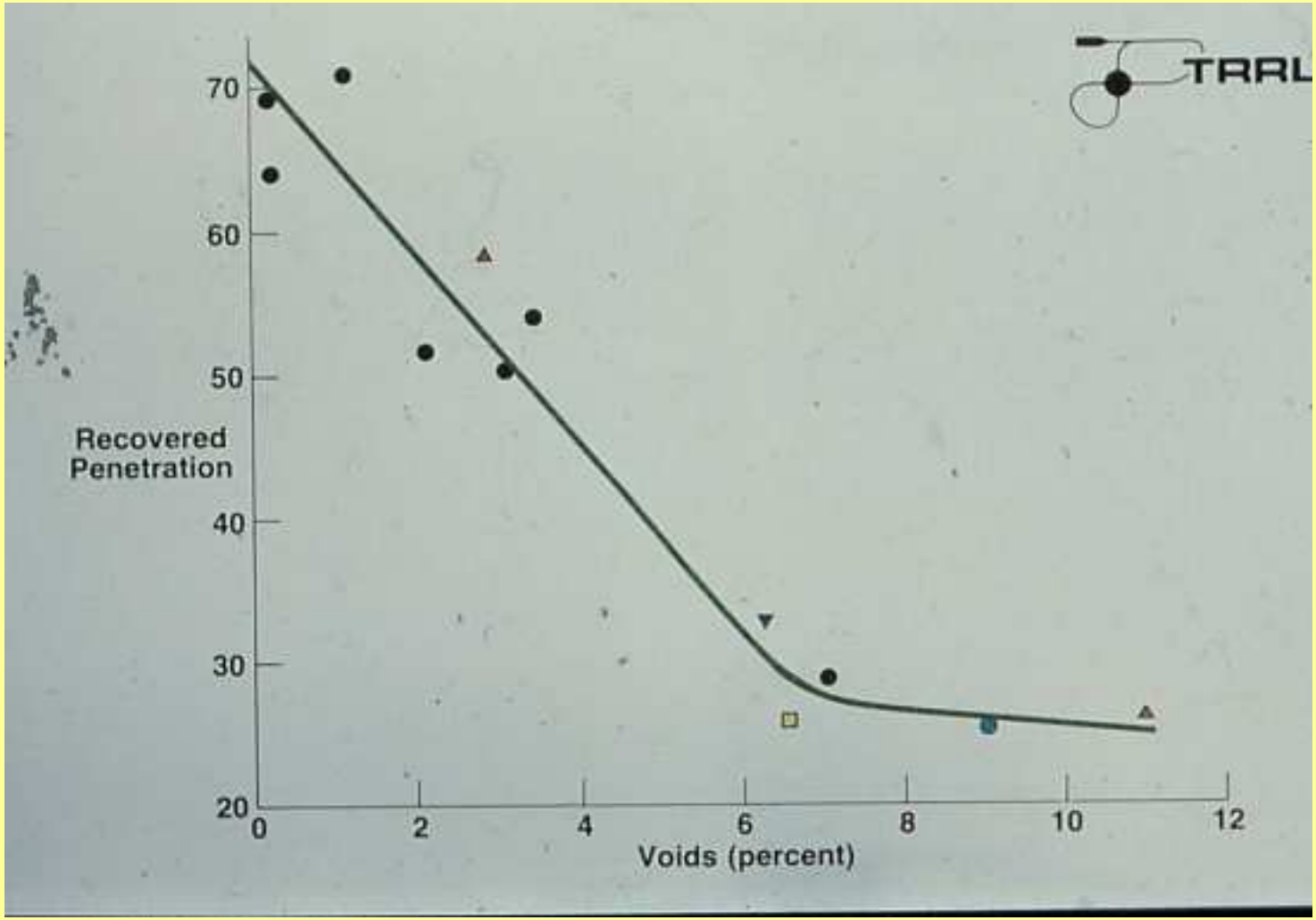
Part 6

Compaction and joints

Compaction in Nepal

Thanks to Colin Loveday

Compaction is ABSOLUTELY VITAL both for **durability** and strength



Compaction is ABSOLUTELY VITAL both for durability and **strength, ie stiffness** *With 6% voids, asphalt base is 1.8 times as stiff as with 12% voids)*

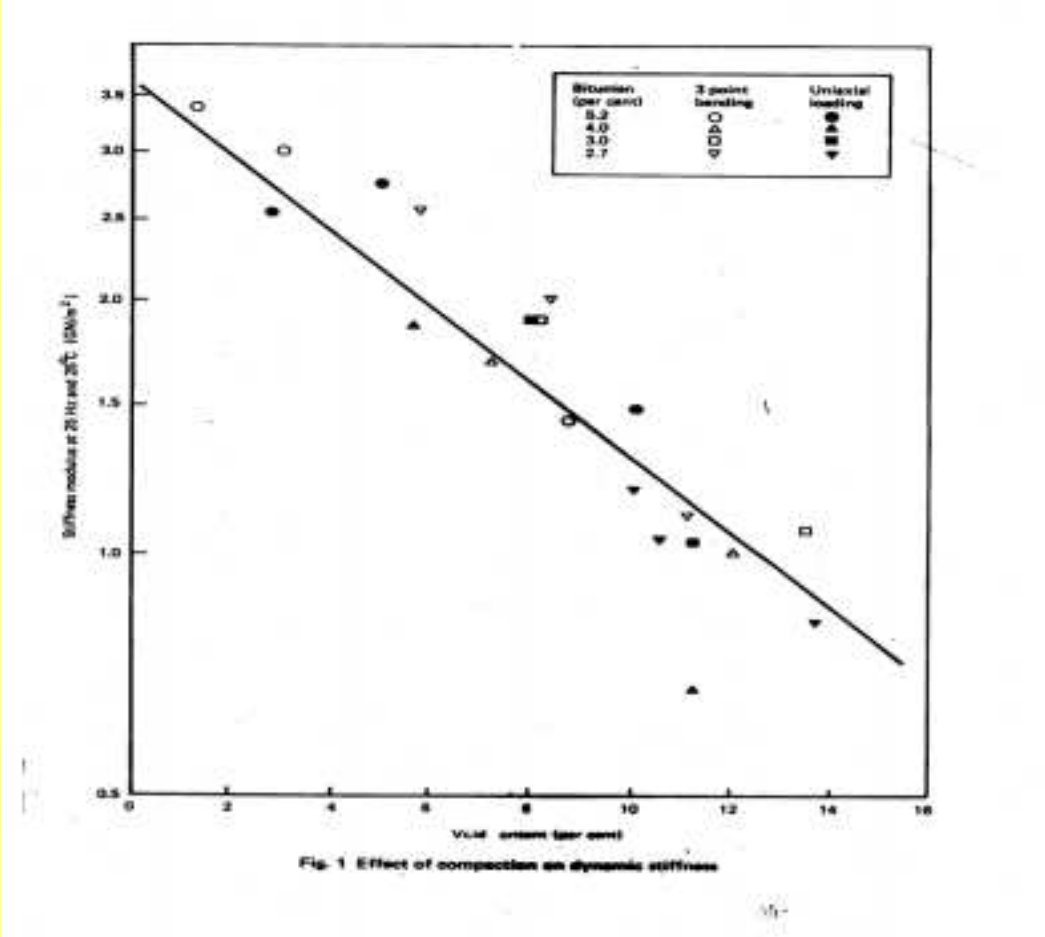


Fig. 1 Effect of compaction on dynamic stiffness

Good compaction depends on strong support layers

Sub-base and capping are the cheapest materials in road pavements

BUT

They are the most expensive to remedy if you get it wrong

Soft spot in formation

DBM 50 on a weak sub-base

Hamm 8-10 tonne deadweight roller, with cutting wheel, current UK industry standard

State of the art, vibrating roller (*Note German bevelled joint-cutting wheel and grit hopper for use on SMA's)*

2 Tonne vibrating roller *Note that Highways England are re-introducing roller trials in their spec because so many contractors use these instead of 8-10 tonne deadweight rollers*

Q. When is compaction complete?

A. When the asphalt stops moving.

Coring to check compaction *This needs to be delayed by at least 8 hrs after laying then the Lab test results will be available about 36 hrs after laying.*

Nuclear density gauge *This needs to be calibrated against cores before works start but will give a result within 2% of core density in about 5 minutes, with a good operator*

You can also use a non-nuclear density gauge, which is safer, has no Nuclear Radiation Protection Board hassle, but is just as easy to use.

It is also permitted by SHW and BS594987.

Non-nuclear density gauge

There should NEVER be roller marks on the finished job

At least 80% of the asphalt's compaction is done by the paver *The tapered area of asphalt was laid by hand so only compacted by the rollers. All this HRA is 25 years old*

JOINTS

Even the best-laid asphalt always eventually fails at the joints

Many surface course joints fail within 2 or 3 years, some even less, all because they were poorly made.

Water gets through poor joints, then beneath the mat and delamination and potholing start.

It is therefore most important that joints are made with the necessary care if the job is to give good service

BS594987: clause 6.8 Surface course joints

All longitudinal and transverse joints in surface courses shall be made flush.

Before the adjacent width is laid, surface course joints shall be made by:

a) **cutting** back the edge to a vertical face that exposes the **full thickness** of the layer; and

b) discarding all loosened material and **painting** or spraying the vertical face completely with a thin uniform coating of **hot applied 40/60 or 70/100 paving grade bitumen,** or cold applied thixotropic bituminous emulsion of similar grade or polymer modified bitumen emulsion bond coat.

6.8.3 Joints in other courses

Joints in other courses (e.g. base and binder course) shall be treated in such a way as to enhance compaction and bonding.

Additionally, SHW Clause 903 requires:-

joints to be cut and painted in binder courses less than 60mm thick

over-banding 150mm wide
of joints in base and binder courses

voids within 100mm of joints to be max. 2% greater than in the mat

Over-banded binder course joint, to SHW clause 903

Note setting out line for surface course off-set by 300mm on RHS

Result of very poorly made joint in binder course

SMA, 6 months old joint, laid too cold

SMA joints, 12 months old, not cut, not painted

Cut and painted but in VERY cold weather

Bevelled edge of mat roller on SMA in Germany,

Now common in UK, excellent. Also nuclear gauge

Forming / cutting of joints - verticality is not important if using German rollers

- All joints in all layers should be cut vertical [BS 594987: 6.8] and painted
  - HA require NDM on joint but this is rarely invoked on LA work
- For TSCS/SMA AT LEAST an amount equal to the layer thickness must be removed
- Joint rollers are <u>strongly</u> recommended
  - Look out for new HA IAN
  - Verticality is less important than good compaction

Trimming edge of first mat, SMA, Germany *Note use of diamond cutting wheel, with no guard but 70degree cut*

The “Tar pot” ie hot bitumen tank/heater for joint work

Painting joint with hot bitumen, Germany

UK, applying bitumen to mat edge

Cold jointing emulsion, OK for patching but not best for good paver work

Note that Colas make a polymer modified cold jointing emulsion which is not as good as a hot bitumen but better than tack coat or bond coat emulsions

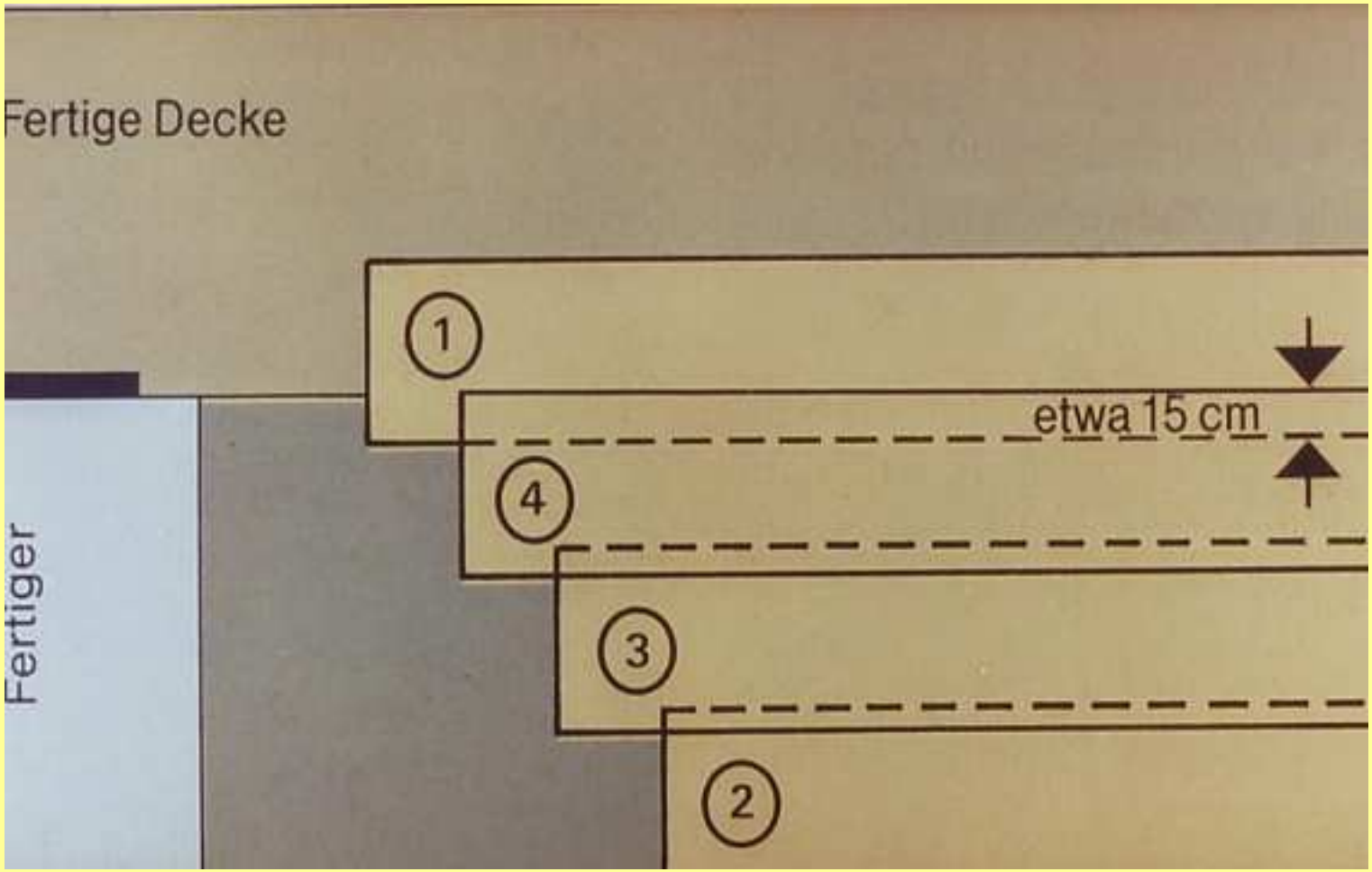
Perfect paving, in echelon, no exposed asphalt in paver hoppers

Deep joint, with step

Tarmac’s very first SMA, all joints cut

Tarmac’s first SMA joint, 12 years later

Correct rolling pattern, any mat, German slide



SMA, 6 months old joint, laid too cold

Worth trying if all else fails, ASI.

Infra-red repairs to failing HRA joints in 2006

Same area, 9 years later

Joints are always weak areas.

Even in a well-laid mat,

the joints will fail first.

Joint in 25 years old HRA

Joints, BS 594987 6.8.1

"Joints shall be made by cutting back the edge to a vertical face ….and painting the face completely with a thin uniform coating of hot applied 40/60 pen or 70/100 pen paving grade bitumen…"

Additionally….

SHW requires:-

Joints in all binder courses less than 60mm thick to be treated as surface course joints

Joints in all base layers to be over-banded with K1/50 or /60 75mm either side of the joint

FULL COMPACTION AND PROPERLY

MADE JOINTS ARE ABSOLUTELY

VITAL IF YOU WANT DURABLE ASPHALT

MORE ASPHALTS FAIL DUE TO POOR

COMPACTION and/or POOR JOINTS

THAN ANYTHING ELSE

Any questions?