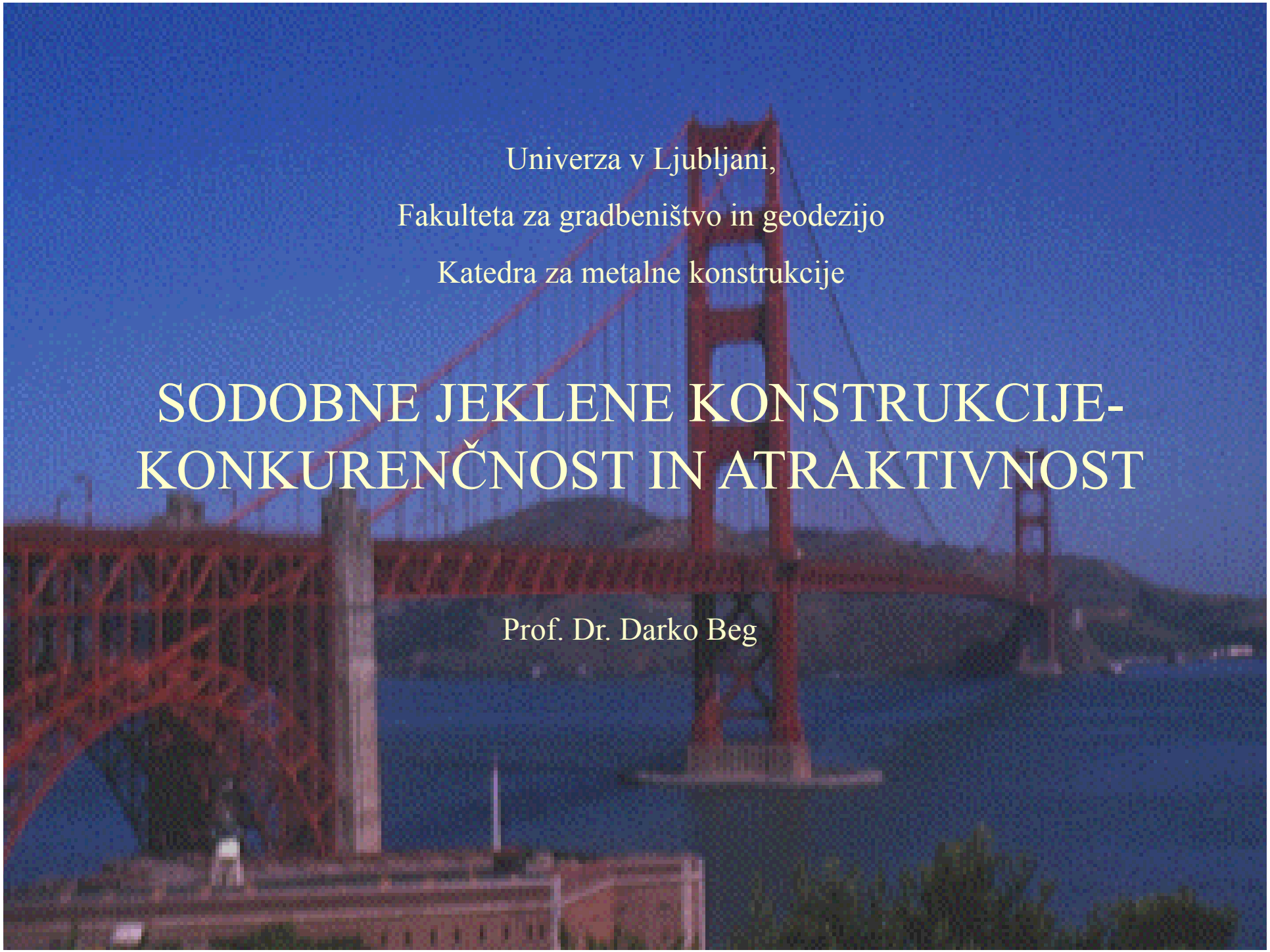


Univerza v Ljubljani,

Fakulteta za gradbeništvo in geodezijo

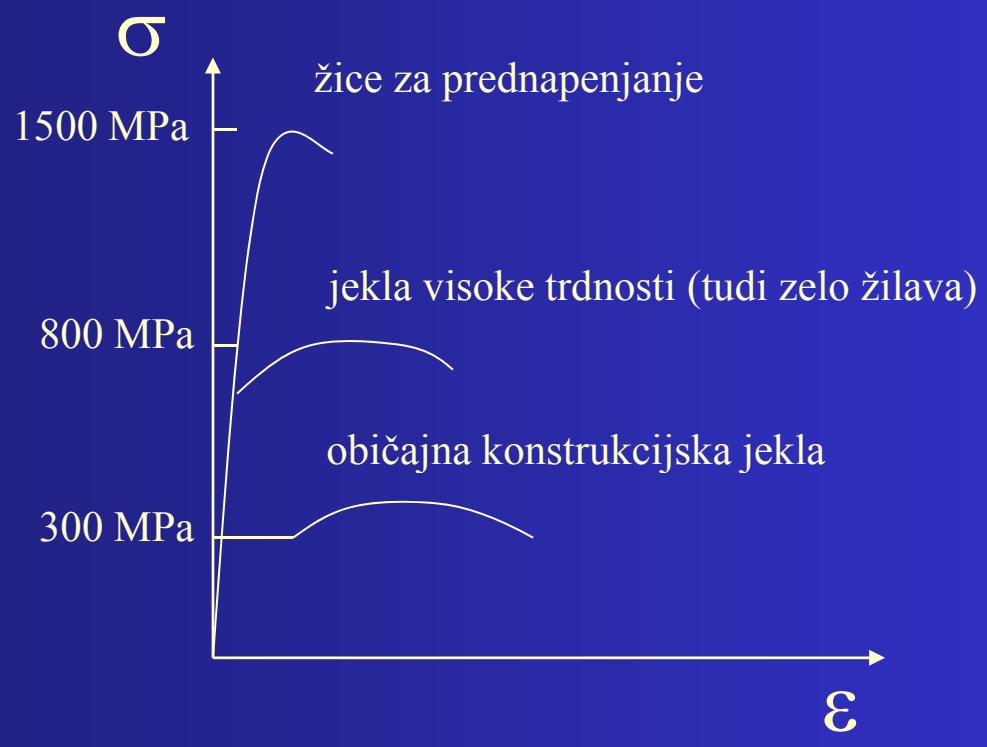
Katedra za metalne konstrukcije

# SODOBNE JEKLENE KONSTRUKCIJE- KONKURENČNOST IN ATRAKTIVNOST

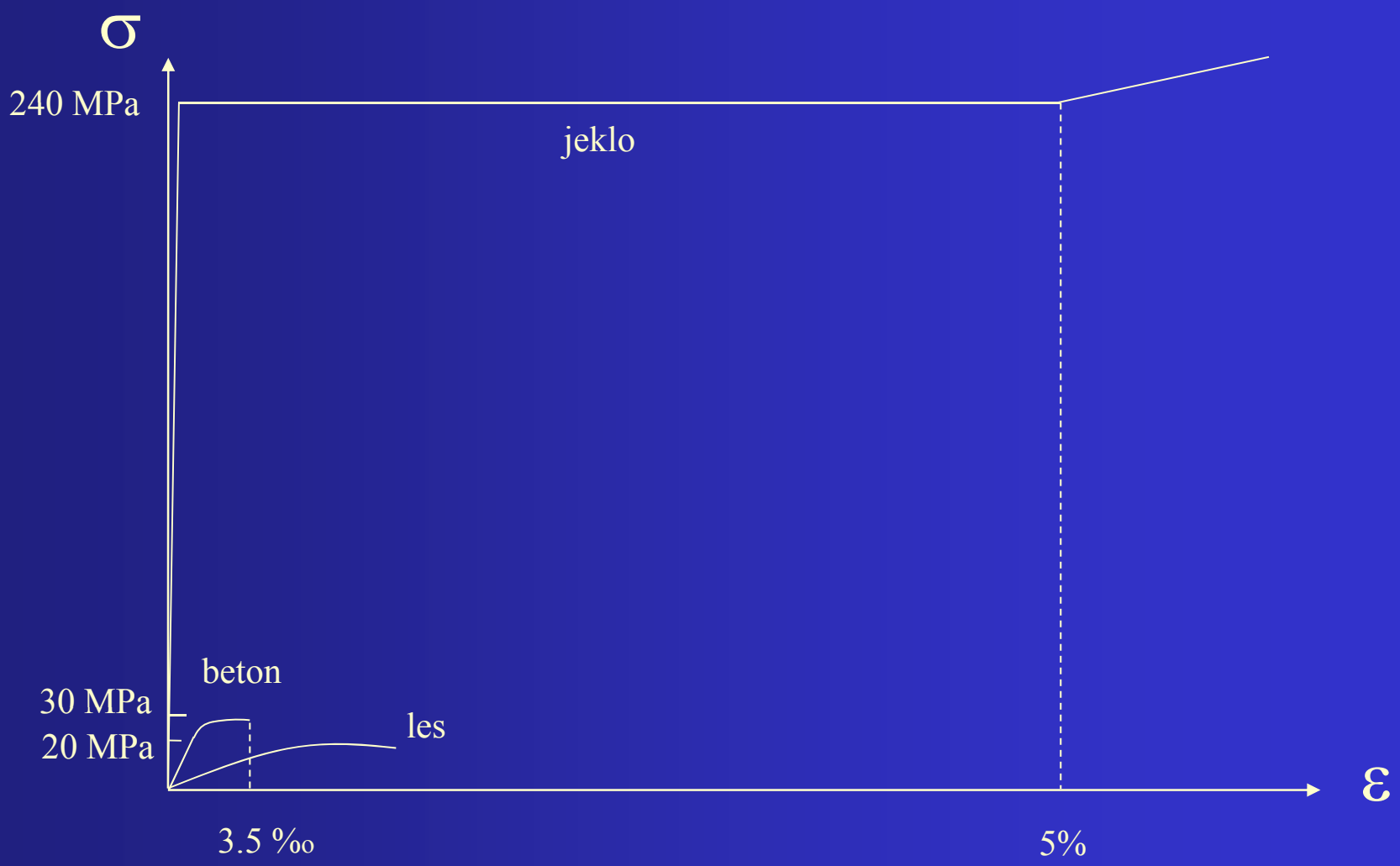
Prof. Dr. Darko Beg

# VRSTE JEKLA

- običajno (mehko) konstrukcijsko jeklo
- jeklo visoke trdnosti
- vremensko odporno jeklo
- nerjavno jeklo



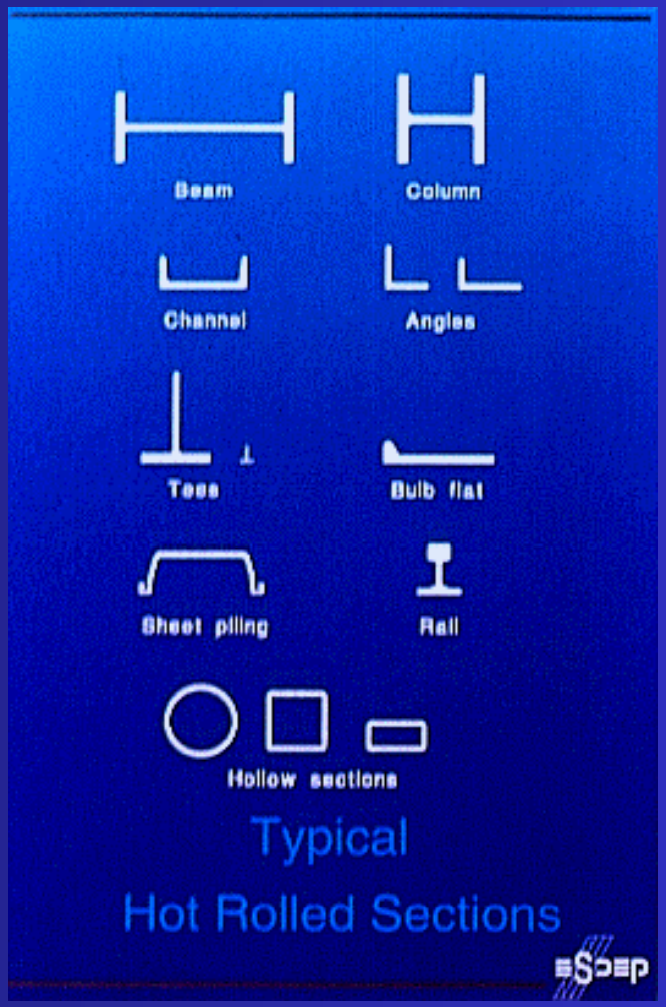

# Mehanske lastnosti jekla

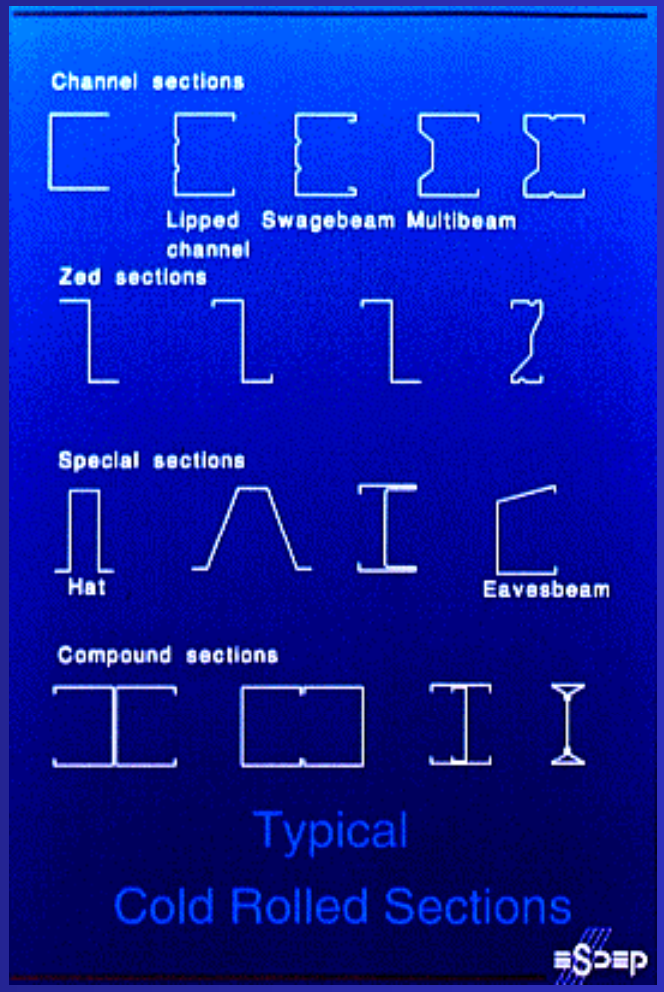


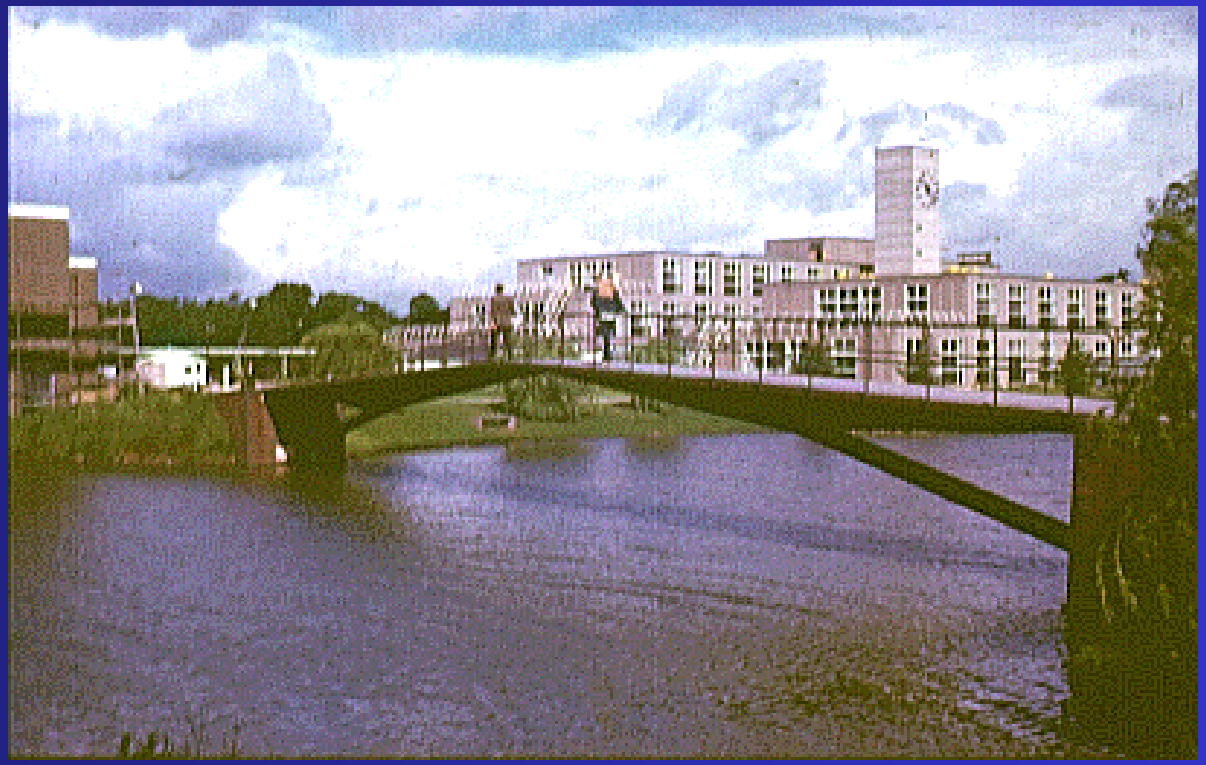

# Mehanske lastnosti jekla

# LASTNOSTI JEKLA

- visoka trdnost
- homogenost
- velika žilavost (potres, udarci, dinamična obtežba)
- kontrola kvalitete na visokem nivoju

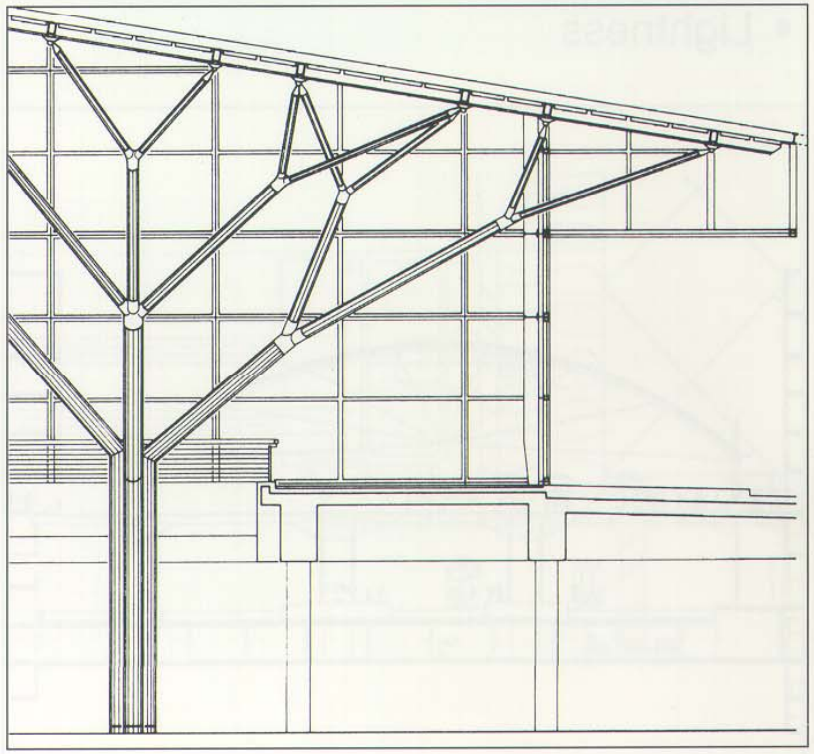

Beam
Column
Channel
Angles
Tees
Bulb flat
Sheet piling
Rail
Hollow sections
Typical
Hot Rolled Sections


Channel sections
Lipped channel
Swagebeam
Multibeam
Zed sections
Special sections
Hat
Eavesbeam
Compound sections
Typical
Cold Rolled Sections



# Estetika in prestiž

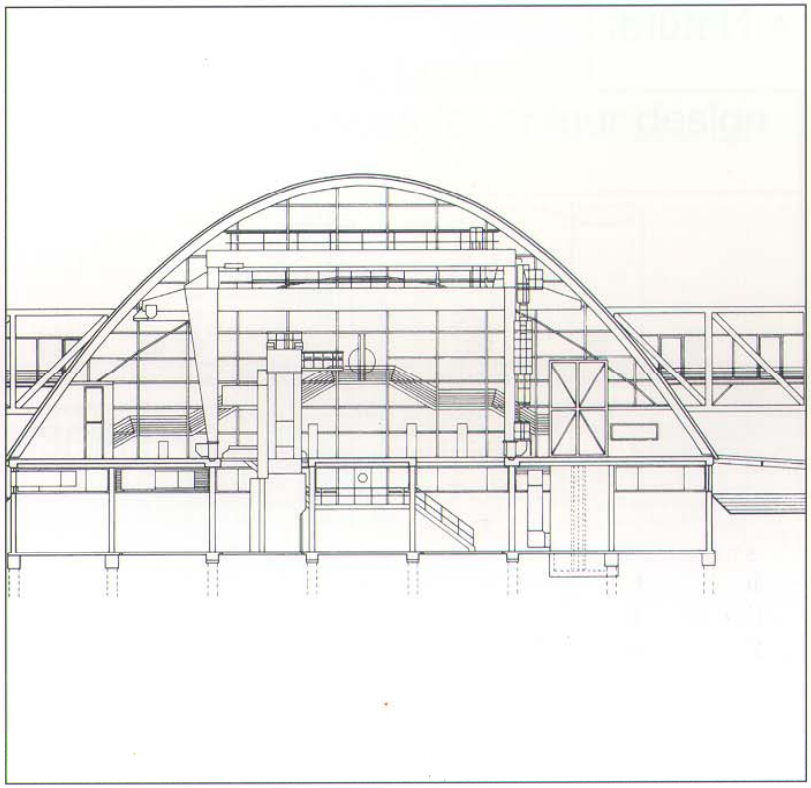
- Svoboda izražanja

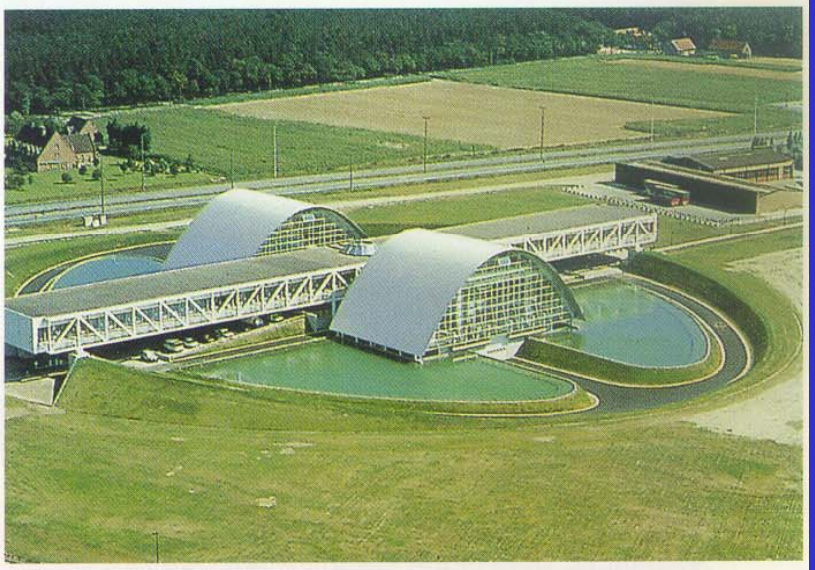



Stuttgart Airport, D
Architects: von Gerkan, Marg + Partner, Hamburg.
Structural Engineers: Weidleplan Consulting GmbH, Stuttgart.
Completed 1992.

# Estetika in prestiž

- Ustvarjalnost pri projektiranju





Research Centre, Zelzate, Gent, B

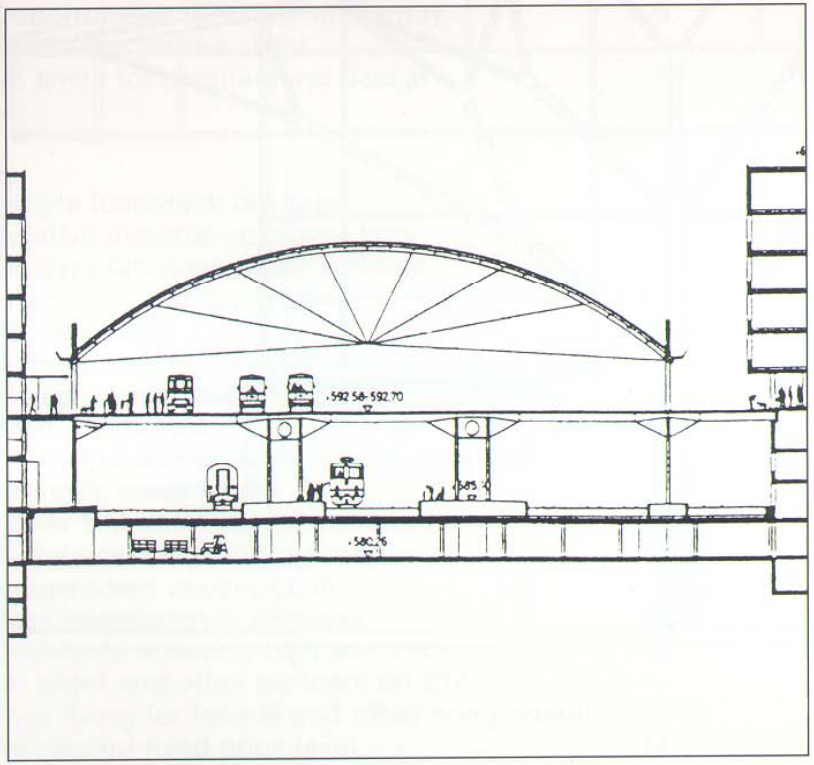
Architects & Structural Engineers: Samyn & Associés, Bruxelles.
Completed 1991.

# Estetika in prestiž

Bus and Railway Station,
Chur, CH

Architects: Richard Brosi, Chur; Obrist und Partner, St. Moritz.
Structural Engineers: Ingenieurgemeinschaft Toscano AG, Zürich; Hegland + Partner AG, Chur; Ove Arup & Partners, London; RFR, Paris.
Completed 1992.

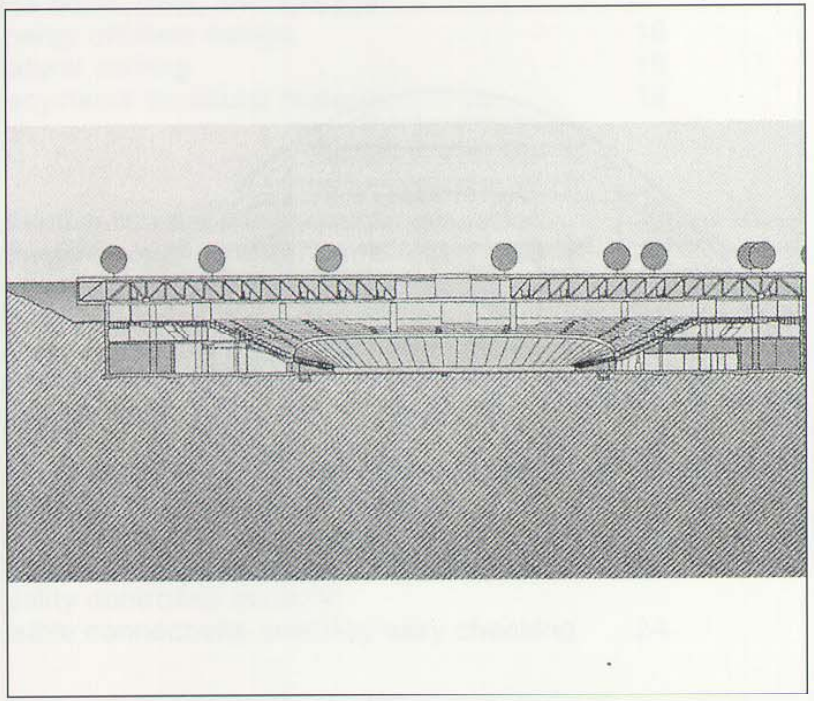
- **Transparentnost**
- **Vitkost**
- **Lahkost**



# Estetika in prestiž

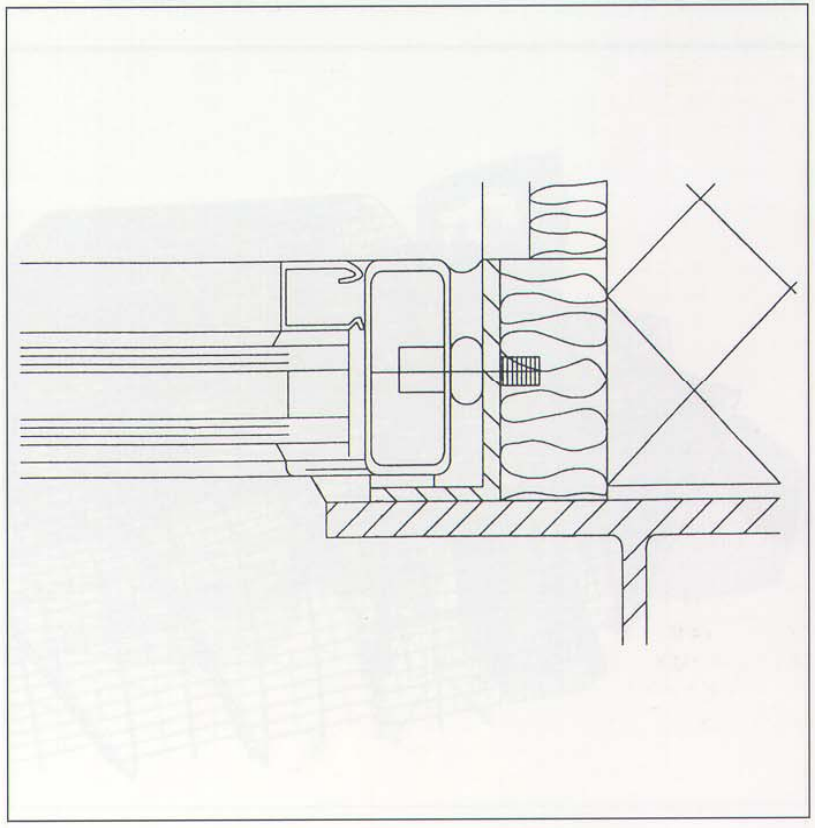
Velodrome, Berlin, D
Architects: Dominique Perault, Paris-Berlin
Structural Engineers: Ove Arup & Partners, London-Berlin.
Completed 1997.

- **Veliki razponi brez vmesnih stebrov**
- **Naravna osvetlitev**



# Estetika in prestiž

- **Elegantna enostavnost**

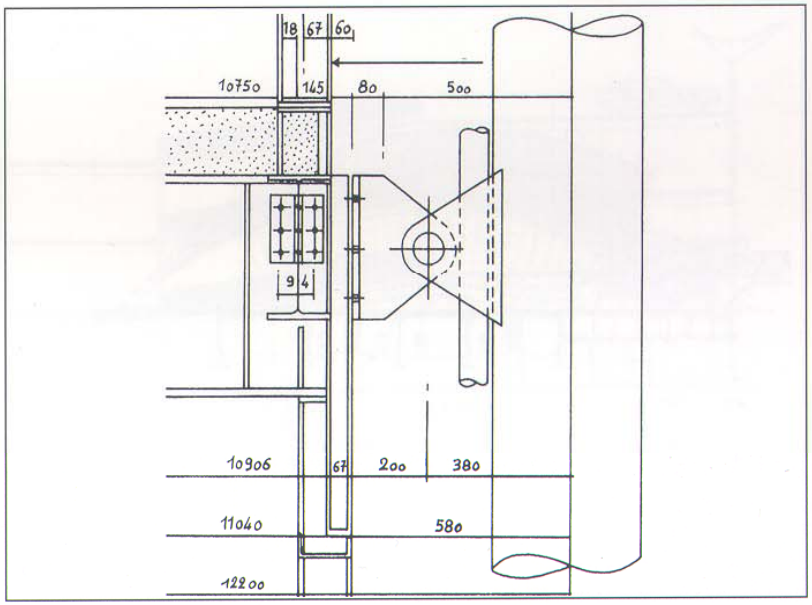


Citizens Advice Bureau,
Chessington, GB

Architects: Bramante Architects, London.
Structural Engineers: Whitby & Bird, London.
Completed 1995.

# Estetika in prestiž

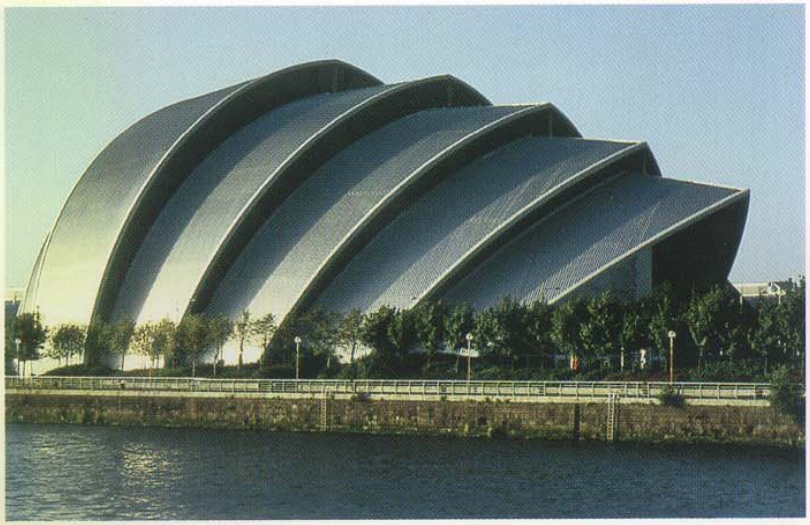
- Uspešna protikorozijska zaščita
- Uspešna protipožarna zaščita
- Priložnost za uporabo barv




French Institute for Polar Research and Technology, Brest, F

Architects: B. Halet & M. Villette, Brest.
Completed 1993.

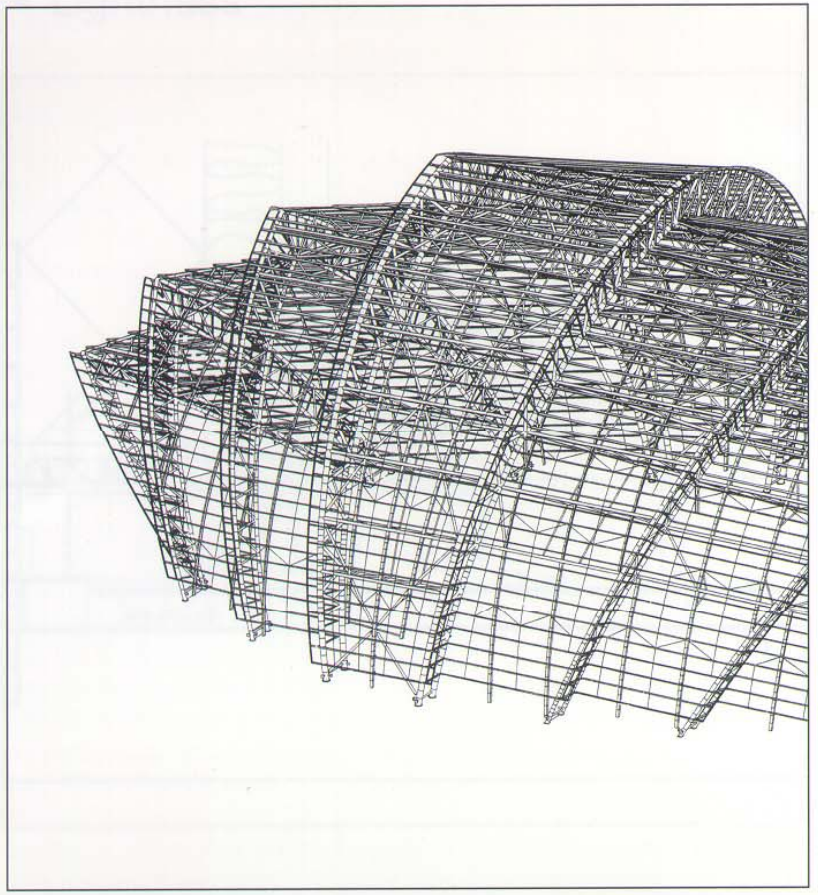
# Estetika in prestiž



Scottish Exhibition and
Conference Centre, Glasgow, GB

Architects: Sir Norman Foster & Partners.
Structural Engineers: Ove Arup & Partners.
Completed 1997.

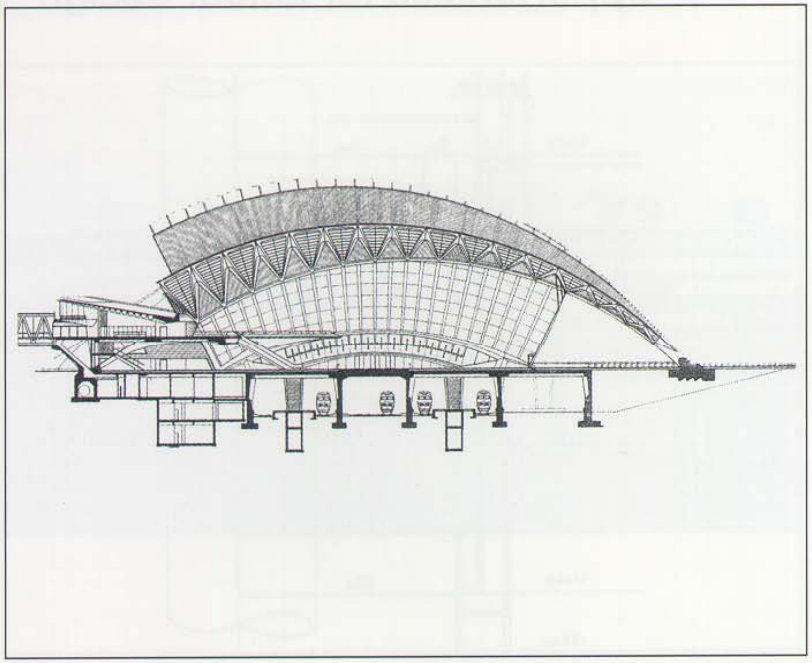
**- Izražanje funkcije**



# Estetika in prestiž

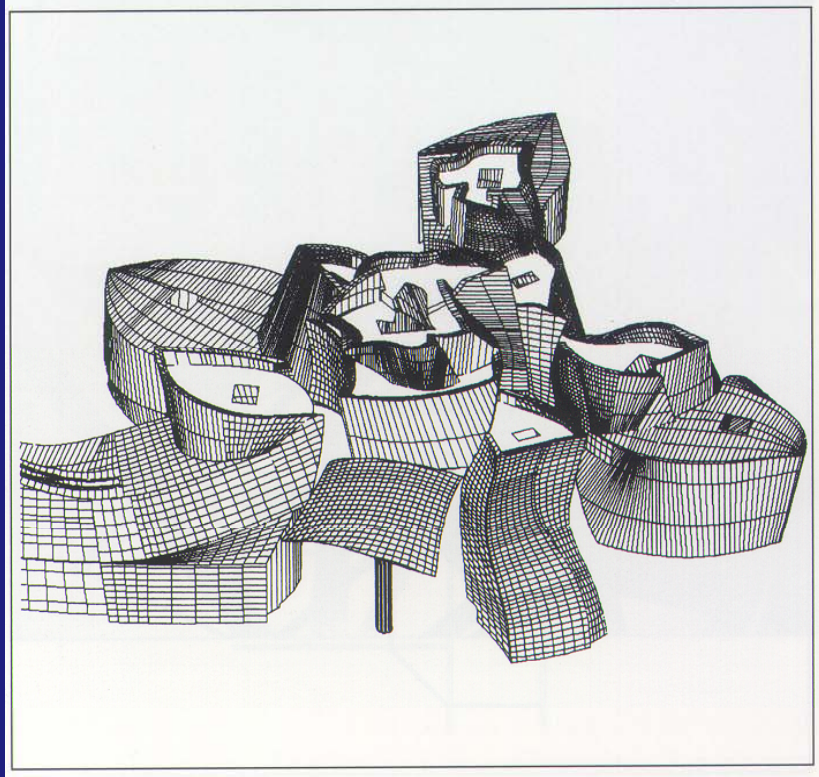
TGV Station, Lyon Satolas, F
Architect & Structural Engineers: Santiago Calatrava Valls, Paris and Zurich.
Completed 1993.

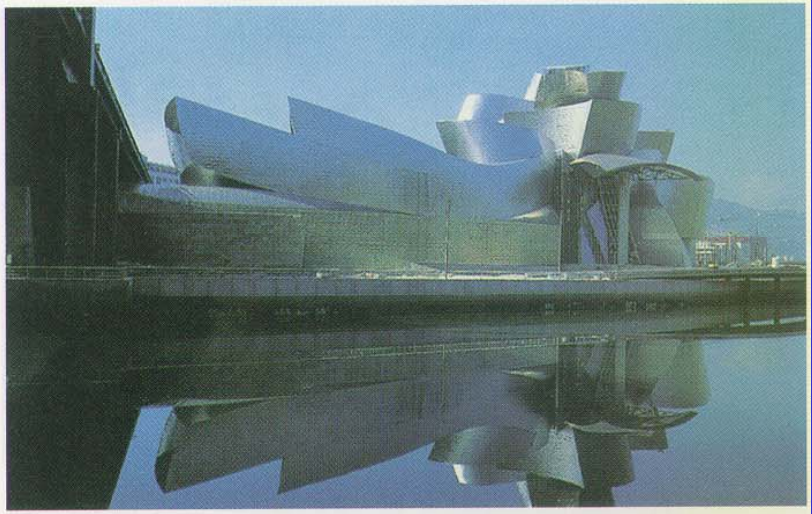
**- Izražanje identitete in imidža naročnika**



# Estetika in prestiž

**- Brez omejitev za domišljijo arhitekta**



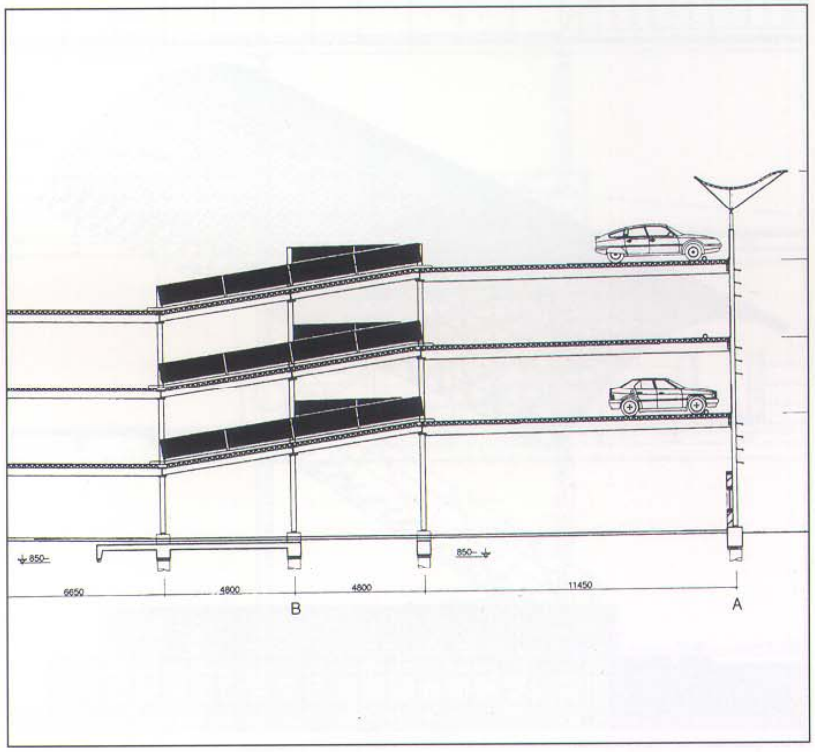


Guggenheim Museum, Bilbao, E

Architects: Frank O. Gehry & Associates Inc., Santa Monica, California.
Structural Engineers: Skidmore Owens & Merril, Chicago.
Completed 1996.

# Ekonomija

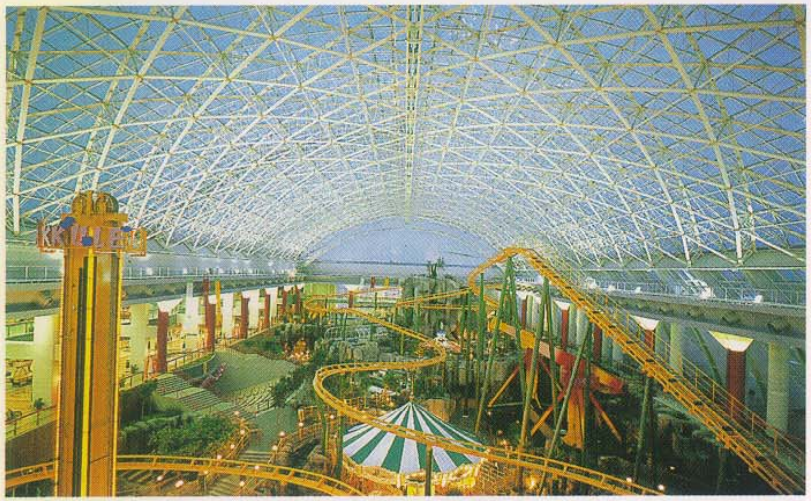
**- Enostavno in funkcionalno projektiranje**




Doorneind Car Park, Helmond, NL

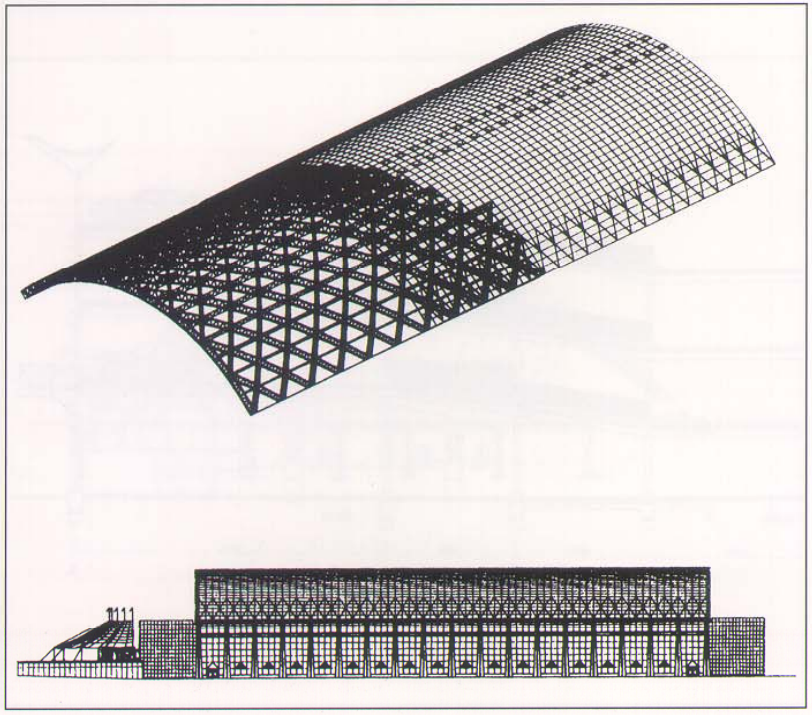
Architects: Architectenbureau Van den Pauwert, Eindhoven.
Structural Engineers: Grabowsky & Poort, Eindhoven.
Completed 1995.

# Ekonomija



Bati Tourism Centre, Istanbul, TR
Architect: Oktay Nayman
Structural Engineers: Erdemli Engineering and Consultancy Ltd.
Completed 1996.

**- Efektna izdelava in montaža konstrukcije**



# Ekonomija

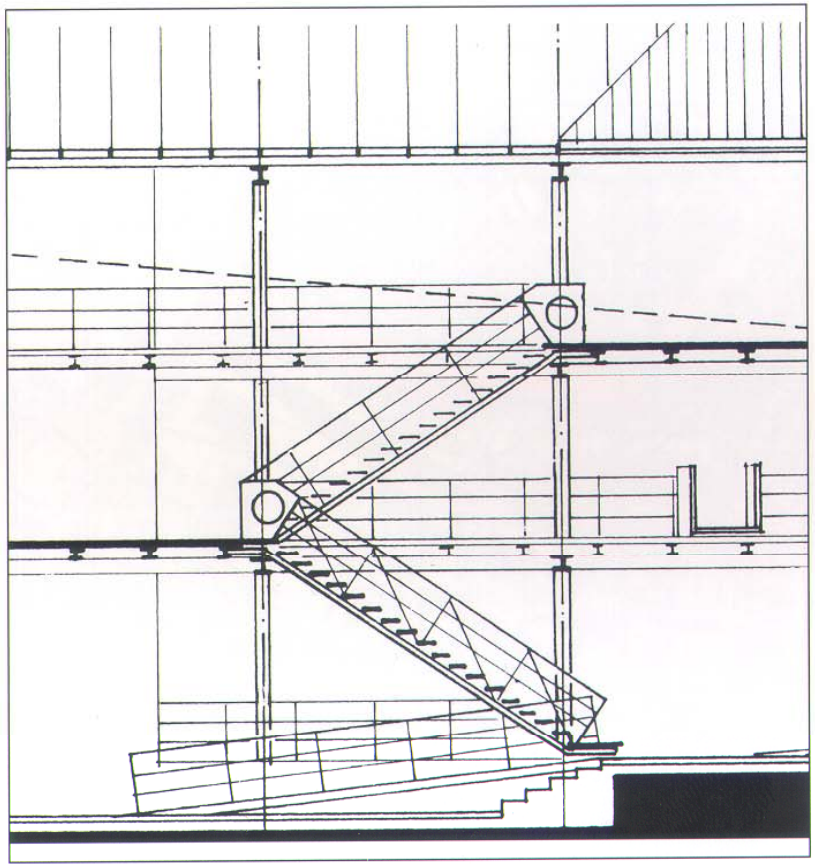
- **Kratek čas izdelave**

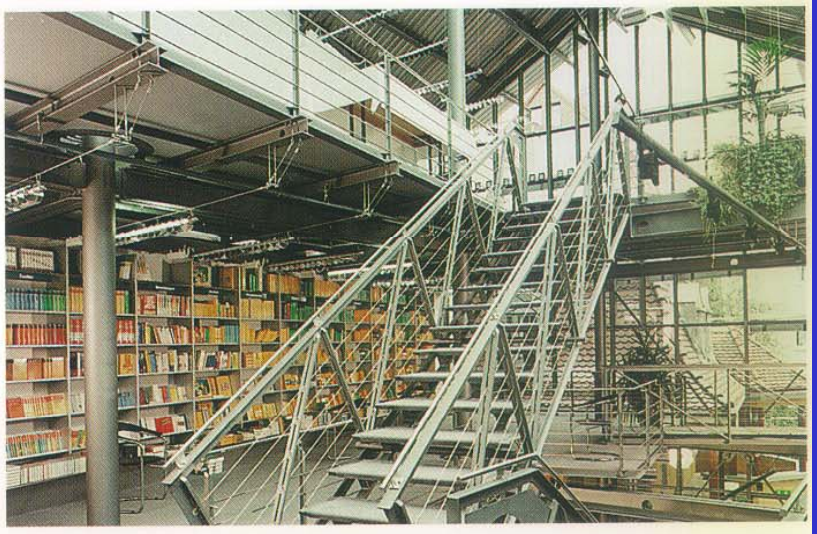
Exhibition Centre,
Chalon-sur-Saône, F

Architects: Phillippe Houot, Saint-Dié.
Completed 1992.

# Ekonomija

- Hitra montaža





Conversion and expansion of bookshop, Konstanz, D

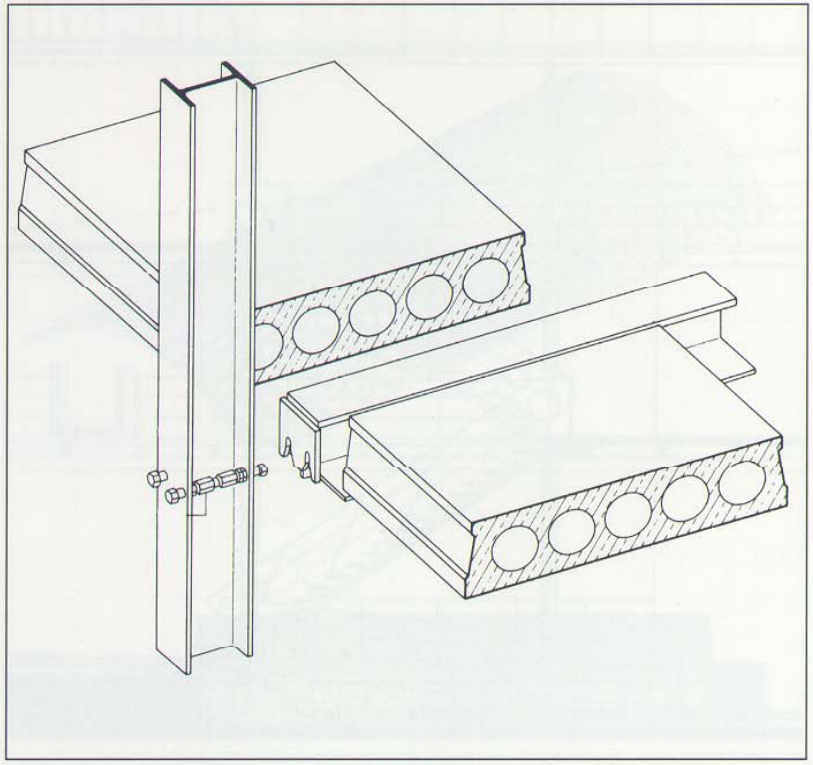
Architects: Herbert Schaudt and Martin Cleffmann, Konstanz.
Structural Engineers: Karl Fischer and Ingenieurbüro Leisering, Konstanz.
Completed 1991.

# Ekonomija


YIT-Yhtma Oy, Office Building, Helsinki, SF

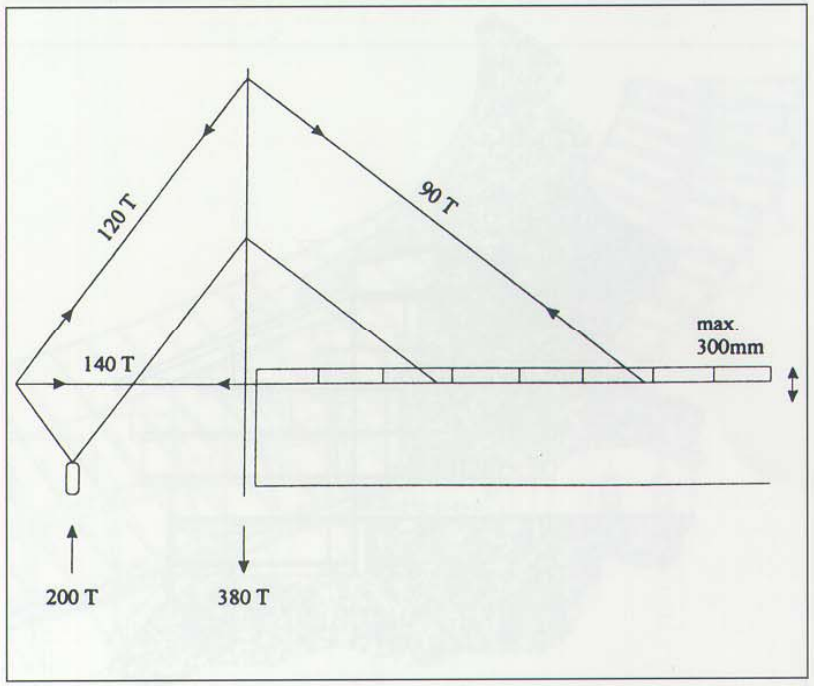
Architects: Architect bureau Ruokosuo Oy ARKS, Helsinki.
Structural Engineers: Ekono Oy, Helsinki.
Completed 1992.

- **Plitve stropne konstrukcije**
- **Suha montaža**



# Ekonomija

**- Manjši stroški temeljenja – manjša lastna teža**

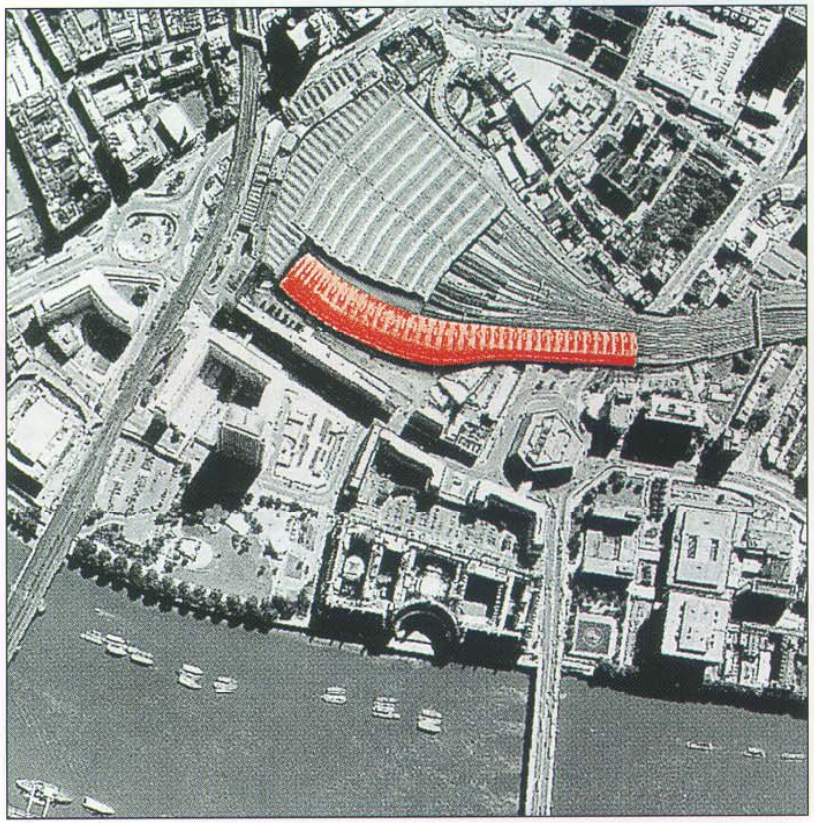



Oxford Ice Rink, GB

Architects: Nicholas Grimshaw & Partners, London.
Structural Engineers: Ove Arup & Partners, London.
Completed 1984.

# Ekonomija

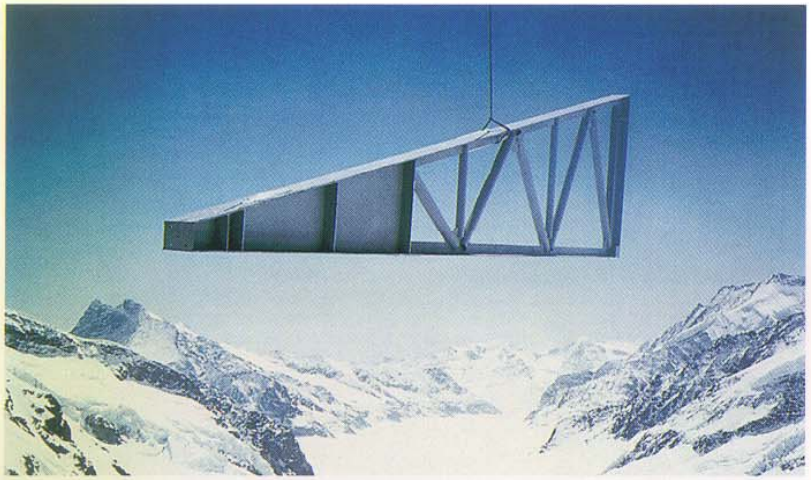
- Majhni stroški gradbišča



International Terminal Waterloo, London, GB

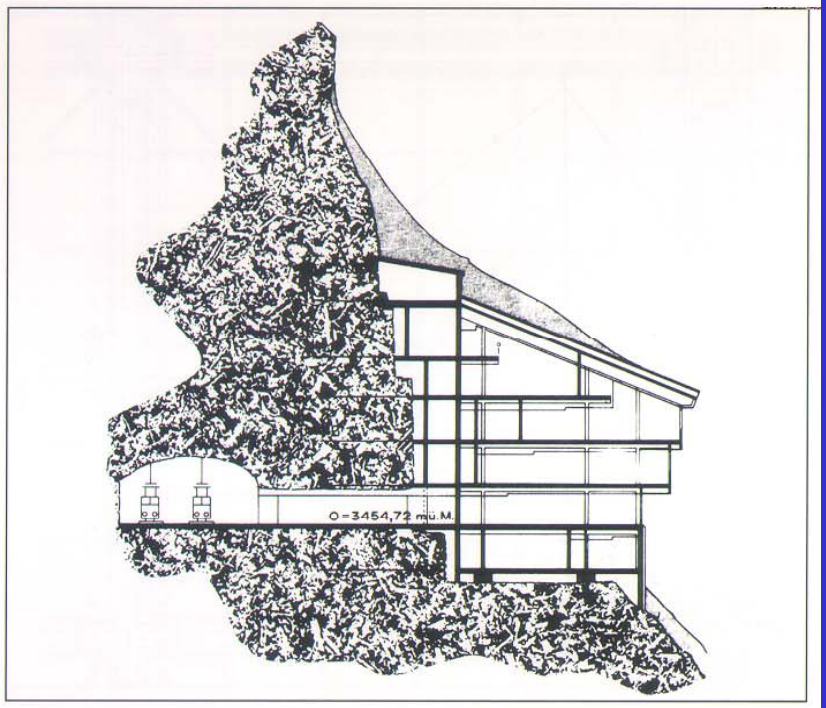
Architects: Nicholas Grimshaw & Partners, London.
Structural Engineers: Anthony Hunt/YRM, Cirencester.
Completed 1994.

# Ekonomija

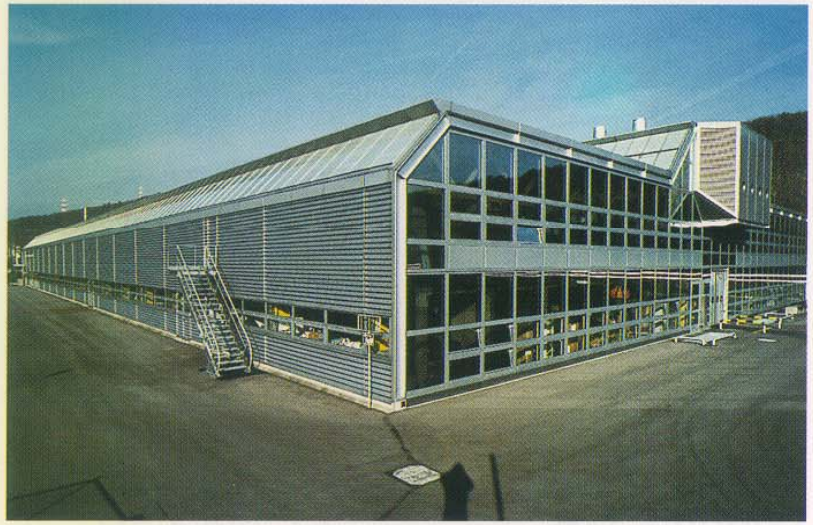


Top of Europe, Jungfraujoch, CH
Architects: E. E. Anderegg, Meiringen.
Structural Engineers: Balzari-Schudel AG, Bern.
Completed 1987.

**- Gradnja v veliki meri neodvisna od vremenskih pogojev - prefabrikacija**



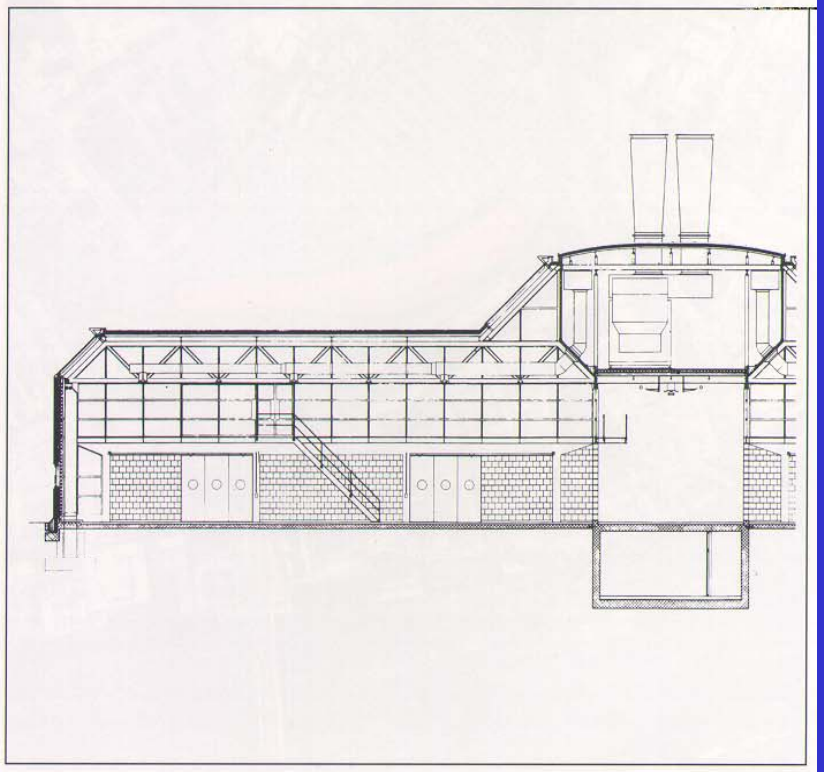
# Ekonomija



Transcolor Works, Hassmerheim, D

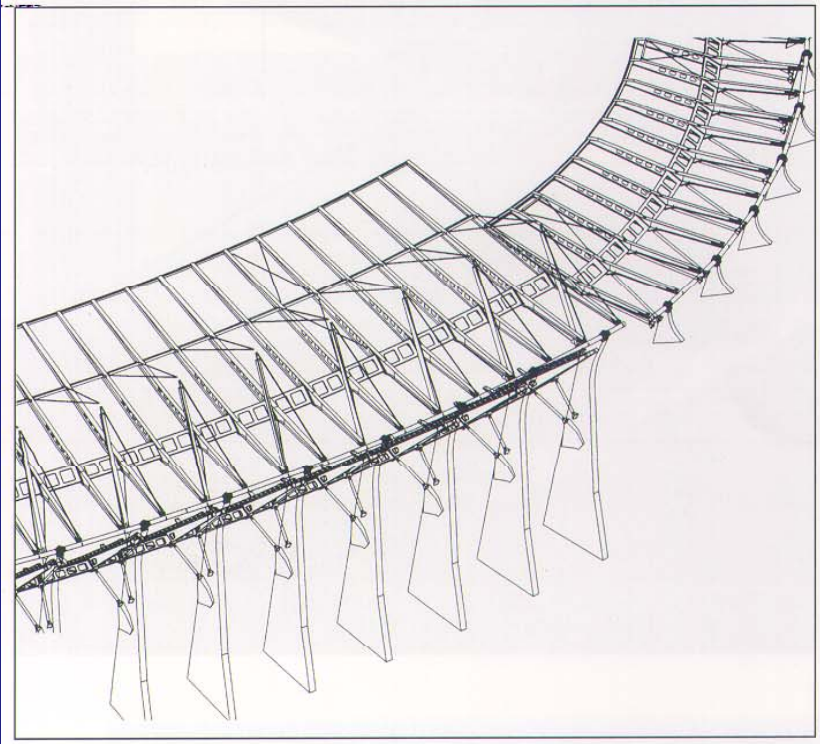
Architects: Theo Hotz, Zurich.
Structural Engineers: A. Lurz, Heilbronn.
Completed 1985.

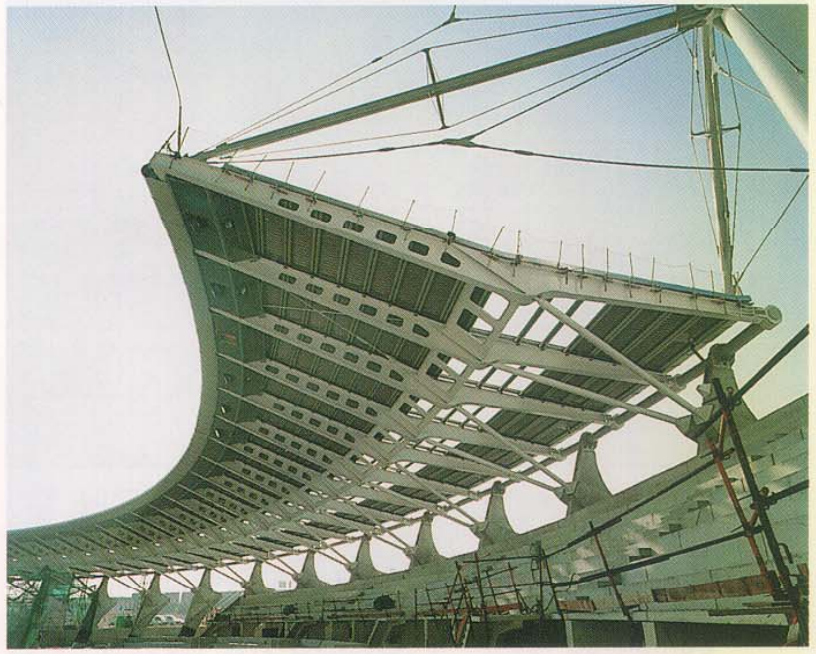
**- Enostavno vodenje instalacij**



# Ekonomija

**- CAD/CAM zagotavlja zanesljivost, hitro projektiranje in izvedbo**

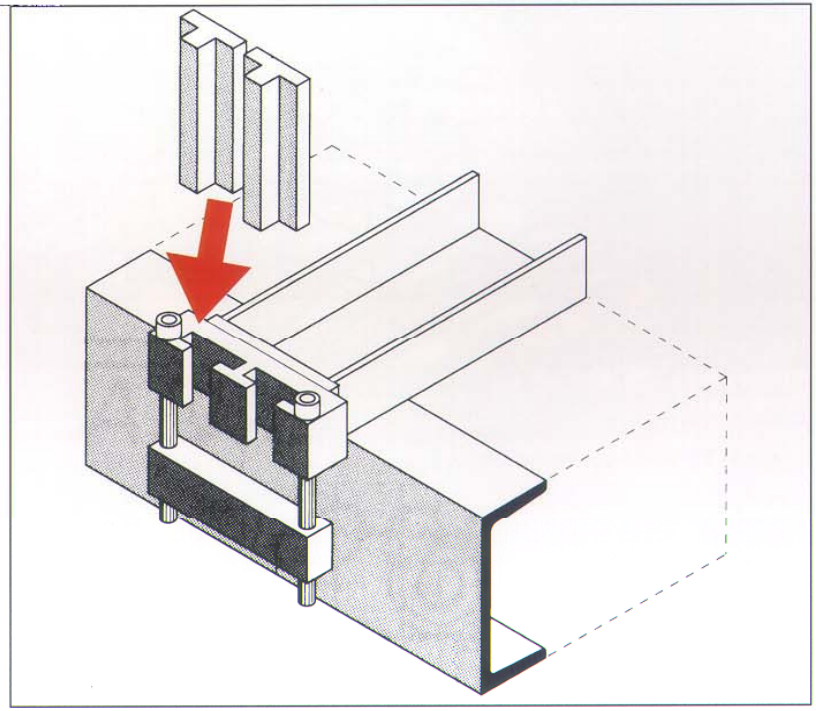




Sébastien Charléty Stadium
Stands, Paris, F
Architects: Henri et Bruno Gaudin, Paris.
Structural Engineers: OTH, Paris.
Completed 1994.

# Ekonomija

- Enostavno pritrjevanje fasad



Rembrandt Tower, Amsterdam, NL
Architects: ZZ + P Architecten, Amstelveen.
Structural Engineers: Samenwerkende
Adviesbureaus Amstelhoek, Amsterdam.
Completed 1995.

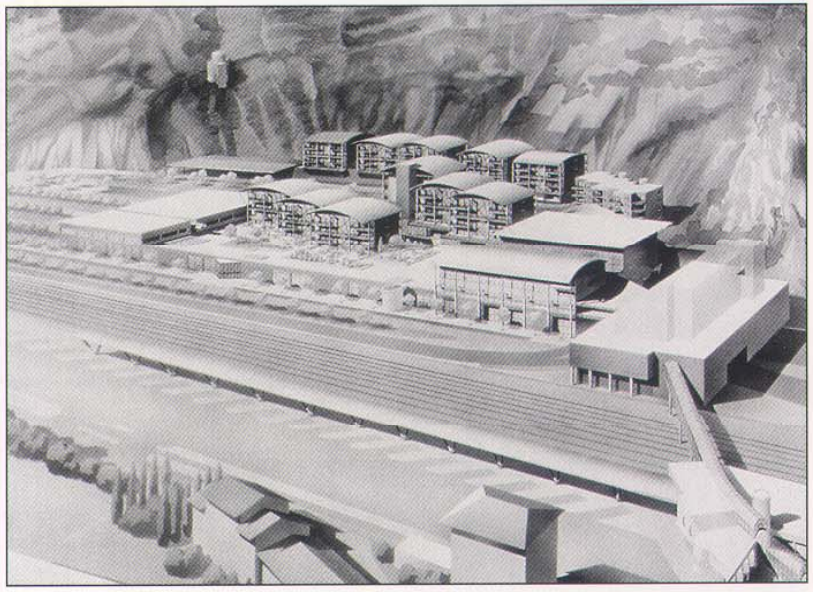
# Ekonomija

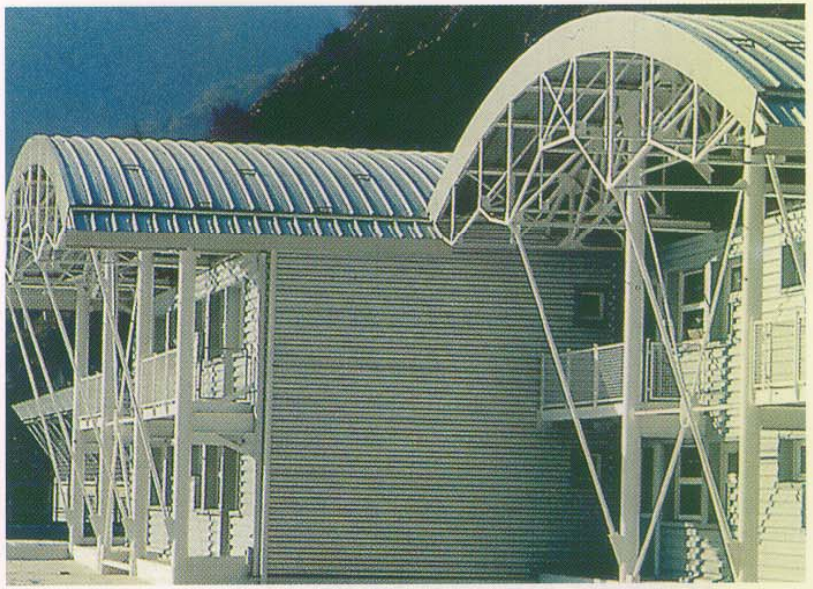
Liverpool Street Station, London, GB
Architects: British Railways Board Architectural Design Group.
Structural Engineers: British Railways New Works Engineers.
Completed 1991.

- **Trajnost, dolga življenska doba**
- **Dobro predvideni stroški vzdrževanja**

# Prilagodljivost

- **Enostavne bodoče spremembe**
- **Enostavna demontaža**
- **Enostavno ojačevanje**





C.I.R.T.V., Moutiers, F

Architects: Denis Sloan, Paris.
Structural Engineers: Technip, Paris La Défense.
Completed 1992.

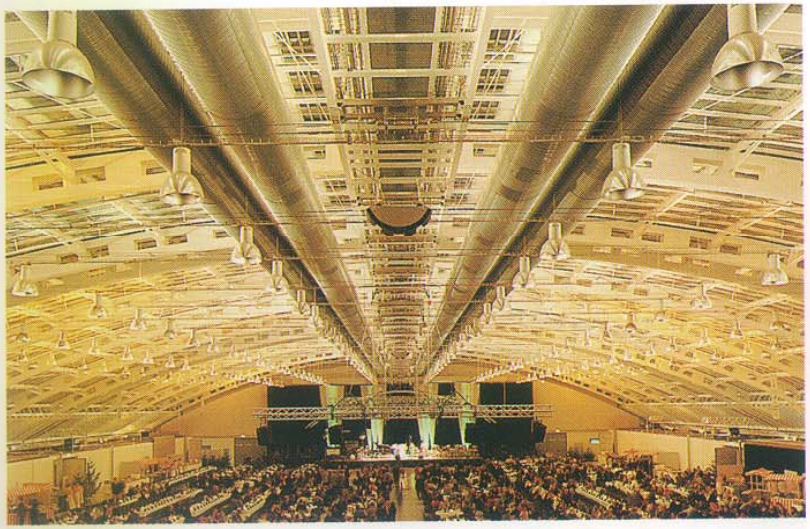
# Prilagodljivost

- Enostavno dograjevanje

Library extension, University of Bath, GB

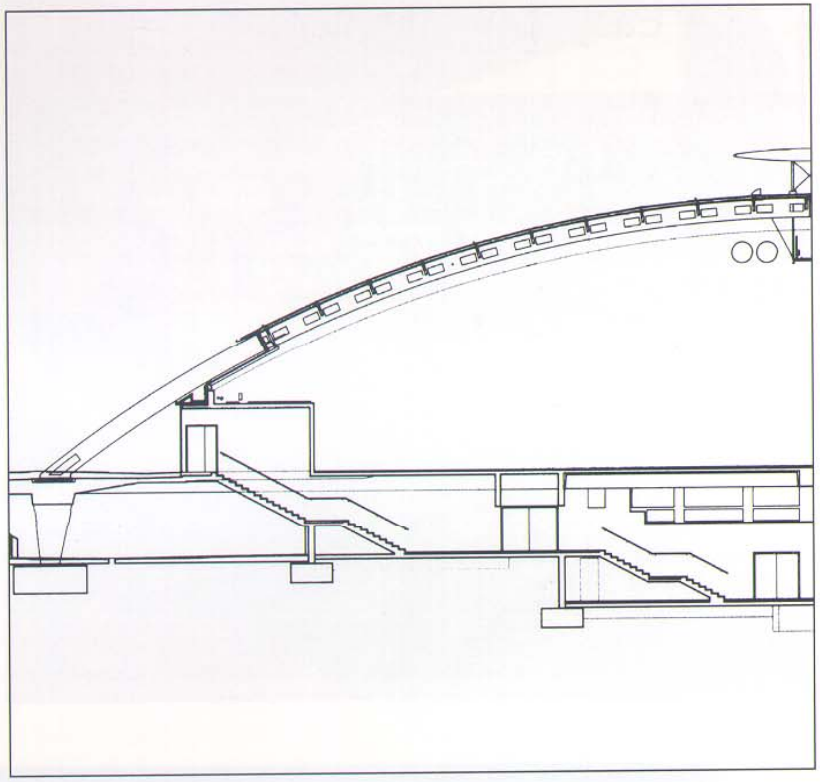
Architects: Alec French Partnership.
Structural Engineers: Oscar Faber.
Completed 1997.

# Prilagodljivost



Design Centre Linz, A
Architects: Herzog + Partner, München.
Structural Engineers: Sailer + Stepan, München;
Kirsch-Muchitsch und Partner, Linz.
Completed 1993.

**- Veliki razponi – uporabnost prostora**

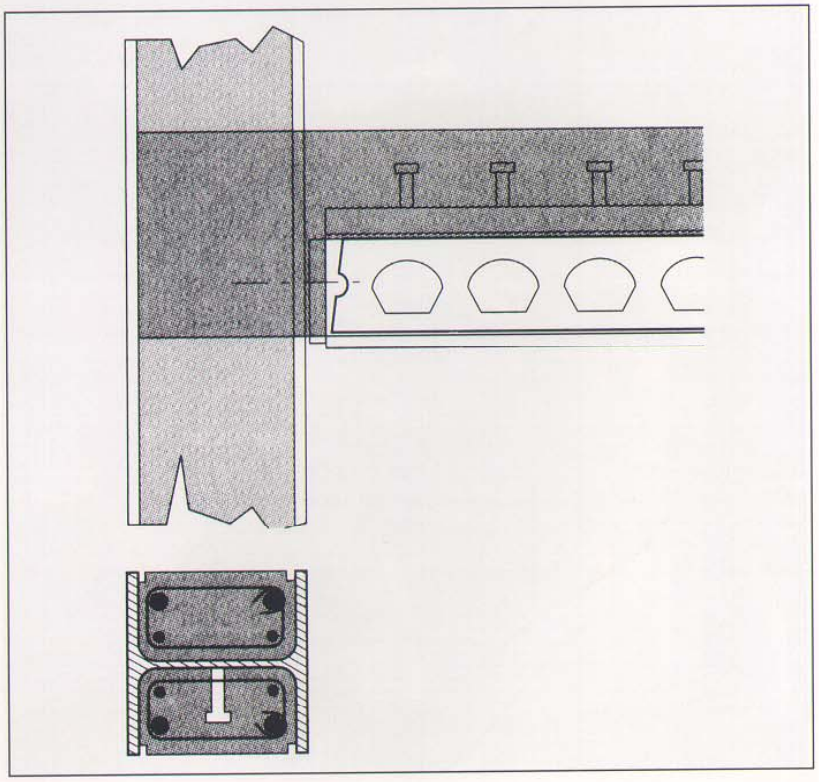


# Prilagodljivost

Ecole Nationale des Ponts et Chaussées, Marne-la-Vallée, F

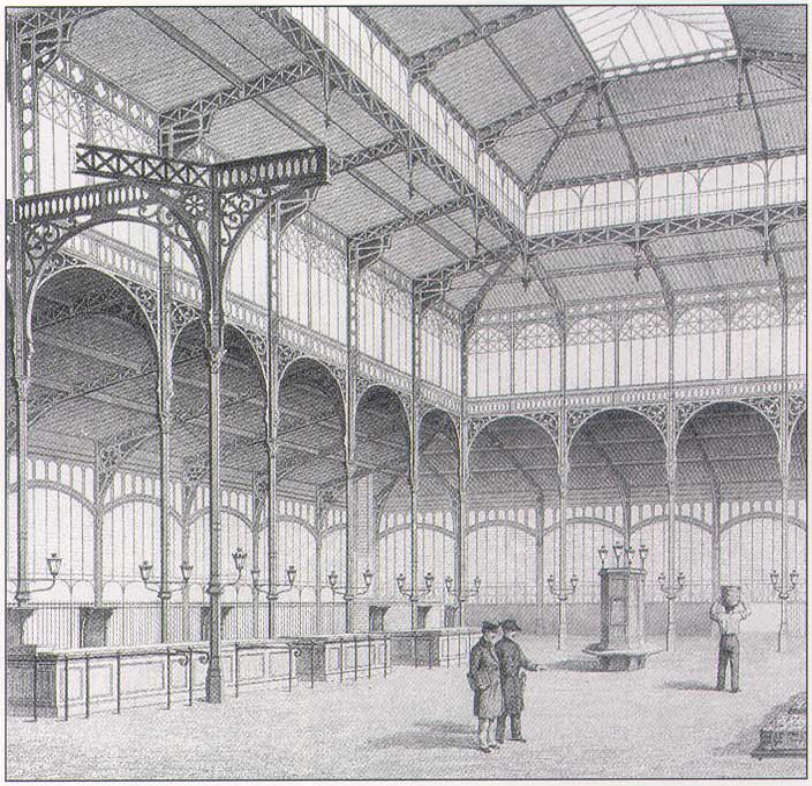
Architects: Atelier d'Architecture Chaix & Morel et Associés, Paris.
Structural Engineers: OTH Bâtiments, Paris.
Completed 1996.

**- Prilagodljivost za vodenje inštalacij**



# Okoljevarstveni vidiki

- **Enostavna prestavitev objekta**



Pavillon Baltard, Paris, F

Architects: Victor Baltard et Félix Callet.
Completed 1854 (relocated 1971).

# Okoljevarstveni vidiki

- **Enostavnejši transport**

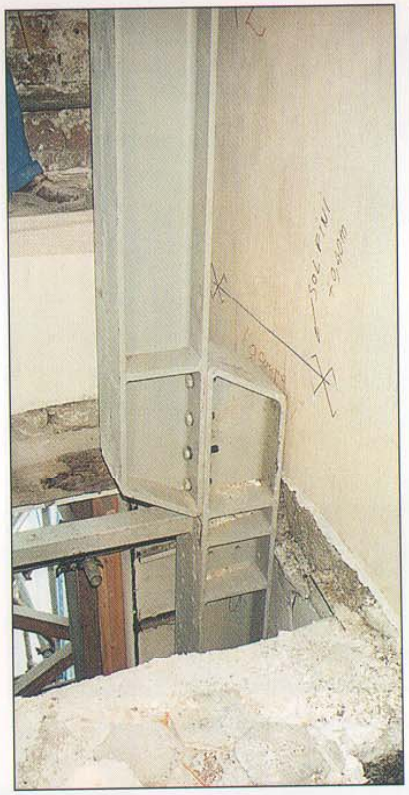
Kansai Airport, Osaka, J
Architects: Renzo Piano.
Structural Engineers: Ove Arup & Partners International.
Completed 1994.

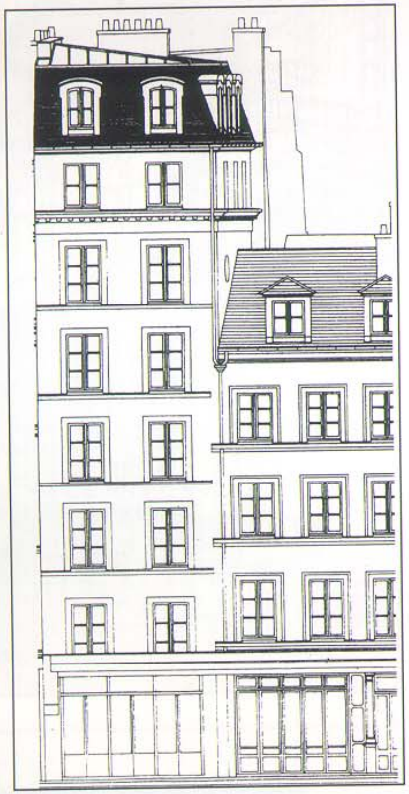
# Okoljevarstveni vidiki

Housing Refurbishment, Quai de Montebello, Paris, F

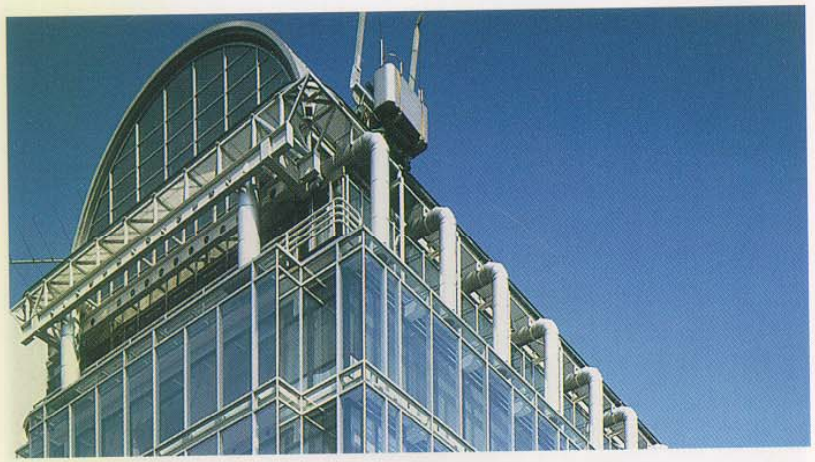
Architects: Michel de Robert, Paris.
Structural Engineers: Jacques Cambon, Clamart.
Completed 1991.

**- Okolju prijazno gradbišče – manj hrupa, manj prahu, manj prostora**



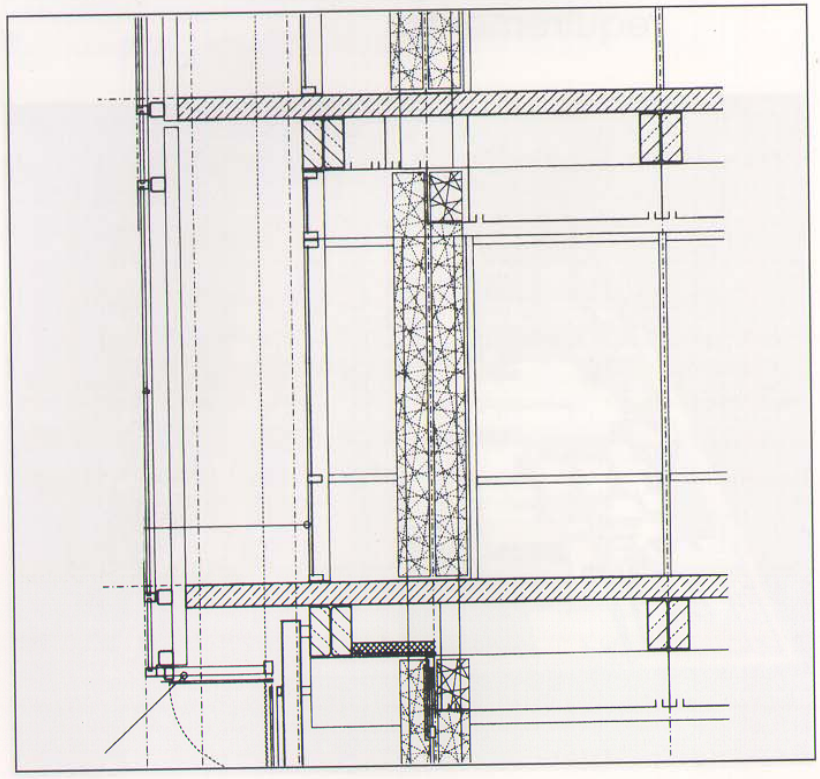


# Okoljevarstveni vidiki



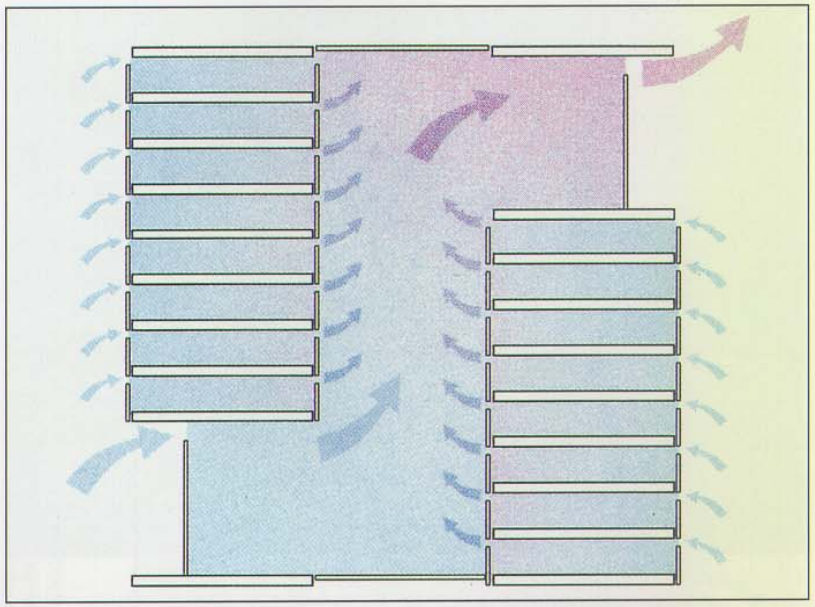
Brussimmo House, Bruxelles, B
Architects: Samyn & Associés, Bruxelles.
Structural Engineers: Setesco.
Completed 1993.

**- Energijsko varčno projektiranje**



# Okoljevarstveni vidiki

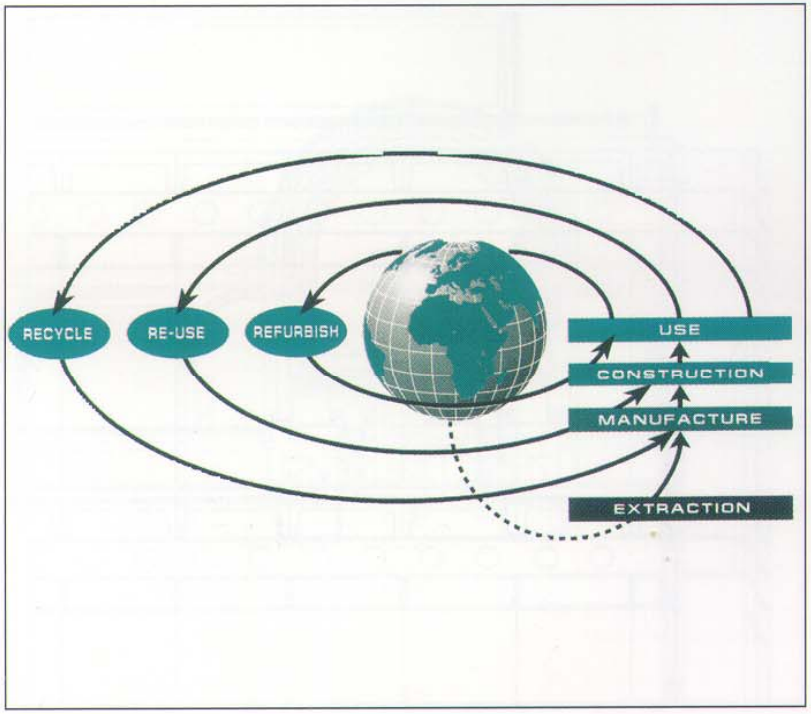
- Naravno hlajenje

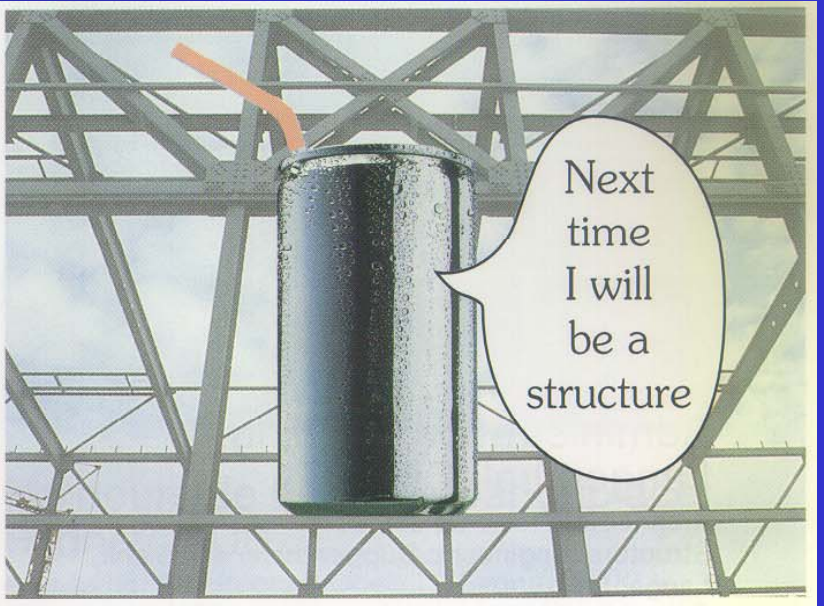


Commerzbank, Frankfurt, D
Architects: Sir Norman Foster & Partners.
Structural Engineers: Ove Arup & Partners.
Completed 1997.

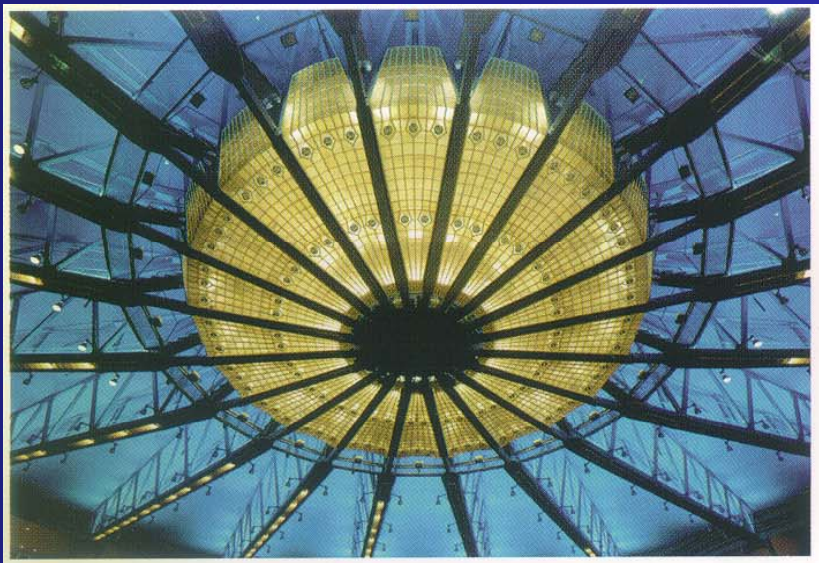
# Okoljevarstveni vidiki

- Recikliranje jekla



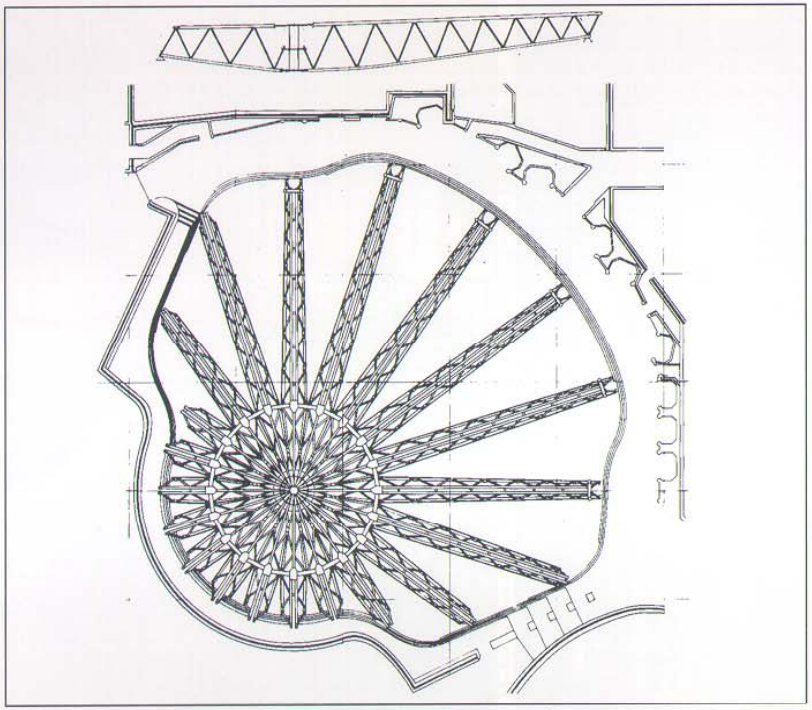
# Tehnični vidiki



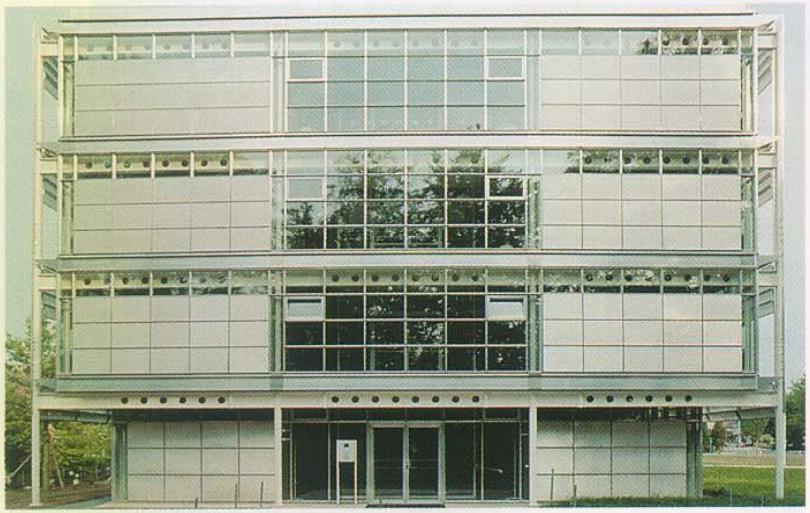
Concert Hall, Köln, D

Architects: Peter Busmann & Godfrid Haberer, Köln.
Structural Engineers: Varwick, Horz, Ladewig, Naumann, Tripler Zilinski, Köln.
Completed 1986.

**- Uspešne rešitve za zvočno izolacijo**



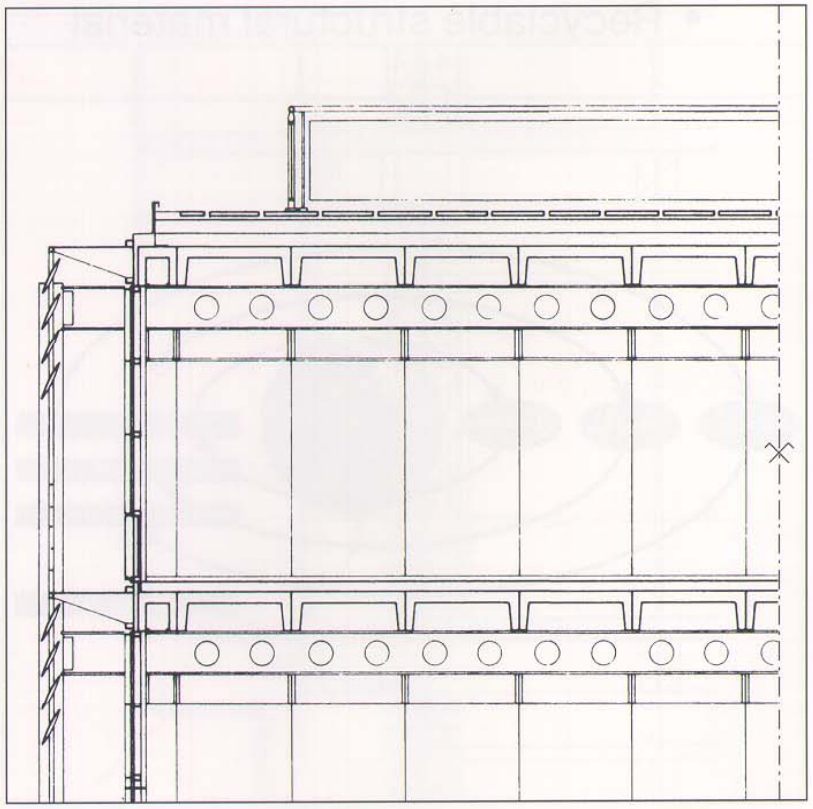
# Tehnični vidiki



Administration Building,
Langenthal, CH

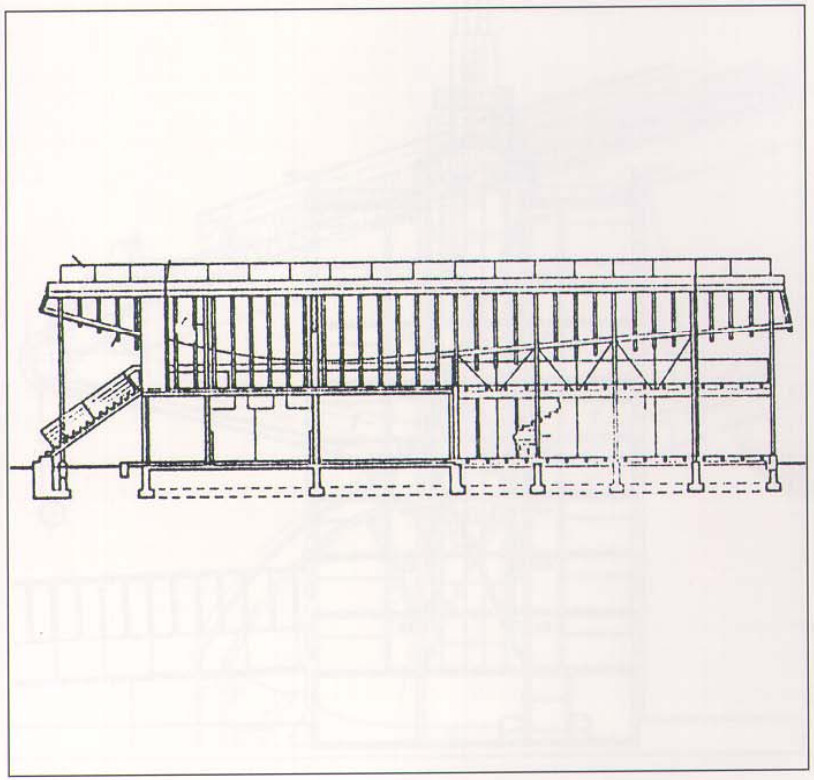
Architects: Frank Geiser, Bern.
Structural Engineers: Duppenthaler + Wälchli, Langenthal.
Completed 1992.

**- Uspešne rešitve za toplotno izolacijo**



# Tehnični vidiki

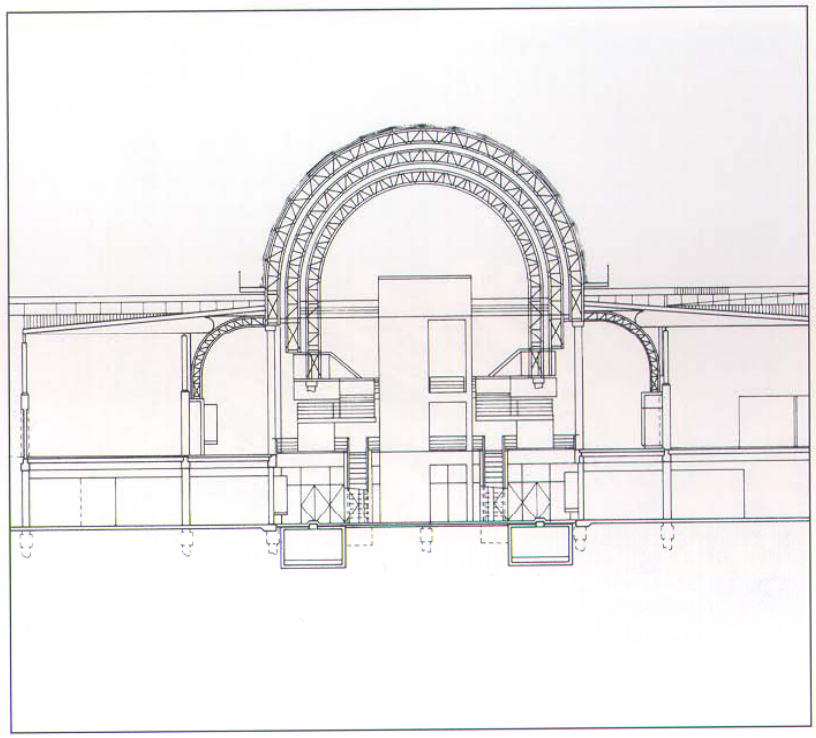
**- Enostavno kombiniranje jekla z ostalimi materiali**

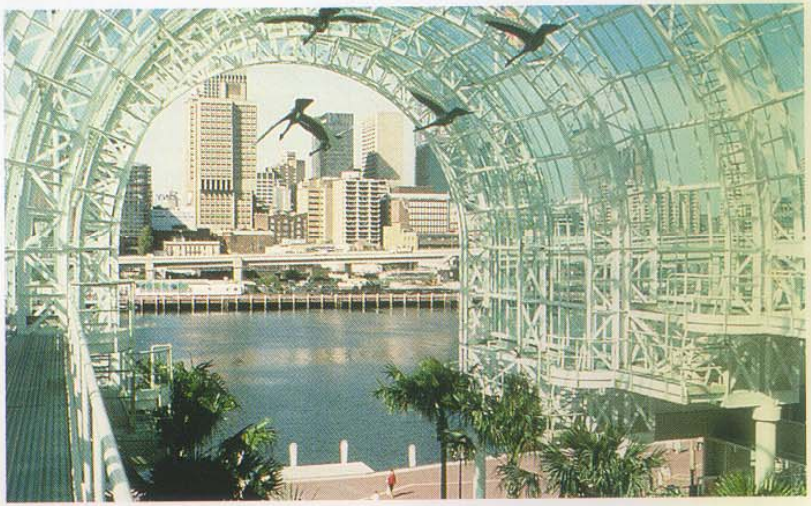


Sailing Club Utting, Ammersee, D
Architects: Wolf-Eckart Lüps, Utting.
Structural Engineers: Jugl + Ebner, Memmingen.
Completed 1993.

# Tehnični vidiki

**- Uspešni sistemi za površinsko zaščito jekla**





Harbourside Festival Marketplace, Sydney, AUS

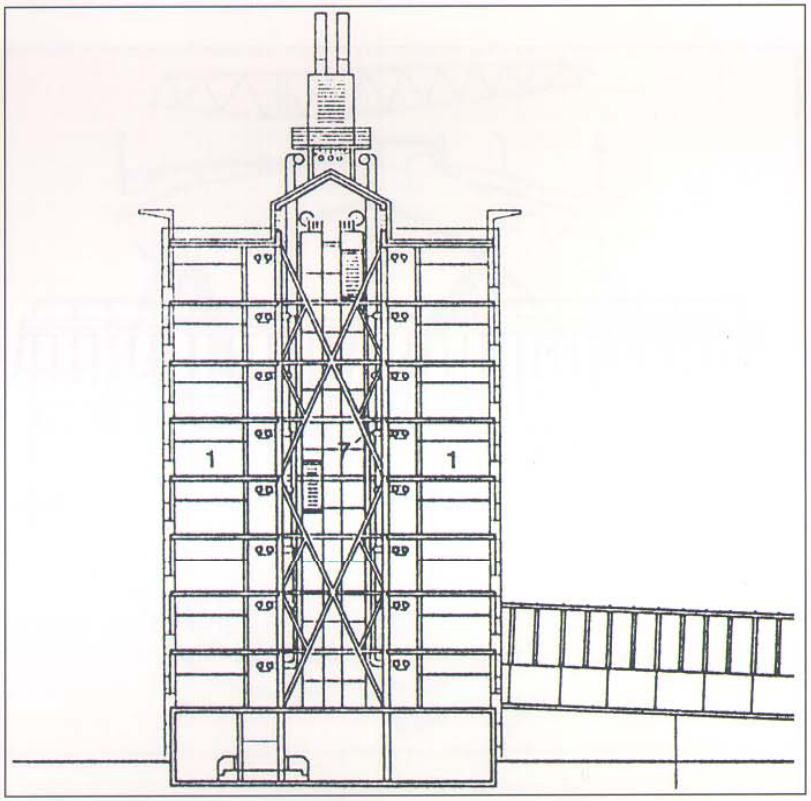
Architects: Architecture Oceania, Sydney; RTKL Associates, USA.
Structural Engineers: Wargon Chapman, Sydney.
Completed 1988.

# Tehnični vidiki

ARBED Research Centre, Esch-sur-Alzette, L

Architects: Architekturbüro Böhm, Köln.
Structural Engineers: Schroeder & Associés, Luxembourg; Arne Hill AS, Oslo/Paris.
Completed 1993.

**- Poceni in uspešna protipožarna zaščita**

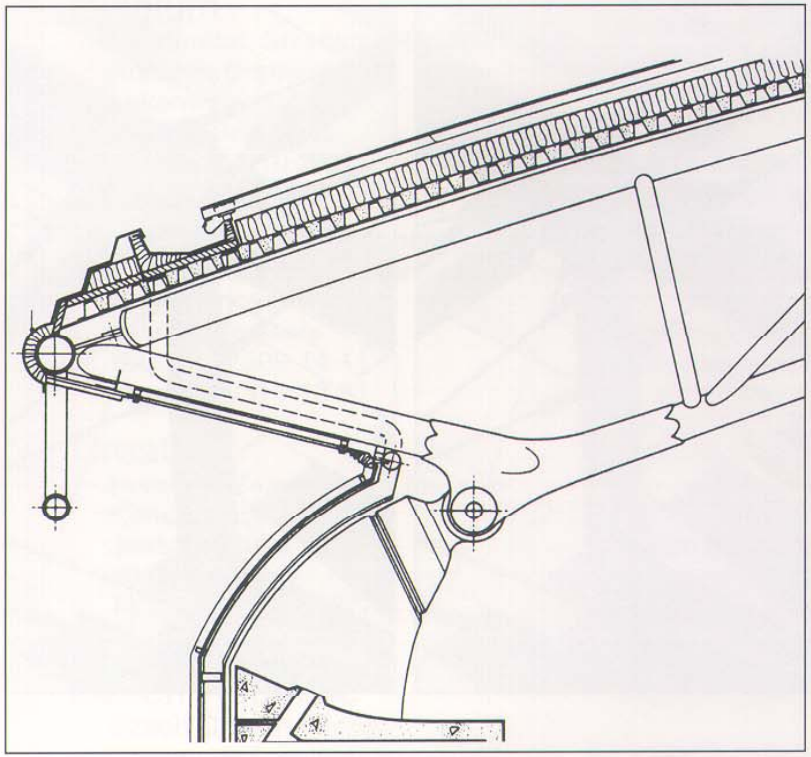


# Varnost

- Sposobnost prevzemanja izjemnih obtežb (potres, eksplozija)

# Varnost

- Zagotavljanje kakovosti

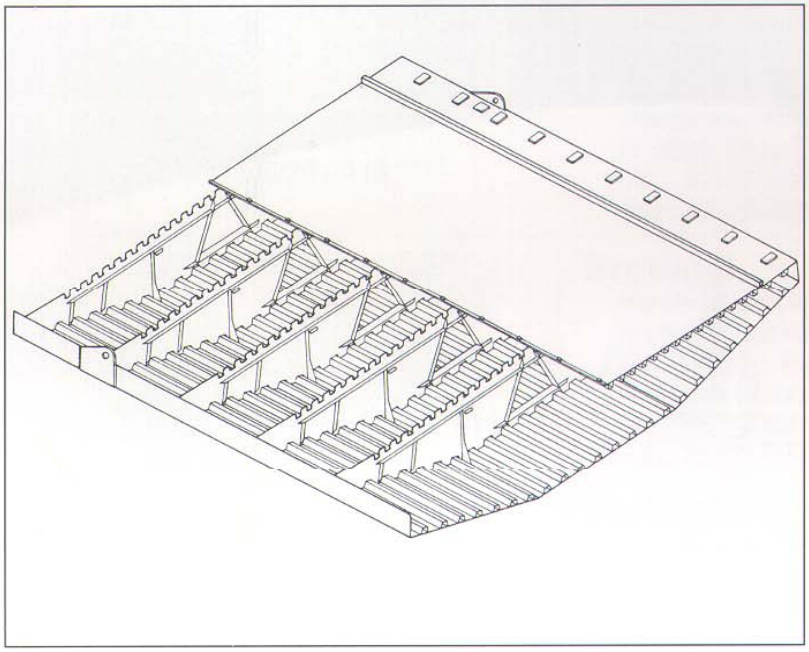


Pondsforge International Sports Centre, Sheffield, GB

Architects: FaulknerBrown, Newcastle.
Structural Engineers: Ove Arup & Partners, Sheffield.
Completed 1991.

# Varnost

- **Homogen material podvržen strogi kontroli kvalitete**



Pont de Normandie, Honfleur, F

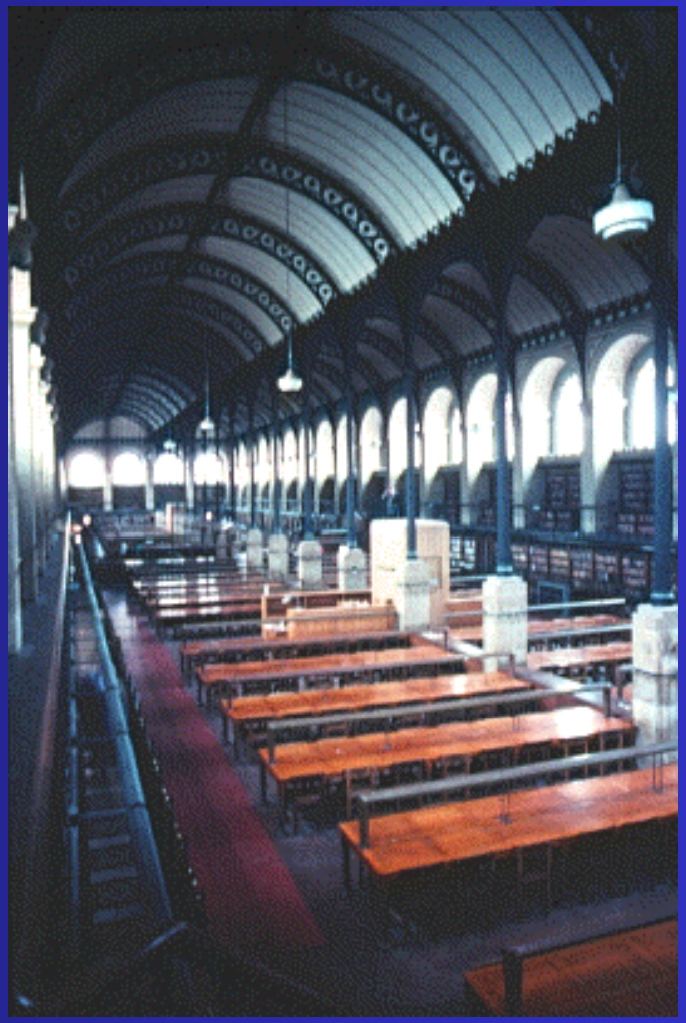
Structural Engineers: DDE de Seine-Maritime;
SETRA: M. Virlogeux, Sofresid – Montreuil.
Completed 1994.

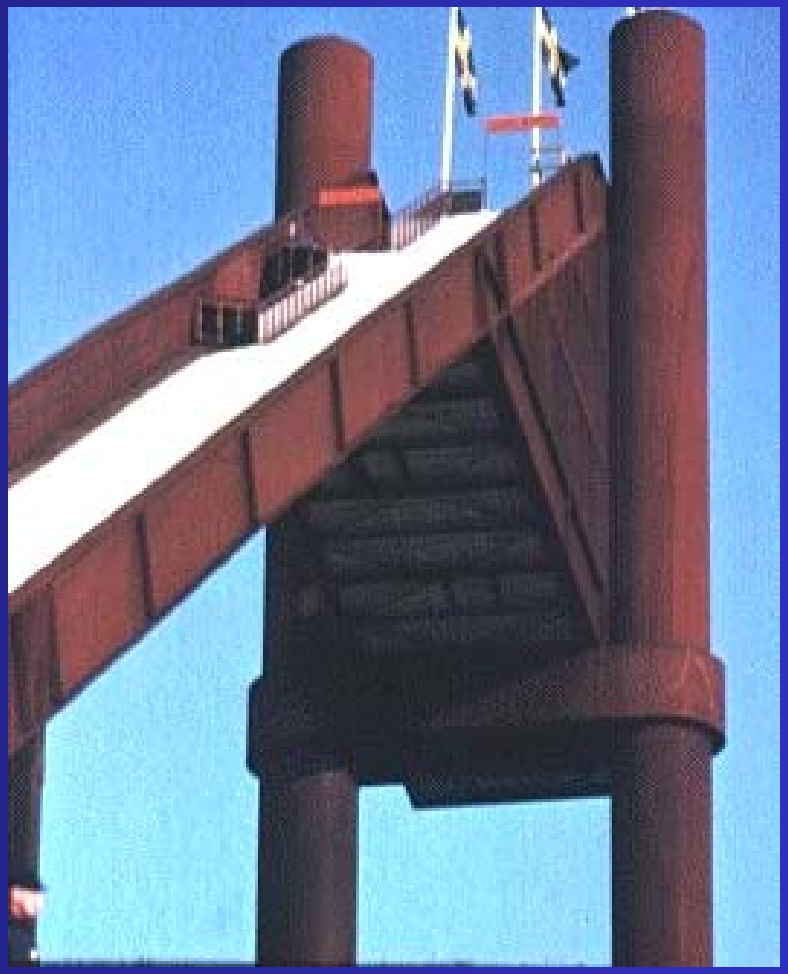
# Varnost

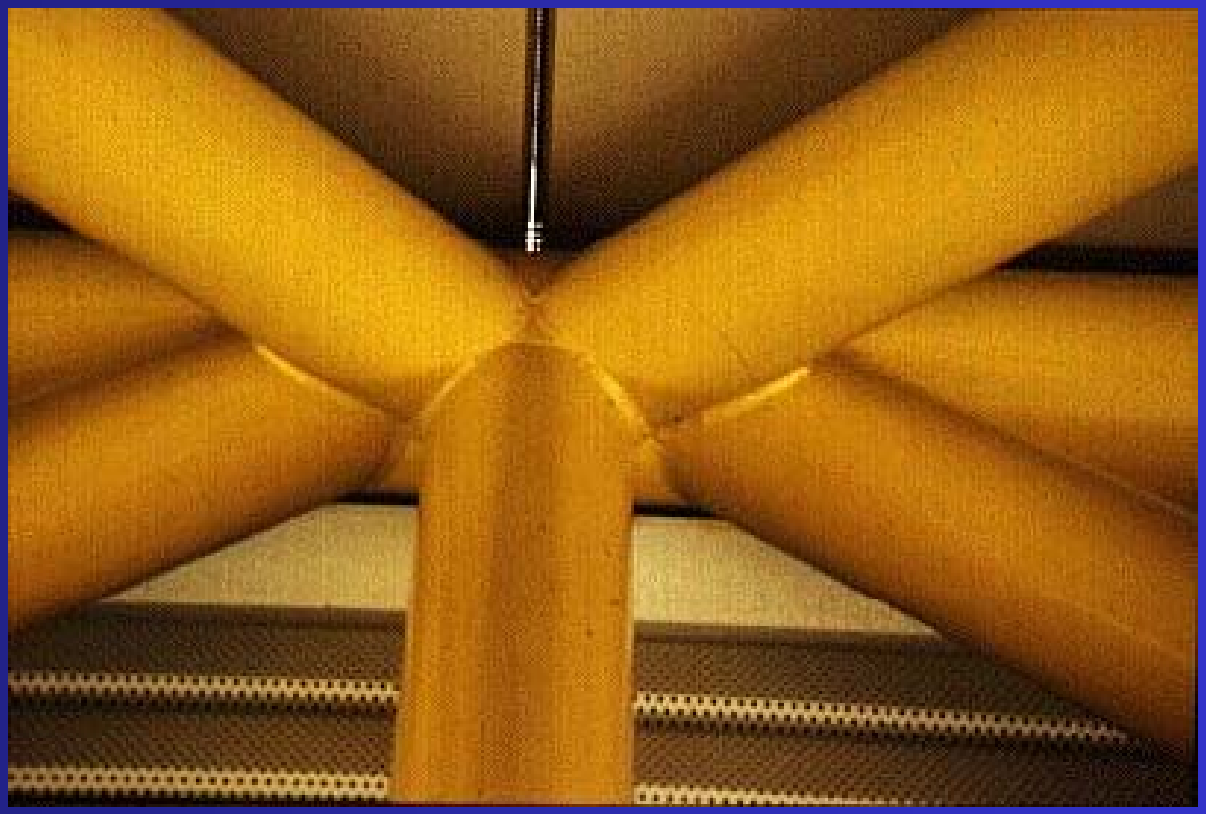

Eurodisney Station,
Marne-la-Vallée, F

Architects: SNCF Paris.
Structural Engineers: ARCORA, Orsay-les-Ulis.
Completed 1993.

**- Vidni stiki – enostavna kontrola**

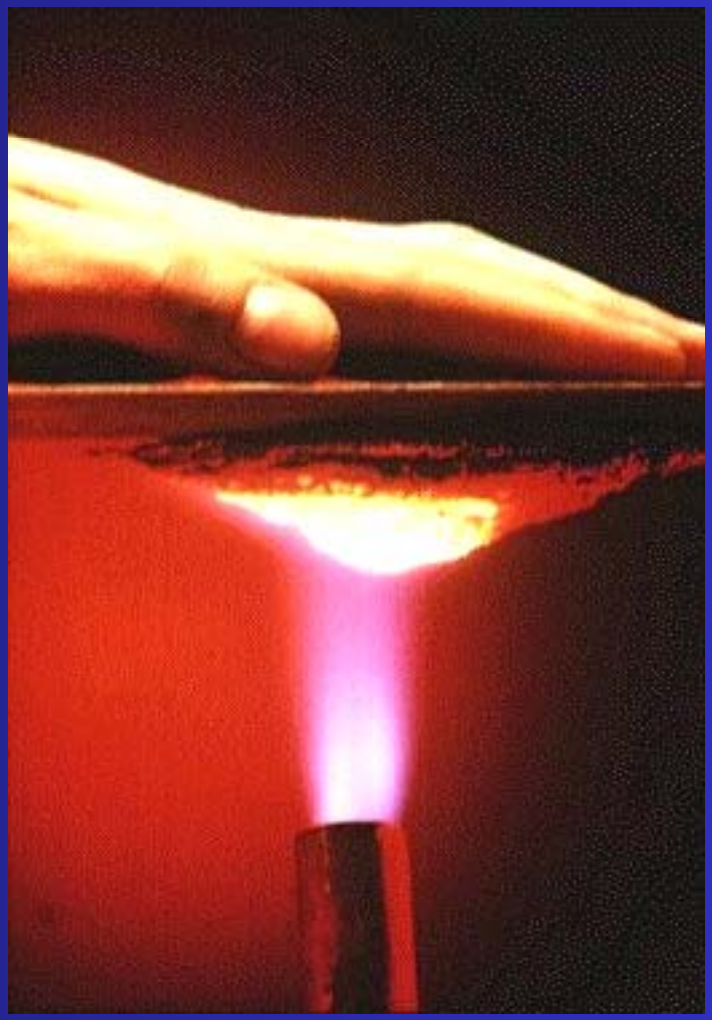


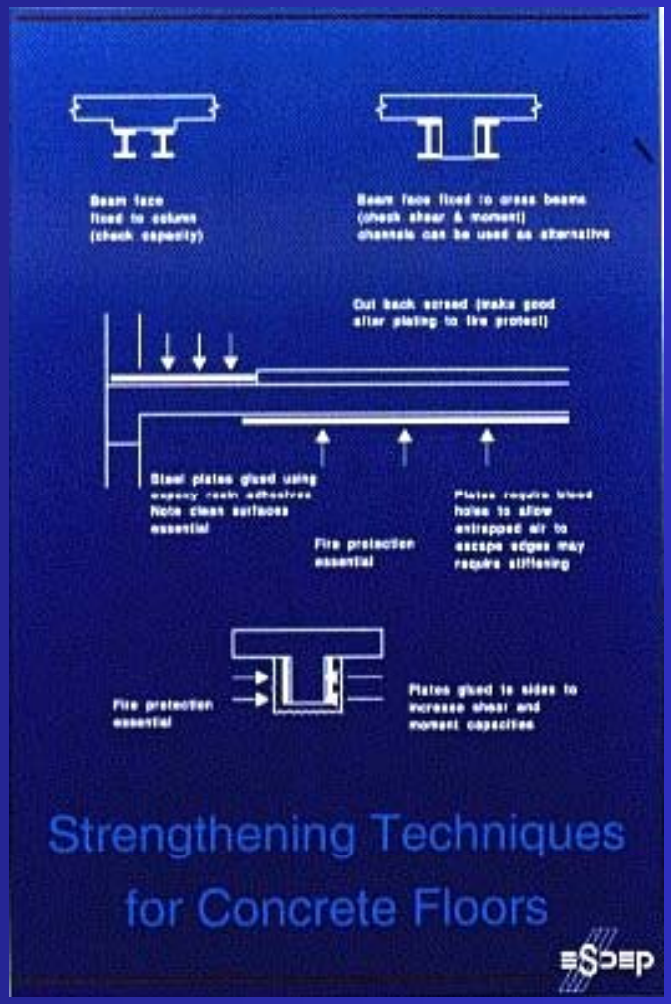




# Interior Steelwork

## Nottingham Post Office - 1893




Beam face
fixed to column
(check capacity)
Beam face fixed to cross beams
(check shear & moment)
channels can be used as alternative
Cut back screed (make good
after plating to fire protect)
Steel plates glued using
Note clean surfaces
essential
Fire protection
essential
Plates glued to sides to
increase shear and
moment capacities
Strengthening Techniques
for Concrete Floors

# Stare zamere – nove priložnosti

- požarna varnost
- visoke stropne konstrukcije

# Primerjalne prednosti jeklenih konstrukcij

- izgled – atraktivnost
- ekonomija – hitra gradnja
- velika prilagodljivost
- trajnost, enostavno vzdrževanje
- velika potresna odpornost
- recikliranje jekla
- varnost – natančneje opredeljena