

Prestressed slabs developments in Europe

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PRESTRESSED SLABS-DEVELOPMENTS IN EUROPE

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RESEARCH

1986, introduction of prestressed concrete slabs
with 20 x 40 cm² depth of 5. Top (base)
of 100 mm (engineering base) (base)
of 100 mm (engineering base) (base)

IN A SQUARE SLAB USING FIVE PLATE STRIPS



Fig. PS 4 - Test arrangement

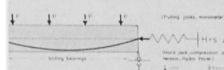


Fig. PS 4 - Test arrangement for plate strips

Series	Number	Span (m)	Load (kN)	Deflection (mm)	Crack width (mm)	Crack width (mm)	Crack width (mm)	Crack width (mm)	Crack width (mm)	Crack width (mm)
1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
10	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0

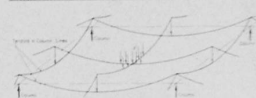
Fig. PS 4 - Test arrangement for plate strips



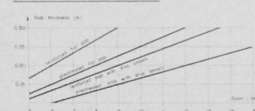
Fig. PS 4 - Test arrangement for plate strips

DESIGN

Scheme of load transfer by tendons



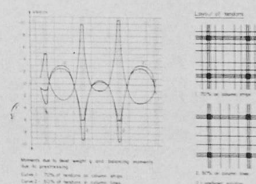
Slenderness of slabs



Punching mechanism

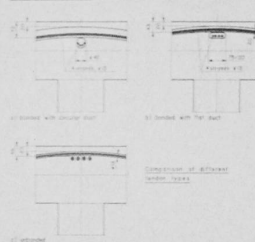


Distribution of tendons



CONSTRUCTION

Excentricities



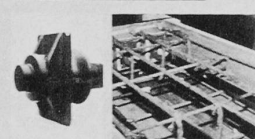
Unbonded monostrand



Extruding of unbonded monostrands



Monostrand stressing anchorage



EXAMPLES OF APPLICATION

Multi-Storey Car Park, Saas-Fee, Switzerland

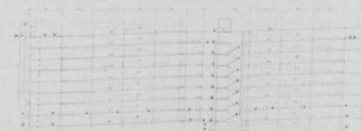
POST-TENSIONING WITH UNBONDED MONOSTRANDS

OWNER: Municipality of Saas-Fee
DESIGNER: Schweizerische Eidgenossenschaft
CONTRACTOR: Alconstrukt & Eisenbeton AG
PRESTRESSING: Soprostrut AG, Lenzburg

Slab with 8 prestressed floors
87.2 x 24.4 m each, for parking of 240 cars

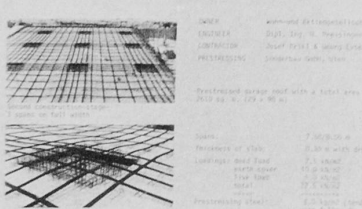
Span: 7.50 m
Thickness: 0.20 m
Loadings: dead load 2.0 kN/m²
live load 2.0 kN/m²
prestressing steel 2.0 kN/m²

UNBONDED SECTION



Underground Garage, Housing Complex Oed XII, Linz, Austria

POST-TENSIONING WITH BONDED TENDONS IN PLATE STRIPS



OWNER: Oed XII, Linz, Austria
DESIGNER: Oed XII, Linz, Austria
CONTRACTOR: Oed XII, Linz, Austria
PRESTRESSING: Oed XII, Linz, Austria

Prestressed garage slab with a total width of 24.4 m (24.4 x 24.4 m)

Span: 7.50 m
Thickness of slab: 0.20 m with 20 mm
Loadings: dead load 2.0 kN/m²
live load 2.0 kN/m²
prestressing steel 2.0 kN/m²



PRESTRESSED SLABS DEVELOPMENTS IN EUROPE

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The development of prestressed slabs in Europe was delayed in comparison with the USA and Australia.

Main reason for that delay was the missing of suitable standards and simplified design methods. With the research done (specially in Germany and Switzerland), standards and design methods could be established.

Today, recommendations are available in the United Kingdom (1) and have also been published by FIP (2). In Germany (3), Switzerland (4) and the Netherlands these standards are under preparation and will be issued shortly.

Most of the questions during the poster-session at the congress did concerne bonded versus unbonded solution, e.g. protection against corrosion, fire and earthquake behaviour.

Following the advantages respectively of unbonded and bonded systems.

Unbonded

- Maximum possible tendon drape
- No grouting required
- Corrosion protection of tendons also during transport, handling and placing
- Simple and fast placing of tendons
- Small friction losses
- Considerable dissipation of energy

Bonded

- Increased ultimate moment
- Local failures of tendons have only localised effects (e.g. in the case of fire, explosion and earthquake)

Finally, a summary of advantages of prestressed slabs:

- . Economical
- . Increased span lengths and span/depth ratios
- . Reduced dead weights and building heights
- . Deflection and crack free under permanent loading
- . Improved punching shear resistance
- . Reduced construction time due to early stripping

References:

1. Flat slabs in post-tensioned concrete with particular regard to the use of unbonded tendons—design recommendations.
Concrete Society Technical report No. 17, published 1979 by C & CA, Wexham Springs, Slough SL3 6PL.
2. Recommendations for the design of flat slabs in post-tensioned concrete (using unbonded and bonded tendons), FIP/2/5, May 1980, published by C & CA, Wexham Springs, Slough SL3 6PL.
3. DIN 4227, Teil 6 "Bauteile mit Vorspannung ohne Verbund"
4. SIA 162, Arbeitsgruppe 5, "Bruchverhalten von Platten"