Premium

Nynas Endura Z

HOT AND WARM MIX ASPHALT APPLICATIONS

v. 4.0, Jan 2018

Nynas Endura is a Premium product range. All Nynas Endura products are designed to deliver the ultimate level of performance. The Nynas Endura Z product group is specifically engineered to deliver an optimum balance of performance versus value in hot mix and warm mix asphalt applications.

Product Overview

Nynas Endura Z is a versatile product group designed for hot mix asphalt applications where confidence of superior performance is needed throughout the product's life cycle. The skilful combination of modifiers and selected bitumen feedstock ensures enhanced performance throughout the working life of the product. The balance of structural contribution, deformation resistance and flexibility are complemented by extended workability and ease of compaction.

Getting the balance between high performance, workability and early opening to traffic has been a longstanding challenge within the asphalt industry. Nynas Endura Z products have been formulated to deliver the solution. Asphalt mixtures incorporating Nynas Endura Z products have been opened to traffic significantly earlier than would have been possible with standard paving grade or traditional polymer modified asphalt.

Nynas Endura products comply with EN 14023 and can be characterised using traditional test methods (see Table 1. below). However, more sophisticated test methods such as rheological profiling gives a better indication of the exceptional performance of these binders.

TABLE 1. TECHNICAL DATA

PROPERTY	UNIT	TEST METHOD	Nynas Endura Z2	Nynas Endura Z4
Penetration @ 25 °C [1]	0.1 mm	EN 1426	10-40	25-55
Softening point	°C	EN 1427	> 80	> 75
Force ductility	J/cm²	EN 13589	≥ 2 at 15 °C	≥ 3 at 10 °C
Fraass breaking point	°C	EN 12593	< -7	< -20

Asphalt Mix Types

The Nynas Endura Z group of products is suitable for use in all types of dense asphalt mixtures. The use of Nynas Endura Z binders will significantly enhance the toughness, rutting resistance and flexibility of any well designed asphalt mixture. Nynas Endura Z binders are particularly suitable for use in high stress / demanding applications. Optimum performance in any application can only be achieved through appropriate mixture design and best practice construction techniques.

Product Application

Nynas Endura Z binders are particularly suited to surfacing applications and have a proven performance history in the most demanding applications across Europe including: container storage areas, bus lanes & depots, race tracks, docks and airfields.

1 The penetration ranges in Table 1 are for certification purposes. Nynas specifications may be more rigorous. For specific data, please check the appropriate Product Data Sheet, PDS, which can be downloaded from nynas.com.

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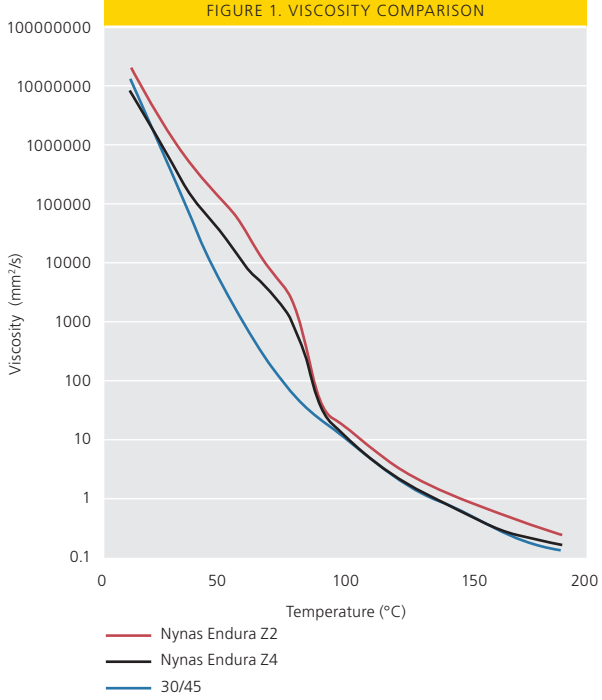
Product Performance

WORKABILITY AND OPENING TO TRAFFIC

Thorough compaction is a prerequisite to satisfactory performance of asphalt regardless of type or location within the pavement structure. Nynas Endura Z binders have been developed to ensure ease of placement and compaction. An indication of this is represented by the viscosity comparison graph shown in Figure 1.

FIGURE 1. VISCOSITY COMPARISON



Traffic delays due to maintenance works can be costly. Essential maintenance work is often carried out during night closures to minimise disruption to normal traffic flows. Traditionally surfacing work needs to be completed several hours before re-opening to allow the material cool and develop sufficient stiffness to withstand traffic loading. In UK current best practice[2] recommends the asphalt surface cools to 25 °C and the mid-mat temperature is below 40 °C before opening to traffic. During hot weather a 24 hr 'curing' period is suggested. In combination with asphalt design, Nynas Endura Z binders can minimise the period needed between completion of the surfacing operation and opening to traffic.

Figure 2 provides an indication of the improved early life resistance to deformation that can be achieved using Nynas Endura Z binders.

FIGURE 2. DEFORMATION VERSUS RELATIVE COMPACTION. DENSE ASPHALT BINDER COURSE, SUBMERGED AT 50 °C, STEEL WHEEL

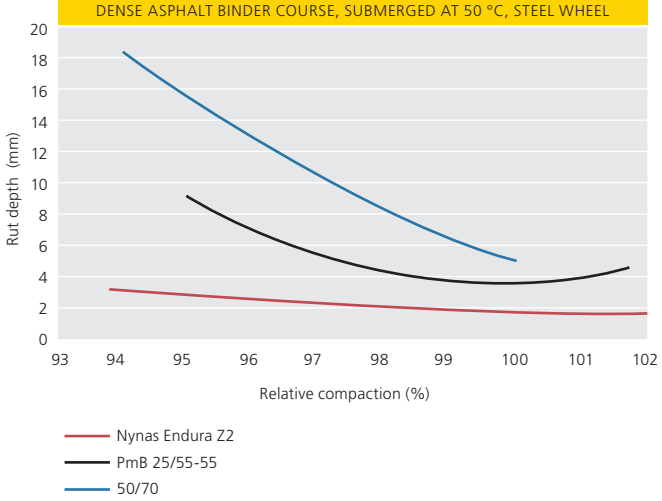


FIGURE 3. WHEELTRACKING RESISTANCE OF NYNAS ENDURA Z2 (RIGHT) COMPARED TO 40/60

RESISTANCE TO DEFORMATION

The rheological parameter G*/sin δ is an indication of a binder's ability to resist permanent deformation particularly at high temperature. Nynas Endura Z binders are highly resistant to deformation at high temperature, with much higher values of G*/sin δ compared to a paving grade bitumen, see Figure 4.

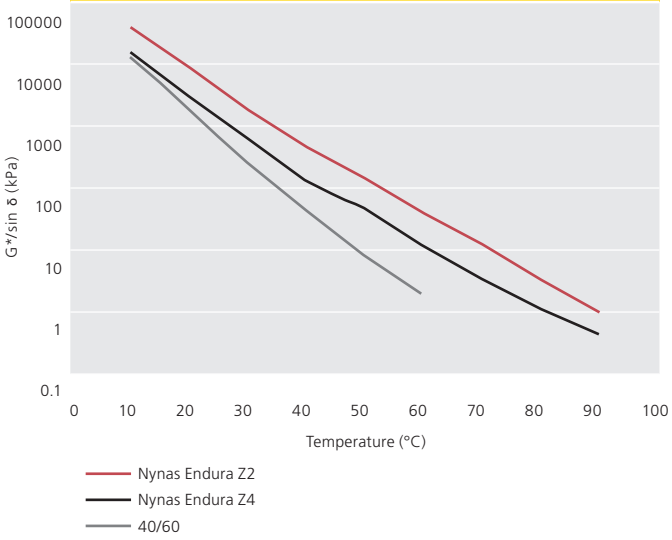
Resistance to deformation is often assessed using laboratory wheel tracking tests. Various test methods and conditions have been developed based on local experience (see Figure 3). All are designed to assess the rutting potential of compacted asphalt under specified loading and temperature conditions; related to expected end use.

The Nynas Endura Z product range exhibits exceptional resistance to deformation in any well designed asphalt mixture.

2 BS 594897, 'Asphalt for roads and other paved areas. Specification for transport, laying and compaction and type testing protocols.'

Extensive laboratory studies have shown that the Nynas Endura range of binders can deliver exceptional deformation resistance in well compacted asphalt mixtures (see Figures 2 & 3).

FIGURE 4. G*/SIN δ. INDICATOR OF THE RUTTING POTENTIAL OF BINDERS



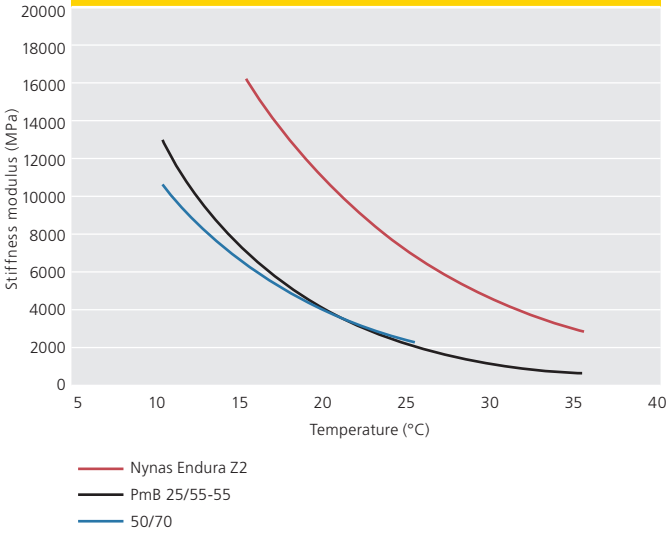
Conventional asphalt is not suited to applications where static loading is an issue. However, asphalts produced with Nynas Endura Z binders have been proven to have significantly improved resistance to heavy static loads in areas such as container terminals (Figure 5). The exceptional performance of asphalt produced with Endura Z binders offers a practical alternative to concrete.

FIGURE 5. HAMBURG DOCKS, POINT LOADING & LIFTING FRAME ON DENSE ASPHALT SURFACE COURSE INCORPORATING NYNAS ENDURA Z2

STRUCTURAL CONTRIBUTION

Asphalt is a thermoplastic, viscoelastic material, with it's ultimate performance influenced by traffic loading & frequency and climate. As temperatures increase or loading frequency decreases, the asphalt becomes less capable of spreading the load. Nynas Endura binders are less affected by temperature, load and frequency. Consequently asphalt produced with Endura Z is more capable of resisting increasing traffic load and temperature. (see Figure 6)

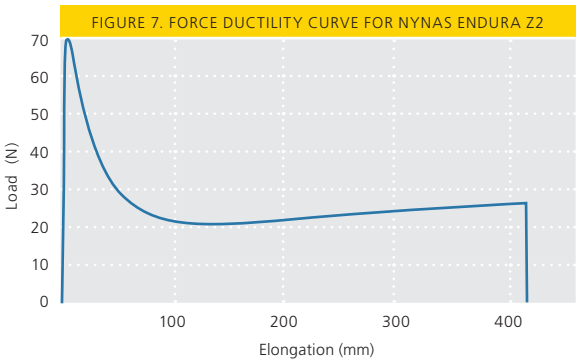
FIGURE 6. STIFFNESS MODULUS (ITSM) VS. TEMPERATURE. NYNAS ENDURA Z2 VS. 50/70.



FLEXIBILITY

Nynas Endura binders exhibit an excellent balance of stiffness and flexibility, which can be demonstrated using the force ductility test (Figure 7). In this test, binders are conditioned to a reference temperature (usually 5 or 10°C) and extended to 400mm. The energy used to extend the binder between 200-400mm is known as the cohesion energy and is a measure of the "toughness" of the binder. Nynas Endura Z binders exhibit significantly greater cohesion energies and elongation than paving grades with equivalent penetration range.

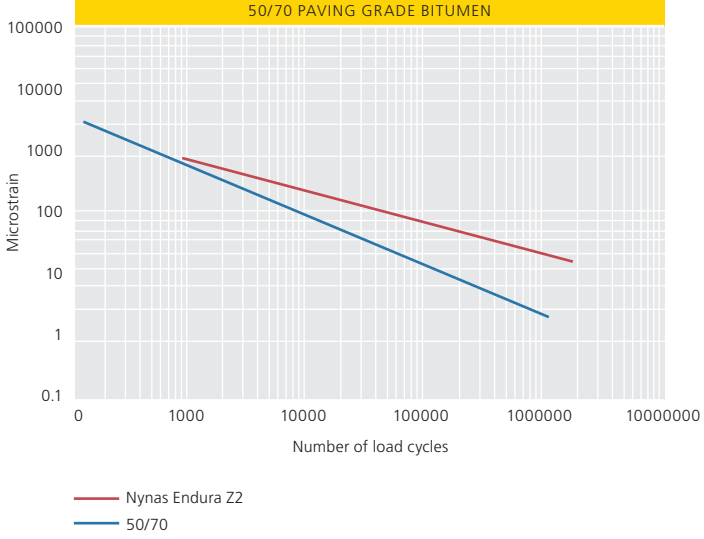
FIGURE 7. FORCE DUCTILITY CURVE FOR NYNAS ENDURA Z2



FATIGUE

Asphalt pavements are constantly subjected to stresses and strains caused by traffic which may, over a period of time, induce cracks. Resistance to cracking is commonly assessed using laboratory fatigue tests. Asphalts produced using Nynas Endura Z binders have been proven to significantly out-perform paving grade binders in laboratory fatigue tests (see Figure 8).
Nynas Endura Z binders are designed to give the optimum balance of stiffness with flexibility and therefore deliver excellent deformation and crack resistance.

FIGURE 8. COMPARISON OF FATIGUE PROPERTIES, NYNAS ENDURA Z2 VS. 50/70 PAVING GRADE BITUMEN



SHEAR RESISTANCE

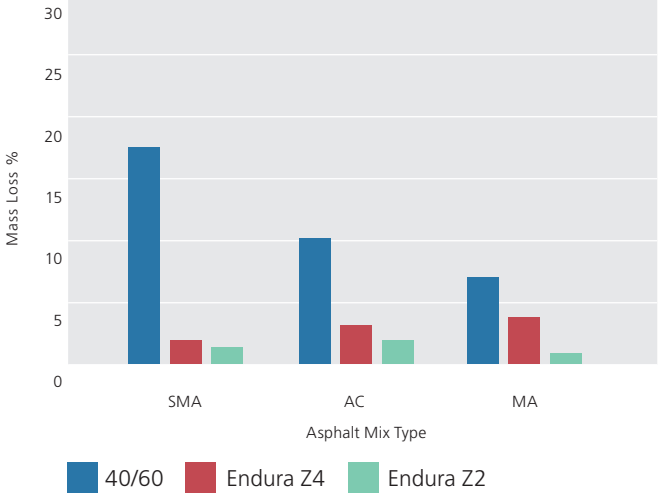
The interaction between tyres and the road surface can generate high levels of shear stresses within the bituminous film that binds the asphalt. In heavy use and specialist applications e.g. container terminals, airfields or race circuits these stresses can be very large. Toughness is a collective term often used to describe resistance to the various stresses that can be induced.
The complementary cohesive, tensile strength and fracture toughness properties of Nynas Endura Z binders are greater than any conventional bitumen or polymer modified binder. This ensures optimum performance regardless of the end-use.

FUEL RESISTANCE

The Nynas Endura range provides enhanced fuel-resisting properties to many types of asphalt. The degree of resistance is influenced by the type of asphalt mixture and the degree of compaction achieved (see Figure 9) Dense low-void mixtures in combination with Endura Z tend to perform well when exposed to fuel spillage.

Any fuel, or oil spillage should be removed as quickly as possible, so that any damage to the asphalt is minimised.

RESISTANCE TO FUEL - EN 12697-43 IMMERSION TEST



Binder Storage

Nynas Endura Z products are high performance specialist modified binders. Advice should be sought from Nynas Product Support before allowing the product to come into contact with other modified binders.

Nynas Endura Z binders are fully storage-stable and should be stored according to the following guidelines:

SHORT TERM HOT STORAGE (UP TO TWO WEEKS)

The recommended short term storage temperature for the Nynas Endura Z product range is 155 - 175 °C.

Reducing the storage temperature to 150 °C during periods when no asphalt production is taking place will help preserve the properties and performance of the binder.

Nynas Endura Z binders should preferably be stirred prior to use and daily during routine asphalt production. Alternatively the binder should be circulated before use but, in common with other hot asphalt binders, excessive circulation should be avoided.

Oxidative ageing can be reduced if the headspace above the binder is kept to a minimum and re-circulation is fed through the bulk material at the base of the tank rather than splash fed from the top.

PROLONGED HOT STORAGE (BEYOND TWO WEEKS)

Nynas does not recommend prolonged hot storage. However if this is unavoidable the tank should be circulated, sampled and tested every 7 days. Contact Nynas Product support for specific advice on assessing product suitability.

In exceptional cases where intermittent use is expected the temperature should be reduced to approximately 110 °C. If long term storage (over four weeks) is necessary the tank temperature should be reduced to 95-100 °C. This will minimise thermal/ oxidative degradation and reduce energy costs.

When bringing the product back to its normal storage/working temperature, intermittent heating should be used to prevent localised overheating. When the binder is at a suitable pumping viscosity it should be stirred or circulated for 2 hours before being sampled and tested. For advice on specific storage situations please contact Nynas Product Support.

Please refer to the Nynas Endura Z Safety Data Sheets (SDS) for advice on safe handling.

Binder Handling and Asphalt Production

The Nynas Endura Z premium products are modified binders that should be handled in accordance with normal industry best practice. During mixing Nynas Endura Z premium products will behave like equivalent paving grade bitumen and do not require any special attention or conditions, see also binder storage recommendations above.

The recommended mixing temperature range for Nynas Endura Z products is 155 to 175 °C, see Table 2 below.

The mixed asphalt should be laid as soon as practical after production. Prolonged hot storage of mixed asphalt is not recommended. Asphalt produced using Nynas Z binders should, ideally, be laid within three hours of mixing.

In-service, Nynas Endura Z products provide high levels of resistance to loading. During placement they facilitate improved workability. Some delay to initial roller placement may be necessary, which is best evaluated under specific site conditions. Typical surfacing temperatures are given in Table 3.

TABLE 2. TEMPERATURE GUIDANCE - ASPHALT PRODUCTION

ASPHALT PRODUCTION	BINDER TEMPERATURE (°C)
Flash point (EN ISO 2592)	> 235
Maximum handling temperature	190[4]
Mixing temperature range	155-175
Minimum pumping temperature	130

TABLE 3. TEMPERATURE GUIDANCE - SURFACING OPERATION

SURFACING OPERATION	ASPHALT TEMPERATURE (°C)
Ideal compaction range	155 - 110
Substantial completion of compaction	110

For binder and application-specific advice regarding surfacing operations, please contact Nynas Product Support.

Asphalt Testing and Quality Control

It should be noted that due the complex nature of the modifiers used in Nynas Endura Z binders some difficulties may be encountered when attempting to extract the binder using solvent-based methods. Binder ignition is therefore recommended as the most accurate method for determination of binder content.

Asphalt Loading and Transportation

It is recommended that asphalt mixtures incorporating Nynas Endura Z products are loaded and dispatched to site within 3 hours of manufacture.

As with any hot mix asphalt, the material should be protected against temperature loss. In all situations best practice working to minimise the risk of temperature loss should be adopted. The use of fully double sheeted insulated trucks is recommended regardless of ambient weather conditions. On discharge at site the asphalt should be sufficiently hot to allow time for effective compaction. As a guide a target paver-out temperature of 155 °C is recommended.

4 Eurobitume guidance recommends an absolute maximum handling temperature of 200 °C for paving grade binders. For binder and application-specific advice regarding mixing and handling temperatures, please contact Nynas Product Support.

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Paving and Compaction Operations

Nynas Endura Z products are designed to deliver exceptional performance in demanding situations. This can only be achieved if the asphalt mixture is properly designed and manufactured and a uniform pavement is constructed to best practice standards. Effective compaction and joint formation are keys to the performance of any asphalt. Particular care should be exercised to minimise temperature segregation and ensure any joints are well constructed.

When practical, hot match joints formed in echelon are considered best practice. Good guidance on best practice is given in Road Note 42 from TRL, the Transport Research Laboratory, in the UK.

If necessary the material can be hand-laid, but as with any high-performance asphalt care should be taken to minimise placement time to facilitate effective compaction.

Weather Restrictions

Nynas Endura Z binders have been engineered to be significantly easier to handle than conventional paving or polymer-modified bitumens. However laying asphalt in poor weather can increase the risk of insufficient compaction due to rapid cooling of the asphalt layers - particularly thin surfacing materials.
Wind chill, resulting from cold weather working and even moderate wind speed can create particularly onerous conditions for laying asphalt surfacing materials. In common with all asphalt mixtures, segregated or poorly compacted materials are prone to premature failure.

In the UK TRL has produced Project Report 13, 'Acceptable weather conditions for laying bituminous materials', which provides general guidance on suitable laying conditions.

Availability

The Nynas Endura Z product range is available throughout UK, Western Europe and the Nordic Region, but during certain periods a 72 hour order lead time may be required. Please contact your local Nynas sales representative for further advice.

Product HSE

Nynas is accredited to the quality standard ISO 9001, environmental standard ISO 14001 and health & safety standard ISO 18001.

For product related HSE information please refer to corresponding safety data sheets available on request or downloadable from our website.

Recycling

Asphalt is considered 100% recyclable. Asphalt materials incorporating Nynas Endura Z binders are subject to the same limitations as recycling any polymer modified asphalt. An appropriate assessment of the properties of the reclaimed asphalt should be conducted during the design of the new asphalt mix.

Product Support

As part of the Nynas product offer, full technical support is available before and after sales from our team of product specialists. Nynas provides assistance and advice to customers on product selection, design and end-performance needs. Contact your local sales office for further assistance.