**Annex Economic Analysis**

**EMERGENCY PROGRAM IN RESPONSE TO HURICANE MATTHEEW**

**HA-L1130**

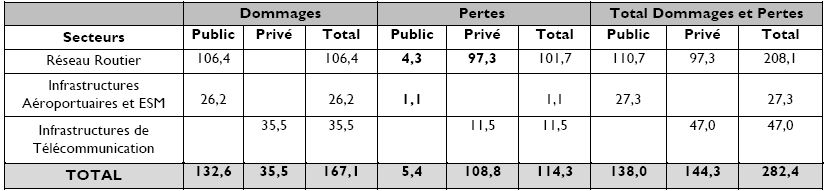
**Project Costs and Economic Viability**

1. **EMERGENCY SITUATIONS AND THE ECONOMIC ANALYSIS OF INVESTMENTS**
   1. The economic evaluation of emergency projects due to natural disasters represents special challenges for planners. These challenges are not limited only to the difficulty of obtaining the information and the very small timeframe in which interventions are expected to be processed, but also to the economic evaluation and the estimation of prices when supply and demand curves move far outside the range observed. For example, when there are substantial decreases in the flow of vehicles on a road one can see that the costs of inputs such as fuel, or freight cargo transport, repeatedly rise above current values, affecting the supply curves of many activities, which can trigger effects that reinforce each other. Estimating these values with ​​non-sufficient field information by simply extrapolating the observed features of regular consumption ranges (for examples motorized trips) can lead to large inaccuracies.
   2. Given the combination of factors mentioned, for this program it has been decided to use the methodology of cost-efficiency by **comparing the estimated cost of rehabilitation of the services included in the program, with the hypothetical cost of building the infrastructure and provide it again as a new asset**. The following section provides basic information that allows these comparisons for each type of infrastructure work considered in the scope of this emergency operation.
   3. In simple terms a cost-efficiency analysis seeks the most affordable and expeditious way to achieve an objective; the final objective is to get the most out of a given volume of resources. This approach applies when the benefit of the project is hard to quantify and / or assess, especially when it involves the application of value judgments. In these cases, it is recognized that the benefits are desired by society and therefore, the criterion to be applied will be the minimum cost. Therefore, an evaluation under a cost-efficient approach does not value the benefits but only the costs involved. The three alternatives analyzed are:
      1. **Localized repair of the elements of the road (pavement, drainage, etc.)** that include costs that were estimated based on technical analysis performed by the Government of Haiti with support of the Bank in preparation of the emergency program after the passage of Hurricane Matthew.
      2. **Localized repair of the elements of the road (pavement, drainage, etc.)** that included costs obtained from previous emergency operations in Haiti, most notably Hurricane Sandy Emergency Operation and it’s Project Completion Report (HA-L1086).
      3. **Complete standard rehabilitation of pavement and all elements of the road** that included costs estimated based on previous and current road segments under construction or recently finished financed by the Bank in Haiti.
2. **COST ANALYSIS**

**Road Infrastructure**

* 1. **An initial appraisal of the situation in Haiti after the occurrence of Hurricane Matthew** where flood events caused significant damage to road infrastructures, suggests the need to carry out the following types of interventions: **repair, stabilization and protection of the main road network** through (i) repairs of road, bridge and road drainage systems of different nature and extension; (ii) stabilization and protection of roads; and (iii) substitution of affected drainage structures. The effect of such interventions will *reestablish quickly the transport connectivity in the affected areas.*
  2. **Alternative#1 Repair and rehabilitate specific road segments:** According to the report by the MTPTC “Evaluation rapide des dommages et des pertes occasionnés par l’ouragan Matthew et éléments de réflexion pour le relèvement et la reconstruction” (Oct-26th, 2016), road rehabilitation amounts to US$ 106.4 million. Consequently, this operation, in an amount of US$ 20.0 million (where US$ 15.23 million will be applied to physical interventions) will help finance 14% of initial damages identified in the road sector.

**Table 1.**



Source: Evaluation rapide des dommages et des pertes occasionnés par l’ouragan Matthew et éléments de réflexion pour le relèvement et la reconstruction (MTPTC, Oct-26th, 2016)

* 1. In order to perform the cost analysis, and for the sake of a conservative estimation, it was selected the most critical segment in terms of cost per kilometer entailing a high density of interventions similar to those executed under the emergency operation after the Hurricane Sandy, including the rehabilitation of the road platform, retaining walls, gabion wall, etc. along several segments of RD204 from Cavaillon to Baraderes.
  2. The total cost estimated to this section (US$ 1.27 million) will finance direct interventions in a total of 8.7 kilometers, which implies an average repair cost per km of **US$ 145,595** that if compared to the weighted average cost per km of alternatives #2 and #3 (see paragraphs 2.5.1 2.5.2) supports the statement that emergency interventions in the road sector will be a cost effective solution.

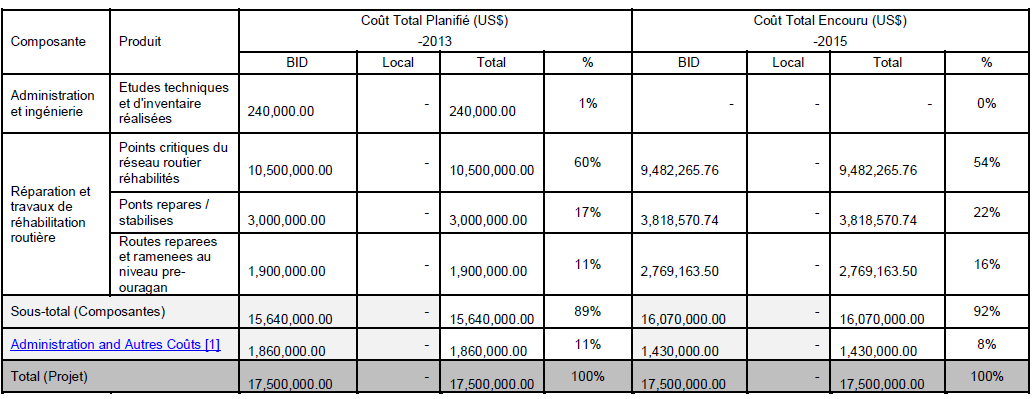
**Table 2. List of expected costs by road section as of November 2016**



Source: [Transport Damage Assessment and program recommendations](http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=40740755)

* 1. **Cost of alternatives #2 and #3**
     1. **Alternative #2**: According to the Project Completion Report of emergency operation after the passage of Hurricane Sandy (HA-L1086) and taking into account that the product km of rehabilitated road to pre-hurricane standards levels added up to 15.4 km, and the total cost for this activity was US$ 2.77 M (see the operation cost matrix from the table below), the average cost per km intervened was **US$ 179,805**.

**Table 3 Cost Matrix of the Emergency Road Rehabilitation Program in Response to Sandy HA-L1086**



Source: IDBDOCS-40016194-v1-PCR\_HA-L1086\_version\_final

* + 1. **Alternative #3:** According to current and previously rehabilitated road segments in Haiti (based on Bank’s operation HA-L1046, HA-L1054, HA-L1058, HA-L1079) the cost of complete standard rehabilitation of pavement and all elements of the road is equivalent to US$ 1.40 M per km

**Figure 1**

Source. Construction cost evolution in Haiti: 2007 – 2015 (internal elaboration)

1. **COST ANALYSIS**
   1. The assumption made in the sensitivity analysis is a 20% increase and 20% reduction in investment costs. This cost variables and sensitivity analysis are the most relevant given the uncertainty within the interventions.

**Table 4. Sensibility Analysis**

|  |  |  |  |
| --- | --- | --- | --- |
| Sector | Baseline | Increased investment by 20% | Decreased investment by 20% |
| Road | Costo x km | Costo x km | Costo x km |
| Average | 34,477 | 41,372 | 27,582 |
| Minimum | 6,730 | 8,076 | 5,384 |
| Maximum | 145,595 | 174,714 | 116,476 |
|  |  |  |  |

* 1. It is observed that despite a 20% increase in investments of the most critical segment yields a cost per kilometer of US$ 174,714 that if compared to the weighted average cost per km of alternatives #2 and #3 is still lower, supporting the statement that emergency interventions in the road sector will be a cost effective solution.