Transport of cold masses in the 40-80 tons range

HFM Forum – D. Lafarge – EN-HE

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Reference (Indico #1430998)

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Introduction

- **Transport on public roads is constrained by physical limitations of a convoy (dimensions and weight of the vehicle + trailer + cargo) but also by regulations. This presentation give information based on French and Swiss regulations;**

- **This presentation doesn’t touch the subject of the sensitivity, or risks, linked to the cargo itself (typically constraints linked to magnets activated or to magnets containing chemicals)**

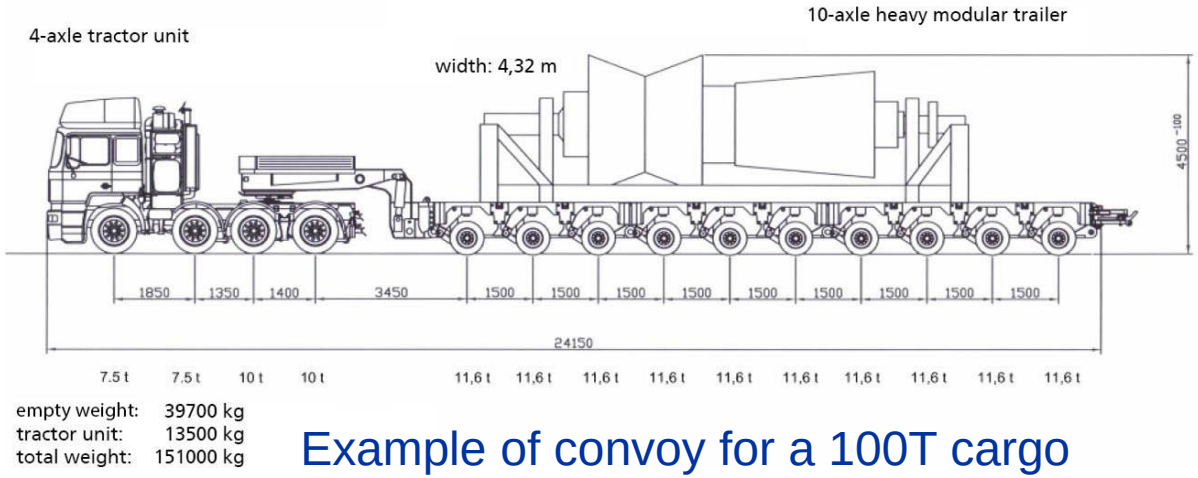
- **The notion of volume is important, since one exceptional transport request is long to handle but doable, in the opposite to repetitive exceptional transport that need, on top of the procedure, involvement with states on the path to maintain the usability of a predetermined path over time (case of the LHC magnets transport)**

- **In case of projects like FCC a work both on CERN side, to optimize weights and dimensions, and outside CERN, to adapt as much as possible infrastructures and maintain them in such state, is a key to success for daily operations**

Physical constraints - weights

- **The limitation linked purely to the weight concerns mainly civil engineering assets like bridges, in some cases some roads are also limited**

- **Another constraint derived from the weight is the dimension of the convoy : the maximal admissible pressure on the road is 12T per axle, with a minimum distance of 1,5 m between axles => the heavier the load, the longer the convoy (see next slide).**



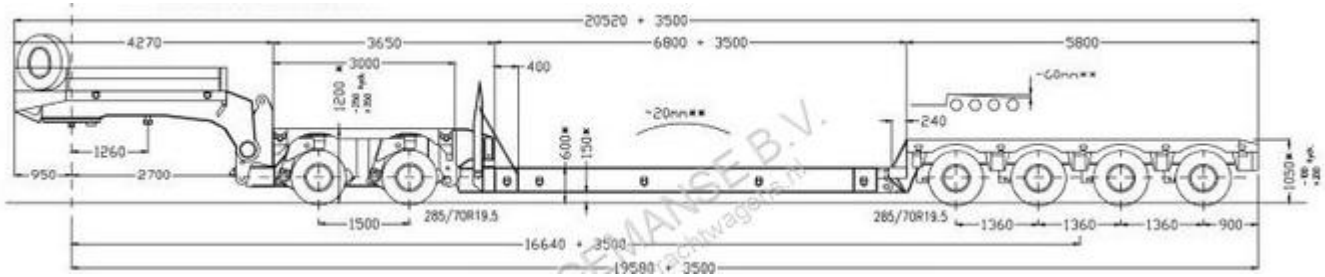
Example of convoy for a 100T cargo

Physical constraints - weights

- **A trailer able to transport 60T magnets:**

Dimensions	
Empattement	1.51 mètres
Hauteur	0.85 mètres
Largeur	2.74 mètres
Longueur	9.4 mètres
Surface	18 m²

- **A trailer able to transport 80T magnets:**



Dimensions	
Empattement	1.36 mètres
Hauteur	2 mètres
Largeur	2.75 mètres
Longueur	20.55 mètres

Physical constraints - dimensions

- **The main constraint with transport by public road is the dimensions of the convoy : outside the standard convoy of 2,5 m width x 4 m height x 16,5 m long, there are lots of obstacles requiring specific studies on-site to assess the feasibility. Length of magnets add significant difficulties for transport above 13,5 m;**

- **In particular the length of a convoy has an impact on the required width of the road because of the increased bending radius (traffic islands, electric poles, panels…)**

The curve at the intersection D2 – D203 is too narrow for this type of convoy. A solution would be that the convoy advances after the intersection and the tractor is switched from the front to the back of the trailer.

In addition, modification works of the traffic island and the barrier are necessary.

The clearance in correspondence of the curve is too small; the utility pole shall be relocated and some works on the outer side of the curve is necessary.

The wall on the inner side of the curve could represent a problem for the convoy; the best path shall be analysed in detail and a modification of the wall may be necessary.

Regulations in Switzerland and in France

- **Regulations both in France and in Switzerland define the parameters (dimensions weight) of standard convoys not requiring special authorisations, the applicable procedures to obtain such authorisations depending on transport parameters**
- **These parameters apply to the whole convoy and not to the cargo only**

De manière générale, les limites applicables sont les suivantes :

Longueur:	max. 16.50 m (véhicules articulés) max. 18.75 m (trains routiers)
Largeur:	max. 2,55 m
Hauteur:	max. 4 m
Poids effectif:	max. 40 t

Parameters for Switzerland

Qu'est-ce qu'un convoi exceptionnel ?

Le **véhicule seul** ou l'**ensemble routier** (1 ou plusieurs remorques) est considéré comme un convoi exceptionnel s'il dépasse l'une des **dimensions** et **poids** suivants :

- Longueur de **plus de 16,5 m**
- et/ou une largeur de **plus de 2,55 m**
- et/ou un poids de **plus de 44 tonnes**

Parameters for France

- **Most likely a convoy to transport a cargo of 60T+ will fall in the most constraining category of exceptional transport**

Reminder – Study to transport FCC-hh magnets

- **In 2018 a study made by an external institute (FIML) validated 2 options from 2 different ports to transport magnets to CERN with the following parameters**

Magnet types	Dipole magnet
Number of magnets	4,800
Weight	60 tons
L / W / H	13.4m x 1.5m x 1.64m.

- **This study shall be updated to demonstrate the feasibility of transport to points A, D, G and J (sites where FCC-ee dipoles magnets can be lowered due to their length), not known precisely at the date of the study**

- **The stress seen by the cargo during the transport remains an issue**

Figure 2-10: Transport stress (g shocks) expected for sea transport

Conclusions

- **It has been proven feasible to transport magnets of 60T from Basel (Rotterdam) and Macon (Marseille) to CERN (in the perspective of a supply from overseas). It is possible that these options could accept transports of up to 80T, but to be demonstrated, mainly for the last km from CERN to sites A, D, G and J. A weight above 60T adds significant difficulties for the manoeuvrability of the convoy;**

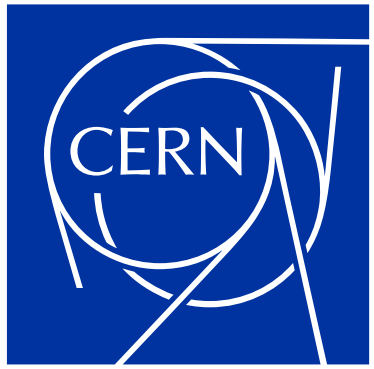
- **We are available to study further the question based on predetermined parameters: it is not possible to do a generic study, we have to review for each path not only the acceptable weight but also the dimensions and surrounding obstacles;**

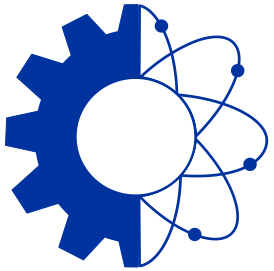
- **Regulation of other states (typically US) has not been studied yet;**

- **It's now a good time to evaluate public infrastructure adaptations and initiate discussions with host states to ease these heavy transports and have more flexibility on a daily basis.**

References

- **Initial study for the transport of FCC-hh magnets: *EDMS or other place holder to be defined* (document done for CDR)**
- **Study for the transport of 240T transformer in point H: FCC-INF-TE-0031 (annex to the Feasibilty Study)**
- **French law portal: Transport exceptionnel | Entreprendre.Service-Public.fr**
- **Swiss law portal: Transports et véhicules spéciaux (admin.ch)**





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