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Transport, logistics and packaging of ITER components

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Abstract

Cadarache, the European site for ITER, is located at around 50 km as the crow flies from the sea. The feasibility of the transport of large and heavy ITER components has thus been thoroughly studied. These studies have covered the following items:

- possible itineraries between the most convenient harbour (Fos) and Cadarache;
- packaging (in particular for the largest and heaviest components);
- means of transport (two types of trailers allowing to avoid lifting and load transfers);
- logistics (analysis of transfer kinematics, including temporary storage);
- administrative procedures and planning for the road adaptation, taking benefit of the recent successful implementation in the south-west of France of an itinerary for the Airbus A380 components.

These studies, performed between 2001 and 2003, led to a viable solution, with a reasonable cost, fully supported by the French authorities. The planning necessary to implement the road modifications is also fully compatible with the expected dates of ITER components delivery.

Keywords: ITER; Cadarache; Site preparation; Transport of large and heavy components; Packaging

1. Introduction

The construction of ITER will be an important challenge over the coming years. Components for the machine will be manufactured by all ITER partners, in factories around the world. These components, some of them very large and heavy, will have to be transported to the ITER construction site.

As largest components to be transported, the dimensions and the mass of the vacuum vessel sectors, the toroidal field coils and the crane beams have been taken into consideration to determine all the needs.

In case of the European site for ITER, at Cadarache in the south-east of France, the transport will have to be ensured over an itinerary of around 100 km, from the nearest industrial harbour to the site.

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2. Itinerary

The itinerary studies have been performed by CETE (State Road Design Office) in three steps:

- analysis of all the possibilities of transport from the Mediterranean sea to the site;
- choice of a reference itinerary, avoiding overpass bridges and road creations;
- optimisation of the reference itinerary, by studying local alternatives.

This optimised itinerary allows minimising the main road improvements to the following:

- enlargement of existing roads or use of temporary tracks at Lançon and Peyrolles;
- rectification of bends at "Fontaine du Garri", which will also improves the road safety;
- enlargement by an overhang at "Défilé de Mirabeau", which will simplify crossings.

A view of the reference itinerary and the local alternatives is shown in Fig. 1.

The components will arrive at Fos harbour by sea-going ships. To offload the heaviest components (in particular VV sectors and TF coils), the ships will be geared or roll-on/roll-off vessels. A dedicated zone will be used for temporary storage, to allow flexibility for logistics.

The components will then be handled by adequate trailers to be loaded onto a barge, which will cross the "Étang de Berre" to the unloading point, by the existing channel allowing a draught of 7 m. To simplify operations as well as for safety reasons, it is recommended to use a roll-on/roll-off method, in particular on the dock to be created at the harbour of "la Pointe".

3. Packaging

The packages designed for VV sectors and TF coils can be slung and jacked, in order to allow roll-on/roll-off, transport and storage operations, but also lifting operations on the ITER site. They are designed to be generic and include:

- handling skid support and closed container (corrosion protection during sea transport);
- fixation, anti-rocking devices and adjustable pads, coherent with 30° tilt of the ship).

A tilted support for the TF coils will allow them to have a similar width as the packages of the 40° VV sectors. The horizontal lifting of the TF coils has also

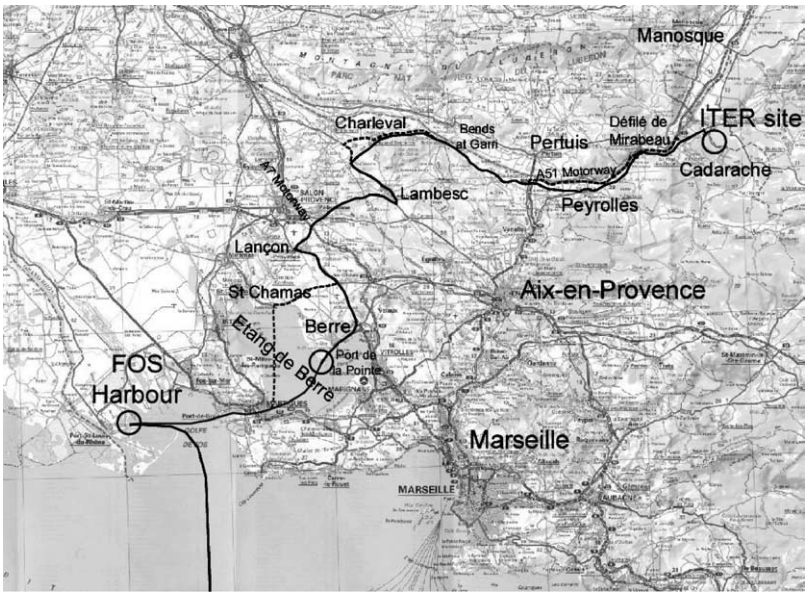

Fig. 1. Reference itinerary and alternatives for transport of ITER components from Fos harbour to the Cadarache site ©IGN.