

INNOVATIVE MATERIALS AND TECHNOLOGIES FOR “THE NEW HYDROELECTRIC”

HYDROELECTRIC POWER PLANT IN LONATO

Claudio FROSIO
Studio Frosio



1.Planning challenges

Most of the hydroelectric resources in Italy have already been exploited and have by now a centuries-old history. The new big hydroelectric power plants which are being planned, especially pumping ones, implement consolidated, but also quite refined, technologies.

Nowadays the new challenges designers have to cope with are small-hydro ones for:

- existing plants restoring
- “Marginal” resources exploitation (“the new hydroelectric”)

2. “The new hydroelectric”

Thanks to new knowledge and technology, we can call “new hydroelectric” the exploitation of resources that in the past were considered second-rate, “marginal”:

- low fall
- very low fall on irrigation channels

...and the partial exploitation of considerable hydraulic resources, otherwise wasted to hydroelectric use.

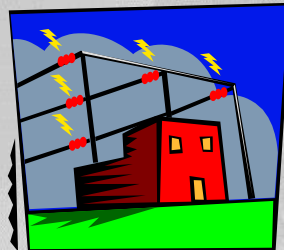
- Reserved flow
- waterworks

3. “The new hydroelectric”

As these resources are more limited, their exploitation is heavily hindered by the cost of investment.

Granting technical-financial feasibility requires a specific designing work as for:

- plant scheme
- building techniques
- equipment



4. Presentation topic: Hydroelectric power plant in Lonato

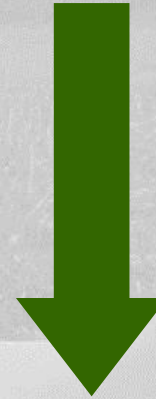
a new hydroelectric power plant on an irrigation channel with low fall

Traditional materials and technologies



NON FEASIBLE

Innovative materials and technologies



FEASIBLE

5. Innovative materials and technologies

INNOVATIVE MATERIALS

Penstock making with CC- GRP HOBAS pipes



INNOVATIVE TECHNOLOGIES

Penstock installing with jacking pipe technique.

5.1 Materials: CC-GRP Hobas pipes for penstock making

Modern materials successfully tested

Consolidated technology

Examples: Esenta and Gardone V.T. plants.



Esenta plant	Distinctive data
Maximum flow	4,3 m ³ /s
Medium flow	2,6 m ³ /s
Penstock diameter	1.600 mm
Length	55 m
Net average fall	23,50 m
Installed power	975 kW
Building year	2001
Production	4.300 MWh

5.2 Materials: CC-GRP Hobas pipes for penstock making



Gardone V.T. plant	Distinctive data
Maximum flow	5 m ³ /s
Medium flow	3 m ³ /s
Diameter	1.800 mm
Length	1.000 m
Net average fall	24 m
Installed power	975 kW
Building year	2000
Production	5.000 MWh

5.3 Innovative technologies: penstock installing with jacking pipe technique

ADVANTAGES

Crossing the motorway without stopping traffic

Combining CC-GRP pipes assures corrosion protection

6. Hydroelectric power plant in Lonato

Lonato HPP	Distinctive data
Maximum flow	4,30 m ³ /s
Medium flow	3,12 m ³ /s
Net average fall	8,76 m
Turbine	Kaplan
Installed power	280 kW
Generator	Asynchronous 400 V - 500 min ⁻¹
Installed power	335 kVA
Production	2.000 MWh



Critical and specific points : motorway underpass, fitting into a complex irrigation net (minimizing inconveniences during power plant activities)

limiting costs

Investment cost (2008): 1.600.000 €

Specific costs: 5.700 €/kW; 800 €/MWh

6.1. Location of Lonato plant: northern Italy, between Brescia e Verona, by the morainic hills of Garda Lake



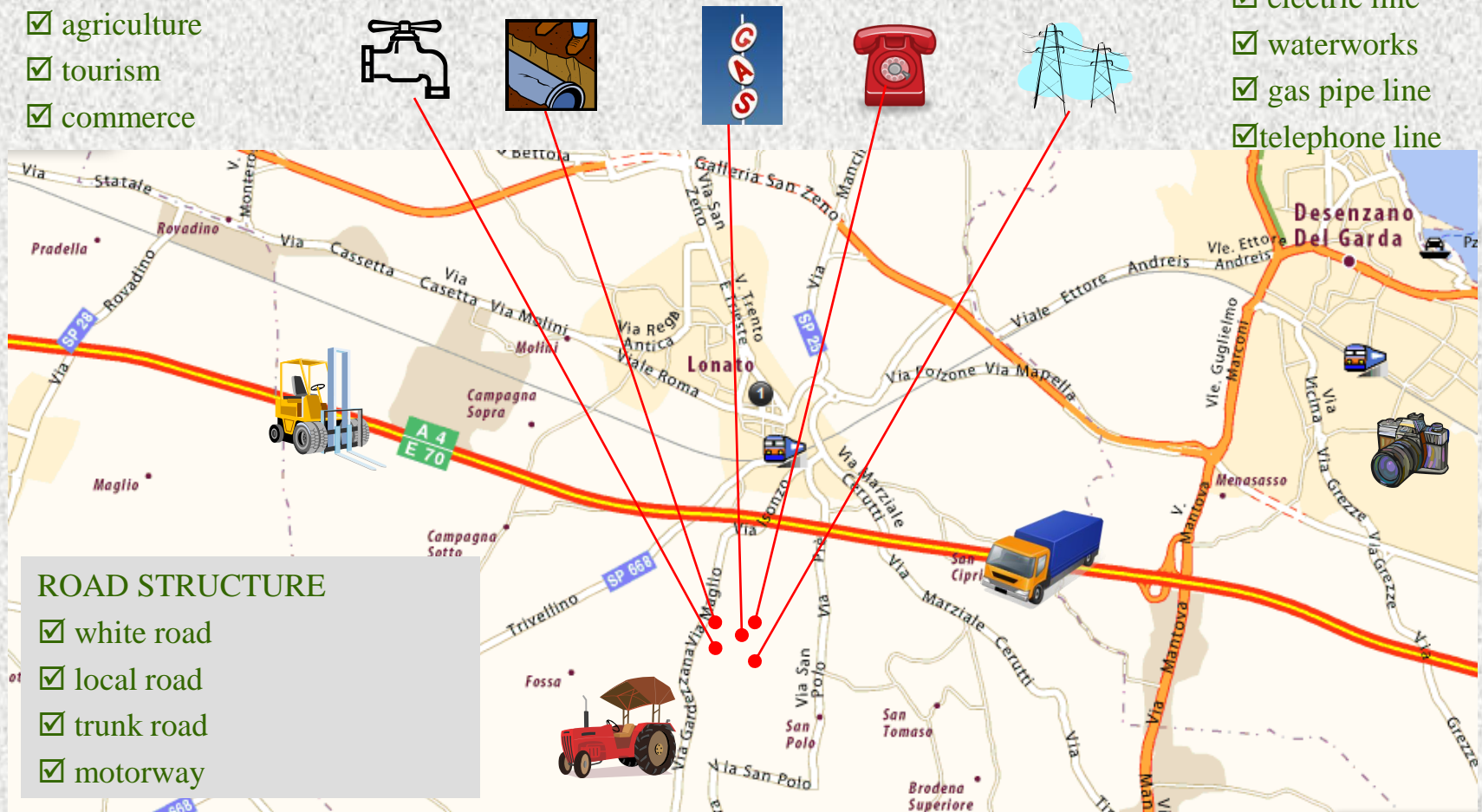
6.2 Area characteristics: it's extremely difficult to fit in new works

HIGH ANTHROPIC ACTIVITY

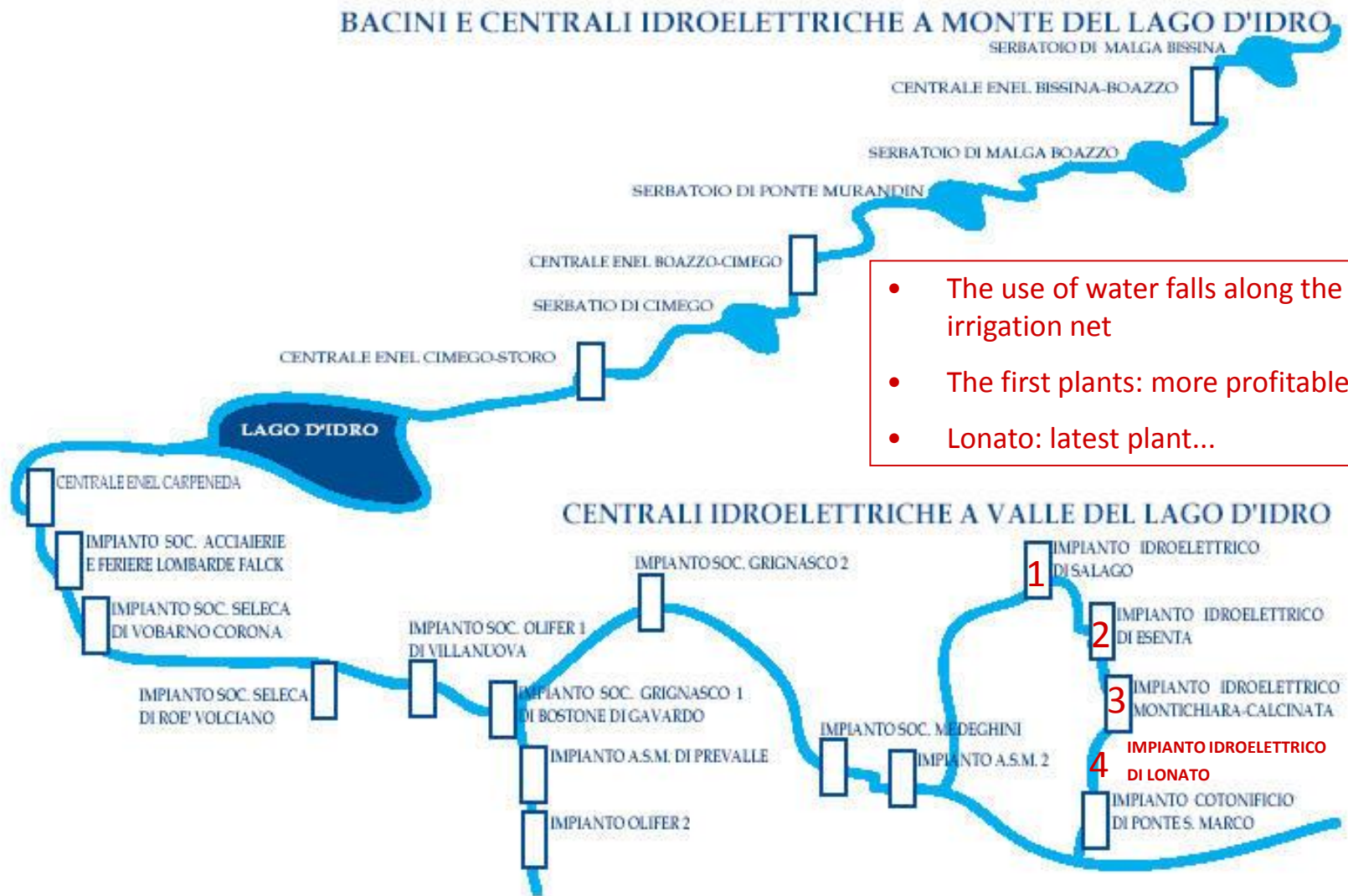
- ✓ industry
- ✓ agriculture
- ✓ tourism
- ✓ commerce

Underground services

- ✓ sewer system
- ✓ electric line
- ✓ waterworks
- ✓ gas pipe line
- ✓ telephone line



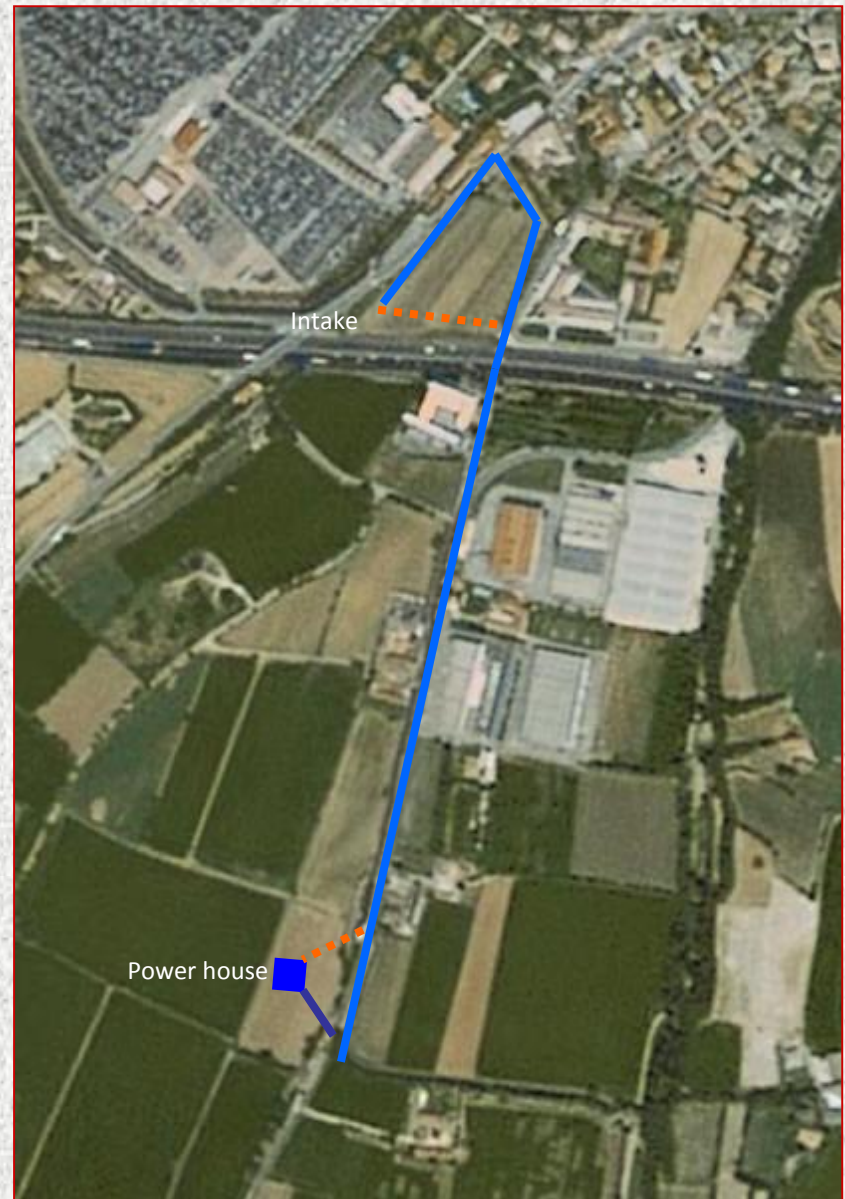
7. Irrigation channels exploitation plan: Lonato the latest plan



8. The original project

- using the existing underpass to cross A4 motorway
- long penstock
- high head losses
- high costs

— Existing channel
... penstock

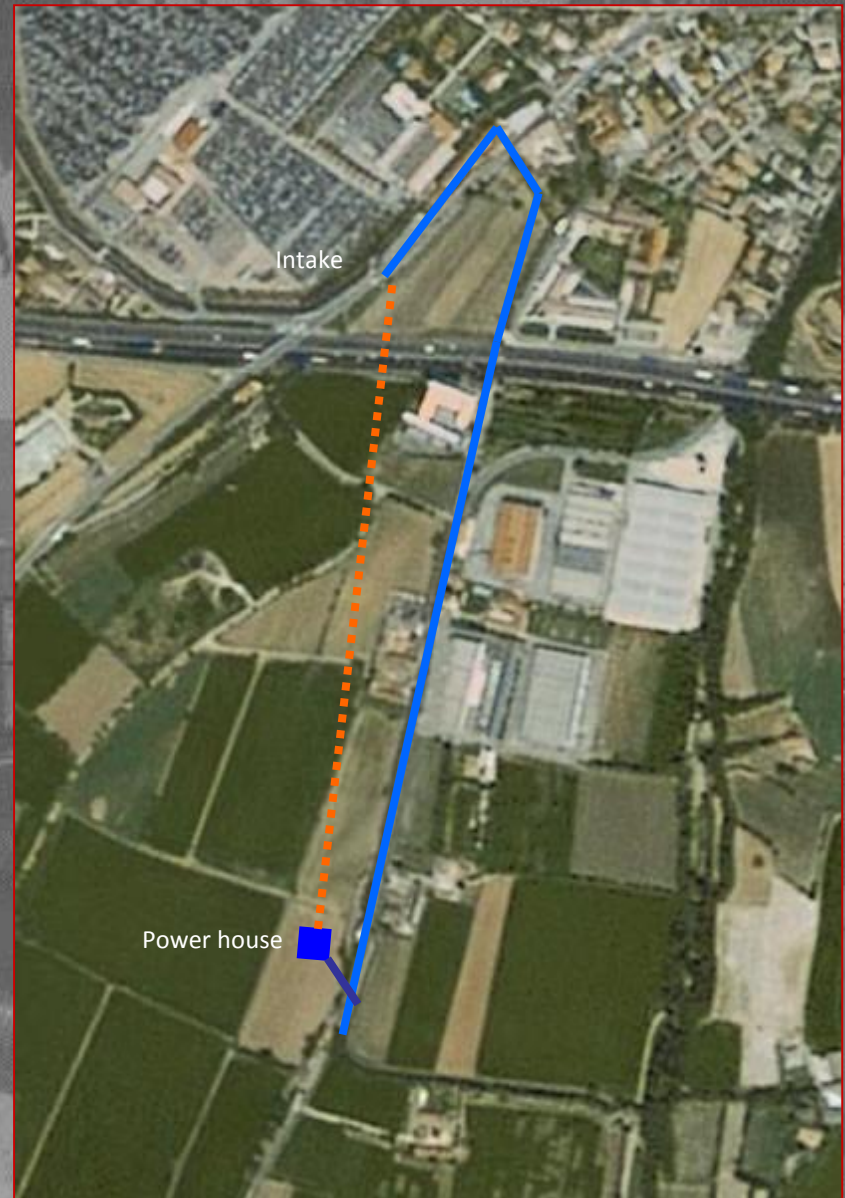


9. The new project

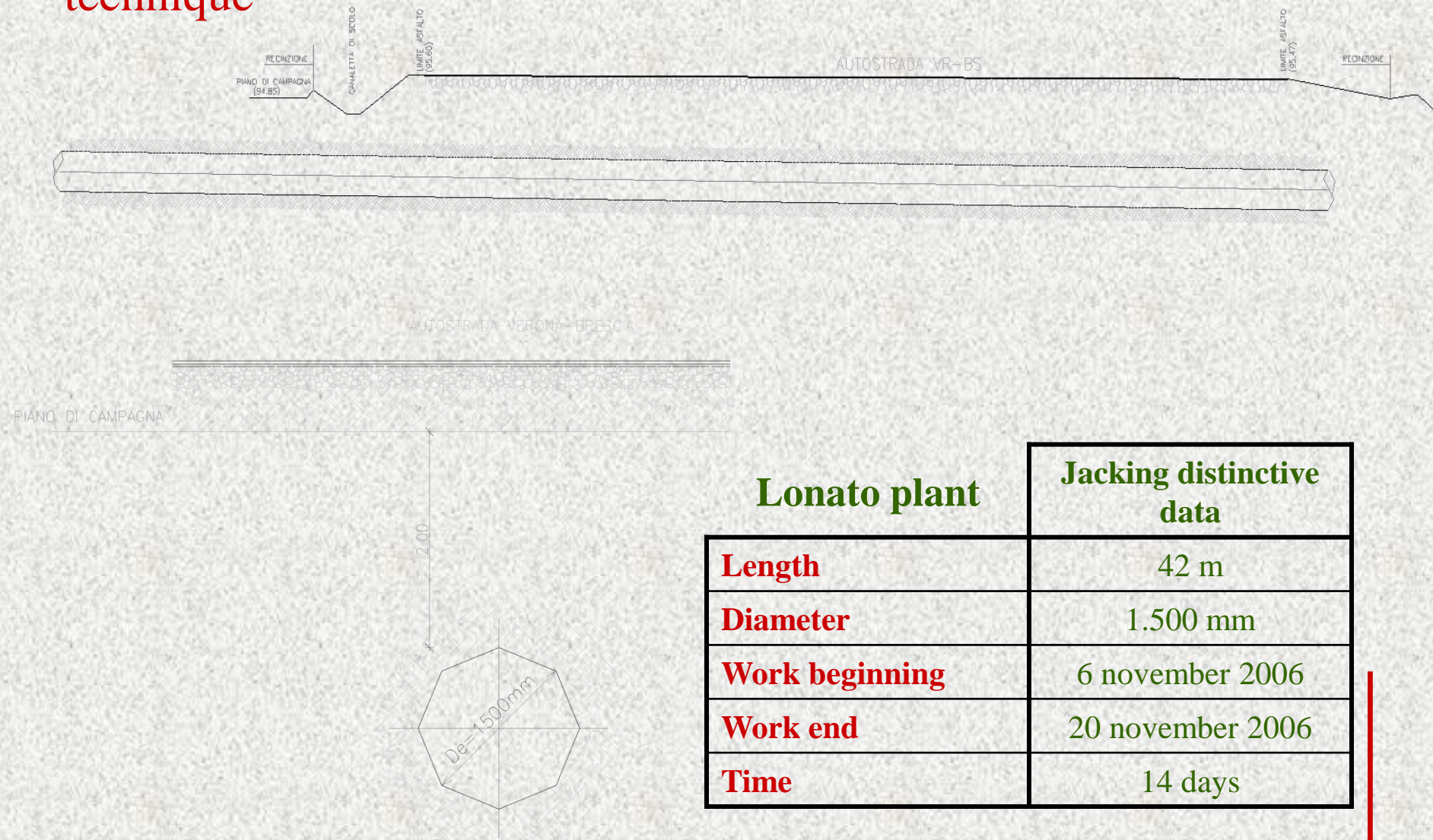
- using the jacking pipe technique to cross the A4 motorway
- Short penstock
- reduced head loses
- reduced costs



————— existing channel
..... penstock



9.1 The part of the penstock realized with the jacking pipe technique



Lonato plant

Jacking distinctive data

Length	42 m
Diameter	1.500 mm
Work beginning	6 november 2006
Work end	20 november 2006
Time	14 days

9.1 during the jacking



MODERN MATERIALS AND TECHNOLOGIES FOR NEW HYDROELECTRIC

Claudio FROSIO
Studio Frosio

Thanks for
your attention!

Via P: F. Calvi, 9
25123 Brescia (Italy)

claudio.frosio@studiofrosio.it
www.studiofrosio.it





