The many and varied uses of Asphalt Concrete

RACE TRACKS

By JP Michaut

Content

- Race track specificities
- Asphalt concrete formulation
- Few examples
- Conclusion





Race track specificities

- Driver safety
  - Skid resistance : wearing course texture
  - Rainwater drainage : visibility
- High tangential stresses due to:
  - Brutal braking and acceleration
  - Bend entrance and exit with short radius
  - Special wide tires





Race track specificities

- Texture and tyre wear: compromise must be found
- Texture wearing course durability
- Wearing course homogeneity
- Use whatever the weather
- No traffic
- Specific design
- Main heavy traffic during construction

Race track specificities

- Tangential stress resistance
  - Aggregate stripping
  - Binder bleeding
  - Mechanical properties
- High evenness level
  - Driver safety
  - F1 behavior

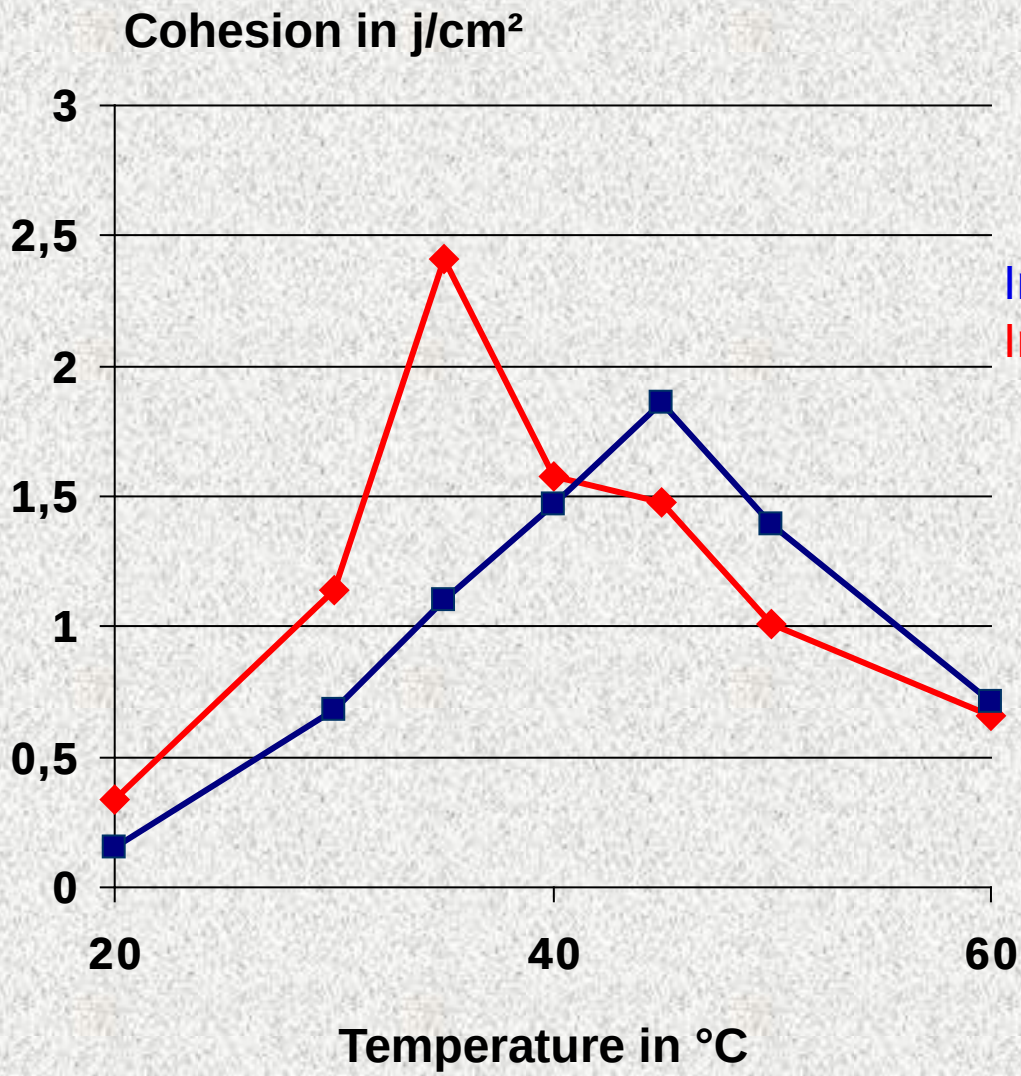
Specific asphalt concrete formulation

- Good aggregates (intrinsic properties)
- Right formulation (generally gap graded)
- Thin asphalt concrete (3 to 5cm thick)
- Maximum size D=10mm
- Macro texture range (best compromise between wearing course texture and tyre wear)

Specific asphalt concrete formulation

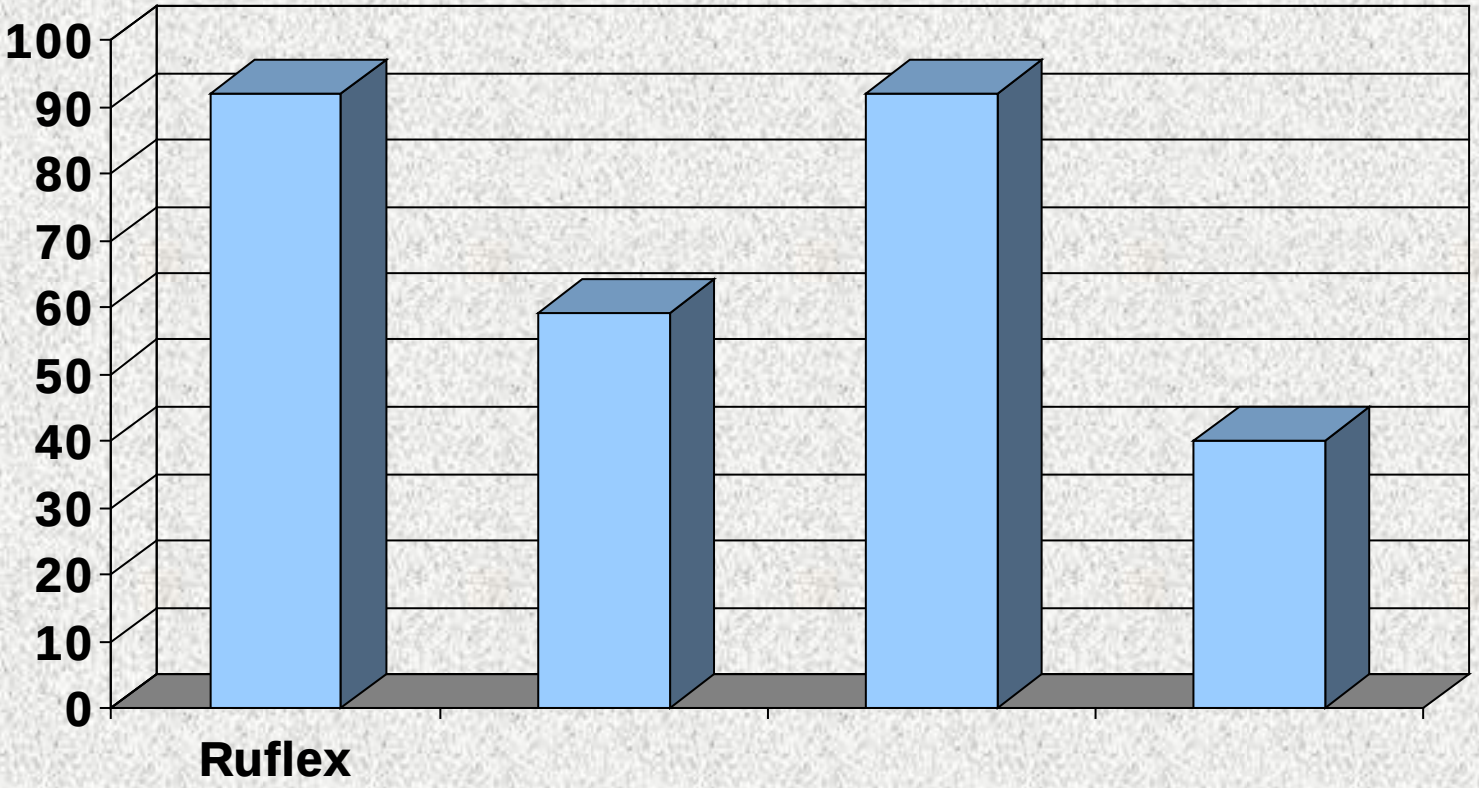
- Modified bitumen for increasing binder cohesion (to avoid aggregate stripping)
- Good mechanical performances mainly surface shear resistance
- Need specific tests

Cohesion improvement



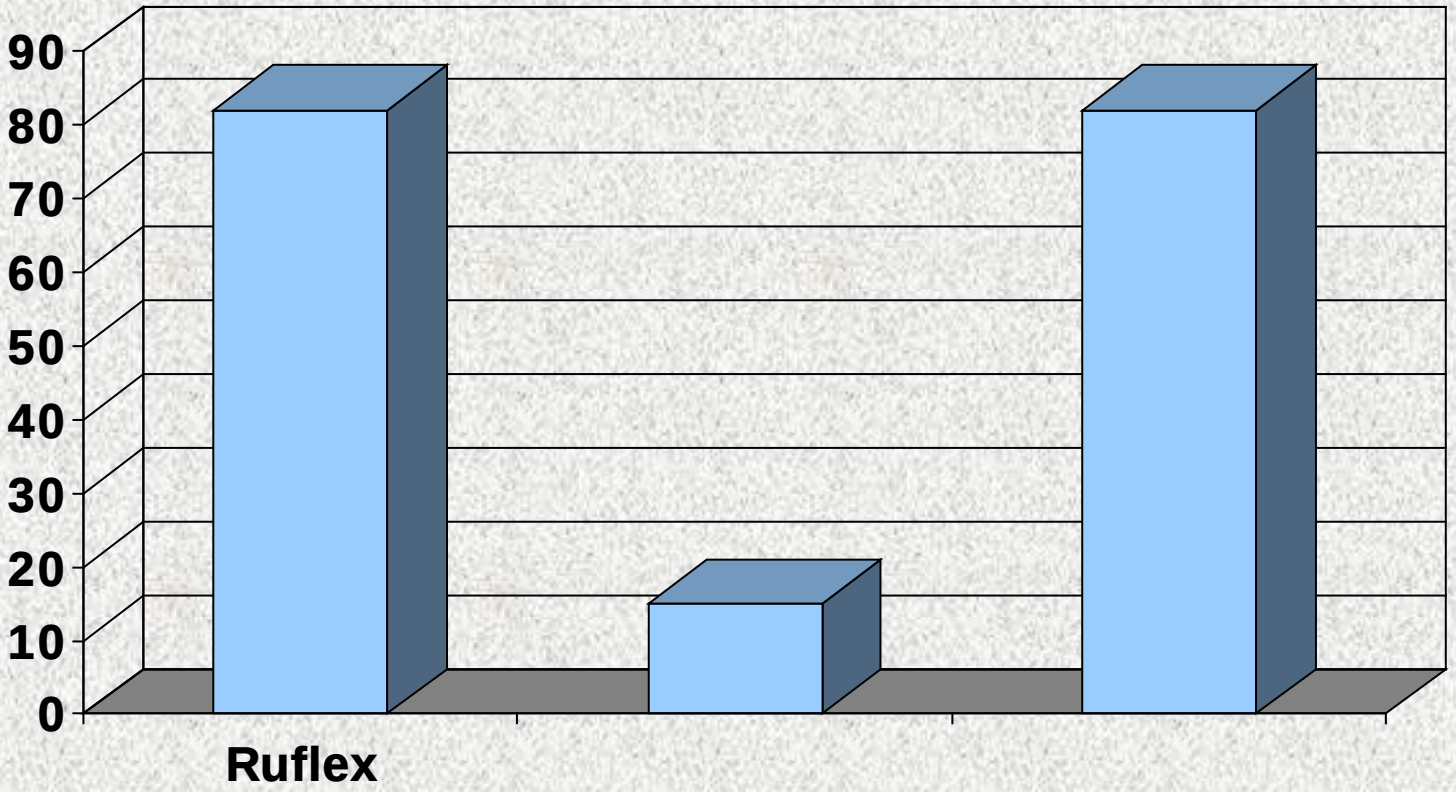
In blue traditional
In red special binder

Particle loss of asphalt concrete



LA equipment at 18°C

Particle loss of asphalt concrete



At - 10 °C

Results

Good result

Bad result





Few examples

- Magny-Cours (Center of France)
- Castelet (South of France)
- Rockingham (U K)
- 24 h du Mans race track (West of France)

Magny-Cours

- Thin asphalt concrete called BBM
- Colas 1990: RUFLEX 0/10
  - 6/10: 67%
  - 0/2 : 30%
- Limestone filler: 3%
- Binder content : 5.6%
- Modified binder
- Specific test to characterize cohesion

Castelet race track : south of France

- Thin asphalt concrete BBM c 0/10
  - 6/10: 22%
  - 2/6: 40%
  - 0/2: 37%
- Limestone filler 1%
- Binder content 5.8%
- Highly modified binder
- Carried out 2001

Castelet race track : south of France

Rockingham race track

Rockingham Motor Speedway - 25th April 2001

Rockingham race track

- Thin asphalt concrete
- Specific formulation: Rugocompact
  - 6/10: 20%
  - 4/6: 50%
  - 0/2: 25%
- Limestone filler: 5%
- Highly modified binder

Rockingham Motor Speedway - 25th April 2001

Le Mans race track

Circuit des 24 Heures du Mans

RD 338

Hunaudières straight line

July 2011





Technical requirements

- Macro texture
  - 0.70 ≤ Texture Depth Average ≤ 0.90
  - And TDA ≥ 0.50 in all points
- Evenness according to French specifications

	SEUILS		
Bandes d'ondes	*de spécification*	*d'application de pénalités*	*de réfection*
Short wavelength	*100% des notes ≥ 6* *90 % des notes ≥ 7*	*pas plus de 10% des notes < 6* *et 0% des notes < 5*	*Si plus de 10% des notes < 6* *ou au moins 1 note <5*
Medium wavelength	*100% des notes ≥ 7* *90% des notes ≥ 8*	*Si non respect des spécifications*	
Long wavelength	*100% des notes ≥ 7* *80% des notes ≥8*	*Si non respect des spécifications*	

Other technical requirements

- BBM b asphalt concrete type
  - class 3 according to EN 13108-1
- High PSV value for France (53) generally 50
- Modified binder ER > 70%

BBM type b 0/10

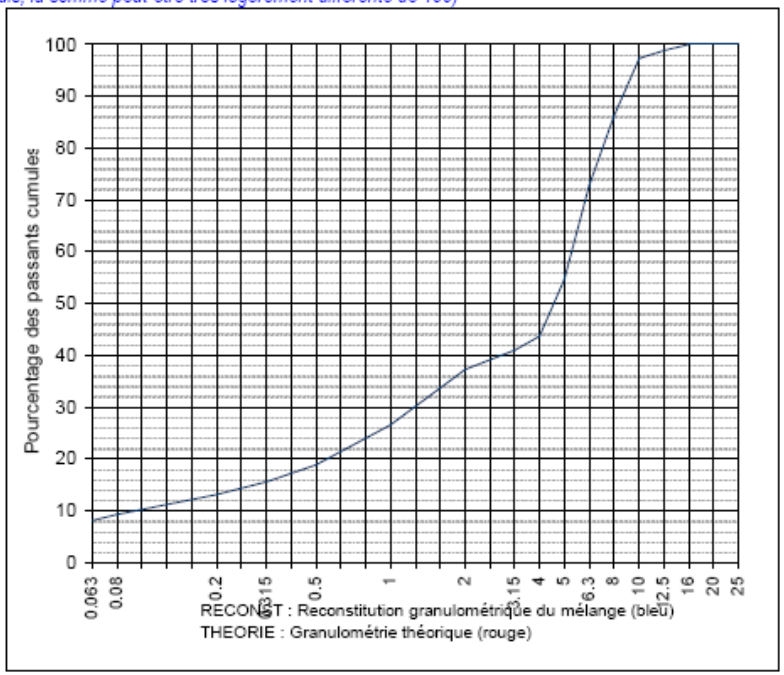
Etude du 17/06/11 **Niveau: 2**

Composition de l'enrobé

		Convention en vigueur selon normes Européennes	Ancienne convention (normes françaises)
6/10	Voutre	21.00 %	22.2 %
4/6	Voutre	36.5 %	38.6 %
0/2	Voutre	33.0 %	34.9 %
Filler		4.0 %	4.2 %
		100%	100%
Liant	COLFLEX PA LT	5.50 %	5.82 ppc
Total liant	*Spécif: ≥ 4.95%*	*5.50 %*	*5.82 ppc*

Convention en vigueur: Les fractions massiques des constituants (%) sont exprimées en masse de liant ou de granulats par rapport à la masse de l'enrobé (compte tenu des arrondis, la somme peut-être très légèrement différente de 100)

TAMIS AFNOR #	RECONST	P014/2010
25	**100**	
20	**100**	
16	**100**	
14	**100**	
12.5	**99**	
10	**97**	
8	**86**	
6.3	**73**	
5	**55**	
4	**44**	
3.15	**41**	
2	**37**	
1	**27**	
0.5	**19**	
0.315	**16**	
0.25	**14**	
0.2	**13**	
0.125	**11**	
0.08	**9.3**	
0.063	**8.2**	
MVRg	2.675	



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es Laboratoires Routiers

Hunaudières straight line

- Low temperature asphalt concrete
- Decrease mixing and laying temperature (saving energy and GHGE)
- Specific binder with additive (140/150°C)
- Laboratory study (Water resistance, gyratory and rutting)
- Results meet requirements for this type of thin AC

Surface spécifique	(m²/kg)	I	=	15,5
Module de richesse		K	=	3,40
Masse Volumique Réelle de l'enrobé	(g/cm3)	MVR	=	2,459
Densité moyenne en place estimée		Mve	=	2,26

ETUDE P.C.G. (NF EN 12697-31)		
Température = 165 °C		
Pente k = 4,580		
Girations	Vides (%)	Spécifications
40	10,6	7 à 12 %

SENSIBILITE A L'EAU à 18 °C (NF EN 12697-12)			Spécifications
Résistance en compression lot "sec"	12070	KPa	
Résistance en compression lot "humide"	10960	KPa	
Rapport i/C	91	%	≥ 70
Masse volumique apparente MVA	2,240	g/cm3	
Pourcentage de vides V	8,9	%	

Module (NF EN 12697-26) Fatigue (NF EN 12697-24)	
Module en MPa (15°C,10Hz)	Spécifications
Fatigue en µdef (10°C,25Hz)	Spécifications

ORNIERAGE (NF EN 12697-22)		
Cycles	Profondeur d'ornière (%)	Spécifications
30 000	6,1	≤ 10%

Agrément LABOROUTE N° 94-17 délivré par la comission

Surface spécifique	(m²/kg)	I	=	14.4
Module de richesse		K	=	3.45
Masse Volumique Réelle de l'enrobé	(g/cm3)	MVR	=	2.459
Densité moyenne en place estimée		Mve	=	2.26

ETUDE P.C.G. (NF EN 12697-31)		
Température = 135 °C		
Pente k = 3.768		
Girations	Vides (%)	Spécifications
40	11.2	7 à 12 %

SENSIBILITE A L'EAU à 18 °C (NF EN 12697-12)			Spécifications
Résistance en compression lot "sec"	10954	KPa	
Résistance en compression lot "humide"	9366	KPa	
Rapport i/C	86	%	≥ 70
Masse volumique apparente MVA	2.251	g/cm3	
Pourcentage de vides V	8.5	%	

Module (NF EN 12697-26) Fatigue (NF EN 12697-24)	
Module en MPa (15°C,10Hz)	Spécifications
Fatigue en µdef (10°C,25Hz)	Spécifications

ORNIERAGE (NF EN 12697-22)		
Cycles	Profondeur d'ornière (%)	Spécifications
30 000	5.2	≤ 10%

Agrément LABOROUTE N° 94-17 délivré par la comission

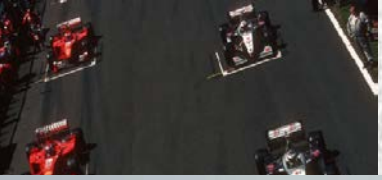
Obtained results

Laying Equipment

- Modified binder plant
- Mixing plant close to Le mans
- Milling equipment with Laser guidance
- 2 pavers in parallel + 1more for connection
- 3 vibratory rollers
- 12 semi-trailers for asphalt concrete delivery
- 4800 t of BBM b

Chicane milling

BBM b 3^{E} laying



Chicane entry (2010)

Conclusion

- Asphalt concrete wearing course for race tracks: specific formulation
- Thin asphalt concrete (0/10)
- Highly modified bitumen (ER> 70%)
- Specific test
- Right micro texture
- Evenness is essential

- Don’t forget laying (need means)

Thank you for your attention

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