

HYPER EXPAN

LOW-DOSAGE TYPE EXPANSIVE ADDITIVE FOR CONCRETE



 **Taiheiyo Materials Corporation**

HYPER EXPAN greatly reduces the cracks in the concrete

Key words for recent concrete technology are high-durability, low cost, performance evaluation, environment, high performance, multi-function etc. Cracks occurred in concrete structures cause not only direct problems such as deterioration of durability and water-tightness etc. of the structures but also deterioration of the appearance of the structures. Expan, which has been contributing to the reduction of the cracks in the concrete structures for more than 30 years, has accomplished high durability for the concrete from the side of the materials for the cracks of the concrete.

HYPER EXPAN has originated from the technology of lime-based expansive additive which has been used for more than 30 years.

■Reduction of the cost for expansive concrete

HYPER EXPAN has originated from the technology on the control of the expansion speed of caustic lime, which we, as a pioneer of lime-based expansive additive, have studied for more than 30 years and has been developed based on the further technology of utilizing the maximal expansion of the lime, that can be obtained through the optimization of the content of A-lite in the lime and voids in clinker.

As a result of these studies, the dosage of HYPER EXPAN is 2/3 as much as that of conventional expansive additive to gain almost the same expansion. Therefore, we could offer low-dosage and low-cost expansive concrete.

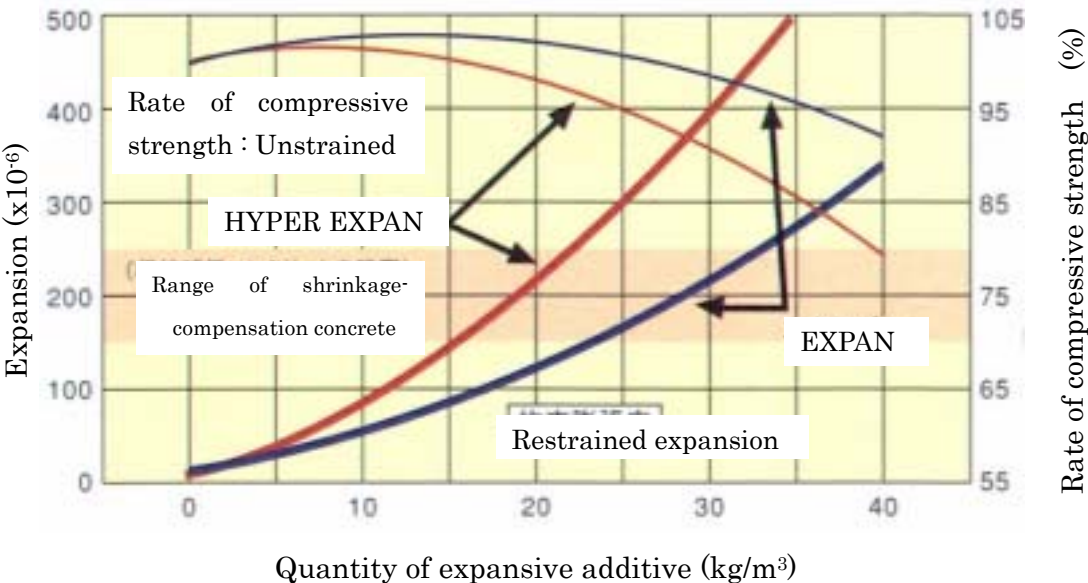


Fig.1 The relationship between the quantity of expansive additive, expansion rate under restrained condition and rate of compressive strength under unrestrained condition

Properties of HYPER EXPAN

1. Efficient expansion can be obtained with small quantity of HYPER EXPAN.
2. The change of slump and the quantity of air in HYPER EXPAN concrete against elapsed time are almost the same as those of a plain concrete. Therefore, HYPER EXPAN is applicable for various concrete.
3. The expansion mechanism of “HYPER EXPAN” is the same as that of conventional “EXPAN”.

Density (g/cm ³)	Fineness (cm ² /g)	Chemical component (% by weight)						
		Ig.loss	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	SO ₃
3.16	3,450	1.2	4.2	1.1	1.0	74	0.51	16.5

Type of HYPER EXPAN

HYPER EXPAN (for structures)

Uses

Reduction of cracks caused by change of volume of general concrete structures

- Restraining cracks due to dry shrinkage
- Restraining cracks due to heat shrinkage
- Restraining cracks due to autonomous shrinkage

Application object

- General buildings : mat foundation, slab, wall, pillar, beam
- Road, bridge, tunnel : deck slab, pier, paved concrete, tunnel lining concrete
- Hydraulic structures : for waterworks and sewageworks, underground pit
- High flowable, high-strength concrete

Standard dosage : 20kg/m³

Package : 20kg/bag

Dosage of HYPER EXPAN might vary with the purpose of use or the application conditions.

HYPER EXPAN M (for restraint of the hydration heat)

Uses

Reduction of cracks caused by change of volume of massive concrete

- Restraining cracks due to dry shrinkage
- Restraining cracks due to heat shrinkage
- Restraining cracks due to autonomous shrinkage

Application object

- Massive hydraulic structures : for waterworks and sewageworks, underground pit, foundation for machine
- Other massive concrete structures : underground structures
- High flow, high-strength concrete

Standard dosage : 20kg/m³

Package : 20kg/bag

Dosage of HYPER EXPAN might vary with the purpose of use application or the application conditions.

Effect of reduction of cracks by HYPER EXPAN

The concrete mixed HYPER EXPAN expands moderately in first hardening stage, and the compressive stress which is caused by the influence of the expansion and the restraint materials such as re-bars occurs into the concrete, where is called Pre-stress Effect. The compressive strength not only cancels or reduces the tensile stress caused by dry shrinkage etc. so that cracking is restrained but tightens the fine voids in the concrete so that water-tightness of concrete is improved. According to the above-mentioned mechanism, high durable concrete can be made.

Characteristic of expansion and shrinkage of HYPER EXPAN

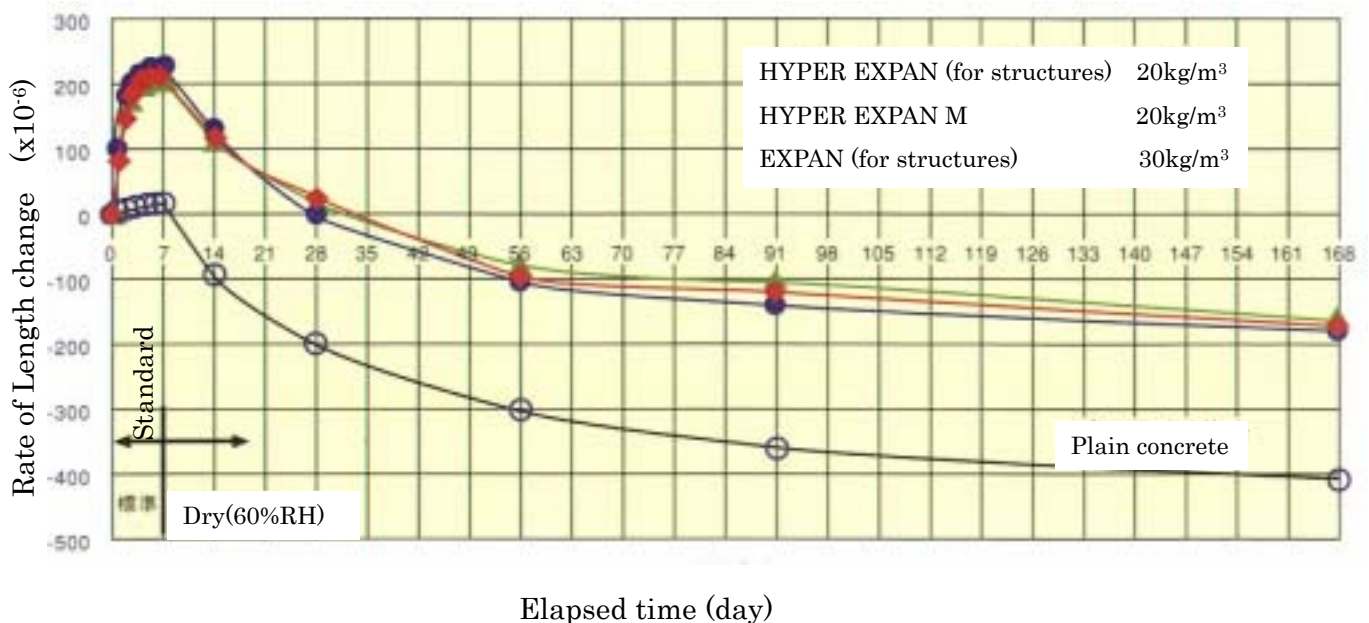


Fig.2 Characteristic of expansion and shrinkage of HYPER EXPAN (JIS A 6202 B method)

■ Water-tightness

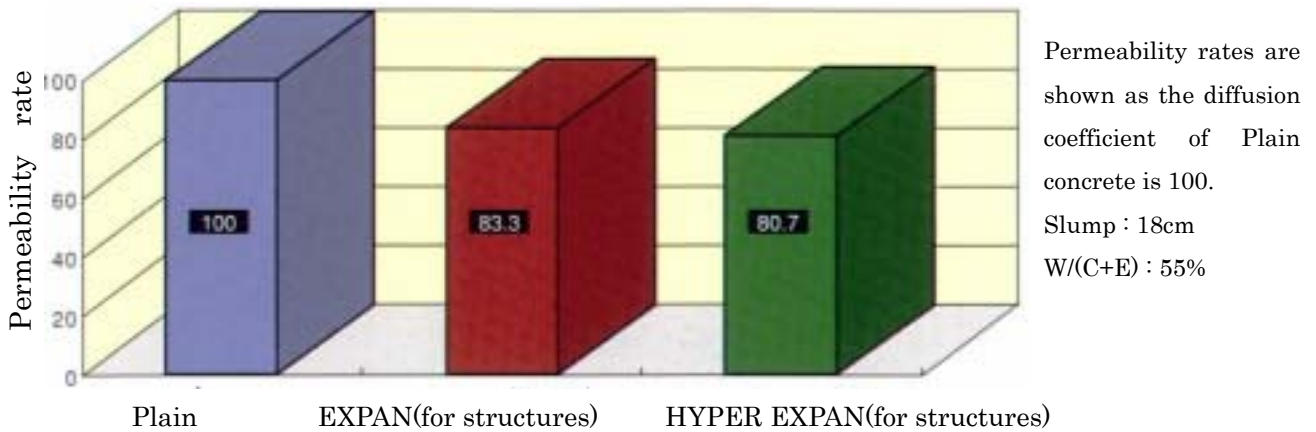


Fig.3 Permeability of HYPER EXPAN

■ Properties of fresh concrete

Properties of fresh HYPER EXPAN concrete are almost the same as those of fresh plain concrete.

(General concrete)

W/C:55.6% Slump:16cm C:309kg/m³ (OPC)

(High flowable concrete)

W/P:31.3% Slump flow:650±50mm

C:389kg/m³ (OPC) Lime powder :167kg/m³

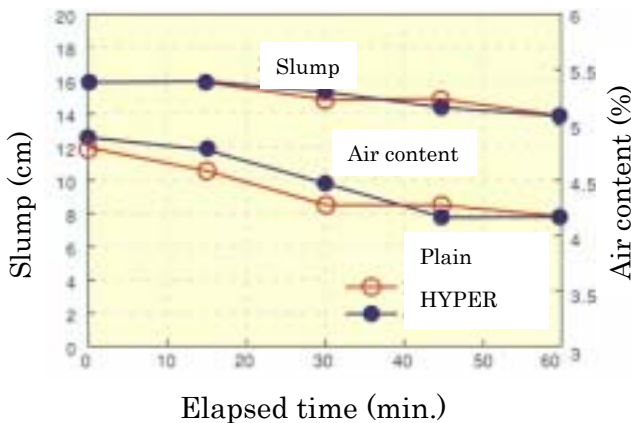


Fig.4 Change of slump and air content

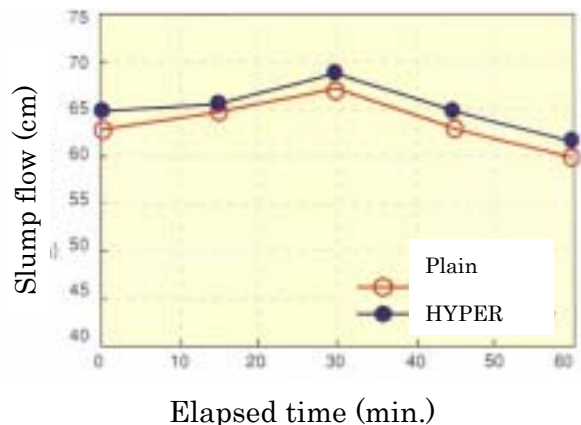


Fig.5 Change of slump flow

Physical properties of HYPER EXPAN M concrete

In case HYPER EXPAN M is used for massive concrete, HYPER EXPAN M restrains the hydration heat in early stage and can moderately control by its expansion shrinkage caused during temperature falling of the concrete.

■Characteristic at hydration

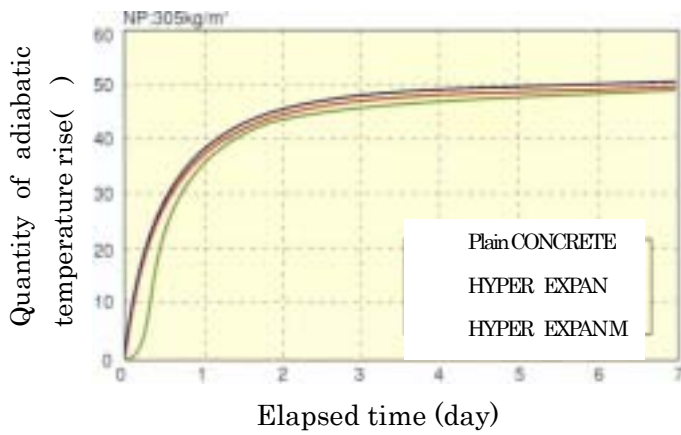


Fig.6 Characteristic of adiabatic temperature rise expansive additive (20)

■Stress in concrete

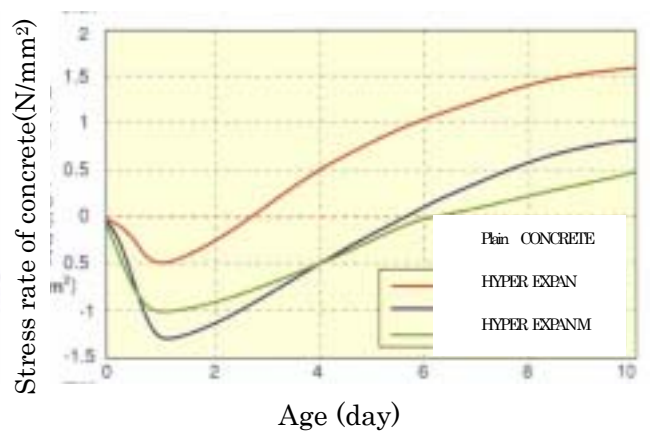


Fig.7 Characteristic of stress in HYPER EXPAN M concrete

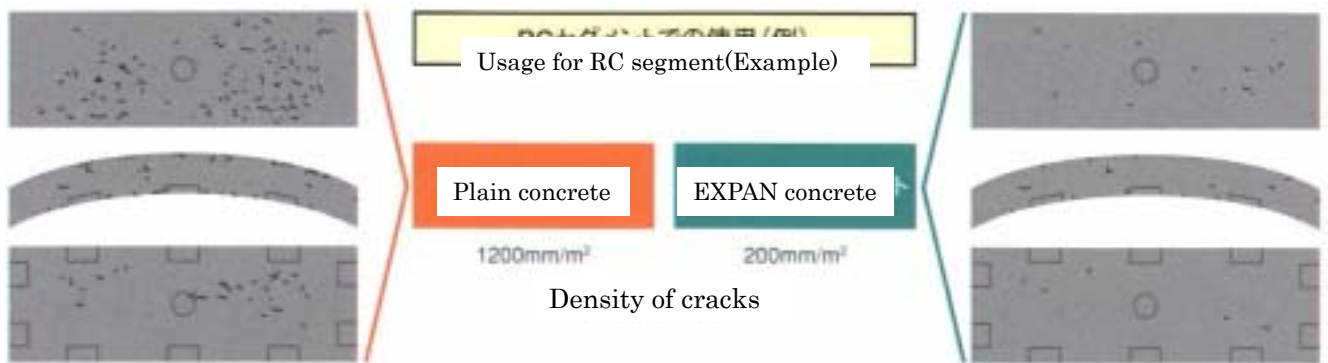
Application example for restraint of cracking

The effect of the restraint of cracking with HYPER EXPAN varies with conditions of application and circumstances.

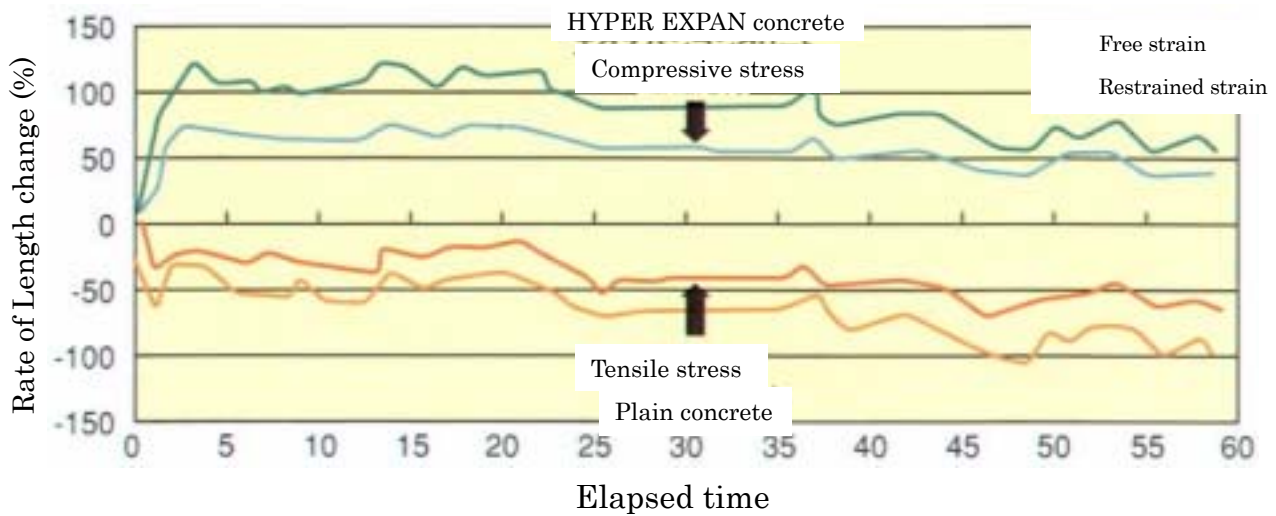
Cracks caused by dry shrinkage

■Exposure test of concrete

The following is a test result of cracking in concrete with 15cm thickness, which was exposed in the open-air conditions for 3 months. The cracking rate for EXPAN concrete reduced to about 20% of the plain concrete.



■ Measuring strain on concrete wall

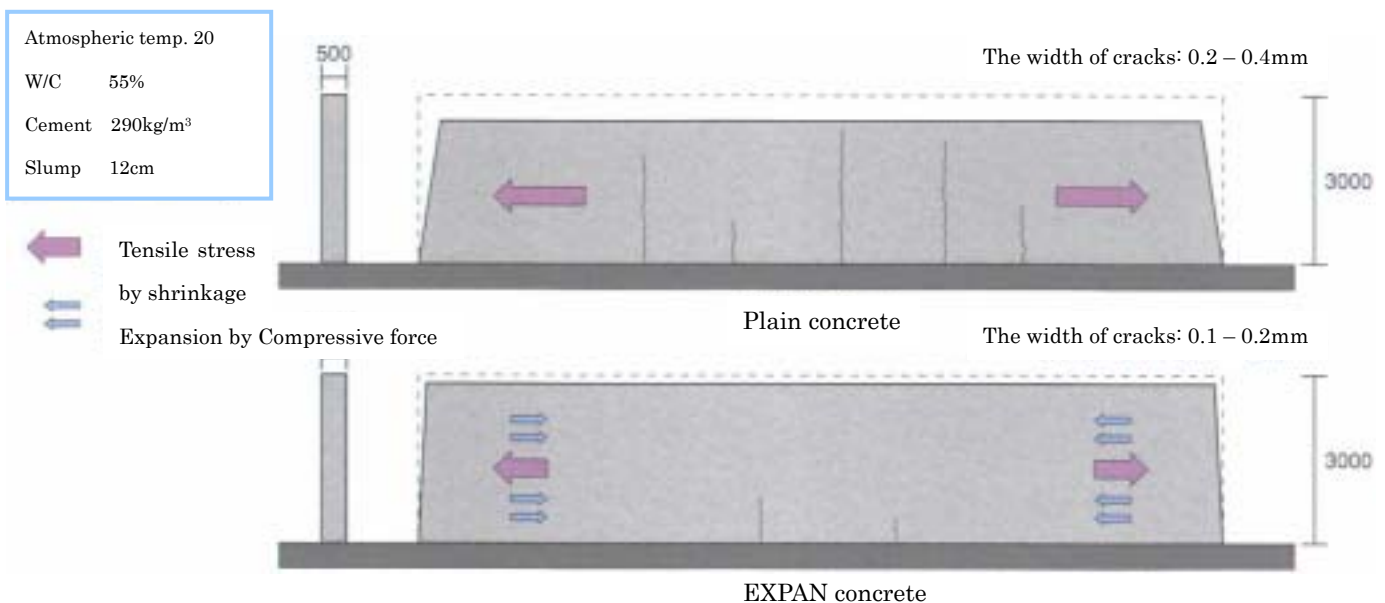


Cracking caused by Hydration heat

The following is an appearance of cracking on Concrete Wall at de-molding, which was restrained by concrete floor.

Though the volume of the concrete changes at temperature rise of concrete, the plain concrete was restrained by concrete floor, so that a big tensile stress occurred in the concrete, and a lot of cracks appeared. On the other hand, no crack appeared in EXPAN concrete at de-molding even under the same conditions, and the width and number of cracks in the EXPAN concrete were less than the plain concrete even after time had passed.

■ Appearance of cracking at de-molding



Instructions for Use

= Dosage and Mix design =

- The standard dosage of HYPER EXPAN is 20kg/m^3 , and the HYPER EXPAN should be regarded as a part of cement.
- In case the decline of concrete strength is concerned about, i.e. too small quantity of cement, too much dosage of HYPER EXPAN etc., mixing tests for checking compressive strength and expansion rate should be previously carried out to decide the proper mix proportion.

= Curing =

- Sprinkling water should be carried out for at least 3 days in summer season and for at least 7 days in winter season to keep the surface of the concrete wet.

= Mixing and charging =

- HYPER EXPAN measured precisely should be charged into a mixer together with cement, and then aggregate and water should be added. Those materials should be mixed enough and uniformly.
- The mixing time should be prolonged 20 – 30 seconds comparing to plain concrete mixing.

= Storage =

- HYPER EXPAN should be stored in a dry place. Once the bag is opened, it is desirable to use it up completely in the same day. If HYPER EXPAN in a opened bag is left, the HYPER EXPAN left must be stored in an anti-moisture bag or a pail and must be used up within 2 or 3 days.