CONSTRUCTION METHODS

# Incremental Launching

Freyssinet

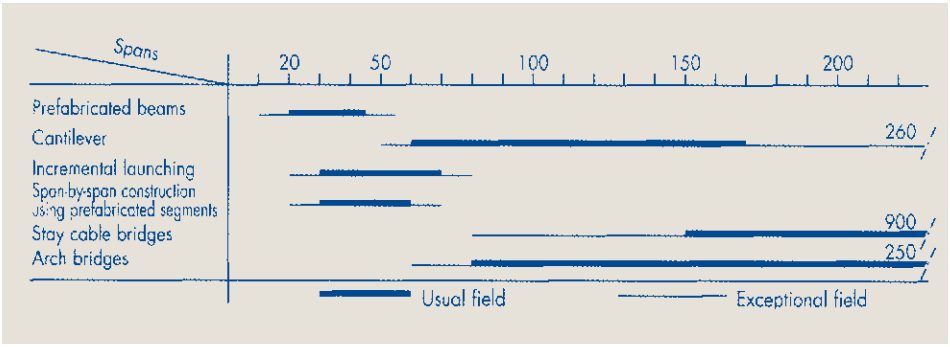
Sustainable Technology

# INCREMENTAL LAUNCHING

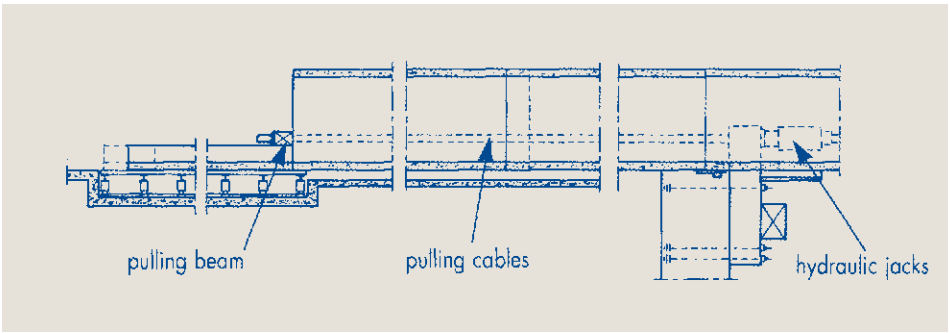
The deck is built from one of the banks of the area to be spanned in successive segments, pushed after concrete hardening. The advantages inherent to this method of construction, in use as early as in the sixties, are numerous:

- suppression of falseworks and scaffolding;
- reduction and optimisation of formworks;
- improved manpower efficiency due to a repetitive cycle;
- quality of fabrication in a casting yard which can be protected from bad weather;
- limited investment in special equipment.

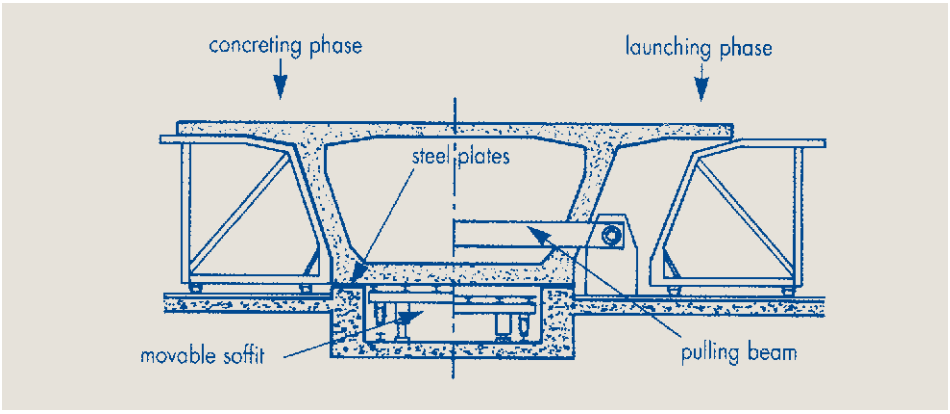
Wroclaw, Poland




Field of application of modern construction methods




Casting yard arrangement




Formwork principle

# CONSTRUCTION SEQUENCE

The span is built in segments over a rigid prefabrication bed allowing for geometric adaptations if required and onto which the formworks are fixed; it is then pushed - in entire spans or in segments - thus making room for carrying out, without interruption, the following span or segment. A steel nose, installed in front of the first span, permits the reduction of the deck cantilever length prior to it reaching a pier. Each pier is fitted with temporary sliding bearings and guiding devices.

# CHARACTERISTICS AND FIELD OF APPLICATION

### GENERAL GEOMETRY

A bridge can be incrementally launched only when the deck soffit can be reproduced by longitudinal displacement along the axis of the intrados: for example, straight bridges or curved bridges with a constant radius of curvature.

### TRANSVERSE SECTION

The constant depth box-girder is the best suited section for this type of construction (torsional rigidity and compression lower flange when passing over the supports). A transverse section made up of a slab with two ribs can be used for short spans (less than 30m).

### LENGTH OF SPANS

Except for the end spans, the spans have approximately the same length. The optimal span length, without need of temporary supports, ranges from 40 to 60 m.

### PRESTRESSING

During the launching phase, the prestressing is centered, except at the deck extremity. It can be achieved using two types of tendons:

- straight permanent tendons, internal or external;
- antisymmetrical tendons, in opposition to the permanent, external tendons, balancing the variations of bending moments during the launching phases.

### EXTERNAL, DETENSIONABLE PRESTRESSING

External prestressing, perfected by Freyssinet, offers many advantages:

- simpler prefabrication, lighter structures;
- improvement of prestressing conditions (installation, grouting);
- possibility of inspecting and monitoring the structures: replacement of tendons if necessary;
- detensionable tendons, when ducts are grouted with wax or grease.

## LAUNCHING EQUIPMENT

Freyssinet can design and supply the special equipment and carry out the incremental launching of the structure:

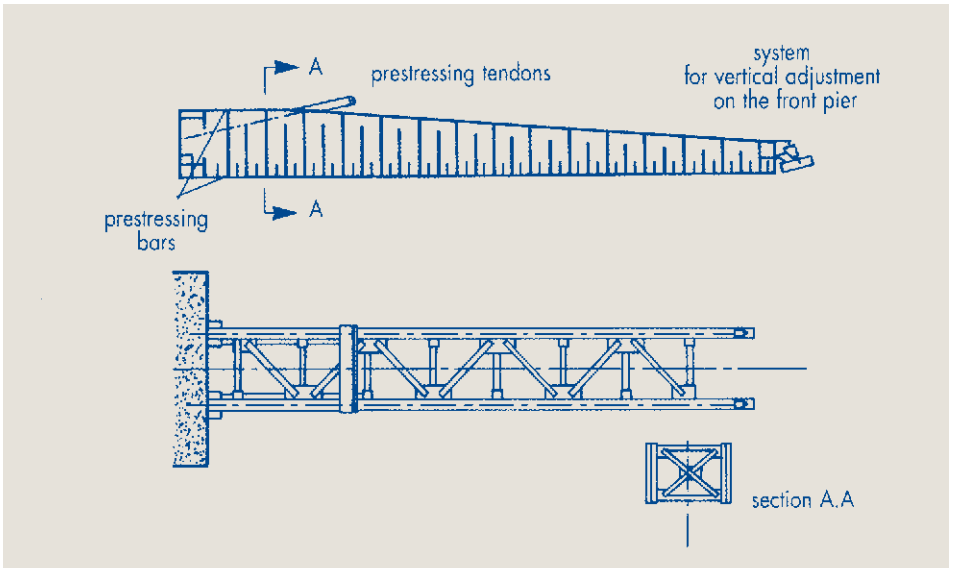
- prefabrication bed and fixed or mobile formworks;
- launching beam;
- hydraulic jacks and automatic, electronic monitors;
- steel nose;
- temporary sliding bearings and guiding devices.

Two systems of hydraulic jacks can be used for the launching:

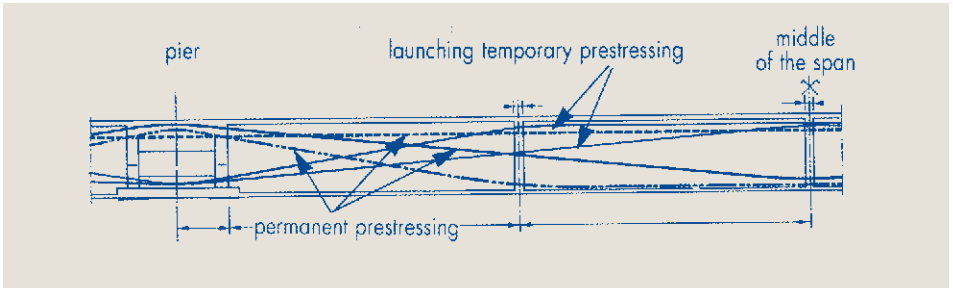
1 - Pulling system with lifting strand jack (SL);

2 - Eberspaecher pushing and lifting jack system.

Sungai Sitiawan, Korea




Launching nose




Typical stressing layout with antisymmetrical tendons

Stressing jack

| Pulling cables (strength in kN) | | | |
|---|---|---|---|
| Type of jack | Number of strands | 15.7 Super strand Grade 1 770 Mpa | |
| | | G.U.T.S | Standard pulling force 50% G.U.T.S |
| SL 12 | 1 | 265 | 132 |
| SL 50 | 5 | 1 325 | 662 |
| SL 180 | 13 | 3 445 | 1 722 |
| SL 230 | 19 | 5 035 | 2 517 |
| SL 450 | 37 | 9 805 | 4 902 |
| SL 700 | 61 | 16 165 | 8 082 |

# JULES VERNE VIADUCT

## Amiens, France

### Characteristics

- Length: 943 m
- Total weight: 15 300 t
- Spans: 19 x 50.50 m
- Straight alignment - Slope: 0.6%

### LAUNCHING

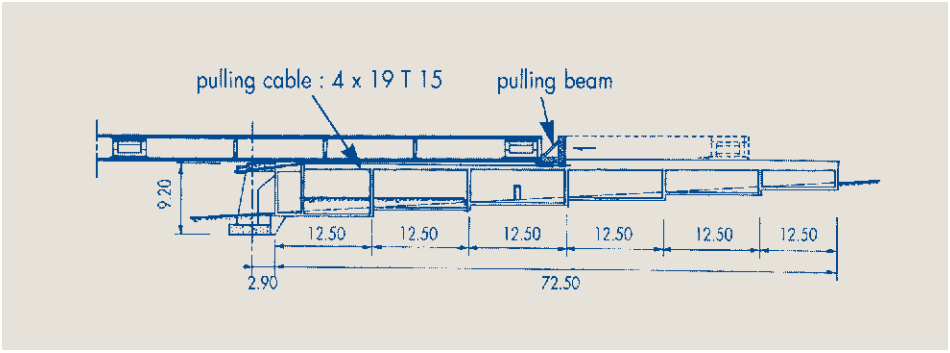
- Maximum force: 760 t
- Hydraulic jacks: 4 x SL 230 type
- Construction cycle: 10 days per span

### QUANTITIES

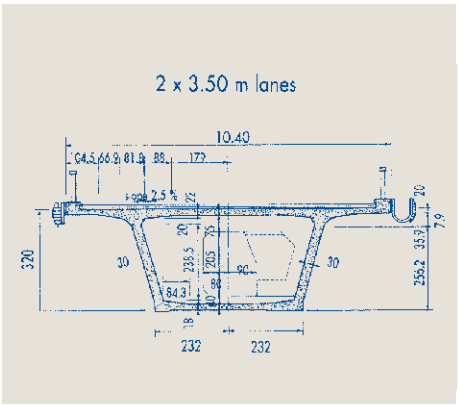
- Concrete: average thickness: 0.60 m
- Reinforcing steel: 130 kg/m$^3$
- Prestressing steel: 36.4 kg/m$^3$

- Client: **Public Works Departmental Authority**
- Consultant and contractor: **Campenon Bernard**
- Prestressing and launching: **Freyssinet**

Jules Verne Viaduct




Casting yard




Cross section

Jules Verne Viaduct

Strzegomski Viaduct

# STRZEGOMSKI VIADUCT

## Wroclaw, Poland

### Characteristics

- Length: 418 m & 428 m
- Total weight: 2 x 12 000 t
- Spans: 15 x 33.5 m

### LAUNCHING

- Maximum force: 7 000 kN
- Hydraulic jacks: 4 x SL 230 type
- Construction cycle: 2 weeks per span (2 pairs)

- Client: **ZBiM Wroclaw (Municipal Road Authority)**
- Contractor: **Budimex Dromex SA**
- Prestressing and launching: **Freyssinet Polska**

# CZERNIAKOWSKI INTERCHANGE

## Warsaw, Poland

### Characteristics

- Length: 2 x 590.4 m
- Total weight: 2 x 7 500 t
- Spans: 19 x 50.50 m
- Radius of curvature :1 300 m in plane
  4 500 m in elevation

### LAUNCHING

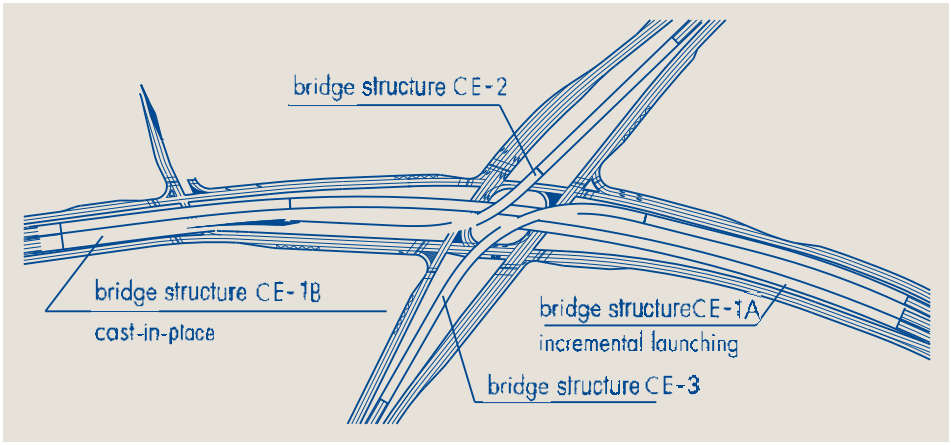
- Hydraulic jacks: SL 230 type
- Construction cycle: 1 week per segment

Bridges 1A and 1B were launched after construction of ramps CE2 and CE3 (see drawing). As a result, the launching was performed over roads with heavy traffic and under existing structures.

Geometrical accuracy was critical: e.g. the distance between some of the piers of the existing bridges and the launched structure was less than 8 cm.

- Client: **ZBM Inwestor Zastepczy / Warsaw Minicipality**
- Contractor: **Budimex Dromex & Mostostal Warszawa**
- Prestressing and launching: **Freyssinet Polska**

Czerniakowski Interchange, Poland




Launching sequence

# MIRYANG GRAND BRIDGE

## Miryang, Korea

### Characteristics

- 2 parallel bridges length: 1 290 m per bridge
- Width: 12.6 m
- Spans: 40m + 25 x 50 m

**LAUNCHING**

- Maximum force: 800 t
- Hydraulic jacks: 2 x 300 t & 1 x 250 t

- Client: **Daegu-Busan Highway Corp**
- Consultant: **Daelim I & C**
- Prestressing and launching: **Freyssinet**

Miryang Grand Bridge, Korea

Dansan Bridge construction

# DANSAN BRIDGE

## Dansan, Korea

### Characteristics

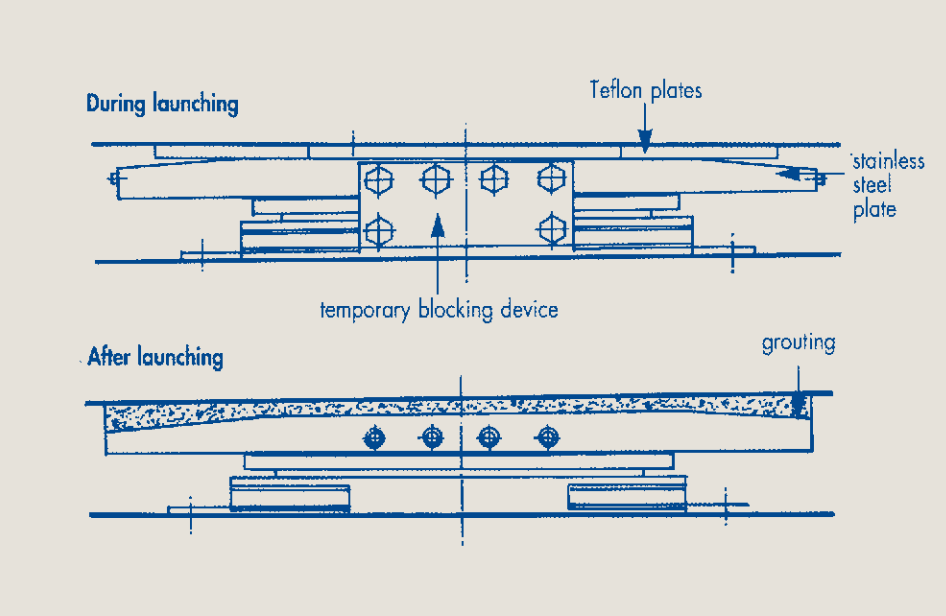
- 2 parallel bridges length: 1 050 m per bridge
- Width: 12.145 m
- Spans: 21 x 50 m

**LAUNCHING**

- Maximum force: 800 t
- Hydraulic jacks: 2 x 300 t & 1 x 250 t

- Client: **Daegu-Busan Highway Corp**
- Contractor: **Hyundai Development Co**
- Prestressing and launching: **Freyssinet**

Dansan Bridge, Korea




Lœwenberg bearings

# LŒWENBERG VIADUCT

## Switzerland

### Characteristics

**TWO VIADUCTS**

- Length: 665 m
- Spans: 17 x 40.20 m
- Total weight: 12 300 t
- Straight alignment - Slope: 2.43 %

**LAUNCHING**

- Maximum force: 760 t
- Hydraulic jacks: 4 x SL 230 type
- Construction cycle: 7 days per 21 m long segment

Special feature: use of permanent mechanical bearings and sliding plates during the launching phase.

- Client: **Fribourg Canton**
- Consultants: **GVH St Blaise S.A. and Brugger, Clement, Collaud**
- Contractor: **Consortium L.H.L.S.C.**
- Prestressing, incremental launching and mechanical bearings: **Freyssinet**

# MEYSSIEZ TGV VIADUCT

## France

### Characteristics

- Length: 614 m
- Spans: 13 x 49
- Total weight: 18 860 t
- Radius of curvature: R = 4 000 m
  Slope: 1.8%

**LAUNCHING**

- Maximum force: 950 t
- Launching nose weight: 33 t

**QUANTITIES**

- Concrete: average depth: 0.98 m
- Reinforcing steel: 124 kg/m$^3$
- Prestressing steel: 62 kg/m$^3$

Meyssiez construction

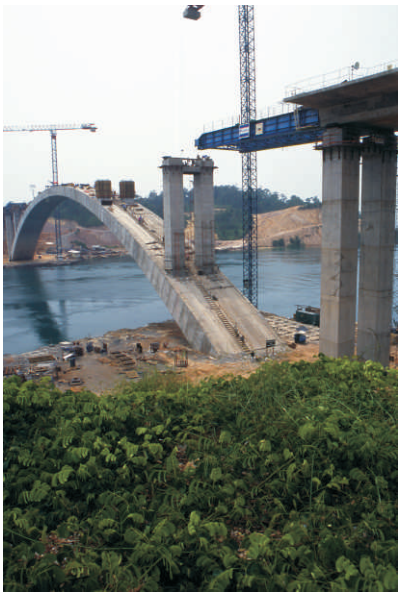
- Client: **SNCF (French Railways)**
- Consultant and Contractor: **Dumez**
- Prestressing and launching: **Freyssinet**

Meyssiez TGV Viaduct: general view

Chiapas Bridge, Mexico

Le Esserts Viaduct, Switzerland


Czerniakowski Interchange, Poland



Barelang Bridge, Indonesia

Meyssiez Viaduct, France

Karuah Bypass, Australia

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