
VDSL	Very-high-bit-rate digital subscriber line
WACC	Weighted average cost of capital