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Experiences with Low Temperature Asphalt in Finland

Lemminkäinen

LTA
Experiences in Finland

- Different LTA-techniques.
- LTA, Principles and common sense
- History of foam-bitumen and foam-asphalt
- Finnish experience of LTA
- LTA, Benefits and challenges

LTA, Low Temperature Asphalt

- **LTA / Low Temperature Asphalt**
  I prefer to use the word LTA!
  WAM (warm asphalt mix) is a brand name of our competitor
- LTA can be produced by different techniques!

  Foaming:
  - foaming of the binder
  - two binders – foaming the other one (WAM)
  - moist sand (LEA)
  - additives that foam (zeolite)

  Additives:
  - waxes
  - waxes + adhesion promotors

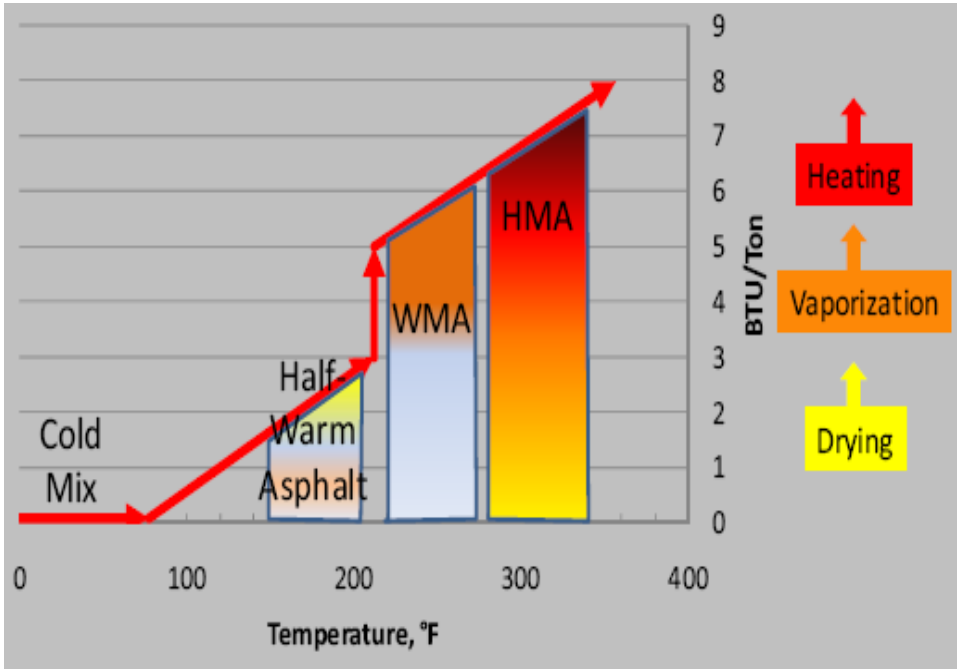
  Others:
  - binder choice (soft binder; emulsion)

LTA-methods
(WMA-methods)

There are different LTA-methods:

- Using additives which improve the mixing and workability. (*waxes!)*
- Foaming of the bitumen
- Some other techniques.

Lemminkäinen has chosen the foaming technique!



LTA / Foaming technique

Foamed bitumen

- 1,5 – 2,5 % water (calc. on bitumen) is lead/sprayed into the hot bitumen → the volume of the bitumen grows 15-20 fold.
- The large binder-volume speeds up the mixing process. The aggregate is coated faster → the mixing time can some times be shortened (~ 5-10 sec). The foamed bitumen is ”fluent” (low viscosity for a certain time). The foamed bitumen has a ”lubricating” effect → the workability is improved (for a certain time).
- Every % of water that is used in the foaming (evaporated), reduce the binder temperature ~22 °C.
- The bitumen has to be hot enough! Prefferably > 150 °C (or even higher). (This might be a practical problem!)

LTA, Low Temperature Asphalt

- A hot topic in the asphalt world!
  EAPA (European Asphalt Pavement Association) is promoting LTA (WAM) actively!
- *Marketing:*
  By using reduced temperatures, we can achieve:
  - better working conditions
  - lower emissions
  - less hardening in the binder
  - slightly lower energy-consumption

  Silence about:
  By lowering the temperature, we can get following challenges:
  - quality
  - reduced workability and/or working time
  - some technical problems in the factory
  - additional investments and costs

LTA, Low Temperature Asphalt

- A hot topic in the asphalt world!
- **Notice! Think!**
- Our normal hot mix asphalt (HMA) is a good and safe process! As long as we use the Temperatures recommended in different standards and guide-lines!
- The emissions from hot mixes are rather low when the temperature is below ~ 170 °C.
- The emissions (exposures) are doubled/halved every 11-12 °C.
- 10 °C lower temperature saves energy 0,2-0,3 l oil/ton
- Our temperature-recommendations are ”conservative” in our standards and guide-lines!
  - The lower temperature limit is often too high (for LTA)! (LTA not considered)
  - The upper temperature limit is for some mixes too high!
  - We live in a cold climate!
  - Hand laying should not steer the production temperature!

  Our temperature recommendations should be checked, (Standards & Autorities!), if we want to improve our working environment!

LTA, Low Temperature Asphalt

- **Common sense!**

  Use LTA, when it is possible!
  In the warm period (summer), LTA is a good alternative to HMA. In the early spring or late autumn, You might get problems!

  LTA has to fit into the production-plan!

- **Calculation of the mix-temperature!**

  Following parameters have a hugh impact on the needed mix-temperature (laying- and compactiontemperature as well):
  - outside temperature
  - wind velocity
  - pavement thickness
  - transport distance (&waiting time)

  There are calculation-programs for that!

- **Attitude!**

  The whole organisation should understand the importance of temperature control!
  The asphalt factory is a modern process-industry!
  The hand-laying crews should not plan and steer the production!

- **Over-temperatures**

  The best way to reduce the temperature is to cut out the over-temperatures that sometimes are used!
  Attitude!

LTA / History & Foaming technique
Lemminkäisen´s experiences / 1

- First asphalt pavements, where foaming was used, were made in 1983 in Kustavi. Foam AC 16 was produced. Idea was to save bitumen! – Not LTA! The pavements behaved well!
  Not possible to continue with lower bitumen because of the standards!
- 1985-1986 Foam-bitumen stabilization started. Foam bitumen has been a standard binder for stabilization after that!
- The first LTA-pavements in Finland were made in the Pori-region in 2004. Foaming technique was used.
  - Luvia test road
  - Pori harbour
- Some LTA-pavements (foam) have been made almost every year since that.
- In the other countries as well different trials with LTA have been made – both with additives and with foam.
- In the last 2-3 years Lemminkäinen has put a lot of focus on LTA-pavements. We produced >160.000 tons LTA in 2014.

LTA / History & Foaming technique
Lemminkäisen´s experiences / 2

- Lemminkäinen (Finland) has now installed foaming equipments into 9 asphalt factories. Internationally we have ~20 plants equipped with foaming equipment.
  The first in Estonia 2015.
- Lemminkäinen in Norway and in Finland have made rather much LTA in 2014.
- In Norway, the Road Authorities have given a ”bonus” for mixes LTA-mixes produced with foaming technique *(no hazardous additives!)*
  The bonus has been given based on health reasons (Safety for workers)!

  LTA-volume in Norway was 7,7 % of the total asphalt market.
  (Finland ~3,5 %)

- ”Low Temperature Asphalt – project” continues in all Lemminkäinen Paving companies!

LTA / Foaming technique Benefits

- Our experiences in Finland are mainly good.
- Different test sections show that:
  - in summer conditions we can make good AC-pavements in temperatures down to 125 °C. Below that – quality problems!
  - LTA with small RAP-additions is OK.
  - The durability of the LTA-pavements is OK after 10 years in use.
- It is possible to reduce Temperature up to 30 °C! In summer conditions!
- A large part of our LTA-pavements have been made with a smaller temperature reduction (10-15 °C)!
- Small savings in energy and emissions (CO_2) have been achieved!
- Faster mixing! Better output.
- Less hardening of the binder. Quality & Durability!?
- Safety for workers is improved! Less exposure to bitumen fumes!

LTA / Foaming technique Challenges / Problems

- Investments are needed! Some methods increase the costs!
- Quality. If the temperature is decreased too much, the workability gets worse. (Laying, compaction, void contents). You have to know the limits!
- Maintenance & Cleaning. Higher moisture in the asphalt mixer lead to a bigger need of cleaning and maintenance. Following problems have been noticed:
  - clogging of nozzles (cleaning)
  - scales get dirty. (wet filler – cleaning)

  Don´t go too down in temperature!
- High amount of RAP. In mixes with high amount of RAP, the volume of added binder is low. You do not have binder enough to foam!

LTA, Low Temperature Asphalt

- A hot topic in the asphalt world!
- By using reduced temperatures, we can achieve:
  - better working conditions — YES!
  - lower emissions — YES!
  - less hardening in the binder — slightly YES
  - slightly lower energy-consumption — in some cases YES

  By lowering the temperature, we can get following challenges:
  - quality — YES, if T too low
  - reduced workability and/or working time — YES, if T too low
  - some technical problems in the factory — YES
  - additional investments — YES

Lemminkäinen generally LTA experiences

- We can produce LTA at temperatures around 130 °C. In some cases (hot summer weather) slightly lower!

- A better working environment is then achieved. Less Emissions. Less Exposures (fumes, smoke and smell)

- Good quality
  - Homogenity (Less separation)
  - Good surface
  - Good workability (Laying & Compaction)

- Production capasity is often slightly increased
  - ~10 ton/h more

LTA

- Temperature Control!
- Over-temperatures cut!
- Common sense used!
- Right attitude!
- Good technical know-how and machinery

- **If YES! Then LTA is the future!**

- Thanks for listening!

Lemminkäinen

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