**BORAL CONCRETE**
Build something great™

# ENVISIA®


## THIS LOWER CARBON* CONCRETE COULD BE A GAME CHANGER

AMAZING NEW **LOWER CARBON HIGH PERFORMANCE** CONCRETE, ACHIEVED THROUGH **ZEP® TECHNOLOGY**

# BREAKTHROUGH TECHNOLOGY IN CONCRETE MIX DESIGN

ENVISIA® is a lower carbon concrete with excellent performance benefits and plastic, placement and finishing properties similar to conventional[1] concretes.

ENVISIA® uses Boral's proprietary ZEP® technology, which allows less carbon-intensive Portland cement to be used in the concrete manufacturing process without impacting on performance. The result is concrete with lower levels of embedded carbon, superior shrinkage and creep performance that behaves like conventional[1] concrete. Additionally, there is no compromise on early strength and cycle times when compared with an equivalent form of conventional[1] concrete.

ENVISIA® delivers a number of formulation benefits tailored to meet the performance needs of different concrete applications.

**BENEFITS INCLUDE:**

## SUSTAINABILITY ADVANTAGE

Page 3

The lower carbon composition of ENVISIA® is achieved using Boral's proprietary ZEP® technology. ENVISIA® achieves a Portland cement reduction of up to 65% using the Green Star MAT-4 method^ without the traditional trade-offs in concrete performance.

## + LOW-SHRINK ADVANTAGE

Page 4

Due to inherent properties in the ZEP® technology, ENVISIA® out-performs conventional[1] concretes in shrinkage and creep – providing up to 50% reduction in shrinkage compared to conventional[1] concrete and reducing creep strain by 40% over conventional[1] concrete of similar characteristic strength and modulus of elasticity.

## + EARLY STRENGTH

Page 5

ENVISIA® performance as a lower carbon concrete is achieved without compromising concrete strength or stressing cycle times (compared to equivalent conventional[1] concrete).

## + HIGH-DURABILITY

Page 6

ENVISIA® provides lower chloride diffusion, water absorption and permeability, compared to an equivalent grade of conventional[1] concrete.

## + CONSISTENT BEHAVIOUR

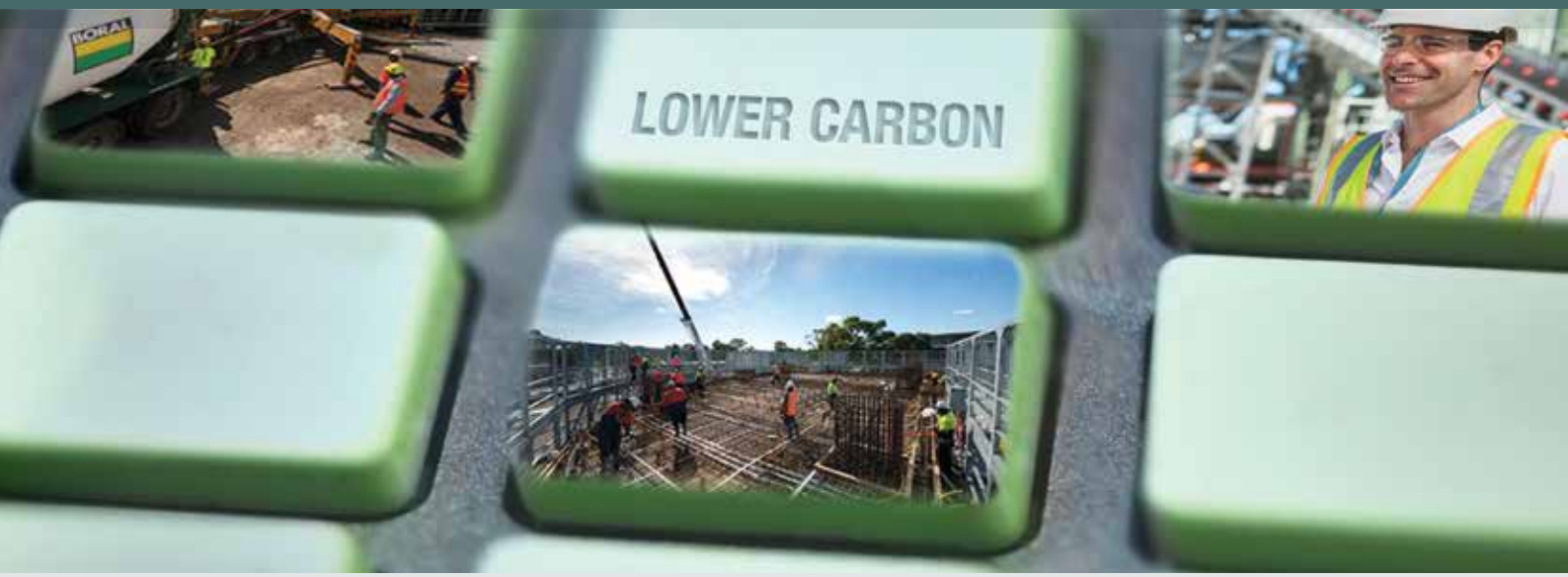
ENVISIA® demonstrates plastic, placement and finishing properties that are consistent with conventional[1] concrete.

## + AS1379 COMPLIANT

Our new concrete range is compliant with Australian Standard AS1379 from cement that complies with Australian Standard AS3972.

[1] Concrete containing currently used blends of Portland cement and SCM that do not include ZEP® technology, that have been in common use for the given applications prior to the availability of ZEP® technology and compliant with AS1379.

^ Using ENVISIA® can help achieve maximum points from the revised Green Star 'Concrete' credit - MAT-4. Please note that individual products are not reviewed or certified under the system. Green Star rating Green Star credit requirements cover the performance of materials in aggregate, not the performance of individual products or brands. www.gbca.org.au/green-star




# ENVISIA® LOWER CARBON WITHOUT THE USUAL COMPROMISE

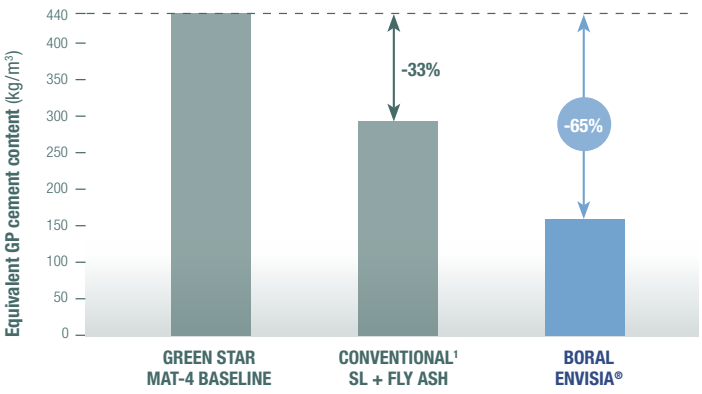
> Boral's ZEP® technology, used in the manufacturing process, means less carbon-intensive Portland cement is required to achieve the same strength outcomes as conventional[1] concretes.

> The lower Portland cement content of ENVISIA® concrete as demonstrated in Graph 1 (right) means lower embedded carbon levels.

> ENVISIA® concrete = less Portland cement = less $CO_2$-e.

## EQUIVALENT GP CEMENT CONTENT — GRAPH 1

**Source:** Boral Laboratory Testing, March 2013.




**Note:** This is for 40 MPa post-tensioned concrete and comparison based on the Green Building Council of Australia material credit for concrete MAT-4.^

(BELOW) Boral is working in close co-operation with Lend Lease on International Towers Sydney within the Barangaroo South project NSW. ENVISIA® has been used in parts of the International Towers Sydney construction and within a prototype structure at Ropes Crossing, Sydney.

**"ENVISIA® concrete is an exciting product innovation helping us achieve our vision for Barangaroo South. Lend Lease is committed to delivering a climate positive and lower carbon outcome for the Barangaroo precinct, pioneering a new era in sustainability and setting new engineering benchmarks for others to follow."**

*TOM WATERS, Lend Lease Construction Manager for Tower 2 of International Towers Sydney at Barangaroo South.*


# ENVISIA® DEMONSTRATES LOW CREEP

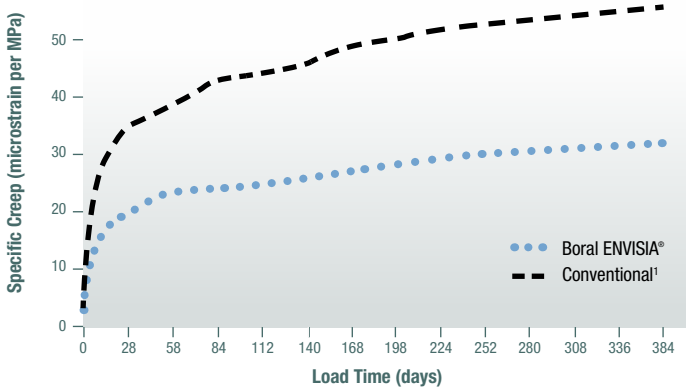
> ENVISIA® can reduce creep strain by 40% over conventional[1] concrete of similar characteristic strength and modulus of elasticity. Graph 2 (right) demonstrates the specific creep of standard concrete and ENVISIA® at similar strength levels measured over time.

> When combining the reduced creep and shrinkage properties of ENVISIA® the structural designer may be able to gain benefit from:

- reduced volume of concrete needed
- reduced reinforcement ratio
- reduced pre-stressing losses

## CREEP PERFORMANCE — GRAPH 2

**Source:** Boral Laboratory Testing (NATA Facilities No. 547 and 9968) May 2012 - August 2013.




**Note:** Conventional[1] concrete = standard concrete with same aggregates as ENVISIA® but with 84% SL cement and 16% Fly ash.

# ENVISIA® LOW SHRINK ADVANTAGE

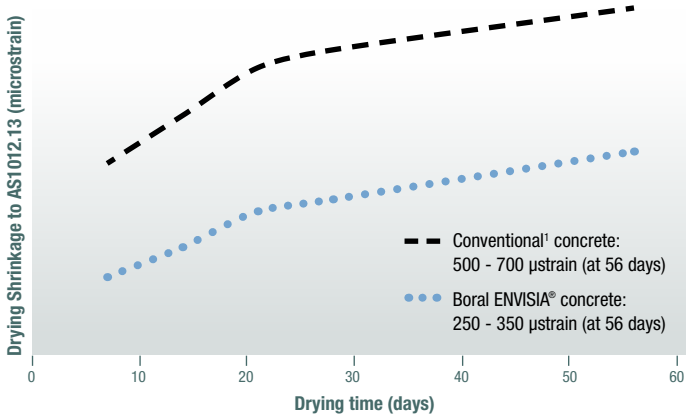
> ENVISIA® outperforms conventional[1] concretes by offering up to a 50% reduction in shrinkage. Typical shrinkage performance is demonstrated in Graph 3 (right).

> ENVISIA® may enable design of large slabs with fewer or no joints using a lower carbon concrete.

> Larger joint spacings and less long term drying shrinkage cracking can now be achieved without compromising on sustainability goals.

## SHRINKAGE PERFORMANCE — GRAPH 3

**Source:** Boral Laboratory Testing (NATA Facilities No. 547 and 9968) 2013 - 2014.




**Note:** These are typical results based on 40 MPa grade concrete. Shrinkage will vary according to the specific aggregates used.

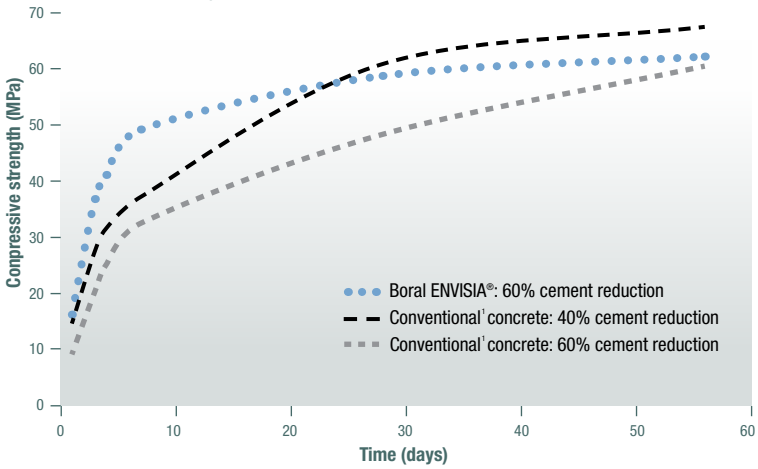
[1] Concrete containing currently used blends of Portland cement and SCM that do not include ZEP® technology, that have been in common use for the given applications prior to the availability of ZEP® technology and compliant with AS1379.


# ENVISIA® EARLY STRENGTH

- ENVISIA® is suited to applications where early strength performance of concrete is paramount, for example suspended commercial slabs or high rise construction.
- The key benefit of using ENVISIA® is that a lower shrink-lower carbon result is achieved without undue compromise in strength performance and stressing cycle times.
- ENVISIA® early strength performance, as indicated in graph 4 (right), is approximately in line with other conventional[1] concretes so the usual trade-offs are not necessary to achieve a lower carbon result.

## EARLY STRENGTH PERFORMANCE — GRAPH 4

**Source:** Boral Laboratory Testing (NATA Facilities No. 547 and 9968) 2013 - 2014.




**Note:** These are 40 MPa concretes typical for post-tensioned construction. Stressing times increase for conventional[1] concrete as the cement reduction level increases. Cement reduction calculated using Green Star 'MAT-4' method.

ENVISIA® was used at Lend Lease's International Towers Sydney prototype at Ropes Crossing, Sydney NSW.

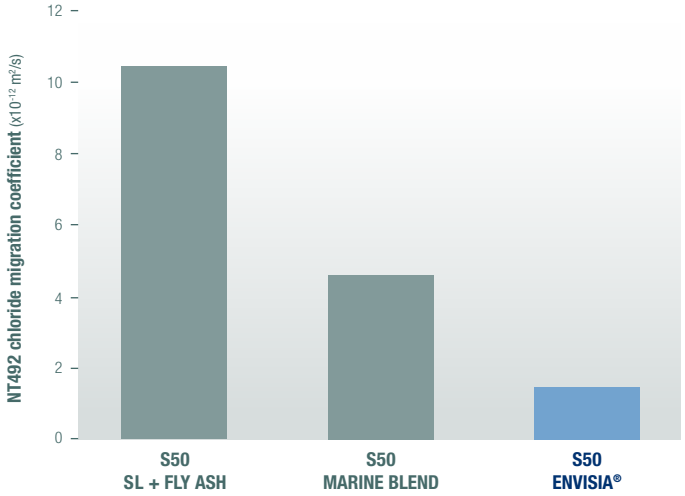

# ENVISIA® HIGH DURABILITY

> ENVISIA® provides lower chloride diffusion, water absorption & permeability compared to an equivalent grade of conventional[1] concrete.

> ENVISIA® can therefore be used in demanding applications where chloride resistance and sulphate expansion characteristics are important.

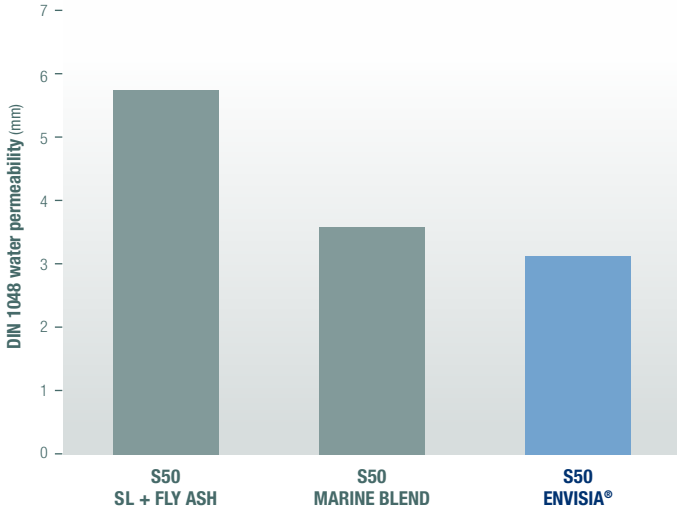
**GRAPH 5**

**Source:** Boral Laboratory Testing (NATA Facilities No. 547 and 9968) 2013-2014.



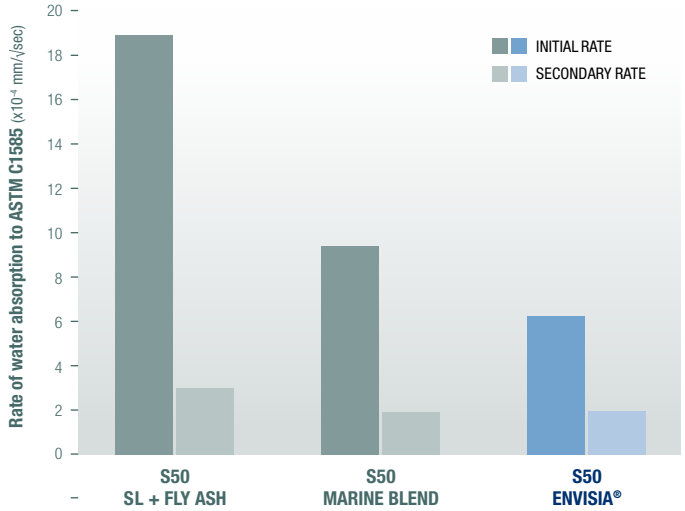

**GRAPH 6**

**Source:** Boral Laboratory Testing (NATA Facilities No. 547 and 9968) 2013-2014.




**GRAPH 7**

**Source:** Boral Laboratory Testing (NATA Facilities No. 547 and 9968) 2013-2014.




[1] Concrete containing currently used blends of Portland cement and SCM that do not include ZEP® technology, that have been in common use for the given applications prior to the availability of ZEP® technology and compliant with AS1379.

# MODEL SPECIFICATIONS

## INDUSTRIAL SLAB FLOOR

Concrete for the industrial slab floor shall be Boral ENVISIA® concrete or similar complying with AS3600 with the following properties:

Characteristic 28 day Strength: **40 MPa**

Nominal Drying Shrinkage at 56 days: **350 microstrain**

Cement reduction (using MAT-4 method^): **60%***

## POST TENSIONED SLAB

Concrete for the post tensioned slab shall be Boral ENVISIA® concrete or similar complying with AS3600 with the following properties:

Characteristic 28 day Strength: **32 MPa**

Minimum strength at 4 days: **22 MPa**

Nominal Drying Shrinkage at 56 days: **350 microstrain**

Cement reduction (using MAT-4 method^): **60%***

## HIGH DURABILITY

Concrete for high durability applications, such as marine environments shall be Boral ENVISIA® concrete or similar complying with AS3600 with the following properties:

Characteristic 28 day Strength: **50 MPa**

Nominal Drying Shrinkage at 56 days: **350 microstrain**

Cement Reduction (using MAT-4 method^): **65%***

Maximum Chloride diffusion by NT443 method:
**$2.5 \times 10^{-12}$ m²/s**

^ Using ENVISIA® can help achieve maximum points from the revised Green Star 'Concrete' credit - MAT-4. Please note that individual products are not reviewed or certified under the Green Star rating system. Green Star credit requirements cover the performance of materials in aggregate, not the performance of individual products or brands. www.gbca.org.au/green-star

* In comparison to conventional concrete (concrete containing currently used blends of Portland cement and SCM that do not include ZEP® technology, that have been in common use for the given applications prior to the availability of ZEP® technology and compliant with AS1379).

Construction of International Towers Sydney underway at the Lend Lease Barangaroo South project in Sydney.

# ENVISIA®

## BORAL CUSTOMER SERVICE CENTRE

## 1300 552 555

**To place an order or make an enquiry:**
6am – 6pm Monday to Friday
6am – 12.00 noon Saturdays

For more information on Boral's exciting range of concrete please visit
**www.boral.com.au/concrete**

Visit **www.boral.com.au** for other Boral products including:
Quarries, Material Testing Services, Cement, Timber, Roofing, Pavers, Tiles, Bricks, Plasterboard and more.

* Boral Laboratory Testing, March 2013, indicated that the manufacture of ENVISIA® concrete with ZEP® technology resulted in a 27% reduction in embedded carbon levels compared to Boral standard 50 MPa PT concrete.



BCC-14942/MAY17