CIVILCORE
CONFERENCE ON RESEARCH IN ENGINEERING
2020

IN SITU, IMMEDIATE AND RELIABLE TESTING WORKS: CHALLENGES IN QUALITY CONTROL FOR PAVEMENT WORKS IN MALAYSIA

IR HAMZAH BIN HASHIM

CONTENT

- Introduction
- Background
- Issues
- Example
- Challenges
- Proposal
- Conclusion

CIVILCORE
CONFERENCE ON RESEARCH IN ENGINEERING
2020

INTRODUCTION

CIVILCORE
CONFERENCE ON RESEARCH IN ENGINEERING
2020

Cracks found on MRR2's Ampang-Cheras exit ramp

By Bernama - August 13, 2019 @ 7:49pm

PWD has found cracks on one of the pier heads at the slip road from Ampang to Billion/Cheras roundabout on the MRR2. - NSTP file pic

Nation's first highway in bad shape

By Kalbana Perimbanayagam - March 23, 2019 @ 8:29am

The morning rush hour on the Federal Highway, from Klang towards Shah Alam. NSTP/FAIZ ANUAR

INTRODUCTION

Traffic jam at Pasir Gudang Highway near Taman Daya.

CIVILCORE
CONFERENCE ON RESEARCH IN ENGINEERING
2020

INTRODUCTION

Downpour causes flash floods, massive traffic jams in city (Update)

NATION

Sunday, 01 Sep 2013

6:13 PM MYT

Home For You Bookmark

BACKGROUND

A cycle of pavement repair works to ensure acceptable serviceability for road users.

Periodic maintenance / Upgrading

Pavement work

Major component in construction of new road, upgrading project

Major repair due to natural disaster e.g flood, landslide, erosion

BACKGROUND

Maintenance – Privatisation of Federal Road Maintenance in Peninsular Malaysia since 2001

Consist of work procedure, plant & equipment, and most important the inspection & test plan

Pavement work

Project Quality Plan has been established

Mostly derived from Spesifikasi Pembinaan Jalan (SPJ)

CIVILCORE CONFERENCE ON RESEARCH IN ENGINEERING 2020

BACKGROUND

Cold In Place Recycling

Mill and pave work

RECONSTRUCTION WORK

CIVILCORE
CONFERENCE ON RESEARCH IN ENGINEERING
2020

BACKGROUND

No.	Type of Testing	Test Name	Remarks
1	Material Testing -Coarse Aggregate	• Los Angeles Abrasion Value < 25% • Magnesium Sulphate Soundness < 18% • Flakiness Index < 25% • Water Absorption < 2% • Polished Stone Value for Wearing Course > 40	Flakiness Index and Water Absorption shall be carry out for every 2,500 tonne of Hot Mix produced. Other test shall be carry out once per source.
2	Material Testing -Fine aggregate	• Sand Equivalent Value > 45% • Fine aggregate angularity> 45% • Methylene Blue Value< 10mg/g • Magnesium Sulphate Soundness< 20% • Water absorption < 2%	Water Absorption shall be carry out for every 2,500 tonne of Hot Mix produced. Other test shall be carry out once per source.
3	Bitumen Testing	• Penetration test (60-70 or 80-100 x 0.1mm) • Softening Point test (45o – 52o C) • Ductility test (Minimum 100 cm) • Flash point test (Minimum 225o C) • Loss On Heating test (maximum 0.5%)	Certificate of Quality from the company that produced the bitumen is enough for bitumen source verification.
4	Mix Design / Job Mix Formula	• Aggregate Grading • Flow • Stiffness • Air Void in Mix (VIM), • Void In Aggregate Filled with Bitumen (VFB)	Different parameters between Wearing Course and Binder Course

BACKGROUND

Aggregate material / hopper

Drum mix batching plant

CIVILCORE
CONFERENCE ON RESEARCH IN ENGINEERING
2020

BACKGROUND

No.	Type of Testing	Test Name	Remarks
5	Plant trial & Trial lay	• Laying Thickness, • Hot mix temperature, • Rolling pattern, • Compaction density, • compacted thickness, • aggregate grading, • bitumen percentage	Accordance to PWD Malaysia Guidelines For Inspection & Testing of Road Works
6	Construction Test -Unbound layer	• Aggregate grading, • moisture content, • maximum dry density, • layer thickness, • compaction density	Accordance to PWD Malaysia Guidelines For Inspection & Testing of Road Works
7	Construction Test -Bituminous layer	• Laying Thickness, • Hot mix temperature • Compaction density, • compacted thickness, • aggregate grading, • bitumen percentage	Accordance to PWD Malaysia Guidelines For Inspection & Testing of Road Works

BACKGROUND

CIVILCORE
CONFERENCE ON RESEARCH IN ENGINEERING
2020

BACKGROUND

coring test

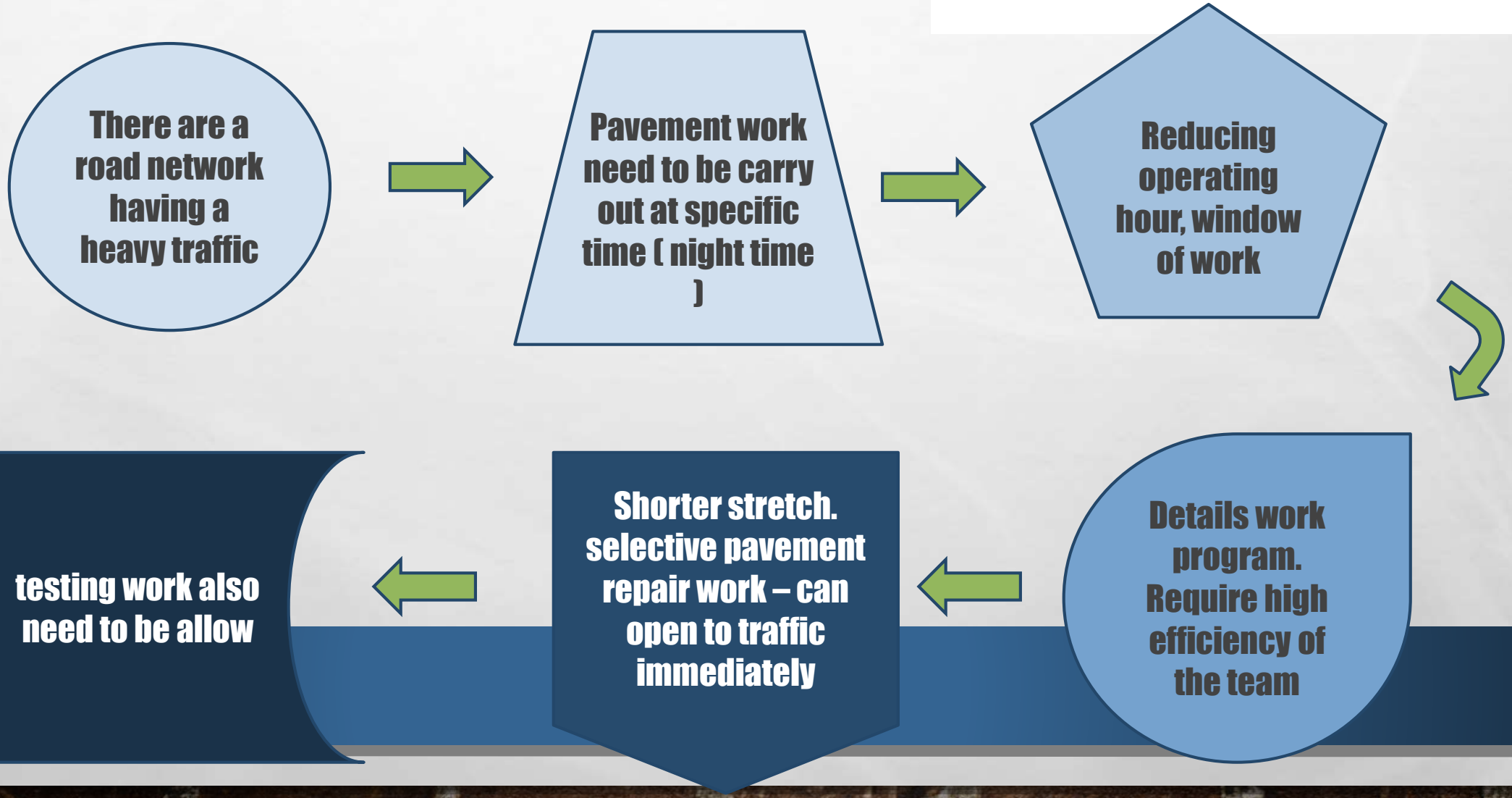
coring sample

thickness

CIVILCORE
CONFERENCE ON RESEARCH IN ENGINEERING
2020

ISSUES

CIVILCORE
CONFERENCE ON RESEARCH IN ENGINEERING
2020



CHALLENGES

CIVILCORE
CONFERENCE ON RESEARCH IN ENGINEERING
2020

Rehabilitated lane need to be open to traffic 3-4 hours after final compaction

All quality control can be perform, but density test are yet to get result

Density is crucial and critical, but?

PAVEMENT WORK AND FREQUENCY OF DENSITY TEST

No	Types of Treatment	Area of Work (m2)	Frequency of Test	No of Test Required
1	Mill and Pave	7000 (1000m length x 7m width)	One (1) sample per 500 sq.m of mix laid, but not less than two (2) samples for the work completed in each paving session	14 nos of AC14
2	Reconstruction	7000 (1000m length x 7m width)	One test per 500 sq metre of each layer laid	14 nos of roadbase layer 14 nos of binder course 14 nos of wearing course
3	CIPR	7000 (1000m length x 7m width)	One test per 500 sq metre of each layer laid	14 nos of roadbase layer 14 nos of binder course 14 nos of wearing course

TIME TAKEN FOR DENSITY TEST

No	Test	Sample Taken / Test is carry out	Time Taken	Result Obtained	
1	Coring test for Marshall Density (ASTM Test Method D 1188 or ASTM Test Method D 2726)	within 24 hours from final compaction (JKR/SPJ2008 Section 4 Clause 4.3.3.5 Construction methods (i))	average of 15 minutes	within a day	

TIME TAKEN FOR DENSITY TEST

No	Test	Sample Taken / Test is carry out	Time Taken	Result Obtained	
1	Coring test for Marshall Density (ASTM Test Method D 1188 or ASTM Test Method D 2726)	after 24 hours from final compaction	average of 15 minutes	within a day	

TIME TAKEN FOR DENSITY TEST

No	Test	Sample Taken / Test is carry out	Time Taken	Result Obtained	
2	Field Density Test (Sand replacement method) BS1377 : Compaction Test	3 hours after final compaction JKR/SPJ2008 Section 4 Clause 4.2.3.3	average of 30 minutes	within a day	

TIME TAKEN FOR IN SITU CBR TEST

No	Test	Sample Taken / Test is carry out	Time Taken	Result Obtained	
3	In Situ CBR Test	3 hours after final compaction	average of 15 minutes	in the spot	

PROPOSAL

CIVILCORE
CONFERENCE ON RESEARCH IN ENGINEERING
2020

SUBGRADE AND UNBOUND LAYER

- HANDHELD FWD / LWD
- CLEGG IMPACT HAMMER (ASTM D5874-02)

- MEASURING STIFFNESS OF MATERIAL
- CORRELATE WITH CBR VALUE REPRESENTING GOOD DENSITY OF LAYER

CIVILCORE
CONFERENCE ON RESEARCH IN ENGINEERING
2020

SUBGRADE AND UNBOUND LAYER

- NUCLEAR DENSITY GAUGE
- DENSITY CAN BE MEASURED IN EITHER THE BACKSCATTER OR DIRECT TRANSMISSION MODE
- MOISTURE IS MEASURED IN THE BACKSCATTER MODE.
- THE BACKSCATTER MODE IS IDEAL FOR CONCRETE AND HOT ASPHALT, WHILE DIRECT TRANSMISSION IS THE CHOICE FOR 50 – 300 MM (2 – 12 INCH) LIFTS OF SOIL AND AGGREGATES.

Troxler 3440 Nuclear Soil Moisture Density Gauge

SUBGRADE AND UNBOUND LAYER

- SOIL DENSITY GAUGE
- NON NUCLEAR TECHNOLOGY
- USES ELECTROMAGNETIC RADIATION IN THE MICROWAVE BAND OF THE RADIO SPECTRUM, AND
- DETECTS THE REFLECTED SIGNALS FROM SUBSURFACE STRUCTURES.

TransTech Systems

Soil Density Gauge (SDG200)

CIVILCORE CONFERENCE ON RESEARCH IN ENGINEERING 2020

SUBGRADE AND UNBOUND LAYER

- PROOF ROLLING
- TO CHECK ON SUBGRADE WEAK AREA BY HAVING IT ROLL WITH 50 TONNES MOVING LOAD.
- CARRY OUT AFTER FINAL COMPACTION BUT WITHIN THE OMC

ASPHALTIC LAYER

- FALLING WEIGHT DEFLECTOMETER
- LIGHT WEIGHT DEFLECTOMETER

ASPHALTIC LAYER

- PAVEMENT QUALITY INDICATOR 380
- NON NUCLEAR TECHNOLOGY
- USES ELECTROMAGNETIC RADIATION IN THE MICROWAVE BAND OF THE RADIO SPECTRUM, AND
- DETECTS THE REFLECTED SIGNALS FROM SUBSURFACE STRUCTURES.

CIVILCORE
CONFERENCE ON RESEARCH IN ENGINEERING
2020

ASPHALTIC LAYER

CIVILCORE
CONFERENCE ON RESEARCH IN ENGINEERING
2020

CONCLUSION

- REVIEW SPECIFICATION IN RELATION TO DENSITY TEST METHOD.
- CONSIDER NEW PARAMETERS - STRENGTH LAYER READING THUS PERFORMANCE BASED CONTRACT?
- SPECIFY NEW METHOD IN JKR EXISTING CONTRACT FOR ROAD PROJECTS?
- APPLICATION JUST FOR THE GUIDANCE FOR THE COMPACTION WORK?
- HELP BOTH SUPERINTENDING OFFICER AND CONTRACTOR IN GETTING CONTROL OF THEIR PAVEMENT COMPACTION WORK

THANK YOU FOR YOUR ATTENTION

CIVILCORE
CONFERENCE ON RESEARCH IN ENGINEERING
2020

EXAMPLE

Rolling Straight Edge

Profilometer

CIVILCORE
CONFERENCE ON RESEARCH IN ENGINEERING
2020