ICCE 2018 – BALTIMORE

PROTECTION AND IMPROVEMENT OF THE BARRIER BEACH OF FRONTIGNAN (France)

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ARTELIA

SUMMARY

CONCEPTION

REALISATION

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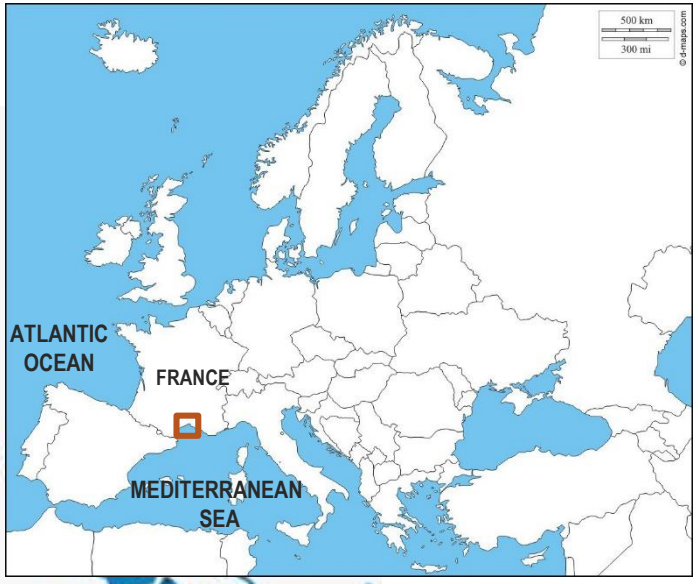
PROTECTION OF THE BARRIER BEACH OF FRONTIGNAN

1. Introduction : presentation of the studied area

1 Urbanized area

2 Non urban area



Lagoon

2

1

BARRIER BEACH OF FRONTIGNAN

MEDITERRANEAN SEA

Sandy spit of Espiguette

Towards Marseille (≈100 km)

0 km 10 km

1. Introduction : presentation of the studied area

1 Urbanized area

Urbanized area of Frontignan (4.7km) protected with many coastal structures

Barrier beach of Frontignan (7 km)

2 Non urban area

Less urban area (2,3km) located in the part North of the site

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2. Evaluation of the maritime risk

Coastline subject to significant erosion and marine submersion due to :

- ✓ Low level of the foreshore area which is around +1 and +2 m IGN69 whereas water level during storm conditions is evaluated to +2 m IGN69
- ✓ Weakness of the dune barrier (small width)

Storm of 30/11/2014

Storm of 28th of November to 1st of December 2014:

- $H_{1/3}$=4.78 m;
- T_p=8.3 s;
- Water level= +1.2 m IGN;
- Wave set-up= 0.45 to 0.55 m

Waves have reached the dune front. This led to dune erosion, overwash and breaching. The road located behind was destroyed.

Waves are very closed to the toe of the houses

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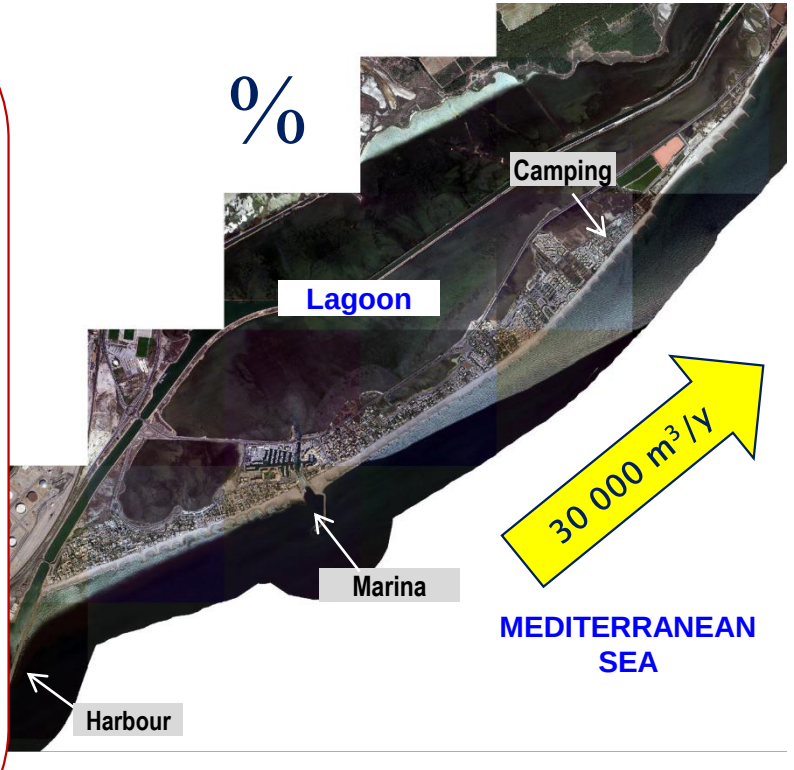
3. Coastal hydrodynamic processes

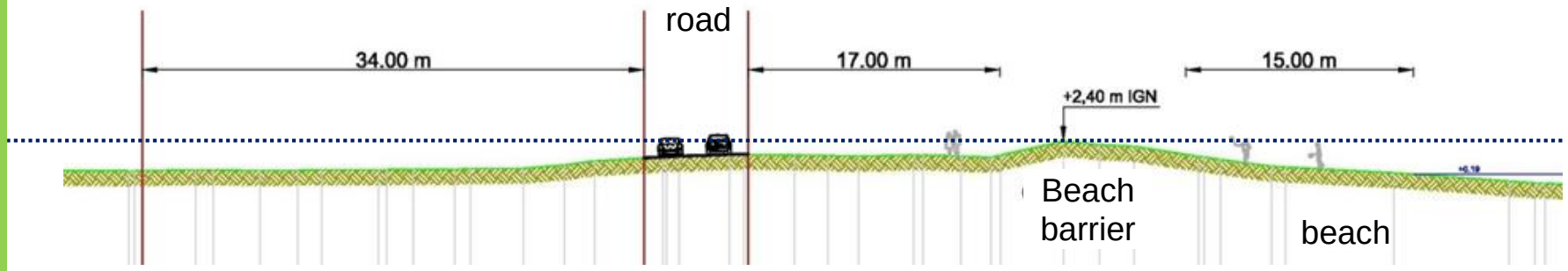
The sedimentological assessment led to the following results:

1. **Usual calibrated formula to assess the littoral drift** : 30 000 m³/y toward North-East

2. **Shoreline evolution** analysis (based on aerial photographies) between 2002 and 2007 :
   - ✓ Beach stability Stability in the area protected by coastal structures (groins)
   - ✓ **Coast retreat (-1 to -2 m/y**) everywhere else.

3. **The risk of marine submersion** has been modelised by the means of a dedicated **numerical model (Xbeach**) for one typical storm return period of 10 years.





Typical profile

3. Coastal hydrodynamic processes

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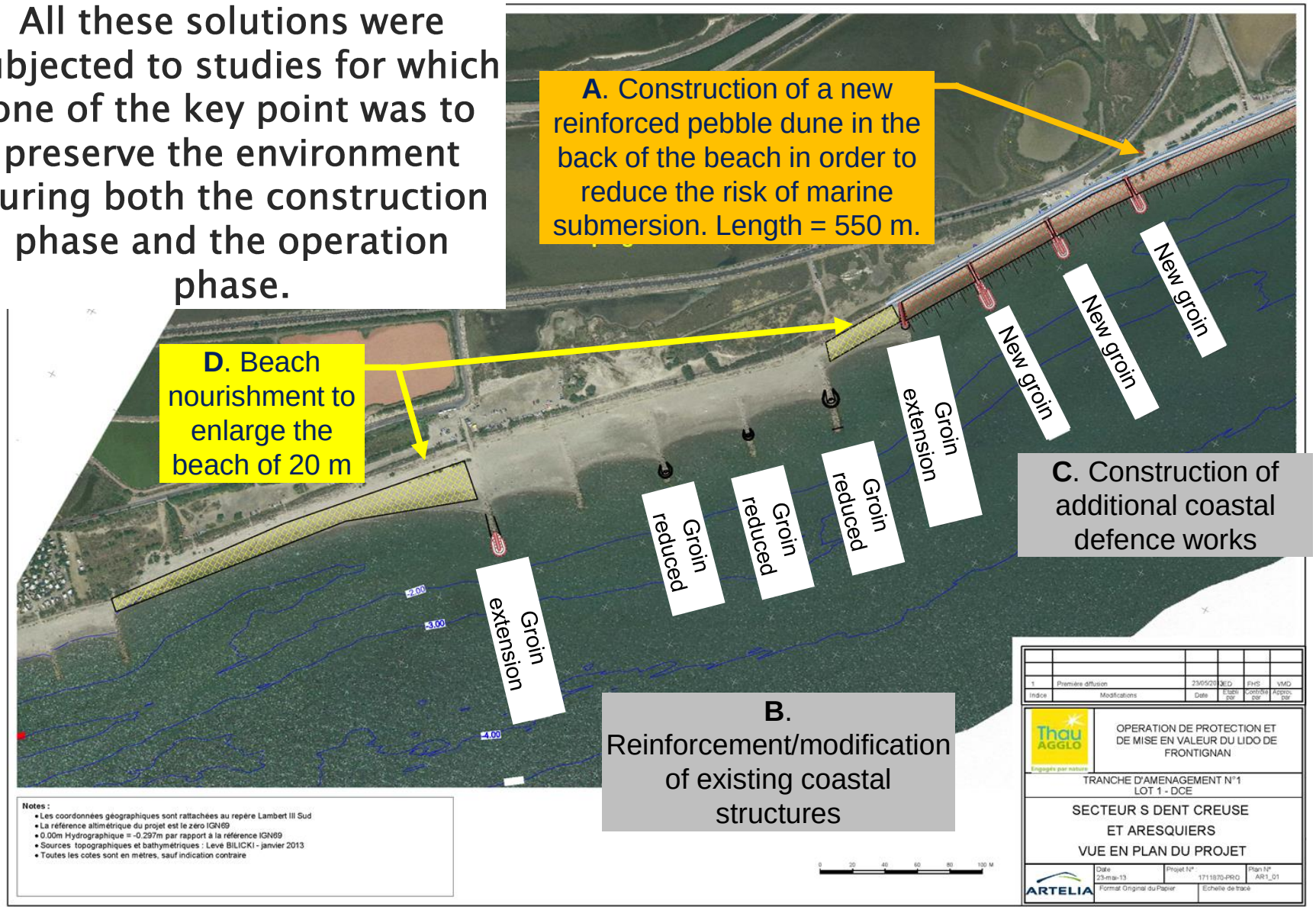
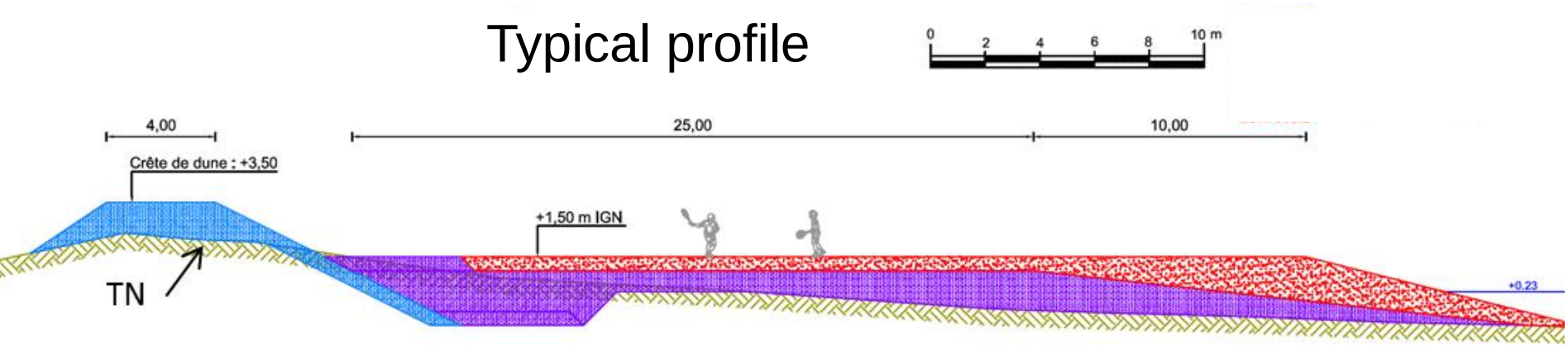
4. Choosen solutions of protection

All these solutions were subjected to studies for which one of the key point was to preserve the environment during both the construction phase and the operation phase.



4. Choosen solutions of protection

Typical profile



- Pebble dune
- Beach nourrishment with pebble
- Beach nourrishment with sand

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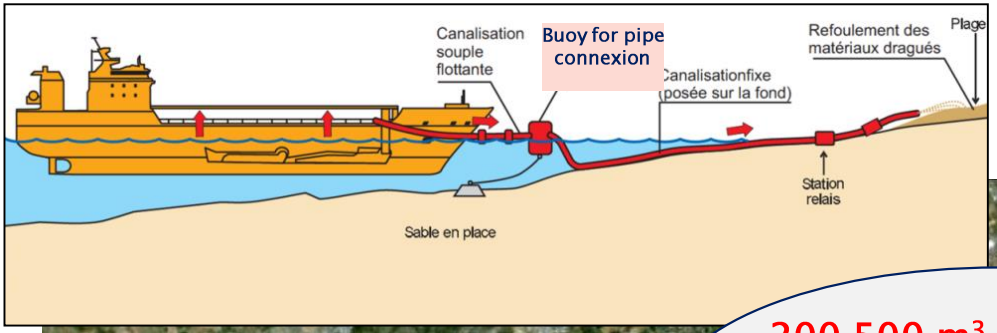
5. Supervision works



Environmental constraints :

-> Adapted construction processes

-> Meticulous monitoring of the environment

Source bathy : SHOM
Référence: mIGN

200 500 m³ dredged and transported by the means of a Trailing Suction Hopper Dredgers (TSHD)

Stage 1: dredging

Stage 2: discharge (pipe)

Stage 3: sand spread by dumpers

-10 m
-15 m
-20 m
-25 m
-30 m

~ 20 km

Dredging area

Position of the pipeline for pumping the sand on the discharge area

Sea grass bed limits

0 2 4
Kilomètres

THOR-R
Draft (unloaded) ~ 3,47 m
Draft (loaded) ~ 5,50 m
capacity ~ 2507 m³
Speed (unloaded) ~ 21 km/h
Speed (loaded) ~ 18 km/h

6 h cycle :
- Load ~ 1h30
- Transport: ~ 2h
- Discharge ~ 1h
- Transport ~ 1h30

5. Supervision works

Dumpers were used to transport the sand to the beaches to be nourished located 2 km towards South

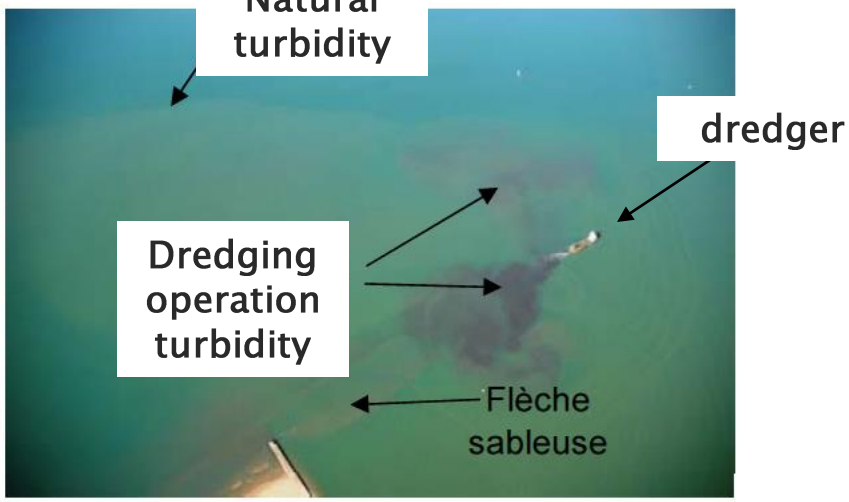
To prevent the increase of the turbidity during dredging discharge operation : dredge spoils were decanted in a temporary sediment settling basin (200 to 300 m length x 5 m depth)

5. Environmental monitoring during the works

Delimitation of the existing vegetation to preserve it from the works

Preservation of the petty surge by nurseryman during the work period

Turbidity assessment during the whole duration of the dredging works



6. CONCLUSION

Pictures taken just after the completion of the works

ARTELIA

International consultancy
Engineering
Project management





Gross revenue / Turnover: € 26 M

Amongst the **leading international engineering and design companies in the field of ports and marine projects**, with hundreds of references gained through more than 60 years of experience.

ARTELIA Maritime draws on the experience and know-how of more than **250 full-time engineers and technicians** in the company, providing quality services at all levels and activities:

- **Ports, Maritime transport and navigation**
- **Tourist development schemes (marinas, beaches, sea front schemes, etc.)**
- **Estuaries, bays and sea outlets, Changes in coastline configuration**
- **Oil & Gas terminals**
- **Marine Renewable Energies**
- **Industrial installations**

QUESTION ?

Ranked by ENR Engineering News-Record among the **top ten maritime & ports** engineering companies

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