LRIC Bottom-up model for interconnection

Consultation Document 3.1

Prepared by BIPT
In collaboration with Bureau van Dijk Management Consultants

23nd April 2002

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0. INTRODUCTION

On the 27th of April and the 3rd of October of last year, the BIPT issues the first and second consultation document in order to define the general methodology and the logical and physical network to be modelled. The summary of these first two consultation documents have been published by the BIPT on June 4 of 2001 and the March 29 of 2002. The decision were commented in further detail to the market on the 24th of June 2001 and the 9th of April 2002 by the BIPT's consultant, *Bureau van Dijk Management Consultants.*

This document constitutes the third and final consultation document for the development of the first version of the bottom-up model.

The first chapter of this document deals with the technical algorithms for the translation of the external demand in quantities of network components. The cost volume relationships were already identified in the Annex 2 of the Summary of the comments on the second consultation document. In this document, the relationships will be translated in algorithms and the cost drivers and network components will be quantified.

The aim of the second chapter is to obtain all the information needed to calculate a total annual cost for the provision of the modelled network. This total annual cost consists first of all of a translation of the physical network quantities needed in annualised capital expenses (depreciation cost and a cost of capital). To these direct capital expenses, indirect capital expenses will be added (e.g. for ICT, vehicles…), as well as direct and indirect operating expenses. Direct non-network related interconnection expenses will be added. Finally, an overhead cost at company level will be added.

The third chapter deals with the output of the cost model. An overview is given of the minimal format of the results of the bottom-up model that will be made public and the relationship between the cost structure and the tariff structure for the interconnection services is outlined.

The results of the bottom-up model, based on the reactions on the questions in the first three chapters, will then be compared with the results of the top-down model. These reconciliation issues are discussed in chapter four. Proposals are made relating to the areas of reconciliation, the level of aggregation and the planning of the reconciliation exercise.

Finally, the fifth chapter deals with the further planning of the development of the bottom-up model.

1. TECHNICAL ALGORITHMS

This chapter will describe in detail how algorithms will be used to dimension the network in the bottom-up model. The first topic concerns the algorithms needed to calculate demand volume. Next, the Institute's approach for dimensioning the switching network will be commented in detail. Third, all transmission algorithms related to the transmission links and transmission equipment are dealt with. Finally, we will go into further detail into the algorithms of the signalling network. A separate paragraph is dedicated to the routing factors.

The goal of this chapter is to quantify the technical parameters in order to determine the values of the algorithms. The BIPT would like to invite all operators to participate extensively in determining these parameters. Other general comments are also highly valued.

1.1 Algorithms for calculating the demand volume

The demand volume is typically expressed in 'billable volumes' (i.e. minutes and calls) or in cost-drivers (BHE, BHCA, E1s and end-user lines) depending on the purpose for which the information is used. The dimensioning of the network uses demand volume expressed in cost-drivers, the calculation of the unit costs will be made based on 'billable volumes'.

1.1.1 Conversion of the number of minutes and calls in BHE and BHCA

In most bottom-up approaches, the number of minutes and calls must be translated in BHE and BHCA in order to be useful as a cost-driver for the modelling of the network. The consecutive steps for the conversion of the number of minutes and calls in BHE and BHCA are illustrated in Figure 1.

The bottom-up model will however be developed based on the demand information at the node level[1]. The information on the BHE per node is available at the incumbent operator. This means that the BHE will not be derived from the number of billed minutes, however, when some specific information is missing, the approach illustrated in Figure 1 can be followed. At this moment, it is not clear whether the incumbent operator will be able to provide information on the BHCA per node or not. If this information is not available, assumptions will be made by the Institute in order to determine the BHCA. These assumptions will be presented to the market for validation.

[1] Cf. Decision of the BIPT – Question 2.1.1. of the second consultation document)

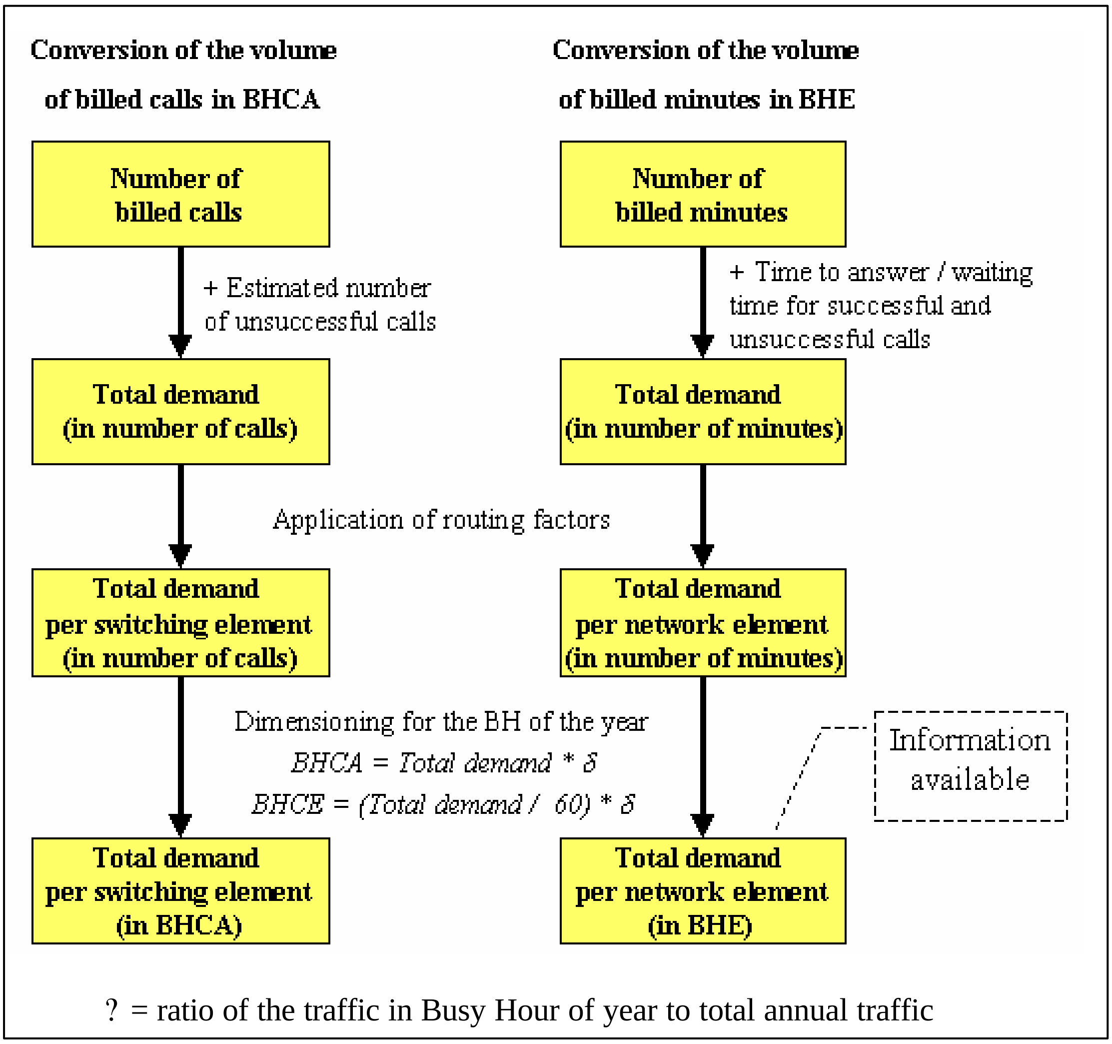

Figure 1: Conversion of the number of minutes and calls in BHE and BHCA
General overview

1.1.2 Conversion of BHE in a number of E1's

In order to use the BHEs for the dimensioning of the switching and the transmission network, the BHEs need to be converted into a number of E1's. This can be done by using the following formula:

*PSTN/ISDN traffic in E1's = ?(traffic in BHE) / (? * ?)?*

? = Erlangs per circuit (circuit efficiency)
? = number of 64 kbit/s channels per E1

The number of 64 kbit/s channels per E1 and the filling ratios (?) for the different categories of network equipment will be discussed in the paragraph 1.2, 1.3 and 1.4.

Question 1.1: The BIPT invites the industry to comment on the formula presented above for the conversion of BHE in a number of E1s.

1.1.3 Demand volume for the dimensioning of the network

- **Volume of the PSTN-ISDN services**

The PSTN-ISDN demand volume for the dimensioning of the network will be based on the BHE, BHCA and the number of user lines per node as presented above. The volumes of the BHE and BHCA of 2002[2] will be corrected by a growth or a reduction percentage. This correction percentage will be determined by taken into account the weight[3] of the different traffic types, but will be applied equally to the BHE and BHCA demand information of all the nodes in the Belgacom network.

The Institute will calculate correction factors to translate the volumes of 2002 into volumes of 2003. These calculations will be based on the actual evolution during the period 1999-2002 and the results will be presented to the market. For some types of traffic however (i.e. terminating services and originating services), the BIPT would like the point of view of the market on the future evolution of the volumes of minutes.

Question 1.2: The BIPT wishes to invite the industry to give its view on the future evolution of the terminating and originating services (expressed in a growth percentage for 2003 compared to 2002). It should be clearly motivated on what the forecasts are based.

- **Volume of the leased lines and the broadband services**

At this moment, no detailed information on the volume of leased lines and broadband services is obtained at the node level. These volumes however will be taken into account when dimensioning the network and when allocating the cost of this network between the different telecommunications services. If this information cannot be obtained from Belgacom, the Institute will propose some assumptions on the volume of the lease lines and the broadband services. These assumptions will be based on a sample of which the results will be extrapolated for the whole network. The global results will then be compared with the information on the overall installed capacity and with the capacity needed for the PSTN-ISDN services, based on the dimensioning algorithms.

1.1.4 Demand volume for the calculation of the unit costs

For the determination of the unit costs, the 'billable volumes' will be taken into account. These volumes are equal to the actual number of minutes and calls of 2001, increased with the correction factor calculated under paragraph 1.1.3 and this for each type of traffic separately[4].

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[2] Depending on the availability of the information at the incumbent's, these volumes will be budgeted volumes for 2002 or 'outlook' volumes (i.e. volumes of the revised budget).

[3] The weight of a traffic type is measured based on the number of BHE of each of the traffic types in 2002. If this information is not available, information on the BHE in 2001 will be used.

[4] The application of the same correction factor for the number of minutes and for the number of calls implies that the average duration of the calls remains unchanged.

1.2 Algorithms for modelling the switching equipment

The figure below illustrates the cost-volume relationships for the switching network. These relationships are the same for the remote concentrators (LDCs and RUs), the local switches (BUs) and the transit switches (CAEs).

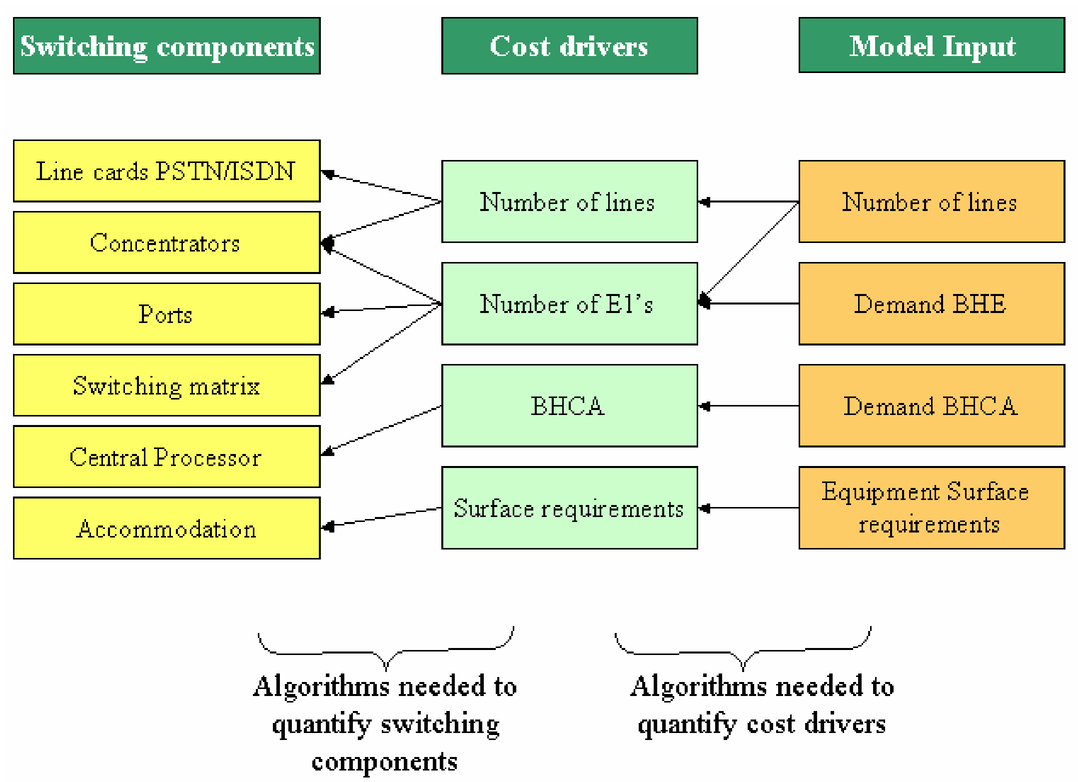

Figure 2: Algorithms for dimensioning the switching network

1.2.1 Determining the cost drivers for the switching network

<u>Calculating the number of lines</u>
Information on the number of lines of each type (PSTN, ISDN-BA, ISDN-PRA) is available at node level. This information, adapted with a correction factor to translate the volumes in volumes for the year 2003 (cf. paragraph 1.1.3) will be used as cost driver.

<u>Calculating the number of E1's</u>
The capacity of the connection between the LDC and its host, will be calculated by means of the following algorithm:

Number of E1 s

*= ?(PSTN/ISDN traffic in BHE) / (? * ?)?*

? = Erlangs per circuit
? = number of 64 kbit/s channels per E1

The BIPT proposes to take into account a circuit efficiency (?) of 0,5 for the E1s in the LDCs and RUs, of 0,6 for the E1s in the BUs and of 0,7[5] for the E1s in the CAEs and to assume that there are 30 64 kbit/s channels per E1[6].

<u>Calculating the number of BHCA</u>
If the actual number of BHCA per node cannot be obtained from the incumbent operator, the methodology for calculating the number of BHCA will be presented to the market for validation (cf. paragraph 1.1.3).

<u>Calculating the surface requirements</u>
Surface requirements for different types of network components will have to be defined and agreed upon. At this moment, no information on the surface requirements is available. This issue will be treated during a technical meeting with the market (cf. paragraph 5).

Question 1.3: The BIPT invites the industry to comment on the determining of the cost drivers of the switching network.

1.2.2 Determining the quantities of the switching components

<u>Calculating the number of line cards (PSTN / ISDN) – in E1 equivalents</u>

Number of PSTN-line cards in E1 equivalents

$$? \frac{\text{Number of PSTN user lines}}{(? * ?)}$$

Number of ISDN line cards in E1 equivalents

$$? \frac{\text{Number of ISDN BA user lines}}{(? * 2 * ?)} ? \frac{\text{Number of ISDN PRA user lines}}{(? * 30 * ?)}$$

? = number of 64 kbit/s channels per E1
? = capacity utilization

The BIPT proposes to take into account a capacity utilization of 60% for an LDC and a RU and of 70% for a BU[7].

<u>Calculating the number of concentrators – in E1 equivalents</u>

Number of concentrators in E1 equivalents

$$? \frac{\text{Number of PSTN user lines}}{? * ?} ? \frac{\text{Number of ISDN BA user lines}}{? * 2 * ?}$$

? = number of 64 kbit/s channels per E1
? = capacity utilization

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[5] Based on the Europe Economics bottom-up model.
[6] The 31st channel will be used for signaling.
[7] Based on Europe Economics bottom-up model

For the ISDN-PRA lines, no concentrators are needed. The BIPT proposes to take into account a capacity utilization of 60% for an LDC and a RU and of 70% for a BU.

Calculating the number of ports – in E1 equivalents

Number of ports in E1 equivalents

*= ?(PSTN/ISDN traffic in BHE) / (? * ? *?)?*

? = capacity utilization

The BIPT proposes to take into account a capacity utilization of 60% for an LDC and a RU, 70% for a BU and 80% for a CAE[8].

Determining the switching matrix needed – in E1 equivalents

Capacity of the switching matrix needed in E1 equivalents

*= ?(PSTN/ISDN traffic in BHE) / (? * ? *?)?*

? = capacity utilization

The BIPT proposes to take into account a capacity utilization of 70% for a BU and 80% for a CAE[9].

Determining the central processor needed – in 1*BHCA equivalents

*Capacity of the central processor needed in 1*BHCA equivalents*

= ?(PSTN/ISDN traffic in BHCA) / ?)?

? = capacity utilization

The BIPT proposes to take into account a capacity utilization of 70% for a BU and 80% for a CAE[10].

Calculating the accommodation needed – in E1 equivalents

The accommodation needed will be calculated per m² for each type of network component. The surface requirements will be discussed during the meeting in the week of May 20 (cf. Paragraph 5).

Question 1.4: The BIPT invites the industry to comment on the determining of the quantities of switching components needed.

[8] Based on Europe Economics bottom-up model.
[9] Based on Europe Economics bottom-up model.
[10] Based on Europe Economics bottom-up model.

1.3 Algorithms for the modelling the transmission links

In the next paragraphs, the algorithms for modelling the transmission links are presented. Consecutively, the links between the LDCs and the regional rings, the regional rings themselves and the core transmission network will be treated.

1.3.1 Modelling the links between the LDCs and the regional rings

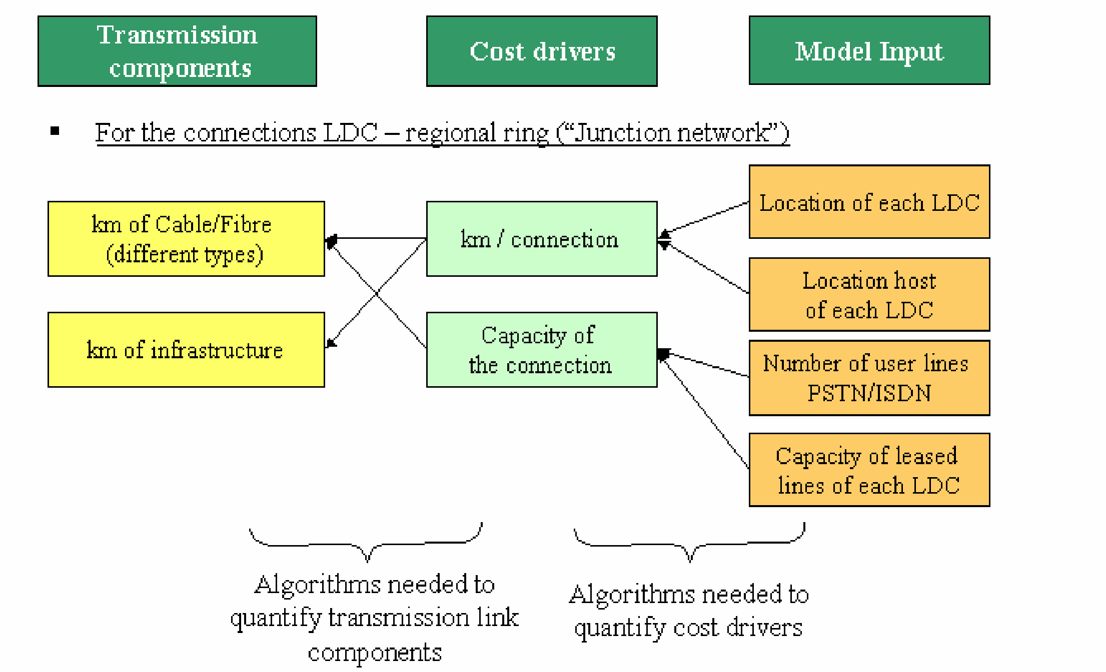

Figure 3: Algorithms for dimensioning LDC-regional rings

✍ **Determining the cost drivers for the connections between the LDCs and the regional rings**

Calculating the km/connection

The distance between an LDC and its host will be determined based on the Lambert-coordinates of the respective nodes. A correction factor will be applied since the infrastructure between the LDC and its host will not be installed in a bird's eye way.

Km/connection

$$= \sqrt{(x_{host} - x_{LDC})^2 + (y_{host} - y_{LDC})^2} * correction \ \ factor$$

Lambert-coordinates LDC = (x_{LDC}, y_{LDC})

Lambert-coordinates host = (x_{host}, y_{host})

Question 1.5: The BIPT invites the industry to propose a correction factor for the connection between an LDC and its host.

Calculating the capacity of the connection

The capacity of the connection between the LDC and its host, will be calculated by means of the following algorithm:

 # E1 per connection

*= ?(PSTN/ISDN traffic in BHE) / (? * ? *$?_1$)? + ?(# Mbit/s for leased lines) / 2*$?_2$?*

? = Erlangs per circuit

? = number of 64 kbit/s channels per E1

$?_1$ = capacity utilisation for PSTN/ISDN services

$?_2$= capacity utilisation for leased lines

The BIPT proposes to take into account a circuit efficiency (?) of 0,5[11] and to assume that there are 30 64 kbit/s channels per E1.[12] Furthermore, the BIPT proposes a value of 100% for the utilisation ratio of 100% for leased lines and of 60% for the PSTN/ISDN services.

Question 1.6a: The BIPT invites the industry to comment on the algorithms proposed for the calculation of the capacity of the connection

✍ **Determining the quantities of the transmission components**

Km of fibre & cable

Km of fibre & cable = km of the connection. # fibre & cable / connection*

Km of trench and km of duct (infrastructure)

Km of trench = km of the connection

Km of duct = km of connection # ducts in a trench*

The assumption will be made that a duct can only contain one cable.

Question 1.6b: The BIPT invites the industry to comment on the algorithms proposed for the calculation of the quantities of transmission components for the connection between the LDC an its host.

[11] Based on the Europe Economics bottom-up model.
[12] The 31st channel will be used for signalling

1.3.2 Modelling the Regional Transmission network (Regional Rings)

Figure 4 presents the cost drivers and the transmission components for the modeling of the Regional Transmission network.:

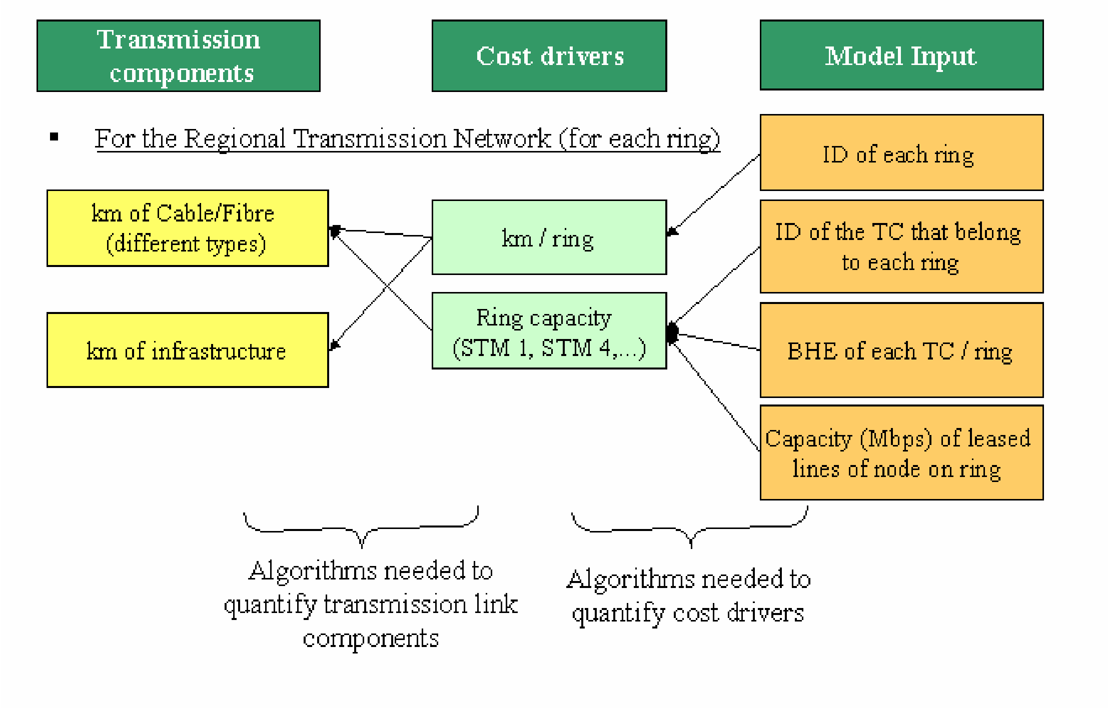

Figure 4: Algorithms for dimensioning the regional transmission network

✍ Determining the cost drivers for the regional transmission network

Calculating the km/ring

For each ring, the distance between each pair of connected nodes will be calculated by means of the following formula:

$$\textit{Distance between connected nodes} = \sqrt{(x_{node\,i} - x_{node\,j})^2 + (y_{node\,i} - y_{node\,j})^2} * \textit{correction factor}$$

$$Km/ring = \sum_{i,j}^{n} \textit{Distance between connected nodes}_{ij}$$

$$\textit{Lambert-coordinates node } i = (x_{node\,i}, y_{node\,i})$$
$$\textit{Lambert-coordinates node } j = (x_{node\,j}, y_{node\,j})$$
$$n = \textit{number of nodes}$$

The existing connections between nodes will be taken into account.

Belgacom has provided information on the actual length of each ring. The results per ring of the formula presented above will be compared with the length per ring given by Belgacom.

Question 1.7: The BIPT invites the industry to comment on the methodology proposed above and asks the industry to propose a correction factor for the determination of the length of the regional rings.

<u>Calculating the capacity of the connection</u>

In the first step of the development of the bottom-up model, the existing installed capacities in the regional rings will be modelled. In order to be able to evaluate the efficiency of these rings, the capacity needed for the PSTN-ISDN services and the leased lines will be calculated by means of the following algorithm:

Capacity per ring (in E1's)

*= ?(PSTN/ISDN traffic in BHE) / (? * ? *$?_1$)? + ?(# Mbit/s for leased lines) / 2*$?_2$?*

? = Erlangs per circuit

? = number of 64 kbit/s channels per E1

$?_1$ = capacity utilisation for PSTN/ISDN services

$?_2$= capacity utilisation for leased lines

The BIPT proposes to take into account a filling ratio (?) of 0,6[13] and to assume that there are 30 64 kbit/s channels per E1. Furthermore, the BIPT proposes to consider a capacity utilisation for the leased lines of 100% and of 70% for the regional rings[14].

The number of rings and the STM-x systems required are then determined following the table below[15]:

Number of E1 groups	*Number of rings*	*Number of STM-1s*	*STM-level*
1 – 63	1	1	1
64 – 252	1	2 – 4	4
253 – 504	2	3 – 4	4
505 – 1008	1	9 – 16	16
1009 – 2016	2	9 – 16	16
2017 – 4032	1	33 – 64	64
4033 – 8064	2	33 – 64	64

Table 1: Determination of the number of STM-1s and STM-level

13 Based on the Europe Economics bottom-up model.

14 Based on the Europe Economics bottom-up model.

15 Soucre : 'Analytical Cost Model National Core Network' – Consultative document 2.0. – Prepared by WIK for the RegTP – 30 June 2000.

Question 1.8: The BIPT invites the industry to comment on the algorithm proposed for the calculation of the capacity of the connection

✍ **Determining the quantities of transmission components for the regional transmission network**

Km of fibre & cable

Km of fibre & cable = km of the connection. # fibre & cable / connection*

Km of trench and km of duct (infrastructure)

Km of trench = km of the connection

Km of duct = km of connection # ducts in a trench*

1.3.3 Modelling the Core Transmission Network

The figure below presents the cost drivers and transmission components needed in order to dimension the Core Transmission Network:

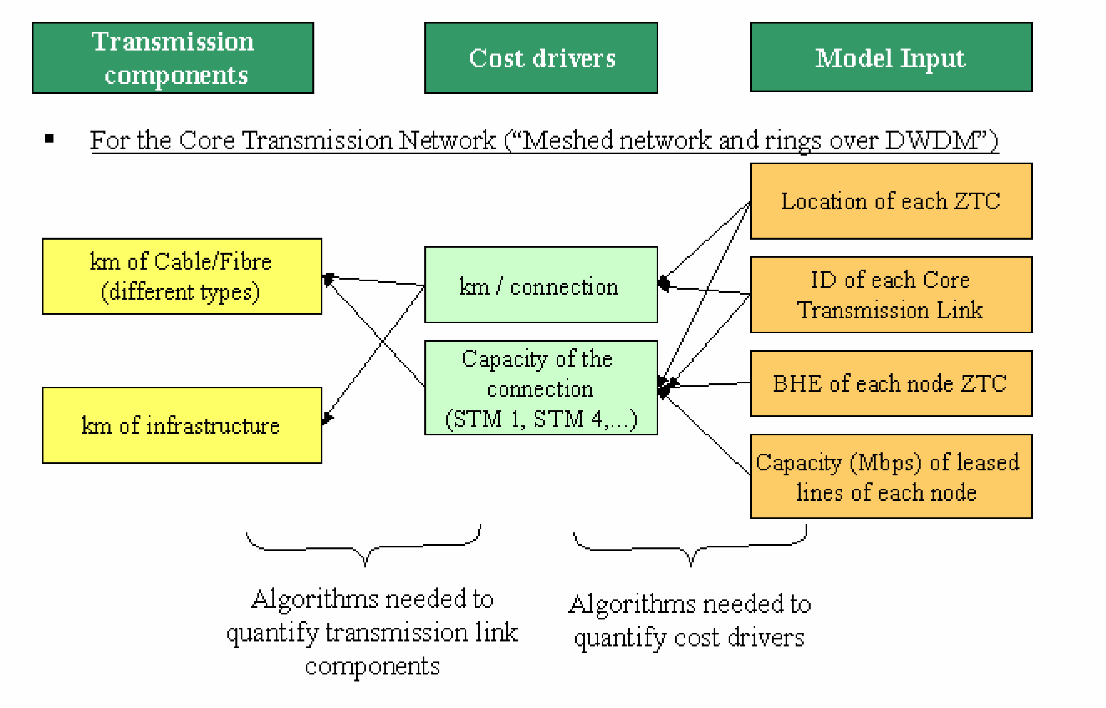

Figure 5: Algorithms for dimensioning the core transmission network

✍ Determining the cost drivers for the modelling of the Core Transmission Network

<u>Calculating the km/connection</u>

a. *For the point-to-point connections:*

The distances between the nodes connected in the meshed network, will be evaluated based on the following formula:

Distance between connected nodes

$$= \sqrt{\left(x_{node1} - x_{node2}\right)^2 + \left(y_{node1} - y_{node2}\right)^2} * correction\ factor$$

Lambert-coordinates node 1 = $\left(x_{node1}, y_{node\,1}\right)$

Lambert-coordinates node 2 = $\left(x_{node\,2}, y_{node2}\right)$

b. *For the rings:*

Distance between connected nodes

$$= \sqrt{\left(x_{node\,i} - x_{node\,j}\right)^2 + \left(y_{node\,i} - y_{node\,j}\right)^2} * correction\ factor$$

$$Km/ring = \sum_{i,j}^{n} Distance\ between\ connected\ nodes_{ij}$$

The number of connections and rings and the STM-x systems required will again be determined based on the table presented in Table 1: Determination of the number of STM-1s and STM-level.

Lambert-coordinates node i = $\left(x_{node\,i}, y_{node\,i}\right)$

Lambert-coordinates node j = $\left(x_{node\,j}, y_{node\,j}\right)$

n = number of nodes

Question 1.9: The BIPT invites the industry to comment on the algorithms proposed for the determining of the cost drivers for the Core Transmission Network.

✍ Determining the quantities of the transmission components needed

<u>Km of cable & fibre</u>

Km of cable & fibre = distance between the connected nodes

<u>Km of infrastructure</u>

Km of infrastructure = distance between the connected nodes

1.4 Algorithms for modelling the transmission equipment

For the modeling of the transmission equipment, specific algorithms will be presented for the modeling of the Local Distribution Centers (LDCs), the Local Transmission Centers (LTCs) and the Zonal Transmission Centers (ZTCs).

1.4.1 Modelling the transmission equipment in the LDCs

The modelling of the transmission equipment in the LDCs, will be based on the algorithms presented in the Figure 6 below:

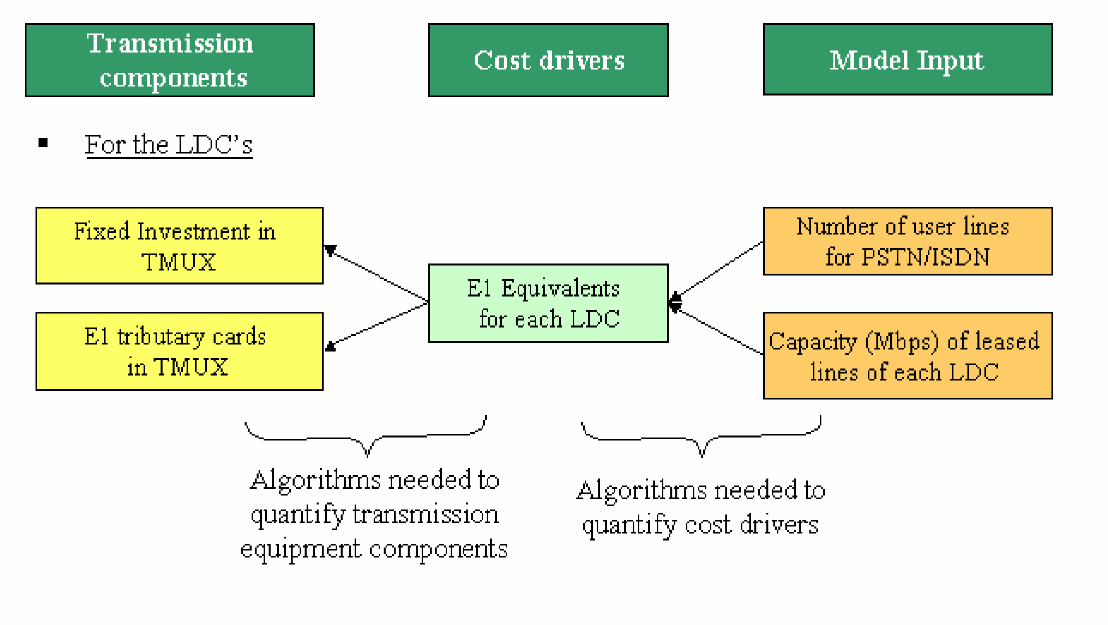

Figure 6: Algorithms for dimensioning transmission equipment

✍ Determining the cost drivers for the Local Distribution Centres

Calculating the E1 equivalents per LDC

The E1 Equivalents for each LDC will be calculated based on the following algorithm:

E1 Equivalents/LDC

= Number of user lines PSTN / ?

*+ Number of user lines ISDN BA / ?   * 2*

+ Number of user lines ISDN PRA

? = Erlangs per circuit
? = number of 64 kbit/s channels per E1

Question 1.10: The BIPT asks the industry to comment on the algorithms proposed for the determining of the cost drivers for transmission equipment in the Local Distribution Centers

The BIPT proposes again to take into account a filling ratio (?) of 0,5[16] and to assume that there are 30 64 kbit/s channels per E1.

✍ **Determining the transmission components needed for the Local Distribution Centers**

Calculating the capacity of TMUX needed – in E1 equivalents

Capacity of TMUX in E1 equivalents

=E1 equivalents per LDC / ?

? = capacity utilization

The BIPT proposes to take into account a capacity utilization of 60% for the connection between the LDC and a transmission center.

Question 1.11: The BIPT invites the industry to give her reactions on the presented algorithm for calculating the transmission components needed in the Local Distribution Center.

1.4.2 Modelling the transmission equipment in the LTCs

The figure below outlines the cost drivers for the modelling of the Local Transmission Centers. The algorithms underneath express the cost volume relationships.

[16] Based on the Europe Economics bottom-up model.

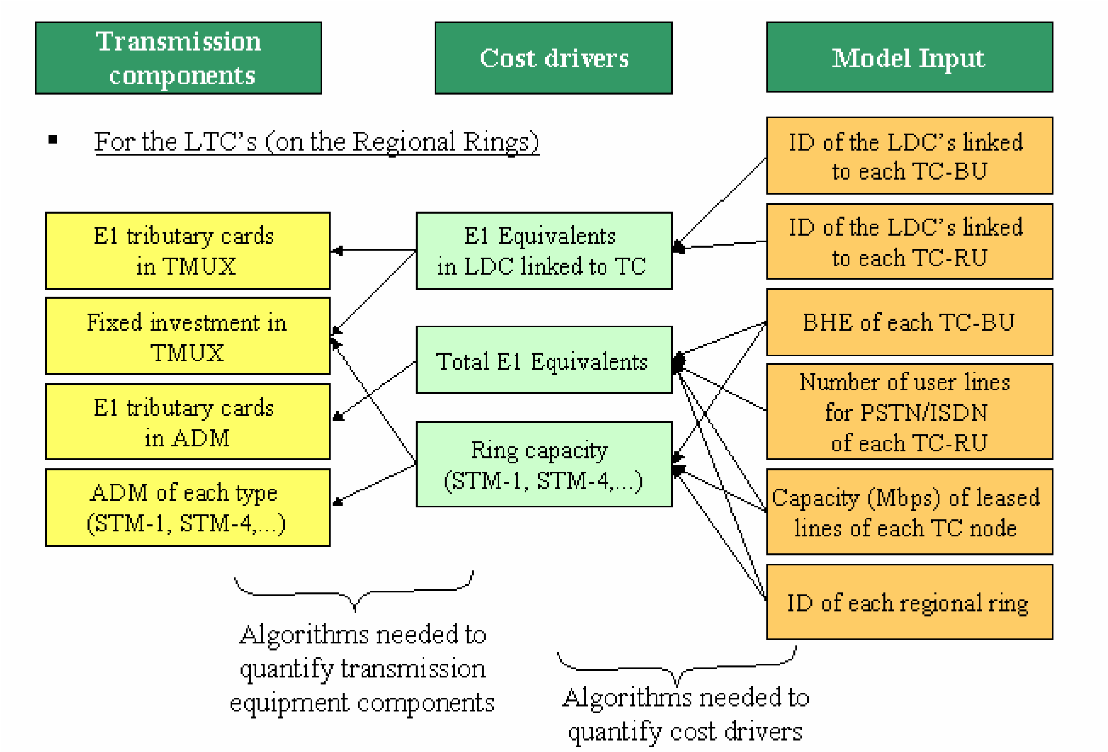

Figure 7: Algorithms for dimensioning LTCs

✍ Determining the cost drivers for the Local Transmission Centers (LTCs)

<u>Calculating the E1 equivalents in the LDCs links to a Transmission Center:</u>

For each Transmission Center (Base Unit or Remote Unit), the total number of E1 equivalents will be calculated of all the LDCs connected to that transmission center following the algorithm below:

E1 Equivalents in LDC's linked to a TC-BU or a TC-RU

$$= \sum_{i?1}^{n} E1\ Equivalents\ in\ LDC_i$$

n = number of LDC's in a certain TC

<u>Calculating the total E1 Equivalents of a certain ring:</u>

For the calculation of the total E1 Equivalents per Transmission Center, the BHEs of the BUs and the number of lines of the RUs situated on that ring have to be totalised. This is presented in the following algorithm:

E1 Equivalent of a certain regional ring =

$$\sum_{i=1}^{n} \frac{\left(PSTN / ISDN\ traffic\ BHE\ TC-BU_i\right)}{\left(? * ? * ?_1\right)}$$

$$+ \sum_{j=1}^{m} \frac{Number\ of\ PSTN\ user\ lines\ of\ TC-RU_j}{\left(? * ?_1\right)}$$

$$+ \sum_{j=1}^{m} \frac{Number\ of\ ISDN\ BA\ user\ lines\ of\ TC-RU_j}{\left(? * ?_1\right) * 2}$$

$$+ \sum_{j=1}^{m} \frac{Number\ of\ ISDN\ PRA\ user\ lines\ of\ TC-RU_j}{\left(? * ?_1\right) * 30}$$

$$+ \sum_{k}^{m+n} Number\ of\ E1\ equivalents\ for\ leased\ lines\ of\ TC_k / ?_2$$

m = number of TC-RU on a certain regional ring
n = number of TC-BU on a certain regional ring
k = number of TC on a certain regional ring
$?_1$ = capacity utilisation for PSTN/ISDN services
$?_2$= capacity utilisation for leased lines

The BIPT proposed to take into account a capacity utilisation of 70% for the PSTN-ISDN services and of 100% for the lease line services[17].

Calculating the ring capacity / ring

The ring capacity of a certain ring, will be derived from the number of E1 equivalents, which was calculated based on the algorithm above. The number of STM-1s and the STM-level of the ring will be determined based on the information in Table 1.

Question 1.12: The BIPT invites the industry to give comments on the algorithms for determining the cost drivers for transmission equipments needed in the Local Transmission Center.

- **Determining the transmission components needed for the Local Transmission Centers (LTCs)**

Calculating the capacity of ADMs and tributary cards needed

The investment in ADMs and tributary cards will be determined by the ring(s) and the number of Equivalents inserted or extracted at each node. Based on these two values, the necessary equipment will be taken into account. An exact description of the algorithms will be provided afterwards.

[17] Based on the bottom-up model of Europe Economics.

When quantifying the volume of ADM-equipment needed, dedicated STM-1 tributary cards will be taken into account for each LDC connected to a Transmission Center.

Question 1.13: The BIPT invites the industry to give comments on the approach for determining the transmission equipment needed in the Local Transmission Centers and welcomes views of the industry on the modelling of the ADMs.

1.4.3 Modelling the transmission equipment in the ZTCs

Finally, for the modelling of the Zonal Transmission Centers, the parameters in Figure 8 will be combined in the algorithms presented below:

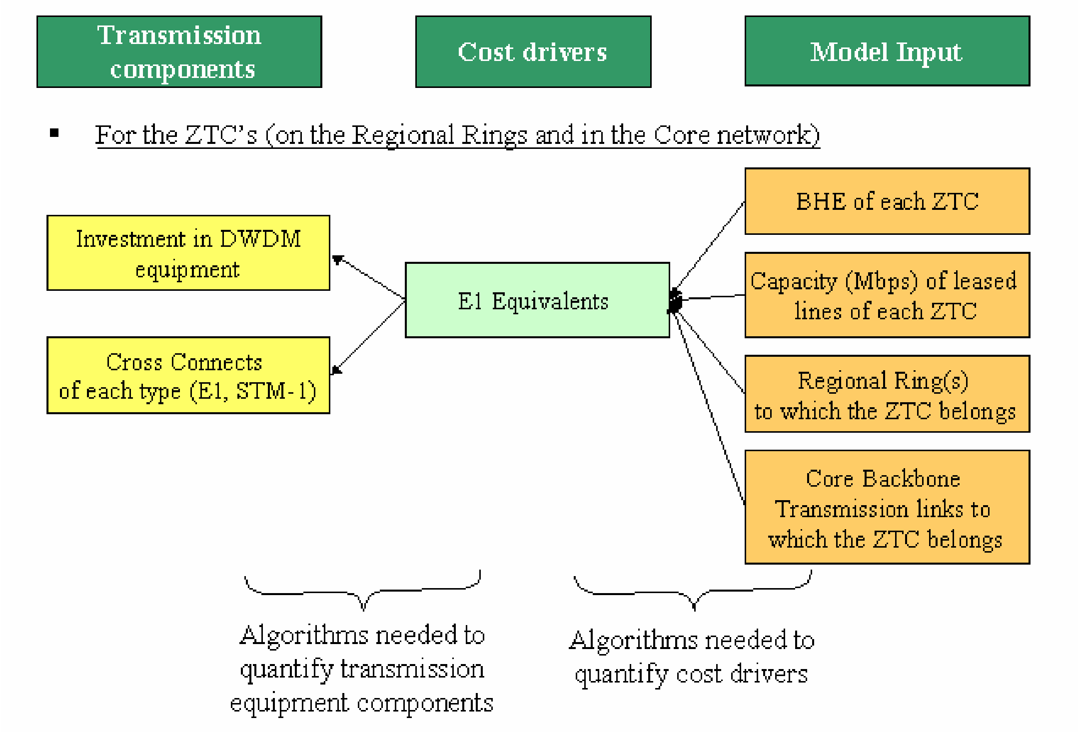

Figure 8: Algorithms for dimensioning the ZTCs

✍ Determining the cost drivers for the Zonal Transmission Centers

<u>Calculating the E1 Equivalents</u>

Capacity of the ZTCs (in E1's)

*= ?(PSTN/ISDN traffic in BHE) / (? * ? *?$_1$)? + ?(# Mbit/s for leased lines) / 2*?$_2$?*

? = Erlangs per circuit
? = number of 64 kbit/s channels per E1
?$_1$ = capacity utilisation for PSTN/ISDN services
?$_2$= capacity utilisation for leased lines

The Institute proposes to use a capacity utilisation of 80% for the PSTN/ISDN and of 100% for the leased line services.

✍ **Determining the transmission components needed for modelling the Zonal Transmission Centers**

<u>Calculating the quantities of Cross Connects and of DWDM-equipment</u>

The investment in Cross Connects and DWDMs will be determined by the overall capacity needed in the Core Transmission network. An exact description of the algorithms will be provided afterwards.

1.5 Algorithms for dimensioning the signalling network

The algorithms for dimensioning the signalling network will be dealt with during the technical meeting in the week of May 20 (cf. Planning in paragraph 5). Any suggestions before this meeting are welcome.

1.6 Routing rules

The use of the incumbents BHE information on node level assumes implicitly that the routing factors specific to the Belgacom network will be used in the bottom-up model. In other words, the bottom-up model assumes that the routing in the incumbents network is done in an efficient way. In the following paragraphs, more details are provided on the CAE-principles and the routing rules applied by Belgacom. The validation of these rules by the market implies the acceptance of the Belgacom specific routing factors for the development of the bottom-up model.

The switching structure of the Belgacom network has 2 hierarchical layers:

- <u>Base level</u>: the Base Units (BUs) on which the subscribers are directly connected or on which they are connected via a remote unit (RU).
- <u>Upper level</u>: the CAE, which are pure transit centres.

By connecting each BU to at least 2 CAEs, securisation will be insured while transit functionalities decrease.

After discussion with Belgacom, BIPT wants to apply the following rules.

When direct links are defined, traffic between the two points will first be routed on these circuits. The following rules are applied:

- A direct E1-link is created if traffic between 2 points exceeds 20 BHE;
- A new E1-link is added when the overflow on the final route exceeds 20 BHE.

The level is carried at 15 BHE if the two points are situated on the same SDH ring, or if both switches are situated in the same zone and if one of them is located the ZTC.

The rules for routing traffic between BUs and CAEs are commented in the paragraphs below. There are 4 possible combinations: BU-BU, BU-CAE same area, BU-CAE other area, CAE-CAE for which specific circuit groups can be defined.

✍ **BU-BU**

When justified, bi-directional links can be created (cf. supra). The traffic is routed with a final overflow to the 2 CAEs of the originating BU. This overflow is an equal load sharing (50%) to the 2 own CAEs with mutual overflow, whatever the number of circuits with the 2 CAEs.

✍ **BU-CAE same area**

There are always bi-directional links (final circuits). All traffic is routed with an equal load sharing (50%) between the 2 CAEs of the own CA with mutual overflow whatever the number of circuits to each CAE.

✍ **BU-CAE other area**

Uni-directional high usage circuits are created when justified. The traffic is routed with an equal load sharing (50%) between the 2 distant CAEs of the other CA with mutual overflow and this, whatever the number of circuits to each CAE of the other CA. The traffic is routed with a final overflow to both CAEs of the CA of the originating BU. This final overflow is also an equal load sharing (50%) to the 2 own CAE with mutual overflow. The load sharing is also 50% whatever the number of circuits with the 2 CAE.

✍ **CAE-CAE**

The traffic is routed between the 2 CAEs with an equal load sharing (50%) with a mutual overflow and a final overflow on its associated CAE.

2. COSTING INFORMATION

2.1 Introduction

One of the main difficulties of building a bottom-up cost model is the actual cost information gathering. It is however obvious that it is crucial for the credibility of the results that this information is correct. One of the objectives of the second consultation document was to obtain an overview of all costs that need to be included in the bottom-up model. Moreover, all operators were able to comment on the fact whether or not the requested information would be available in the presented format. This was the first step to ensure data consistency and data integrity.

There are however a lot of pitfalls that should be avoided when requesting cost information: different operators have different suppliers, different operators get different discounts and pricing schemes from the same supplier, functionality of the equipment can vary considerably, etc.. In order to stay clear of these pitfalls, a list of principles is defined that should constantly be kept in mind when providing cost data.

1. **All prices are VAT excl.;**
2. **Prices should be up to date (2002);**
3. **Only CAPEX costs should be included in the price [18];**
4. **Answers should always list the following information (if available):**
    i. **Supplier list price (€);**
    ii. **Date of price list;**
    iii. **Operator Discount (%);**
    iv. **Discount Scheme (% relative to volume);**
    v. **Special terms if relevant;**
5. **Prices should be given at the level of detail required (e.g. line card, E1-tributary card). If however the operator does not have the data on a detailed basis, aggregate data can be submitted. In this case, several configurations with their actual price should be given.[19] Moreover, it should be clear what functionality is exactly covered by the aggregate cost;**
6. **The price requested should cover the complete one time purchase cost paid to the supplier. Some contracts however contain recurrent yearly prices, maintenance costs and some future upgrade costs included. If information is only available under this format, this should be mentioned explicitly.**

The BIPT would like to stress that complete confidentiality of all cost information submitted is guaranteed. It has to be clear that individual data obtained from the operators shall never be disclosed publicly. This does however not imply that the final determination of the costs of the equipment will be a 'black box' for the operators. On the contrary, a detailed description of how this process will be done will be available at a later stage, and this to such a degree that all individual submitted data will remain confidential.

[18] OPEX costs will be treated further on.
[19] E.g. a concentrator able to concentrate 30 E1s on an STM1 costs € X. A concentrator able to concentrate 90 E1s on an STM1 costs € Y, etc… This will allow the BIPT and its consultant to isolate the detailed component costs by means of multiple regression analysis.

2.2 Investment costs of the switching equipment

In the following paragraphs, investment costs for switching equipment will be asked for. There will be no further specifications of the functionality of all the equipment. For further detail on the exact function of each equipment part, we refer to the second consultation document or to the contact persons mentioned at the end of this document. It is however useful to repeat that only capital expenditure costs (CAPEX) costs should be included in the prices of the operators since operating expenditure costs (OPEX) will be treated further on by means of mark-ups.

2.2.1 Cost of switching equipment for the remote units and LDCs

Question 2.1: The BIPT invites the operators to provide the following cost information for the switching equipment in the remote concentrator units and LDCs.

- **PSTN and ISDN line card costs**

The underlying table specifies the requested information for the line cards in the remote concentrator units. We nevertheless like to repeat that these Remote units and LDCs do not possess any switching capacity.

Supplier list price of 1 PSTN line card	
Number of users that can be connected to 1 PSTN line card	
Supplier list price of 1 ISND line card	
Number of users that can be connected to 1 ISDN line card	
Date of list prices	
Percentage of discount on list prices given to operator	
Discount scheme	
Other special terms	

✍ Concentrator costs

With regard to concentrator costs, the aim of the BIPT is to obtain several concentrating costs on which multiple regression analyses can be applied. Therefore, the BIPT is seeking cost input data for several configurations. The BIPT invites the operators to choose the configurations for which they can provide costs.[20]

Supplier list price for a concentrator configuration 1 **Supplier list price for a concentrator configuration 2** **Supplier list price for a concentrator configuration 3** **Supplier list price for a concentrator configuration 4**	
Number of customer lines configuration 1 **Number of customer lines configuration 2** **Number of customer lines configuration 3** **Number of customer lines configuration 4**	
Number of E1s configuration 1 **Number of E1s configuration 2** **Number of E1s configuration 3** **Number of E1s configuration 4**	
Date of list price	
Percentage of discount on list prices given to operator	
Discount scheme	
Other special terms	

✍ Port costs

The objective of the underlying table is to obtain port costs per E1 group.

Supplier list price for n ports	
Total capacity of ports expressed in number of E1s (n)	
Date of list prices	

[20] E.g. configuration 1 = 30 end-user lines, 2 E1s, € 5.000

Percentage of discount on list prices given to operator	
Discount scheme	
Other special terms	

✍ **Accommodation costs for buildings**

Accommodation costs per m² are the only CAPEX cost category where OPEX costs should be included. They typically include building annualisation, air conditioning, building maintenance costs…. The exact treatment of the accommodation costs shall be further discussed in the technical meeting during the week of May 20, 2002.

Average building cost per m² for the RUs and LDCs	

2.2.2 Cost of switching equipment of the base units

The following paragraphs request information concerning base unit investment costs. Many of the costs have already been addressed when looking at the remote units investment costs. We would like however to repeat each category since prices may differ according to the function of the unit. Whenever prices would be the same for base units and remote units, reference can be made to the above tables.

Question 2.2: The BIPT invites the operators to provide the following cost information for the switching equipment in the base units

✍ **PSTN and ISDN line card costs**

Supplier list price of 1 PSTN line card	
Number of users that can be connected to 1 PSTN line card	
Supplier list price of 1 ISND line card	
Number of users that can be connected to 1 ISDN line card	
Date of list prices	

Percentage of discount on list prices given to operator	
Discount sche me	
Other special terms	

✍ **Concentrator costs**

Supplier list price for a concentrator configuration 1 **Supplier list price for a concentrator configuration 2** **Supplier list price for a concentrator configuration 3** **Supplier list price for a concentrator configuration 4**	
Number of customer lines configuration 1 **Number of customer lines configuration 2** **Number of customer lines configuration 3** **Number of customer lines configuration 4**	
Number of E1s configuration 1 **Number of E1s configuration 2** **Number of E1s configuration 3** **Number of E1s configuration 4**	
Date of list price	
Percentage of discount on list prices given to operator	
Discount scheme	
Other special terms	

✍ Port costs

Supplier list price for n ports	
Capacity of port expressed in number of E1s (n)	
Date of list prices	
Percentage of discount on list prices given to operator	
Discount scheme	
Other special terms	

✍ Switching Matrix costs

The switching matrix costs provides 64 Kbit/s user information channels between incoming and outgoing lines. The cost driver for switching matrix investment is the number of E1 groups.

Supplier list price for switching matrix (n * E1s)	
Number of E1s that can be switched (n)	
Date of list prices	
Percentage of discount on list prices given to operator	
Discount scheme	
Other special terms	

✍ **Processor Costs**

The central processor controls the switching matrix and provides routing and charging functionality. The cost driver for the central processor is BHCA.

Supplier list price for central processor (n * 1 BHCA)	
Number of BHCA that can be processed (n)	
Does this cost include signalling processing (Yes/No)	
If signalling is included, what percentage of the processor cost should be allocated to signalling	
Date of list prices	
Percentage of discount on list prices given to operator	
Discount scheme	
Other special terms	

✍ **Accommodation Site**

Average building cost per m² for the BUs	

2.2.3 Cost of switching equipment of the covering area exchanges

The following paragraphs request information concerning covering area exchanges investment costs. Many of the costs have already been addressed when looking at the remote units investment costs and the base unit investment costs. We would like however to repeat each relevant category since prices may differ according to the function of the unit. Whenever prices would be the same for covering area exchanges as for base units or remote units, reference can be made to the above tables.

Question 2.3: The BIPT invites the operators to provide the following cost information for the switching equipment in the covering area exchanges.

✍ **Port costs**

Supplier list price for n ports	
Capacity of port expressed in number of E1s (n)	
Date of list prices	
Percentage of discount on list prices given to operator	
Discount scheme	
Other special terms	

✍ **Switching Matrix costs**

Supplier list price for switching matrix (n * E1s)	
Number of E1s that can be switched (n)	
Date of list prices	
Percentage of discount on list prices given to operator	
Discount scheme	
Other special terms	

✍ **Processor Costs**

Supplier list price for central processor (n * 1 BHCA)	
Number of BHCA that can be processed (n)	
Does this cost include signalling processing (Yes/No)	
If signalling is included, what percentage of the processor cost should be allocated to signalling	
Date of list prices	
Percentage of discount on list prices given to operator	
Discount scheme	
Other special terms	

✍ **Accommodation Site**

Average building cost per m² for the Covering Area Exchanges	

2.3 Investment costs of the transmission equipment and infrastructure

In the following paragraphs, investment costs for transmission equipment and infrastructure will be asked for. There will be no further specifications of the functionality of all the equipment. For further detail on the exact function of each equipment part, we refer to the second consultation document or to the contact persons mentioned at the end of this document. We would like to repeat that, as with switching, only capital expenditure costs (CAPEX) costs should be included in the prices of the operators since operating expenditure costs (OPEX) will be treated further on by means of mark-ups.

The same principles as outlined in paragraph 2.1 apply here.

2.3.1 Cost of transmission equipment

Question 2.4: The BIPT invites the operators to provide the following cost information for the transmission equipment

✍ **E1 tributary card investment costs for TMUX**

Data on E1 tributary cards here should refer to extra E1 tributary cards provided by supplier to add to an existing TMUX (where there could be an existing amount of E1 present already). Notice that a tributary card can contain several E1 interfaces and that this number should also be provided.

Supplier list price for a E1 tributary card (n * E1)	
Number of E1 interfaces per tributary card (n)	
Date of list prices	
Percentage of discount on list prices given to operator	
Discount scheme	
Other special terms	

✍ **Fixed Investment costs in TMUX equipment**

The BIPT is seeking to determine fixed investment in TMUX equipment. This normally excludes all E1 tributary cards already present in the TMUX. However, if the operator is unable to provide this information, the number of E1s present should be mentioned and data on several configurations would be welcomed, in order to make multiple regression analyses possible.

Supplier list price for TMUX equipment	
Number of E1 tributary cards included	
Date of list prices	
Percentage of discount on list prices given to operator	

Discount scheme	
Other special terms	

✍ **Investment costs to insert E1 connections into the ADM**

The questions in the table below refer to data about tributary cards that are able to insert/extract an E1 data stream into the ADM. This tributary cards are typically able to insert/extract multiple E1s. The number of E1s that are covered by the investment in the tributary card should therefore also be mentioned.

Supplier list price for tributary card (n * E1)	
Number of E1s that can be inserted/extracted with tributary card (n)	
Date of list prices	
Percentage of discount on list prices given to operator	
Discount scheme	
Other special terms	

✍ **Investment costs in ADM equipment**

The BIPT is looking for cost data about the fixed cost of the ADM, the cost of the STM-x line card included.

Supplier list price for ADM for STM1 ring	
Supplier list price for ADM for STM4 ring	
Supplier list price for ADM for STM16 ring	
Supplier list price for ADM for STM64 ring	

Date of list prices	
Percentage of discount on list prices given to operator	
Discount scheme	
Other special terms	

✍ Investment costs in E1 cross connects

The BIPT has understood from the answers of the previous consultation document that the cross connection of E1s from within an STM1 stream requires usually distinct equipment from the equipment that is needed to cross connect STM1s. It is therefore that the BIPT will first ask for investment costs for cross connecting E1s from within an STM1 stream. These costs should include tributary card costs as well as the fixed costs of the cross connect itself. The BIPT would appreciate different configurations and their corresponding prices.

Supplier list price for E1 cross connect (n * STM1 inputs, m * E1s) **Configuration 1** **Configuration 2** **Configuration 3** **Configuration 4**	
Number of STM1 inputs (n) **Configuration 1** **Configuration 2** **Configuration 3** **Configuration 4**	
Number of E1 ports (m) **Configuration 1** **Configuration 2** **Configuration 3** **Configuration 4**	
Date of list prices	
Percentage of discount on list prices given to operator	
Discount scheme	

Other special terms	

✍ Investment cost for STM1 cross connects

In the table below, the BIPT is collecting cost information concerning equipment cost for cross-connecting STM1s. Costs should cover all capital costs related to the purchase of the cross connect including STM1 tributary cards and fixed investment in the cross connect. The BIPT would appreciate different configurations (configurations) and their corresponding prices.

Supplier list price for STM1 cross connect (n * STM1 traffic streams) **Configuration 1** **Configuration 2** **Configuration 3** **Configuration 4**	
Number of STM1 traffic streams **Configuration 1** **Configuration 2** **Configuration 3** **Configuration 4**	
Date of list prices	
Percentage of discount on list prices given to operator	
Discount scheme	
Other special terms	

✍ Investment costs for multiplexing

In the backbone transmission network, traffic demands are often high enough to justify STM4, STM16 or STM64 transmission equipment. This requires the appropriate add/drop multiplexers. Tributary cards of the appropriate capacity are therefore needed in the ADM. The price of the ADM itself should not be included since this was already treated above.

Supplier list price for STM1 tributary card	
Supplier list price for STM4 tributary card	
Supplier list price for STM16 tributary card	
Supplier list price for STM64 tributary card	
Date of list prices	
Percentage of discount on list prices given to operator	
Discount scheme	
Other special terms	

✍ **Invest costs for DWDM equipment**

The BIPT has not yet decided on how DWDM-equipment might be modelled. It is therefore that no investment costs will be determined yet for DWDM equipment since this will be the subject of a separate communication.

2.3.2 Cost of infrastructure equipment

In the previous paragraphs, costs for investment in transmission equipment have been determined. In the following paragraphs, investment costs for infrastructure need to be determined. Two cost categories will be used, i.e. cable costs and duct costs.

Question 2.5: The BIPT invites the operators to provide the following infrastructure cost information

✍ **Investment costs for cable**

Investment cost for cable may vary according to the number of fiber in the cable. The BIPT assumes the use of standard 12, 24, 48 or 96-fiber cable. Costs should include cable material, insulation costs, splicing costs and cable installation costs.

Supplier list price for 12 fiber cable (€/meter)	
Supplier list price for 24 fiber cable (€/meter)	

Supplier list price for 48 fiber cable (€/meter)	
Supplier list price for 96 fiber cable (€/meter)	
Date of list prices	
Percentage of discount on list prices given to operator	
Discount scheme	
Other special terms	

✍ **Investment costs for ducts and trenches**

Next to the actual cost of the cable and the fiber, costs for ducts and trenches should be taken into account. The BIPT requests the operators to provide costs for three geo-types (Metropolitan, Urban, Rural) if available. If not, average costs should be supplied. Moreover, the BIPT request the operators to indicate the average trench/meter and duct/meter cost for their network.

It is however possible that only one combined cost for the ducts and trenches per m is available. If this is the case, this should be mentioned explicitly.

Supplier list price for duct/meter METROPOLITAN	
Supplier list price for duct/meter URBAN	
Supplier list price for duct/meter RURAL	
Date of list prices	
Percentage of discount on list prices given to operator	
Average duct/meter cost (incl. discount) for operators network	
Discount scheme	
Other special terms	

Supplier list price for trench/meter METROPOLITAN	
Supplier list price for trench/meter URBAN	
Supplier list price for trench/meter RURAL	
Date of list prices	
Percentage of discount on list prices given to operator	
Average trench/meter cost (incl. discount) for operators network	
Discount scheme	
Other special terms	

2.4 Investment costs in the signalling network

Now that all direct investment costs for switching and signalling have been determined, direct investment costs in the signalling network should be provided. Only costs for the signalling nodes will be asked for, since the transmission of the signalling network will be physically collocated with the PSTN/ISDN transmission network. A problem when determining signalling costs is that these costs may be absorbed within the local switch processor. Whenever this is the case, an estimate of the signalling cost should be made. Double counting with investment costs for switching processing should be avoided by all means. Since BHCA is the cost driver for the signalling processing costs, the corresponding capacities should always be given.

✍ **Investment in signalling point costs**

Supplier list price for investment in signalling points (n * 1 BHCA)	
BHCA capacity for signalling point investment (n)	
Date of list prices	
Percentage of discount on list prices given to operator	
Discount scheme	

Other special terms	

✍ **Investment in signalling transfer point costs**

Supplier list price for investment in signalling transfer points (n * 1 BHCA)	
BHCA capacity for signalling point investment (n)	
Date of list prices	
Percentage of discount on list prices given to operator	
Discount scheme	
Other special terms	

2.5 Indirect network costs

2.5.1 PSTN/ISDN network support investment

In the previous chapters, we have determined all direct switching, transmission and signalling costs that are directly attributable to the actual network. There is however also a considerable amount of indirectly attributable network investment costs that need to be taken into account. These costs are indispensable for network operation but cannot be determined easily by the use of cost drivers.

In the summary of the answers on the second consultation document, it was decided by the BIPT that the classification below would be used to model the capital expenditure costs (CAPEX).

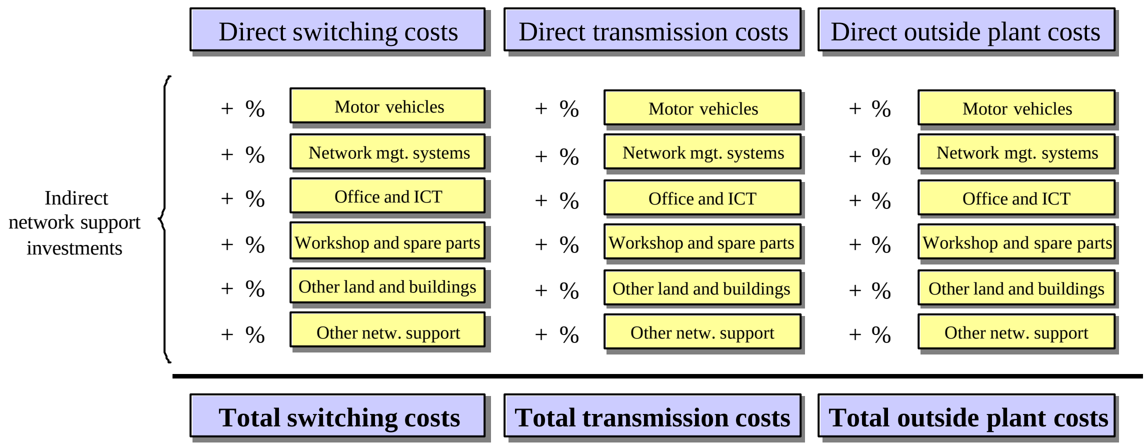

Figure 9: indirect network costs

The percentages in the figure above represent a % relative to the initial investment cost of the asset. E.g., when a switch is bought for 100.000 € and an additional 30.000 € investment would be needed in office and ICT equipment to make this switch work, the percentage would be 30 %. It is clear that these support investment have to be depreciated as well. If, in our example, we assume that the life span of the office and ICT equipment is 5 years, yearly depreciation would be 6000 €.

Next to the above CAPEX costs presented in *Figure 9*, operating expenditure costs (OPEX) have to be added. These OPEX costs are typically a percentage of the investment cost of the network support investment. In the above example, the OPEX cost for the office and ICT equipment will represent yearly e.g. 10 % of the cost of the network support investment, i.e. € 3000. The total switching cost will therefore be € 10.000 direct switching costs (depreciation 10 years) plus € 6000 office and ICT equipment and € 3000 operating costs, thus totalling € 19.000.

Question 2.6: The BIPT invites the operators to fill in the table below. The above example is illustrated in the table in order to ensure that there can be no misunderstanding. The BIPT has already made a proposal with regard to the depreciation periods. If other depreciation periods are proposed by the operator, please motivate.

	Direct Switching			***Direct Transmission***			***Direct Outside Plant***		
	CAPEX %	Asset life	OPEX %	CAPEX %	Asset life	OPEX %	CAPEX %	Asset life	OPEX %
Motor vehicles	…%	5	…%	…%	5	…%	…%	5	…%
Network Mgt. Systems	…%	5	…%	…%	5	…%	…%	5	…%
Office and ICT	**30 %**	**5**	**10 %**	…%	5	…%	…%	5	…%
Workshop	…%	5	…%	…%	5	…%	…%	5	…%

and spare parts									
Other land and buildings	…%	37	…%	…%	37	…%	…%	37	…%
Other netw. Support	…%	5	…%	…%	5	…%	…%	5	…%

***CAPEX %**: Total initial investment cost (not yearly) of the network support item; % relative to the total investment cost of the direct switching costs.*

***Asset life**: Technical life span of the network support item; in years*

OPEX %: *Yearly operating costs that are related to the network support item; % relative to the Total investment cost (not yearly) of the network support item.*

It is the BIPT's objective to obtain this information on the level of detailed as specified by the above table. However, if the operator is unable to deliver the information under the above format, aggregate information can be provided. The underlying table provides an alternative to the more detailed approach.

	Direct Switching		***Direct Transmission***		***Direct Outside plant***	
	CAPEX	OPEX	CAPEX	OPEX	CAPEX	OPEX
Total network support investment	… %	…%	…%	…%	…%	…%

***CAPEX %**: Total initial investment cost (not yearly) of the all network support items; % relative to the total investment cost of the direct switching costs.*

OPEX %: *Yearly operating costs that are related to all network support item; % relative to the Total investment cost (not yearly) of the network support item.*

2.5.2 Other operating costs for the PSTN/ISDN network

Besides the operating costs that were calculated in the previous paragraphs, there are still some operating costs that are at this point not integrated in the model. These concern maintenance cost of the switching and the transmission network as well as network planning and development costs. The "maintenance costs" have to cover all services provided for maintaining the assets functions, i.e. providing infrastructure that enables the delivery of PSTN/ISDN calls. The "network planning and development" costs cover costs for capacity planning, network build planning, route planning and research and development for network optimisation. It has to be clear that manpower costs as well as small material costs are included here, as far as they have not already been integrated in previous costs.

Question 2.7: The BIPT invites the operators to fill in the underlying table. Costs should be expressed as a percentage of total direct investments. E.g., if the total switching network would cost € 1.000.000.000, and personnel maintenance costs would be € 10.000.000, the value should read 1%. Moreover, the BIPT requests the operators to supply separate data for local/transit switching and regional/core transmission. If this level of detail should not be available, a more aggregate approach (switching/transmission) could be used.

		Switching Equipment		***Transmission Equipment***			***Outside plant***	
		Local	Transit	LDC	LTC	ZTC	Regional	Core
Maintenance	Personnel	…%	…%	…%	…%	…%	…%	…%
	Material	…%	…%	…%	…%	…%	…%	…%
	Other	…%	…%	…%	…%	…%	…%	…%
Network planning and development	Personnel	…%	…%	…%	…%	…%	…%	…%
	External	…%	…%	…%	…%	…%	…%	…%

2.6 Non-network related overhead costs for the PSTN/ISDN network

Now that all direct and indirect network costs have been determined, there is still a significant amount of overhead costs that cannot be allocated to the network by means of simple cost drivers. When building a real business cost model, these cost would typically be allocated to the different services by means of activity based costing methods. In a theoretic bottom-up model however, a different approach has to be followed.

The following list identifies all overhead categories and their proposed cost drivers. It has to be noted that the BIPT will ask for two cost drivers. The first cost driver determines the total amount of overhead, which could be necessary to provide all services of the operator. The second cost driver determines the amount of overhead that will be allocated to the PSNT/ISDN network. It is important to keep in mind that during the reconciliation process, these cost will be the subject of a thorough analysis with the actual Belgacom figures and that the costs estimated on the presented cost drivers will only serve as a first rough estimate.

a) Human Resources Management Costs

Human Resource Management Cost includes all cost that are related to the Human Resources Department. The Human Resources Department is responsible for remuneration issues, salary administration, IT with regard to HR, evaluation tasks, internal communication, change management etc. These costs include manpower costs, building costs, services and other goods costs, etc. The BIPT proposes to use the number of employees, measured in full time equivalents (FTE) as a cost driver for all HR overhead costs. It should however be noted that a second cost driver has to be presented to isolate the amount of HR overhead that is attributable to

PSTN/ISDN services. The BIPT proposes to take the ratio (revenue from PSTN-ISDN services/total revenue) as the appropriate cost driver;

b) Finance Department

The finance department is responsible for the financial management of the company. It includes all cost necessary to guarantee accounting of the operator, budgetary control, risk management, etc. Note that billing costs are not born by the finance department. These costs are already included in the "office and ICT" costs in the network support investment category. The BIPT proposes to use the number of employees as a raw cost driver to determine the cost of the finance department, since the size of the company has a direct impact on the workload of the finance department. To determine the part that is relevant to PSTN-ISDN services, the same cost driver will be used as the one for the HR-department (revenue from PSTN-ISDN services/total revenue);

c) Legal services, Regulatory and Public Affairs

The legal services and Regulatory and Public Affairs department is first of all responsible for all legal matters within the company. Next to this, this department ensures the positioning of the operator within the national and European regulatory framework. All costs incurred to provide this support should be included (personnel, buildings, services and other goods, IT,). The BIPT is unable to present an approach to determine these costs based on simple cost drivers. Moreover, given its regulated status, the operator that is modelled has very specific regulatory obligations that are not present with competing operators. It is therefore that the BIPT has opted to determine these costs based on detailed information from the incumbent, combined with expertise gathered abroad from comparable operators. The operators should therefore not submit any data regarding the legal services and regulatory and public affairs department;

d) Strategy and development and CEO support

The strategy and development department is responsible for determining strategic options for the operator and the management of the scarce resources in the company. The CEO support division includes the board of directors, and its secretary services. Once again, all costs ranging from personnel to buildings should be included. The BIPT proposes to use turnover as a raw cost driver to determine these cost. To allocate part of these costs to the PSTN-ISDN network, the same cost driver will be used as for the HR and finance department (revenue from PSTN-ISDN services/total revenue);

e) Communication department

The communication department is responsible for the external communication of the company. The goal of this department is to create a positive image of the company. Since costs of this department are not at all relevant to provide interconnect services to other operators, these costs will not be modelled.

f) Business Development department

The business development department has as its main tasks the development of the operator through alliances and take-overs. These costs are considered to be irrelevant for the provision of PSTN-ISDN interconnect services and are therefore not modelled.

g) Marketing department

The marketing department is responsible for all marketing management of the operator. Since these costs are not relevant for the provision of PSTN-ISDN interconnect services, these costs are discarded in the model.

The BIPT insists to refocus on the fact that the cost drivers identified above, and the cost data provided by the OLOs, will only be a rough estimate of these overhead costs. The main data source will be the actual incumbent's data that will be analysed in high detail. Next to this, foreign cost information from other bottom-up exercises will be consulted. Operators are free to provide any additional information from other countries that can help determine these overhead costs.

Question 2.8: The BIPT invites the operators to submit data in the underlying table. Based on the data provided, the BIPT and its consultant will be able to calculate the appropriate cost drivers and costs.

Total Company Revenue (turnover in €) – in 2001	
Total Revenue from PSTN-ISDN services (in €) – in 2001	
Total Number of FTE[21] – in 2001	
Yearly HR department costs for your company (in €) – in 2001	
Yearly Finance department costs for your company (in €) – in 2001	
Yearly Strategy development costs for your company (in €) – in 2001	

In order to ensure that operators that also have mobile activities provide consistent information, the cost-information presented in the table above should only include costs related to the fixed telecommunications activities.

2.7 Interconnection specific costs

Costs of certain assets and activities are directly related to the provision of interconnection services. These costs are e.g. related to additional (wholesale) billing systems, the relations with other operators.

Since these costs are very specific for an incumbent, they will be based on an international comparison and on a detailed analysis of the information available at the incumbent.

Question 2.9: The BIPT invites the industry to list all interconnection specific costs, if any, that have not been treated yet. Moreover, the BIPT welcomes all input on the cost drivers that should be used to allocate these costs to all of the interconnection services (traffic and non-traffic related).

2.8 Remuneration of capital

Regulated activities, such as interconnection services of an operator with significant market power, have a regulated income. The remuneration of capital is therefore also subject to regulation and it is generally accepted that this is calculated by the weighted average cost of capital formula:

[21] FTE: full time equivalents

$$WACC_{pré ? tax} \; ? \; \left(\frac{r_e}{1 \; ? \; t_c} \; ? \; \frac{E}{E \; ? \; D} \right) ? \left(r_d \; ? \; \frac{D}{E \; ? \; D} \right)$$

r_e : Cost of equity (after taxes),
r_d : Cost of debt (before taxes),
t_c : Corporate tax rate,
E : Market value of equity,
D : Market value of debt.

and

$$Re = Rf + ?_{equity} * [\, E(r_m) - Rf \,]$$

$$Rd = Rf + risk\ premium$$

R_f : Risk free interest rate,
$E(r_m)$: Expected return of a well diversified investment portfolio,
$E(r_m)-r_f$: Market risk premium,
ßequity : Systematic risk a a specific company or activity.

The exact value of the WACC formula is the subject of elaborate research done by the Institute and its consultant during the update of the existing top-down model for interconnection. We will therefore not go any deeper into the way the WACC will be calculated and refer to the top-down model documentation for further detailed information.

Question 2.10: The BIPT invites the operators to comment on the use of the WACC formula.

2.9 Calculating annualisations

The investment costs used in the bottom-up model need to be annualised in order to calculate the relevant costs for a particular year. Next to the purchase price of the assets, this requires information on asset lives, price trends of each asset, as well as on the residual value of the asset at the end of its economic life. Moreover, the cost of capital needs to be determined. This cost consists of the multiplication of the mean capital employed by the Weighted Average Cost of Capital (WACC) and was treated in more detail in paragraph 0. The annualised investment cost and the cost of capital combined determine the capital charge in the relevant period.

2.9.1 Depreciation methodologies

An accurate annualisation charge should preferably have a depreciation profile that reflects economic reality, but, at the same time, it should allow an efficient operator to recover costs. Different depreciation rules can have a significantly different impact on the costs estimated for a particular year. The most commonly theoretically accepted depreciation method to calculate tariffs is the economic depreciation.[22] It measures the change in an asset's economic value. This value is the maximum of either the resale value or the value of the asset to the business measured by the (discounted) cash flow that the asset will generate in the future. The economic depreciation is calculated then as the difference between the value of the asset at the start and the end of a year. In a regulatory setting however, there is the difficulty that the decisions of the regulator may affect the cash flow, hence influence the asset's value and the level of economic depreciation.

Economic depreciation is in practice very difficult to calculate. One of the main problems of the economic depreciation approach is that it is very information intensive. It requires future insight in asset values in relation to technological advances. Moreover, when calculating the net present value of the asset (NPV), difficult choices regarding revenue allocation have to be made. In practice, many operators have little idea of how the value evolution of a given asset actually looks like.

Because of these practical difficulties when calculating economic depreciation, more straightforward approaches are often preferred. Most of these approaches focus on recovering the replacement cost of a specific asset during its life. The appropriate depreciation profile may differ for each asset category. The goal however is to come as close as possible to the theoretically correct measure of depreciation (economic depreciation).

✍ Straight-line depreciation

The first alternative approach to calculate depreciation charges is the straight-line depreciation. Straight-line depreciation divides the asset's price by the asset's life to produce an annual depreciation charge. To this annual charge, a capital cost is added in order to obtain the annualisation charge. The straight-line depreciation approach is simple and may be appropriate for assets where technological progress is not very likely. Charges will be slightly higher in the first years (because of the higher capital costs) than in later years. The formula below calculates the annualisation factor for the straight-line depreciation methodology.

$$\left(1/\mathit{asset\ life} + \mathit{cost\ of\ capital}\right) * \mathit{asset\ value}$$

The goal of each alternative depreciation method is to provide an accurate estimate for the economic depreciation. In order to obtain this, the technical asset life should be taken into account, since the straight-line depreciation formula assumes the resale value of the asset of the end of the period to be zero.

✍ Tilted straight line

Some assets have prices that are expected to fall or to increase. For these assets, tilted straight-line depreciation might be more appropriate. When prices are expected to fall, the use of tilted straight-line depreciation will result in a steeper depreciation profile when compared to the unadjusted straight-line depreciation. The formula below describes this approach mathematically and calculates the depreciation values.

[22] Economic depreciation is also the preferred approach of the IRG (independent regulators group).

$$\frac{\left[asset\ price(i\ ?\ 1)\ ?\ annual\ \%\ price\ change(i)\ ?\ remaining\ asset\ life(i)\ ?\ asset\ price(i)\right]}{Asset\ life}$$

$1 \leq i \leq$ asset life
Asset price(i) = price of the asset at the beginning of the year i
Remaining asset life (i) = remaining asset life with year i included

The cost of capital has to be added to the above formula to obtain the annualisation values. Note that for declining prices, the annual % price change factor will be negative. This implies that when prices decrease, depreciation will be higher in the first years than in later years. For increasing prices, the opposite is true. Tilted straight-line depreciation also implies the use of technical asset lifes.

✍ Sum of digits

The sum of digits is a crude method for generating a front loaded depreciation schedule. This method may be useful whenever the asset's operating costs are expected to rise or when its price or the revenue it generates is expected to fall. The formula below describes the depreciation value when the sum of digits methodology is used.

$$\frac{\left(n + 1 - i\right)}{\left(n + (n-1) + (n-2) + \ldots + 1\right)} \times asset\ \ price$$

$1 \leq i \leq$ asset life
n= asset life

To obtain the annualisation values, a cost of capital should be added.

✍ Annuities

The annuities approach calculates both the depreciation charge and the cost of capital, but results in stable annualisation charges, provided the correct adjustments are made to capture the possibility of price changes. The balance between depreciation and the cost of capital within the constant payment however would vary: depreciation will be typically low at the start of the asset life, a higher proportion being used to cover the return on capital employed. Depreciation charges would be correspondingly higher towards the end of the asset life, since a lower proportion would be used to cover the interest charges on debt. The annualisation factor is calculated as follows.

$$cost\ of\ capital / \left(1 - \left(1/(1 + cost\ of\ capital)^{asset\ life}\right)\right)$$

Note that sometimes, a tilted annuity may be calculated when the price of the asset is expected to change over time.

2.9.2 Depreciation periods in the bottom-up model

In order to calculate tariffs in the bottom-up model, depreciation periods for each of the separate components that are modelled have to be identified, together with the appropriate depreciation methodology. The list below summarizes every component that the BIPT and its consultant have identified during the previous market consultations. An indication of the technical life of the asset is also given.[23] The BIPT also asks the operators their opinion on the depreciation method that should be used, together with the necessary parameters.

The BIPT wants to stress the importance of providing accurate depreciation data as well as a well over thought decision on the methodology proposed. The impact of the depreciation methodology on the final results of the model can be significant. Annuities for example will provide stable costs throughout the different future years. When opting for tilted straight line depreciation, when prices are declining, results will be higher during the first years, when prices are increasing, results will be lower during the first years. It should however always be kept in mind that the depreciation methodology should try to come as close as possible to the economic reality.

✍ **Switching**

a. Remote concentrator units and LDC

The table below summarizes the asset lives for the different components in the remote units that will be used in the bottom-up model.

Component	***Asset life***
Line cards	15
Concentrator	12
Ports	12
Accommodation (site)	38

Question 2.11: The BIPT invites the operators to comment the values of the asset lives above.

Question 2.12: The BIPT invites the operators to express their view on the depreciation methodology that should be used for each component. (straight-line, tilted straight-line, sum of digits, annuities). If tilted straight-line depreciation should be used, please do not forget to mention the estimated annual price increase/decrease of the asset.

[23] Based on the Europe Economics bottom-up model

b. <u>Base Units (local exchanges)</u>

The table below summarizes the asset lives for the different switching components of the base units that will be used in the bottom-up model.

Component	*Asset life*
Line card	15
Concentrator	12
Ports	12
Switching Matrix	13
Processor Cost	12
Accommodation (site)	37

Question 2.13: The BIPT invites the operators to comment the values of the asset lives above.

Question 2.14: The BIPT invites the operators to express their view on the depreciation methodology that should be used for each component. (straight-line, tilted straight-line, sum of digits, annuities). If tilted straight-line depreciation should be used, please do not forget to mention the estimated annual price increase/decrease of the asset. Note that consistency should exist with the concentrator units and CAEs.

c. <u>Covering Area Exchanges</u>

The table below summarizes the asset lives for the different switching components of the CAEs that will be used in the bottom-up model.

Component	*Asset life*
Ports	11
Switching Matrix	13
Processor Cost	12
Accommodation (site)	37

Question 2.15: The BIPT invites the operators to comment the values of the asset lives above.

Question 2.16: The BIPT invites the operators to express their view on the depreciation methodology that should be used for each component. (straight-line, tilted straight-line, sum of digits, annuities). If tilted straight-line depreciation should be used, please do not forget to mention the estimated annual price increase/decrease of the asset. Note that consistency should exist with the concentrator units and the base units.

✍ **Transmission**

a. Transmission equipment

The table below summarizes the different asset lives for the transmission equipment that will be used in the bottom-up model.

Electronics	***Asset life***
E1 tributary cards	10
TMUX	10
STM-x cards	10
ADM-x	10
Digital Cross Connect	10

The BIPT proposes to use the same depreciation periods for each type of STM-card and Add Drop Multiplexer.

Question 2.17: The BIPT invites the operators to comment the values of the asset lives above.

Question 2.18: The BIPT invites the operators to express their view on the depreciation methodology that should be used for each component. (straight-line, tilted straight-line, sum of digits, annuities). If tilted straight-line depreciation should be used, please do not forget to mention the estimated annual price increase/decrease of the asset.

b. Infrastructure

The table below summarizes the different asset lives for the infrastructure assets.

Equipment	***Asset Life***
Fibre cable	23
Infrastructure (duct and trench)	38

Question 2.19: The BIPT invites the operators to comment the values of the asset lives above.

Question 2.20: The BIPT invites the operators to express their view on the depreciation methodology that should be used for each component. (straight-line, tilted straight-line, sum of digits, annuities). If tilted straight-line depreciation should be used, please do not forget to mention the estimated annual price increase/decrease of the asset.

2.10 Working capital

2.10.1 Introduction

Working capital can be roughly defined as current assets less current liabilities. It is the amount of capital that is tied up in the business to keep the company running. Working capital is often used to build a 'bridge' between the moment that money flows out of the company and the time that the money from the sales of the goods or services flows in.

When there is a positive amount of working capital in a company, this means that not only all fixed assets but also a part of the current assets are financed by permanent funding. This is the most common situation. However, when working capital is negative, this implies that part of the fixed assets in the company are being financed by current liabilities. This might be a dangerous situation when the negative working capital is not structural: whenever supplier or other short-term credit is decreased, refinancing becomes crucial. When this negative working capital is on the contrary structural, it can provide a company with a very cheap means of funding, since a big part of the current liabilities such as supplier debts are not interest bearing.

2.10.2 Calculating working capital

The following (simplified) formula gives a better view on the different components that have an impact on the working capital in a company:

Working capital = stock + debtors + cash - creditors

The cost of working capital can be calculated as follows:

Cost of working capital = working capital x financing cost

In practice however, it is not always very straightforward to calculate the amount of working capital in a bottom-up exercise that models the costs of an efficient operator. The approach that the BIPT wants to propose in order to take into account the cost of working capital was initially presented by Oftel and later refined by Europe Economics.[24] For further details on this approach, we refer to the Europe Economics documents. The formula to calculate the tariff surcharge[25] is as follows:

$$\frac{\text{Debtor days} - (\text{Creditor days} \times (a/b))}{365} \times r$$

[24] Study on the preparation of an adaptable bottom-up costing model for interconnection and access pricing in European Union countries, Europe Economics, April 2000

[25] This surcharge can be negative when there is a negative working capital.

a = total cost relating to the creditors
b = total economic cost
r = cost of capital

To calculate the total capital cost in use, the total capital equipment cost has to be multiplied by the cost of capital (r). The surcharge calculated by the above formula has to be applied to the total cost excluding working capital to produce a total cost including working capital. This surcharge, which is a percentage, should be applied to all investment categories such as RU, BU, CAE etc.

Question 2.21: The BIPT invites the operators to comment on the proposed approach to take into account the cost of working capital in the bottom-up model.

3. OUTPUT OF THE MODEL

The output of the cost model will consist of separate costs for individual network components, as well as aggregated tariffs for the interconnection services.

3.1 Separate costs for individual network components

Total and average per minute costs will be calculated for the following individual components:

	Costs/min	*Total cost*
SWITCHING Equipment		
Remote Units		
Base Units		
Covering Area Exchanges		
TRANSMISSION Equipment		
Local Distribution Center		
Local Transmission Center		
Zonal Transmission Center		
TRANSMISSION Links (= Outside plant)		
Link LDC-TC		
Regional Transmission Rings		
Core Transmission		
Network		
TOTAL		

Table 2: cost for network components

The average per minute cost is calculated by dividing the total cost of the network components, by the demand for it. This demand takes into account the growth factors (cf. paragraph 1.1.4) and the routing factors (cf. paragraph 1.6).

Question 3.1: The BIPT wishes to invite the industry to give its view on the above list of network components for which total and average per minute costs will be provided as an output of the model.

For each network component, the following costs will be identified separately:

- *CAPEX (Capital Expenses)*
  - Direct network costs (resulting of the algorithms)
  - Indirect network costs (calculated as a percentage on the direct investment costs)

- *OPEX (Operating Expenses)*
  - Network-related operating costs
  - Non-network related operating costs

- *OVERHEAD (at company level)*

Question 3.2: The BIPT invites the industry to comment on the categorisation of costs that will be distinguished for each network component.

3.2 Tariffs for interconnection services

The tariffs for following interconnection services will be calculated:

- Local terminating service
- Intra Access Area (IAA) terminating service
- Extra Access Area (EAA) terminating service

The calculation of the IAA and the EAA terminating service tariffs will take into account the Belgacom specific routing factors. The BIPT proposes to base the calculation of the local terminating service on the routing factors of the IAA terminating services for those network parts that are actually used by the local terminating service. This assumes that the volume of the local terminating service (which is not asked for at this moment) would replace a part of the IAA terminating volume.

In the first version of the bottom-up model (BRIO 2003), the output of the bottom-up cost model will be limited to the terminating services.

Question 3.3: The BIPT invites the industry to comment on the list of interconnection services for which tariffs will be calculated and on the methodology of calculating the tariff for the local interconnection service.

3.2.1 Tariff structure

In order to calculate more cost reflective interconnection charges, a two part charging structure will be defined, attributing call-related costs to call set-up and other, usage-related costs to call duration.

	Call-related costs	***Usage-related costs***
Switching		
Transmission		

Table 3: Call-related versus usage-related costs

The call-related transmission cost will take the average call set-up time into account of 16,5 seconds[26]. The call-related costs are driven by the number of BHCA, the usage-related

[26] Calculated based on the assumptions of Europe Economics: weighted average of 15 seconds (for the 90% successful calls) and 30 seconds (for the 10% unsuccessful calls).

costs are driven by the number of BHE. The costs that are driven by the number of lines will be split in a call-related and a usage-related cost.

	Call-related costs (in %)	***Usage-related costs (in %)***	***TOTAL***
SWITCHING			100%
Line cards			100%
Concentrators			100%
TRANSMISSION			100%
Connection LDC-TC			100%
TMUX			100%

Table 4: Costs driven by the number of user lines

Question 3.4: The BIPT invites the industry to give its opinion on the proposal to derive a two-part charging structure for the interconnection services and asks to provide more information on the split of costs driven by the number of lines.

Question 3.5: The BIPT invites the industry to provide information on the average call set-up time in their networks and on the percentage of successful calls.

4. RECONCILIATION ISSUES

4.1 Aim of the reconciliation

The aim of the reconciliation is to identify and to understand the differences between the results of the bottom-up and the top-down model. The analysis of the differences between the two models will provide a better understanding in the cost structure of incumbent operator and will enable the regulator to evaluate and to take into account the impact of inefficiencies. It should be clear that the aim of the reconciliation process is not to come to equal outputs of the top-down and the bottom-up model.

In a first stage, the results of the top-down model will be reconciled with the results of the top-down model for interconnection for the BRIO 2002.

4.2 Areas of reconciliation

The reconciliation will focus on the following four main areas:

- Capital expenses (CAPEX)
- Operating expenses (OPEX)
- Overhead costs at company level
- Demand volumes
- Routing factors

4.2.1 Capital expenses (CAPEX)

At this moment, there is no unambiguous relation between the network related asset categories defined in the bottom-up model (Asset Classes and ONP-Blocks[27]) and the asset categories (switching equipment, transmission equipment and transmission links) defined in the bottom-up model. A first exercise will consist in the regrouping the Asset Classes and ONP-Blocks in categories that match those defined for the bottom-up model. In a second step, the regrouping of the non-network CAPEX (land & property, vehicles, ICT…) will need to be done. Since the non-network CAPEX are all allocated to the ONP-Blocks as defined in the top-down model, the regrouping can happen in an analogue way.

Since the bottom-up model is developed under a modified scorched node approach and node optimisation will not be considered in the first version of the bottom-up model, the number and functionality of the nodes will not be an issue for the reconciliation of the CAPEX. It will focus mainly on the capacity and the technology of the assets modelled, the asset prices and accounting differences (depreciation methodologies and asset lives).

[27] Cf. Beschrijving van het kostenmodel van het BIPT voor de berekening van de interconnectietarieven (BIPT website)

4.2.2 Operating expenses (OPEX)

The network related operating expenses will be regrouped in the same way as the network related CAPEX. As far as the non-network related OPEX are concerned, a distinction will be made between those OPEX (e.g. for ICT) that are booked on the accounts of a separate existing division within the incumbent and those OPEX (e.g. for Other land and buildings) that are part of the total OPEX cost of a more general division.

4.2.3 Overhead cost at company level

The overhead cost at company level, as defined for the development of the bottom-up model, consists of partly of CAPEX and partly of OPEX. The overhead costs are related to distinct divisions within the organisational structure of Belgacom and it should therefore be rather easily possible to isolate them from the direct and indirect CAPEX and OPEX.

4.2.4 Demand volumes

The top-down model for the BRIO 20002 uses the 'Outlook 2001' volumes for the determination of the unit costs. The bottom-up model however will use forecasted volumes for the year 2002, based on an extrapolation of historic figures.

4.2.5 Routing factors

Within the framework of the top-down model, routing factors are provided per ONP-block (e.g. ONP_Terminal Switches, ONP_2 Mbit/s PSTN local…) and at a very detailed level of traffic types (e.g. distinct routing factors for all VAS-services…). These routing factors will have to be translated into routing factors at the level of the asset categories defined in the bottom-up model (e.g. connection LDC-TC, Regional Rings…) and for the traffic types taken into account.

4.3 Level of aggregation of the reconciliation

Once the asset categories (and the related operating expenses) are made comparable, the results of both models can be compared. Initially, a comparison of the intermediate results, expressed in a cost per minute, will be made at a very aggregated level. This will enable the BIPT and its consultant to identify rather quickly where the biggest points of difference are situated. The analysis of the factors that cause the differences will then be focused on these points. In a further stage, the analyses can be used as an input for sensitivity-studies and efficiency-studies.

The tables in the next paragraphs present the format of the aggregated comparisons that will be established in the first step of the reconciliation process. Analysis can be made horizontally and vertically.

4.3.1 Capital expenses (CAPEX)

Costs/min	***CAPEX Direct network***		***CAPEX Indirect network***		***TOTAL CAPEX***	
	BU	TD	BU	TD	BU	TD
SWITCHING Equipment						
Remote Units						
Base Units						
Covering Area Exchanges						
TRANSMISSION Equipment						
Local Distribution Center						
Local Transmission Center						
Zonal Transmission Center						
TRANSMISSION Links (= Outside plant)						
Link LDC-TC						
Regional Transmission Rings						
Core Transmission						
Network						
TOTAL						

Table 5:Aggregated comparison of the CAPEX

4.3.2 Operating expenses (OPEX)

Costs/min	*OPEX Network related*		*OPEX Non network related*		*TOTAL OPEX*	
	BU	TD	BU	TD	BU	TD
SWITCHING Equipment						
Remote Units						
Base Units						
Covering Area Exchanges						
TRANSMISSION Equipment						
Local Distribution Center						
Local Transmission Center						
Zonal Transmission Center						
TRANSMISSION Links (= Outside plant)						
Link LDC-TC						
Regional Transmission Rings						
Core Transmission Network						
TOTAL						

Table 6: Aggregated comparison of the OPEX

4.3.3 Overhead cost at company level

Costs/min	*OVERHEAD*	
	BU	TD
Human Resources Management		
Finance Department		
Legal Services en RPA		
Strategy and Development & CEO		
Support		
TOTAL		

Table 7: Aggregated comparison of the overhead at company level

4.3.4 Demand volumes

Traffic types	***% Variance between volumes in BU and TD***
Terminating IAA	
Terminating EAA	
Originating	

Table 8: Comparison of the Demand Volumes

4.3.5 Routing factors

Traffic type	***Switching Equipment***			***Transmission Equipment***			***Transmission Links***		
	RU	BU	CAE	LDC	LTC	ZTC	LDC-TC	Regional Ring	Core Transmission
Local									
Zonal non local									
Interzonal A									
Interzonal B									
Internet traffic									
Vlue Added Services									
Terminating IAA									
Terminating EAA									
Originating									
Outgoing to fixed									
operator IAA									
Outgoing to fixed									
operator EAA									
Outgoing to mobile									
Operator IAA									
Outgoing to mobile									
Operator EAA									
Outgoing international									
Incoming international									
National transit									
International transit									
EAA									

Table 9: routing factors

4.4 Planning of the reconciliation

A big part of the reconciliation study will consist of making the information in the top-down model comparable with the information in the bottom-up model. Since the top-down model for the BRIO 2002 is already available, the regrouping of the CAPEX and the OPEX will be done whilst developing the bottom-up model. These preliminary analyses will facilitate the evaluation of the differences between the top-down and bottom-up model at the end of the project.

Question 4.1: The BIPT invites the industry to give its opinion on the proposed areas of reconciliation and on the level of aggregation at which the analyses will be made.

5. PLANNING

Comments to this third consultation document should be submitted in writing before **Friday, June 7**, 2002 at 17.00 p.m. to:

B.I.P.T.
Ms. Hilde Verdickt
Sterrenkundelaan 14 / 21
1210 BRUSSELS
Tel: + 32 2 226 87 34
Fax: + 32 2 226 88 04
Email: hilde.verdickt@bipt.be

In **the week of May 20**, a technical meeting will be organised concerning the third consultation document. During this meeting, questions raised during the first lecture of the document can be treated and the technical algorithms can be discussed in more detail (e.g. algorithms for signalling and DWDM-equipment, the surface requirements for the determination of accommodation costs). The aim of this meeting is to guarantee that all questions are well understood and that remarks on the modelling algorithms can be treated before the process of collecting the values for the parameters is finished.

For any further information on the contents of the consultation document, please contact Ms. Hilde Verdickt (BIPT) or the Bureau van Dijk:

Bureau van Dijk Management Consultants
Ms. Tine Debusschere
M. Wim Torfs
Avenue Louise 250 / 14
1050 BRUSSELS
Tel: + 32 2 639 06 06
Fax: + 32 2 648 82 30
Email: tine.debusschere@bvdmc.com
wim.torfs@bvdmc.com