# THE MILLAU VIADUCT

Royal Aeronautical Society

Hamburg

28th October 2010

Jean-François Coste

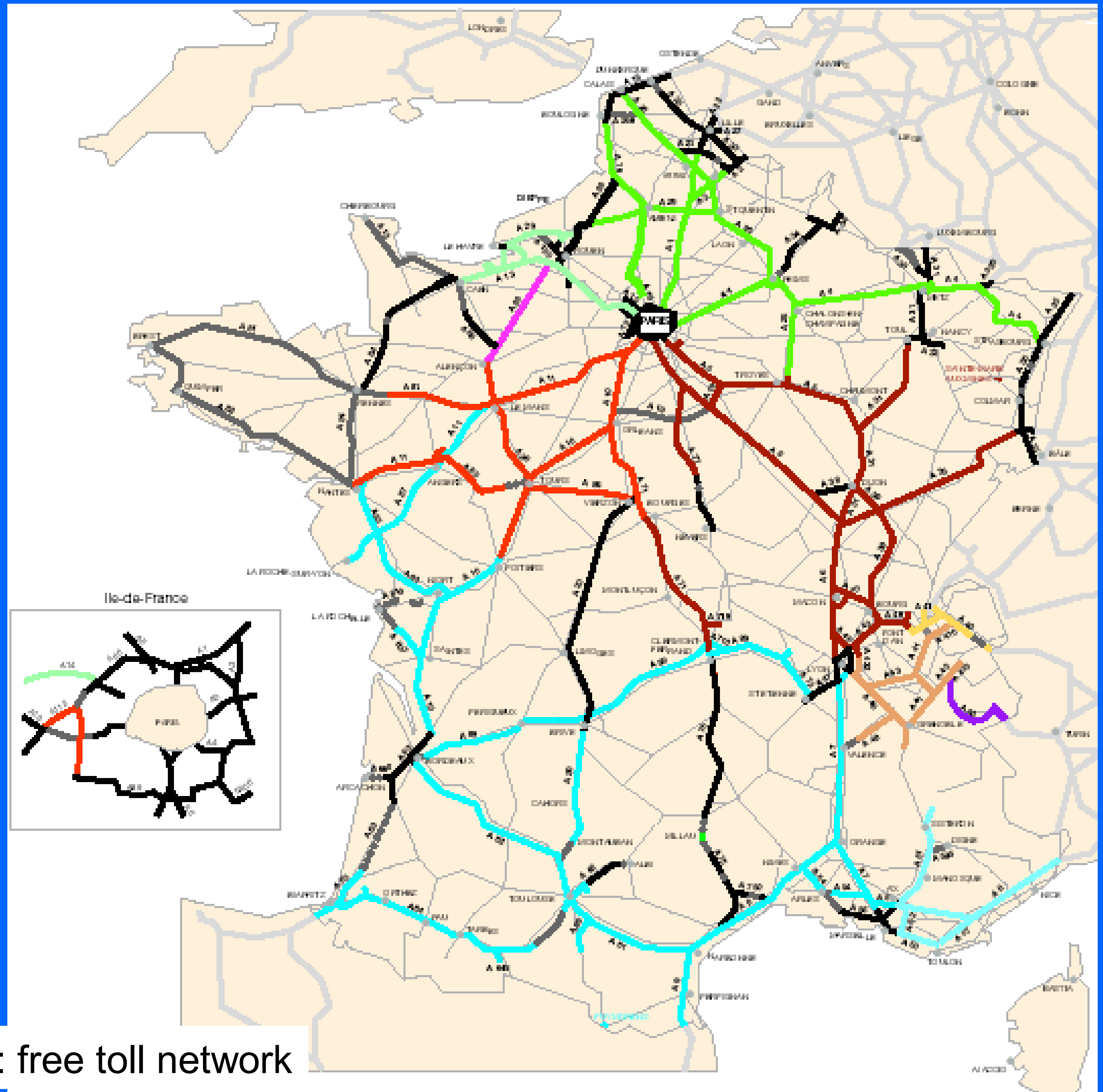
# The viaduct of Millau
# an outstanding structure

- The Conception
- The Concession
- The Construction

# A North -South route since the Middle Age

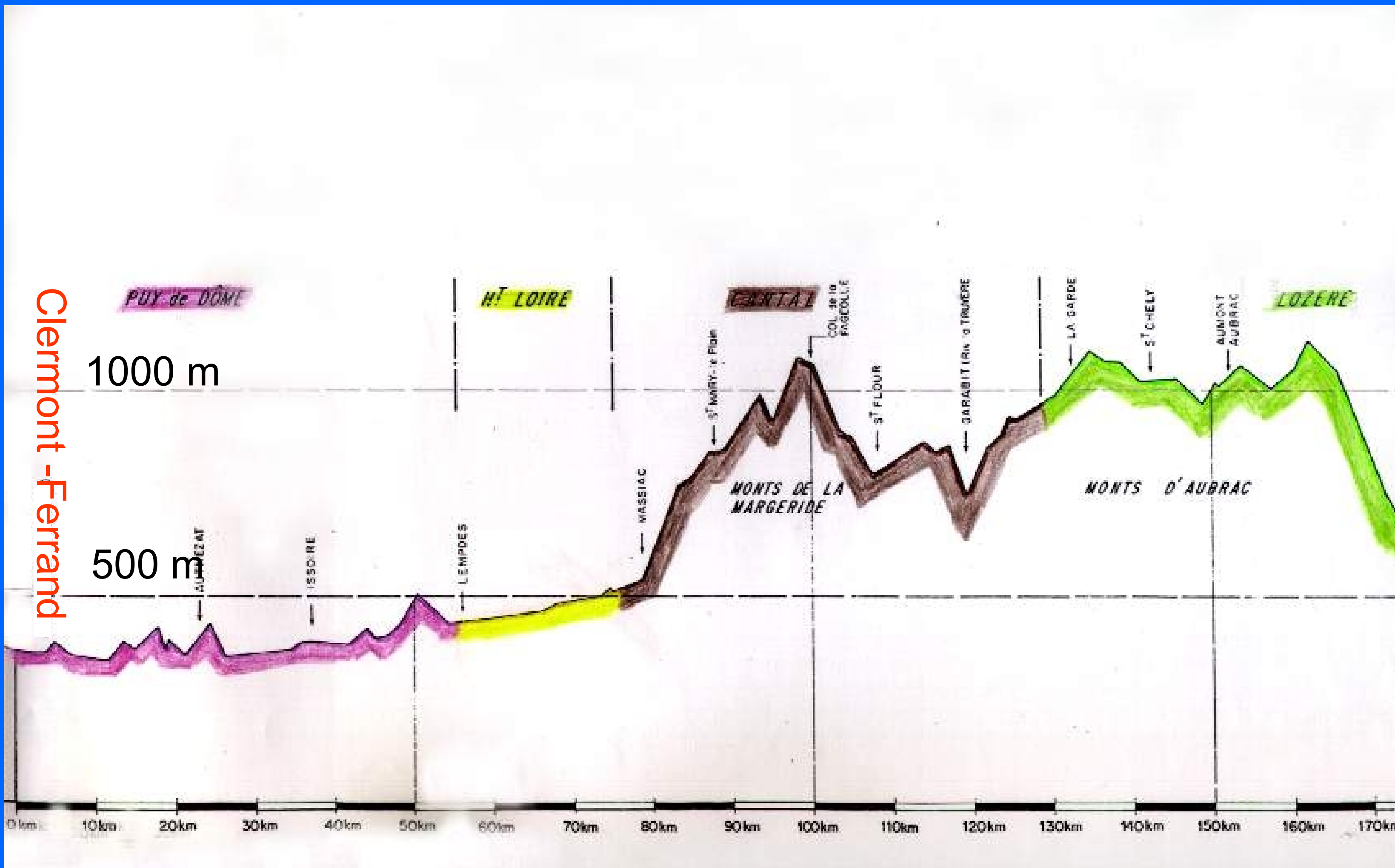
# …with a toll bridge crossing the Tarn River in Millau

Motorway network in 2003

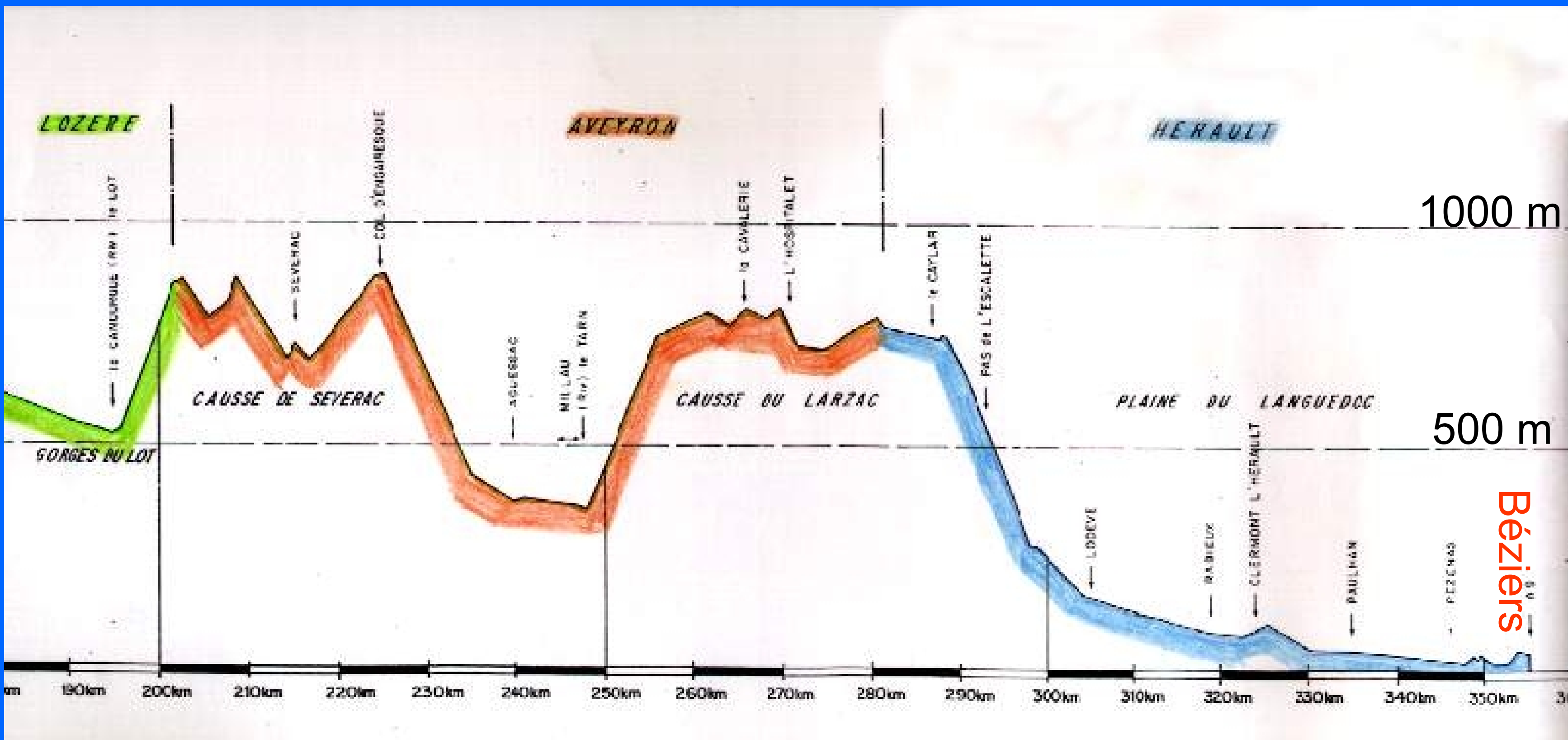


**In black** : free toll network

# A75: longitudinal section across Massif Central Mountains (1)



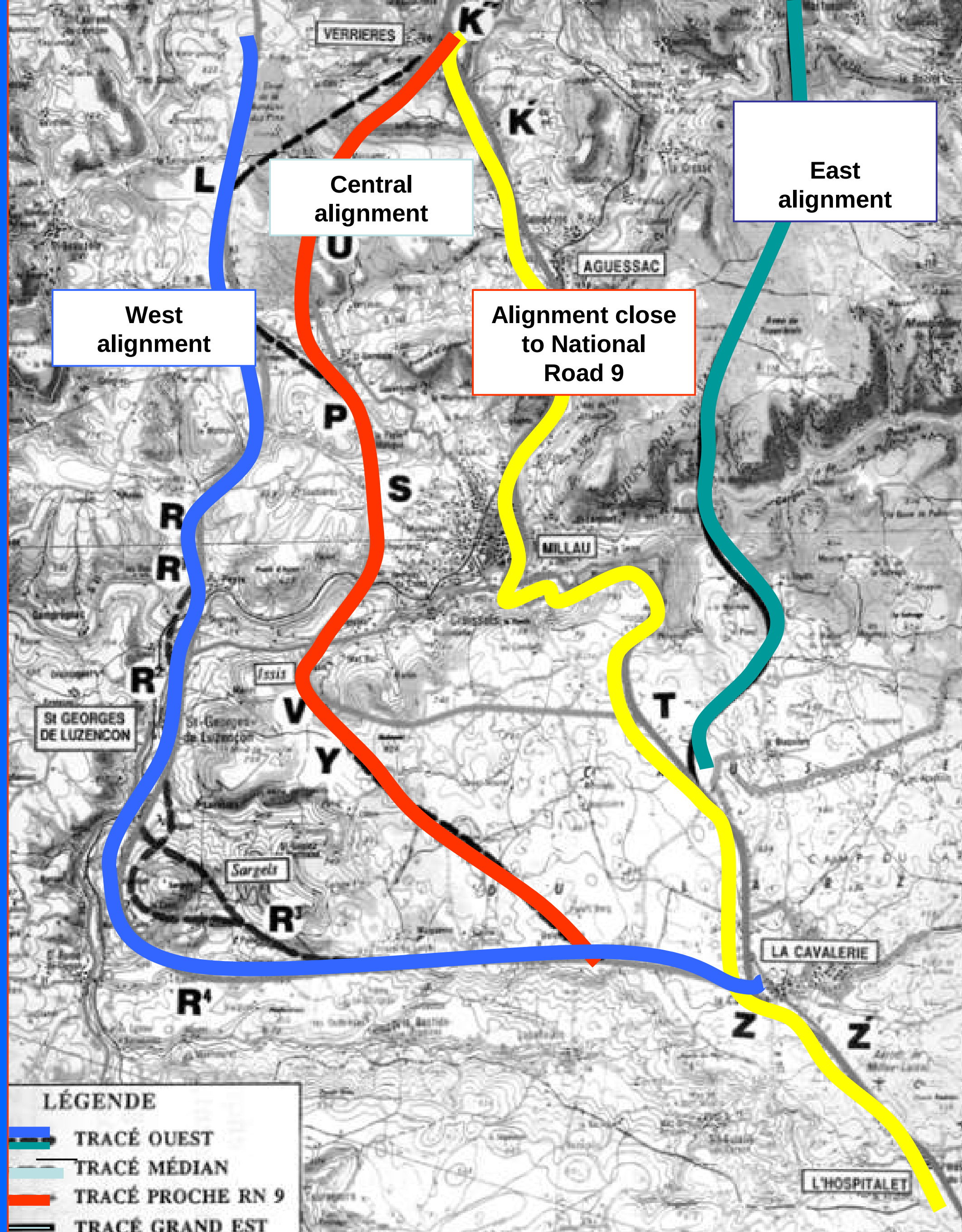
# A75 : longitudinal section across Massif Central Mountains (2)



# A75 motorway
# Clermont-Ferrand Béziers
# 340 Km

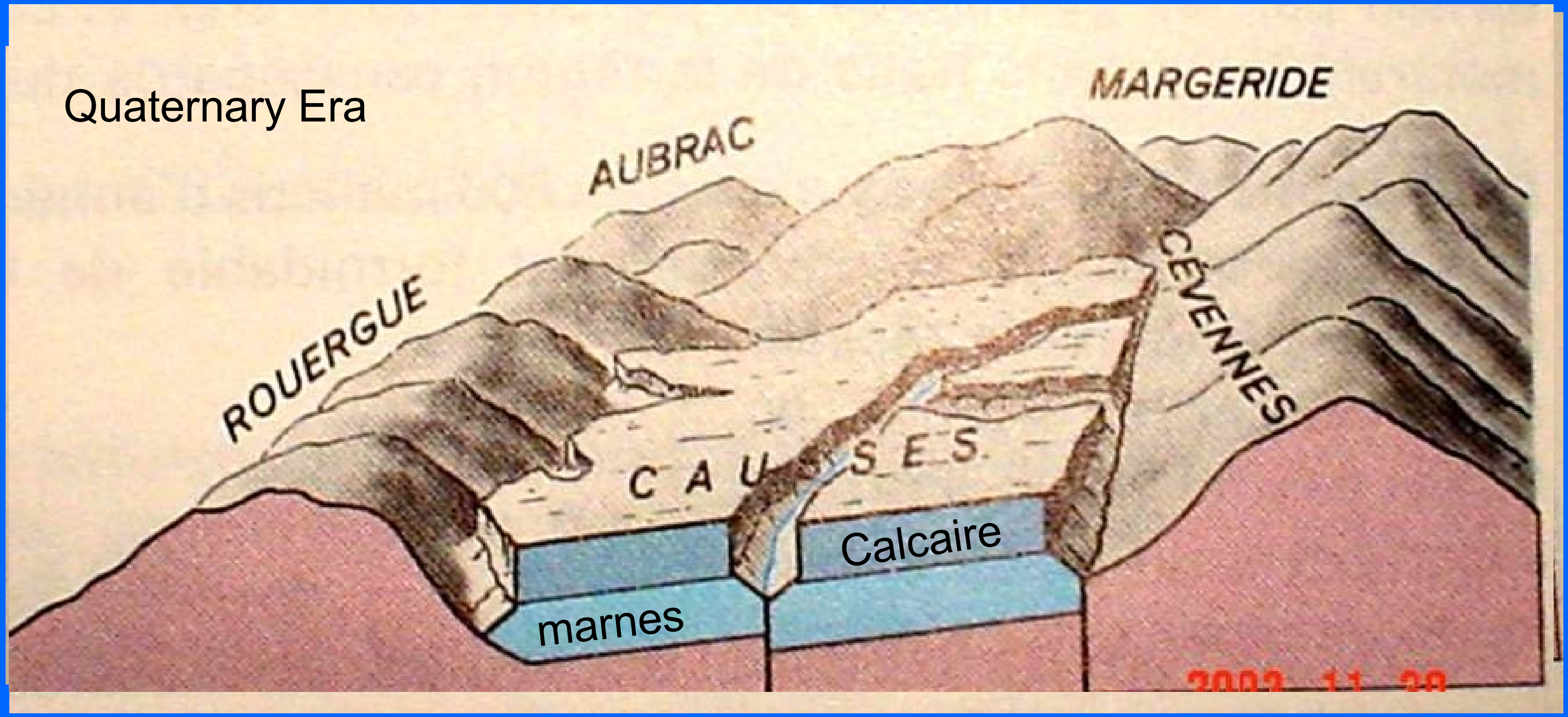

Bypass of MILLAU
Millau
Red Plateau
Puech d'Ausset
Larzac Plateau
The Tarn River

# 1988 -1989

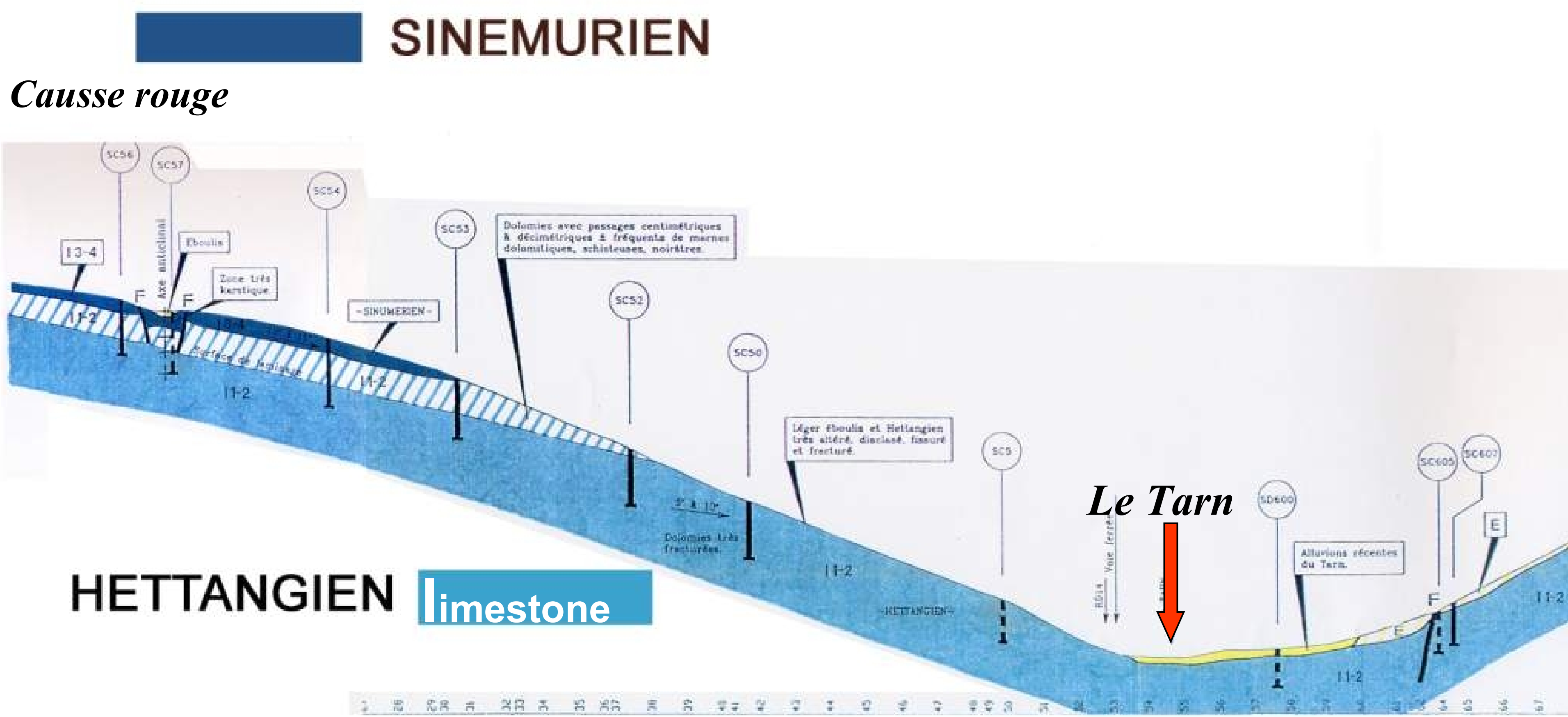


VERRIERES
K
K
L
Central alignment
East alignment
U
AGUESSAC
West alignment
Alignment close to National Road 9
P
S
R
R
MILLAU
Creissels
R
Issis
V
T
St GEORGES DE LUZENCON
Y
Sargels
R
LA CAVALERIE
R
Z
Z
L'HOSPITALET
LÉGENDE
TRACÉ OUEST
TRACÉ MÉDIAN
TRACÉ PROCHE RN 9
TRACÉ GRAND EST

# Geology of limestone plateau "Causses"

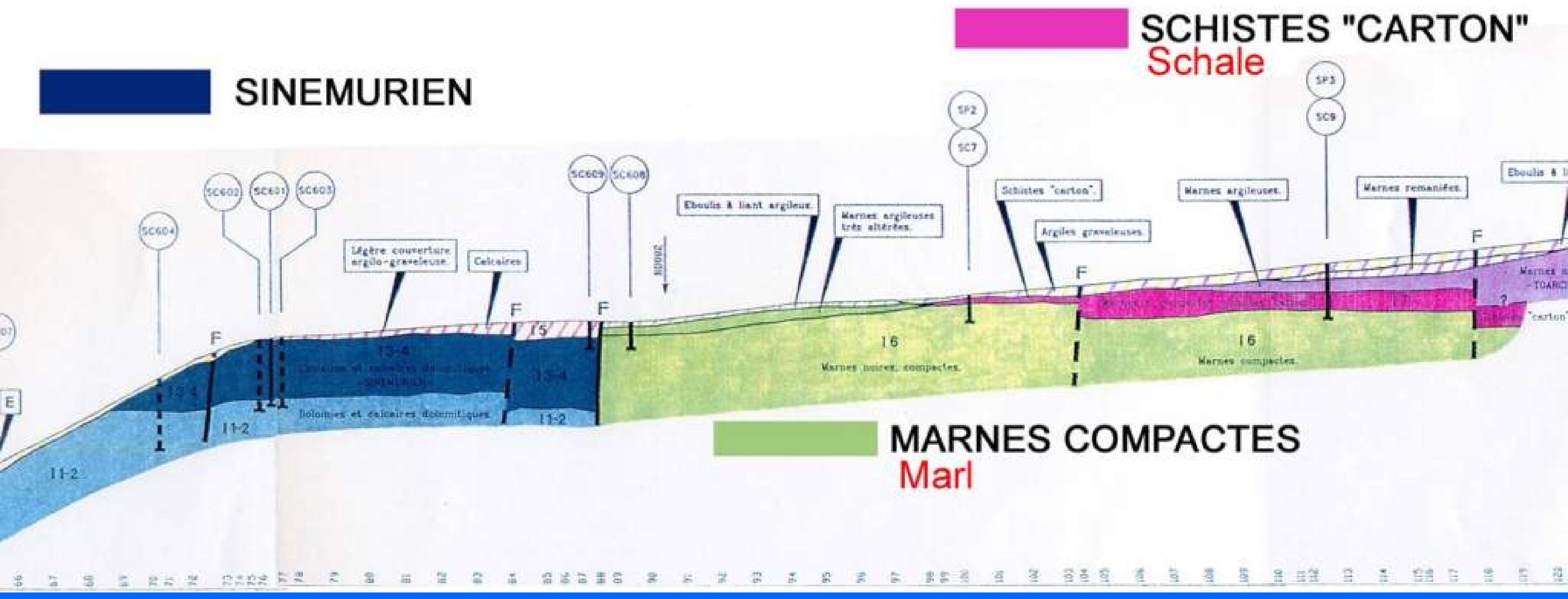


# Geology (1)

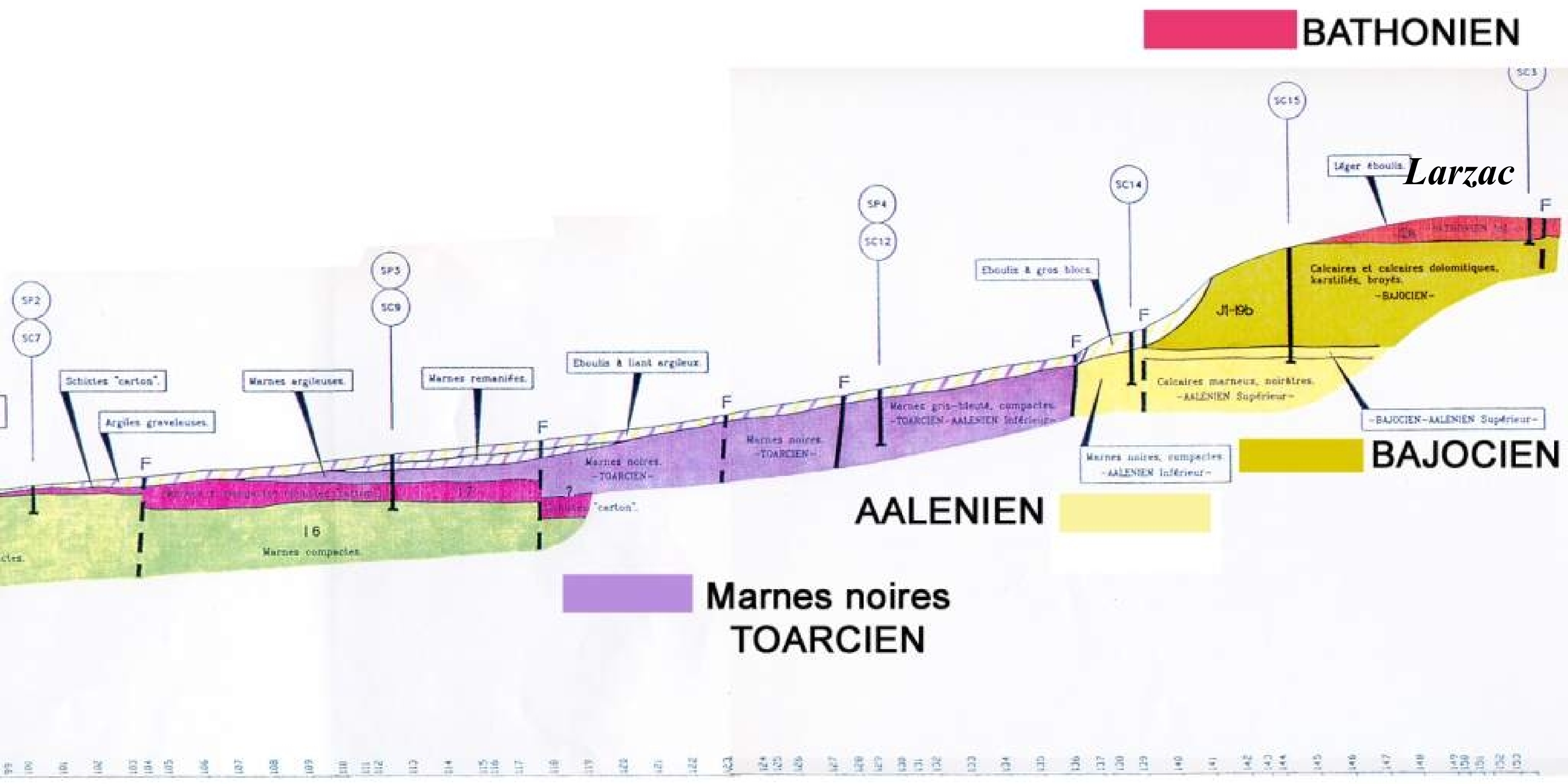


SINEMURIEN
Causse rouge
SC56
SC57
SC54
SC53
SC52
SC50
SC5
SD600
SC605
SC607
l3-4
Eboulis
Axe anticlinal
Zone très karstique
F
-SINEMURIEN-
Dolomies avec passages centimétriques à décimétriques ± fréquents de marnes dolomitiques, schisteuses, noirâtres
Léger éboulis et Hettangien très altéré, diaclasé, fissuré et fracturé
l1-2
Dolomies très fracturées
-HETTANGIEN-
Alluvions récentes du Tarn
E
Le Tarn
HETTANGIEN
limestone

# Geology (2)


SCHISTES "CARTON"
Schale
SINEMURIEN
MARNES COMPACTES
Marl
SC604
SC602
SC601
SC603
SC609
SC608
SP2
SC7
SP3
SC9
Légère couverture argilo-graveleuse
Calcaires
Eboulis à liant argileux
Marnes argileuses très altérées
Schistes "carton"
Argiles graveleuses
Marnes argileuses
Marnes remaniées
Marnes noires, compactes
Marnes compactes
Dolomies et calcaires dolomitiques
F
I1-2
I3-4
I5
I6

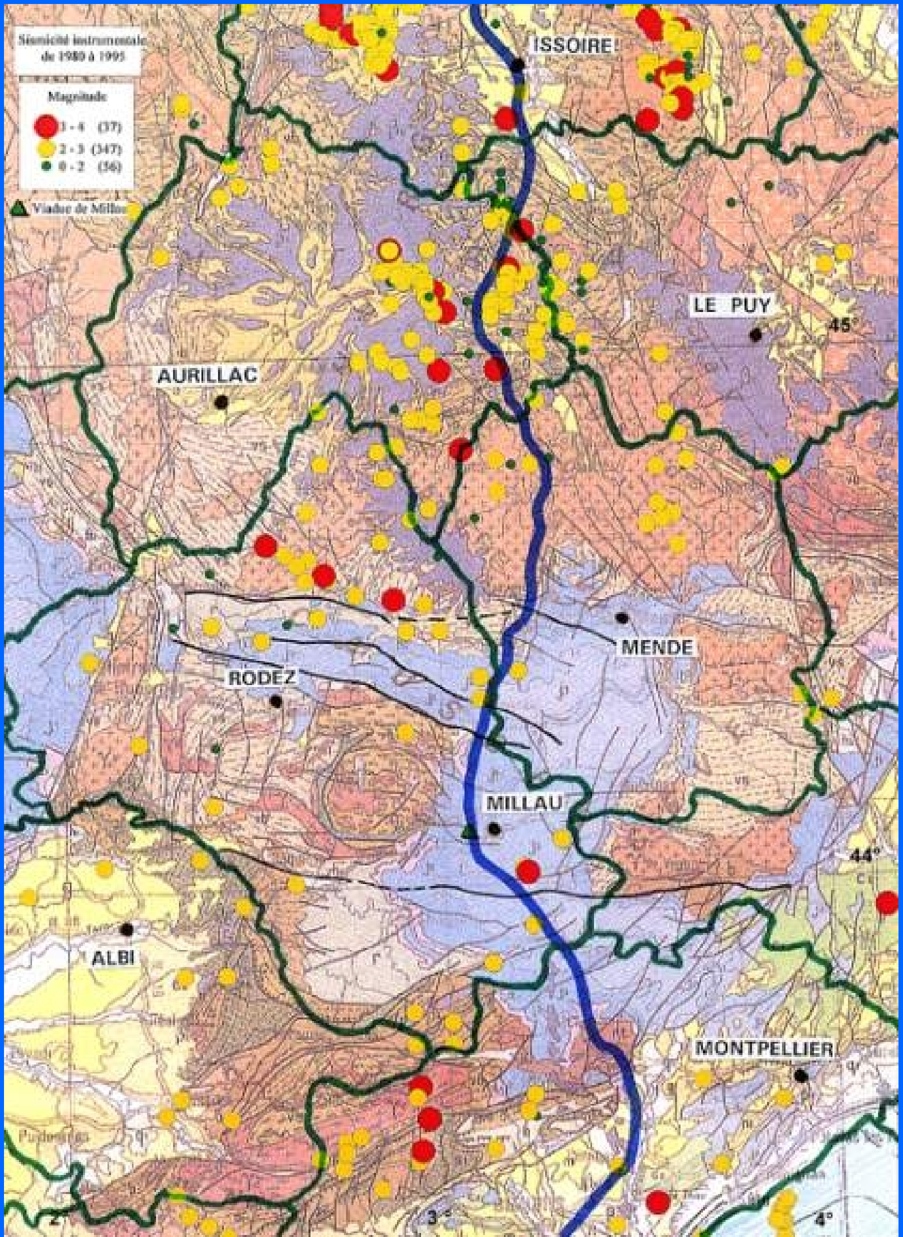
# Geology (3)

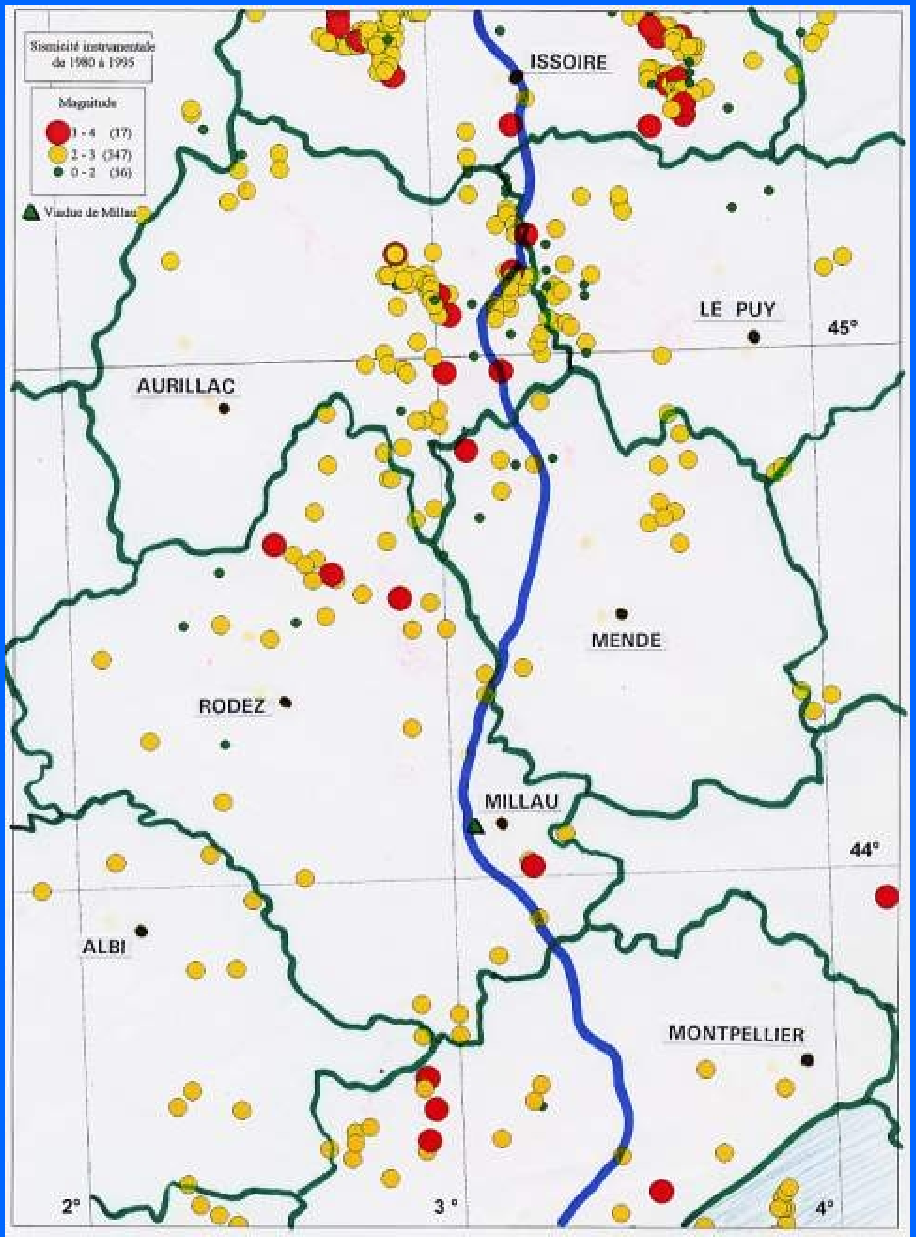


BATHONIEN
Larzac
BAJOCIEN
AALENIEN
Marnes noires
TOARCIEN
Calcaires et calcaires dolomitiques, karstifiés, broyés. -BAJOCIEN-
Calcaires marneux, noirâtres. -AALENIEN Supérieur-
-BAJOCIEN-AALENIEN Supérieur-
Marnes noires, compactes. -AALENIEN Inférieur-
Marnes gris-bleuté, compactes. -TOARCIEN-AALENIEN Inférieur-
Marnes noires -TOARCIEN-
Eboulis à gros blocs
Eboulis à liant argileux
Marnes remaniées
Marnes argileuses
Schistes "carton"
Argiles graveleuses
Marnes compactes
Léger éboulis

# Seismicity

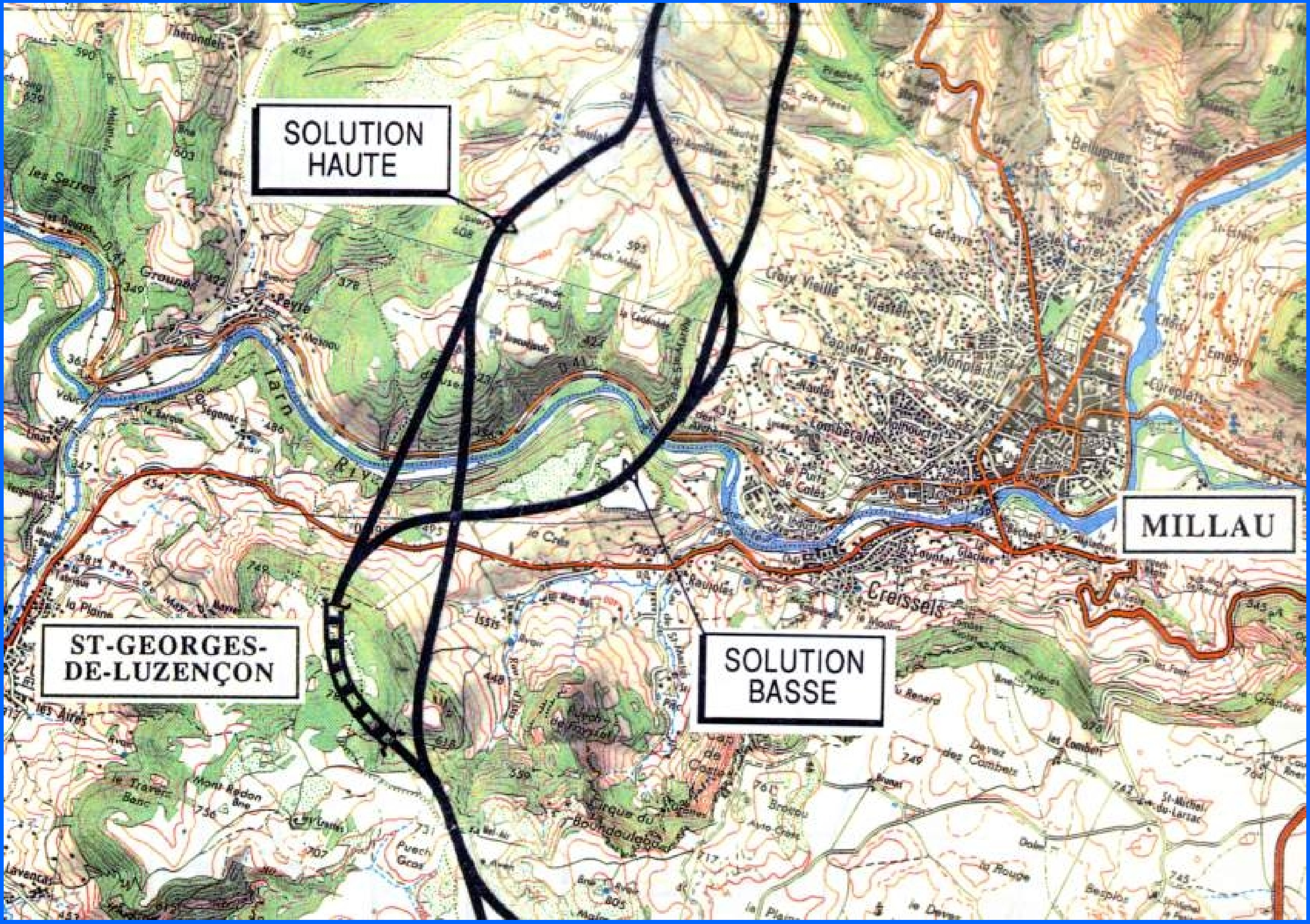
## (as recorded by measuring instruments)



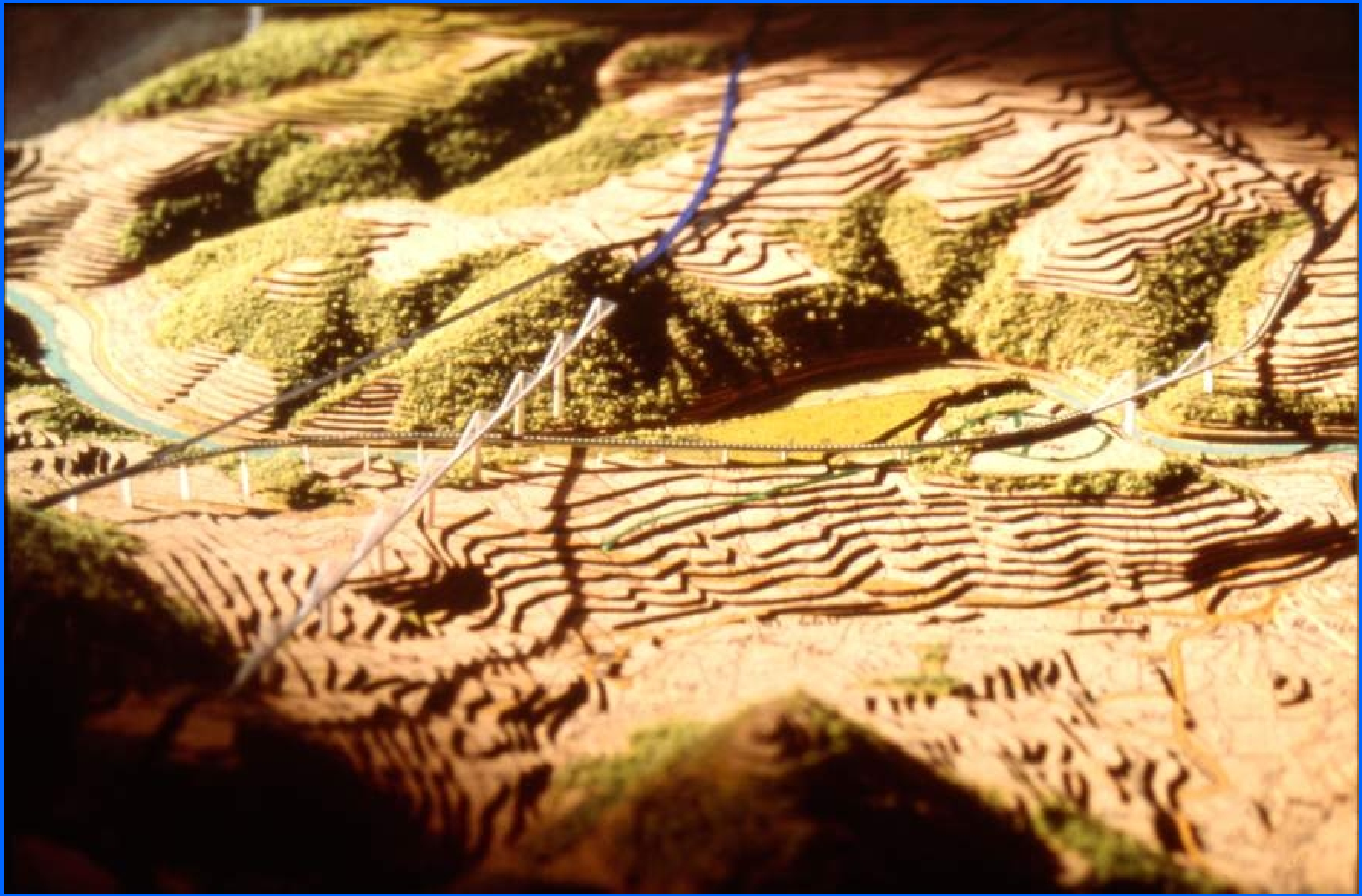



1990

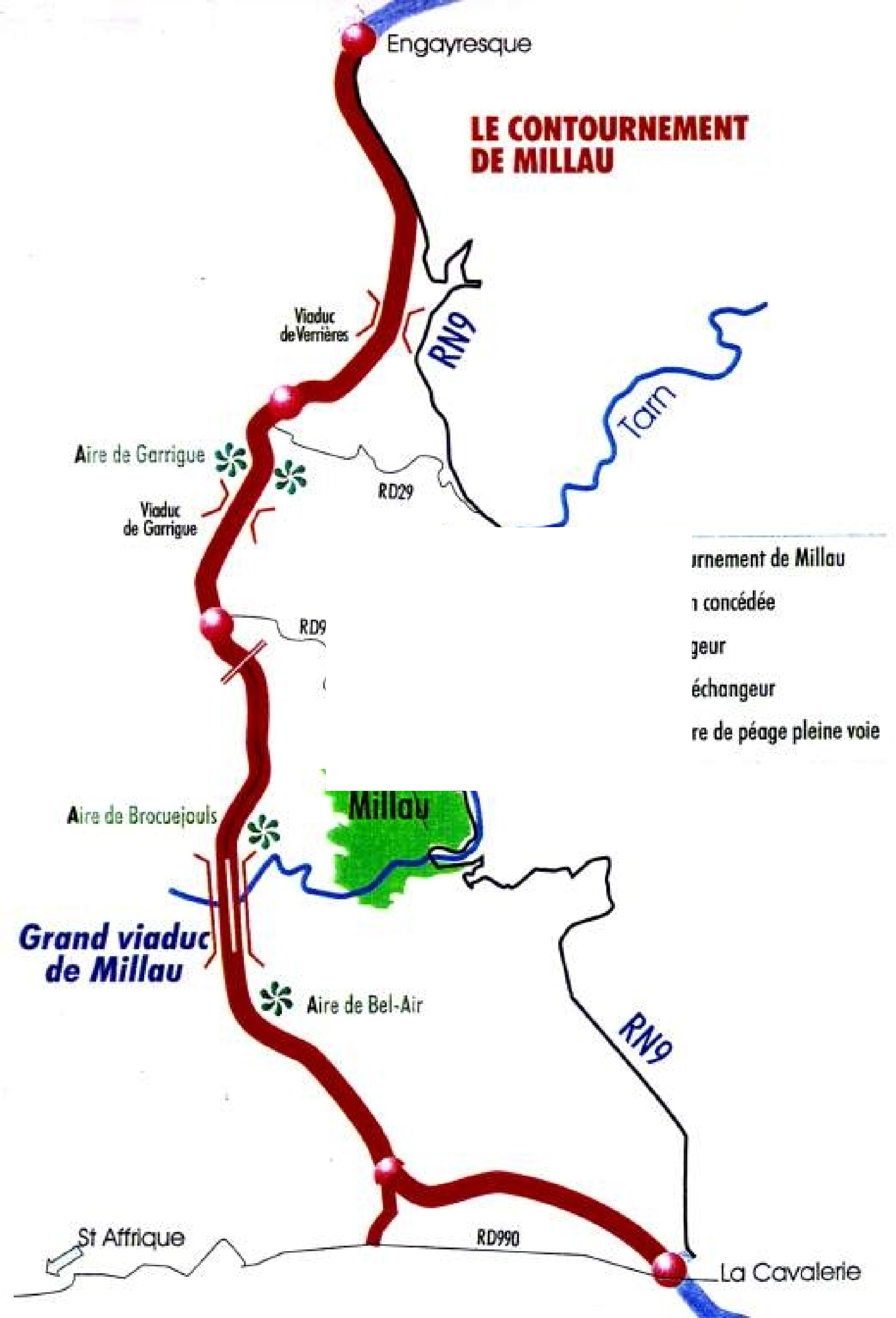
# High and low solutions



# Models of
# High and low structures

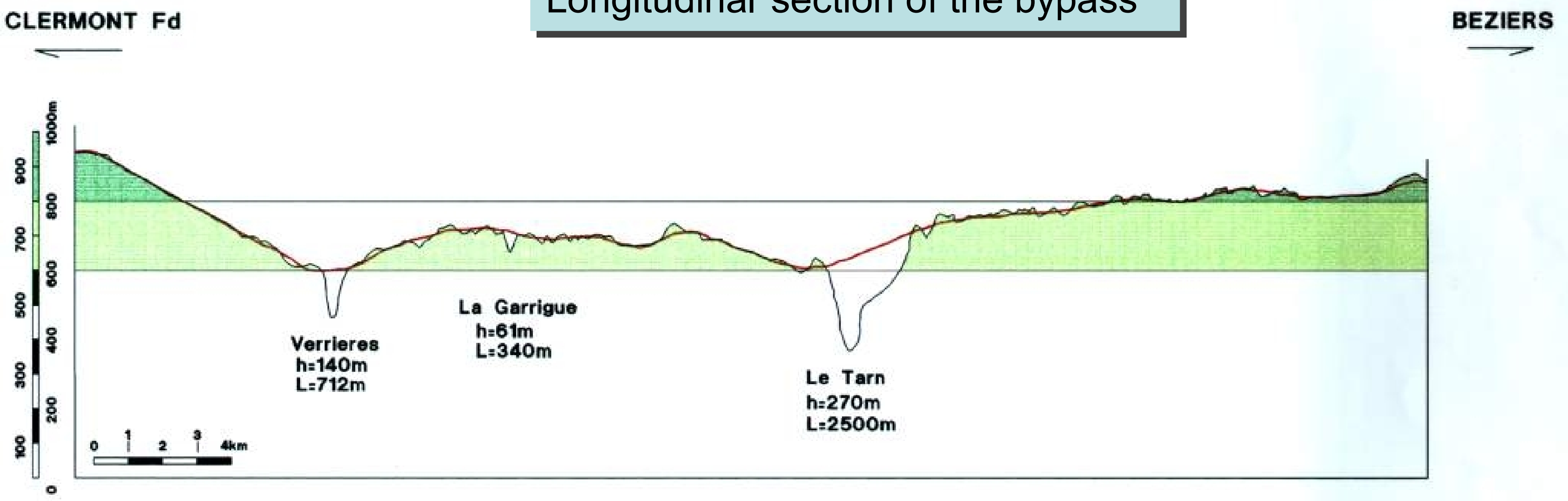


# Bypass of Millau



# Bypass of Millau

Longitudinal section of the bypass




VIADUCt of MILLAU
1991-1999
How the project came into being

Preliminary analysis

**Review of possible solutions**

**8** Design Offices

**7** Architects

**Selection of 5 types of conceptual design**
**Setting up 5 mixed teams**
**Design Offices – Architects**
**Feasibility of the viaduct validated by a panel of international experts**

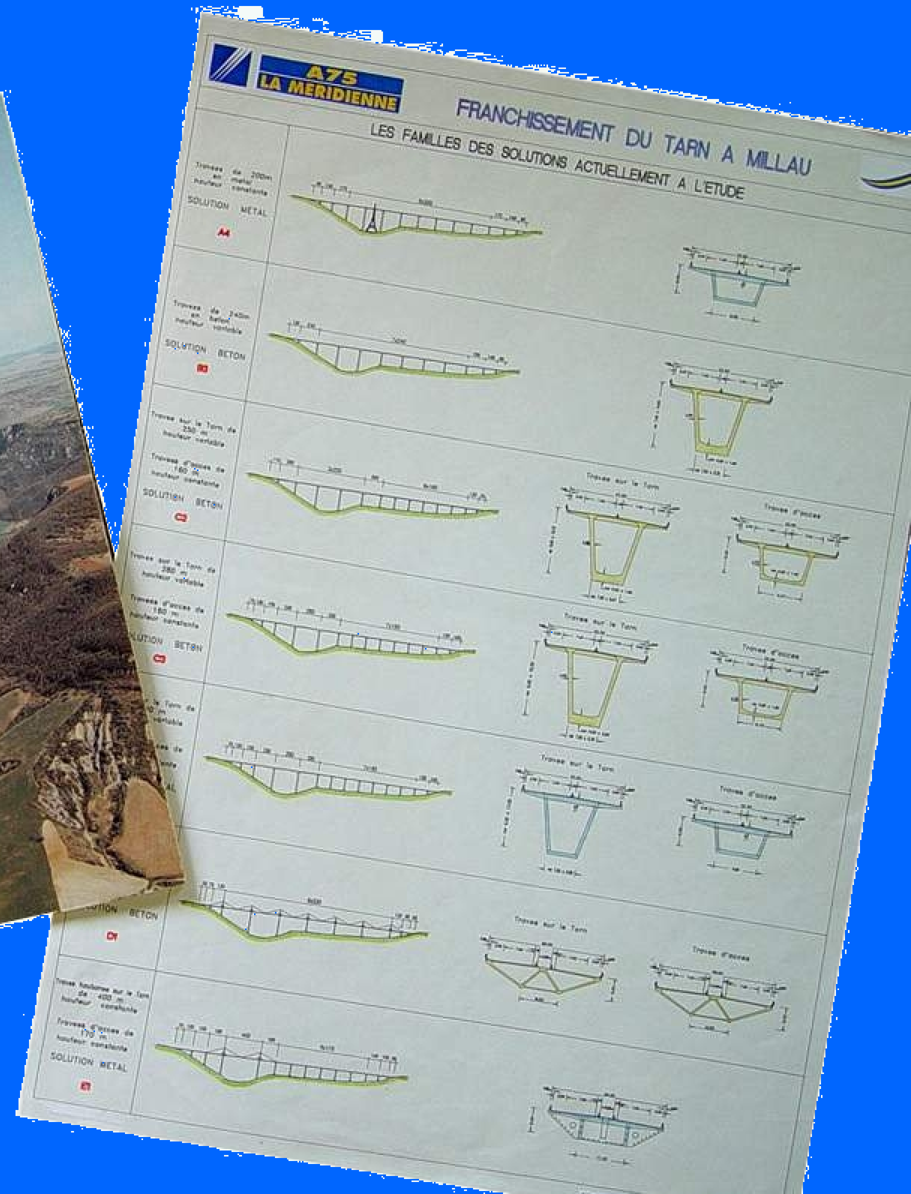
**Design competition**

between the 5 teams,
each of them developing one
of the 5 selected project

**Selection of 1 or 2 solutions**

# 1991-1993

# Preliminary design

# 1993-1994

# THE CANDIDATES

## *DESIGN OFFICES*

( 17 candidates )

1. Europe Etudes Gecti (EEG)
2. Jean MULLER International (JMI)
3. OVE ARUP and Partners
4. SECOA
5. SETEC TPI
6. SOFRESID
7. SOGELERG
8. S.E.E.E.

## *ARCHITECTS*

( 38 candidates )

1. BERLOTTIER
2. HONDELATTE
3. FOSTER and Partners CHAPELET DEFOL MOUSSEIGNE
4. FRALEU
5. SLOAN
6. SOLER
7. SPIELMANN

# Purpose of the project review

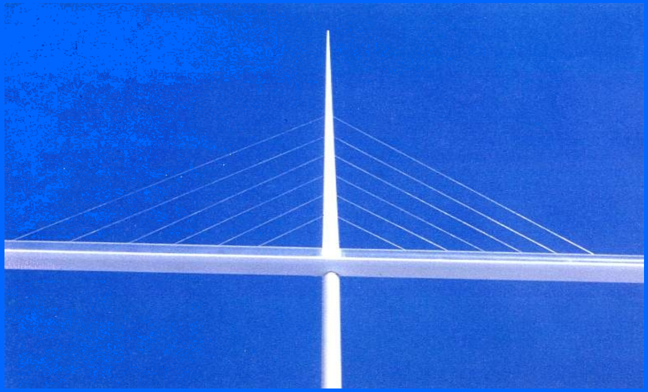
1 – to give a professional advice on the preliminary analysis

2 – to propose new solutions

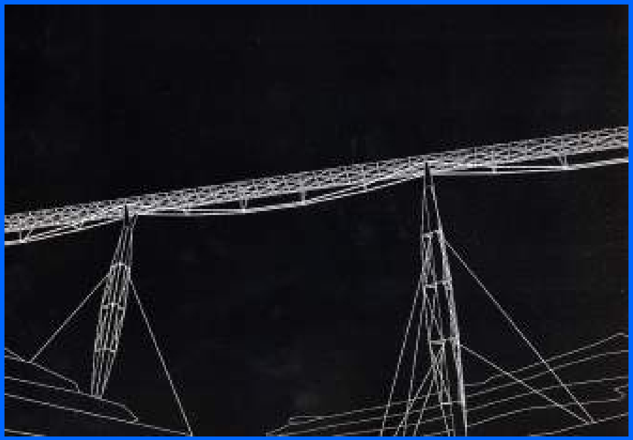
3 – to set up a working method for project development

4 – to give their view on the viaduct implementation with regard to the natural landscape

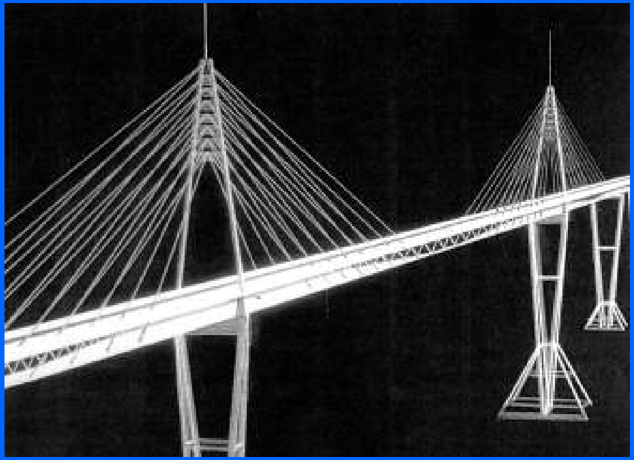
5 – how to reward the 5 design teams



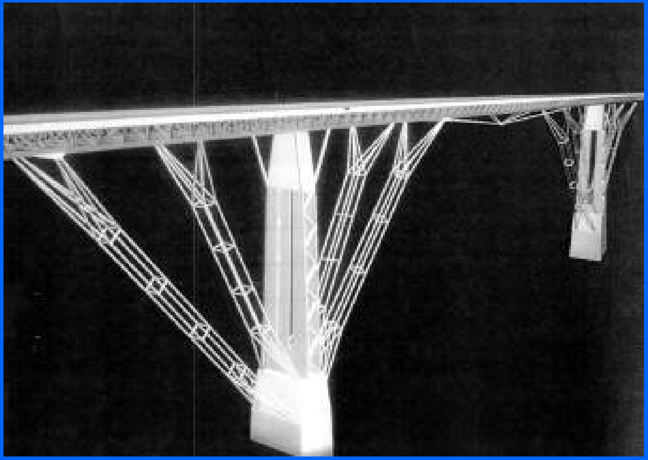
***FOSTER & PARTNERS***

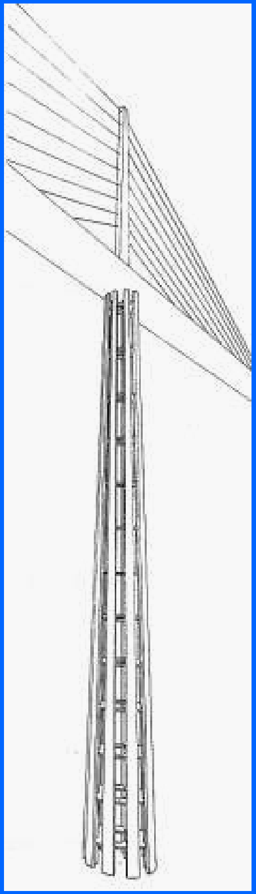
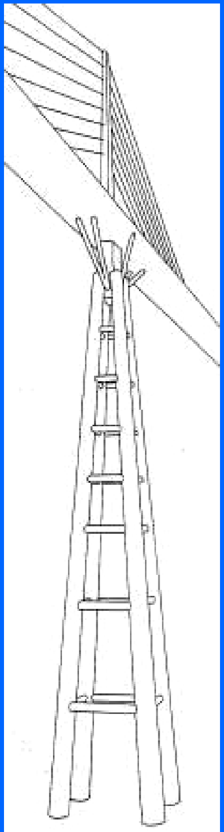
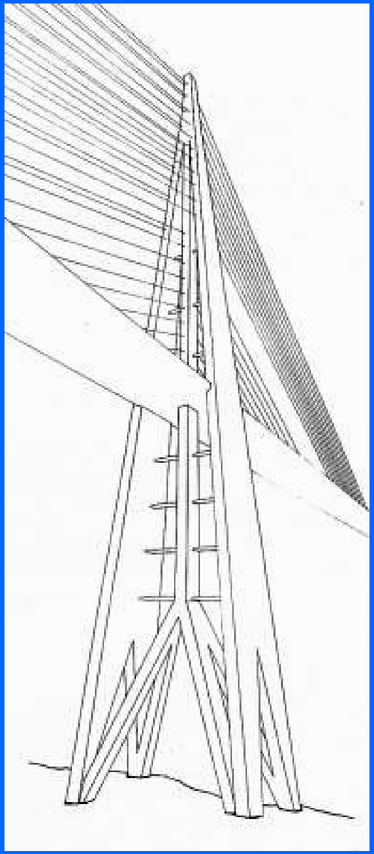


SOLER

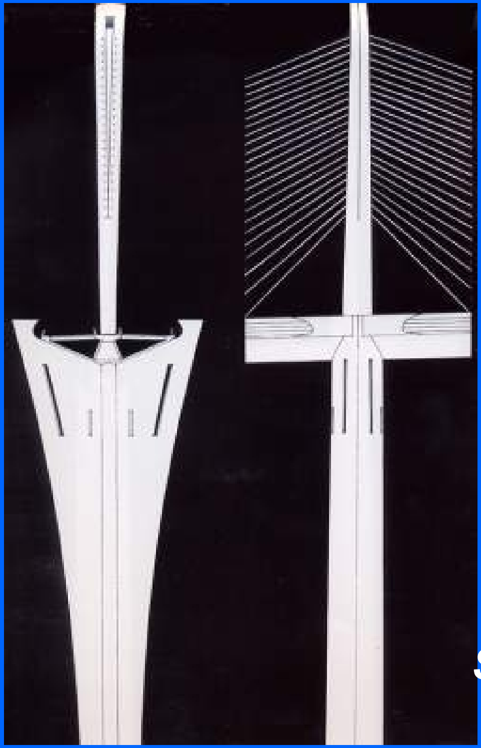


SLOAN

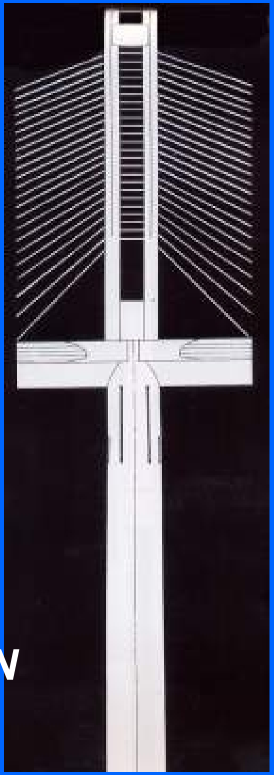


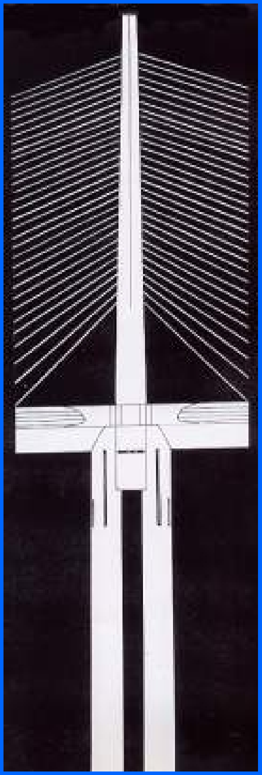




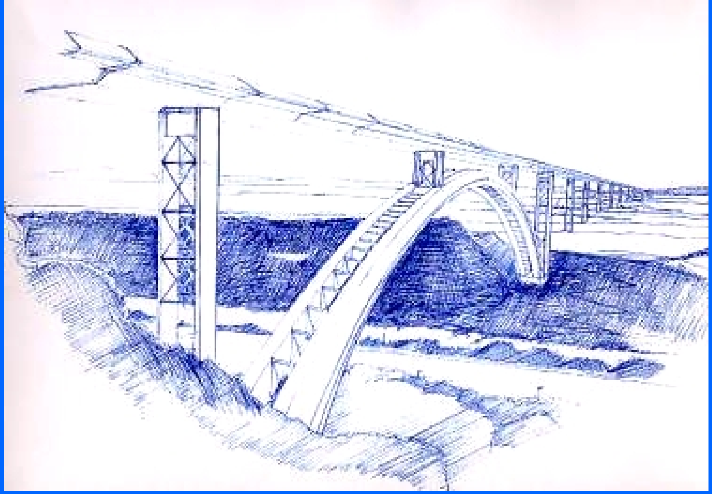
**BERLOTTIER**

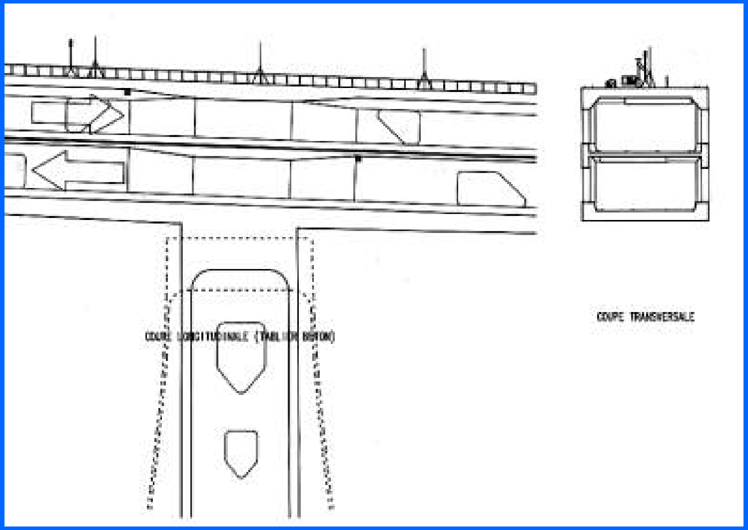



SPIELMANN

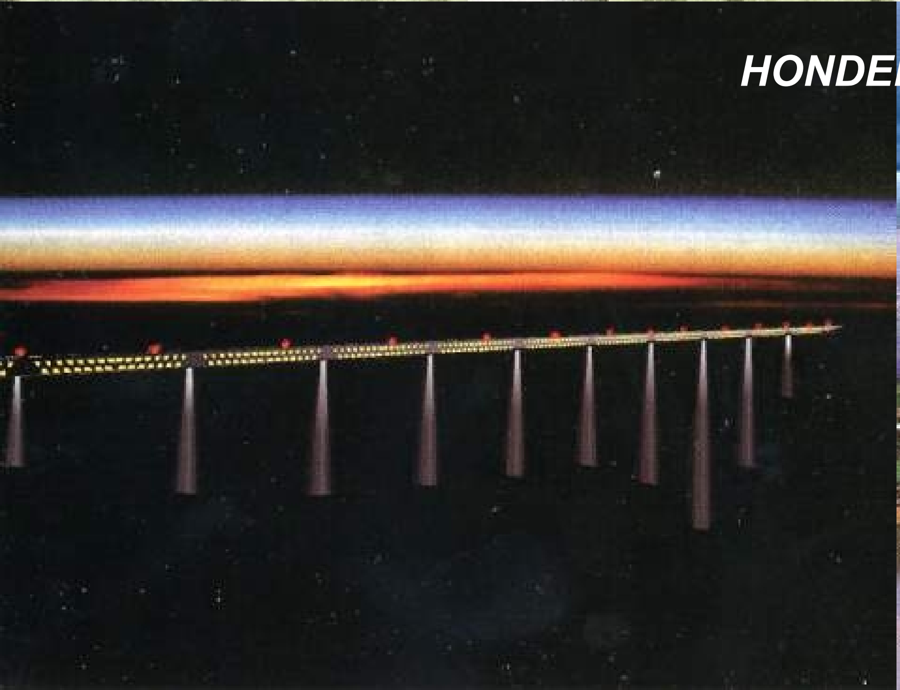




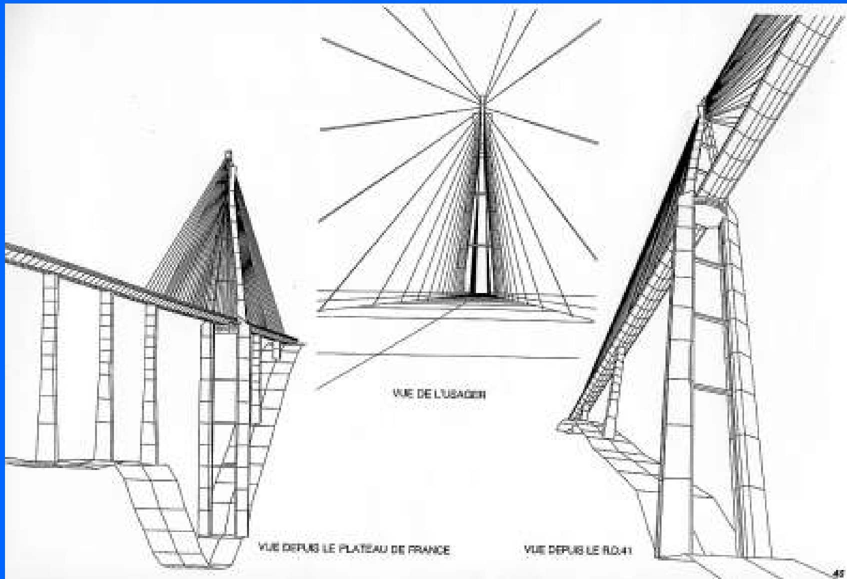




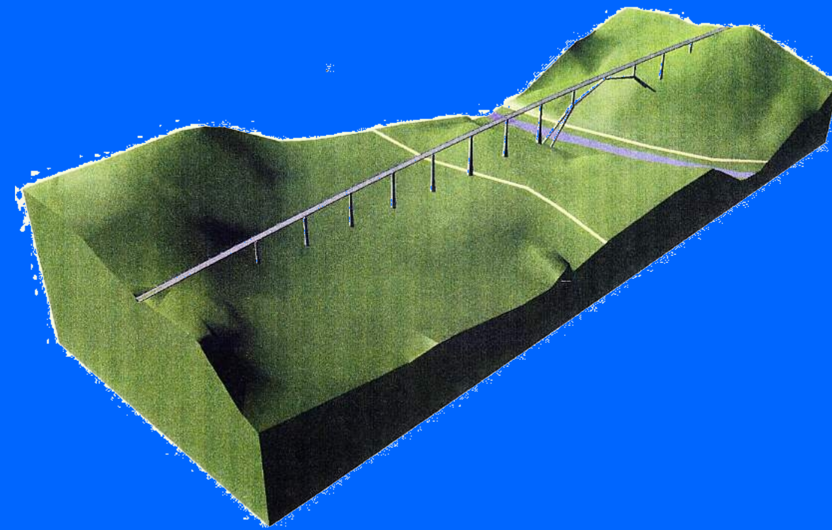

# HONDELATTE



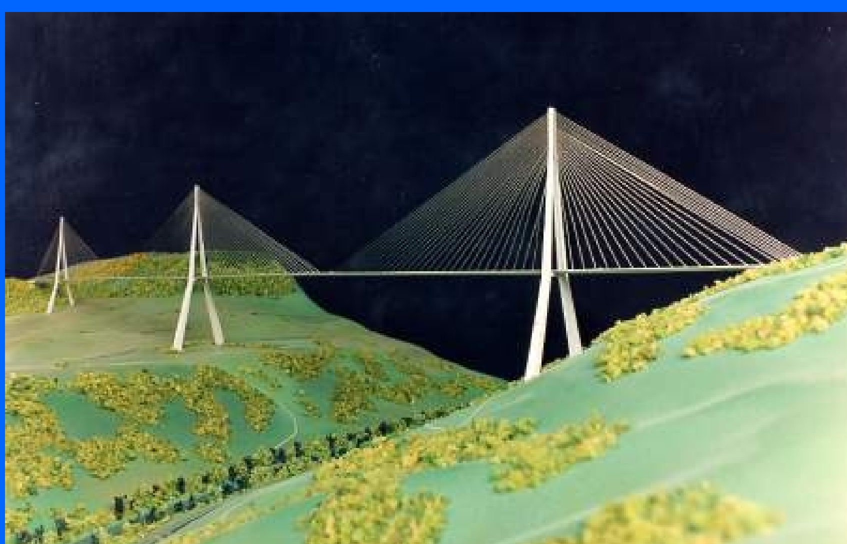
## FRALEU




## OVE ARUP & PARTNERS



## JEAN MULLER INTERNATIONAL



1993

# THE INTERNATIONAL EXPERT PANEL

**JF COSTE**
**(Chairman)**

David BILLINGTON (USA)

Alan DAVENPORT (Canada)

René WALTHER (Switzerland)

François BAGUELIN (F)

Jean-Claude FOUCRIAT (F)

Roger LACROIX (F)

Bernard LASSUS (F)

Jean PERA (F)

# Main conclusions of the international expert panel

- THE HIGH OPTION IS VALIDATED

- THE SOLUTIONS DESIGNED BY SETRA ARE FEASIBLE

- 2 MAIN TYPES OF SOLUTIONS
    - THOSE « SUSPENDED » ABOVE THE VALLEY
    - THOSE « EMERGING » FROM THE BOTTOM OF THE VALLEY

-NEED TO DEVELOP 5 FAMILIES OF SOLUTIONS
BY INDEPENDANT COMPETING DESIGN TEAMS

# FIVE COMPETING TEAMS

| Design Offices | Architects |
|---|---|
| 1. SETEC TPI | ➢ Francis Soler |
| 2. SEEE & SOFRESID | ➢ Denis Sloan |
| 3. SOGELERG & EEG & SERF | ➢ Norman Foster |
| 4. Jean Muller International | ➢ Alain Spielmann |
| 5. SECOA | ➢ Jean-Vincent Berlottier |

# 1995-1996

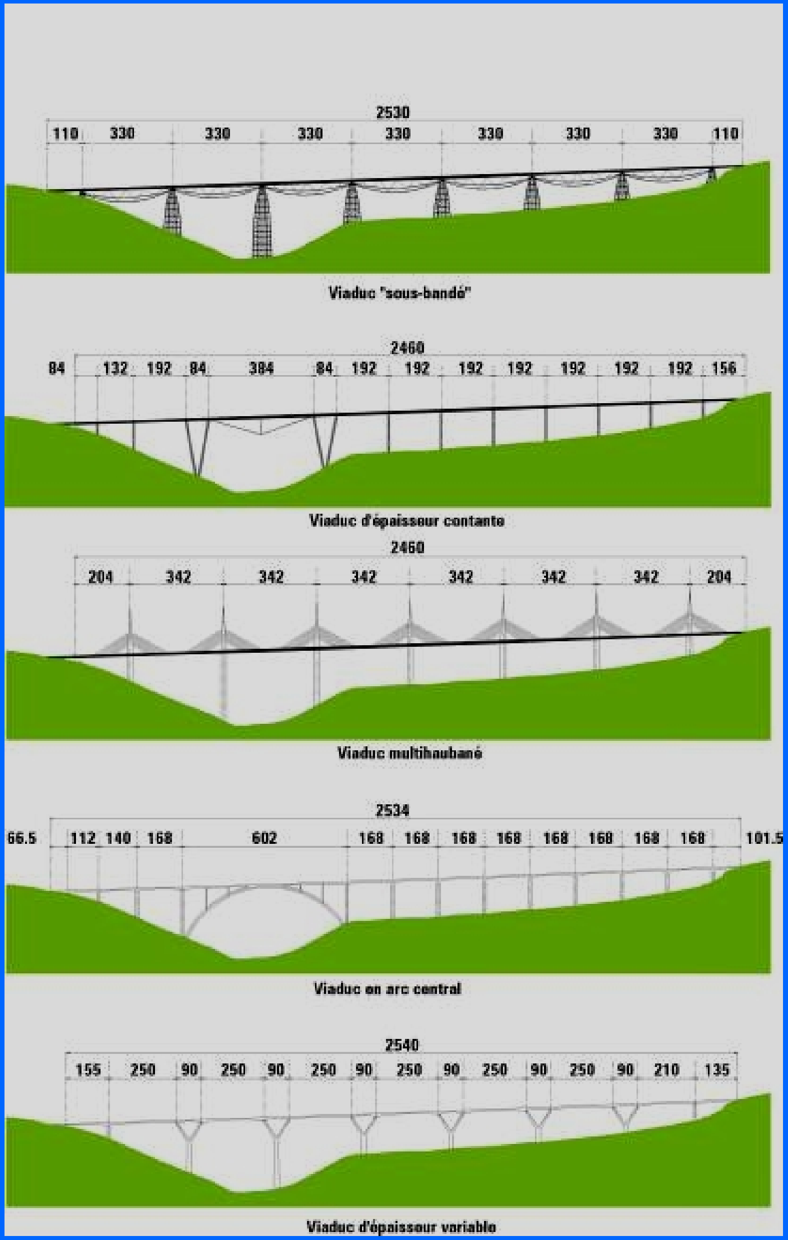
Steel deck with multiple sub-bended spans

Steel deck with continuous spans
of constant depth

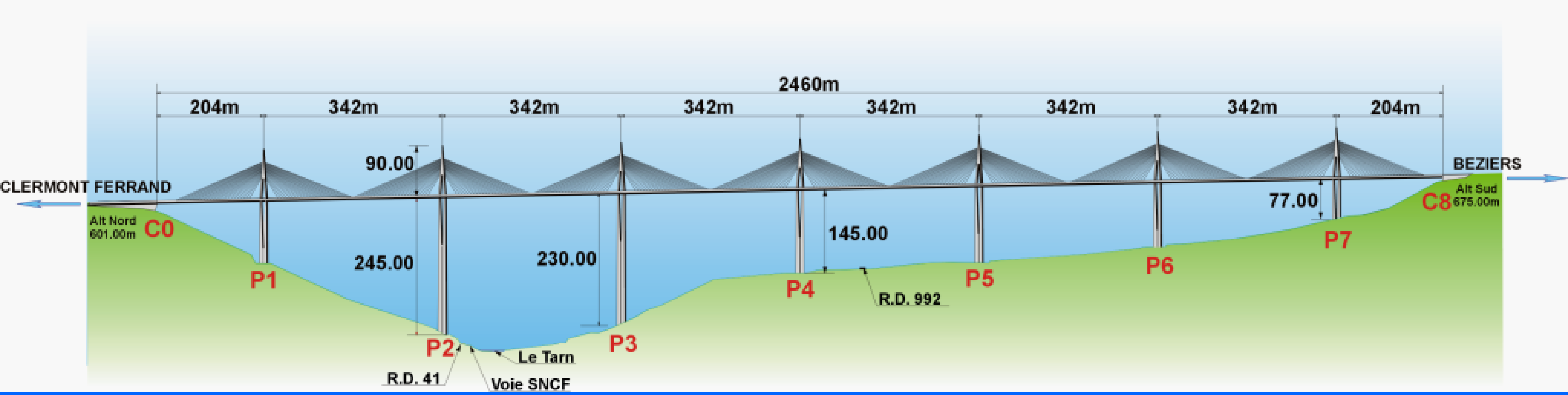
Steel or concrete deck
with multiple cables-stayed spans

Concrete bridge including an arch with an
opening 600m wide over the River Tarn

Viaduct with continuous spans
of variable depth
in concrete or composite material



# The selected project
# From Norman Foster Architect




7 piers P1 to P7
2 abutments C0 & C8
6 spans 342 m long
2 side -spans 204 m long

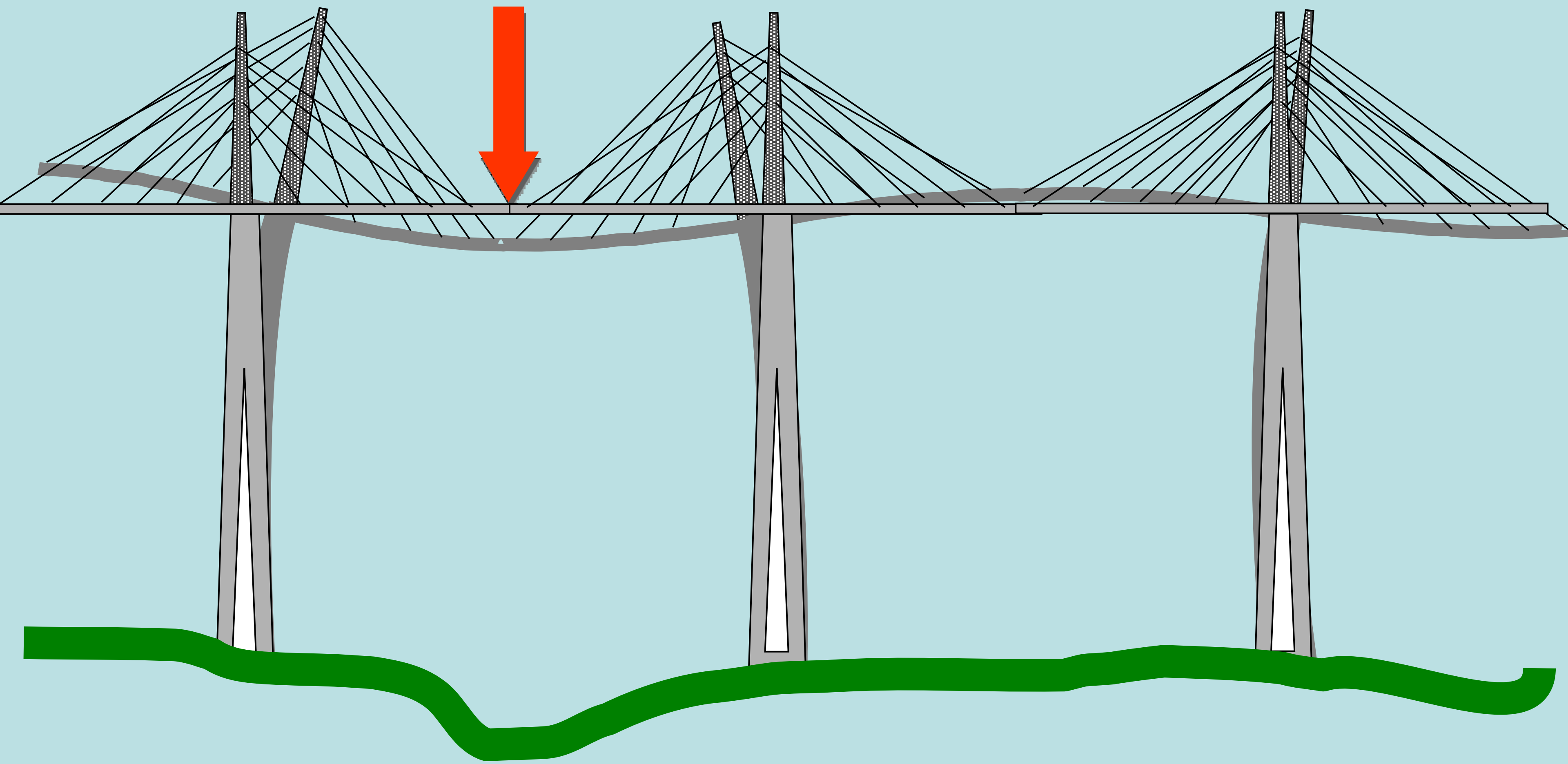
A curved alignment

1996 -1998

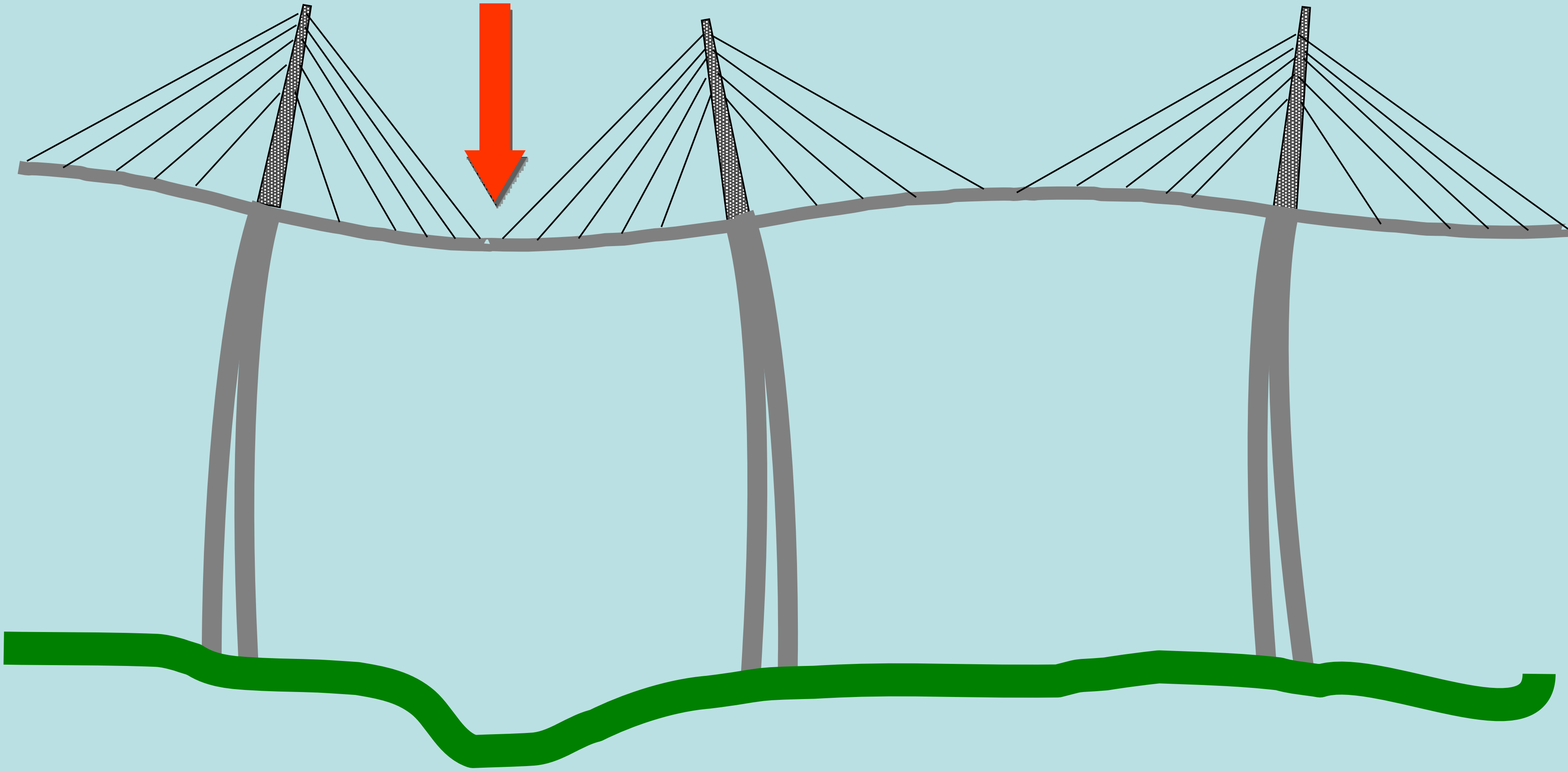
# The project development issues

**Geology**
**Géotechnics**
**Testing bored pile foundation**
**Design of piers and deck**
**Meteorological records**
**Wind studies**
**Snow**
**High performance concrete design**
**Seismicity**
**Maintenance and operation**
**Users’ behaviour**
**Building methods**
**Construction management**
**Cost analysis**
**Hydraulic studies**
**Archaeology**

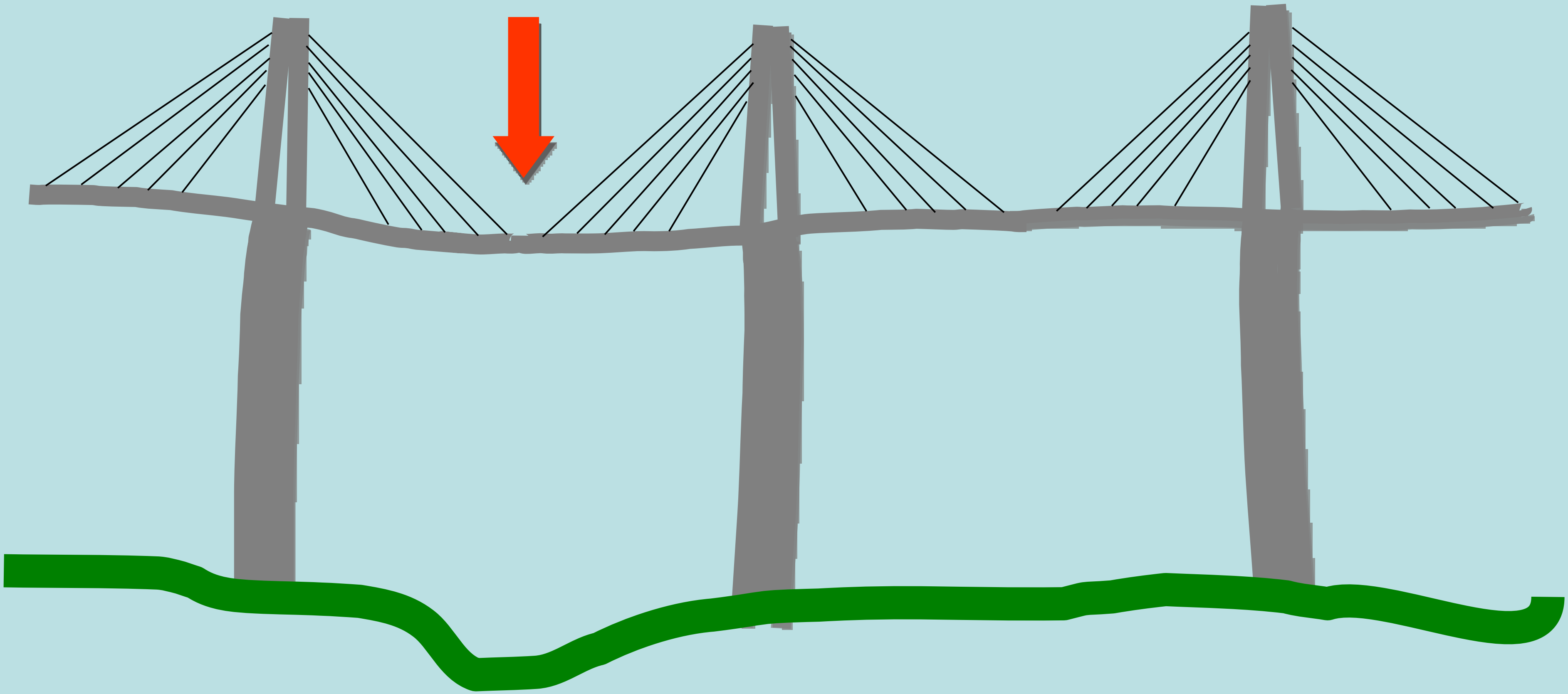
# The pier design : flexible pier at their base strong distortion of the deck (1)



## The pier design : flexible piers at their base strong distortion of the deck (2)

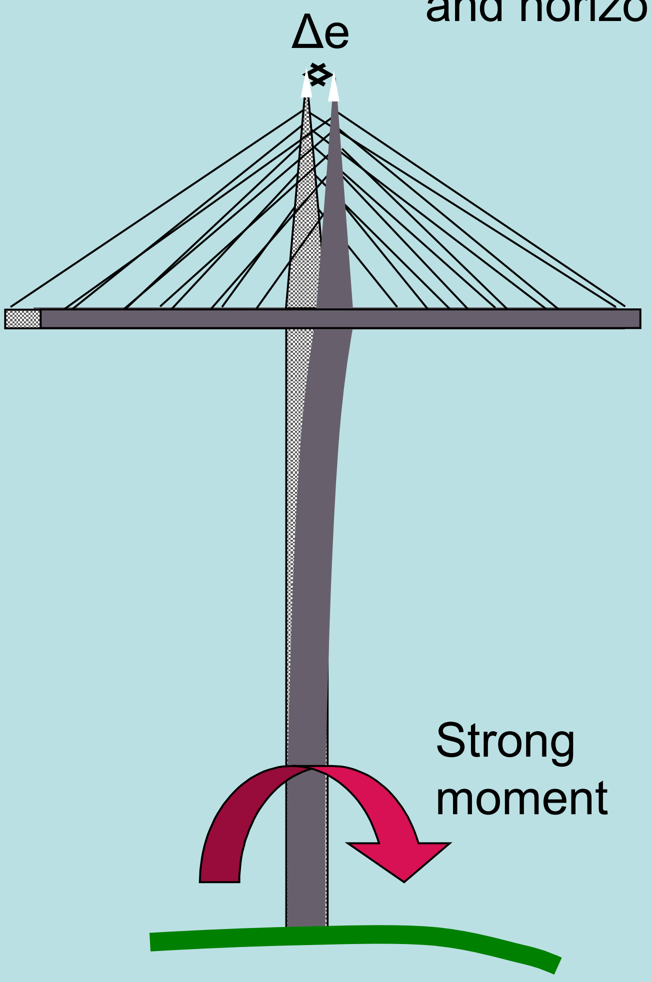


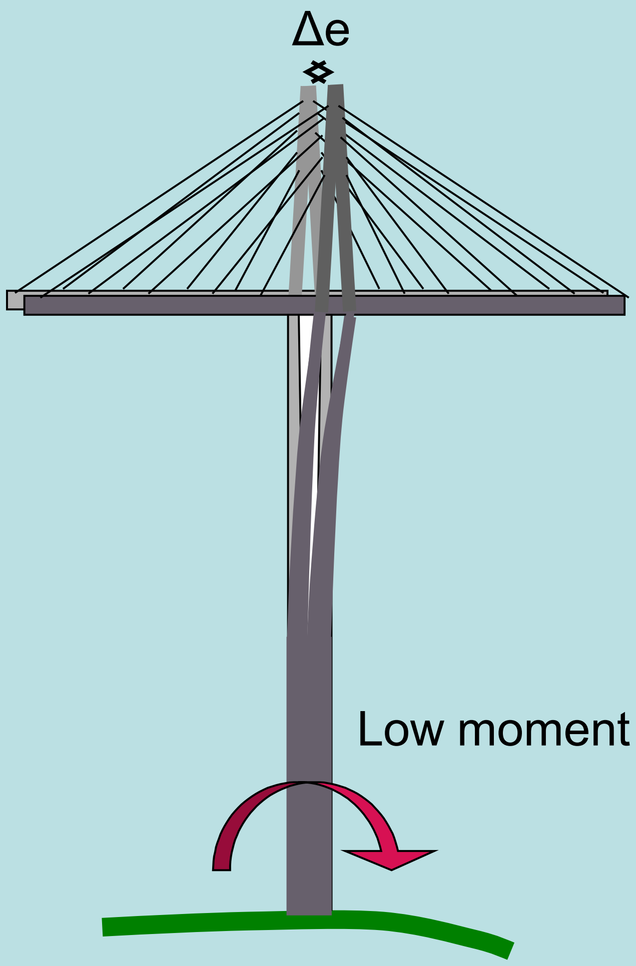
**Pier design : piers with flexural rigidity at their base**
**Less distortion of the deck**



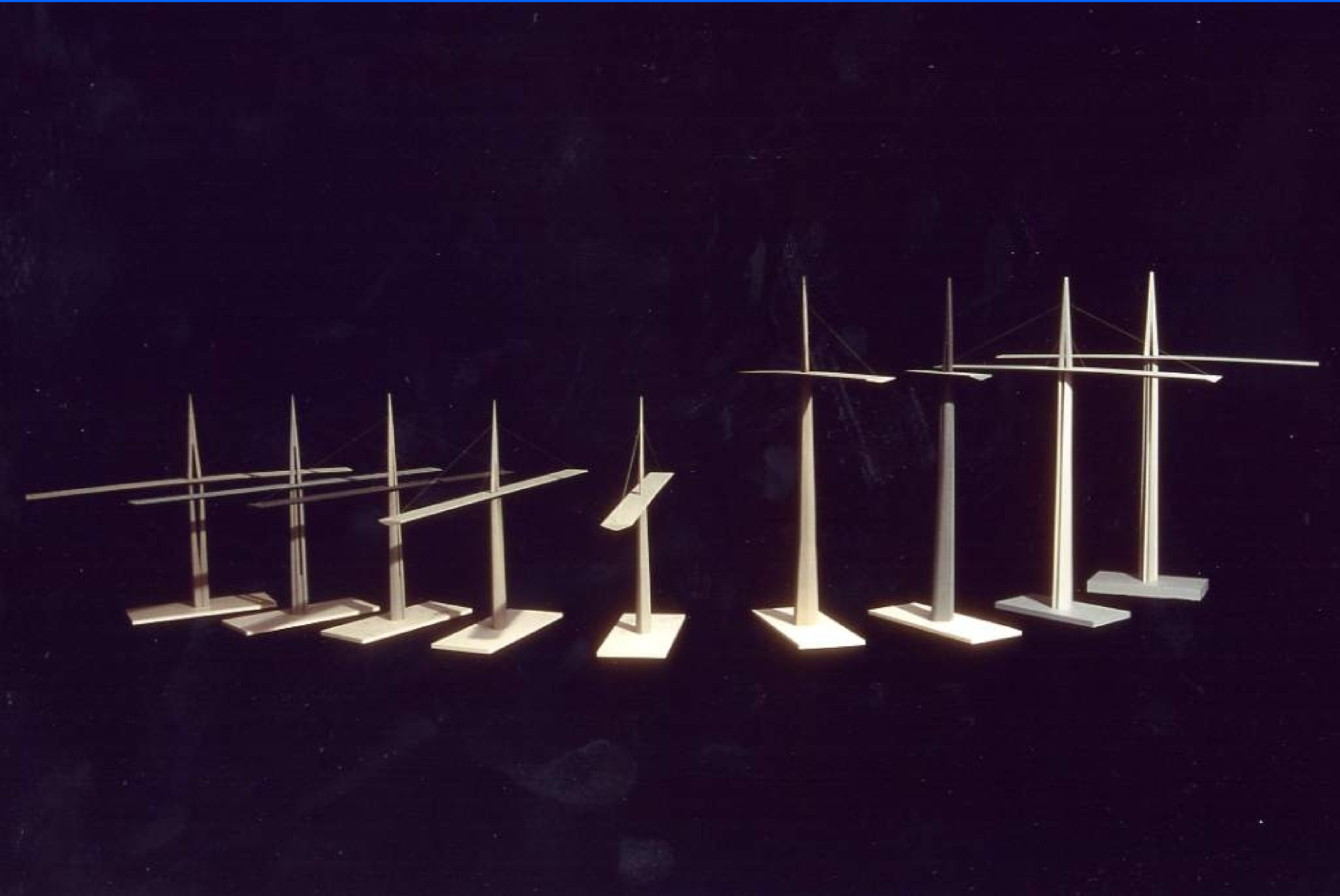
# Splitting the top of piers into two parts over 90 meters

- Less important fixing moment at the base
- Horizontal flexibility  regarding the deck thermal expansion and horizontal forces

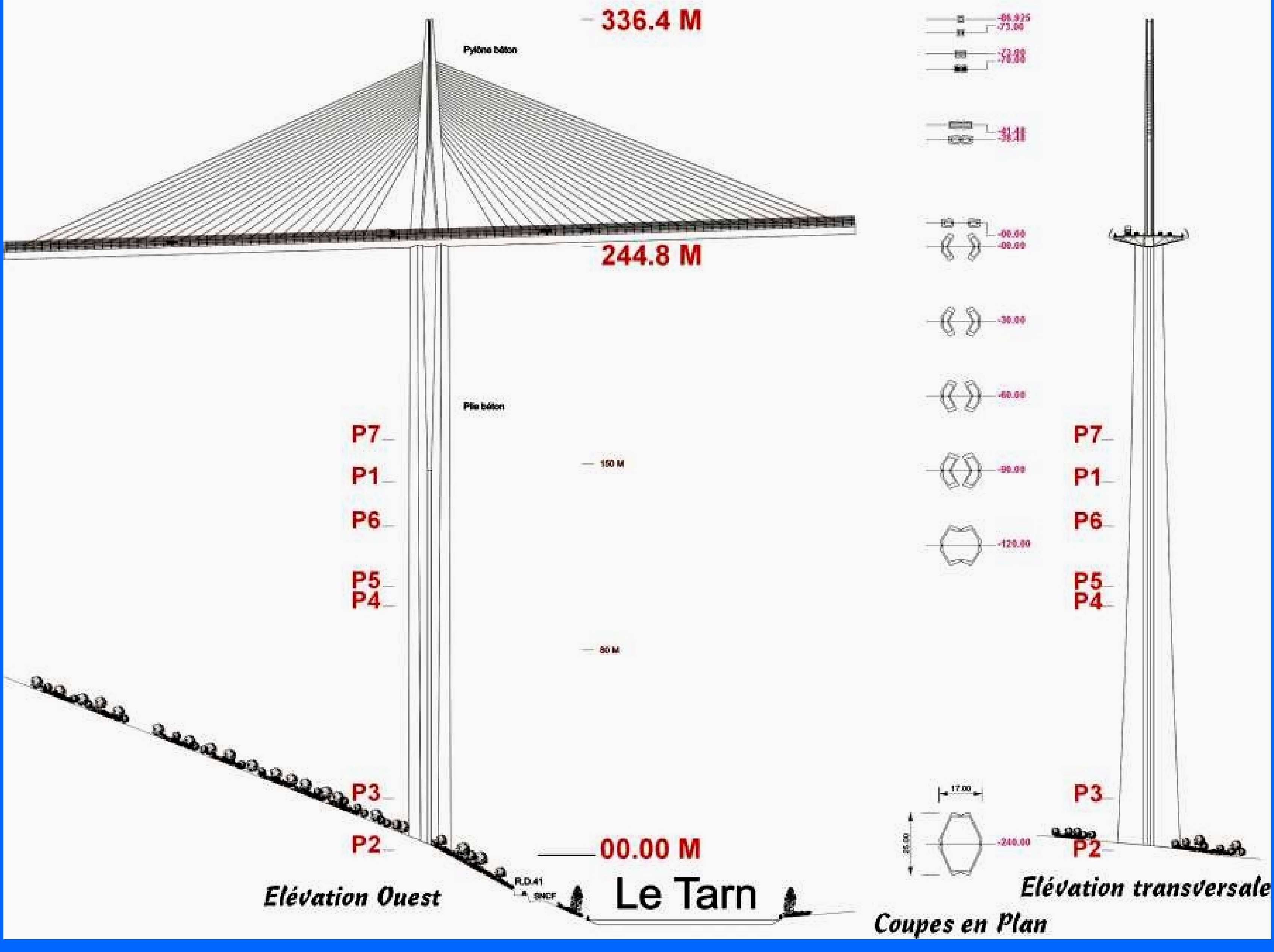


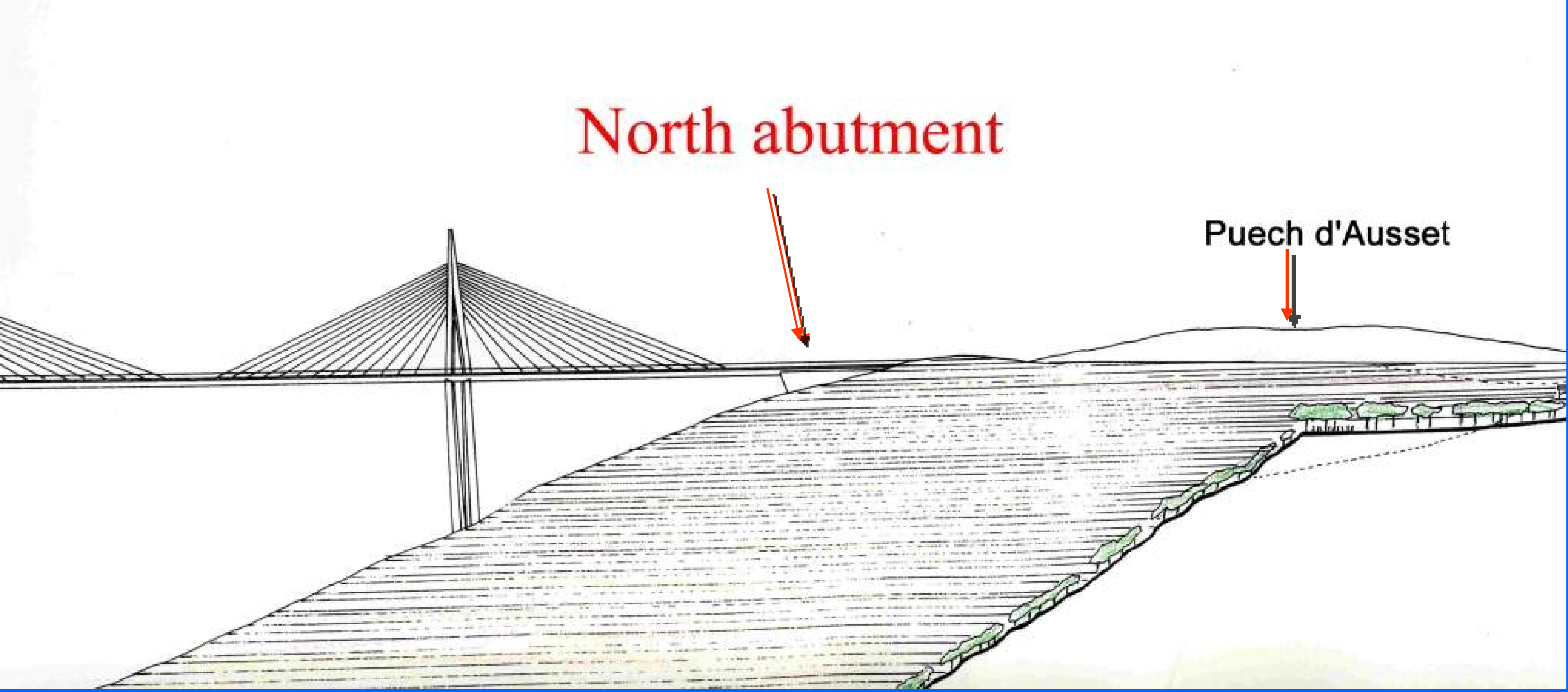
# Architectural design of piers



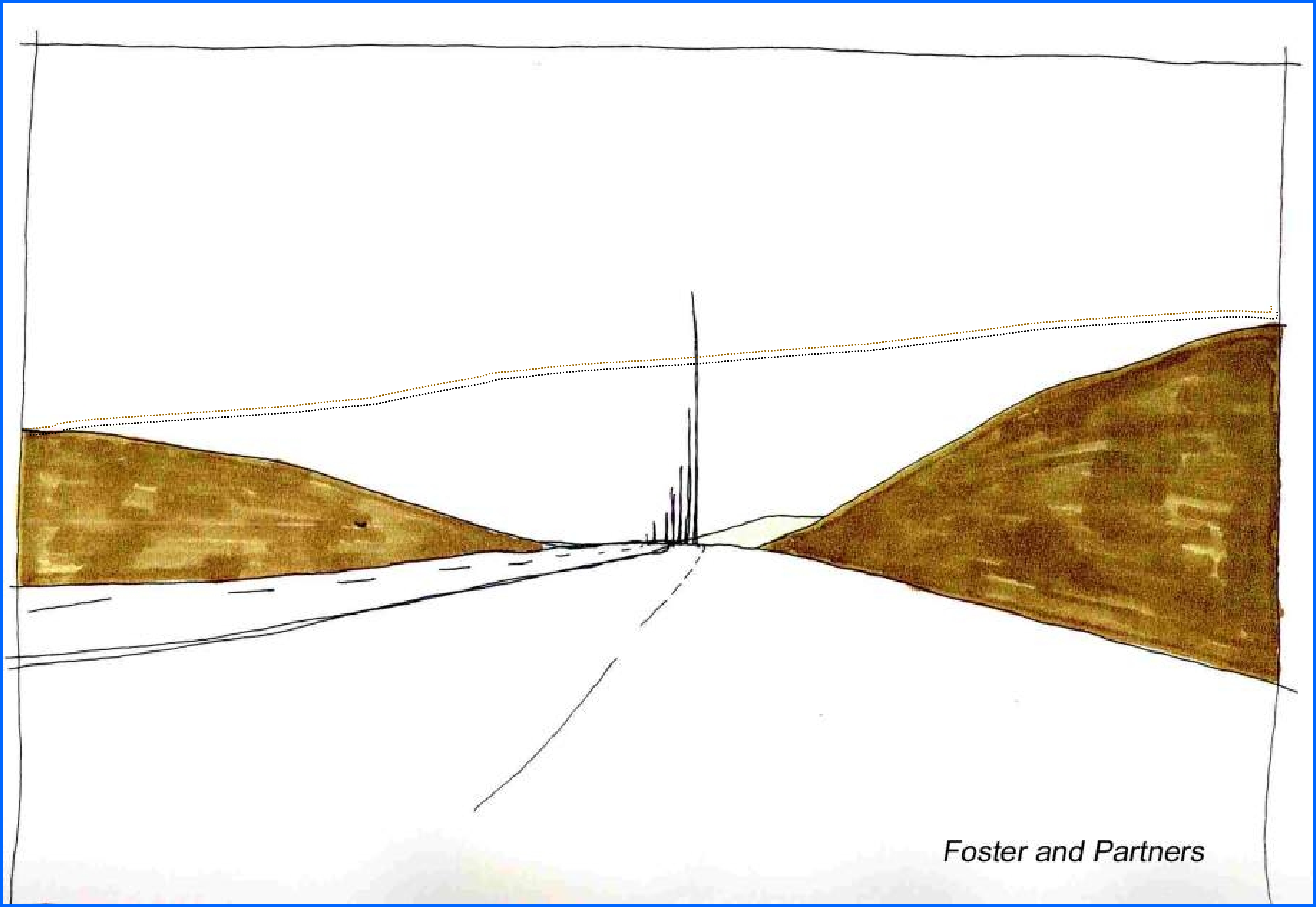
# Pier P2


336.4 M
Pylône béton
244.8 M
Pile béton
P7
P1
P6
P5
P4
P3
P2
00.00 M
Le Tarn
Elévation Ouest
Elévation transversale
Coupes en Plan

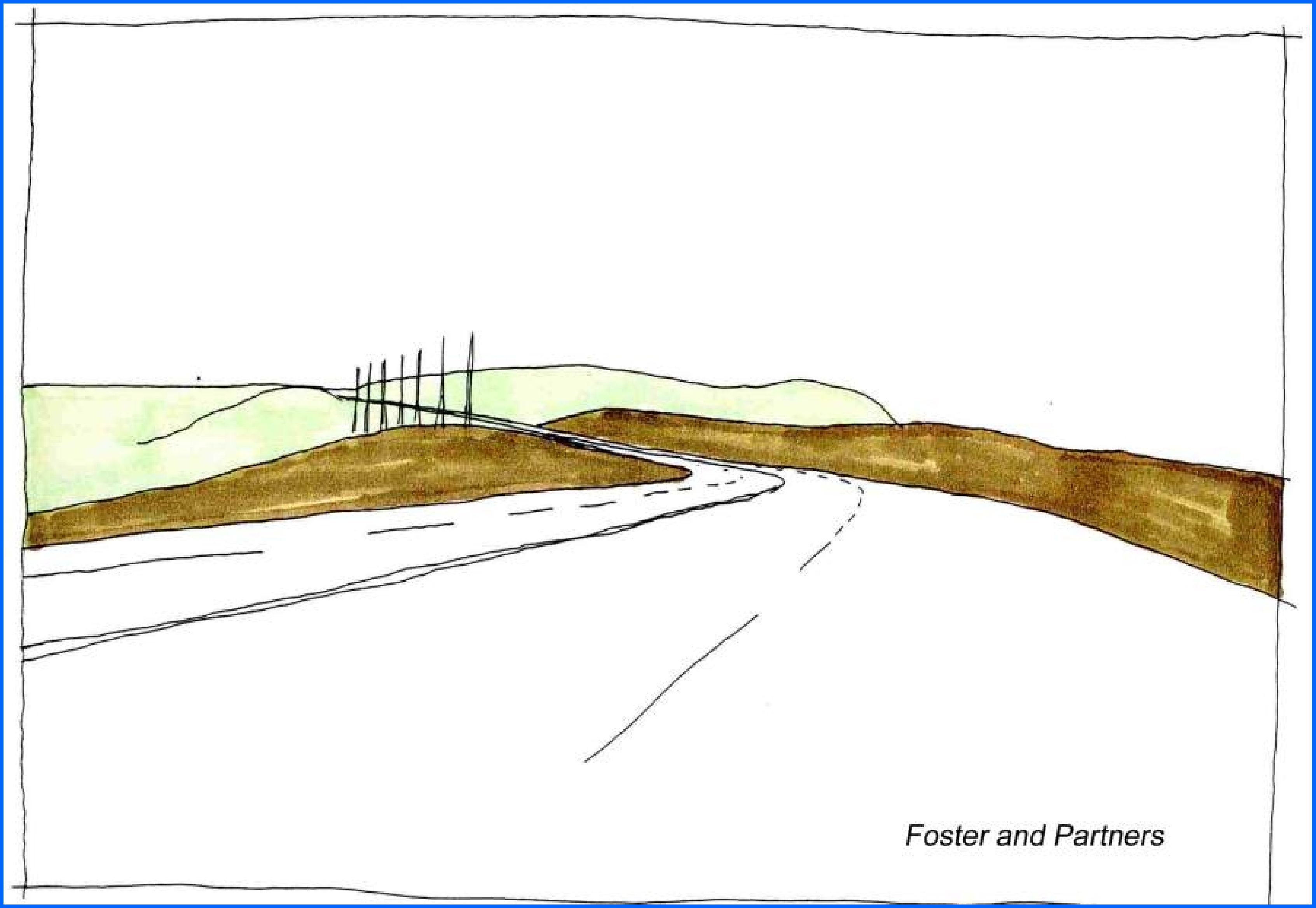
# North abutment design and deck "landing"



# Reshaping the Puech d'Ausset



# North approach of the viaduct



# The Millau viaduct and wind action

- Wind characteristics at site
- Turbulence effects
- Aeroelastic effects

# The Millau viaduct response to wind action

- The response to wind action is at the heart of the design of long span bridge structures and their components : piers, deck, pylons, wind screen,
- During the construction phase, wind forces and excitations account for 25% of the total forces and loads acting on the Millau viaduct
- Investigating wind characteristics at site is a preliminary step before defining the mechanisms of wind action on the bridge structure

# Steps to be taken for assuming the safety of the Millau viaduct under wind forces
(From A.G. Davenport)

Alan Davenport

1. Identify the wind directional pattern and measure the wind characteristics on site and from statistical recordings of the meteorological local stations.
2. Identify the mechanisms of wind action: steady forces, gust forces, wake induced forces, motion induced forces
3. Define suitable models for describing the wind and bridge structure and predicting the response
4. Define parameters for the models from wind local measurements and wind-tunnel tests
5. Assess the uncertainties in the models and parameters
6. Quality control of the experimental and analytical results

# Investigating wind characteristics at site

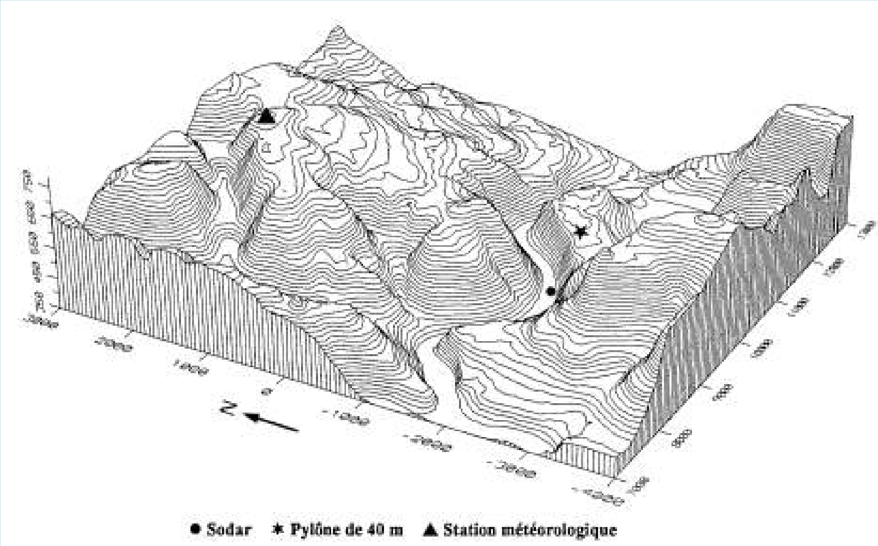
- Pylon 40 m high, located on the Plateau de France:
  - Average wind characteristics measured during 9 month
    ( weather vane anemometer- Gill )
  - turbulence : 4 measurement series of the 3 components of the instantaneous wind velocity
    ( sonic anemometer )

- Measurement with SODAR - Remtech equipment
  ( wind profile distribution at different levels up to 300 m high )
  - Mean velocity
  - Vertical turbulence
    - Along the Tarn river , straight up to the viaduct alignment :
      4 series
    - Plat de Peyre : 3 series

# Assessment of the design wind velocity

- Computing (19 km x 17 km)
  - Correlation of the mean wind at the deck level with data from the local meteorological station at Soulobre
  - Assessment through SODAR measurements

- Annual wind statistics
  - Mean wind velocity: 3 times per hour and annual maxima
  - Tempest method (N.J. Cook) 2 types of wind storms NW et SE




**Mean wind every 50 years at the deck level: 210 km/h**

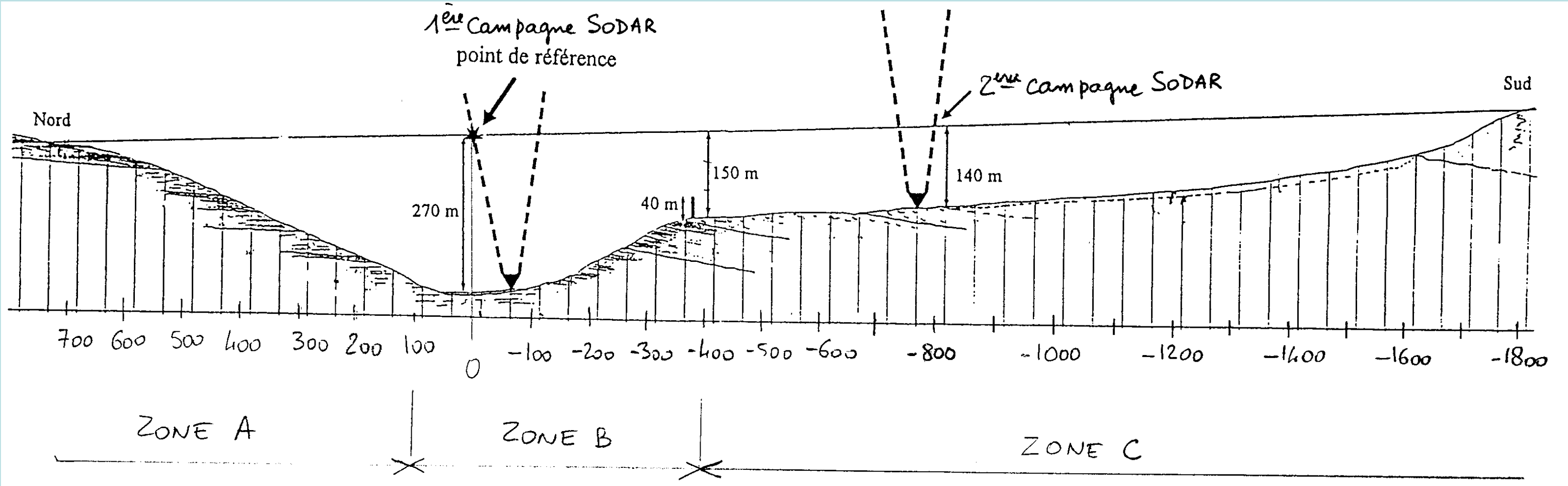
# Wind models

- Defining wind models in the CSTB wind tunnel from the local topographical mock-up scale 1 / 250th
  - Domain size: Ø 5 km
  - measurements (with gauges - 3 hot wires)
    - Along the deck
    - Along the pier height
    - At the pylon top(40 m high)
  - Data recorded:
    - Mean velocity $\bar{V}(y,z)$
    - Standard deviation $\sigma_u, \sigma_w$
    - correlation along the deck ( and piers) $L_u^y, L_v^y, L_w^y$
    - DSP $S_u(n), S_w(n)$
    - coherence $C_u^y, C_w^y$

# Wind models

- 3 directions :
  - East (perpendicular to the deck )
  - South East (45° to the deck alignment)
  - North-West
- 3 separate zones and 3 corresponding models:

A, B, C



# Viaduct response under wind action

Two main types of response have been identified under the action of strong wind:

- Induced vibrations  resulting from the turbulence vortex trail behind elements of the viaduct, at low wind velocity (12 m/s): deck, pylons, cables, wind screen,…

- Aeroelastic oscillations (flutter) of the deck at higher wind velocity resulting from wind-structure interaction: vertical (lift) , transversal and torsional oscillations.

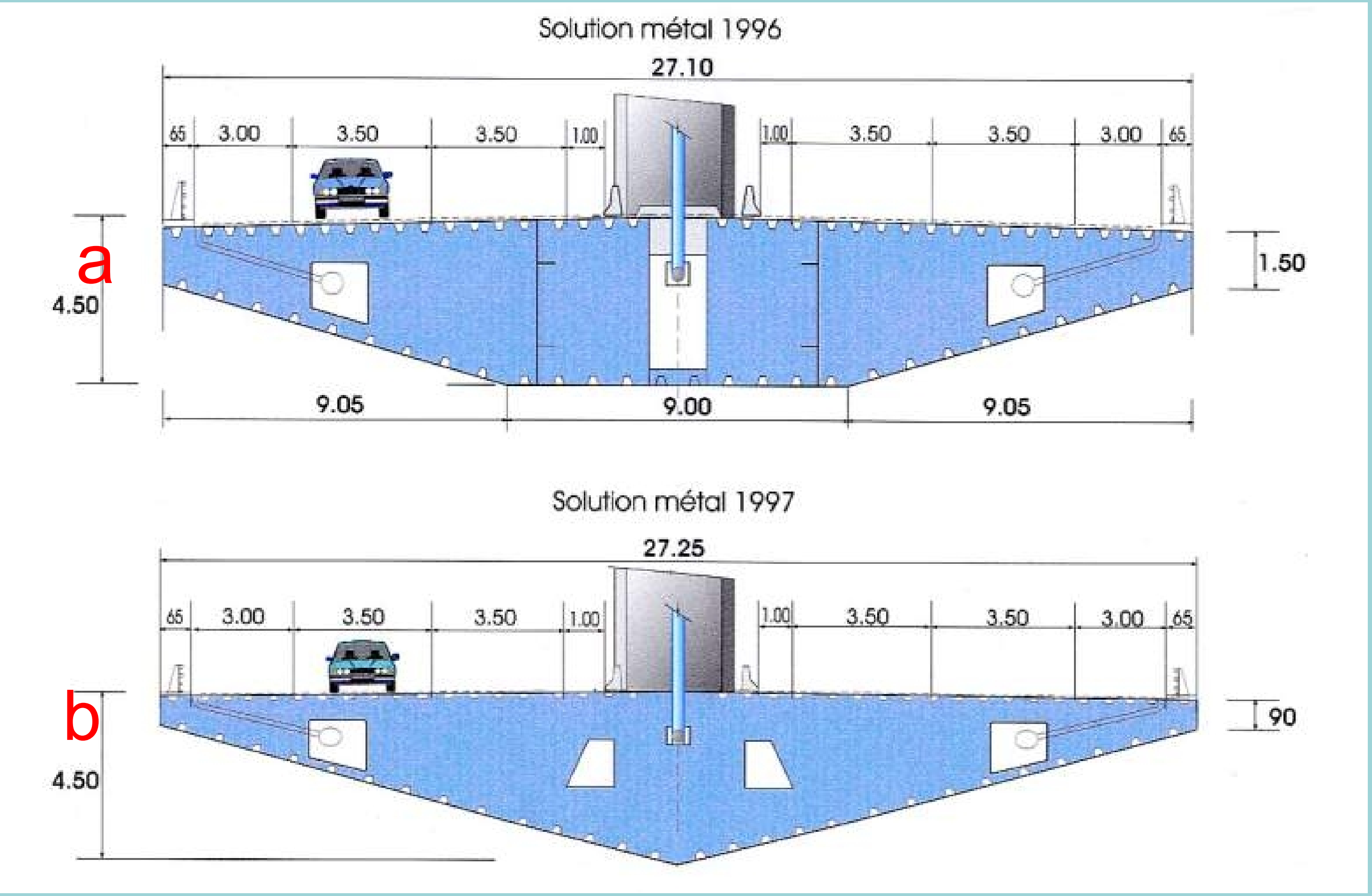
➢ These effects were modelled and studied in the CSTB wind tunnel (Nantes)

Model of the deck

Wind tunnel testing (CSTB)

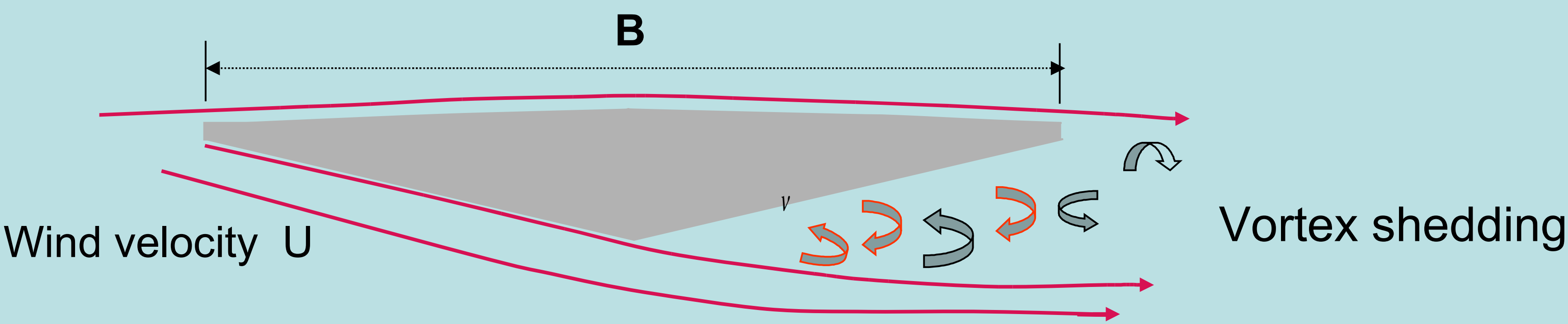
# Alternative cross-sections and response to turbulence effects

Alternative b was proposed by the architect and the designer and tested in wind tunnel

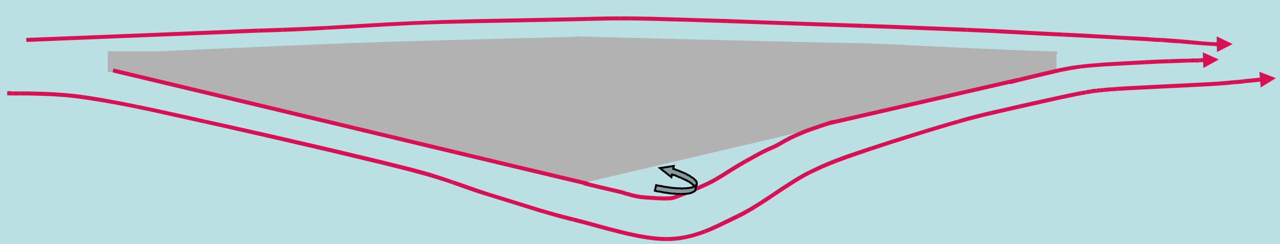


# Wind stream along the deck cross section and turbulence
# Case of a triangular section

The Reynolds Number $\mathrm{Re} = \frac{UB}{\nu}$
is the ratio between inertial forces of the air represented by *UB* and the viscosity forces linked to the viscosity coefficient $\nu$

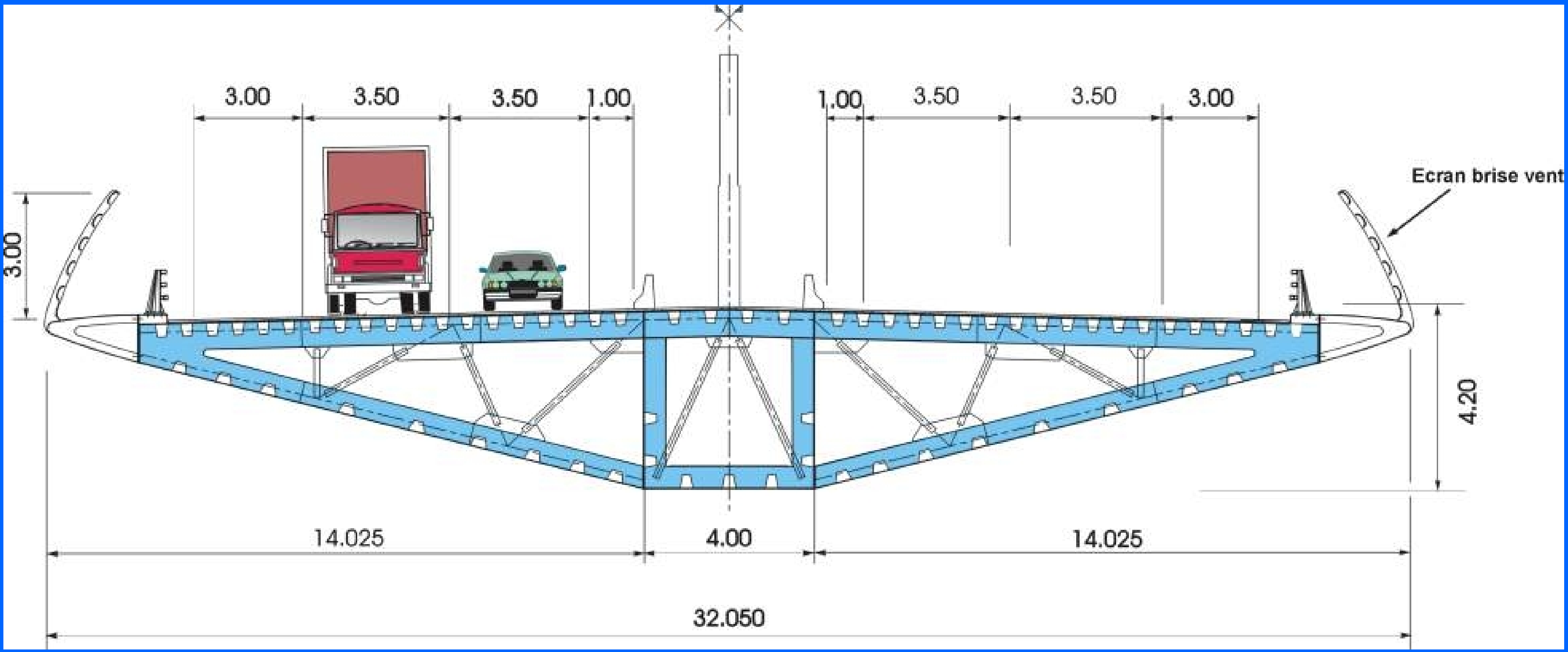



**Wind stream with a low Reynolds number Re < 4.105**



**Wind stream with a high Reynolds number Re > 4.105**

# Final steel deck cross-section: a compromise



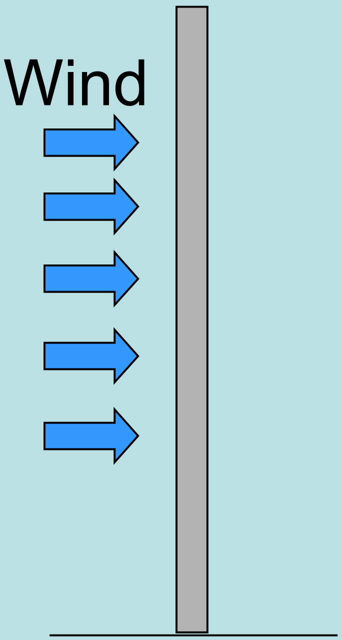
# Vortex induced vibration : case of Pylons

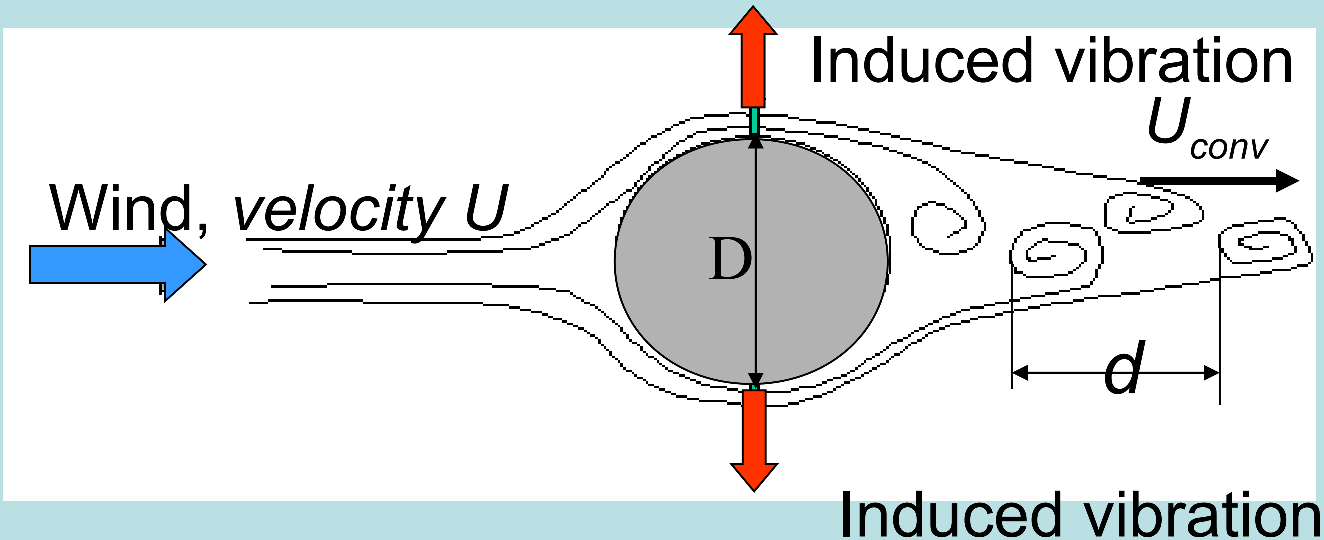
The vibration motion is derived from the classical linear oscillator: $m\ddot{x}(t) + c\dot{x}(t) + kx(t) = F\sin(2\pi f_t t)$

*m: mass of pylon*
*c: damping of pylon*
*k : rigidity of the pylon*
*$f_0$ :natural frequency of oscillation* $f_0 = \sqrt{\frac{k}{m}}$

*F : amplitude of external exciting force* $= \frac{1}{2}\rho U^2 C_L$
*$f_t$ : fréquency of vortices=StU/D*
*St =Strouhal number*

*Resonnant amplification if* $f_0 \cong f_t$ *for low damping*



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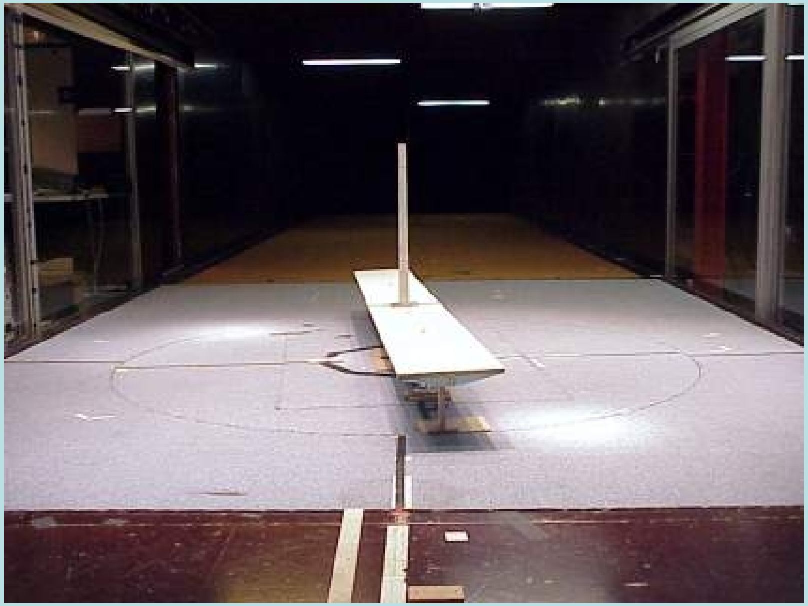
# Wind tunnel testing of a steel pylon

Model dynamically similar
Scale 1/100th



Steady wind

Turbulent wind, I=12% à 70 m over the deck

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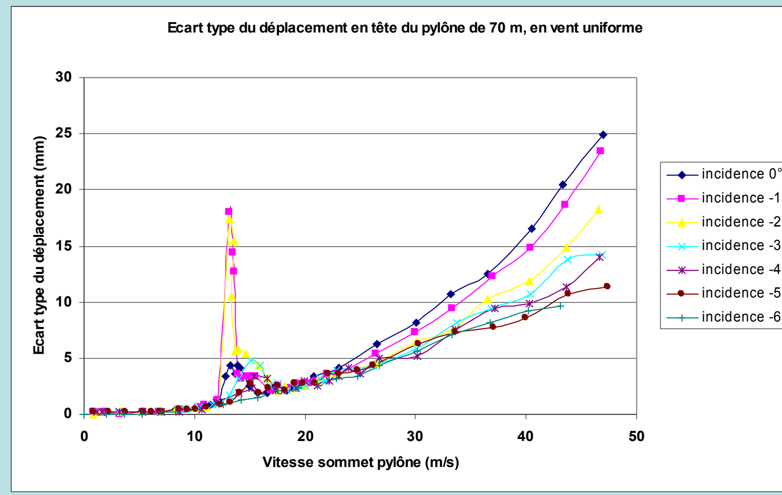
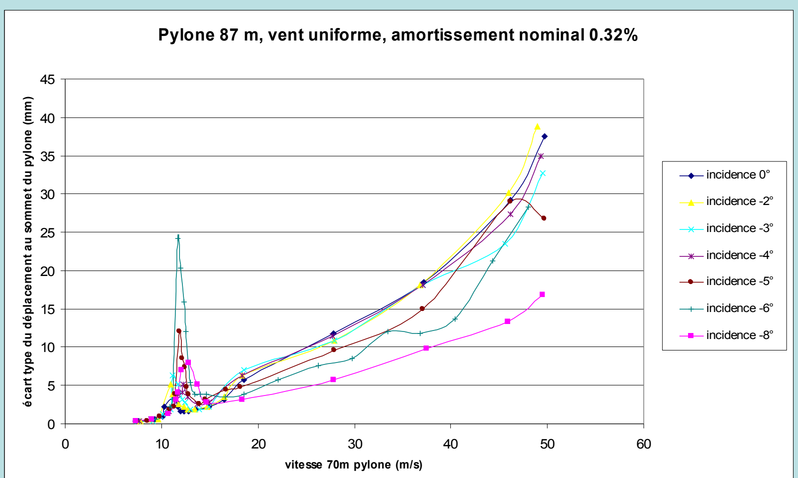
# Wind tunnel testing of a steel pylon

Steady wind, pylon 70m high, vortex shedding for ±2 deg., wind velocity 13m/s

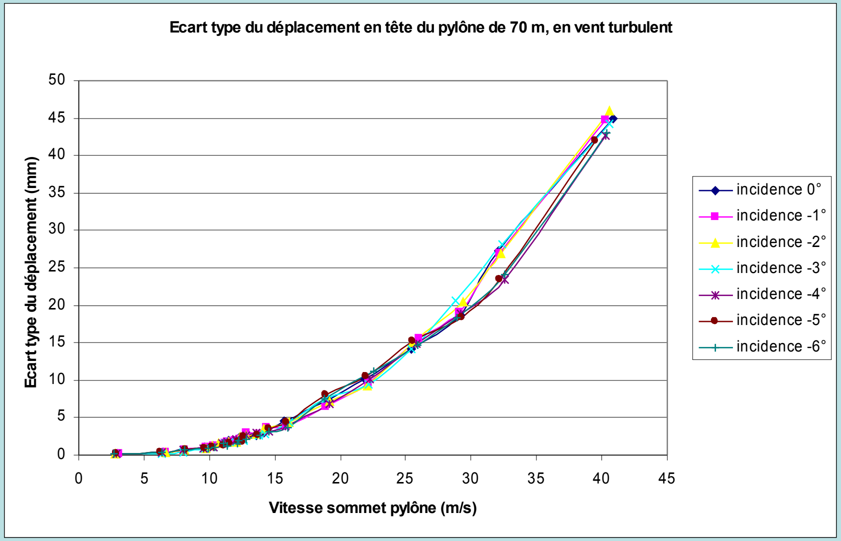


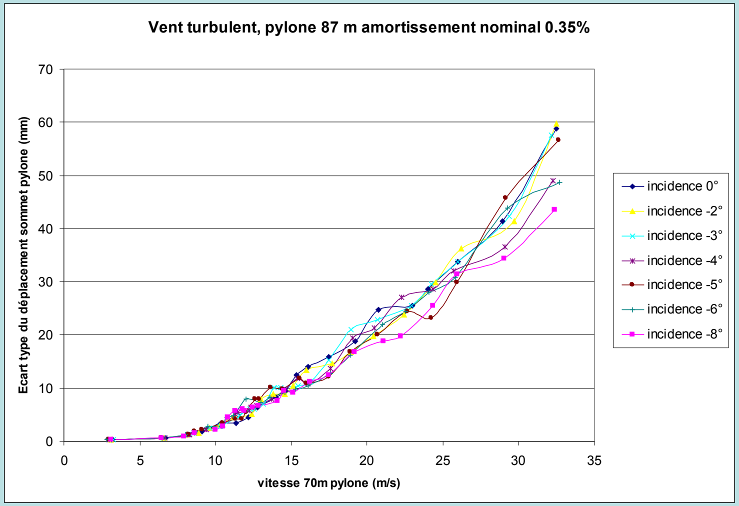




Steady wind, pylon 87m high, vortex shedding for ±6 deg., wind velocity 12 m/s

# Wind tunnel testing of a steel pylon

Turbulent wind




Vortex shedding slightly visible but still in a latent state

# Steel Pylon and vibrations

- Further analysis shown that the results of the wind tunnel testing should be viewed with  reservation : in fact, the pylon is coupled with stay cables and must be modelled consequently
- The new analysis demonstrated conclusively that there was no risk of resonance,
- The results of the analysis are in accordance with the observation and the measurements carried out on the pylons of the viaduct

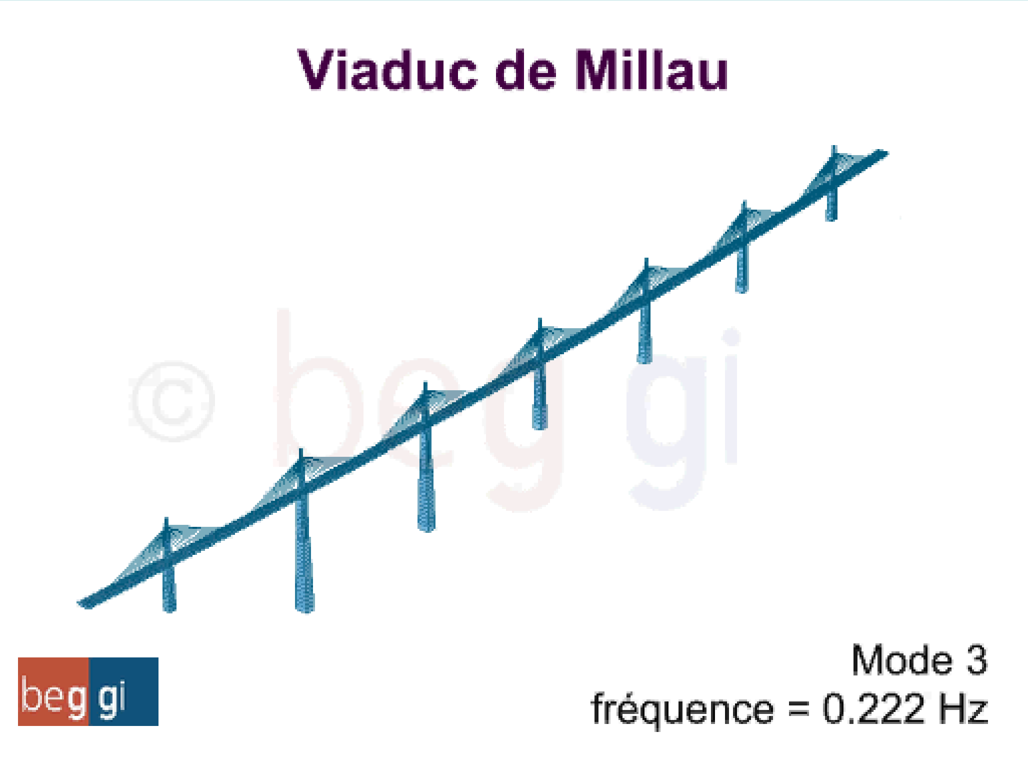
# Aeroelastic wind response

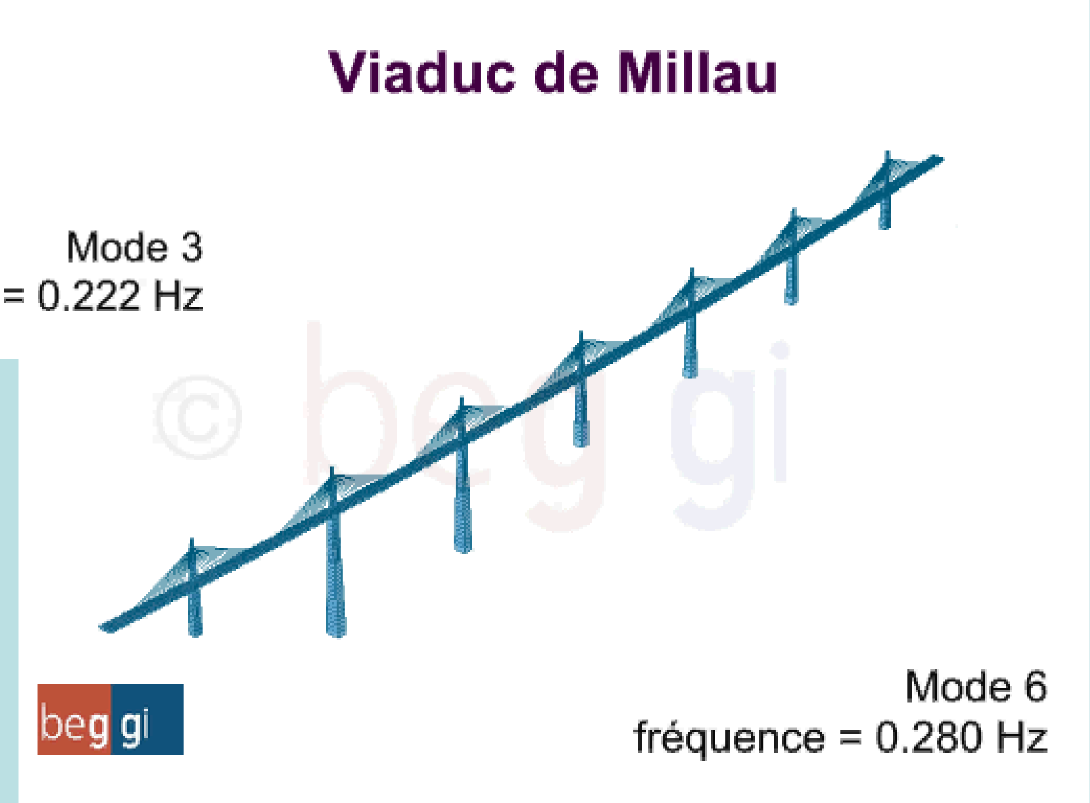
- The deck of the Millau Viaduct is very flexible as a result of its slenderness

***Deformed shape during launching***

Under aeroelastic effects , the deck oscillates at the natural frequencies of its structure.  These frequencies are established by computing.

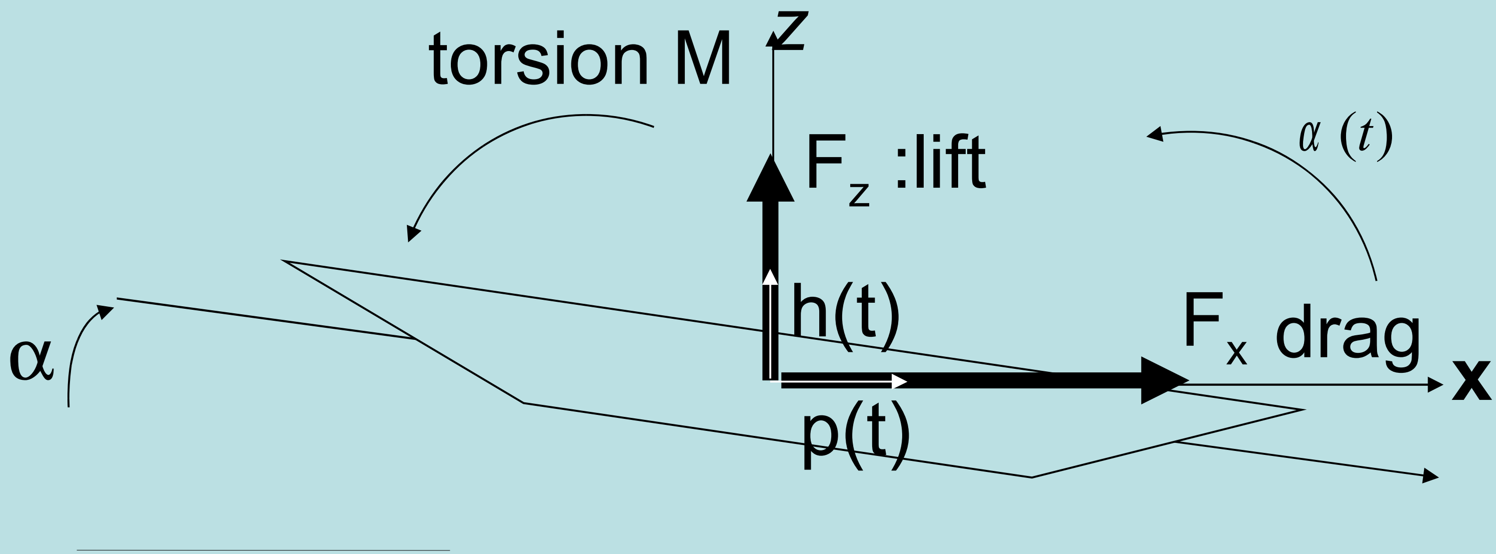
# 2/22 mode shapes of the viaduct



# Aeroelastic wind response

- The wind forces on the cross section are similar to aerodynamic forces on an airfoil. But in the case of the heavy structure of the viaduct, the wind flows are low in speed compared to those of aeronautics and the aerodynamic forces are weaker: they do not influence the responding modes nor their frequencies.




Wind velocity U

Static aerodynamic coefficients versus angle of attack

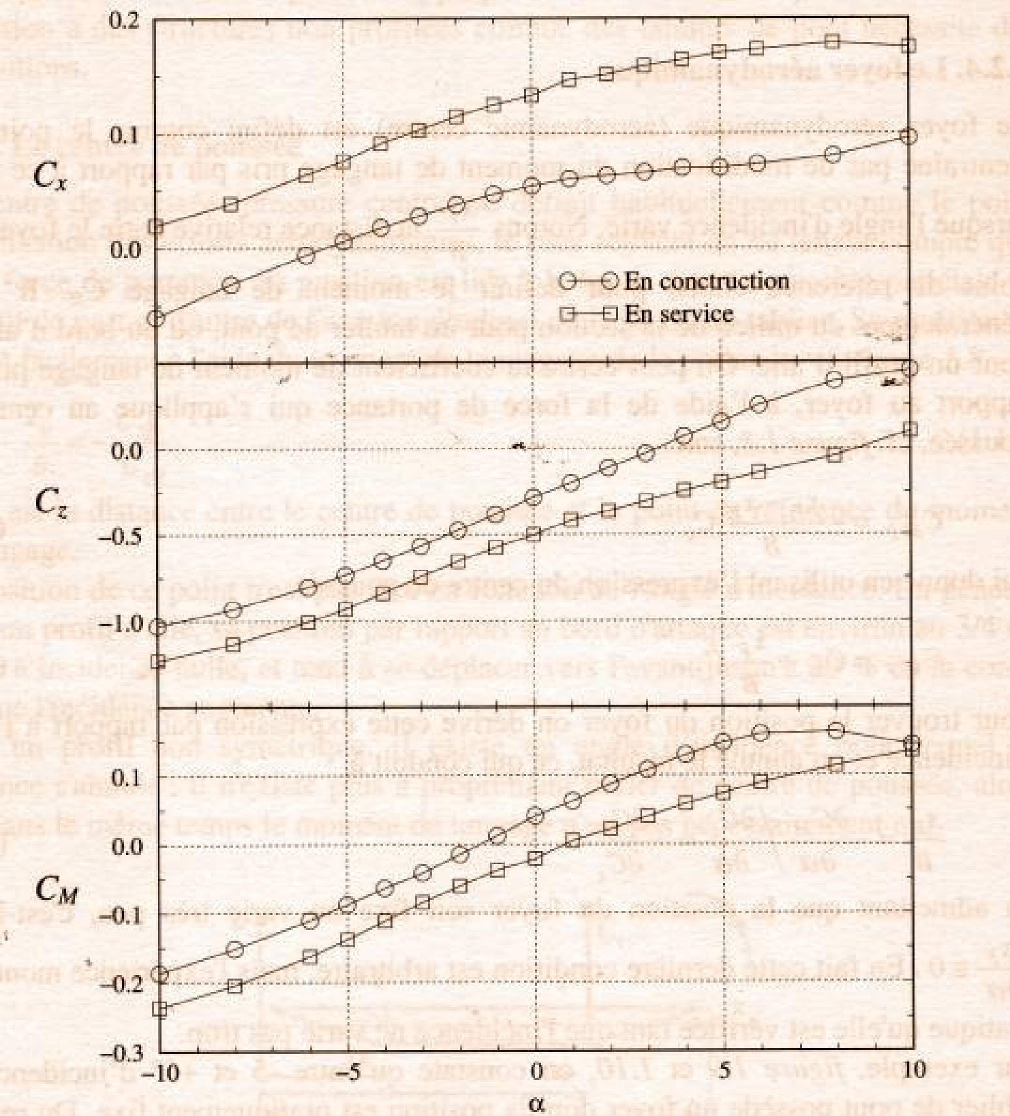



*Figure 1.9. Coefficients aérodynamiques stationnaires d'un tablier profilé (type Millau).*

# Aeroelastic response and damping

Damping plays a critical role. Three possible events can be identified with respect to the wind speed U:

1. $0 < \varsigma_a + \varsigma_s < 1$ Resonant amplification: this is the normal range of damping

2. $\varsigma_a + \varsigma_s > 1$ Over damping: no resonance

3. $\varsigma_a + \varsigma_s < 0$ Instability: the resonant oscillations grow to large and unacceptable amplitudes; (cf. the Tacoma Narrows bridge failure)

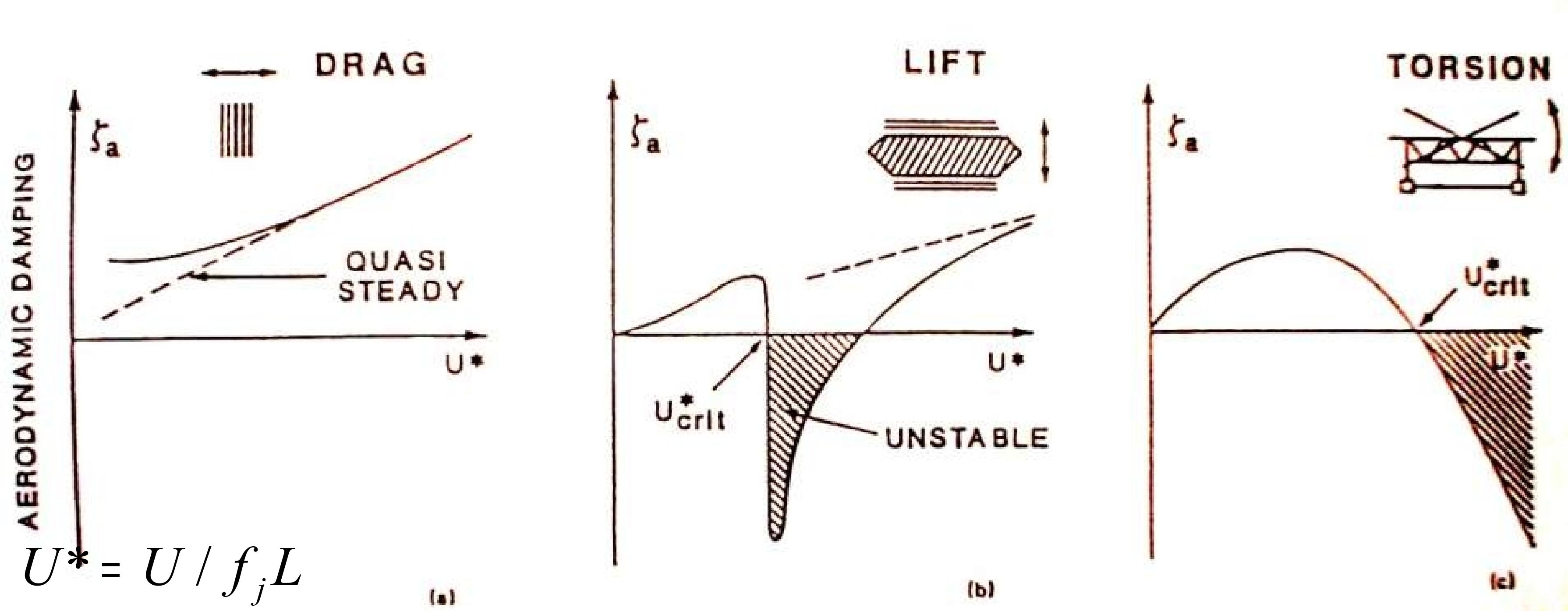
# Tacoma Bridge
# (November 1940)

**Torsion motion of the main span**

***The drop in level between the sidewalks increased up to 8,50 m***

# Aeroelastic response and aerodynamic damping

( from A. Davenport)




$U^* = U / f_j L$

*U : wind velocity*

*fj : frequency of j mode*

*L deck width*

Aerodynamic damping coefficients measured in wind tunnel (non turbulent wind)

$H_1^*$: LIFT

$A_2^*$: TORSION

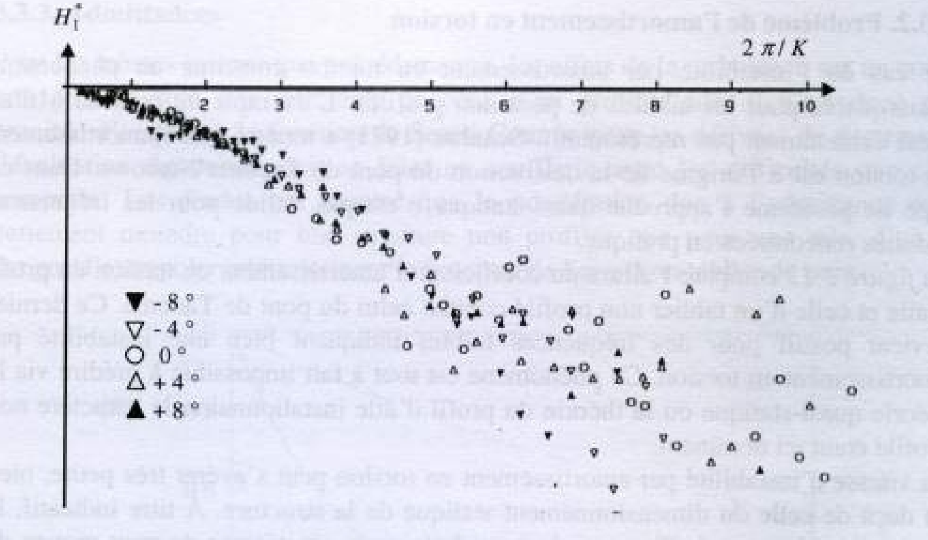



*Figure 3.10. Coefficient $H_1^*$ du tablier du viaduc de Millau en écoulement non turbulent en fonction de la vitesse réduite (rapport CSTB-EN-AEC 98-80 C).*

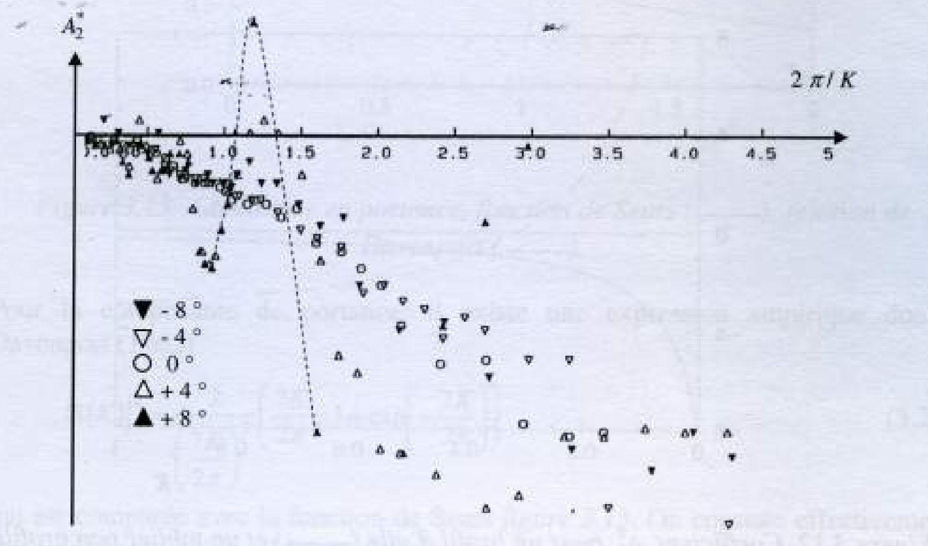



*Figure 3.11. Coefficient $A_2^*$ du tablier du viaduc de Millau en écoulement non turbulent en fonction de la vitesse réduite (rapport CSTB-EN-AEC 98-80 C).*

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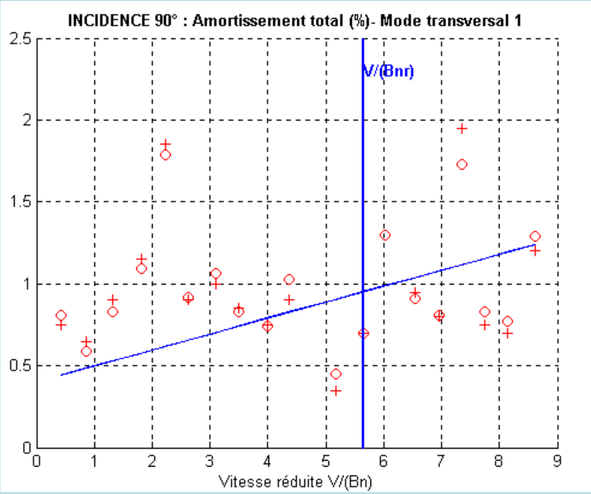
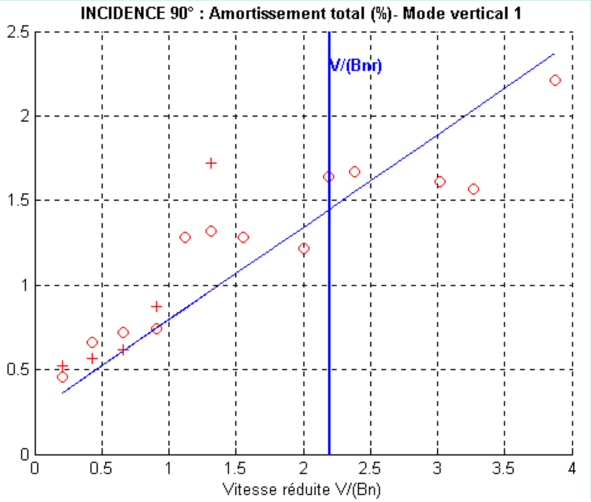
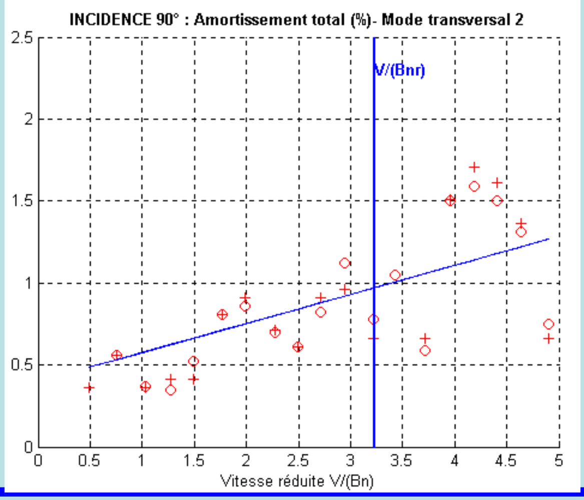
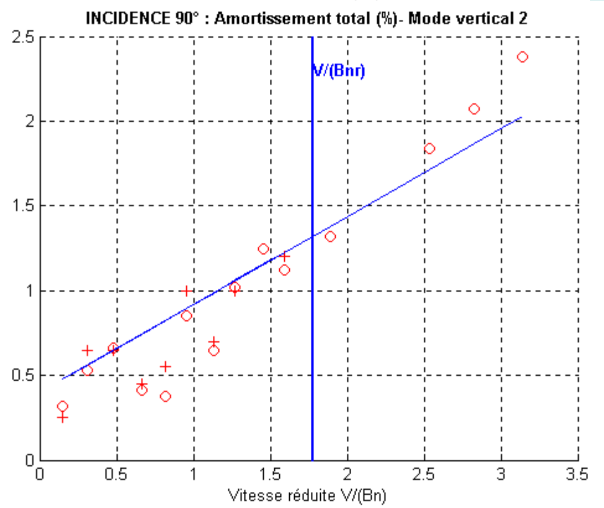
# Aeroelastic testing of the critical construction phase of the pylon on temporary pier Pi2

# Aeroelastic testing of the construction phase of the pylon on temporary pier Pi2
# aerodynamic damping ratios (transversal and vertical mode shapes)

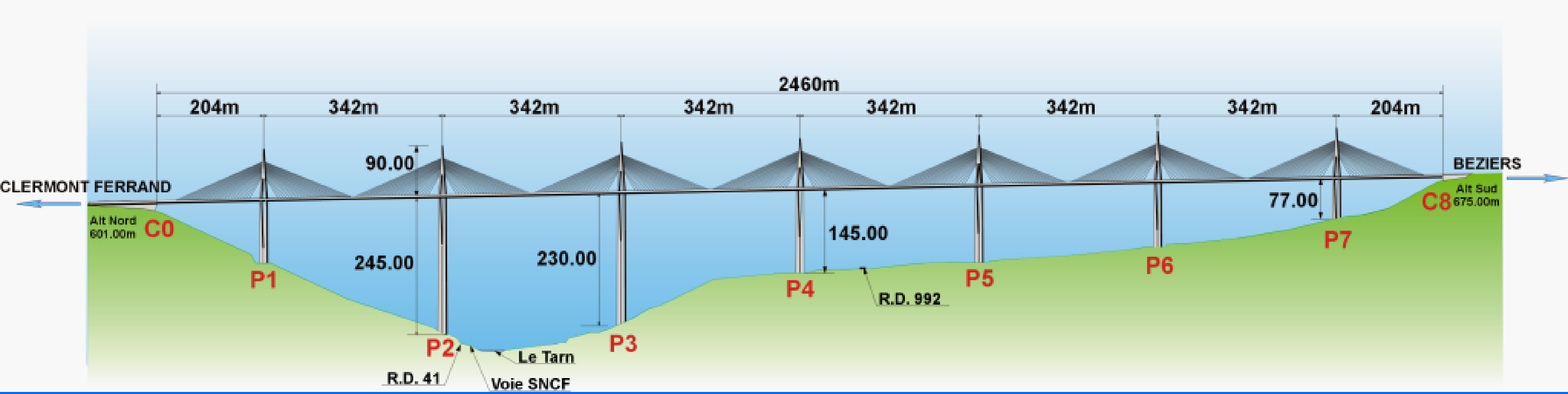


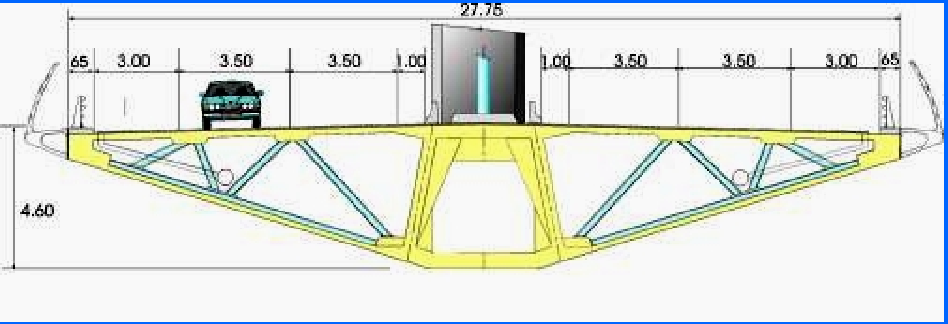



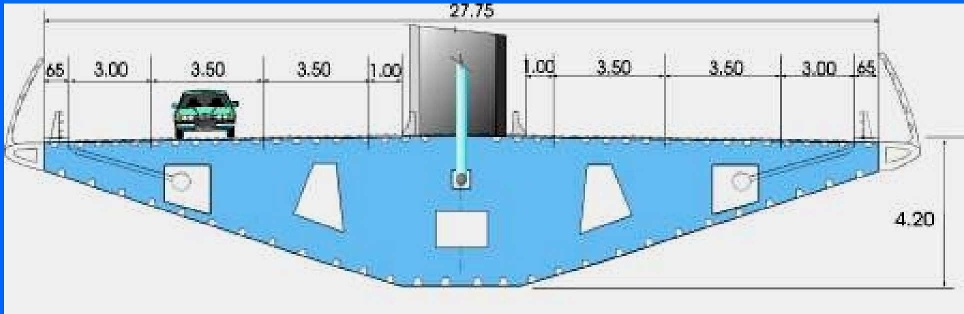
# 1997 The final project

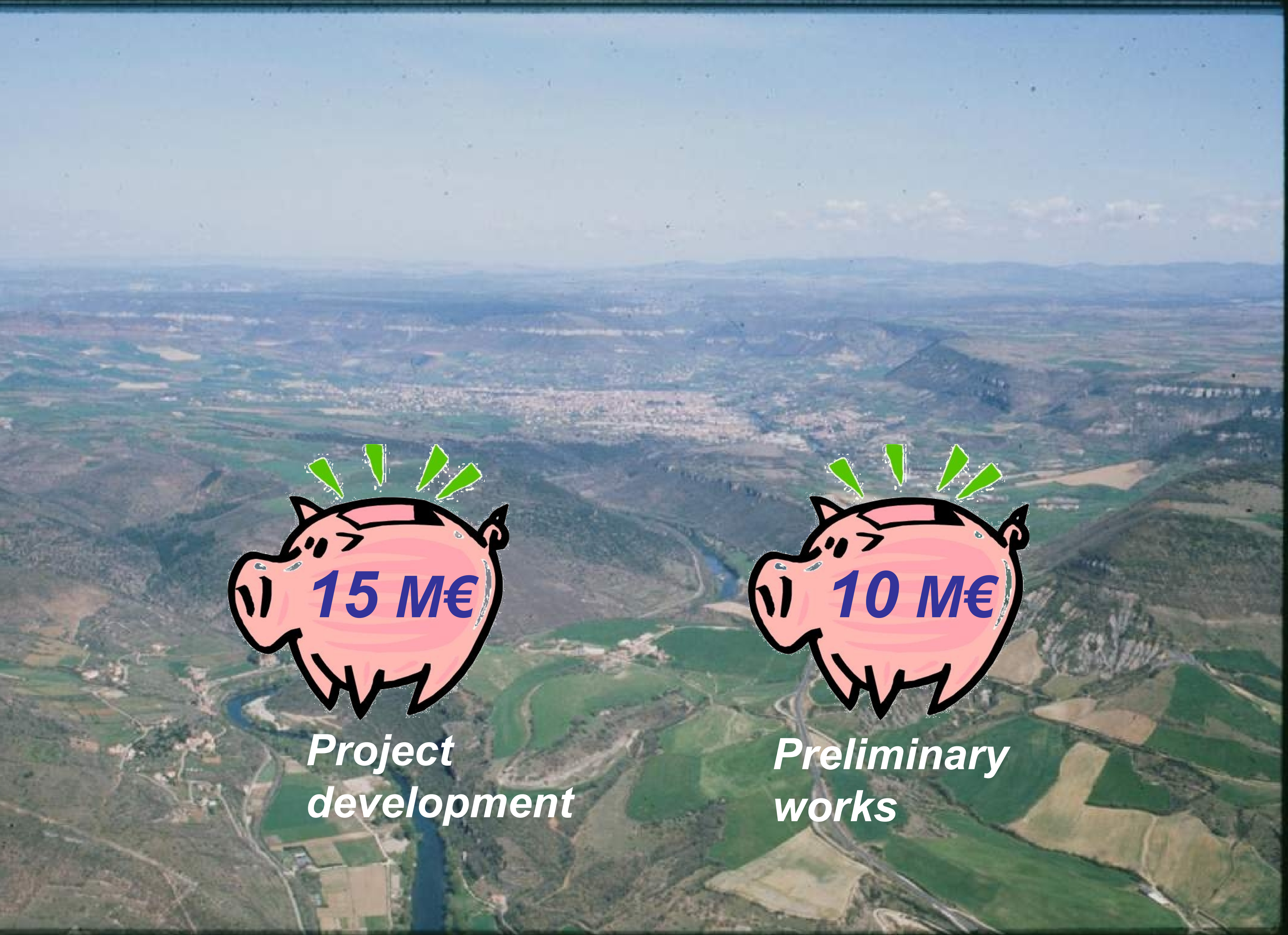



*concrete cross-section*




*steel cross-section*




15 M€
Project development
10 M€
Preliminary works

| | |
|---|---|
| 20/05/1998 | Government decision to out contract the construction and the operation of the viaduct to a concessionaire |
| 29/10/1998 | Minister decision approving the project of A 75 motorway bypass of Millau |
| 16/12/1998<br>10/02/1999 | New Public Inquiry resulting from the decision of the concession of the viaduct |
| 23/11/1999 | Public notice of the viaduct project |
| 1/12/1999 | Public announcement of European call for tenders |
| 08/06/2000 | 4 selected Companies are invited to tender |
| 21/11/2000 | 3 Company bids are submitted to an advisory Committee |

# The 4 selected Company Pools

- **Société du Viaduc de Millau, ASF, EGIS, Groupe GTM, Bouygues Travaux Publics, SGE, CDC projets, TOFINSO (France)** et **Autostrade SpA (Italie)**

- **Société EIFFAGE (France ), Involving EIFFAGE Construction** and **EIFFEL**

- **Générale Routière, Via GTI (France),CINTRA, NECSO, Acciona and Ferrovial Agroman (Espagne)**

- **Dragados (Espagne), Skanska (Suède)** et **Bec (France)** conducted by **Dragados (those Companies withdrawn).**

# The 3 tenders
## 21 November 2000

March 2001 Eiffage concessionaire is selected

May 2001 The concession contract is signed by Eiffage

August 2001 Approval of the Government decree related to the concession by the Council of State

**10 October 2001**
**The decree approving the concession was published**
**(Official Government Gazette)**

# Main features of the concession

- The concession is at the own cost and own risk of Eiffage Company for the construction and the operation
- The concession period includes the construction period (3 years) and the operational period of  de concession set at 75 years
- Keeping the architectural design is mandatory
- The concessionaire is responsible for the development of technical aspects, construction techniques and traffic operation
- The toll tariffs have to be approved by the Minister of Transport
- The structure is guaranteed 120 years

# An flexible period of concession

- The date of expiry is 31/12/2079 ; 75 years for the operational period; such a long term period:
  - Improves the visibility and secures the debt reimbursement
  - Facilitates the amortization and is more profitable for the concessionaire
  - But creates a risk of « undue income » granted to the concessionaire
  - **The concession period may end in advance in case of one out of the two following possibilities :**
    - On request of the concessionaire
    - As soon as the total cumulated income is greater than 375 M€ taking account of an updating rate of 8%, but not before 31 December 2044

# Financial data

- An investment accounting for  320 M€ from the concessionaire Eiffage on its own capital stock
- An entirely private funding  with no financing from the French State or Local Authorities
- *A corporate* funding with a possible  long term refinancing from 2009
- A contribution of the concessionaire amounting  to 1% of the investment  (3 M€) for the development of local tourism
- Seasonal tariffs set by the French Government in 2010: 6,10 € for private vehicles except 7,90 € in Summer – 29,50  € for trucks (VAT included)

# The Millau Viaduct

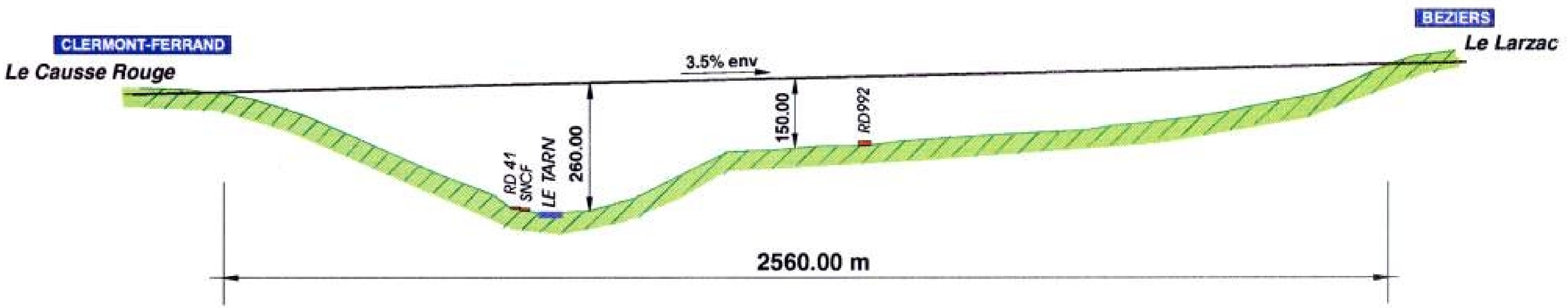
- The construction 2001-2005

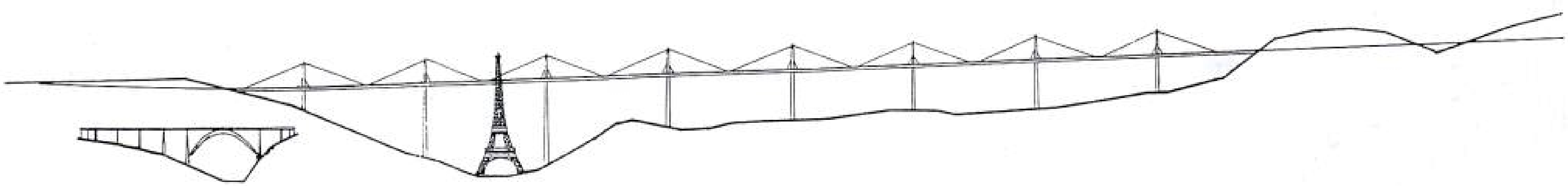
# Works Planning

- 10 octobre 2001 : works starting
- 14 December 2001 : “first stone” laid by the French Ministry of Transport
- January 2002 : starting the pier and abutment foundation works
- September 2002 : starting assembling the steel deck
- 9 December 2003 : completion of the pier construction
- 25/26 March 2003 : first launching operation of the steel deck
- 28 May 2004 : joining the two sections of the deck
- August November 2004 : installation of pylons and setting up of 154 cable stays, coating and dismantling of the temporary piers
- 14 December 2004 : inauguration of the viaduct by Jacques Chirac

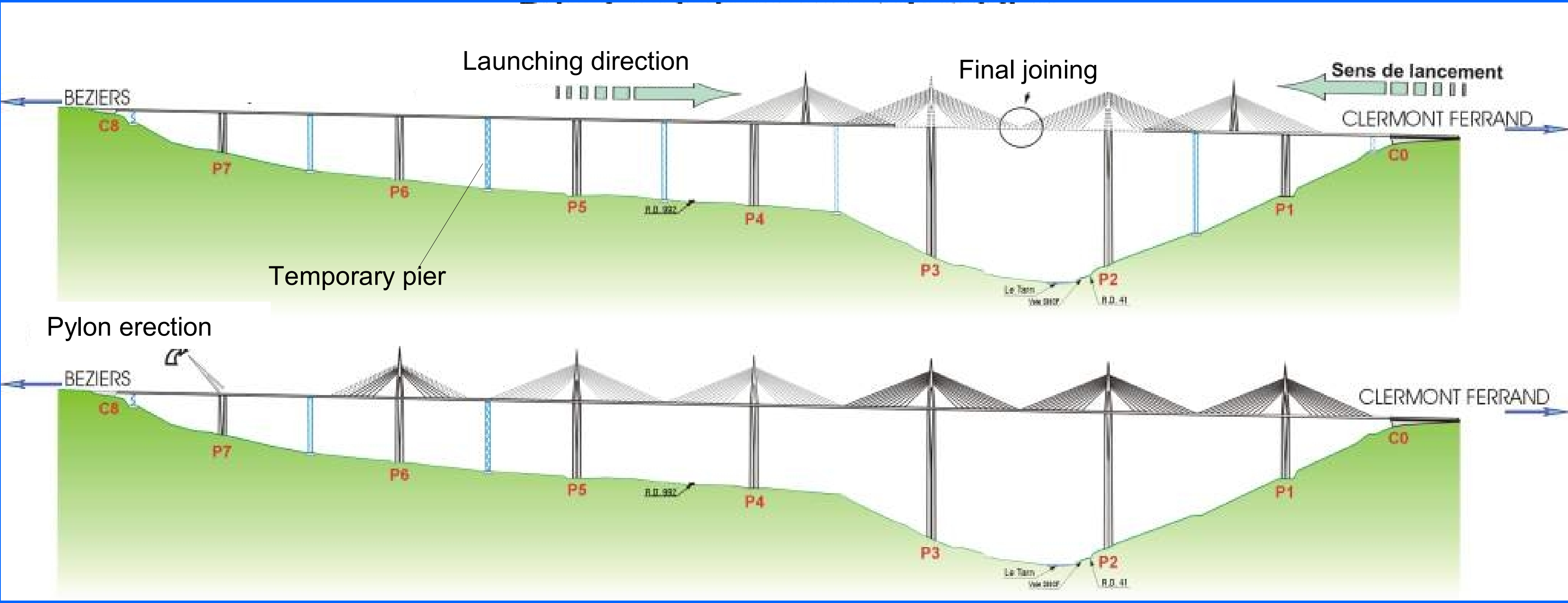
# Key data

- total length : 2460 m
- width : 32,05 m
- deck thickness : 4,20 m
- 7 piers
- Height of the tallest pier: 245 m
- Length of each span : 342 m
  except side spans: 204 m
- Volume of concrete 85 000 m³ including 50 000 m³ of High Strength concrete (cement CM I 52,5)
- Cable stay tension: 9000 kN for the longest ones
- Weight of the steel deck: 36 000 tons - S 355 and S 460 (4 times the Eiffel Tower weight)


CLERMONT-FERRAND
Le Causse Rouge
3.5% env
BEZIERS
Le Larzac
260.00
150.00
RD992
RD 41
SNCF
LE TARN
2560.00 m



# Deck launching



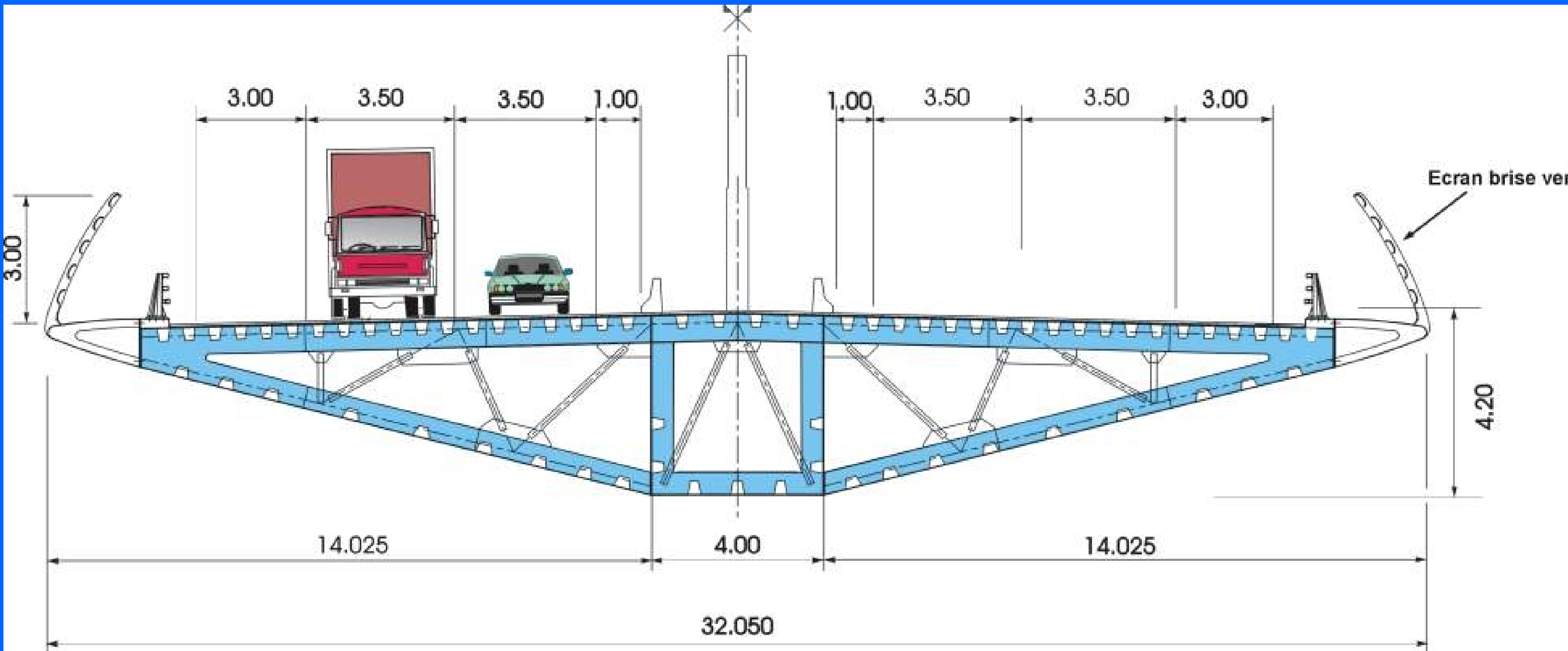
# 4 months  atfer work started :
# fondation  of pier P6


# Concreting by night

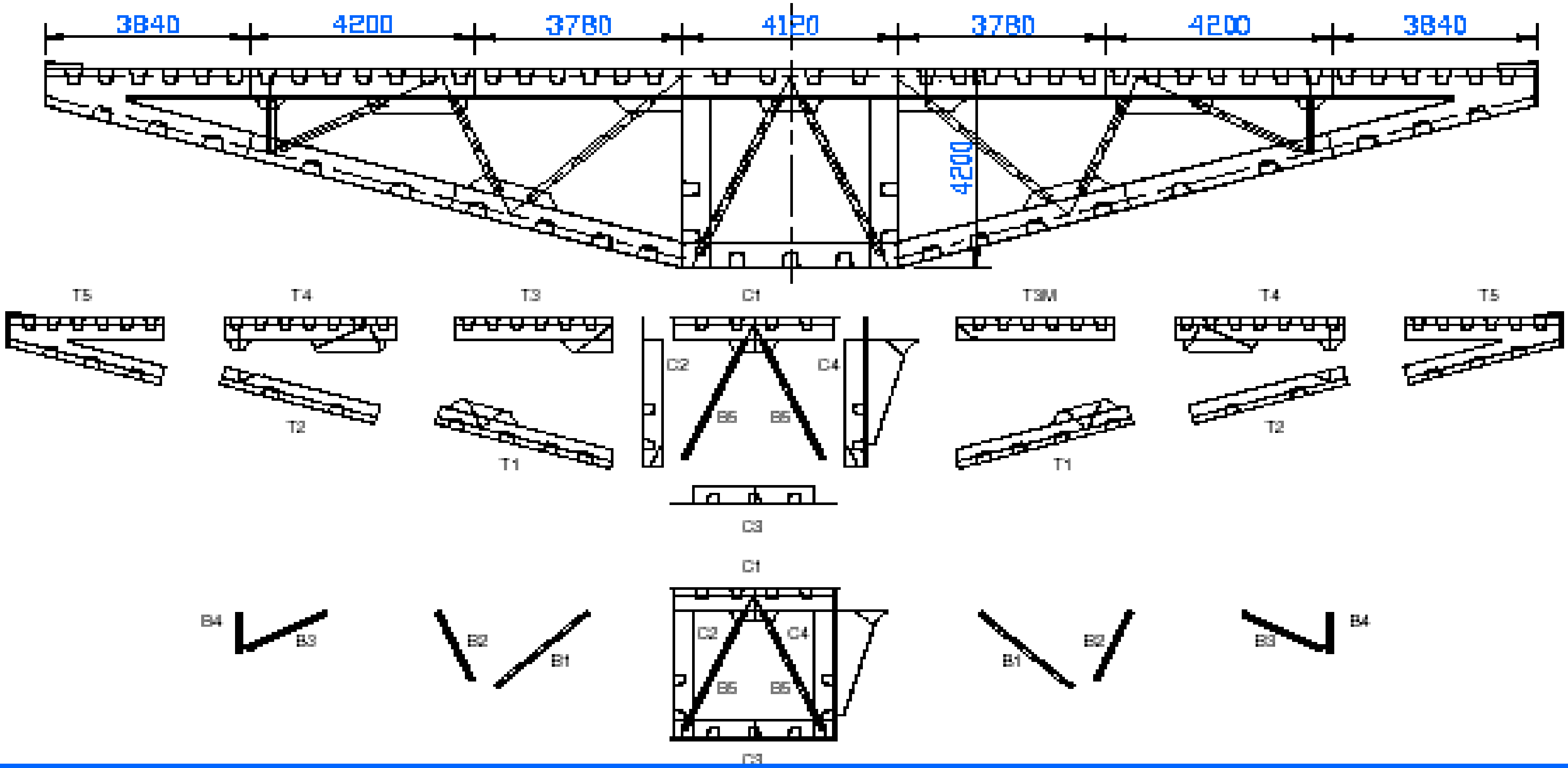
## The piers almost completed

# Décember 2003 : fireworks celebrate the completion of piers

# Steel deck cross-section



# Deck components : a kit mounting



# Assembling a central box girder of the deck at the Eiffel factory in Fos-sur- mer

# Transport of central box girder elements by special wide load trucks

# The central box girder elements are joined end to end on the North and South worksites

# Prefabrication of lateral deck elements in the eiffel high- tech plant in Lauterbourg

Welding robot at work

# Welding by two headed robots

# Windscreen

# Launching nose and the deck girder at the rear back

# Launching equipment

Slide shifter

# Launching equipment


EIFFEL
2003 2 26

# Launching issues

- Wind effects are very important on the cantilever structure during launching phases : 25% of the efforts are due to wind effects versus 75% due to the dead load

- Working design was developed taking account of wind tunnel tests

- Each launching operation requires 48 hours of non stop work with a wind velocity less than 72 km/hour (monitored in accordance with meteorological forecasts)

Phase L2 South
March 2003

# *Assembling the pylons on the construction site*

Pylons P2 and P3 : 54 elements
Pylons P1 and P4 à P7 : 56 elements

Height of a pylon : 87 m
Weight : 600 tons

22 stay cables per Pylon

2 elements of pylon P3

Pylon placed on the edge of the south half of the deck
June 2003

## Launch L3 South
## July 2003

## Launch L3 South
## July 2003

Launch L3 completed
July 2003


Launch L4 South
August 2003


Launch L4 South
August 2003


Launch L4 South
August 2003


Launch L4 South
August 2003


Launch L5 South
October 2003


Launch L6 South
November 2003

# Launch L8 South
# February 2004

Launch L9 South
March 2004

## Before joining the South and North parts
## April2004

**Meeting 268 m**
**above the Tarn river**
**May 2004**

## Joining the South and North parts of the deck
## 28 May 2004

**Transport of pylons**
**June 2004**

# Erection of the pylons
June 2004

# Pylon erected on pier P1
# June 2004

Dismantling of temporary piers
September 2004

## Asphalting after a waterproof membrane was applied
## September 2004

# Inauguration of the viaduct
# 14 December 2004


Des ailes de géant
pour le viaduc de Millau

- 4 700 000 vehicles crossed the viaduct in 2009 on the viaduct . The 22 000th vehicle crossed the viaduct in October 2010.

- The Heavy Good Vehicle (HGV) traffic represents 8 % of total traffic (1000 HGV per day)

- The most direct route between Spain and the Paris area has conquered new carriers

- Toll rates (2010):
  - LV: 6,10 €  (7,90€ in summer**)**
  - HGV: 29,50 € (along the year)

- The information pavilion Viaduct Info Space and  the open air exhibition allow visitors to get more details on the viaduct construction and the belvedere gives access to a unique view over the viaduct

# THE END
## Thank you for your attention

For further information, please visit the following website

http://www.leviaducdemillau.com/