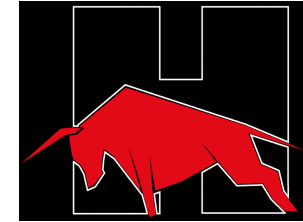


Anmeldung zum 13. Weimarer Straßenbau- Symposium am 31. März 2011

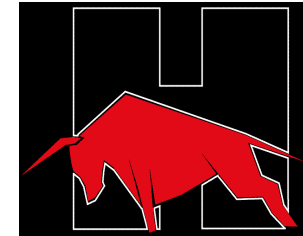


- **Warm asphalt: an experience in Angola**
- **Niedrigtemperaturasphalt: ein Versuch
Angola**

Dr. Joao Virgilio Merighi – Mackenzie Presbyterian
Universität- Brasilien

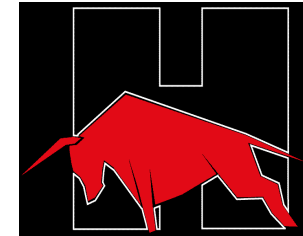
Ing. Cecilia Fortes Merighi – Fidens Engenharia- Brasilien

Anmeldung zum 13. Weimarerer Straßenbau-Symposium am 31. März 2011



- **DR. JÜRGEN HUTSCHENREUTHER:**
- First, we would like to thank you again, for this opportunity e second, congratulation for this excellent symposium.
- **Erste wir möchten danke sagen und zweite herzlichen glückwunsch: das Symposium ist ausgezeichnet.**

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- DR. JÜRGEN HUTSCHENREUTHER:



The distance between Frankfurt – Sao Paulo is 11
hours

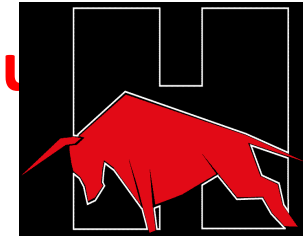
So, isn't that far...

**Der Abstand Frankfurt – Sao Paulo ist 11 Stunden.
Na ja, nicht so weit...**

Warm asphalt: an experience in Angola

**13. Weimarer
Symposium am 31. März 2011**

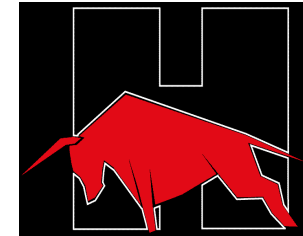
Straßenbau



- **Objective:** Objective: show the experience in pavement airport construction and road construction in Saurimo, Angola using warm mix asphalt.
- **Ziel:** Die Erfahrung in Flughafen Pflaster-und Straßenbau in Saurimo, Angola Territorium des Landes, mit Niedrigtemperaturasphalt.

Warm asphalt: an experience in Angola

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ITEMS

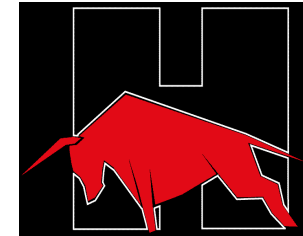
- 1-Introduction
- 2- Warm Asphalt Philosophy
- 3- Local Restriction
- 4- Design and Its Restriction
- 5- Construction
- 6- Conclusion/Lessons
Learned

ARTIKEL

- Einleitung
- Philosophie
Niedrigtemperaturasphalt
- Lokale Einschränkungen
- Design und Seine
Beschränkung
- Herstellung und Einbau
- Fazit

Warm asphalt: an experience in Angola

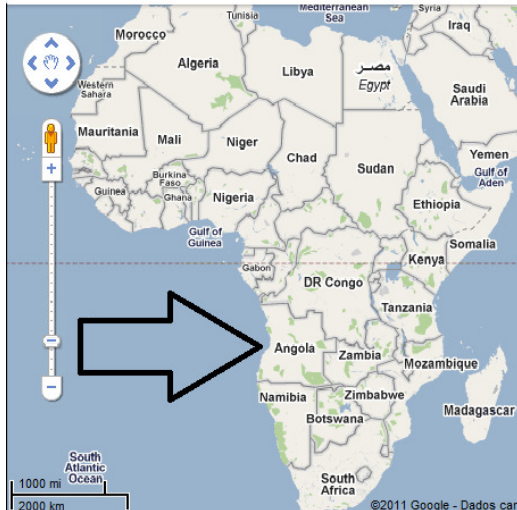
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1- Introduction/**Einleitung**

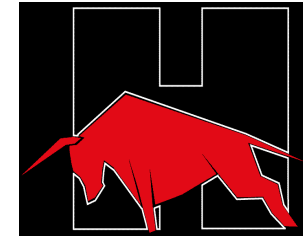
Saurimo: Where is it?

Wo ist denn das?



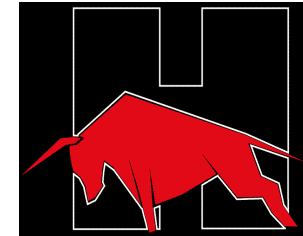
Warm asphalt: an experience in Angola

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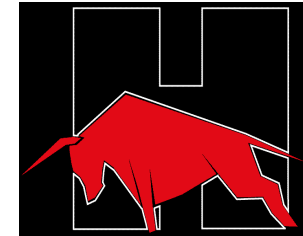
- The airport preliminary conditions
 - Operated aircraft: B 727-100;
 - Unpaved runway;
 - Consequences: dangerous operations, not attending the international operations procedures

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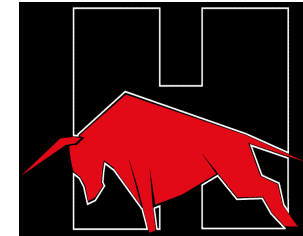
- **Why build an airport in Catoca?**
- **These photos are the answer. Boeing aircrafts B727-100 used to takeoff in unpaved runway. On security ways, this operation is very dangerous.**
- **Warum bauen den Flughafen in Catoca?**
- **Das Foto ist die Antwort. Alle Zeit Boeing Start in unbefestigte Landebahn. Das ist sehr gefährlich in Bezug auf Sicherheit**

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Warm asphalt: an experience in Angola

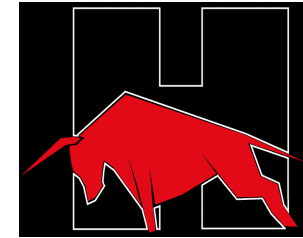
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2- Warm Mix Asphalt Philosophy

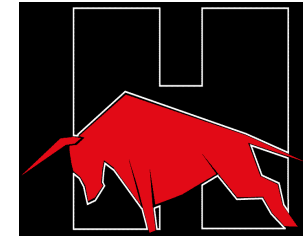
- 1) Pollutant emissions during WMA production are even lower than those during HMA production
- 2) Reduce the temperatures at which asphalt mixtures are produced and compacted;

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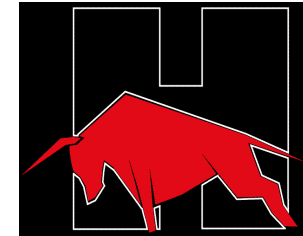
- 3) Alleviate compaction problems associated with cool weather;
- 4) Reduce compaction equipment needs at the jobsite;

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- 5) Reduced Fuel and Energy Usage;
- 6) Ability to pave in cooler temperatures and still obtain density;

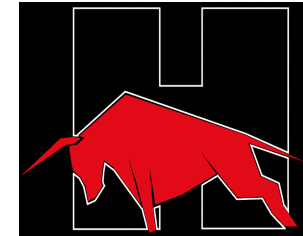
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7) Ability to haul the mix longer distances and still have workability to place and compact.

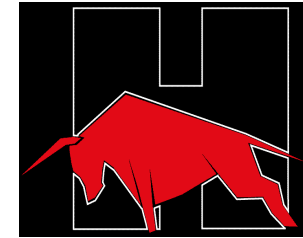
- These items are generic information about Warm Mix Asphalt however; there are Several WMA technologies around of the world. In this study we will discuss the CCBit Technology.

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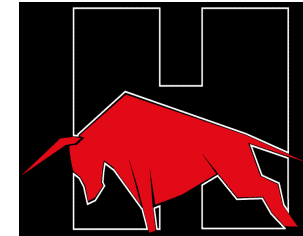
- We will discuss the CCBit technology application considering the introduction of the organic additives in Asphalt Bitumen. Some advantages in terms of performance in laboratory investigation - comparison with HMA (obtained in Catoca airport construction):

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- Better mechanic resistance –
 - indirect tensile strength (20%) and
 - Marshall Stability (20%);
- Better adhesion;
- Decrease the measure of the bitumen penetration (20%), consequently occur increase of the permanent deformation resistance.

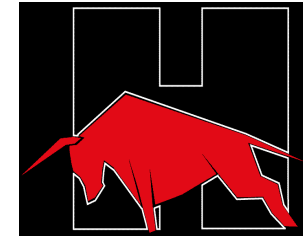
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- **3-Local Restriction**

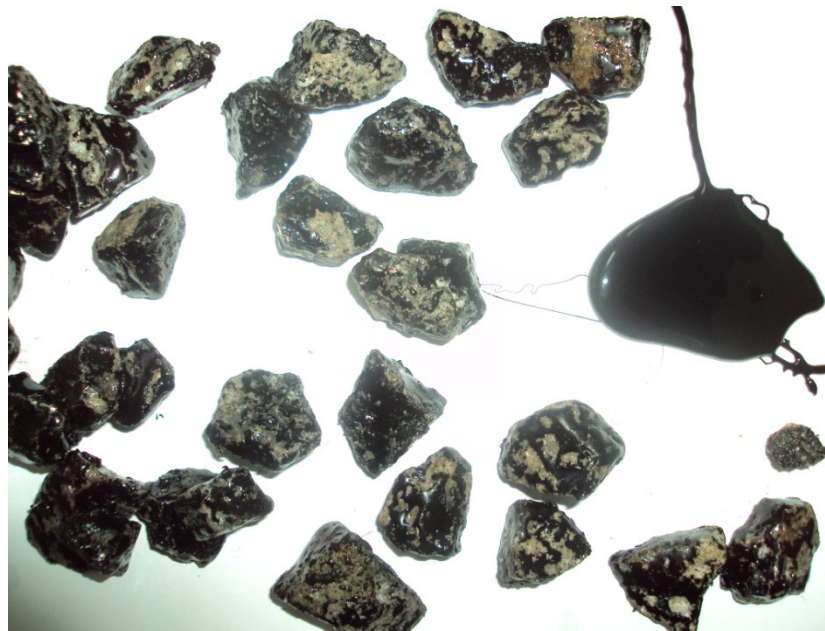
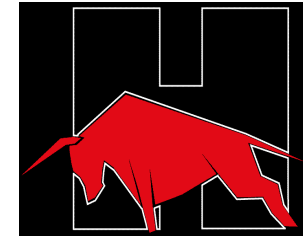
- During the construction of the inferior layers was observed that the local soil didn't have lateritic behavior.
- Also, the asphalt adhesion was very poor and consequently there was reduction of the mechanical resistance!.

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- **4- Design and Its Restriction**
- Catoca Airport Runway Project
 - Initiative idea - 5 cm layer of HMA;
 - To attend the proceedings FAA Advisory Circular (AC) 150/5320-6D and Computation Mode, COMFAA in terms of asphalt layer: 10 cm of HMA.
- **The first idea was do an asphaltic layer and consider the unpaved layer the base of the structure. There was a previous conception that the local soil had a GRAVEL LATERÍTIC SOIL BEHAVIOR.**

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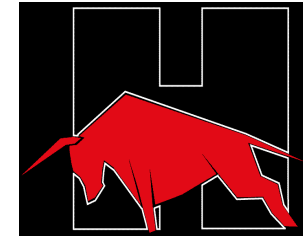
no CCBit



with CCBit

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5- Construction

- Sub grade: sand
- Sub-base (lateritic soil): 40 cm
- Base: Lateritic soil + gravel: 20 cm
- HMA: 10 cm
- Porous Friction Course: 3 cm **PLUS 3% CCBit**

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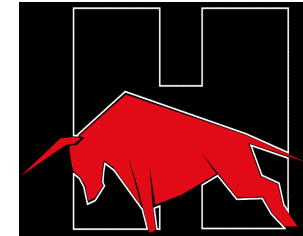
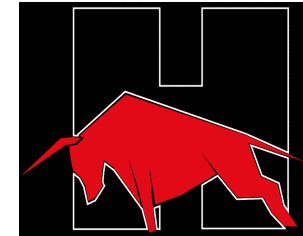


TABLE 1. AGGREGATE-POROUS FRICTION COURSE
PERCENTAGE BY WEIGHT PASSING SIEVES

Sieve	3/4" maximum	1/2" maximum	Job-Mix (Production) Tolerances **
3/4"	100	100	100
1/2"	70-90	100	+/- 5%
3/8"	40-65	85-95	+/- 5%
#4	15-25	30-45	+/- 5%
#8	8-15	20-30	+/- 2%
#30	5-9	9-17	+/- 2%
#200	1-5	2-7	+/- 2%
Bitumen			+/- 0.2%
Temperature of Mix			+/- 20 degrees F.

Gradation Requeriments for Porous Friction
Course (FAA P-402).

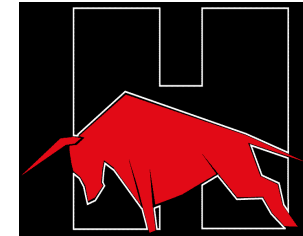
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COMPARISON 3% CCBIT

MATERIAL	MARSHALL STABILITY (kgf)	INDIRECT TENSILE STRENGTH (kgf/cm ²)	AIR VOID (%)
WITH CCBIT	1225	7,9	10,8
WITHOUT CCBIT	1035	6,2	11,0

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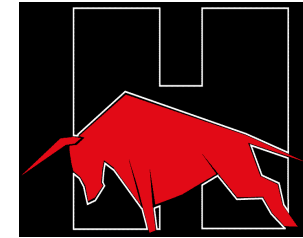


Field test - no permeability test equipment available in the lab.



Warm asphalt: an experience in Angola

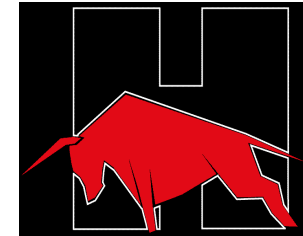
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5- Conclusion/Lessons Learned

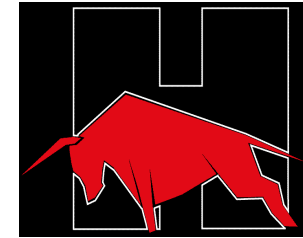
- There was good performance in terms of resistance and adhesion in the porous friction course layer;
- In interview, the pilots of the TAAG Airline, filling more security in the porous friction course airfield during the rain (there rain a lot!)

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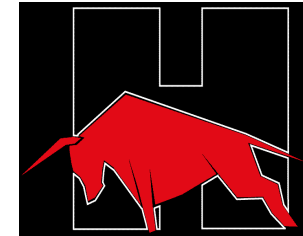
- The PFC layer compaction was conducted only with 2 passes of steel-wheel vibratory rollers;
- Good workability of the asphalt mix
- Was used a heavy tamping-bar vibratory-screed pavers BUT Considering that the surface temperature pavement was/is around 70C after 11h AM, NORMALLY NEED LOST TEMPERATURE before to use steel-wheel vibratory (1 hour!!)

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- Quality Control – lab
 - Equipments issues – old technologies (MARSHALL)
 - Team issues - Non specialized workers

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Catoca Airport 2010.



THANK YOU

Warm asphalt: an experience in Angola