Development of the Fixed Infrastructure Sharing Cost Model

Description of the Fixed Infrastructure Sharing Cost Model

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AXON

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1. Introduction

This report describes the modelling approach, model structure and calculation process that is followed in the development of the Fixed Infrastructure Sharing Model ('the model') commissioned by the Office of Utilities Regulation of Jamaica (hereinafter, the OUR) to Axon Partners Group (hereinafter, Axon Consulting).

The main characteristics of the model are described below.

- It calculates the costs of sharing some infrastructure elements such as:
  - Duct rental
  - Sub-duct rental
  - Pole rental
  - Dark fibre
  - Collocation in Submarine Cable Landing Stations (SCLS)

  and other ancillary services such as:

  - Feasibility study
  - Service registration
  - Accompaniment
- It allows the consideration of multiple year time frames (2018-2025)[1]

The following sections present the main methodological aspects considered in the development of the model and provides an overview of the structure of this Descriptive Manual.

1.1. Methodological choices

The key structural and methodological choices have been determined in the Determination Notice entitled "Assessment of Fixed Infrastructure Sharing Costs – Principles and Methodology - Determination Notice" (Document No. 2020/TEL/021/DET.005), published on 2020 December 28

[1] The model can be extended in future updates up to a total of 25 years

The following exhibit contains a summary of the methodological framework that has been set for the development of the model.

Methodological Issue	Approach Adopted
Period of time Modelled	The fixed infrastructure sharing model will cover the period 2018-2025.
Data Sources	The Office will use the information provided by operators as the primary source of data. International benchmark information, deemed appropriate for the Jamaican reality, will be utilised as an alternative data source.
Network CapEx	Network CapEx elements considered in the fixed infrastructure sharing model will include costs of deployment, installation and other one-off fees.
Network OpEx	Network OpEx will be included in the fixed infrastructure sharing model as the absolute yearly unit OpEx (or percentage over unit CapEx) for each network element.
General & Administrative (G&A) Costs	G&A expenses will be included in the fixed infrastructure sharing model based on a mark-up percentage on top of costs.
Cost of Capital	The Weighted Average Cost of Capital (WACC) will be included for the calculation of the reasonable rate of return on the capital of the operator.
Treatment of Capital-Related Costs - Asset Valuation Method	The fixed infrastructure sharing model will utilize the absolute valuation methodology in its evaluation of assets on a current cost accounting (CCA) basis. In addition, the model will include an option to remove the fully depreciated assets of the modelled operator from the cost base.
Services to be included in the fixed infrastructure sharing model	**Infrastructure Sharing Implementation and Testing Services** ▶ The following implementation and testing services will be included in the model: Feasibility Study, Service Registration and Accompaniment. **Rental Charges for use of Infrastructure** ▶ The following rental services will be included in the fixed infrastructure sharing model: Duct Rental, Sub-duct Rental, Pole Rental, Dark Fibre and Collocation in Submarine Cable Landing Stations (SCLS)

Exhibit 1.1: Summary of the methodological framework. [Source: Axon Consulting]

1.2. Structure of the document

The remainder of this document describes the modelling approach followed, the structure of the model and the calculation processes and algorithms used. The document is structured as follows:

- **General Architecture of the Model**- introduces the general structure of the model, the inputs, calculation and costing modules.
- **Model Inputs**- describes the relevant inputs needed for the model.
- **Association between Resources and Services**- presents the relationship between the resources and the infrastructure sharing services implemented in the model.
- **Costs Calculation Module-** shows costs calculation (OpEx, Depreciation and Cost of Capital) associated to the network resources considered in the model.
- **Calculation of the Costs of the Services**- presents the methodology used for the allocation of resources' cost to the services.

In addition to this Descriptive Manual, a User Manual has also been produced. It is provided as a separate document.

2. General Architecture of the Model

This section introduces the general structure of the model. Exhibit 2.1 below shows the function of the blocks and their interrelationship in the model.

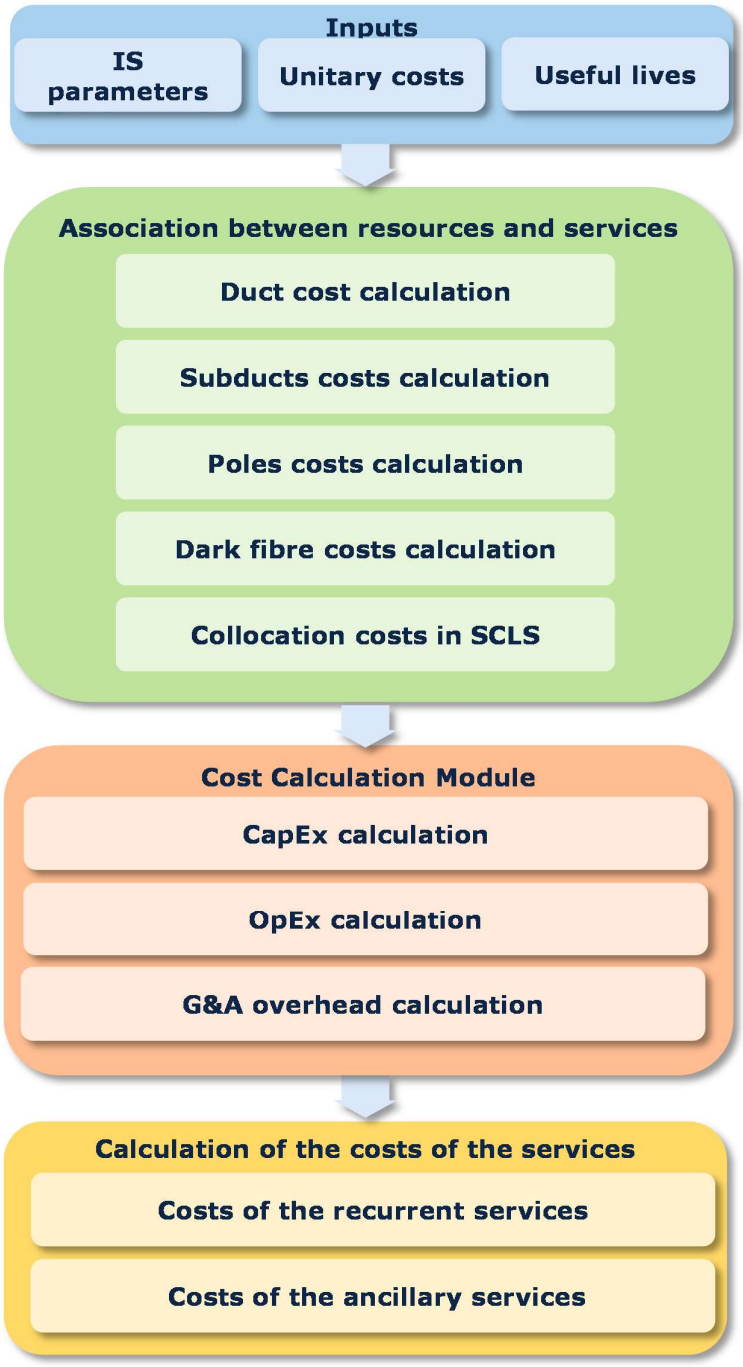

Exhibit 2.1: Structure of the model [Source: Axon Consulting]

Several calculation blocks can be identified above, namely:

- **Inputs:** Refers to the main inputs of the model (e.g. Infrastructure sharing parameters, unitary costs and useful lives).
- **Association between resources and services:** Presents the relationship between the resources and the services with a usage factor. In other words, it presents how much each resource is used to provide a unit (e.g. minute) of any given service.
- **Cost calculation module:** Calculates cost of resources, in terms of OpEx and CapEx (GBV). It also calculates the G&A costs as a mark-up.
- **Calculation of the costs of the services:** In this section the results of recurrent services and ancillary services are presented.

Each block of the model is further explained in the following sections.

3. Model Inputs

Some of the main inputs of the model are the unitary costs and the infrastructure sharing parameters. However, additional data is required. Exhibit 3.1 presents the input worksheets, outlining the information contained in each one of them.

Name	Title	Input Information
1A INP UNITARY COSTS	Unitary Costs Input	▶ Unitary costs (differentiating CAPEX and OPEX) for each resource/cost item.
1B INP COST TRENDS	Input: Cost Trends	▶ Cost trends of the unitary costs by resource (differentiating CAPEX and OPEX).
1C INP EXCHANGE RATES	Exchange Rates Input	▶ Exchange rates between currencies considered in the model.
1D INP COST GA	Overhead Costs Input	▶ G&A overheads considered in the model.
1E INP OTHER SERV	Ancillary services input	▶ Introduces different concepts and values of the implementation and testing services
2A INP NW	Network Input	▶ Introduces the infrastructure sharing parameters needed for the calculation of the infrastructure services.
2B INP RESOURCES LIFE	Input: Useful Lives	▶ Useful lives for the annualisation of resources costs.

Exhibit 3.1: Input information used in the model. [Source: Axon Consulting]

4. Association between Resources and Services

To calculate the cost of the different infrastructure sharing assets, we need to define a relationship between the network assets included in the model (e.g. trenches, ducts, etc.) and the services. For this purpose, a set of "usage factors", representing how many times a resource is used by a specific service, have been defined.

As defined in the "Assessment of Fixed Infrastructure Sharing Costs – Principles and Methodology - Determination Notice", the model should include rental charges for use of the infrastructure. For this purpose, the following services has been included in the model:

- **Duct rental**- This service includes the costs related to trenches, manholes and the duct itself. This service is measured in JMD per km and per year. Also, the cost of the service is disaggregated in the following categories:
  - **Urban**: This category corresponds with sharing of infrastructure that is located within a city or town.
  - **Inter-urban**: This category corresponds with the sharing of infrastructure that is located outside a city or town (e.g. in a road between cities/towns).
- **Sub-duct rental-** The subduct corresponds to a pipe that generally has a smaller diameter compared to ducts, whose main purpose is to carry and protect fibre cables. The subducts are introduced into the ducts.

  This service includes the costs related to trenches, manholes, ducts and the subduct itself. This service will be measured in JMD per km and per year. Also, the cost of the service is disaggregated in the following categories:
  - **Urban:** This category corresponds with sharing of infrastructure that is located within a city or town.
  - **Inter-urban:** This category corresponds with sharing of infrastructure that is located outside a city or town (e.g. in a road between cities/towns).
- **Pole rental-** This service includes the cost of the poles and is measured in JMD per pole, per year.
- **Dark fibre-** In the deployment of fibre networks it is common that operators deploy excess fibre capacity for future use. These additional fibres are often not used and thus denominated "dark fibre". This dark fibre can be shared

with other operators that desire to "light" them. In such a case, the alternative operator uses its own active equipment to light the fibre.

This service includes the costs related to trenches, manholes, ducts, subducts and dark fibre itself. This service is measured in JMD per km and per year. Also, the cost of the service is disaggregated in the following categories:

- **Urban:** This category corresponds with the dark fibre cost in the same city/town, i.e. the dark fibre cost from one point to the other in the same city/town.
- **Inter-urban:** This category corresponds with the dark fibre cost between cities/towns, i.e. the dark fibre cost from one point (in a city/town A) to the ending point (in city/town B).

- **Collocation in Submarine Cable Landing Stations (SCLS) -** This service includes the costs related to the space available in SCLS, maintenance cost of the space (e.g. security, cleaning, etc.), costs related to the energy and air conditioning as well as any other operational costs involved in the provision of the service. This service is measured in JMD per square metre per year.

In the sections following, the relationship of each of the infrastructure elements considered in the model with each of the rental service is presented.

4.1. Ducts costs calculation

The duct rental service makes use of certain infrastructure elements in order to be provided. In the specific case of the duct sharing service, the following elements and usage factors are considered:

- Ducts: A usage factor of "1" is considered for this service.
- Trenches:

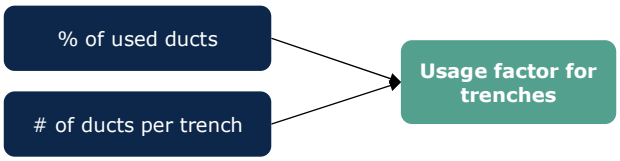

Exhibit 4.1: Algorithm for calculating the usage factors of the trenches for the ducts rental service [Source: Axon Consulting]

- Manholes:

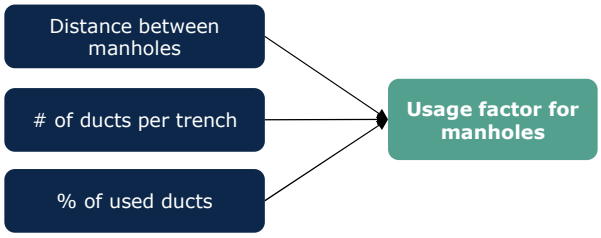

Exhibit 4.2: Algorithm for calculating the usage factors of the manholes for the ducts rental service [Source: Axon Consulting]

The utilisation factor for all other network elements is set to zero in relationships with this service. Further, it should be noted that the previous approach is followed separately for urban and inter-urban services, utilising the appropriate infrastructure sharing parameters for each service.

4.2. Subducts costs calculation

The subduct sharing service makes use of certain infrastructure elements in order to be provided. In the specific case of the subduct sharing service, the following elements are considered:

- Subducts: A usage factor of "1" is considered for this service.
- Ducts:

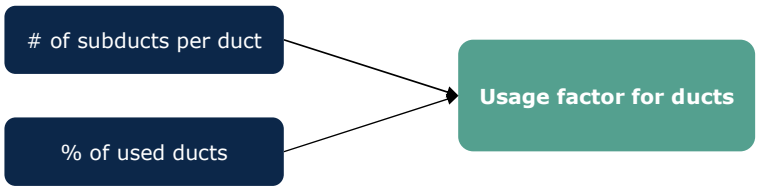

Exhibit 4.3: Algorithm for calculating the usage factors of the ducts for the subducts rental service [Source: Axon Consulting]

- Trenches:

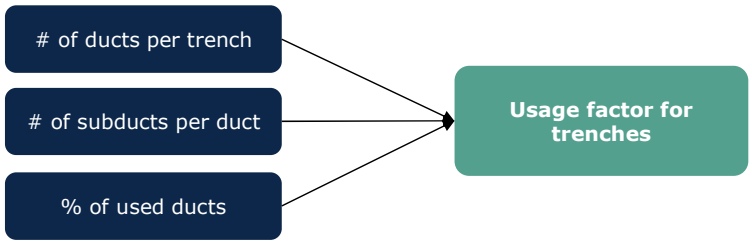

Exhibit 4.4: Algorithm for calculating the usage factors of the trenches for the subducts rental service [Source: Axon Consulting]

- Manholes:

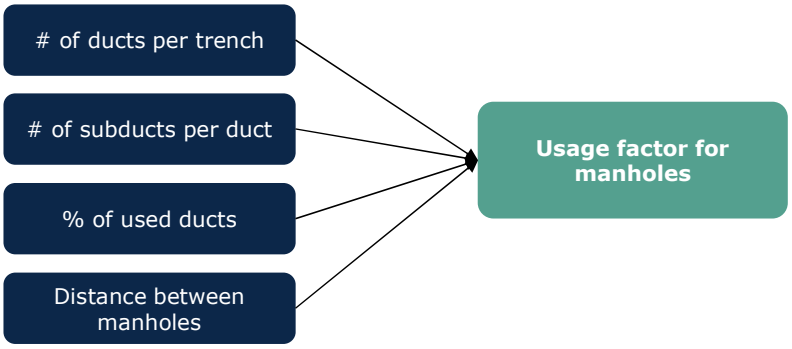

Exhibit 4.5: Algorithm for calculating the usage factors of the manholes for the subducts rental service [Source: Axon Consulting]

The utilisation factor for all other network elements is set to zero in relationship with this service. Further, it should be noted that the previous approach is followed separately for urban and inter-urban services, utilising the appropriate infrastructure sharing parameters for each service.

4.3. Poles costs calculation

The poles sharing service makes use of certain infrastructure elements in order to be provided. In the specific case of the poles sharing service, the following elements are considered:

- Wood Poles:

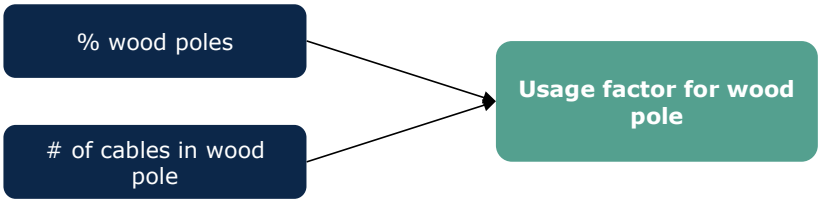

Exhibit 4.6: Algorithm for calculating the usage factors of the wood poles for the poles rental service [Source: Axon Consulting]

- Concrete Poles:

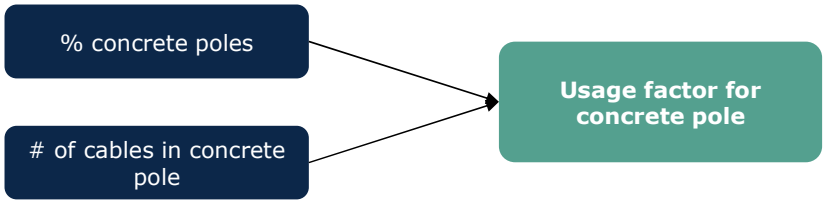

Exhibit 4.7: Algorithm for calculating the usage factors of the concrete poles for the poles rental service [Source: Axon Consulting]

The utilisation factor for all other network elements is set to zero in relationships with this service.

4.4. Dark fibre costs calculation

The dark fibre service makes use of certain infrastructure elements in order to be provided. In the specific case of this service, the following elements are considered:

- Ducts:

Exhibit 4.8: Algorithm for calculating the usage factors of the ducts for the dark fibre service [Source: Axon Consulting]

- Subducts:

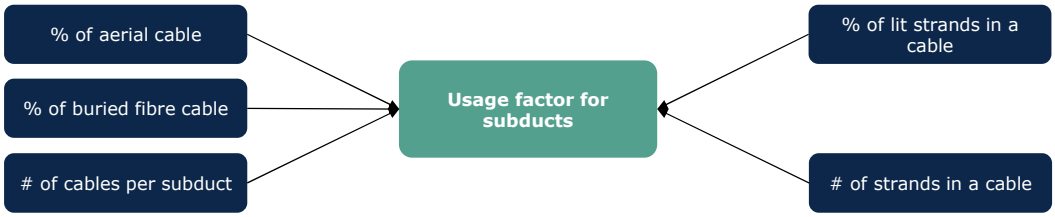

Exhibit 4.9: Algorithm for calculating the usage factors of the subducts for the dark fibre service [Source: Axon Consulting]

- Trenches:

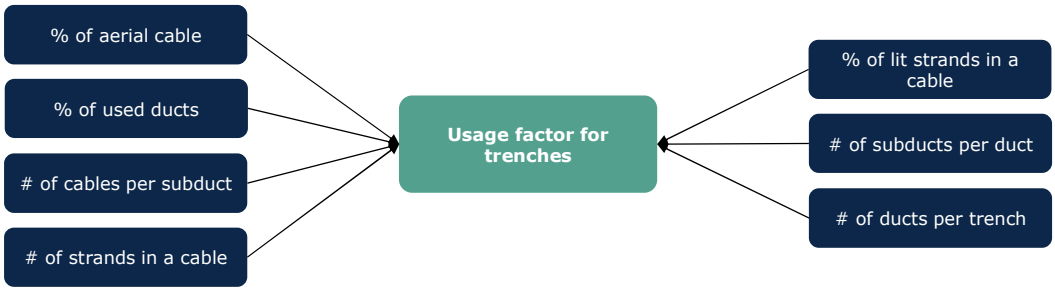

Exhibit 4.10: Algorithm for calculating the usage factors of the trenches for the dark fibre service [Source: Axon Consulting]

- Manholes:

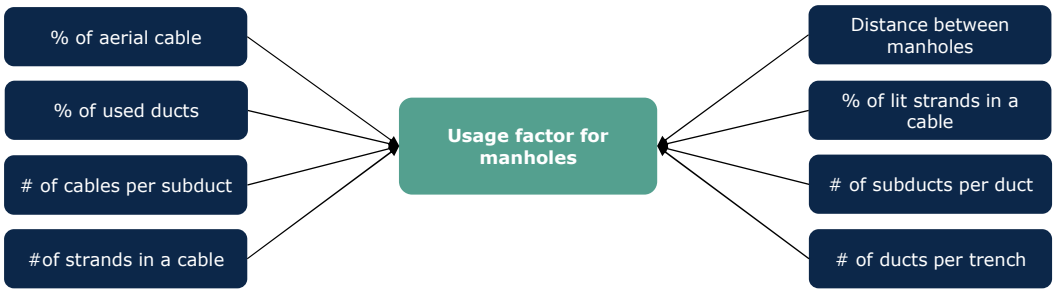

Exhibit 4.11: Algorithm for calculating the usage factors of the manholes for the dark fibre service [Source: Axon Consulting]

- Wood Poles:

Exhibit 4.12: Algorithm for calculating the usage factors of the wood poles for the dark fibre service [Source: Axon Consulting]

- Concrete Poles:

Exhibit 4.13: Algorithm for calculating the usage factors of the concrete poles for the dark fibre rental service [Source: Axon Consulting]

- Aerial Cable:

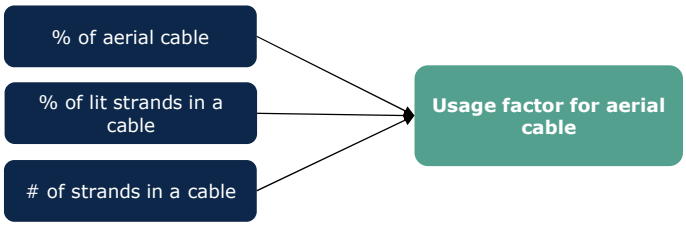

Exhibit 4.14: Algorithm for calculating the usage factors of the aerial cable for the dark fibre service [Source: Axon Consulting]

- Underground cable:

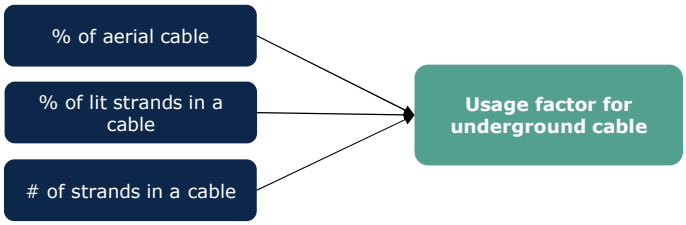

Exhibit 4.15: Algorithm for calculating the usage factors of the underground cable for the dark fibre service [Source: Axon Consulting]

The utilisation factor for all other network elements is set to zero in relationships with this service. Further, it should be noted that the previous approach is followed separately for urban and inter-urban services, utilising the appropriate infrastructure sharing parameters for each service.

4.5. Collocation costs in submarine cable landing stations

Regarding the collocation costs in SCLS, the main parameter considered for the calculation is the percentage of space available for telecommunications equipment, as can be seen in Exhibit 4.16.

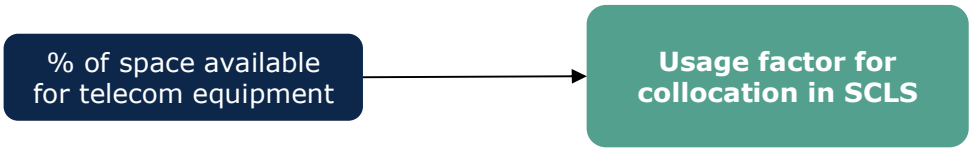

Exhibit 4.16: Algorithm for calculating the cost of Collocation in SCLS. [Source: Axon Consulting]

The utilisation factor for all other network elements is set to zero in relationships with this service.

5. Costs Calculation Module

The purpose of this module is to calculate the unit CapEx (annualised) and OpEx with the network resources included in the model. In addition, G&A mark-ups are also calculated in this section.

This process is performed separately for CapEx, OpEx and G&A and is presented as such in the following sections.

5.1. CapEx calculation

In order to calculate CapEx for all the network elements included in the model, we first estimate the unit cost of acquisition (without annualising) of the network elements for each of the years included in the model. To do this, we consider the unit CapEx for the reference year included in worksheet "1A INP UNITARY COSTS" for each network element and then extrapolate for other years taking the CapEx trends presented in worksheet "1B INP COST TRENDS".

Once the total (without annualising) CapEx has been calculated, we proceed to annualisation, following the tilted annuities approach (as presented in the Determination Notice).

Tilted annuities adapt the profile of the costs recovery with the objective of recognising the variations in asset prices. For example, in the event prices of assets decrease, a new entrant in the market could have a great advantage over existing operators because it will benefit from best prices and therefore lower depreciation costs.

With the tilted annuities method, if prices decrease, a higher proportion of the asset is recovered during the initial period so the same cost will be recognized for all operators, not taking into account the time when they entered the market.

For this reason, the model obtains the annuity value using the following formula:

$$Annuity(WACC) = \frac{WACC - \Delta p}{1 - \left(\frac{1+\Delta p}{1+WACC}\right)^{Asset\ Life}} \times Asset\ Value$$

Where:

- $WACC = the\ weighted\ average\ cost\ of\ capital$;

- $\Delta p = rate\ of\ price\ change$ ("tilt");
- $Asset\ Value = the\ current\ investment\ cost\ of\ the\ asset$;
- $Asset\ Life = the\ useful\ life\ of\ the\ asset$.

For the application of the WACC, it is important to bear in mind that the equipment is already adjusted for inflation when the cost trends and currency exchange rates are applied. Therefore, the effect of the inflation is eliminated from the WACC to avoid including it twice.

Even though the tilted annuities do not separate the depreciation from the cost of capital components (as it may be done in straight line depreciation methodology), the model splits such components for presentation and transparency purposes. In order to do so, the following formulas are applied:

- $Depreciation = Annuity(0)$
- $Cost\ of\ Capital = Annuity(WACC) - Annuity(0)$

5.2. OpEx calculation

In order to calculate OpEx for all the network elements included in the model, we simply estimate the unit OpEx (cost of maintenance and operation) of the network elements for each of the years included in the model. To do this, we consider the unit OpEx (measured as a percentage of Unit CapEx) for the reference year included in worksheet "4A CALC CAPEX OPEX CONSOL" for each network element and then extrapolate for other years considering the inflation rate.

5.3. G&A overhead calculation

As defined in the methodology and principles defined by the OUR, the OpEx related network working capital should be calculated as a percentage of network OpEx (overheads).

To be aligned with the current fixed cost model, the most suitable alternative to calculate the G&A overhead is as a percentage over network costs, similar to what is applied for the working capital.

Based on this methodology, G&A Costs are calculated as follows:

$$G\&A = G\&AOverhead \cdot (Network\ OpEx + Network\ Depreciation)$$

Please note that the overhead percentages are calculated based on operators' overall financial statements consistent with the formula above.

6. Calculation of the Costs of the Services

The costs of the services are calculated differently for recurrent and for ancillary services. As such, each of these groups of services is presented separately below.

6.1. Costs of the recurrent services

To calculate the total cost of the recurrent services, we take the costs associated to each of the network elements (including, CapEx, OpEx and G&A overheads as presented in section 5). Then, for each service, we take the usage factors presented in section 4 and multiply by the costs for each relationship, as presented in the image below.

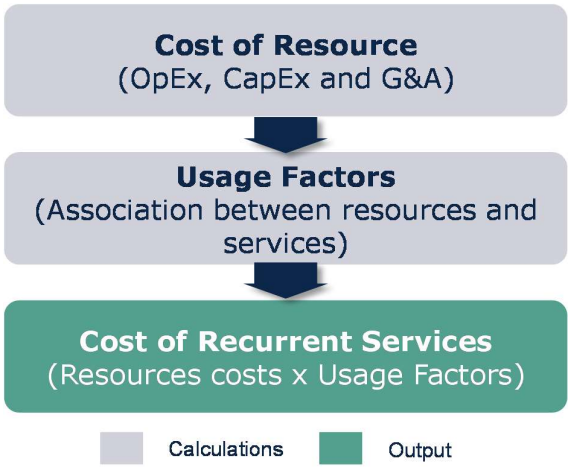

Exhibit 6.1: Calculation process followed to obtain the services´ costs. [Source: Axon Consulting]

6.2. Costs of the ancillary services

As defined in the Determination Notice, the model also includes all relevant ancillary services identified. Specifically, the model includes the following services:

- **Feasibility study-** This entails performing a new analysis of the infrastructure elements associated to a route in order to identify those elements that could be shared between the infrastructure seeker and the infrastructure provider. This service is measured in JMD per km.

- **Service registration-** The infrastructure seeker must complete a form requesting the registration of the service and the infrastructure provider shall make available the infrastructure element to be shared. This service is measured in JMD per event.
- **Accompaniment-** It refers to the provision of a technician's support during any task developed by the infrastructure seeker (e.g. during the installation of the seeker's equipment within the shared infrastructure). This service is measured in JMD per minute.

In order to calculate the tariffs of the ancillary services some inputs are considered. The inputs to calculate the costs of ancillary services are introduced in worksheets '1E INP OTHER SERV' and '2A INP NW' of the model. The main inputs required to calculate the costs of these services are:

- Wages per employee category (technician and administrative) in JMD per hour.
- Percentage of the total personnel costs that are due to the salary.
- Number of hours required from each of the employee categories (technician and administrative) to perform each one of the services.
- Cost of materials required to provide each service.

Based on the parameters listed above, the rates for ancillary services are calculated based on the following inputs:

Exhibit 6.2: Algorithm for calculating the cost of the ancillary services. [Source: Axon Consulting]

As can be seen in Exhibit 6.2, these services also include an additional mark-up to account for G&A overheads.