CABLE ROOFS
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1st SOLETANCHE BACHY & FREYSSINET MEETING - PARIS - 10 JUNE 2010
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• 1. Cable roofs structures
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• 4. Anchorages
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• Minsk Arena, Biellorussia (2008)
• New Delhi Stadium, India (2010)
• BC Place Stadium, Canada (2011)
1. Cable roof Structures

Stadium roofs

New Delhi Stadium

BC Place Stadium

Minsk Arena
1. Cable roof Structures

Minsk Arena

- Central node
- 7 strand cable
- 27 strand cable
- Struts (steel tubes)
- Crossing cables
- 120 m
1. Cable roof Structures

New Delhi Stadium

Compression ring

Stabilizing cable (13st)

Supporting cable (25st)

Mast

Collars

130 m

New Delhi Stadium
1. Cable roof Structures

**BC Place Stadium**

- **Mast**
- **Back stays (2x72T15)**
- **Roof**
- **Upper Suspension cable (2xØ90)**
- **Central Node**
- **Hangers (Ø18 to Ø36)**
- **Lower Stabilizing cables (2xØ70)**
- **Compression ring beam**

BC Place Stadium

260m
1. Cable roof Structures

**Elements:**
- Roof
- Supporting suspension cable
- Hangers / compression masts
- Stabilizing cables
- Compression ring
- (tension Rings)

**Avantages:**
- Very large span without supports
- Light structure
- Aesthetics
2. Cable technologies

Prefabricated Cables

- **Spiral strand or Locked Cables**
  - Compactness
  - Clamp “ability”
  - Installation drawbacks
    - heavy cable
    - large anchorage (big jacks)
  - Poor durability
    - rust in the cable
    - high maintenance cost (paint)
    - low fatigue resistance (100 MPa)
2. Cable technologies

Multi strand cables: Cohestrand®

Durability requirement & Similarity with suspended bridges lead Freyssinet to propose a Cohestrand solution:

- 7 high grade steel wires
- Hot dip galvanisation
- Resin filling around and within strand ensuring full bond of sheath on strand (7MPa)
- Full-bonded HDPE coating (patented)

**Avantages:**
- Sliding forces are transmitted from the HPED duct to the strand steel through the resin
- High fatigue performance
- Corrosion protection:
  - Double layer corrosion protection
  - Continuity of the protection all along the cables
- Strand by strand installation
3. Clamps

Collars

- Cast iron frame
- PA shims
- Cohestrand
- triangles inserts

→ Continuity of the corrosion protection through the collar
→ Plastic / Plastic tightening
3. Clamps

Deviation « saddle »

• Target:
  Accommodates angle variations of the cables while limiting the flexural stresses

• Principle of “saddle clamps”:
  Impose a acceptable radius of curvature of the cables
4. Anchorages

- Classic anchorages (bloc and bearing plate):

In compression ring

In central node
4. Anchorages

- **Fork anchorages:**

  - In compression ring
  - On central node
  - In tension ring cables
  - On masts
5. Methods

Ph 1: Prefabrication

- Cable prefabrication bench

![Prefabrication bench](image1.png)

![Strand marking](image2.png)

![Storage](image3.png)

![Marking and unsheathing](image4.png)
5. Methods

Ph.2 : Clamp Connections

Clamp connection with pre-curved cable

Clamp installation

Strand bundle compaction

Pre-tightening
5. Methods

Ph.3 : Launching

Cable launchin with mast installation

Cable net launching
5. Methods

Ph.3 : Launching

Initial ref. strand launching and adjustment (sag)

Strand launching
5. Methods

Ph.3 : Lifting

Lifting of prefabricated cable net
5. Methods

Ph.4 : Separation and mast installation
5. Methods

Ph.5: Stressing

• Fabrication at length
  > (Adjustment at sag if possible)
  > (Pre-load: Central node release)
  > Application of roof load
Thank You