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*International Balkans Conference on Challenges of Civil Engineering, BCCCE,*
*19-21 May 2011, EPOKA University, Tirana, ALBANIA.*

# Deficiencies Of Some Important Bridges In Albania

Erion PERIKU [1], Yavuz YARDIM [1]

[1]*Department of Civil Engineering, EPOKA University, Tirana, Albania.*

## ABSTRACT

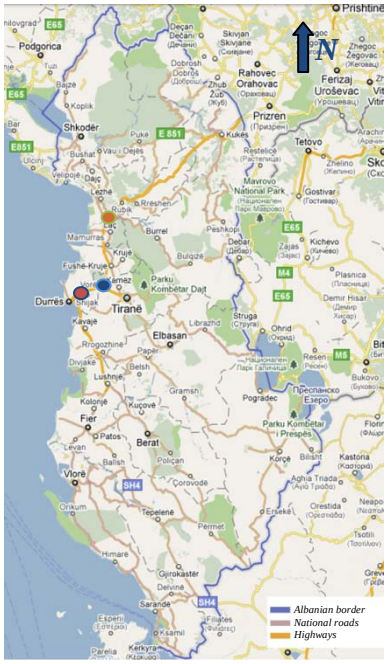
Over the past decades Albania has built many new bridges and roads. The construction of these bridges and roads has been done under different periods and characterized from different types of construction codes. The work reported on this paper was carried out to survey the present condition of three important bridges in national roads of Albania. Literature review was carried out to identify common defects on same type of bridges. Interviews were conducted with different engineers worked on similar type of bridges' design, construction and inspection in Albania. Site inspections of these three bridges were carried out to identify defects on the bridges. The study was extended to inspect all the members on the bridges to define causes of the defects. The main causes of the defects were classified as; lack of detailing in design, poor quality of construction, poor concrete quality, inadequate concrete cover, water leakage and last but not least lack of maintenance. These bridges are classified as poor or very poor conditions based on visual inspection in the study.

*Keywords*: Bridges; Defects; Inspection.

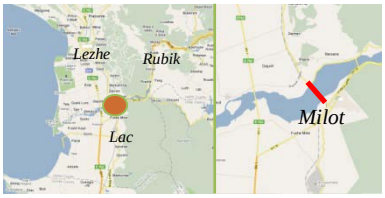
## INTRODUCTION

Bridges are very important and expensive structures. It is very necessary that such structures have a monitoring system for their assessment. Bridges systematic assessment lowers the cost of repairs and makes the bridge operation safely within the service life. The construction of Albanian bridges has been done under different codes and political regimes. Mainly for the construction of these bridges there are three time periods and six construction codes. From these different codes only one is Albanian Code [4]. It is recorded that Albania national ways has 562 bridges running a total length of 19295m over the entire country [9]. For this case study, three bridges which cover a total length of 1127m that represents approximately 6% of entire bridge length of the Albania were inspected. The functionality of these bridges is closely related with the development of the country. The aim of this study is to evaluate the current status of these bridges and suggest further studies to evaluate and improve current status of existing bridges in Albania. Similar studies are done in different countries [1-3]. The main material used in national road bridges is reinforced concrete therefore this study is mostly focused on reinforced concrete bridges. For this case study the bridges are chosen so to present the time and type of construction mostly used on Albanian bridge construction. Location map and pictures of the bridges is shown in Figure 1. Mat bridge is 787 meters long and has 33 spans. It was built in 1976 as reinforced concrete. The bridge has the greatest number of spans of all Albanian bridges and it was built for double purpose; two lanes for vehicle pass and one lane as railway. It is very important bridge as it connects the Albania with Montenegro via railway and north part with the other part of the country via national road. Vora railway overpass is 320 meters long and has 18 spans. It was

built in 1989 as reinforced concrete. The bridge plays a vital role in Albanian economy as it connects the national greatest seaport with the airport and north part of Albania. Sukth railway overpass is 20 meters long and has 1 span. It was built in 2001 as composite structure reinforced concrete and steel. This bridge is over Tirana – Durres highway which has a heavy traffic as these are two biggest cities of Albania.

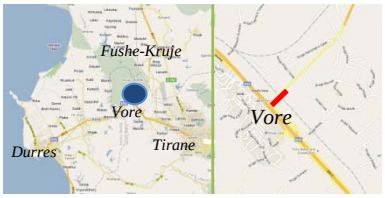


*Albanian national road network*



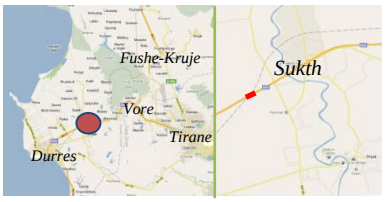
*Lezha district*


*Mat Bridge*



*Tirana district*


*Vora Railway Overpass*



*Durres district*


*Sukth Railway Overpass*

Figure 1 Location of the bridges

## METHODOLOGY

This study is done in consecutive steps in order to have a clear definition of the bridges' defects. The work has started with literature review to identify the common problems on bridges. Site inspections take a huge part to complete the defect definitions of these bridges. It was very difficult to take information from the institutes that designed and constructed these bridges. In order to fulfil this gap personal interview with engineers who have worked in the designing and implementing of these projects were conducted. Additional interviews with engineers who have made the first and only bridge inspections in the country helped for the choice of bridges. To prepare appropriate questionnaires for individual interviews and to make a better check list for site visual inspection, the literature findings from different county inspection guides [5-8] were used as helpful resource. Visual inspection method based on different inspection manuals was conducted to draw general defects condition and causes of these three bridges.

## DEFICIENCIES OF BRIDGES

The elements of these bridges are classified as substructure, superstructure, bearings, expansion joints, and drainage system. All this elements are inspected and the defects are listed has follows:

**Substructure**

Albania rivers have mass flow rate so scouring is one of the main concern for bridge substructure. Mat bridge passes over Mat river and foundation consists on piles connected with a pile cap. Almost all piles exposed and have some problems. Scoring were recorded with different severity level. Sever scouring were observed at some part of the foundation as shown in [Fig.2(a)]. Reinforcements of pile cap were exposed and rusted because of lack of concrete cover and poor workmanship. Moreover, considerable amount of soil was found in pile cap concrete as an evidence of poor construction supervision [Fig.2(b)]. The piles have concrete deterioration defects and very often steel bars are exposed to environment [Fig.2(c)].

*(a) Pile erosion*

*(b) Pile cap bad workmanship*

*(c) Pile concrete deterioration*

Figure 2 Substructure defects

**Superstructure**

Bridge superstructure defects were seen in all three bridges. because of aging factor, more serious defects were seen on Mat and Vora Bridge compare to Sukth Bridge which was built after 1990.Workmanship problems such as improper frame work and inadequate concrete cover are very obvious in three bridges [Fig.3(a), Fig.4(f)]. Diaphragms that are very sensitive parts must align beams on correctly position. However the most of the diaphragms in these bridges were found out of position. The miss alignment were measured more than 5 cm on some of the diaphragms [Fig.3(b)]. Because of poor workmanship and design detail, reinforcement were placed so closely that does not allow the concrete enter between them so exposed reinforcement are widely seen [Fig.3(c)]. This problem was associated with improper concrete cover and water leakage and result with heavily rust on the reinforcement all over the bridges' structural members [Fig.4(a),(e)]. The reinforcement diameter was around 4mm at some rusty place. Chemical attack is widely seen on every superstructure element [Fig.4(b)]. Spalling and delamination were other two commonly defects seen all over the bridges' superstructures [Fig.4(c),(d)].

*(a) Improper framework*

*(b) Diaphragm misalignment*

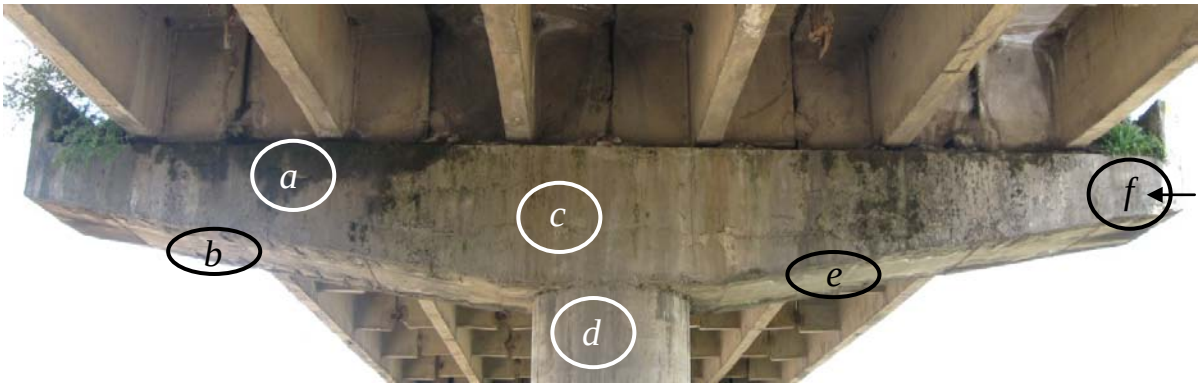
*(c) Dense bars, concrete gap*

Figure 3 Deck defects

*(a) Concrete spalls*

*(b) Chemical attack*

*(c) Rusted bar*




*(d) Delamination*

*(e) Extremely rusted bar*

*(f) Opposite slope*

Figure 4 Pier and beam cap defects


*(a) Bearing offset*

*(b) Blocked and rusted bearing*

*(c) Shifted bearing*

Figure 5 Bearing defects

**Bearings**

Mainly there are four types of bearings used on Albanian bridges; Roller bearing, linear rocker bearing, plane sliding bearing and elastomeric laminated bearing. Any defects on bearings prevent the structure to move as originally designed, therefore high stresses observed on beams. This high stress may cause individual span or entire bridge failure. Therefore routine inspection and replacement of bearings is extremely important. Metal bearings on the bridges were corroded and clogged with debris as shown in [Fig.5(b)]. Some of the plane sliding bearing have misaligned and lost its functionality at all. As it is shown in [Fig.5(c)], bearings sliding plates does not touch each other and they totally have lost originally design

purpose. Most of the elastomeric laminated bearings have offset problems that vary from one to some centimetres. The angle of offset on elastomeric bearings varies from $15^0$ to $20^0$ [Fig.5(a)]. A common defect of all bearing is locking with debris [Fig.5(a),(b),(c)].

**Expansion joints**

Abnormal noise is made almost in every expansion joint mostly caused from difference in level. As matter of workmanship sometimes the expansion joints are not put at all [Fig.6(a)]. Seal and sealant are generally out of function so they allow water to pass throw. Components like bolts and welds are mostly out of function [Fig.6(b)]. Concrete or asphalt adjacent to the joints supports of faces has generally spalls or cracks. Missing elements of the expansion joints are often seen [Fig.6(c)]. This missing elements cause problems to other elements such as bearings. The undersides of the expansions were not constructed properly. This leads water leakage and failure of entire expansion joints.

*(c) Missing joint*

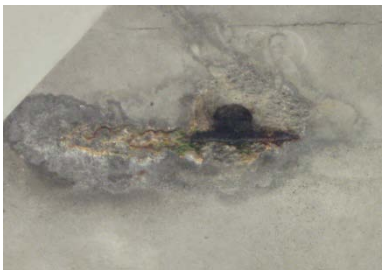
*(b) Missing bolts and welds*

*(a) Missing joint elements*

Figure 6 Expansion joint defects

**Drainage system**

Drainage system inspection is one of the most important part all types of inspections. The lack of maintenance on the system will definitely lead durability problem on concrete and steel structure. Condition of the system in all three bridges is seriously defected. The drainage holes were created after construction of deck by destroying some part of structure member [Fig.7(a)]. Drainage pipes were not found and the structure directly exposed to rain water. As a result, the decks under surface have problems like chemical attack, moss and wetness [Fig.7(b),(c)].



*(c) Water leakage, rusted bar*

*(b) Missing pipe*

*(a) Blocked hole*

Figure 7 Drainage system defects

## CONCLUSIONS

This research explored the current status of three important bridges in Albania. Existing condition of the bridges are decided as poor stage and urgent maintenance is needed. The main defects were recorded based on visual inspection and causes of the defects were discussed. Lack of detailing, bad construction, poor concrete, inadequate concrete cover were mentioned as causes of the biggest defects such as scoring, chemical attack, concrete spalls and extremely rusted steel. Moreover all the bridges are suffering for locked bearings and expansion joints and blocked drainage. The study suggests that more number of bridges have to be inspected to draw general picture of the condition assessment of the bridges in Albania.

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