

SAFETY IN ROAD TUNNELS

Transmitted by the Government of Switzerland

1. Introduction

Prescriptions concerning tunnels as those developed by the WP.15 have the purpose to simplify the transport of dangerous goods which can be considered fundamentally as positive. Switzerland knows already since years prescriptions for the transport of dangerous goods in tunnels. A comparison of the new ADR-rules for tunnels with the Swiss dangerous goods regulation shows that these new ADR rules in their actual version have negative consequences as well for the safety as for the economy.

The following analysis shows the different problems.

2. Problem analysis

The following problems can be distinguished:

A. Tunnel categorization

a. Concrete observation: Statistical data for passages south-north through the St. Gotthard tunnel during the year 2004

The St. Gotthard tunnel can be considered of tunnel category E because of the following criteria:

- b) length (over 15 km)
- c) bidirectional
- d) Density of traffic
- e) Topography

Considering the former criteria the St. Gotthard tunnel has to be of category E. The choice of tunnel category E is also reasonable if we consider that in a tunnel of category D the passage for example of gasoline would be totally free. Another parameter indicating why the tunnel has to be of category E is the great sensibility of the surrounding population regarding the St. Gotthard tunnel. Furthermore the transport provisions have to be harmonized also with the environment legislation: These prescriptions provide restrictions regarding the carried amounts of dangerous goods in tunnels.

Accepting the fact that this tunnel is of category E a small study of the passage of all dangerous goods which have been declared in the direction south-north in the St. Gotthard tunnel during the year 2004 shows the following features:

On the whole **48,2%** of the passages for the year 2004 would have been forbidden if the criteria of ADR had been applied at that time. It appears that **33%** of the forbidden passages concern international carriages.

Some examples of international carriages of **important products** for the energy supply, transport or as industrial products, which could not have crossed the tunnel with the application of ADR-criteria are the following:

UN 1203 Gasoline
UN 1050 HYDROGEN CHLORIDE, ANHYDROUS
UN 1066 NITROGEN, COMPRESSED
UN 2796 SULPHURIC ACID with not more than 51% acid
UN 2984 HYDROGEN PEROXIDE, AQUEOUS SOLUTION

Moreover, the following dangerous goods in **empty, uncleaned tanks and cylinders** and which were allowed to cross the St. Gotthard tunnel during the year 2004 would also be forbidden following the future ADR rules:

UN 1978 PROPANE
UN 1965 HYDROCARBON GAS MIXTURE, LIQUEFIED, N.O.S.
UN 1005 AMMONIA, ANHYDROUS

b. Abstract observation: Consequences of the application of the new ADR-rules instead of the actual Swiss regulation in the St. Gotthard tunnel

A comparative study on a theoretical basis of the Swiss dangerous goods regulation (SDR) and the foreseen rules in ADR gives us some interesting results regarding the St. Gotthard tunnel as a tunnel of category E. For the justification of the assignment to category E see the former explanations in 2.A.a above. The following table shows the consequences of the application of the ADR-rules instead of the actual rules in Swiss legislation for each transport category:

Transport category following 1.1.3.6.3 ADR	Total number of UN entries in ADR	Amount of entries which will be more restricted following ADR compared to SDR	% of entries with more restriction following ADR compared to SDR
0	127	43	34
1 (20)	789	579	73
2 (333)	1310	1141	87
3 (1000)	562	533	95
4	45	-	-
Total	2833	2296	81

The next table shows the consequences in the other direction, that is how many entries would have less restriction when applying the future ADR rules:

Transport category following 1.1.3.6.3 ADR	Total number of UN entries in ADR	Amount of entries which will be less restricted following ADR compared to SDR	% of entries with more restriction following ADR compared to SDR
0	127	-	-
1 (20)	789	174	22
2 (333)	1310	169	13
3 (1000)	562	24	4
4	45	32	71
Total	2833	399	14

On the whole, **81%** of the entries will observe more restrictions as today. On the other hand **14%** of the entries will observe a relaxation. The increase in the number of entries undergoing more restriction by applying the future ADR rules is considerable in all transport categories except transport category 4. Even taking account of the cases where there is a relaxation in ADR compared with SDR the results is on a whole a considerable increase of restrictions.

Furthermore, it has to be noted that **705** entries are actually not restricted in the Swiss legislation but only **45** are not restricted in ADR. This represents again, on the whole, a considerable increase of restrictions. Moreover, there are **113** entries which actually are allowed **in empty uncleaned tanks** in the Swiss legislation and that would be forbidden in tanks in tunnels in ADR. **10** entries for gases are allowed in tanks in amounts of **3000 l**. This is also not permitted in ADR.

c. Conclusion

The former observations show that the new tunnel provisions contain more restrictions as the Swiss regulation regarding the transport of dangerous goods in tunnels. This will have a negative influence on the economy.

B. Exemptions following 1.1.3. ADR

a. Exemptions

The exemptions following the 1.1.3 ADR takes not account of the **specific circumstances of tunnels**, for example:

- In case of fire in a tunnel a kind of “chimney effect” can result, which favors and accelerates the building of flames. Furthermore the temperatures are higher and the heat lasts longer compared to a fire outside.
- In case of explosion in a tunnel the pressure will be canalized with the

consequence that the shock wave will be faster, more destructive and reach longer distances as in case of explosion outside a tunnel.

- Because of the confinement, for toxic substances escaping in a tunnel the concentration of the toxic vapors remains higher in longer distances as outside.

The following examples highlight the problem of exemptions in tunnels:

i. 1.1.3.2 f)

Uncleaned empty static pressure vessels of any gas (also toxic and flammable) and of any size are totally exempted. In that case, it is very difficult to know how much gas remains in the vessel. The vessels can be of considerable size, even bigger as the existing normal tanks for road carriages. This large size joint to the fact, that there are big differences in temperatures between inside and outside the tunnel, increases the risks in tunnels.

ii. 1.1.3.4.1

The following two examples exemplify why a blind exemption of chapter 3.3 special provisions cannot guarantee the safety in tunnels:

Alcoholic beverages of UN 3065 with not more of 70% alcohol by volume when carried in receptacles of 250 litres or less, are exempted from the ADR through the special provision 145 in cha. 3.3. Aerosol dispensers of UN 1950 with a capacity not exceeding 50 ml containing non-toxic constituents are exempted of the ADR by the special provision 190 in chap. 3.3, even it they contain flammable gases. A full load of such dangerous goods containing flammable liquids or gases can have in case of accident in the tunnel the consequences as described before.

iii. 1.1.3.4.2 Limited quantities

Among the 1718 entries which can be carried under the exemptions of chapter 3.4, 80 of them are of class 3, PG I, some of them with subsidiary risk toxic or corrosive. They are allowed in limited quantities (LQ3). But it has to be noticed, that the total amount per transport unit is unlimited. This is particularly relevant for very flammable substances. One pregnant example is UN 2059 NITROCELLULOSE SOLUTION, FLAMMABLE with not more than 12.6% nitrogen, by dry mass, and not more than 55% nitrocellulose (vapour pressure at 50 °C more than 175 kPa). The possible consequences of an accident in a tunnel are described above.

Furthermore, as already mentioned in the French report on safety for limited quantities in the document <http://www.unece.org/trans/doc/2002/ac10c3/UN-SCETDG-21-inf28e.pdf> the small packaging doesn't represent a better safety quite contrary.

iv. 1.1.3.6

It is allowed to carry unlimited quantities of empty uncleaned packaging containing dangerous goods, with the exception of transport category 0. This means that the carriage of unlimited quantities of empty uncleaned packaging, for example, of flammable substances of Class 3 of packing group I is permitted.

Another example is that it is possible to carry substances of Class 1, group 1.4S, in unlimited quantities through tunnels.

In case of accident the possible consequences in a tunnel have been described above.

b. Conclusion

As the examples demonstrate the exemptions in 1.1.3 adopted by the WP.15 represent a problem for the safety in tunnels.

3

Possible solutions

- The exemptions of 1.1.3 ADR shall not apply in tunnels
 - Minimal amounts for the special case of tunnels should be defined. The competent authority should have the possibility to authorize bigger quantities
 - The competent authority should have the possibility to make exceptions in individual cases.
-