Discussion of operator responses on draft model

20 April 2010

Annex to model documentation – PUBLIC VERSION

1 Revisions to the draft model

Migration off the modelled voice and data technologies has been applied

A number of operator comments (see below) refer to the lack of technology migration in the draft model.

The model has now been adjusted so that technology-specific assets have a utilisation profile that declines to zero after 15 years. The utilisation profile has been chosen to reflect a reasonably rapid movement from the modelled technologies to the next (un-modelled) technologies, and is equal to the migration profile adopted in OPTA's 2006 mobile BULRIC model.

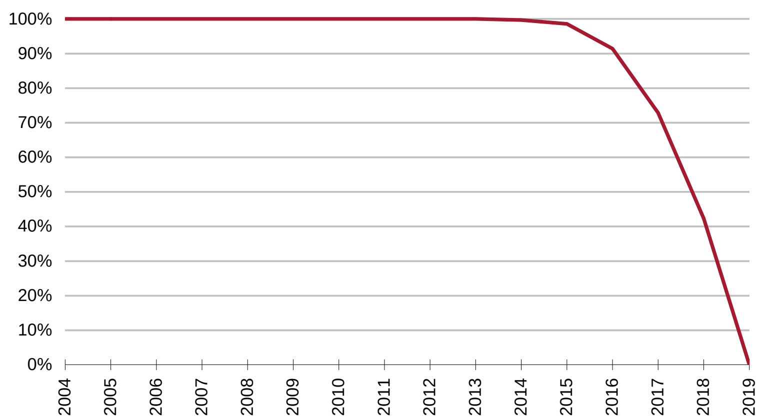


Figure 1: Technology migration curve [Source: Analysys Mason]

All of the modelled technology-specific expenditures are recovered from the technology's volumes during the 15-year period. Enduring assets that will continue to support the next generation traffic do not have the migration profile applied. Technology-specific migration has been applied to the following assets:

Fixed network	*Mobile network*
MSAN	BTS and TRX
Switches and routers	NodeB, channel kit and HSPA
SBC	BSC and RNC
Call server and software	MSC, MSS and MGW
Interconnect equipment	PCU, GGSN and SGSN
DWDM and CWDM transmission	2G and 3G licence fees

Figure 2: Technology specific assets [Source: Analysys Mason]

The following network elements are treated as enduring assets and not treated with the migration profile:

Fixed network	*Mobile network*
Switch sites and ancillary equipment	Radio sites and ancillary equipment
Trench and fibre cables	Transmission links and dark fibre
Platforms which are not technology specific and perform the same function for current and future generations with ongoing replacement (DNS, BRAS, Radius, VMS, IN, WBS, NMS)	Main switching sites Platforms which are not technology specific and perform the same function for current and future generations with ongoing replacement (HLR, AUC, EIR, SMSC, MMSC, VMS, IN, WBS, NMS)

Figure 3: Enduring assets [Source: Analysys Mason]

Correction to pure BULRIC avoided cost calculation

The calculation of the *pure BULRIC* result has been corrected to remove the *price trend* from the calculation of total avoided cost (the draft model was including this effect twice: both in the economic depreciation of avoided expenditures, and in the calculation of total avoided cost). In addition, a number of checks have been added to show the PV of (avoided) costs recovered and the end *pure BULRIC* result. This PV check shows where there may be avoided costs that are not included in the *pure BULRIC* per minute – e.g. interconnection related costs, which are treated as a separate service, or HSPA upgrade costs, which are avoided as a result of having fewer traffic-driven 3G sites.

The calculation has also been adjusted so that the volumes used to unitise the avoided costs have the demand ramp-up applied to the initial years of the calculation.

Corrections to the network design applied in the mobile pure BULRIC calculation

The removal of wholesale voice termination in the mobile model was assumed to have certain implications for some network design rules. Two corrections have been made to this part of the calculation.

The first correction has been applied in the final model: the “indoor cell radius multiplier” is now unadjusted in the *with* and *without* models. This change has been made because the effect of lower 2G traffic load and lower cell breathing (i.e. fewer GSM and UMTS radio sites without termination traffic) already includes a reduction in the number of sites needed. A second reduction of indoor coverage using the “indoor cell radius multiplier” would be double-counting this effect.

The second correction has been applied to the spectrum allocation in the *pure BULRIC* case: *without* termination traffic, the amount of paired GSM spectrum is reduced by 25% (2x7.5MHz). This spectrum is removed from the DCS band since DCS spectrum is used for higher traffic loads. UMTS spectrum is not reduced because it is required in complete 2x5MHz wideband carriers.

The other mobile network design adjustments in the *pure BULRIC* situation are:

- reduction of the minimum deployment of GSM TRX and release 99 traffic CE per site
- relaxation of the cell breathing effect from 50% load to 40% load
- reduction in the number of GSM special sites.

Underlying forecasts for the Dutch market

From 2017 onwards, Centraal Bureau voor de Statistiek (CBS) assumes approximately 0.1% annual population growth. Forecasts of households and business sites have also been set to increase only at 0.1% (the underlying population growth rate) from 2017 onwards.

Fixed to mobile substitution of Dutch households has been reduced from 33% to 20% in the long-term (having reached 19% in 2008). In addition, estimated FMS percentages have been inserted in years 2000-2003 to give smooth historic estimates. *Business lines per business premise* has been forecast on the basis of lines per premise (a forecast of 4.0) rather than calculating business lines as the difference between *total forecast lines* and *residential lines* – i.e. these forecasts are now independent. Data traffic (kbit/s) for business connections has also been given the same growth projection as domestic DSL traffic (10% annual growth for six years followed by a declining growth percentage).

Although we have reduced fixed to mobile line substitution to 20%, the model still has ongoing substitution of voice traffic to a 40:60 (fixed: mobile) share.

The projection of mobile-data-only households has also been reduced from 17% of households to 8% of households in the long-term.

A number of adjustments have been made to the market forecast as a result of OPTA's latest market information

The following changes have been applied to the model:

- Mobile penetration has been increased according to 1H2009 subscribers, the long-term forecast penetration of 130% of population maintained.
- The voice forecast for the market has been updated: there has been a further decline in fixed voice traffic, as well as lower growth in mobile traffic. We have therefore applied a long-term projection of stable voice volumes for the entire market.
- The percentage of mobile origination traffic to international destinations has been reduced to 3% in 2009 and in the forecast years.
- There has been a lower proportion of on-net mobile-to-mobile traffic in 1H2009. Therefore, we have applied a reduction to the *mobile call weighting factor* to fit the lower on-net proportion of traffic.
- A slightly increased SMS growth from 2008 to 2009 has been applied, reflecting 1H2009 message growth.

- The final model has a higher mobile broadband usage, based on 1H2009 data traffic, which indicates a much higher growth than predicted in the draft model. Consequently, the long-term forecast has also been increased to 3500Mbytes per mobile broadband user per year.

Fixed operator WACC

For the fixed model, the calculated WACC of KPN (6.56% real pre-tax) has now been averaged with the cable operators' WACC (8.2% real pre-tax) calculated for OPTA by Analysys Mason. This change has been applied because the model is a hypothetical existing fixed operator in a two-player market.

Therefore the WACC applying to the fixed operator is now 7.38%.

VoIP software allocation

The VoIP platform software fees (estimated at EUR12 per line per year) have been applied with the voice call routeing factor of the VoIP call server platform. This means that these costs form part of the traffic-sensitive *Plus BULRAIC* cost of fixed voice termination traffic. The cost-per-minute of this network element is also included in the *Pure BULRIC* of fixed voice termination.

These changes have been applied because we consider it reasonable that, in the long run, the level of VoIP platform software costs will predominantly vary with the volume of traffic that the call servers carry. In addition, this is consistent with the treatment of other network element software components (e.g. MSC) which – although this software could be priced per subscriber or per network – are assumed also to be variable with hardware load in the long-run (or included in the hardware unit cost).

Fixed access network EPMU or allocation

The fixed network *Plus Subscriber BULRAIC* calculation takes the annualised cost of the fixed subscriber costs (access network, line cards, numbering fees) and allocates them to traffic services. The model now allows this allocation to be either:

- a cost-based EPMU
- a specified percentage of the cost allocated to voice services.

This adaptation has been made so that OPTA can calculate a range of possible *Plus Subscriber* cases with which to inform its market analysis.

Fixed network voice over IP rate

The fixed network VoIP rate has been adjusted so that it is now a time series as follows:

- 95kbit/s until 2010
- 132.8kbit.s in 2012 (based on the introduction of 10ms packetisation for improved network quality and interconnect interworking)
- 148.8kbit/s in 2014 (based on the introduction of IPv6 headers).

MNP platform and support costs

A mobile number portability network element has been added to the mobile model to accommodate platform, related support and COIN costs.

The cost of the fixed network buildings have been adjusted as a result of detailed investigation into a reasonable building size estimate

The draft model contained an estimate of the (average) cost of each fixed network buildings (small metro, large metro, distribution, core, national), resulting in a total fixed network building GRC of EUR957 million. The fixed network building estate has been finalised as in the table below and amounts to a GRC of EUR852 million.

Node	*Estimated average size, m^2*	*Capital cost per m^2, EUR*	*Cost per building, EUR*	*Number of buildings*	*Total GRC of estate, EUR*
Small metro	100	2200	220 000	379	83 million
Large metro	250	2200	550 000	819	450 million
Distribution	600	2200	1 320 000	145	191 million
Core	1300	4000	5 200 000	12	62 million
National	4000	4000	16 000 000	4	64 million

Figure 4: Fixed network buildings [Source: Analysys Mason]

These building sizes include an estimated allowance for the following facilities:

- Cable access room / chamber
- MDF
- internal wiring
- MSAN
- WDM transmission equipment
- routers, switches and platforms (in the larger nodes)
- network management and operations (in the national nodes)
- power supplies
- air conditioning/cooling
- generator/battery backup
- fire control, tools and equipment
- personnel facilities and local IT
- security and entry.

The building size estimates do not contain an allowance for co-location facilities, business overhead functions or retail divisions.

Longer mobile network ring lengths to ensure two points of connection on each ring

In the draft mobile transmission design, the Noord-Holland ring (purple zone) and the North-East rings (red zone) were considered to have only one point of connection with the national backbone ring (at Amsterdam and Arnhem respectively). We agree with the submission of the industry party that improved redundancy could be applied at these points.

Consequently, the length of the dark fibre rings in the mobile network have been adjusted so that each regional ring connects to two core locations:

- The national backbone and Randstad rings now go from Amsterdam to The Hague via Haarlem
- The North-East and Utrecht-Flevoland rings have been "interleaved" so that the North-East ring goes Zwolle-Utrecht-Arnhem, and the Utrecht-Flevoland ring goes Zwolle-Arnhem-Utrecht.

This results in the following adjusted mobile ring lengths:

Transmission rings	*Length (km) – old*	*Net change as a result of rework*	*Length (km) – new*
North-east	464	88.49	552
Noord-Holland	233		233
Utrecht-Flevoland	220	32.29	252
Randstad	200	17.65	218
Rotterdam-Zeeland	344		344
South-east	404		404
Core ring	**420**	**17.65**	**437**

Figure 5: Transmission ring adjustments [Source: Analysys Mason]

The fixed network transmission route *Amsterdam to The Hague* has also been modified to go *via Haarlem*, for consistency in redundancy.

Figure 6: *Ring adjustments [Source: Analysys Mason]*

Proportion of urban sites connected to regional rings; Fibre and Backhaul Access E1s on the rings

Based on geoanalysis of Antennebureau mast locations, we estimate that 15% of urban sites are connected to hubs on the regional rings rather than 5% as in the draft model.

Sites using fibre last-mile backhaul links, and the proportion of other radio sites connected to the dark-fibre rings, now have their last-mile-access E1 requirement mapped onto the capacity calculation of the six regional rings. The number of last-mile E1s per-access point on the ring is added into the ring capacity requirements.

Adjustment to the economic depreciation of the mobile core MSC-MSS/MGW and associated STM-IP transmission

The hypothetical existing operator starts its deployment with STM and MSC equipment in 2004, and then deploys IP and MSS/MGW equipment from 2009-2010 onwards. In the final model we have treated the replacement with IP and MSS/MGW equipment as a ‘replacement cycle’, rather than a ‘migration’ because:

- the short period that STM and MSC equipment is assumed to be active in the hypothetical network, and
- we have accepted the migration profile applied to technology-specific assets and to have a migration within a migration would imply long-run costs which have sequential short-term steps in them – rather than the smoother economic cost trend which we aim for in principle with economic depreciation.

This means we have annualised the economic costs of all the relevant equipment (STM, IP, MSC, MSS/MGW) over the whole network element lifetime – this results in a smoothly developing economic cost of voice traffic, reflecting the cost blend of all underlying equipment types.

2G and 3G radio network inputs and calibration

In response to a number of operator comments, the inputs to the 2G and 3G radio network design have been adjusted:

Population coverage is now based on operator data for “indoor” signal coverage, consistent with the use of “indoor” cell radii in the coverage calculation.

Coverage cell radii are now based on:

- a set of outdoor coverage inputs at 900MHz
- a 0.60 multiplier for 1800MHz based on higher frequency propagation
- a further multiplier of 0.78 for 2100MHz based on higher frequency propagation plus the effect of cell loading (cell breathing).

The probability of indoor coverage signals in rural areas at 2100MHz is limited only to those dwellings near the base stations sites (i.e. in the village where the site is located) and not to the dwellings present in the countryside in-between villages. In the model this means a 1.0 multiplier for indoor cell radius applied at 2100MHz. In reality, it would be exceptionally costly to provide indoor coverage at 2100MHz using macro cells to **all** dwellings in rural areas – the model suggests that this would mean every house within 1.8km from a macro NodeB.

Within the covered areas, the *SNOCC* (factors <1) are applied to the cell radii at **all** frequency bands in urban and suburban areas. This means that operators aim for *seamless* signal coverage in urban and suburban areas, and will be affected by imperfect site positioning. However, due to the small size of 2100MHz cells, in rural areas it would be impractical to offer seamless 2100MHz coverage (when seamless 900MHz coverage is in any case ubiquitous). Therefore we do not model seamless coverage at 2100MHz.

The co-siting of NodeBs on 2G sites has been adapted so that we now apply a 20% proportion for UMTS sites deployed on UMTS-only base stations (taking into account whether there are sufficient 2G sites to contain the 80% which aim to be co-sited).

The BTS and NodeB utilisation factors (applied nationally in the model) have been reduced to take account of the sharing of capacity (spectrum) in border areas, from 70% to 66% on average.

Asset lifetimes	In the fixed model, a number of adjustments have been applied: • corrected the National Data Switch lifetimes to eight and five years (chassis and cards) • reduced the transmission card/interconnect E1, transponder lifetimes to five years • set the call server lifetime to be six years, consistent with other platforms in the fixed and mobile models.
MSAN unit costs	The MSAN equipment unit costs have been adjusted in response to one operator's comments as follows: • MSAN rack capex increased to EUR25 000 • DSL line card unit (48-port) decreased to EUR2500.
Mobile switch unit costs	The following adjustments have been made in the mobile model: • MSC capital cost EUR1.2 million • MSC software capital cost EUR1.4 million • MGW capital cost EUR1.46 million.
VoD reduction	We have reduced the volume of video on demand load in the fixed model to 40% of the market total. This is because we have assumed a design consistent with a copper-based access network in which only a proportion of customers could be served with VoD over exchange-based VDSL. We have validated the suggested 40% input by two calculations: • the proportion of ZIP6 business addresses which are within 1.1km of the MDF locations (54%) • the proportion of ZIP4 population which is within 1.1km of the MDF locations (32%). A distance of 1.1km is chosen as the approximate radial distance of a 1.5km copper line from the exchange (the anticipated VDSL limit for VoD).
Utilisation inputs	The utilisation percentage of the fixed network wholesale billing system (WBS) has been set to 80%, consistent with other fixed and mobile platforms.
OPTA numbering fees in the fixed model	The draft model omitted OPTA numbering fees from the cost base. We have added a network deployment unit of 1 so that OPTA numbering fees are now incurred in the fixed network model.
Mobile wholesale billing system routeing factors	Only voice call attempts are used to dimension the WBS, therefore the routeing factors for the WBS in the mobile network have been adjusted to remove SMS services.

2 Operator comments

2.1 General comments

An operator disagrees with the concept of any incremental cost based regulation; it is unfit and disproportionate given its market position	OPTA will discuss this in its market analysis.
Further analysis of the WACC should be conducted later in the project	The WACC analysis of the project has been concluded.
The model should take into account different spectrum assignments	This is a conceptual comment which was discussed in the earlier stages of the project.
The model should take into account market share differences in fixed and mobile markets	This is a conceptual comment which was discussed in the earlier stages of the project.
The model should be modelling actual operators, or a realistic new operator	This is a conceptual comment which was discussed in the earlier stages of the project.
A significant proportion of KPN's and Vodafone's costs have been already recovered; later licensing of T-Mobile means that it has not enjoyed a similar opportunity – as such the model is discriminatory and should instead reflect actual operators or a hypothetical new entrant	This is a conceptual comment. T-Mobile (and Orange) entered the market twelve years ago by bidding for spectrum in a market-based auction – and its shareholders took the decision to purchase the licence to operate (and the spectrum) at the prevailing auction price. The forward-looking efficient costs of T-Mobile can not be considered exogenously influenced by the events and cost recovery around (or before) 1998, because: • T-Mobile entered the market by an open auction • all parties are now paying the market price for spectrum • many network elements have lifetimes less than 12 years and therefore *all* operators will be on a second or third asset deployment and cost recovery cycle.

Pure BULRIC is not economically viable to regulate call termination	OPTA will discuss this in its market analysis.
OPTA should provide the consumer and producer welfare effects of the various BULRIC options	OPTA will discuss this in its market analysis.
If operators are not allowed to recover the full costs of termination in their termination prices, than this should be compensation in the regulated tariffs of wholesale services such as CPS and WLR	OPTA will discuss this in its market analysis.
OPTA cannot allocate significant amounts of cost to other non-regulated services and ignore the implications	OPTA will discuss this in its market analysis.
The pure BULRIC method is in conflict with the requirement for cost orientation – because it assumes a last-increment approach	OPTA will discuss this in its market analysis.
The plus BULRAIC method (as proposed) is in conflict with the requirement for cost orientation – because it forces services to be priced at a uniform average cost, preventing welfare-optimising prices and making it impossible to recover total network costs: common costs should be weighted more to voice than data	OPTA will discuss this in its market analysis.
Request more explanation on how the pure BULRIC calculations work	Relevant documentation is provided at: section 4.3 of the model documentation, slides 121-122 in the IG2 presentation.
Pure LRIC is inconsistent with OPTA's statutory duties and the EC's proposed approach is flawed	OPTA will discuss this in its market analysis.
Termination charges should contribute to fixed and common costs	OPTA will discuss this in its market analysis.
Ramsey pricing should be used, particularly in plus subscriber BULRAIC *which would require more subscriber costs to be allocated to the fixed subscription*	Ramsey pricing has already been discussed in the conceptual conclusion of the modelling.
Regarding Plus versus Pure BULRIC, how does OPTA view consistency with its previous approaches, and the impact of pure BULRIC on higher costs for customers?	OPTA will discuss this in its market analysis.

The fixed model should reflect the market share of KPN, and should be consistent with the network topology of KPN	This is a conceptual comment which was discussed in the earlier stages of the project.
Small operators such as Online have a unit cost per minute significantly higher than a 50% share operator	Operators, such as Online, will have a different cost structure than the modelled hypothetical fixed operator. Online will not have incurred the large costs of deploying a national network, as it relies instead on unbundled access at the local exchange. Online can choose whether to operate as an unbundler or a national fixed network operator (OPTA is not prohibiting Online from deploying a national fixed network). Furthermore, it can also choose *where* to operate as a unbundler. Online *may* be subject to lower economies of scale in its VoIP platform – because of its relative small scale and small voice volume. However, OPTA is not imposing small scale on Online – its market share is within its own control. We are also aware that VoIP platforms can be procured at low cost for small operators, distinct from large capacity platforms that might be needed by a national incumbent operator. Consequently, higher costs for Online which may arise as a result of these effects are within Online's control and should not determine higher efficient termination rates for itself (or for other parties).
The impacts of significantly lower interconnection establishment and management charge will lead to complexity, inefficiency, operational risk etc	OPTA will discuss this in its market analysis.
Further analysis of the WACC should be conducted later in the project	The WACC analysis of the project has been concluded.

The real pre-tax mobile WACC should be at least 9.85%	We have concluded on the WACC in the *Conceptual approach for the fixed and mobile BULRIC models, Version after industry comment.* It is our view that the mobile WACC has reduced since 2006 because the asset beta (the measure of risk) for mobile operators has reduced. The business models, forecasts and expectations for mobile operators are now seen to be more certain than they were prior to 2006 (from when the previous beta benchmark was derived).

2.2 Comments related to both fixed and mobile models

The model is overly complex, non-transparent and potentially unstable (5 modules, use of a pure LRIC macro, combined fixed and mobile model, converged market module, hard-coded values); separate costing models should be developed for fixed and mobile, and for each costing method	We are of the opinion that the alternative model which is suggested would be: • larger • harder to navigate • more difficult to maintain consistently since it would contain multiple repeated calculation sections, each of which would have to be separately maintained or changed. Furthermore, given the increasing competition between fixed and mobile services, we consider it important that the demand volumes feeding the fixed and mobile models are derived from an internally consistent, single market forecast. The suggested model might also suffer from memory limits in Microsoft Excel if it could not be opened in its entirety. The complexity of the suggested model compared to the complexity of the current model is illustrated in the figure below.

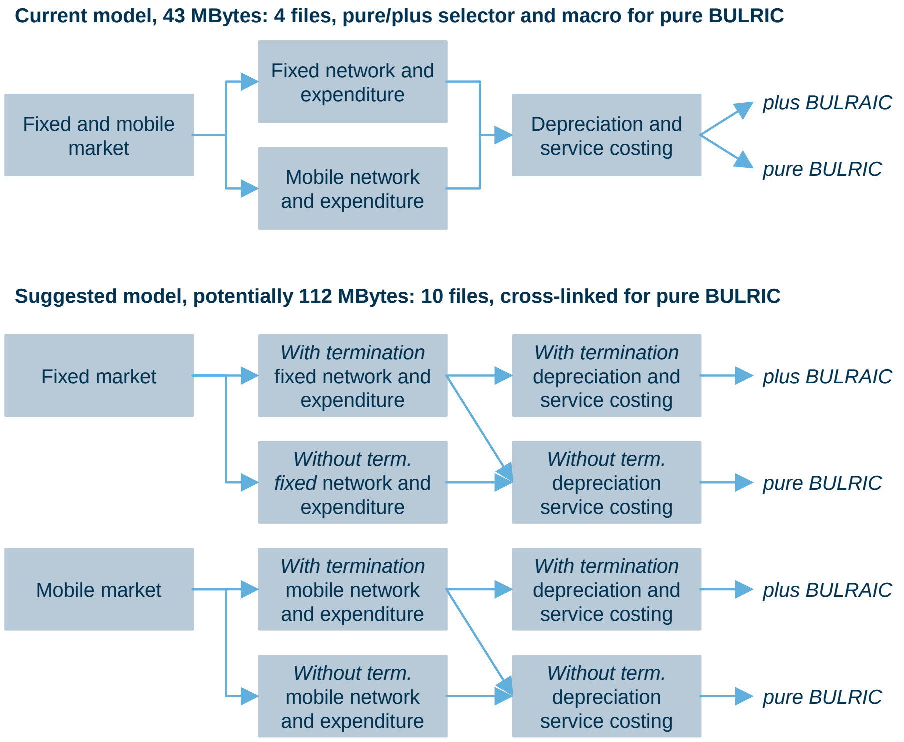


Figure 7: Comparison of model flows [Source: Analysys Mason]

A 50-year modelling period is too long

The relevant consideration here is **terminal value**. We consider that the Dutch telecoms businesses have a significant long-term value (i.e. the terminal value at the point that cost recovery is suggested to cease) – in terms of trench, radio sites, transmission, switching sites and of course established subscriber and revenue base. We consider that it is highly unlikely that a network consisting of 1000s of radio sites or kilometres of trenching with granted permissions for use and transmission will not be of value to any other business venture on expiry of a licence or conclusion of a specified cost recovery duration.

It is unreasonable for OPTA to ask wholesale termination customers of other networks to fully fund an operator’s cash-flow up to a suggested zero terminal value by allowing the operator the “cost-less” decision to exit the market at the end of its licence or cost recovery without realising any remaining value. In the same respect, it is normal practise for equity analysts to assume terminal values in their valuation of operator shareholdings.

The purpose of modelling 50 years is to ensure that there is no need to consider the terminal value of the business – because 50 years of discounting is sufficient to reduce the terminal value to a negligible level in present value terms (less than 2%). The purpose of modelling 50 years is not to predict precisely what the fixed and mobile markets will look like at that time.

If we were to model any shorter time period for full cost recovery, such as fifteen years, it would be necessary for us to consider the remaining terminal value of the business at the end of fifteen years (we have chosen instead to model the steady-state continuation of the residual value network, rather than a simple terminal value estimate, including the effects of technology migration).

Assuming zero terminal value and full cost recovery by a set date for a network business could be appropriate in the circumstances of a "concessionary" licence, in which the government would seize all assets and subscribers at the end of the specified licence without recompense to the licence holder.

Finally, the model projects a conservative long-term situation in which mobile (and fixed) voice and data services are subject to technology specific migration off 2G and 3G (and IP/WDM) generations.

We consider that the calculations of the model are reasonable for the purpose of setting wholesale mobile termination rates in The Netherlands. Our approach of using a long modelling period for OPTA is the same as that adopted by a number of other European regulators (Ofcom, BIPT, NITA, PTS and NPT).

A modelling period of 50 years is excessive, in particular given mobile asset lifetimes. Instead lifetime of operator licence or current technologies should be used, and different period for fixed versus mobile. An acceptable alternative is a shorter period plus a terminal value for any assets still with a remaining lifetime

A 50-year lifetime (or terminal value) is discussed in response to the same comment previously in this document. See section 1 for our model adjustments on current technology lifetime (migration).

The model does not assume migration after NGN	Migration at the beginning of the network is modelled (with a rollout during two years 2004-2005, followed by a load-up of traffic onto the network from the previous legacy network). We have examined the submitted information on fixed voice platform migrations over the years. It can be observed that a technology standard (e.g. digital PSTN) has a lifetime less than 50 years, and during the technology cycle, three evolutions exist: first evolution, followed rapidly by a second evolution that operates until the final stages of the technology when a final evolution of the standard is needed to accommodate emerging requirements of the next technology. Underlying these voice platforms are similar evolutions in transmission technology. We accept that a shorter period than 50 years can be applied to specific fixed network equipments however this shorter migration period should not apply to fixed network buildings or core network trench/duct. A similar conclusion has been developed for the modelled mobile network in respect of 2G, 3G and LTE technologies, in which it is assumed that 2G and 3G generations will endure until around 2019. A migration curve at the end of the network technologies will also be applied. See section 1 for more details.
Voice migration in the period 2004-2010 is much too optimistic	The model uses a faster load-up curve for residential voice, and a much slower curve for business voice, acknowledging the fact that legacy PBX issues complicate such a transition. In the Dutch market, KPN provides one example of how fast voice might migrate to the next generation technology ("PSTN will exist until at least 2015"). However, the cable operators provide a counter example. These providers are using a 100% NGN platform to support their share of the (residential) voice market. KPN also has a residential VoIP service which has seen significant take-up recently. Therefore, we consider that adopting 5 years for residential voice traffic migration is reasonable and captures the efficient requirements of the Dutch residential telephony market (and is also an average between 0 years and 10 years migration for the two types of NGN voice provider). Applying 10 years for business voice traffic is consistent with the comment submitted.

In mobile, spectrum procurement and adaptation costs should be included because 50 years is longer than the duration of licences	Taking into account migration off the modelled 2G and 3G technologies means that future procurement and adaptation costs can be considered to fall into the costs of the replacement technology (i.e. should not be modelled).
Additional costs of LTE upgrades in 2011/2012 should be taken into account	Higher voice termination costs arising in 2G and/or 3G networks as a result of operators deploying LTE in 2011/2012 are not costs which should be paid for by wholesale termination customers. LTE is primarily aimed at supporting higher mobile data volumes and is not a requirement for mobile voice termination. To the extent that LTE carries voice traffic in the near future, there is no reason for voice termination regulation to be set on the basis of higher LTE voice costs (if that were the outcome) because a proven technology (e.g. 2G) will exist for (we expect) at least the next regulatory period. If LTE can deliver lower voice termination costs than 2G+3G, including a contribution to the "additional costs of LTE upgrades", then it would be reasonable for OPTA to set regulatory target charges on the basis of lower LTE-only network costs and model an LTE-only operator.
The fixed market share should not be based on access share, but on traffic sensitive core share (20-25%)	It would be unrealistic to assume four or five national operators since there are not this many players with full national and regional transmission networks, or full national exchange building deployments – fixed costs (economies of scale) for a national 3-level fixed core network are sufficiently great that a large number of players will not set an efficient cost price for voice termination. Consequently, it is considered reasonable that two national networks should provide the efficient cost for fixed voice termination in the long-run.
The mobile market share should apply the EC-specified 20% share, or prove otherwise	The EC recommendation only indicates a *minimum* market share, and therefore leaves the option open for a higher efficient scale. Recent market consolidation in The Netherlands demonstrates that the efficient scale for mobile voice services is higher than 20%. This is also confirmed by the model which shows a significant decreasing cost price up to a market share of at least 33%.

The assumed strong decrease of total voice traffic (slide 10) is not consistent with expectations

The chart on slide 10 was not based on recent OPTA market information (it was based on Analysys Mason estimates over the overall market prior to the update with OPTA information). The fixed and mobile traffic volumes in the final model are shown below, indicating a slowly declining trend.

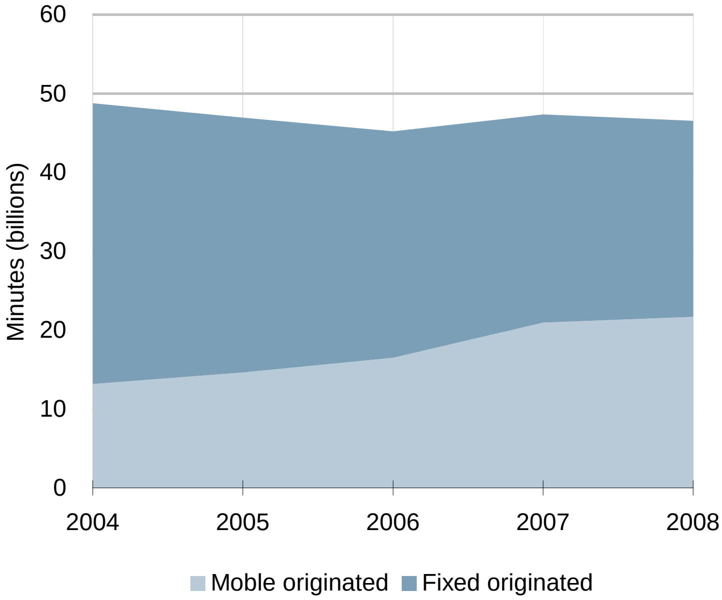


Figure 8: Voice traffic volumes [Source: Final model]

Updates to the draft model with 1H2009 data confirm that voice traffic is slowly declining, and mobile technologies are taking an increasing share of the market.

Labour, legacy network maintenance and energy opex increase by more than inflation

We have looked into historical and forecast labour and energy costs: we do not agree that the suggested increases should apply in the long-term.

The chart below shows the development of labour costs and energy costs (using US oil price growth trend as a proxy, adjusting into Euros and taking 2007 as base year), relative to inflation.

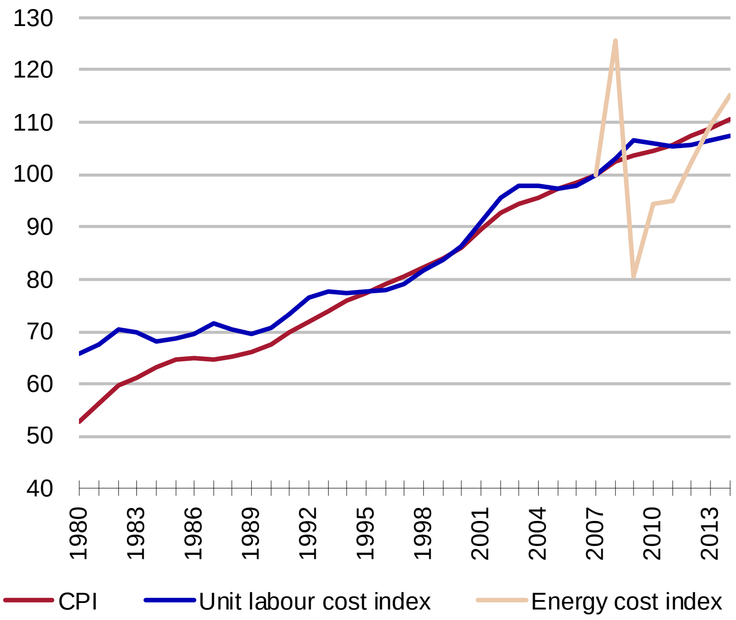


Figure 9: Labour cost index [Source: EIU] and energy cost index [Source: US energy administration]

According to the historical data and forecast supplied by EIU, the labour cost index from around the year 2000 has varied around the general trend of inflation. The same conclusion can be drawn for energy costs (although the variation is evidently more volatile). Consequently, we shall maintain our 0% real terms opex trends.

On the suggestion of increasing maintenance and support operating expenditures with maturing technology, we note that the operator does not compare the modelled fixed operator's operating expenditures (e.g. in 2009, EUR237 million for core network plus EUR30 million overheads, plus EUR100 million access maintenance) with its own opex that it claims already includes increasing PSTN-related obsolescence costs. With the migration profile applied to the final model, operating expenditures continue to be fully incurred until the final year of the technology cycle. Therefore, we consider that the model already reflects a reasonable level of operating expenditures over the lifetime of the modelled network equipment, consistent with current levels of network expenditure.

Lifetimes of transmission, BTS, TRX and call servers should be shorter

To be consistent with other assets in the BULRIC model, we have reduced the transmission card/transponder lifetimes to 5 years, and the lifetime of the call server to six years (consistent with IN and other fixed and mobile platforms).

We have verified our other lifetime assumptions with those adopted or proposed in a number of other European countries in our other similar models of this form. We consider that 8 years is a reasonable lifetime to adopt for the majority of network equipment in an economic costing model which will set the level of wholesale termination costs recovered from the customers of other operators. The economic lifetimes of some network elements were – in both the draft and final models – already accepted to be lower than 8 years.

The table below compares the final OPTA model with the range of operator information for *financial accounting* lifetimes and other regulators' economic cost models.

	Range of Operator data submitted for financial asset lifetimes	**OPTA 2010 Final model**	**Other regulatory cost models**				
			OPTA's 2006 model	**Scandinavian regulator**	**West European regulator**	**PTS**	**ARCEP**
Radio sites	7, or to end of licence	**15-20 depending on ownership**	13-14 depending on type	10-15 depending on ownership		25	18
BTS and TRX	7, or to end of licence	**8**	8	8		10	8
BSC	7, or to end of licence	**7**	7	8		10	8
NodeB and CE	5 to 8	**8**	not modelled	8		10	8
MSC	7 to 8 for HW, 2 to 8 for SW	**8 for HW base unit, 7 for ports 3 for SW**	7	8 for HW base unit, 8 for ports 3 for SW	*same as OPTA's final model*	10 for HW, 5 for SW	8 for HW, 4 for SW
Switch buildings	approx 30	**20**	17	20		25	20
HLR	7 to 8	**6**	6	6		10 for HW, 2 for	8
VMS	7 to 8	**6**	6	6		10	
IN, platforms, etc	5 to 8	**5**	6	annual investment		not modelled	8
IT	3 to 8 for HW, 2 to 8 for SW	**5**	6	6		not modelled	4 to 8

Figure 10: Financial and modelled economic asset lifetimes [Source: Analysys Mason, Operator data, OPTA, Other regulators' cost models]

Core upstream and downstream capacity is symmetrical and should be allocated separately, in both fixed and mobile

We recognise that some services on the fixed and mobile networks have an asymmetric traffic pattern (HSDPA, DSL data) whereas voice has a symmetric traffic pattern (duplex circuits or VoIP streams). However, if the demand from a service requires a symmetrical capacity link to be deployed (i.e. with the same capacity in the up and down stream directions) – for example, the use of paired spectrum or the operation of a duplex 10Gbit/s link – then the intrinsically-linked costs of spare upstream capacity should not be separated from the service that caused the downstream capacity to be deployed and allocated elsewhere.

Therefore, we shall maintain the dominating link load in our traffic allocation matrix:

- downstream data bits plus voice bits in the fixed network, and
- downlink data traffic plus voice Erlangs in the mobile network.

A 'total avoided costs' calculation under a pure BULRIC case does not seem to behave properly

We have investigated the pure calculation and found a calculation error in the final stage that calculates total avoided cost (the price trends were being factored in twice) and included the load-up profile in the avoided volumes. A present value check has also been added to indicate whether any assets are not contributing to the avoided cost, and to check that the PV of avoidable costs can be fully accounted for.

See section 1 for more details.

Not all avoided CAPEX and OPEX contribute to the pure BULRIC price

This comment *is correct*: not all avoided assets contribute to the avoidable cost of termination. However, the calculation of the model is correct in this regard. Assets which fall into this category are those which: are avoided with the reduction in wholesale termination volumes in the model, but which support services other than terminated traffic defined in the *plus BULRAIC* routeing factors.

For example, in the fixed and/or mobile models:

- the reduction in termination traffic results in a reduction in interconnection E1 ports and gateways. However, these costs are already fully covered by the separate interconnection service and should not be double counted in the *pure BULRIC* also.
- the reduction in mobile terminated traffic results in a reduction in the number of UMTS sites (through the relaxation of the cell-breathing effect) and therefore a consequential saving in the costs of HSPA upgrades for those avoided sites. However, in order for the HSPA volume to be carried unchanged, then these HSPA upgrades would in any case be re-deployed on other radio sites in the vicinity of the sites removed with the termination increment.

The WACC should be increased to reflect uncertainty of the long modelling period	NERA applies a bond duration applicable to the regulatory period; this aspect has been previously concluded by NERA.
Bottom-up fixed network rules are not clearly identifiable	A description of the bottom-up fixed network rules was provided in the extensive IG2 presentation; the *fixed.xls* file contains these rules encoded in a number of sheets (as previously introduced in the accompanying Model Documentation): • *Coverage* contains node rollouts and lines by node • *Network_design_inputs* contains technical inputs • *Demand_subs_calc* contains the conversions from annual network traffic to peak network load (Mbit/s at different layers) • *Network_design* contains the calculation of the equipment at each network layer, as well as containing technical geoanalysis inputs which are not user-modifiable.
Surprisingly, the cost results are not very sensitive to the WACC	A 20% increase in the mobile cost of capital results in a 7% increase in mobile BULRAIC costs; a 20% increase in the fixed cost of capital results in a 3% increase in fixed BULRAIC costs. There are two effects here: the extent to which services use capital assets (heavy use of large capital assets means higher sensitivity to the WACC); and the discounting over time of future traffic (which is the typical method of recovering the expenditures incurred). The relative insensitivity of fixed voice costs to the WACC is due to the fact that the majority of fixed network voice costs are from network elements which have: • reasonably steady expenditure outflows over time • reasonably steady voice volumes over time. The effect of increased discounting therefore reduces the future impact of both expenditures and voice traffic, and overall, the discounted cost per minute is similar. Conversely, the cost of xDSL data traffic is more sensitive to the WACC: a 20% increase in WACC results in more than a 10% increase in traffic costs in each year. This is because the xDSL cost is primarily due to a majority share of the large upfront traffic network investments recovered over a long-term stream of increasing xDSL (and other traffic) volumes. In this situation, greater discounting of future traffic flows increases the unit cost of traffic without significantly affecting the present value of the upfront expenditures required to deploy the network.

The allocation of costs to data traffic should be on an "economic" basis reflecting value per bit

The allocation of costs between voice and data in the traffic-incremental core network was discussed in the conceptual documentation. Whilst it is possible to envisage value-based adjustments to the costs, this approach was rejected at the conceptual stage.

What is included in business overheads?

Consistent with OPTA's market definition, only network costs have been calculated (retail costs are excluded from the model).

The business overheads in the model reflect the estimated network share of *overhead costs that are common to retail and network operations*, and are included as a mark-up in the *plus BULRAIC* results.

Business overheads are defined as the activities of the business common to network and retail functions: CEO and executive board along with centralised management functions (accounting, regulation, legal, financial reporting) and corresponding office space, but excluding variable overheads such as the human resource teams which typically vary as a function of the network and/or retail employee base.

Of these overheads, we have applied a 50% network share for all fixed and mobile operators, consistent with the assumption in OPTA's previous mobile BULRIC model.

This 50% network share of business overheads is included in the *plus BULRAIC* models. The "interconnection business unit" is also included as part of the overall overheads, but has been extracted from the overheads and allocated to the service of *establishing and maintaining interconnection* rather than per-minute traffic charges.

In the *Pure BULRIC* models, business overheads are assumed to be invariant with the wholesale termination increment. A proportion (e.g. the half related to incoming interconnection) of the interconnection business unit would be avoided in the absence of wholesale termination volumes, and thus some interconnection establishment costs would be incremental to wholesale termination (if not otherwise paid for through separate *establishing and maintaining interconnection* charges).

Should the initial 2006 capacity be fully recoverable? (slide 117)	The initial 2006 capacity (deployed on launch, plus upgraded in future years as demand grows) will be fully recovered from the demand occurring over the lifetime of the business, subject to the migration profile applied.
Why are different assumptions used for calculating WACC? (slide 116)	The IRG discusses whether the adoption of a differentiated WACC, that takes into account different levels of risk that each business unit (or project) faces, is reasonable. If the risks faced by companies across various regulated products are materially different, the use of a single rate of return may adversely impact the ability of NRAs to simultaneously encourage efficient investments and protect customers from excessive pricing. Mobile operators generally have a lower reliance on debt than fixed operators because of the greater variability in costs and returns compared with fixed-line operations.

2.3 Fixed model comments

The fixed network should deploy redundant core rings (separate trench routes for the same ring)	Based on our analysis and discussions with the Dutch core network operators, we have come to the conclusions that: • a modern, efficient, ring-based core network supporting 50% of the core network demand of the country would not **require** the extra redundancy provided by separate trench routes to provide reasonably resilient network services • modelling ring structures and 40% utilisation on network routers provides sufficient resilience for a physical disruption to a core ring to be accommodated in the network. We accept that there is a small statistical probability that physical disruption could occur simultaneously to both directions (clockwise and anticlockwise) on a core ring. It is our view that providing a diverse parallel ring and 'squaring' this *already small* probability would amount to an inefficient cost for our modelled 50% share operator.
The voice call bandwidth should be increased to 160.8kbit/s, for IPv6, 10ms delay and "presence"	This comment has been partly accepted. See section 1. Presence is a value added service over and above traditional voice interconnection. It is not provided over the existing TDM, SS7 interconnect used in the market, nor is likely to be required during the period of regulation.

The BH calculation should be adapted to reflect the fact that residential and business infrastructure are largely separate	Our assumption is that residential and business infrastructure are shared in the NGN. Given that the voice platform – consistent with other core transmission infrastructure – has a utilisation factor of 40%, then we consider that the model has included sufficient redundancy.
VoIP licence costs should be allocated to voice traffic, not to subscribers	This comment has been accepted. See section 1.
MSAN rack cost is too low, perhaps MSAN line cards costs are too high	This comment has been accepted. See section 1.
A higher proportion of MSAN costs should be allocated to traffic/voice	In the model, the MSAN rack is allocated 100% to traffic – this accounts for around 30% of the economic costs of the MSAN components in 2013, approaching 40% in the long-term. The line card components (75% in 2013, 60% in the long-term) are allocated to subscriptions. The operator data supporting this comment is based on a significantly higher rack cost than is estimated for the model. Therefore, we do not consider the percentages suggested as relevant to the costs that are present in the model – the cost of the rack itself is discussed above.
The valuation of the national, core and distribution nodes is too low	See section 1.
Building space should be allocated based on space, not on traffic	The allocation of core network building costs in the model is based on traffic in the core network. If the costs were allocated on the basis of space, a large proportion would be allocated to subscriber access (e.g. MDF) and not traffic (voice or data). In a NGN, the voice platform occupies a considerably smaller footprint than the PSTN switches in a legacy voice network. Therefore, in allocating all building costs on the basis of traffic, including a traffic-share to voice, we consider that the result is conservative.

The modelled rollout of fixed buildings (1359 in total) is higher than KPN's all-IP design (187 sites) – therefore, inefficient	Whilst KPN's all-IP design has 187 main network nodes (comparable to our 161 Distribution, Core and National nodes), it will still have network aggregation points at many of the other 1359 network buildings. As such, scorched-node modification would be applicable in any case to this comment. However, as we are modelling a VDSL based network, the rollout of fixed network buildings as MSAN locations remains relevant to the cost model.
VoD demand should reflect the fact that a large part of the subscriber base can not be provided with sufficient bandwidth	This comment has been accepted. See section 1.
The hypothetical existing operator would deploy FTTH in its access network – consequently, data volumes are significantly underestimated: a long-term forecast of data traffic should be developed taking into account the likely increase of FTTH in The Netherlands	In the draft model, the majority of shared costs in the traffic-driven core network are already allocated to the modelled data volumes, therefore including more aggressive fixed data volumes is unlikely to influence the cost of voice to a significant extent.
OPTA and NMA have agreed a 25-year payback period for KPN-Reggefiber	The lifetime assumed for *access network fibre deployments* for the KPN-Reggefiber payback was set by OPTA for the purposes of regulating fibre access (and not for costing copper access). In the fixed model we have adopted a 40-year lifetime for the modelled copper access network (because it is likely that the majority of access connectivity within the next regulatory period will still be based on copper connections).

The pure BULRIC model does not behave properly when changing market share

Calculating *pure BULRIC* results with different input parameters should be undertaken with care, since the *pure BULRIC* is a difference between two model states, and it is likely that the change of input (e.g. market share) affects both the modelled costs *with* and costs *without* termination traffic.

When market share is reduced (increased), the on-net/off-net traffic calculations of the model in *Market.xls* adjust to the smaller (larger) operator and a smaller (larger) proportion of traffic is carried on-net. This means that the trend in pure BULRIC results should not be observed in isolation as other effects are influencing the underlying economic costs of network elements.

In the mobile model, a number of technical adjustments are applied in the *with* and *without* cases (e.g. reduction of DCS spectrum, reduction of 2G cell-breathing network load). These adjustments mean that pure BULRIC results should not be varied in isolation with other input parameters without due care: e.g. a revised calculation at a lower market share **should also** be accompanied by a reduction in the amount of spectrum and in the level of cell-breathing load inputted into the model in both the *with* and *without* cases.

The pure BULRIC model does not behave properly when changing voice bandwidth

The **draft model** does exhibit a varying upwards trend in the *pure BULRIC* with changing voice bandwidth (as shown below).

The **draft model** fixed network pure BULRIC comprises:

- more than 80% call server and wholesale billing system avoided costs (these are not dependent on the voice bandwidth)
- less than 17% avoidable costs of some Level 3 router ports/cards. These cost are dependent on voice bandwidth.

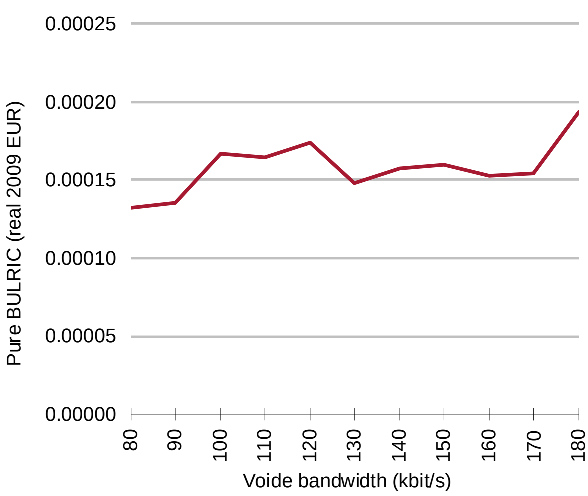


Figure 11: Draft model variation of Pure BULRIC with voice bandwidth [Source: Analysys Mason]

As can be seen, the Pure BULRIC cost of voice termination in the fixed network **of the draft model** is small, because of:

- the (relatively) small volume of voice termination traffic in relation to total network traffic,
- a limited traffic sensitivity of its supporting platforms.

As such, the calculation of pure BULRIC with a variation in traffic load (voice bandwidth) is a somewhat *noisy* measurement which is derived from very small effects in the context of the entire large cost base (e.g. the advance/delay of a particular router card install, or move from 1Gbit/s to 10Gbit/s cards marginally earlier or later).

In the final model, the VoIP platform software has been allocated to the pure BULRIC of fixed voice termination. As such, although this variable (noisy) effect will still be present, it will be much smaller in comparison to the total pure BULRIC cost obtained predominantly from the VoIP software.

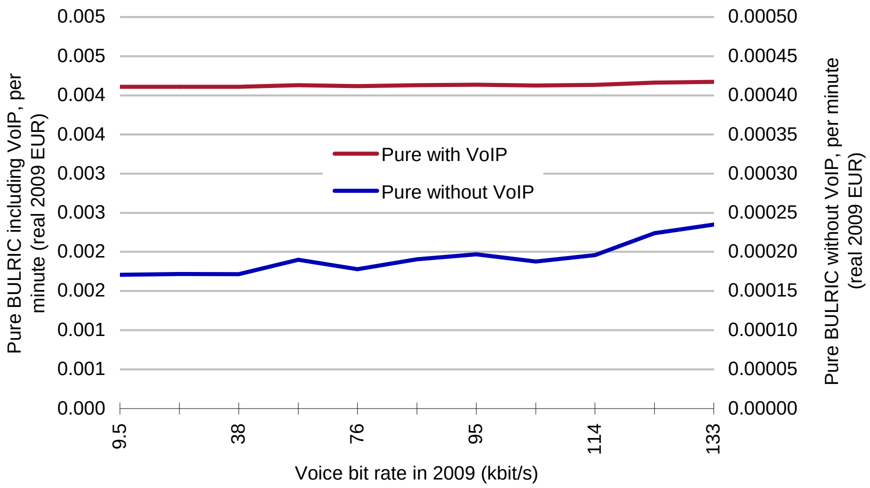


Figure 12: Comparison of Pure BULRIC variation with voice bit-rate in the final cost model (with allocation of VoIP licence) [Source: Analysys Mason]

The mobile pure BULRIC follows a downward trend, whereas the fixed tariff does not show the same trend

The pure BULRIC calculation has been corrected to include the load-up curve in the volumes used to calculate the per minute BULRIC, and now shows the relevant downward trend in the fixed model.

What is the source of the fixed core and fixed access capital investment numbers?	The fixed core capital investment is calculated by the *Fixed.xls* model: refer to sheet *C-Capex* for the chart, and sheet *Total_Capex* for the source values. The fixed access network capex is an Analysys Mason estimate based on operator data, from which we derived a fixed access network length of approximately 250 000km and a cost of EUR40 000 per km (in 2009 currency). As roll-out is assumed to occur in 2004-2005, and a price trend is applied, this leads to a fixed access network capex of EUR9.1 billion (in real 2009 Euros).
Does rising fixed cumulative capex in the context of falling minutes imply idle capacity, and if so, how is this absorbed in prices? (slide 16, 110)	Rising cumulative capex occurs because the modelled network is rolled out over time, traffic levels grow (e.g. mobile voice, mobile data, fixed data), and assets are replaced periodically over time. In the cases where demand is falling, the model takes the conservative view that equipment deployed in the first 15-year technology cycle to serve the peak (e.g. the fixed voice peak on the modelled network)) is maintained and operated until the entire close-down of the technology in 2019 at the end of the technology cycle. Economic depreciation spreads the costs over the total minutes carried.
How does the increase in fixed investments relate to a sharp decline in fixed plus BULRAIC costs? (slide 130)	The increase in investments is not related to the decline in *plus BULRAIC costs*. The decline in *plus BULRAIC* costs comes about from: 1. the action of the projected negative price decline for network equipment in the economic depreciation calculation. 2. the effect of the plus-subscriber common cost mark-up for subscriber access related costs meaning that a declining proportion of costs are recovered from voice services over time as the proportion of cost recovery due to data services increases.
What is the primary driver for difference between Plus Subscriber and Plus BULRIC for fixed? (slide 123, 124)	With a *separate* subscriber service (*Plus BULRAIC*), the subscriber access last-drop connection costs, shared access connection costs and other subscriber-driven costs are not included in the FTR. As a result, the difference between *Plus BULRAIC* and *Plus Subscriber BULRAIC* is the total subscriber cost that is being allocated to the voice (and other) services.
The applied debt premium is not appropriate for cable operators (slide 116)	This comment has been accepted. See section 1.

The fixed network WACC should take into account cable operators' WACC

This comment has been accepted. See section 1.

2.4 Mobile model comments

Please clarify the large differences of the draft BULRAIC results with previous mobile results

There are four main differences leading to lower calculated mobile costs in the draft cost model:

- the mobile market is larger than previously forecast: e.g. a total of 33 billion mobile minutes plus more data traffic in 2008 compared to 29 billion minutes as forecast in the previous model
- the long-run market share is larger than previously modelled (33% share compared to 25% share)
- the previous model assumed a slow rollout and a slow load-up of traffic onto the modelled mobile network; the current model now assumes full roll-out at launch, and consequently rapid load-up of traffic which also takes into account the fact that all mobile operators have now reached a state of mature 2G network operations.
- the **draft model** assumed that the 2G, 3G and fixed technologies operate in perpetuity (with no migration off the technology).

The assumption of no new entrants is unrealistic, particularly given "heavy" MVNOs in the Dutch market; the market share should be expressed at different layers of the network

Three national operators are assumed to determine the efficient cost of mobile voice termination in The Netherlands. This is supported by the current market structure.

On this basis, it is not appropriate to take possible future entry or additional operators into account in *N*, since an increase of cost price due to future entry would not lead to an efficient cost price. This approach does not mean that future entry is disregarded or considered unlikely, but that future entry should not be based on an inefficiently high termination rate.

Also operators without a full network (e.g. MVNOs) should not be taken into account in order to calculate an efficient cost. The proportion of costs which they replicate of the full network operators is limited, and any small dis-economies of scale that might arise can be mitigated by endogenous business decisions such as:

- sourcing low-cost platforms from alternative suppliers
- multi-national operations
- joint operations with a fixed network operator or un-bundler
- other joint-venture possibilities or business synergies.

	We do not include MVNOs in the specification of N national mobile operators because to do so would not lead to an efficient voice termination rate.
New spectrum licences could result in new entry to the market; MTR charge controls should only be determined after the 2.6GHz auction	**Three** national operators are assumed to determine the efficient cost of mobile voice termination in The Netherlands. This is supported by the current market structure. On this basis, it is not appropriate to take possible future entry or additional operators into account in *N*, since an increase of cost price due to future entry would not lead to an efficient cost price. This approach does not mean that future entry is disregarded or considered unlikely.
Decommissioning of 2G and 3G is likely around 2020	This comment has been accepted. See section 1.
LTE will happen before 2050 and traffic will migrate off the existing 2G/3G networks	This comment has been accepted. See section 1.
The hypothetical operator migrates to 3G after just two years, whereas real operators purchased 3G licences in 2000, and it has taken many years for the network to carry traffic (e.g. HSPA)	We model a hypothetical existing operator which starts investing in 2004, but is not a new entrant. On launch (in 2006), the modelled hypothetical existing operator matches three aspects of the actual operators' networks: • the average 3G coverage • the average amount of 3G data traffic, including HSPA volumes • the average 2G-3G migration. Whilst it took many years since licensing to reach this situation, it is not reasonable to allow a higher voice termination rate because of the slow development or traffic take-up of the technology when we are modelling a rapid roll-out of the network for an operator launching a new network in 2006, and when we are not modelling the costs of the pre-2004 period.

50 year cost recovery is reasonable for a fixed network where "enduring passive assets duct and trench remain valuable irrespective of technological progress", but unreasonable for a mobile network where there are short technical and spectrum lifetimes	A mobile network also contains enduring passive assets which remain valuable irrespective of technological progress, for example 3000-4000 radio sites (although their lifetime may be less than that of fixed network trench and duct because of the permit and outdoor exposure aspects of mobile infrastructure compared to buried ducts). See section 1 regarding migration.
The forecasts of the cost model should be adapted to the MTR pricing scenario envisaged (e.g. pure LRIC means higher costs for origination and mobile broadband)	The costing method selected by OPTA will have a number of impacts on the future market and network operators, including: • revenues from incoming termination traffic will decline • costs for outgoing termination traffic will decline. Therefore, operators will have the freedom to balance the effects of both lower revenues and lower costs within their pricing of various services. Whilst certain traffic types may decline or increase with different pricing regimes, we consider it unnecessarily complex to include 'circular' effects within the costing calculation and to embed aspects of OPTA's pricing decision into the cost model. We think that it is unlikely that service volumes will universally decline for either fixed or mobile operators as a result of a pure LRIC regulation (i.e. unlikely that there will be implications of universally higher or lower network costs for all players as a result).
Demand forecasts should be set conservatively to reduce the risk of cost under-recovery	It is our opinion that the forecasts in the final model are already conservative – a number of adjustments, particularly the inclusion of migration off the modelled technologies, reduce the risk of cost under-recovery to a reasonably conservative level for the purposes of setting wholesale termination charges.
Traffic forecasts do not anticipate the effects of regulation	The feedback of regulation into traffic forecasting is discussed in response to the same comment elsewhere in this document.

*The model states that operators **must** charge the cost of mobile broadband in order to recover its costs – six times the current market price (approx. EUR200 compared to EUR30 per month for 2.5Gbytes allowance); model disregards multi-product pricing for mobile services; operators will be forced to recover more costs from data*	The criticism raised by the operator is incorrect. The model does not state that operators **must** set the cost of mobile broadband according to the cost calculated in the model – the model specifies the basis on which the cost of mobile termination shall be calculated. Mobile operators are not forced to recover the specified service costs from data as they have other services from which they can recover those costs within a package, bundle or mixture of usage charges: OPTA's wholesale mobile termination regulation does not prevent a mobile operator from changing any combination of its retail prices. The operator's calculation of EUR200 for a 2.5Gbyte allowance neglects the fact that most users do not utilise their full bundle allowance. Using the model we estimate that for a user consuming 2.5Gbytes of data per month (assuming 5% Release-99, 87% HSDPA and 8% HSUPA usage), the *plus BULRAIC* costs of the package would be EUR194 per month (the actual market price for a 2.5Gbyte per month package is around EUR50 per month). However, given that the average usage per user is well below the average data bundle purchased, then the individual user comparison illustrated above does not hold relevant for **total** cost recovery. In the model, the average mobile broadband users generates 266Mbytes per month in 2010. This usage has a cost of EUR21 per month (on a *plus BULRAIC* basis). This cost is reasonably comparable to entry level (500Mbyte or similar) mobile data packages available for around EUR20 from the Dutch mobile operators. Furthermore, the out-of-bundle mobile data usage prices offered in the market (around EUR0.12 per Mbyte) are consistent with the *plus BULRAIC* costs of mobile data traffic calculated by the model (EUR0.13 per Mbyte for Release-99 data, EUR0.08 per Mbytes for HSDPA traffic).
The near-doubling of data traffic on the 2G/3G network in the next two years might prove optimistic; traffic might migrate to LTE or Femto cells	OPTA's 1H2009 market information already shows that our draft forecast was conservative – we consider it is likely that there will be significantly more than doubling of data traffic on the 2G/3G network in the next two years. We have updated the mobile data traffic forecast (see section 1) however, we maintain a conservative position on the projection of mobile data traffic in the long-term and include migration off 2G and 3G which removes the sensitivity to uncertain longer-term volumes. If the mobile operators choose to deploy LTE or Femto technology to carry data traffic then this may be is done for a number of possible reasons: • the new technology is a more cost-effective solution for data traffic • the new technology can offer a higher throughput • the new technology can carry higher volumes of data traffic.

	Other parties may also choose to deploy LTE or Femto technology to carry higher data volumes, or compete for the data volumes of the three existing mobile operators. There is no reason for wholesale voice call termination customers to bear the burden of possibly higher voice costs that arise from these situations because the effects mentioned above are related to competitive activities in the mobile data market.
A forecast of increasing voice traffic for 50 years is unrealistic	This comment has been accepted. See section 1. Voice traffic forecasts have been adjusted to remain stable in the future years.
The modelled current flat mobile voice growth, followed by 10% growth is unrealistic	The total voice market growth has been set, based on recent 1H09 traffic declines to 0% forecast growth – although we forecast that the mobile networks will continue to take an increasing share of this traffic (from 49% in 2009 to nearly 60% in the long term.
Further analysis of the WACC should be conducted later in the project	The WACC analysis of the project has been concluded.
The angular shaped mobile data growth should be smoother	An adjustment has been applied to mobile data traffic. See section 1.
Assumed fast mobile data growth is unsustainable as prices may rise, if only as result of modelling outcome	It is true that the fast data growth experienced in 2007 and 2008 may not be sustainable over many years – we are modelling a significant reduction in mobile data growth in forecast years from 2009 onwards, as illustrated below.

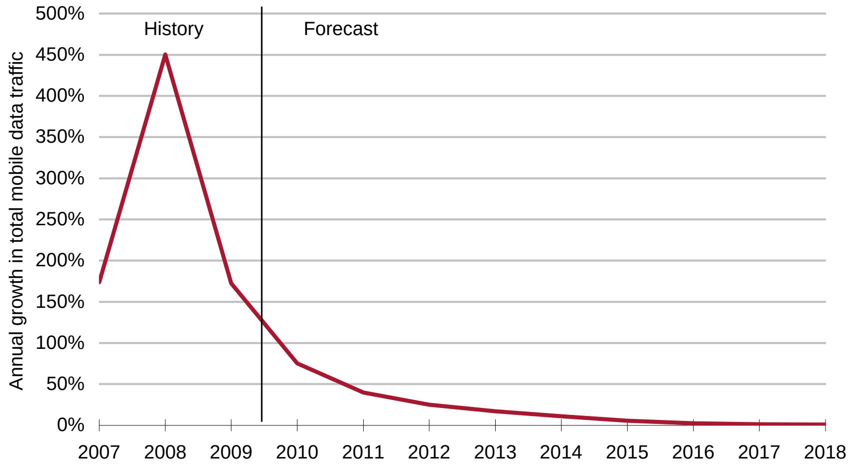


Figure 13: Mobile data growth rate [Source: OPTA market information, Analysys Mason]

We have updated the mobile data traffic forecast in response to OPTA's 1H09 market information (see section 1) however, we maintain a conservative position on the projection of mobile data traffic in the long-term and include migration off 2G and 3G which removes the sensitivity to uncertain longer-term volumes.

Mobile data growth could cannibalise mobile voice and SMS usage

We have discussed (elsewhere in this document) that today's mobile voice services may in future years be carried by alternative technologies (e.g. VoIP, or Voice over data applications such as Skype as suggested in this comment). Similarly, SMS may be carried as IP instant messaging.

The application of migration off the modelled technologies (see section 1) reduces the sensitivity of the model results to the long-term voice forecast and effects such as Voice over data or IP.

Therefore, we believe that it would be unreasonable to assume a more aggressive loss of voice traffic (or SMS traffic) in the 2G and 3G network costing.

Model takes no account of migration of voice to mobile VoIP ; migration of voice to mobile VoIP will be an "important development after 2015"; around 2020 half of mobile voice might be VoIP	Migration off 2G and 3G has been included in the model, so any sensitivity to this issue in the long-term has been significantly reduced. However: • if VoIP is more cost effective and operators offer VoIP themselves, then this is not a reason to take any higher costs into account; MNOs will still receive income from retail VoIP and mobile VoIP termination • if VoIP is not possible to block, or regulation restricts blocking, then offering flat-rate inclusive voice and data bundles would limit the ability of VoIP providers to target customers, and the MNO could continue to accrue its revenues from the whole bundle.
Mobile demand could be lower due to WiFi/Femto access, and new entry	These comments are discussed elsewhere in this document.
Fixed to mobile substitution will not accelerate to 33%. *The model does not correctly respond to a reduction in this forecast*	This comment has been accepted. See section 1. The fixed to mobile subscriber substitution percentage has been reduced, however there is a separate input which controls the proportion of voice traffic on mobile and fixed networks (*market.xls*, sheet *Market*, lines 170-171). In the previous years, more than 2% of the voice traffic in the market has moved from fixed to mobile networks in each year. We forecast this traffic substitution to continue until just under 60% of voice traffic is carried on (three) mobile networks.
Fixed to mobile broadband substitution will not reach 14% of households *The model does not correctly respond to a reduction in this forecast*	This comment has been accepted. See section 1. The number of mobile broadband customers is derived from an Analysys Mason Research forecast (*Market.xls*, sheet *Market*, line 645). The input of fixed to mobile broadband substitution only controls the number of remaining fixed broadband customers (and the number of mobile-only households).

The roll-out and load-up of the network is unrealistically fast and could not be achieved in practice	The modelled operator is a hypothetical operator with an existing subscriber base – it rolls out its network rapidly, and has full national coverage and sufficient capacity available on launch. Therefore, it is also reasonable to load up the modelled network rapidly: we assume four years to reach 98% load-up, although in theory, with an established GSM subscriber base, existing operators could load-up the network as fast as new SIM cards can be distributed and accepted by customers. During the rollout and load-up period in the model (2004-2009), the actual mobile operators were fully using their existing mobile networks which were deployed a number of years earlier. The model therefore allows the full cost of deploying a modern network (2G+3G for mobile and NGN for fixed) without the need to grow the demand or subscriber market from scratch. In the period 2004-2006, mobile operators are not actually experiencing a migration **to** 2G technology from a prior technology, therefore the model only needs to reflect a network transition from an old network (not modelled) to a new network (as modelled).
The modelled operator entering in 2006, with immediate 33% market share, is unrealistic – it should grow over time like an actual new entrant	The issue of a new entrant was discussed at the conceptual stage of the modelling. The conceptual approach to the model does not aim to reflect the growth profile which an actual new entrant would experience. Instead, the modelled operator is a hypothetical operator with an existing subscriber base – it rolls out its network rapidly, and has full national coverage and capacity available on launch.
The model is very sensitive to certain input variables, e.g. indoor cell radius multiplier	We agree that the model is sensitive to some inputs – particularly those which determine the amount of traffic carried or amount of network deployed. In the case of cell radii inputs (radius, indoor multiplier, SNOCC) then these factors are squared within the model – increasing their sensitivity. However, when changing the input of indoor cell radius multiplier, care must be taken that the value is adjusted sensibly. Reducing the input value (which is then squared) results in a significant increase in the number radio sites deployed – beyond a credible comparison with the real mobile operators in The Netherlands.

The model does not allow testing the costs of having 1800MHz grid to be calculated	The purpose of the model is not to calculate the costs of having an 1800MHz grid. However, the model *is capable* of doing this by changing three or four inputs on the mobile model control panel: • Spectrum usage (primary) • Spectrum usage (secondary) • Amount of paired spectrum • Coverage by spectrum band. Higher (or lower) costs of an operator using only 1800MHz spectrum are not considered the relevant basis for determining costs.
The DCS1800 and UMTS cell radii should be decreased	This comment has been accepted. See section 1.
Maximum site utilisation (70% should be aligned with that assumed in cell radii (50%).	The 50% loading of the air interface assumed in the cell radius (cell-breathing) calculation is the effective signal-to-noise level which is designed into the UMTS coverage deployment. The 60-70% utilisation assumed for CE (and TRX) capacity is the estimated factor reflecting the real-life aspects of radio cell-by-cell busy load: that this varies from the ‘static’ network average busy hour across each cell and at each time of day. Therefore, these two inputs need not be aligned.
The percentage of 2G sites available for 3G should be decreased	This comment has been accepted. See section 1.
MSC and MSS/MGW assets should be treated as replacements and depreciated over the full time period without an instantaneous swap	This comment has been accepted. See section 1.

The model assumes the mobile network can be deployed more perfectly than in reality

We disagree with this submission. We believe that considerable acceptance of real network deployment effects and corresponding real-life modelling parameters have been included sufficiently in the draft model.

We provide further details in response in the sections below.

Furthermore, the modelled network does not materially understate the required network equipment compared to the actual Dutch mobile operators.

The model should take into account that most incremental capacity is in urban areas, which have high peak traffic, reduced ability to optimally locate cells, greater site acquisition costs, high radio clutter

The model already reflects these points (discussed elsewhere in this document).

Whilst there are no real-world comparisons to assist in the modelling of a network without wholesale termination traffic, we consider that our approach to calculating the *pure BULRIC* is reasonably conservative (see other discussions on the *pure BULRIC*).

The use of only ZIP population as a proxy for geotype classification is ridiculous: workers, visitors and commuters are also determinants

We accept that population density does not capture **all** the traffic and coverage load effects in a mobile network. However, we consider that it is the best proxy for geotype classification in an economic costing model. Furthermore, the model already includes factors to capture the suggestions here: urban and suburban areas include a higher weighting of traffic per pop than the rural areas, since workers, visitors and commuters will concentrate in urban and suburban areas where businesses, shopping and visitor attractions will predominate:

- urban traffic per pop is 1.9 times suburban traffic per pop.
- suburban traffic per pop is 1.8 times rural traffic per pop.

The model assumes the same busy hour in all geotypes; in reality the number of Erlangs should be increased in urban areas; Non-populated locations are characterised by irregular traffic profiles

Although the model uses a single ‘network busy hour’ calculation of radio load, a lower maximum utilisation factor is already applied in the draft model to urban areas to reflect the suggestion that the urban busy hour has a higher Erlang per minute ratio.

We agree that irregular traffic profiles exist across the network, and that the magnitude of variation depends on geotype characteristics. The model already reflects this effect: utilisation of peak TRX and CE traffic capacity is:

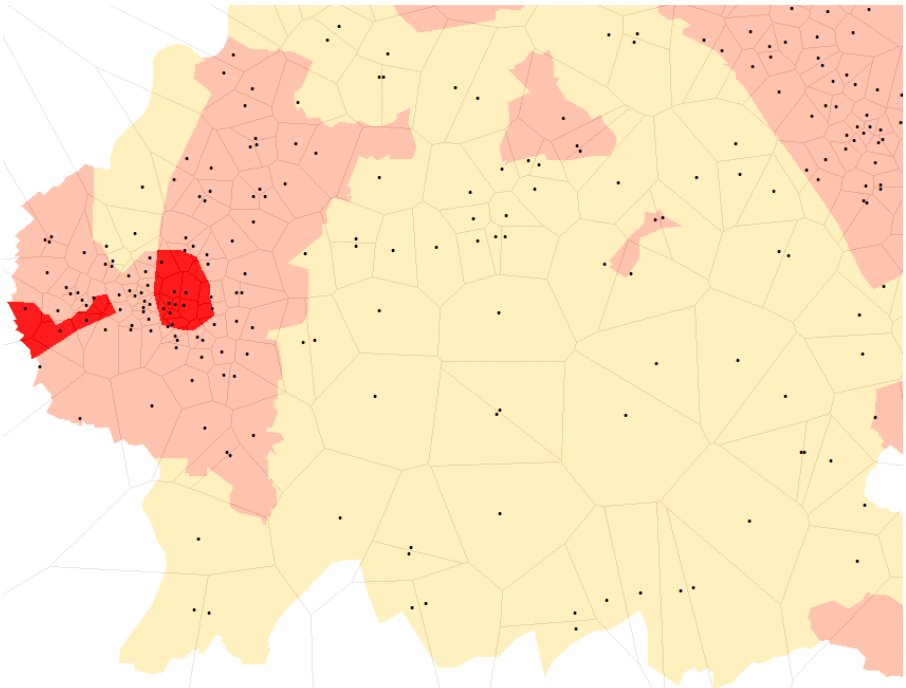
- 60% in urban areas
- 65% in suburban areas
- 70% in rural areas.

It would be more accurate to use ZIP5 codes to determine geotypes – otherwise the model is biased towards rural areas – which are in reality clusters of urban areas surrounded by sparsely populated areas

This suggestion is incorrect. ZIP5 codes present population data on a too-granular basis. The suggestion of the operator is that the Margraten area is characterised by pockets of urban areas surrounded by less-populated rural areas. Whilst this is undoubtedly the case at a granular (ZIP5) level, it is not relevant for mobile network deployment which must consider the demand load over the extent of the coverage site.

Figure 14 illustrates the radio deployment and effective coverage of sites around Margraten (showing a polygon plotted at the boundary between each of the cell sites). It can be seen that sites deployed in the Margraten villages (denser pockets on a ZIP5 scale) provide the entirety of coverage in the wider (rural) zone.

We do not claim that our ZIP4 modelling is perfect, however we believe that our ZIP4 geotyping reasonably matches the density of radio antenna in the real networks.



Key: Urban Suburban Rural

Figure 14: Geotypes and radio sites around Maastricht and Margraten. The Antennebureau points show all operators' masts, therefore the coverage polygons do not show the real coverage of one operator [Source: Analysys Mason, Antennebureau]

The geotype thresholds might be too high

We disagree with this comment. The geotype thresholds are set to give a reasonable representation of the factors influencing clutter types in the real Dutch networks, and to match the proportion of *urban:rural* area used in the previous mobile BULRIC modelling. In this regard, the urban:rural coverage was set according to the average of actual operator data collected in 2006.

Schiphol and other important areas are missed out of the ZIP codes

In our geotype data (sourced from OPTA and CBS), 33 ZIP4 codes have population but no area, and 30 ZIP4 codes have area but no population. We have included these very small unallocated measures in the remaining 3978 ZIP4 codes as a:

- 0.32% area uplift
- 0.51% area uplift.

The population density of this unallocated group is around 750 people per km^2 which is would be classified as suburban in the model. The following figure indicates the areas without population (shown in blue). Most of these areas are adjacent to both rural and suburban areas – consistent with the overall unallocated population density of 750 per km^2.

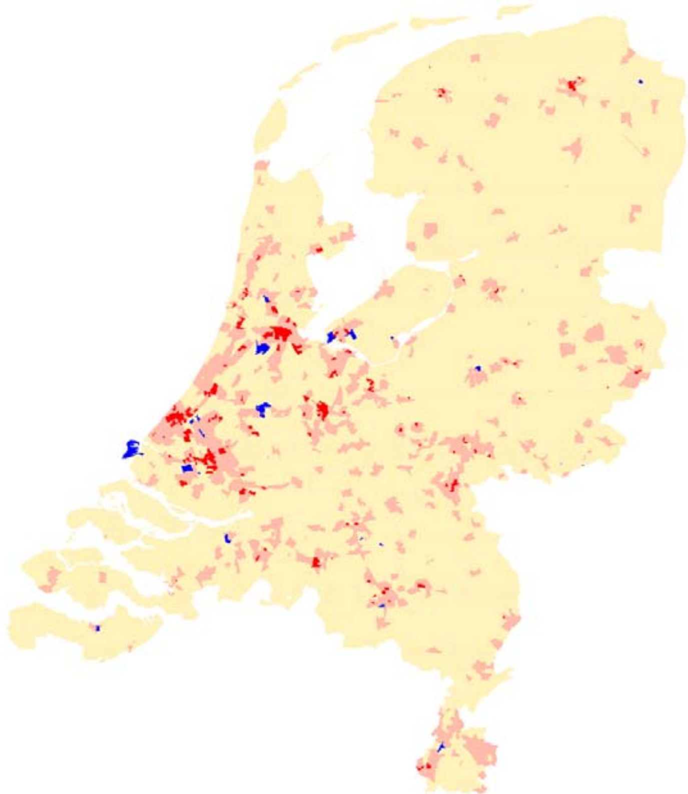


Figure 15: Population density map, showing urban (red), suburban (orange) and rural (yellow) and 'zero population' (blue) regions [Source: Analysys Mason based on CBS and OPTA data]

One of these unallocated areas is Schiphol, some are near the Hague, shown below. The areas near the Hague represent new housing estates.

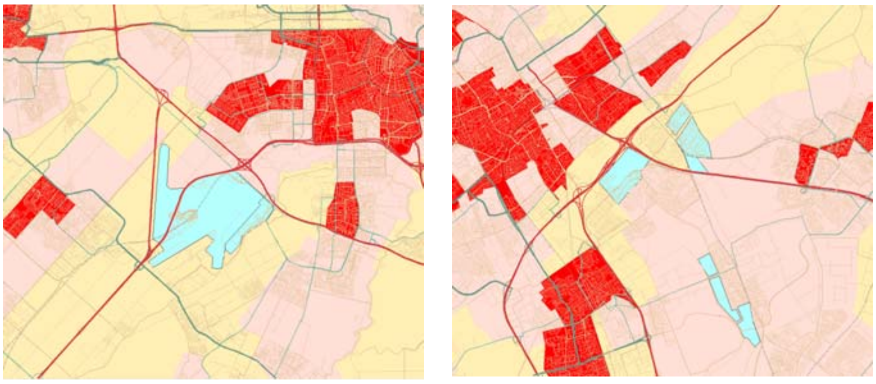


Figure 16: *Geotypes in Schiphol and the Hague areas [Source: Analysys Mason based on OPTA, CBS and StreetPro data]*

When using the Antennebureau data, measures were taken to compensate for the loss of information. For example, if certain radio towers fall into one of these regions, they would then be assumed to take the geotype of their nearest regions with population information. The following figure shows such an example: A and B are assumed to be "suburban" radio sites, while C and D are assumed to be "rural" radio sites.

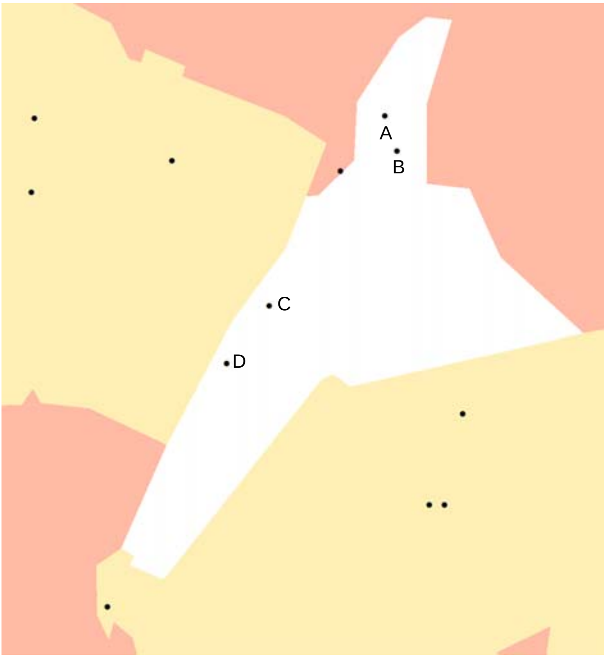


Figure 17: *Radio sites in the 'zero population' (white) region. The map also shows rural areas in yellow and suburban areas in orange [Source: Analysys Mason based on CBS, OPTA and Antennebureau data]*

The 'unpopulated' blue ZIP4 area of Schiphol is significantly larger than the centre of Amsterdam, and does not reflect the urban clutter type – it is a flat airfield across large parts of which mobile usage is prohibited; it is not full of five-storey buildings and narrow streets like Amsterdam. Furthermore, a significant proportion of the traffic occurring in this area will be served by indoor sites, not outdoor macro sites (the model includes 250 indoor sites as a separate asset). The extent of radio site deployments in Schiphol and Amsterdam are shown below. Sites can clearly be seen on the A-F piers of the airport building (most likely indoor sites as opposed to roof-top macro sites).

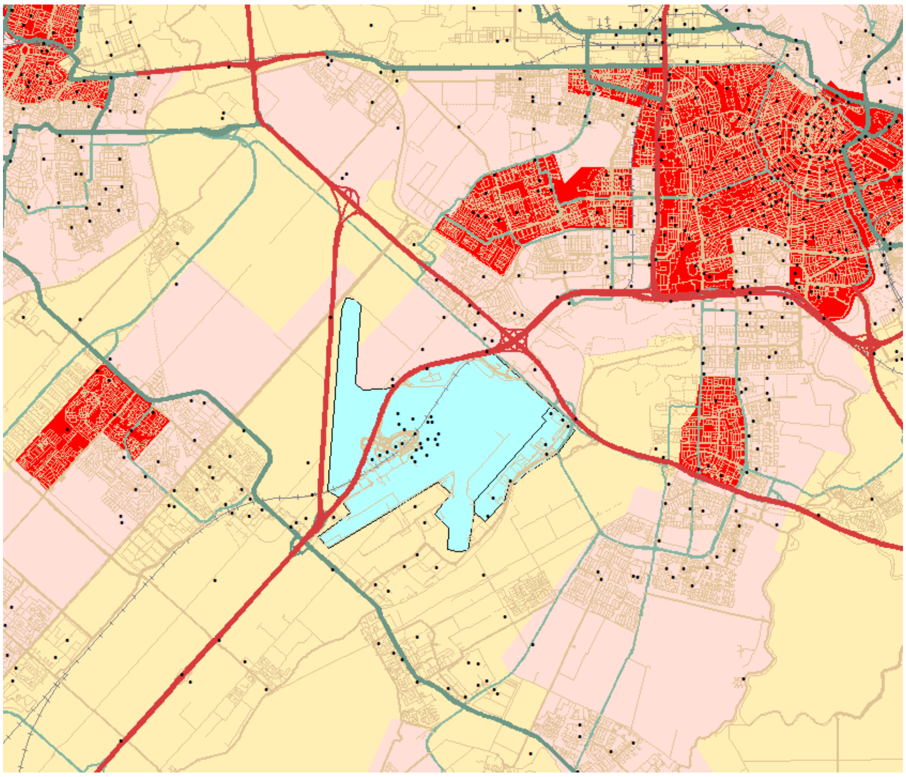


Figure 18: Radio sites in Schiphol and Amsterdam [Source: CBS, OPTA, Antennebureau data]

We conclude that:

- to treat the Schiphol post-sector as an urban area would grossly overstate the number of macro sites in its area, and Schiphol traffic will largely be serviced by special indoor sites.
- to uplift the allocated ZIP4 area and population by 0.32% and 0.51% respectively, as in the draft model, will immaterially distort the model calculations.

The model should use separate inputs in traffic-dense geotypes to reflect: diurnal traffic profile, costs of site acquisition, finding sites in optimal locations	The model already captures these effects: • peak utilisation of radio channel capacity in the busy hour is lower in urban areas • site acquisition costs and rents are higher in urban areas • the ratio of effective to theoretical cell radius is lowest in urban areas.
RNC hardware releases have occurred very frequently in recent years (e.g. to reach 800Mbit/s IuB)	RNC IuB capacity is primarily increased to support higher HSDPA throughputs. Voice traffic does not require this level of throughput at each RNC. Therefore, the costs of frequent RNC upgrades for data service upgrades should not be recovered from voice termination. In the model we have applied a seven-year lifetime to the modelled large RNC, which we consider is a reasonably conservative value for the economic lifetime applied for the purposes of voice termination costing.
Obtaining site permits is a long 5-12 month process	The model already reflects this comment with a nine-month planning period for site macro site acquisition and 3G upgrades, and six-month planning period for indoor sites.
The model should deploy full coverage of UMTS to 94.4% rural area (matching GSM) because there is no opportunity to use 2G EDGE fall-back	At the current time, the mobile operators have not matched GSM coverage with 2100MHz UMTS coverage, and given that the majority of voice traffic is carried on GSM at the current time (and is likely to be so over the duration of OPTA's price control) then we see no reason to include the costs of complete UMTS coverage in the cost of voice termination. If mobile operators choose to deploy UMTS indoor coverage to 99.9% population because there is no opportunity to use EDGE technology as a fall-back data service, then the additional costs should be recovered only from data services.
2100MHz has more propagation losses than 900MHz	The model already includes this effect: • 2100MHz cell radii < 1800MHz cell radii < 900MHz cell radii. An adjustment in this area has been applied. See Section 1.

UMTS, having a re-use factor of 1, will be even more range limited than GSM to avoid interference

Cell range is a function of transmit power, antenna height, receiver sensitivity and frequency of operation. According to Analysys Mason's technical radio expert, cell range is not a function of the re-use factor, which is just a way of arranging adjacent cells in the network.

UMTS communications are, nevertheless, dependent on the signal to noise ratio: Eb/No. However Eb/No must be higher for HSPA services, meaning that cell range will be more interference limited for data coverage compared to voice coverage: higher costs arising from this effect should not be recovered from voice termination services.

The model incorrectly captures GSM and UMTS coverage requirements – the example of coverage in Eindhoven is supplied

Our geotype modelling of Eindhoven (approx 86km^2) is shown below – the majority of the area in this city is classified in our geotype model as suburban.

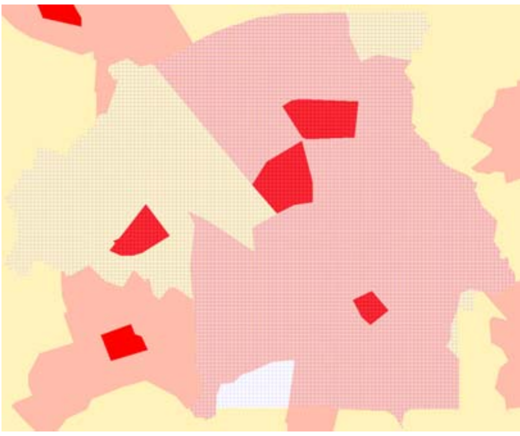


Figure 19: Population density map in and around Eindhoven (the shaded region). This map shows urban (red), suburban (orange), rural (yellow) regions, and 'zero population' regions. [Source: Analysys Mason based on CBS and OPTA data]

In 2010, the model calculates an area per cell as shown below (where each cell is identified as a 900MHz, 1800MHz or 2100MHz sector):

	GSM area per cell, km^2	*UMTS area per cell, km^2*
Urban	0.10	0.14
Suburban	0.92	0.56
Rural	6.87	5.95

Figure 20: Cell area in the model [Source: Analysys Mason]

We consider that the modelled average deployment is therefore broadly consistent with the submitted confidential data.

Obligatory requirements for indoor coverage with 2100MHz is not taken into account (cell radius too large)	Indoor 2100MHz coverage has been revised in the final model and is now taken into account through the use of an indoor coverage population percentage and coverage cell radius that is lower than the estimated outdoor cell radius.
The actual UMTS network deployed provides indoor coverage beyond the licence conditions	We consider that the cost model already reflects the typical levels of UMTS deployments of the actual operators (it deploys around the same number of UMTS sites as the actual networks).
The model does not take into account radio constraints in border areas	This comment has been accepted. See section 1.
The conversion factor of 1.45 between data to minutes overstates the burden of data traffic because it ignores HSDPA 7.2	The conversion factor of 1.45 is based on HSDPA traffic carried as 3.6Mbit/s per 32 radio CE (i.e. 112.5kbit/s per CE). We model HSDPA7.2 as requiring 64 CE, therefore using the same 1.45 conversion factor as HSPA3.6 carried in 32 CE. Therefore, we do not see a reason to further reduce the allocation of mobile traffic costs to HSDPA Mbytes.
The E1 utilisation rate is too high: 120 circuits per E1 in backhaul and 30 circuits per E1 in core	The model applies 120 circuits per E1 in backhaul (16kbit/s voice channels; HSDPA channels are provisioned separately) and 30 circuits per E1 in core (64kbit/s voice circuits). We apply a 100% utilisation rate to backhaul E1s because they are driven directly by radio channels (which already include numerous under-utilisation effects). In the core network we apply at 40% channel utilisation rate to allow for both headroom and redundancy. Therefore, we do not consider that the model assumes too-high utilisation.
The backhaul rings shown in the network design should have connections at two national nodes	This comment has been accepted. See section 1.

"Fibre LMA share" and "Backhaul Access Node Share" inputs are zero: this gives rise to an error message in the model	This comment has been accepted. See section 1.
TRX formula rounds down to the nearest 0.1 of a TRX which is not logical: should be rounded down to nearest whole TRX	The TRX formula calculates the average maximum number of TRX per macro sector on the basis of the physical capacity (4 TRX per sector) and the average utilisation of this maximum physical capacity (around 70%). Therefore, it is logical to have this average maximum as a fractional TRX: some sites will have more physical capacity limitations (e.g. at 2 TRX) and other site will have fewer limitations (e.g. 3 or 4 TRX). On average, the maximum number of TRX per sector will be fractional, between two and three. It is necessary thereafter to round to 0.1 TRXs as the Erlang look-up table is programmed in 0.1 TRX increments.
The actual network had more than double the 7 buildings (interconnection) modelled	The modelled hypothetical operator has seven MSC sites and 17 remote BSC sites – and is thus consistent with the submitted viewpoint. The modelled network is *capable* of interconnecting to KPN's current 20-region structure, but is assumed to connect in an efficient four-region topology.
The actual network started with costly leased lines and used far-end-handover of traffic	We do not consider the high cost of legacy (old) technologies to be relevant to the efficient regulated prices which OPTA intends to apply in the coming regulatory period. This applies equally to mobile network leased lines and fixed network legacy PSTN/TDM switching.
It was not possible to obtain a redundant dark-fibre core from a single supplier in 2004	There were no technical barriers to obtaining a redundant dark-fibre core from a single supplier in 2004 – the operator making this claim started *its* fibre procurement in 2002. Therefore, consistent with our rapid network roll-out in 2004-2005 for a 2006 launch, we are of the opinion that the rapid procurement of a dark-fibre core network (from one or more separate suppliers) is also reasonable.

Cost declines of 2% for BTS/NodeB and 5% for Switches should be set with a higher negative decline	The suggested price declines are at the bottom end of our internal estimates and benchmarks. The effect of these higher negative price declines is a lower unit cost in 2013 and onwards – because of economic depreciation which smoothes out the cost recovery according to price trend. Therefore, the model is currently conservative in this respect and we do not propose to adopt these more aggressive price declines (lower cost in 2013 and beyond).
Wholesale billing costs should be higher, and allocated only to termination	The wholesale billing system is a platform which performs the following functions: • recording the number and duration of voice calls in the network (it is dimensioned on processing 12 million CDRs per day) • summing up the number of minutes per month which pass to and from the (other) two mobile and the other two fixed networks plus roaming-in traffic. As such, we consider that it is a simple platform, with relatively low costs (EUR1.4 million capex), the costs of which should be recovered from domestic calls both *from and to* other domestic networks. The complexity (and cost) observed in the actual wholesale billing systems will be due to complex inter-operator relationships such as: • international and roaming relationships (the costs of which should not be borne by domestic termination customers) • MVNOs hosted on the network and other wholesale support services for complex retailing activities, e.g. revenue sharing (the costs of which should not be allocated to wholesale charges paid by other network operators). A minor adjustment to the cost allocation of the WBS has been applied in the mobile model: to remove the SMS allocation (see section 1).
Due to various exogenous factors, an efficient operator still ends up with an inefficient amount of spectrum: the costs should be raised by a hypothetical inefficiency factor to licence fees and network capex/opex	We recognise that each operator is not able to perfectly adapt its spectrum to its actual demand – although spectrum trading should enable operators to sell unwanted spectrum. Currently, Vodafone has around 25% market share but less than 25% of the GSM spectrum in the market; KPN has around 50% market share but less than 50% of the GSM spectrum in the market. By taking all of the spectrum of the three operators and allocating a 1/3 share to the modelled operator we have already included the degree to which the actual mobile operators have an inefficient (i.e. extra) allocation of spectrum than actually needed. Therefore, we do not think that it is reasonable that further factors are required.

900MHz values applied do not reflect true market value; 1800MHz fees do not reflect current valuation; coverage was more important in 1998; capacity is more important today (e.g. to support future technologies such as LTE).	In Figure 4.1 in the *Conceptual approach for the fixed and mobile BULRIC models, Version after industry comment*, we show that the value of 900MHz spectrum indicated by the 1998 auction is more than the value applied in Vodafone and KPN's recent renewal, and higher than the value applied in the model. This supports the suggested opinion that coverage was more important in 1998. However, whilst capacity could be more important today with mobile data services, it does not appear to be the case that mobile data services will support high payments for the spectrum they use: recent 2100MHz, 2000MHz and 2600MHz licence payments are not higher than 900MHz or 1800MHz valuations/payments. It is our view that our current valuations remain reasonable and consistent with the value and use of 900MHz, 1800MHz and 2100MHz spectrum.
The 2000MHz (2100MHz) valuation does not take into account that data traffic has increased since 2005	Data traffic has increased since 2005, however in Sweden where mobile data usage is amongst the highest levels in the world, 2.6GHz spectrum – particularly appropriate for data traffic was sold in 2008 at a value significantly below that we apply in the model for 2100MHz spectrum. This supports our view that high volumes of (expected) data traffic do not necessarily mean high valuations for the spectrum that it uses.
Spectrum prices should be increased to reflect new 2.6GHz competition, or historic prices should be used	New entry is just one of many factors that determine spectrum prices. For example, overall spectrum supply, in terms of spectrum available for mobile communications, is expected to increase. On balance we consider that our proposed approach, which takes into account both historic prices as well as observed and expected trends, is reasonable.
MNP costs are not included (e.g. significant investment upgrade); fees to the MNP platform provider are not included	This comment has been accepted. See Section 1.

Depreciation periods should be checked: IT assets 3 years, VMS and HLR 4 years, site construction 15 years, site radio 8 years, etc	The operator submitting this information reports a financial accounting lifetime of eight years for its network hardware and software items. As highlighted in Figure 10 and its associated paragraph, we consider that the final cost model contains a reasonable duration for network element lifetimes, and to adopt significantly lower asset lifetimes for major network elements would overstate the efficient costs of voice termination.
If a 50-year period is maintained, the WACC should be increased to reflect the higher risk of very long duration government bonds	NERA applies a bond duration applicable to the regulatory period; this aspect has been previously concluded by NERA. The costing methodology used (year-by-year top-down costing data, as used for EDC, or BULRIC modelling) does not change the appropriate bond duration.
The capex in the model in 2009 (EUR104 million) is too low. Capex for certain assets should also be adjusted	In the final model, capex during per year in 2008-2010 is around EUR124 million (similar to the actual value submitted by the operator). We have adjusted a small number of mobile network capex costs. See section 1.
The network design adjustments for pure LRIC in the mobile network are not justified (and could incorporate other technical adjustments)	See section 1 for the mobile network design adjustments applied in the pure LRIC case. We consider that it is reasonably conservative to include all of the following effects in the mobile pure BULRIC: TRX adjustments, CE adjustments, the effects of cell-breathing and a 25% reduction in GSM spectrum. The industry party does not suggest any other technical adjustments.
The pure BULRIC model does not behave properly when cell radius is adjusted; they don't expect both the pure and plus costs to converge to 2.2 cents	Adjusting the cell radius inputs to the model must be done with care – this is because it may result in a mobile model which is significantly over (or under) scaled compared to the actual Dutch mobile networks. The convergence of pure and plus which was referred to in the draft model is coincidental. As the 2100MHz cell radius is reduced, the effect of removing mobile termination volumes in the pure BULRIC case is increased. This is because the removal of mobile termination volume is accompanied by a relaxation of the cell breathing effect which is a function of the 2100MHz cell radius.

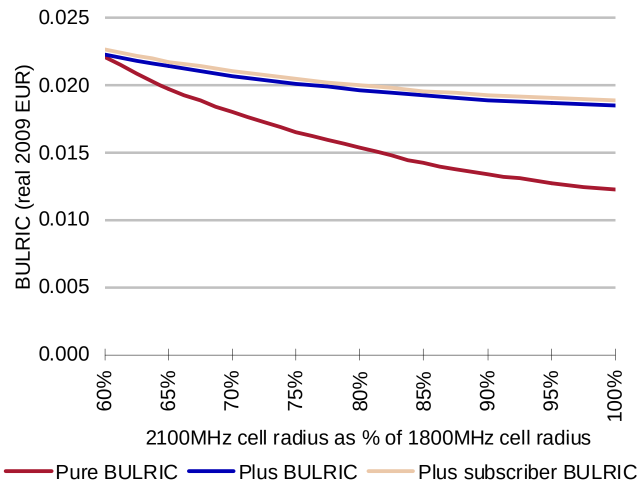


Figure 21: Draft model variation of cost with 2100MHz cell radius multiplier [Source: Analysys Mason]

Note that the model does not calculate with an (unrealistically) low cell radius and large coverage, because the MSC look up table gets exhausted[1].

The model fails to recognise the opportunity costs of the use of the coverage network and the conceptual paper does not explain why

Parts of the network which are not traffic driven (in the long-run) can be considered to still be in their "coverage" state. By virtue of the fact that they are not traffic driven means that they have spare capacity available for more traffic – occupying spare capacity in a coverage cell does not cause any *incremental* cost to be incurred (the incremental cost is zero in these areas).

If the mobile network is traffic-driven in other areas, then the mobile termination increment will cause *all* the relevant traffic-carrying costs to be incurred (i.e. the *incremental* cost reflects the full costs of carrying mobile termination in these areas).

The mobile network pure BULRIC calculation makes a conservative allowance for costs that would be avoided in the absence of mobile termination traffic:

- in traffic-driven areas, all of the costs which vary with termination traffic are allowed into the pure BULRIC of termination (even if they are *originally derived* from the coverage network)
- in all areas (traffic and coverage driven), the minimum TRX / CE deployment per sector / NodeB is reduced in the absence of mobile termination traffic.
- one quarter of the modelled GSM spectrum is assumed to be unnecessary with the removal of mobile termination traffic.

1 If many 3G sites are assumed to be required, then lots of backhaul links are required, which in turn drives RNC port requirements, which in turn drives RNC requirements, which in turn drives MSC port requirements and therefore number of MSCs exceeds 20, which is the maximum permitted by the model.

The model fails to recognise that spectrum resources are incremental to termination traffic	This comment has been accepted. See section 1.
The model omits the cost of the HLR and location update costs from the pure BULRIC which are "solely required for terminating traffic"	The HLR and location update costs are not *solely* required for termination traffic – they are also required for on-net voice traffic and SMS termination. Given that the customers still need to be registered (in the HLR) and have their locations maintained (in the location update VLR) after the removal of externally delivered mobile termination traffic, then there is no reason for these costs to be included in the *pure BULRIC* result. We believe that the operator which submitted this comment is misinterpreting the original 2006 statement of Analysys.
The model assumes that "some costs have been recovered prior to 2006" then ignores the opportunity for this cost recovery	The calculation model takes the *conservative* position that all costs modelled in the deployment and expansion of the modelled network from 2004 onwards are included in the costs recovered from 2006 onwards when service traffic commences.
The pure BULRIC misstates 'avoided capex' and opex – for some items expenditures are higher without termination	It is entirely possible for some costs to be higher without mobile termination traffic – this can arise in at least two ways in the model: • the reduction in GSM traffic means that fewer GSM sites are available to co-site UMTS NodeBs on in future years. This means that without wholesale termination traffic, the model may have to deploy **more UMTS-only sites** • the reduction in voice traffic may mean that some radio sites are deployed later in time that they otherwise would have. Because we assume a positive cost trend for sites, then they become **more expensive if they are acquired later in time**.

3 Interconnection model adjustments

Following industry comments, the calculations of the interconnection module have been simplified and revised for the specific interconnection activities applying to the direct interconnection in The Netherlands. The following revisions have been applied.

Preparation and network testing components

The activities required for first establishing interconnection have re-estimated, shown on the sheet *New ic, new op*.

The activities required for establishing interconnection at an additional location have been re-estimated, shown on the sheet *New ic, existing op.*

The activities required for expanding an existing interconnection link have been re-estimated, shown on the sheet *ic expansion*. The expansion of interconnection is assumed to be required when additional port capacity is added to existing gateway equipment at an existing interconnection location.

The activities required for terminating interconnection at a site have been re-estimated, shown on the sheet *ic termination*.

Equipment components

Interconnection capacity equipment provisioned in the interconnect provider's network is rented to the interconnection seeker. An interconnection seeker can request *either* E1 port *or* STM1 port interconnection.

The model calculates the cost per E1 port per month, and the cost per STM1 port per month. Both of these monthly costs include a share of the interconnection gateway (gateway capacity is assumed to be STM1) and cable connections to the exchange cable chamber/room.

Ongoing monthly management costs

The activities within the interconnection provider's department for managing the interconnection seeker relationship have been simplified and re-estimated, as shown on the sheet *monthly ongoing costs*.

Space components

The cost elements which are leased from the interconnection provider in the case of *interconnection co-location* within a footprint in the provider's exchange building have been recalculated.

The model estimates the total monthly rental per $2m^2$ footprint. This calculated footprint cost includes:

- connection of the access seeker's fibre from the exchange cable room to the co-location space via in-building wiring and the optical distribution frame
- power supply, generator backup and air conditioning
- preparation of the co-location footprint
- lockable steel cabinet, cable ducts, power feeds, etc within the footprint
- all power consumption (assuming 2.4kW per day)
- rental of $2m^2$ of building space, estimated according to a city centre building including full re-build value of the exchange space.

Details are illustrated on sheet *co-location diagram*. Calculations are shown on sheet *equipment costs*.

A high-level reconciliation of total activities to FTE

On the *Summary* sheet, an approximate reconciliation based on the number of interconnection parties, interconnect locations and frequency of interconnect activities has been provided. This illustrates the levels of activity we assume for an annualised four FTE interconnection provision department.

Hourly rates

A number of hourly rates for different staff have been standardised and re-estimated.

3.1 Operator comments

Interconnection costs should be allocated to termination minutes in both pure and plus results

We have isolated the costs which are driven by the activities of establishing and maintaining interconnection between parties. These costs are not dependent on traffic volumes, but on the number of direct interconnections in the hypothetical modelled fixed and mobile markets.

These identified costs therefore form the basis of cost-based regulation of direct interconnection that OPTA may consider necessary. These costs should not be allocated into the per-minute rates, as this would imply that establishing direct interconnection *would not be charged between parties*. Whilst this might be acceptable in the hypothetical efficient modelled market of two fixed and three mobile operators, it is unlikely to assist in the proper functioning of the real Dutch market, where there are some large and many small interconnection parties for which enabling many direct interconnections may not be efficient.

The labour cost pool of EUR500k is much too low; this cost pool can only be recovered with 14 direct interconnect operators, which is unrealistic

4 FTE is too low: an operator needs at least 5 FTE plus outsourced department (e.g. to KPN's "premium transit service")

The labour cost pool of EUR500k relates to approximately four FTE working in the interconnection establishment department. This level of staffing is estimated to be necessary for the modelled hypothetical efficient direct interconnection situation where there is:

- interconnection at only four main cities
- domestic interconnection between only three mobile and two fixed operators
- interconnection with one international carrier at each city (per operator).
- no additional interconnection requirements which may arise from multiple sub-national cable franchises, unbundlers, MVNOs or international roaming partners.

An approximate reconciliation of total activities has been added to the *interconnect.xls* spreadsheet.

According to our estimates, the interconnection establishment cost pool of four FTE covers the following works:

- Monthly ongoing activities for each interconnection seeker (1.1 FTE in total)
- Set-up of interconnection for all interconnection links (a team of 8 FTE 'amortised' over eight years = 1 FTE averaged in total)
- ongoing interconnect expansion for all interconnection links (2.5 FTE in total).

3 FTE for finance, regulatory and legal should be included in the interconnection team

We have modelled finance, regulatory and legal activities within the business overheads, as they will support various wholesale and retail activities.

Substantial external legal costs for interconnection support (EUR200k) should be included

Legal (contract) activities are already included in the modelled bottom-up activities (30 hours for the first interconnection with a new operator plus 7.5 hours per month on minor dispute resolution). Additional legal costs which might arise in the actual interconnection market are not considered reasonable or efficient in the hypothetical modelled efficient direct interconnection market. Also, disputes on regulated interconnect should be less likely.

External legal support for interconnection dispute costs should not be covered by interconnection seekers or termination traffic, but the party determined to be at fault by the dispute resolution.

The hourly rate should be EUR[higher]	The hourly rate submitted by the party reflects an outsourced network engineering function. The modelled operator supplies these activities internally, therefore the additional management costs are already included costs within the modelled interconnection, network and business overhead activities.
Depreciation period of ports should be shorter to reflect market dynamics	The lifetime of interconnection ports has been reduced to five years (see other comments relating to asset lifetimes). Whilst the actual interconnection establishment market may exhibit some rapid dynamics, within the modelled hypothetical fixed and mobile operators we aim to capture a reasonably efficient and economic level of interconnection activity. Therefore, we have adopted eight years for interconnection equipment (and five years for E1 port cards).
Wholesale billing costs should be included (instead of being part of termination costs)	The wholesale billing system supports both incoming and outgoing interconnection traffic, since it records traffic flows both ways in order to reconcile the interconnection billing between parties. It is our position (as in the draft model) that the wholesale billing system is likely to be part of, or linked to, various other network systems, such as mediation interfaces, network monitoring systems, retail billing functions and prepaid credit platforms. As such, we have treated it as an integral part of the network (therefore allocated to traffic), rather than a standalone interconnection facility.
Costs for system changes, such as network migrations or new point codes/numbering ranges are not included	We have incorporated ongoing upgrade activities within our simple reconciliation of four interconnect FTE. We do not consider that the activities suggested here (numbering changes, etc) should cause additional costs to interconnecting parties other than the specified interconnect upgrade activities (see the final *interconnection.xls*).
Requests further information on the assumed EUR40k capex per common switch element	The EUR40k capex is assumed to cover an STM1 interconnect gateway excluding ports.
An omission in the cost summation should be corrected	The revised *interconnect.xls* file has been corrected so that costs are added correctly.