# CURRICULUM

## Convegni e Seminari - Relatore

UNIVERSITA' DEGLI STUDI DELLA BASILICATA
FACOLTA' DI INGEGNERIA
ISTITUTO DI ARCHITETTURA, EDILIZIA ED IMPIANTI
VIA NAZARIO SAURO, 85 - 85100 POTENZA

Prot. n. 192 /06

Si attesta che, nell'ambito dell'insegnamento ufficiale di "Tecnica ed Organizzazione di Cantiere" del quarto anno della Facoltà di Ingegneria dell'Università degli Studi della Basilicata, é stato tenuto dall'ing. Michele MINENNA dell'ANAS di Bari un seminario sul tema "Organizzazione dei cantieri dal punto di vista della pubblica amministrazione, con particolare riferimento ai cantieri di movimento terra" in data 05.03.1987-

Potenza, lì 16 MAR. 1987

IL DIRETTORE
(prof. ing. Renato CERVINI)

Università degli Studi della Basilicata - POTENZA - FACOLTA' DI INGEGNERIA

PER COPIA CONFORME
IL CAPO UFFICIO AMM/VO
IL DIRIGENTE AMM/VO
(Dott Beniamino Clemente)

COMPARTIMENTO VIABILITA' BARI - A.N.A.S.

LE MOD... CHE DI
CO... E
MANU... DELLE
SOVRAST... STRADALI
NELLE ... AZIONI
PU... ALI

Torino, 8 giugno 1987

Oggetto: Convegno "Le moderne tecniche di costruzione e manutenzione delle sovrastrutture stradali"

Con la presente si attesta che il Sig. Minenna Michele ha partecipato al Convegno in oggetto, svoltosi a Torino dal 4 al 6 giugno u.s.

In fede.

La Segreteria

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A.N.A.S. COMPARTIMENTO VIABILITA' BARI

CENTRO INCONTRI CASSA DI RISPARMIO DI TORINO - CORSO STATI UNITI 23

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AZIENDA NAZIONALE AUTONOMA
DELLE STRADE
(A. N. A. S.)

DIREZIONE GENERALE

10 OTT. 1989

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Via Mozambano, 10 - 00185 ROMA

AL DIRIGENTE IL COMPARTIMENTO
DELLA VIABILITA'

09100 CAGLIARI

DIREZ.CENTR.AA.GG. E PERS.

Settore I - Sezione IV

Prot. n. 12916 Allegati 12.9.1989

Risposta al foglio n. 11911 del ..........

OGGETTO: Richiesta partecipazione " International Conference Strategic Highway Research Program and Traffic Safety on two Continents".

Il Dr. Ing. Michele MINENNA, Dirigente il Compartimento della Viabilità di CAGLIARI, è autorizzato a partecipare alla Conferenza in oggetto indicata, che si terrà a Gothenburg (Svezia) nei giorni 27 - 28 - 29 settembre 1989.

IL MINISTRO

8

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*Università degli Studi di Bari*
DIPARTIMENTO DI VIE E TRASPORTI
CATTEDRA DI MACCHINE ED ORGANIZZAZIONE DEI CANTIERI

70125 Bari 1° ottobre 1988
Via Re David, 200 - Tel. 242382

# A T T E S T A T O

Si attesta che l'ing. Michele Minenna (A.N.A.S.) ha preso parte in qualità di relatore al Seminario sul tema "Cantieri stradali e prospettive occupazionali per l'ingegnere", riservato ai laureati che nell'anno accademico 1987 - 1988 hanno svolto la tesi di laurea in questa disciplina, tenutosi nei giorni 27, 28 e 29 giugno 1988.

Il Professore Ufficiale della Disciplina
(Prof. ing. Pasquale Colonna)

UNIVERSITA' DEGLI STUDI DI BARI
DIPARTIMENTO DI VIE E TRASPORTI

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1° DIRIGENTE AMM/VO
(Dott Beniamino Clemente)

BARI - A.N.A.S. - COMPARTIMENTO VIABILITA'

UNIVERSITA DI CAGLIARI
FACOLTA DI INGEGNERIA
ISTITUTO DI GIACIMENTI MINERARI,
GEOFISICA E SCIENZE GEOLOGICHE

CATTEDRA DI GEOLOGIA APPLICATA

Cagliari, 15.5.1989

Egregio Signor

Dr. Ing. Michele MINENNA

Ingegnere Capo del Compartimento A.N.A.S.
della Sardegna

Cagliari

Caro Ingegnere,

a conclusione del I Corso di Valutazione di Impatto Ambientale (V.I.A.) organizzato da questa Cattedra in collaborazione con l'Ordine degli Ingegneri della Provincia di Cagliari, desidero esprimerLe il mio piu' vivo apprezzamento per la Sua lezione sui diversi aspetti tecnici della valutazione dell'impatto ambientale nella progettazione stradale.

I diversi argomenti da Lei trattati, con particolare riguardo alla rete viaria della Sardegna, hanno suscitato vivo interesse sia sui docenti sia sugli ingegneri partecipanti al corso.

La ringrazio per laSua fattiva collaborazione e La prego di gradire i migliori saluti

Il Titolare della Cattedra

Prof. Dr. Giovanni BARROCU

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DIRIGENTE AMM/VO
(Dott Benigno Clemente)

A.N.A.S. COMPARTIMENTO VIABILITA' BARI

*Università degli Studi di Bari*
DIPARTIMENTO DI VIE E TRASPORTI
CATTEDRA DI MACCHINE ED ORGANIZZAZIONE DEI CANTIERI

*70125 Bari* 16 giugno 1989
Via Re David, 200 - Tel. 242382

Prot.n.390

Si attesta che l'ing. Michele MINENNA, Capo Compartimento A.N.A.S. di Cagliari, ha tenuto, in questo Dipartimento e nell'ambito della disciplina "Macchine ed organizzazione dei cantieri", l'insegnamento seminariale dal titolo "Esperienze tecniche ed amministrative nella gestione pubblica dei lavori stradali" dalle ore 15,30 alle ore 18,30 del giorno 27 aprile 1989.

UNIVERSITA' DEGLI STUDI DI BARI - DIPARTIMENTO DI VIE E TRASPORTI

Il Professore della disciplina

IL DIRETTORE
*Prof. Ing. Giuseppe Abbrescia*

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IL CAPO UFFICIO AMM/VO
O DIRIGENTE AMM/VO
*(Dott. Beniamino Clemente)*

A.N.A.S. COMPARTIMENTO VIABILITA' BARI

Convegno di Shangai

# A CABLE-STAYED BRIDGE IN AN URBAN ZONE IN LUINO (LUINO)

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Dott. Ing. M. MINENNA
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## SOMMARY

The cable-stayed bridge built in Luino on the Tresa river covers a span of 50 m and has allowed the designer to solve a urban problem with the use of deck of steel concrete composite section of only 1,20 m depth. The bridge presents a single, eccentric tower. The cables, manifactured by V.S.L. of Berna, are attached at one end to a special anchor box mounted on the top of the tower, and at the other end to special transversal ribs which protrude from the deck.

The paper describes the design characteristics, the structural analysis and the construction sequence. Special attention is given to the dynamic behaviour and to the effects of temperature variations.

## DESIGN REQUIREMENTS AND STRATEGIES

The cable-stayed bridge over the Tresa river in LUINO CITY (VARESE-ITALY) proposes a particular application of this kind of structures oriented to the solution of the problems of urban straffic.

This bridge substitutes an old one with three arches with a total length of about 50 m collapsed in April 1992 because of the settlement of its foundation.

Since the bridge is in the city it was impossible to raise the level of the street, and for the reconstruction the best solution was considered a bridge without any piles in the river.

With these requirements several design strategies were examined:
- a single span bridge with precast prestressed beam with a span of about 50 m (or two or three segments assembled in place)
- the same, but cast in place
- a single span bridge with a composite concrete steel beam with a span of about 50 m.

All these solutions with a single span of 50-55 m were found unfeasible owing to the small available depth of section.

The minimum height of a beam 50 m long is about 2.50-3.00 m.

These evaluations led to a solution based on a cable-stayed bridge with span of 50-55 m.

Convegno di Shangai

# A CABLE-STAYED BRIDGE IN AN URBAN ZONE IN LUINO (LUINO)

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## BRIDGE CHARACTERISTICS

The bridge has one span of 55,50 m and a deck 11,00 m wide.

The geometrical characteristics are shown in Fig. 1.

### Bridge Deck

The transversal section is realized with four longitudinal steel beams of 1.00 m height. Two of these, in lateral position, have single box section. The upper slab, in reinforced concrete, is 0.30 m thick and the complete trasversal section is 1.30 m in height.

Along its span the section is stiffened by a set of trasversal box beams wich are located in corrispondence to the cables. Such beams finish with two short cantilevers to wich the cables are anchored. Fig. 1b.

Starting from the axis of the towers, there are three beams equally spaced at 15 m.

### Towers

The two asymmetric towers are 23 m in heigth, and their inclination with respect to the vertical is chosen in such a way that their direction is the same of the resultant of the dead load actions of the front and the back cables.

The cross section of the towers is rectangular with a depth varying along height and shaped, from the frontal view in a particular form. At the top the cross section is 2.23 m in depth; near the base the depth increases up to 7.24 m.

The top ends of the towers carry the devices for the crossing and the anchorages of the cables.

In total there are three seats, the highest of them placed at the height of 22.86 m from the deck plane. The other two are placed, respectively, at heights of 22.00 m and 21.14 m.

The device at the top consists of steel boxes which make it possible to anchor the cables leaving them crossed but not intersected on the same plane. (Fig. 2). The choice of such kinds of seats was imposed by the slope of the cables.

### Cables

Each tower has three pairs of cables. The front cables, anchored to the cantilevers of the transverse beams of the deck are slanted with respect to the horizontal of 25.69 degrees. The back cables anchored to the foundation block are parallel with a slant with respect to the horizontal of 60 degrees.

The cables are of the type V.S.L. Stay Cable System 200, and are composed of, 55 and 31 strands of 0.6" diameter. Fig. 3 shows the most important cross sectional characteristics of this cable system.

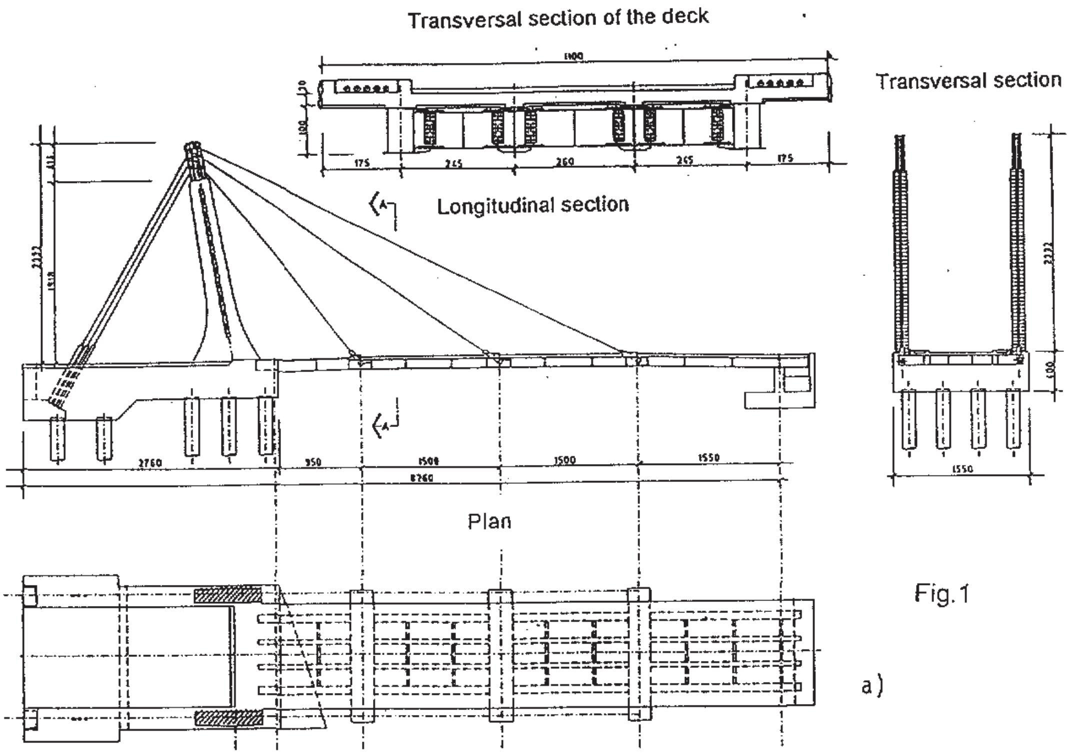
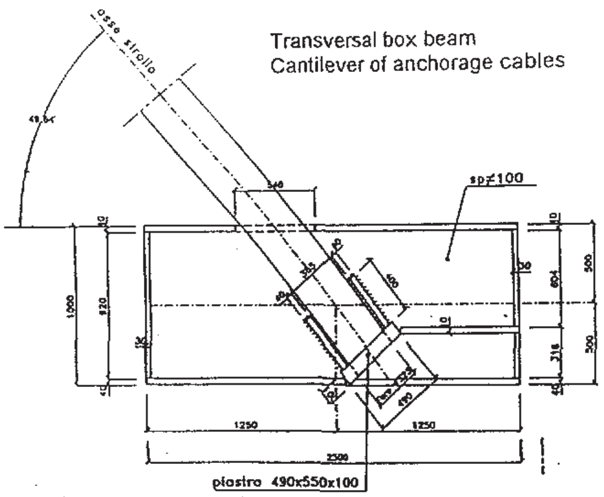



Fig.1

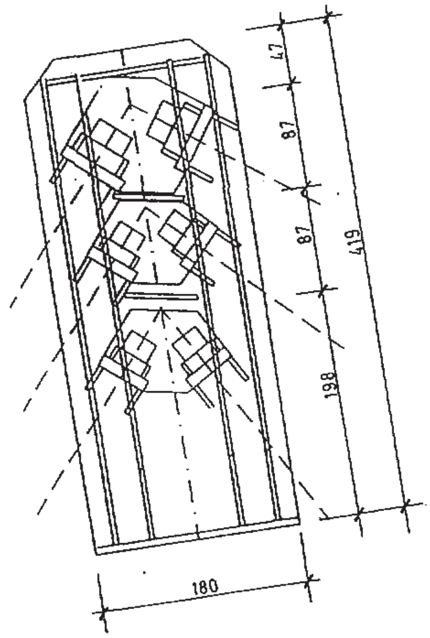
a)

Transversal box beam
Cantilever of anchorage cables

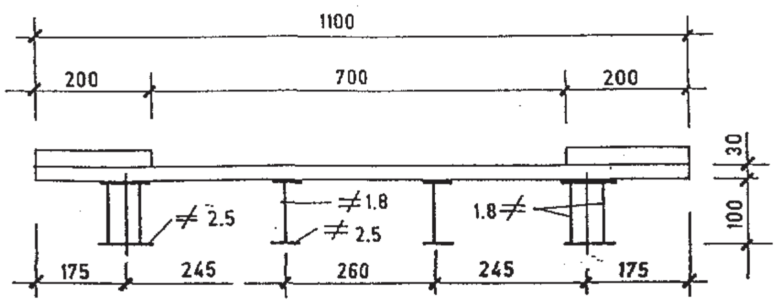



b)

Fig.2 Top of the tower
Device of anchorage cables




Transversal section of the deck
Thickness of girders




c)

Fig. 4 shows the results from fatigue tests made by V.S.L. The upper curve shows the results of the tests with single strauds $\phi$ = 15 mm, A = 140 $mm^2$ steel quality St 1.670/1.360, while the lower curve was obtained in tests with V.S.L. Stay Cable 6-6 and 6-54 (6 and 54 strands respectively).

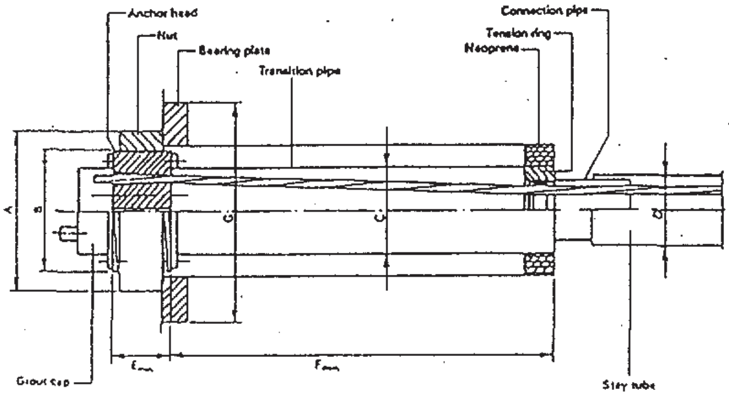



Fig.3 Section through the stressing anchorage of the "V.S.L. Stay Cable System 200".

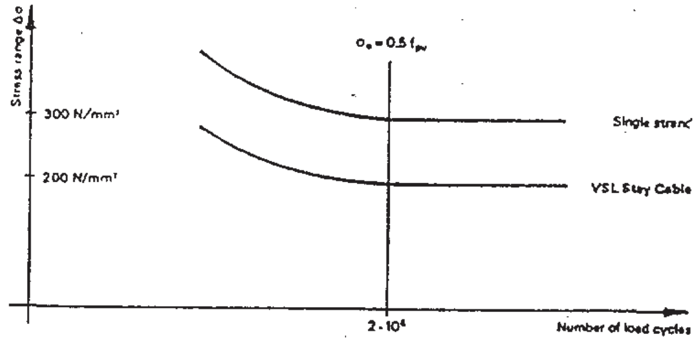



Fig.4 Wholer curves from the V.S.L. fatigue tests.

<u>**Bearing supports**</u>

The bridge supports were selected from the production by ALGA S.p.A. (Milan). (Fig. 5)

The bearing surfaces are made by neoprene and teflon. The most important characteristics of the bearings over the abutment are listed in Table.

The steel beams, on the contrary, are fixed to the foundation block.

<u>**Abutment, Foundation**</u>

The abutment on the Germignana side, for the impossibility of enlarging the foundation due to the presence of a seven storey building dated back to the fifties against the road, has a usual form. In this case it is prepared for the maintenance and the substitution of the bearings.

It is easier then to understand the choice to realize a non symmetrical bridge and to place the main foundation on the Luino side (right bank of the river). This foundation appears as a parallelepiped widened and deepened at the back (Fig. 6) with a volume of 2050 $m^3$. In the lower part it should be noted the presence of two small rooms to house the anchoring devices of the stay cables and to allow the movement of the tension jack.

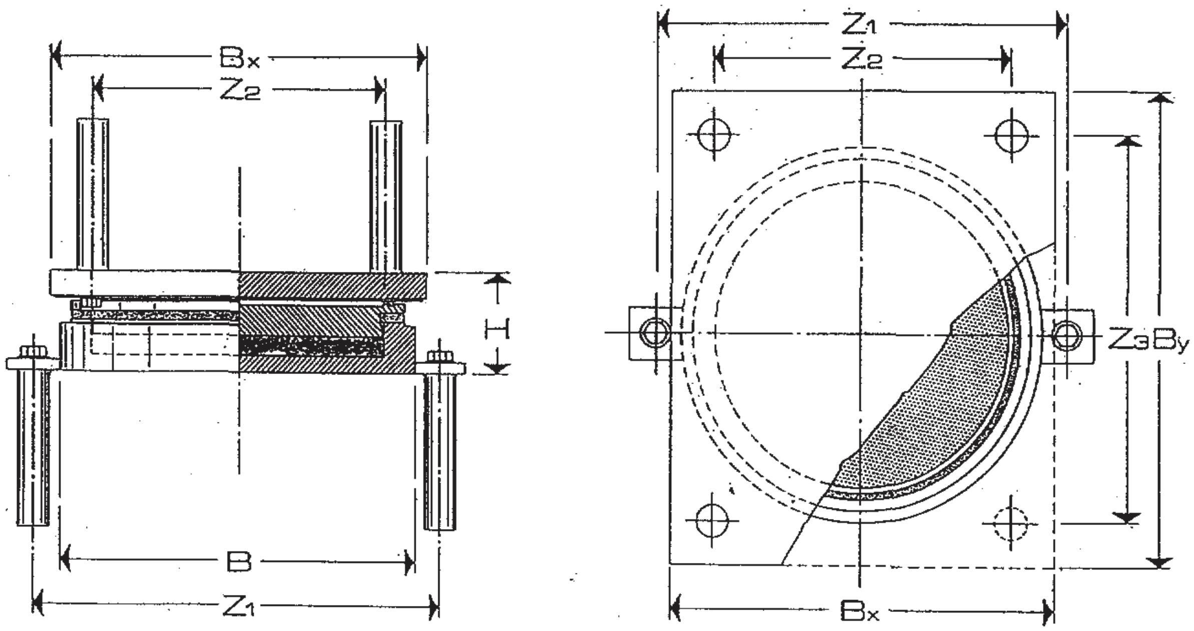



Fig.5

<u>**Functions**</u>

Contrary to what the massive appearance may cause to think, the foundation serves an articulate complex of static functions which have required a considerable amount of work both in the design and the realization.

In fact, besides the normal counterbalancing function of the deck which loads it with 165 t, equal to approx 3/4 of the deck total weight, the foundation collects also the horizontal compression of the main beams(1570 t), the sub-vertical compression of the towers (2x1675 t) and the inclined pull of the stay cables (2 x 979 t). Such actions, as can be seen from fig. 6, are applied mainly to the perimeter of the foundation, thus causing considerable problems of diffusion and distribution of stresses in the mass of concrete.

In the design it was necessary to take account many binding factors such as:
- high compressibility of the soil made up mainly of fine sand of modest compactness;
- difficulty in deepening the excavation due to the rising of water and sand from the bottom;
- dimensional limits imposed by the presence of adiacent buildings;
- rapidity of realization of the bridge to replace the demolished one.

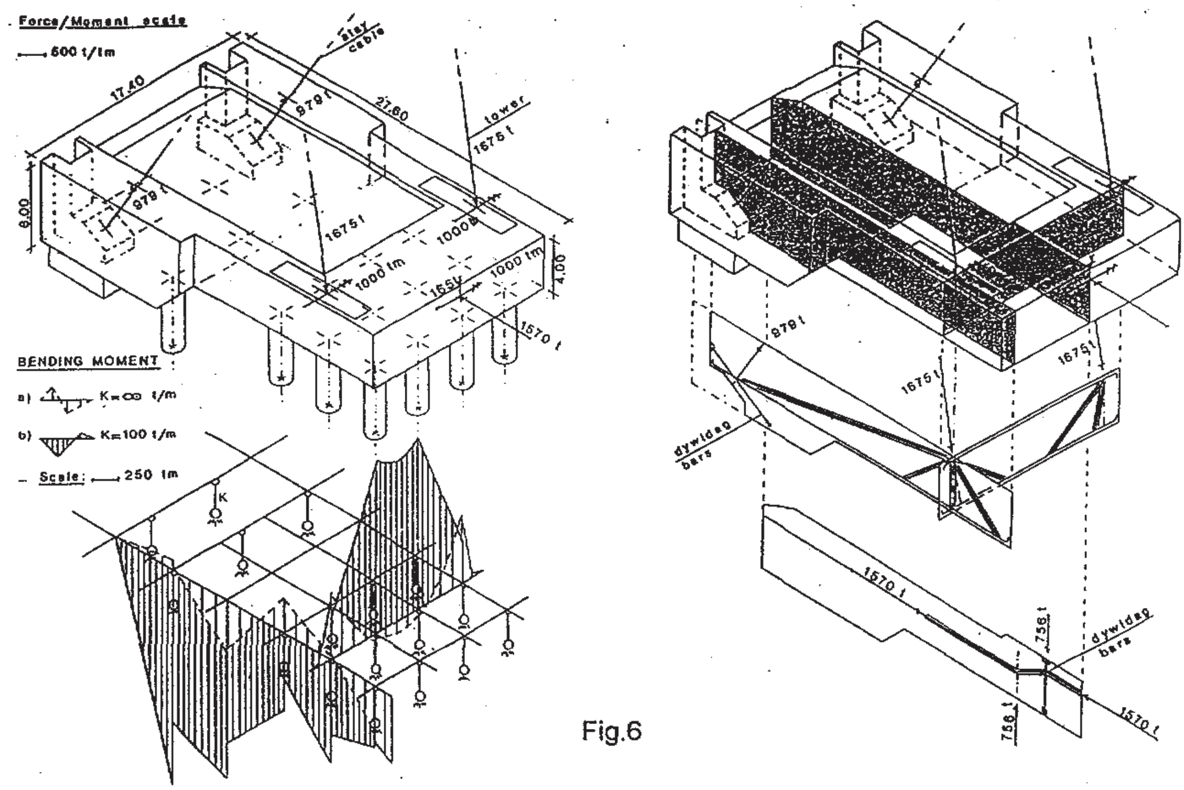



Fig.6

Given such requirements, the foundation block was based onto drilled poles 1500 mm in diameter and 22 m long, each of 500 t bearing capacity. Furthermore the courtain of sheet piling LARSSEN type created for the containment of excavation walls was driven to 11 m, in order to confine the looser sand of the upper layers, and to limit even more the settlements. Moreover, the sheet piling is a protection barrier of the foundation against water erosion.

In spite of such a sheet belting, the water and sand reflux from the bottom was of such an entity as to make the deepening of excavation problematic; consequently the height of the foundation block had to be limited to "only" 4.0 m at the front and 6.0 m at the back.

## STRUCTURAL ANALYSIS

### Deck

After the preliminary studies carried out viewing the bridge as a plane frame, the analysis was focused on the particular behaviour caused by the form in plane of the deck.

For long bridges with a length L 200-300 m and a standard width B the ratio L/B is about 10-15. In such cases the deck has fundamentally the same behaviour as a beam with appropriate restraints.

In this case, on the contrary, the ratio L/B value is 55.50/11 = 5 and the deck has the behaviour of a plate over elastic supports. Consequently the deck was analysed as a grillage.

In order to see the stresses in the slabs, the trasversal section was first

analysed with the Finite Strip Method, modelling the structural elements as an assembly plate strips with membrane actions. In these elements the field of displacements is expressed through polynominal expansions in the transversal direction and through eingenfunctions in the longitudinal direction.

So this semi-analytical method is not able to take exactly into account the true boundary conditions along the entire span of the bridge.

However it was useful to find local effects in the slabs on the current section far from the transversal beams and the other support singularities.

The analysis of the whole structure was carried out using one model based on a three dimensional frame analysis in which the deck was represented by a grillage of beams.

The analysis was carried out using the SAP90 finite element program. Fig.7 shows the mesh and Fig.8 shows one loading condition with longitudinal and transversal bending moments.

Besides this, special analysis were made on the following design problems:
- bridge behaviour due to the going out of service of any cable;
- stiffness reduction of the cables due the Dischinger effect;
- tensioning and adjustment of the cable system in order to have zero vertical displacements at the anchorage points along the deck;
- temperature effects;
- analysis of details such as the saddles and the ends of the transversal beams housing the anchorages;
- dynamic analysis whose essential results are shown in the following table (Fig. 9).

**Foundation**

Given the complexity of the functions the foundation was meant to fulfil and its scarse thickness, quite a few problems had to be solved in order to assure a correct diffusion and distribution of loads. In the design it was taken into account both of the global effects in the foundation-poles system, and the local effects induced by the single structural elements, and precisely: the deck beams, the towers, the stay cables.

**Global analysis**

For the calculation of the loads on the poles and of the strains within the foundation block, the latter was schematized as a girder (see fig. 6) supported by the poles. For these the following limit conditions were considered:
a) poles as infinitely rigid supports ($K = \infty$),
b) poles as elastic supports ($K = 100$ t/cm),
where the value of stiffness K was calculated on the basis of the geotechnical characteristics of the site.

The static analysis was carried out with SUPERSAP code by ALGOR inc. Pittsburg USA.

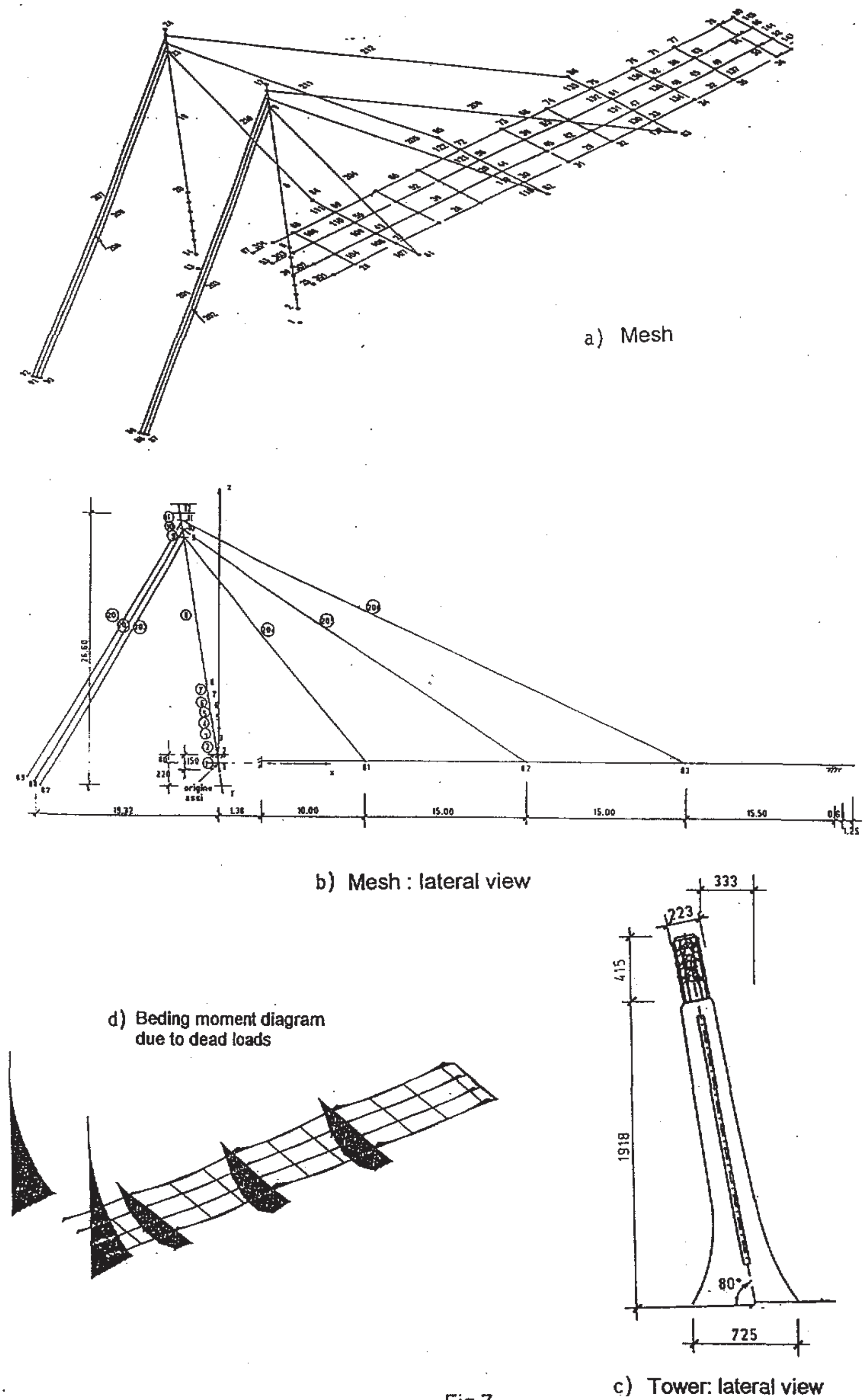
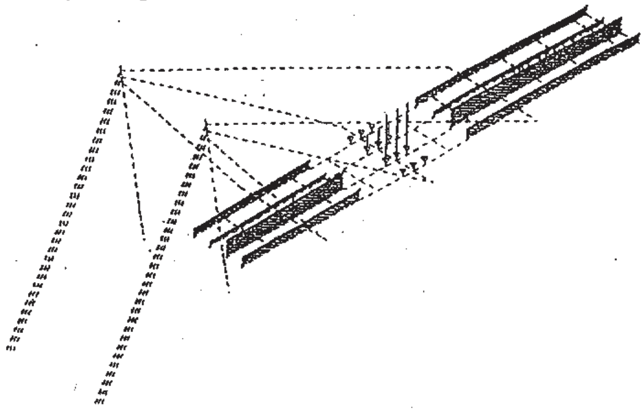

a) Mesh
25.60
origine assi
19.32
1.38
10.00
15.00
15.00
15.50
1.25
b) Mesh : lateral view
333
223
415
1918
80°
725
c) Tower: lateral view
d) Beding moment diagram due to dead loads

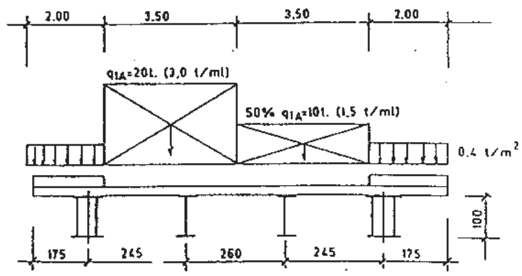
Fig.7

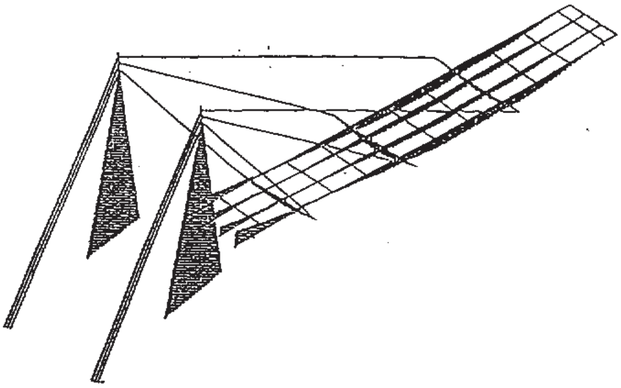
LIVE LOADS

a) Longitudinal disposition

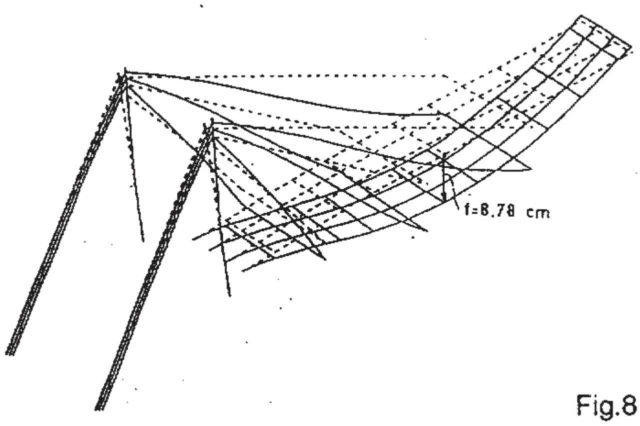


d) Transversal disposition



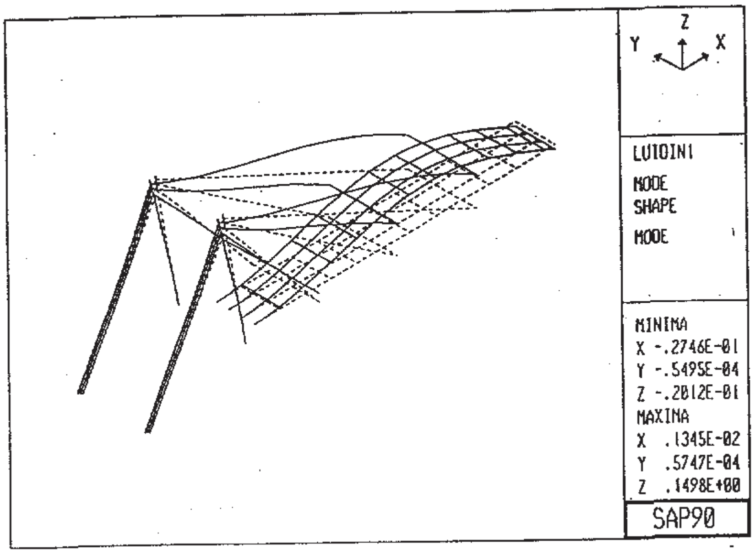



b) Bending moments diagram




c) Deformation

Fig.8



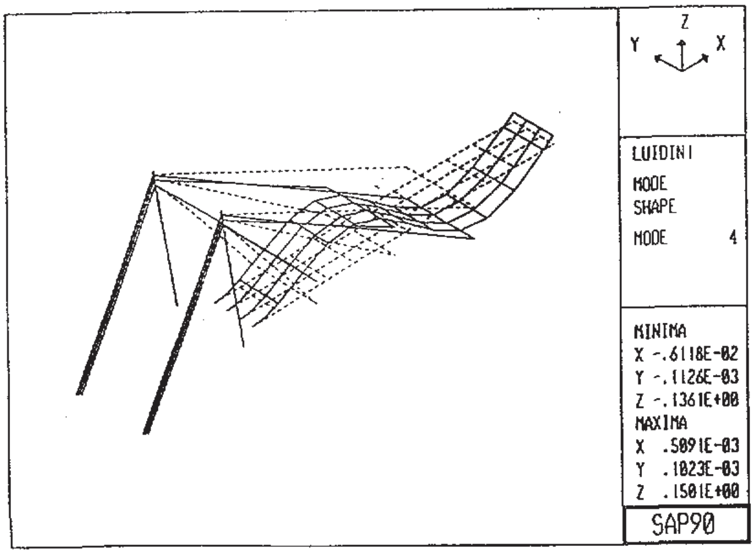
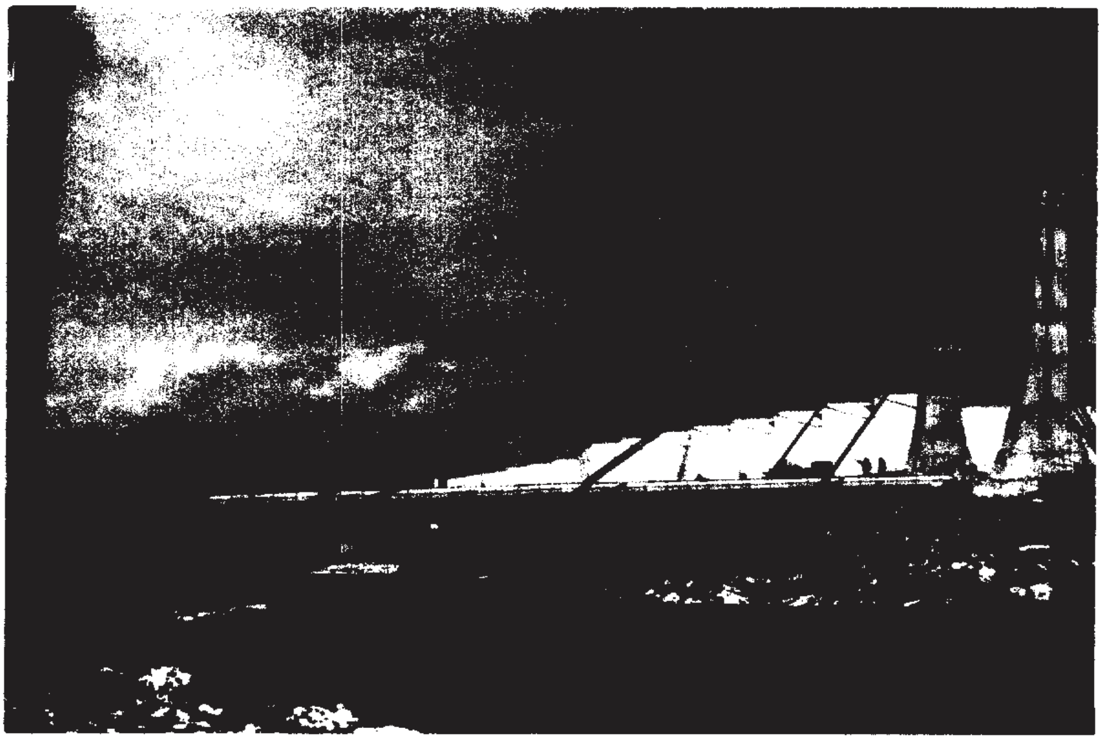




Fig.9

In Fig. 6 the diagrams are presented of the bending moments along the two more significant alignements, calculated in the two above-mentioned limit conditions. It should be noted that while the first hypotesis brings to results on the safe side relatively to the poles reactions, the second one results are more prudent for what concerns the structure (in the specific case the foundation block).

In conformity with the scheme of calculation used, the main reinforcements have been arranged according to the ideal alignements of the beams of the girder. The effective height, relatively low due to the operative constraints on the thickness of the foundation, required a considerable amount of steel bars $\phi$ 26 arranged in crossed layers.



The reinforcement index, referred to laminated steel only, resulted about 62 $Kg/m^3$.

**Local analysis**

As shown in the diagram of Fig. 6, the main aspects concerned:
- the deviation of horizontal thrust of the deck;
- the anchoring of the stay cables at the back;
- the transversal distribution of towers loads;
- the longitudinal distribution of towers loads.

For the calculus of the strains, static schemes of isostatic or hyperstatic lattices were used. Where it was possible to identify more than one resistant lattice, it was attributed to each of them a shares of the load the sum of which were precautionally above 100% (normally 130%). This in order to take accont of the uncertainties about the effective distribution of the actions.

As for the first two aspects, given the entity of the forces in action, especially of traction, a local use of pre-stressing by means of Dywidag bars was adopted; this also prevents cracking of concrete which, owing to the variation of the nearby lake level is subjected to alternate cycles of soaking.

Instead, for what concerns the transmission of the tower loads, it was verified that the reinforcement already placed to sustain the global effects was sufficient.

## ERECTION PROCEDURE AND CONCLUSIONS

The erection procedure developed following this scheme:
a) preparation of the sites;
b) casting of abutment, pile foundation, counter weight block and towers;

c) placing of bearing supports;
d) assembly of longitudinal and transversal steel elements on provisional supports;
e) tensioning and adjustment of the cable system;
f) static and dynamic tests.

The bridge is shown in the Foto 1 and 2.

The material specifications were fixed by the Italian Building Code.

The most important data on material quantities is as follows:

| | | |
|---|---|---|
| concrete for foundations | : | 4,932 mc |
| concrete reinforcement | : | 180,301 kg |
| concrete for the two towers | : | 179 mc |
| concrete reinforcement | : | 32,144 kg |
| concrete for the deck | : | 305 mc |
| steel for the deck | : | 247,143 kg |
| concrete reinforcement for the deck | : | 43,154 kg |
| cables | : | 16,500 kg |

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COPIA

# Ente nazionale per le strade

Direzione Generale

Prot. 1275
del 27.9.96

Al Dott. Ing. Michele Minenna
SEDE

Al Direttore Virgilio Pandolfi
SEDE

e p.c. Alla Direzione centrale lavori
Alla Direzione amministrazione
e finanza

SEDE

Oggetto : WERD Meeting - Copenhagen 3-4 ottobre 1996.

Le SS. LL. sono designate a rappresentare l'ANAS al WERD Meeting che si terrà a Copenhagen nei giorni 3 e 4 ottobre p.v. secondo l'agenda lavori qui trasmessa dal Segretariato del Comitato presso il competente Dipartimento Strade della Danimarca.

L'AMMINISTRATORE
(Dott. Giuseppe D'Angiolino)

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Società Italiana
di Chirurgia d'Urgenza

Istituto Chirurgia Generale II
Università degli Studi di Bari
Direttore: Prof. G. M. Bonomo

# XXV Congresso Nazionale della Società Italiana di Chirurgia d'Urgenza

Bari, 31 ottobre - 2 novembre 1997
Sheraton Nicolaus Hotel



**Segreteria Organizzativa:**
Centro Internazionale Congressi
II Trav. Via S. Matarrese, 3
70124 Bari
Tel. 080/5617299
Fax 080/5614533

Bari, 4 dicembre 1997

Ill.mo Ing.
Michele Minenna
Dirigente Ufficio Speciale Infrastrutture
ANAS
00172 Roma

Caro Ing. Minenna,

è stato per noi motivo di viva soddisfazione ospitare a Bari il ***XXV Congresso Nazionale della Società Italiana di Chirurgia d'Urgenza*** e desideriamo esprimerti il ns. più vivo apprezzamento per aver contribuito al successo del congresso, presentando la relazione su **"Il problema della sicurezza stradale".**

Speriamo che in futuro avremo nuove occasioni per un proficuo scambio di esperienze e ci auguriamo che la permanenza a Bari sia stata di tuo gradimento.

In attesa di rivederti, ti porgiamo i ns. migliori saluti.

Dott. Enrico Pierangeli

Prof. G. Martino Bonomo