# PAVEMENT PROJECT INTEGRATED IN THE DETAILED ENGINEERING DESIGN OF THE FLUIDITY WORKS OF RODOVIA DOS IMIGRANTES BR-070



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CONSULSTRADA was responsible for preparing the Pavement Project integrated in the detailed engineering design of the Fluidity Works of Rodovia dos Imigrantes BR-070. The BR-070 road runs between the junctions of BR-163 with MT-407 (Tijucal Access - km 496 + 000) and BR-070 (B) with MT-060 (B) (Trevo do Lagarto interchange - km 524 + 000). This road infrastructure is also designated as the ring road of the City of Cuiabá, capital of the State of Mato Grosso, Brazil.

*Figure 1 – Overview of BR-070 at quilometre 497+500*

In terms of characteristics of geometric cross-sections, the current road infrastructure consists of a single carriageway, with a lane in each traffic direction (12); at U-turns the cross-section indicates two or three lanes in each direction. Only level intersections are found along the entire route. In general, with regard to geometric characteristics, this project will provide the section of BR-070 under study with the following elements:

- In some areas construction of additional lanes or acceleration / deceleration lanes;
- Unlevelled crossings (interchanges), with the construction of viaducts and branches;
- Construction of side roads.

The existing pavement structure is flexible.

Characterization of the existing situation at functional and structural levels was carried out, in particular the assessment of the load capacity of pavements through the execution of load tests with the Falling Weight Deflectometer. Consulstrada proceeded with the interpretation of the load tests, and based on this analysis drafted a survey plan that included boreholes for extraction of probes and drilling of test pits. Consulstrada accompanied excavations operations on-site.

Based on the deflections obtained in the load tests and the information gathered from the excavation of test pits, structural behaviour models were used to calculate the current load capacity of the road.

Heavy vehicle traffic is very high, with an average annual daily traffic (AADT), per direction, of approximately 3880 heavy vehicles (about 45% of vehicles on the road). Based on the AADT was determined the equivalent number of passages of the standard axis of 80 kN (N), which was calculated for the load equivalency factors recommended by the US Army Corps of Engineers.

*Figure 2 – Details of pit excavation*

*Figure 3 – Heavy vehicle traffic*

From the assessment carried out it was concluded that the existing structure does not have parameters that match the level of demand from users, and does not have sufficient capacity to deal with future traffic (considering to a period of 10 years).

As mentioned previously, since the current pavement structures do not have enough load capacity to withstand the projected traffic for a period of 10 years, this constraint would imply very substantial reinforcement works, which would lead to an increased surface level of the pavement of about 25 cm, in order to minimize demolition of existing pavements. Since the

*Continuation*

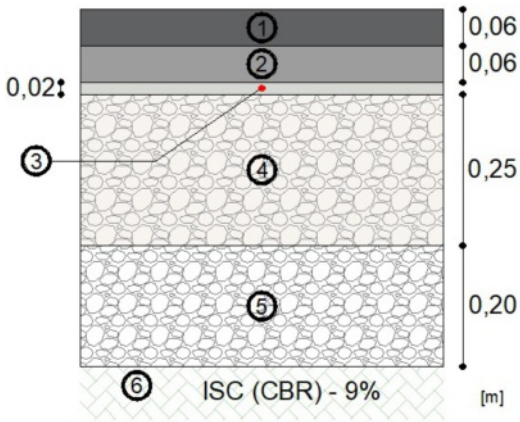
geometric design has necessarily to safeguard connections with the existing layout, in particular in its surroundings, as well as to maintain levels as approximate as possible to the existing ones, due to the other components of the highway, in particular drainage devices, the design of new pavement structures revealed to be the most efficient solution.

Heavy vehicle traffic is very high on this road, which in itself implies that the structures developed in this project should have substantial thicknesses. In order to minimize the thicknesses of bituminous layers, design options fell upon semi-rigid pavements.

Pavements were designed for a period of 10 years, according to the methodology defined in the DNIT manual. Subsequently structures were verified through the application of the empirical-mechanistic method. The following degradation mechanisms were considered in the empirical-mechanistic design method:

- Fatigue cracking with origin at the base of the bituminous layers;
- Fatigue cracking with origin at the base of the lean concrete layer;
- Excessive permanent deformation due to the contribution of the foundation soil

Heavy truck traffic on this road, associated with high service temperatures, makes it more likely that there will occur other degradation phenomena in the bituminous layers, such as the disintegration of bituminous mixtures and top-down cracking. The use of modified bituminous binders was prescribed to minimize the ocurrence of these degradation phenomena.




Legenda:

1. Camada de rolamento em concreto usinado a quente com cimento asfáltico de petróleo modificado com polímero do tipo SBS 60/85
2. Camada intermédia em concreto usinado a quente com cimento asfáltico de petróleo modificado com polímero do tipo SBS 60/85
3. Tratamento superficial duplo com emulsão asfáltica catiónica de rotura rápida modificada com polímero SBS do tipo RR2C-S
4. Camada de base em brita graduada tratada com cimento
5. Camada de sub-base em brita graduada simples
6. Subleito

*Figure 4 – Detail of the new pavement structure envisaged*

As the bituminous layers are composed of modified bitumen and the service temperatures are high, the deformability modules of bituminous layers were calculated according to the methodology foreseen in the recent AASHTO (Mechanistic-Empirical Pavement Design Guide) design method.