

## Water: a constraint for the development of road infrastructures in Douala (Cameroon)

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**Abstract:** Douala, the economic capital of Cameroon, is a coastal city situated in the heart of Africa. The climate of the city is tropical, with long raining season marked by incessant deluge (700 mm of rainfall in July-August). The soil is made up of coastal sands, black mud of mangrove swamps and fluvial deposits.

The Douala region suffers from continuous damages of its road infrastructures. This situation disrupts the urban transport system, provokes accidents and destabilises the schedules and activities of the inhabitants, and event neighbouring towns.

An inventory of its infrastructures reveals that water is the main factor responsible for this degradation. In fact, we observed that the level of the water table is shallow (0.5 to 3 m) and the rainfall is high during a long period of the year. The region is extremely flat, which favours the stagnation of trickling water.

This work recapitulates some practical methods that could minimise the effect of water in a region where the lifespan of road infrastructures depends on the ingenuity behind the construction of its drainage system.

**Key words:** Douala, water, infrastructure, constraint, drainage.

### INTRODUCTION

A good road infrastructure is an undeniable support to economic, social, agricultural and industrial development of a nation. The management measures of these financial assets have appear necessary so as to avoid experiencing a period of crisis.

Regarding to the road infrastructure management, the distinct hydrological and hydrogeological contexts of the Cameroonian territory and the specificity of the causes of degradation do not allow adoption of a general policy for the entire territory.

The case of road infrastructure in the city of Douala, which is experiencing and advanced state of degradation, is the subject of this study, with the aim of proposing actions to be undertaken in order to protect this sensitive heritage.

## ROAD DEGRADATIONS AND IMPACTS

For about a hundred kilometres of roads evaluated in the city, a degradation of more than 80 % of highway is easily detected through the presence of many potholes (Figure 1). According to CETE (1989), potholes are the ultimate indicators of the state of degradation of a highway. Sometimes, potholes could give the impression of appearing on the highway almost spontaneously; however, if the evolution could be very fast during the rains and or during heavy traffic periods, this such potholes could only appear on a roadway presenting somewhat inadequate surface and structural state.

On certain roadways, we equally observe cracks. However, SETRA and LPC (1990) noted that cracks have been taken into account for the conception and the sizing of roadway structure, and call for maintenance techniques, which consider these measures.

The increase of the motor park together with the degradation of roadway in the Douala city seriously disrupts the urban transport system. This situation also provokes accidents and destabilizes the schedules and activities of the inhabitants, and event neighbouring towns. In fact potholes have consequence on the circulation. The Douala city that presents important industrial activities, is affected by the slowing down of the rhythm of evacuation of manufactured goods. This implies that potholes need an urgent attention. Most often, holes are filled with the available local materials.

Concerning the potholes, we observed the phenomena of the regressive and pluvial erosions which favours the over digging on the one hand and the progressive filling of these potholes with flood alluvium and limon, on the other hand.

For over a decade, many highway roads have been abandoned. Thus, taxis become scarce at the benefit of motorbikes (commonly called Bend skins), which take care of the urban transport of the inhabitants.

## CAUSES OF DEGRADATIONS

The inventory of the affected infrastructures reveals that water is the main factor that accounts for this degradation. Its constant presence could provoke hydraulic disturbance that could affect the lifespan of the road. In fact water is a living environment, which is complex and diversifies and in which the components interact continuously.

Furthermore, we observed that the static level of the water table is shallow (0.5 to 3 m). Rainfall is also high during a long period of the year (march to November) and the region presents a topography with very little relief. Here and there the urban planning is anarchic. The topography favours the stagnation of running water. The inadequacy and the deflection of the sanitation system contribute to the floods. Thus, the permanent stagnant waters make the environment vulnerable.

## MAIN SUGGESTIONS

Up to now, there is no cartography of sanitation system comprising topographic information which are necessary for detailed studies of functioning during the raining periods. In order to better respond to the present and future needs as regards quality road infrastructures in the Douala region, we propose the following suggestions:

- the main outlet of the Douala city is the Wouri River, which unfortunately is subjected to the influence of tides. It is necessary to look for other outlets for rainwater and to recalibrate present secondary outlets that have limited capacity;
- the management of rainwater is of utmost importance. Thus, it is necessary to develop sanitation systems to transport running water and wastewater to appropriate outlet. This gives town-planning solutions that will prevent the sanitation system from flooding. This predictive method of management permits the reconciliation of the contradictory objective of fighting against floods and pollution (CUVILIER ET AL., 2002);
- environmental problems progressively become socio-political major stakes. In that case, sudden awareness by the whole community is of patrimonial value of road infrastructures constitutes the first step for sustainable management. Thus, the real problem becomes the acceptance by the users themselves and the validity of the application of the management principle with all the constraints attached;
- the solution involving water infiltration or storage or a combination of the two could be considered. In fact, according to TABUCHI (2002), it concerns the storing of rainfall in the body of the roadway, constituted by porous material that could be either a crush material (ballast) of the railway type, or a cellular material of the honeycomb type, which offers a greater volume of vacuum compared to the crush (90 % of vacuum against 30 %);
- lastly, the use of numerical models for the diagnosis and sizing of the sanitation network system during the rain season are becomes more and more common. It would be interesting to test software, which are based on long series of real rain (RENAUDET, 2002).

## CONCLUSION AND PROSPECTS

The city of Douala is confronted with shallow ground water levels, as well as frequent and important floods, which then associated with the nature of the soils, favour the degradation of the road infrastructure.

The principal challenge consists of taking into account many technical, social and institutional factors, which have an influence on the implementation of appropriate action for the control of ground and superficial water, limiting factors for the sustainable development of the Douala city, the heart of Cameroon's economic activity.

The initiative taken by the Douala Urban Council since the year 2002 to rehabilitate the degraded infrastructures show that the Cameroon government is anxious to see the develop-

ment of innovative solutions permitting to reduce some inadequacies and alleviate the road degradation.

## REFERENCES

- CETE (1989): Le bouchage des nids de poule, *Note d'information*, No. 49, 8p.
- CUVILIER, F., JACQUET, G., VOIGNIER, P. AND BOURNIQUEL, J. -M. (2002): Quelques perspectives pratiques d'étude et d'aide à l'exploitation ouverte par le radar d'Abbeville. Le cas de Boulogne-Sur-Mer. *TSM*, No. 7-8, juillet-août, pp 64-71.
- RENAUDET, D. (2002): Quelle pluie pour la modélisation ? pluie de projet, classe de pluie, pluies réelles, *TSM*, No. 7-8, juillet-août, pp. 53-60.
- SETRA/LPC (1990): Limites et intérêts du colmatage des fissures de retrait des chaussées semi-rigides, *Note d'information*, No. 56, 4p.
- TABUCHI, J. -P. (2002): Urbanisation et eaux pluviales, *TSM*, No. 7-8, juillet-août, pp 38-52.